Operation and Maintenance Data

City of Rock Island, WA

Dewatering Skid

Conveyor

VOLUME 1

OPERATION AND MAINTENANCE MANUAL
FOR
Dewatering Skid
Biosolids Conveyor

City of Rock Island
Screw Press Dewatering Equipment Procurement

Screw Press SP
Flocculation Tank SP-FT
Polymer Makedown System SP-PLY
Sludge Feed Pump SP-PMP
Screw Press Local Control Panel SP-LCP
Shaftless Screw Conveyor SP-CNVR

VOLUME 1

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Dewatering Skid

DEWATERING SKID

OPERATION AND MAINTENANCE MANUAL FOR BIOSOLIDS DEWATERING

FKC CO., LTD.
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DEWATERING GENERAL DESCRIPTION

Dewatering is a subset of liquid-separation technologies available for wastewater treatment. Specifically, dewatering is a mechanical unit operation meant to remove moisture content from the material being processed. In the case of municipal sludges, the vast majority of suspended, colloidal particles are retained in the discharged cake while large quantities of liquid along with the majority of dissolved solids are discharged in the pressate.

FKC screw presses have been in use with pulp & paper, food, chemical, and industrial applications for dewatering since 1958. Uses include, primary and secondary sludge dewatering, wood pulp dewatering, rejects dewatering, fruit juicing, imitation crabmeat (surimi) production, and fryer oil recovery. In the municipal sector screw presses have been used to dewater primary, secondary, aerobic, anaerobic, alum, ferric, and lime sludges.

Municipal sludges generally need to be conditioned before dewatering. Organic chemicals called flocculants are usually used. Flocculants are polymers with very high molecular weights (long chains of monomers) and vary by their ionic charge. Colloidal particles will get “fixed” and accumulate on the long polymer chains by charge attraction causing larger particle sizes to form. This process is called flocculation which then induces a release of water from the sludge. In order for flocculation to be maximized, enough mixing energy and time must be offered for a sludge/polymer mixture to form floc without shearing or floc destruction.

FKC flocculation tanks are used to provide the necessary mixing energy and detention time to a sludge/polymer mixture for optimal flocculation. The sludge/polymer mixture enters at the bottom of the tank then flows upward through the tank. The agitator blades rotate at an operator set speed to provide mixing energy. The size and shape of the tank provides the volume and detention time. With a proper polymer dose the sludge is flocculated by the time it reaches the top of the tank. It then discharges by gravity into either a rotary screen thickener (RST) or the headbox of the screw press.

The function of the screw press is to remove liquid from a solid/liquid mixture. This is accomplished by squeezing the flocculated, solid/liquid mixture. Liquids escape through perforated screens surrounding the screw while solids are retained inside the press. The solids are conveyed by the screw flights down the length of the press until they are ultimately discharged.

2

The skid will be delivered tarped on a flatbed truck.

There are four lifting points, all found on the screw press base. Use shackles and lifting straps/cables to prepare the skid for lifting with a crane.

Example #1 of lifting the dewatering skid using the four lifting points on the screw press base.

Example #2 of lifting the dewatering skid using the four lifting points on the screw press base.

CITY OF ROCK ISLAND, WA
LIFTING POINTS

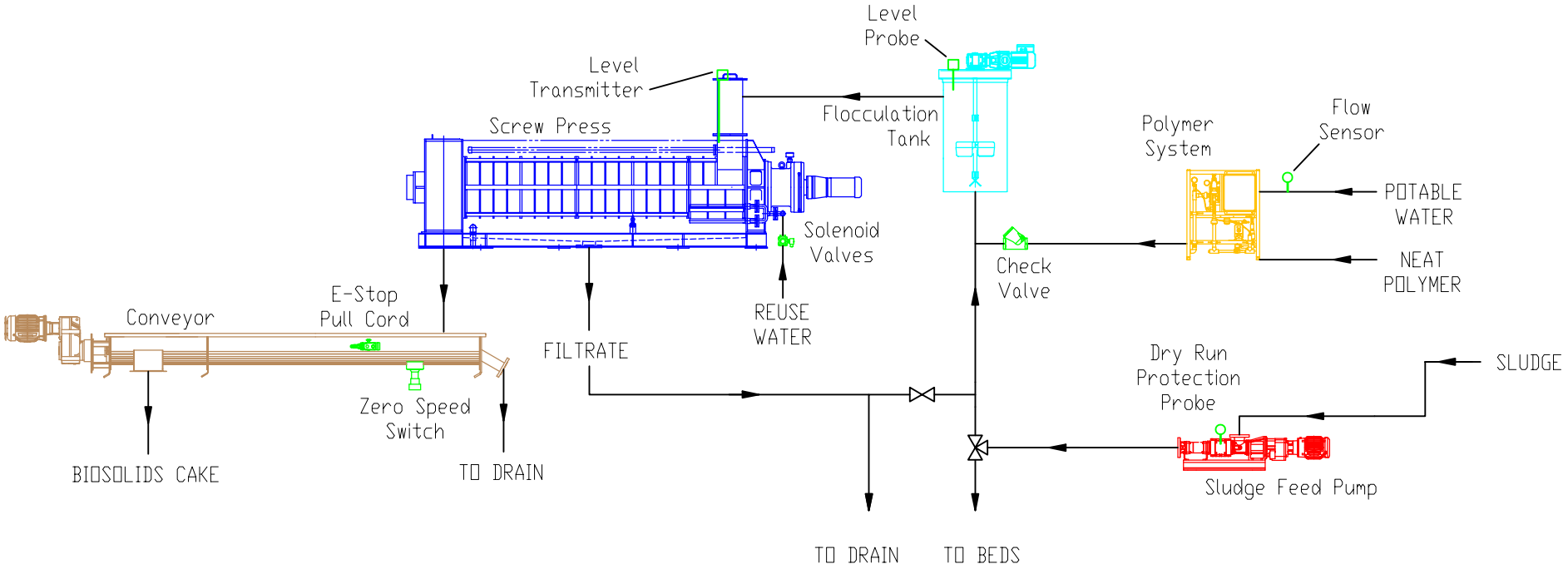
4 total, 2 on each side of screw press base

Notice the chains go up and inside the cover support rails.

The length of each chain as shown is A-138, B-143, C-149 and D-144 inches. These measurements assume all the straps/chains come to one point (no spreader bar).

CITY OF ROCK ISLAND, WA
SKID CUSTOMER CONNECTION POINTS

1. Electrical
    a. Control Panel
        i. 480V / 3 ph / 60 Hz / 21.06 FLA
2. Potable Water
    a. Polymer System
        i. 1-inch (F)NPT
3. Reuse Water
    a. Screw Press
        i. 1-1/4 inch (M)NPT
4. Sludge
    a. Sludge Feed Pump
        i. 4-inch STD 150# ANSI Flange
5. Neat Polymer
    a. Polymer System
        i. 5/8-inch Hose Barb Fitting
6. Filtrate
    a. Screw Press
        i. 4-inch Schedule 80 PVC to be cut and glued in the field
7. Anchor Bolts
    a. Skid Base
        i. 3/4-inch holes
        ii. Anchors by others
    b. Conveyor Support Legs
        i. 5/8-inch and 3/4-inch holes (See Dwg S408-902)
        ii. Anchors by others
8. Conveyor
    a. to Screw Press
        i. M12 tapped holes
        ii. M12 x 25 bolts by FKC

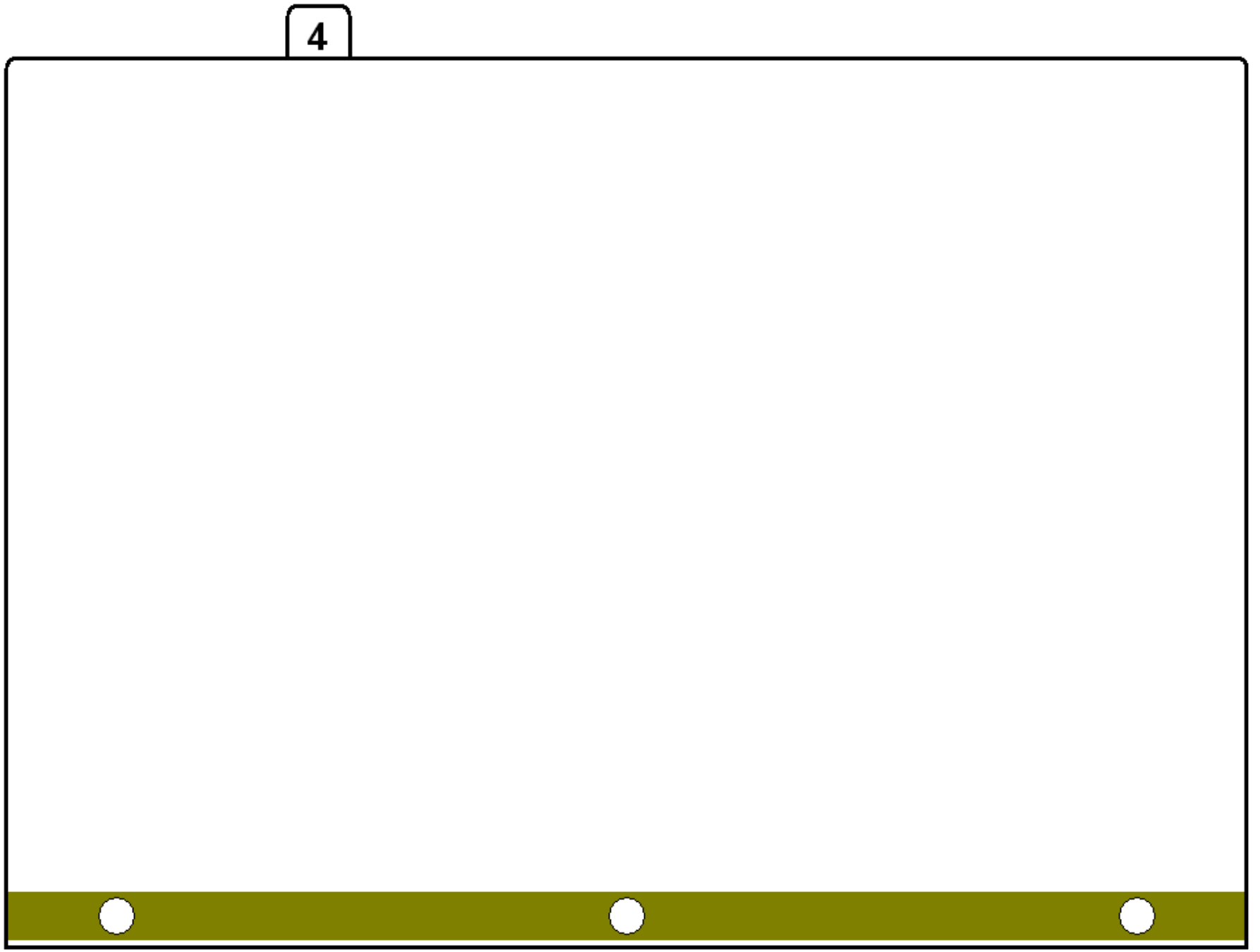


Rev.	Date	Description	Drawn by	Rev. by	Appd. by

Purchaser		Quantity	
End user	*Reference Only*	1	
Job name	*CITY OF HARD ROCK, WA*	Scale	
Dwg. name	*SKID PROCESS DIAGRAM*		
Job No.			
Dwg. No.		Ref. job No.	

FUKOKU KOGYO CO., LTD.

SEE SPEC'S OR PLAN'S FOR CONFORMED DETAILS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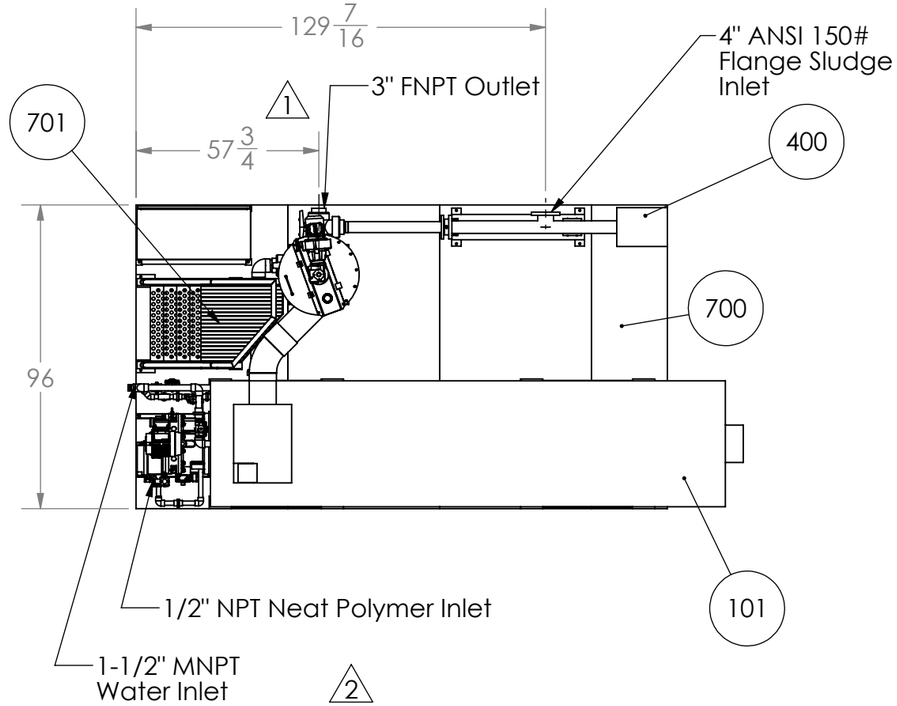
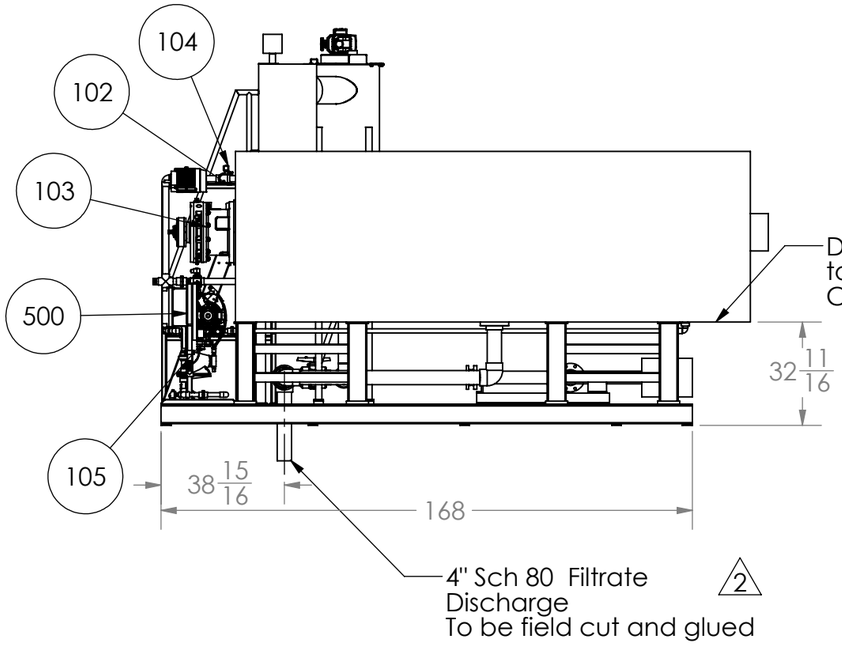
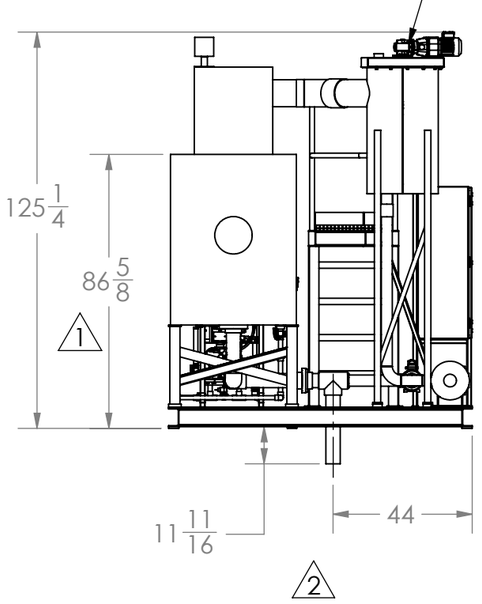


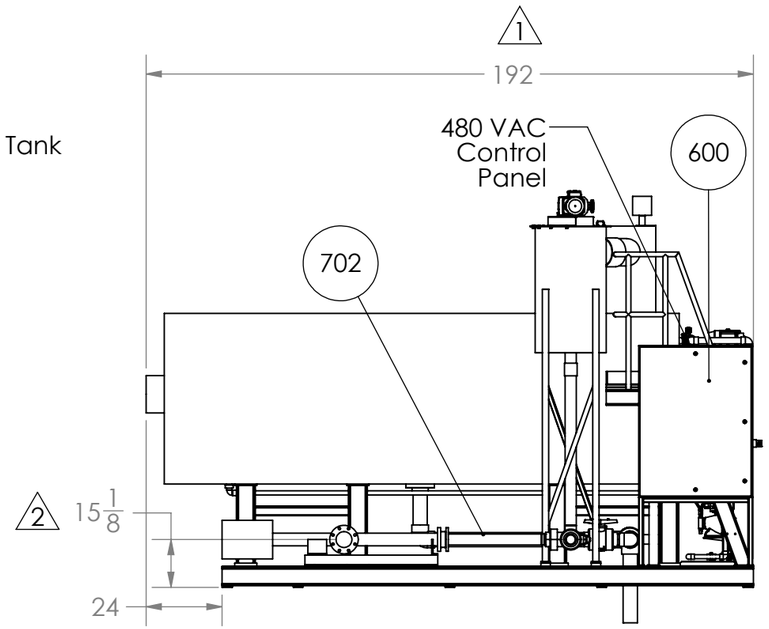
Note:

- Equipment Weight: 9,500 LBS
- Operating Weight: 12,100 LBS
- Skid Material of Construction: 6061-T6 & 3003 Aluminum
- Sludge Pipe: 304 SS.
- Shower Water Piping: Sch 80 PVC
- Conduit and Fittings: LFNC-B
- FKC recommends 3" non shrink grout under all equipment.

2







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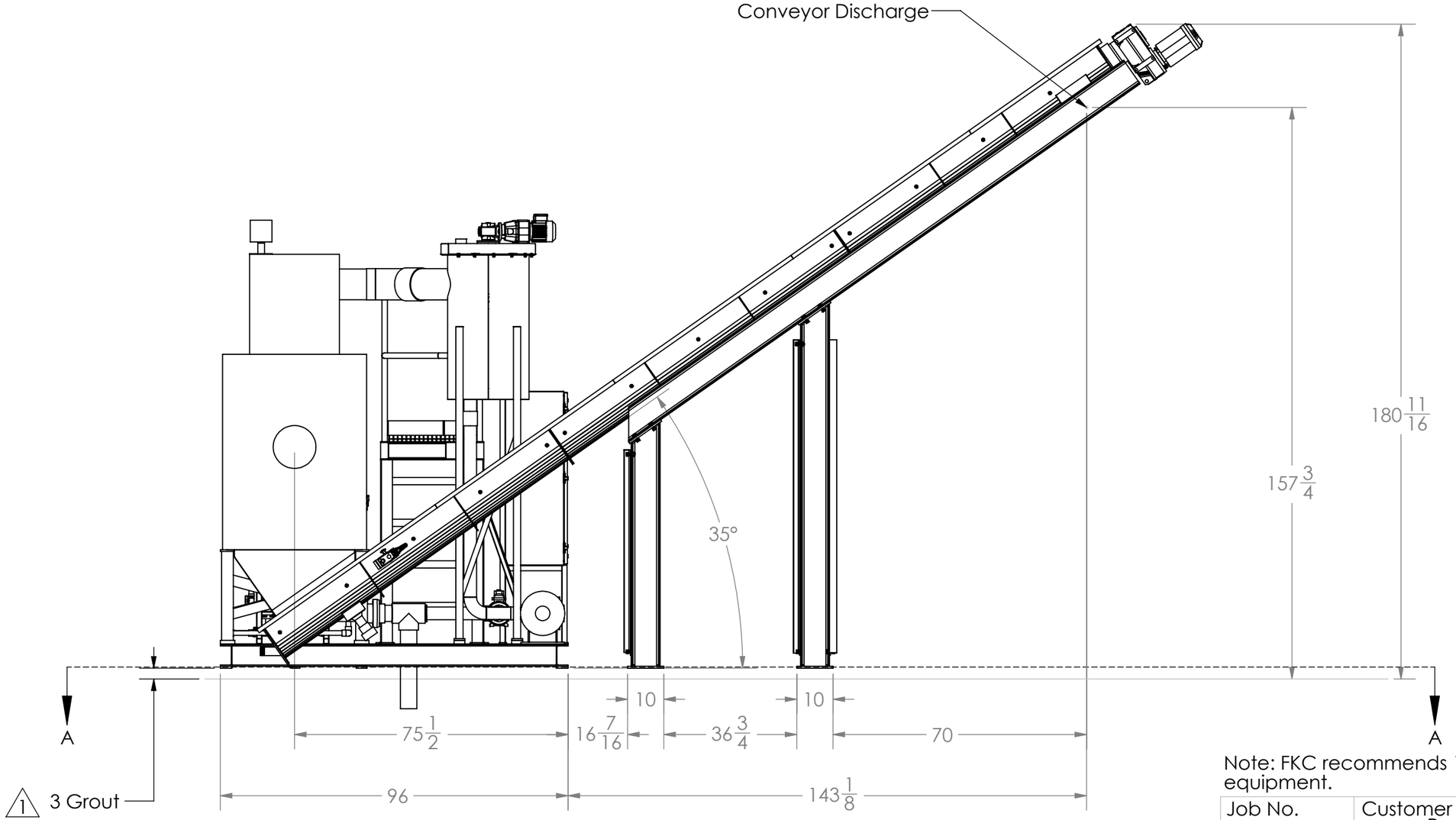
No.	Alteration	Date	Sign
3	Issued as Certified	9/25/19	RTB
2	Layout	9/6/19	RTB
1	Outlet & Layout	9/3/19	RTB
0	Issued for Approval	8/1/19	RTB

Job No. SKID-408	Customer Rock Island WWTP Rock Island, WA	Wt. Lbs.
Drawing No. A408-900	Title BHX-600x3500L Dewatering Skid Assembly Details	Quantity
		Date 9/29/17
FKC	FKC CO. LTD 2708 W 18th St. Port Angeles, WA 98363 (360) 452-9472 Fax (360) 452-6880	Drawn By RTB
Revision		SHEET 1 OF 3



Note: FKC recommends 1-1/2" of grout under all equipment.

Job No. SKID-408	Customer Rock Island WWTP Rock Island, WA	Wt. Lbs.
Drawing No. L408-901	Title BHX-600x3500L Skid and Conveyor Layout Details	Quantity 1
		Date 9/29/17
FKC CO. LTD 2708 W 18th St. Port Angeles, WA 98363 (360) 452-9472 Fax (360) 452-6880		Drawn By RTB

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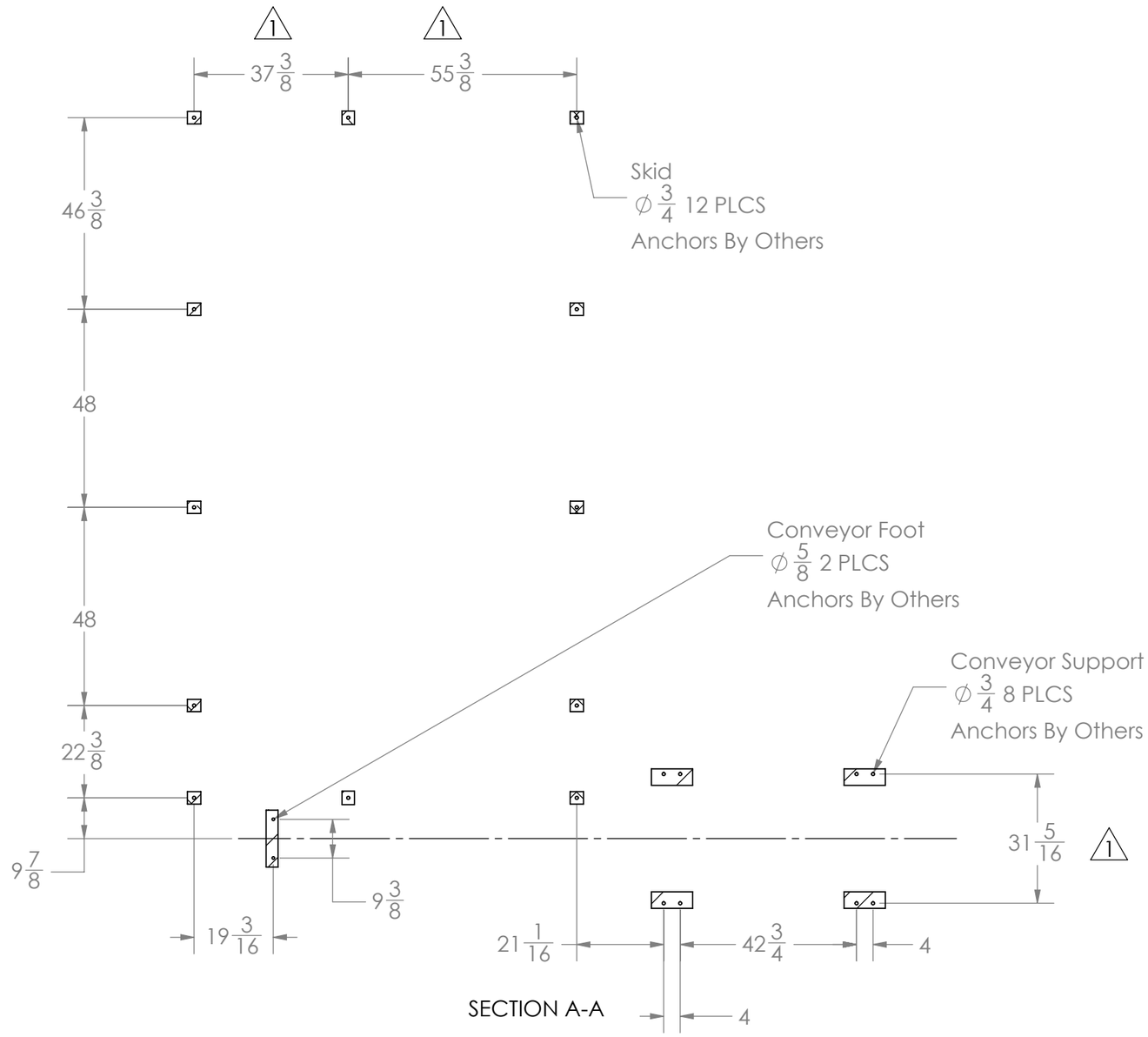
1	Grout	9/6/19	RTB
0	Issued for Approval	8/1/19	RTB



SECTION A-A

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1	Layout	9/6/19	RTB
0	Issued for Approval	8/1/19	RTB

Job No. SKID-408	Customer Rock Island WWTP Rock Island, WA	Wt. Lbs.
Drawing No. S408-902	Title BHX-600x3500L Skid & Conveyor Anchor Layout Details	Quantity 1
		Date 9/29/17
FKC	FKC CO. LTD 2708 W 18th St. Port Angeles, WA 98363 (360) 452-9472 Fax (360) 452-6880	Drawn By RTB
	Revision	SHEET 3 OF 3

Rock Island, WA WWTP
FKC Bill of Materials
DEWATERING SYSTEM

	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Screw Press - #M-3075	FKC	BHX-600X3500L	1	101	304 SS Wetted Parts
Motor w/ AEGIS ring	Toshiba	00224SDSR44A-P	1	102	CS
Drive	Sumitomo Cyclo	CHVJ6215DA-3481	1	103	CS
Screw	FKC	Screw 600Ø x 3500L	1	--	304 SS
Drums	FKC	Drum 600Ø x 1000L	3	--	304 SS
Covers	FKC	Covers	11	--	304 SS
Head Box	FKC	Head Box 600L	1	--	304 SS
Inlet Bearing Housing	FKC	NA	1	--	CS / Painted
Outlet Discharge Box	FKC	NA	1	--	304 SS Wetted Parts CS - Non Wetted Parts
Cone	FKC	NA	1	--	304SS
Base	FKC	NA	1	--	CS / Galvanized
Showers Headers	FKC	NA	3	--	304 SS
Shower Nozzles	FKC	NA	53	--	304 SS
Solenoid Valve 1-1/2"	ASCO	8221G011	2	104	Brass
Solenoid Valve 1"	ASCO	8221G007	1	105	Brass
Calibration Column	Koflo	100 MLSC	1	106	PVC
Flow Switch	IFM	SI5006	1	107	
Three Way Valve	Hayward	TW1300T	1	--	PVC
Check Valve	McMaster-Carr	46635K65	1	108	316 SS
Flocculation Tank	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Motor	SEW Eurodrive	DRS71S4	1	201	CS
Gear Box	SEW Eurodrive	SAF37D16B	1	202	CS
Tank Body	FKC	55 Gallon	1	203	14 ga. 304L SS
Agitator Shaft	FKC	--	1	204	304L SS
Mixer Base	FKC	--	1	205	304L SS
Lid	FKC	--	1	206	304L SS
8" Flexible Pipe Coupler	Fernco	1056-88	1	207	Rubber

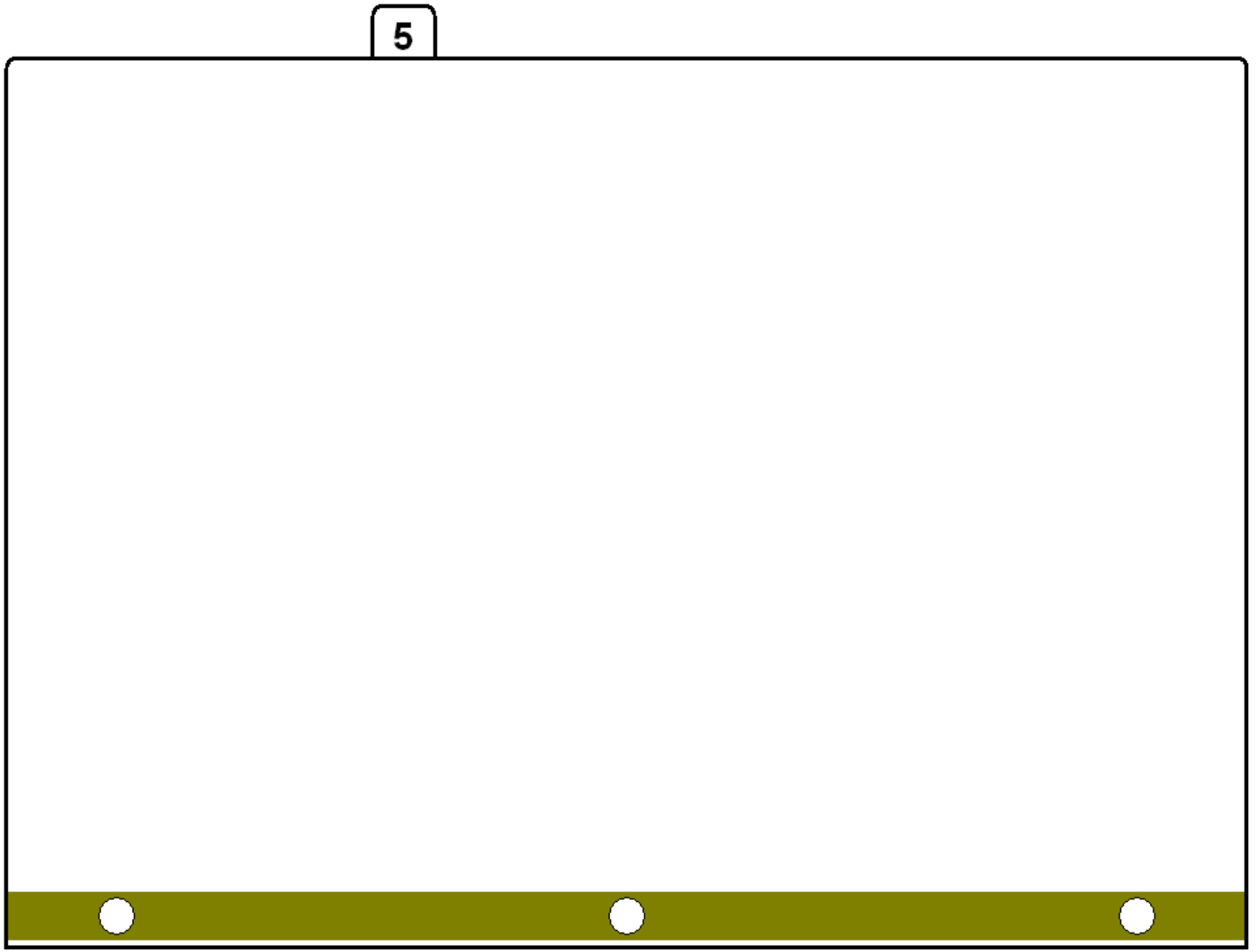
Inclined Conveyor	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Transition Chute between Screw Press and Conveyor	FKC	--	1	301	12-gage, 304L SS
End plate	FKC	--	1	302	3/8" plate, 304L SS
Trough sections (8 foot max.)	FKC	--	3	303	10 gage, 304L SS
U shaped, trough flanges	FKC	--	6	304	1/4" plate, 304L SS
UHMWP trough liner (4 foot max.)	FKC	--	6	305	1/2" thick UHMW
Discharge end plate	FKC	--	1	306	3/8" plate, 304L SS
Conveyor supports	FKC	--	1	307	CS - Galv
Discharge Chute	FKC	--	1	308	12-gage, 304L SS
9" Screw	Falcon Industries	--	1	309	9" diameter, shaftless flighting formed from 3/4" thick x 2.5" wide 220 Brinell alloy steel
Gear Box	SEW	SEW FAZ77	1	310	CS - Painted
Motor 3 HP	SEW	DRN100L4	1	311	CS - Painted
E-Stop	Omron	ER6022-021NEL	2	312	
Zero Speed Probe	Siemens	SITRANS WM100	1	313	

Sludge Pump	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Progressive Cavity Pump	SEEPEX	BN 17-6L		400	See Bill of Materials

Polymer System	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Veloblend	Velodyne	VM-2.0D-300-C-O-A-X	1	500	See Bill of Materials

Control Panel	Manufacturer	Part Number	Quantity (total)	Item #	Material of Construction
Custom Panel	TSI Inc.	--	1	600	See Bill of Materials
Skid	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Skid	FKC	--	1	700	6061 T6 Aluminum
Access Platform	FKC	--	1	701	6061 T6 Aluminum
Electrical Conduit	Hubble or Equal	--	--	--	LFNC-B
Interconnecting Sludge Piping	--	--	--	702	304L SS

Spare Parts	Manufacturer	Part Number	Quantity	Item #	Material of Construction
One Set of Special Tools	FKC	--	1	--	CS
Spare Screw Press Screens	FKC	--	4	--	304 SS


5

CONTROL PANEL
SCREENS & OPERATION

NOTE:

see
other sections of O&M MANUAL
for
hardware itemized cut sheets

SETPOINT VALVES AT TIME OF START UP DATE: _____

BY: _____

PARAMETER	VALUE	UNITS
		Inches
Headbox Desired Level		Inches
Headbox Hi-Hi Level Alarm		Inches
Headbox Hi Level Warning (Stop Feed)		Inches
Headbox Level to Resume Feed		%
Constant Flow Mode Feed Pump Speed		%
Variable flow Mode Screw Press Speed		%
Polymer Ratio to Feed Pump		Minutes
Screw Press Shutdown Delay		Minutes
Conveyor Shutdown Delay		Minutes
Maximum Pause Time Allowed		Minutes
System Run Time SP		Hours
Washwater Headbox Solenoid ON Time		Seconds
Washwater Headbox Solenoid OFF Time		Minutes
Washwater Drum Solenoid ON Time		Seconds
Washwater Drum Solenoid OFF Time		Minutes
Washwater Pan Solenoid ON Time		Seconds
Washwater Pan Solenoid OFF Time		Minutes
Constant Flow PID		
Gain / Proportional		n/a
Integral		n/a
Derivative (typ zero)		n/a
Min Speed		%
Max Speed		%
Zero Cutoff Deadband		Inches
Use on Startup	Initial CV	Initial CV
Initial CV		%
Variable Flow PID		
Gain / Proportional		n/a
Integral		n/a
Derivative (typ zero)		n/a
Min Speed		%
Max Speed		%
Zero Cutoff Deadband		Inches
Use on Startup	Initial CV	Initial CV
Initial CV		%

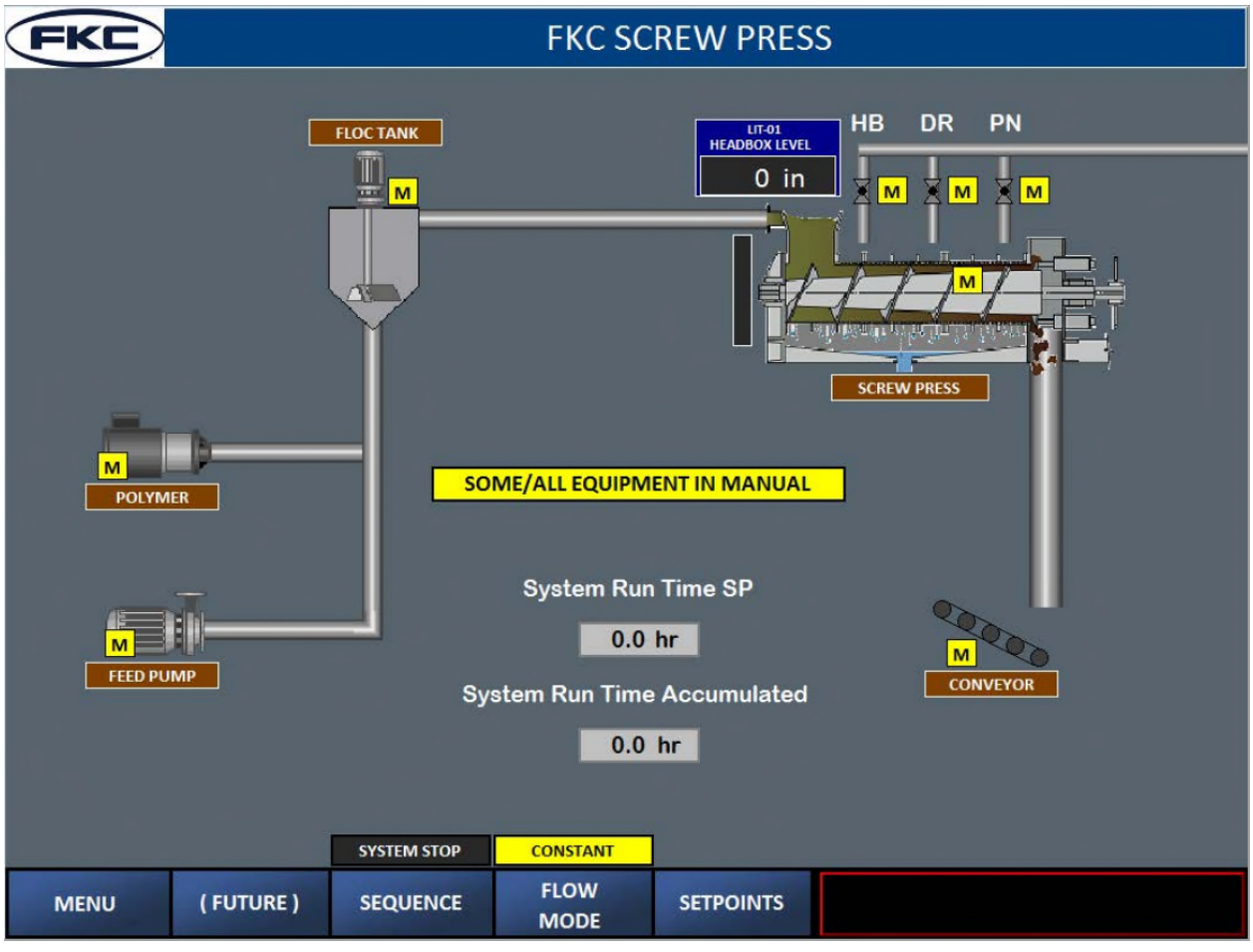


Figure CP-1: Screw Press Overview Screen

System Labels

System Labels appear as white text with brown backgrounds. The operator cannot select or change these labels. They are for information display only, showing what the graphic, switch or value is referring to. They remain constant over time and do not change.

Alarms

Alarms are displayed as white text with red backgrounds. They are not normally displayed and appear only when an alarm occurs. If an alarm is displayed, then it will disappear only when the alarm has been cleared on the Alarm screen.

FAILURE

This alarm occurs when the motor starter trips or VFD faults for a specific piece of equipment. It will be displayed next to the graphic of the equipment that has faulted. The motor starter or VFD will need to be reset, then the alarm cleared from the Alarm screen before system operation can proceed.

HI-HI LEVEL

This alarm occurs when the level in the screw press headbox hits the hi-hi level probe electrode mounted on the headbox.

RUN/FAIL

This alarm occurs when a piece of equipment does not run when it is being called by the control panel to run. It will be displayed next to the graphic of the equipment that has faulted. The cause of the alarm will need to be resolved, then the alarm cleared from the Alarm screen before system operation can proceed.

STOP PB PRESSED

This alarm occurs when the Process Stop Button is pressed on the front door of the control panel.

SYSTEM ALARM

This alarm can occur for several reasons. When this alarm is displayed then the operator will need to go to the Alarm screen to see what the specific alarm is, then clear the alarm before system operation can proceed.

System Status Labels

System Status Labels appear as black text with yellow backgrounds. They are for information display only and may change over time depending on the current status of the system.

HIGH LEVEL WARNING (PAUSE FEED)

This occurs when a high level is reached in the screw press headbox while running in AUTO. See Systems Setpoint screen for the Headbox High Level Warning setpoint. The sludge and polymer flows stop along with the flocculation tank. Once the screw press headbox level drops to zero then the flows and flocculation tank start back up again.

SYSTEM RUN SOME EQUIPMENT IN MANUAL

If the system is running in AUTO and one or more pieces of equipment are then set to HAND, then this system status label appears to let the operator know that not all equipment is in AUTO. This means that some of the interlocks programmed for the equipment in HAND may not be active. Typically, all equipment should be set to AUTO while the system is running in AUTO.

###.# mins

If the system is in an auto shutdown, then the system uses operator setpoints for the amount of time left to run the screw press and/or conveyor. This "###.# mins" label displays for the operator how much time is left for the screw press and/or conveyor to run in auto shutdown.

Paused ###.# mins

If the system has detected a high level in the screw press headbox, then the system pauses all the equipment except for the screw press and conveyor. This is an attempt to drop the headbox back down to normal levels. A "High Level Warning (Pause Feed)" and "Paused ###.# mins" status labels are then displayed. The "Paused ###.# mins" label displays for the operator how much the system has been paused due to a high level warning.

Equipment Status Labels

Equipment Status Labels appear as white text with a green background. They are for information display only and may change over time depending on the current status of the piece of equipment. They display if a piece of equipment is currently “RUNNING”, “H” for in HAND, or “A” for in AUTO. This type of display can also show if the equipment which flow mode (VARIABLE or CONSTANT) is active for running in AUTO.

CONSTANT

If CONSTANT is selected in FLOW MODE, then the HMI will display CONSTANT on the main overview screen. The PLC will maintain constant sludge and polymer flows while varying the screw press speed to maintain a relatively constant headbox level over time.

VARIABLE

If VARIABLE is selected in FLOW MODE, then the HMI will display VARIABLE on the main overview screen. The PLC will maintain a constant screw press speed while varying the sludge and polymer flow to maintain a relatively constant headbox level over time. This is the preferred mode over CONSTANT.

Analog Parameter Value Displays

Analog Parameter Value Displays appear as white numbers with a dark gray background. They are for information display only and change over time depending on the current value of the analog signal. The values shown correspond to flow for flow meters and the level for the screw press headbox. See the Equipment Control Pop-Up screen description for how to set HAND speeds of these analog parameters. See the System Setpoints screens description for how to set AUTO speed for these analog parameters.

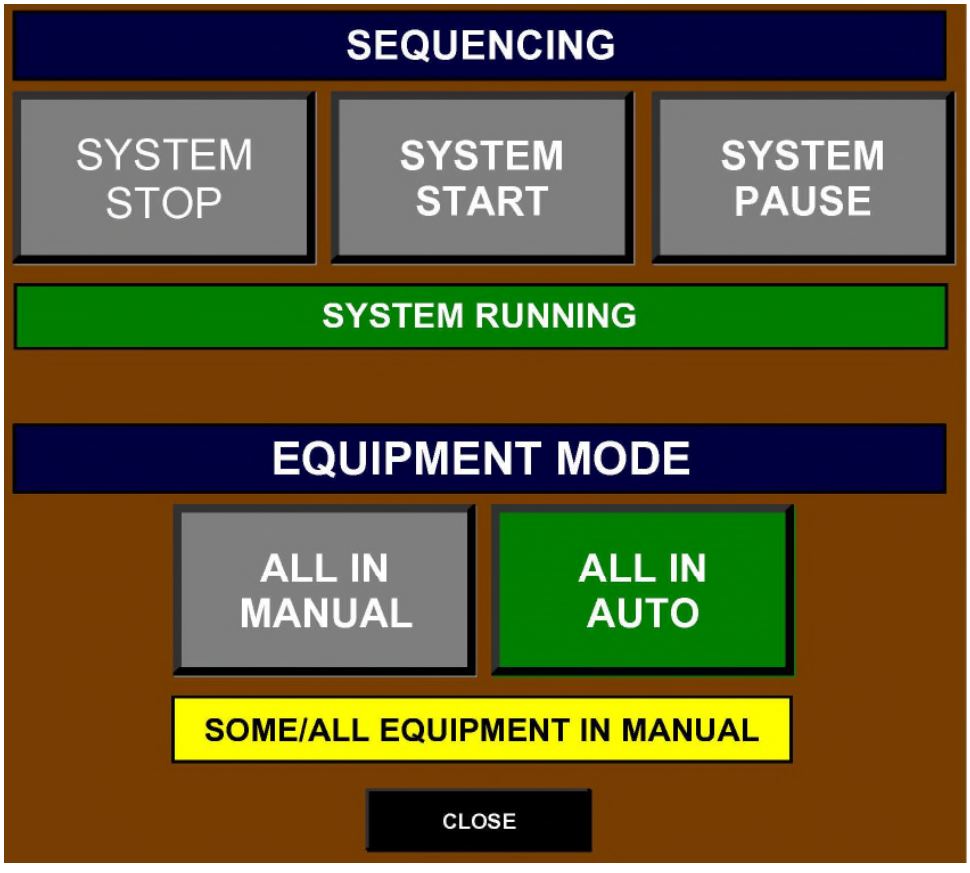


Figure CP-2: Sequence Screen

SYSTEM STOP

Pressing this button will set all equipment to OFF on the HMI controls. This does not stop any equipment that is set to HAND with their HOA switch on the front panel of the control panel.

SYSTEM START

With all the HOA switches set to AUTO on the front door of the control panel, and with all equipment set to AUTO on the HMI control screens, the entire dewatering system will startup in AUTO when this SYSTEM START button is pressed.

SYSTEM PAUSE

With all the HOA switches set to AUTO on the front door of the control panel, and with all equipment set to AUTO on the HMI control screens, the entire dewatering system will pause when this SYSTEM PAUSE button is pressed. See System Status Labels in the Screw Press Overview screen description for more information.

SYSTEM RUNNING

This shows the status of the entire dewatering system. It will either show that the system is OFF, the system is running, or the system is in PAUSE.

ALL EQUIPMENT IN MANUAL

With all the HOA switches set to AUTO on the front door of the control panel, pressing this button will cause all the equipment to be set in HAND by the PLC Control. See the Equipment Control Pop-Up screen for more information.

ALL EQUIPMENT IN AUTO

With all the HOA switches set to AUTO on the front door of the control panel, pressing this button will cause all the equipment to be set in AUTO by the PLC Control. See the Equipment Control Pop-Up screen for more information.

SOME/ALL EQUIPMENT IN MANUAL

This shows the status of all the equipment. It will either show that that all equipment is in HAND, all equipment is in AUTO, or SOME/ALL EQUIPEMENT IN MANUAL.

CLOSE

Pressing this button will return you to the Screw Press Overview Screen.

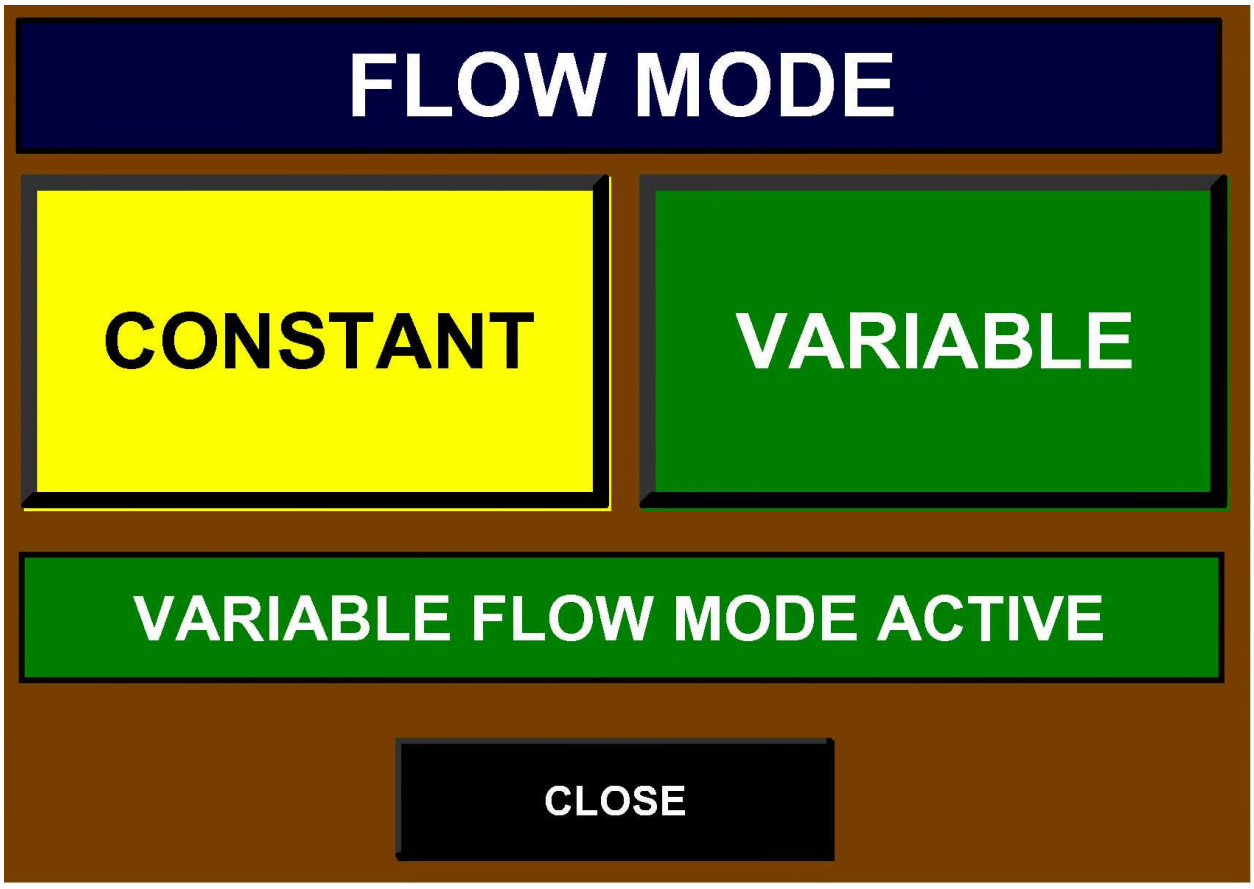


Figure CP-3: Flow Mode Screen

CONSTANT

This button affects how the system runs the process while in AUTO mode. If CONSTANT is selected, then the PLC will maintain constant sludge and polymer flows while varying the screw press speed to maintain a relatively constant headbox level over time.

VARIABLE

This button affects how the system runs the process while in AUTO mode. If VARIABLE is selected, then the PLC will maintain a constant screw press speed while varying the sludge and polymer flow to maintain a relatively constant headbox level over time. This is the preferred mode over CONSTANT.

VARIABLE FLOW MODE ACTIVE

This shows the current status of the system. It will either show VARIABLE FLOW MODE ACTIVE or CONSTANT FLOW MODE ACTIVE.

CLOSE

Pressing this button will return you to the Screw Press Overview Screen.

Figure CP-4: System Setpoints Screen

Headbox Desired Level

When running in AUTO, the PLC attempts to maintain a relatively stable screw press headbox level by varying either the screw speed or the sludge & polymer flows. The Headbox Desired Level setpoint is the operator selected target level that the PLC is always trying to achieve.

Headbox Hi-Hi Level Alarm

Whether in AUTO, HAND or OFF, the headbox level sensor continually measures the level in the screw press headbox. This Headbox Hi-Hi Level Alarm setpoint is the level at which the Hi-Hi Level Alarm will occur. A backup for this alarm (should the headbox level sensor fail) is the conductance level probe mounted on the headbox that will also cause the Hi-Hi Level Alarm to occur.

Headbox Hi Level Warning (Stop Feed)

When running in AUTO, the PLC attempts to maintain a relatively stable screw press headbox level. Situations like poor screw press screen drainage or poor flocculation will cause the headbox level to rise regardless of the PLC's attempt to bring the level down. This Headbox Hi Level Warning setpoint is the level at which the operator would like the sludge and polymer flows to stop in an attempt to prevent hitting the headbox hi-hi level. Once the headbox level drops to zero then the sludge and polymer flows will start up again.

Constant Flow Mode Feed Pump Speed

This value sets the sludge feed pump speed at a constant speed for CONSTANT FLOW MODE operation while running in AUTO. The polymer pump will also maintain a constant speed since in AUTO it proportionally follows the sludge feed pump speed.

Variable Flow Mode Screw Press Speed

This value sets the screw press speed at a constant speed for VARIABLE FLOW MODE operation while running in AUTO.

Polymer Ratio to Feed Pump Flow

In AUTO mode, the polymer pump speed proportionally follows the sludge feed pump speed. The polymer pump % speed is calculated using this setpoint. The simplified calculation can be expressed as [Sludge Pump Speed] x [Polymer Ratio to Feed Pump Flow setpoint] = [Polymer Pump Speed].

Screw Press Shutdown Delay

When the system undergoes an AUTO shutdown cycle, the flocculation tank, sludge and polymer flows shutdown immediately. However, the screw press will continue to run based on the time entered in the Screw Press Shutdown Delay setpoint. This allows the operator to select how empty he would like to leave the screw press after an AUTO shutdown.

Maximum Pause Time Allowed

See the Headbox Hi Level Warning setpoint description. The Headbox Max. Pause Time Allowed setpoint is used to time how long the system remains PAUSED after the screw press headbox hi level is reached. If the Max. Pause Time Allowed is exceeded, then the system will alarm and shutdown with the expectation that something is wrong with the process. The operator will need to troubleshoot the dewatering process and correct the problem before starting up again.

SYSTEM RUN TIME SP

This value counts down the time until an automatic shutdown occurs. If the value is 5.0 hours, then the dewatering system will do an auto shutdown 5 hours after the system is started up in AUTO.

WASHWATER SETPOINTS

Press this button to access the Washwater Setpoints screen.

PID SETPOPINTS

Press this button to access the PID Setpoints screen.

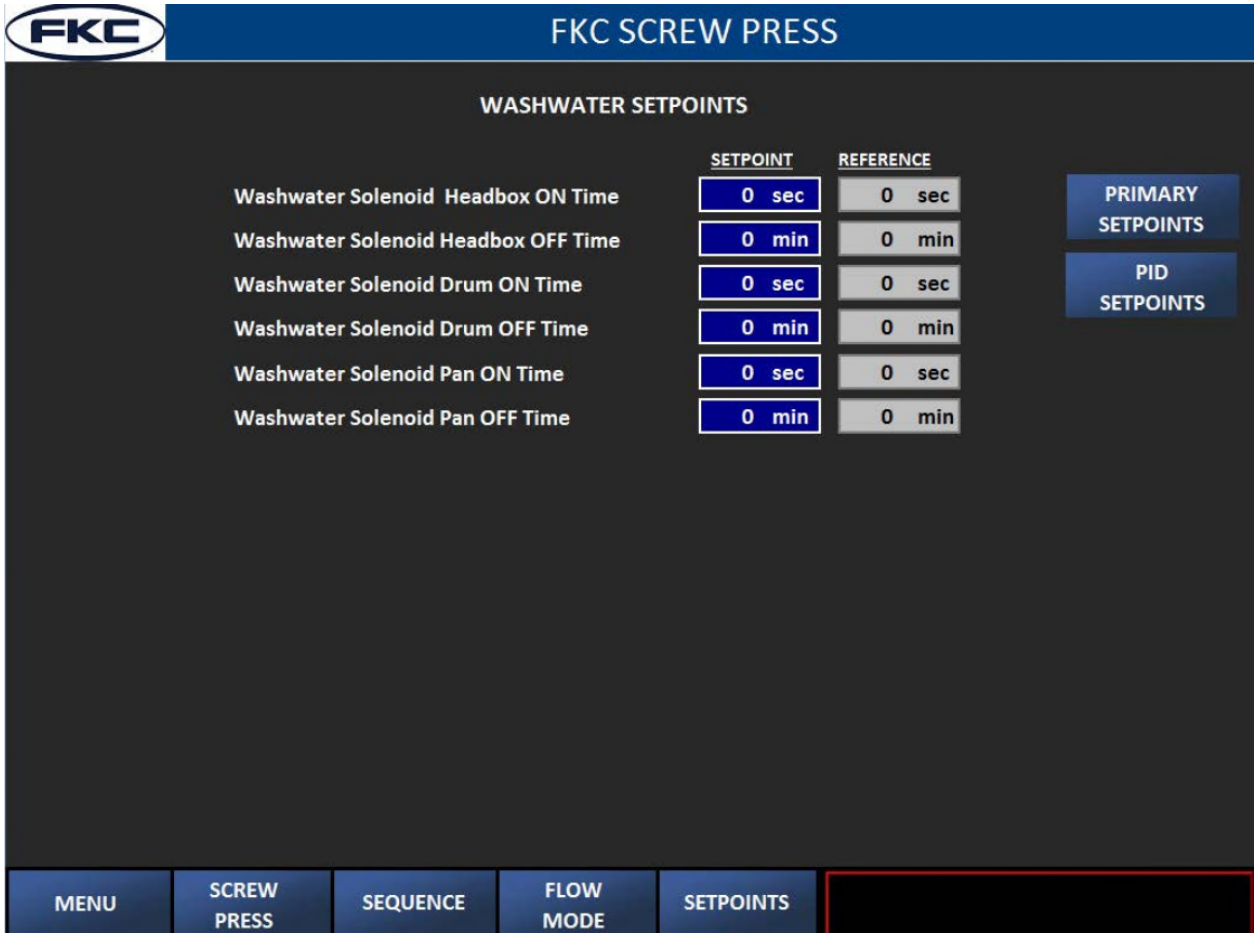


Figure CP-5: Washwater Setpoint Screen

The PLC will ensure that only one solenoid valve will be on at one time.

Washwater Headbox Solenoid ON Time

This is the amount of time in seconds that the headbox solenoid valve will be open.

Washwater Headbox Solenoid OFF Time

This is the amount of time in minutes that the headbox solenoid valve will be closed.

Washwater Drum Solenoid ON Time

This is the amount of time in seconds that the drum solenoid valve will be open.

Washwater Drum Solenoid OFF Time

This is the amount of time in minutes that the drum solenoid valve will be closed.

Washwater Pan Solenoid ON Time

This is the amount of time in seconds that the pan solenoid valve will be open.

Washwater Pan Solenoid OFF Time

This is the amount of time in minutes that the pan solenoid valve will be closed.

Figure CP-6: PID Setpoints Screen

Gain / Proportional

This value is the Proportional Gain of the PID loop that attempts to maintain relatively constant headbox level. For Constant Flow, the screw press speed is adjusted. For Variable flow, the sludge & polymer flows are adjusted. Proportional Gain accounts for the present value of the headbox level error from the desired setpoint. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Integral

This value is the Integral Gain of the PID loop that attempts to maintain relatively constant headbox level. For Constant Flow, the screw press speed is adjusted. For Variable flow, the sludge & polymer flows are adjusted. Integral Gain accounts for past values of the headbox level errors away the desired setpoint. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Derivative (typically zero)

This value is the Derivative of the PID loop that attempts to maintain relatively constant headbox level. For Constant Flow, the screw press speed is adjusted. For Variable flow, the sludge & polymer flows are adjusted. The derivative accounts for possible future values of headbox level errors away the desired setpoint. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Min Speed

When running in AUTO Constant Flow Mode, this sets the minimum speed of the screw press. In AUTO Variable Flow Mode, this sets the minimum speed of the sludge feed pump. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Max Speed

When running in AUTO Constant Flow Mode, this sets the maximum speed of the screw press. In AUTO Variable Flow Mode, this sets the maximum speed of the sludge feed pump. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Zero Cutoff Deadband

For the PID loop that attempts to maintain a relatively constant headbox level, this setpoint determines the deadband (+/-) around the headbox level setpoint that is insignificant. This generally means that although the current headbox level is not EXACTLY at the desired level setpoint, the PID loop does not consider the error to be significant enough for a change to occur. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Use on Startup

This determines was value is plugged into the Process Value (PV) of the PID at startup. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Initial CV

This is the value that will be plugged into the Current Value (CV) of the PID loop at startup. The operator does not have security access to change this setpoint. Please consult with FKC before making any PID setpoint changes.

Primary Setpoints

Press this button to access the Setpoints screen.

Washwater Setpoints

Press this button to access the Washwater Setpoints screen.

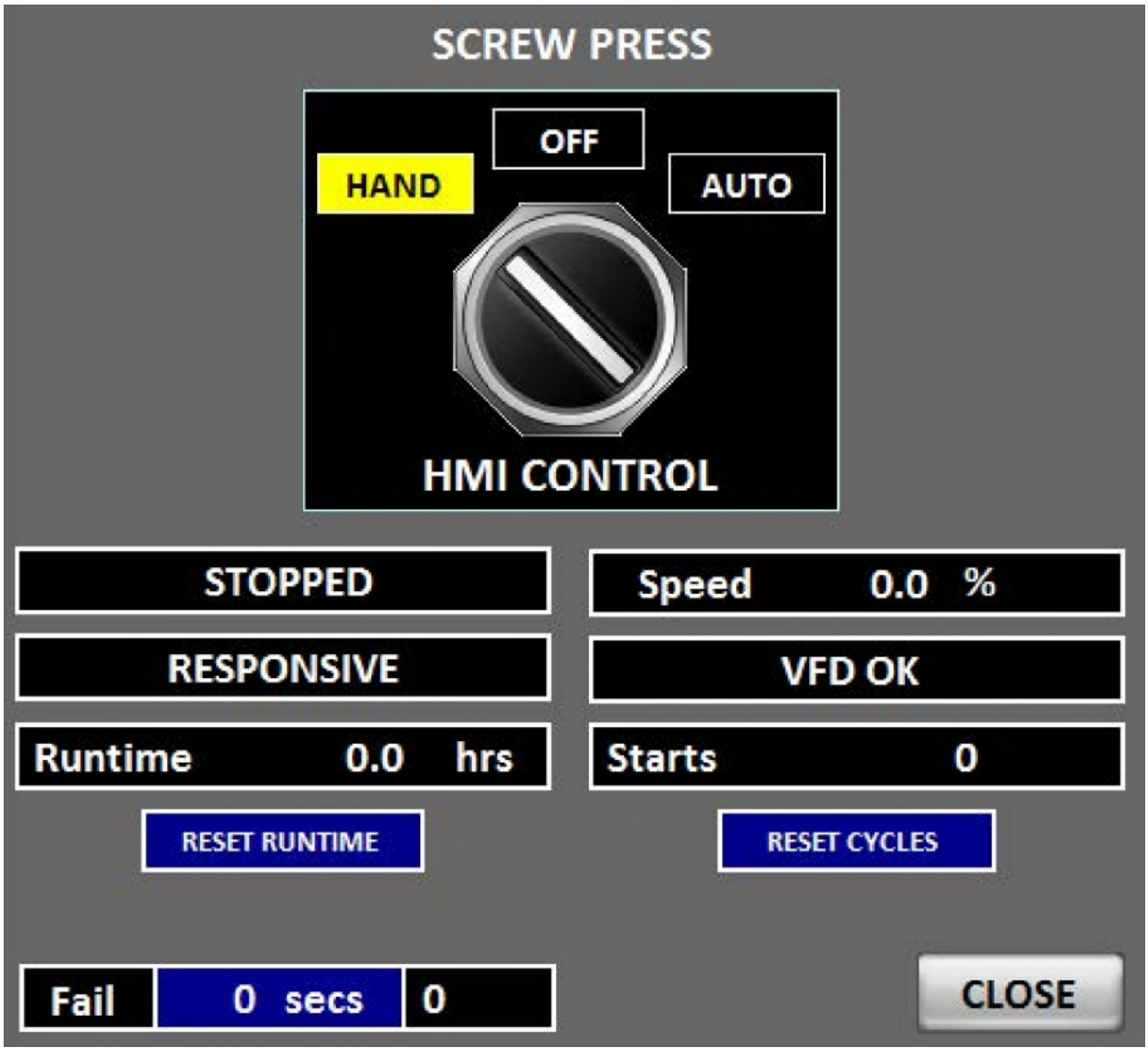


Figure CP – 7: Equipment Control Pop-Up Screen

This pop-up is accessed for each piece of equipment on the main overview screen by pressing the M logo beside the equipment's graphic.

HAND/OFF/AUTO

This graphic allows the operator to switch PLC Control from HAND, OFF or AUTO.

RUNNING AMPS

This label shows the current running status and amp draw for the given equipment's motor.

SPEED

This label shows the current running speed for the given equipment's motor.

FAIL TO START

This label indicates that a FAIL TO START alarm has occurred for this equipment. To reset and make this alarm disappear, touch this FAIL TO START label.

VFD OK / FAULT

This label indicates that a VFD is OK or that a VFD FAULT has occurred for this equipment's motor. To clear the fault and make this alarm disappear, touch this VFD FAULT label.

RUNTIME HOURS

This label displays the runtime hours for this equipment's motor since the last reset. To reset this value, touch this RUNTIME HOURS label and it will reset to zero.

STARTS

This label displays the number of starts that has occurred with this equipment's motor since the last reset. To reset this value, touch this NUMBER OF STARTS label and it will reset to zero.

FAIL

This is a setpoint for motor operation. This value is the wait time (delay) between a motor not starting and a FAIL START ALARM occurring.

RESET RUNTIME

This resets the Runtime Hours counter displayed on this screen.

RESET CYCLES

This resets the Starts counter displayed on this screen.

CLOSE

Pressing this button will return you to the Screw Press Overview Screen.

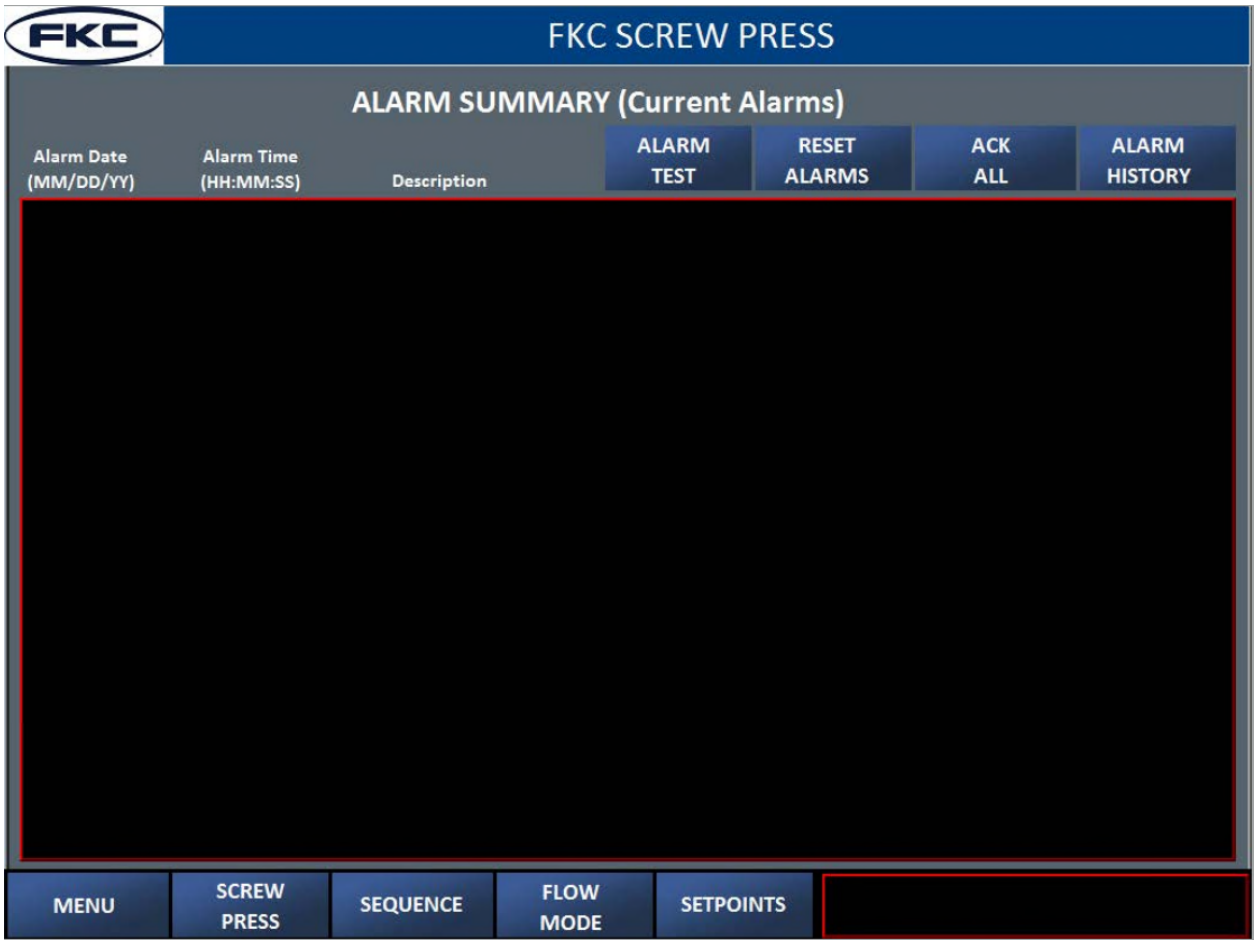


Figure CP – 8: Alarm Screen

ALARM TEST

This button allows you to simulate an alarm occurring to test the dewatering system. Please contact and consult with FKC before trying this operation.

RESET ALARMS

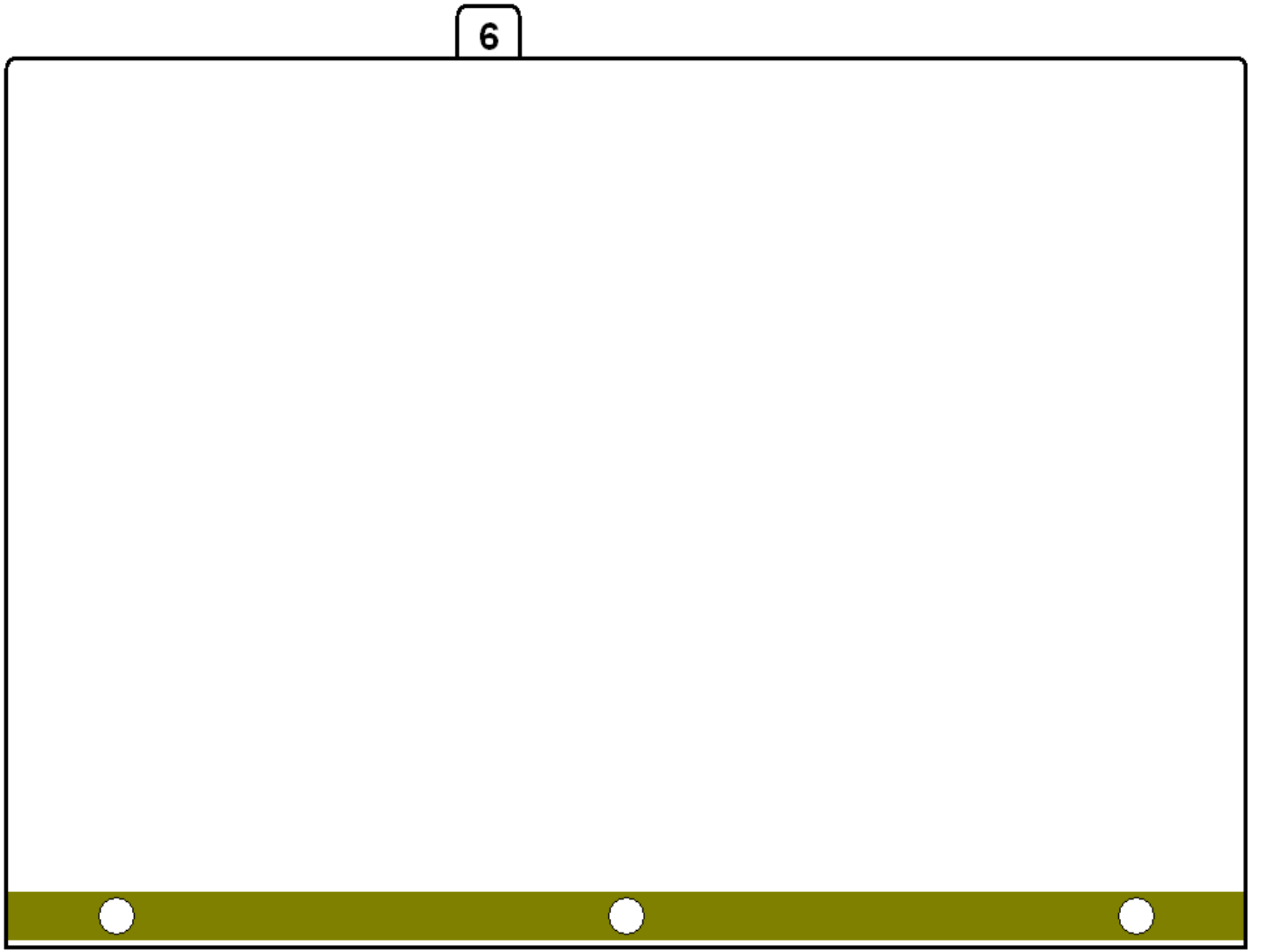
Press this button to reset and clear all the current alarms.

ACK ALL

Press this button to acknowledge all current alarms. This will allow the alarms to clear and the equipment to be re-started in HAND or AUTO.

ALARM HISTORY

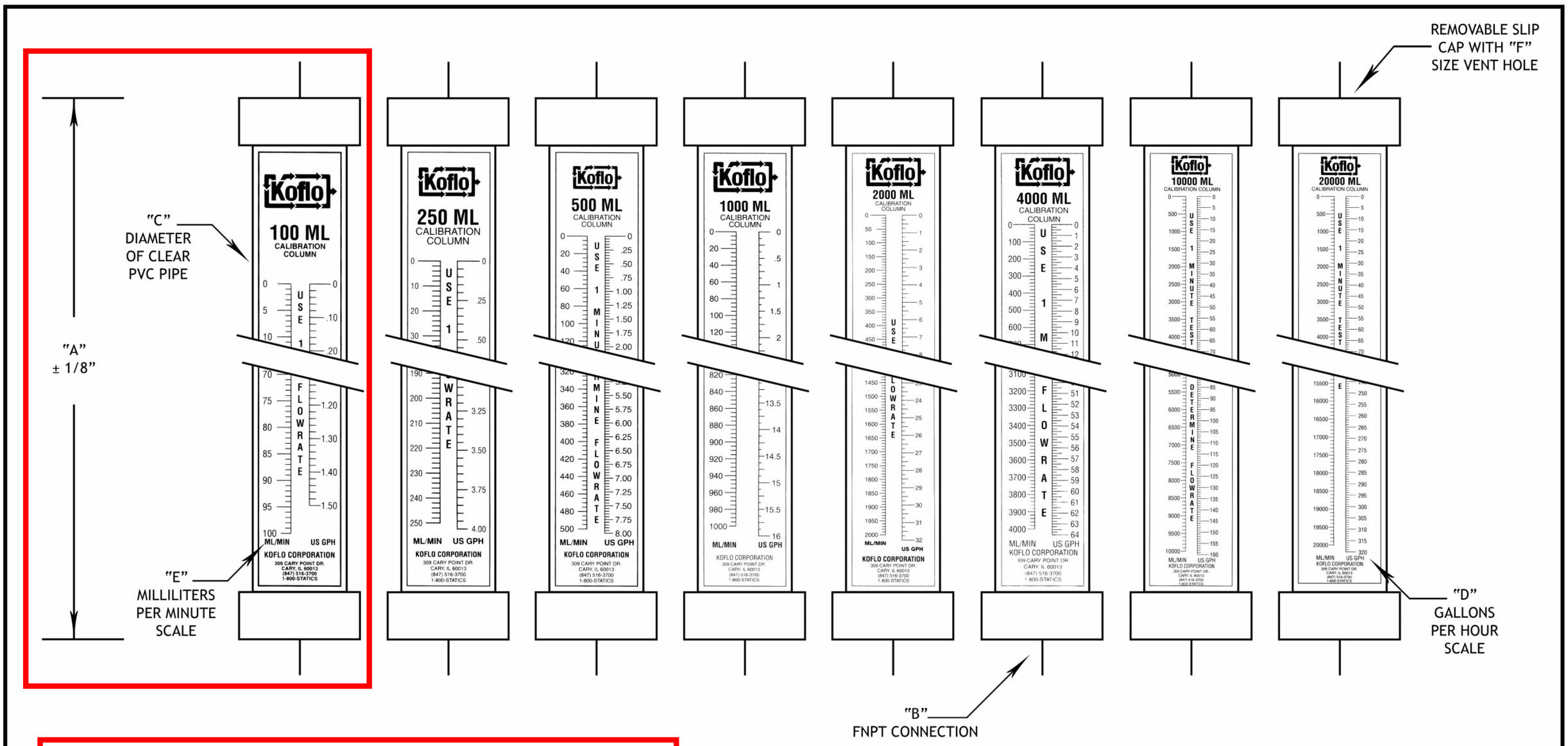
Press this button to view the list of alarms in the order they occurred.


6

Koflo
Calibration Column

Calibration Columns with Top Slip Cap

Drawing



MODEL	"A"	"B"	"C"	"D"	"E"	"F"	INCREMENTS
100 ML-SC	12-1/2"	1/2"	1"	1.5	100	1/4"	1 ML /.02 GPH
~~250 ML-SC~~	~~16-1/4"~~	~~1/2"~~	~~1-1/4"~~	~~4.0~~	~~250~~	~~1/4"~~	~~2 ML / .05 GPH~~
500 ML-SC	16"	3/4"	2"	8.0	500	1/4"	5 ML / .05 GPH
1000 ML-SC	25"	3/4"	2"	16.0	1000	1/4"	5 ML / .125 GPH
2000 ML-SC	24"	1"	3"	32.0	2000	3/8"	10 ML / .25 GPH
4000 ML-SC	34"	1"	3-1/2"	64.0	4000	1/2"	20 ML / .25 GPH
10000 ML-SC	27"	2"	6"	160.0	10,000	1/2"	100 ML / 1 GPH
20000 ML-SC	46"	2"	6"	320.0	20,000	1/2"	100 ML / 1 GPH

NOTE: USE ONE (1) MINUTE TEST TO DETERMINE FLOWRATE

Koflo Corporation
309 CARY POINT DR.
CARY, IL 60013

SCALE: NONE	APPROVED BY	DRAWN BY N.J.F.
DATE: 2/6/07		REVISED 8/9/07
CUSTOMER:		REVISED
MODEL NO: PVC CALIBRATION COLUMNS WITH TOP SLIP CAP		REVISED
		DRAWING NUMBER KD-1033

Technical Specifications

Capacity		Model Number		Tube O.D.	Column Height	FNPT End Connections	Weight
mL/min	GPH	Fixed Cap	Top Slip Cap				
100	1.5	100 ML	100 ML-SC	1.315"	12-1/2"	1/2"	7 oz
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
500	8	500 ML	500 ML-SC	2.375"	16"	3/4"	1.4 lb
1,000	16	1000 ML	1000 ML-SC	2.375"	25"	3/4"	1.9 lb
2,000	32	2000 ML	2000 ML-SC	3.500"	24"	1"	4 lb
4,000	64	4000 ML	4000 ML-SC	4.000"	34"	1"	6.5 lb
10,000	160	10000 ML	10000 ML-SC	6.625"	27"	2"	7.5 lb
20,000	320	20000 ML	20000 ML-SC	6.625"	46"	2"	10 lb

McMaster Carr

Check Valve

McMaster-Carr

McMaster-Carr Supply Company [US] | https://www.mcmaster.com/catalog/124/530

McMASTER-CARR

46635K65

Choose a Category

Abrading & Polishing
Building & Grounds
Electrical & Lighting
Fabricating
Fastening & Joining
Filtering
Flow & Level Control
Furniture & Storage
Hand Tools
Hardware
Heating & Cooling
Lubricating
Material Handling
Measuring & Inspecting
Office Supplies & Signs
Pipe, Tubing, Hose & Fittings
Plumbing & Janitorial
Power Transmission
Pressure & Temperature Control
Pulling & Lifting
Raw Materials
Safety Supplies
Sawing & Cutting
Sealing
Shipping
Suspending

Corrosion-Resistant High-Flow Threaded Backflow-Prevention Valves for Water, Oil, Inert Gas, Fuel, and Steam

- Max. Pressure: 200 psi @ 70° F
- Max. Steam Pressure: 150 psi @ 350° F
- Min. Opening Pressure: 0.5 psi
- Temperature Range: -20° to 400° F

For high-flow applications in corrosive environments, these valves have internal components designed to reduce flow resistance and a 316 stainless steel body. They open to allow flow in one direction and close when flow stops or reverses. All have a threaded cap that provides easy access to internal components for maintenance.

CAD For technical drawings and 3-D models, click on a part number.

Pipe Size	End-to-End Lg.	Mounting Orientation	Valve Type		Each
NPT Female					
316 Stainless Steel Body and Seal					
1/4	2 9/16"	Horizontal, Vertical	Check	46635K62	$66.92
3/8	2 9/16"	Horizontal, Vertical	Check	46635K63	66.92
1/2	2 9/16"	Horizontal, Vertical	Check	46635K64	66.92
3/4	2 15/16"	Horizontal, Vertical	Check	**46635K65**	86.74

Product Detail CAD

High-Flow Backflow-Prevention Valve, Corrosion-Resistant, 3/4 NPT Female

Each

ADD TO ORDER

In stock

1	3 9/16"	Horizontal, Vertical	Check	46635K66	92.55
1 1/4	4 1/8"	Horizontal, Vertical	Check	46635K67	107.55
1 1/2	4 11/16"	Horizontal, Vertical	Check	46635K68	154.09
2	5 7/16"	Horizontal, Vertical	Check	46635K69	206.36
2 1/2	6 1/8"	Horizontal, Vertical	Check	46635K71	338.51
3	7 5/16"	Horizontal, Vertical	Check	46635K72	439.24

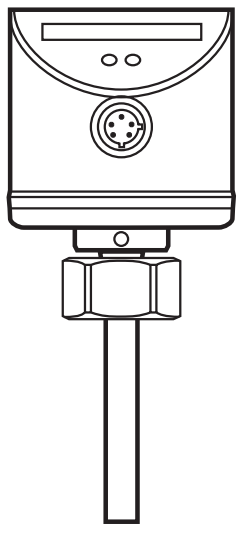
IFM Efector
Flow Switch

Operating instructions
Flow monitors

efector300

SI5006

UK



704194/04 05 / 2016

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1 Preliminary note

1.1 Symbols used

▶ Instruction

> Reaction, result

[…] Designation of buttons, switches or indications

→ Cross-reference

Important note
Non-compliance can result in malfunctions or interference.

UK

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the units result in a loss of the warranty claims.
- Protect the units and the cables efficiently against damage.
- This is a class A product. This unit may cause radio interference in domestic areas. If required, take appropriate EMC screening measures.

3 Functions and features

3.1 Application area

The unit monitors the flow of liquid and gaseous media.

3.2 Operating principle flow monitoring

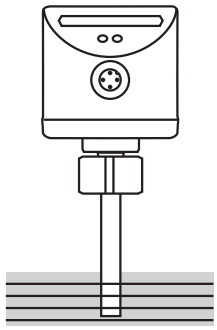
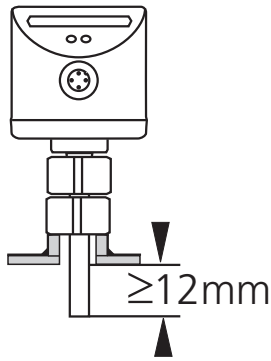
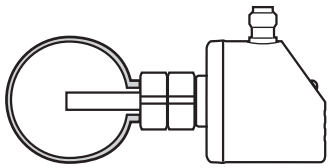
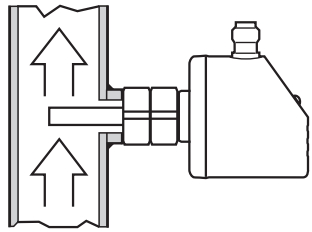
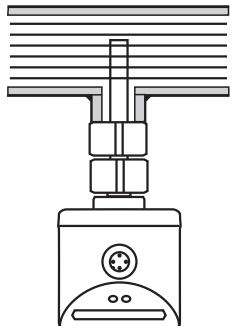
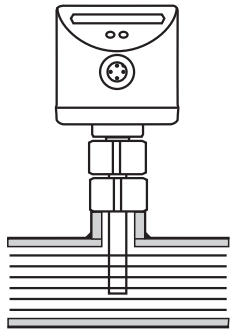
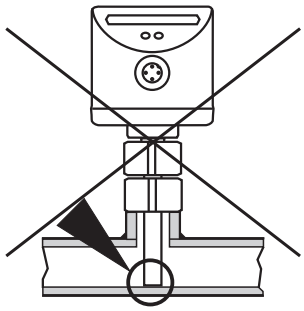
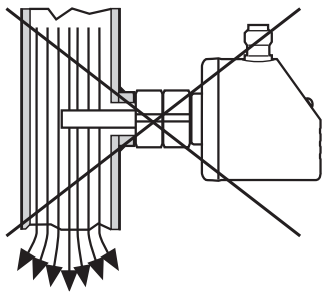
- The unit detects the flow speed to the calorimetric measuring principle and switches the output:
  - output closed if medium is flowing / output open if no medium is flowing.
  This applies to the unit on delivery: output = normally open. In case of need you can change the output to normally closed (→ 8.2). It then applies: output open if medium is flowing.
- If the flow speed increases, the switching status changes when the switch point is reached.
- If the flow speed falls again, the switching status changes if the value "SP minus hysteresis" is reached.
  The hysteresis changes with the flow speed and it is essentially influenced by the set monitoring range.
  It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.
- The typical response time of the unit is 1...10 s. It can be influenced by the setting of the switch point:
  - Low switch point = quick reaction with rising flow.
  - High switch point = quick reaction with falling flow.

4 Installation

Using process adapters the unit can be adapted to different process connections.

- Adapters have to be ordered separately as accessories.
  A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.
- For small flow rates ifm adapter blocks are available.

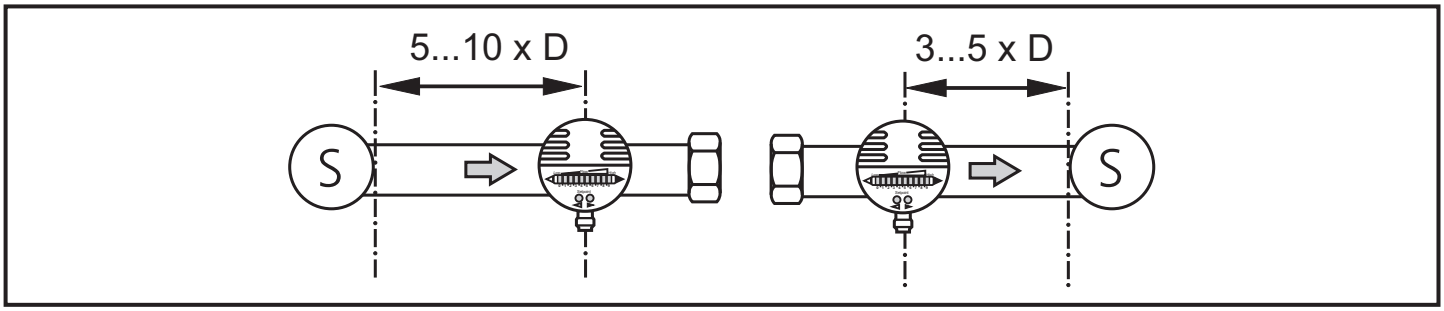
4.1 Installation location

General • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum 12 mm.		
Recommended • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe.		
Conditional • Horizontal pipe /mounting from the bottom: if the pipe is free from build-up. • Horizontal pipe /mounting from the top: if the pipe is completely filled with medium.		
To avoid • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom!		

4.2 Sources of interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

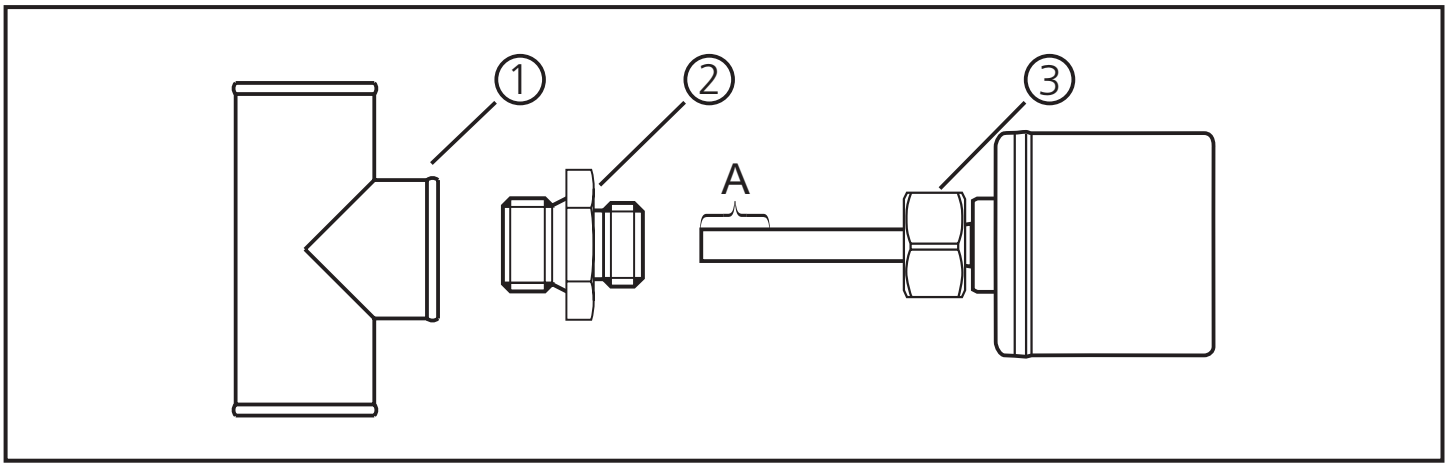
Recommendation: Adhere to the distances between sensor and sources of interference:



D = pipe diameter; S = sources of interference

4.3 Mounting operation

- ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.



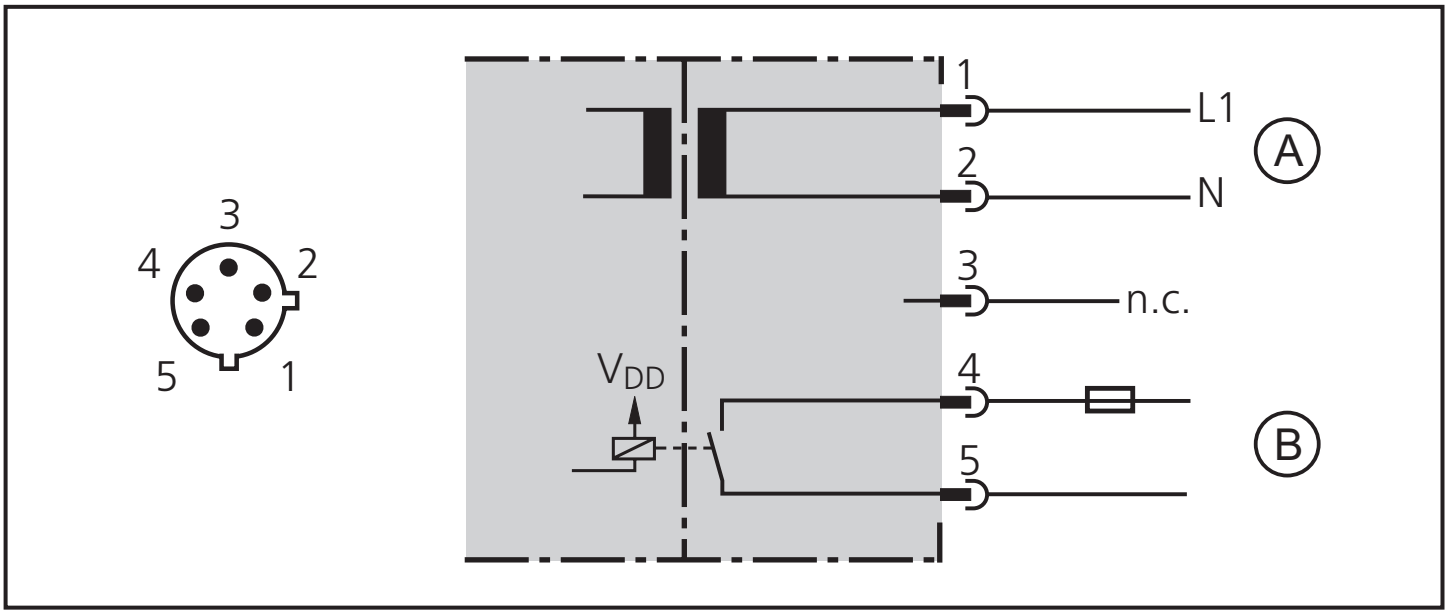
- ▶ Grease the threads of the process connection (1), adapter (2) and nut (3). Note: The sensor tip (A) must not be in contact with grease.
- ▶ Screw the suitable adapter into the process connection.
- ▶ Place the flow monitor onto the adapter and tighten the nut. Tightening torque 25 Nm. Ensure that the unit is correctly oriented.

5 Electrical connection

- The unit must be connected by a qualified electrician.
- The national and international regulations for the installation of electrical equipment must be adhered to.
- Caution: For the output circuit the same protective measures as
- for the supply circuit must be taken.
- Insert a miniature fuse according to IEC60127-2 Sheet 1 (≤ 5 A fast acting).
- The permissible potential difference between supply and output circuit is max. 300 V.
- The metal parts of the housing must be properly grounded. For this, you can, for example, attach a grounding clip to the connector and ensure the grounding using a potential equalisation cable.
- Due to the integrated EMC filters, leakage currents of typ. < 0.5 mA can flow via the potential equalisation to the earth potential.
- If several units are used in parallel, take into account that the leakage currents add.
- The applicable standards must be adhered to.

▶ Disconnect power.

▶ Connect the unit as follows:

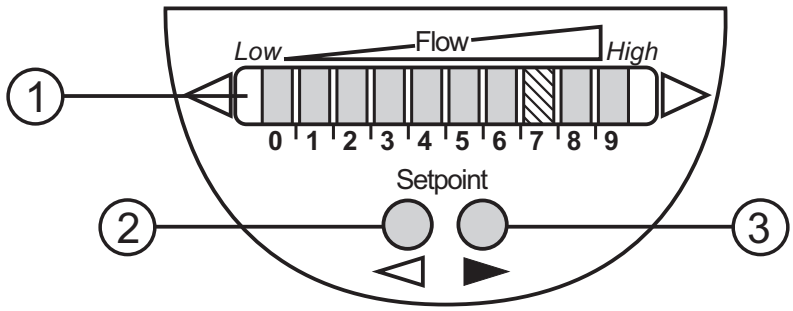


A: supply circuit; B: output circuit

— · — · — : safe separation

ifm-sockets are available as accessories:
Order no. E11248, E11249, E11250, E11251
Core colours of ifm sockets:
1 = BN (brown), 2 = BU (blue), 4 = BK (black), 5 = WH (white)

6 Operating and display elements



1: Operation display
• The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow). • A lighting LED indicates the position of the switch point (orange = output closed, red = output open).
2, 3: Setting buttons for adjustment and configuration

7 Set-up and settings for water

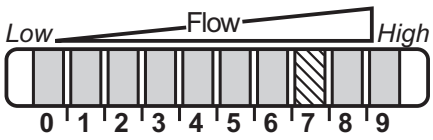
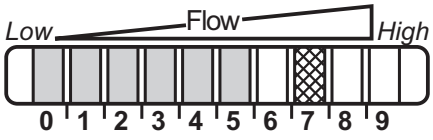
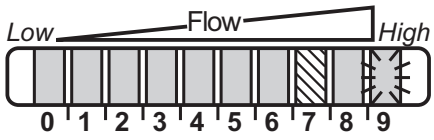
(For media other than water → 8.1: Low flow adjustment).

▶ Switch on the supply voltage.

> All LEDs light and go out again step by step. During this time the output is closed (if configured as normally open). The unit is in the operating mode.

▶ Let the normal flow circulate in the installation.

▶ Check the display and determine further actions.

1		The factory setting is suitable for the application. ▶ No further settings are required.
2		Your normal flow is below the representation range of the display. 2 setting options: ▶ Change the switch point (→ 7.1). ▶ Carry out high flow adjustment (→ 7.2).
3		Your normal flow exceeds the representation range of the display (LED 9 flashes). ▶ Carry out high flow adjustment (→ 7.2).

You can restore the factory setting any time. (→ 8.3).

7.1 Change the switch point (optional)

For the factory setting the switch point is at LED 7. A change makes sense in the folowing cases:

- the display shows example 2.
- the flow fluctuates much or pulsates.
- a faster response time of the unit is requested (low switch point = fast response with rising flow, high switch point = fast response with falling flow).

▶ Briefly press the pushbutton ◁ or ►.

> The switch point LED flashes.

▶ Press the pushbutton ◁ or ► as often as required. Each press of the push-button shifts the LED by one position in the indicated direction.

Note: If no pushbutton is pressed for 2 s, the unit returns to the operating mode with the newly set value.

7.2 High flow adjustment (optional)

The unit determines the existing flow as normal flow and adapts the display representation (all LEDs except the switch point LED light green).

▶ Let the normal flow circulate in the installation.

▶ Press the pushbutton ► and keep it pressed.

> LED 9 lights, after approx. 5 s it flashes.

▶ Release the pushbutton.

The unit is now adapted to your flow conditions. It passes into the operating mode, the display should now show example 1.

Note: The adjustment affects the switch point: It is increased proportionally (maximum up to LED 7).

8 Additional settings (optional)

8.1 Low flow adjustment

If the unit is used in media other than water, you should additionally adapt the unit to the minimum flow.

Note: The following adjustment must only be carried out after the high flow adjustment.

▶ Let the minimum flow circulate in the installation or ensure flow standstill.
▶ Press the pushbutton ◁ and keep it pressed.
> LED 0 lights, after approx. 5 s it flashes.
▶ Release the pushbutton. The unit adopts the new value and passes into the operating mode.

8.2 Configure the switching output

The unit is delivered as normally open. In case of need you can change the output to normally closed:

▶ Press the pushbutton ◁ for at least 15 s.
> LED 0 lights, after approx. 5 s it flashes.
> After 10 s the current setting is displayed: LEDs 5...9 light orange (= output normally open).
> After approx. 15 s LEDs 0...4 flash orange.
▶ Release the pushbutton. The output is changed to normally closed operation.

For a new changeover repeat the operation.

8.3 Restore the factory setting (reset)

▶ Press the pushbutton ► for at least 15 s.
> LED 9 lights, after approx. 5 s it flashes.
> After approx. 15 s LEDs 0...9 flash orange.
▶ Release the pushbutton. All settings are reset to the factory setting:
- operating area: 5 ...100 cm/s for water
- switch point: LED 7
- output function: NO
- unlocked.

8.4 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

▶ Press both setting pushbuttons simultaneously for at least 10 s in the operating mode.

> The indication goes out, the unit locks or unlocks.

On delivery: unlocked.

9 Error during adjustment

If no adjustment is possible, all LEDs flash red. The unit then passes into the operating mode with unchanged values.

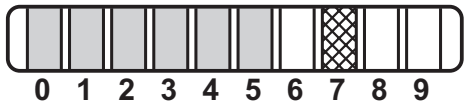
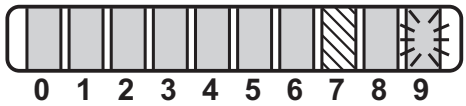
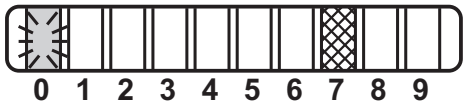
Possible cause /aid:

Error during installation.	▶ Read chapter 4 Installation. Check whether all requirements have been met.
The difference between maximum flow and minimum flow is too small.	▶ Increase the flow difference and carry out the adjustment once again.
The sequence high flow /low flow adjustment was not adhered to.	▶ Carry out the two adjustment operations again in the right sequence.

10 Operation

After every power on all LEDs light and go out again step by step (during this time the output is closed if configured as normally open). The unit is then ready for operation.

In case of power failure or interruption all settings remain.

Operating indicators	
	Green LED bar: Current flow within the representation range. Indication of the switch point (SP): - LED orange: output closed. - LED red: output open.
	LED 9 flashes: current flow above the representation range.
	LED 0 flashes: current flow far below the representation range.
Interference indicators	
Display OFF (no LED lights):	Operating voltage too low (< 85 V AC) or failed. Ensure a correct voltage supply.

11 Maintenance

Recommended maintenance:

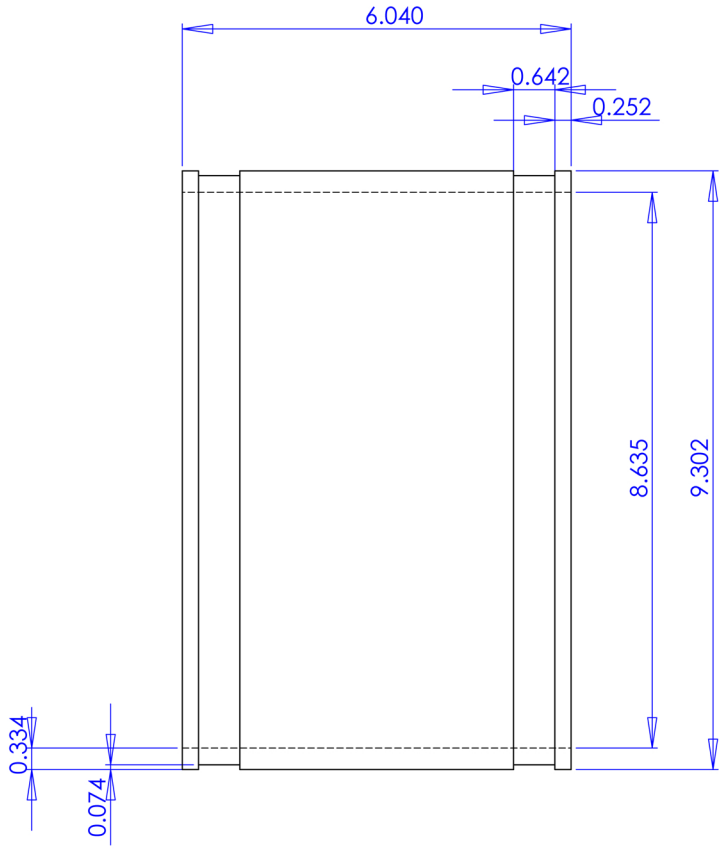
- ▶ Check the sensor tip for build-up from time to time.
- ▶ Clean it using a soft cloth. Stubborn build-up (e.g. lime) can be removed using a common vinegar cleaning agent.

12 Technical data

Technical data and scale drawing at www.ifm.com.

Fernco
Rubber Pipe Sleeve

Fernco Inc.
Davison, MI • PH: 810-653-9626 • FAX: 810-653-8714 • www.Fernco.com



*This Part requires two clamps, part number 152-300.
See additional drawing for information on these clamps.

Part Weight	3.02 lbs.
Min/Max Temp.	-30/140 Degrees F
Pressure Tested	4.3 PSI
Material	Flexible PVC
Installation Torque	60" Lbs.
Conforms to ASTM	D5926, C1173
Box Quantity	10
Clamps used	300 Series

TOLERANCES:
.X= Fractional ±
.XX= ±.02
.XXX= ±.030
ANG.= ±0.5°
UNLESS OTHERWISE SPECIFIED

DESCRIPTION:
Coupling 8" Plastic x 8" Plastic

1056-88

NOTES:
- SOME HIDDEN LINES NOT SHOWN
-BREAK ALL SHARP CORNERS
-REPORT ALL CHANGES TO ENGINEERING

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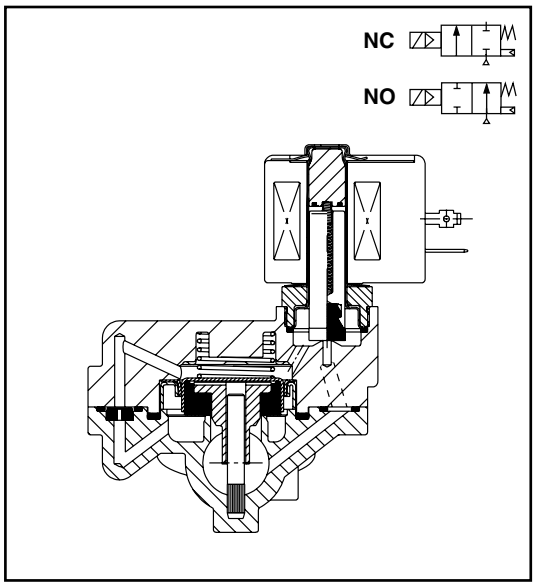
UNITS:	SIZE	DESIGNER:	SCALE
INCHES	A	D. Brady	not to scale
3RD ANGLE PROJECTION DO NOT SCALE DRAWING	CHECKER:	DATE: 1/31/2007	SHEET 1 OF 1

ASCO
Solenoid Valves

Features

- Pilot operated, normally open or normally closed
- Snubber slows disc closing speed to protect system against water hammer damage more effectively than other techniques
- Pressure spike due to water hammer is reduced to a point eliminating the need for suppressors or other controls in most water systems
- Fluid Controls Institute Inc. evaluations have classified these valves:

Pipe Sizes	FCI-82-1 Class
3/8", 1/2", 3/4"	CC
1", 1 1/4", 1 1/2", 2", 2 1/2"	BB



Construction

Valve Parts in Contact with Fluids	
Body	Brass
Disc	NBR
Seals	PTFE & NBR
Core Tube	305 Stainless Steel
Core and Plugnut	430F Stainless Steel
Springs	302 Stainless Steel
Piston	Stainless Steel or Brass
Shading Coil	Copper

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part No.			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	11.6	6.1	16	30	238210	238710	238214	238714
F	16.8	16.1	35	95	272610	97617	272614	97617
F	22.6	-	-	-	-	238710	-	238714

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
Other voltages are available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.

Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; RedHat - Explosionproof and Raintight, Types 3, 7, and 9. (To order, add prefix "EF" to catalog number.)

See Optional Features Section for other available options.

Nominal Ambient Temp. Ranges:

RedHat II/
RedHat AC: 32˚F to 125˚F (0˚C to 52˚C)
RedHat II DC: 32˚F to 104˚F (0˚C to 40˚C)
RedHat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)

Refer to Engineering Section for details.

Approvals:

CSA certified (Excludes 8221G015, -035, -G035).
UL listed, General Purpose Valves.
RedHat II meets applicable CE directives.

Refer to Engineering Section for details.

Specifications (English units)

Pipe Size (in)	Orifice Size (in)	Cv Flow Factor	Operating Pressure Differential (psi)			Max. Fluid Temp. ˚F		Brass Body	Const. Ref.	Watt Rating/ Class of Coil Insulation ③	
			Min. ①	Max. AC Water ②	Max. DC Water ②	AC	DC	Catalog Number		AC	DC
NORMALLY CLOSED (Closed when de-energized)											
3/8	9/16	3	5	150	125	180	150	8221G001	1	6.1/F	11.6/F
1/2	9/16	3.5	5	150	125	180	150	8221G003	1	6.1/F	11.6/F
1	1	11.5	5	150	125	180	150	8221G007	5	6.1/F	11.6/F
1 1/4	1 1/8	13	5	150	125	180	150	8221G009	6	6.1/F	11.6/F
2	1 3/4	36	5	150	125	180	150	8221G013	11	6.1/F	22.6/F
2 1/2	1 3/4	38	5	150	125	180	150	8221G015 ④	12	6.1/F	22.6/F
NORMALLY OPEN (Open when de-energized)											
3/8	9/16	3	5	-	125	-	150	8221 021	15	-	16.8/F
3/8	9/16	3	5	150	-	180	-	8221G021	3	16.1/F	-
1/2	9/16	3.5	5	-	125	-	150	8221 023	15	-	16.8/F
1/2	9/16	3.5	5	150	-	180	-	8221G023	3	16.1/F	-
3/4	3/4	5.5	5	-	125	-	150	8221 025	16	-	16.8/F
3/4	3/4	5.5	5	150	-	180	-	8221G025	4	16.1/F	-
1	1	11.5	5	-	125	-	150	8221 027	17	-	16.8/F
1	1	11.5	5	150	-	180	-	8221G027	8	16.1/F	-
1 1/4	1 1/8	13	5	-	125	-	150	8221 029	18	-	16.8/F
1 1/4	1 1/8	13	5	150	-	180	-	8221G029	9	16.1/F	-
1 1/2	1 1/4	24	5	-	125	-	150	8221 031	19	-	16.8/F
1 1/2	1 1/4	24	5	150	-	180	-	8221G031	10	16.1/F	-
2	1 3/4	36	5	-	125	-	150	8221 033	20	-	16.8/F
2	1 3/4	36	5	150	-	180	-	8221G033	13	16.1/F	-
2 1/2	1 3/4	38	5	-	125	-	150	8221 035 ④	21	-	16.8/F
2 1/2	1 3/4	38	5	150	-	180	-	8221G035 ④	14	16.1/F	

① Valves require a 5 psi Minimum Pressure Differential to open. Once open, they remain open with 3 psi differential pressure.
② Refer to Steam/Hot Water Valve Series for Hot Water constructions.
③ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
④ Not CSA certified.

Specifications (Metric units)

Pipe Size (in)	Orifice Size (mm)	Kv Flow Factor (m3/h)	Operating Pressure Differential (bar)			Max. Fluid Temp. ˚C		Brass Body	Const. Ref.	Watt Rating/ Class of Coil Insulation ③	
			Min. ①	Max. AC Water ②	Max. DC Water ②	AC	DC	Catalog Number		AC	DC
NORMALLY CLOSED (Closed when de-energized)											
3/8	14	2.6	0.3	10	9	82	65	8221G001	1	6.1/F	11.6/F
1/2	14	3.0	0.3	10	9	82	65	8221G003	1	6.1/F	11.6/F
3/4	19	4.7	0.3	10	9	82	65	8221G005	2	6.1/F	11.6/F
1	25	9.9	0.3	10	9	82	65	8221G007	5	6.1/F	11.6/F
1 1/4	29	11	0.3	10	9	82	65	8221G009	6	6.1/F	11.6/F
1 1/2	32	21	0.3	10	9	82	65	8221G011	7	6.1/F	11.6/F
2	44	31	0.3	10	9	82	65	8221G013	11	6.1/F	22.6/F
2 1/2	44	33	0.3	10	9	82	65	8221G015 ④	12	6.1/F	22.6/F
NORMALLY OPEN (Open when de-energized)											
3/8	14	2.6	0.3	-	9	-	65	8221 021	15	-	16.8/F
3/8	14	2.6	0.3	10	-	82	-	8221G021	3	16.1/F	-
1/2	14	3.0	0.3	-	9	-	65	8221 023	15	-	16.8/F
1/2	14	3.0	0.3	10	-	82	-	8221G023	3	16.1/F	-
3/4	19	4.7	0.3	-	9	-	65	8221 025	16	-	16.8/F
3/4	19	4.7	0.3	10	-	82	-	8221G025	4	16.1/F	-
1	25	9.9	0.3	-	9	-	65	8221 027	17	-	16.8/F
1	25	9.9	0.3	10	-	82	-	8221G027	8	16.1/F	-
1 1/4	29	11	0.3	-	9	-	65	8221 029	18	-	16.8/F
1 1/4	29	11	0.3	10	-	82	-	8221G029	9	16.1/F	-
1 1/2	32	21	0.3	-	9	-	65	8221 031	19	-	16.8/F
1 1/2	32	21	0.3	10	-	82	-	8221G031	10	16.1/F	-
2	44	31	0.3	-	9	-	65	8221 033	20	-	16.8/F
2	44	31	0.3	10	-	82	-	8221G033	13	16.1/F	-
2 1/2	44	33	0.3	-	9	-	65	8221 035 ④	21	-	16.8/F
2 1/2	44	33	0.3	10	-	82	-	8221G035 ④	14	16.1/F	-

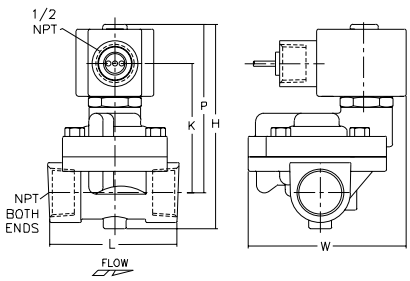
① Valves require a 0.3 bar Minimum Pressure Differential to open. Once open, they remain open with 0.2 bar differential pressure.
② Refer to Steam/Hot Water Valve Series for Hot Water constructions.
③ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
④ Not CSA certified.

Dimensions: inches (mm)

Const. Ref.		H	K	L	P	W
1	in	4.34	2.69	2.72	3.59	3.41
	mm	110	68	69	91	87
2	in	4.53	2.85	2.78	3.75	3.41
	mm	115	72	71	95	87
3	in	5.22	3.14	2.72	4.47	3.69
	mm	133	80	69	114	94
4	in	5.41	3.30	2.78	4.62	3.69
	mm	137	84	71	117	94
5	in	5.62	3.15	3.75	4.03	3.16
	mm	143	80	95	102	80
6	in	5.56	3.15	3.66	4.03	3.56
	mm	141	80	93	102	90
7	in	6.12	3.66	4.38	4.13	4.12
	mm	156	84	111	106	105
8	in	6.53	3.59	3.75	4.91	3.16
	mm	166	91	95	125	80
9	in	6.47	3.59	3.56	4.91	3.56
	mm	164	91	93	125	90
10	in	7.03	3.74	4.38	5.06	4.12
	mm	179	95	111	129	105
11	in	7.38	3.71	5.06	4.59	4.72
	mm	188	94	129	117	120
12	in	7.38	3.71	5.50	4.59	5.19
	mm	188	94	140	117	132
13	in	8.22	4.15	5.06	5.47	4.72
	mm	209	105	129	139	120
14	in	8.22	4.15	5.50	5.47	5.19
	mm	209	105	140	139	132
15	in	5.22	-	2.72	4.47	3.69
	mm	133	-	69	114	94
16	in	5.41	-	2.78	4.62	3.69
	mm	137	-	71	117	94
17	in	6.53	-	3.75	4.91	3.16
	mm	166	-	95	125	80
18	in	6.47	-	3.66	4.91	3.56
	mm	164	-	93	125	90
19	in	7.03	-	4.38	5.06	4.12
	mm	179	-	111	129	105
20	in	8.22	-	5.06	5.47	4.72
	mm	209	-	129	139	120
21	in	8.22	-	5.50	5.47	5.19
	mm	209	-	140	139	132

IMPORTANT: Valves may be mounted in any position.

Const. Ref. 1, 2



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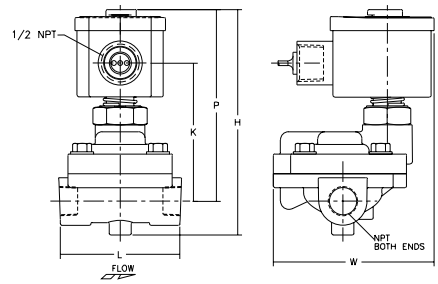

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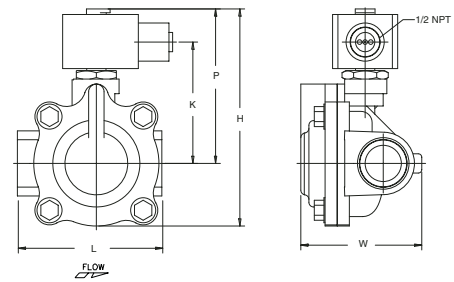

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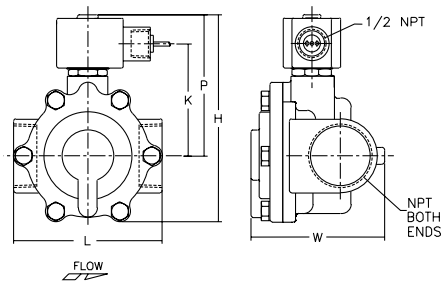

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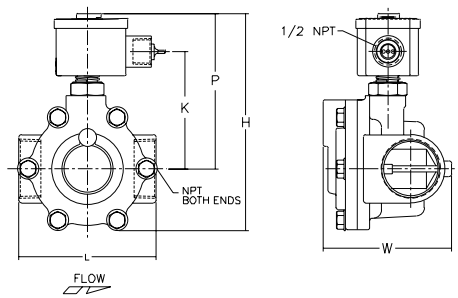

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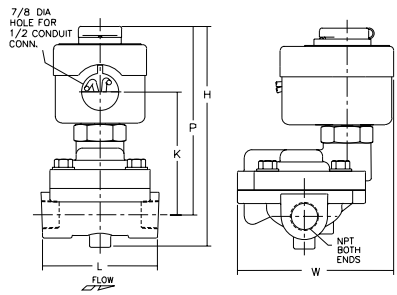

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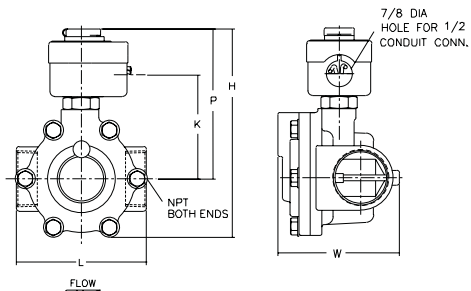

Installation & Maintenance Instructions

2–WAY INTERNAL PILOT–OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION — SOFT CLOSING
1″, 1 ¼″, 1 ½″, 2″, OR 2 ½″ NPT

SERIES

8221

Form No.V6492R1

IMPORTANT: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Causes of Improper Operation, and Coil or Solenoid Replacement.

DESCRIPTION

Series 8221 valves are 2–way normally closed, internal pilot–operated solenoid valves designed for soft closing. Valves are made of forged brass with internal parts of brass or stainless steel and elastomers of Buna N, or ethylene propylene, depending upon service requirements. Valves may be provided with a general purpose, explosionproof or explosionproof/watertight solenoid enclosure.

OPERATION

Normally Closed: Valve is closed when solenoid is de–energized; open when energized.

IMPORTANT: Minimum operating pressure differential required is 5 psi. Valve will remain open down to 3 psi differential.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart. Check catalog number prefix and suffix on nameplate to determine the maximum temperatures. See example following chart.

Construction AC or DC	Catalog Number Prefix	Catalog Number Suffix	Maximum Temperature °F	
			Ambient	Fluid
AC	None	None	125	180
	HT	None	140	180
	None	HW	125	210
	HT	HW	140	210
DC	None, or HT	None	77	150

EXAMPLES: For Catalog No. HT8221G19, AC construction the maximum ambient temperature is 140° F with a maximum fluid temperature of 180°F. For Catalog No. 8221G13HW, AC construction the maximum ambient temperature is 125° F with a maximum fluid temperature of 210°F.

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Piping

Connect piping or tubing to valve according to markings on valve body.

⚠ **CAUTION: Valves with suffix "HW" in the catalog number are equipped with ethylene propylene elastomers which can be attacked by oils and greases. Use on oil–free systems only. Wipe the threads clean of cutting oils.**

Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

IMPORTANT: To protect the solenoid valve, install a strainer or filter suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ **WARNING: To prevent the possibility of personal injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.**

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

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Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- While in service, the valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Causes of Improper Operation

- **Incorrect Pressure**: Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage**: Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

Note: Refer to Figure 1 for AC construction and 1″, 1 1/4″ or 1 1/2″ NPT (pipe size). Refer to Figure 2 for DC construction and 2″ or 2 1/2″ NPT (pipe size).

1. Disassemble valve in an orderly fashion using exploded views for identification of parts.
2. Remove solenoid, see separate instructions.

⚠ **CAUTION: Do not remove body plug on 2″ or 2 1/2″ NPT valves. The body plug has been sealed in place at the factory. Removal is not necessary for cleaning or rebuilding.**

3. Unscrew solenoid base sub−assembly and remove core assembly, core spring, and solenoid base gasket.
4. For normal maintenance (cleaning), it is not necessary to remove the valve seat. However, for valve seat removal use a 7/16″ thin wall socket wrench. For DC construction 2″ or 2 1/2″ NPT only (Figure 2), remove seat washer.
5. Remove bonnet screws and valve bonnet from valve body. Then remove the following parts:

- Piston Spring
- Lip Seal
- Support
- Piston
- Disc
- Aspirator tube †
- Snubber
- Body gasket
- Bleed gasket
- Bleed washer
- Flow control
- Lower bleed washer †

† Present on 2″ & 2 1/2″ NPT valve constructions only.

6. All parts are now accessible to clean or replace. Replace worn or damaged parts with a complete ASCO Rebuild kit.

Valve Reassembly

1. Lubricate the disc and all gaskets with DOW CORNING® 111 Compound lubricant or an equivalent high−grade silicone grease.
2. On 2″ or 2 1/2″ NPT valve constructions, install lower bleed washer (small diameter) into valve body. Then position the flow control into valve body with concave end outward; facing the valve bonnet. Position bleed washer and gasket over the flow control.
3. Preassemble aspirator tube (2″ or 2 1/2″ NPT construction only), snubber, disc, and piston.
4. Position lip seal, flanged end up, onto piston. Position body gasket and support in valve body cavity. Install piston assembly with lip seal into support in valve body cavity.
5. Replace piston spring, valve bonnet and bonnet screws. Torque bonnet screws in a crisscross manner to 144 ± 15 in−lbs [16,3 ± 1,7 Nm].
6. If removed, replace seat washer (used only with 2″ or 2 1/2″ NPT, DC valve constructions) and valve seat. Use a small amount of thread sealing on male threads. Torque valve seat to 65 ± 15 in−lbs [7,3 ± 1,7 Nm].
7. Replace solenoid base gasket, core assembly, core spring, and solenoid base sub−assembly.

Note: For AC construction (Figure 1), position wide end of core spring in core first, closed (tapered) end protrudes from top of core.

8. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
9. Install solenoid, see separate solenoid instructions. Then make electrical hookup to solenoid.

⚠ **WARNING: To prevent the possibility of personal injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.**

10. Restore line pressure and electrical power supply to valve.
11. After maintenance is completed, operator the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

ORDERING INFORMATION

FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

Torque Chart

Part Name	Torque Value Inch−Pounds	Torque Value Newton−Meters
solenoid base sub−assembly	175 ± 25	19,8 ± 2,8
valve seat	65 ± 15	7,3 ± 1,7
bonnet screws	144 ± 15	16,3 ± 1,7

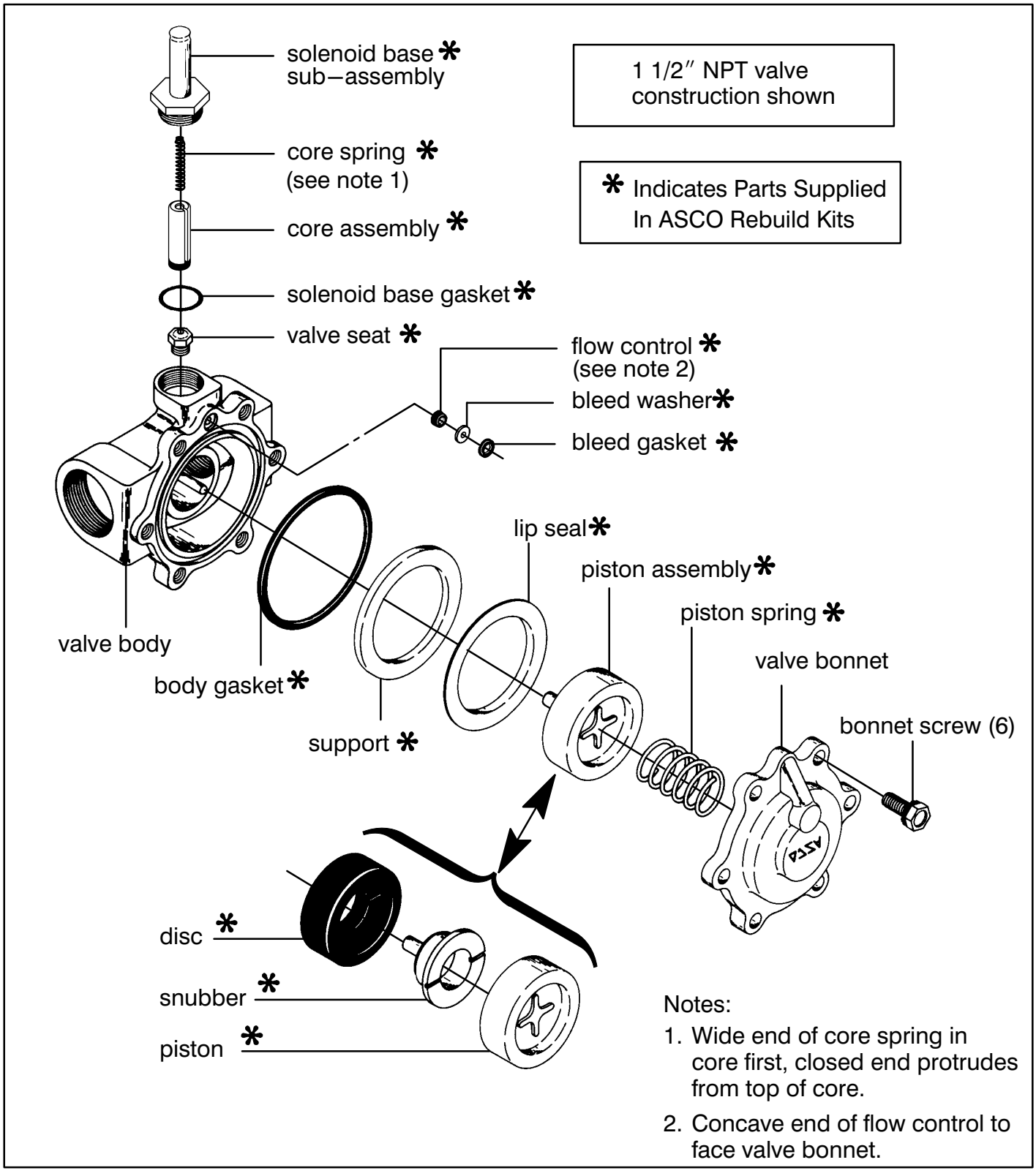

Figure 1. Series 8221, 1″, 1 1/4″ or 1 1/2″ NPT, AC construction shown.

Torque Chart

Part Name	Torque Value Inch−Pounds	Torque Value Newton−Meters
solenoid base sub−assembly	175 ± 25	19,8 ± 2,8
valve seat	65 ± 15	7,3 ± 1,7
bonnet screws	144 ± 15	16,3 ± 1,7

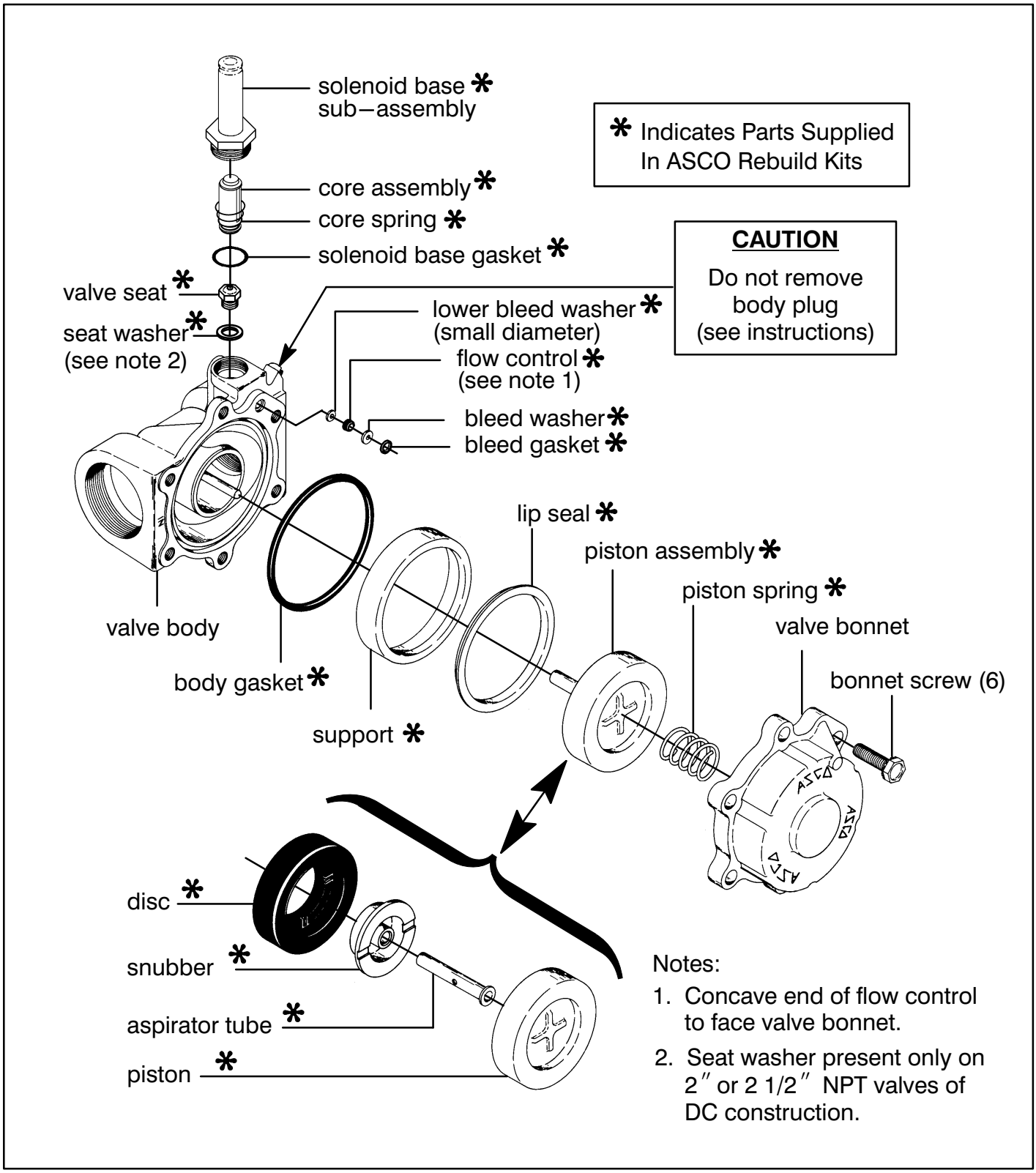

Figure 2. Series 8221, 2″ or 2 1/2″ NPT, DC construction shown.

Screw Press

EQUIPMENT SUMMARY FORM

Owner:	City of Rock Island, WA	**Date:**	1/15/2020
Contractor:	DBJ Construction LLC		
Project Name:	Screw Press Dewatering Equipment Procurement	**Project No.:**	10612

Summary of Equipment

1. Equipment Item: Screw Press
2. Manufacturer: FKC Co., Ltd.
3. Equipment ID No.(s) Screw Press - SP
4. Location of Equipment Biosolids Building
5. Weight of Individual Components (Over 100 Pounds)

   Screw 652 lbs, Discharge Box 491 lbs, Drum 225 lbs,

   Inlet Stand 322 lbs, Gearbox 543 lbs, Base 519 lbs.
6. Nameplate Data:

Horsepower	2.0 HP
Amperage	3.0
Voltage	230/460 VAC
Service Factor (S.F.)	1.15 SF
Speed	1750 rpm
ENC Type	TEFC
Capacity	
Other	
7. Manufacturer's Local Representative:

Name:	Victor Pedroni
Address:	4580 Klahanie Dr. SE #271, Issaquah, WA 98029
Phone Number:	1-425-369-6164
8. Maintenance Requirements:

   Bearings - EVERY 1 TO 3 MONTHS Grease inlet and outlet bearings.

   Gearbox - FIRST 500 HRS Change out oil.

   Gearbox - EVERY 2,500 HRS Change out oil.
9. Lubrication List:

   Bearing grease - Shell Alvania EP1 or equivalent. Gearbox oil - Mobilgear 627, 629 or equivalent.
10. Spare Parts: (recommendations):

    Screens - Qty (2) 1.5 Dia, x 1.5T x 4.0P x 499W

    Screens - Qty (2) 1.5 Dia, x 1.5T x 6.0P x 499W
11. Comments:

    Drums & shower piping should be emptied when not in operation and under freezing conditions .

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Section 5	Operating Instructions	
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Section 7	Maintenance Instructions	
Section 8	Commercial Parts Literature	
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Section 10	Performance Data	

SECTION 1

GENERAL PRINCIPLES

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1B GENERAL MECHANICAL CONSTRUCTION Page 1-2

1C GENERAL OPERATING PRINCIPLES Page 1-3

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b) HEADBOX LEVEL Page 1-4

c) PRESSURE CONE SETTING Page 1-4

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d) SLUDGE PROPERTIES Page 1-6

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SECTION 1A

SCREW PRESS INTRODUCTION

A screw press will achieve maximum performance only if the operator controls the various factors affecting its operation. In order to control these various conditions, the screw press operator must have the basic understanding regarding screw press operation this manual provides.

FKC screw presses have been in use with pulp & paper, food, chemical, and industrial applications since 1958. Uses include, primary and secondary sludge dewatering, wood pulp dewatering, rejects dewatering, fruit juicing, imitation crabmeat (surimi) production, and fryer oil recovery.

The function of the screw press is to remove liquid from a solid/liquid mixture. This is accomplished by squeezing the solid/liquid mixture while allowing liquids to escape through perforated screens surrounding the screw while retaining the solids inside the press.

As shown in Figure 1A, the solid/liquid mixture enters the screw press by way of the head box at the inlet end. The mixture is conveyed from the inlet end to the outlet end of the press by the rotating screw. As the material is conveyed along the length of the press it is squeezed between the tapered screw shell and the screen drums. The dry solids exit the press at the discharge end and fall down the discharge box. The liquid (pressate) that was forced out through the screens is collected in the pressate pan and flows to the discharge flange.

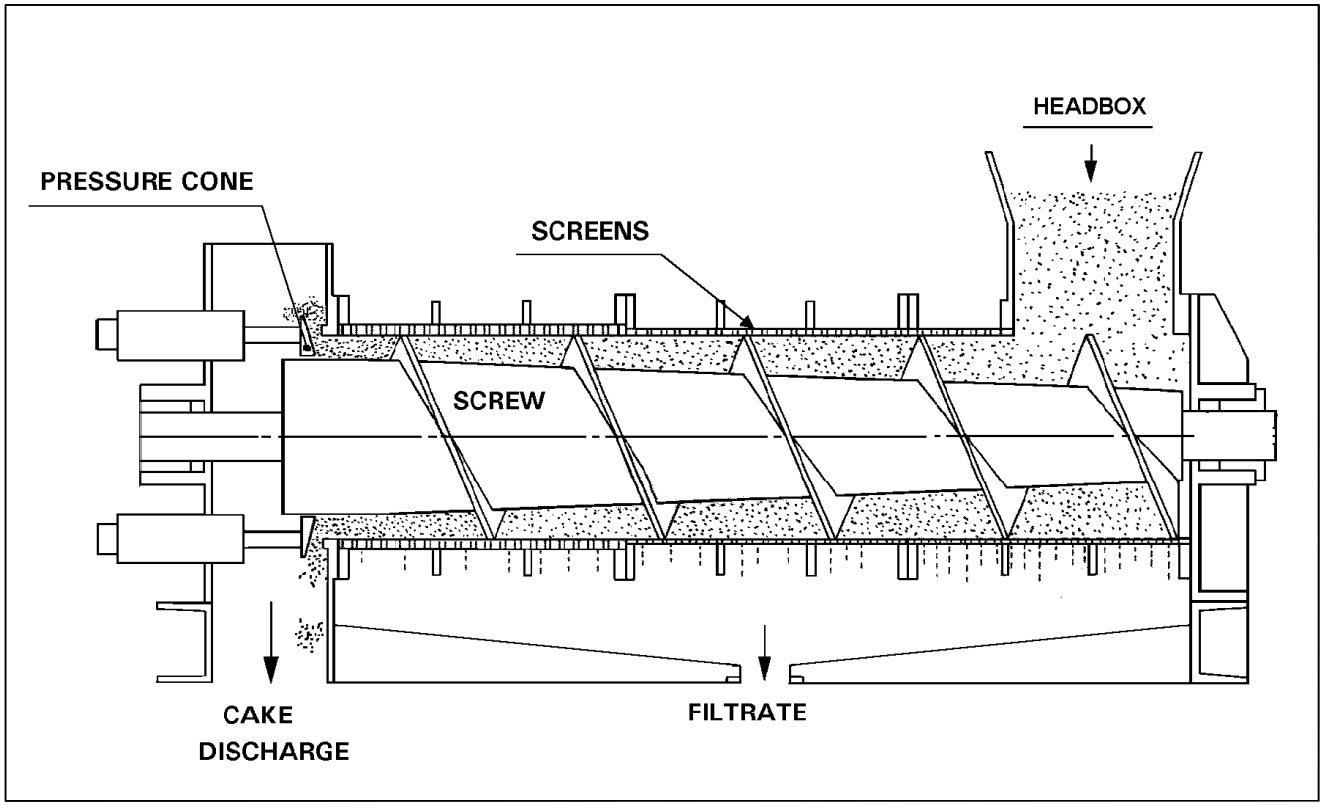


FIGURE 1A SCREW PRESS CROSS SECTION

SECTION 1B

GENERAL MECHANICAL CONSTRUCTION

The key component of the screw press is the screw. As Figure 1B shows, the screw consists of a tapered shell to which a helical flight is attached. The outside diameter of the flight is constant. The tapered shell is smallest at the inlet end and largest at the discharge end. The screw rotates inside a series of drums lined with replaceable, perforated, stainless steel screens.

The screw is supported by two radial, spherical roller bearings. The screw and bearings can be accessed by lifting the top half of the drums and bearing stands as shown in Figure 1B.

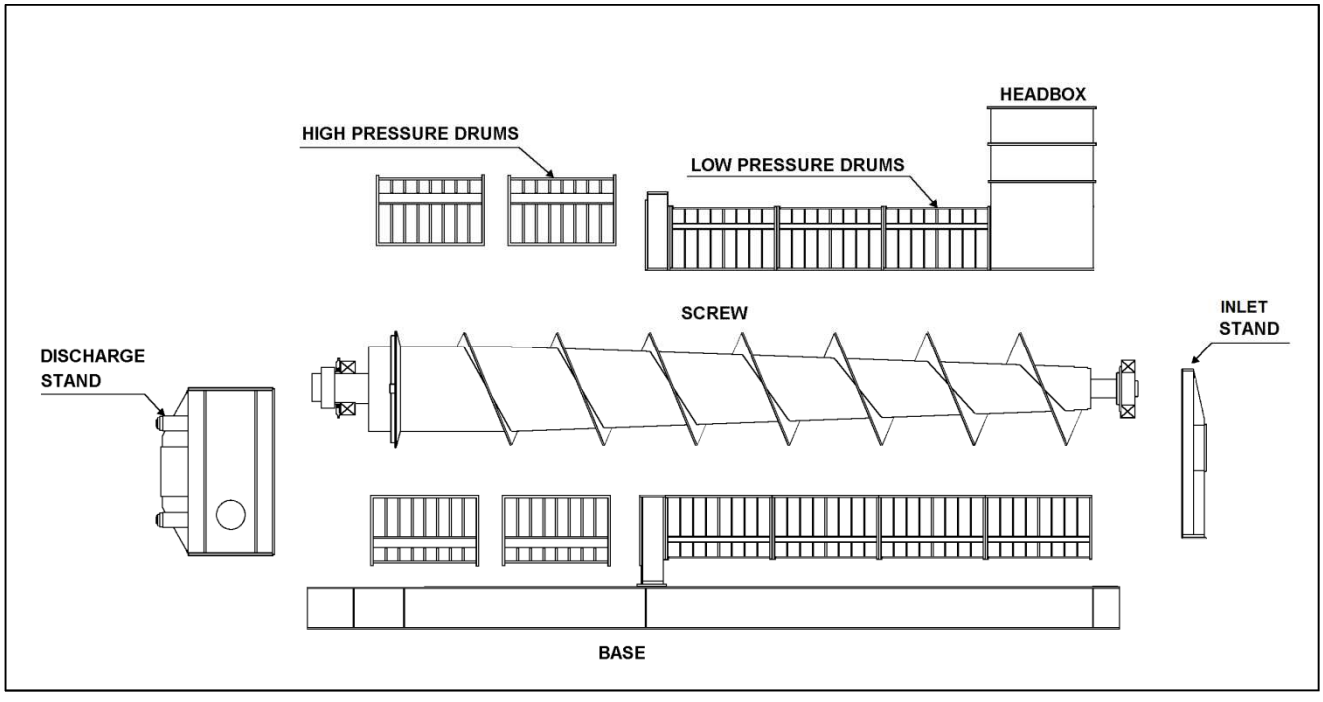


FIGURE 1B - SCREW PRESS EXPLODED VIEW

SECTION 1C

GENERAL OPERATIONAL PRINCIPLES

Screw Press throughput and discharge cake consistency are determined by many factors including screw speed, headbox level, sludge feed rate, back pressure, heat addition, sludge inlet consistency, sludge conditioning, and other sludge properties. To thoroughly facilitate overall screw press performance, the effect each factor has on throughput and discharge cake consistency must be understood.

Table 1D below summarizes the resulting screw press performance caused by varying screw speed, headbox level, and backpressure. Detailed explanations can be found on the following pages.

	OPERATING PARAMETER		OUTPUT CONSISTENCY	THROUGHPUT CAPACITY	MOTOR LOAD
a.	SCREW SPEED	UP	DOWN	UP	UP
		DOWN	UP	DOWN	DOWN
b.	HEADBOX LEVEL	UP	UP	UP	UP
		DOWN	DOWN	DOWN	DOWN
c.	BACK PRESSURE	UP	UP	DOWN	UP
		DOWN	DOWN	UP	DOWN
d.	INLET CONSISTENCY	UP	SAME	GPM DOWN	SAME
		DOWN	SAME	GPM UP	SAME

TABLE 1C - FUNDAMENTAL OPERATING RELATIONSHIPS

Assuming sludge pump speed is controlled by headbox level and all other factors remain constant, adjustments to the operational parameters listed will have the effects noted on the chart above.

Note: The effects of backpressure on discharge cake solids should be relatively minimal compared with the resulting increase of required motor amperage.

SECTION 1C (con't)

a) SCREW SPEED

Screw speed is directly related to throughput and inversely related to discharge cake consistency, assuming all other factors (listed below) remain constant.

Throughput will increase if screw speed is increased and will decrease if screw speed is decreased. The screw press works similar to a screw conveyor in that the faster it turns, the more material it conveys.

Discharge cake consistency will decrease if screw speed is increased and will increase if screw speed is decreased. A faster screw speed reduces retention time of the sludge in the press resulting in less dewatering or lower discharge cake consistency. A slower screw speed allows for a longer retention time of sludge in the press, which results in more dewatering and a higher discharge cake consistency.

The screw speed or throughput rate at which a given discharge cake consistency can be achieved/maintained will vary as sludge characteristics change.

b) HEADBOX LEVEL

Headbox level is directly related to both throughput and discharge cake consistency, assuming all other factors remain constant.

If headbox level is increased (i.e. sludge flow is increased), throughput, discharge cake consistency, and drawn motor amperage will increase. This is because the higher headbox level promotes increased dewatering in the "gravity drainage" section (first section at the inlet end of the press), resulting in a higher consistency material (more solids per volume) being fed into the press.

Conversely, if headbox level is decreased (i.e. sludge flow is decreased) both throughput and discharge cake consistency will decrease. This is because less gravity drainage occurs at the inlet end of the press resulting in a lower consistency material (less solids per volume) being fed into the press.

c) PRESSURE CONE SETTING (BACK PRESSURE)

The pressure cone applies backpressure on the cake in the high-pressure section of the press (see Figure 1A). The pressure is adjusted by turning the spring arbor nuts to change the spring force on the pressure cone. Generally, as backpressure is increased, the discharge cake consistency of fibrous materials increases and the throughput remains constant (or possibly decreases) due to increased rotation of sludge with the screen. The adverse effects of increasing back pressure include accelerated wear, higher motor load, increased chance of plugging, and decreased capture efficiency for low fiber sludges.

d) INLET CONSISTENCY

At a given screw speed and sludge type, the screw press over time will process the same amount of dry pounds per hour. When the inlet consistency varies, the dry pounds per hour capacity stays the same while the flow or gallons per minute capacity will change.

INLET CONSISTENCY	DRY SOLIDS LBS/HR	GALLONS PER MINUTE
0.60%	183	61.0
0.65%	183	56.3
0.70%	183	52.2
0.75%	183	48.8
0.80%	183	45.7
0.85%	183	43.0
0.90%	183	40.6
0.95%	183	38.5
1.00%	183	36.6
1.05%	183	34.8
1.10%	183	33.2
1.15%	183	31.8
1.20%	183	30.5
1.25%	183	29.3
1.30%	183	28.1
1.35%	183	27.1
1.40%	183	26.1

TABLE 1D-2 Relationship to inlet consistency and gallons per minute.

It is also important to keep the same polymer dosage rate, even when the inlet consistency varies. If the inlet consistency varies greatly overtime, then increased operator attention or monitoring of the inlet consistency may be required to maintain a proper polymer dose.

SECTION 1D

ADDITIONAL PERFORMANCE INFORMATION

a) FEED RATE

Feed rate (which is a function of both sludge flow & consistency) and headbox level are interrelated. If the screw speed is kept constant, then an increase in feed rate will result in an increase in headbox level. The increase in headbox level will promote gravity drainage at the inlet end of the press and result in increases in throughput and discharge cake dryness. Conversely, if the feed rate decreases (with screw speed remaining constant), the headbox level will decrease and less gravity drainage will occur resulting in decreased throughput and discharge cake consistency.

b) HEAT ADDITION

Heat is added by injecting steam through a short passageway in the screw shaft into the open space between the screw shaft and the tapered screw shell. Generally, heat addition increases discharge cake consistency by making the sludge easier to dewater. Heat addition reduces the friction between the screw and the sludge resulting in less wear and less motor load. Heat addition can indirectly increase throughput by lowering motor amperage allowing the press to be run at a higher headbox level.

c) CHEMICAL CONDITIONING (FLOCCULATION)

Various types of pulp and some simple settling sludges containing long fibers can be dewatered efficiently without chemical conditioning. Most sludges, however, require flocculation prior to being dewatered. Typically, the chemical conditioning rate is ratioed to the sludge feed rate to insure correct dosage.

In order to minimize polymer consumption (i.e. maximize polymer efficiency) and improve dewaterability, it is important to choose the chemical or combination of chemicals (e.g. coagulant and/or flocculant) best suited for the specific sludge to be dewatered.

Poor conditioning results in decreased capture efficiency for the press and reduces dewaterability of the sludge yielding lower throughput capacity and discharge cake consistency.

d) SLUDGE PROPERTIES

The most important, yet least controllable factor in sludge dewatering is the sludge itself. Dewaterability depends upon the type, freeness, fiber content, ash content, pH level, etc. of the sludge.

Although it is generally difficult to control sludge properties it is important to understand the effects of sludge characteristics on sludge dewaterability.

Freeness (the rate at which water/liquid will drain from a material) is the most commonly used test in the pulp and paper industry for dewaterability. Higher freeness values mean easier dewatering. Freeness is dependent upon sludge properties such as fiber content, fiber length, ash content, chemical conditioning, etc.

d) SLUDGE PROPERTIES (continued)

As fiber content and/or length increases, dewaterability generally increases. As ash content increases, discharge cake consistency generally also increases; however, both capture efficiency and wear due to abrasion can increase.

Primary sludges are easier to dewater than secondary sludges. As the ratio of primary to secondary sludge varies in a blended sludge, the dewaterability of the sludge blend will vary accordingly.

Changes in the pH level of the sludge indirectly affect dewaterability. Generally, chemical Conditioners (polymers) added to flocculate the sludge work best within a certain pH range. If the pH level of the sludge swings outside the functional range of the polymer, then poor conditioning results, leading to reduced dewaterability, throughput, discharge cake consistency, and capture efficiency.

SECTION 1E

CONCLUSION

A screw press operator needs to understand the various factors involved in press performance to be able to operate the screw press efficiently and safely.

In ideal situations, sludge conditions do not change so that the operational settings of the screw press (screw speed, headbox level, etc.,) remain constant. In the real world, sludge conditions change on a day-to-day, and sometimes hour-to-hour, basis.

As sludge conditions (flow rate, inlet consistency, fiber content, etc.) vary, appropriate changes need to be made to screw press operational settings to optimize performance or to avoid overload situations. Since every sludge is different and each mill experiences unique periodic variations in their sludge, it is not possible to itemize specific operational changes for each change in sludge characteristics. However, with good operational records, see section 10, FKC can assist in making recommendations for fine-tuning.

Initial screw press operation should be based on operational settings determined by FKC during start-up. If significant changes occur in the sludge properties after start-up, contact FKC for revised operational settings.

Contact your FKC representative if you have any questions or concerns about FKC Screw Press operations.

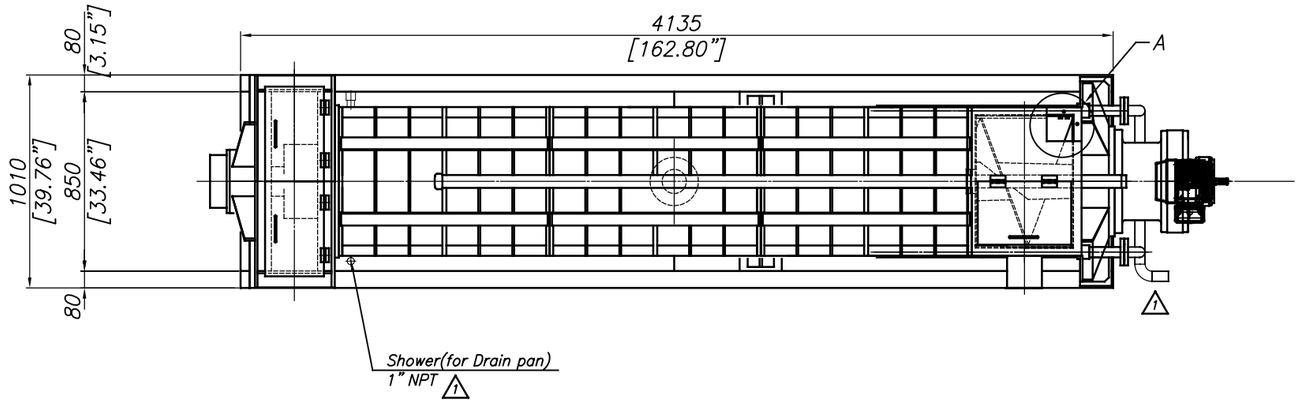
2

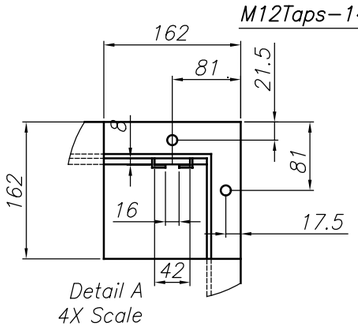
SECTION 2

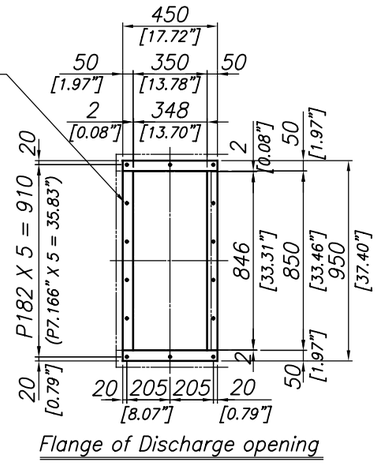
DRAWINGS & PARTS LISTS

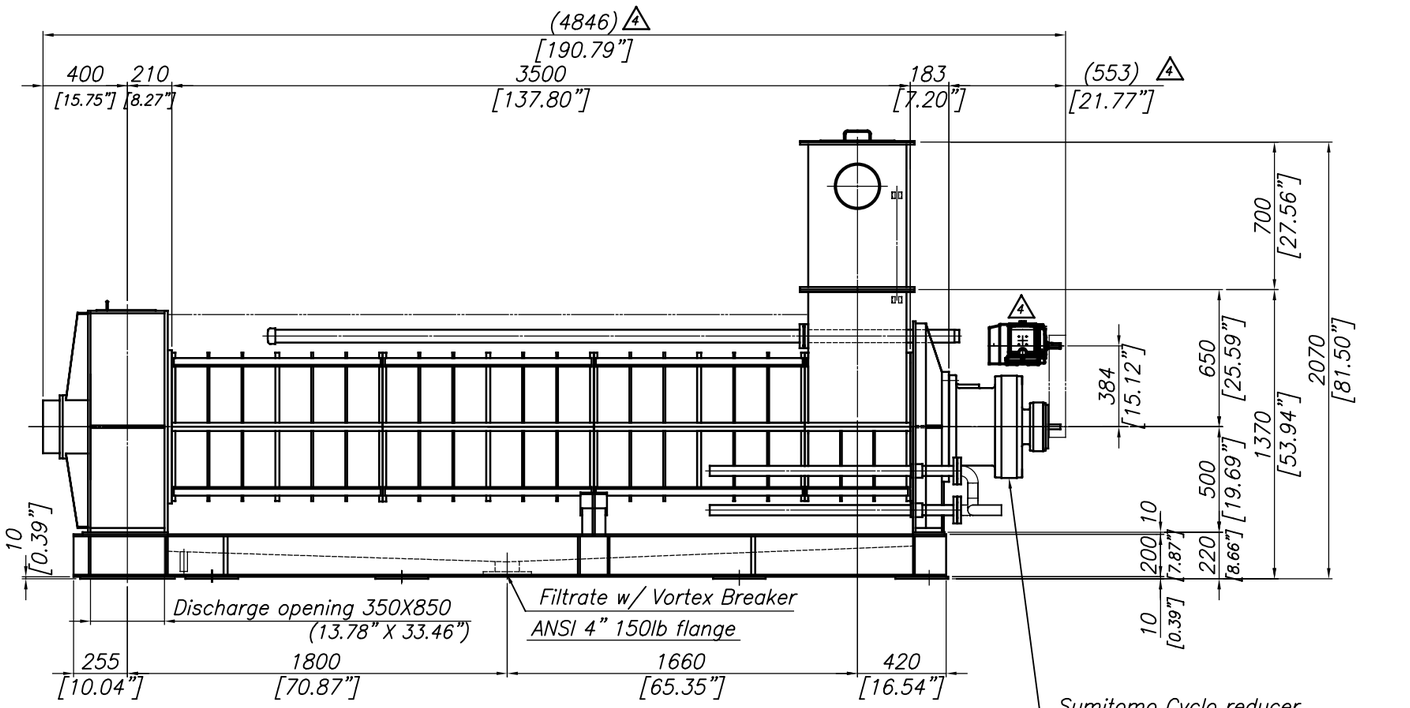
2A SCREW PRESS ASSEMBLY DRAWING Page 2-1

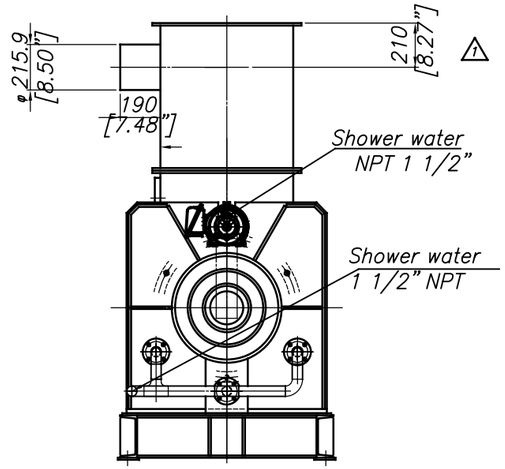
2B PARTS DRAWINGS & LISTS Page 2-2











Screw rev.
180 ~ 1800 X 1/5133 = 0.035 ~ 0.351 rpm

Total weight = 3,000 kg (6,614 lbs)
Operating weight = 4,000 kg (8,819 lbs)

Rev.	Date	Description	Drawn by	Rev. by	Appd. by
4	9/26 '19	Motor Location	RTB		
3	7/17 '19	Revised name to Rock Island, WA	KAL		
2	4/22 '19	Issued as Certified	RTB		
1	4/22 '19	Gerneral Revisions	RTB		
0	4/22 '19	Approval	S.ENDO	H.ABE	T.Ogawa

		Quantity	配布先	
発注先 Purchaser	FKC CO., LTD.	1	貿易部	.
			FKC	.
最終客先 End user	City of Rock Island, WA WWTP	Scale	営業部	.
工事名称 Job name	BHX−600X3500L Screw press	1/20	QC部	.
			QCファイル	.
図面名称 Dwg. name	Assembly		製造部	.
			設計部	.
工事番号 Job No.	M−3209		釧路工場	.
			大阪営業所	.
図面番号 Dwg. No.	S3209−01	.	富士営業所	.
		Ref. job No.	合計	.

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SCREW PRESS

FKC SCREW PRESS

CONSTRUCTION & PARTS LIST

FKC SCREW PRESS, MODEL: BHX-600X3500L (M-3209)

CUSTOMER: City of Rock Island, WA

CONTENTS

<CONSTRUCTION FOR SCREW PRESS>

PRINCIPAL PARTS [FIG 1] ----------1

OUTLET STAND BEARING AND INLET STAND [FIG 2] ----------2

SHOWER [FIG 3] ----------3

SCREEN ARRANGEMENT [FIG 4] ----------4

<PARTS LIST FOR SCREW PRESS>

PRINCIPAL PARTS (TABLE 1) ----------5

OUTLET STAND BEARING AND INLET STAND (TABLE 2) ----------5

SHOWER (TABLE 3) ----------5

SCREEN ARRANGEMENT (TABLE 4) ----------5

FIG 1

FKC SCREW PRESS (MODEL: BHX-600X3500L)
PRINCIPAL PARTS

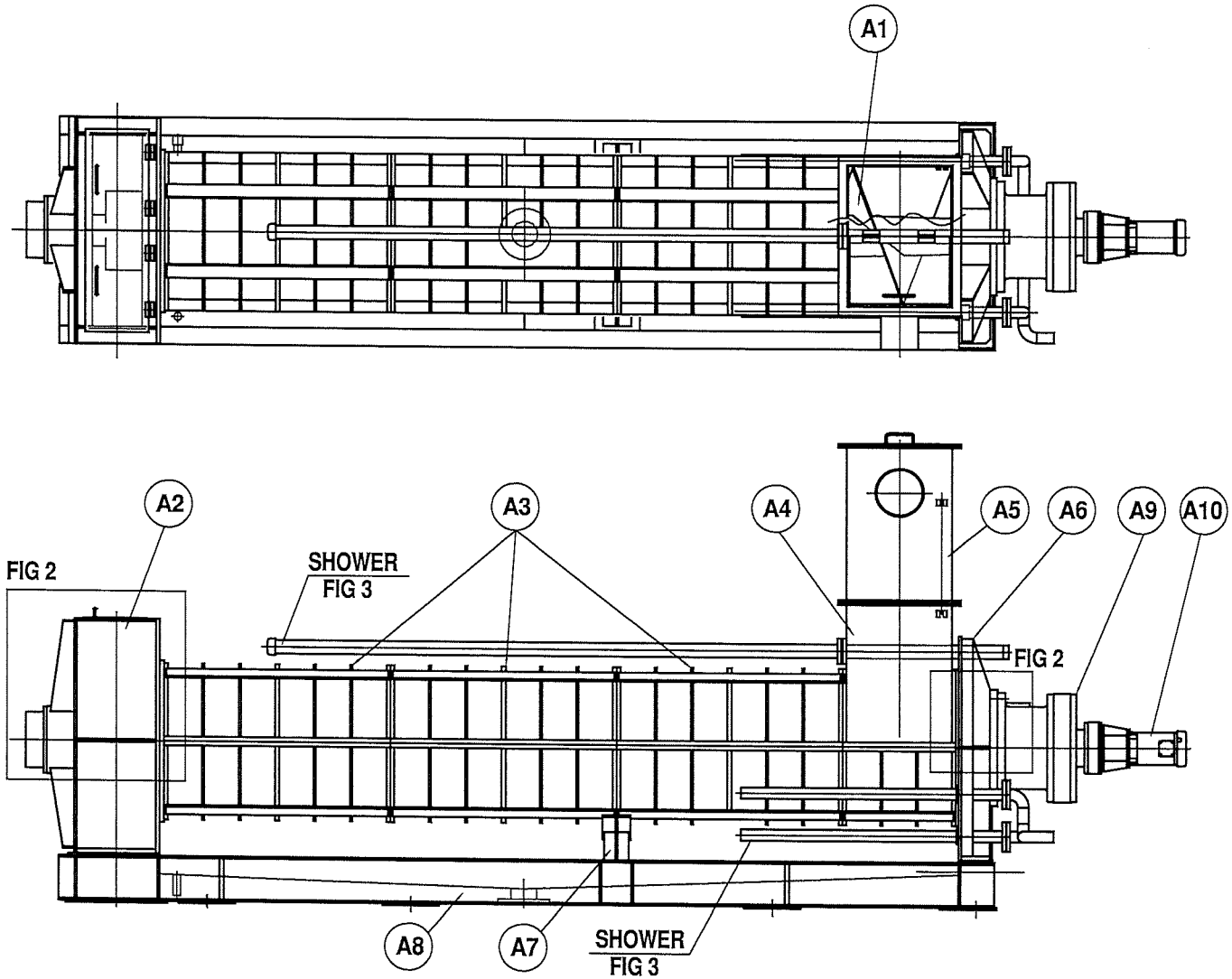


FIG 2

OUTLET STAND BEARING AND INLET STAND

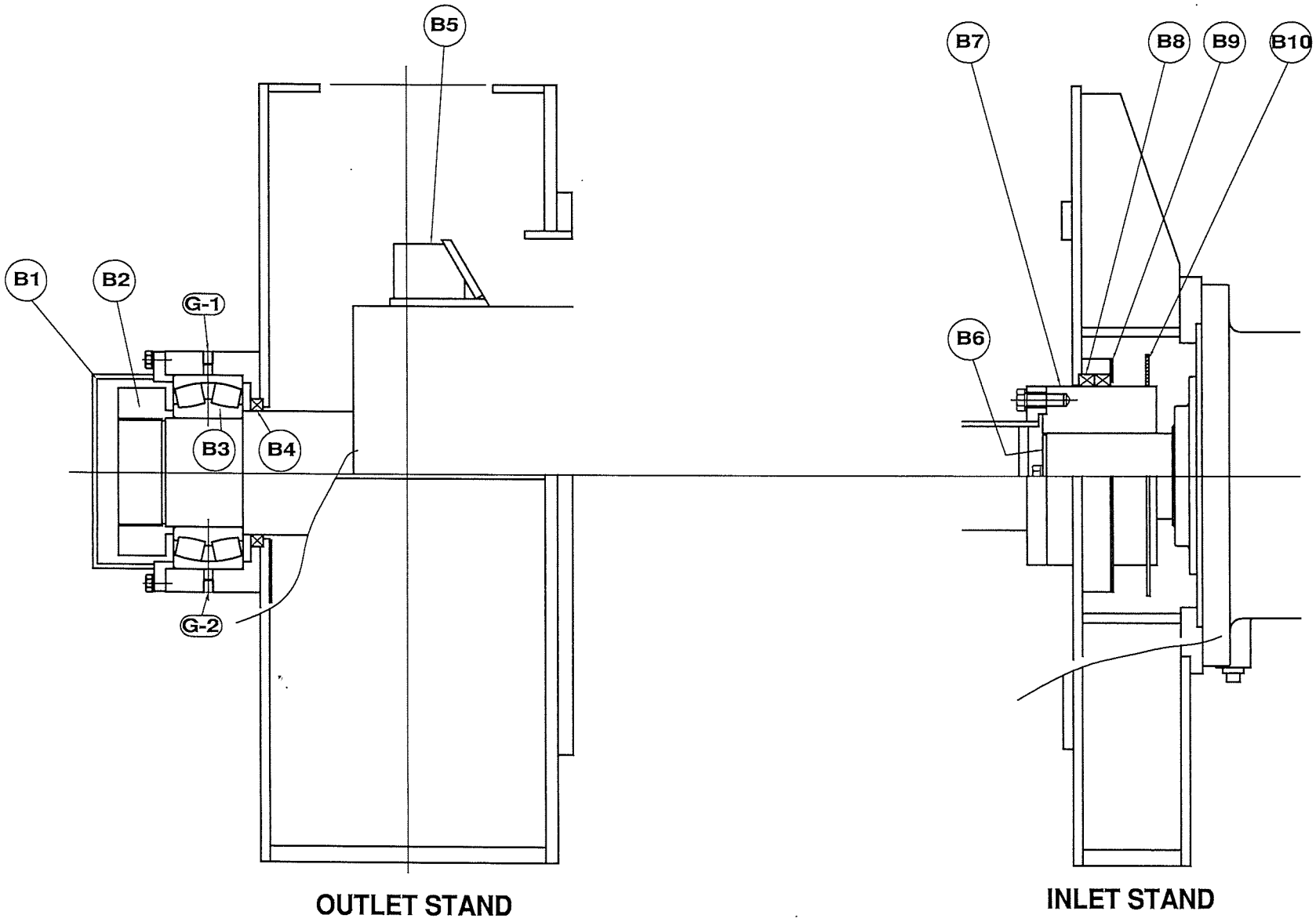


FIG 3

SHOWER

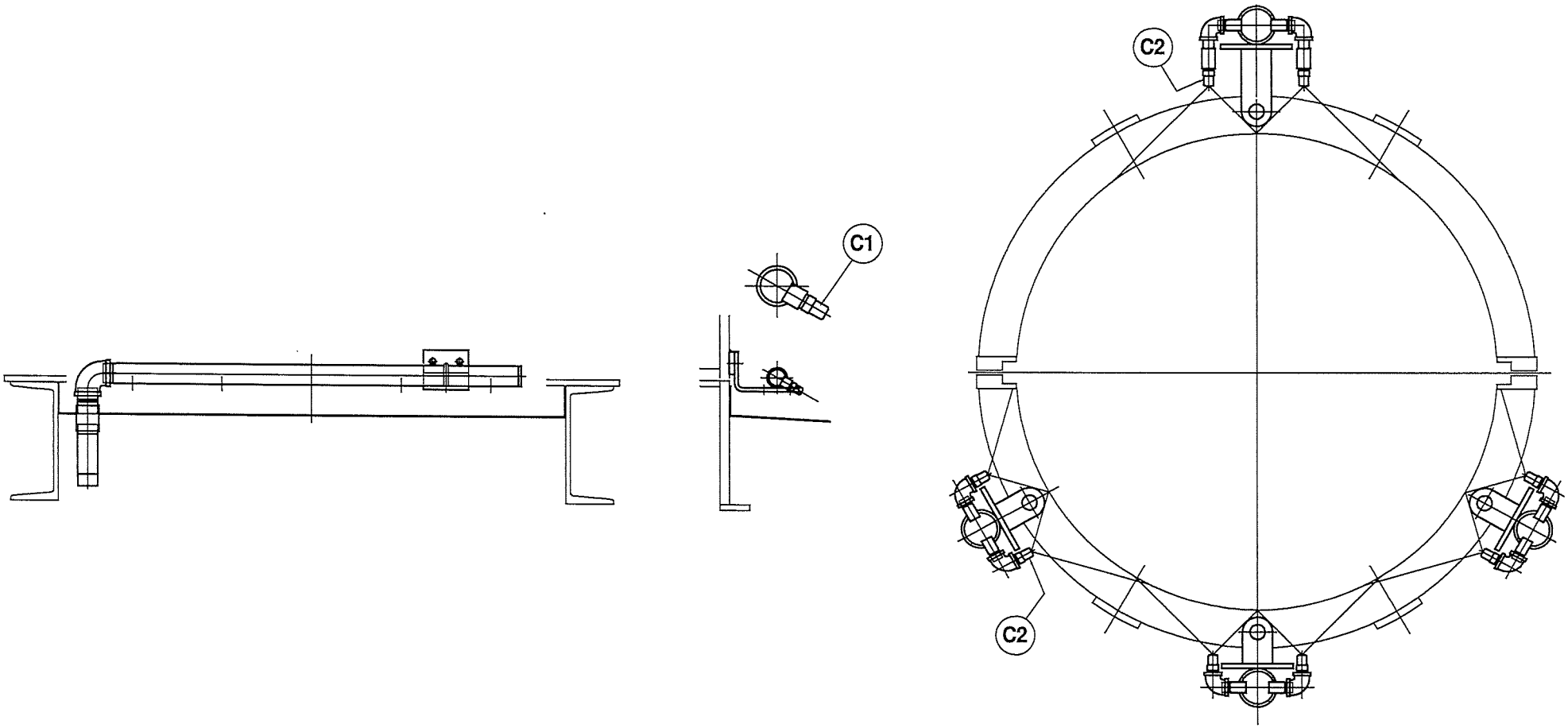


FIG 4

SCREEN ARRANGEMENT

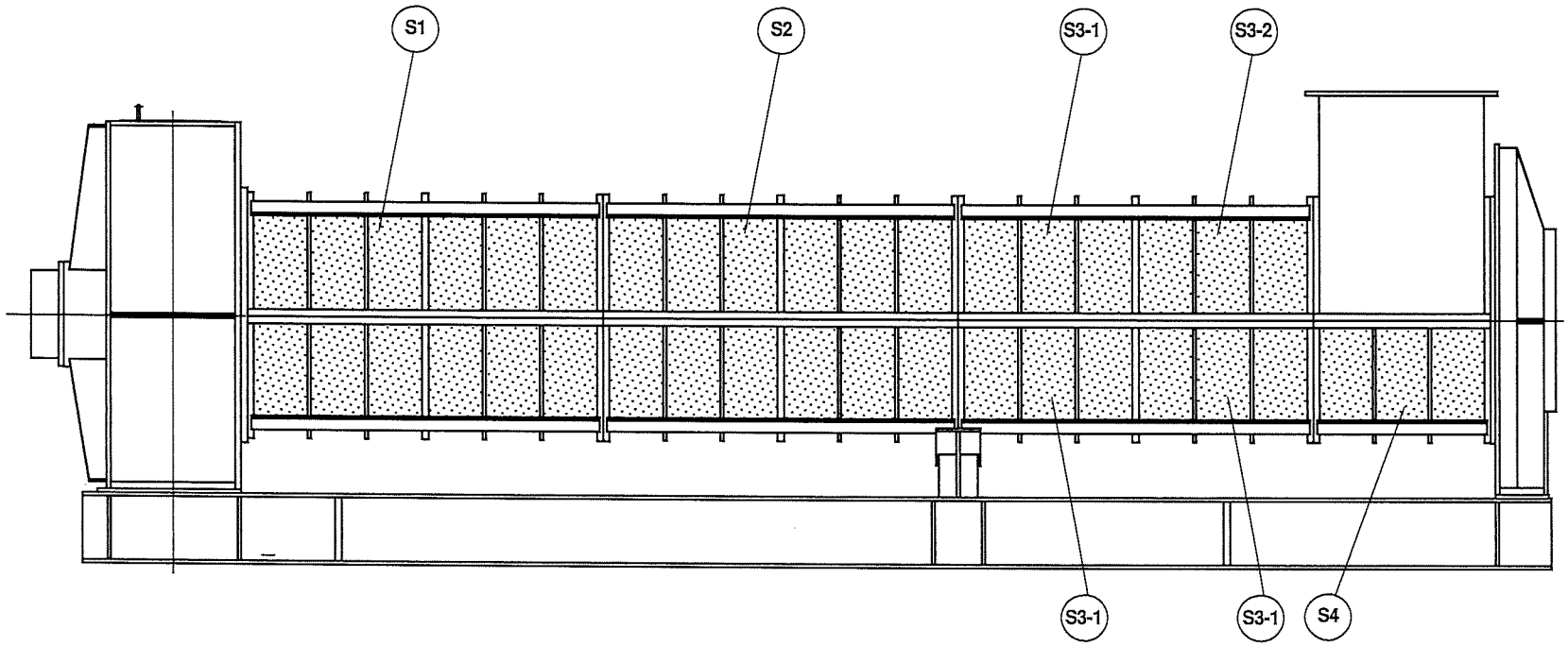


FIG. 1

TABLE 1. PRINCIPAL PARTS

PARTS NO.	DESCRIPTION	Q'TY	MATERIAL	REMARKS
A1	SCREW WITH SHAFT (TEFLON COATED)	1	SS304-CS	FKC
A2	OUTLET STAND	1	SS304-CS	FKC
A3	LOW PRESSURE DRUM 1000L	3	SS304	FKC
A4	INLET DRUM 500L	1	SS304	FKC
A5	INLET HOPPER 700H	1	SS304	FKC
A6	INLET STAND	1	SS304	FKC
A7	DRUM SUPPORT	1	SS304	FKC
A8	BASE	1	SS304-CS	FKC
A9	CYCLO REDUCER CHVJ-6215DA-5133	1		SUMITOMO
A10	VARIABLE SPEED MOTOR 2Hp, 1800rpm	1		CUSTOMER SUPPLIED

FIG. 2

TABLE 2. OUTLET STAND BEARING AND INLET STAND

PARTS NO.	DESCRIPTION	Q'TY	MATERIAL	REMARKS
B1	BEARING COVER	1	CS	FKC
B2	THRUST NUT	1	CS	FKC
B3	SPHERICAL ROLLER BEARING 23228	1		SKF
B4	OIL SEAL 160 × 190 × 16 UD	1		MUSASHI
B5	TAPER CONE (SPLIT TYPE)	1	SS304	FKC
B6	END PLATE	1	SS304	FKC
B7	COUPLING	1	SS304	FKC
B8	OIL SEAL 220 × 255 × 18 UE	2		MUSASHI
B9	OIL SEAL COVER	1	SS304	FKC
B10	RUBBER SLINGER DRIP RING	1		FKC

* GREASE LUBRICATION

[FIG 2]	SECTION	FILLING	DRAINING	STANDARD GREASE
	OUTLET STAND BEARING	G-1	G-2	MOBILITH SC1500 (MOBIL)

FIG. 4

TABLE 3. SHOWER

PARTS NO.	DESCRIPTION	Q'TY	MATERIAL	REMARKS
C1	SPRAY NOZZLE 1/4VVP2*90/6.5 S316	5	SS316	IKEUCHI
C2	SPRAY NOZZLE 1/4JJXP2*90/5 S316	66	SS316	IKEUCHI

FIG. 3

TABLE 4. SCREEN ARRANGEMENT

PARTS NO.	DESCRIPTION	Q'TY	MATERIAL	REMARKS
S1	SCREEN ϕ2.5×1.5t×10p 499WIDE	4	SS304	L.P DRUM(FKC)
S2	SCREEN ϕ2.5×1.5t×7.5p 499WIDE	4	SS304	L.P DRUM(FKC)
S3-1	SCREEN ϕ2.5×1.5t×4.5p 499WIDE	3	SS304	L.P DRUM(FKC)
S3-2	SCREEN ϕ2.5×1.5t×4p 499WIDE	1		
S4	SCREEN ϕ2.5×1.5t×4.5p 499WIDE	1	SS304	INLET DRUM(FKC)

SECTION 3

DRAWINGS & PARTS LISTS

3A SCREW PRESS DRUM COVERS Page 3-1

3B SCREW PRESS COVER DRAWING Page 3-2

SECTION 3A

SCREW PRESS DRUM COVERS

a) DRUM COVER INSTALLATION INSTRUCTIONS

The lightweight drum covers are designed to be installed and removed easily by one person without the use of tools.

Note that there are two types of covers - top covers and side covers. All of the covers are numbered.

Note that the draw latches which attach the side covers to the top covers have a LOCK BUTTON on the side of the latch. The LOCK BUTTON must be pressed before the latch can be opened. If the latch is forced open it will be permanently damaged.

For simple installation and removal, refer to the following instructions and drawings:

1. Hang the cover clips on the drums as shown on the attached DRUM COVER ASSEMBLY drawing. Note that the clips should be positioned about 7 inches from the drum ends. There are four different types of clips - two sizes used with the upper drum halves, and two sizes used with the lower drum halves. Of the two upper drum types, the clips used on the low pressure drums (the drums toward the inlet end) are longer in length. Conversely, clips used on the lower half of the the low pressure drums are the shorter of the two lower half types.

2. Install the #2 top cover.

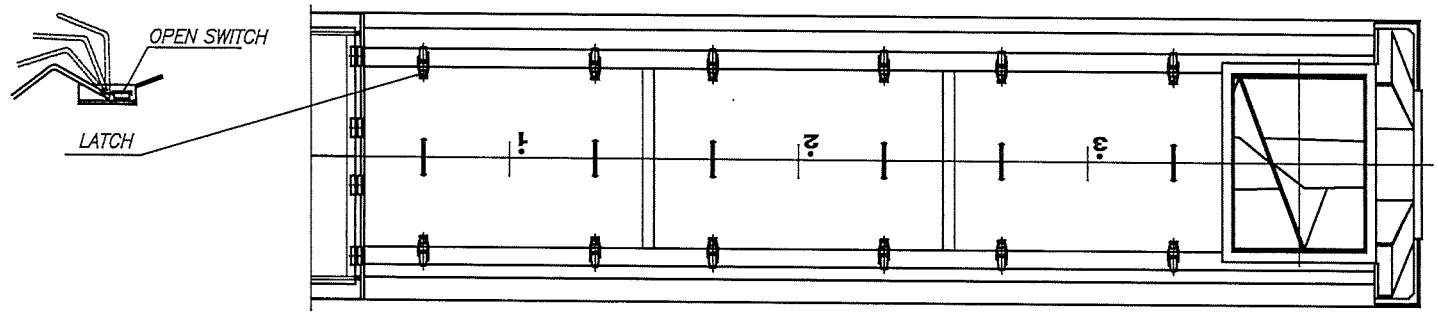
3. Install the #1 top cover.

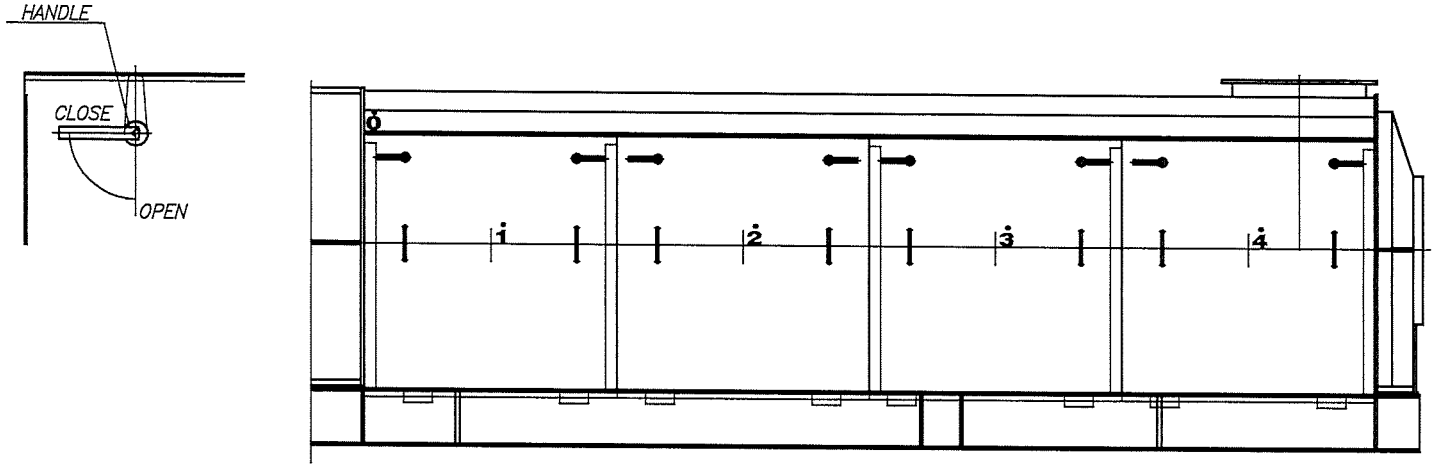
4. Install the #2 and #3 side covers.

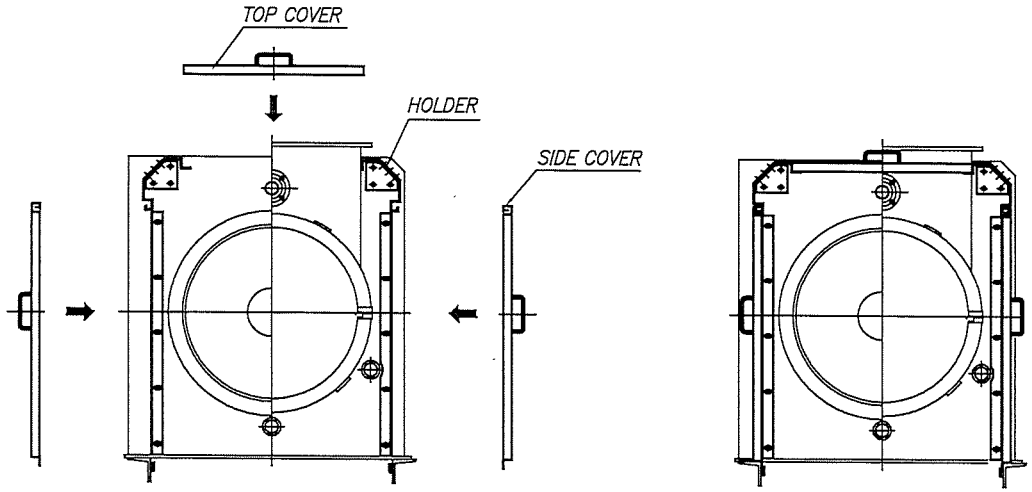
   Note that one side has dots over the numbers and the other side does not.

5. Install the #1 side cover.

6. Use the draw latches to attach the side covers to the top covers.







THE ORDER OF ASSEMBLY OF DRUM COVER

(LOWER SIDE COVER) 2→1→4→3 → 2→1→3 (UPPER SIDE COVER)

2→1→4→3 (LOWER SIDE COVER)

JOB No.	Messrs.	Quantity	Scale
M–3209	City of Rock Island, WA	1	–
Drawing No.	Title	Date	
	BHX–600X3500L Drum cover assembly	8/6/19	
		Drawn by	
		S.Endo	
		Ref. JOB No.	

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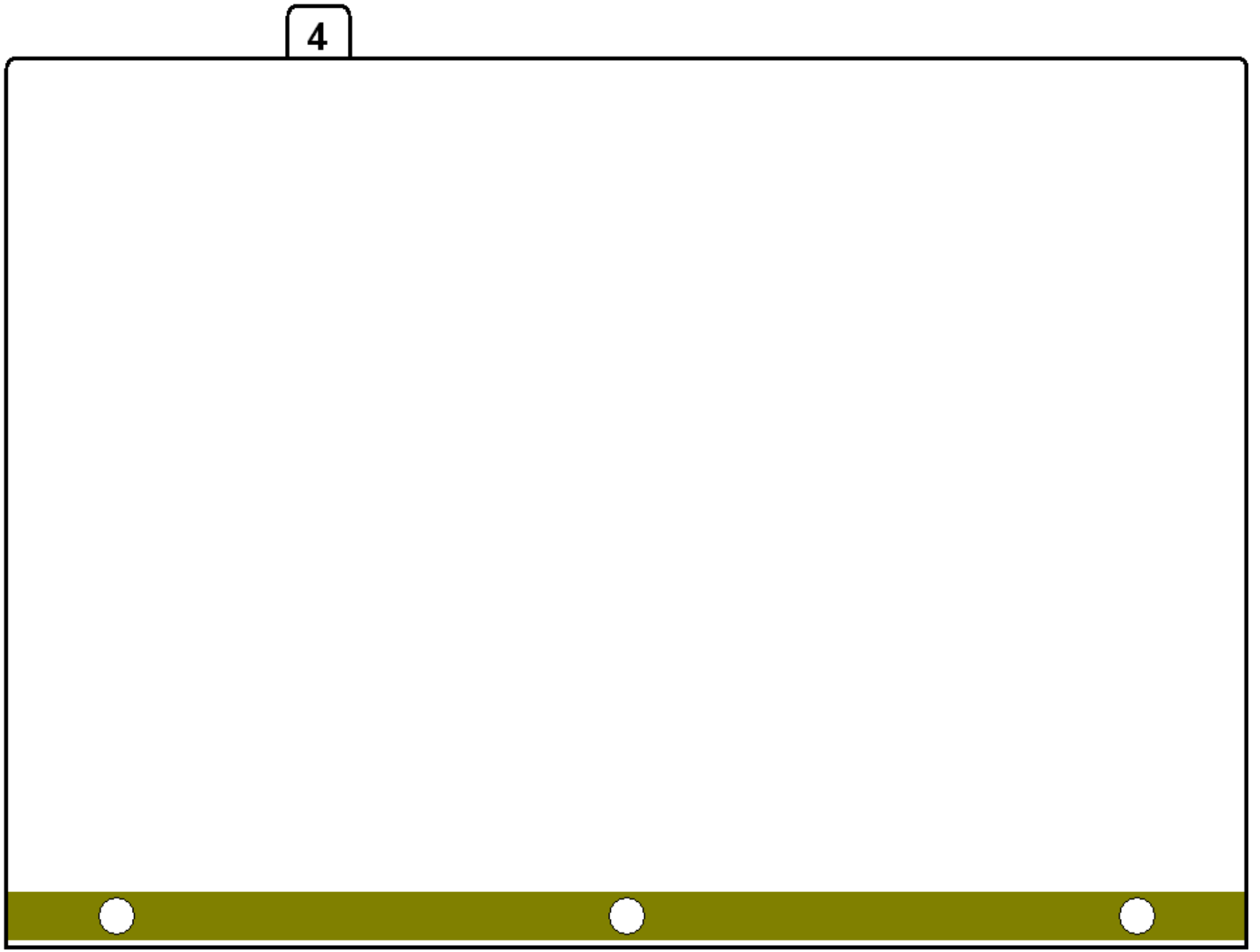
TIGHTENING TORQUES FOR RIGID SCREWS

TIGHTENING TORQUES & PRE-STRESSING FORCES FOR RIGID SCREWS (NORMAL THREADS)

	Pre-stressing forces (kN)					Tightening Torques (Nm)				
Class (Mat. No.)	5.6	8.8	A4-50	A4-70	C3-80	5.6	8.8	A4-50	A4-70	C3-80
Thread										
M-16	28	60	20	42	60	75	160	53	115	160
M-20	44	94	31	66	94	145	315	105	220	315
M-24	64	436	44	53	436	255	545	180	210	545
M-30	101	215	71	84	215	505	1080	355	420	1080
M-36	147	314	103	123	314	885	1890	620	735	1890
M-42	202	430	-	-	430	1420	3020	-	-	3020
M-48	265	566	-	-	566	2130	5430	-	-	4530

The thread and screw head should be lubricated with an appropriate lubricatnt (for example Molyslide Plus by Loctite) in order to obtain the required friction coefficient. This applies in particular to stainless and adic-resistant screws since the friction coefficient for these two materials can be much higher without lubricant.

The above pre-stressing figures are standard bolt connection.


4

SECTION 4

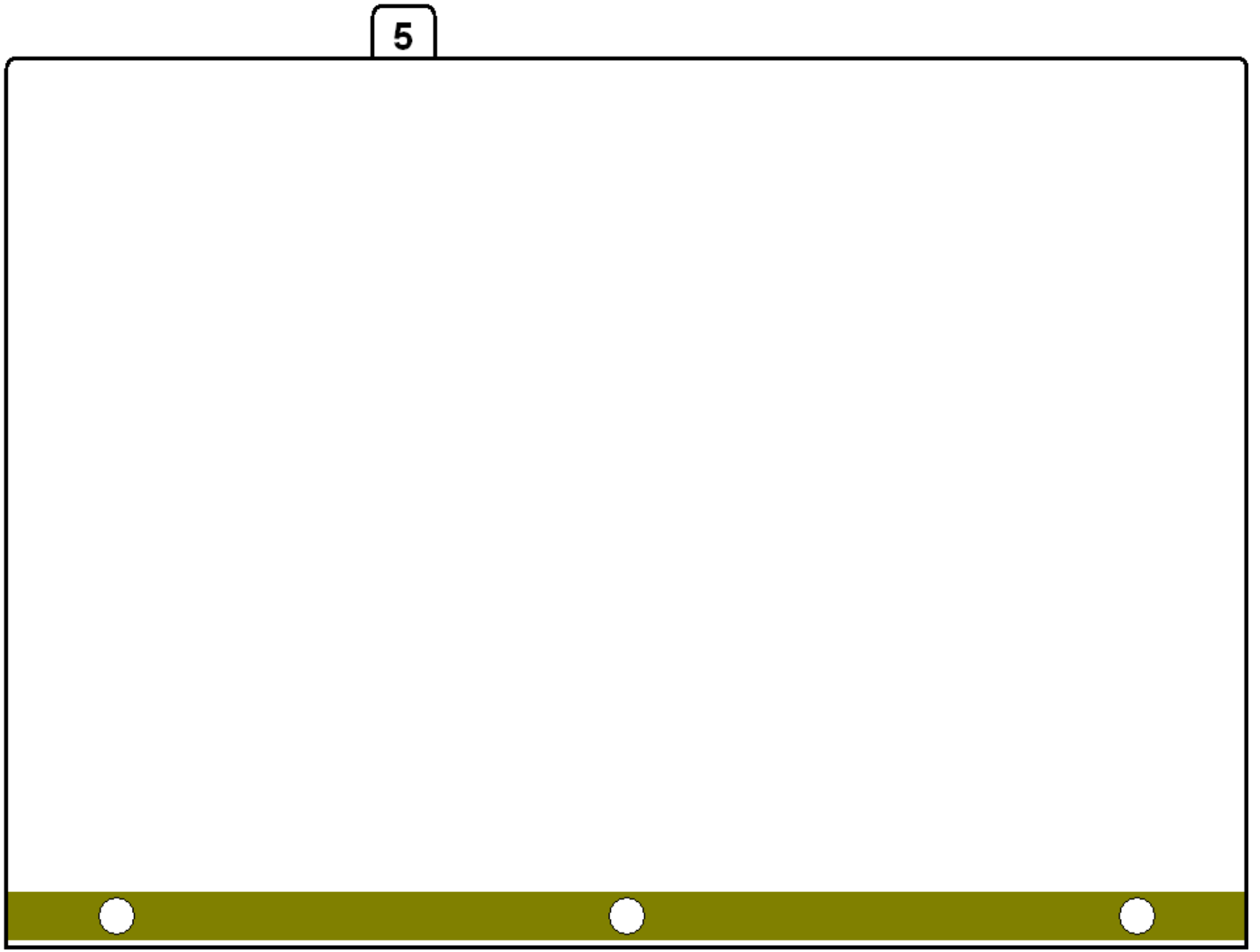
INITIAL PRESTART INSPECTION

SECTION 4

INITIAL PRESTART INSPECTION

Prior to FKC arriving on-site for screw press start-up, confirm the following items:

		✓
A)	Verify screw press is mounted on rigid foundation, installed with the specified anchor bolts, and leveled per FKC requirements. See Section 3A for leveling specifications.	
B)	Verify that all anchor bolts are tight.	
C)	Re-torque all bolts on screw press prior to startup.	
D)	Verify that the press is completely assembled including safety guards.	
E)	Verify screw press covers are properly installed.	
F)	Verify that the supplied motor matches the motor specified by FKC.	
G)	Verify that the motor and speed reducer have been properly aligned. Send copies of alignment records if motor was not installed at the factory.	
H)	Verify lubrication of: ⇒ Speed Reducer ⇒ Main Screw Shaft Bearings	
I)	Verify electrical connections are complete.	
J)	Verify control headbox level / flow control system is complete including flow meter.	
K)	Verify calibration of headbox level transmitter and flow meter.	
L)	Verify high motor load alarm trip set-point is set per FKC recommendations.	
M)	Program DCS/PLC to stop the screw press when the actual % motor load exceeds high motor load alarm set-point.	
N)	Verify polymer delivery systems are complete and functional.	
O)	Bump Floc Tanks and Screw Press motors for no more than 10 seconds to: ⇒ Verify rotation Check and record amp draw, load on equipment	
P)	Verify clearance between screw flight and inner screen surface along entire screw. Clearance is adjusted at factory however drums occasionally shift during shipment. See Section 7C for instructions on checking clearances. This item will be completed by FKC personnel prior to start-up. Retorque <u>all</u> drum bolts after checking clearances.	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SECTION 5

OPERATING INSTRUCTIONS

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5C CLEANING THE SCREW PRESS	Page 5-3
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5E WARNING: OVERLOADING	Page 5-5
5F UNPLUGGING THE SCREW PRESS	Page 5-6
5G WARNING: MECHANICAL WARRANTY	Page 5-7

SECTION 5A

STARTING THE SCREW PRESS

AUTO START

1. For an initial screw press startup, the checklist in section 4 must be completed before the following instructions. Verify that the press is empty, that is, the press was emptied of sludge during the previous shutdown.

   Note that since the screw flight does not extend all of the way to the discharge end, there will normally be some material visible at the discharge end although the rest of the press is empty.

2. Set all the screw press and flocculation tank to AUTO using the HOA switches on the front of the control panel.

3. Set the local polymer system control panel to REMOTE.

4. Ensure that the inlet pipe to the sludge feed pump is full of liquid, either by the sludge itself or with water filled from a priming port.

4. Set all the equipment to AUTO in the HMI control screens of the control panel.

5. Verify that all the control setpoints have the desired values.

6. Press the “Start System In AUTO” button.

7. Ensure that the stroke length is set properly for the polymer system pump.

8. Verify proper flocculation of the sludge in the flocculation tank just before it enters into the screw press headbox.

MANUAL START

1. Set the screw press % speed potentiometer on the front of the control panel to the desired screw press speed.

2. Set the HOA switch of the screw press to HAND.

.

SECTION 5B

STOPPING THE SCREW PRESS

AUTO STOP

There are two differents methods to perform an AUTO stop:

1. Before starting the system in AUTO, verify that the "*SP Run Timer After Shutdown"* setpoint is set to the proper amount of time.
    a. Once the system is started up in AUTO, this timer will run down to zero. Once zero is accomplished then the system will go into an AUTO system shutdown.

2. With the system running in AUTO , press the "Auto System Shutdown" button.

MANUAL STOP

1. Set the HOA switch of the screw press to OFF.

SECTION 5C

CLEANING THE SCREW PRESS

The screw press should be cleaned at least once every month. The press should be cleaned as follows:

1. The press does not need to be shut down to be cleaned. It is recommended that the person doint the cleaning wear protective raingear with full face shield.
2. The top and side covers on the press should be removed. See section 3C.
3. Wash the press from top to bottom the entire length with mill water washdown hose. If there is significant hard deposits of dried sludge, scale, etc. the press may need to be pressure washed.
4. After cleaning the press it should be inspected and the high and low pressure drum bolts checked. See section 7.

SECTION 5D

WARNING: FREEZING CONDITIONS

Do not allow sludge/pulp or condensate to freeze in the equipment! Failure to do so may result in mechanical damage due to freezing expansion!

Please note the following guidelines for operating the FKC screw press under freezing conditions.

1. Completely discharge the sludge/pulp from the screw press prior to stopping the equipment.

2. If the sludge/pulp becomes frozen in the equipment it must be thawed prior to starting. Equipment overload and damage will occur if the equipment is started without thawing the frozen sludge.

SECTION 5E

WARNING: OVERLOADING

Overloading (plugging) of the screw press and drive train should be avoided at all times. However, FKC realizes that at times overload situations occur which can cause the screw press to electrically trip out and stop operating. When an overload situation arises the recommended procedure for restarting/returning to service an overloaded or plugged press is as follows:

1. Inspect the screw press outlet cake. If the material is compressed/compacted to an extremely high consistency and is very hard or if knots, chips, or very long fiber are present, do not attempt to restart the press. Digging out the plugged area of the press must be completed, as described in Section 5E, before restarting. The high-pressure drums should be removed as described in Section 7B, after which the compacted material should be removed. With the top high pressure drums removed the press can be restarted to assist with unplugging.

2. **Screw press with variable frequency drive (VFD)**

   If the outlet cake is soft and has normal fiber and ash content then the press can be restarted as follows:

   a. Back out the pressure cone.

   b. For a VFD (Variable Frequency Drive) unit set speed at 25% and **restart only once**. If the press trips out on overload again **DO NOT RESTART**, unplugging the press must be completed as described in Section 5F.

   d. If the press remains running after restarting at 25% speed then as the motor load drops the speed can be increased slowly until the normal operating speed is achieved.

SECTION 5F

UNPLUGGING THE SCREW PRESS

To unplug a screw press, the following procedure should be followed:

1. Remove the covers on the high pressure section of the press and remove the upper half of the high pressure drums as described in Section 7B.

2. Dig out as much compacted material as possible. With the upper high pressure drums removed start the press. Starting the press will allow the compacted material in the lower portion of the high-pressure drums to rotate out of the press.

3. Once the press is clear of compacted material then reassemble the high pressure drums as described in Section 7B.

4. Replace the covers and restart the press. Increase the screw speed to a faster RPM than normal. Re-establish flow with a low headbox level. Let the system run until it stabilizes and then fine tune operation by adjusting headbox level, RPM, polymer and pressure cone.

SECTION 5G

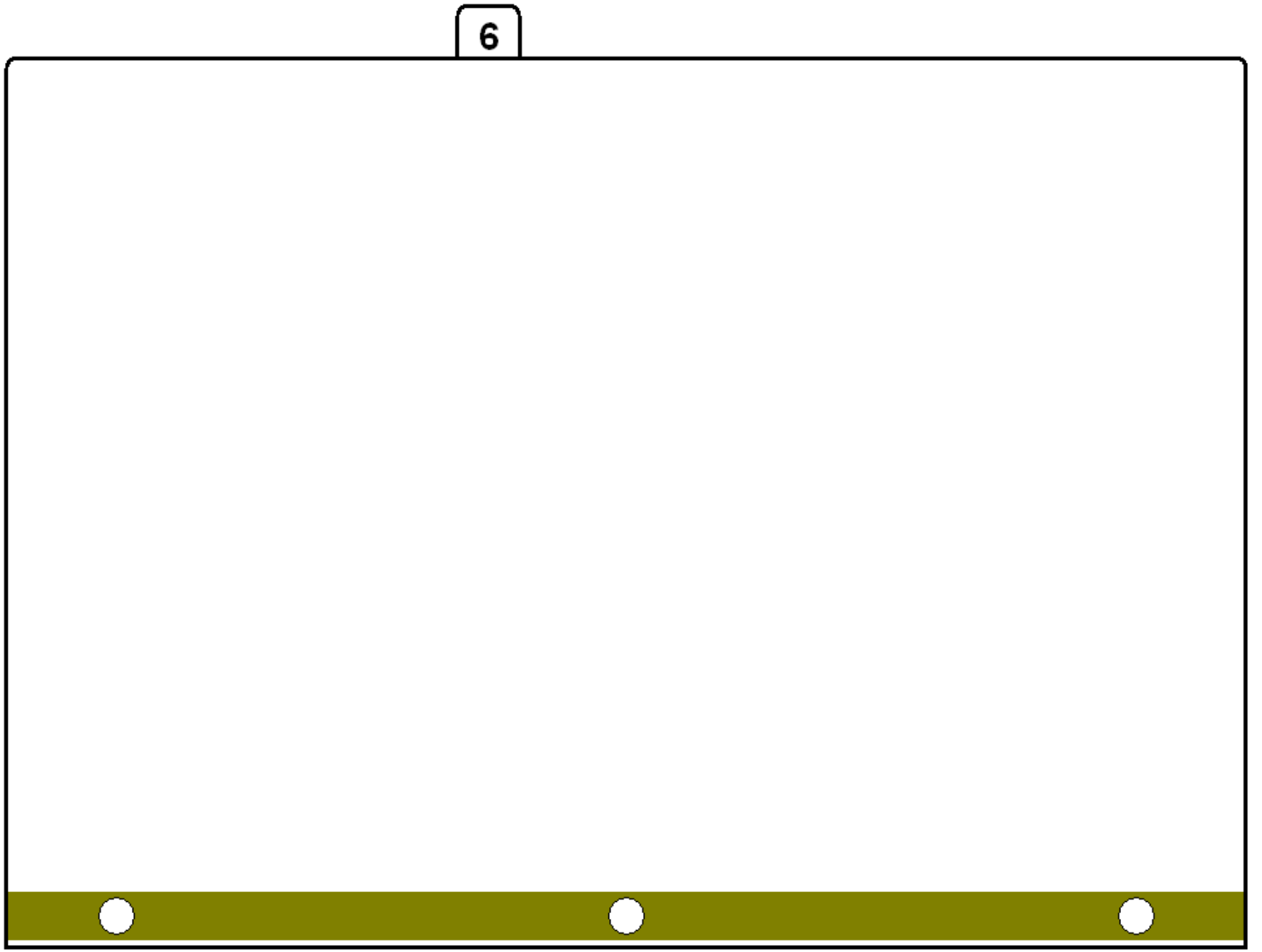
WARNING: MECHANICAL WARRANTY

1. Jogging

Repetitive restarts (jogging) of the screw press should never be attempted. Failure to follow the unplugging recommendations in section 5D and 5E could result in damage to the screw and/or drive train components. The Mechanical Equipment Warranty does not cover damage to any screw press component caused by jogging an overloaded machine.

2. Reversing

Running the screw backwards **is not** an acceptable method of unplugging the screw press. Reversing a plugged screw press can result in damage to the screw press (Inlet and discharge bearings, chain tensioner, screw flight, and drums). The Mechanical Equipment Warranty does not cover damage caused by reversing the screw.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SECTION 6

TROUBLESHOOTING

6A PROBLEM: Low Cake Discharge Dryness	Page 6-1
6B PROBLEM: High Screw Press Motor Load	Page 6-1
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6D PROBLEM: Poor Capture Rate	Page 6-2
6E PROBLEM: Headbox Level Too High	Page 6-2
6F PROBLEM: Unusual Vibration	Page 6-2
6G PROBLEM: Covers Difficult to Install	Page 6-2

SECTION 6

TROUBLESHOOTING

6A PROBLEM: Low Cake Discharge Dryness	
POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Screw Speed Too Fast.....	Reduce Screw Press Speed
- Poor Conditioning.....	Adjust Polymer Flow & Agitation
- Changing Sludge Properties.....	Adjust Polymer/Screw speed/Headbox
- Low Headbox Level.....	Raise Headbox Level Setpoint
- Plugged Screens.....	Remove Covers and Wash Press
- Clearance Problems.....	Readjust Clearances (also, see SECTION 7, parts C,D, and E)
- Low Feed Consistency.....	Check Sludge Properties/Conditioning

6B PROBLEM: High Screw Press Motor Load	
POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Too High Headbox Level.....	Lower Headbox Setpoint
- Too Slow Screw Speed.....	Increase Screw Speed
- Increased Fiber Content.....	Reduce Headbox Lvl/Increase Screw Speed
- Too Much Backpressure.....	Back Off Pressure Cone

6C PROBLEM: Low Screw Press Throughput Capacity	
POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Low Headbox Level.....	Raise Headbox Level Setpoint
- Low Feed Consistency.....	Check Sludge Properties/Conditioning
- Low Screw Speed.....	Increase Screw Speed
- Poor Conditioning.....	Adjust Polymer Flow & Agitation
- Clearance Problems.....	Readjust Clearances (also, see SECTION 7, parts C,D, and E)
- Low Sludge Flow.....	Increase Sludge Flow/Headbox Level

TROUBLESHOOTING (con't)

6D PROBLEM: Poor Capture Rate

POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Poor Conditioning.....	Adjust Polymer Flow, Adjust Agitator
- Too Much Backpressure.....	Back Off Pressure Cone
- Screw Speed Too Fast.....	Reduce Screw Press Speed
- Screen Damage.....	Inspect/Replace Damaged Screens
- Low Feed Consistency.....	Check Sludge Properties/Conditioning

6E PROBLEM: Headbox Level Too High

POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Conditioning Problem.....	Adjust Polymer Flow, Adjust Agitator
- Flow Rate Too High.....	Reduce Flow Rate
- Plugged Overflow.....	Unplug Overflow
- Feedback Loop Overcompensation.....	Adjust Headbox Level Control Setpoints

6F PROBLEM: Unusual Vibration

POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Lack of Chain Lubrication.....	Lubricate Chain/Sprockets (check wear)
- Motor Coupling.....	Inspect for Wear
- Loss of Steam Pressure.....	Increase Steam Pressure/Temperature
- Screw & Screen Contact.....	Readjust Clearances
- High Motor Load.....	Lower Headbox Lvl,Increase Screw Speed
- Stock Spill/ Wood Chips.....	Lower Headbox Lvl,Increase Screw Speed
- Drive Misalignment.....	Realign Drive Train

6G PROBLEM: Covers Difficult to Install

POSSIBLE CAUSES:	REMEDY / ACTION REQUIRED:
- Missing Clips/Holders.....	Install New Clips/Holders
- Bent Covers.....	Rebend Covers to Proper Radius
- Installed in Wrong Order.....	See SECTION 3B for Instructions
- Latches Damaged.....	Remove and straighten LOCK BUTTON

7

SECTION 7

MAINTENANCE INSTRUCTIONS

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7D SCREEN REPLACEMENT Page 7-8
a) GENERAL Page 7-8
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7E FLIGHT REPAIR Page 7-11
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7F LUBRICATION DIAGRAM Page 7-12

7G INSPECTION DIAGRAM Page 7-13

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7I SCREW DISASSEMBLY & REASSEMBLY Page 7-15
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b) SCREW REINSTALLATION Page 7-16

SECTION 7A

LUBRICATION (SEE SECTION 7F FOR LUBRICATION DIAGRAM)

a) SPEED REDUCER

1. The oil should be replaced every 6 months when the press is operated less than 10 hours per day.
2. The oil should be replaced every 2500 hours when the press is operated 10 to 24 hours per day.
3. The oil should be replaced every 1 – 3 months when the press is operated high temperature, high humidity, or atmospheric active gases are present.
4. Please refer to the respective SM-CYCLO 6000 series manual for specific recommended schedules, lubricant specifications, replenishment and grease change guidelines.

b) INLET STAND BEARING / OUTLET STAND BEARING

1. Lubricate each bearing monthly using a high quality EP 1 grease. All bearings on the screw press are fitted with grease nipples and spring loaded relief valves. Grease should be injected until it begins to come out the pressure relief valve.
2. **NOTE: These bearings must be kept totally full of grease** due to the extreme low speed operation.

SECTION 7B

OPENING THE SCREW DRUM

a) Drum Removal

Note: Numbers in parenthesis correspond to items shown on the maintenance diagram in Section 7H.

It is usually not necessary to open the Screw Press for inspection, repair, etc. But you may run into a case where a screw inspection is warranted. Often removal of only the upper half of a drum is required. The procedure to remove a complete drum is as follows:

1. Remove all of the bolts from the vertical flanges of the drum half (#3).

2. Remove all of the bolts from the horizontal flanges of the drum half (#2).

3. Lift off the upper drum slowly using a cable and chain block or crane as shown in Maintenance Diagram 7H.

4. Record the number of shims (#1) between the left and right sections and set these shims aside for reinstallation.

5. Support the lower drum half to prevent it from falling. Remove all of the bolts from the vertical flanges (#3).

6. Remove the lower drum from the bottom. If it is tight then use a lead hammer (or the equivalent) to tap it downward. Use caution when removing a bound drum half. Excessive force can cause damage to the drums and fixed supports.

SECTION 7B

OPENING THE SCREW DRUM

b) DRUM REINSTALLATION

Note: Numbers in parenthesis correspond to items shown on the maintenance diagram in Section 7H of this manual.

1. Verify that there are no burrs on the drum end flanges, which can make reinstallation difficult.

2. Install the lower drum half from the bottom. Slowly pull the lower drum half in place until the screw flight to screen clearance (#6) is 0.5 mm to 1.5 mm. See Diagram 7C.

3. Install and tighten the vertical flange bolts (#3) for the lower drum.

4. Replace the shims (#1) which were removed during disassembly.

5. Lower the upper drum half into place. If the upper drum is tight, use a lead hammer to tap it into position.

6. Install and tighten the horizontal flange bolts (#2) for the upper drum.

7. Install and tighten the vertical flange bolts (#3) for the upper drum.

8. Check to confirm that all bolts are tight.

9. Verify that the screw flight to screen clearance (#6) for the upper drum half is 0.5 mm to 1.5 mm.

10. Turn the screw press over at minimum speed setting to confirm no contact between the screw flight and screen surfaces.

SECTION 7C

CLEARANCES

a) GENERAL INFORMATION

Proper clearance between the inner surface of the screens and the screw flight is very important for optimum Screw Press performance. Check clearances every six to twelve months and adjust as required to maintain maximum screw press performance.

Although the screw shaft rotates very slowly, the outer edge of the screw flight may gradually wear. As the screw flight wears, the clearance slowly increases. Increased clearance can result in screen blinding, decreased dewatering ability, and decreased throughput capacity.

In most cases, the clearance between the inner surface of the screens and the screw flight should be 0.5 to 1.5 mm depending upon the location along the length of the screw press. A greater clearance is generally acceptable at the high pressure section.

Clearance is adjusted by moving the drums in relation to the screw. Clearances can be adjusted in two ways - by removing or inserting shims between the upper and lower halves of the drum sections and by using the jacking bolts to move the drums in relation to the screw. Removing shims is helpful to compensate for wear of the screw flight. The jacking bolts are used to center the drums around the screw. In many instances it is sufficient to adjust clearances along the bottom half of the screw press only.

Note that on new presses there are 0.5 and 1.0 mm shims. If removal of more than 5 mm of shims is required to bring the top & bottom clearances within tolerances then weld build up of the screw flight may be recommended (see SECTION 7E).

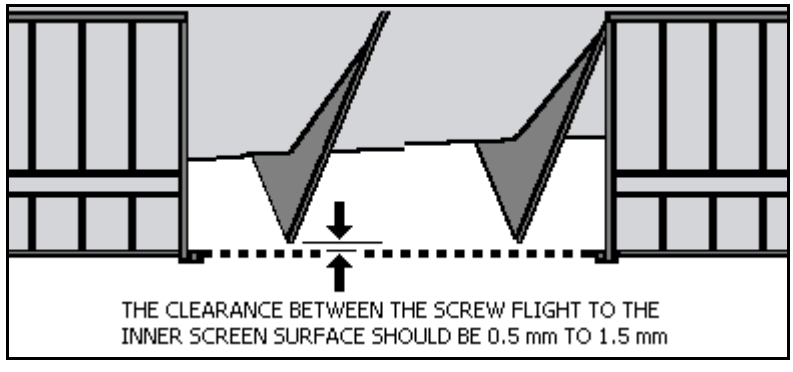


FIGURE 7C – SCREEN CLEARANCE DIAGRAM

SECTION 7C

CLEARANCES

b) CLEARANCE MEASUREMENT

A depth gage is required to measure clearances. The depth gage must have a rod/blade small enough to pass through the screen plate holes (Check the parts list in SECTION 2 for the screen plate hole sizes.). A metric venire caliper with a depth rod is recommended.

1. With the screw press stopped and empty, locate the screw flight by looking through the screen plate holes.

2. Measure the distance from the outer surface of the screen plate to the screw flight using a depth gage.

3. Subtract the thickness of the screen plate from the previous measurement to get the clearance between the inner surface of the screens and the screw flight.

4. Repeat steps 1-3 for the top, bottom, and both sides of each drum along the length of the screw press.

5. Record the clearances on a Screen Clearance Measurement Diagram similar to that shown on page 7-17.

SECTION 7C

CLEARANCES

c) CLEARANCE ADJUSTMENT: SHIM METHOD

Note: Numbers in parenthesis correspond to items shown on the Maintenance Diagram in Section 7H.

1. Using the clearance information recorded on the Screen Clearance Measurement Diagram (pg. 7-22), determine the number of shims (#1) to be removed (or added) to adjust the clearances at the top and/or bottom of the press to within tolerance.

2. Loosen the vertical flange bolts (#3) on the lower half of the drum section(s).

3. Loosen the horizontal flange bolts (#2) on the drum section(s) to be adjusted. Note: All of the drum halves in the low-pressure section may be adjusted together as one unit rather than adjusted separately. Separate adjustment of the drum sections may be required to achieve desired tolerance.

4. Back off on the jacking bolts (#4) to allow the lower half of the drum section(s) to drop slightly.

5. Remove all horizontal flange bolts (#2) and remove (or insert) the appropriate number of shims between the upper and lower half of the drum section(s). Verify that the same number of shims are used on both sides of each drum section.

6. Insert and securely tighten all horizontal flange bolts (#2) to draw the lower half of the drum section(s) up to the upper half drum section(s).

7. Securely tighten all vertical flange bolts (#3) on the lower half of the drum section(s). Tighten the jacking bolts (#4) up against the lower drum halves and lock in place with the jam nuts.

8. Recheck clearances to confirm that the proper screw flight to inside screen clearance has been achieved. If the screw is not centered side to side in the drums and the top and bottom clearances are not within tolerance then use the jacking bolts (#4) for the final adjustment.

9. After clearances are rechecked (page 7-6), rotate the screw at minimum speed setting to confirm no contact between the screw flight and inside screen surfaces along the entire length of the Screw Press.

Warning: If the screw is touching the screen at any point, do not operate the press until the proper clearance is achieved. Failure to do so may result in serious mechanical damage.

SECTION 7C

CLEARANCES

d) CLEARANCE ADJUSTMENT: JACKING BOLT METHOD

Note: Numbers in parenthesis correspond to items shown on the Maintenance Diagram in Section 7H.

1. Loosen the vertical flange bolts (#3) on the drum(s) to be adjusted.

2. Turn the jacking bolts (#4) to adjust the position of the drum(s). Adjust the drum position to achieve the clearances required (page 7-6).

3. Securely tighten the vertical flange bolts (#3) on the upper and lower drum halves.

4. Recheck clearances to confirm that the proper screw flight to inside screen clearance has been achieved.

5. After clearances are rechecked, rotate the screw at minimum speed setting to confirm no contact between the screw flight and inside screen surfaces along the entire length of the Screw Press.

Warning: If the screw is touching the screen at any point, do not operate the press until the proper clearance is achieved. Failure to do so may result in serious mechanical damage.

SECTION 7D

SCREEN REPLACEMENT

a) GENERAL

The screens lining the screw press drums can become damaged by several means. Depending on the abrasiveness of the sludge, they can wear over the years until they weaken and break. Screen damage can also occur during severe overload conditions or if foreign objects (pipe wrenches, etc.) are introduced into the press.

b) DRUM REMOVAL

Numbers in parenthesis correspond to items shown on the Maintenance Diagram on page 7-17.

Note: remove only the drum half with the damaged screen. Removal of both upper and lower sections at the same time will make reinstalling more difficult.

1. Remove the bolts (#3) from the vertical annular joint between the damaged drum half and the adjacent drum or fixed stand.

2. Remove the bolts (#2) from the horizontal joint joining the upper and lower halves. Note, if the lower drum half is being removed brace the lower drum so it does not fall when the bolts are removed.

3. Remove the drum half from the press. Record the number of shims between the upper and lower sections and set these shims aside for reinstallation.

SECTION 7D

SCREEN REPLACEMENT (BOLT-IN TYPE)

a) SCREEN REMOVAL (BOLT-IN)

1. Remove the drum in accordance with 7b, then put it on a flat workbench with its split surface upside.

2. Remove the screws the retainer bar and screens can be detached.

b) SCREEN INSTALLATION (BOLT-IN)

1. Install the screen along the drum inner surface with equal margin at both ends of the drum.

2. Replace the retaining bars and screws. Tighten retaining bar screws evenly on both sides of drum. Tightening drum strainers evenly. Tap the convex part marked 4 slightly with a hammer to lay the strainer tightly to the drum surface. Then repeat the procedure until the retainer bars are completely seated and the screws are tightened fully.

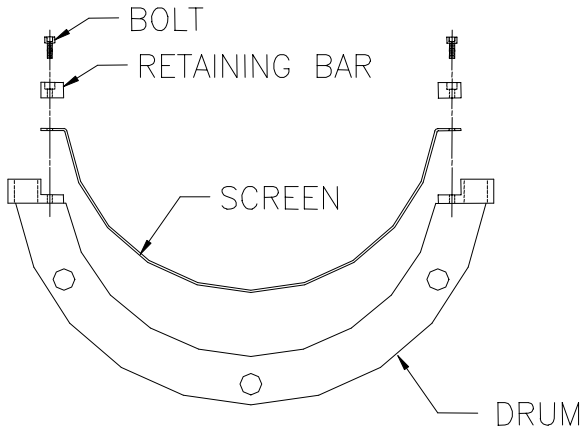


FIGURE 7D - SCREEN REPLACEMENT DIAGRAM
BOLT-IN TYPE

SECTION 7D

SCREEN REPLACEMENT

e) DRUM REINSTALLATION

Reinstall the drum half on the press using the same number of shims that existed when the drum half was removed. Note that when assembled at the factory, a total of 10 mm of shims are normally installed using a combination of 2 mm and 1 mm thick shims.

FOR AN UPPER DRUM HALF:

1. Replace the shims (#1) which were removed during disassembly.
2. Lower the upper drum half into place. If the upper drum is tight, use a lead hammer to tap it into position.
3. Align the reinstalled drum half with the adjacent drums.
4. Install and tighten the horizontal flange bolts (#2) then the vertical flange bolts (#3).
5. Check and adjust clearances as described in Maintenance Instruction TOPIC: CLEARANCES.

FOR A LOWER DRUM HALF:

1. Slowly pull the lower drum half in place. If the drum is tight, use a lead hammer to tap it into position.
2. Replace the shims (#1) which were removed during disassembly.
3. Install and tighten the horizontal flange bolts (#2) then the vertical flange bolts (#3).
4. Check and adjust clearances as described in Section 7C b) CLEARANCES.

Warning: If the screw is touching the screen at any point, do not operate the press until the proper clearance is achieved. Failure to do so may result in serious mechanical damage. If the clearance between the inner surface of the screen and the screw is not within acceptable tolerances then the clearance must be adjusted.

SECTION 7E

FLIGHT REPAIR

The flight at the high-pressure end of the screw will slowly wear. The rate of wear is dependent upon two main factors; the screw speed and the abrasiveness of the material being dewatered. As the abrasiveness and screw speed increase, the rate of wear will also increase. For municipal applications with very low screw sped and low sludge abrasiveness, no significant wear is expected in the first 20 years of operation.

As the screw flight wears, the performance of the screw press declines and the wear of the high-pressure screens accelerates.

FKC recommends inspecting the high pressure screw flight every 5 to 7 years and repairing the worn flight as required. For municipal secondary sludges, repairing worn flight is not typically done within the first 20 years.

a) FLIGHT BUILD-UP

Figure 7E shows the method for field weld build-up of the screw flight to repair minor flight wear.

WARNING:

During weld build-up of the screw flight, ground the welding unit to the screw only. If the welding unit is grounded to the screw press foundation, the electric current will arc through the bearings causing expensive damage.

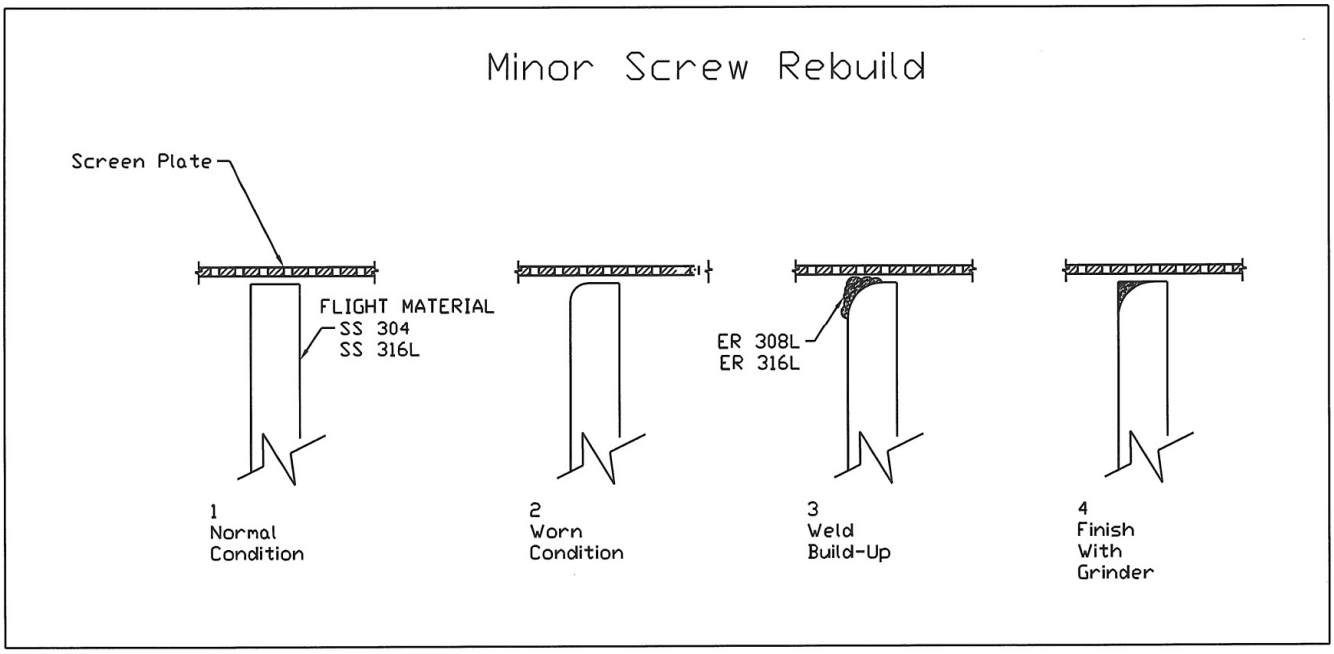
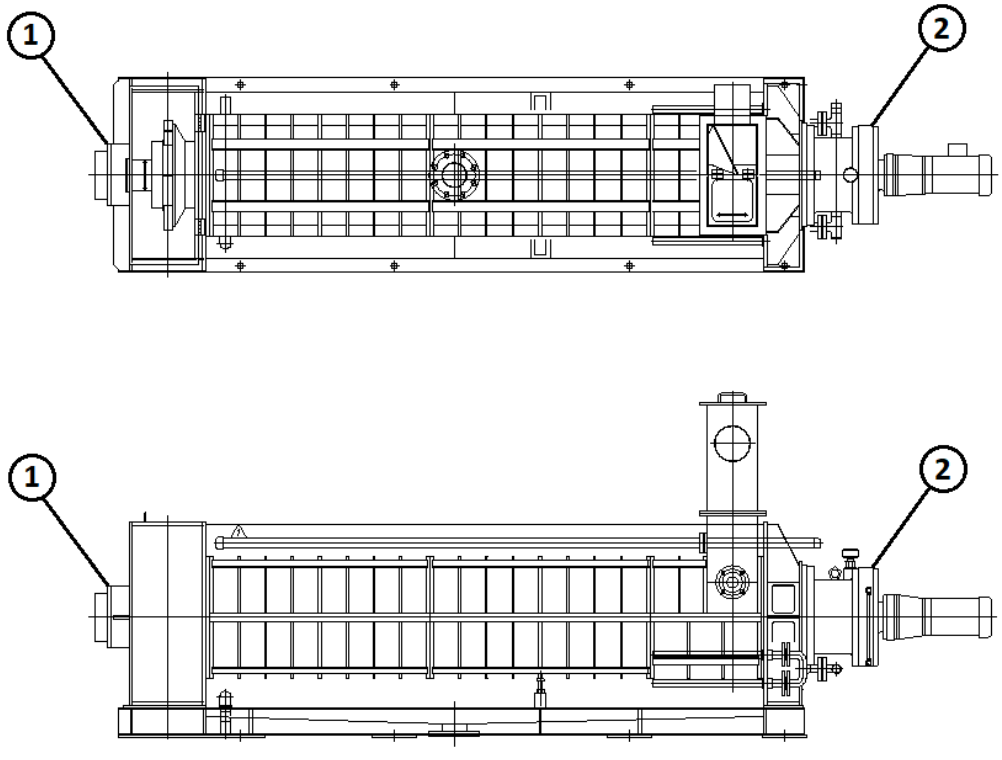


FIGURE 7E - FLIGHT BUILD-UP DIAGRAM

SECTION 7F

LUBRICATION DIAGRAM

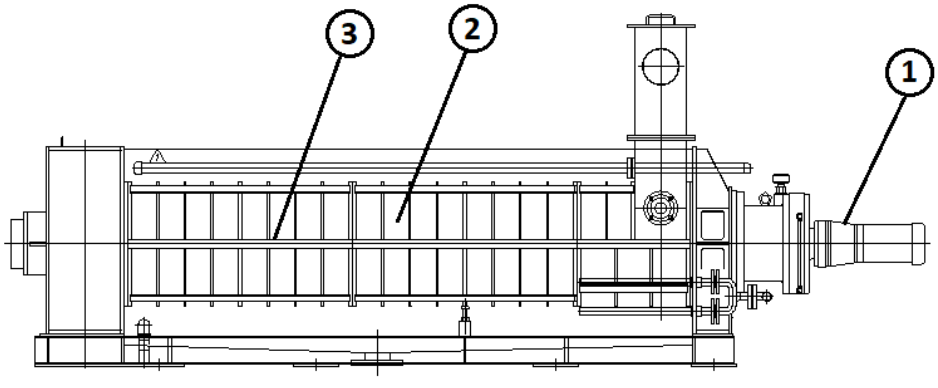
Part #	Part	Inspection Interval	Lubrication Interval	Lubrication Specification
1	Bearing	1 week	1 - 3 months	Shell Alvania EP 1
2	Reducer	1 month	1 - 3 months	See Section 8, Table A-11



SECTION 7G

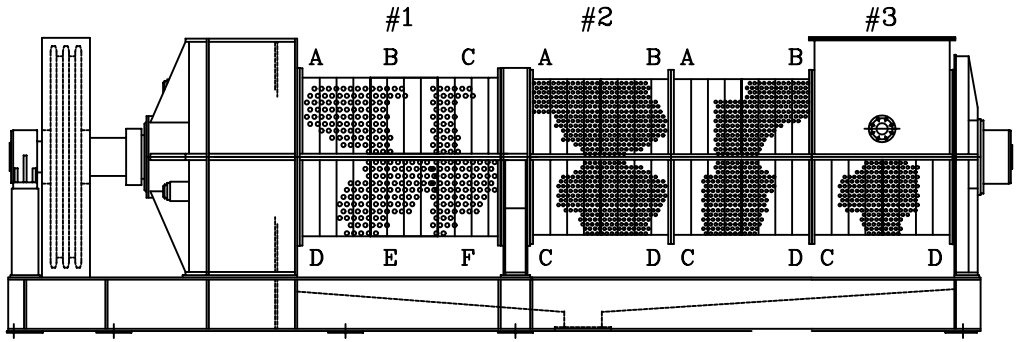
INSPECTION DIAGRAM

PART #	PART	INSPECTION INTERVAL	INSPECTION NOTES
1	COUPLING	1 YEAR	CHECK FOR EXCESSIVE WEAR CHECK FOR EXCESSIVE VIBRATION
2	CLEARANCES	5 YEARS	CHECK SCREW FLIGHT CLEARANCES CHECK DRAINAGE PATTERN
3	BOLTS	5 YEARS	CHECK TORQUE'S AT HIGH PRESSURE DRUMS

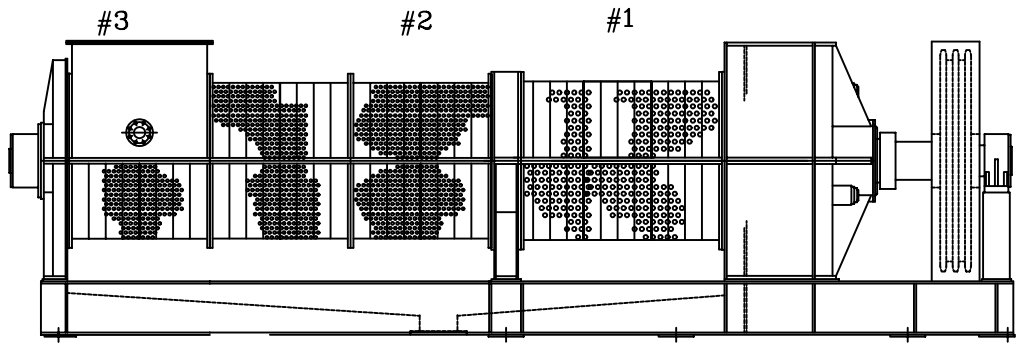


SECTION 7K–SCREW PRESS SCREEN CLEARANCE & INSPECTION DIAGRAM – 3000L

PRESS NO. :		LOCATION:	
DATE:		INSPECTOR:	



LEFT SIDE



RIGHT SIDE

REPLACE SCREENS
PER THIS TABLE

SCREEN #

DRUM #	A	B	C	D		
#1						
#2						
#3						
#4						

R = REPLACE SCREEN

I = INSPECT DURING NEXT SHUTDOWN

FINAL CLEARANCE
PER THIS TABLE

SCREEN #

DRUM #	A	B	C	D		
#1						
#2						
#3						
#4						

SECTION 7I

Screw Press Screw Removal & Re-Assembly

In municipal applications the screw in the FKC screw press is designed to last the life of the equipment, 20+ years. Therefore, screw replacement rarely occurs.

However, when it is necessary to remove the screw from a press the following describes the preferred procedure for completing the job. FKC recommends that our service representative be present during the screw removal and reinstallation process.

A) Screw Removal

1. Disconnect power to the machine. (Lock machine out.)
2. Remove all process piping, electrical and instrumentation items from the headbox, drum covers, and main body of the screw press.
3. Remove all the drum covers from the press.
4. Remove the headbox.
5. Support the gearbox in preparation for its removal.
6. Remove the bolts from the gearbox flange that seats against the screw press inlet stand.
7. Remove all drum halves from the press.
8. Remove the bolts and alignment pins holding down the inlet and discharge stands.
9. Support the screw at each end between the stands.
10. At the inlet end of the screw;
    a. Remove the bolts from the end plate (C1) of the screw shaft coupling (C2).
    b. Remove the gearbox from the screw shaft.
11. Remove the inlet stand from the screw.
12. At the discharge end of the screw, remove the following items in the order listed;
    a. Thrust nut
    b. Bearing cover
    c. Bearing housing
    d. Bearing
13. Remove the discharge stand from the screw.

Screw Press Screw Removal & Re-Assembly

B) Screw Reinstallation

The new or rebuilt screw should be reinstalled in the reverse order as described in the removal section above. The following should be completed during the reassembly process.

NOTE: FKC recommends that all new bearings be installed on the screw.

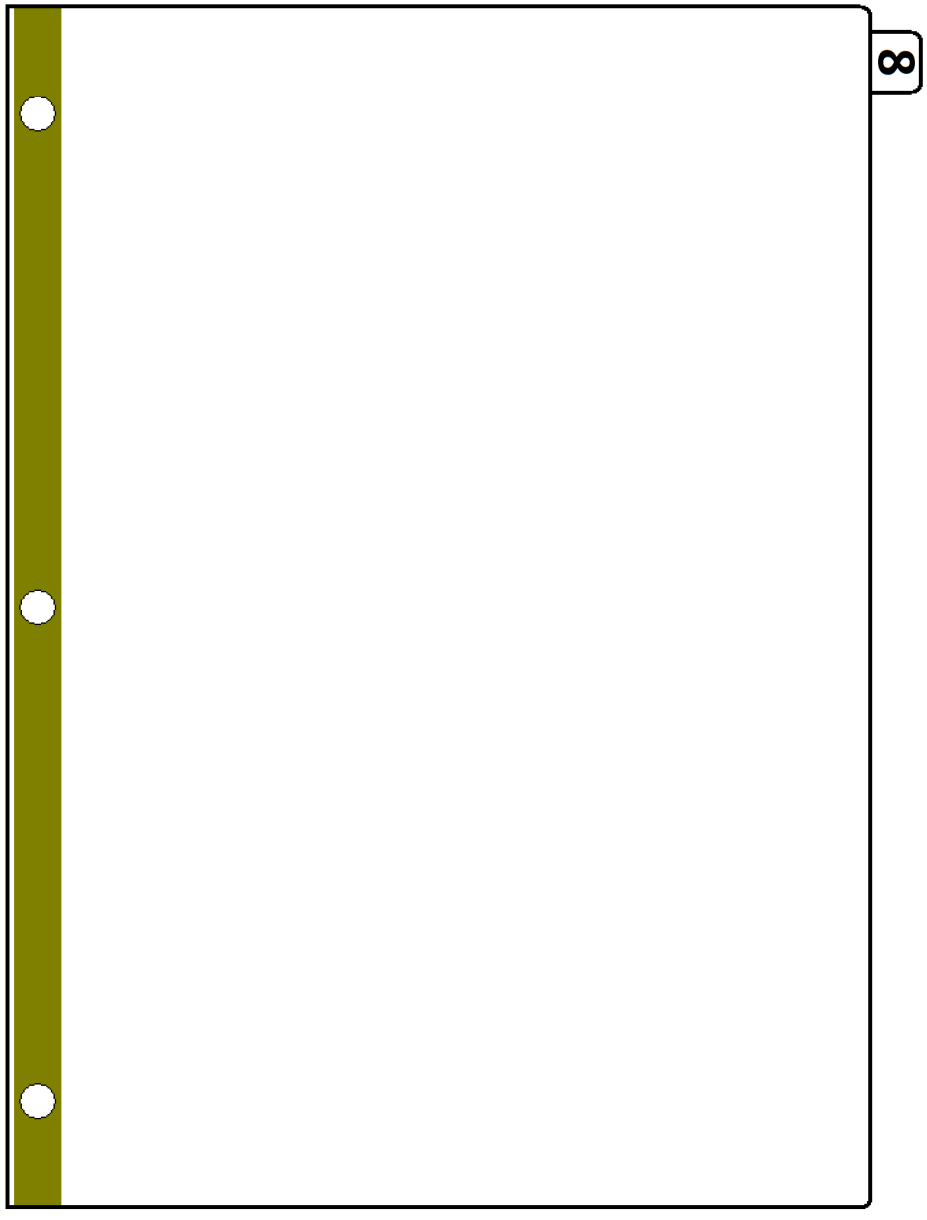
1. After the screw with the inlet and outlet stands has been set in place, install all of the bottom drum halves of the screw press first.

2. The clearance between the screw and screens should be adjusted and set as described in section 7C along one side of the press before installation of the top drum halves.

3. The top drum halves should be reinstalled and aligned one at a time starting from the inlet end. Clearances should be adjusted and set as described in section 7C.

4. After all the clearances have been checked and set and the bearings lubricated, the press should be run briefly to check for unusual noise or screw to screen contact.

5. Prior the restarting the press the items on the pre-start up inspection checklist should be re-verified.

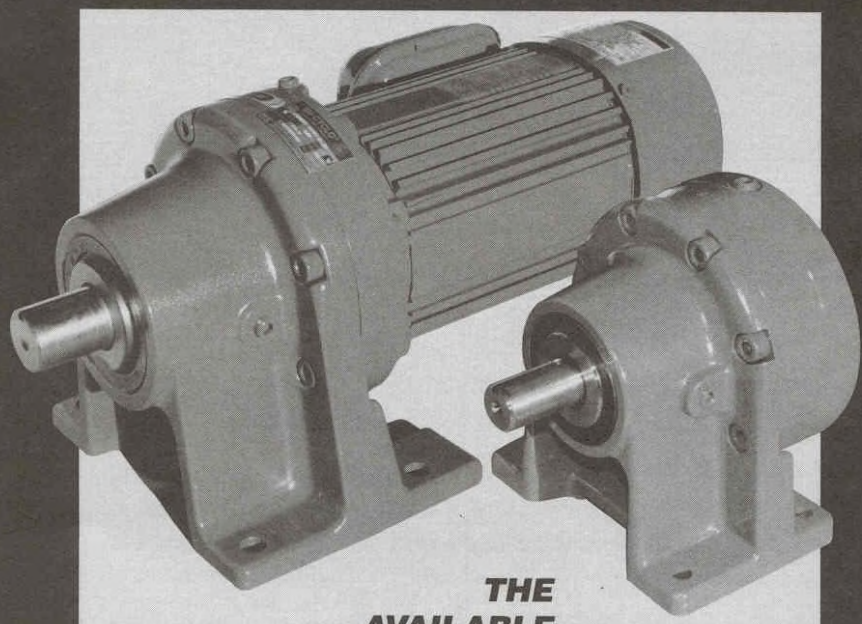

8

Sumitomo
Gearbox

SM-CYCLO®

Speed Reducers, Gearmotors and Brakemotors

6000 SERIES



THE AVAILABLE SOLUTION, WORLDWIDE.

SUMITOMO
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Manual
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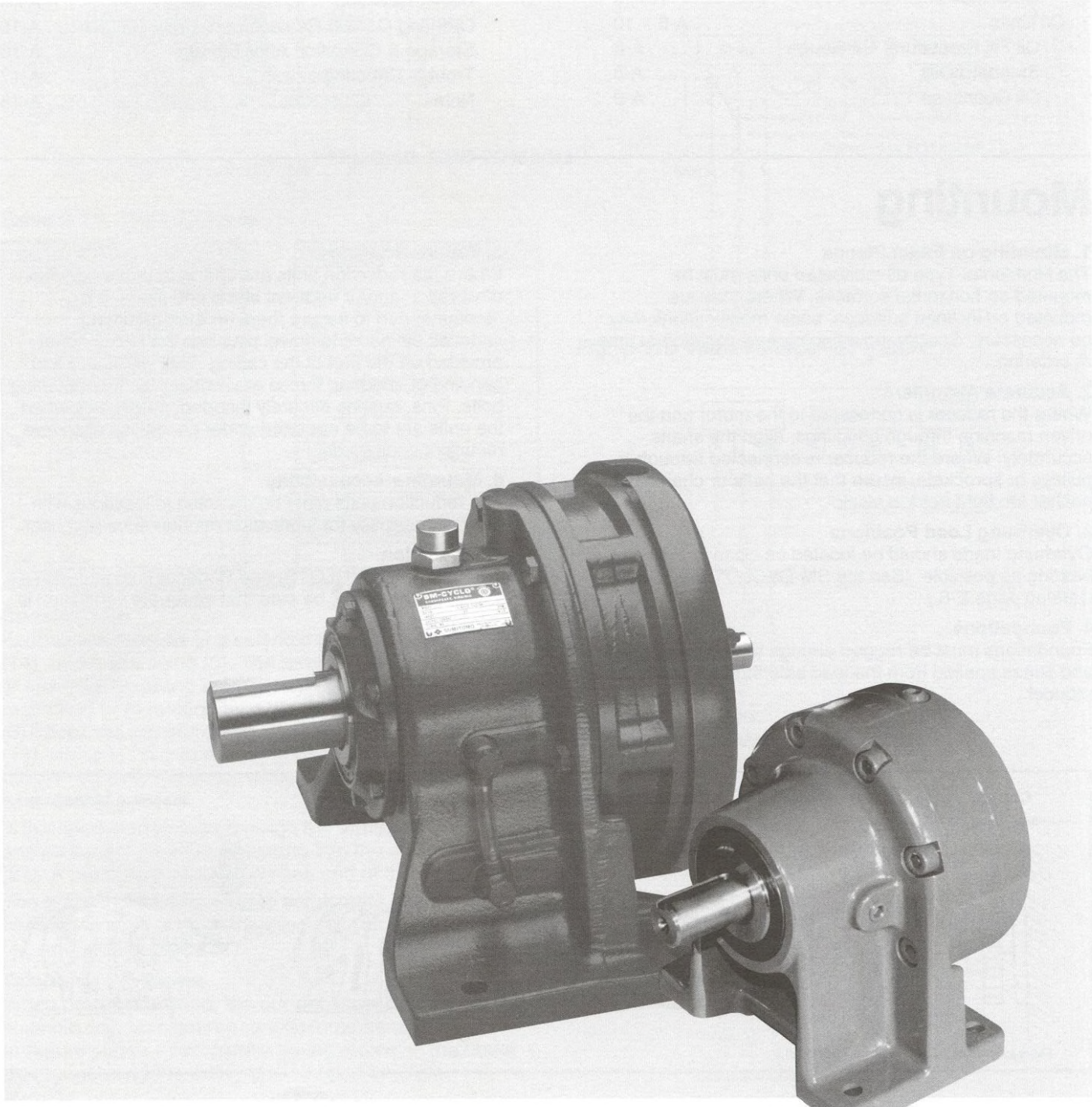
WARNINGS

- Consult factory if SM-Cyclo speed reducers are driven by D.C. motors, variable frequency A.C. drives, or speeds other than standard catalog input speeds.
- Be sure to install and operate SM-Cyclo speed reducers, gearmotors and brakemotors in compliance with applicable local and national safety codes. Appropriate guards for rotating shafts should be used and are available from the factory.
- When using SM-Cyclo speed reducers, gearmotors or brakemotors in a system for human transport, install a secondary safety device in order to minimize the risk of accidents that may result in personal injury, death or equipment damage.

SM-CYCLO®
SPEED REDUCERS



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Mounting

1. Mounting on Exact Planes
The Horizontal Type oil-lubricated units must be mounted on horizontal surfaces. Where they are mounted on inclined surfaces, some modifications may be necessary. Specify mounting plane inclination at time of ordering.

2. Accurate Alignment
Where the reducer is connected to the motor and the driven machine through couplings, align the shafts accurately. Where the reducer is connected through V pulleys or sprockets, insure that the belts or chains are neither too tight nor too slack.

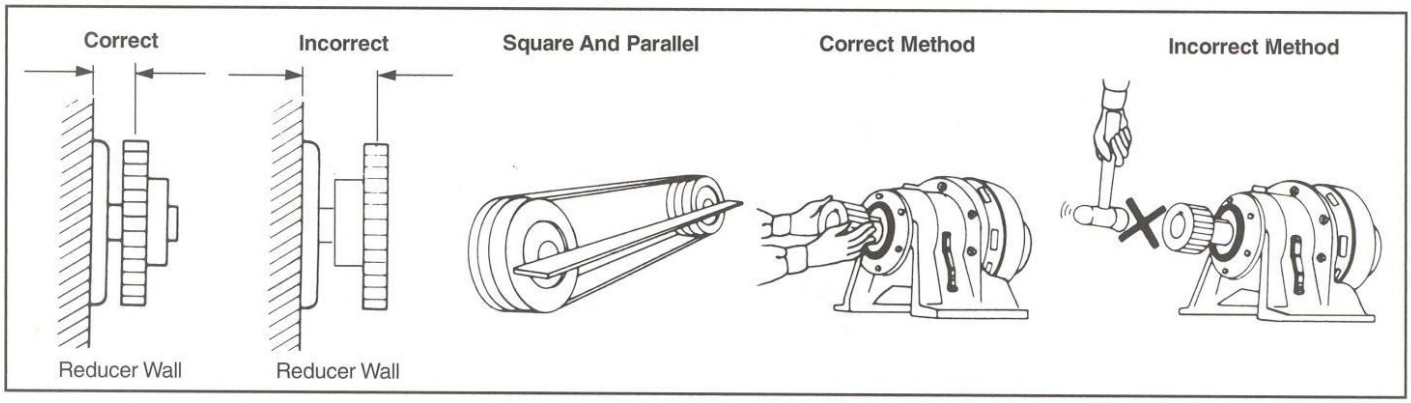
3. Overhung Load Positions
Overhung loads should be located as close to the bearing as possible. (See the SM-CYCLO® 6000 Series Catalog page E-8.)

4. Foundations
Foundations must be rugged enough to withstand shock and stress applied from the load side through the reducer.

5. Secure Housing
Where the reduction units are operated under conditions of vibration and/or frequent starts and stops, it is recommended to secure them on their mounting surfaces by inserting dowel pins into the knock-holes provided on the foot of the casing. This will insure that bending or shearing forces are reduced on the mounting bolts. Pins must be securely inserted, particularly when the units are to be operated under conditions of severe recurrent peak loads.

6. Mounting Accessibility
The reduction units must be mounted in locations with easy accessibility for lubrication maintenance purposes.

7. Ventilation
When the SM-CYCLO® Speed Reducer is mounted in a separate enclosure, be sure that adequate ventilation is provided.



GENERAL CONSTRUCTION

Fig. A-1 Speed Reducer – Horizontal Foot Mount, Single Reduction

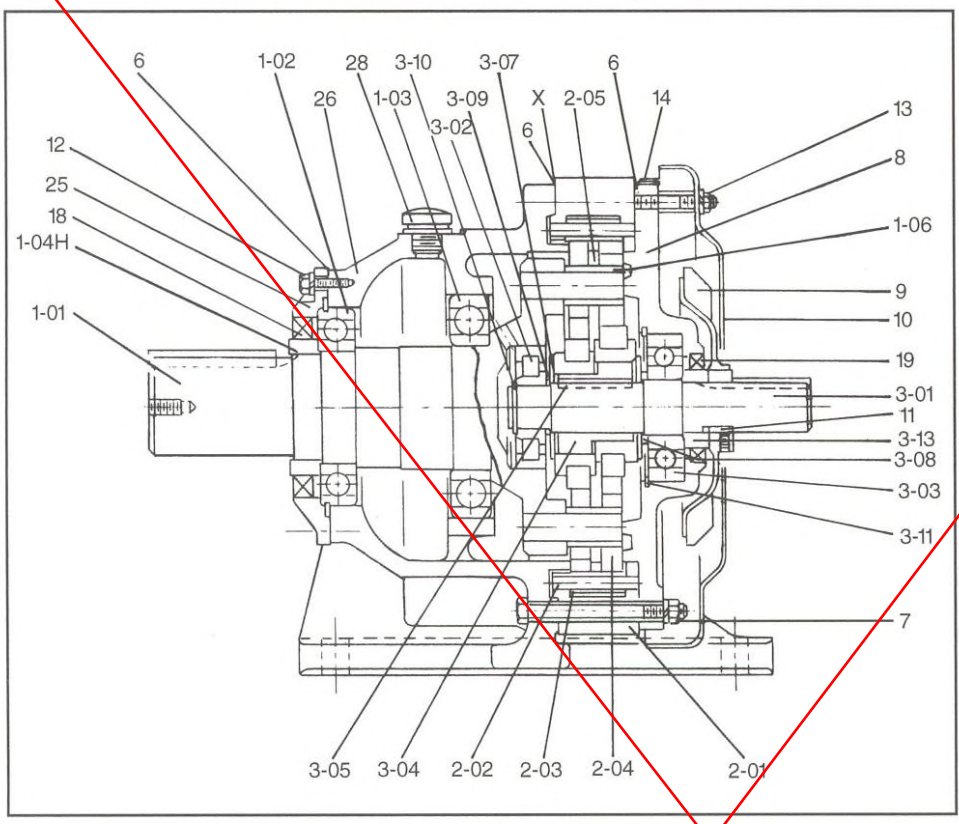
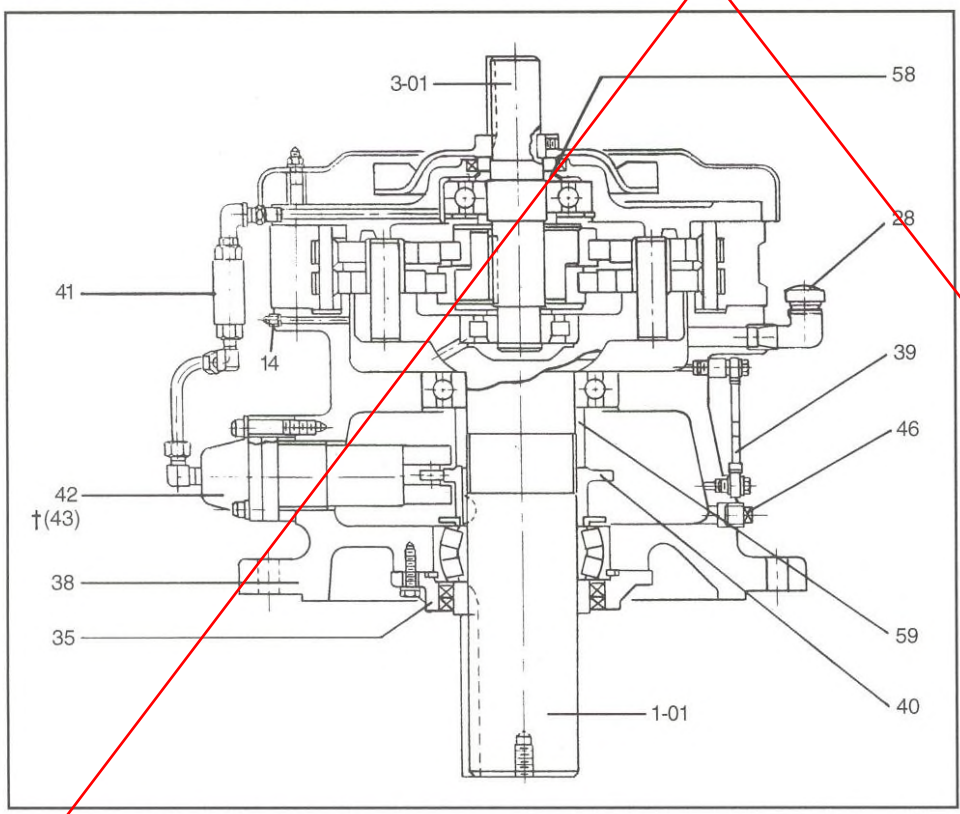


Fig. A-2 Speed Reducer – Vertical Base Mount, Single Reduction



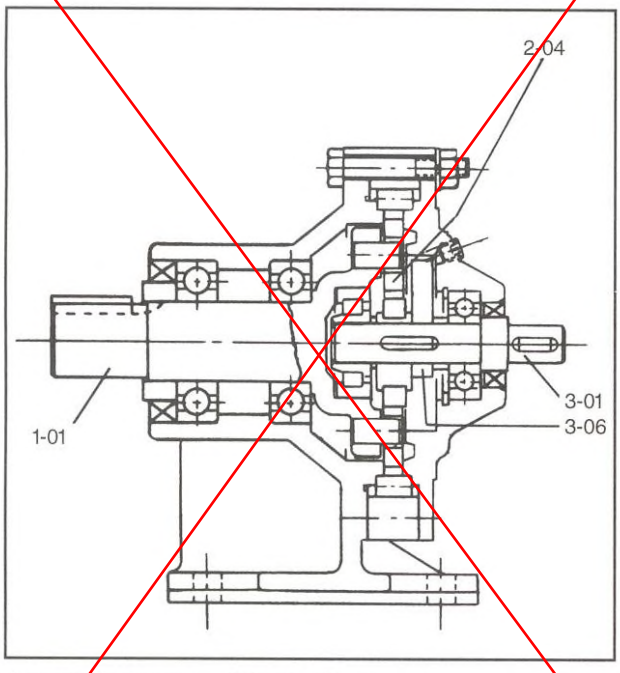
Note: For details of oil seals, bearings or gaskets, refer to A-11 ~ 13.
†Refer to Table A-16 on Pg. A-9 for units which require a positive displacement pump.
*Pt. No. 58 — frame sizes 6195-6275 only; Pt. No. 59 — frame sizes 6205-6275 only.

Table A-1. Speed Reducer Main Parts

Part No.	Part Name
1-01	Slow Speed Shaft w/pins
1-02	Bearing A
1-03	Bearing B
1-04H	Oil Seal Collar—Horizontal
1-06	Slow Speed Shaft Rollers
2-01	Ring Gear Housing
2-02	Ring Gear Pins
2-03	Ring Gear Rollers
2-04	Cyclo Disc
2-05	Spacer Ring
3-01	High Speed Shaft
3-02	Bearing C
3-03	Bearing D
3-04	Eccentric Bearing Assembly
3-05	Eccentric Key
**3-06	Balance Weight
3-07	Spacer
3-08	Spacer
3-09	Spacer
3-10	Retaining Ring
3-11	Retaining Ring
3-13	Collar
ǂ 5-01	Intermediate Shaft w/Pins
ǂ 5-02	Bearing F
ǂ 5-03	Bearing G
ǂ 5-04	Eccentric Bearing Assembly
6	Gasket Set
7	Casing Nuts & Bolts
8	High Speed End Shield
9	Cooling Fan & Set Screw
10	Fan Cover
11	Fan Key
12	Bolts For SS Oil Seal Housing
13	Bolts, Spacers For Fan Cover
14	Plug
ǂ 15	Grease Nipple
18	Slow Speed Output Oil Seal
19	High Speed Input Oil Seal
25	Horizontal Oil Seal Housing
26	Horizontal Case
28	Oil Fill Plug
29	Oil Gauge—Horizontal Unit
35	Vertical Oil Seal Housing
38	Vertical Case (Integral V Type)
39	Oil Gauge—Vertical Unit
40	Cam
41	Piping Set & Oil Signal
42	Plunger Pump
43	Positive Displacement Pump
46	Drain Plug
ǂ 55	Intermediate Cover
ǂ 57	Eye Bolt
*58	Oil Slinger
*59	Spacer

GENERAL CONSTRUCTION

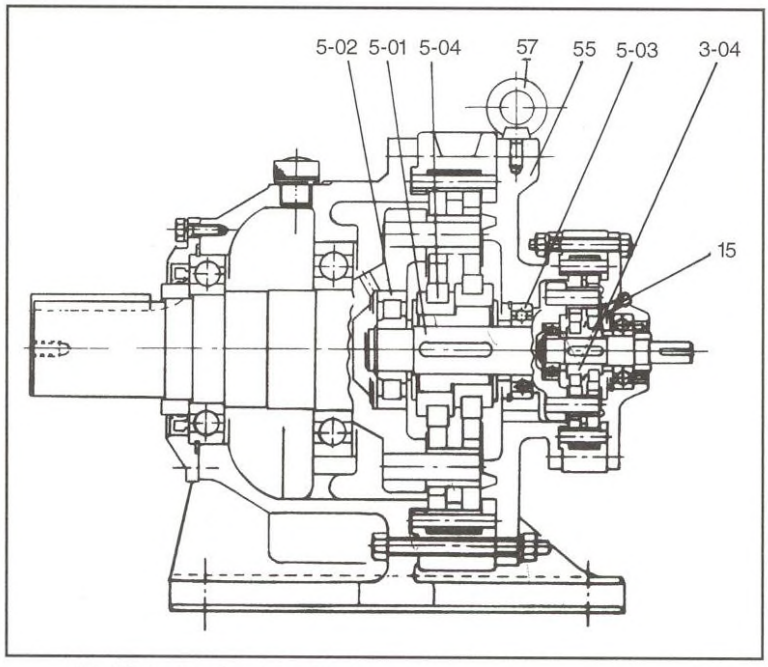
Fig. A-3 Speed Reducer/Single Disc Type (Frame Size 6060-6095)



Speed Reducer — Single Disc

SM-CYCLO® single reduction, Models No. 6060-6095, employ the use of a single planetary gear (Cycloid Disc) and a balance weight.

Fig. A-4 Speed Reducer/Double Reduction



Multiple Reduction Reducers

Multiple reduction SM-CYCLO® Reducers are a combination of standard reduction mechanism assemblies connected using an intermediate shaft (Part No. 5-01) and intermediate cover (Part No. 55) between them.

Table A-2. Frame Sizes and Ratio Combination of Double Reduction Models

Frame Size Combination

Frame Size	Second Stage	First Stage
6060DA	6060	6060
6065DA	6065	6065
6070DA	6070	6065
6075DA	6075	6065
6090DA	6090	6075
6095DA	6095	6075
6100DA	6100	6075
6105DA	6105	6075
6120DA	6120	6075
6120DB	6120	6095
6125DA	6125	6075
6125DB	6125	6095
6130DA	6130	6075
6130DB	6130	6095
6130DC	6130	6105
6135DA	6135	6075
6135DB	6135	6095
6135DC	6135	6105
6140DA	6140	6075
6140DB	6140	6095
6140DC	6140	6105
6145DA	6145	6075
6145DB	6145	6095
6145DC	6145	6105
6160DA	6160	6095
6160DB	6160	6105
6160DC	6160	6125
6165DA	6165	6095
6165DB	6165	6105

Frame Size	Second Stage	First Stage
6165DC	6165	6125
6170DA	6170	6095
6170DB	6170	6105
6170DC	6170	6125
6175DA	6175	6095
6175DB	6175	6105
6175DC	6175	6125
6180DA	6180	6105
6180DB	6180	6135
6185DA	6185	6105
6185DB	6185	6135
6190DA	6190	6125
6190DB	6190	6135
6195DA	6195	6125
6195DB	6195	6135
6205DA	6205	6125
6205DB	6205	6135
6215DA	6215	6135
6215DB	6215	6165
6225DA	6225	6135
6225DB	6225	6175
6235DA	6235	6165
6235DB	6235	6185
6245DA	6245	6165
6245DB	6245	6185
6255DA	6255	6175
6255DB	6255	6195
6265DA	6265	6195
6275DA	6275	6195

Reduction Ratio Combination

Total Ratio	Second Stage Ratio	First Stage Ratio
104	13	8
121	11	11
143	13	11
165	15	11
195	15	13
231	21	11
273	21	13
319	29	11
377	29	13
473	43	11
559	43	13
649	59	11
731	43	17
841	29	29
1003	59	17
1247	43	29
1479	87	17
1849	43	43
2065	59	35
2537	59	43
3045	87	35
3481	59	59
4437	87	51
5133[1]	87	59
6177	87	71
7569	87	87

Note: [1] For frame sizes 6205DA, DB or DC ~ 6265DA, DB or DC, second stage ratio is 59 and first stage ratio is 87.

LUBRICATION

Standard Type Mounted Reducer (Slow Speed Shaft Horizontal)[1,2]

Table A-3. Horizontal Mounted Single Reduction Reducers

Frame Size \ Reduction Ratio	3	5	6	8	11	23	15	17	21	25	29	35	43	51	59	71	87	119
6060 6065	Grease Lubricated (G)		Maintenance-Free Grease Lubrication (MF)															
6070 6075															59			
6080 6085																	87	
6090 6095																		
6100 6105 610H																		
6110 6115																		
6120 6125 612H																		
6130 6135	Oil Bath Lubrication (PB)																	
6140 6145 614H																		
6160 6165 616H																		
6170 6175																		
6180 6185																		
6190 6195																		
6205																		
6215																		
6225																		
6235																		
6245																		
6255																		
6265																		
6275																		

Table A-4. Horizontal Mounted Double Reduction Reducers

Frame Size \ Reduction Ratio	104	121	143	165	195	231	273	319	377	473	559	649	731	841	1003	1015	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569
6060DA 6065DA	Maintenance-Free Grease Lubrication (MF)																				2537				5133		
6070DA 6075DA																											
6090DA 6095DA																											
6100DA 6105DA																											
6120DA 6120DB																											
6125DA 6125DB																											
6130DA 6135DA	Grease Lubrication (G)																										
6130DB 6135DB																											
6130DC 6135DC																											
6140DA 6140DB 6140DC																											
6145DA 6145DB 6145DC																											
6160DA 6165DA																											
6160DB 6165DB																											
6170DA 6175DA																											
6170DB 6175DB																											
6180DA 6185DA																											
6160DC 6165DC	Oil Bath Lubrication (PB)																										
6170DC 6175DC																											
6180DB 6185DB																											
6190DA 6195DA																											
6190DB 6195DB																											
6205DA 6205DB																											
6215DA 6215DB		121		165																							
6225DA 6225DB																											
6235DA 6235DB																											
6245DA 6245DB																											
6255DA 6255DB																											
6265DA																											
6275DA									377																		

Notes: [1] Tables A-3 and A-4 show the standard lubrication method when the Cyclo drive is driven at the standard input speed.
[2] Ratios shown in white in Tables A-3 and A-4 are unavailable for the given unit sizes.

LUBRICATION

Standard Vertical Mounted Reducer (Slow Speed Shaft Vertical)[1,2,3]

Table A-5. Vertical Mounted Single Reduction Reducer

Frame Size \ Reduction Ratio	3	5	6	8	11	13	15	17	21	25	29	35	43	51	59	71	87	119
6060 6065	Grease Lubricated (G)		Maintenance-Free Grease Lubrication (MF)												59		87	
6070 6075																		
6080 6085																		
6090 6095																		
6100 6105																		
6110 6115																		
6120 6125																		
6130 6135			Oil Bath Lubrication (PB)															
6140 6145																		
6160 6165																		
6170 6175																		
6180 6185			Forced Oil Lubrication (P)															
6190 6195																		
6205																		
6215																		
6225																		
6235																		
6245																		
6255																		
6265																		
6275											TP		TP		TP		TP	

TP: Positive Displacement Pump Lubrication (see Table A-16.)

Table A-6. Vertical Mounted Double Reduction Reducer

Frame Size \ Reduction Ratio	104	121	143	165	195	231	273	319	377	473	559	649	731	841	1003	1015	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569
6060DA 6065DA	Maintenance-Free Grease Lubrication (MF)																				2537				5133		
6070DA 6075DA																											
6090DA 6095DA																											
6100DA 6105DA																											
6120DA 6120DB 6125DA 6125DB																											
6130DA 6135DA	Grease Lubrication (G)																										
6130DB 6135DB																											
6130DC 6135DC																											
6140DA 6140DB 6140DC																											
6145DA 6145DB 6145DC																											
6160DA 6165DA																											
6160DB 6165DB																											
6170DA 6175DA																											
6170DB 6175DB																											
6180DA 6185DA																											
6160DC 6165DC										473				841		1015				2065							
6170DC 6175DC																											
6180DB 6185DB																											
6190DA 6195DA																											
6190DB 6195DB																											
6205DA 6205DB				165						Forced Oil Lubrication (P)									1849								
6215DA 6215DB		121																			2537						
6225DA 6225DB																											
6235DA 6235DB																											
6245DA 6245DB		(P)																									
6255DA 6255DB																											
6265DA																											
6275DA										TP : Positive Displacement Pump Lubrication (see Table A-16)																	

Notes: [1] Please consult the factory for applications where the slow speed shaft is up.
[2] Tables A-5 and A-6 show the standard lubrication method when the Cyclo drive is driven at the standard input speed.
[3] Ratios shown in white in Tables A-5 and A-6 are unavailable for the given unit sizes.

Lubricants

Grease Lubricated Models

Those models listed in Tables A-3 ~ A-6 as grease lubricated are filled with grease before shipment to the customer and are ready for use.

Table A-7. Standard Greases[1]

Ambient Temperature[2]		SM-Cyclo® Speed Reducer
°F	°C	Shell Oil
14 to 122	-10 to 50	Shell Alvania® Grease 2 (NLGI Grade #2)

Table A-8. Grease Replenishment and Change Interval

Model	Condition		Interval[3]
Single and Double Reduction Maintenance Free Type	Replenishment		NOT REQUIRED
	Overhaul[4]		Every 20,000 Hours or Every 4 ~ 5 Years
Double Reduction	Replenishment	Less Than 10 Hours Per Day Operation	Every 3 ~ 6 Months
		10 ~ 24 Hours Per Day Operation	Every 500 ~ 1000
	Change	Speed Reducer Mechanism, High Speed Shaft Bearings (Speed Reducer Type)	Every 2 ~ 3 Years
		Slow Speed Shaft Bearings	Every 3 ~ 5 Years

Replenishment and Change Guidelines

Replenish grease to the reduction mechanism 1/3 to 1/2 of the quantity listed in Table A-9 or A-10 for the first reduction stage at the interval recommended in Table A-8.

When the unit is disassembled for overhauling, refill with the grease quantities indicated in Table A-9 or A-10. Or alternatively, 80% of the space around the reduction mechanism and slow speed shaft bearings of single reduction units, and 50% around the reduction mechanism of both the first and second stage of double reduction units.

Slightly larger quantities may be supplied to lower reduction ratio units, and somewhat smaller quantities for high reduction ratio units.

Apply grease liberally to the central part (i.e., around the eccentric bearings) of the mechanism. Apply grease to both the slow speed and high speed shaft bearings as you would to ordinary bearings at the time of re-assembly.

If excessive grease is added, agitation heating of the grease will raise the operating temperature of the unit. Avoid excessive greasing, but do not supply an insufficient amount of grease. When the grease is insufficient, it will raise the unit's operating temperature due to breakdown of the lubrication films on the eccentric bearing. In this case, if the operating temperature rises, supply grease immediately.

Table A-9. Single Reduction Grease Quantities – oz. (g.)

Frame Size	6060 6065	6070 6075	6080 6085	6090 6095	6100 6105 610H	6110 6115	6120 6125 612H
Speed Reduction Mechanism	0.9 (25)		2.3 (65)	3.2 (90)	4.9 (140)	7.1 (200)	11.6 (330)
Slow Speed Shaft Bearing	1.2 (35)		2.5 (70)	3.5 (100)		3.2 (90)	4.2 (120)

Notes: [1] Avoid the use of grease other than shown in Table A-7.
[2] Consult the factory when the drives are used under widely fluctuating temperatures, ambient temperatures other than those listed in Table A-7, or any other special conditions.
[3] Single reduction frame sizes 6060 ~ 612H and double reduction frame sizes 6060DA ~ 6125DB are maintenance free units. Grease replenishment is not necessary. Where longer life of the drive is expected or if re-lubricating is preferred before the recommended interval, refer to Tables A-7, A-8, A-9 and A-10.
[4] Overhauling consists of disassembling the unit, replacing the seals and gaskets, cleaning the internal parts and then repacking the unit with designated grease.

LUBRICATION

Table A-10. Double Reduction Grease Quantities – oz. (g.)

Frame Size	6060DA 6065DA	6070DA 6075DA	6090DA 6095DA	6100DA 6105DA	6120DA 6125DA	6120DB 6125DB	6130DA 6135DA	6130DB 6135DB	6130DC 6135DC	6140DA 6145DA	6140DB 6145DB	6140DC 6145DC
Speed Reduction Mechanism (1st Stage)	0.9 (25)					3.2 (90)	0.9 (25)	3.2 (90)	4.9 (140)	0.9 (25)	3.2 (90)	4.9 (140)
Speed Reduction Mechanism (2nd Stage)	0.9 (25)		3.2 (90)	4.9 (140)	11.6 (330)		15.9 (450)					
Slow Speed Shaft Bearing (2nd Stage)	1.2 (35)		3.5 (100)		4.2 (120)		10.6 (300)					

Frame Size	6160DA 6165DA	6160DB 6165DB	6160DC 6165DC	6170DA 6175DA	6170DB 6175DB	6170DC 6175DC	6180DA 6185DA	6180DB 6185DB	6190DA 6195DA	6190DB 6195DB	6205DA	6205DB
Speed Reduction Mechanism (1st Stage)	3.2 (90)	4.9 (140)	11.6 (330)	3.2 (90)	4.9 (140)	11.6 (330)	4.9 (140)	15.9 (450)	11.6 (330)	15.9 (450)	11.6 (330)	15.9 (450)
Speed Reduction Mechanism (2nd Stage)	26.5 (750)			35.3 (1000)			38.8 (1100)		52.9 (1500)			
Slow Speed Shaft Bearing (2nd Stage)	10.6 (300)			17.6 (500)			21.2 (600)		24.7 (700)			

Frame Size	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB	6245DA	6245DB	6255DA	6255DB	6265DA
Speed Reduction Mechanism (1st Stage)	15.9 (450)	26.5 (750)	15.9 (450)	35.3 (1000)	26.5 (750)	38.8 (1100)	26.5 (750)	38.8 (1100)	35.3 (1000)	52.9 (1500)	
Speed Reduction Mechanism (2nd Stage)	70.5 (2000)		88.2 (2500)		141.1 (4000)		158.7 (4500)		211.6 (6000)		282.2 (8000)
Slow Speed Shaft Bearing (2nd Stage)	28.2 (800)		31.7 (900)		35.3 (1000)		38.8 (1100)		42.3 (1200)		45.9 (1300)

Oil Lubricated Models

Oil Fill Procedure

Oil lubricated models are not filled with oil prior to shipping. Before start-up, remove the oil fill plug (See Pg. A-3, Fig. A-2, Part #28) and fill the reducer with recommended oil. Refer to Tables A-11~A-14 for standard oil, allowable viscosity, quantity, and change interval. The oil level must be to the upper red line on the oil level gauge while the unit is not operating, and above the lower red line during operation. If too much oil is supplied, the unit's operating temperature will rise due to the churning heat of the oil, or oil will leak across the high speed shaft oil seal.

Before filling a vertical base type unit with oil, remove the vent plug (Pg. A-3, Fig. A-2, Part #14). After filling, apply teflon sealing tape to threads of the vent plug before installing.

When draining oil, remove drain plug (Fig. A-5, Part #46) or lower side plug of the oil level gauge.

Oil Level Gauge

The gauge must be replaced when it becomes difficult to check the oil level due to discoloration of the vinyl hose. Use the standard vinyl oil gauge for a reducer operating in ambient temperature –4°F to 100°F (–20°C to 40°C). Where the reducer is used at ambient temperatures greater than 100°F (40°C) or less than –4°F (–20°C), a glass gauge set or a dipstick is recommended.

The oil level gauge can be attached on either side of the casing on horizontal units. Attach on the side that is most convenient for checking the oil level. (The oil level gauge is usually attached on the right side when viewed from the slow speed shaft end.)

Table A-11. Standard Oils

Ambient Temperature[1,2] °F	Ambient Temperature[1,2] °C	Gulf Oil	Exxon Oil	Mobil Oil	Shell Oil	BP Oil
14 to 41	-10 to 5	EP Lubricant HD 68	Spartan® EP 68	Mobilgear® 626 (ISO VG 68)	Omala® Oil 68	Energol® GR-XP 68
32 to 95	0 to 35	EP Lubricant HD 100 HD 150	Spartan® EP 100 EP 150	Mobilgear® 627, 629 (ISO VG 100, 150)	Omala® Oil 100, 150	Energol® GR-XP 100 GR-XP 150
86 to 122	30 to 50	EP Lubricant HD 220 HD 320 HD 460	Spartan® EP 220 EP 320 EP 460	Mobilgear® 630, 632 633, 634 (ISO VG 220-460)	Omala® Oil 220, 320, 460	Energol® GR-XP 220 GR-XP 320 GR-XP 460

Notes: [1] Use the lower viscosity oil specified for each ambient temperature range for use in winter or relatively low ambient temperatures.
[2] Please consult the factory for consistent use in ambient temperatures other than 32°F - 104°F (0°C - 40°C).

Fig. A-5

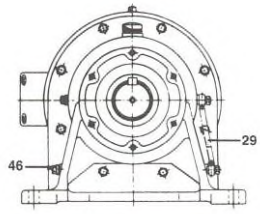


Table A-12. Oil Fill Quantities[1]

Single Reduction					Double Reduction				
Frame Size	Mounting Configuration				Frame Size	Mounting Configuration			
	Horizontal		Vertical			Horizontal		Vertical	
	U.S. gal.	liter	U.S. gal.	liter		U.S. gal.	liter	U.S. gal.	liter
6130, 6135	0.18	0.7	0.29	1.1	6160DC, 6165DC	0.40	1.5	0.26	1.0
6140, 6145, 614H	0.18	0.7	0.29	1.1	6170DC, 6175DC	0.63	2.4	0.50	1.9
6160, 6165, 616H	0.37	1.4	0.26	1.0	6180DB, 6185DB	0.92	3.5	0.53	2.0
6170, 6175	0.50	1.9	0.50	1.9	6190DA, 6195DA	1.5	5.8	0.71	2.7
6180, 6185	0.66	2.5	0.53	2.0	6190DB, 6195DB	1.6	6.0	0.71	2.7
6190, 6195	1.1	4.0	0.71	2.7	6205DA, 6205DB	1.6	6.0	2.9	11
6205	1.5	5.5	1.5	5.7	6215DA, 6215DB	2.6	10	3.7	14
6215	2.2	8.5	2.0	7.5	6225DA, 6225DB	2.9	11	4.8	18
6225	2.6	10	2.6	10	6235DA, 6235DB	4.5	17	6.1	23
6235	4.0	15	3.2	12	6245DA, 6245DB	4.8	18	7.7	29
6245	4.2	16	4.0	15	6255DA, 6255DB	6.1	23	11.1	42
6255	5.5	21	11.1	42	6265DA	8.5	32	13.5	51
6265	7.7	29	13.5	51	6275DA	15.9	60	(15.9)	(60)
6275	14.8	56	(15.9)	(60)					

( ) with trochoid pump

Table A-13. Allowable Oil Viscosity

Minimum Allowable Viscosity To Maintain Lubricating Oil Film		80 SUS During Operation
Maximum Allowable Viscosity To Allow Easy Starting	Oil Bath	20,000 SUS At Operation Start
	Forced Oil Lubrication	10,000 SUS At Operation Start

Table A-14. Oil Change Interval

Oil Change Interval		Operation Condition
Initial Oil Change	After 500 Hours of Primary Operation	Under Every Condition
Subsequent Oil Change	Every 6 Months	Less Than 10 Hours/Day Operation
	Every 2,500 Hours	10 ~ 24 Hours/Day Operation
	Every 1 ~ 3 Months	High Ambient Temperature, High Humidity or Atmosphere of Active Gas

Forced Lubrication For Vertical Units

Table A-15. Plunger Pump Type

Small Size Pump		Large Size Pump	
Frame Size	Ratio	Frame Size	Ratio
6160, 6165, 6170, 6175, 6180, 6185, 6190, 6195	See Table A-5	6205, 6215, 6225, 6235, 6245, 6255, 6265, 6275	See Table A-5
6160DC, 6165DC, 6170DC, 6175DC, 6180DB, 6185DB, 6190DA, 6195DA, 6190DB, 6195DB	See Table A-6	6205DA, 6205DB, 6215DA, 6215DB, 6225DA, 6225DB, 6235DA, 6235DB, 6245DA, 6245DB, 6255DA, 6255DB, 6265DA	See Table A-6

Plunger Pump Lubrication

The plunger pump (Fig. A-2, Part #42) is automatically operated by a cam (Fig. A-2, Part #40) fitted on the slow speed shaft (Fig. A-2, Part #1-01). The number of pumping cam teeth required is in direct relation to the reduction ratio and frame size. Please consult the factory for input speeds other than standard.

Table A-16. Positive Displacement (Trochoid) Pump Type

Cyclo Drive			Trochoid Pump[2,3]							
Type	Frame Size	Reduction Ratio	Pump Type	Pump Motor	50 Hz Zone				60 Hz Zone			
					Flow		Max. Pressure		Flow		Max. Pressure	
					gal/min	l/min	psi	kgf/cm²	gal/min	l/min	psi	kgf/cm²
Vertical Shaft	6275	29, 43, 59, 87	TOP216HA-VB3	1 HP (0.75 kW) 4P	6.3	24.0	113.8	8	7.6	28.8	71.1	5.0
	6275DA	All	TOP204HA-VB3	1/2 HP (0.4 kW) 4P	1.6	6.0	227.6	16	1.9	7.2	163.6	11.5

Positive Displacement (Trochoid) Pump Lubrication

Forced oil lubrication is accomplished by using a positive displacement pump and motor that requires an additional electric power source. It is recommended that the main motor be interlocked with the pump motor to avoid operation without lubrication. The pump must be started 30 seconds or longer before the main motor is operated.

Notes: [1] Please consult the factory for oil quantities when the reducer/gearmotor is mounted in any other position or angle.
[2] Consult the factory when using an inverter.
[3] A relief valve, pressure set at 42.7 psi (3 kgf/cm²), is a standard attachment on the trochoid pump.

OIL LEVEL DIMENSIONS

Foot Mount Horizontal Type
Fig. A-6

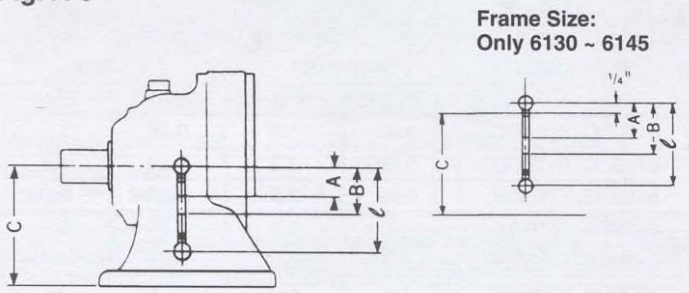
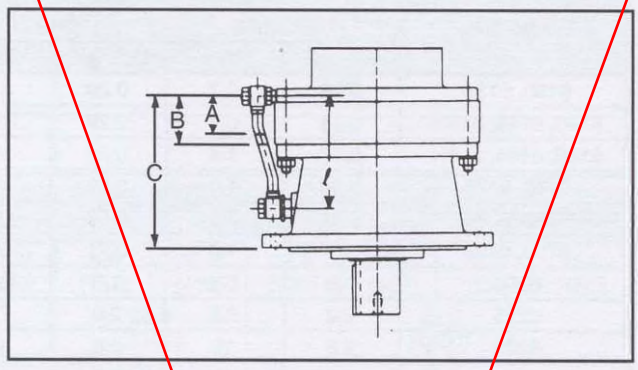


Table A-17. Oil Level Dimensions (Inches)

Frame Size	A	B	C	ℓ
6130-6135	1.38	2.17	5.91	4.65
6140, 6145, (614H)	1.38	2.17	5.91 (6.30)	4.65
6160-6165, (616H)	1.57	2.76	6.30 (7.87)	3.70
6160DC-6165DC	1.18	1.77	6.30	3.70
6170-6175	1.97	3.35	7.87	4.96
6170DC-6175DC	1.18	1.77	7.87	4.96
6180-6185	2.17	3.94	8.66	5.91
6180DB-6185DB	1.38	2.17	8.66	5.91
6190-6195	2.26	3.25	9.84	6.61
6190DA-6195DA	1.18	1.77	9.84	6.61
6190DB-6195DB	1.38	2.18	9.84	6.61
6205	2.12	3.19	9.84	6.06
6205DA	1.26	1.93	9.84	6.06
6205DB	1.26	2.13	9.84	6.06
6215	2.05	3.03	10.84	6.85
6215DA	1.18	1.97	10.43	6.85
6215DB	1.57	2.76	10.43	6.85
6225	2.25	3.43	11.03	6.85
6225DA	1.26	2.05	11.03	6.85
6225DB	1.85	3.43	11.03	6.85
6235	2.48	3.47	11.81	7.64
6235DA	1.57	2.75	11.81	7.64
6235DB	1.97	3.35	11.81	7.64
6245	2.76	3.78	13.19	8.46
6245DA	1.65	2.72	13.19	8.46
6245DB	2.00	3.35	13.19	8.46
6255	3.19	4.17	14.76	9.02
6255DA	1.97	3.35	14.76	9.02
6255DB	2.05	3.23	14.76	9.02
6265	3.23	4.21	15.75	10.16
6265DA	2.28	3.27	15.75	10.16
6275	3.35	4.53	21.26	11.22
6275DA	2.26	3.25	21.26	11.22

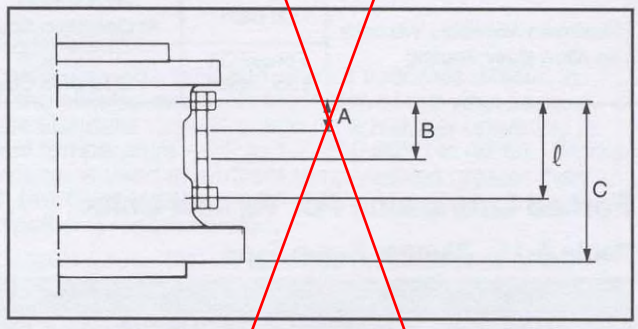
Base Mount Vertical Type
Frame Size: 6130 ~ 614H
Fig. A-7



Base Mount Vertical Type
Table A-18. Oil Level Dimensions (Inches)
Frame Size: 6130 ~ 614H

Frame Size	A	B	C	ℓ
6130-614H	1.85	2.72	7.52	5.79

Base Mount Vertical Type
Frame Size: 6160 ~ 6275
Fig. A-8



Base Mount Vertical Type
Table A-19. Oil Level Dimensions (Inches)
Frame Size: 6160 ~ 6275

Frame Size	A	B	C	ℓ
6160-6165, 616H	1.02	1.42	4.68	2.72
6170-6175	1.69	2.48	6.02	3.78
6180-6185	1.93	2.72	6.81	4.25
6190-6195	2.09	3.27	7.87	5.47
6205	1.46	2.05	7.09	3.54
6215	1.46	2.05	7.09	3.54
6225	1.46	2.05	7.87	3.54
6235	1.46	2.05	7.72	3.54
6245	1.46	2.05	7.96	3.54
*6255	4.33	4.92	19.76	6.57
*6265	4.65	5.24	21.69	7.17
6275	1.97	2.76	13.39	5.51

*Note: V6255 & V6265 Oil Gauge is on the Ring Gear Housing instead of V-Casing.

Fig. A-9

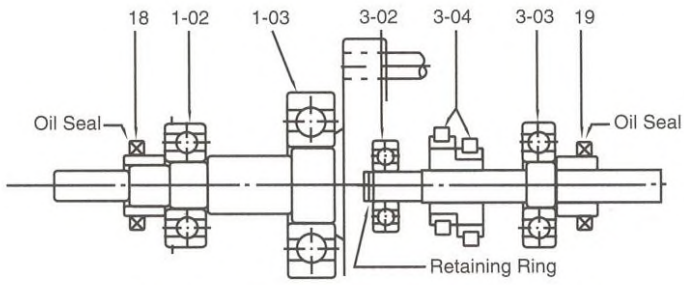


Table A-20. Slow Speed Shaft Bearing

Frame Size		Slow Speed Shaft	
Single Reduction	Double Reduction	Bearing A Part #1-02	Bearing B Part #1-03
6060, 6065	6060DA, 6065DA	6204Z	6909
6070, 6075	6070DA, 6075DA	6204Z	6909
6080, 6085	–	6305Z	6009
6090, 6095	6090DA, 6095DA	6306Z	16011
6100, 6105, 610H	6100DA, 6105DA	6306Z	16011
6110, 6115	–	6307Z	6011
6120, 6125, 612H	6120DA, 6125DA, 6120DB, 6125DB	6308Z	6013
6130, 6135	6130DA, 6135DA, 6130DB, 6135DB, 6130DC, 6135DC	6211NR	6213
6140, 6145,614H	6140DA, 6145DA, 6140DB, 6145DB, 6140DC, 6145DC	22211EXNR	6213
6160, 6165	6160DA, 6165DA, 6160DB, 6165DB, 6160DC, 6165DC	3TM-6213NR[1]	6215[1]
6170, 6175	6170DA, 6175DA, 6170DB, 6175DB, 6170DC, 6175DC	6216NR[1]	6218[1]
6180, 6185	6180DA, 6185DA, 6180DB, 6185DB	6218NR[1]	6220[1]
6190, 6195	6190DA, 6195DA, 6190DB, 6195DB	6221NR[1]	6026[1]
6205	~~6205DA, 6205DB~~	~~22220BNRC2~~	~~6222C2~~
6215	6215DA, 6215DB	23022BNRC2	6224C2
6225	~~6225DA,6225DB~~	~~23024BNRC2~~	~~6226C2~~
6235	6235DA, 6235DB	23026BNRC2	NUP228C2
6245	6245DA, 6245DB	23028BNRC2	NUP230C2
6255	6255DA, 6255DB	23032BNRC2	NUP234C2
6265	6265DA	23034BNRC2	NUP236C2
6275	6275DA	23136BNXR	6340

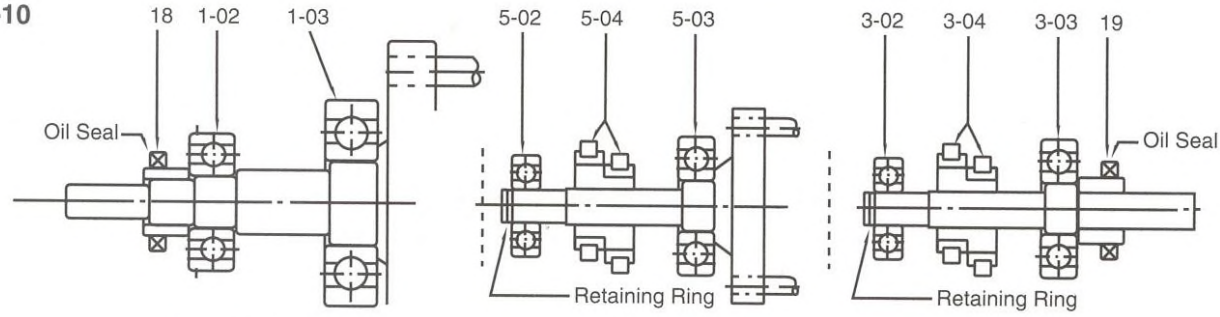
Table A-21. High Speed Shaft Bearing

Frame Size		High Speed Shaft			
Single Reduction	Double Reduction	Bearing C Part #3-02	Bearing D Part #3-03	Eccentric Part #3-04	Qty.
6060, 6065	6060DA, 6065DA, 6070DA, 6075DA	6301	6301Z	607YXX	1
6070, 6075	6090DA, 6095DA, 6100DA, 6105DA, 6120DA, 6125DA, 6130DA, 6135DA, 6140DA, 6145DA	6301	6301Z	607YXX	1
6080, 6085	–	6301SH	6302Z	6004RSH2ZZC3	1
6090, 6095	6120DB, 6125DB, 6130DB, 6135DB, 6140DB, 6145DB, 6160DA, 6165DA, 6170DA, 6175DA	6302RSH2	6302Z	Refer to Table A-22	1
6100, 6105, 610H	6130DC, 6135DC, 6140DC, 6145DC, 6160DB, 6165DB, 6170DB, 6175DB, 6180DA, 6185DA	6302RSH2	6302Z		
6110, 6115	–	6302RSH2	6302Z	611YSS, 611GSS	2
6120, 6125, 612H	6160DC, 6165DC, 6170DC, 6175DC, 6190DA, ~~6195DA, 6205DA~~	6304	6305Z	Refer to Table A-22	1
6130, 6135	6180DB, 6185DB, 6190DB, 6195DB, 6205DB, 6215DA, 6225DA	6305	6306		
6140, 6145, 614H	–	~~6305R~~	~~6306~~		
6160, 6165, 616H	6215DB, 6235DA, 6245DA	6307R	6308		
6170, 6175	6255DA, 6255DB	6406	6407	617YSX	2
6180, 6185	6235DB, 6245DB	6407	6409	618YSX	2
6190, 6195	6255DB, 6265DA, 6275DA	6408	6411	619YSX	2
6205	–	NJ310EV7	21311V1	620GXX	2
6215	–	NJ311EV16	21311V1	621GXX	2
6225	–	NJ312EV11	21312V1	622GXX	2
6235	–	NJ313EV11	21314V1	623GXX	2
6245	–	NJ314EV7	21315V1	624GXX	2
6255	–	NJ316EV1	21318V1	625GXX	2
6265	–	NJ317EV1	21318V1	626GXX	2
6275	–	NJ417	22222BL1	627GXX	2

Note: [1] For grease lubricated models, a sealed bearing should be used, which changes the following letters in the part number to those shown in bold: NR (Std.) – **ZNR;** NXR – **ZNXR;** None – add **Z**.

BEARINGS, OIL SEALS, GASKETS

Fig. A-10



Slow Speed Shaft

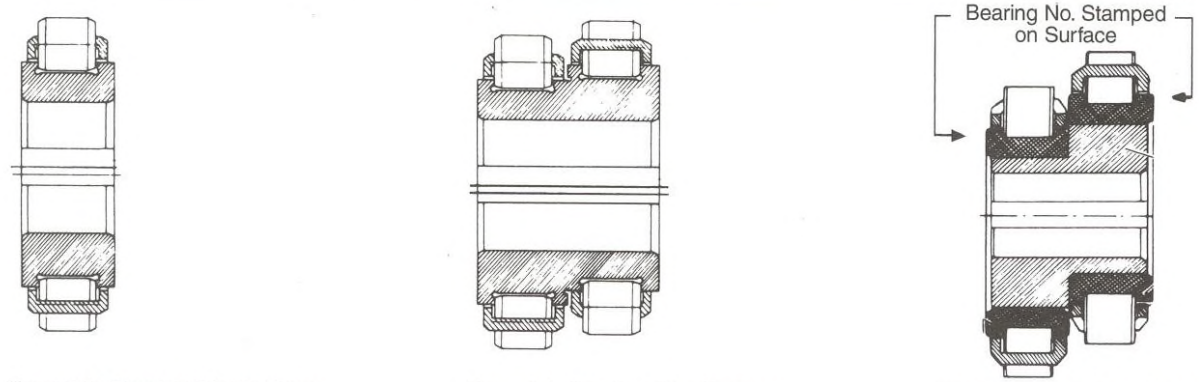
Intermediate Shaft
(For Double Reduction Units)

High Speed Shaft

Table A-22. Eccentric Bearing

	Frame Size					
High Speed Shaft, Motor Shaft Part #3-04	**6090, 6095**	**6100, 6105**	**6120, 6125**	**6130, 6135**	**6140, 6145**	**6160, 6165**
Intermediate Shaft Part #5-04 / **Reduction Ratio**	**6090DA 6095DA**	**6100DA 6105DA**	**6120DA, 6125DA 6120DB, 6125DB**	**6130DA, 6135DA 6130DB, 6135DB 6130DC, 6135DC**	**6140DA, 6145DA 6140DB, 6145DB 6140DC, 6145DC**	**6160DA, 6165DA 6160DB, 6165DB 6160DC, 6165DC**
6	60906YRX	6100608YRX	6120608YRX	61406-11YSX	61406-11YSX	6160608YRX2
8	60908-15YSX	6100608YRX	6120608YRX	61406-11YSX	61406-11YSX	6160608YRX2
11	60908-15YSX	61011-15YRX	6121115YSX	61406-11YSX	61406-11YSX	61611-15YSX
13	60908-15YSX	61011-15YRX	6121317YSX	61413-17YSX	61413-17YSX	61611-15YSX
15	60908-15YSX	61011-15YRX	6121115YSX	61413-17YSX	61413-17YSX	61611-15YSX
17	60917YSX	61017YSX	6121317YSX	61413-17YSX	61413-17YSX	61617-25YSX
21	60921YSX	61021YRX	61221YRX	6142125YSX	6142125YSX	61617-25YSX
25	6092529YSX	6102529YRX	6122529YSX	6142125YSX	6142125YSX	61617-25YSX
29	6092529YSX	6102529YRX	6122529YSX	6142935YSX	6142935YSX	6162935YSX
35	60935YSX	61035YRX	61235YRX	6142935YSX	6142935YSX	6162935YSX
43	60943YSX	61043YSX	61243YSX	61443-59YSX	61443-59YSX	6164351YSX
51	60951YRX	61051YRX	6125159YSX	61443-59YSX	61443-59YSX	6164351YSX
59	60959YSX	61059YRX	6125159YSX	61443-59YSX	61443-59YSX	61659YSX
71	60971YRX	61071YRX	6127187YSX	6147187YSX	6147187YSX	61671YRX2
87	60987YSX	61087YRX	6127187YSX	6147187YSX	6147187YSX	61687YSX
119	609119YSX	610119YSX	–	–	–	–

Fig. A-11



Eccentric Bearing Single Type Frame Sizes

Eccentric Bearing Double Type Frame Sizes

Eccentric And Bearings For Eccentric Frame Sizes

Table A-23. Intermediate Shaft Bearing

Frame Size	Intermediate Shaft				Frame Size	Intermediate Shaft			
	Bearing F Part #5-02	Bearing G Part #5-03	Eccentric Bearing Part #5-04	Qty.		Bearing F Part #5-02	Bearing G Part #5-03	Eccentric Bearing Part #5-04	Qty.
6060DA, 6065DA	6301	6909	607YXX	1	6180DA, 6185DA	6407	6208	618YSX	2
6070DA, 6075DA	6301	6909	607YXX	1	6180DB, 6185DB	6407	6213	618YSX	2
6090DA, 6095DA	6302RSH2	6007	Refer to Table A-22	1	6190DA, 6195DA	6408	6210	619YSX	2
6100DA, 6105DA	6302RSH2	6007			6190DB, 6195DB	6408	6213	619YSX	2
6120DA, 6125DA	6304	6007			6205DA	NJ310EV7	6210	620GXX	2
6120DB, 6125DB	6304	6205			6205DB	NJ310EV7	6310	620GXX	2
6130DA, 6135DA	6305	6007			6215DA, 6215DB	NJ311EV16	6311	621GXX	2
6130DB, 6135DB	6305	6206			6225DA, 6225DB	NJ312EV11	6313	622GXX	2
6130DC, 6135DC	6305	6206			6235DA, 6235DB	NJ313EV11	6314	623GXX	2
6140DA, 6145DA	6305	6007			6245DA	NJ314EV7	6315	624GXX	2
6140DB, 6145DB	6305	6206			6245DB	NJ314EV7	6316	624GXX	2
6140DC, 6145DC	6305	6206			6255DA, 6255DB	NJ316EV1	6318	625GXX	2
6160DA, 6165DA	6307R	6207			6265DA	NJ317EV1	6320	626GXX	2
6160DB, 6165DB					6275DA	NJ417	22220RH	627GXX	2
6160DC, 6165DC	6307R	6208							
6170DA, 6175DA	6406	6207	617YSX	2					
6170DB, 6175DB									
6170DC, 6175DC	6406	6208	617YSX	2					

Table A-24. Oil Seals

Frame Size	Slow Speed Shaft Part #18				High Speed Shaft Part #19		
	Type[1]	Dimension (mm)	Quantity		Type[1]	Dimension (mm)	Quantity
		(I.D. x O.D. x W)	Horizontal Shaft	Vertical Shaft		(I.D. x O.D. x W)	
6060, 6065	D	30 x 47 x 8	1	1	S	17 x 30 x 6	1
6070, 6075	D	30 x 47 x 8	1	1	S	17 x 30 x 6	1
6080, 6085	D	45 x 62 x 9	1	1	S	17 x 30 x 6	1
6090, 6095	D	50 x 72 x 12	1	1	S	20 x 35 x 7	1
6100, 6105	D	50 x 72 x 12	1	1	S	20 x 35 x 7	1
6110, 6115	D	55 x 80 x 12	1	1	S	20 x 35 x 7	1
6120, 6125	D	65 x 90 x 13	1	1	D	32 x 52 x 8	1
6130, 6135	D	68 x 88 x 12	1	2	D	38 x 58 x 11	1
6140, 6145	D	65 x 88 x 12	1	2	D	38 x 58 x 11	1
6160, 6165	D	85 x 110 x 13	1	2	D	55 x 78 x 12	1
6170, 6175	D	95 x 130 x 15	1	2	D	60 x 82 x 12	1
6180, 6185	D	110 x 145 x 15	1	2	D	65 x 88 x 12	1
6190, 6195	D	120 x 155 x 16	1	2	S	70 x 88 x 10	1
6205	D	120 x 155 x 16	1	2	S	70 x 88 x 10	1
6215	D	130 x 160 x 14	1	2	S	75 x 100 x 13	1
6225	D	145 x 175 x 14	1	2	S	75 x 100 x 13	1
6235	D	160 x 190 x 16	1	2	S	85 x 110 x 13	1
6245	D	170 x 200 x 16	1	2	S	95 x 120 x 13	1
6255	D	190 x 225 x 16	1	2	S	110 x 140 x 14	1
6265	D	200 x 240 x 20	1	2	S	110 x 140 x 14	1
6275	D	230 x 270 x 20	1	2	S	120 x 150 x 14	1

Note: [1] D indicates lip (dust proof and seal lip) type.

DISASSEMBLY/ASSEMBLY

Disassembly

SM-CYCLO® Reducers are designed to provide maximum ease when disassembing and reassembling; they require no special maintenance skills.

1. Remove the complete SM-CYCLO® Reducer with adaptor (motorized type) from the driven machine.

2. Remove the plug at the bottom of the oil gauge to drain all oil from the unit.

3. Remove the cooling fan cover and fan from those Speed Reducers (not motorized) equipped with a cooling fan, and stand the unit on a solid base with its high speed shaft side down. Remove the through bolts for the high speed end shield, ring gear housing, and lift the slow speed side, thus separating the unit into two parts so that the inner mechanism can be removed (Figs. A-12 ~ A17).

Note: If the reducer is motorized (C-adaptor and coupling) remove the motor and coupling before following the procedure outlined above. As a final step, remove the adaptor and cooling fan.

4. If the unit will not separate easily, gently drive a wedge at the line X shown in Fig. A-1 on page A-3 (if this produces a burr, be sure to remove it before reassembly).

5. To lift the slow speed side, attach an eyebolt to the tapped hole on the end of the slow speed shaft and use a hoist or chain block (Fig. A-12).

6. Take out the slow speed shaft rollers, item 1-06, page A-3 (Fig. A-13). Check the slow speed shaft pins (1-01) to see whether any rollers have adhered to them.

7. Using both hands, lift out the top cycloid disc (2-04) on the slow speed side (Fig. A-14).

8. Remove the spacer ring (2-05).

9. The eccentric (3-04) can be removed from the input shaft (3-01) after taking out the retaining ring (3-10) and the inner bearing raceway (Figs. A-15, A-16).

Note: In certain sizes, the eccentric bearings are roller bearings without a retainer. Remove bearings of the top disc before proceeding with the next step.

10. Take out the second disc located on the motor side. (Also remove second disc bearings and eccentric with inner bearing raceway if required.)

11. Remove the ring gear housing (2-01).

12. Follow these steps to remove the slow speed shaft (1-01) with its bearings from the casing (26): (a) Remove the horizontal oil seal housing (25). (b) With a wooden or hard rubber mallet, rap the inner end of the slow speed shaft to expose the retaining ring* from the outer raceway of the bearing. (c) Remove the retaining ring. (d) Rap the outer end of the slow speed shaft with a wooden or hard rubber mallet, and remove it from the casing.

13. The high speed shaft (3-01) with bearings is removed from the high speed shaft end shield (8) by tapping the shaft end after first taking off the retaining ring (3-11).

14. The cycloid disc is made from heat-treated bearing steel and the spacer ring is cast iron. Take care not to strike them together while handling.

The above instructions cover complete disassembly. In ordinary cases, however, only the removal of the cycloid discs and the eccentric, and removal of the slow speed shaft from the slow speed end cap is necessary.

***Note:** Retaining ring is part of bearing A (Part No. 1-02).

Assembly

SM-CYCLO® Reducers are reassembled by reversing the disassembly procedure. Care must be taken to exclude dust or foreign matter from the moving parts, and to see that gaskets are properly placed to make the assembly oil-tight.

Following are some helpful points to remember when assembling SM-CYCLO® Reducers.

1. Set the ring gear housing and insert the ring gear pins and rollers; then test-rotate the pins and rollers by hand. (Apply grease liberally to the ring gear pins and rollers before they are inserted in grease lubricated SM-CYCLO® Reducers.)

2. Cycloid discs are a matched pair. Each carries the same number stamped on one side of the disc.

3. Set the cycloid disc with the stamped number face up as shown in Fig. A-17.

4. Insert the spacer (3-07) and then insert the eccentric with bearings by rapping with a wooden or hard rubber mallet (Fig. A-16).

5. Insert the other spacer and the inner bearing raceway. Secure them with the retaining ring (Fig. A-15).

6. Set the spacer ring in place.

7. Insert top disc in such a way that the mark is 180° opposed to the mark on the bottom disc (Fig. A-13).

8. Insert slow speed shaft rollers (Fig. A-13).

9. Put the slow speed shaft pins into the rollers (Fig. A-12). The above instructions are for **eccentric bearings with retainer.** Following are the instructions suggested for **roller bearings without retainer.**

a. First insert the eccentric with inner raceways of bearings by rapping with a wooden or hard rubber mallet.

Fig. A-12

Fig. A-13

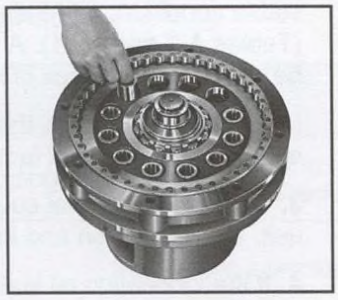


Fig. A-14

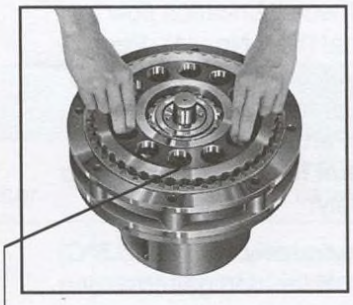


Fig. A-15

Fig. A-16

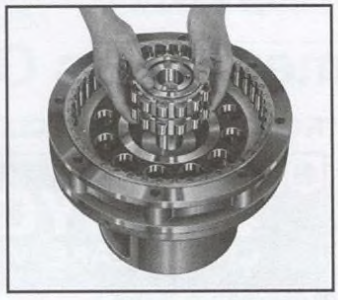
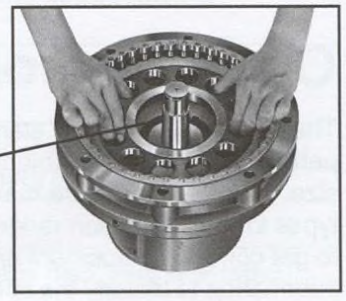


Fig. A-17



Note: Insert second disc with number facing slow speed side, exactly 180° opposed to number on first disc.

Note: Set disc with number facing slow speed side.

b. Apply grease to the raceway of the eccentric on the disc. Fix the rollers and set disc in place.

c. Insert the spacer ring and set second disc in such a way that mark is 180° opposed to mark on the bottom disc.

Eccentric Bearing Replacement Precautions

The eccentric bearings are specially designed for installation on SM-CYCLO® Reducers. They are special roller bearings without outer raceways (refer to the list of bearings on pages A-12 ~ A-13).

It is necessary to insert replacement bearings with numbered surfaces of the inner raceways facing outward. Note that incorrect insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes trouble.

Disassembly and Assembly of Sizes 6060-6095 SM-CYCLO® Reducers

Small sizes 6060-6095 have a single disc system, so they differ in construction from larger sizes in the following ways:

1. A balance weight is provided in lieu of the two-disc system. Refer to figure A-18.

2. The balance weight must be positioned exactly 180° as opposed to that of the eccentric.

3. There are no end plates on either side of the eccentric. In all other respects, 6060-6095 have exactly the same construction as the larger sizes. Follow the instructions given under "Disassembly and Assembly".

Disassembly Of Output Side (6060-612H)

1. With casing supported, tap output shaft until it is disengaged from casing.

2. Remove bearing "A" by using pulling tool.

3. Replace all bearings, gaskets and seals when reassembling. (Pages A-11 ~ A-13).

Assembly Of Output Side (6060-612H)

1. Assemble the "B" bearing (Part No. 1-03) on the slow speed shaft (Part No. 1-01). Heating of "B" bearing is recommended for easier assembly.

Note: Do not exceed temperature of 200°F.

2. Assemble the casing (Part No. 26) over the slow speed shaft (Part No. 1-01), being sure to maintain "X" (Fig. A-18).

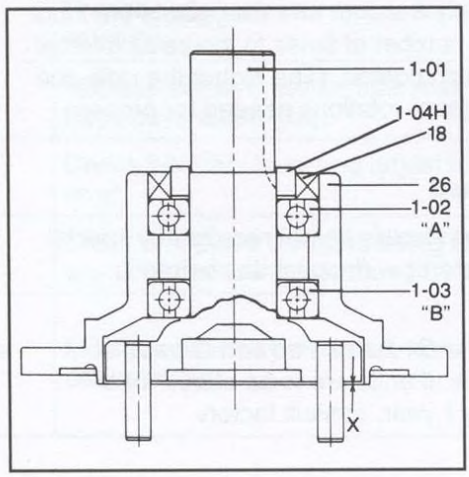
3. Carefully tap bearing "A" (Part No. 1-02) onto the slow speed shaft (Part No. 1-01) until the bearing is flush with the shoulder of the casing.

4. Place the collar (Part No. 1-04H) onto the slow speed shaft (Part No. 1-01). Heating the collar is recommended for easier assembly.

5. Insert the oil seal (Part No. 18), lip in, into the casing (Part No. 26).

Note: Measure for dimension "X" preferably in 3 places to insure proper spacing.

Fig. A-18



X" Dimension (inches)

Frame Size	Dimension
6060/65	0.046 ± 0.007
6070/75 6080/85	0.042 ± 0.007
6090/95	0.046 ± 0.007
6100/05 610H	0.046 ± 0.007
6110/15/20/ 25, 612H	0.042 ± 0.007

DAILY INSPECTION

1. Visually check the oil level gauge on the vertical unit, forced-lubricated type. Check lubrication flow by viewing piping set and oil signal (Part No. 41). Faulty operation is caused by a lack of lubrication oil, damage to the plunger pump (Part No. 42) or the positive displacement pump (Part No. 43) or the clogging of pipes, etc. In case of faulty operation, stop and inspect the unit immediately.

2. A temperature rise of approximately 105°F (40.6°C) above ambient on the surface of the ring gear housing (Part No. 2-01) is allowable if the temperature fluctuation is small. If temperature rises rapidly from a stable condition, add the recommended oil or grease (Tables A-7 and A-11). A rapid temperature rise may be caused from a lack of lubrication.

If after lubricating unit, the problem persists, stop operation and consult factory.

3. When an abnormal sound is heard from inside the unit, stop operation and inspect the unit.

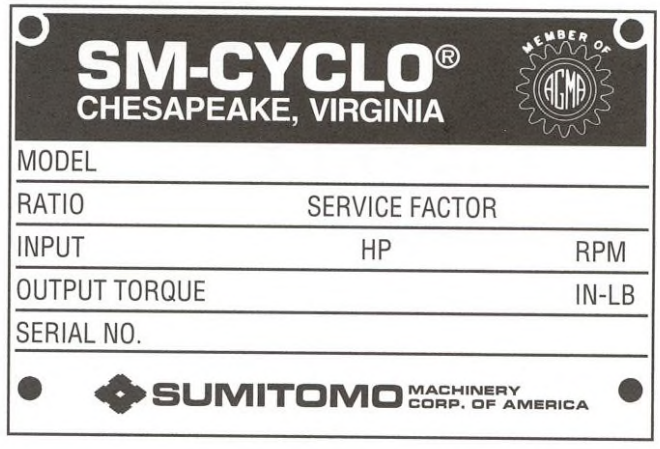
4. If the lubrication oil leaks, replace the damaged or worn part with a new one. (Refer to Part No. 1-04H, Page A-3.)

Ordering Correct Replacement Units Or Parts

The SM-CYCLO® is fully standardized to offer maximum part interchangeability among models of the same frame size. However, there are many frame sizes, models and types in the production range of SM-CYCLO®. Therefore to get correct replacement units or parts, proper information to identify the speed reducer in question is essential. The name plate, which is secured to the body of the drive, provides this identifying data.

Please give the full description shown on the name plate to your distributor. Be sure to include the *SERIAL NUMBER* and *MODEL NUMBER*. This information, along with our production records, will enable us to provide you with the correct replacement unit or parts.

Name Plate on SM-CYCLO®



Storage And Operation After Storage

Storage 6 Months–1 Year

Oil-Lubricated

1. Completely fill unit(s) with a rust-preventive oil (NP20 or equivalent) or a circulating oil (Shell VSI No. 100 or equivalent).

2. At approximately 3 month intervals, rotate the input shaft a sufficient number of times to insure all internal components remain coated. (The higher the ratio, the greater the amount of rotations needed for proper lubrication.)

Grease-Lubricated

Grease-lubricated models do not require any special attention during storage. (Inspect unit before operation.)

Note: For both the *Oil-Lubricated* and *Grease-Lubricated* models, if units are to be stored for a period exceeding 1 year, consult factory.

Operation After Storage 6 Months–1 Year

Oil-Lubricated

1. Completely drain the rust preventive, or circulating oil from unit.

2. Flush unit with the recommended operating oil as shown in Table A-11.

3. After flushing, fill the unit to the proper oil level with the recommended lubricating oil.

Grease-Lubricated

Add ½ of the recommended quantity of new grease as shown in Table A-10.

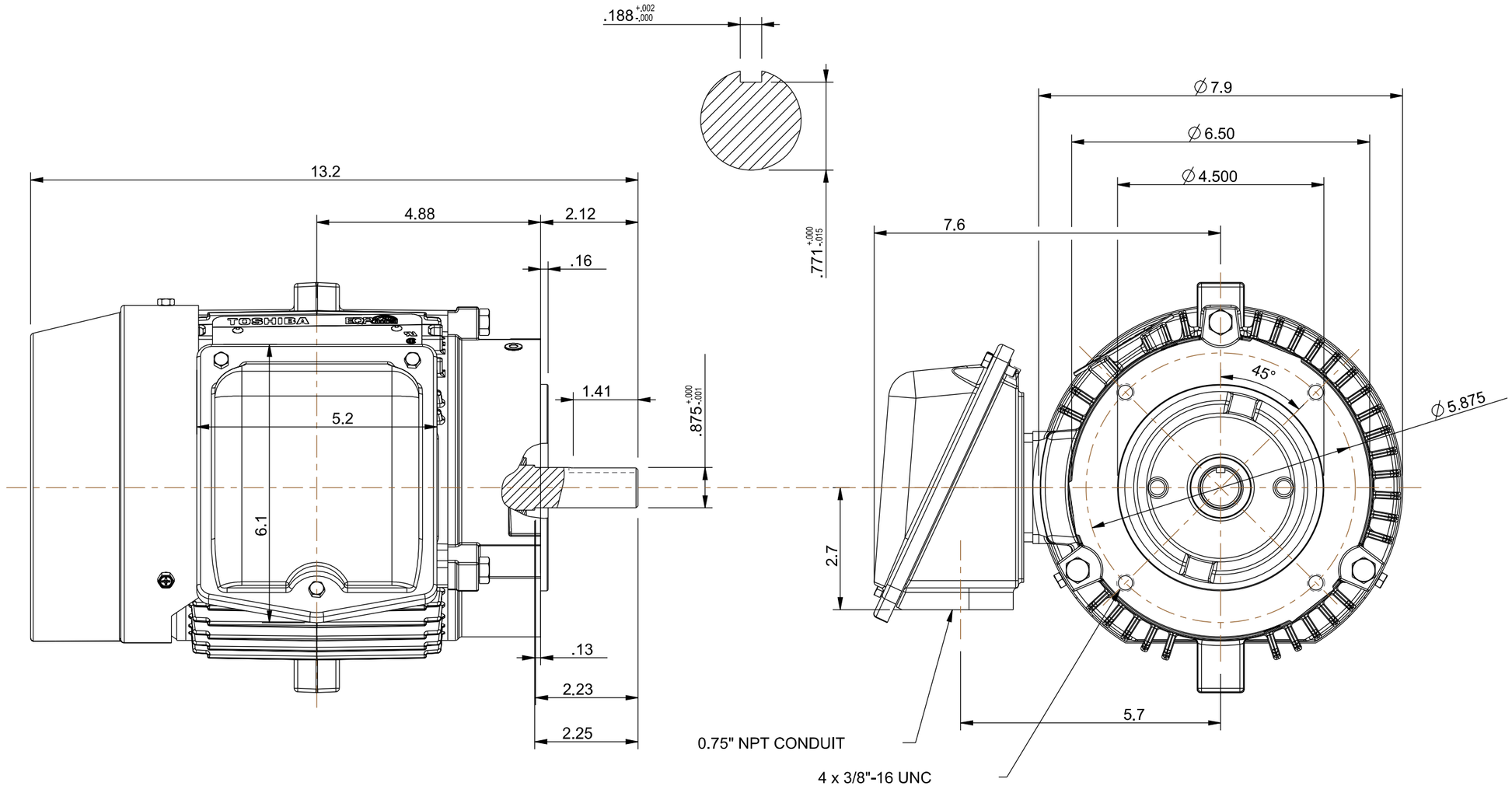
Note: Consult the factory before operating units stored for periods greater than 1 year.

TROUBLESHOOTING AND REPAIR

This troubleshooting guide is to help you identify and overcome common problems of reducers. If you have a problem not listed below, please consult factory.

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer.	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load.
	Improper Lubrication	Insufficient lubrication.	Check lubricant level and adjust up to recommended levels.
		Excessive lubrication.	Check lubricant level and adjust down to recommended level.
		Wrong lubricant.	Flush out and refill with correct lubricant as recommended.
Runs Noisy	Loose Foundation Bolts	Weak mounting structure.	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts.	Tighten bolts.
	Worn Disc	Overloading unit may result in damage to disc.	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant.	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload.	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory-recommended level.
	Damaged Pins & Rollers	Overloading of reducer.	Disassemble and replace ring gear pins and rollers. Check load on reducer.
Output Shaft Does Not Turn	Input Shaft Broken	Overloading of reducer can cause damage.	Replace broken shaft. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
	Eccentric Bearing Broken	Lack of lubricant.	Replace eccentric bearing. Flush and refill with recommended lubricant.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Breather filter may be clogged. Replace or clean filter.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace element, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Mount horizontally or rework reducer to wall or ceiling mount.

Toshiba
Screw Press Motor



NOTE: Motor has an AEGIS shaft grounding ring

UNITS: INCHES

NOTES:
1. MAIN CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS
2. STANDARD PRODUCT USE BI-DIRECTIONAL FAN. OPPOSITE ROTATION AVAILABLE ONLY BY CONNECTION CHANGE.
3. KEY DIMENSIONS EQUAL 0.188" x 0.188" x 1.38" (MOTOR SUPPLIED WITH KEY)

TOSHIBA RESERVES THE RIGHT TO MAKE CHANGES OF TECHNICAL IMPROVEMENT WITHOUT NOTICE. DO NOT USE FOR CONSTRUCTION, INSTALLATION, OR APPLICATION PURPOSES UNLESS THE DRAWING IS CERTIFIED.

140TC TEFC ROUND BODY FRAME F1 ASSEMBLY

MDSLV205-01

TOSHIBA
TOSHIBA INTERNATIONAL CORPORATION

TOLERANCES
.X .1
.XX .03
.XXX .005
.XXXX .0005

MAXIMUM MOTOR WEIGHT
56 lbs.
25 kgs.

NO	REVISION	DRAWN BY	DATE	CHECK
1	ADDED KEY DIMS. (OVERRIDE 'R' & 'S' DIM. VALUES)	S. CLANCY	08/07/12	
0	FIRST ISSUE	N. MOMIN	03/17/11	

EQP Global SD
XT SERIES

DRAWN BY: N. MOMIN
CHECK BY:
APPROVED BY:

www.toshiba.com/ind

Issued Date	8/18/2016	Transmit #	
Issued By	dschoeck	Issued Rev	

TOSHIBA
Leading Innovation

TYPICAL MOTOR PERFORMANCE DATA

Model: 0024SDSR44A-P

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
2	1.5	4	1750	145TC	230/460	60	3	6/3
Enclosure	**IP**	**Ins. Class**	**S.F.**	**Duty**	**NEMA Nom. Eff.**	**NEMA Design**	**kVA Code**	**Ambient (°C)**
TEFC	55	F	1.15	CONT	86.5	B	L	40 C

Load	HP	kW	Amperes	Efficiency (%)	Power Factor (%)
Full Load	2	1.5	3.0	86.5	84.8
¾ Load	1.50	1.1	2.4	86.0	67.5
½ Load	1.00	0.7	2.0	83.4	55.2
¼ Load	0.50	0.4	1.2	79.8	48.1
No Load			1.6		7.9
Locked Rotor			24.00		68.4

Torque				Rotor wk² Inertia (lb-ft²)
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	
6	255	225	390	0.13

Safe Stall Time(s)		Sound Pressure dB(A) @ 1M	Bearings*		Approx. Motor Weight (lbs)
Cold	Hot		DE	NDE	
35	15	-	6305ZZC3	6305ZZC3	

*Bearings are the only recommended spare part(s).

Motor Options:
Mounting:C-Face Round,Shaft:T Shaft

Customer	
Customer PO	
Sales Order	
Project #	

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	mcampbell	Doc. Written By	D. Suarez	Doc.# / Rev	MPCF-1119 / 0
Engr. Date	2/2/2012	Doc. Approved By	M. Campbell	Doc. Issued	6/8/2011

Issued Date	8/18/2016	Transmit #	
Issued By	dschoeck	Issued Rev	

TOSHIBA
Leading Innovation

TYPICAL MOTOR PERFORMANCE DATA

Model: 0024SDSR44A-P

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
2	1.5	4	1430	145TC	190/380	50	3	6.80/3.40
Enclosure	**IP**	**Ins. Class**	**S.F.**	**Duty**	**NEMA Nom. Eff.**	**NEMA Design**	**kVA Code**	**Ambient (°C)**
TEFC	55	F	1.0	CONT	82.5	B	L	40 C

Load	HP	kW	Amperes	Efficiency (%)	Power Factor (%)
Full Load	2	1.5	3.4	85.7	75.3
¾ Load	1.50	1.1	2.6	86.5	68.2
½ Load	1.00	0.7	2.1	85.3	55.7
¼ Load	0.50	0.4	1.7	75.3	42.3
No Load			1.6		8.0
Locked Rotor			30.00		90.7

Torque				Rotor wk² Inertia (lb-ft²)
Full Load (lb-ft)	**Locked Rotor (% FLT)**	**Pull Up (% FLT)**	**Break Down (% FLT)**	
7.35	235	195	270	0.13

Safe Stall Time(s)		Sound Pressure dB(A) @ 1M	Bearings*		Approx. Motor Weight (lbs)
Cold	**Hot**		**DE**	**NDE**	
15	10	-	6305ZZC3	6305ZZC3	

*Bearings are the only recommended spare part(s).

Motor Options:
Mounting:C-Face Round,Shaft:T Shaft

Customer	
Customer PO	
Sales Order	
Project #	

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	jhock	Doc. Written By	D. Suarez	Doc.# / Rev	MPCF-1119 / 0
Engr. Date	4/7/2014	Doc. Approved By	M. Campbell	Doc. Issued	6/8/2011

Issued Date	8/18/2016	**Transmit #**	
Issued By	dschoeck	**Issued Rev**	

TOSHIBA
Leading Innovation >>>

SPEED TORQUE/CURRENT CURVE

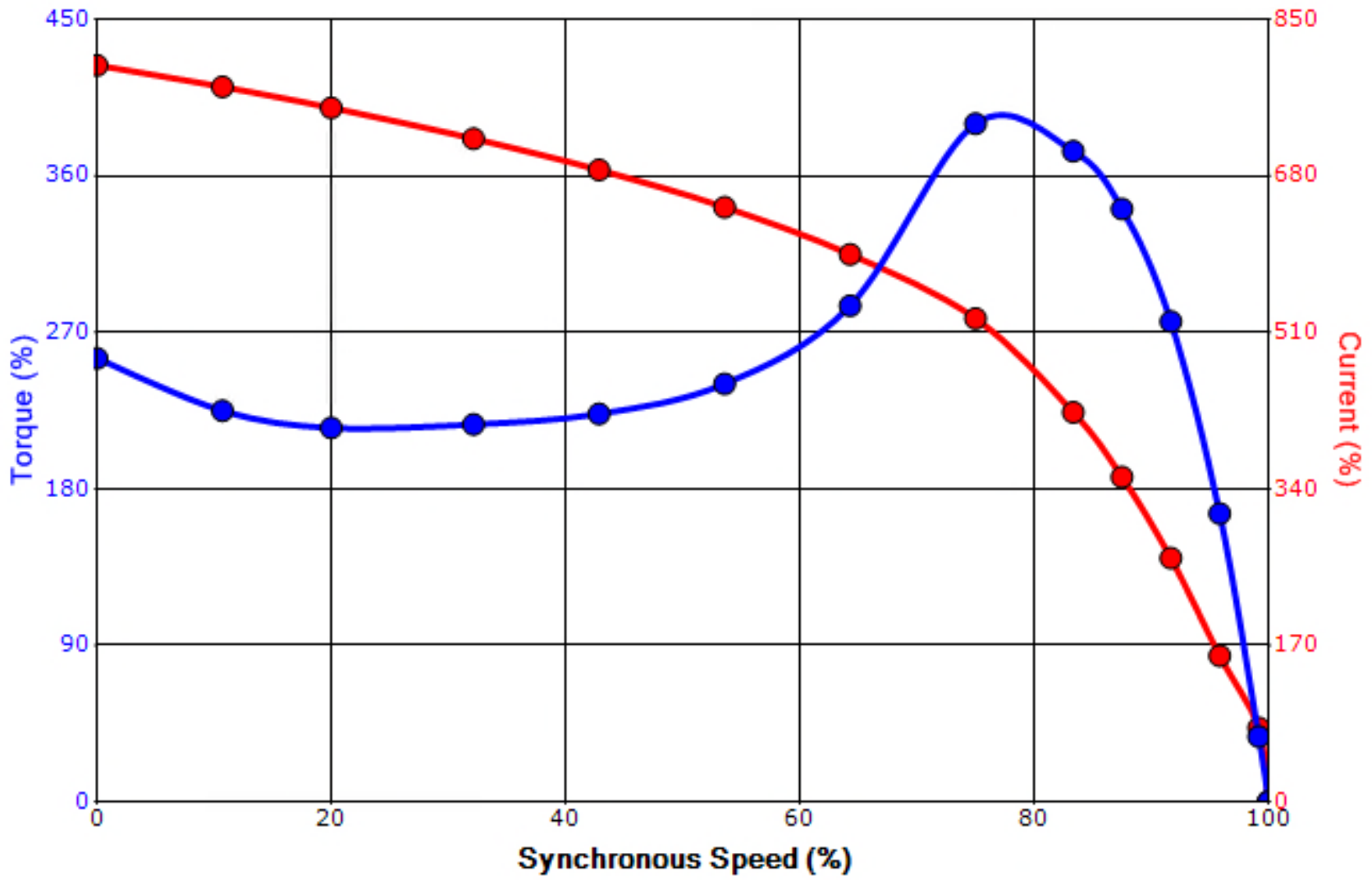
Model: 0024SDSR44A-P

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
2	1.5	4	1750	145TC	230/460	60	3	6/3

Enclosure	IP	Ins. Class	S.F.	Duty	NEMA Nom. Eff.	NEMA Design	kVA Code	Ambient (°C)
TEFC	55	F	1.15	CONT	86.5	B	L	40 C

Locked Rotor Amps	Rotor wk² Inertia (lb-ft²)	Torque			
		Full Load (lb-ft)	Locked Rotor (%)	Pull Up (%)	Break Down (%)
24.00	0.13	6	255	225	390

Design Values



Customer			**wk² Load Inertia (lb-ft²)**	-
Customer PO			**Load Type**	-
Sales Order			**Voltage (%)**	100
Project #			**Accel. Time**	-

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	mcampbell	**Doc. Written By**	D. Suarez	**Doc.# / Rev**	MPCF-1121 / 0
Engr. Date	2/2/2012	**Doc. Approved By**	M. Campbell	**Doc. Issued**	6/8/2011

Issued Date	8/18/2016	Transmit #	
Issued By	dschoeck	Issued Rev	

TOSHIBA
Leading Innovation

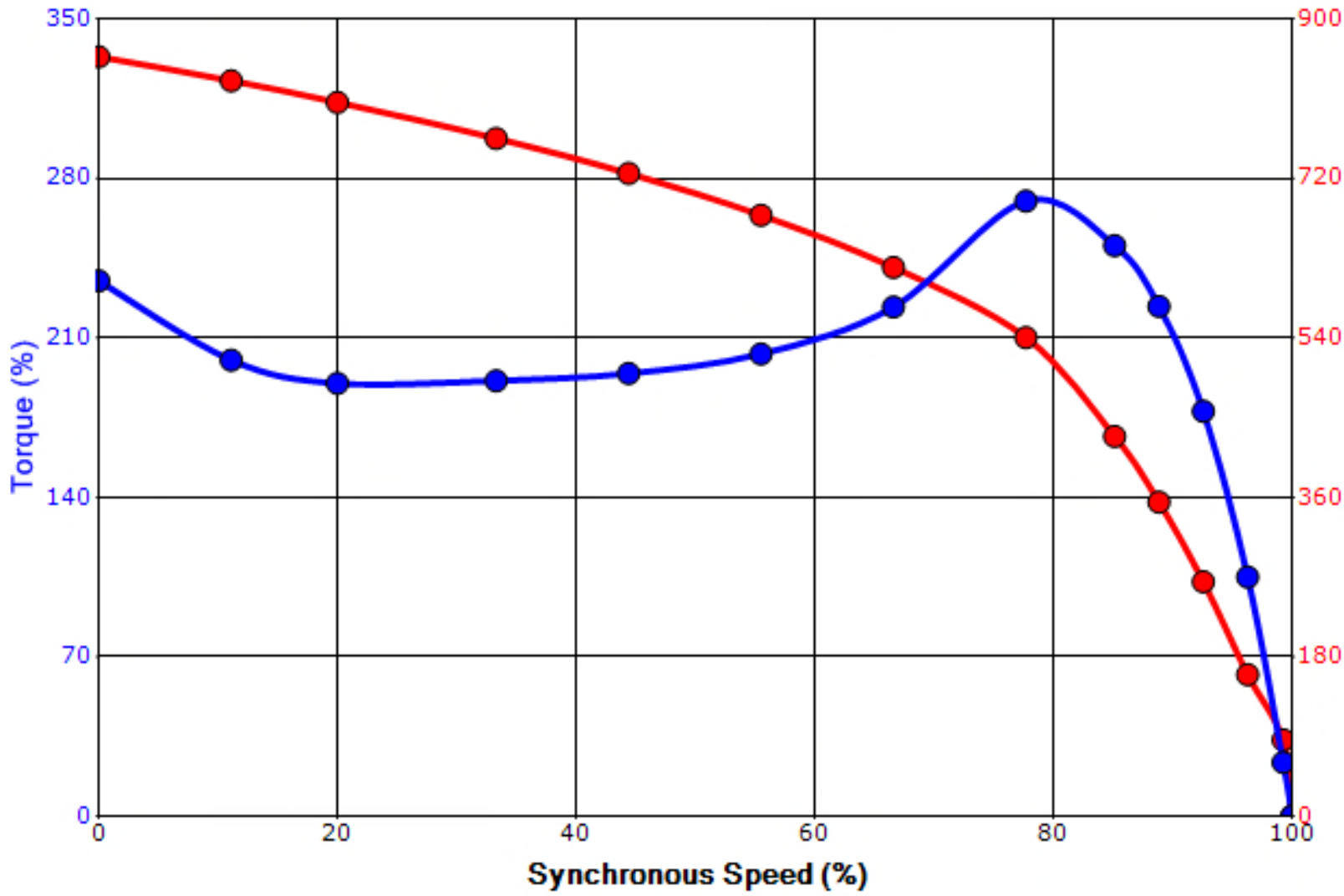
SPEED TORQUE/CURRENT CURVE

Model: 0024SDSR44A-P

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
2	1.5	4	1430	145TC	190/380	50	3	6.80/3.40
Enclosure	**IP**	**Ins. Class**	**S.F.**	**Duty**	**NEMA Nom. Eff.**	**NEMA Design**	**kVA Code**	**Ambient (°C)**
TEFC	55	F	1.0	CONT	82.5	B	L	40 C

Locked Rotor Amps	Rotor wk² Inertia (lb-ft²)	Torque			
		Full Load (lb-ft)	Locked Rotor (%)	Pull Up (%)	Break Down (%)
30.00	0.13	7.35	235	195	270

Design Values



Customer			**wk² Load Inertia (lb-ft²)**	-
Customer PO			**Load Type**	-
Sales Order			**Voltage (%)**	100
Project #			**Accel. Time**	-

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

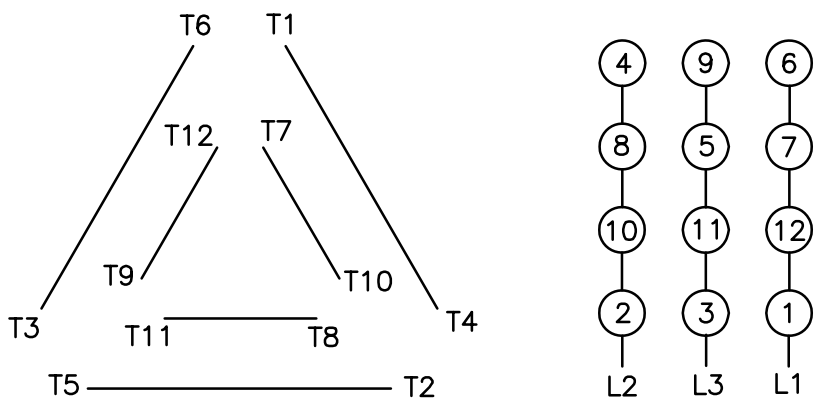
Engineering	jhock	**Doc. Written By**	D. Suarez	**Doc.# / Rev**	MPCF-1121 / 0
Engr. Date	4/7/2014	**Doc. Approved By**	M. Campbell	**Doc. Issued**	6/8/2011

TOSHIBA INTERNATIONAL CORPORATION | 12DV

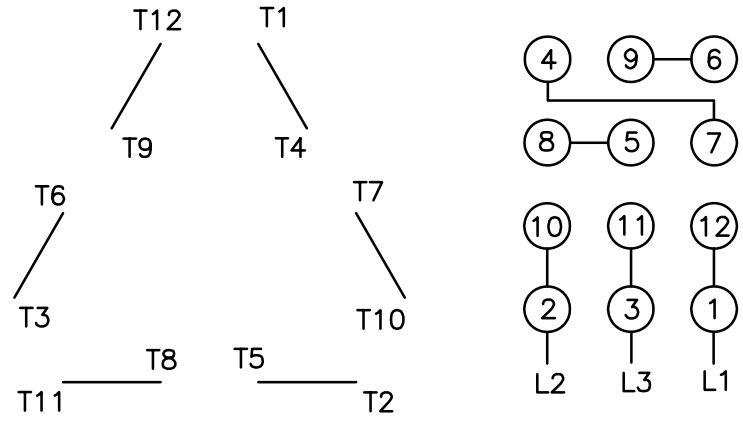
Motor Connection Diagrams
12 Leads

Across-the-Line Starting / Running Connections

Low Voltage Delta



High Voltage Delta

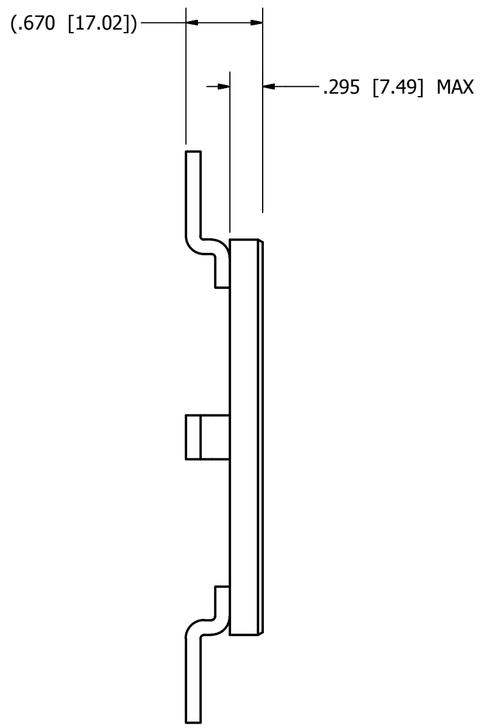


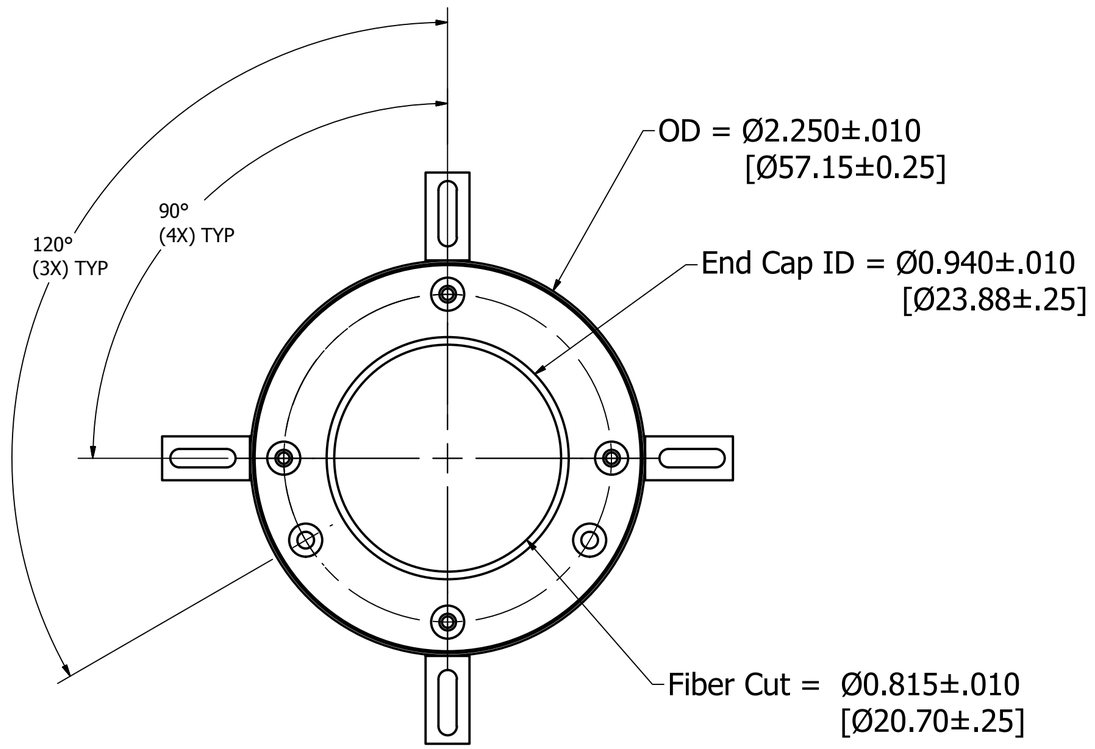
Switch L1 and L2 to reverse rotation

Suitable for Wye–Delta Starting and Limited Part–Winding–Starting.
Please Contact Toshiba International for specific connections.

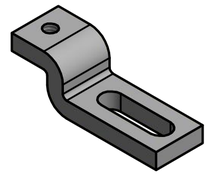
By: R. Murillo	Date: 4/9/08	Checked: MDC	Date: 5/17/11	Revision 1

Not Drawn to Scale



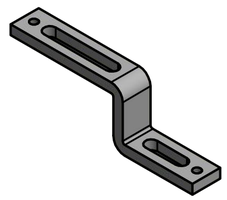


Bracket Shown on Drawing



A-97000-18

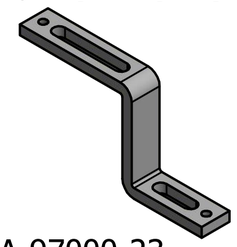
Mtg Bolt Circle: Ø2.650 -- Ø3.450
[Ø67.31] [Ø87.63]



A-97000-22
(Reversible)

Mtg Bolt Circle: Ø3.950 -- Ø5.625
(normal) [Ø100.33] [Ø142.88]

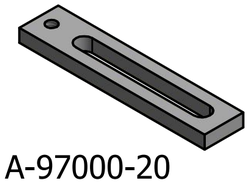
Mtg Bolt Circle: Ø4.825 -- Ø5.625
(reversed) [Ø122.56] [Ø142.88]



A-97000-23
(Reversible)

Mtg Bolt Circle: Ø3.950 -- Ø5.625
(normal) [Ø100.33] [Ø142.88]

Mtg Bolt Circle: Ø4.825 -- Ø5.625
(reversed) [Ø122.56] [Ø142.88]



A-97000-20

Mtg Bolt Circle: Ø2.700 -- Ø4.575
[Ø68.58] [Ø116.21]

Notes:

AEGIS SGR-0.875-UKIT Includes

(1) AEGIS SGR Bearing Protection Ring
(4) Universal brackets Of Each size (16 total)
(4) 5-40 x 3/8 Flat Head Cap Screws
(4) 6-32 x 3/8 Socket Head Cap Screws
(4) #6 Flat Washers
(4) #6 Split Lock Washers
5/64" Allen Wrench
7/64" Allen Wrench

Patented Technology US Patent 8,199,453; 8,169,766; 7,193,836

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN: inch [mm]

UNTOLERANCED DIMENSIONS ± .020 [0.5mm]

DATE: 5/2/2017

ENGINEER: A. Gen

ELECTRO STATIC TECHNOLOGY
AN ITW COMPANY
31 WINTERBROOK ROAD, MECHANIC FALLS, MAINE 04256
PHONE (207)998-5140 FAX (207)998-5143

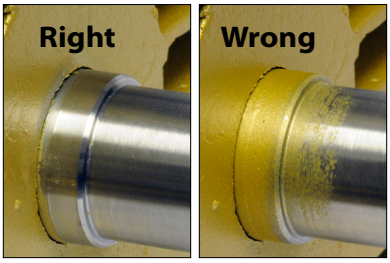
To Suit 0.875" Shaft Diameter

PART NUMBER: SGR-0.875-UKIT REV A

AEGIS® Installation Guide

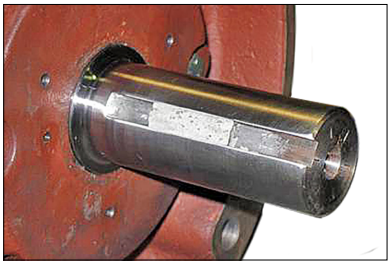
Shaft Preparation for Internal and External Installation

REFER TO AEGIS® HANDBOOK FOR BEST PRACTICES



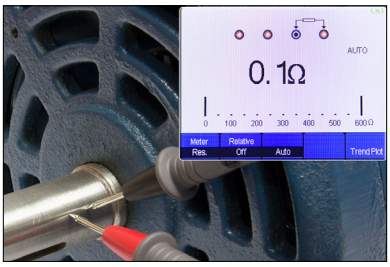
Motor shaft must be free from sharp edges and mechanical discontinuities: Ensure that the selected shaft location for the ring is smooth and free from any keyways, balancing holes or the like.

Motor shaft must be conductive: Shaft must be clean and free of any coatings, paint, corrosion, or other nonconductive material (clean to bare metal). Depending on the condition of the shaft, it may require using emery cloth or Scotch-Brite™. Once the shaft is visibly clean, a non-petroleum based solvent may be used to remove any residue. If possible, check the conductivity of the shaft using an ohmmeter.

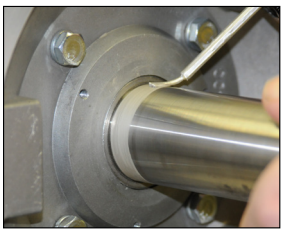


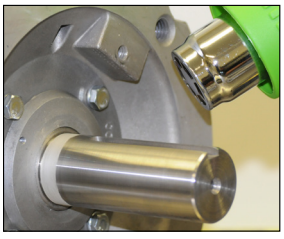
If possible, adjust or change spacer and screw lengths to avoid the keyway; or

Fill the keyway (in the area where the AEGIS® microfibers will be in contact with the shaft) with a fast-curing epoxy putty such as Devcon® Plastic Steel® 5 Minute® Putty. Ensure smooth transition at edges of epoxy and shaft.



Basic surface resistance test: Place the positive and negative meter leads on the shaft where the microfibers will contact. Each motor will have a different reading but in general you should have a maximum reading of less than 2 ohms anywhere you check the shaft. If the reading is higher, clean the shaft again and retest.





Colloidal Silver Shaft Coating PN# CS015

AEGIS® CS015 Colloidal Silver Application:

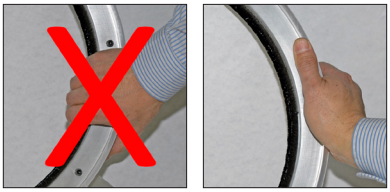
Recommended for all applications

Safety Data Sheet with PPE information available for download at www.est-aegis.com

1. If possible, gently warm the shaft when the AEGIS® CS015 will be applied. This helps the CS015 cure faster. Allow CS015 to come to room temperature prior to opening.
2. Thoroughly stir the silver coating.
3. Apply a thin, uniform coat of the AEGIS® Colloidal Silver Shaft Coating to the area where the AEGIS® microfibers will be in contact with the motor shaft. Apply all around the shaft. Wait for the first coat to dry to a tack free surface. Drying can be accelerated with the use of gentle heat from a heat gun, but don't exceed 200°F (93°C) while curing.
4. Apply a 2nd thin, uniform coat of CS015.
5. Allow CS015 to dry to a tack free surface before installing the AEGIS® Ring.
6. Allow the CS015 to cure completely before running the motor. The coating will cure at room temperature in 16-20 hours or in about 60 minutes at 200°F (93°C).

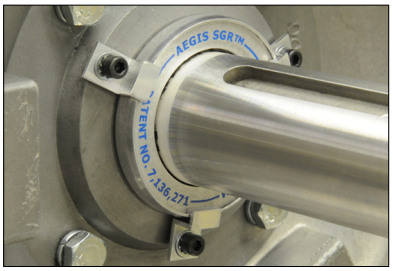
General Installation Instructions

REFER TO AEGIS® HANDBOOK FOR BEST PRACTICES



Take care when handling ring.

Do not crush fibers.

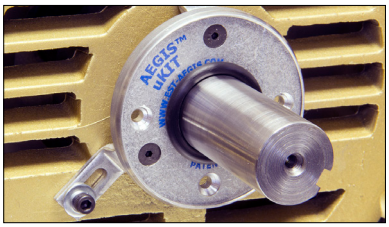


Install the AEGIS® SGR so that the aluminum frame maintains an even clearance around the shaft. AEGIS® conductive microfibers must be in contact with conductive metal surface of the shaft. Care should be taken when handling the ring to prevent fiber damage during installation.

Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground. If thread lock is required, use a small amount of EP2400 AEGIS® Conductive Epoxy to secure the screws in place.

After installation, test for a conductive path to ground using an ohmmeter. Place one probe on metal frame of AEGIS® Ring and one probe on motor frame. Reading should be < 1 ohm.

Motor must be grounded to common earth ground with drive according to applicable standards.



Where excessive debris is present, additional protection of the AEGIS® fibers may be necessary.

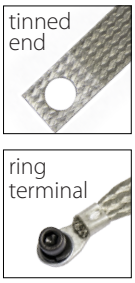
Installing an O-ring or V-slinger against the ring is sufficient in some cases. Contact Customer Support for more information.

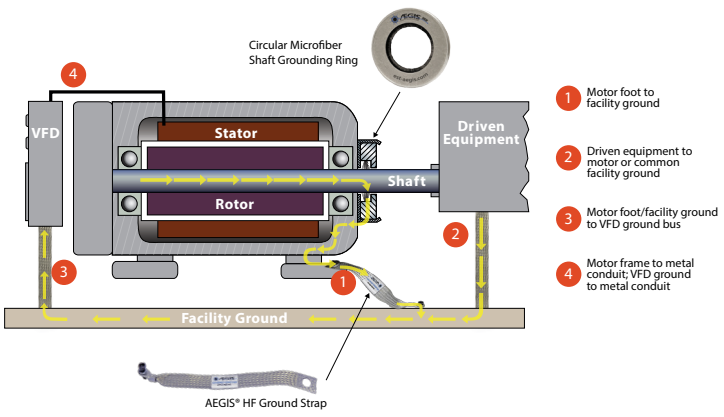
Motor Grounding: Motor must be grounded to common earth ground with drive according to applicable standards.

Recommend: AEGIS® HFGS High Frequency Ground Strap

When installation HFGS, ensure metal-to-metal contact at both terminals by removing paint or corrosion (down to clean, bare metal) at the motor foot and the ground location.

Secure tinned end to motor foot. Secure ring terminal to metal ground





Installation - uKIT

AEGIS® SGR uKit Includes:

(1) AEGIS® SGR Bearing Protection Ring (solid or split ring)

(4) universal bracket sets of each size (16 total)

(4) 5-40 x 3/8" flat head screws (for ring to bracket connection) (IEC Kit: same)

(4) 6-32 x 3/8" socket head cap screws (IEC Kit: M4 x 10mm SHCS)

(4) #6 split lock washers (IEC Kit: M4)

(4) #6 flat washers (IEC Kit: M4)

5/64" allen wrench

7/64" allen wrench (IEC Kit: 3mm)

Tools required for installation:

#36 drill (IEC Kit: 3.3mm or #30)

#6-32 tap (IEC Kit: M4)

Fine grit emery cloth/sand paper

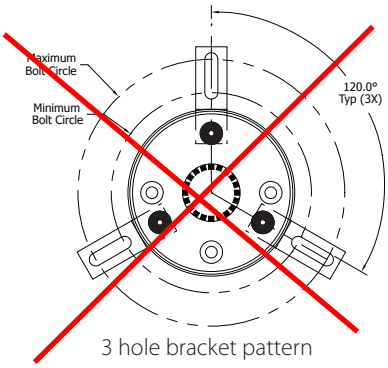
CS015 AEGIS® Colloidal Silver Shaft Coating (recommended)

Additional Tools for Easy AEGIS® Conductive Epoxy mounting:

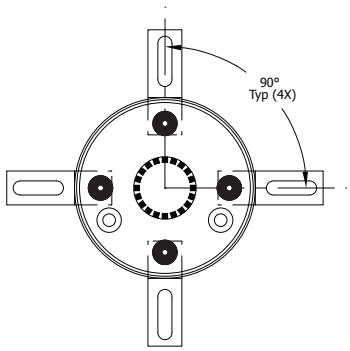
EP2400 AEGIS® Conductive Epoxy (sold separately)

Dremel tool for removing paint on motor end bracket

Heat gun to expedite curing time of conductive epoxy



3 hole bracket pattern



4 hole bracket pattern

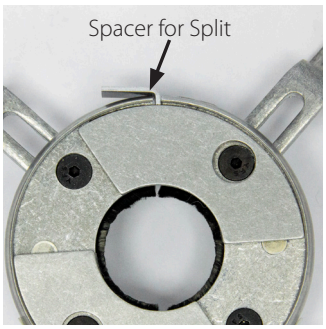
1. Prepare the shaft as per the shaft preparation instructions.
2. For Solid Ring choose either a 3 or 4 hole bracket pattern based on the configuration of the motor end bracket. Use a minimum of 3 brackets to safely secure the uKIT. Split Rings use 4 hole pattern.
3. Select a bracket based on the clearance needed on the motor end bracket/slinger/shaft shoulder. For specifications of each bracket, visit www.est-aegis.com/uKIT
4. Using the 5/64" allen wrench, assemble the brackets to the AEGIS® ring using the 5-40 x 3/8" flat head screws.
5. Split Ring Only: The plastic hinge is used as an installation aid to keep the two sections attached. Do not remove the tape release paper at this time.

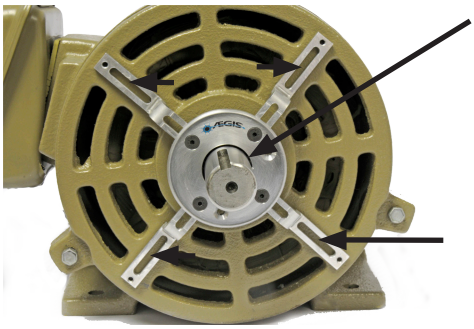
Drill and Tap Instructions

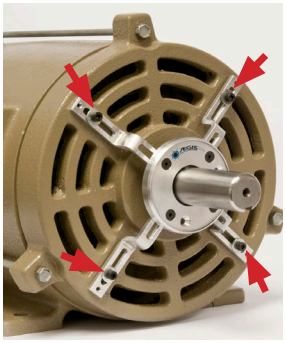
Determine drill points:

Solid Ring: Place the ring over the shaft. Maintain an an even clearance around the shaft. Conductive microfibers should be in contact with the shaft. Mark drill points.

Split Ring: For Split Ring, a .04" (1mm) space between both halves of the ring is needed to maintain the roundness of the ring. When the ring is cut in half at time of production, some material is removed. Use the spacers provided to aid in alignment. Mark drill points.







Do not use Loctite

Drill holes into motor end bracket:

Using a #36 drill (IEC Kit: 3.3mm or #30). Avoid drilling into bearing.

Depth of hole should be 1/4" (6mm)

Tap each hole with a #6-32 tap (IEC Kit: M4)

Installation - uKIT

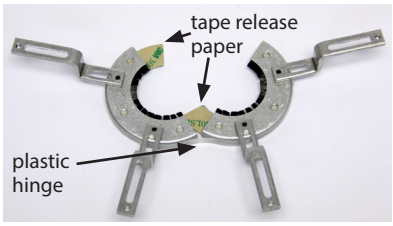
Drill and Tap Instructions continued

Install uKIT:

Solid Ring: Install the uKIT and secure to the motor using the hardware provided.

Split Ring: Remove the tape release paper from the 2 tabs and place the uKIT around the motor shaft. Add the spacer to the ring as shown above then press the ring segments together to secure the tape. Be sure to have a .04" space to ensure roundness of the ring. Mount brackets to the motor using the 6-32 (IEC Kit: M4) cap screws, split lock washers and flat washers provided. The bolts provide the path to ground. Do not use Loctite© or any other non-conductive material to secure the screws. Once ring is secure to the motor, remove the spacer and discard.

Attach AEGIS® Installed sticker to motor.



Conductive Epoxy Instructions

AEGIS® Conductive Epoxy EP2400 sold separately

Mark your epoxy locations.

Remove paint on the motor end bracket where the AEGIS® uKIT brackets will be attached. These areas must be clean & free of any coatings, paint, or other nonconductive material.

Prepare conductive epoxy per package directions then apply to universal mounting brackets.

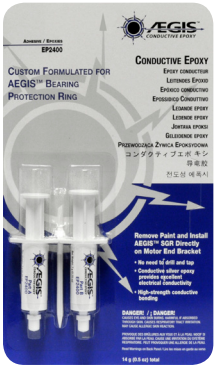
Install uKIT:

Solid Ring: Install the uKIT around the motor shaft. Hold the uKIT in place until epoxy is firmly holding. Allow epoxy to cure for 4 hrs at or above 75°F (24°C). For quickest curing time, use a heat gun to heat epoxy for 10 minutes, then allow to cool.

Split Ring: For Split Ring, a .04" (1mm) space between both halves of the ring is needed to maintain the roundness of the ring. When the ring is cut in half at time of production, some material is removed. Use the spacers provided to aid in alignment.

Remove the tape release paper from the 2 tabs and install the uKIT around the shaft. Add the spacer to the ring as shown below then press the ring segments together to secure the tape. Be sure to have a .04" space to ensure roundness of the ring. Place the uKIT against the motor end bell, ensure even clearance around the shaft and hold in place until epoxy is firmly holding. Allow epoxy to cure for 4 hrs at or above 75°F (24°C). For quickest curing time, use a heat gun to heat epoxy for 10 minutes, then allow to cool.

Installation - Conductive Epoxy



EP2400 GHS SDS available for download at www.est-aegis.com

Remove paint on the motor end bracket where the ring will be attached. These areas must be clean & free of any coatings, paint, or other nonconductive material. This is the discharge path to ground, and therefore metal to metal contact is essential.

Prepare the shaft as per the shaft preparation instructions prior to mixing the epoxy.

Install the ring so that the aluminum ring is concentric around the shaft. Conductive MicroFibers™ must maintain uniform contact with conductive metal surface of the shaft.

The epoxy cures at room temperature in 4 hours at or above 75°F (24°C). For quickest curing time, use a heat gun to heat epoxy to 150-250°F (66-121°C) for 10 minutes then allow to cool.

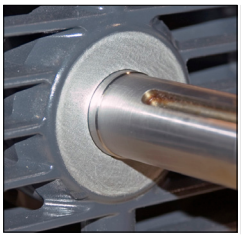
Mix AEGIS® Conductive Epoxy EP2400 according to package directions. Apply a layer of epoxy to the back side of the AEGIS® SGR. Use protective gloves during application.

SOLID RING: Install the ring and hold in place until epoxy is firmly holding the ring.

SPLIT RING: Split Ring must be installed on a flat surface. Remove the tape and spacer from one edge of the ring. Install over shaft.Retape the ring together, ensure spacers are in position and push ring back to the end bracket. Hold ring in place until epoxy is firmly holding the ring. Once epoxy is cured, remove spacers and tape.

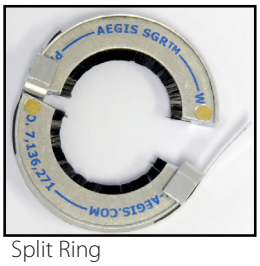
If you have a slinger or a shaft shoulder that is less than 0.375"(9.5mm), you will need the uKIT style ring.

Attach AEGIS® Installed sticker to motor.

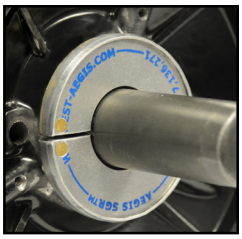


Cleaned shaft & end bracket

Solid Ring Installed



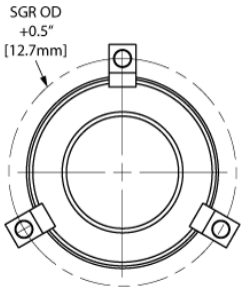
Split Ring



Split Ring Installed

Contact Customer Service for specific drawing

Installation - Clamps (Solid and Split Ring designs)



Bolt Circle

Prepare the shaft as per the shaft preparation instructions.

English Mounting Hardware- part number suffix -1. Includes AEGIS® Ring, clamps, 6-32 x 1/4" SHCS, and washers.

a. Drill (2 to 4) holes in end bell using a #36 drill
b. Depth of hole should be 1/4". Caution: do not drill into bearing
c. Tap each hole with a #6-32 tap

Metric Mounting Hardware- part number suffix -2. Includes AEGIS® Ring, clamps, M3 x .50 x 8mm SHCS, and washers.

a. Drill (2 to 4) holes in end bell using a 2.5mm drill
b. Depth of hole should be 6mm. Caution: do not drill into bearing
c. Tap each hole with a M3 tap

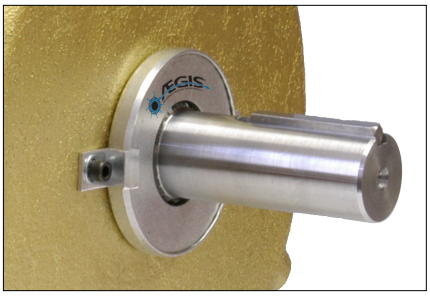
Solid Ring: Hold the ring in place by fastening clamps to motor end bracket using screws and washers provided. Use a minimum of 2 mounting clamps to ensure proper ground connection.

Split Ring: Must be installed on a flat surface. Peel back one side of the tape to disconnect the 2 pieces of the ring. Place the ring over the shaft. Pinch both halves together, ensure spacers are in place and replace tape firmly against side of ring. The spacers remain in place until the ring is firmly mounted to the end bell. Use a minimum of 4 mounting clamps to ensure proper ground connection. Once secure, remove spacers and tape.

Attach AEGIS® Installed sticker to motor.

Do not use Loctite© or any other non-conductive material to secure the screws.

If you have a slinger or a shaft shoulder that is less than 0.375"(9.5mm), you will need the uKIT style ring.


External Installation on Motor Bracket

Contact Customer Service for specific drawing

Installation - Bolt Through

Prepare the shaft as per the shaft preparation instructions.

Offered with various mounting hardware including flat head cap screws and standard cap screws.

1. Drill holes in motor end bell
2. Depth of hole should be 1/4" (6mm). Caution: do not drill into bearing.
3. Tap holes

Screw	Drill	Tap
10-32	#21	10-32
8-32	#29	8-32
6-32	#36	6-32
5-40	#38	5-40
4-40	#43	4-40
M3-0.5	#40	M3-0.5
M4-0.7	#30	M4-0.7
M6-1.0	#10	M6-1.0

Secure the ring to motor end bracket using screws and washers provided.

Attach AEGIS® Installed sticker to motor.

Do not use Loctite© or any other non-conductive material to secure the screws.

If you have a slinger or a shaft shoulder that is less than 0.375"(9.5mm), you will need the uKIT style ring.

Internal Installation on Bearing Cap

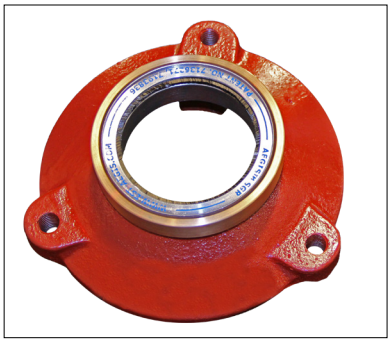
External Installation on Motor Bracket

Patented Technology
AEGIS® SHAFT GROUNDING RING
INSTALLED

Contact Customer Service for specific drawing

Installation - Press Fit

SGR OD machined edge



Patented Technology
AEGIS® SHAFT GROUNDING RING
INSTALLED

No oils or other lubricants should be used to assist installation as this may prevent the conductive path to ground.

Follow Press Fit Specification & Tolerance below for standard parts. For custom parts, refer to manufacturers drawing.

Do not use Loctite© or any other non-conductive material.

Attach AEGIS® Installed sticker to motor.

Press Fit Specification & Tolerance for Standard Parts	
SGR OD	Motor Bore
Tolerance +0"/-0.001" [+0mm/-0.025mm] Constrained for Machined Tolerance	Tolerance +0.001"/-0" [+0.025mm/-0mm]
1.580" [40.132mm]	1.576" [40.030mm]
2.080" [52.832mm]	2.076" [52.730mm]
2.660" [67.564mm]	2.656" [67.462mm]
3.080" [78.232mm]	3.076" [78.130mm]
3.580" [90.932mm]	3.576" [90.830mm]
4.080" [103.632mm]	4.076" [103.530mm]
4.580" [116.332mm]	4.576" [116.230mm]
5.080" [129.032mm]	5.076" [128.930mm]
5.580" [141.732mm]	5.576" [141.630mm]
6.080" [154.432mm]	6.076" [154.330mm]
6.580" [167.132mm]	6.576" [167.030mm]
7.080" [179.832mm]	7.076" [179.730mm]
It is important to stay within the tolerance noted to ensure optimum shaft grounding	
If the AEGIS® Ring has an OD that is different from these above, then you have a custom ring and should refer to the drawing for Motor Bore dimensions.	

Contact Customer Service for specific drawing

WARRANTY: Units are guaranteed for one year from date of purchase against defective materials and workmanship. Replacement will be made except for defects caused by abnormal use or mishandling. All statements and technical information contained herein, or presented by the manufacturer or his representative are rendered in good faith. User must assume responsibility to determine suitability of the product for intended use. The manufacturer shall not be liable for any injury, loss or damage, direct or consequential arising out of the use, or attempt to use the product.

AEGIS® SGR, AEGIS® Bearing Protection Ring, Conductive MicroFiber™ are trademarks of Electro Static Technology-ITW

Installation - PRO Series & WTG

Drive end: Install one AEGIS® Bearing Protection Ring.

Non-Drive End: Bearing housing must be isolated with insulated sleeve or coating or use insulated ceramic or hybrid bearing to disrupt circulating currents.

Note: The recommendation above is the preferred configuration for most applications. Contact sales@est-aegis.com with any questions.

Drive End External Installation:

Solid Ring - Secure using bolt through mounting hardware or brackets (sold separately).

Solid Ring-Press Fit - Clean, dry press fit. See AEGIS® drawing for motor bore dimensions.

Split Ring - Disassemble ring by removing screws from the face. Reassemble PRO on shaft. Secure to motor with bolt through mounting hardware or brackets.

Drive End Internal Installation:

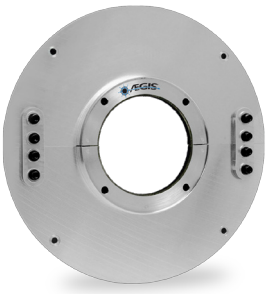
Install on bearing cap using bolt through mounting method

DO NOT USE Loctite as it will interupt the grounding path.

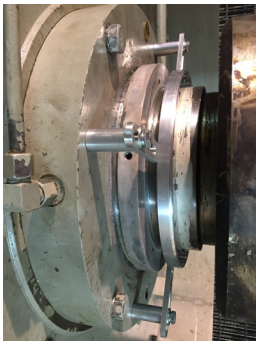
Attach AEGIS® PRO Installed sticker to motor.

AEGIS® PRO Brackets

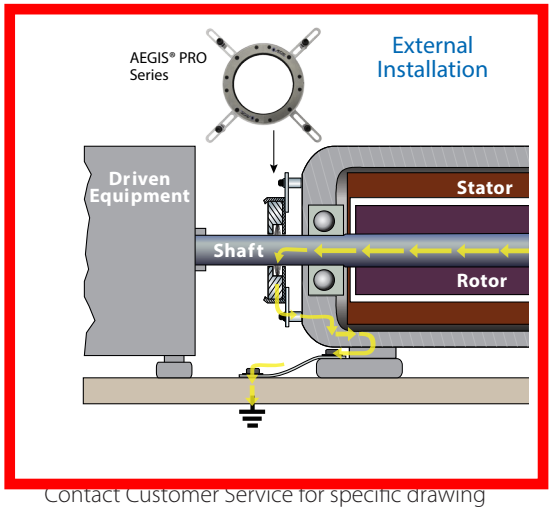
Bearing Cap Mounting

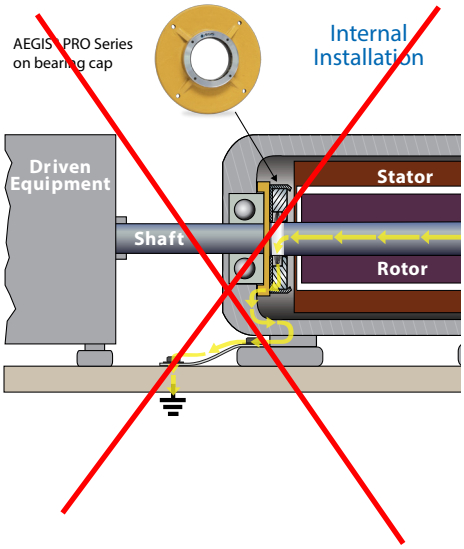


Custom Split Mounting Plate with tie bars



AEGIS® PRO installed with PRO Brackets

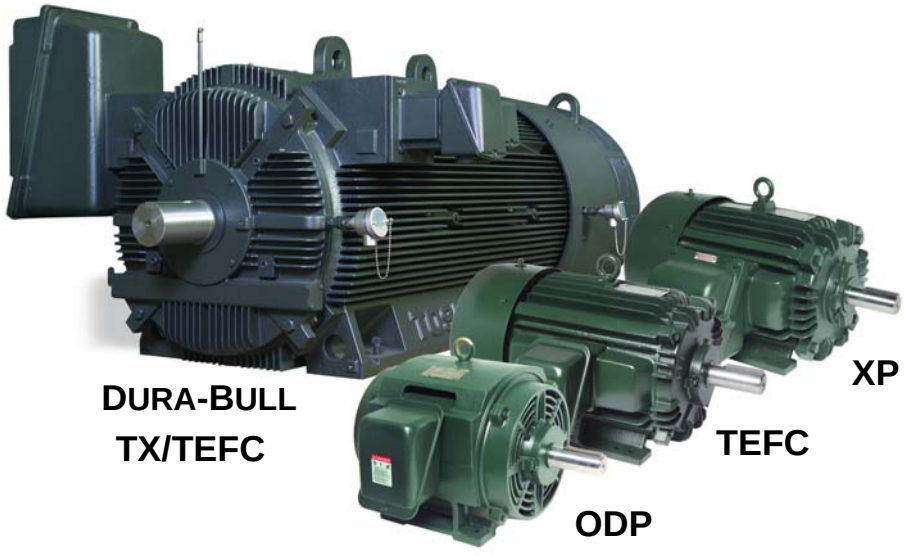




Contact Customer Service for specific drawing

TOSHIBA
Leading Innovation

August, 2015



Low Voltage 50 and 60 Hz Motor
Installation and Maintenance Manual

DN: 195-0014
Rev. 003

TOSHIBA

Leading Innovation

Low-Voltage Motor Instruction Manual

Installation and Maintenance for Polyphase 50 and 60 Hz AC Motors

Frame Size

- Frames 143 through 5810 Open Drip Proof (ODP)
- Frames 56 through 5811 Totally Enclosed Fan Cooled (TEFC)
- Frames 143 through 449 Expolsion Proof (XP)
- Frames 56 through 5811 Totally Enclosed Air-Over (TEAO)
- Frames 56 through 449 Totally Enclosed Non-Ventilated (TENV)
- Frames 143 through 5811 Totally Enclosed Blower Cooled (TEBC)

⚠ WARNING

- To reduce the risk of fire or explosion, do not install Division 2 motors in areas where the operating temperature code (shown on the motor nameplate or Division 2 label) exceeds the ignition temperature of the hazardous environment.
- Do not attempt to install, operate, maintain or dispose of this equipment until you have read and understood all the product safety information and directions that are contained in this manual.
- Do not disable or bypass any safety guards or protective devices.
- Avoid touching the hot surfaces of the electric motor without wearing proper protection.
- Keep the terminal box cover in place and secured while the motor circuits are powered.
- Two people are required to lift a 140 frame motor.
- Hearing protection is required around noise levels exceeding 80 dBA.
- Protection for overloads, peak starting currents, short circuit current, and ground fault currents, should be in strict accordance with the National Electrical Code (latest release) Article 430, local electrical codes, and building codes.
- Proper circuit protection is required to prevent automatic reset devices from automatically restarting the motor.
- Only qualified personnel are to perform maintenance in an effort to prevent equipment failure or damage.

Notes

- Each Toshiba International Corporation (TIC) electric motor is thoroughly tested at the factory and carefully packaged for standard shipping. Confirm the overall packaging condition upon receipt.
- The equivalent lead wire markings per NEMA(IEC) are: TI(U1), T2(V1), T3(W1), T4(U2), T5(V2), T6(W2), T7(U5), T8(V5), T9(W5), T10(U6) T11(V6), T12(W6).
- All dimensions are in inches. Multiply inch value by 25.4 to convert to millimeters (mm).
- Any motor operated using an Adjustable Speed Drive is subject to potential premature bearing failures due to the increased shaft currents caused by common mode voltages inherent with operation on a sinusoidal power source. TIC recommends insulating both bearings on frame sizes 444 and larger. Smaller motors are at risk as well and should be considered after review of the application and installation. The user is responsible for protecting the couplings and driven

equipment from shaft currents from the motor. Insulated couplings are recommended. Shaft grounding devices provide additional protection, but cannot be used in hazardous areas because of electrical arcing.

- Contact TIC for a complete copy of the TIC **Standard Motor Warranties HBB0001** policy.
- Match the nameplate rating of the motor, connection diagram, and lead numbers with the appropriate category for the applicable connection requirement. TIC special built or special rated motors may follow different connections. If more information is required, contact TIC with the nameplate Model Number and Serial Number of the motor for connection information.
- EQP GLOBAL motors in frames 143T – 184T and all other TIC motors rated 0.5 HP – 5 HP are Wye-connected motors. All other standard size TIC motors are Delta-connected.
- TIC standard motors are built to F-1 assembly specifications. The motor uses the standard connection configuration and, while facing the non-drive end of the motor, the standard rotation is counter-clockwise (CCW).
- For references to the National Electrical Code (NEC) see the latest release of the NEC.
- All products and company names in this document are trademarks or registered trademarks of the respective owners and are used for identification purposes.

Storage

If the equipment is not put into immediate use, it should be stored indoors in an area that is clean and dry. Care should be taken to keep the equipment covered when moving from a cold location to a warm location, otherwise condensation may occur. If condensation does occur, allow the motor to dry thoroughly before applying power. Using a megohmmeter, test the insulation resistance of the windings before applying power. A minimum of 10 megohms is recommended.

For long-term storage or when indoor storage is not available, the motor must be covered with plastic or weather-proof tarp. Cover the motor completely. To ward off the formation of condensation, do not wrap the motor tightly. This will allow for adequate ventilation. Precautions must also be taken to protect the motor from flooding or being exposed to harmful chemical vapors.

Ensure that any unpainted sections are covered. Retouch any scratched or flaked areas.

If condensate plugs or drain plugs are used, ensure that they are functional.

Whether indoors or outdoors, the area should be free from vibration. Excessive vibration can cause bearing damage. Any motor which must be stored in an area that is exposed to vibration must have the shaft locked to prevent any movement.

If the motor is equipped with space heaters, ensure that the space heaters are properly connected and functional. The motor interior temperature should be maintained approximately 5.6° C (10° F) degrees above ambient.

A systematic inspection and maintenance schedule should be established. If the motor is to be stored for 6 months or longer, it should, in addition to the minor precautions above, have the insulation resistance of the windings tested every 3 to 6 months. A minimum of 10 megohms is recommended. A record of insulation values, temperature, time, humidity, and length of voltage application should be recorded to show winding conditions prior to start up.

If windings are designed for outdoor operation, they will not be affected by extreme or sudden temperature changes, or inclement weather in general. However, a weather proof cover with provisions for adequate ventilation should be used to guard against intrusion of salt, dust, or other abrasive or corrosive material.

It is recommended that the rotor be turned every month to redistribute the lubricant in the bearings. Oil or grease should be added every 6 months.

— READ THE FOLLOWING CAREFULLY BEFORE INSTALLING OR STARTING MOTOR —

Receiving

1. Ensure that the nameplate data is consistent with the order specifications.
2. Check whether any damage has occurred during transportation. Typically, motors are shipped FCA TIC factory. Freight Claims must be submitted by the consignee to the carrier.

3. Remove the bearing lock plate before start up (if used). Save the plate for reuse if subsequent shipping is required.

   Note: *If unable to reinstall the bearing lock plate, use wooden wedges to block the shaft to prevent any movement during shipping.*

4. Turn the shaft by hand to ensure that it turns freely.

Location

1. The motor should be installed in an area of unrestricted ventilation. Ensure that there are no limits or obstructions imposed on the operation of the motor.
2. Drip Proof motors are designed for indoor installations in a well ventilated area where the atmosphere is reasonably free of dirt, moisture, and corrosion. Contact TIC for any required modifications.
3. Totally enclosed motors may be installed where dirt, moisture (not running water), and corrosion are present. Outdoor applications are acceptable, subject to the environment. Contact TIC for any required modifications.
4. Explosion Proof motors are designed and built for hazardous locations. Listed by U L for Class 1, Group D; and Class II, Groups E, F and G; temp code T3B (165C); Division 1. Also listed by C.S.A.

Mounting

1. Mount the motor securely on a firm and flat base. All ball and roller bearing normal thrust motors through frame 447 are mechanically capable of being mounted in any position. Consult with TIC for frames larger than 447. Special drains, seals, or support construction may be required on all sizes, subject to the environment.
2. Align the motor accurately, using a flexible coupling if possible. For drive recommendations, consult with the drive manufacturer, equipment manufacturer, or TIC Customer Support Center. See additional information in the section titled Alignment Procedure on pg. 5. Ball bearings are recommended for direct coupled applications. Roller bearings may be used with flexible couplings — ensure proper alignment. Rigid couplings require extra allowance for thermal shaft growth toward the coupling. Skidding noise may result from the combination of internal bearing clearances and alignment tolerances. **DO NOT RUN A ROLLER BEARING WITHOUT A LOAD CONNECTED**.
3. V-belt Sheave Pitch Diameters should not be less than the values listed in Table 1 on page 4 (NEMA recommended values), or calculated from the formula for frames above 445T.
4. Tighten belts enough to prevent slippage **only**. Belt speed should not exceed 6500 ft. per minute, or consult belt/sheave supplier.
5. Motors must not be subjected to vibration exceeding 0.5 G force. Motors are not to be mounted to shaker screens or vibrating equipment that exceeds 0.5 G force on the motor. Complete isolation is required.

Power Supply & Connections

1. Nameplate voltage and frequency should be consistent with the power supply. The motor will operate satisfactorily on line voltages within 10% of the nameplate value. The frequency shall be within 5% of the nameplate value. The combined variation shall not exceed 10%. A motor that is rated for 230 volts can be operated on 208-volt network systems per the nameplated amps, but with slightly modified performance characteristics.
2. Dual voltage and single voltage motors can be connected for the desired voltage by following the connection diagram shown on the nameplate. Alternate starting connections are shown in the conduit box or see the connection diagrams on pg. 8 and pg. 9.
3. Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent an excessive external surface temperature of the motor in accordance with UL standards. The **P1** and **P2** terminals of the thermal protectors should be connected to the motor control equipment. These are bimetal thermostats that are used for the primary thermal protection. Optional auxiliary thermistors embedded in the winding can only be used as secondary devices for thermal protection. The leads will be labeled **TP1** and **TP2** for thermistors. All supplementary device leads will be extended through the main terminal box.
4. Wiring of the motor and control, overload protection, and grounding should be in accordance with the National Electrical Code and local building codes. Explosion Proof motors have the internal terminal grounding connection inside of the main terminal box which must be used for the equipment grounding connection. An optional external grounding terminal on the feet is for a supplemental bonding connection, where local codes permit or require such a connection.
5. Lock out/Tag out and disconnect the motor from the power supply before opening the conduit box or performing any maintenance or repair on the motor.

6. Using a megohmmeter, test the insulation resistance of the motor before energizing. A minimum of 10 megohms is recommended.

Table 1. V-Belt Sheave Pitch Diameters (MG 1-14.42).

Frame Number	Horse Power at Synchronous Speed RPM			V-Belt Sheave (Inches)			
				Conventional		Narrow	
				A, B, C, D, and E		3V, 5V, and 8V	
	3600	1800	1200	Min. Pitch Diameter	*Max. Width	Min. Pitch Diameter	**Max. Width
143T	1.5	1.0	0.75	2.2	4.250	2.2	2.250
145T	2 – 3	1.5 – 2	1.0	2.4	4.250	2.4	2.250
182T	3.0	3.0	1.5	2.4	5.250	2.4	2.750
	5.0	—	—	2.6			2.750
184T	—	—	2.0	2.4	5.250	2.4	2.750
	5.0	—	—	2.6			
	7.5	5.0	—	3.0		3.0	
213T	7.5 – 10	7.5	3.0	3.0	6.500	3.0	3.750
215T	10	—	5.0	3.0	6.500	3.0	3.750
	15	10	—	3.8		3.8	
254T	15	—	7.5	3.8	7.750	3.8	4.000
	20	15	—	4.4		4.4	
256T	20 – 25	—	10	4.4	7.750	4.4	4.000
	—	20	—	4.6			
284T	—	—	15	4.6	9.000	4.4	4.250
	—	25	—	5.0			
286T	—	30	20	5.4	9.000	5.2	4.250
324T	—	40	25	6.0	10.250	6.0	5.250
326T	—	50	30	6.8	10.250	6.8	5.250
364T	—	—	40	6.8	11.500	6.8	5.250
	—	60	—	7.4		7.4	5.250
365T	—	—	50	8.2	11.500	8.2	5.500
	—	75	—	9.0		8.6	
404T	—	—	60	9.0	14.250	8.0	7.250
	—	100	—	10.0		8.6	
405T	—	—	75	10.0	14.250	10.0	7.250
	—	100	—			8.6	
	—	125	—	11.5		10.5	
444T	—	—	100	11.0	16.750	10.0	8.500
	—	125	—			9.5	
	—	150	—	—	—	10.5	
445T	—	—	125	12.5	16.750	12.0	8.500
	—	150	—	—	—	10.5	
	—	200	—	—	—	13.2	

*Maximum sheave width - 2 (N-W)-¼". **Maximum sheave width = N-W.

Sheave ratios greater than 8:1, or with a center-to-center distance less than the diameter of the large sheave, should be referred to TIC. Sheaves must be mounted close to the shaft shoulder.

For motors above 445T frame with narrow V-belts:

Sheave Diameter (inches) = $25\ (H/N_R)^{1/3}$

Where:

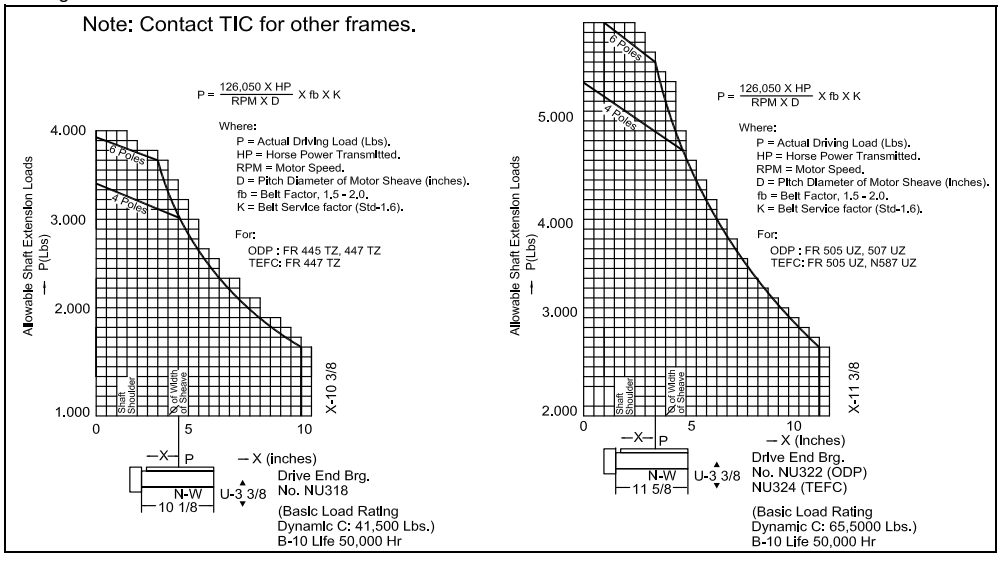
H = Rated motor HP

N_R = Rated motor speed in RPM

Maximum sheave width = N-W of shaft. Contact TIC for other sizes.

Belt Speed (Ft/min) = (Shaft RPM x 3.14 x Sheave Diameter)/12.

Figure 1. Shaft Extension Loads Due to Transmission of Power.



Alignment Procedure

Motor Leveling & Coupling Alignment

When the base has been adjusted, leveled, and grouted, the correct motor leveling and coupling alignment are obtained with the aid of shims between the motor and the base. To give the motor proper support, it is important that the base and shims combine to create a level and stable platform.

Rigid Coupling

Shaft Alignment

Extreme care must be taken to obtain correct shaft alignment when using rigid couplings. Circular concentric peripheral surfaces of the two coupling halves must indicate correct alignment to within 0.0005 inches to 0.001 inches when the two coupling halves are rotated together. The separation between the faces of the two coupling halves must also be maintained within the same tolerance.

The alignment may be checked by utilizing a dial indicator, or with the aid of a straight-edge and thickness gauge or feelers as shown on pg. 7.

The preferred method of checking alignment is with the dial indicator. Bolt the indicator to one of the coupling halves and indicate the position of the dial button on the opposite coupling half with a chalk mark. Set the indicator dial to zero at the first position and then rotate both halves of the coupling to a new position where a reading is to be made. All readings must be made with the dial button located at the chalk mark. At least six readings are to be taken.

A variation in the dial reading at different positions of coupling rotation will indicate whether the machine has to be raised, lowered, or moved to one side or another to obtain alignment of the circular concentric peripheral surfaces of the two coupling halves within the specified tolerance.

Coupling Faces

In addition to the above check, a check of the separation of the coupling faces must be made to establish correct alignment. The separation between the faces of the coupling may be checked with a dial indicator fastened to one coupling half and a

reference surface fastened to the other coupling half. Mark the location of the dial button on the reference surface and make all readings with the indicator in this position.

Set the dial of the indicator to zero for the first reading and use this as the reference. Be sure to rotate both halves of the coupling the same amount, aligning the bottom of the indicator and the mark on the reference surface for each of six readings. A variation of the readings at different positions will indicate how the machine has to be adjusted to obtain correct alignment. After each adjustment of the motor, repeat the above procedure to ensure that the correct alignment and leveling have been obtained.

Flexible Coupling

Units coupled through flexible couplings should be aligned as accurately as possible. The two halves should indicate correct alignment to within 0.002 inches on both the circular concentric peripheral surfaces and the separation between faces. Although most flexible couplings will withstand greater misalignment than rigid couplings, extreme misalignment can cause vibration possibly resulting in failure of motor bearings and/or shaft.

If the method shown in Figure 2 on pg. 7 is used to check alignment of the machines, correct alignment exists when:

- The peripheries of the coupling halves are true circles of the same diameter and if the faces are flat.
- The separation between the faces is held to within the specified tolerance at all points and a straight-edge lies squarely across the rims at any point.

Non-parallel faces will be indicated by a variation in separation of the coupling halves as they are rotated, and a difference in height of the coupling halves will be indicated by the straight-edge and feeler gauge test.

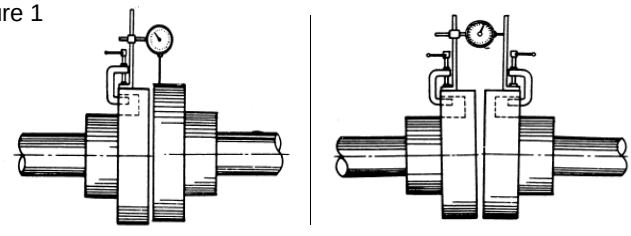
When the coupling halves have been correctly aligned with the motor feet bolted in position, place temporary bolts in two coupling holes for clamping the halves together. Then, ream for a light drive fit through both halves for regular coupling bolts.

The preferred method of measuring coupling alignment is with a dial indicator as shown in Figure 1.

Clamp the dial indicator to the coupling as indicated below to measure the circular concentric peripheral surfaces of the coupling halves for parallel alignment.

Also, as shown in Figure 1, clamping a reference surface to the opposite coupling half allows the dial indicator to be used for measuring the separation of the coupling halves for axial alignment.

Figure 1



Balance (Direct Coupled Units)

TIC motors are balanced at the factory to standard NEMA commercial tolerances. However, if direct coupling units have been disassembled in the field and are not reassembled with the shafts in the same position as they were originally, an unbalanced condition may occur.

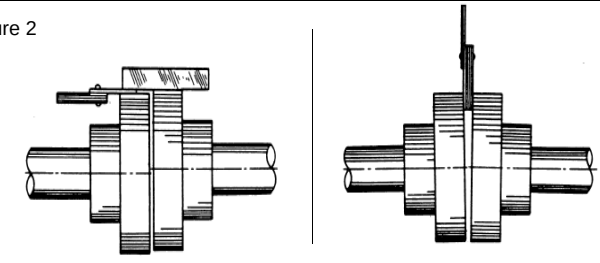
To correct this condition, disconnect the coupling halves and rotate one shaft 90° with respect to the other shaft. Re-connect the coupling and run the motor. If not corrected, repeat the procedure until normal operation resumes.

The straight-edge or thickness gauge or feeler gauge is an alternative method of measuring coupling adjustment as shown in Figure 2 on pg. 7.

Use a straight-edge and thickness gauge of feeler gauge to check the alignment of the circular concentric peripheral surfaces of the coupling halves as shown below. The separation between the faces of the coupling halves can be measured as shown.

Rigid Coupling Tolerances 0.0005 inch to 0.001 inch. Flexible Coupling Tolerance: 0.002 inch.

Figure 2



Warnings

⚠ WARNING

BEFORE STARTING MOTOR, REMOVE ALL UNUSED SHAFT KEYS AND LOOSE ROTATING PARTS TO PREVENT THEM FROM FLYING OFF.

CAUTION: CHECK DIRECTION OF MOTOR ROTATION BEFORE COUPLING MOTOR TO LOAD. TO REVERSE THE MOTOR ROTATION, REVERSE ANY TWO OF THE THREE LEADS TO THE POWER PHASES. IF THE MOTOR IS NOT BI-DIRECTIONAL, CONFIRM THE CONNECTION DIAGRAM AND ROTATION ARROW, OR CONTACT TIC.

⚠ WARNING

ROTATING PARTS, SUCH AS COUPLINGS, PULLEYS, EXTERNAL FANS, AND UNUSED SHAFT EXTENSIONS, SHOULD BE PERMANENTLY GUARDED AGAINST ACCIDENTAL CONTACT WITH HANDS OR CLOTHING. THIS IS PARTICULARLY IMPORTANT WHERE THE PARTS HAVE SURFACE IRREGULARITIES SUCH AS KEYS, KEYWAYS OR SET SCREWS.

⚠ WARNING

WHEN A LIFTING MEANS IS PROVIDED FOR HANDLING THE MOTOR OR GENERATOR, IT SHOULD NOT BE USED TO LIFT THE MOTOR OR GENERATOR PLUS ADDITIONAL EQUIPMENT SUCH AS GEARS, PUMPS, COMPRESSORS, OR OTHER DRIVEN EQUIPMENT.

⚠ WARNING

THE FRAMES AND OTHER METAL EXTERIORS OF MOTORS AND GENERATORS (EXCEPT FOR INSULATED PEDESTAL BEARINGS) USUALLY SHOULD BE GROUNDED TO LIMIT THEIR POTENTIAL TO GROUND IN THE EVENT OF ACCIDENTAL CONNECTION OR CONTACT BETWEEN LIVE ELECTRICAL PARTS AND THE METAL EXTERIORS.

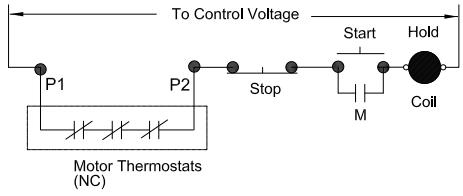
⚠ WARNING

WHEN CAREFUL CONSIDERATION OF THE HAZARDS INVOLVED IN A PARTICULAR APPLICATION INDICATE THE MACHINE FRAMES SHOULD NOT BE GROUNDED OR WHEN UNUSUAL OPERATING CONDITIONS DICTATE THAT A GROUNDED FRAME CANNOT BE USED, THE INSTALLER SHOULD MAKE SURE THAT THE MACHINE IS PERMANENTLY AND EFFECTIVELY INSULATED FROM GROUND. IN THOSE INSTALLATIONS WHERE THE MACHINE FRAME IS INSULATED FROM GROUND, IT IS RECOMMENDED THAT APPROPRIATE WARNING LABELS OR SIGNS BE PLACED ON THE EQUIPMENT OR IN THE AREA OF THE EQUIPMENT BY THE INSTALLER.

⚠ WARNING FOR EXPLOSION-PROOF MOTOR

Disconnect power before working on motor-driven equipment. This motor is equipped with an automatic temperature-limiting device. The National Electrical Code and Underwriter's Laboratories require connection of leads P1 and P2 into the control circuit of a manual reset starter per the following diagram.

Klixon Type	AC Volt	Volt Amp Rating
9700K	120-600 Volt	720 VA



Note: *Frames 256T and smaller have two thermostats.*

Figure 3. Typical Connection Diagrams.

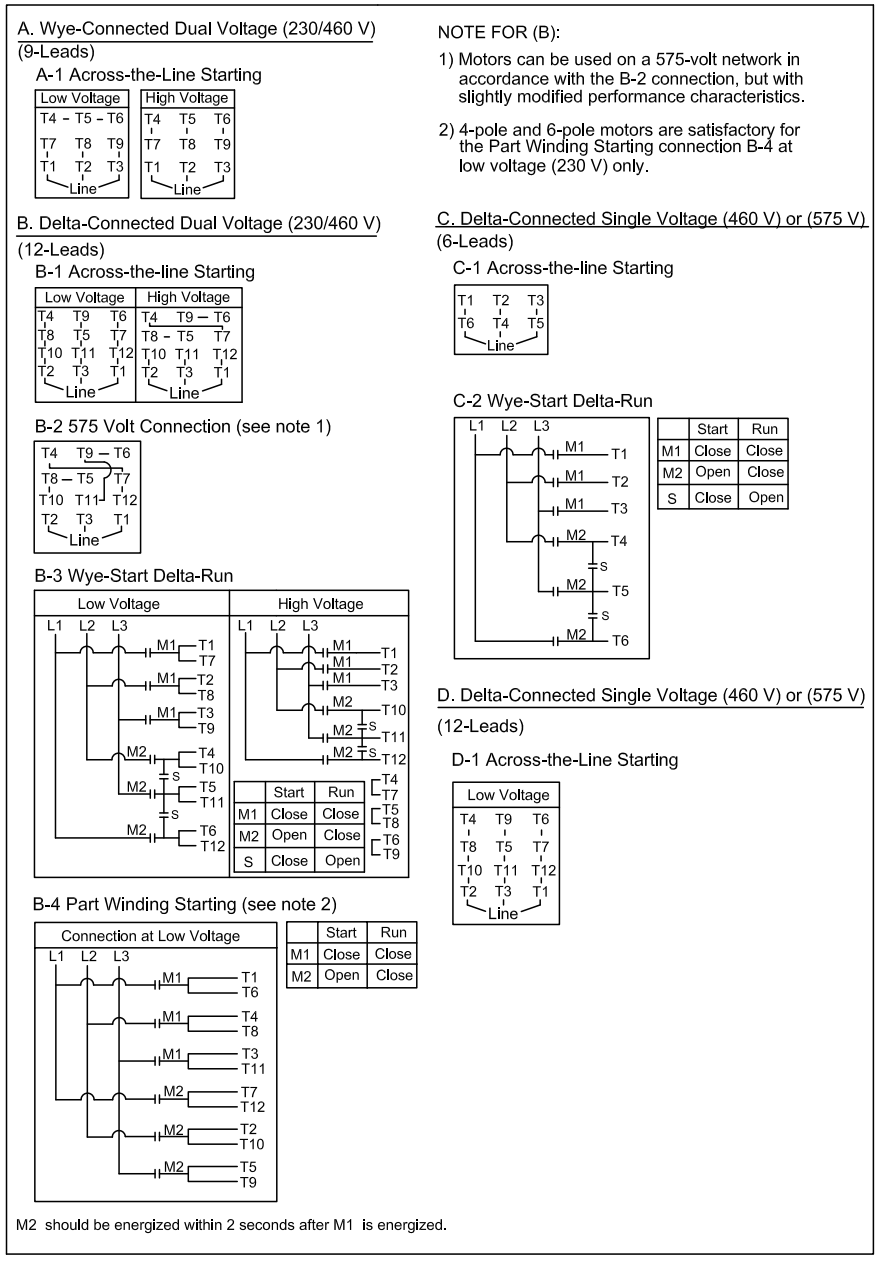
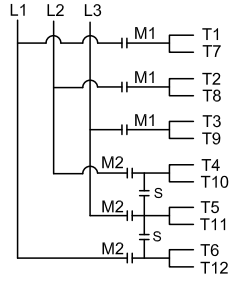


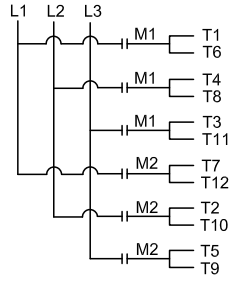
Figure 4. Typical Connection Diagrams (Cont.)

D-2 Wye-Start Delta-Run



	Start	Run
M1	Close	Close
M2	Open	Close
S	Close	Open

D-3 Part Winding Starting (4-Pole and 6-Pole Motors)

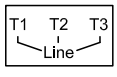


	Start	Run
M1	Close	Close
M2	Open	Close

M2 should be energized within seconds after M1 is energized.

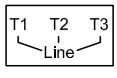
E. Wye-Connected (460 V) or (575 V)
(3-Leads)

E-1 Across-the-Line Starting



F. Delta-Connected (460 V) or (575 V)

F1 Across-the-Line Starting



NOTE

Frames N449T-5811UZ will have 3 leads with multiple cables in each lead numbered the same in each respective lead cable.

Maintenance

Inspection

Inspect motor at regular intervals. Keep the motor clean and the vent openings unobstructed.

Lubrication

Frames 143T – 256T are furnished with double sealed or shielded ball bearings that are lubricated with lithium-based grease prior to installation. Grease fittings are not supplied and bearings are designed for average 100,000 hours operation under standard conditions (see Table 2).

Frames 284T – 5811UZ are furnished with double shielded, open ball, or roller bearings. Depending on HP size and/or the operating speed, it may be necessary to relubricate anti-friction bearings periodically (see Table 2).

These motors are supplied with provisions for greasing and have been lubricated prior to shipping. However, before start up, it is recommended that approximately 30 grams (1 oz.) of grease be applied because of possible settling of grease during storage. Any oil leakage around bearing caps indicate overpacking — excess grease should be purged by operating motor temporarily with relief open.

Table 2. Relubrication Frequency.

Sync. RPM Range	Frame Range	Type Of Service	
		Standard Duty	Severe Duty
3600	143T - 256T	5 Years	3 Years
	284TS - 286TS	12 Mos.	4 Mos.
	324TS - N5811USS	9 Mos.	3 Mos.
1800	143T - 256T	7 Years	3 Years
	284T - 326T	4 Years	1.5 Years
	364T - 365T	2.5 Years	10 Mos.
	404T - 447TZ	2 Years	8 Mos.
	505US - N5811UZ	1.5 Years	6 Mos.
1200 and Slower	143T - 256T	7 Years	3 Years
	284T - 326T	4 Years	1.5 Years
	364T - 447TZ	3 Years	1 Year
	505US - N5811UZ	2 Years	8 Mos.

Note: Typical schedule provided. See nameplate for actual schedule and type of grease, if applicable.

Service Conditions	
Standard Duty	Eight hours per day, light to normal loading, clean condition free of dust.
Severe Duty	Twenty-four hours per day, or light to normal shock loading vibration, exposure to dirt or dusty conditions.
Very Severe Duty	For very severe conditions where the motor is subject to high vibration or heavy shock loading and vibration use 1/3 of the value shown in the severe duty table

Instructions for Lubricating

Toshiba motors (284T – 5811UZ) are furnished with grease fittings. Before greasing, be sure fittings are clean and free of dirt.

Remove the grease relief plug or plate and, using a low pressure grease gun, pump in the required grease amount. Do not over grease. Relubrication intervals are specified in Table 2. After relubricating, allow the motor to run for 10 minutes before replacing relief hardware. All EQP 841 motors have grease fittings. See the **Motor Relubrication** document **#MDS-O-0001** for details on both standard horizontal and vertical motor bearings.

Recommended Greases for Standard Applications

Unless otherwise specified by the grease nameplate of the motor, use the following greases for the listed temperature range. The TIC standard, 840, and 841 motors are greased at the factory with the polyurea base Mobil Polyrex® EM grease.

Operating Ambient Temp. -30° C – 50° C.	
Chevron® SRI	Chevron Corp.
Mobil Unirex® N 2	Exxon Mobil Corp.
Mobil Polyrex® EM	Exxon Mobil Corp.
Shell Dolium® R	Shell Oil Co.
Mobilith SHC® 100	Exxon Mobil Corp.

Recommended Greases for Special Applications

The following greases are recommended for special applications only and should be used only for motors specifically built for such conditions.

Minimum Ambient Temperature -60° C	
Beacon™ 325	Exxon Mobil Corp.
Maximum Ambient Temperature 90° C	
Dow Corning® 44	Dow Corning Corp.
Mobil Unirex® S 2	Exxon Mobil Corp.
Triton® 460	ConocoPhillips Co.
Mobilith SHC® 460	Exxon Mobil Corp.

⚠ **WARNING**: In general it is not recommended to mix greases of different brands. The mixing of different types of thickeners may destroy the composition and physical properties of the grease. In the event that a different grease is required by the end user, the following steps can be taken. Using the instructions for lubrication, open grease outlet and purge the system as much as possible of the old or unwanted grease. Repeat this same operation after 1 week of service. Consult Toshiba Customer Support Center for further recommendations on grease compatibility.

WARRANTY

Toshiba International Corporation (TIC) warrants that the received Goods will be free of defects in materials and workmanship.

This warranty expires eighteen (18) months after the date that the Goods are received by the Purchaser or twelve (12) months after the Goods are placed into operation, whichever occurs first. Neither shall exceed 18 months from the date of receipt of the Goods.

Goods that are received in an unacceptable condition shall, at the sole discretion of TIC, be repaired, replaced, updated, or have the purchase price refunded.

To file a claim, the Purchaser must (1) promptly notify TIC in writing of the nonconformity, (2) furnish TIC satisfactory proof of the nonconformance, and (3) if requested by TIC, return the nonconforming equipment or part to TIC and pay all expenses incurred in connection with such return.

The repaired/replaced item, part, or software, shall be delivered, free of charge, to the Purchaser, FCA TIC designated facility or at TIC's option, FCA TIC-authorized service shop (INCOTERMS 2010). Purchaser shall pay all costs following such delivery, including, without limitation, all handling, transportation, assembly, installation, insurance, testing, and inspection charges.

The warranty excludes (1) normal wear and tear; (2) Goods that have not been properly stored, assembled, installed, serviced, maintained, operated, or used within the limits of rated capacity and normal usage; (3) Goods not used in accordance with current operating and maintenance instructions furnished by TIC, and (4) Goods that have been altered or modified in any manner without the written consent of TIC.

THE FOREGOING OBLIGATION TO REPAIR, REPLACE, OR REFUND THE PURCHASE PRICE PAID FOR THE GOODS SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER, ITS CUSTOMERS AND USERS OF THE GOODS FOR THE NONCONFORMANCE OF THE RECEIVED GOODS.

TIC SHALL HAVE NO OBLIGATION TO DISASSEMBLE ANY NONCONFORMING GOODS OR TO INSTALL ANY REPAIRED OR REPLACEMENT PART, EQUIPMENT OR SOFTWARE OR TO PAY ANY COSTS INCURRD IN CONNECTION WITH SUCH DISASSEMBLY OR INSTALLATION.

THERE ARE NO OTHER WARRANTIES AND TIC HEREBY EXPRESSLY DISCLAIMS ALL OTHER EXPRESS, STATUTORY, AND IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

RENEWAL PARTS

1. Use only genuine Toshiba renewal parts.
2. When ordering, specify complete motor information. Model Number and Serial Number are a minimum requirement. Specify quantity and describe part.
3. For information and service contact the Toshiba Customer Support Center.

⚠ WARNING

Explosion-Proof Motors are constructed to comply with the UL Label Service Procedure Manual. Repair of **Explosion-Proof Motors** must be made by the manufacturer or UL-listed service center to maintain the UL listing.

Customer Support

The TIC Customer Support Center is open from 8 a.m. to 5 p.m. (CST), Monday through Friday.

The toll free number is US (800) 231-1412/(713) 466-0277 — Fax (713) 466-8773.

For after-hours support follow the directions in the outgoing message when calling.

You may also contact Toshiba International Corporation by writing to:

Toshiba International Corporation
13131 West Little York Road
Houston, Texas 77041-9990
Attn: Motors.

For further information on Toshiba International Corporation’s products and services, please visit our website at www.toshiba.com/TIC.

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TOSHIBA INTERNATIONAL CORPORATION
13131 W LITTLE YORK ROAD
HOUSTON TX 77041-9988

TOSHIBA PRODUCT WARRANTY REGISTRATION

Thank you for purchasing a Toshiba International Corporation product. This Product Warranty Registration form documents your Toshiba product's current warranty. Your completed registration form can be submitted electronically or by mail. To submit the Product Warranty Registration form electronically, please complete this form online at http://www.toshiba.com/ind/warranty.

All items marked with an asterisk (*) are required.

SECTION I • Company Information

*Company Name:

*First Name: *Last Name:

*Title:

*Address:

*City: *State: *ZIP Code:

*Country:

*Work Phone Number: ( )

*Email Address:

Company Website:

SECTION II • Product Information

*Product: ☐ Drive ☐ Motor ☐ UPS ☐ Other:

*Model Number:

*Serial Number:

*Date of Installation:

*Company Purchased From:

City: State: ZIP Code:

Country:

Authorized Start-Up Agent Certificate Number:

Section III • Additional Information

If you would like to receive additional information about your recently purchased Toshiba product and/or information on additional Toshiba Industrial products and services, please complete the following sections.

- Additional Information on Product Offerings:

☐ Product Repair Training
☐ Product Application Training
☐ Extended Warranty Options
☐ Maintenance Agreements

- Additional Information on Toshiba Industrial Products:

☐ Motors
☐ Motor Starters
☐ Drives
☐ Solid State Starters
☐ Instrumentation
☐ Programmable Logic Controllers
☐ Uninterruptible Power Systems
☐ Contactors
☐ Other:

P/N 44668-001

TOSHIBA
Leading Innovation >>>

Dist Mktg. QC

1. SCOPE

To give the recommended guidelines for electric motor relubrication.

2. START UP

Toshiba motors are properly greased at the time of manufacture. It is recommended that motors which have been stored for a period of six months or more be relubricated prior to starting (See Table 1) using a standard hand held grease gun. (Typically, low pressure hand held grease guns deliver approximately 1.25 grams/pump.)

Frame Size	Quantity of Pumps
143-256	2 to 3 strokes
284-405	4 to 5 strokes
444 and larger	6 to 10 strokes

Table 1: Recommended relubrication quantity for stored motors

Relubrication of electric motors should be part of a planned maintenance program.

Make sure grease nipples are clean and free from dirt before regreasing. Always use grease that is fresh and free from contamination.

Toshiba motors may be equipped with an automatic grease relief fitting, a grease plug or a grease outlet cover plate.

Grease leakage around the shaft hole could indicate over-packing. Excess grease should be purged by operating the motor temporarily with the relief open.

It may be necessary to remove an automatic grease relief fitting due to hardening of grease. Motors utilizing a grease plate may require that old grease be scrapped out a minimum of once every two years.

3. STANDARD SERVICE

1. Select the proper service condition from Table 2.
2. Select the frequency from Table 3 for horizontal motors or Table 4 for vertical motors.
3. Select the volume from Table 5 for horizontal motors or Table 6 or 7 for vertical motors.
4. Before greasing make sure fittings are clean and free from dirt.
5. Remove relief plug or plate and pump the required amount of grease using a low pressure hand held grease gun.

6. It is important that the machine be relubricated while it is running. Allow the motor to run with the grease outlets open for the following recommended time periods before replacing hardware;
   - 143T to 365T - 20 to 30 minutes
   - 405T and larger - 30 to 60 minutes

7. Used grease may not always come out of the grease outlet when new grease is pumped in. Use the recommended volumes to avoid over-greasing.

Service Conditions	
Standard Duty	Eight hours per day. Light to normal loading. Clean condition, free from dust.
Severe Duty	24 hours per day. Light to normal shock loading, vibration. Exposure to dirt or dusty conditions.
Very Severe Duty	24 hours per day. High ambient temperature. Normal to high shock loading, vibration. Dusty conditions. Confined mounting conditions.

Table 2: Description of Service Conditions

Sync. RPM Range	Frame Size	Type of Service		
		Standard Duty	Severe Duty	Very Severe Duty
3600 - 3000	143 - 256	8 mo	4 mo	1 mo
1800 - 750		30 mo	12 mo	4 mo
3600 - 3000	284 - 365	8 mo	4 mo	1 mo
1800 - 750		24 mo	12 mo	4 mo
3600 - 3000	404 - 5811	8 mo	4 mo	1 mo
1800 - 750		18 mo	8 mo	3 mo

Table 3: Horizontal Motor Lubrication Schedule

Sync. RPM Range	Frame Size	Type of Service		
		Standard Duty	Severe Duty	Very Severe Duty
3600 - 3000	180 - 250	8 mo	4 mo	1 mo
1800 - 750		30 mo	10 mo	3 mo
3600 - 3000	280 - 360	8 mo	3 mo	1 mo
1800 - 750		24 mo	8 mo	3 mo
3600 - 3000	400 - N449	4 mo	2 mo	1 mo
1800 - 750		18 mo	6 mo	2 mo

Table 4: Vertical Motor Lubrication Schedule

Frame Range	Bearing Size	Periodic Grease Amount
143 to 256	6205 / 6206	3 grams
	6207 / 6208 / 6305	5 grams
	6306	10 grams
	6308 / 6309	20 grams
284 to 365	6211	10 grams
	6309	20 grams
	6310 / 6312	30 grams
	6314	50 grams
404 to 5811	6216	20 grams
	6313/NU313 /NU317	30 grams
	NU318 / NU320	50 grams
	6317 / 6318	80 grams
	6320 / 6322 / 6324	80 grams
	NU322 / NU324	80 grams
	NU328 / NU228	100 grams

Table 5: Horizontal Motor Bearing Relubrication Volumes

Frame Range	Bearing Size	Periodic Grease Amount
180HP	6306	7 grams
210HP to 280HP	6308	10 grams
	6309	13 grams
	6310	15 grams
320HP to 360HP	6311	17 grams
	6312	20 grams
400HP to N449HP	6313	23 grams
	6314	26 grams
	6315	30 grams
	6318	41 grams

Table 6: Vertical Motor Bearing Relubrication Volumes

Frame Range	Bearing Size	Periodic Grease Amount
180LP	7306B	14 grams
210LP to 280LP	7308B	21 grams
	7309B	25 grams
	7310B	30 grams
320LP to 360LP	7311B	35 grams
	7312B	40 grams
400LP to N449LP	7313B	46 grams
	7314B	53 grams
	7315B	56 grams
	7318B	82 grams

Table 7: Vertical Motor Angular Contact Bearing Relubrication Volumes

Notes:
1. When relubricating roller bearings divide the monthly service time by two.
2. See Table 2 for definitions of Service Conditions
3. Gram quantity when using a typical low pressure hand grease gun is approximately 4 pumps for 5 grams.

4. RECOMMENDED GREASES

Confirm if the motor nameplate has specified the grease used.

Standard, 840 and 841 motors greased at the factory will use:

Grease Name:	Mobil Polyrex EM or equivalent
Manufactured By:	Exxon Mobil Corporation
Operating Ambient Temp.:	-30°C to 50°C

5. RECOMMENDED GREASES FOR STANDARD APPLICATIONS

Use the following greases listed for the given temperature range, unless otherwise indicated on the motor grease nameplate:

Operating Ambient Temp. -30°C to 50°C	
Chevron SRI	Chevron Products Co.
Exxon Unirex N 2	Exxon Mobil Corp.
Polyrex EM	Exxon Mobil Corp.
Shell Dolium R	Shell Oil Co.
Mobilith SHC 100	Exxon Mobil Corp.

6. RECOMMENDED GREASES FOR SPECIAL APPLICATIONS

The following greases recommended for special applications only and should be used only for motors specifically built for such conditions.

Minimum Ambient Temp. -60°C	
Beacon 325	Exxon Mobil Corp.
Maximum Ambient Temp. 90°C	
Dow Corning 44	Dow Corning Corp.
Unirex S 2	Exxon Mobil Corp.
Triton 460	ConocoPhillips Co.
Mobilith SHC 460	Exxon Mobil Corp.

WARNING: In general it is not recommended to mix greases of different brands. The mixing of different types of thickeners may destroy the composition and physical properties of the grease. In the event that a different grease is required by the end user, the following steps can be taken; using the instructions for lubrication, open grease outlet and purge the system as much as possible of the old or unwanted grease. Repeat this same operation after 1 week of service. Consult TOSHIBA/HOUSTON Engineering for further recommendations on grease compatibility.

REVISION HISTORY

REV No.	DATE	BY	DESCRIPTION
0	01/24/1996	I. Marquez	First Issue
1	07/31/2008	S. Johnson	Added Vertical Motor Relubrication Schedule Updated list of recommended greases
2	4/29/2013	R. Roth	Change Std. Grease from Chevron SRI and Include Frame Sizes to 5811.

TOSHIBA INTERNATIONAL CORPORATION
13131 W. Little York Rd.
Houston, Texas 77041
Phone: 713-466-0277
Fax: 713-466-8773

STORAGE INSTRUCTIONS

Short Term Storage

If the equipment is not put into immediate use it should be stored in a clean, dry location. Care should be taken to keep the equipment covered when moving from a cold location to a warm location, otherwise condensation may occur. If condensation does occur, and the equipment is moist, allow it to dry thoroughly before applying power.

Long Term Storage

1. Cover machined metal parts with weatherproof cover, but leave ventilating area exposed.

2. Make certain unpainted portions are covered and retouch any scratches or flaked areas.

3. If condensate plugs or drain plugs have been used, make sure they are operative.

4. Cover completely with plastic cover and insert silica-gel bags inside the cover for moisture control.

5. If motor is equipped with space heaters make sure space heaters are properly connected and operative. The motor interior temperature should be maintained approximately 5.6º C (10º F) above ambient.

6. A systematic inspection and maintenance schedule should be established. If rotating apparatus is to be stored for 6 months or longer, it should, in addition to the minor precautions above, be given a megger test every 3 to 6 months. A minimum reading of 10 megohoms is recommended. A record of insulation values, temperature, time, humidity and length of voltage application should be recorded to show winding conditions prior to start up.

7. If windings are designed for outdoor operation, they will not be affected by extreme or sudden temperature changes or inclement weather in general. However a weather proof cover with provisions for adequate ventilation should be used to guard against intrusion of salt, dust, or other abrasive or corrosive material.

8. It is recommended that the rotor be turned every month to redistribute the lubricant in the bearings and oil or grease be added every 6 six months.

9. Preferably, storage would be in a warehouse or enclosed building but the same precautions should be followed.

SECTION 9

ANNUAL INSPECTION

9A GENERAL INFORMATION Page 9-1

9B INSPECTION CHECKLIST Page 9-2

SECTION 9

ANNUAL INSPECTION

9A GENERAL INFORMATION

FKC recommends that the screw press be thoroughly inspected on an annual basis in order to:

1. Optimize screw press performance
2. Maximize equipment life
3. Minimize the chance of unscheduled maintenance shutdowns.

To maximize equipment life, a detailed annual inspection helps in uncovering minor problems that, if caught soon enough, can be corrected before becoming major problems. Since the rotational speed of the FKC Screw Press is very low, wear on sprockets, couplings, screw flight, etc. occurs very slowly. By catching wear in the early stages, lubrication procedures or operational procedures may be modified to slow the rate of wear thereby extending equipment life.

An annual inspection is a good time to check screen deformation and lubrication procedures. If significant screen bulging or damage is found, then screens should be changed before they fail completely. Changing damaged screens during a scheduled shutdown is generally more economical than waiting until they completely fail and changing them during an unscheduled shutdown.

The Screw Press Inspection Checklist on the following page can be used as a general guide during an annual inspection.

SCREW PRESS INSPECTION CHECKLIST

PRESS #:	DATE:	INSPECTOR:

ITEM #	CHECKPOINT DESCRIPTION	√	COMMENTS
1	SCREEN DEFORMATION/DAMAGE LOW PRESSURE DRUMS EXTERIOR SURFACE		
2	SCREEN DEFORMATION/DAMAGE HIGH PRESSURE DRUMS EXTERIOR SURFACE		
3	INSPECT FOR CORROSION OF HIGH AND LOW PRESSURE DRUM SECTIONS/BOLTS		
4	INSPECT SPEED REDUCER, SPEED VARIATOR, AND ALL OIL SEALS FOR OIL LEAKAGE		
5	VERIFY PROPER LUBRICATION OF: a) SPEED REDUCER b) OUTLET STAND BEARING		
6	VERIFY HEADBOX LEVEL TRANSMITTER CALIBRATION		

SECTION 10

PERFORMANCE DATA

10A GENERAL INFORMATION Page 10-1

10B SCREW PRESS TRIAL DATA SHEET Page 10-2

SECTION 10

10A GENERAL INFORMATION

As sludge characteristics change, operating parameters may need to be re-defined. In order for FKC Co., Ltd. to provide additional operational advice and instruction, please begin to develop a performance profile for the screw press by recording the following data:

- Date
- Time
- Inlet sludge consistency
- Inlet sludge flow
- Inlet sludge non-volatile solids
- Inlet sludge fiber content (150 mesh screen)
- Outlet consistency
- Filtrate solids
- Solids throughput
- Polymer name
- Polymer percent activity
- Polymer density
- Polymer ratio setpoint
- Polymer pump maximum speed
- Polymer makedown water flow
- Polymer active dosage
- Solids capture rate
- Screw press motor load
- Screw press speed
- Headbox level setpoint
- Headbox highest level reached
- Headbox lowest level reached
- Headbox periodicity (time to go from one highest level reached to the next time it is reached)
- Drum number where majority of drainage occurs
- Flocculation tank agitator speed
- Floc size (small,medium,large)
- Floc strength (weak,average,strong)

Use the attached Data Sheets or a similar form for record keeping.

10B SCREW PRESS TRIAL DATA SHEET

| # | Data | Units | | |

Flocculation Tank

EQUIPMENT SUMMARY FORM

Owner:	City of Rock Island, WA	**Date:**	1/15/2020
Contractor:	DBJ Construction LLC		
Project Name:	Screw Press Dewatering Equipment Procurement	**Project No.:**	10612

Summary of Equipment

1. Equipment Item: Flocculation Tank
2. Manufacturer: FKC Co., Ltd.
3. Equipment ID No.(s) Flocculation Tank SP-FT
4. Location of Equipment Dewatering Building
5. Weight of Individual Components (Over 100 Pounds)

   Gearbox 543 lbs.

6. Nameplate Data:

Horsepower	0.5 HP
Amperage	0.92A
Voltage	460 VAC
Service Factor (S.F.)	1.15 SF
Speed	1800 rpm
ENC Type	TEFC
Capacity	
Other	

7. Manufacturer's Local Representative:

Name:	Victor Pedroni
Address:	4580 Klahanie Dr. SE #271, Issaquah, WA 98029
Phone Number:	1-425-369-6164

8. Maintenance Requirements:

   Gearbox - FIRST 500 HRS Change out oil.

   Gearbox - EVERY 10,000 HRS Change out oil.

9. Lubrication List:

   Gearbox oil - VG680 Mobil SHC636 or equivalent.

10. Spare Parts: (recommendations):

    None.

11. Comments:

    Tank & piping should be emptied when not in operation and under freezing conditions .

Table of Contents - Flocculation Tank

Section 1	General Description	
Section 2	Operation	
Section 3	Maintenance Instruction	
Section 4	Equipment Drawings	
Section 5	Commercial Parts Information	

SECTION 1

GENERAL DESCRIPTION

The FKC Flocculation Tank is designed to optimize the mixing of sludge and polymer prior to dewatering. Typically, conditioned sludge from the flocculation tank flows into a rotary screen thickener or screw press for dewatering.

Optimum mixing of the sludge and polymer benefits the dewatering system operator in two ways. First, by controlling the mixing energy involved, polymer dosage is minimized. Too little agitation and the polymer does not disperse fully in the sludge. This results in some un-reacted polymer scattered throughout the sludge. Too much agitation and the flocculated sludge particles are broken up before they make it to the next process. Excessive agitation requires excessive polymer to hold the flocculated particles together. Optimum agitation results in optimum polymer usage. Second, the flocculation tank is sized to allow sufficient retention time for the polymer to react with the sludge. With too little retention time the sludge does not have sufficient time to flocculate prior to exiting the tank.

The open top flocculation tank also allows the dewatering system operator to visually check the conditioning of the sludge as it overflows to the screw press. The visual check is a very fast and simple method of verifying proper floc tank operation.

The flocculation tank consists of a tank with the sludge /polymer inlet on the bottom and the conditioned sludge overflow on one side near the top. The flocculation tank is supplied with a variable speed top mounted agitator for controlled mixing of the sludge and polymer. The agitator speed is adjusted with either a mechanical speed variator or a variable speed motor.

2

SECTION 2

OPERATION

START-UP

- Start-up of the flocculation tank is normally performed in conjunction with the rotary screen thickener and/or screw press start-up.

- Verify that the agitator gear reducer is properly lubricated and that the agitator mounting bolts are tight.

- Start the flocculation tank agitator motor. Verify proper rotation. The axial vane impellers should force the sludge downwards towards the inlet to provide for proper mixing of the sludge and polymer.

- Begin polymer flow. Begin sludge flow.

OPTIMIZING PERFORMANCE

Optimum sludge conditioning involves minimizing polymer costs while producing a flocculated sludge that can be mechanically dewatered by the equipment that follows. The flocculation tank is the last element of the sludge conditioning system. For optimum performance of the flocculation tank, the other elements in the system must first be optimized.

Factors affecting the performance of the conditioning system include: polymer selection, post make-down concentration, polymer age, post dilution water addition, and polymer injection point location(s). Polymer sales representatives should be consulted to determine the best polymer for each application and for recommendations on polymer makedown equipment, tanks and pumps. Optimum post make-down concentration and post dilution water addition is normally determined after equipment startup.

FKC recommends that the polymer injection point be within five feet of the flocculation tank inlet to prevent uncontrolled mixing of the polymer and the stillage prior to entering the tank.

SHUT DOWN

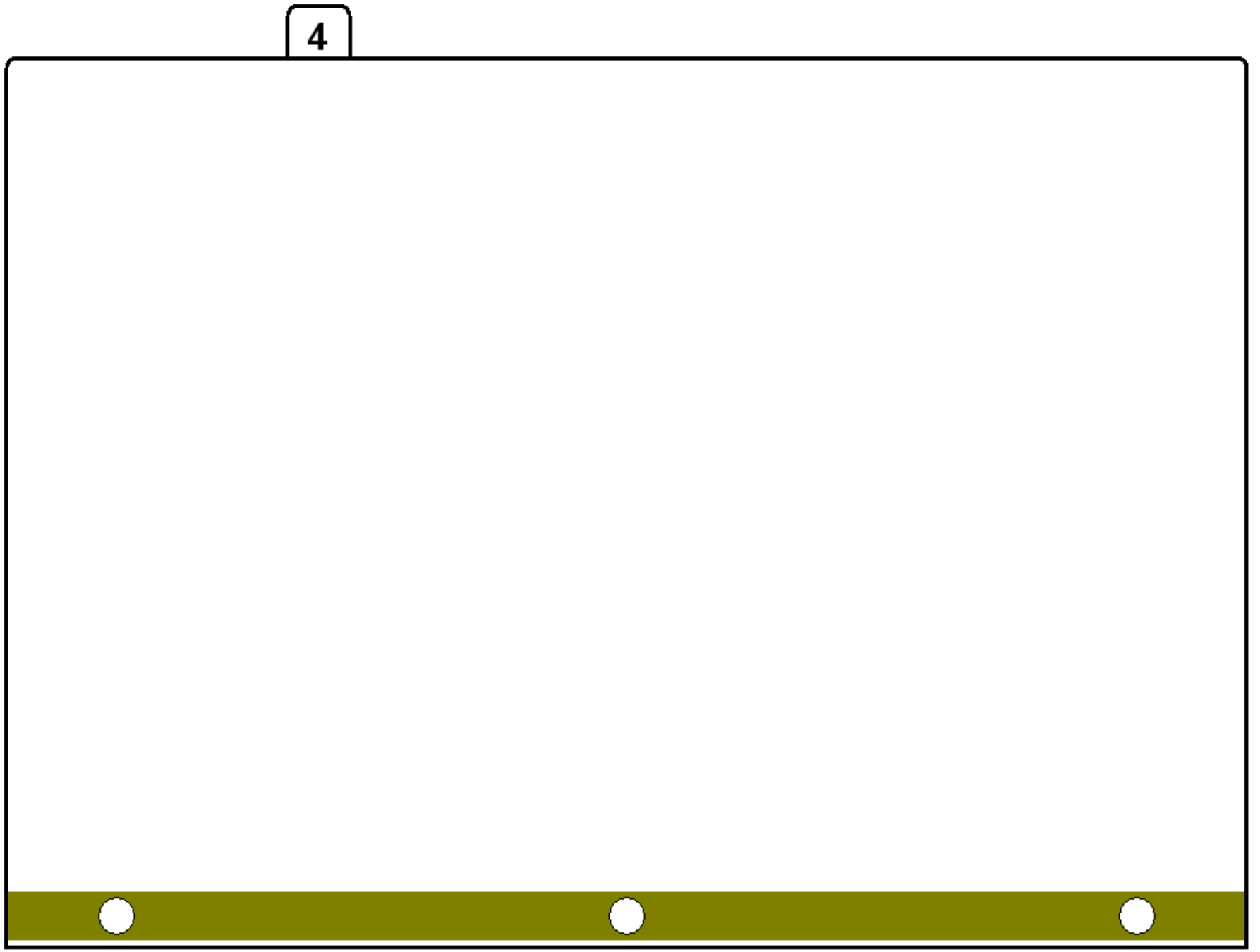
- Stop sludge flow. Stop polymer flow. Stop Floc Tank agitator motor.

- Drain the flocculation tank if the dewatering system will be shut down for an extended period of time.

SECTION 3

MAINTENANCE

The oil level and oil quality in the agitator drive should be checked at frequent intervals due to the wet, humid, and dirty atmosphere that the equipment normally operates in. Oil changes are required at intervals of 20,000 operating hours or every four years, whichever comes first. See the Lubrication Schedule for details.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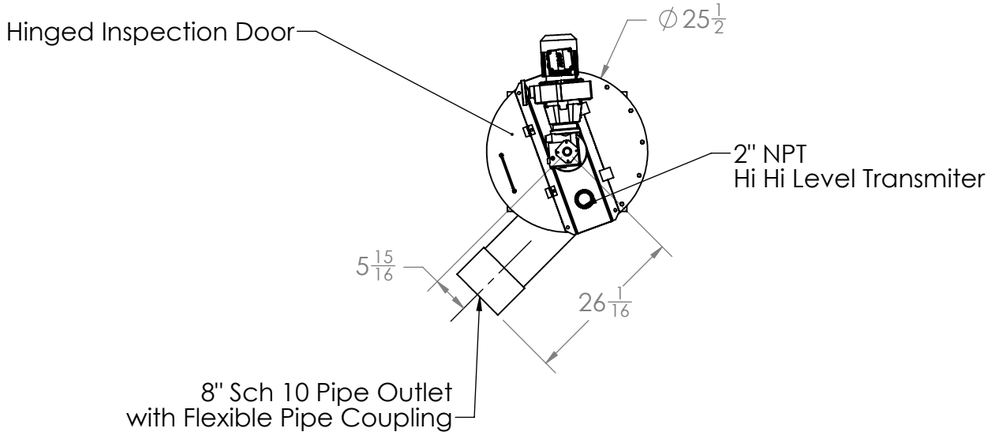
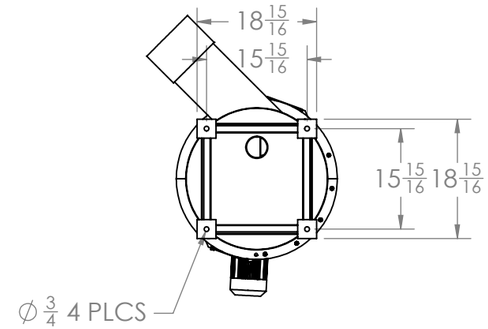
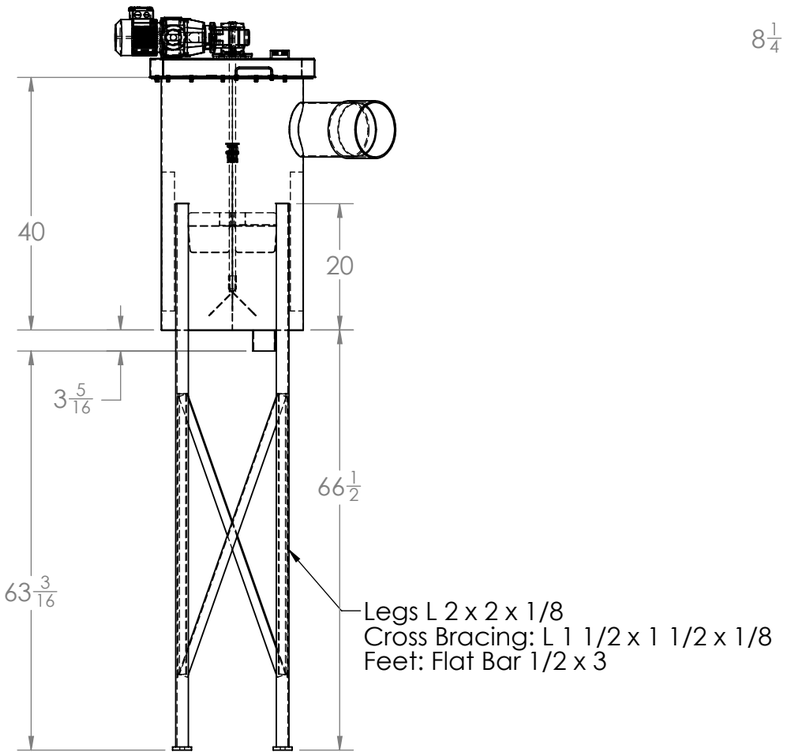
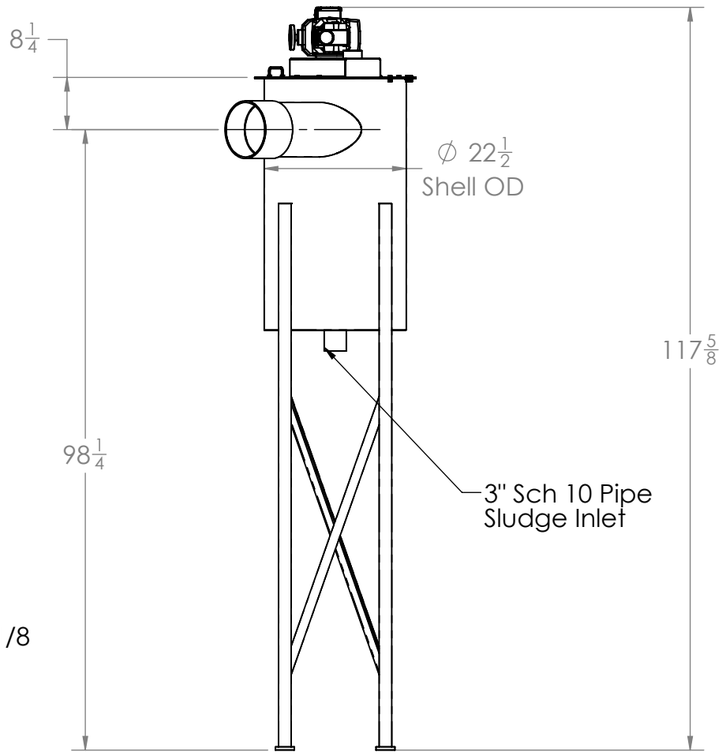




Bottom View





Note:
1. Tank Material 304 S.S. 14ga.
2. Tank Volume: 55 Gallons
3. Equipment Weight: 400 Lbs.
4. Operating Weight: 862 Lbs.
5. Gear Reducer: SEW SAF37D16BDRS71S4 43.68:1 Ratio
6. Motor: SEW 1/2 Hp, 1800 RPM, 230-480 VAC
7. Agitator Speed 8~40 RPM.
8. Agitator Speed is manually controlled.

Job No.	Customer	Wt. Lbs.
FT-408	Rock Island WWTP Rock Island, WA	
Drawing No.	Title	Quantity
A408-200	55 Gallon Flocculation Tank Assembly Details	1
		Date
		5/6/13
	FKC CO. LTD 2708 W 18th St. Port Angeles, WA 98363 (360) 452-9472 Fax (360) 452-6880	Drawn By
		RTB

No.	Alteration	Date	Sign
2			
1	Issued as Certified	9/25/19	RTB
0	Issued for Approval	8/1/19	RTB

Revision

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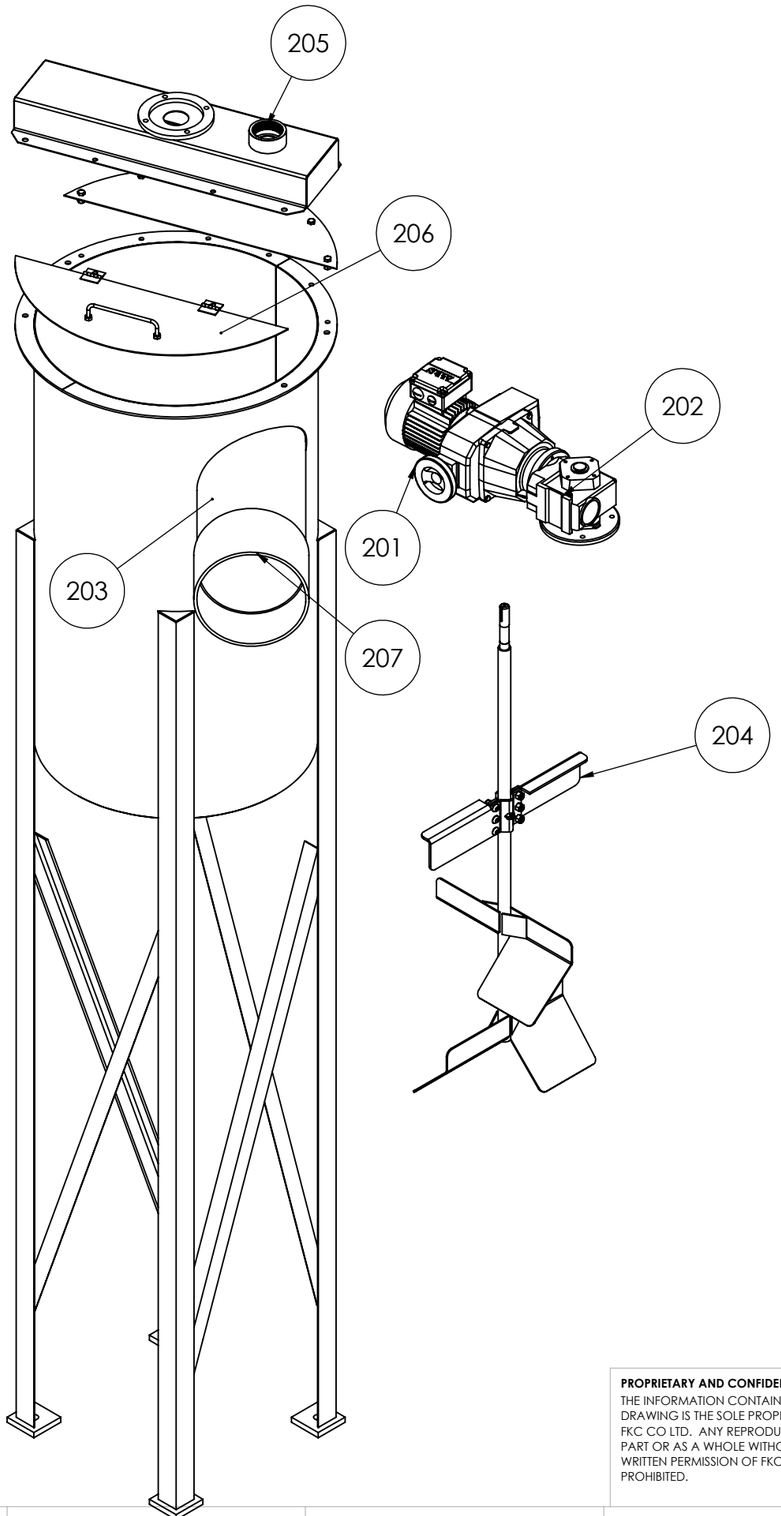

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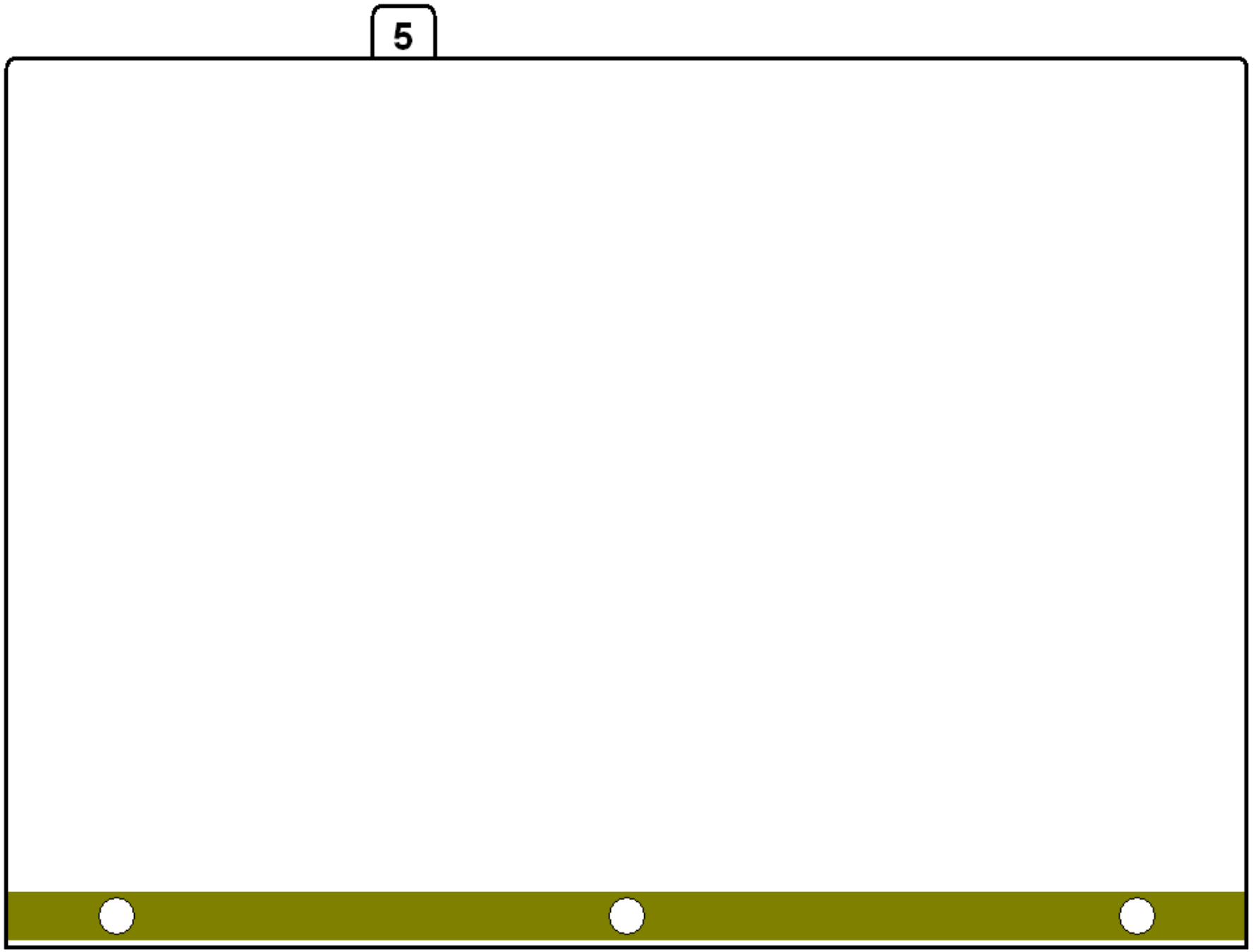
No.	Alteration	Date	Sign
2			
1	Issued as Certified	9/25/19	RTB
0	Issued for Approval	8/1/19	RTB

Job No. FT-408	Customer Rock Island WWTP Rock Island, WA	Wt. Lbs.
Drawing No. G408-201	Title 55 Gallon Flocculation Tank Parts list	Quantity 1
		Date 5/6/13
FKC	FKC CO. LTD 2708 W 18th St. Port Angeles, WA 98363 (360) 452-9472 Fax (360) 452-6880	Drawn By RTB
	Revision	SHEET 2 OF 2

City of Rock Island, WA WWTP
FKC Bill of Materials
FLOCCULATION TANK

	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Flocculation Tank	Manufacturer	Part Number	Quantity	Item #	Material of Construction
Motor	SEW Eurodrive	DRS71S4	1	201	CS
Gear Box	SEW Eurodrive	SAF37D16B	1	202	CS
Tank Body	FKC	55 Gallon	1	203	14 ga. 304L SS
Agitator Shaft	FKC	--	1	204	304L SS
Mixer Base	FKC	--	1	205	304L SS
Lid	FKC	--	1	206	304L SS
8" Flexible Pipe Coupler	Fernco	1056-88	1	207	Rubber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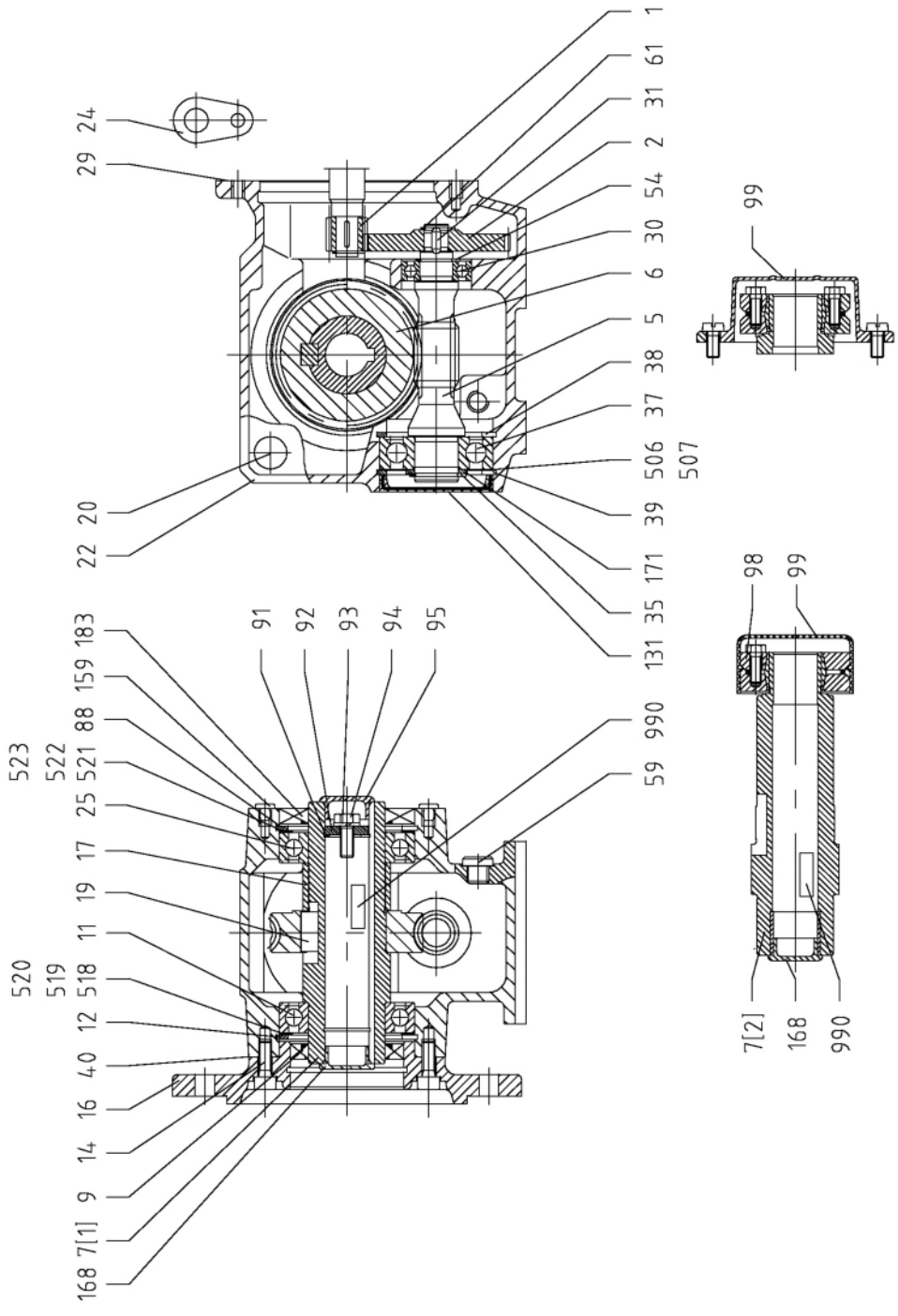
SEW
Gearbox

Parts List

Helical-worm gear unit
SAF37, SHF37

28 260 12 96

SEW EURODRIVE



Mount-on gear units have motors, variable speed gear units or special input shaft assemblies mounted on the drive end. For parts see appropriate parts list.
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
1	Pinion			*	1
2	Gear			*	1
5	Worm			*	1
6	Worm gear			*	1
7	Hollow Shaft	SAF37	Ø 20 mm	01671480	1
7	Hollow Shaft	SAF37; stainless; ASEPTICplus	Ø 20 mm	00453021	1
7	Hollow Shaft (inch)	SAF37	Ø 0,750 in.	01671588	1
7	Hollow shaft for shrink disc	SHF37	Ø 20 mm	06442579	1
7	Hollow shaft for shrink disc	SHF37; stainless	Ø 20 mm	00435848	1
9	Oil seal		DIN AS35x52x7-NBR	00127523	1
9	Oil seal	optional oil seal in FKM; ATEX model according to category II2G, II2D, II3G, II3D; ASEPTICplus	W AS35x52x7-FKM	00175595	1
11	Deep groove ball bearing		6007-Z	00117471	1
12	Circlip		DIN472 62x2-FS	00103217	1
14	Machine screw		ISO4762 M6x16-8.8-A2F	00123145	4
16	Output Flange		Ø 120 mm	01671472	1
16	Output Flange		Ø 160 mm	0167160X	1
17	Spacer tube		Ø35,6xØ40x22mm	01671448	1
19	Key		DIN6885-1 B10x8x18 +C	00110094	1
20	Breather valve		W4087 M10x1-CuZn-HEI	00130303	1
20	Breather valve	stainless; ASEPTICplus	W4087 M10x1-Niro-HEI	00136239	1
22	Gear Housing			06443699	1
24	Eyebolt			01675966	1
25	Deep groove ball bearing		6007-Z	00117471	1
29	Sealing compound			09102558	X)
30	Deep groove ball bearing		6002	00117412	1
31	Key		DIN6885-1 B4x4x8 55HRC	00134899	1
35	Circlip		DIN471 20x1,2-FS	00102717	1
37	Deep groove ball bearing		6304-Z	0010521X	1
38	Circlip		DIN472 52x2-FS	00103195	1
39	Circlip		DIN472 52x2-FS	00103195	1
40	Sealing compound			09102558	X)
54	Circlip		DIN471 15x1-FS	00102679	1
59	Screw plug		W4085 M10x1-St-ADC3K	0011426X	1
61	Circlip		DIN471 11x1-FS	00102644	1
88	Circlip		DIN472 62x2-FS	00103217	1
91	Circlip	SAF37; Hollow shaft Ø 20 mm	DIN472 20x1-FS	00130079	1
91	Circlip	SAF37; Hollow shaft Ø 20 mm; stainless; ASEPTICplus	W4161 20x1-Niro	13227998	1
91	Circlip	SAF37; Hollow shaft Ø 0,750 in.	DIN472 19x1-FS	00130125	1
92	Disc	SAF37; Hollow shaft Ø 20 mm	W4126 6,4x19,8x4-St	00112283	1
92	Disc	SAF37; Hollow shaft Ø 20 mm; stainless; ASEPTICplus	W4126 6,4x19,8x4-A1	13228064	1
92	Disc	SAF37; Hollow shaft Ø 0,750 in.	W4126 0,31x0,74x3/16-St	08069727	1
93	Lock washer	SAF37; Hollow shaft Ø 20 mm, 0,750 in.	W4146 A6-FS-Q3F	00109908	1
93	Lock washer	SAF37; Hollow shaft Ø 20 mm; stainless; ASEPTICplus	W4146 A6-A2	13228129	1
94	Hex head screw	SAF37; Hollow shaft Ø 20 mm	ISO4017 M6x16-8.8-A2F	00101052	1
94	Hex head screw	SAF37; Hollow shaft Ø 20 mm; stainless; ASEPTICplus	ISO4017 M6x16-A2-70	00118540	1
94	Hex head screw	SAF37; Hollow shaft Ø 0,750 in.	ASME-B18 1/4-20x5/8-A2F	08069549	1
95	Closing plug	SAF37	W4299 1-20,7-PE-LD-BK	01147439	1

* Gearing parts have embossed part numbers. These must always be quoted!
X) if required
Mount-on gear units have motors, variable speed gear units or special input shaft assemblies mounted on the drive end. For parts see appropriate parts list.
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
98	Shrink Disc	SHF37	W4941 DK-24x50	00139858	1
98	Shrink Disc	SHF37; stainless	W4941 DK-24x50-Niro	19067739	1
99	Hood Cover	SHF37		06442595	1
99	Hood cover complete	SHF37		06435122	1
99	Hood cover complete	SHF37; ATEX model according to category II2G, II2D, II3G, II3D; stainless		06444768	1
131	Closing cap		W4300 1-52x7	00124435	1
159	Closing plug		W4299 4-5,2-PE-LD-NA	19067801	4
168	Closing plug		W4299 1-20,7-PE-LD-BK	01147439	1
171	Supporting disc		DIN988 S20x28x2-FS	00103438	1
183	Oil seal		W AS35x62x7-NBR	0012740X	1
183	Oil seal	optional oil seal in FKM; ATEX model according to category II2G, II2D, II3G, II3D; ASEPTICplus	W BASF35x62x8/6-FKM	00176125	1
506	Shim		DIN988 42x52x0,1-St	00103756	X)
507	Shim		DIN988 42x52x0,3-St	00103993	X)
518	Shim		DIN988 50x62x0,1-St	00103764	X)
519	Shim		DIN988 50x62x0,3-St	00104000	X)
520	Shim		DIN988 50x62x0,5-St	00104183	X)
521	Shim		DIN988 50x62x0,1-St	00103764	X)
522	Shim		DIN988 50x62x0,3-St	00104000	X)
523	Shim		DIN988 50x62x0,5-St	00104183	X)
990	Contact corrosion inhibitor			09107819	1

X) if required
Mount-on gear units have motors, variable speed gear units or special input shaft assemblies mounted on the drive end. For parts see appropriate parts list.
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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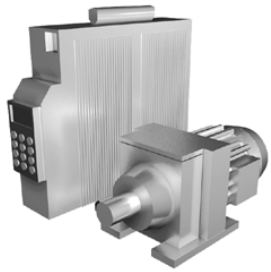
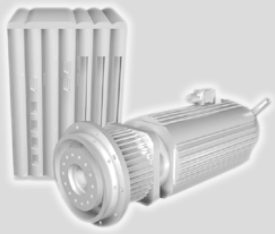
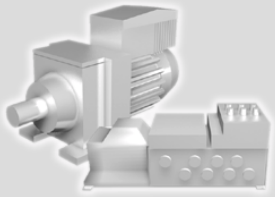
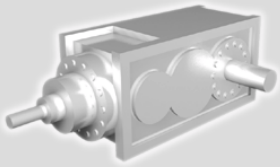
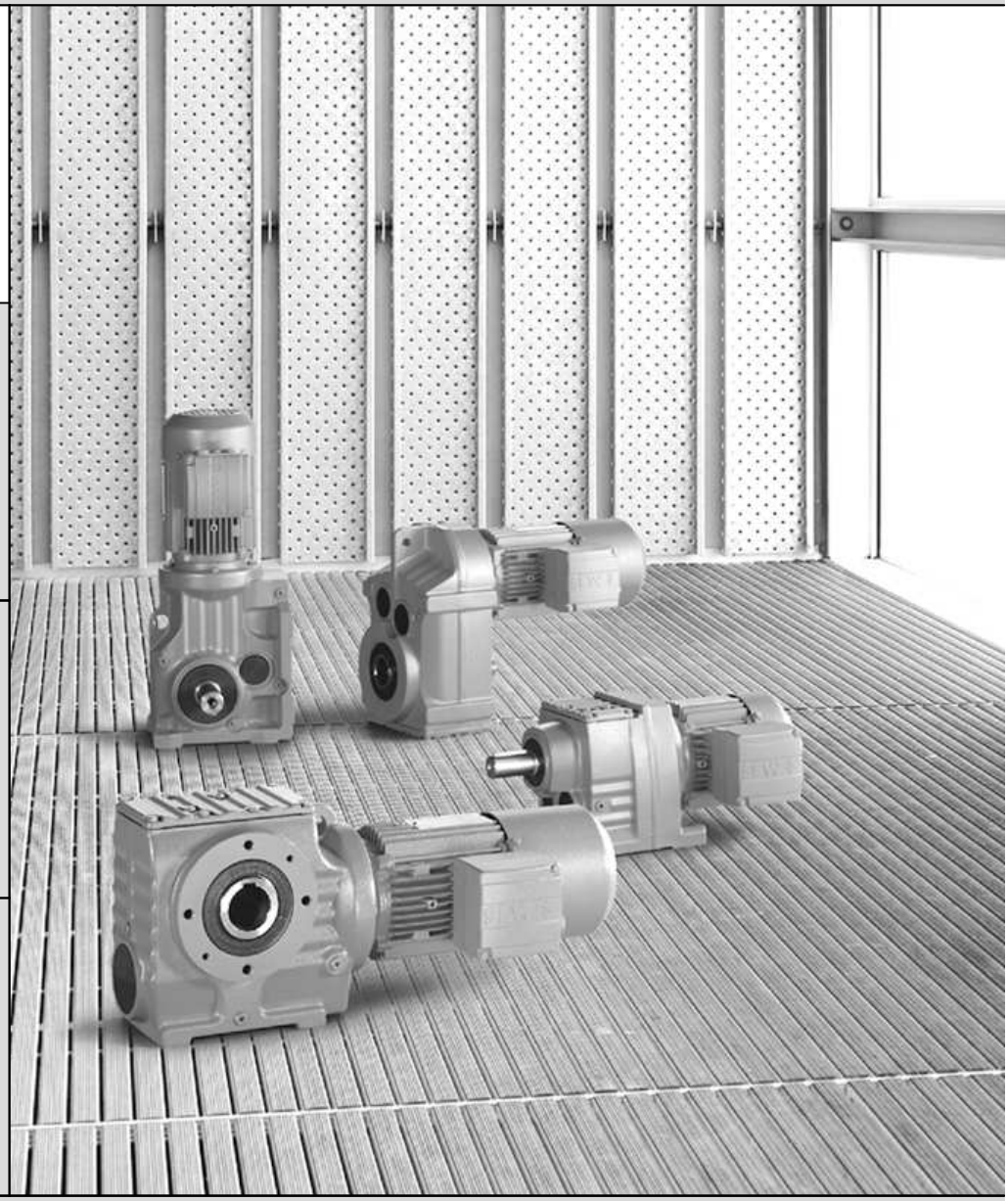
SEW EURODRIVE











Gear Units, R..7, F..7, K..7, S..7 Series, SPIROPLAN® W

Edition 10/2007
11226811 / US

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1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Tips and useful information.

You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under guarantee

Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the gear unit.

- Adjust the lubricant fill volume and position of the breather valve accordingly in the event of a change of mounting position (see Sec. "Lubricants" and "Mounting Positions").
- Follow the instructions in Sec. "Mechanical installation" / "Installing the gear unit"!

Waste disposal

Please follow the latest instructions: Dispose of the following materials in accordance with the regulations in force:

- Steel scrap:
  - Housing parts
  - Gears
  - Shafts
  - Anti-friction bearing
  - Gray-cast iron (if there is no special collection)
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears as appropriate.
- Collect waste oil and dispose of it correctly.

2 Safety Notes

Preface

The following safety notes are primarily concerned with the use of gear units. If using **gearmotors**, please also refer to the safety notes for motors in the relevant operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, gearmotors, gear units and motors have:

- Live parts
- Moving parts
- Hot surfaces (may be the case)

Only qualified personnel may carry out the following work:

- Transportation
- Putting into storage
- Installation / assembly
- Connection
- Startup
- Maintenance
- Servicing

The following information and documents must be observed during these processes:

- Relevant operating instructions and wiring diagrams
- Warning and safety signs on the gear unit / gearmotor
- System-specific regulations and requirements
- National / regional regulations governing safety and the prevention of accidents

Serious injuries and property damage may result from:

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

Gearmotors / gear units from SEW are intended for industrial systems. They correspond to the applicable standards and regulations.

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential that you follow all the instructions!

Transportation

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be that you are not permitted to startup the drive due to the damage.

Tighten installed eyebolts. The eyebolts are only designed for the weight of the gearmotor / gear unit. Do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. The loads and regulations specified in this standard must always be observed. If two eyebolts are available, use both of them for transport. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Extended storage of gear units

Gear units of the "extended storage" type have:

- An oil fill suitable for the mounting position so the unit is ready to run (mineral oil CLP and synthetic oil CLP HC). You should still check the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").
- A higher oil level in some cases (synthetic oil CLP PG / food grade oil). Correct the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").

Comply with the storage conditions specified in the following table for extended storage:

Climate zone	Packaging[1)]	Storage location	Storage time
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

Installation / assembly	Observe the instructions in the sections "Installation" and "Assembly/Removal"!
Startup / operation	Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates. Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode. Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW-EURODRIVE if necessary.
Inspection / maintenance	Follow the instructions in the section "Inspection and Maintenance"!

3 Gear Unit Structure

The following figures are block diagrams. Their purpose is only to make it easier to assign components to the spare parts lists. Discrepancies may occur depending on the gear unit size and version!

3.1 Basic structure of helical gear units

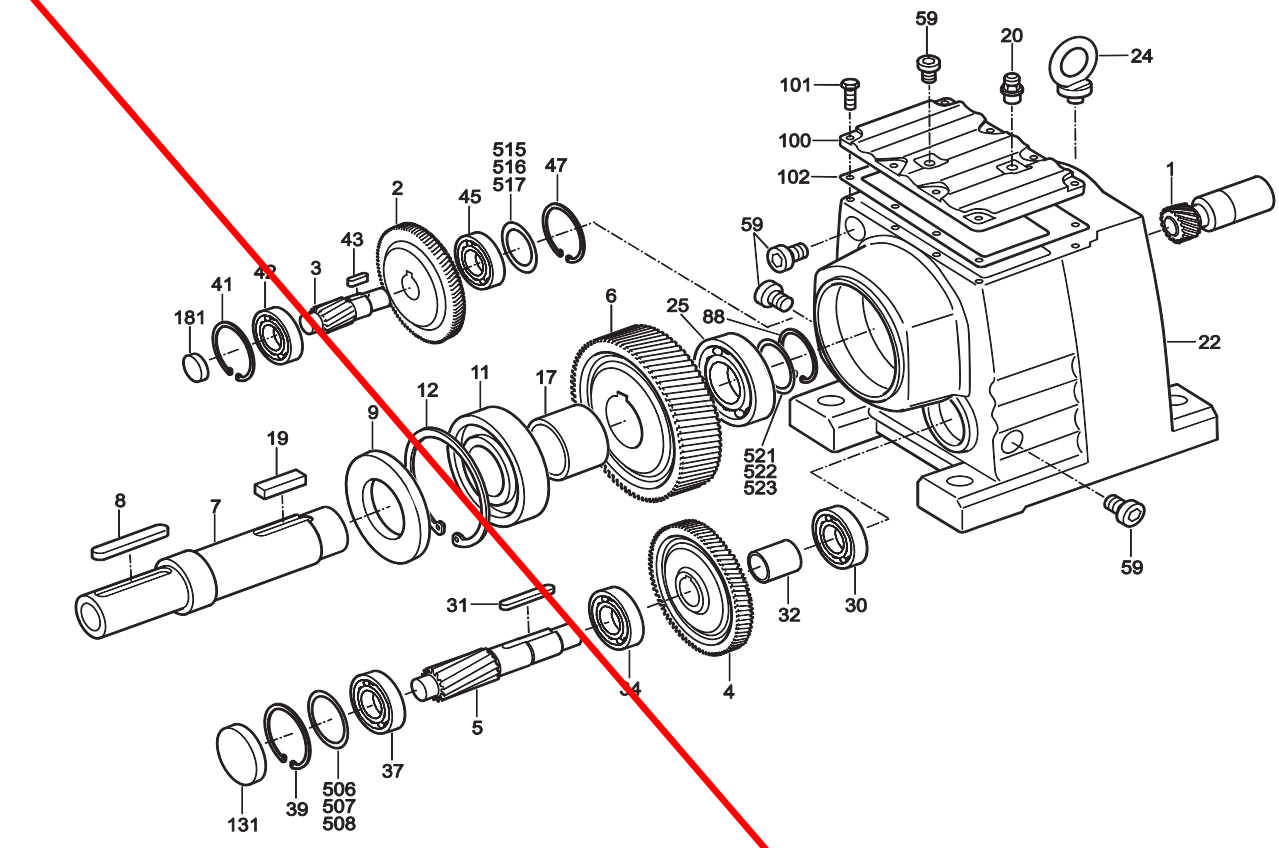

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Figure 1: Basic structure of helical gear units

Key

1 Pinion	19 Key	42 Anti-friction bearing	507 Shim ring
2 Gear	20 Breather valve	43 Key	508 Shim ring
3 Pinion shaft	22 Gearcase	45 Anti-friction bearing	515 Shim ring
4 Gear	24 Lifting eyebolt	47 Circlip	516 Shim ring
5 Pinion shaft	25 Anti-friction bearing	59 Screw plug	517 Shim ring
6 Gear	30 Anti-friction bearing	88 Circlip	521 Shim ring
7 Output shaft	31 Key	100 Gearcase cover	522 Shim ring
8 Key	32 Spacer	101 Hex head bolt	523 Shim ring
9 Oil seal	34 Anti-friction bearing	102 Gasket	
11 Anti-friction bearing	37 Anti-friction bearing	131 Closing cap	
12 Circlip	39 Circlip	181 Closing cap	
17 Spacer	41 Circlip	506 Shim ring	

3.2 Basicstructure of parallel shaft helical gear units

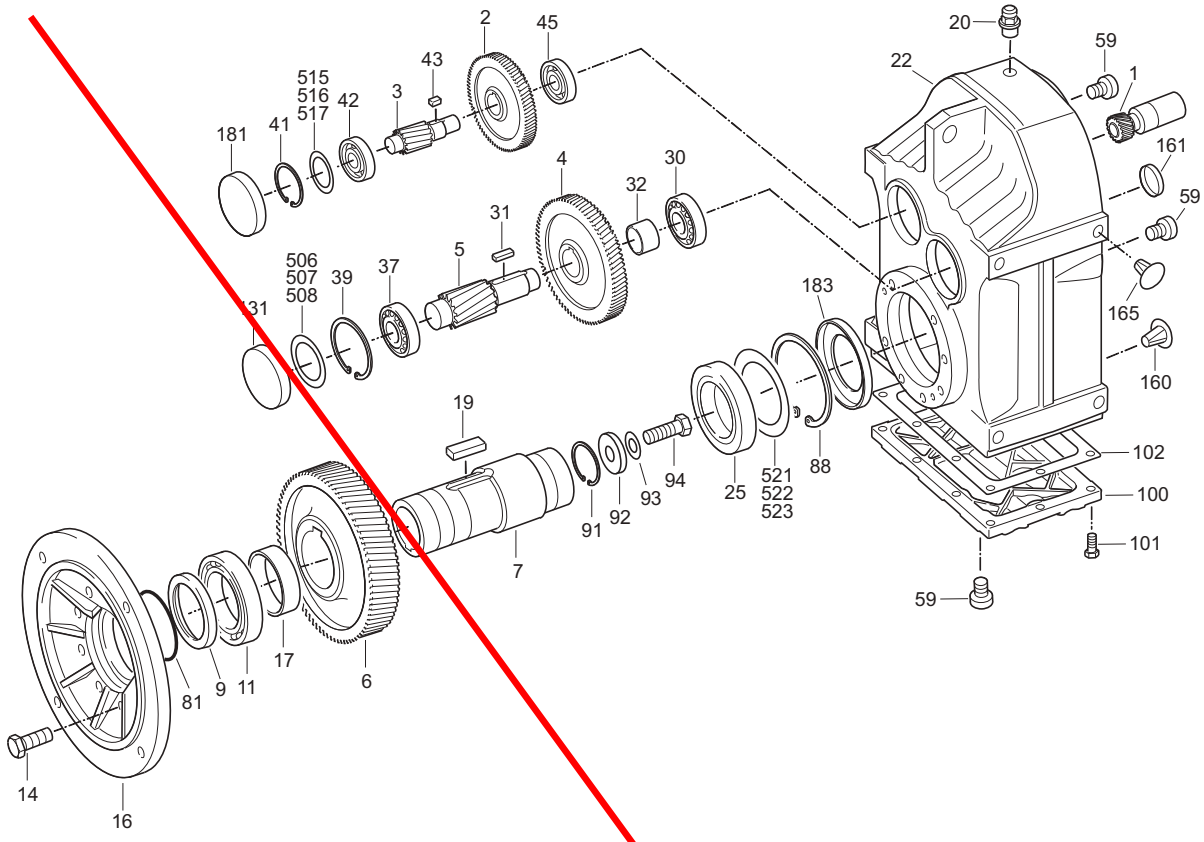

Figure 2: Basic structure of parallel shaft helical gear units

Key

1	Pinion	22	Gearcase	91	Circlip	506	Shim ring
2	Gear	25	Anti-friction bearing	92	Washer	507	Shim ring
3	Pinion shaft	30	Anti-friction bearing	93	Lock washer	508	Shim ring
4	Gear	31	Key	94	Hex head bolt	515	Shim ring
5	Pinion shaft	32	Spacer	100	Gearcase cover	516	Shim ring
6	Gear	37	Anti-friction bearing	101	Hex head bolt	517	Shim ring
7	Hollow shaft	39	Circlip	102	Gasket	521	Shim ring
9	Oil seal	41	Circlip	131	Closing cap	522	Shim ring
11	Anti-friction bearing	42	Anti-friction bearing	160	Closing plug	523	Shim ring
14	Hex head bolt	43	Key	161	Closing cap		
16	Output flange	45	Anti-friction bearing	165	Closing plug		
17	Spacer	59	Screw plug	181	Closing cap		
19	Key	81	O-ring	183	Oil seal		
20	Breather valve	88	Circlip				

3.3 Basic structure of helical-bevel gear units

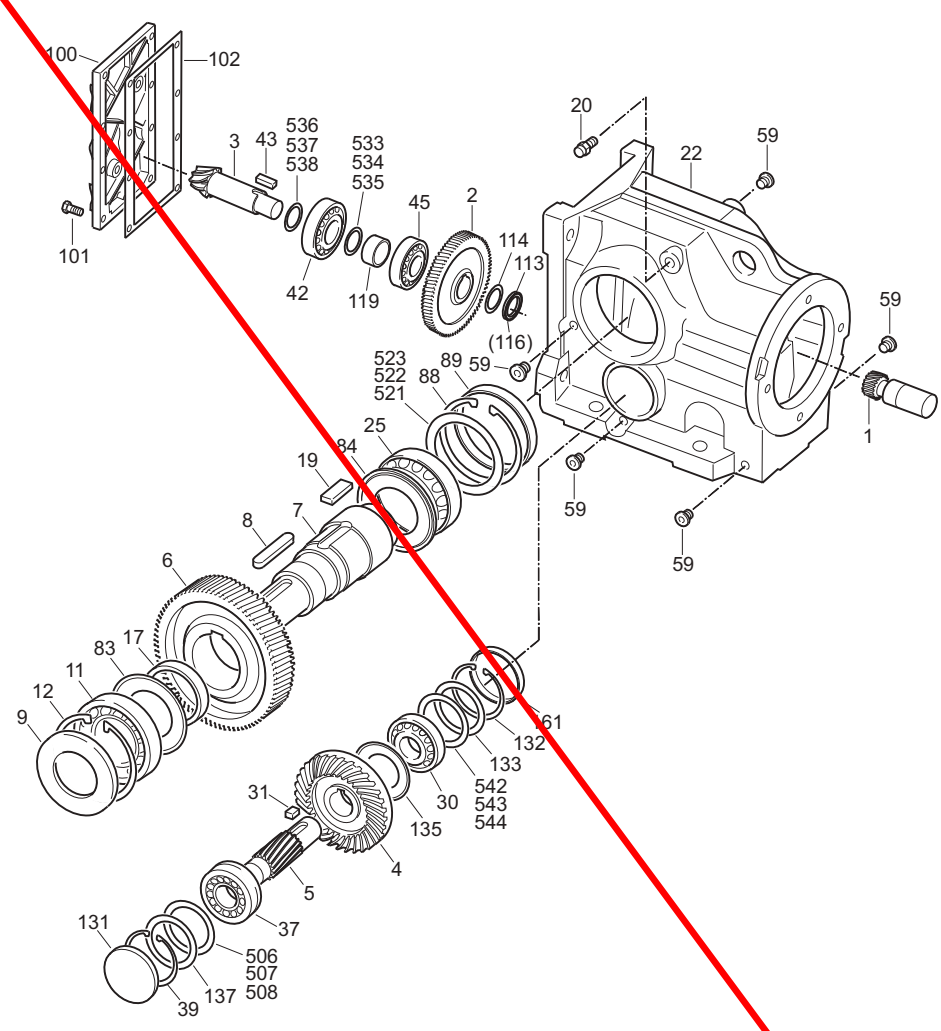

Figure 3: Basic structure of helical-bevel gear units

Key

1 Pinion	25 Anti-friction bearing	102 Adhesive and sealing compound	522 Shim ring
2 Gear	30 Anti-friction bearing	113 Slotted round nut	523 Shim ring
3 Pinion shaft	31 Key	114 Multi-tang washer	533 Shim ring
4 Gear	37 Anti-friction bearing	116 Thread lock	534 Shim ring
5 Pinion shaft	39 Circlip	119 Spacer	535 Shim ring
6 Gear	42 Anti-friction bearing	131 Closing cap	536 Shim ring
7 Output shaft	43 Key	132 Circlip	537 Shim ring
8 Key	45 Anti-friction bearing	133 Spacer	538 Shim ring
9 Oil seal	59 Screw plug	135 Nilos ring	542 Shim ring
11 Anti-friction bearing	83 Nilos ring	161 Closing cap	543 Shim ring
12 Circlip	84 Nilos ring	506 Shim ring	544 Shim ring
17 Spacer	88 Circlip	507 Shim ring	
19 Key	89 Closing cap	508 Shim ring	
20 Breather valve	100 Gearcase cover	521 Shim ring	
22 Gearcase	101 Hex head bolt	521 Shim ring	

3.4 Basic structure of helical-worm gear units

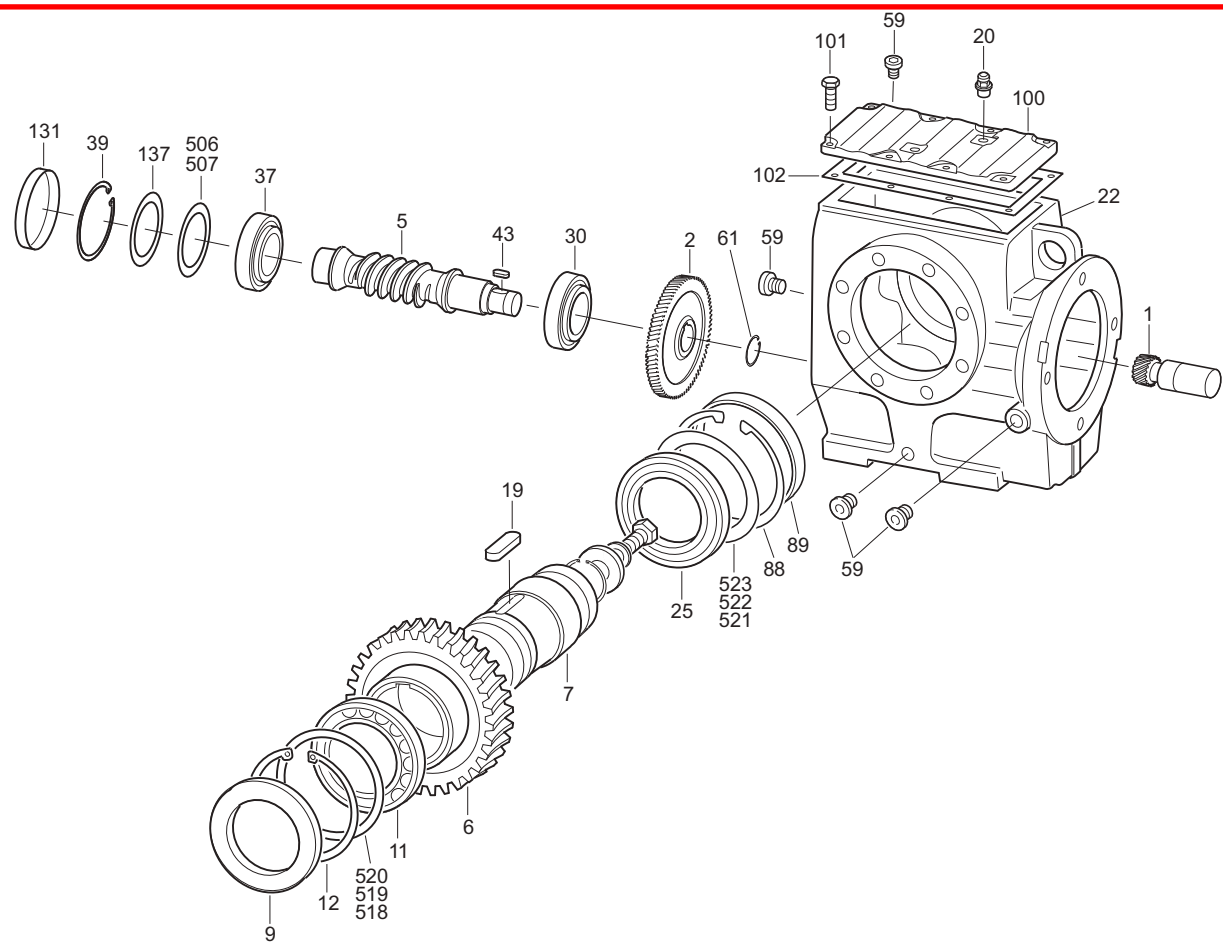

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Figure 4: Basic structure of helical-worm gear units

Key

1	Pinion	20	Breather valve	88	Circlip	518	Shim ring
2	Gear	22	Gearcase	89	Closing cap	519	Shim ring
5	Worm	25	Anti-friction bearing	100	Gearcase cover	520	Shim ring
6	Worm gear wheel	30	Anti-friction bearing	101	Hex head bolt	521	Shim ring
7	Output shaft	37	Anti-friction bearing	102	Rubber seal	522	Shim ring
9	Oil seal	39	Circlip	131	Closing cap	523	Shim ring
11	Anti-friction bearing	43	Key	137	Spacer		
12	Circlip	59	Screw plug	506	Shim ring		
19	Key	61	Circlip	507	Shim ring		

3.5 Basic structure of SPIROPLAN® gear units

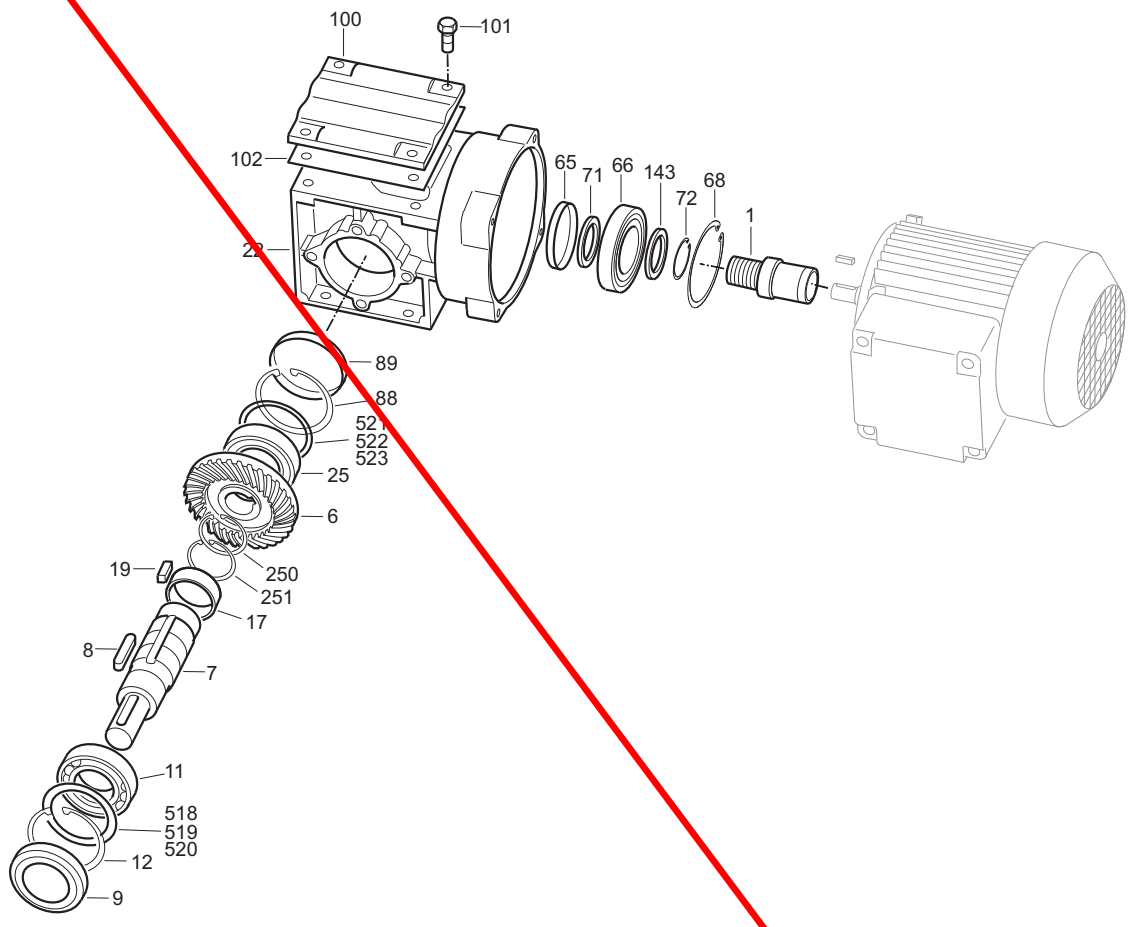


Figure 5: Basic structure of SPIROPLAN® gear units

Key

1	Pinion	19	Key	88	Circlip	251	Circlip
6	Gear	22	Gearcase	89	Closing cap	518	Shim ring
7	Output shaft	25	Anti-friction bearing	100	Gearcase cover	519	Shim ring
8	Key	65	Oil seal	101	Hex head bolt	520	Shim ring
9	Oil seal	66	Anti-friction bearing	102	Gasket	521	Shim ring
11	Anti-friction bearing	71	Spacer	132	Circlip	522	Shim ring
12	Circlip	72	Circlip	183	Oil seal	523	Shim ring
17	Spacer	143	Spacer	250	Circlip		

3.6 Nameplate, unit designation

Sample nameplate

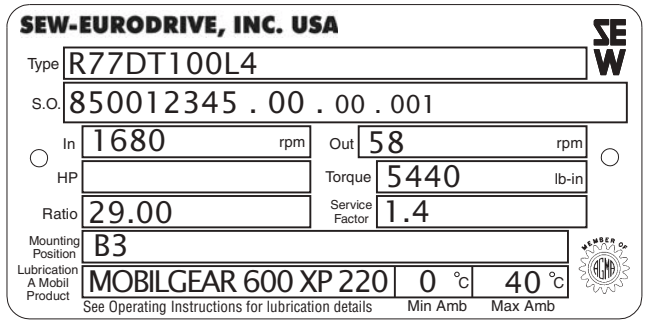
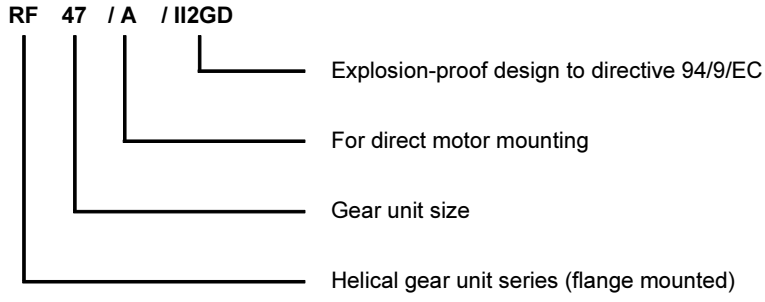


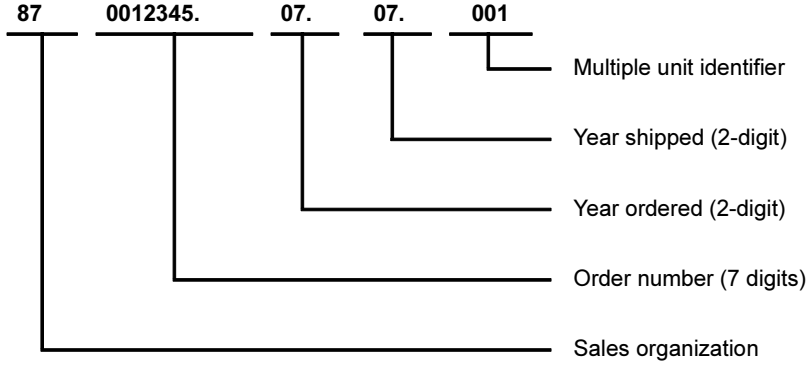
Figure 6: Sample nameplate

Unit designation

Example: Helical gear unit, category II2GD



Example: Serial number



4 Mechanical Installation

4.1 Required tools / aids

- Set of spanners
- Torque wrench for:
  - Shrink discs
  - AQH motor adapter
  - Input shaft assembly with centering shoulder
- Mounting device
- Shims and distance rings if necessary
- Fixing devices for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt adhesive (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not part of the delivery

Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 • ISO k6 for solid shafts with ∅ ≤ 50 mm (1.97") • ISO m6 for solid shafts with ∅ > 50 mm (1.97") • ISO H7 for hollow shafts • Center bore in accordance with DIN 332, shape DR	Centering shoulder tolerance in accordance with DIN 42948 • ISO j6 with b1 ≤ 230 mm (9.06") • ISO h6 with b1> 230 mm (9.06")

4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The data on the nameplate of the gearmotor matches the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:
  - **For standard gear units:**
    Ambient temperature according to the lubricant table in Sec. "Lubricants" (see standard).
    The drive must not be assembled in the following ambient conditions:
    - Potentially explosive atmosphere
    - Oil
    - Acids
    - Gas
    - Vapors
    - Radiation
  - **For special versions:**
    The drive configured in accordance with the ambient conditions.
  - **For helical-worm / SPIROPLAN® W gear units:**
    No large external mass moments of inertia which could exert a retrodriving load on the gear unit.
    [At η' (retrodriving) = $2 - 1/\eta < 0.5$ self-locking]

- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not let the solvent come into contact with the sealing lips of the oil seals – danger of damage to the material!
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

4.3 Installing the gear unit

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. SPIROPLAN® gear units are not dependent on the mounting position.

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

Maximum permitted flatness error for foot and flange mounting (approximate values with reference to DIN ISO 1101):

- Gear unit size ≤ 67: max. 0.4 mm (0.016")
- Gear unit size 77 ... 107: max. 0.5 mm (0.020")
- Gear unit size 137 ... 147: max. 0.7 mm (0.028")
- Gear unit size 157 ... 187: max. 0.8 mm (0.031")

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads!

Secure the gearmotors with bolts of quality 8.8.

Secure the following gearmotors with bolts of quality 10.9:

- RF37, R37F with flange ∅ 120 mm (4.72")
- RF47, R47F with flange ∅ 140 mm (5.51")
- RF57, R57F with flange ∅ 160 mm (6.30")

The oil checking and drain screws and the breather valves must be freely accessible!

At the same time, also check that the oil fill is as specified for the mounting position (see Sec. "Lubricants" / "Lubricant fill quantities" or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position.

Please contact our SEW customer service if you change the mounting position of K gear units to M5 or M6 or between M5 and M6.

Please contact our SEW customer service if you change the mounting position of size S47 S97 S gear units to mounting position M2.

Use plastic inserts (2 ... 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical bleeder resistor < 10^9 Ω. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also install the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

Installation in damp locations or in the open

Drives are supplied in corrosion-resistant versions for use in damp areas or in the open air. Repair any damage to the paint work (e.g. on the breather valve).

When mounting the motors onto AM, AQ, AR, AT adapters, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.

Gear unit venting

No breather plug is required for the following gear units:

- R07 in mounting positions M1, M2, M3, M5 and M6
- R17, R27 and F27 in mounting positions M1, M3, M5 and M6
- SPIROPLAN® W gear units

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

Exceptions:

1. SEW supplies the following gear units with a screw plug on the vent hole provided:
   - Gear units for extended storage
   - Pivoted mounting positions, if possible
   - Gear units for mounting on a slant

   The breather valve is supplied with the unit. Before startup, you must install the breather plug in the location specified.
2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

Activating the breather valve

If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture
2. Remove the transport fixture
3. Breather valve activated

02053BXX 02054BXX 02055BXX

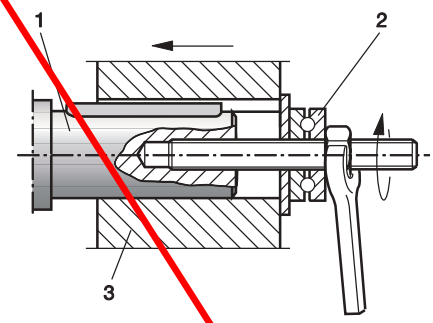
Painting the gear unit

If you paint or respray the drive, ensure that you cover the breather valve and oil seals carefully. Remove the strips of tape after completing the painting work.

4.4 Gear unit with solid shaft

Installing input and output elements

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.



1) Gear shaft end
2) Thrust bearing
3) Coupling hub

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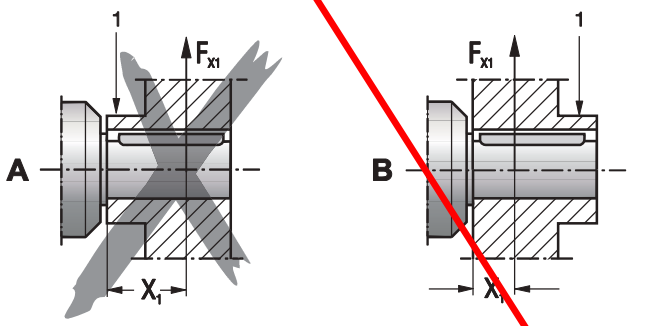
Avoid impermissibly high overhung loads: Install the gear or chain sprocket according to figure **B**.



1 = Hub

A = Unfavorable
B = Correct

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- Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer This will damage the bearings, housing and the shaft!**
- **In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotor" or "Explosion-Proof Drives" catalogs for permitted values).

Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly to 80 ... 100 °C (176 ... 212°F).

Installing couplings

Couplings must be mounted and balanced according to the information provided by the coupling manufacturer:

a) Maximum and minimum clearance

b) Axial misalignment

c) Angular misalignment

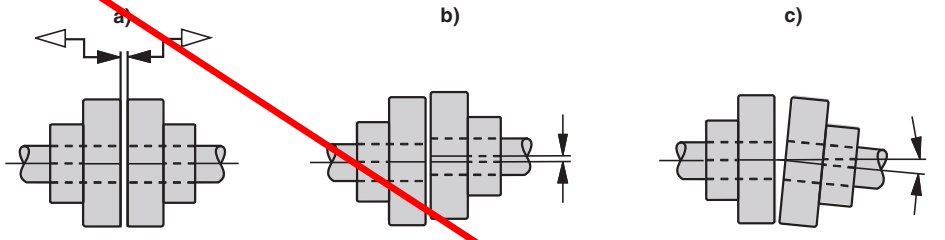


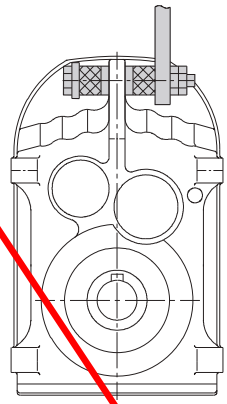
Figure 7: Clearance and misalignment for coupling installation

Input and output elements such as belt pulleys, couplings, etc. must be protected against contact!

4.5 Torque arms for shaft mounted gear units

Do not place torque arms under strain during installation!

Parallel shaft helical gear units

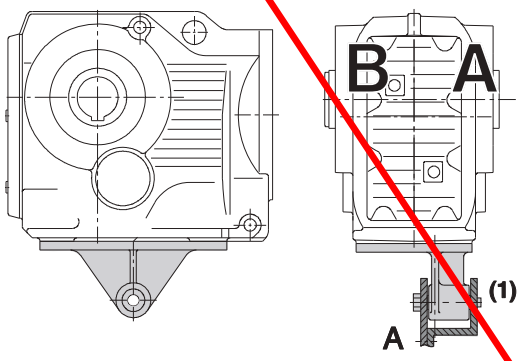


01029BXX

Figure 8: Torque arm for parallel shaft helical gear units

Helical-bevel gear units

- Secure on each side of torque arm→ (1).
- Install connection end B as a mirror image of A.



01030CXX

Figure 9: Torque arm for helical-bevel gear units

Gear unit	Bolts	Tightening torque
KA37	4 × M10 × 25 – 8.8	48 Nm (425 lb-in)
KA47	4 × M10 × 30 – 8.8	48 Nm (425 lb-in)
KA67	4 × M12 × 35 – 8.8	86 Nm (761 lb-in)
KA77	4 × M16 × 40 – 8.8	210 Nm (1858 lb-in)
KA87	4 × M16 × 45 – 8.8	210 Nm (1858 lb-in)
KA97	4 × M20 × 50 – 8.8	410 Nm (3628 lb-in)
KA107	4 × M24 × 60 – 8.8	710 Nm (6283 lb-in)
KA127	4 × M36 × 130 – 8.8	2500 Nm (22125 lb-in)
KA157	4 × M36 × 130 – 8.8	2500 Nm (22152 lb-in)

Helical-worm gear units

- Secure on each side of torque arm → (1).

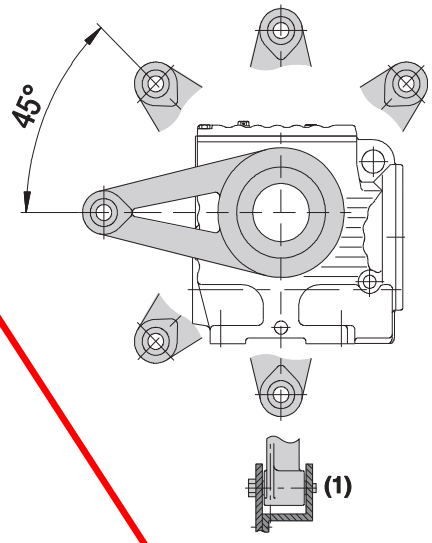


Figure 10: Torque arm for helical-worm gear units

Gear unit	Bolts	Tightening torque
SA37	M6 × 16 – 8.8	11 Nm (97 lb-in)
SA47	M8 × 20 – 8.8	25 Nm (222 lb-in)
SA57	M8 × 20 – 8.8	25 Nm (222 lb-in)
SA67	M12 × 25 – 8.8	86 Nm (761 lb-in)
SA77	M12 × 35 – 8.8	86 Nm (761 lb-in)
SA87	M16 × 35 – 8.8	210 Nm (1858 lb-in)
SA97	M16 × 35 – 8.8	210 Nm (1858 lb-in)

SPIROPLAN® W gear units

- Secure on each side of torque arm → (1)

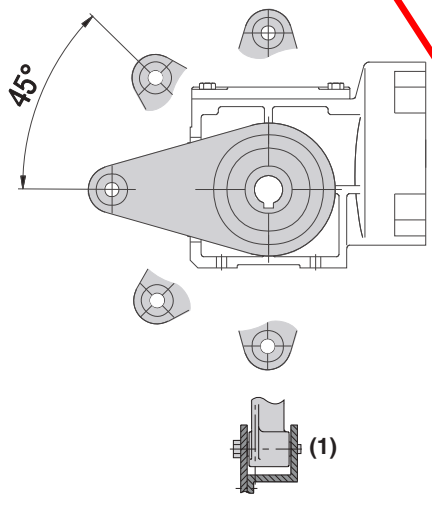


Figure 11: Torque arm for SPIROPLAN® W gear units

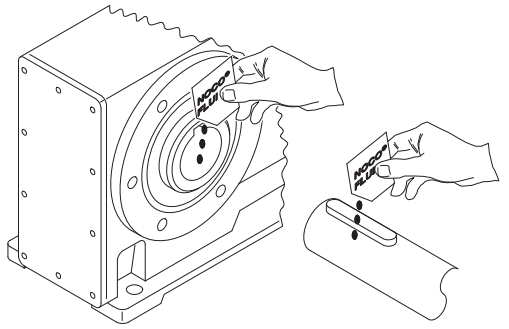
Gear unit	Bolts	Tightening torque
WA10	M6 × 16	11 Nm (97 lb-in)
WA20	M6 × 16	11 Nm (97 lb-in)
WA30	M6 × 16	11 Nm (97 lb-in)

4.6 Mounted gear unit with keyway or splined hollow shaft

For the configuration of customer shafts, please also refer to the design notes in the Gearmotors catalog!

Installation notes

1. Apply NOCO® fluid.



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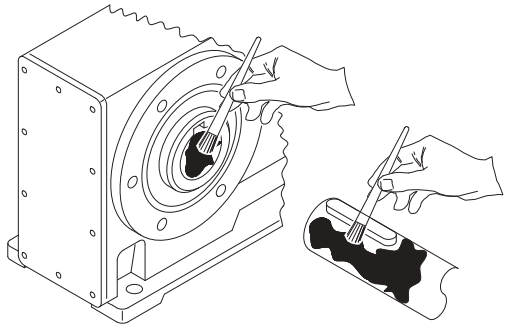
2. Distribute the NOCO® fluid carefully.



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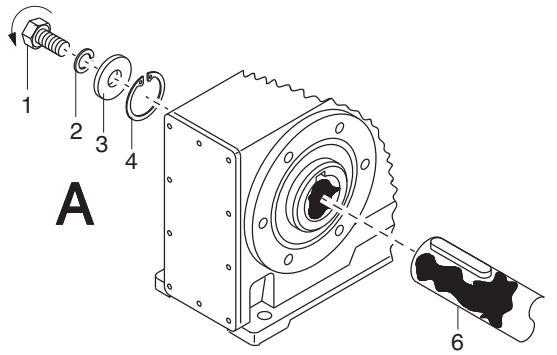
3. Install the shaft and secure it axially

   (mounting is facilitated by using a mounting device)

   3A: Mounting with standard scope of delivery



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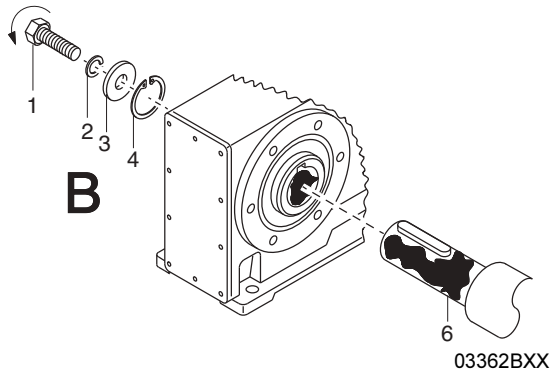
1 Short retaining bolt (standard scope of delivery)
2 Lock washer
3 Washer
4 Circlip
6 Customer shaft

3B: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

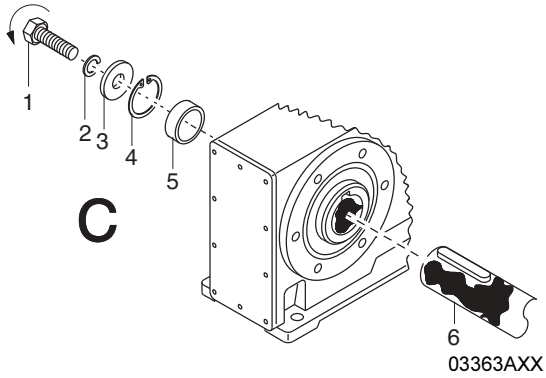
– Customer's shaft **with** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
6 Customer's shaft with contact shoulder

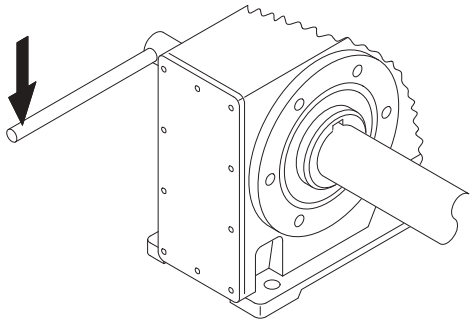
3C: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

– Customer's shaft **without** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer's shaft without contact shoulder

4. Tighten the retaining bolt to the appropriate torque (see table).



Bolt	Tightening torque
M5	5 Nm (44 lb-in)
M6	8 Nm (70 lb-in)
M10/12	20 Nm (177 lb-in)
M16	40 Nm (354 lb-in)
M20	80 Nm (708 lb-in)
M24	200 Nm (1770 lb-in)

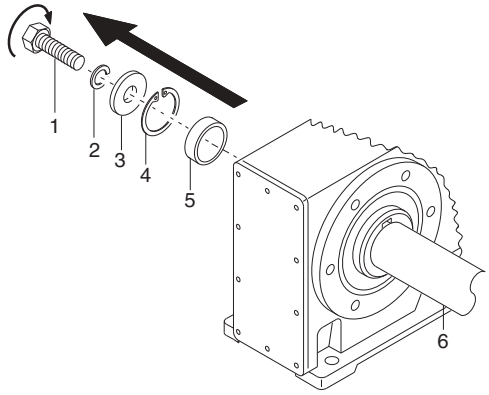
Note:

To avoid contact corrosion, we recommend that the customer's shaft should additionally be recessed between the two contact surfaces!

Removal notes

This description is only applicable when the gear unit was assembled using the installation/removal kit from SEW-EURODRIVE(→ page 26) (see the previous description, point 3B or 3C).

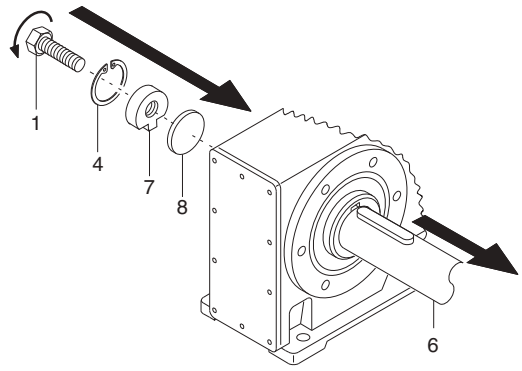
1. Loosen the retaining bolt [1].
2. Remove parts 2 to 4 and, if fitted, spacer 5.



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer shaft

03366AXX

3. Insert the forcing washer [8] and the fixed nut [7] from the SEW-EURODRIVE installation/removal kit between the customer's shaft [6] and the circlip [4].
4. Re-insert the circlip [4].
5. Screw the retaining bolt [1] back in. Now you can force the gear unit off the shaft by tightening the bolt.



1 Retaining bolt
4 Circlip
6 Customer shaft
7 Fixed nut
8 Forcing washer

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SEW installation/removal kit

The SEW-EURODRIVE installation/removal kit can be ordered under the following part number. The kits are currently only available for metric shaft sizes.

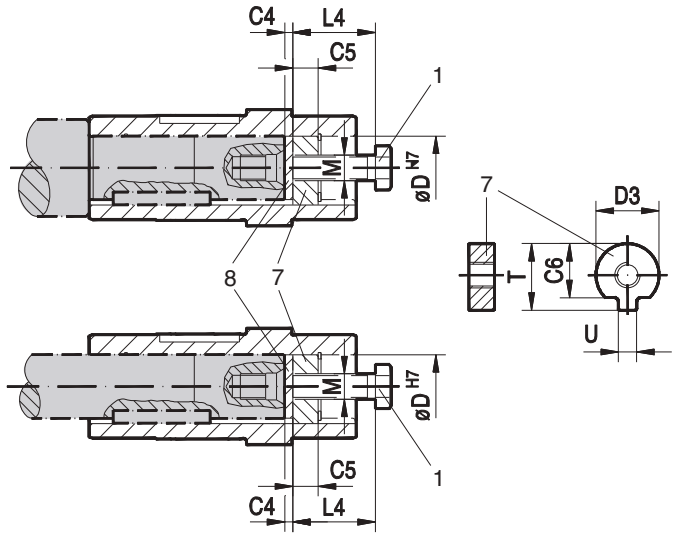

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Figure 12: SEW-EURODRIVE installation/removal kit

1 Retaining bolt
7 Fixed nut for disassembly
8 Forcing washer

Type	D^{H7} [mm]	M[1)]	C4 [mm]	C5 [mm]	C6 [mm]	$U^{-0.5}$ [mm]	$T^{-0.5}$ [mm]	$D3^{-0.5}$ [mm]	L4 [mm]	Part number of installation/removal kit
WA..10	16	M5	5	5	12	4.5	18	15.7	50	643 712 5
~~**WA..20**~~	~~18~~	~~M6~~	~~5~~	~~6~~	~~13.5~~	~~5.5~~	~~20.5~~	~~17.7~~	~~25~~	~~643 682 X~~
WA..20, WA..30, SA..37	20	M6	5	6	15.5	5.5	22.5	19.7	25	643 683 8
~~**FA..27, SA..47**~~	~~25~~	~~M10~~	~~5~~	~~10~~	~~20~~	~~7.5~~	~~28~~	~~24.7~~	~~35~~	~~643 684 6~~
FA..37, KA..37, SA..47, SA..57	30	M10	5	10	25	7.5	33	29.7	35	643 685 4
FA..47, KA..47, SA..57	35	M12	5	12	29	9.5	38	34.7	45	643 686 2
FA..57, KA..57, FA..67, KA..67, SA..67	40	M16	5	12	34	11.5	41.9	39.7	50	643 687 0
SA..67	45	M16	5	12	38.5	13.5	48.5	44.7	50	643 688 9
FA..77, KA..77, SA..77	50	M16	5	12	43.5	13.5	53.5	49.7	50	643 689 7
FA..87, KA..87, SA..77, SA..87	60	M20	5	16	56	17.5	64	59.7	60	643 690 0
FA..97, KA..97, SA..87, SA..97	70	M20	5	16	65.5	19.5	74.5	69.7	60	643 691 9
FA..107, KA..107, SA..97	90	M24	5	20	80	24.5	95	89.7	70	643 692 7
FA..127, KA..127	100	M24	5	20	89	27.5	106	99.7	70	643 693 5
FA..157, KA..157	120	M24	5	20	107	31	127	119.7	70	643 694 3

1) Retaining bolt

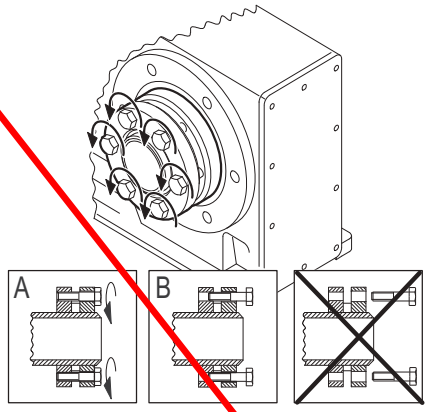
The SEW assembly kit for mounting the customer shaft is a recommendation from SEW-EURODRIVE. You must always check whether this design can compensate the axial loads. In particular applications (e.g. mounting mixer shafts), a different design may have to be used to secure the shaft axially. In these cases, customers can use their own devices. However, you must ensure that these designs do not cause potential sources of combustion according to DIN EN 13463 (for example, impact sparks).

4.7 Mounted gear units with shrink disc

Installation notes

- Do not tighten the locking bolts unless the shaft is installed - the hollow shaft could become deformed!

1. Loosen the locking bolts by a few turns (do not unscrew them completely!).



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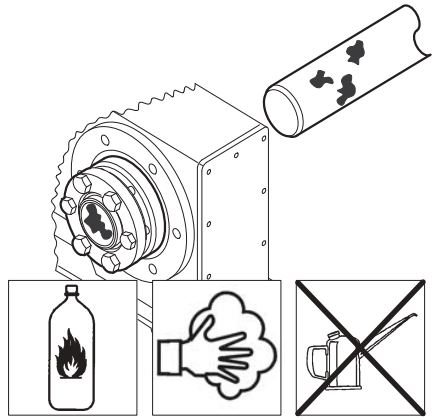
2. Carefully degrease the hollow shaft hole and the input shaft.



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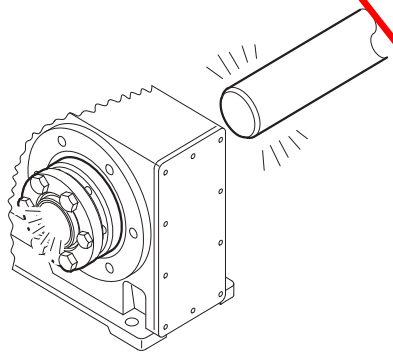
3. Hollow shaft/input shaft after degreasing



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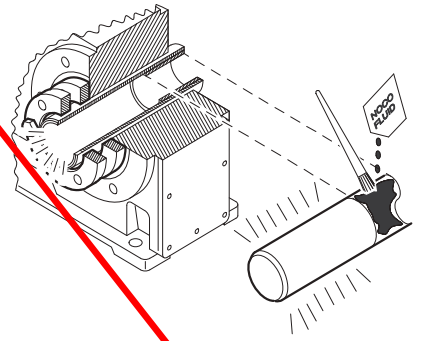
4. Apply NOCO® fluid to the input shaft[1] in the area of the bushing.



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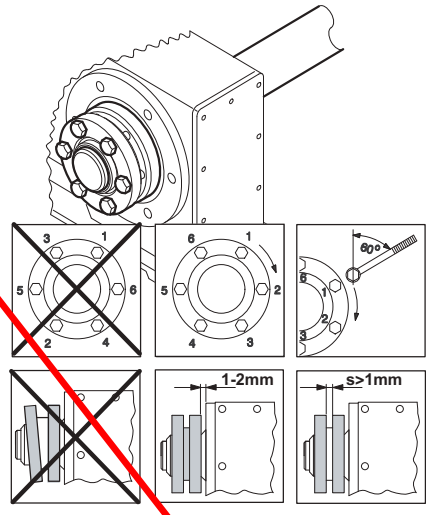
STOP

[1] It is essential to make sure that the clamping area of the shrink disk is free from grease!
For this reason, never apply NOCO® fluid directly to the bushing as the paste may be able to get into the clamping area of the shrink disk when the input shaft is put on.

5. Install the input shaft, making sure that the locking collars of the shrink disk are installed in parallel to each other[2)]. For gear unit housing **with a shaft collar**, mount the **shrink disc to the stop on the shaft collar**. For gear unit housing **without a shaft collar**, mount the **shrink disk with a clearance of 1 to 2 mm from the gear unit housing**. Tighten the locking bolts with the torque wrench by working round several times from one bolt to the next (not in diametrically opposite sequence) until the bolts cannot be tightened any more. See the following table for tightening torques.



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[2)] **After installation**

- There must be a gap s > 1 mm between the locking collars
- Grease the outside of the hollow shaft in the area of the shrink disk to prevent corrosion.

Gear unit type			Bolt	Nm (lb-in)	◁ max.[1)]
		SH37	M5	5 Nm (44 lb-in)	60°
KH37...77	FH37...77	SH47...77	M6	12 Nm (106 lb-in)	
KH87/97	FH87/97	SH87/97	M8	30 Nm (265 lb-in)	
KH107	FH107		M10	59 Nm (522 lb-in)	
KH127/157	FH127		M12	100 Nm (885 lb-in)	
KH167			M16	250 Nm (2212 lb-in)	
KH187			M20	470 Nm (4159 lb-in)	

1) Maximum tightening angle per cycle

Notes on removing the shrink disk

1. Unscrew the locking bolts evenly one after the other. Each locking bolt may only be unscrewed by about one quarter turn in the initial cycle. This is in order to avoid tilting and jamming the locking collars. Do not fully unscrew the locking bolts!
2. Remove the shaft or pull the hub off the shaft. (You must first remove any rust that may have formed between the hub and the end of the shaft.)
3. Pull the shrink disk off the hub.

Caution!

Risk of injury if the shrink disk is not removed correctly!

Cleaning and lubricating the shrink disk

There is no need to strip down and re-grease disassembled shrink disks before they are screwed back on.

The shrink disk only needs to be cleaned and re-greased if it is contaminated.

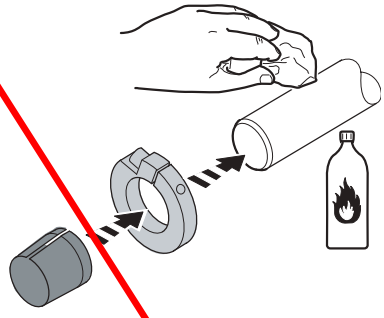
Use one of the following solid lubricants for the tapered surfaces.

Lubricant (Mo S2)	Sold as
Molykote 321 (lube coat)	Spray
Molykote spray (powder spray)	Spray
Molykote G Rapid	Spray or paste
Aemasol MO 19P	Spray or paste
Aemasol DIO-sétral 57 N (lube coat)	Spray

Grease the locking bolts with a multipurpose grease such as Molykote BR 2 or similar.

4.8 Mounted gear units with TorqLOC®

1. Clean the inside of the hollow shaft and the customer shaft. Ensure that all traces of grease or oil are removed.
2. Install the split ring and the bushing on the customer shaft.



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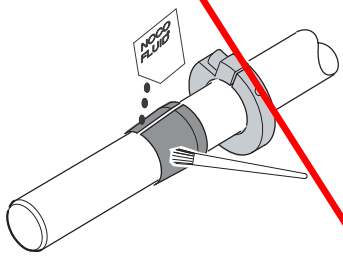
3. Apply NOCO® fluid to the bushing and distribute it carefully.



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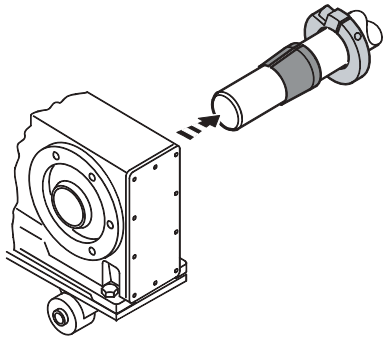
4. Push the gear unit onto the customer shaft.



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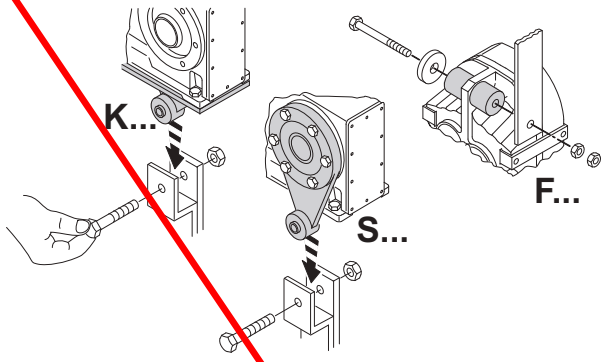
5. Preassemble the torque arm (do not tighten the bolts). Refer to "Torque arms for shaft mounted gear units" on page 21.



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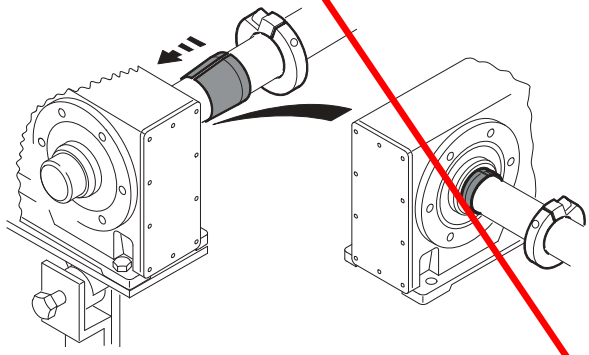
6. Push the bushing onto the gear unit up to the stop.



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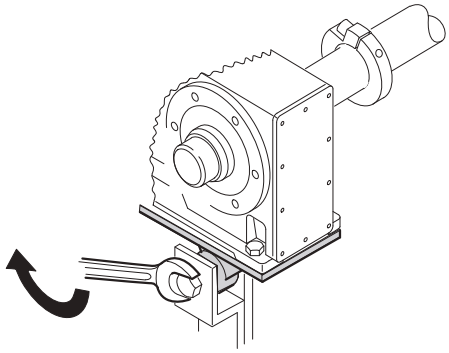
7. Tighten all the retaining bolts for the torque arm. Refer to "Torque arms for shaft mounted gear units" on page 21.



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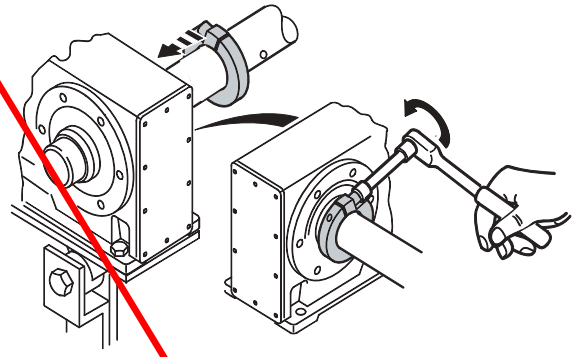
8. Secure the bushing with the split ring. Tighten the split ring on the bushing using the appropriate torque as specified in the following table.



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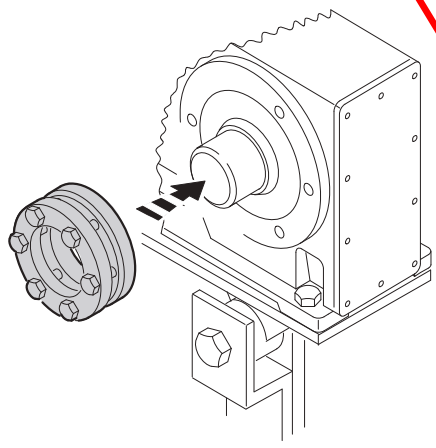
Type		Torque [Nm (lb-in)]	
KT/FT	ST	Steel	Stainless steel
-	37	18 (159)	7.5 (66)
37	47	18 (159)	7.5 (66)
47	57	18 (159)	7.5 (66)
57, 67	67	35 (309)	18 (159)
77	77	35 (309)	18 (159)
87	87	35 (309)	18 (159)
97	97	35 (309)	18 (159)

9. Slide the shrink disk onto the hollow shaft. Ensure that all bolts have been loosened.



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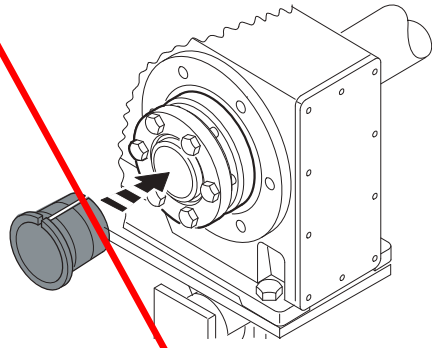
10. Push the counter bushing onto the customer shaft and into the hollow shaft or shrink disk right into the seat.



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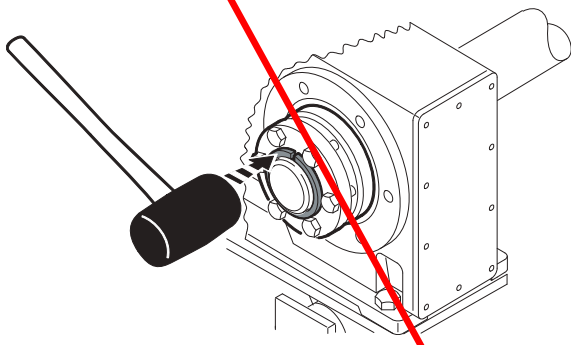
11. Tap lightly on the flange of the counter bushing to ensure that the socket is fitted securely in the hollow shaft.



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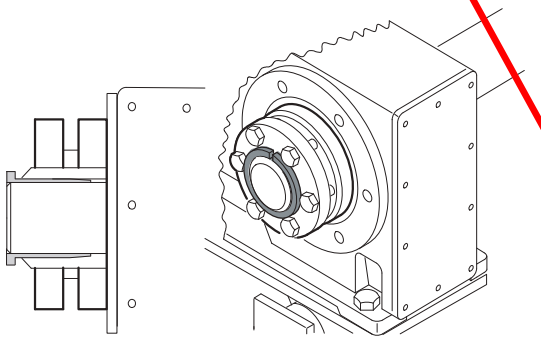
12. Ensure that the customer shaft is fitted in the counter bushing.



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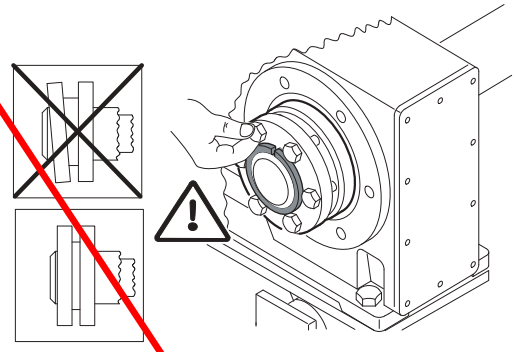
13. Tighten the bolts of the shrink disk by hand and ensure that the end rings of the shrink disc are parallel.



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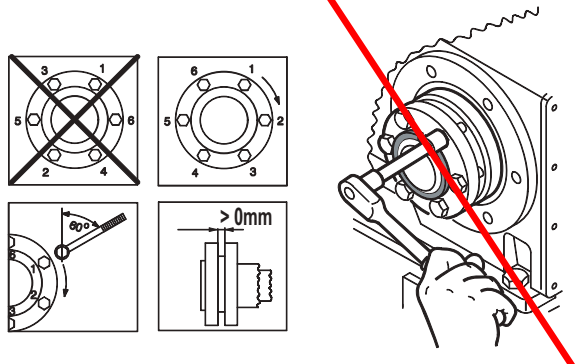
14. Tighten the locking bolts by working round several times from one bolt to the next (not in diametrically opposite sequence). See the table for tightening torques.

After installation, the remaining gap between the outer rings of the shrink discs must be > 0 mm.



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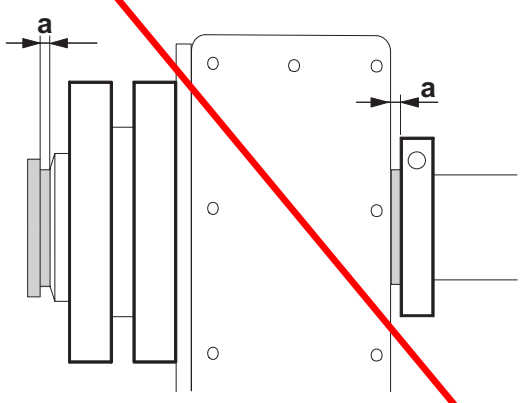
Type		Steel	Stainless steel
KT/FT	ST	Torque [Nm (lb-in)]	
-	37	4.1 (36)	6.8 (60)
37	47	10 (89)	6.8 (60)
47	57	12 (106)	6.8 (60)
57, 67	67	12 (106)	15 (133)
77	77	30 (266)	30 (266)
87	87	30 (266)	50 (443)
97	97	30 (266)	50 (443)

15. The distance between the counter bushing and the hollow shaft end and between the split ring and the clamping ring must not exceed the following values. The following table lists the maximum and minimum gap width.



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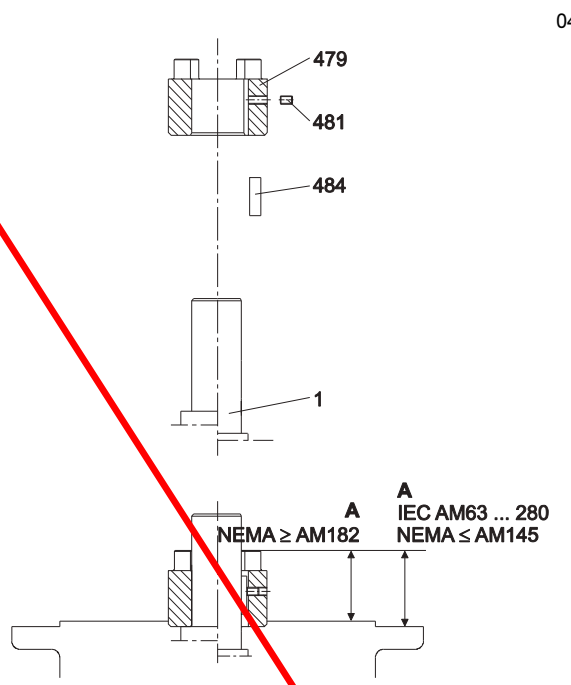
Type		Distance [mm (in)]	
KT/FT	ST	a min.	a max.
-	37	3.3 (0.130)	5.6 (0.220)
37	47	3.3 (0.130)	5.6 (0.220)
47	57	5.0 (0.197)	7.6 (0.299)
57, 67	67	5.0 (0.197)	7.6 (0.299)
77	77	5.0 (0.197)	7.6 (0.299)
87	87	5.8 (0.228)	8.6 (0.339)
97	97	5.8 (0.228)	8.6 (0.339)

4.9 AM adapter coupling

IEC adapter AM63 225 / NEMA adapter AM56 365



1. Clean the motor shaft and flange surfaces of the motor and adapter.
2. Remove the key from the motor shaft and replace it with the supplied key (484) (not AM63 and AM250).
3. Heat the coupling half (479) to approx. 80 – 100 °C (176 – 212°F) and push the coupling half onto the motor shaft until stop at motor shaft shoulder (position to point **A** for AM250 / AM280 and NEMA).
4. Secure key and coupling half using set screw (481) and tightening torque T_A on motor shaft according to the table.
5. Check point **A**.
6. Seal the contact surfaces between the adapter and motor using a suitable sealing compound.
7. Mount the motor on the adapter. When doing this, make sure the coupling jaws of the adapter shaft engage the plastic spider.

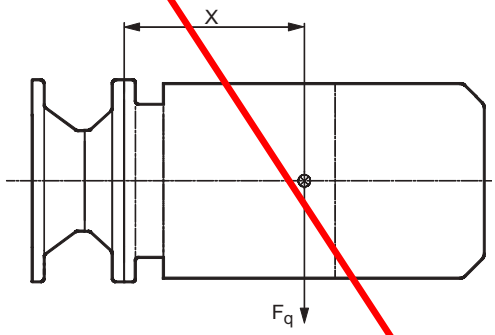
IEC AM	uom	63 / 71	80 / 90	100 / 112	132	160 / 180	200	225	250 / 280
A	mm	24.5	31.5	41.5	54	76	78.5	93.5	139
	in	0.965	1.240	1.634	2.126	2.992	3.091	3.681	5.472
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10
NEMA AM	uom	56	143 / 145	182 / 184	213 / 215	254 / 256	284 / 286	324 / 326	364 / 365
A	mm	46	43	55	63.5	78.5	85.5	107	107
	in	1.811	1.693	2.165	2.500	3.091	3.366	4.213	4.213
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10

To avoid contact corrosion, we recommend applying NOCO® fluid to the motor shaft before mounting the coupling half.

When installing a motor onto the adapter, you must use an anaerobic sealant to ensure that moisture cannot penetrate the adapter.

Permitted loads

The load data specified in the following table must not be exceeded when a motor is mounted.



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Adapter type			F_q [1] [N (lb)]	
IEC	NEMA	x [1] [mm (in)]	IEC adapter	NEMA adapter
AM63/71	**AM56**	77 (3.03)	530 (119)	410 (92)
AM80/90	**AM143/145**	113 (4.45)	420 (94)	380 (85)
AM100/112	**AM182/184**	144 (5.67)	2000 (450)	1760 (396)
AM132 [2]	**AM213/215** [2]	186 (7.32)	1600 (360)	1250 (281)
AM132..	**AM213/215**		4700 (1057)	3690 (830)
AM160/180	**AM254/286**	251 (9.88)	4600 (1034)	4340 (976)
AM200/225	**AM324 - AM365**	297 (11.69)	5600 (1259)	5250 (1180)
AM250/280	-	390 (15.35)	11200 (2518)	-

1) The maximum permitted weight of the attached motor F_{qmax} must be reduced proportionally as the distance between the adapter flange and the middle of the motor (x) increases. When this distance is reduced, the maximum permitted weight F_{qmax} cannot be increased.

2) Diameter of the adapter drive flange: 160 mm (6.30 in)

Adapter AM with backstop AM../RS

Check the direction of rotation of the drive before installation and startup. Please inform the SEW-EURODRIVE customer service if the direction of rotation is incorrect.

The backstop is maintenance-free in operation, and does not require any further maintenance work.

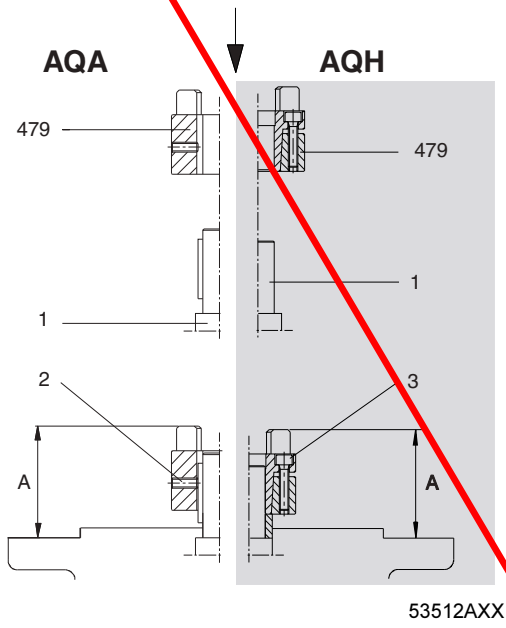
The backstops have a minimum lift-off speed depending on the size (→ following table). If the minimum lift-off speeds are violated, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

Type	Maximum locking torque of backstop [Nm (lb-in)]	Minimum lift-off speed [rpm]
AM80/90/RS, AM143/145/RS	90 (797)	640
AM100/112/RS, AM182/184/RS	340 (3009)	600
AM132/RS, AM213/215/RS	700 (6195)	550
AM160/180/RS, AM254/256/RS	1200 (10620)	630
AM200/225/RS, AM324-365/RS	1450 (12832)	430

STOP

In rated operation, the lift-off speeds must not drop below the minimum values. The lift-off speeds are only permitted to drop below the minimum values during start-up or braking.

4.10 AQ adapter coupling



1 Motor shaft
2 Setscrew
3 Bolt

AQA = With keyway
AQH = Without keyway

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1. Clean the motor shaft and flange surfaces of the motor and adapter.
2. **Type AQH:** Unscrew the bolts of the coupling half (479) and loosen the conical connection.
3. Heat the coupling half 80°C – 100°C (176°F – 212°F) and push it onto the motor shaft.

   Type AQA / AQH: Up to clearance "A" (see table).

4. **Type AQH:** Tighten the bolts on the coupling half in diametrically opposite sequence (work round several times tightening the bolts evenly one after the other) until all bolts reach the tightening torque T_A specified in the table.

   Type AQA: Use a setscrew to secure the coupling half (see table).

5. Check the position of the coupling half (clearance "A", see table).

   Install motor onto the adapter making sure that the dogs of the two coupling halves engage in each other. The force that must be applied when joining the two coupling halves is dissipated after final assembly, so there is no risk of any axial load being applied to adjacent bearings.

Only for AQA, not permitted for AQH: To avoid contact corrosion, we recommend applying NOCO® fluid to the motor shaft before mounting the coupling half.

When installing a motor onto the adapter, you must use an anaerobic sealant to ensure that moisture cannot penetrate the adapter.

Setting dimensions, tightening torques

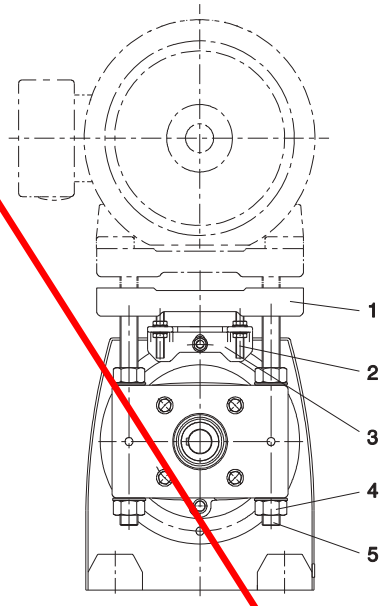
Type	Coupling size	Clearance "A" [mm (in)]	Bolts DIN 912		Tightening torque T_A [Nm (lb-in)]	
			AQA	AQH	AQA	AQH
AQA /AQH 80 /1/2/3	19/24	44.5 (1.75)	M5	M4	2 (17.7)	3 (26.5)
AQA /AQH 100 /1/2		39 (1.54)				
AQA /AQH 100 /3/4		53 (2.09)				
AQA /AQH 115 /1/2		62 (2.44)				
AQA /AQH 115 /3	24/28	62 (2.44)	M5	M5	2 (17.7)	6 (53.1)
AQA /AQH 140 /1/2		62 (2.44)				
AQA /AQH 140 /3	28/38	74.5 (2.93)	M8	M5	10 (88.5)	6 (53.1)
AQA /AQH 190 /1/2		76.5 (3.01)				
AQA /AQH 190 /3	38/45	100 (3.94)	M8	M6	10 (88.5)	10 (88.5)

4.11 AD input shaft assembly

Please refer to Sec. "Installing input and output shafts" for information on mounting of input elements.

Cover with motor mounting platform AD../P

Mounting the motor and adjusting the motor mounting platform.



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1 Motor mounting platform
2 Stud bolt (only AD6/P / AD7/P)
3 Support (only AD6/P / AD7/P)
4 Nut
5 Threaded column

1. Set the motor mounting platform to the required mounting position by evenly tightening the adjusting nuts. It may be necessary to remove the lifting eyebolt from helical gear units in order to achieve the lowest adjustment position. Touch up any damage to the paint work.
2. Align the motor on the motor mounting platform (shaft ends must be in alignment) and secure it.
3. Mount the input elements on the input shaft end and the motor shaft. Line them up with one another. Correct the motor position again if necessary.
4. Put on traction elements (V-belt, chain, etc.) and apply a preload by evenly adjusting the motor mounting platform. Do not stress the motor mounting platform and the columns against one another when doing this.
5. Tighten the threaded columns using the nuts which are not used for adjustment.

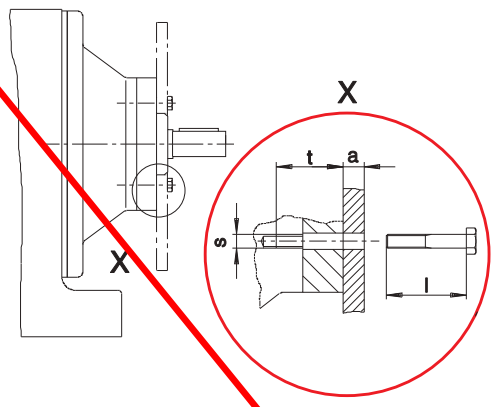
Only AD6/P and AD7/P:

Unscrew the nuts on the stud bolts before adjustment to allow the stud bolts to move axially in the support without restriction. Do not tighten the nuts until the final adjustment position has been achieved. Do not adjust the motor mounting platform using the support.

Type with centering shoulder AD../ZR

Mounting applications on the input shaft assembly with centering shoulder.

1. Retaining bolts of a suitable length must be used to secure the application. The length l of the new bolts is calculated as follows:



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l = t + a
t = Screw-in depth (see table)
a = Thickness of the application
s = Retaining thread (see table)

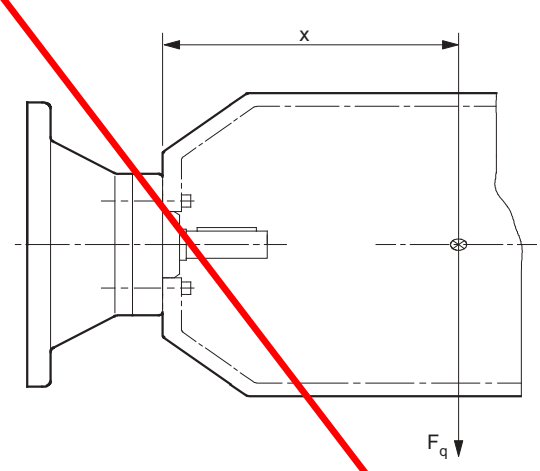
Round down the calculated bolt length to the next smaller standard length.

2. Remove the retaining bolts from the centering shoulder.
3. Clean the contact surface and the centering shoulder.
4. Clean the threads of the new bolts and apply a bolt locking compound (e.g. Loctite 243) to the first few threads.
5. Position the application against the centering shoulder and tighten the retaining bolts to the specified tightening torque T_A (see table).

Type	Screw-in depth t [mm (in)]	Retaining thread s	Tightening torque T_A for connection bolts in strength class 8.8 [Nm (lb-in)]
AD2/ZR	25.5 (1.00)	M8	25 (221)
AD3/ZR	31.5 (1.24)	M10	48 (425)
AD4/ZR	36 (1.42)	M12	86 (761)
AD5/ZR	44 (1.73)	M12	86 (761)
AD6/ZR	48.5 (1.91)	M16	210 (1859)
AD7/ZR	49 (1.93)	M20	410 (3629)
AD8/ZR	42 (1.65)	M12	86 (761)

Permitted loads

The load values specified in the following table must not be exceeded.



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Type	x[1) [mm (in)]	F_q[1) [N (lb)]
AD2/ZR	193 (7.60)	330 (74)
AD3/ZR	274 (10.79)	1400 (315)
AD4/ZR[2)]	361 (14.21)	1120 (252)
AD4/ZR		3300 (742)
AD5/ZR	487 (19.17)	3200 (719)
AD6/ZR	567 (22.32)	3900 (877)
AD7/ZR	663 (26.10)	10000 (2248)
AD8/ZR	516 (20.31)	4300 (967)

1) Maximum load values for connection bolts in strength class 8.8. The maximum permitted weight of the attached motor F_{qmax} must be reduced proportionally as the distance between the adapter flange and the middle of the motor (x) increases When this distance is reduced, the F_{qmax} cannot be increased.

2) Diameter of the adapter output flange: 160 mm (6.30 in)

Cover with backstop AD../RS

Check the direction of rotation of the drive before installation and startup. Please inform the SEW-EURODRIVE customer service if the direction of rotation is incorrect.

The backstop is maintenance-free in operation, and does not require any further maintenance work.

The backstops have a minimum lift-off speed depending on the size (→ following table). If the minimum lift-off speeds are violated, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

Type	Maximum locking torque of backstop [Nm (lb-in)]	Minimum lift-off speed [rpm]
AD2/RS	90 (797)	640
AD3/RS	340 (3009)	600
AD4/RS	700 (6195)	550
AD5/RS	1200 (10620)	630
AD6/RS	1450 (12833)	430
AD7/RS	1450 (12833)	430
AD8/RS	2860 (25311)	430

In rated operation, the lift-off speeds must not drop below the minimum values. The lift-off speeds are only permitted to drop below the minimum values during start-up or braking.

5 Startup

Prior to startup check that the oil level is as specified for the mounting position. The oil checking and drain screws and the breather valves must be freely accessible.

5.1 Startup of helical-worm and SPIROPLAN® W gear units

Note: The direction of rotation of the output shaft in series S..7 helical-worm gear units has been changed from CW to CCW; this is different from the S..2 series. Change direction of rotation: Swap over two motor feeder cables.

Run-in period

SPIROPLAN® and helical-worm gear units require a run-in period of at least 24 hours before reaching their maximum efficiency. A separate run-in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.

No. of starts	Worm		Spiroplan®	
	Power reduction	i range	Power reduction	i range
1 start	ca. 12 %	ca. 50...280	ca. 15 %	approx. 40 ... 75
2 start	ca. 6 %	ca. 20...75	ca. 10 %	ca. 20...30
3 start	ca. 3 %	ca. 20...90	ca. 8 %	ca. 15
4 start	-	-	ca. 8 %	ca. 10
5 start	ca. 3 %	ca. 6...25	ca. 5 %	ca. 8
6 start	ca. 2 %	ca. 7...25	-	-

5.2 Startup of helical, parallel shaft helical and helical-bevel gear units

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with Sec. "Mechanical Installation".

6 Inspection and Maintenance

6.1 Inspection and maintenance intervals

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months.	• Check oil and oil level. • Check the seals visually for leakage. • For gear units with a torque arm: Check the rubber buffer and change it, if necessary
• Depending on the operating conditions (see chart below), every 3 years at the latest. • According to oil temperature.	• Change mineral oil.
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Depending on the operating conditions (see chart below), every 5 years at the latest. • According to oil temperature.	• Change synthetic oil
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Gear unitsR07, R17, R27, F27 and Spiroplan® are have lubrication for life and are therefore maintenance-free	
• Varying (depending on external factors).	• Touch up or renew the surface/anticorrosion coating.

6.2 Lubricant change intervals

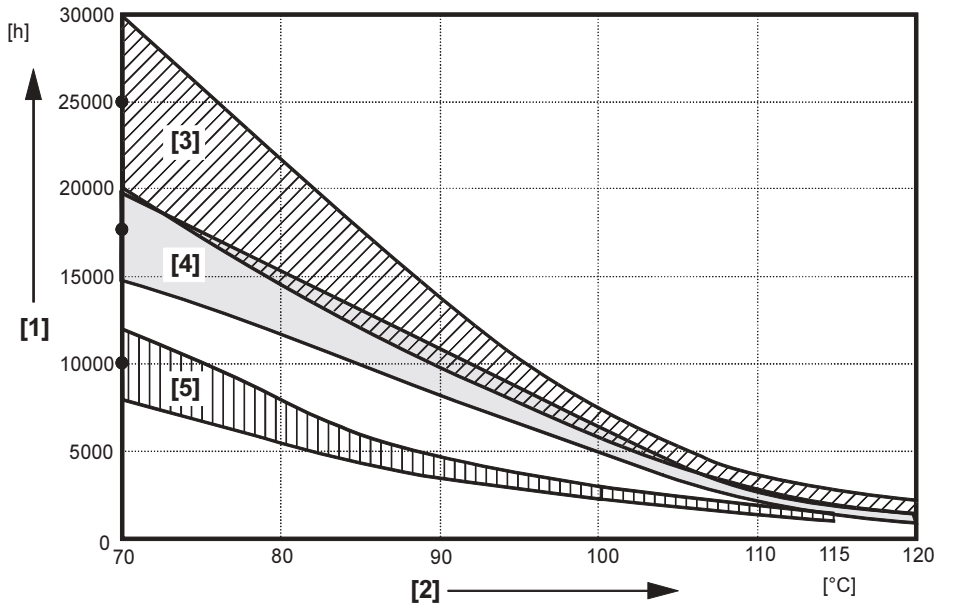

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Figure 13: Oil change intervals for standard gear units under normal environmental conditions

[1] Operating hours
[2] Sustained oil bath temperature
- Average value per oil type at 70 °C

[3] CLP PG
[4] CLP HC / HCE
[5] CLP / HLP / E

6.3 Inspection and maintenance of the gear unit

Do not intermix synthetic lubricants and do not mix synthetic and mineral lubricants together!

The standard lubricant is mineral oil (except for Spiroplan® gear units).

The position of the oil level and oil drain plug and the breather valve depends on the mounting position. Refer to the diagrams of the mounting positions.

Checking the oil level

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Refer to Sec. "Installing the gear unit" when changing the mounting position!
3. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Checking the oil

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Remove a little oil from the oil drain plug.
3. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance periods".
4. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Changing the oil

Only change the oil when the gear unit is at operating temperature.

De-energize the gearmotor and secure it to prevent it from being switched back on inadvertently!

Wait until the gear unit cools down - Danger of burns!

Note: The gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil correctly.

With oil drain plug / oil level screw

1. Place a container underneath the oil drain plug
2. Remove the oil level plug, breather plug/breather valve and oil drain plug.
3. Drain all the oil.
4. Screw in the oil drain plug.
5. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   - Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
   - Check at the oil level plug.
6. Screw the oil level plug back in
7. Screw in the breather plug/breather valve.

Without oil drain plug / oil level plug

1. Remove cover plate.
2. Drain the oil through the cover plate opening.
3. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   – Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
4. Check the oil level (→ Sec. "Check oil level for gear units with oil level plug")
5. Attach cover plate (observe the tightening torque and series → Sec. "Check the oil level for gear units without an oil level plug")

Changing the oil seal

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. When changing the oil seal, ensure that there is a sufficient grease reservoir between the dust lip and protective lip, depending on the type of gear unit.
3. If you use double oil seals, the space has to be filled one-third with grease.

6.4 Inspection / maintenance of AM / AQA adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check torsional play • Visually check the elastic annular gear • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease • Replace oil seal (do not install it in the same track) • Change the elastic coupling spider

6.5 Inspection / maintenance of AD adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check running noise for possible bearing damage • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease
	• Change the oil seal

7 Malfunctions

Customer service

Please have the following information to hand if you require the assistance of our customer service:
- Data from the nameplate (complete)
- Nature and extent of the fault
- Time and peripheral circumstances of the fault
- Presumed cause

7.1 Gear unit malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	A Meshing/grinding noise: Bearing damage. B Knocking noise: Irregularity in the gearing	A Check the oil (see Sec. "Inspection and Maintenance"), change bearings B Contact customer service
Unusual, irregular running noise	Foreign bodies in the oil	• Check the oil (see Sec. "Inspection and Maintenance") • Stop the drive, contact customer service
Oil leaking[1)] • From the gear cover plate • From the motor flange • From the motor oil seal • From the gear unit flange • From the output end oil seal	A Rubber seal on the gear cover plate leaking B Seal defective C Gear unit not vented	A Tighten the bolts on the gear cover plate and observe the gear unit. Oil still leaking: Contact customer service B Contact customer service C Vent the gear unit (see Sec. "Mounting Positions")
Oil leaking from breather valve	A Too much oil B Drive operated in incorrect mounting position C Frequent cold starts (oil foams) and/or high oil level	A Correct the oil level (see Sec. "Inspection and Maintenance") B Mount the breather valve correctly (see Sec. "Mounting Positions") and correct the oil level (see "Lubricants")
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send in the gear unit/gearmotor for repair

1) Short-term oil/grease leakage at the oil seal is possible in the run-in phase (24 hours running time).

7.2 AM / AQA / AL adapter malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send the gear unit to SEW-EURODRIVE for repair.
Change in running noise and / or vibrations occur	A Annular gear wear, short-term torque transfer through metal contact B Bolts to secure hub axially are loose.	A Change the coupling spider B Tighten the bolts
Premature wear in annular gear	A Contact with aggressive fluids / oil; ozone influence; too high ambient temperatures etc, which can cause a change in the physical properties of the annular gear. B Impermissibly high ambient/contact temperature for the annular gear; maximum permitted temperature –20 °C to +80 °C. C Overload	Contact SEW-EURODRIVE customer service

7.3 AD input shaft assembly malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage.	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the input shaft is rotated.	Connection between shaft and hub in gear unit or cover interrupted	Send the gear unit to SEW-EURODRIVE for repair.

8 Mounting Positions

8.1 General information on mounting positions

Mounting position designation

SEW differentiates between six mounting positions M1 ... M6 for gear units. The following figure shows the spatial orientation of the gearmotor in mounting positions M1 ... M6.

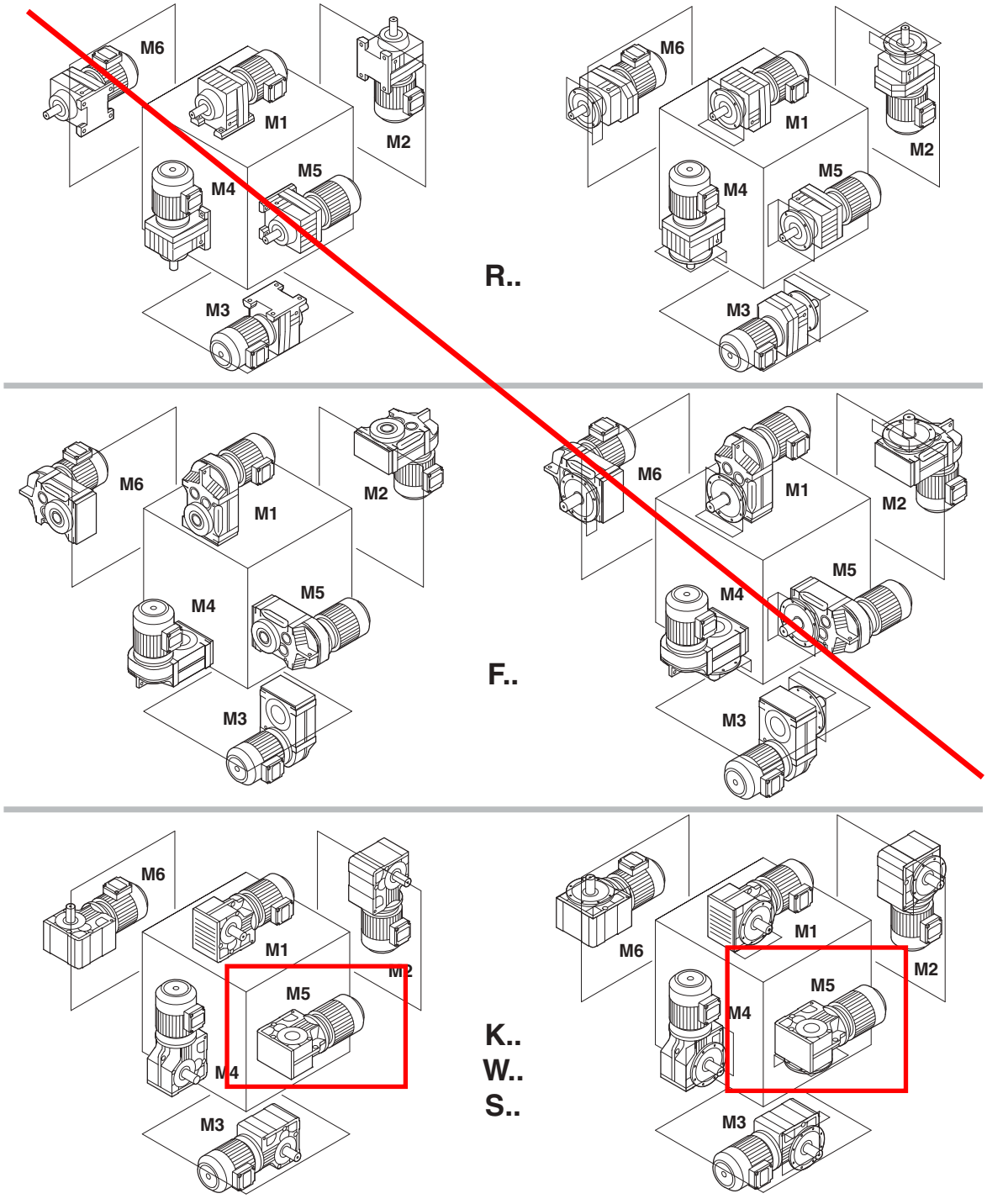


Figure 14: Depiction of mounting positions M1 ... M6

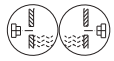
8.2 Key to the mounting position sheets

SPIROPLAN® gearmotors do not depend on any particular mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

Important: SPIROPLAN® gearmotors cannot be equipped with breather valves, oil level plugs or drain plugs.

Symbols used

The following table shows the symbols used in the mounting position sheets and what they mean:

Symbol	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

Churning losses

Increased churning losses may arise in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

Mounting position	Gear unit type	Gear unit size	Input speed [rpm]
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

SF/SAF/SHF/SAZ/SHZ47-97

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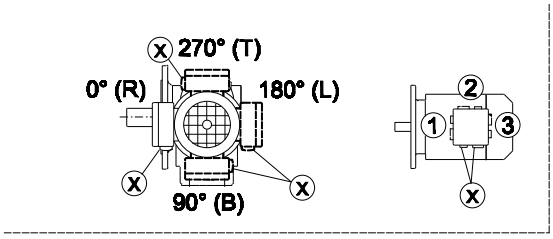

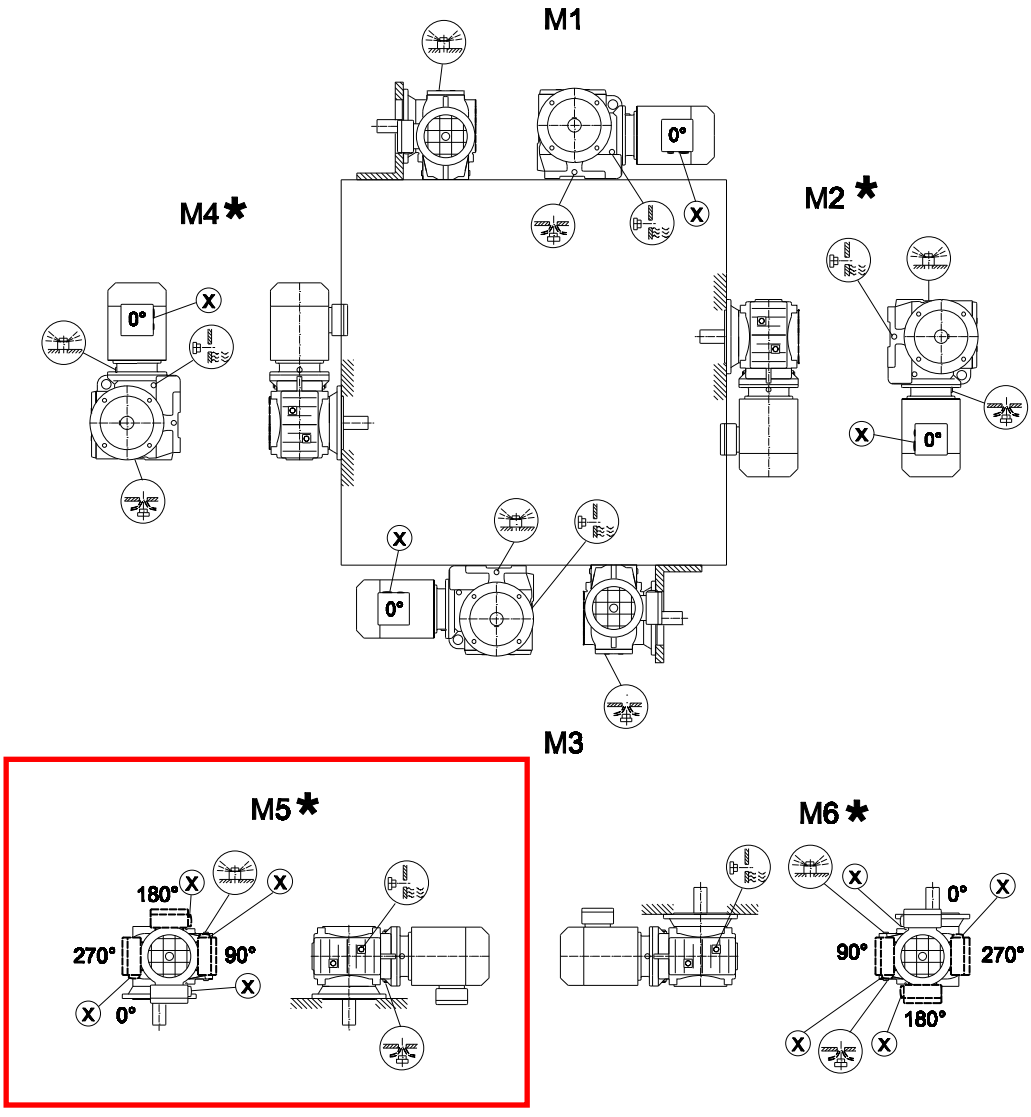

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9 Lubricants

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 ... M6, → Sec. "Mounting Positions and Important Order Information") specified when ordering the drive. You must adapt the lubricant fill to any subsequent changes made to the mounting position (→ Lubricant fill quantities).

9.1 Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Please note the following key to the lubricant table.

Key to the lubricant table

Abbreviations used, meaning of shading and notes:

CLP	= Mineral oil
CLP PG	= Polyglycol (W gear units, NSF cerfitied H1)
CLP HC	= Synthetic hydrocarbons
E	= Ester oil (water hazard class 1 (German regulation))
HCE	= Synthetic hydrocarbons + ester oil (NSF certified H1)
HLP	= Hydraulic oil
	= Synthetic lubricant (= synthetic-based anti-friction bearing grease)
	= Mineral lubricant (= mineral-based anti-friction bearing grease)
1)	Helical-worm gear units with PG oil: Please contact SEW-Eurodrive
2)	Special lubricant for Spiroplan® gear units only
3)	SEW $f_B \geq 1.2$ required
4)	Pay attention to critical starting behavior at low temperatures!
5)	Ambient temperature
	Lubricant for the food industry (food grade oil)
	Biodegradable oil (lubricant for use in agriculture, forestry and water resources)

Anti-friction bearing greases

The anti-friction bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in gear unit	-20 °C ... +60°C	Mobil	Mobilux EP2
	-40 °C ... +60 °C	Mobil	Mobiltemp SHC 100
Anti-friction bearing in motor[1)2)]	-20 °C ... +80 °C	Esso	Polyrex EM
	+20 °C ... +100 °C	Klüber	Barrierta L55/2
	-40 °C ... +60 °C	Kyodo Yushi	Multemp SRL[3)]
Special greases for anti-friction bearings in gear units:			
	-35 °C ... +40 °C	Shell	Shell Cassida Grease EPS 2
	-25 °C ... +40 °C	Klüber	Klübersynth UH1 14-222
	-40 °C ... +40 °C	Klüber	Klüberbio M 72-82

1) The motor anti-friction bearings are covered on both sides and cannot be regreased.

2) Greases providing equivalent performance are acceptable

3) Recommended for continuous operation at ambient temperature below 0°C, example in a cold storage.

The following grease quantities are required:

- For fast-running bearings (motor and gear unit input end): Fill the cavities between the rolling elements one third full with grease.
- For slow-running bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two thirds full with grease.

Lubricant table

01 805 09 92US

	5) °C	DIN (ISO)	ISO,NLGI	ExxonMobil	Shell	Klüber	ARAL	bp Tribol	TEXACO	Optimol	FUCHS	TOTAL
R...	-10 +40 Standard	CLP(CC)	VG 220	Mobilgear 600XP 220	Shell Omala 220	Klüberoil GEM 1-220 N	Aral Degol BG 220	BP Energol GR-XP 220 / Tribol 1100/220	Meropa 220	Optigear BM 220	Renolin CLP 220	Carter EP 220
	-25 +80	CLP PG	VG 220	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220 / Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
	-40 +80 4)	CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Klübersynth GEM 4-220 N	Aral Degol PAS 220	Tribol 1510/220	Pinnacle EP 220	Optigear Synthetic A 220	Renolin Unisyn CLP 220	
K...(HK...)	-40 +40 4)	CLP HC	VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N			Pinnacle EP 150			Carter SH 150
	-20 +25	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100 / Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-30 +10	HLP (HM)	VG 68-46 VG 32	Mobil D.T.E. 13M	Shell Tellus T 32	Klüberoil GEM 1-68 N	Aral Degol BG 46	Tribol 1100/68	Rando EP Ashless 46	Optigear 32	Renolin B 46 HVI	Equivis ZS 46
F...	-40 +10 4)	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32			Cetus PAO 46			Dacnis SH 32
	-40 -20 4)	HLP (HM)	VG 22 VG 15	Mobil D.T.E. 11M	Shell Tellus T 15	Isoflex MT 30 ROT		BP Energol HLP-HM 15	Rando HDZ 15			Equivis ZS 15
	0 +40 Standard	CLP (CC)	VG 680	Mobilgear 600XP 680	Shell Omala 680	Klüberoil GEM 1-680 N	Aral Degol BG 680	BP Energol GR-XP 680 / Tribol 1100/680	Meropa 680	Optigear BM 680	Renolin CLP 680	Carter EP 680
	-20 +60	CLP PG	VG 680 1)		Shell Tivela S 680	Klübersynth GH 6-680		BP Enersyn SG-XP 680 / Tribol 800/680	Synlube CLP 680			
	-30 +80 4)	CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460	Klübersynth GEM 4-460 N			Pinnacle EP 460			
S...(HS...)	-40 +10 4)	CLP HC	VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N			Pinnacle EP 150			Carter SH 150
	-20 +10	CLP (CC)	VG 150 VG 100	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100 / Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
	-25 +20	CLP PG	VG 220 1)	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220 / Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
	-40 0 4)	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32			Cetus PAO 46			Dacnis SH 32
	-20 +40 Standard	CLP PG	VG 460 1)			Klübersynth UH1 6-460						
R...,K...(HK...) F...,S...(HS...)	-30 +40 4)	HCE	VG 460		Shell Cassida Fluid GL 460	Klüberoil 4UH1-460 N	Aral Eural Gear 460			Optileb GT 460		
	-20 +40	E	VG 460			Klüberbio CA2-460	Aral Degol BAB 460			Optisynt BS 460		
	-20 +40 Standard	SEW PG	VG 460 2)			Klüber SEW HT-460-5						
W...(HW...)	-40 +10 4)	API GL5	SAE 75W90 (~VG 100)	Mobilube SHC 75 W90-LS								
	-20 +40	CLP PG	VG 460 3)			Klübersynth UH1 6-460						

SA.., SH.., SAF.., SHF.., SAZ.., SHZ..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3[1)]	M4	M5	M6
S..37	0.25	0.40	0.50	0.50	0.40	0.40
S..47	0.40	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.10	1.00/1.50	1.50	1.20	1.20
S..67	1.00	2.00	1.80/2.60	2.90	2.50	2.50
S..77	1.80	3.90	3.60/5.0	5.8	4.50	4.50
S..87	3.80	7.4	6.0/8.7	10.8	8.0	8.0
S..97	7.0	14.0	11.4/16.0	20.5	15.7	15.7

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

10 Appendix

10.1 Index of changes

The following additions and changes have been made compared to the previous edition of the "Explosion-Proof Gear Units R..7, F..7, K..7, S..7, SPIROPLAN® W" (publication number: 1055520x, edition 11/2002) operating instructions:

General additions and corrections.

Mechanical installation

- Installing the gear unit: Data on flatness error
- Installing torque arms for mounted gear units: Data on retaining bolts
- Mounted gear units with shrink disks: Information on assembly / removal has been added
- Mounted gear units with TorqLOC®
- AM adapter coupling: Point A

Inspection and maintenance

- Lubricant change intervals

General

Manual adapted for US market.

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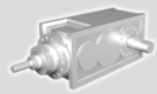

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SEW
Varimot

Variable Speed Unit VARIMOT® D16

PARTS LIST

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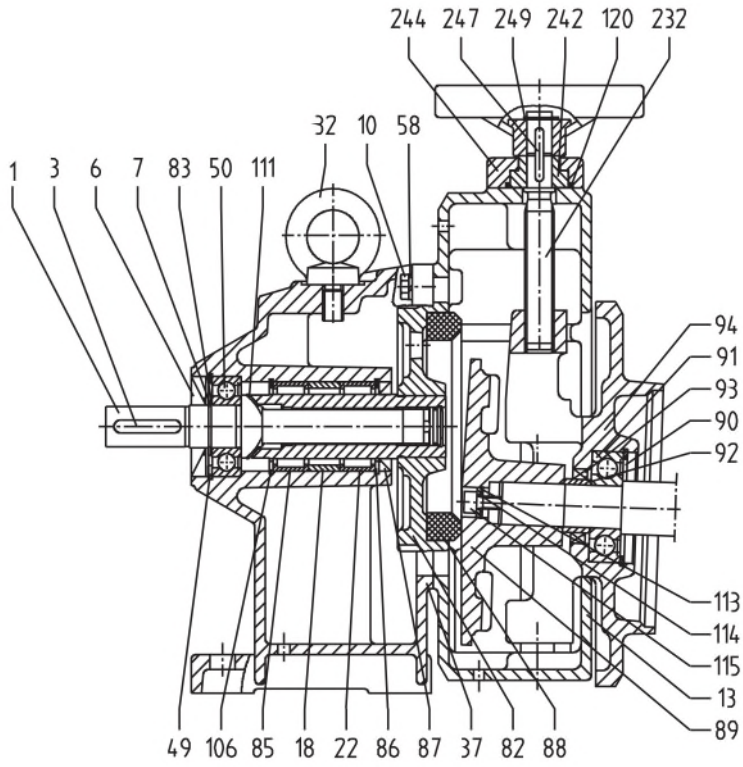

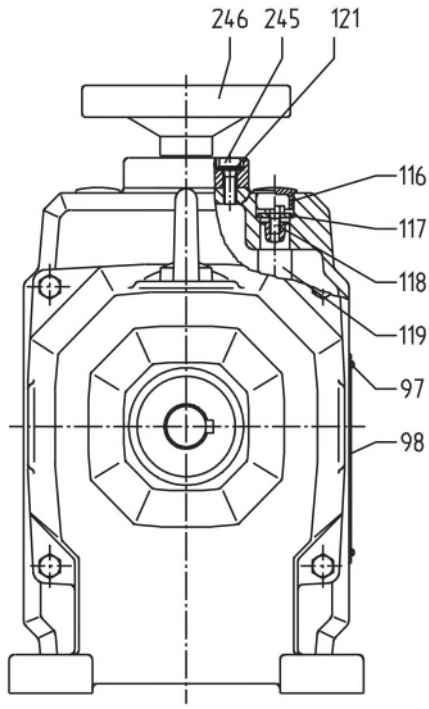

When ordering parts, please supply nameplate data with serial number or S.O. number, model number, description of part and part number.
X - As required

Shaded items denote recommended spare parts.
Ⓑ - Option B - Severe Duty Feature.

Item	Part Name	Description	Part No	Qty
1	Output Shaft Complete	19mm Diameter	154 002 5	1
1	Output Shaft Complete	0.750 in. Diameter	154 003 3	1
3	Key 19mm Dia. Shaft	A6x6x32mm	010 015 3	1
3	Key 0.750 in. Dia. Shaft	3/16x3/16x1-1/16 in.	806 920 4	1
6	Oil Seal	A20x47x7mm-No Spring	011 190 2	1
7	Retaining Ring	20x1.2mm External	010 271 7	1
10	Hex Head Screw	M6x20mm	010 107 9	4
13	Mounting Plate		150 762 1	1
18	Spacer		150 570 X	1
22	Needle Roller Bearing	RNA4905	010 582 1	1
32	Eyebolt	M10mm	010 229 6	1
37	Housing		150 547 5	1
49	Retaining Ring	47x1.75mm Internal	010 318 7	1

Item	Part Name	Description	Part No	Qty
50	Ball Bearing	6204-2Z	010 498 1	1
58	Lockwasher	B6mm	010 990 8	4
82	Hollowshaft Complete	With Friction Ring	154 030 0	1
82	Hollowshaft Complete	Without Friction Ring	154 026 2	1
83	Shim	20x28x0.5mm	010 415 9	1
85	Needle Roller Bearing	RNA4905	010 582 1	1
86	Retaining Ring	42x1.75mm Internal	010 317 9	1
87	Oil Seal	A30x42x5.7mm	010 616 X	1
88	Friction Ring		150 755 9	1
89	Driving Cone		150 768 0	1
89	Driving Cone Ⓑ	Chrome Plated	150 814 8	1
90	Retaining Ring	52x2mm Internal	010 319 5	1
91	Ball Bearing	6304-2RS-J	806 986 7	1

Variable Speed Unit VARIMOT® D16

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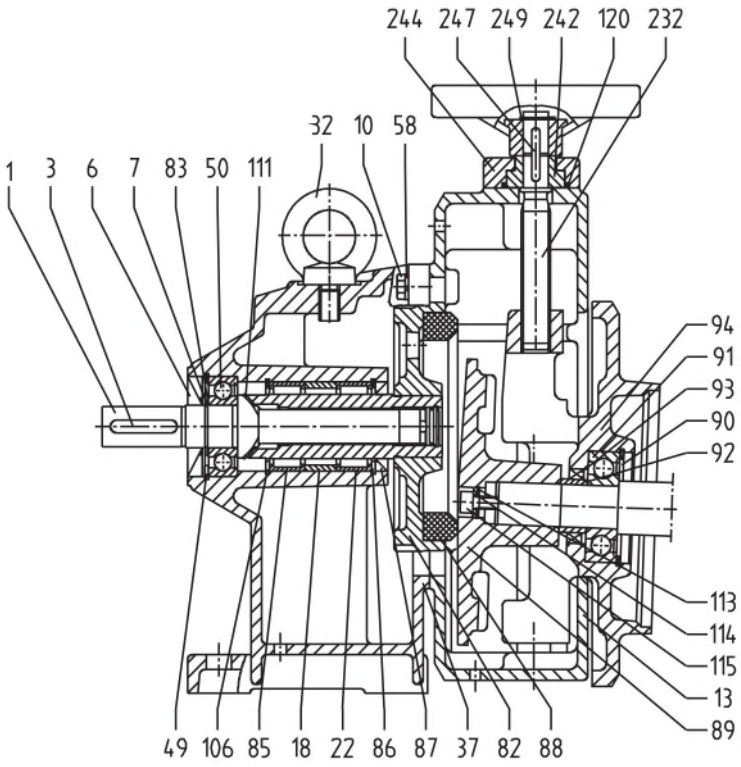
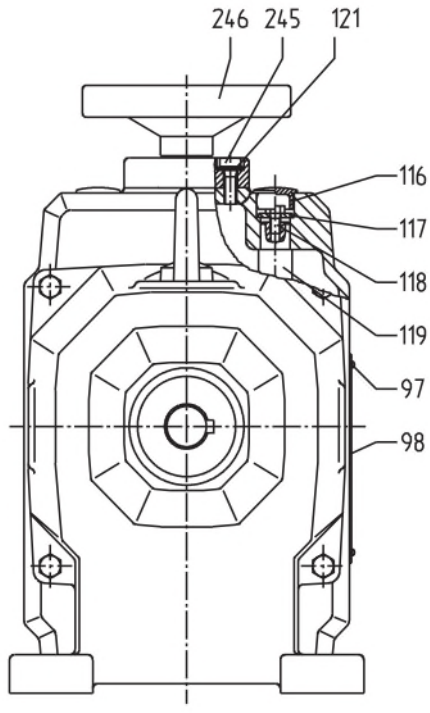




When ordering parts, please supply nameplate data with serial number or S.O. number, model number, description of part and part number.
X - As required

Shaded items denote recommended spare parts.
Ⓑ - Option B - Severe Duty Feature.

Item	Part Name	Description	Part No	Qty
92	Wear Sleeve		150 822 9	1
93	Oil Seal	AS25x35x7mm	010 654 2	1
94	Motor Mounting Plate	DT71-80 Frame Motor	154 042 4	1
97	Cheese Head Nail	2x4mm	010 764 6	2
98	Scale		150 122 4	1
106	Retaining Ring	42x1.75mm Internal	010 317 9	1
111	Cam Washer		150 425 8	1
113	Retaining Ring	14x1mm Internal	011 451 0	1
114	Disc	6.4x13.8x2mm	013 961 0	1
115	Socket Head Screw	M6x25mm	010 134 6	1
116	Closing Plug	18.5mm	011 375 1	2
117	Disc	5.3x17.8x2mm	013 960 2	2
118	Hex Head Screw	M5x16mm	010 104 4	2

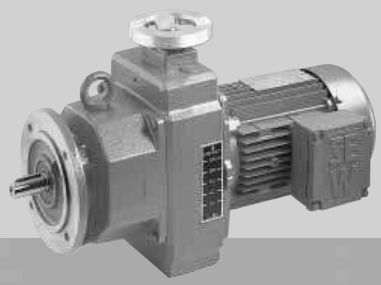
Item	Part Name	Description	Part No	Qty
119	Guide Pillar		150 796 6	2
119	Guide Pillar Ⓑ		150 788 5	2
120	O-Ring	27x2.5mm	017 644 3	1
121	Washer	B6.4mm	010 236 9	2
232	Spindle		150 585 8	1
242	Sleeve		150 525 4	1
244	Plate		150 580 7	1
245	Socket Head Screw	M6x16mm	010 156 7	2
246	Handwheel	100x12mm	010 747 6	1
246	Handwheel-HS Complete	100x12mm	150 841 5	1
247	Key	A4x4x25mm	013 529 1	1
249	Retaining Ring	12x1mm External	010 265 2	1

SEW EURODRIVE

VARIMOT® Variable Speed Gear Unit and Options

Edition

09/2000



Operating Instructions

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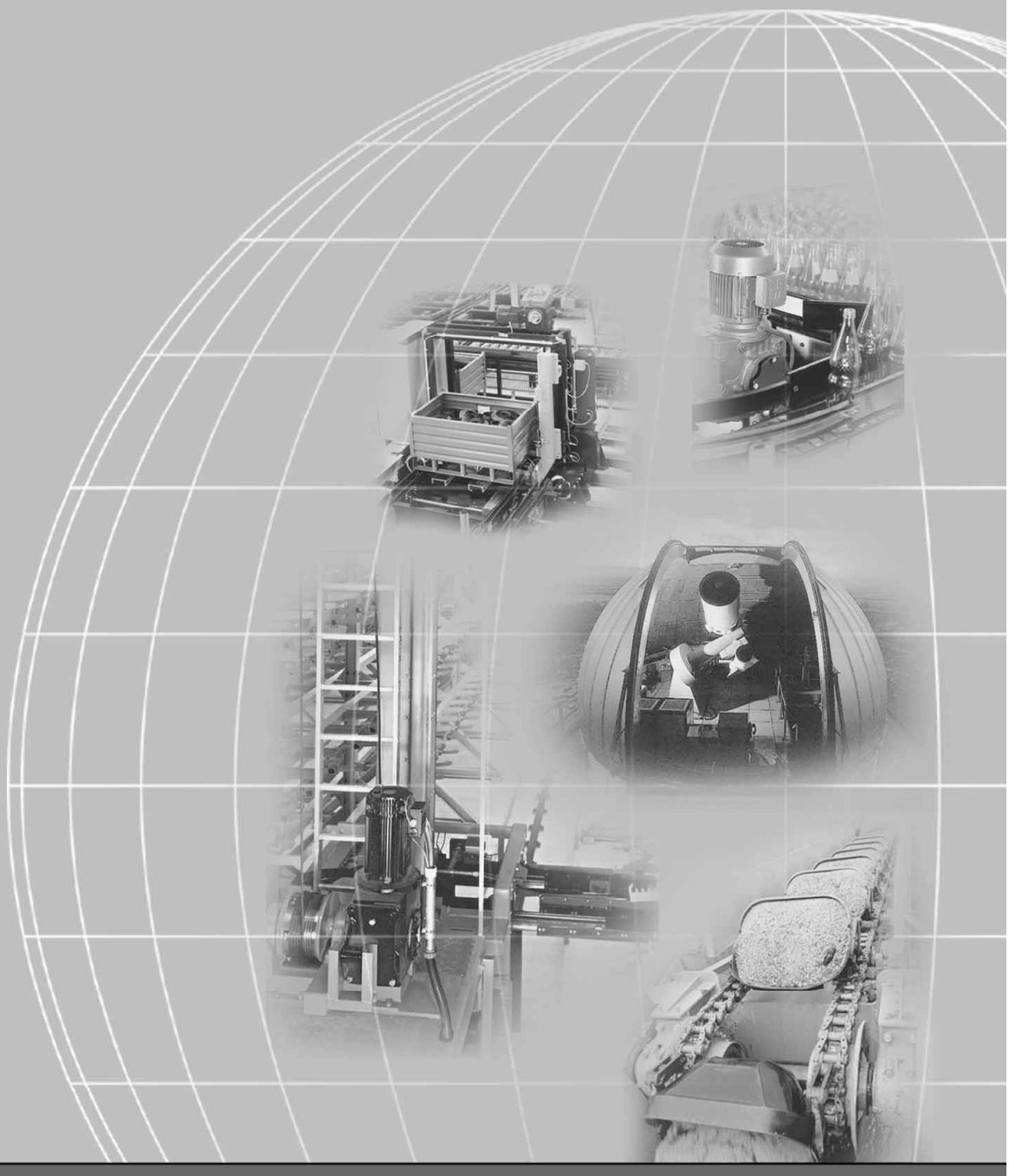

SEW-EURODRIVE

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1 Important Notes

Safety and warning instructions

Always follow warnings and safety instructions in this publication!

Electrical hazard
Possible effects: Serious or fatal injury.

Immediate danger
Possible effects: Serious or fatal injury.

Dangerous situation
Possible effects: Minor injury.

Harmful situation
Possible effects: Damage to equipment or surroundings.

Application hints and useful information.

Close adherence to these instructions is required for fault-free operation and fulfillment of any warranty claims. Read these instructions carefully before you start operating the drive!

These operating instructions contain vital servicing information and should be stored close to the drive unit.

Disposal

(Please observe all applicable regulations):

- Housing components, gear wheels, shafts and rolling bearings of gear units should be disposed of as steel scrap. This also applies to components made of cast iron if no separate collection is available.

Revisions to edition 3/95 are indicated by a gray bar in the margin.

2 Safety Notes

Preliminary remarks

The following safety notes apply to variable speed gear units.

When using **variable speed geared motors**, please observe safety notes for gear units and motors in the appropriate operating instructions.

Please refer to the additional safety notes in the individual sections of these operating instructions.

General

All tasks related to transport, storage, installation/assembly, connection, startup, service and maintenance may be performed by qualified technical personnel only with strict adherence to:

- detailed operating instruction(s) and block diagrams
- warning and safety labels on the gear unit/geared motor
- system-specific regulations and requirements
- national/regional safety and accident prevention regulations

Serious personal injuries and material damage may occur through

- incorrect use
- improper installation or operation
- inadmissible removal of required protective covers or of the housing

Be aware that variable speed geared motors contain live and moving components and hot surfaces during and after operation.

Intended usage

These variable speed geared motors/variable speed gear units are intended for industrial systems. They comply with existing standards and regulations. The technical data and information on approved operating conditions can be found on the nameplate and in the documentation.

All details must be strictly observed!

Transport / Storage

Inspect the shipment for damages upon receipt. Inform the shipping company immediately of any damages. In case of damages, startup may have to be cancelled.

Securely tighten lifting eyebolts. The eyebolts are specifically designed for the weight of the geared motor/gear unit; no additional loads may be applied.

If necessary, use appropriate and sufficiently dimensioned handling equipment. Remove existing shipping braces prior to startup.

3 VARIMOT® Design

3.1 VARIMOT® variable speed gear unit – unit design

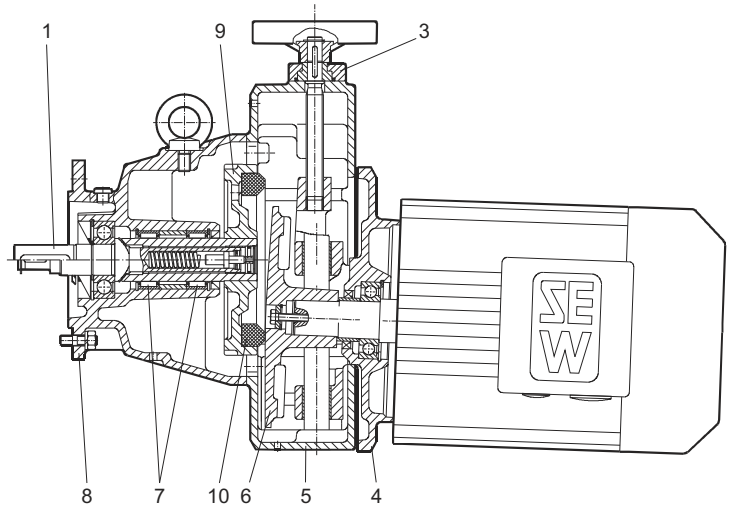

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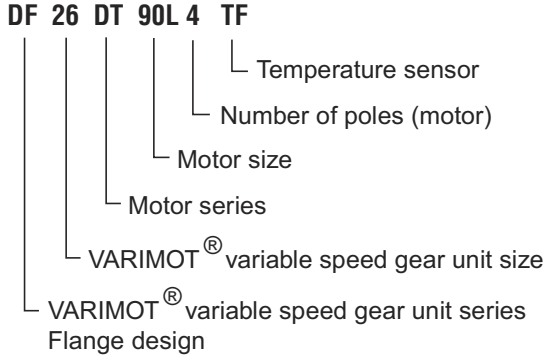
Figure 1: VARIMOT® design

1 Output shaft, complete
3 Plate
4 Adjustable plate
5 Cover
6 Drive disc
7 Needle bearing
8 Housing
9 Hollow shaft, complete
10 Friction ring

3.2 Type designation

Example



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3.3 Overview of VARIMOT® mounting options

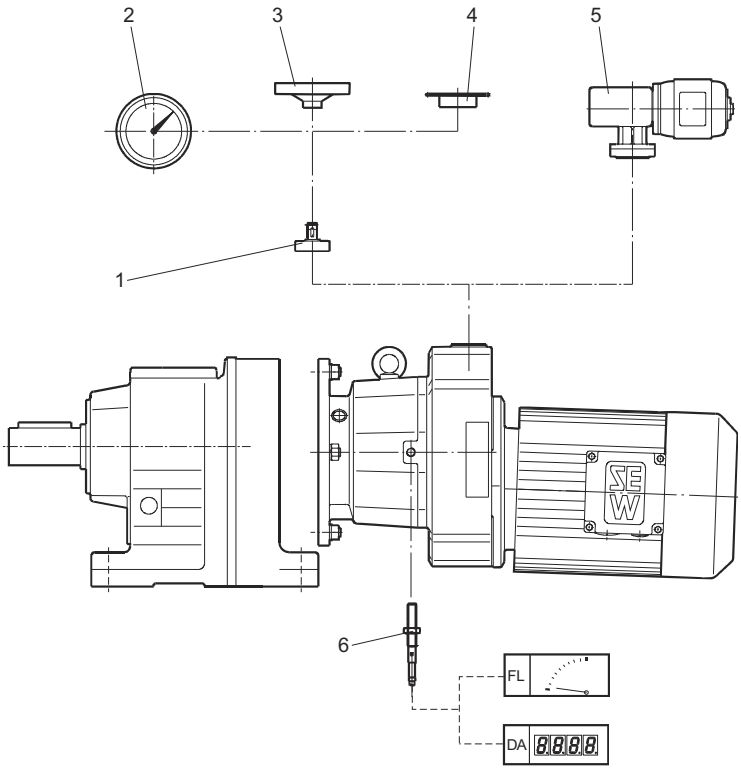

Figure 2: Overview of VARIMOT® mounting options

1 Adjustment device with free shaft end NV
2 Adjustment device with handwheel and position indication HS
3 Adjustment device with handwheel H (standard design)
4 Adjustment device with sprocket wheel K
5 Electromechanical remote adjustment EF and EFPA (with remote position indication)
6 Voltage pulse encoder IG with analog/digital remote speed display FL/DA

4 Installation

4.1 Before you begin

The drive may only be installed if

- the entries on the nameplate of the drive match the supply voltage
- the drive is not damaged (no damage resulting from transport or storage)
- the following requirements have been properly fulfilled:
  - ambient temperature between 0 °C and +40 °C,
  - no oils, acids, gases, vapors, radiation, etc.
- IP enclosure corresponds to ambient conditions

4.2 Preliminary work

Variable-speed gear units

Output shafts and flange surfaces must be completely free of anti-corrosion agents, contamination or other impurities (use a commercially available solvent). Do not let the solvent come into contact with the sealing lips of the oil seals – damage to the material may result!

Please note:

- The service life of the lubricant in the bearings is reduced if the unit is stored for more than one (1) year.

4.3 Installation of VARIMOT®

- The variable speed geared motor may be mounted or installed only in the specified position on a level[1)], vibration-free and torsionally rigid support structure. Do not tighten housing legs and mounting flanges against each other.

Please note:

- VARIMOT® design HS (handwheel with position indication) must be mounted so that the adjusting spindle is horizontal; otherwise the position indication will not function properly.

- **The breather valves must be easily accessible! The plastic plug of the condensate drain hole at the lowest position must be removed prior to operation (danger of corrosion!)**

- Carefully align the motor and driven machine to avoid overloading the motor shaft (observe approved overhung loads and axial forces!).
- Do not hammer or hit the shaft end.

- **Protect vertically mounted motors with an appropriate cover to protect equipment from foreign bodies or fluids! (cowl C)**

- Ensure adequate supply of cooling air and that heated air from other units is not drawn in.

Installation in damp areas or in the open

- VARIMOT® gear units are supplied in corrosion-resistant versions (design B) for use in damp areas or in the open. Any paint damages must be repaired.
- Coat the threads of screwed cable glands and sealing plugs with sealant, and tighten well – apply another coat of sealant.

1) Maximum permitted flatness error for flange mounting (approximate value with reference to DIN ISO 1101): with → flange 120 – 600 mm max. error 0.2 – 0.5 mm

- Properly seal the cable entry.
- Thoroughly clean the sealing surfaces of the terminal box and terminal box cover before re-assembly. Replace porous seals!

Painting the gear unit

If the drive will be painted or partially repainted, ensure that the breather valve and oil seals are carefully covered with tape. Remove tape strips after the paint work is finished.

Required tools

- Wrench set
- Mounting device
- Mounting materials for output components

Installation tolerances

Shaft end	Flanges
Diametric tolerances in accordance with DIN 748 • ISO k6 for solid shafts with d, $d_1 \leq 50$ mm • ISO k7 for solid shafts with d, $d_1 > 50$ mm • Center hole acc. to DIN 332, shape DR..	Centering shoulder tolerances acc. to DIN 42948 • ISO j6 at $b_1 \leq 230$ mm • ISO h6 at $b_1 > 230$ mm

4.4 Mounting of output components

Figure 3 shows an example of a mounting device for mounting clutches or hubs onto variable speed gear unit shaft ends. The thrust bearing on the mounting device may become redundant.

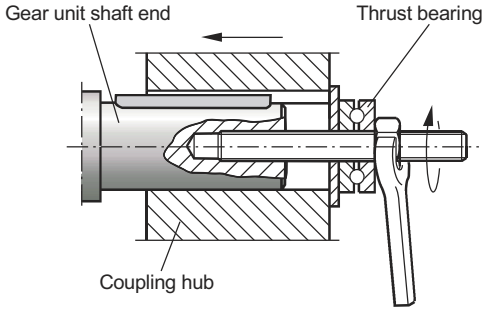

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Figure 3: Example of a mounting device

Figure 4 shows the correct mounting arrangement ② of a gear or sprocket wheel in order to avoid excessive overhung loads.

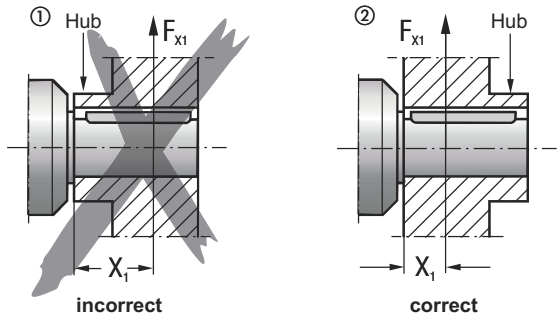

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Figure 4: Correct mounting arrangement of a gear wheel or a sprocket wheel

- Only use a mounting device (see Figure 3) for installing input and output elements. Use the center bore and the thread on the shaft end for positioning purposes.
- **Never drive belt pulleys, clutches, pinions, etc. onto the shaft end by hitting them with a hammer (damage to bearings, housing and the shaft!).**
- **Please observe correct tension of the belt for belt pulleys (in accordance with manufacturer's specifications).**
- Mounted transmission elements should be balanced and may not cause any unacceptable radial or axial forces (see Figure 4).

Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly (80–100 °C).

Installation of clutches

While installing clutches, the following items must be balanced in accordance with clutch manufacturer specifications:

a) Maximum and minimum clearance

b) Axial offset

c) Angular offset

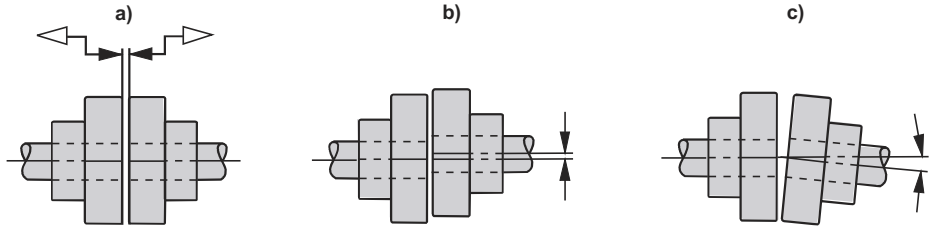

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Figure 5

Input and output elements such as belt pulleys, clutches, etc. must be equipped with a touchguard device!

5 Startup

5.1 VARIMOT® startup

Check the correct direction of rotation in the **disengaged** state (paying special attention to unusual sliding noises during racing phase).

Secure key for operation of output components in trial run. Do not deactivate monitoring and protection devices – not even for the trial run.

If in doubt, modifications to normal operation (e. g. increased temperature, noises, vibrations) may require that the variable speed geared motor be switched off. Determine the cause and contact SEW, if necessary.

6 Installation and Setup of Optional Equipment

Secure key for trial run without output components. Do not deactivate monitoring and protection devices – not even for the trial run.

6.1 Connection and setup of EF/EFPA adjustment device

Electromechanical remote speed adjustment EF, EFPA

The electromechanical remote speed adjustment option consists of a variable speed motor featuring a display unit in the EFPA version. This display unit may be installed in a control cabinet. The display does not indicate speed changes due to load fluctuations.

Note:

The electromechanical remote speed adjustment option EF is designed for 40 % ED and a switching rate of ≤ 20 times per hour. It is not suited for automatic control.

Connecting the variable speed motor EF, EFPA

1. Remove housing cover (1) from the switch element of the variable speed motor
2. Electrically connect the device
   - – according to the enclosed wiring diagram
   - – in accordance with the information on the nameplate
3. a) if desired, limit the speed range for the variable speed motor EF (see section "Limiting the speed range for EF, EFPA" on page 13), otherwise replace housing cover

   b) for EFPA variable speed motor, connect the display unit according to the enclosed wiring diagram (section "Connecting / adjusting display unit for EFPA" on page 13)

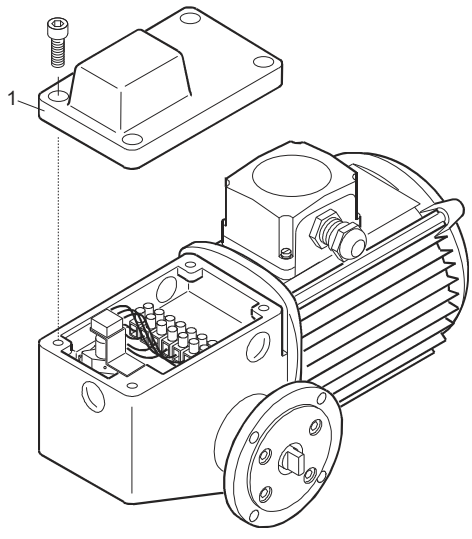

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Figure 6: Connecting variable speed motor EF, EFPA

Connecting / adjusting display unit for EFPA

The display unit for the electromechanical remote speed adjustment option can be used only in conjunction with the EFPA variable speed geared motor.

1. Connect the unit according to the enclosed wiring diagram
2. Adjust variable speed geared motor to desired minimum speed
3. Adjust display unit via "MIN" setting screw:
   - for D16 through D36 to 20 %
   - for D46 to 25 %
4. Adjust variable speed geared motor to desired maximum speed
   - Adjust display unit via "MAX" setting screw to 100 %

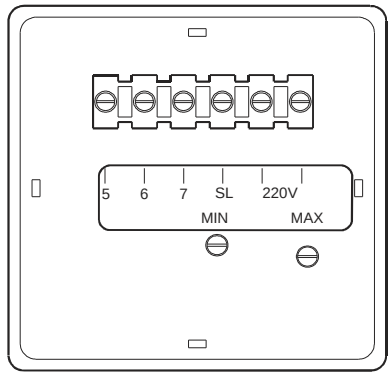

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Figure 7: Location of setting screws on the display unit

Limiting the speed range for EF, EFPA

The operating cams for the limit switches are set in the factory so that the complete speed range of the VARIMOT® variable speed geared motor is available. The range can be limited as follows (Figure 8):

Limit the adjustment range only via limit switches – do not run motor to mechanical stop (potential material damage)!

1. Remove housing cover (1) from switch element of the variable speed motor
2. Adjust VARIMOT® to desired upper limit position (scale ≤ 100 = maximum speed)
3. a) **upper operating cam (3):**
   - loosen with screwdriver
   - turn <u>counterclockwise</u> until tripping point is reached

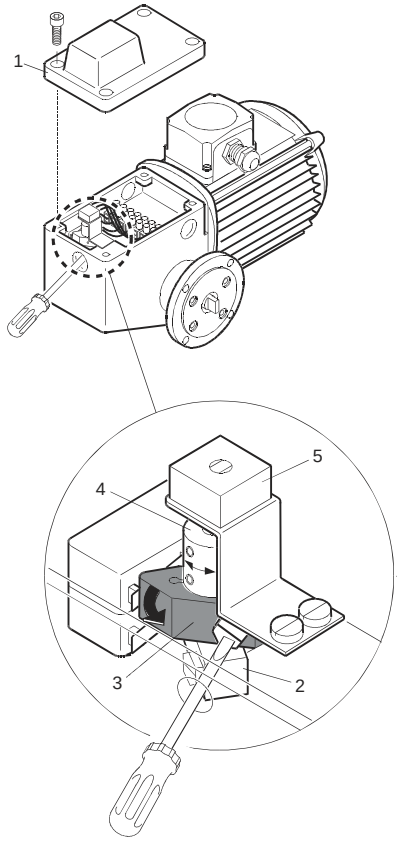

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Figure 8: Position and detail view of setting cams

for design with potentiometer (5)
(Figure 9):

b) loosen lower screw of clutch (4)
c) turn potentiometer (5) on clutch
   – counterclockwise until stop is reached
   – clockwise by approx. 15 ° until 120 to 180 Ω are present on terminals 6 and 7
d) tighten lower screw of clutch (4)

4. tighten upper operating cam (3)
5. set VARIMOT® to desired lower limit position (scale ≥ 100 = minimum speed)
6. **lower operating cam (2)**
   – loosen with screwdriver, turn clockwise until tripping point is reached
   – tighten
7. install housing cover (1) (enclose wiring diagram)

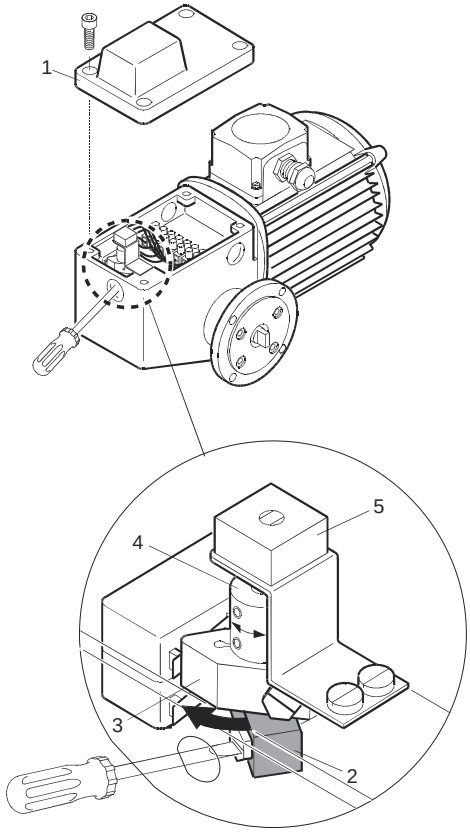

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Figure 9: Position and detail view of setting cams

6.2 Installation, connection and setting of IG, FL and DA

Various designs

The following designs are possible:

1. IG:
   – The scope of delivery for this design contains only the IG voltage pulse encoder without FL or DA display unit.
2. FL:
   – The scope of delivery for this design contains the IG voltage pulse encoder with FL analog remote speed indication.
3. DA:
   – The scope of delivery for this design contains the IG voltage pulse encoder with DA digital remote speed indication.
4. IGV:
   – This design includes an M16x1 thread for attaching a voltage pulse encoder to the housing of the variable speed geared motor.

Installation of the IG voltage pulse encoder

The separate IG voltage pulse encoder is installed as follows:

1. Install voltage pulse encoder (30) into the appropriate thread of the geared motor housing until it touches the pressure disc (31).
2. Turn back voltage pulse encoder (30) by two turns (clearance = 2 mm)
3. Secure voltage pulse encoder (31) with lock nut
4. If no display is present, correct input sensitivity:
   – increase or decrease clearance between voltage pulse encoder and pressure disc

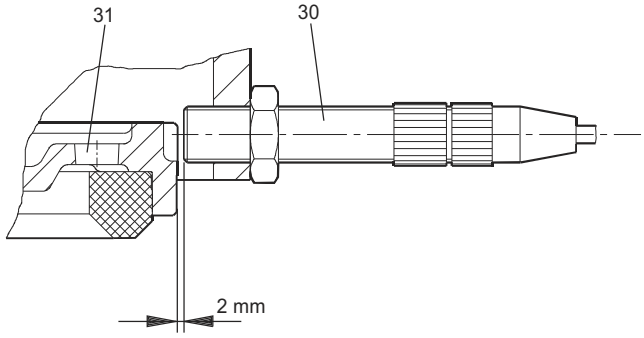

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Figure 10: IG voltage pulse encoder

Contact-free FL analog remote speed display

- IG voltage pulse encoder
- Analog display unit (scale from 0 % to 100 %)
- Supply voltage 230 V, 40-60 Hz
- Encoder connection with two-core shielded cable

Connection/ adjustment of FL

The FL analog remote speed display is connected to the IG voltage pulse encoder at the VARIMOT®.

1. Connect the device
2. Operate drive at maximum speed
3. Adjust the unit via setting screws "GROB" (coarse) or "FEIN" (fine) (at the back of the display unit) to a reading of 100 %
4. Ensure perfect ground connection at terminal M

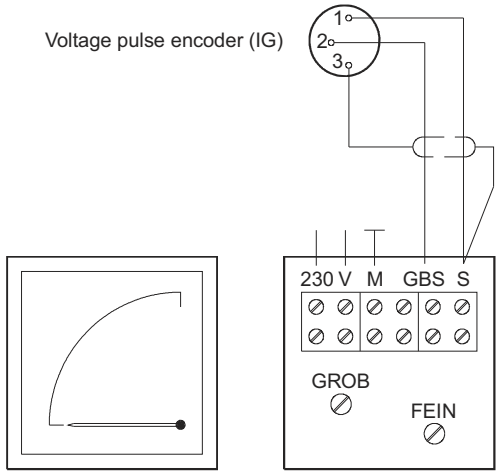

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Figure 11: Connecting and adjusting FL analog remote speed display

Contact-free DA digital remote speed display

- IG voltage pulse encoder
- Digital display unit
- Supply voltage 230 V, 50-60 Hz
- Power consumption approx. 4.2 VA
- Encoder connection with two-core cable, shielded

Connection/ adjustment of DA

The DA digital remote speed display is connected to the IG voltage pulse encoder (Figure 12 and Figure 13):

1. Connect the device (Figure 12)
2. Ensure perfect ground connection at terminal 1
3. Set measuring interval (Figure 13 and Section "DA calculation examples" on page 18)
   - Calculation using a formula
   - Data in accordance with Table 1 on page 18
4. Adjust input sensitivity (Figure 13):
   - Turn potentiometer "input sensitivity" clockwise until pulse indicator light starts to glow

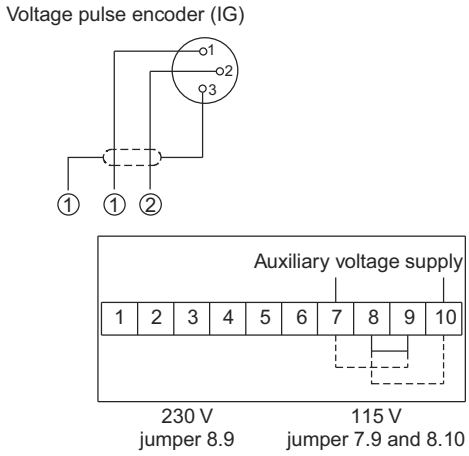

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Figure 12: Connecting the DA digital remote speed display

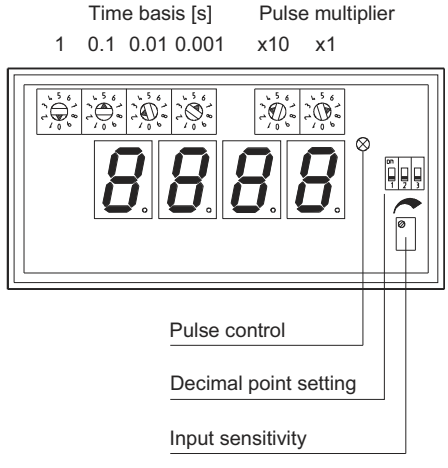

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Figure 13: Adjusting the DA digital remote speed display

DA adjustment information

- Accuracy of indication: + / -1 of last digit
- Measuring interval (quartz): adjustment in increments of 0.001 s in the range of 0.010 s to 9.999 s after removing the face plate, recommended measuring interval: 0.5 to 2 s
- Pulse multiplier: adjustment in the range from 1 to 99 after removing the face plate
- Decimal point setting: via DIP switch after removing the face plate
- Calculation of measuring interval:

$$\text{Measuring interval} = \frac{60 \cdot A}{n \cdot k \cdot z \cdot f}$$

A = 4-digit display (at maximum speed), without decimal indication

n = speed (Table 1 on page 18)

k = pulse multiplier ≥ 1

z = pulses / revolution (Table 1)

f = calculation factor (at 50 Hz = 1, at 60 Hz = 1.2)

Type / Size VARIMOT®	Pulses / Revolution	VARIMOT® reference speed [rpm]			
		2-pole	4-pole	6-pole	8-pole
D 16	6	3305	1690	1065	833
D 26		3520	1825	1200	885
D 36		3370	1675	1080	825
D 46		3240	1610	1073	850

Table 1: DA reference data

DA calculation examples

	Example 1	Example 2
Drive	R103R72D36DADV112M4	R103R72D36DADVDV112M4
Data	Output speed n_a = 1.5 – 7.5 Pulses / revolution z = 6 (Table 1 on page 18) Max. speed var. speed gear n = 1675 rpm (Table 1 on page 18)	Output speed n_a = 1.5 – 7.5 Pulses / revolution z = 6 (Table 1 on page 18) Max. speed var. speed gear n = 1675 rpm (Table 1 on page 18)
Selected display	Output speed A = 1.500 – 7.500 min^{-1}	Belt speed A = 0.5 . 2.5 m/min
$\frac{60 \cdot A}{n \cdot k \cdot z \cdot f}$	$\frac{60 \cdot 7500}{1675 \cdot 1 \cdot 6 \cdot 1} = 44,78s$	$\frac{60 \cdot 2500}{1675 \cdot 1 \cdot 6 \cdot 1} = 14,925s$
Recommended measuring interval	0.5 - 2 s (max. 9.999 s)	
Calculation with new pulse multiplier	k = 50 Measuring interval = $\frac{60 \cdot 7500}{1675 \cdot 50 \cdot 6 \cdot 1} = 0,896s$	k = 10 Measuring interval = $\frac{60 \cdot 2500}{1675 \cdot 10 \cdot 6 \cdot 1} = 1,493s$
Device setup	Measuring interval: [0] [8] [9] [6] Pulse multiplier: [5] [0] Decimal point setting: 1	Measuring interval: [1] [4] [9] [3] Pulse multiplier: [1] [0] Decimal point setting: 1

7 Inspection / Maintenance

7.1 Inspection and maintenance intervals

Unit / unit part	Interval	What to do?	-> Section
VARIMOT®	Every **3000** hours of operation At least **every six months**	Check torsional play (wear of friction ring)	see "Check torsional play" on page 19
EF, EFPA	Every **20 000** adjustments At least **every six months**	Check adjusting spindle • replace, if necessary • otherwise lubricate	see "Lubricate EF/ EFPA adjusting spindle" on page 21

7.2 Before you begin

Required tools

- Wrench set
- Hammer
- Mandrel or drift punch
- Hand lever press
- Lubricant "Never Seeze normal"

Before opening the drive, the motor must be disconnected from the power supply and protected from unintentional re-start!

7.3 Inspection / maintenance of VARIMOT®

Check torsional play

The torsional play of the output shaft is increased through wear of the friction ring. The torsional play can be checked as follows:

1. Remove fan cover of drive motor
2. Adjust output to speed ratio 1:1 (approximately value "80" on the scale of the position indication)
3. Check torsional play at motor fan blade with fixed drive shaft
4. If torsional play measures > 45 °, the friction ring must be checked (see "Checking the friction ring" on page 20)

Checking the friction ring

1. Loosen all retaining screws (2)
2. Disconnect drive between housing cover and housing
3. Check friction ring
   - if chamfers are visible: friction ring is OK
   - if friction ring is damaged or chamfer is ground off: replace friction ring

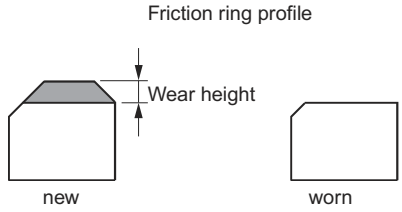

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Figure 14: Check friction ring

Replacing the friction ring

1. Pull entire hollow shaft (9) from housing (8)
2. Remove friction ring (10) from hollow shaft using hammer and mandrel or drift punch
3. Place new friction ring on a clean, level base
4. Place complete hollow shaft on friction ring
   - pre-center via friction ring offset
5. Press hollow shaft and friction ring together using slight pressure (if possible, use hand lever press) until stop is reached
6. Lubricate needle bearing (7) with anti-friction bearing grease

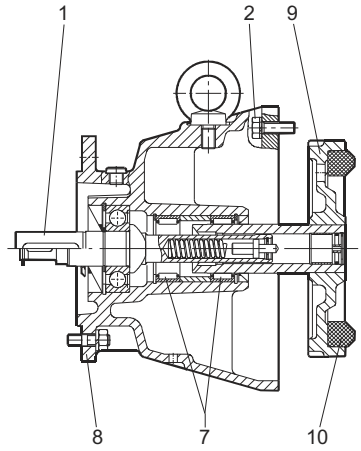

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Figure 15: Checking/replacing friction ring

7. Clean bearing surface:
   - friction ring – use dry paper or cloth
   - drive disc (6) – use degreasing detergent
8. Push entire hollow shaft with friction ring into the housing
   - turn the hollow shaft during insertion until cam lines are engaged (do not turn hollow shaft any further)
9. Carefully join housing and housing cover and tighten evenly
10. Check torsional play at output shaft
    - correct: minor torsional play can be detected
11. Switch on varibale speed geared motor:
    - slowly pass through the speed range
    - correct: drive runs noise-free and vibration-free

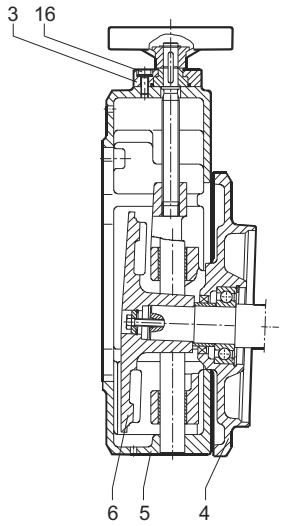

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Figure 16: Checking/replacing friction ring

7.4 Lubricate EF/ EFPA adjusting spindle

1. Remove variable speed motor (11) and intermediate flange (12)
2. Remove adjusting spindle (13) from drive by turning it clockwise
3. Lubricate adjusting spindle (4) with well-adhering lubricant, e. g. "Never Seeze normal"
4. Install in reverse order

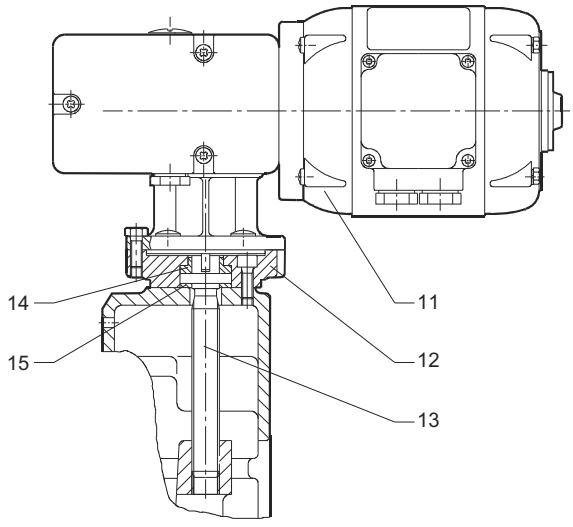

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Figure 17: Lubricate EF/ EFPA adjusting spindle

8 Operation and Service

Please provide the following information if you require assistance from customer service:

- Nameplate information
- State type and extent of the fault
- Time and circumstances of the fault
- Presumed cause

8.1 Malfunction of VARIMOT® variable speed gear unit

Malfunction	Possible cause	Solution
Drive slips	Friction ring is worn	Replace friction ring (Section "Check torsional play" on page 19)
	Friction ring or face of adjustment disc is contaminated	Clean contaminated part. • Friction ring – use dry paper or cloth • Drive disc – use solvent or similar product
	Load is too high	Check measured power and reduce to catalog values
Drive warms up excessively Note: Housing temperatures up to 70 °C are normal	Load is too high Ambient temperature is too high or was not considered during dimensioning	see above Reduce load based on ft factor in accordance with the catalog
Drive is too loud	Friction ring is damaged **Note:** Damage can occur • after brief stalling of the drive • with intermittent loading of the drive	1. Remedy cause 2. Replace friction ring (Section "Replacing the friction ring" on page 20)
Rated motor power is not transferred	Speed range is too small	Increase speed range

8.2 Malfunction of optional equipment

Electromechanical remote speed adjuster EF, EFPA

Malfunction	Possible cause	Solution
Adjustment rate too low	Sluggish conduction (e. g. due to corrosion) if B design is not used in humid locations	Re-establish low-friction conduction • Remove screws between housing and housing cover • Open drive • Place drive vertically on fan cover • Loosen screws under plastic cap next to handwheel • Pull pillar guides down and out of the drive • Lubricate guide screws with well-adhering lubricant, e. g. "Never Seeze normal" **Tip:** • First remove the pillar guides individually, then lubricate and re-assemble them.
Speed cannot be adjusted	Unit is not wired properly	Wire unit correctly in accordance with circuit diagram
Speed range cannot be reached	Limit switches of variable speed motor switch off too early	Adjust cams correctly for limit switch actuation (Section "Limiting the speed range for EF, EFPA" on page 13)
No display	• Display unit is not properly connected • Voltage supply is missing or interrupted	Connect display unit correctly in accordance with circuit diagram
Incorrect display	Display is not properly adjusted	Adjust display on back of unit (Section "Limiting the speed range for EF, EFPA" on page 13)

Contact-free remote speed display FL and DA, voltage pulse encoder IG

Malfunction	Possible cause	Solution
No display or no signal	Input sensitivity (clearance of pulse encoder / screw head) too high or too low	Correct input sensitivity: Increase or decrease clearance between IG voltage pulse encoder and screw head (Section "Various designs" on page 15)
	• Unit is not properly connected • Voltage supply is missing or interrupted	Connect unit correctly in accordance with wiring diagram

SEW Worldwide

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	Additional addresses for service in Germany provided on request!		
France			
Production Sales Service	Haguenau	SEW-USOCOME SAS 48-54, route de Soufflenheim B.P.185 F-67506 Haguenau Cedex	Phone: 03 88 73 67 00 Fax: 03 88 73 66 00 http://www. USOCOME.com sew@usocome.com
Production	Forbach	SEW-USOCOME SAS Zone industrielle Technopole Forbach Sud B. P. 30269 F-57604 Forbach Cedex	
Assembly Service Technical Office	Bordeaux	SEW-USOCOME SAS Parc d'activités de Magellan 62, avenue de Magellan - B. P.182 F-33607 Pessac Cedex	Phone: 05 57 26 39 00 Fax: 05 57 26 39 09
	Lyon	SEW-USOCOME SAS Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Phone: 04 72 15 37 00 Fax: 04 72 15 37 15
	Paris	SEW-USOCOME SAS Zone industrielle, 2, rue Denis Papin F-77390 Verneuil l'Etang	Phone: 01 64 42 40 80 Fax: 01 64 42 40 88
	Additional addresses for service in France provided on request!		

Argentina			
Assembly Sales Service	Buenos Aires	SEW EURODRIVE ARGENTINA S.A. Centro Industrial Garin, Lote 35 Ruta Panamericana Km 37,5 1619 Garin	Phone: (3327) 45 72 84 Fax: (3327) 45 72 21 sewar@sew-eurodrive.com.ar
Australia			
Assembly Sales Service	Melbourne	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Phone: (03) 99 33 10 00 Fax: (03) 99 33 10 03
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Phone: (02) 97 25 99 00 Fax: (02) 97 25 99 05
Austria			
Assembly Sales Service	Vienna	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Phone: (01) 6 17 55 00-0 Fax: (01) 6 17 55 00-30 sew@sew-eurodrive.at
Belgium			
Assembly Sales Service	Bruxelles	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Phone: (010) 23 13 11 Fax: (010) 2313 36 http://www.caron-vector.be info@caron-vector.be
Brazil			
Production Sales Service	Sao Paulo	SEW DO BRASIL Motores-Redutores Ltda. Caixa Postal 201-0711-970 Rodovia Presidente Dutra km 213 CEP 07210-000 Guarulhos-SP	Phone: (011) 64 60-64 33 Fax: (011) 64 80-43 43 sew.brasil@originet.com.br
Bulgaria			
Sales	Sofia	BEVER-DRIVE GMBH Bogdanovetz Str.1 BG-1606 Sofia	Phone: (92) 9 53 25 65 Fax: (92) 9 54 93 45 bever@mbox.infoPhone:bg
Canada			
Assembly Sales Service	Toronto	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, Ontario L6T3W1	Phone: (905) 7 91-15 53 Fax: (905) 7 91-29 99
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Phone: (604) 9 46-55 35 Fax: (604) 946-2513
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Street LaSalle, Quebec H8N 2V9	Phone: (514) 3 67-11 24 Fax: (514) 3 67-36 77
Chile			
Assembly Sales Service	Santiago de Chile	SEW-EURODRIVE CHILE Motores-Reductores LTDA. Panamericana Norte No 9261 Casilla 23 - Correo Quilicura RCH-Santiago de Chile	Phone: (02) 6 23 82 03+6 23 81 63 Fax: (02) 6 23 81 79
China			
Production Assembly Sales Service	Tianjin	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Phone: (022) 25 32 26 12 Fax: (022) 25 32 26 11

Colombia			
Assembly Sales Service	Bogotá	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Phone: (0571) 5 47 50 50 Fax: (0571) 5 47 50 44
Croatia			
Sales Service	Zagreb	KOMPEKS d. o. o. PIT Erdödy 4 II HR 10 000 Zagreb	Phone: +385 14 61 31 58 Fax: +385 14 61 31 58
Czech Republic			
Sales	Prague	SEW-EURODRIVE S.R.O. Business Centrum Praha Luná 591 16000 Praha 6	Phone: 02/20 12 12 34 + 20 12 12 36 Fax: 02/20 12 12 37 sew@sew-eurodrive.cz
Denmark			
Assembly Sales Service	Copenhagen	SEW-EURODRIVEA/S Geminivej 28-30, P.O. Box 100 DK-2670 Greve	Phone: 4395 8500 Fax: 4395 8509
Estonia			
Sales	Tallin	ALAS-KUUL AS Paldiski mnt.125 EE 0006 Tallin	Phone: 6 59 32 30 Fax: 6 59 32 31
Finland			
Assembly Sales Service	Lahti	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Phone: (3) 589 300 Fax: (3) 780 6211
Greece			
Sales Service	Athens	Christ. Boznos & Son S.A. 12, Mavromichali Street P.O. Box 80136, GR-18545 Piraeus	Phone: 14 22 51 34-6 + 14 22 51 48-9 Fax: 1-4 22 51 59 Boznos@otenet.gr
Great Britain			
Assembly Sales Service	Normanton	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 GB-Normanton, West- Yorkshire WF6 1QR	Phone: 19 24 89 38 55 Fax: 19 24 89 37 02
Hungary			
Sales Service	Budapest	SEW-EURODRIVE Ges.m.b. H. Hollósi Simon Hút 14 H-1126 Budapest	Phone: (01) 2 02 74 84 Fax: (01) 2 01 48 98
Hong Kong			
Assembly Sales Service	Hong Kong	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road, Kowloon, Hong Kong	Phone: 2-7 96 04 77 + 79 60 46 54 Fax: 2-7 95-91 29 sew@sewhk.com
India			
Assembly Sales Service	Baroda	SEW-EURODRIVE India Private Limited Plot NO. 4, Gidc Por Ramangamdi · Baroda - 391 243 Gujarat	Phone: 0 265-83 10 86 Fax: 0 265-83 10 87 sewindia@wilnetonline.net
Ireland			
Sales Service	Dublin	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Phone: (01) 8 30 62 77 Fax: (01) 8 30 64 58

Italy			
Assembly Sales Service	Milan	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Phone: (02) 96 98 01 Fax: (02) 96 79 97 81
Japan			
Assembly Sales Service	Toyoda-cho	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Toyoda-cho, Iwata gun Shizuoka prefecture, P.O. Box 438-0818	Phone: (0 53 83) 7 3811-13 Fax: (0 53 83) 7 3814
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Assembly Sales Service	Ansan-City	SEW-EURODRIVE CO., LTD. R 601-4, Banweol Industrial Estate Unit 1048-4, Shingil-Dong Ansan 425-120	Phone: (031) 4 92-80 51 Fax: (031) 4 92-80 56
Luxembourg			
Assembly Sales Service	Bruxelles	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Phone: (010) 23 13 11 Fax: (010) 2313 36 http://www.caron-vector.be info@caron-vector.be
Macedonia			
Sales	Skopje	SGS-Skopje / Macedonia Teodosij Sinactaski” 6691000 Skopje / Macedonia	Phone: (0991) 38 43 90 Fax: (0991) 38 43 90
Malaysia			
Assembly Sales Service	Johore	SEW-EURODRIVE Sdn. Bhd. 95, Jalan Seroja 39 81100 Johore Bahru Johore	Phone: (07) 3 54 57 07 + 3 54 94 09 Fax: (07) 3 5414 04
Netherlands			
Assembly Sales Service	Rotterdam	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004AB Rotterdam	Phone: (010) 4 46 37 00 Fax: (010) 4 15 55 52
New Zealand			
Assembly Sales Service	Auckland	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Phone: (09) 2 74 56 272 74 00 77 Fax: (09) 274 0165 sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Phone: (09) 3 84 62 51 Fax: (09) 3 84 64 55 sales@sew-eurodrive.co.nz
Norway			
Assembly Sales Service	Moss	SEW-EURODRIVE A/S Solgaard skog 71 N-1539 Moss	Phone: (69) 2410 20 Fax: (69) 2410 40
Peru			
Assembly Sales Service	Lima	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos # 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Phone: (511) 349-52 80 Fax: (511) 349-30 02
Poland			
Sales	Lodz	SEW-EURODRIVE Polska Sp.z.o.o. ul. Pojezierska 63 91-338 Lodz	Phone: (042) 6 16 22 00 Fax: (042) 6 16 22 10 sew@sew-eurodrive.pl

Portugal			
Assembly Sales Service	Coimbra	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Phone: (0231) 20 96 70 Fax: (0231) 20 36 85 infosew@sew-eurodrive.pt
Romania			
Sales Service	Bucharest	Sialco Trading SRL str. Madrid nr.4 71222 Bucuresti	Phone: (01) 2 30 13 28 Fax: (01) 2 30 71 70 sialco@mediasat.ro
Russia			
Sales	St. Petersburg	ZAO SEW-EURODRIVE P.O. Box 193 193015 St. Petersburg	Phone: (812) 3 26 09 41 + 5 35 04 30 Fax: (812) 5 35 22 87 sewrus@post.spbnit.ru
Singapore			
Assembly Sales Service	Singapore	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644 Jurong Point Post Office P.O. Box 813 Singapore 91 64 28	Phone: 8 62 17 01-705 Fax: 8 61 28 27 Telex: 38 659
South Africa			
Assembly Sales Service	Johannesburg	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O. Box 27032 2011 Benrose, Johannesburg	Phone: (11) 49 44 380 Fax: (11) 49 42 300
	Capetown	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens, 7441 Cape Town P.O.Box 53 573 Racecourse Park, 7441 Cape Town	Phone: (021) 5 11 09 87 Fax: (021) 5 11 44 58 Telex: 576 062
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 39 Circuit Road Westmead, Pinetown P.O. Box 10433, Ashwood 3605	Phone: (031) 700 34 51 Telex: 622 407
Spain			
Assembly Sales Service	Bilbao	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnologico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Phone: 9 44 31 84 70 Fax: 9 44 31 84 71 sew.spain@sew-eurodrive.es
Sweden			
Assembly Sales Service	Jönköping	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Phone: (036) 34 42 00 Fax: (036) 34 42 80 www.sew-eurodrive.se
Switzerland			
Assembly Sales Service	Basel	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein near Basel	Phone: (061) 4 17 17 17 Fax: (061) 4 17 17 00 http://www.imhof-sew.ch info@imhof-sew.ch
Thailand			
Assembly Sales Service	Chon Buri	SEW-EURODRIVE (Thailand) Ltd. Bangpakong Industrial Park 2 700/456, M007, Tambol Bonhuaroh Muang District Chon Buri 20000	Phone: 0066-38 21 45 29/30 Fax: 0066-38 21 45 31

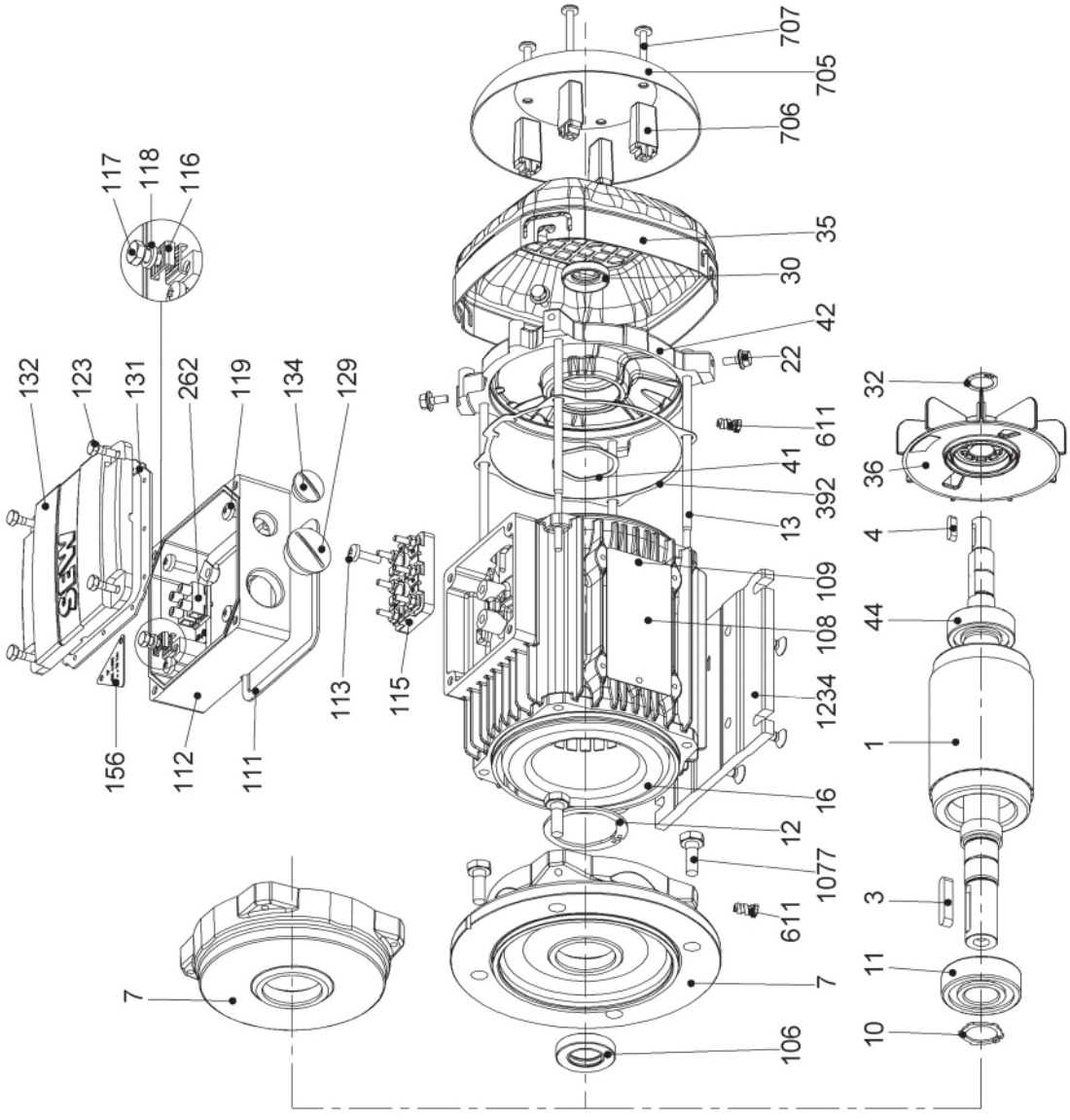
Turkey			
Assembly Sales Service	Istanbul	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti Bagdat Cad. Koruma Cikmazi No. 3 TR-81540 Maltepe ISTANBUL	Phone: (0216) 4 41 91 63 + 4 41 91 64 + 3 83 80 14 + 3 83 80 15 Fax: (0216) 3 05 58 67 seweurodrive@superonline.com.tr
Uruguay			
	Please contact our office in Argentina.		
USA			
Production Assembly Sales Service	Greenville	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Phone: (864) 4 39 75 37 Fax: Sales (864) 439-78 30 Fax: Manuf. (864) 4 39-99 48 Fax: Ass. (864) 4 39-05 66 Telex: 805 550
Assembly Sales Service	San Francisco	SEW-EURODRIVE INC. 30599 San Antonio Road P.O. Box 3910 Hayward, California 94544	Phone: (510) 4 87-35 60 Fax: (510) 4 87-63 81
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 200 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Phone: (856) 4 67-22 77 Fax: (856) 8 45-31 79
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Phone: (9 37) 3 35-00 36 Fax: (9 37) 4 40-37 99
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Phone: (214) 3 30-48 24 Fax: (214) 3 30-47 24
	Additional addresses for service in the USA provided on request!		
Venezuela			
Assembly Sales Service	Valencia	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia	Phone: (041) 32 95 83 + 32 98 04 + 32 94 51 Fax: (041) 32 62 75 sewventas@cantr.net sewfinanzas@cantr.net

SEW
Motor

Parts List

08 115 10 05

AC motor
DR.71S+M/FF/FT/FI/FE/FY/2W/C/AL/LN/Z
Flange version, Foot mounting



Refer to spare parts list for parts of the bed plate kit 08832__10
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
1	Rotor			*	1
3	Key	for IEC 14x30	DIN6885-1 A5x5x22 +C	00100072	1
3	Key	for IEC 19x40	DIN6885-1 A6x6x32 +C	00100153	1
4	Key	2W	DIN6885-1 A4x4x16 +C	00135232	1
7	A bearing end shield		FI	13612727	1
7	Flange		FF130 D160	13612689	1
7	Flange		FF165 D200	13612700	1
7	Flange		FT85 D105	13612751	1
7	Flange		FT100 D120	13612786	1
10	Retaining ring		DIN983 20x1,2-FS	00114618	1
11	Deep groove ball bearing		6204-2Z-C3-K52	13238795	1
12	Retaining ring		DIN472 47x1,75-FS	00103187	1
13	Machine screw	DR.71S	W4018 M5x131-6.8-ADB3	13237160	4
13	Machine screw	DR.71M	W4018 M5x156-6.8-ADB3	13237179	4
16	Stator			*	1
22	Hex head screw		EN1665 A-M5x10-8.8-A2F	13237616	4
30	Oil seal	with Item no. 998	W BAOFSF16x28x6/7-NBR	13262041	1
30	Oil seal	with Item no. 998; for 2-pole version	W BAOFSF16x28x6/7-FKM	13262351	1
32	Retaining ring		DIN471 15x1-FS	00102679	1
35	Fan Guard			13610503	1
35	Fan Guard	2W		13614487	1
35	Fan Guard	LN		13611690	1
36	Fan		D=101	13611550	1
36	Aluminum fan	AL	D=112	13611968	1
36	High Inert.Flywheel	Z	J=0,00213 kgm²	13640542	1
41	Equalizing ring		W4253 33x39,1x0,5	00115894	1
42	B bearing end shield	AL		13640712	1
42	B bearing end shield	GG		13639250	1
44	Deep groove ball bearing		6203-2Z-C3-K52	13236601	1
106	Oil seal	with Item no. 998	DIN AS20x35x7-NBR-OF	13241362	1
106	Oil seal	with Item no. 998; for 2-pole version	W AS20x35x7-FKM-OF	13241370	1
108	Nameplate			*	1
109	Grooved Pin		ISO8746 2x4-A-Niro	00107646	2
111	Gasket for lower part			01355635	1
112	Terminal box lower part		1x M25x1,5 ; 1x M16x1,5	13610570	1
112	Terminal box lower part		2x NPT 1/2"-14	13612018	1
113	Screw	parts included in stator complete	W4041 CE-M5x16-TX-A2F-GM1	00130591	1
115	Terminal Block	parts included in stator complete	W4720 KTM4-4.08-AS-KB-	13226193	1
116	Terminal clip		W4727 C10-FS-E2E	00104426	2
117	Screw		W4041 DE-S-M5x16-A2F-GM1	13237136	1
118	Lock washer		DIN7980 5-A2	00118206	1
119	Screw		W4041 CE-M5x16-TX-SZ-A2F-GM1	00130591	4
123	Screw		W4041 DE-S-M5x16-A2F-GM1	13237136	4
129	Screw plug		W4411 M25x1,5-PA6.6GF30-	00131385	1
129	Screw plug	for NPT thread 1/2"	W4411 M20x1,5-PA6.6GF30-	13256300	2
131	Gasket for cover			01355627	1
132	Terminal Box Cover			13611763	1
134	Screw plug		W4411 M16x1,5-PA6.6GF30-	00131334	1
156	Identification	for TF version	W4499 - TF	01366815	1
262	Terminal clip	2 pole		01823183	1
392	Gasket			13749056	1
611	Drain hole plug	DH		13618865	*
705	Protection canopy	C		13611623	1
706	Distance support	C		13618598	4
707	Pan head screw	C	W4036 REMFORM-6,0x35-TX-VZ	13262599	4

* order-dependently
Refer to spare parts list for parts of the bed plate kit 08832__10
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
998	Synthetic grease	for Item no. 30, 106	Klüber Petamo GHY133N	04963458	X)
1077	Hex head screw	for mounting to Adapter; for flange FF130 D160	ISO4017 M8x20-8.8-A2F	00110256	4
1077	Hex head screw	for mounting to Adapter; for flange FF165 D200	ISO4017 M10x30-8.8-A2F	00101176	4
1234	Bed plate kit	DR.71S FE/FI/FY	H=71; AxB=112x90	17534488	1
1234	Bed plate kit	DR.71M FE/FI/FY	H=71; AxB=112x90	17534585	1
1234	Bed plate kit	DR.71M FE80M/FI80M/FY80M	H=80; AxB=125x100	17534682	1
1439	Earth/gr.termin.complete	Kit		13633953	1

X) if required
Refer to spare parts list for parts of the bed plate kit 08832__10
When ordering spare parts always quote nameplate data with serial number and designation with part number!

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SEW EURODRIVE

Operating Instructions

AC Motors DR.71-225, 315

Edition 12/2009

16880811 / EN

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1 General Information

1.1 How to use the operating instructions

The operating instructions are an integral part of the product and contain important information on operation and service. The operating instructions are written for all employees who assemble, install, startup, and service this product.

The operating instructions must be accessible and legible. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. Consult SEW-EURODRIVE if you have any questions or if you require further information.

1.2 Structure of the safety notes

1.2.1 Meaning of the signal words

The following table shows the grading and meaning of the signal words for safety notes, notes on potential risks of damage to property, and other notes.

Signal word	Meaning	Consequences if disregarded
⚠ DANGER	Imminent danger	Severe or fatal injuries
⚠ WARNING	Possible dangerous situation	Severe or fatal injuries
⚠ CAUTION	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment
INFORMATION	Useful information or tip: Simplifies the handling of the drive system.	

1.2.2 Structure of the section safety notes

The section safety notes do not apply to a specific action, but to several actions pertaining to one subject. The used symbols indicate either a general or a specific hazard.

This is the formal structure of a section safety note:

⚠ SIGNAL WORD

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the danger.

1.2.3 Structure of the embedded safety notes

The embedded safety notes are directly integrated in the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

- **⚠SIGNAL WORD** Nature and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent the danger.

1.3 Rights to claim under warranty

Adhering to the operating instructions is a prerequisite for fault-free operation and the fulfillment of any right to claim under warranty. Read the operating instructions before you start working with the unit.

1.4 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of the electric motors and to achieve the specified product characteristics and performance features. SEW-EURODRIVE does not assume liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

1.5 Copyright

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2 Safety Notes

The following basic safety notes are intended to prevent injury to persons and damage to property. The operator must ensure that the basic safety notes are read and observed. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, please contact SEW-EURODRIVE.

2.1 Preface

The following safety notes relate primarily to the use of motors. If using gearmotors, please also refer to the safety notes for gear units in the corresponding operating instructions.

Also observe the supplementary safety notes in the individual sections of these operating instructions.

2.2 General information

⚠ DANGER

During operation, the motors and gearmotors can have live, bare and movable or rotating parts as well as hot surfaces, depending on their enclosure.

Severe or fatal injuries.

- All work related to transportation, storage, setup/mounting, connection, startup, maintenance and repair may only be carried out by qualified personnel, in strict observation of:
  - The relevant detailed operating instructions
  - The warning and safety signs on the motor/gearmotor
  - All other project planning documents, operating instructions and wiring diagrams related to the drive
  - The specific regulations and requirements for the system
  - The national/regional regulations governing safety and the prevention of accidents
- Never install damaged products
- Immediately report any damage to the shipping company

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to machinery.

Refer to the documentation for additional information.

2.3 Functional safety technology (FS)

Drives of SEW-EURODRIVE can be supplied with safety-relevant components.

MOVIMOT®, encoders or brakes, or other accessories, can be integrated in the AC motor as safety-relevant components either individually or in combination.

SEW-EURODRIVE indicates such an integration by the FS mark and a number on the nameplate (page 16).

The number is a code that indicates which components in the drive are safety-relevant. See the following code table:

Functional safety	Inverter (e.g. MOVIMOT®)	Brake	Manual brake release monitoring	Brake monitoring	Motor protection	Encoder
01	x					
02		x				
03					x	
04						x
05	x	x				
06	x				x	
07	x					x
08		x	x			
09		x		x		
10		x			x	
11		x				x
12					x	x
13	x	x				x
14	x				x	x
15		x	x			x
16		x		x		x
17		x			x	x
18	x	x	x		x	
19	x	x	x			x
20	x	x		x	x	
21	x	x		x		x
22	x	x			x	x
23	x	x	x		x	x
24	x	x		x	x	x
25	x	x	x	x	x	x

If the drive bears the FS mark on the nameplate, it is essential that you adhere to the information in the following documents:

- "MOVIMOT® MM..D Functional Safety" manual
- "Functional Safety for AC Motors DR.71-225, 315 – Geber" addendum to the operating instructions
- "Functional Safety for AC Motors DR.71-225, 315 – Brakes" addendum to the operating instructions

You find the characteristic safety values of the following components in the technical data (page 118) section so you can determine the security level for systems and machines yourself:

- Characteristic safety values for brakes: $B10_d$ values
- Characteristic safety values for encoders: $MTTF_d$ values

The characteristic safety values of SEW components are also available on the SEW homepage on the internet and in the SEW library for the BGIA Sistema software.

2.4 Target group

Any mechanical work may only be performed by adequately qualified personnel. Qualified personnel in this context are persons who are familiar with the setup, mechanical installation, trouble shooting and maintenance for this product. Further, they are qualified as follows:

- Training in mechanical engineering, e.g. as a mechanic or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

Any electronic work may only be performed by adequately qualified electricians. Qualified electricians in this context are persons who are familiar with the electronic installation, startup, trouble shooting and maintenance for this product. Further, they are qualified as follows:

- Training in electrical engineering, e.g. as an electrician or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

All work in further areas of transportation, storage, operation and waste disposal may be carried out only by persons who are trained appropriately.

All qualified personnel must wear appropriate protective clothing.

2.5 Designated use

These electric motors are intended for industrial systems.

When installed in machines, startup of the motors (i.e. start of designated operation) is prohibited until it is determined that the machine meets the requirements stipulated in EC directive 2006/42/EC (Machine Directive).

Use in potentially explosive atmospheres is prohibited, unless measures are expressly taken to make it possible.

Air-cooled types are dimensioned for ambient temperatures of -20 °C to +40 °C and installation altitudes ≤ 1000 m above sea level. Note that information on the nameplate may differ. It is essential that the conditions where the unit is operated correspond with all the nameplate data.

2.6 Other applicable documents

The following publications and documents have to be observed as well:

- Wiring diagrams provided with the motor
- "Gear Unit Series R..7, F..7, K..7, S..7, SPIROPLAN® W" operating instructions for gearmotors
- "DR Series AC Motors" catalog and/or
- "DR Gearmotors" catalog
- "Characteristic safety values for BE.. brakes" data sheet
- If required "Functional Safety for AC Motors DR.71-225, 315 – Brakes" addendum to the operating instructions
- If required "Functional Safety for AC Motors DR.71-225, 315 - Encoders" addendum to the operating instructions
- if required "MOVIMOT® MM..D Functional Safety" manual

2.7 Transport

Inspect the shipment immediately upon receipt for any damage that may have occurred during transportation. Inform the shipping company immediately. It may be necessary to preclude startup.

Tighten the eyebolts securely. They are only intended for the weight of the motor/ gearmotor; do not attach any additional loads.

The built-in lifting eyebolts comply with DIN 580. Always observe the loads and regulations listed in this standard. If the gearmotor is equipped with two eyebolts, both of these should be used for transportation. In this case, the tension force vector of the slings must not exceed a 45° angle according to DIN 580.

Use suitable, sufficiently rated handling equipment when necessary. Remove any transportation fixtures prior to startup. Reattach these in the case of further transportation.

2.8 Installation

Make sure that the supports are even, the foot and flange mounting is correct and if there is direct coupling, align with precision. Resonances between the rotational frequency and the double network frequency caused by the structure are to be avoided. Turn the rotor manually and listen for unusual noises. Check the direction of rotation in decoupled state.

Only install or remove belt pulleys and couplings using suitable devices (heat up) and cover with a touch guard. Avoid improper belt tension.

Make the pipe connections that may eventually be required. Mounting positions with shaft ends pointing upwards should be equipped with a cover to prevent foreign objects from falling into the fan. Ensure that ventilation openings are not obstructed and that used air, including air from adjacent units, cannot be drawn in again straight away.

Observe the notes in the "Mechanical Installation" section.

2.9 Electrical connection

All work may only be carried out by qualified personnel. During work, the low-voltage machine must be on standstill, enabled, and safeguarded against accidental restart. This also applies to auxiliary circuits (e.g. anti-condensation heating or forced cooling fan).

Check that the motor is de-energized!

Exceeding the tolerances in EN 60034-1 (VDE 0530, part 1) – voltage + 5%, frequency + 2%, curve shape, symmetry – increases the heating and influences electromagnetic compatibility. Also comply with EN 50110 (where necessary, observe other applicable national regulations, such as DIN VDE 0105 for Germany).

Observe the wiring information and differing data on the nameplate as well as the wiring diagram in the terminal box.

The connection should be a continuous secure electrical connection (no protruding wire ends); use the cable end equipment intended for this purpose. Establish a secure protective earth connection. When the motor is connected, the distances to non-insulated and live parts must not be shorter than the minimum values according to IEC 60664 and national regulations. With low voltage, the distances should be no shorter than the following values, in compliance with IEC 60664:

Rated voltage V_N	Distance
≤ 500 V	3 mm
≤ 690 V	5.5 mm

The terminal box must be free of foreign objects, dirt and humidity. Unused cable entry openings and the box itself must be closed so that they are dust and water proof. Secure keys for test mode without output elements. When operating low-voltage machines with brakes, check that the brake is functioning correctly before startup.

Observe the notes in the "Electrical Installation" chapter.

2.10 Operation

Whenever changes to normal operation occur, such as increased temperatures, noise, vibrations, etc., you should determine the cause. Consult the manufacturer if required. Never deactivate protection devices, even in test mode. Switch off the motor if you are not sure.

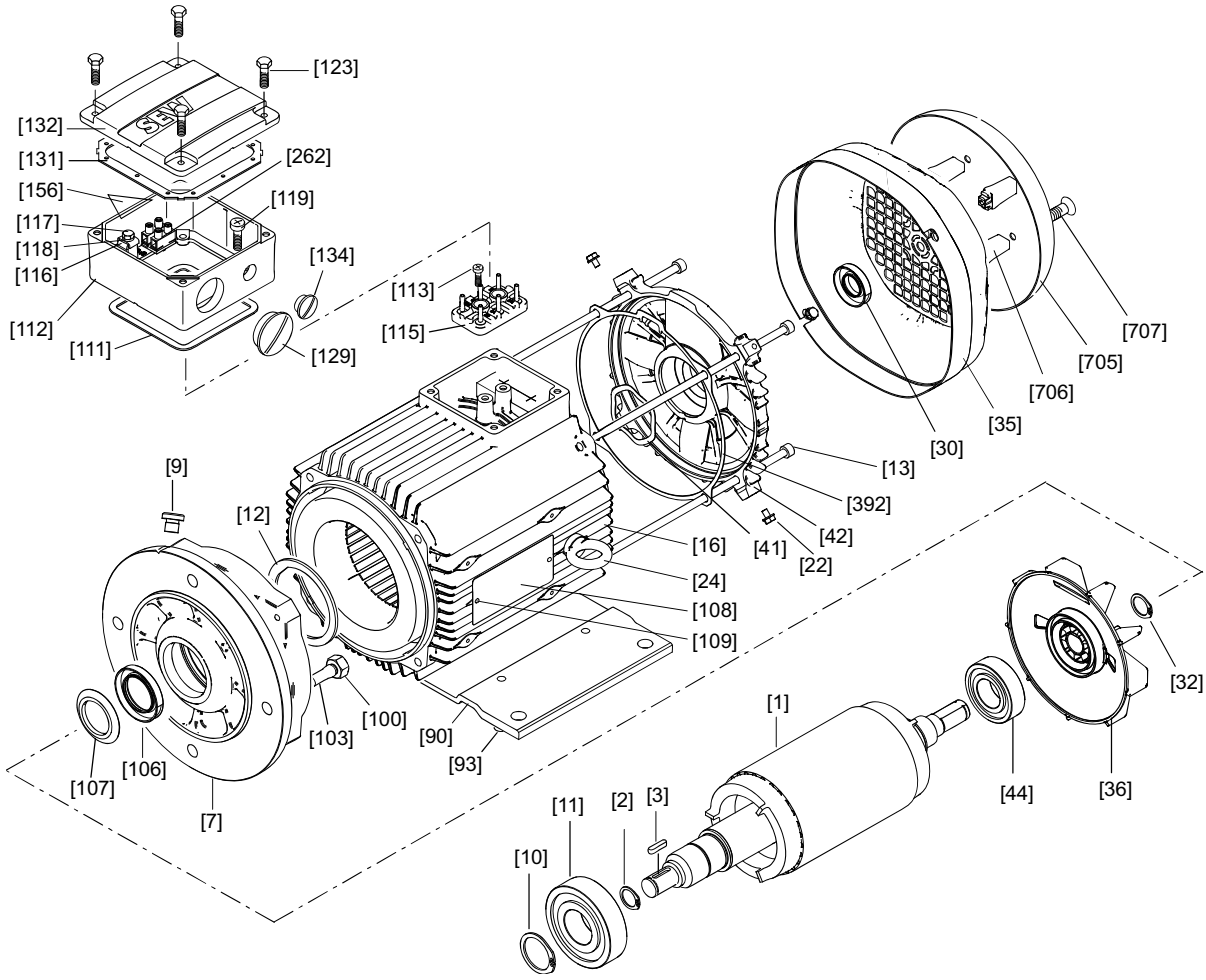
Regularly clean air ducts in dusty or dirty environments.

3 Motor Structure

INFORMATION

The following illustration is intended to explain the general structure. It helps you to assign components to the spare parts list. Deviations are possible depending on the motor size and version.

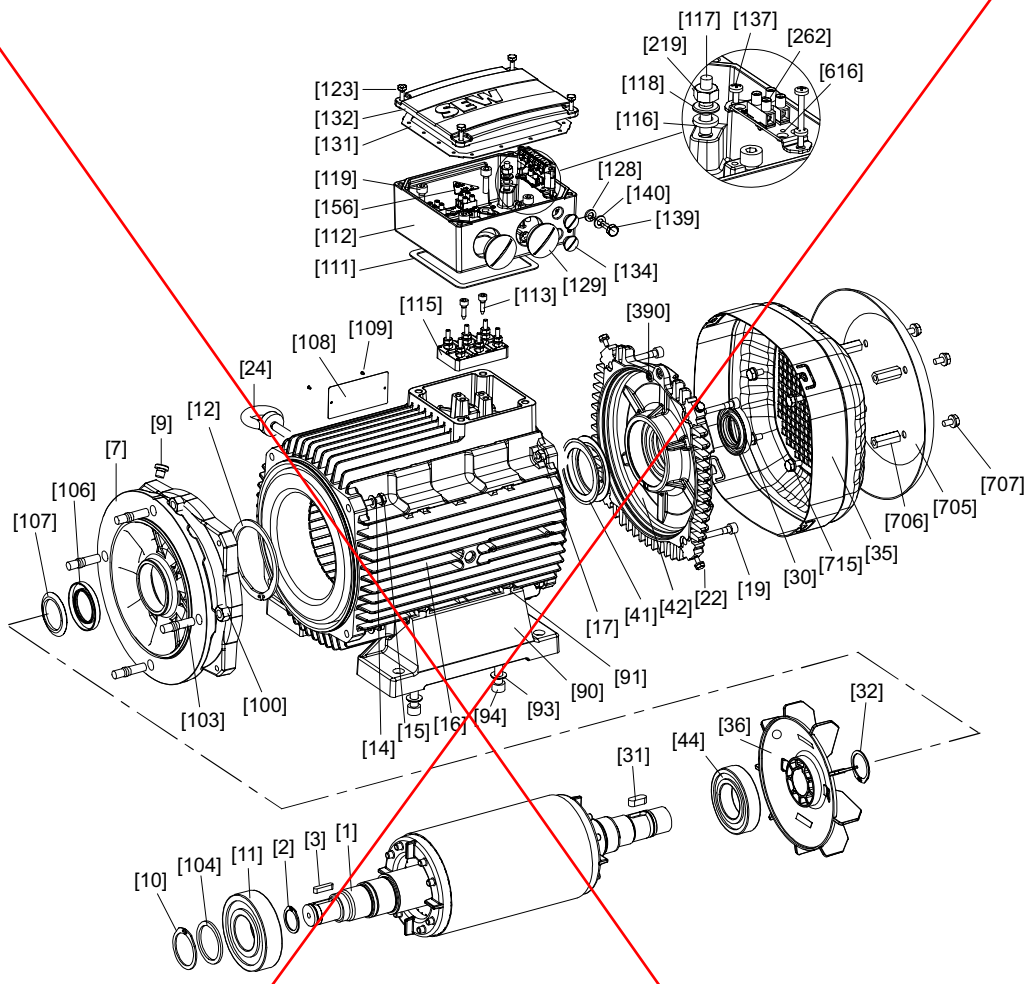
3.1 DR.71 - DR.132 – basic structure



173332747

[1] Rotor
[2] Circlip
[3] Key
[7] Flanged end shield
[9] Screw plug
[10] Circlip
[11] Grooved ball bearing
[12] Circlip
[13] Machine screw
[16] Stator
[22] Hex head screw
[24] Lifting eyebolt
[30] Oil seal
[32] Circlip
[35] Fan guard
[36] Fan
[41] Shim washer
[42] B-side endshield
[44] Grooved ball bearing
[90] Base plate
[93] Pan head screw
[100] Hex nut
[103] Stud
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Pan head screw
[115] Terminal board
[116] Terminal clip
[117] Hex head screw
[118] Lock washer
[119] Pan head screw
[123] Hex head screw
[129] Screw plug with O-ring
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug with O-ring
[156] Label
[262] Terminal clip, complete
[392] Sealing
[705] Protective cowl
[706] Spacer
[707] Pan head screw

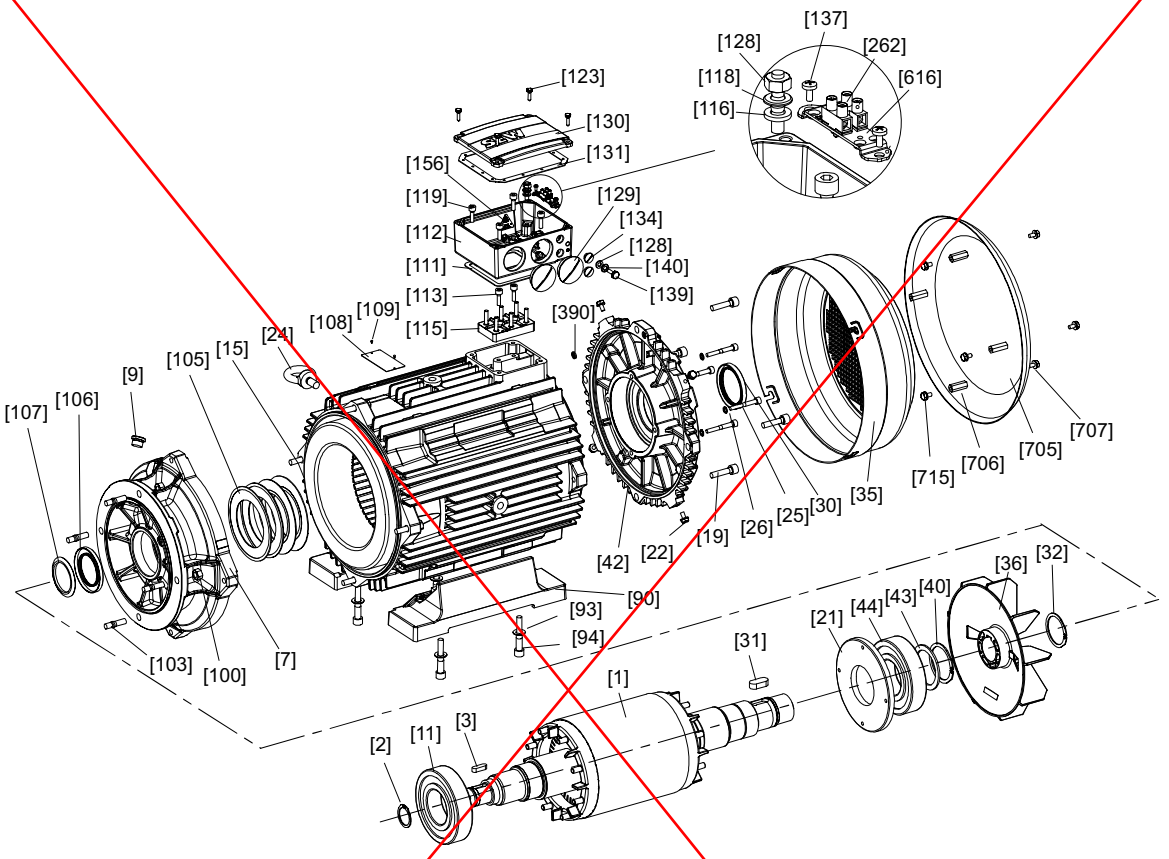
3.2 DR.160 - DR.180 – basic structure



527322635

[1] Rotor
[2] Circlip
[3] Key
[7] Flange
[9] Screw plug
[10] Circlip
[11] Grooved ball bearing
[12] Circlip
[14] Washer
[15] Hex head screw
[16] Stator
[17] Hex nut
[19] Machine screw
[22] Hex head screw
[24] Lifting eyebolt
[30] Sealing ring
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[41] Cup spring
[42] B-side endshield
[44] Grooved ball bearing
[90] Foot
[91] Hex nut
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[104] Supporting ring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Machine screw
[121] Grooved pin
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug with O-ring
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug with O-ring
[137] Screw
[139] Hex head screw
[140] Washer
[153] Terminal strip
[156] Label
[219] Hex nut
[262] Terminal clip
[390] O-ring
[616] Retaining plate
[705] Protective cowl
[706] Spacer
[707] Hex head screw
[715] Hex head screw

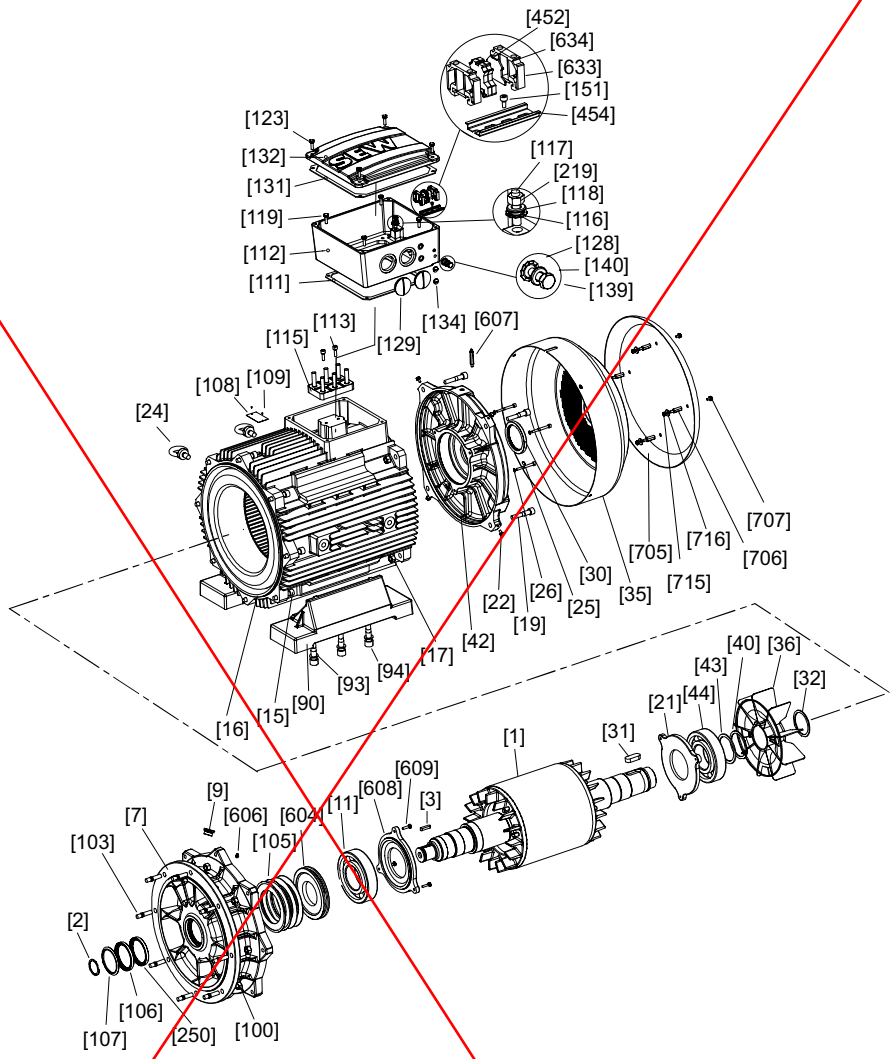
3.3 DR.200 - DR.225 – basic structure



1077856395

[1] Rotor
[2] Circlip
[3] Key
[7] Flange
[9] Screw plug
[11] Grooved ball bearing
[15] Hex head screw
[16] Stator
[19] Machine screw
[21] Oil seal flange
[22] Hex head screw
[24] Lifting eyebolt
[25] Machine screw
[26] Sealing washer
[30] Oil seal
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[40] Circlip
[42] B-side endshield
[43] Supporting ring
[44] Grooved ball bearing
[90] Foot
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[105] Cup spring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Machine screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Machine screw
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug
[137] Screw
[139] Hex head screw
[140] Washer
[156] Label
[219] Hex nut
[262] Terminal clip
[390] O-ring
[616] Retaining plate
[705] Protective cowl
[706] Spacer bolt
[707] Hex head screw
[715] Hex head screw

3.4 DR.315 – basic structure



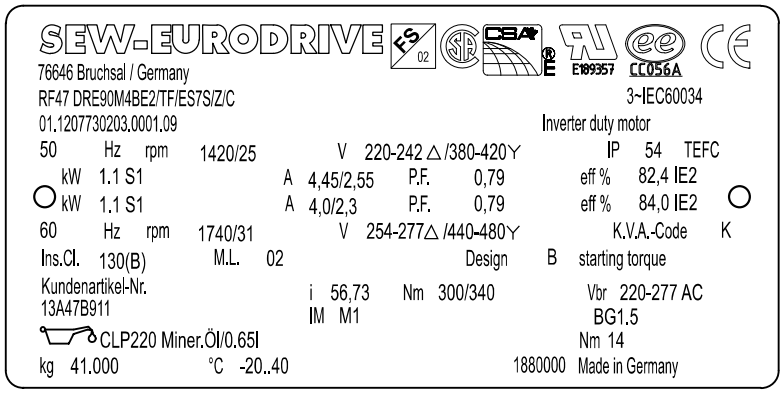
351998603

[1] Rotor
[2] Retaining ring
[3] Key
[7] Flange
[9] Screw plug
[11] Rolling bearing
[15] Machine screw
[16] Stator
[17] Hex nut
[19] Machine screw
[21] Oil seal flange
[22] Hex head screw
[24] Lifting eyebolt
[25] Machine screw
[26] Sealing washer
[30] Oil seal
[31] Key
[32] Retaining ring
[35] Fan guard
[36] Fan
[40] Retaining ring
[42] B-side endshield
[43] Supporting ring
[44] Rolling bearing
[90] Foot
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[105] Cup spring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Machine screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Hex head screw
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug
[139] Hex head screw
[140] Washer
[151] Machine screw
[219] Hex nut
[250] Oil seal
[452] Terminal strip
[454] Top hat rail
[604] Lubrication ring
[606] Greasing nipple
[607] Greasing nipple
[608] Oil seal flange
[609] Hex head screw
[633] End bracket
[634] End plate
[705] Canopy
[706] Spacer bolt
[707] Hex head screw
[715] Hex nut
[716] Washer

3.5 Nameplate, unit designation

3.5.1 Nameplate

Example: DRE gearmotor with brake



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The marks (page 117) on the upper edge of the nameplate are only present when the motor has been certified accordingly or when it includes the relevant components.

3.5.2 Unit designation

Example: Foot-mounted AC motor with brake

DRE 90 M4 BE2 /FI /TF /ES7S

- Motor option sinusoidal encoder ES7S
- Motor option thermal motor protection with thermistor TF
- IEC foot-mounted motor type
- Motor with brake BE2
- Motor length and number of poles
- Motor size
- DR motor series with code letter E type IE2 energy-efficient motor or MEPS A2 (Australia/New Zealand)

4 Mechanical Installation

INFORMATION

Comply with the safety notes in chapter 2 of these operating instructions during installation.

If the nameplate of the drive bears the FS mark, also comply with the information on mechanical installation in the associated addendums to the operating instructions and/ or the associated manual.

4.1 Before you start

NOTICE

The mounting position for installation must correspond to the specifications on the nameplate.

Only install the drive if the following conditions are met:

- The specifications on the nameplate of the drive correspond to the supply system or the output voltage of the frequency inverter
- The drive is undamaged (no damage caused by transportation or storage)
- You are certain that the following requirements have been met:
  - Ambient temperature between -20 °C and +40 °C.

    Note that the temperature range of the gear unit may also be restricted (see gear unit operating instructions)
  - No oil, acid, gas, vapors, radiation, etc.
  - Installation altitude max. 1000 m above sea level

    Observe chapter "Installation altitude" (page 27).
  - Note the restrictions for encoders
  - Special design: Drive configured in accordance with the ambient conditions

The above mentioned information refers to standard orders. The conditions might be different when you order drives other than the standard. Please refer to the order confirmation for differing conditions.

4.2 Mechanical installation

4.2.1 Preliminary work

Motor shaft ends must be thoroughly cleaned of anti-corrosion agents, contamination or similar (use a commercially available solvent). Do not allow the solvent to penetrate the bearings or shaft seals – this could damage the material.

Motors with reinforced bearing

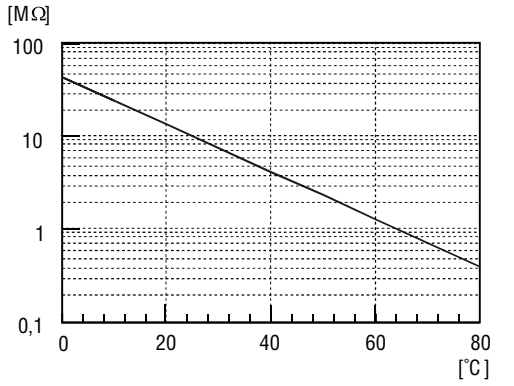
⚠ NOTICE

Motors with a reinforced bearing must not be operated without an overhung load. Otherwise you risk damaging the bearings.

Extended storage of motors

- Note that the service life of the lubricant in the ball bearings is reduced by 10% per year after the first year of storage.
- Before startup, you should relubricate the lubrication devices on motors that have been in storage for longer than 5 years. Observe the information on the motor lubricant plate.
- Check whether the motor has absorbed moisture as a result of being stored for a long time. Measure the insulation resistance for this purpose (measuring voltage 500 V).

The insulation resistance (see following figure) varies greatly depending on the temperature. The motor must be dried if the insulation resistance is not adequate.



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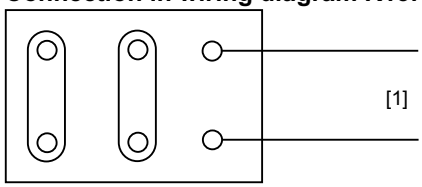
Drying the motor

Heat the motor:

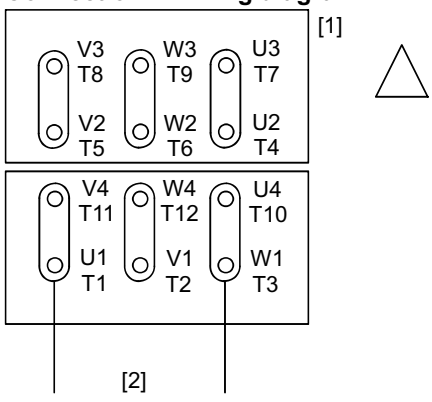
- With hot air or
- Using isolation transformer
  - Connect the windings in series (see following figures)
  - Auxiliary AC voltage supply max. 10% of the rated voltage with max. 20% of the rated current

Connection in wiring diagram R13:



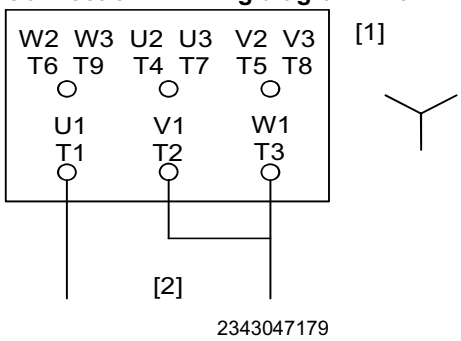
[1] Transformer

Connection in wiring diagram R72:



[1] Motor terminal boards
[2] Transformer

Connection in wiring diagram R76:



[1] Motor terminal board
[2] Transformer

The drying process is finished when the minimum insulation resistance has been exceeded.

In the terminal box, check that:

- The inside is clean and dry
- The connections and fixing parts are free from corrosion
- The gasket and sealing surfaces are functioning
- The cable glands are tight, otherwise clean or replace them

Non-SEW encoder mounting

If a drive was ordered with non-SEW encoder, SEW-EURODRIVE will deliver the drive with mounted coupling. For operation without non-SEW encoder, the coupling must be removed before operating the drive.

4.2.2 Installing the motor

⚠ CAUTION

Sharp edges due to open keyway.

Minor injuries.

- Insert key in keyway.
- Pull protective sleeve over shaft.

- Only install the gearmotor in the specified mounting position on a level, vibration-free and torsionally rigid support structure.
- Align the motor and the driven machine carefully to prevent the output shaft from being exposed to unacceptable strain. Observe the permitted overhung and axial forces.
- Do not jolt or hammer the shaft end.
- Use an appropriate cover, e.g. motor option /C "Canopy", to prevent objects or fluids entering motors in vertical mounting positions (M4/V1).
- Check that there is sufficient clearance around the motor to provide for adequate cooling, and that the motor does not suck in warm air from other devices.
- Balance components for subsequent mounting on the shaft with a half key (motor shafts are balanced with a half key).
- **Existing condensation drain holes are sealed with closing plugs. You must not remove these plugs as this would invalidate the higher degree of protection of the motor.**
- If using brakemotors with manual brake release, screw in either the hand lever (with self-reengaging manual brake release) or the setscrew (with lockable manual brake release).

Installation in damp locations or in the open

- If possible, arrange the terminal box so that the cable entries are pointing downwards.
- Coat the threads of the cable glands and filler plugs with sealing compound, tighten the glands properly, and coat again.
- Seal the cable entry properly.
- Clean the sealing surfaces of the terminal box and the terminal box cover carefully before re-assembly; gaskets have to be glued in on one side. Replace any brittle seals.
- If required, touch up the corrosion protection (especially at the eyebolts).
- Check the degree of protection.

4.2.3 Installation tolerances

Shaft end	Flanges
Diameter tolerance according to EN 50347 • ISO j6 with Ø ≤ 28 mm • ISO k6 with Ø ≥ 38 mm up to ≤ 48 mm • ISO m6 at Ø ≥ 55 mm • Center bore in accordance with DIN 332, shape DR..	Centering shoulder tolerance in accordance with EN 50347 • ISO j6 with Ø ≤ 250 mm • ISO h6 with Ø ≥ 300 mm

5 Electrical Installation

INFORMATION

- It is essential to observe the safety notes in section 2 during installation.
- Use switch contacts in utilization category AC-3 according to EN 60947-4-1 for switching the motor and the brake.

If the motor includes safety-relevant components, observe the following safety note:

⚠ DANGER

Disabling functional safety devices.

Severe or fatal injuries.

- Only qualified personnel is allowed to carry out work on functional safety components.
- Any work on functional safety components must be carried out by strictly observing the specifications in the operating instructions at hand and the respective addendum to the operating instructions. Else, the right to claim under warranty will become invalid.

5.1 Additional regulations

The generally applicable installation regulations for low-voltage electric equipment (such as DIN IEC 60364, DIN EN 50110) must be complied with when setting up electrical machinery.

5.2 Compulsory use of the wiring diagrams

Connect the motor only as shown in the wiring diagram(s) included with the motor. **You must not connect or start up the motor if the wiring diagram is missing.** You can obtain the valid wiring diagrams from SEW-EURODRIVE free of charge.

5.3 Wiring notes

Comply with the safety notes during installation.

5.3.1 Protecting the brake control system against interference

Unless they are shielded, brake cables must always be routed separately from other power cables with phased currents to protect brake controls against interference. Power cables with phased currents are in particular

- Output cables from frequency inverters and servo controllers, soft start units and brake units
- Supply cables for braking resistors and similar options

5.3.2 Protecting the motor protection devices against interference

To protect against interference by SEW motor protection devices (temperature sensors TF, winding thermostats TH):

- You may route separately shielded supply cables together with switched-mode power lines in one cable.
- You must not route unshielded supply cables together with switched-mode power lines in one cable.

5.4 Special aspects for operation with a frequency inverter

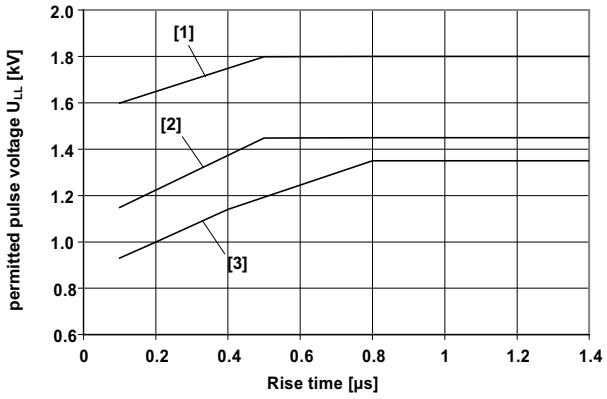
When motors are powered from inverters, you must adhere to the wiring instructions issued by the inverter manufacturer. You must also observe the operating instructions for the frequency inverter.

5.4.1 Motor on SEW inverter

SEW-EURODRIVE has tested operation of the motor on SEW frequency inverters. The required dielectric strength values of the motors were confirmed and the startup routines adjusted to the motor data. You can operate the DR motor with any frequency inverter from SEW-EURODRIVE. To do this, start up the motor as described in the operating instructions for the frequency inverter.

5.4.2 Motor on a non-SEW inverter

Operating SEW motors on non-SEW frequency inverters is permitted if the pulse voltages at the motor terminals indicated in the following figure are not exceeded.



244030091

[1] Permitted pulse voltage for DR motors with reinforced insulation (../RI)
[2] Permitted pulse voltage for DR standard
[3] Permitted pulse voltage according to IEC60034-17

INFORMATION

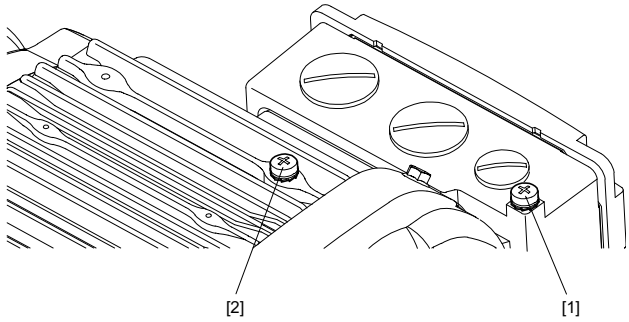
The diagram applies to motor operation of the motor. If the permitted pulse voltage is exceeded, you must install limiting measures, such as filters, chokes or special motor cables. Consult the manufacturer of the frequency inverter.

5.5 Improving the grounding (EMC)

For improved, low-impedance grounding at high frequencies, we recommend using the following connections: SEW-EURODRIVE recommends to use corrosion-resistant and preferrably nickel plated connection elements.

5.5.1 Size DR.71-DR.132:

Size DR.71-DR132
• 1 x self-tapping screw DIN 7500 M5 x 12 • 1 x washer ISO 7090 • 1 x serrated lock washer DIN 6798

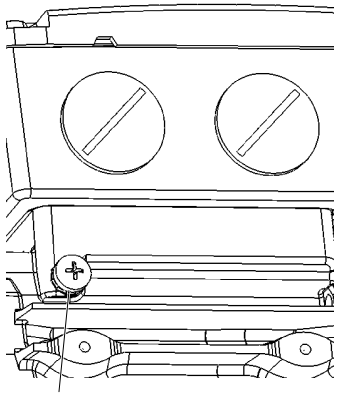


176658571

[1] Use the pre-cast bore at the terminal box (brakemotor)
[2] Make a bore in the stator housing with Ø =4.6 and t_{max}= 11.5

Connection variant for size DR.71-DR.132:

Size DR.71-DR132
• 1 x self-tapping screw DIN 7500 M5 x 12 • 1 x washer ISO 7090 • 1 x serrated lock washer DIN 6798

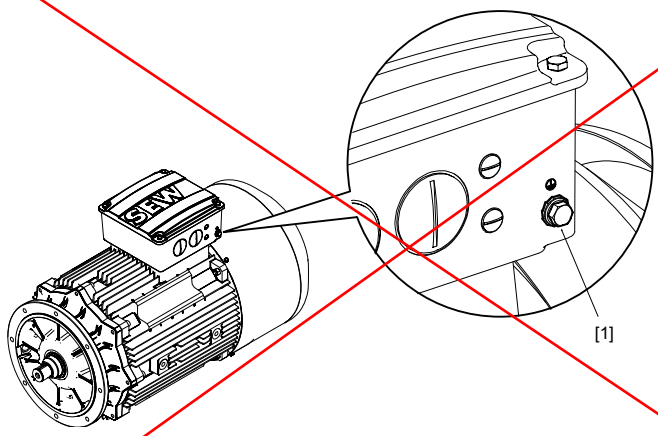


2455209483

[1] Use the pre-cast bore at the stator shoulder

5.5.2 Size DR.160-DR.315:

Size DR.160-DR.225	Size DR.315
• 1 x hex head screw ISO 4017 M8 x 20 • 1 x washer ISO 7090 • 1 x serrated lock washer DIN 6798	• 1 x hex head bolt ISO 4017 M12 x 30 • 1 x washer ISO 7090 • 1 x serrated lock washer DIN 6798



370040459

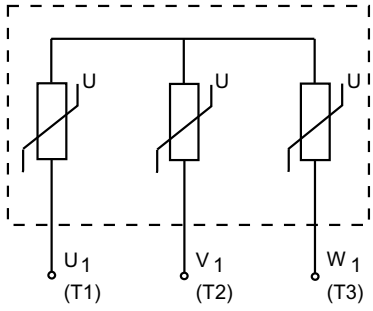
[1] Use the grounding screw at the terminal box

5.6 Special aspects in switching operation

When the motors are used in switching operation, possible interference of the switchgear must be excluded by ensuring suitable wiring. According to EN 60204 (electrical equipment of machines), motor windings must have interference suppression to protect the numerical or programmable logic controllers. As it is primarily switching operations that cause interference, SEW-EURODRIVE recommends installing protective circuitry in the switching devices.

5.7 Special aspects of torque motors and low-speed motors

Due to the design of torque motors and low-speed motors, very high induction voltages may be generated when they are switched off. Consequently, SEW-EURODRIVE recommends using the varistor circuit shown below for protection. The size of the varistors depends, among other factors, on the starting frequency – note the project planning.



797685003

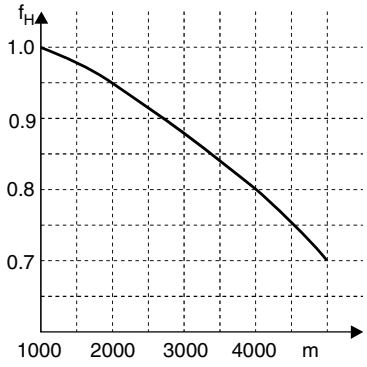
5.8 Ambient conditions during operation

5.8.1 Ambient temperature

Unless otherwise specified on the nameplate, you must observe the temperature range of -20 °C to +40 °C. Motors intended for use in higher or lower ambient temperatures have specific designations on the nameplate.

5.8.2 Installation altitude

The maximum installation altitude of 1000 m above sea level must not be exceeded. Otherwise, power is reduced by the factor f_H according to the diagram below.



The reduction in rated power is calculated according to the following equation:

$$P_{N1} = P_N \times f_H$$

P_{N1} = reduced rated power [kW]
P_N = rated power [kW]
f_H = factor for reduction due to installation altitude

5.8.3 Hazardous radiation

Motors must not be subjected to hazardous radiation (such as ionizing radiation). Contact SEW-EURODRIVE if necessary.

5.8.4 Gaskets

DR. series AC motors are usually equipped with gaskets made of NBR.

If the motor is operated in environments with high environmental impact, such as increased ozone values, DR motors can be equipped with high-quality gaskets made of EPDM or FKM (fluoroelastomers). Please contact SEW-EURODRIVE when you are in doubt about the reliability of the environmental impact.

5.9 Connecting the motor

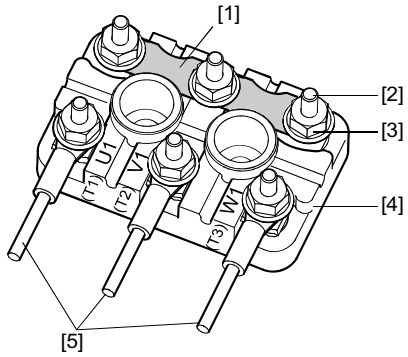
INFORMATION

The terminal box must be free of foreign objects, dirt and humidity. Unused cable entry openings and the terminal box itself must be closed so they are dust and water-proof.

- According to the circuit diagram provided
- Check cable cross section
- Arrange terminal links correctly
- Tighten connections and protective earth
- In terminal boxes: Check winding connections and tighten them if necessary

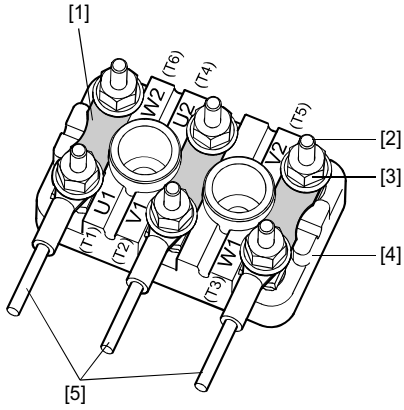
5.9.1 Connecting the motor via the terminal box according to wiring diagram R13

Arrangement of terminal links with ⅄ connection

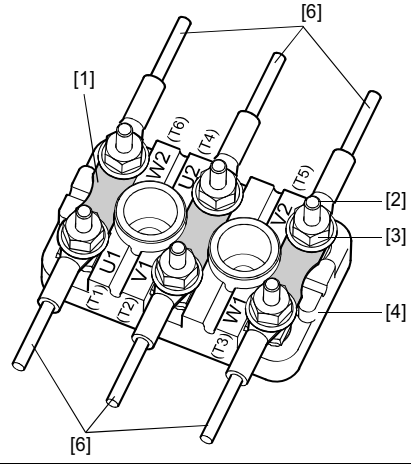


Arrangement of terminal links with △ connection

Motor size DR.71-DR.225:



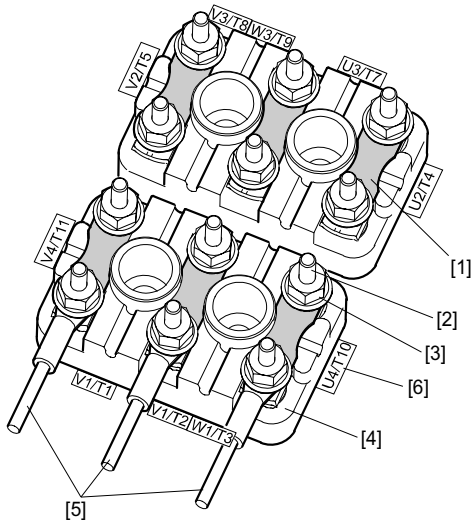
Motor size DR.315:



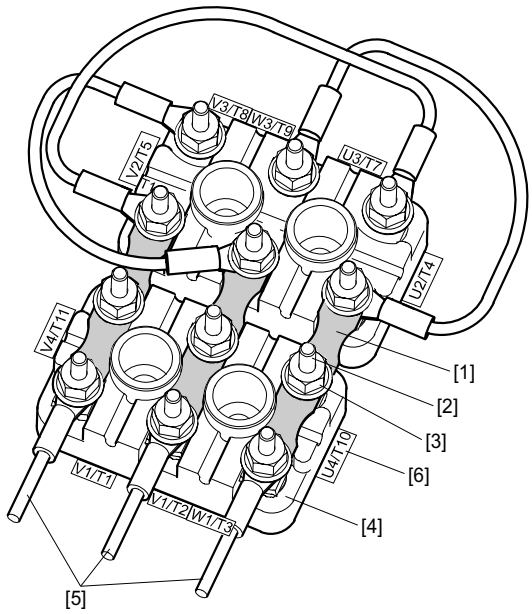
[1] Terminal link
[2] Terminal stud
[3] Flange nut
[4] Terminal board
[5] Customer connection
[6] Customer connection with split connection cable

5.9.2 Connecting the motor via the terminal box according to wiring diagram R72

Arrangement of terminal links for △ connection



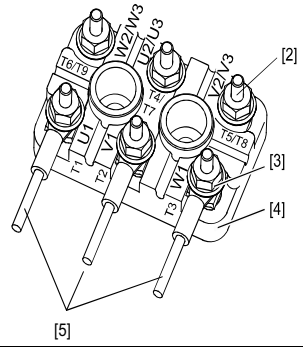
Arrangement of terminal links for △△ connection



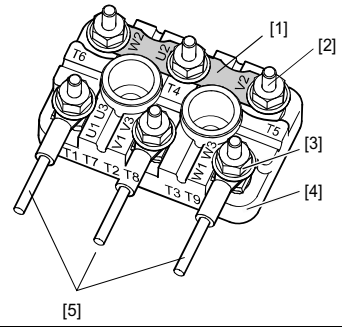
[1] Terminal link
[2] Terminal stud
[3] Flange nut
[4] Terminal board
[5] Customer connection
[6] Wiring designation plate

5.9.3 Connecting the motor via the terminal box according to wiring diagram R76

Arrangement of terminal links for ⅄ connection



Arrangement of terminal links for ⅄⅄ connection



[1] Terminal link
[2] Terminal stud
[3] Flange nut
[4] Terminal board
[5] Customer connection

INFORMATION

Three winding lead ends must be rewired to change from high to low voltage:

The lines designated U3 (T7), V3 (T8) and W3 (T9) must be reconnected.

- U3 (T7) from U2 (T4) to U1 (T1)
- V3 (T8) from V2 (T5) to V1 (T2)
- W3 (T9) from W2 (T6) to W1 (T3)

Changing from low to high voltage is carried out in reverse order.

In both cases, the customer connection is made to U1 (T1), V1 (T2) and W1 (T3). The direction of rotation is changed by exchanging 2 leads.

5.9.4 Motor connection terminal box

The motors are supplied and connected differently depending on the electrical design. Arrange the cables and terminal links as shown in the wiring diagram and screw them on firmly. Observe the tightening torques specified in the following tables.

Motor size DR.71-DR.100							
Connection stud Ø	**Tightening torque for the hex nut**	**Connection Customer Cross section**	**Variant**	**Connection type**	**Scope of delivery**	**PE terminal stud Ø**	**Variant**
M4	**1.6 Nm** (14.2 lb-in)	**≤ 1.5 mm²** (AWG 16)	**1a**	**Solid wire Conductor end sleeve**	**Pre-assembled terminal links**	M5	4
		≤ 6 mm² (AWG 10)	**1b**	**Ring cable lug**	**Pre-assembled terminal links**		
		≤ 6 mm² (AWG 10)	2	Ring cable lug	Small connection accessories enclosed in bag		
M5	2.0 Nm (17.7 lb-in)	≤ 2.5 mm² (AWG 14)	1a	Solid wire Conductor end sleeve	Pre-assembled terminal links		
		≤ 16 mm² (AWG 6)	1b	Ring cable lug	Pre-assembled terminal links		
		≤ 16 mm² (AWG 6)	2	Ring cable lug	Small connection accessories enclosed in bag		
M6	3.0 Nm (26.5 lb-in)	≤ 35 mm² (AWG 2)	3	Ring cable lug	Small connection accessories enclosed in bag		

Motor size DR.112-DR.132							
Terminal stud Ø	**Tightening torque for the hex nut**	**Customer connection Cross section**	**Variant**	**Connection type**	**Scope of delivery**	**PE terminal stud Ø**	**Variant**
M5	**2.0 Nm** (17.7 lb-in)	**≤ 2.5 mm²** (AWG 14)	**1a**	**Solid wire Conductor end sleeve**	**Pre-assembled terminal links**	M5	4
		≤ 16 mm² (AWG 6)	**1b**	**Ring cable lug**	**Pre-assembled terminal links**		
		≤ 16 mm² (AWG 6)	2	Ring cable lug	Small connection accessories enclosed in bag		
M6	3.0 Nm (26.5 lb-in)	≤ 35 mm² (AWG 2)	3	Ring cable lug	Small connection accessories enclosed in bag		

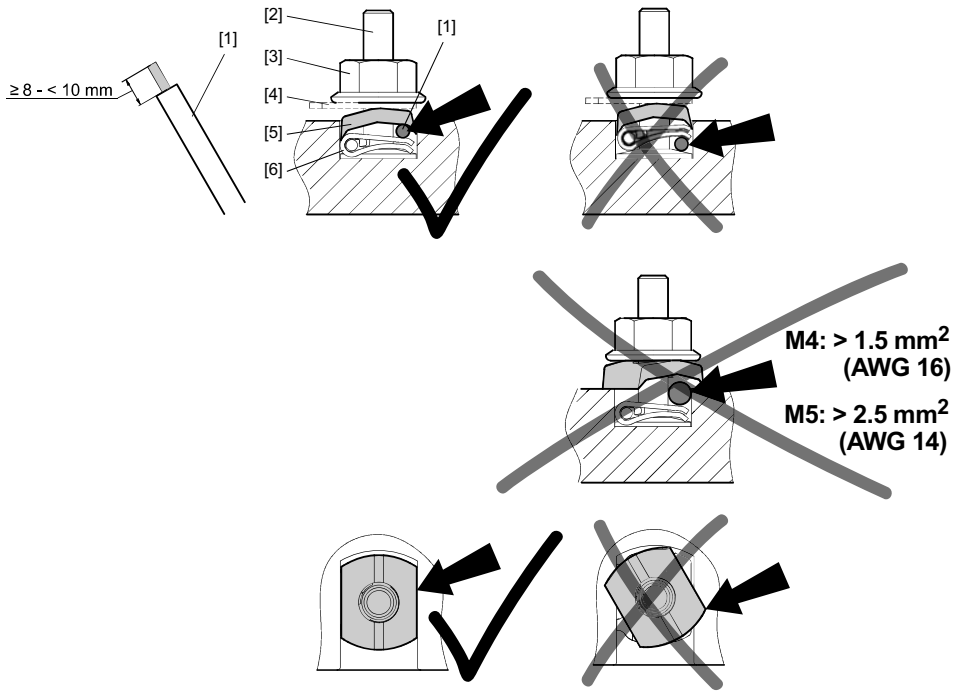
Motor size DR.160							
Terminal stud Ø	**Tightening torque for the hex nut**	**Customer connection Cross section**	**Variant**	**Connection type**	**Scope of delivery**	**PE terminal stud Ø**	**Variant**
M6	**3.0 Nm** (26.5 lb-in)	**≤ 35 mm²** (AWG 2)	**3**	**Ring cable lug**	**Small connection accessories enclosed in bag**	M8	5
M8	6.0 Nm (53.1 lb-in)	≤ 70 mm² (AWG 2/0)	3	Ring cable lug	Small connection accessories enclosed in bag	M10	5

Motor size DR.180-DR.225							
Terminal stud Ø	**Tightening torque for the hex nut**	**Customer connection Cross section**	**Variant**	**Connection type**	**Scope of delivery**	**PE terminal stud Ø**	**Variant**
M8	**6.0 Nm** (53.1 lb-in)	**≤ 70 mm²** (AWG 2/0)	**3**	**Ring cable lug**	**Small connection accessories enclosed in bag**	M8	5
M10	10 Nm (88.5 lb-in)	≤ 95 mm² (AWG 3/0)	3	Ring cable lug	Small connection accessories enclosed in bag	M10	5
M12	15.5 Nm (137.2 lb-in)	≤ 95 mm² (AWG 3/0)	3	Ring cable lug	Small connection accessories enclosed in bag	M10	5

Motor size DR.315							
Terminal stud Ø	**Tightening torque for the hex nut**	**Customer connection Cross section**	**Variant**	**Connection type**	**Scope of delivery**	**PE terminal stud Ø**	**Variant**
M12	**15.5 Nm** (137.2 lb-in)	**≤ 95 mm²** (AWG 3/0)	**3**	**Ring cable lug**	**Connection parts pre-assembled**	M12	5
M16	**30 Nm** (265.5 lb-in)	**≤ 120 mm²** (AWG 4/0)					

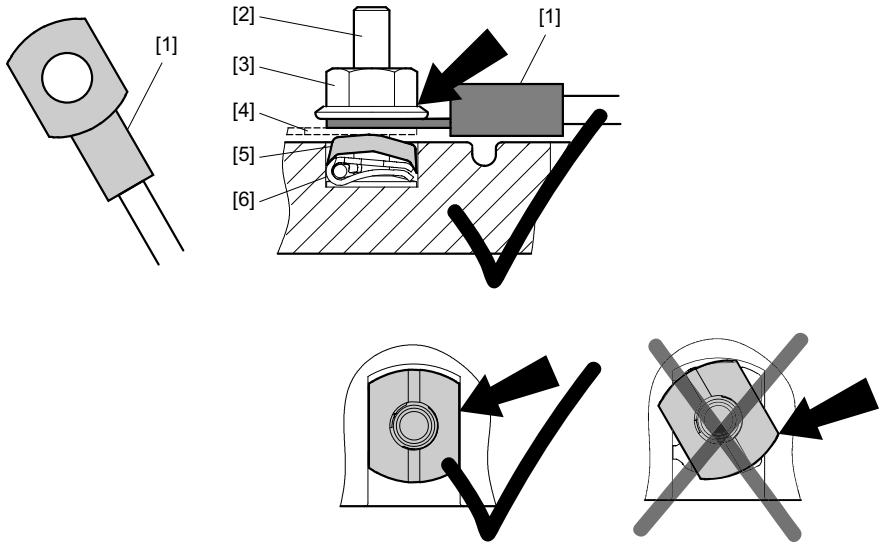
The designs in bold print apply to S1 operation for the standard voltages and standard frequencies according to the data in the catalog. Other versions may have different connections, for example different terminal stud diameters and/or a different scope of delivery.

Variant 1a:



[1] External connection
[2] Terminal stud
[3] Flange nut
[4] Terminal link
[5] Terminal washer
[6] Winding connection with Stocko connection terminal

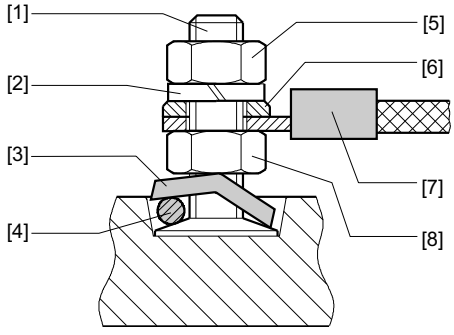
Design 1b:



88864779

[1] External connection with ring cable lug, to DIN 46237 or DIN 46234, for example.
[2] Terminal stud
[3] Flange nut
[4] Terminal link
[5] Terminal washer
[6] Winding connection with Stocko connection terminal

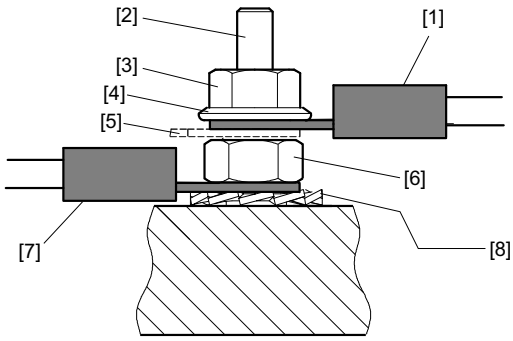
Design 2



185439371

[1] Terminal stud
[2] Lock washer
[3] Terminal washer
[4] Winding connection
[5] Upper nut
[6] Washer
[7] External connection with ring cable lug, to DIN 46237 or DIN 46234, for example.
[8] Lower nut

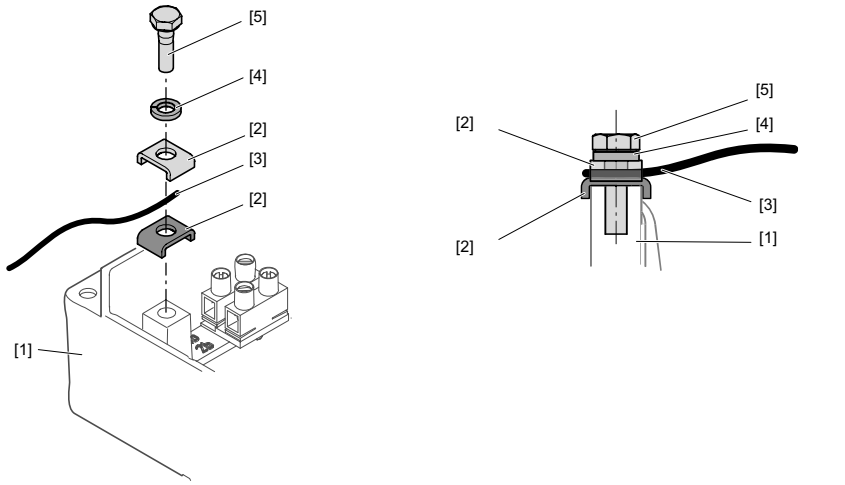
Design 3



199641099

[1] External connection with ring cable lug, to DIN 4637 or DIN 46234, for example.
[2] Terminal stud
[3] Upper nut
[4] Washer
[5] Terminal link
[6] Lower nut
[7] Winding connection with ring cable lug
[8] Serrated lock washer

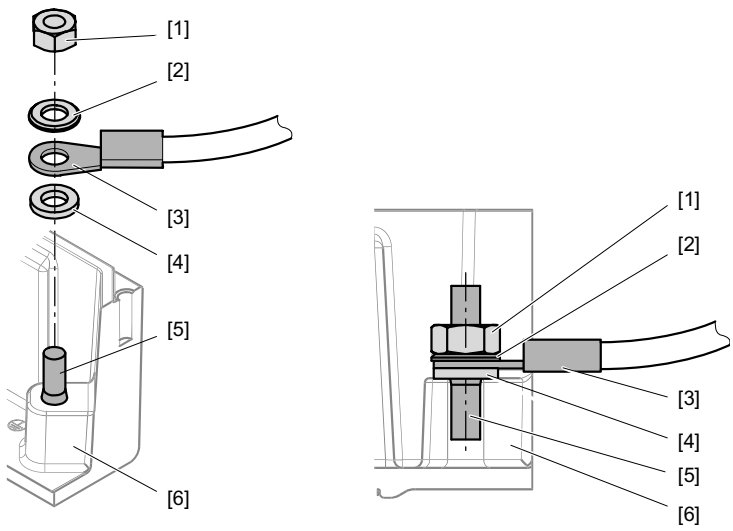
Design 4



1139606667

[1] Terminal box
[2] Terminal clip
[3] PE conductor
[4] Lock washer
[5] Hex head screw

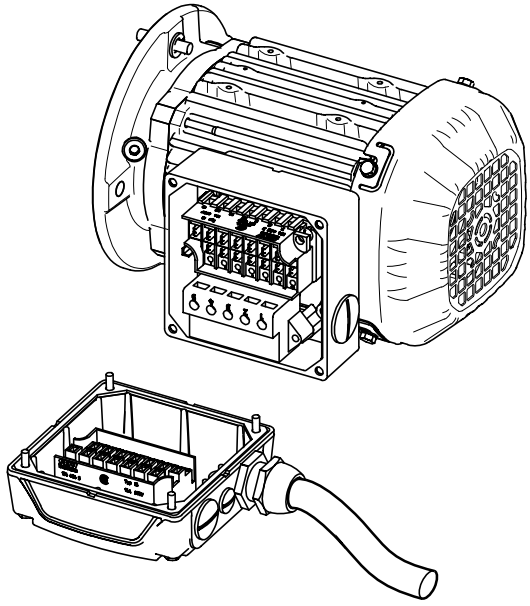
Design 5



1139608587

[1] Hex nut
[2] Washer
[3] PE conductor with cable lug
[4] Serrated lock washer
[5] Stud
[6] Terminal box

5.9.5 Connecting the motor using the IS plug connector



1009070219

The IS plug connector is supplied from the factory with its base fully wired-up, including additional features such as a brake rectifier. The upper section of the IS connector is included in the scope of delivery and must be connected as shown in the wiring diagram.

⚠ WARNING

No grounding due to incorrect installation.

Severe or fatal injuries.

- It is essential to comply with the safety notes in chapter 2 during installation.
- Tighten the retaining screws of the IS plug connector properly with 2 Nm (17.7 lb-in), as these screws also act as the protective earth contacts.

The IS plug connector has CSA approval up to 600 V. Note for application according to CSA regulations: Tighten the M3 terminal screws to a torque of 0.5 Nm (4.4 lb-in). See the following table for American Wire Gauge (AWG) cable cross sections.

Cable cross section

Make sure that the type of cable complies with the applicable regulations. The rated currents are specified on the nameplate. The cable cross sections that can be used are listed in the following table.

Without variable terminal link	With variable terminal link	Link cable	Double assignment (motor and brake/SR)
0.25 - 4.0 mm^2	0.25 - 2.5 mm^2	max. 1.5 mm^2	max. 1 x 2.5 und 1 x 1.5 mm^2
AWG 24 - 12	AWG 24 - 14	max. AWG 16	max. 1 x AWG 14 und 1 x AWG 16

Wiring the upper section of the plug connector

- Loosen the housing cover screws:
  - Remove the housing cover
- Loosen the screws from the upper section of the plug connection.
  - Remove the upper connector section from the cover
- Strip the insulation off the connection lead:
  - Strip off about 9 mm of insulation
- Pass the cable through the cable gland

Wiring up as shown in wiring diagram R83

- Connect the lines as shown in the circuit diagram:
  - Tighten the clamping screws carefully.
- Install the plug connector (→ section "Installing the plug connector")

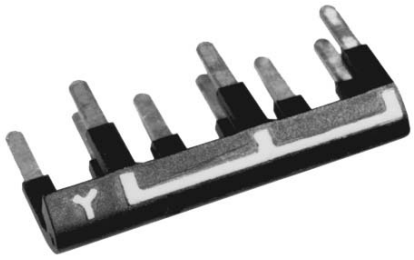
Wiring as shown in wiring diagram R81

For ⅄ / △ startup:

- Connect with 6 lines:
  - Tighten the clamping screws carefully.
  - Motor contactors in the control cabinet
- Install the plug connector (→ section "Installing the plug connector")

For ⅄ or△ startup:

- Connect as shown in the wiring diagram
- Install the variable terminal link as shown in the following figures according to the required motor operation (⅄ or △).
- Install the plug connector (→ section "Installing the plug connector")



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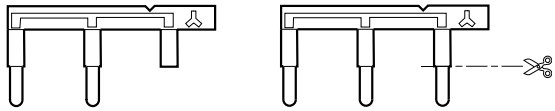
798608523

Brake control BSR – Preparing the variable terminal link

For ⅄ operation:

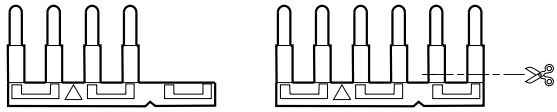
On the ⅄ side of the variable terminal link as shown in the following figure: Remove only the bare metal pin of the marked prong horizontally – touch guard!



798779147

For △ operation:

On the △ side of the variable terminal link as shown in the following figure: Completely remove two prongs horizontally.



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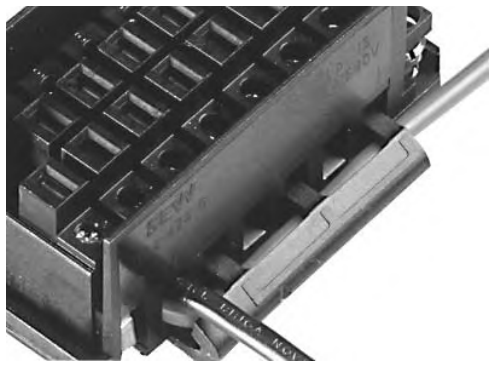
Wiring up as shown in wiring diagram R81 for ⅄ or △ operation with double terminal assignment

- At terminal point for double assignment:
  - Connect the link cable
- When operation is as required:
  - Insert the link cable in the variable terminal link
- Install the variable terminal link.
- At terminal point for double assignment:
  - Connect the motor lead above the variable terminal link
- Connect the other lines as shown in the wiring diagram
- Install the plug connector (→ section "Installing the plug connector")

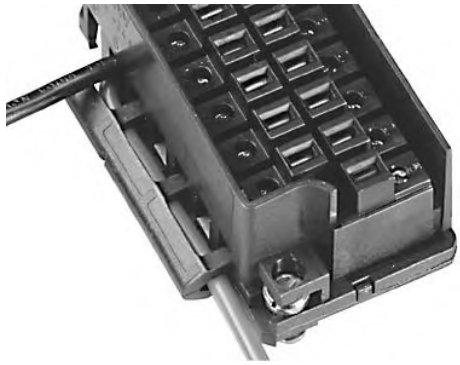


798780811

Installing the plug connector

The housing cover of the IS plug connector can be screwed onto the lower section of the plug connector depending on the required position of the cable lead. The upper section of the plug connector shown in the following figure must first be installed in the housing cover so it will match the position of the lower section of the plug connector:

- Define the required mounting position
- Install the upper section of the plug connector into the housing cover in accordance with the mounting position
- Close the plug connector
- Tighten the cable gland



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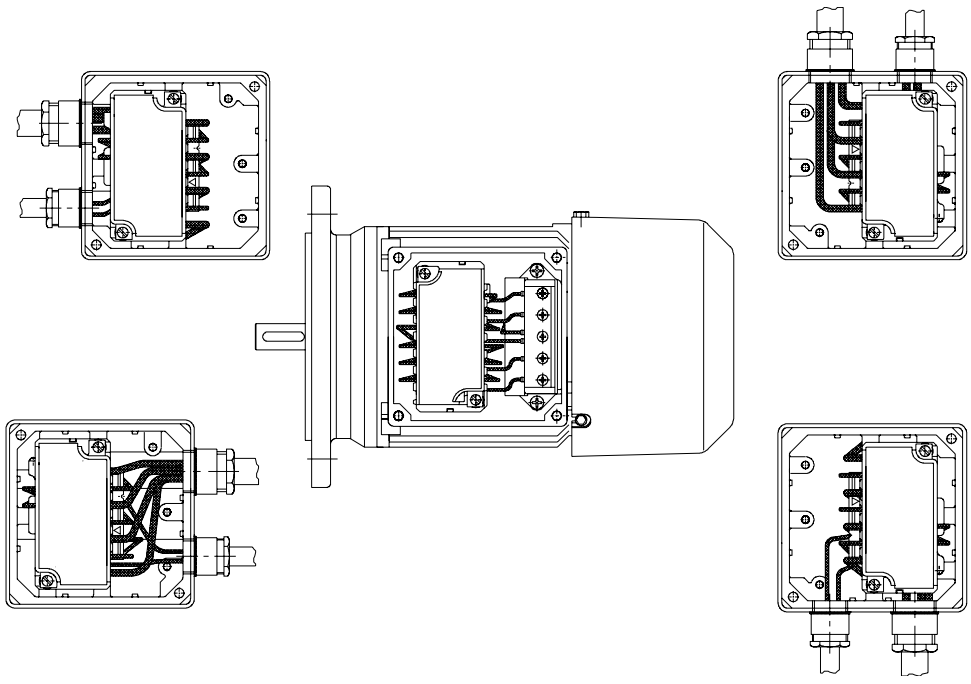
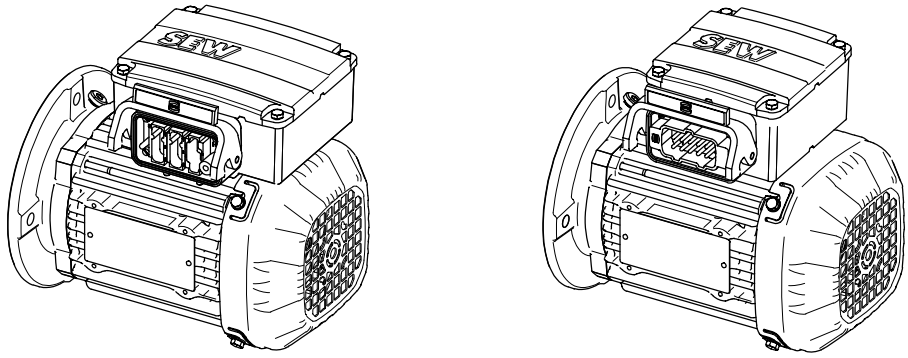
Mounting position of the upper section of the plug connector in the housing cover



798785163

5.9.6 Connect the motor using plug connectors AB.., AD.., AM.., AK.., AC.., AS



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The installed AB.., AD.., AM.., AK.., AC.. and AS connector systems are based on the connector systems made by Harting.

- AB.., AD.., AM.., AK.. Han Modular®
- AC.., AS.. Han 10E / 10ES

The plug connectors are located at the side of the terminal box. They are locked either using two clamps or one clamp on the terminal box.

UL approval has been granted for the plug connectors.

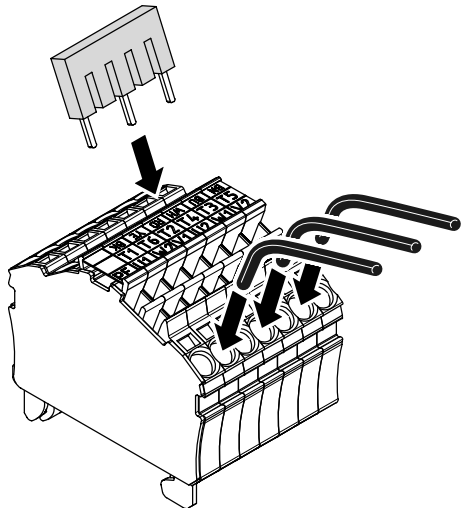
The mating connector (sleeve housing) with socket contacts is not included in the scope of delivery.

The enclosure is only ensured when the mating connector is mounted and locked.

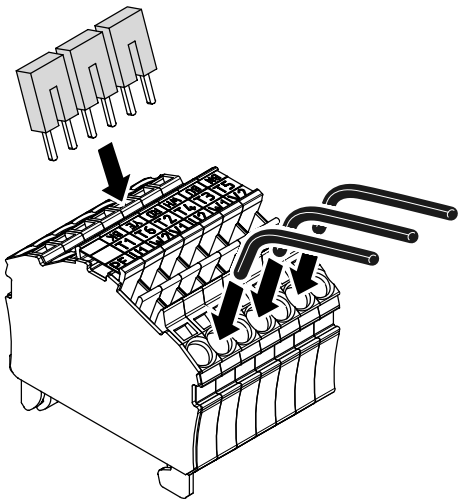
5.9.7 Connecting the motor via the KCC terminal strip

- According to the circuit diagram provided
- Check the maximum cable cross section:
  - 4 mm^2 (AWG 12) rigid
  - 4 mm^2 (AWG 12) flexible
  - 2.5 mm^2 (AWG 14) flexible with conductor end sleeve
- In terminal boxes: Check winding connections and tighten them if necessary
- Strip-off length 10-12 mm

Arrangement of terminal links for ⅄ connection



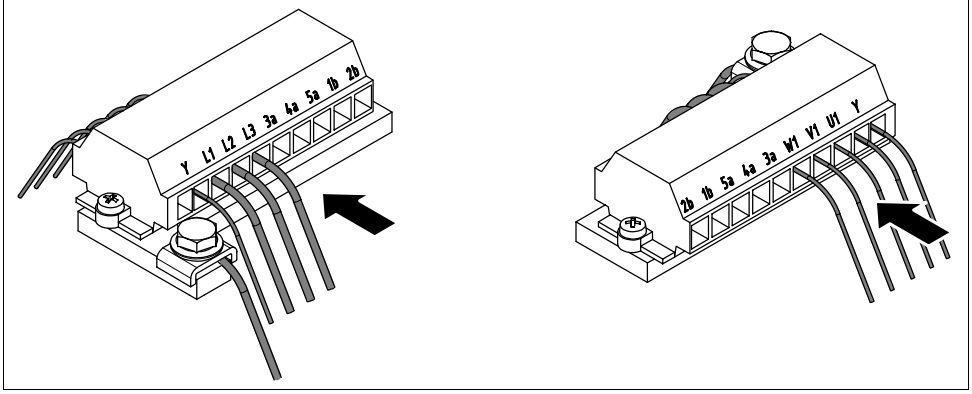
Arrangement of terminal links for △ connection



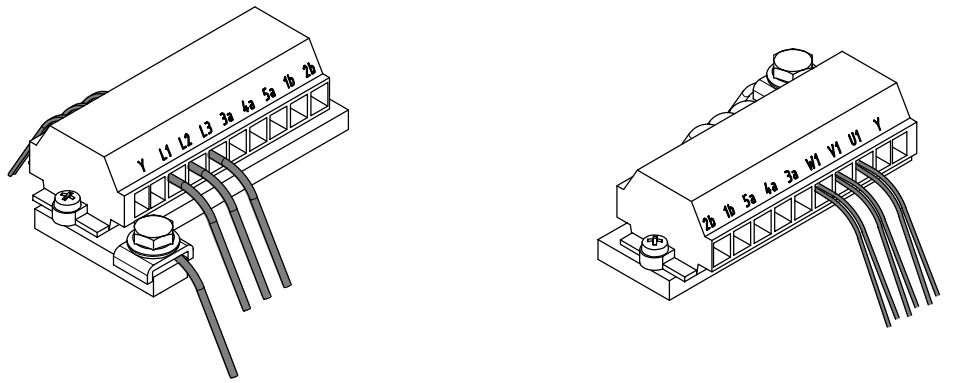
5.9.8 Connecting the motor via the KC1 terminal strip

- According to the wiring diagram provided
- Check the maximum cable cross section:
  - 2.5 mm^2 (AWG 14) rigid
  - 2.5 mm^2 (AWG 14) flexible
  - 1.5 mm^2 (AWG 16) flexible with conductor end sleeve
- Strip-off length 8-9 mm

Arrangement of terminal links for ⅄ connection



Arrangement of terminal links for △ connection



5.10 Connecting the brake

The brake is released electrically. The brake is applied mechanically when the voltage is switched off.

⚠ WARNING

Risk of crushing if the hoist falls.

Severe or fatal injuries.

- Comply with the applicable regulations issued by the relevant employer's liability insurance association regarding phase failure protection and the associated circuit/circuit modification.
- Connect the brake according to the wiring diagram supplied with the brake.
- In view of the DC voltage to be switched and the high level of current load, it is essential to use either special brake contactors or AC contactors with contacts in utilization category AC-3 to EN 60947-4-1.

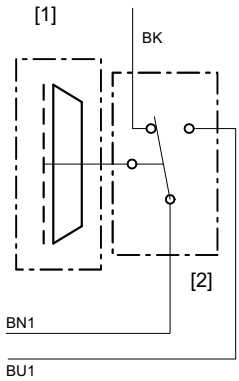
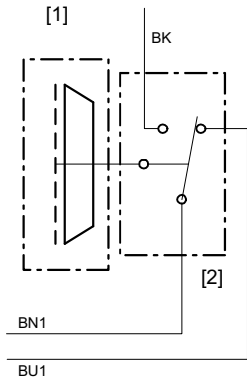
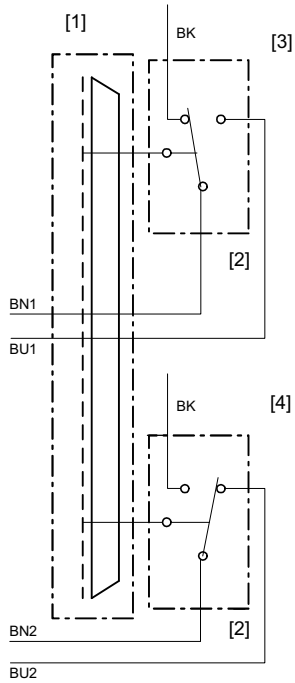
5.10.1 Connecting the brake control

The DC disk brake is powered from a brake control system with protection circuit. It is located in the terminal box/IS lower part or must be installed in the control cabinet.

- **Check the cable cross sections – braking currents (see section "Technical Data")**
- Connect the brake control system according to the wiring diagram supplied with the brake
- For motors in thermal class 180 (H), the brake rectifier and brake control systems are usually installed in the control cabinet. If you have ordered a brakemotor with insulating plate, it will be delivered with the terminal box isolated thermally from the brakemotor. In this case, the brake rectifier and brake control can be installed in the terminal box. The insulating plate increases the height of the terminal box by 9 mm.

5.10.2 Connecting the DUB diagnostics unit

Connect the diagnostics unit as shown in the wiring connection diagram(s) provided with the motor. The maximum permitted connection voltage is AC 250 V with a maximum current of 6 A. With low voltage the maximum voltage is AC 24 V or DC 24 V with max. 0.1 A. Subsequent change to low voltage is not permitted.

Function monitoring	Wear monitoring	Function and wear monitoring
		
[1] Brake [2] MP321-1MS microswitch	[1] Brake [2] MP321-1MS microswitch	[1] Brake [2] MP321-1MS microswitch [3] Function monitoring [4] Wear monitoring
1145889675	1145887755	1145885835

5.11 Accessory equipment

Connect accessory equipment as shown in the wiring connection diagram(s) provided with the motor. **Do not connect or start up the accessory equipment if the wiring diagram is missing.** You can obtain the valid wiring diagrams from SEW-EURODRIVE free of charge.

5.11.1 TF temperature sensor

NOTICE

Damage of the temperature sensor due to excessive heat.

The drive system might be damaged.

- Do not apply voltages > 30 V to the TF temperature sensor.

The PTC thermistors comply with DIN 44082.

Resistance measurement (measuring instrument with V ≤ 2.5 V or I < 1 mA):

- Standard measured values: 20...500 Ω, thermal resistance > 4000 Ω

When using the temperature sensor for thermal monitoring, the evaluation function must be activated to maintain reliable isolation of the temperature sensor circuit. If the temperature reaches an excessive level, a thermal protection function must be triggered immediately.

5.11.2 TH winding thermostats

The thermostats are connected in series and open when the permitted winding temperature is exceeded. They can be connected in the drive monitoring loop.

	AC V	DC V	
Voltage U [V]	250	60	24
Current (cos ϕ = 1.0) [A]	2.5	1.0	1.6
Current (cos ϕ = 0.6) [A]	1.6		
Contact resistance max. 1 ohm at DC 5 V / 1 mA			

5.11.3 KTY84-130 temperature sensor

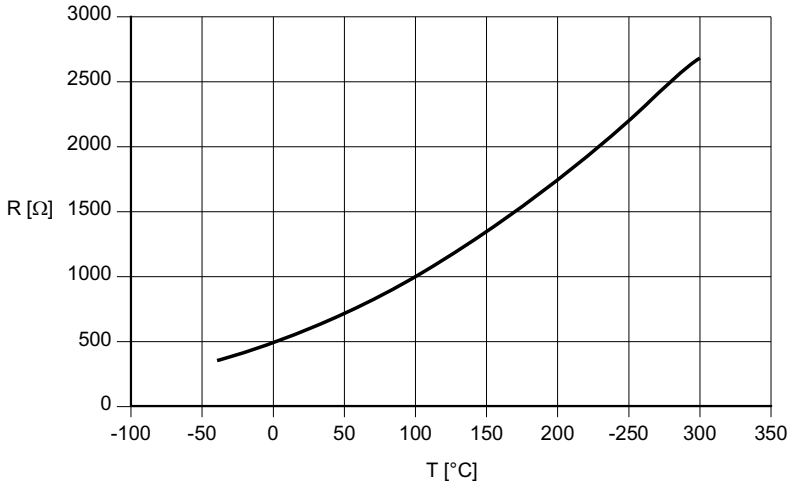
NOTICE

Excessive self-heating of the temperature sensor can damage the insulation of the temperature sensor.

The drive system might be damaged.

- Avoid currents > 4 mA in the circuit of the KTY.
- Observe the correct connection of KTY to ensure correct evaluation of the temperature sensor. Ensure correct polarity.

The characteristic curve in the following figure shows the resistance curve subject to the motor temperature with a measuring current of 2 mA and correct pole connection.



Technical data	KTY84 - 130
Connection	Red (+) Blue (-)
Total resistance at 20 - 25 °C	540 Ω < R < 640 Ω
Test current	< 3 mA

5.11.4 PT100 temperature detection

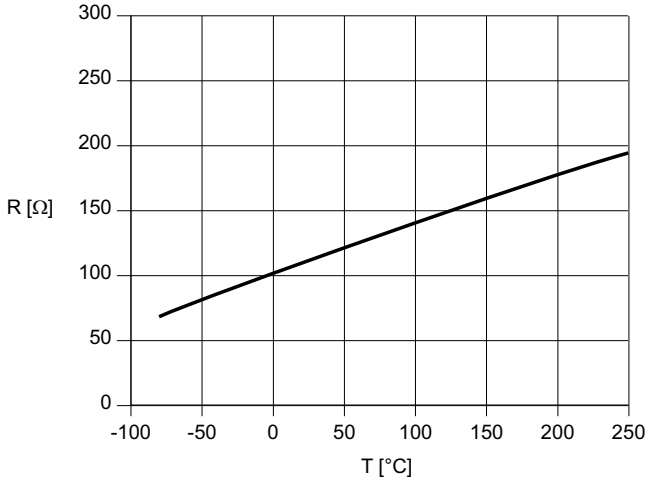
NOTICE

Excessive self-heating of the temperature sensor can damage the insulation of the temperature sensor.

The drive system might be damaged.

- Avoid currents > 4 mA in the circuit of the PT100.
- Observe the correct connection of PT100 to ensure correct evaluation of the temperature sensor. Ensure correct polarity.

The characteristic curve in the following figure shows the resistance curve subject to the motor temperature.



Technical data	PT100
Connection	Red/white
Resistance at 20 - 25 °C per PT100	107 Ω < R < 110 Ω
Test current	< 3 mA

5.11.5 V forced cooling fan

- Connection in separate terminal box
- Max. connection cross section 3 × 1.5 mm^2 (3 × AWG 15)
- Cable gland M16 × 1.5

Motor size	Operating mode/ connection	Frequency in Hz	Voltage V
DR.71-DR.132	1 ~ AC ⊥ 1) (△)	50	100 - 127
DR.71-DR.132	3 ~ AC ⅄	50	175 - 220
DR.71-DR.132	3 ~ AC △	50	100 - 127
DR.71-DR.180	1 ~ AC ⊥ 1) (△)	50	230 - 277
DR.71-DR.315	3 ~ AC ⅄	50	346 - 500
DR.71-DR.315	3 ~ AC △	50	200 - 290

1) Steinmetz circuit

Motor size	Operating mode/ connection	Frequency in Hz	Voltage V
DR.71-DR.132	1 ~ AC ⊥ 1) (△)	60	100 - 135
DR.71-DR.132	3 ~ AC ⅄	60	175 - 230
DR.71-DR.132	3 ~ AC △	60	100 - 135
DR.71-DR.180	1 ~ AC ⊥ 1) (△)	60	230 - 277
DR.71-DR.315	3 ~ AC ⅄	60	380 - 575
DR.71-DR.315	3 ~ AC △	60	220 - 330

1) Steinmetz circuit

Motor size	Operating mode/ connection	Voltage V
DR.71-DR.132	DC 24 V	24

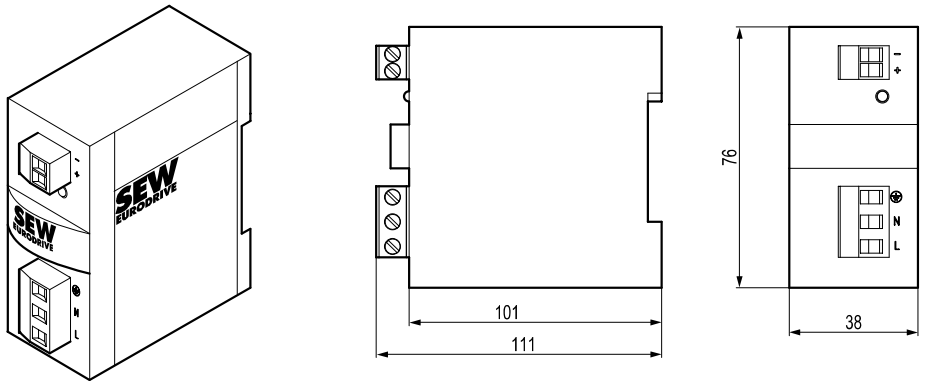
INFORMATION

For information on how to connect the V forced cooling fan, refer to the wiring diagram (page 130).

5.11.6 UWU52A switched-mode power supply

The forced cooling fan type V for DC 24 V includes the UWU52A switched-mode power supply, if you have ordered it. If you have not specifically ordered the switched-mode power supply, you can order it separately from SEW-EURODRIVE by quoting its part number.

The following figure depicts the UWU52A switched-mode power supply:



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Input:	AC 110 ... 240 V; 1.04 - 0.61 A; 50/60 Hz
	DC 110 ... 300 V; 0.65 - 0.23 A
Output:	DC 24 V; 2.5 A (40 °C)
	DC 24 V; 2.0 A (55 °C)
Connection:	Terminal screws 1.5 ... 2.5 mm^2, separable
Degree of protection:	IP20; attachment to EN 60715 TH35 support rail in the control cabinet
Part number:	0188 1817

5.11.7 Air filter LF

The air filter, a kind of fleece mat, is mounted in front of the fan guard. It can be easily removed and mounted again for cleaning purposes.

The air filter avoids that dust and other particles drawn in by the air are distributed. It also prevents the ducts between the cooling fins from becoming clogged with dust.

In very dusty environments, the air filter protects the cooling fins from dirt or from becoming clogged.

The air filter must be cleaned or replaced depending on the amount of dust in the environment. No maintenance intervals can be specified due to the individuality of each drive and the environment where it is installed.

Technical data	Air filter
Approvals	All approvals
Ambient temperature	-40 °C to +100 °C
Suitable for the following motor sizes:	DR.71 – DR.132
Filter material	Viledon PSB290SG4 fleece

5.11.8 Overview of mount-on encoders

Refer to the wiring connection diagrams on information on how to connect incremental encoders:

Encoder	Motor size	Encoder type	Mounting type	Power supply	Signal	Wiring diagram
ES7S	DR.71-132	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos	68 180 xx 08
ES7R	DR.71-132	Encoder	Shaft-centered	DC 7..30 V	TTL (RS 422)	68 179 xx 08
ES7C	DR.71-132	Encoder	Shaft-centered	DC 4.5..30 V	HTL / TTL (RS 422)	68 179 xx 08
AS7W	DR.71-132	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos	68 181 xx 08
AS7Y	DR.71-132	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos + SSI	68 182 xx 07
EG7S	DR.160-225	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos	68 180 xx 08
EG7R	DR.160-225	Encoder	Shaft-centered	DC 7..30 V	TTL (RS 422)	68 179 xx 08
EG7C	DR.160-225	Encoder	Shaft-centered	DC 4.5..30 V	HTL / TTL (RS 422)	68 179 xx 08
AG7W	DR.160-225	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos	68 181 xx 08
AG7Y	DR.160-225	Encoder	Shaft-centered	DC 7..30 V	1Vpp sin/cos + SSI	68 182 xx 07
EH7S	DR.315	Encoder	Shaft-centered	DC 10..30 V	1Vpp sin/cos	08 259 xx 07
AH7Y	DR.315	Encoder	Shaft-centered	DC 9..30 V	TTL+SSI (RS 422)	08 259 xx 07

INFORMATION

- Maximum oscillation load for encoders ≤ 10 g ≈ 100 m/s^2 (10 Hz ... 2 kHz)
- Shock resistance ≤ 100 g ≈ 1000 m/s^2 for the DR.71-DR.225
- Shock resistance ≤ 200 g ≈ 2000 m/s^2 for the DR.315

5.11.9 Overview of built-in encoders

Encoder	Motor size	Power supply	Signals
EI71	DR71-132	DC 9..30 V	HTL 1 period/revolution
EI72			HTL 2 periods/revolution
EI76			HTL 6 periods/revolution
EI7C			HTL 24 periods/revolution

The LED display provides an optical feedback according to the following table:

LED color	Track A	Track B	Track /A	Track /B
Orange (red and green)	0	0	1	1
Red	0	1	1	0
Green	1	0	0	1
Off	1	1	0	0

INFORMATION

For information on how to connect the built-in encoder, refer to the wiring diagram.

- Observe the "Wiring diagrams" (page 123) chapter for connection via terminal strip.
- Observe the enclosed wiring diagram for connection via M12 connectors.

5.11.10 Encoder connection

When connecting encoders to inverters, always follow the operating instructions for the respective inverter.

- Maximum line length (inverter - encoder):
  - 100 m with a capacitance per unit length ≤ 120 nF/km
- Core cross section: 0.20 ... 0.5 mm^2 (AWG 24 to 20)
- Use shielded cable with twisted pair conductors and apply shield over large area on both ends:
  - To the connection cover of the encoder, in the cable gland, or in the encoder plug
  - To the inverter on the electronics shield clamp or to the housing of the D-sub connector
- Install the encoder cables separately from the power cables, maintaining a distance of at least 200 mm.

5.11.11 Anti-condensation heating

Observe the permitted voltage according to the nameplate.

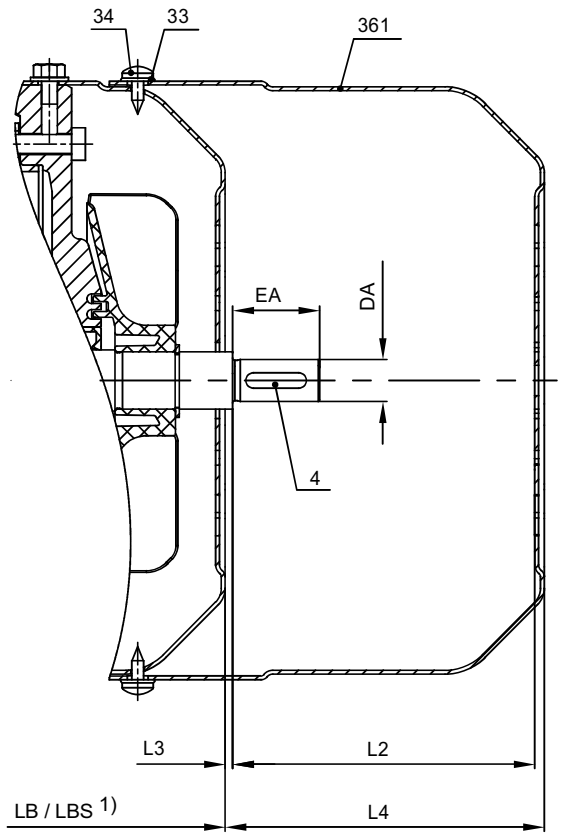
5.11.12 Second shaft end with optional cover

As standard, SEW-EURODRIVE supplies the accessory equipment "2nd shaft end" with inserted key and additional protection by means of a tape. No cover is supplied as standard. The cover can be ordered separately.

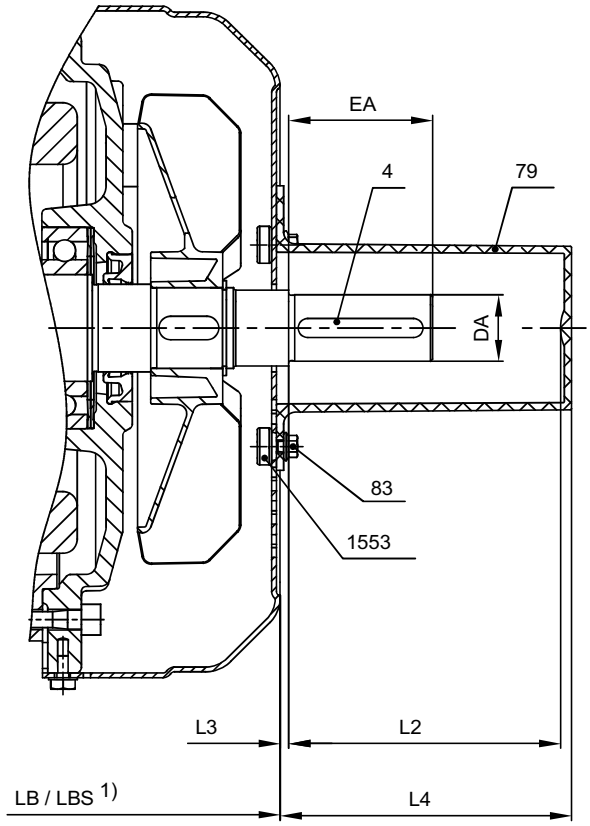
A cover is supplied with small sizes up to DR. 132. A plastic cover is used for size DR.160 and greater.

The following figure shows the dimensions of the covers:

Sizes DR.71 – DR.132



Sizes DR.160 – DR.225



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4	Keyway	79	Cover	1553	Push-in nut
33	Washer	83	Hex head screw	LB/LBS	Length of the motor/brakemotor
34	Tapping screw	361	Protection cover	1)	Refer to the catalog for dimensions

Motor size	DA	EA	L2	L3	L4
DR.71	11	23	80	2	91.5
DR.80	14	30	93	2	95.5
DR.90	14	30	86.5	2	89
DR.100	14	30	86.5	2	89
DR.112/132	19	40	122.5	3.5	125
DR.160	28	60	122	3.5	124
DR.180	38	80	122	3.5	122
DR.200/225	48	110	122	5	122

Size DR.315 is supplied without cover as standard.

6 Startup

6.1 Prerequisites for startup

INFORMATION

- It is essential to observe the safety notes in section 2 (page 7) during installation.
- In case of problems, refer to the "Malfunctions" (page 132) chapter.

If the motor includes safety-relevant components, observe the following safety note:

⚠ DANGER

Disabling functional safety devices.

Severe or fatal injuries.

- Only qualified personnel is allowed to carry out work on functional safety components.
- Any work on functional safety components must be carried out by strictly observing the specifications in the operating instructions at hand and the respective addendum to the operating instructions. Else, the right to claim under warranty will become invalid.

6.1.1 Before startup

Before startup, make sure that:

- The drive is undamaged and not blocked
- The measures stipulated in section "Preliminary work" (page 18) are performed after extended storage periods.
- All connections have been made properly
- The direction of rotation of the motor/gearmotor is correct
  - Motor rotating clockwise: U, V, W (T1, T2, T3) to L1, L2, L3
- All protective covers have been properly installed
- All motor protection equipment is active and set for the rated motor current
- There are no other sources of danger

6.1.2 During startup

During startup, make sure that:

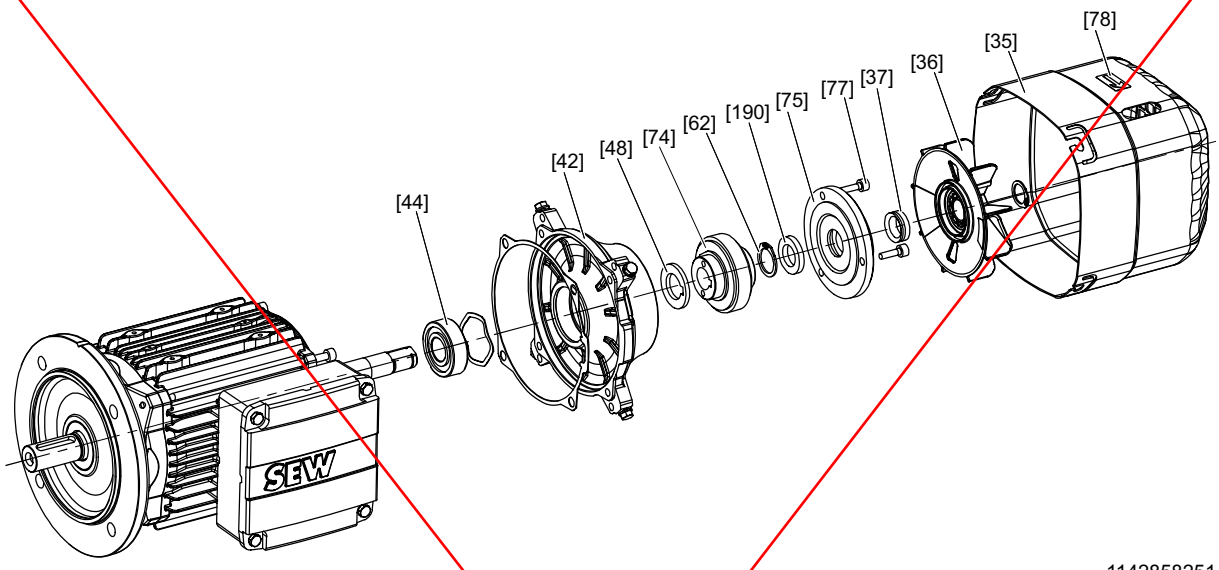
- The motor is running properly, which means
  - No overload,
  - No speed fluctuation,
  - No loud noises,
  - No unusual vibrations, etc.
- The braking torque corresponds to the respective application. Observe the "Technical Data" (page 104) chapter and the nameplate.

INFORMATION

On brakemotors with self-reengaging manual brake release, the lever must be removed after startup. A bracket is provided for storing the lever on the outside of the motor housing.

6.2 Changing the blocking direction on motors with a backstop

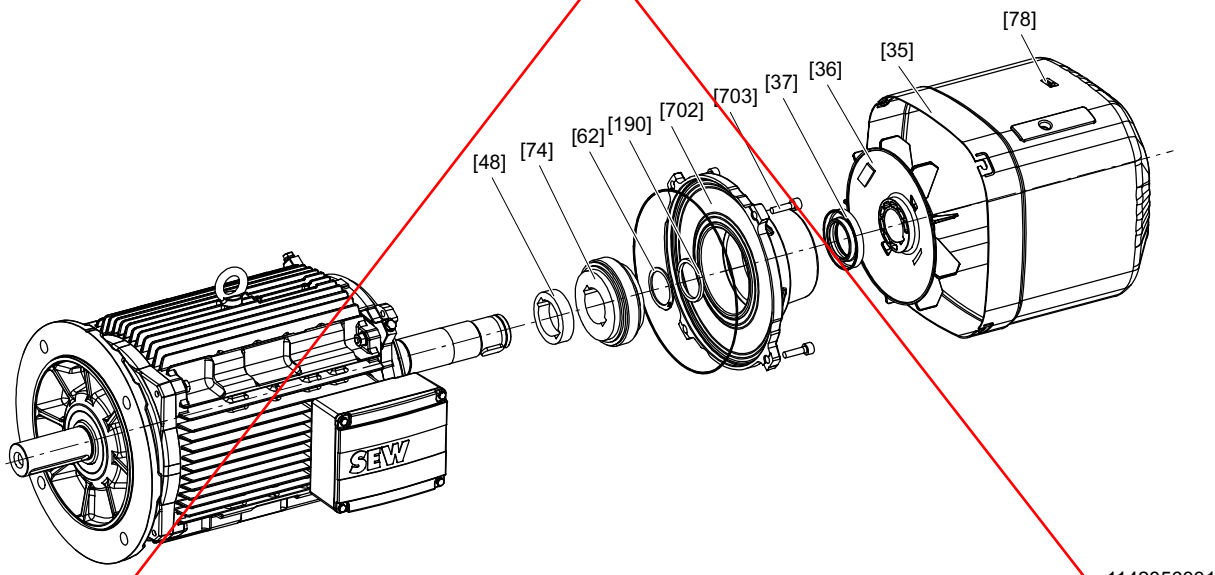
6.2.1 DR.71-DR.80 with backstop – basic structure



1142858251

[35] Fan guard
[36] Fan
[37] Sealing ring
[42] Backstop endshield
[44] Grooved ball bearing
[48] Spacing ring
[62] Circlip
[74] Wedge element ring, complete
[75] Sealing flange
[77] Screw
[78] Label
[190] Felt ring

6.2.2 DR.90-DR.315 with backstop – basic structure



1142856331

[35] Fan guard
[36] Fan
[37] Sealing ring
[48] Spacing ring
[62] Circlip
[74] Wedge element ring, complete
[78] Label
[190] Felt ring
[702] Backstop housing, complete
[703] Machine screw

6.2.3 Changing the blocking direction

The backstop is used to block a direction of rotation of the motor. The direction of rotation is indicated by an arrow on the fan guard of the motor or on the gearmotor housing.

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Before starting work, isolate the motor and, if installed, the forced cooling fan from the power supply.
- Safeguard against accidental startup.
- Carefully observe the steps described below.

Proceed as follows to change the blocking direction:

1. Remove forced cooling fan and incremental encoder (if installed).

   See section "Motor and brake maintenance – preliminary work" (page 61).
2. Remove flange cover or fan guard [35]
3. For the DR.71-80: Remove the sealing flange [75].

   For the DR.90-315: Completely remove the backstop housing [702]
4. Loosen the circlip [62]
5. Remove the wedge element ring [74] via screws in the forcing threads or using a puller
6. Spacing ring [48] – if there is one – remains installed
7. Turn over the wedge element [74] and press it back on
8. Install circlip [62]
9. For the DR.71-80: Apply Hylomar to cover sealing flange [75] and install it. Replace felt ring [190] and sealing ring [37] if required

   For the DR.90-315: Replace sealing [901], felt ring [190] and sealing ring [37] if required, and install the backstop housing [702].
10. Reinstall the removed parts.
11. Replace the label indicating the direction of rotation

7 Inspection/Maintenance

⚠ DANGER

Risk of crushing if the hoist falls or in the event of uncontrolled unit behavior.

Severe or fatal injuries.

- Secure or lower hoist drives (danger of falling)
- Safeguard and/or protect the driven machine against touching
- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Only use genuine spare parts in accordance with the valid parts list.
- Always install a new brake controller at the same time as replacing the brake coil.

If the motor includes safety-relevant components, observe the following safety note:

⚠ DANGER

Disabling functional safety devices.

Severe or fatal injuries.

- Only qualified personnel is allowed to carry out work on functional safety components.
- Any work on functional safety components must be carried out by strictly observing the specifications in the operating instructions at hand and the respective addendum to the operating instructions. Else, the right to claim under warranty will become invalid.

⚠ CAUTION

The surface temperatures on the drive can be very high during operation.

Danger of burns.

- Let the motor cool down before you start your work.

NOTICE

For assembly, the ambient temperature and the oil seals themselves may not be colder than 0 °C, else the oil seals might be damaged.

7.1 Inspection and maintenance intervals

Unit / unit part	Time interval	Required steps
BE brake	• **If used as a working brake:** At least every 3000 hours of operation[1)]	Inspect the brake • Measure the brake disk thickness • Brake disk, lining • Measure and set working air gap • Pressure plate • Carrier/gearing • Pressure rings • Suck off any abrasion • Inspect the switch contacts and replace them if necessary (e.g. when burnt)
	• **If used as a holding brake:** Every 2 to 4 years, depending on operating conditions [1)]	

Unit / unit part	Time interval	Required steps
Motor	• **Every 10 000 operating hours**[2)]	Inspect motor: • Check rolling bearing and Change if necessary • Replace the oil seal • Clean the cooling air passages
Drive	• Varies (depending on external factors)	• Touch up or renew the surfaces/ anticorrosion coating • Check and clean the air filter.

1) The periods of wear depend on many factors and can be short. The machine designer must calculate the required inspection/maintenance intervals individually in accordance with the project planning documents (e.g. "Project Planning for Drives").

2) For the DR.315 with relubrication device, please note the shortened relubrication periods in the "Bearing lubrication DR.315" section.

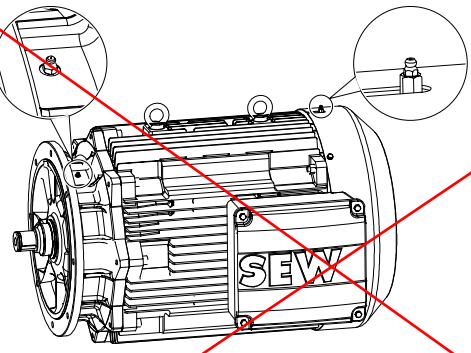
7.2 Bearing lubrication

7.2.1 Bearing lubrication for DR.71- DR.225

The motor bearings generally come with lubrication for life.

7.2.2 Bearing lubrication for DR.315

Size 315 motors may be equipped with a lubrication device. The following figure shows the positions of the lubrication devices.



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[1] Lubrication device in type A in accordance with DIN 71412

Under normal operating conditions and at an ambient temperature between -20 °C C to +40 °C, SEW-EURODRIVE uses ESSO Polyrex EM (K2P-20 DIN 51825), a polyurea-based mineral high-performance, high-temperature grease for initial lubrication.

For motors in the low temperature range up to -40 °C, SEW-EURODRIVE uses SKF GXN, which is also a polyurea-based mineral grease.

Relubrication

You can purchase the lubricants in 400 g cartridges from SEW-EURODRIVE. For order information, refer to the section "Lubricant tables for rolling bearings of SEW motors" .

INFORMATION

Only mix lubricants of the same thickness type, the same base oil and the same consistency (NLGI class)!

Grease the motor bearings in accordance with the information on the lubricant plate. The used grease collects inside the motor and should be removed every 6-8 relubrication cycles during an inspection. Each time you relubricate, ensure that the bearing is two-thirds full.

After relubricating the motors, you should startup slowly, if possible, so that the grease is distributed evenly.

Re-lubrication period

The relubrication intervals for the bearing correspond to the following table for the following conditions:

- -20 °C...+40 °C ambient temperature
- 4-pole speed
- Normal load

At greater speeds, higher loads or higher ambient temperatures, the relubrication intervals are shorter. Use 1.5 times the quantity for the initial filling.

	Horizontal mounting position		Vertical mounting position	
Motor type	**Duration**	**Quantity**	**Duration**	**Quantity**
DR.315 /NS	5000 h	50 g	3000 h	70 g
DR.315 /ERF /NS	3000 h	50 g	2000 h	70 g

7.3 Reinforced bearing

In the /ERF (reinforced bearing) option, cylindrical rolling bearings are installed on the A side.

NOTICE

Bearings might be damaged due to missing overhung load.

The drive system might be damaged.

- Do not operate cylindrical roller bearings without overhung load.

The reinforced bearing is only offered with the /NS (relubrication) option so as to facilitate optimal lubrication of the bearing. Please observe the notes on bearing lubrication in section "Bearing lubrication of the DR.315" (page 59).

7.4 Motor and brake maintenance – preliminary work

⚠ DANGER

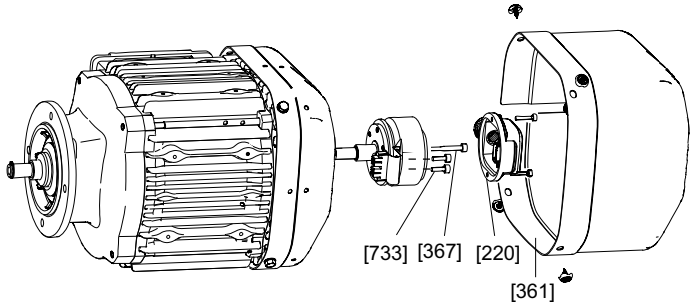
Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Before starting work, isolate the motor, brake, and if installed, the forced cooling fan from the power supply.
- Safeguard against accidental startup.

7.4.1 Remove the incremental encoder from DR.71-DR.132

The following figure shows how to remove an encoder using the ES7 incremental encoder as an example.



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[220] Connection cover
[361] Protection cover
[367] Retaining screw
[733] Screws

Removing ES7./ AS7.

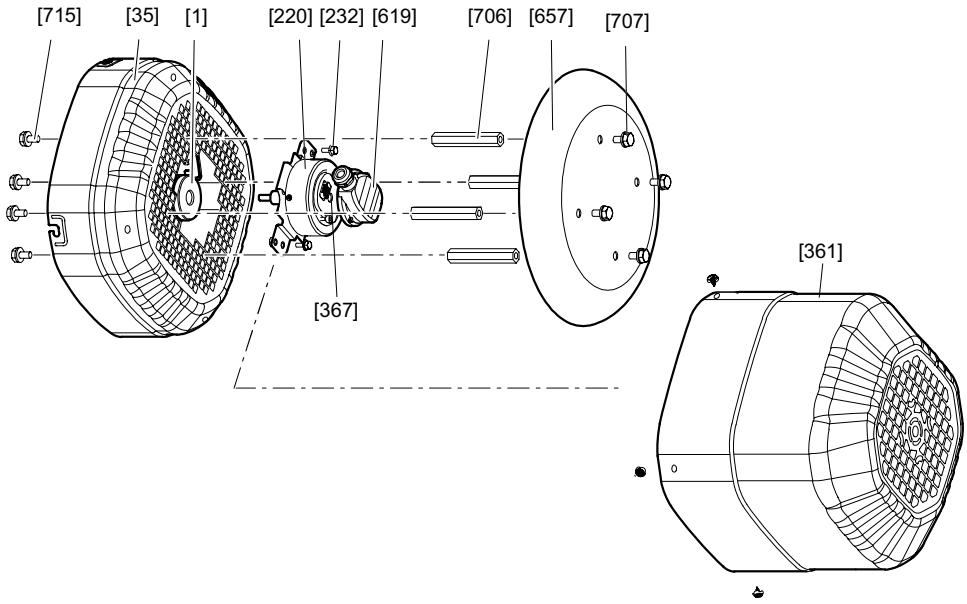
- Remove the protection cover [361].
- Unscrew the connection cover [220] and remove it. Do not disconnect the encoder connection cable.
- Unfasten the expansion anchor by unscrewing the screws [733] from the cover grid.
- Unscrew the central retaining screw [367] by about two to three turns and unfasten the spread shaft cone by tapping lightly on the head of the screw.
- Remove the incremental encoder from the bore of the rotor [1]

Re-assembly

For re-assembly, please note:

- Apply NOCO® Fluid to the encoder spigot.
- Tighten the central retaining screw [367] with a tightening torque of 2.9 Nm (25.7 lb-in).
- Tighten the screw [733] in the expansion anchor with a maximum tightening torque of 1.0 Nm (8.8 lb-in).

7.4.2 Removing the incremental encoder from 160-DR.225



2341914635

[1] Rotor	[232] Screws	[657] Cover	[707] Screws
[35] Fan guard	[367] Retaining screw	[706] Spacer bolt	[715] Screws
[220] Connection cover	[619] Encoder		

Removing EG7./ AG7.

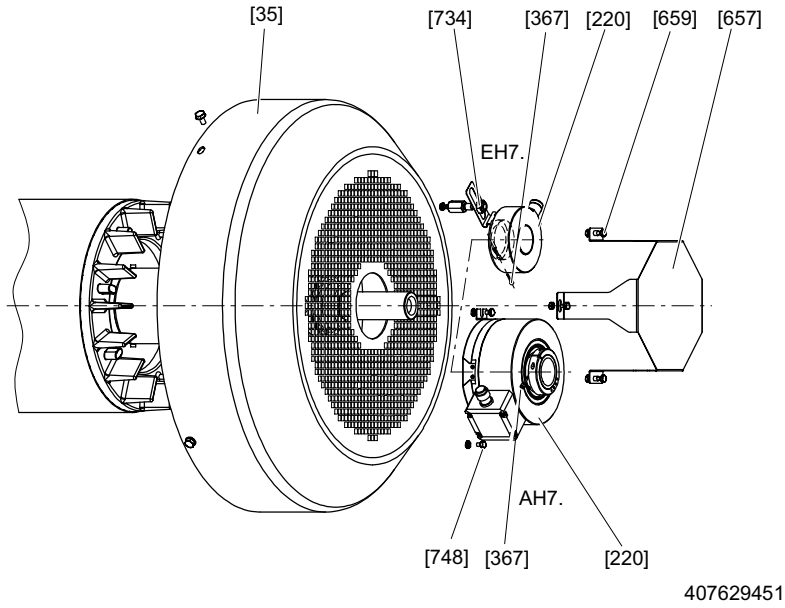
- Loosen the screws [707] and remove the cover [657]. Use SW13 spacer bolts [706] to counterhold.
- Unscrew the connection cover [619] and remove it.
- Remove the screws [232]
- Remove the fan guard [35]
- Force off the encoder by loosening the central retaining screw [367]
- If the encoder is hard to loosen, you can loosen or counterhold the encoder shaft at the installed SW17 spanner flat.

Re-assembly

- Apply NOCO® Fluid to the encoder shaft.
- Place the encoder in the rotor bore and tighten the central retaining screw [367] (max.6 Nm (53.1 lb-in)).
- Install the fan guard
- Attach the torque plate of the encoder to the air outlet using the 2 screws [232].
- Install connection cover [619].
- Install the cover [657] with the screws [707].

7.4.3 Removing the incremental encoder from DR.315

The following figure shows the disassembly of the incremental encoder on the DR.315



[35] Fan guard
[220] Encoder
[367] Retaining screw
[657] Protection cover
[659] Screw
[734] Nut
[748] Screw

Removing EH7

- Remove the protection cover [657] by loosening the screws [659].
- Separate the encoder from the fan guard by loosening the nut [734].
- Loosen the retaining screw [367] on the encoder and remove the encoder [220] from the shaft.

Removing AH7.

- Remove the protection cover [657] by loosening the screws [659].
- Separate the encoder from the fan guard by loosening the screws [748].
- Loosen the retaining screw [367] on the encoder and remove the encoder [220] from the shaft.

Re-assembly

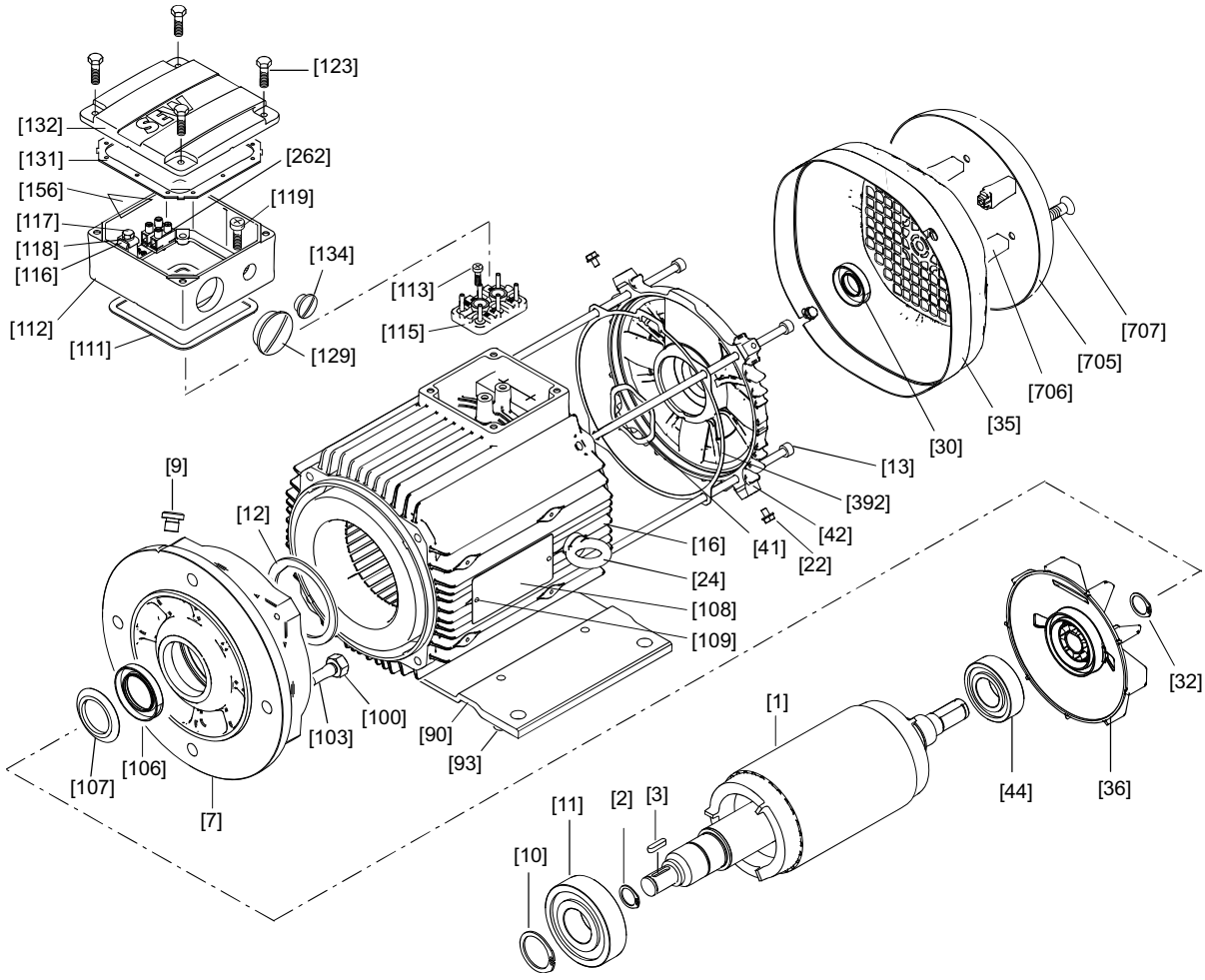
For re-assembly, please note:

- Apply NOCO® Fluid to the encoder spigot.
- Tighten the retaining screw with the following tightening torques:

Encoder	Tightening torque
EH7.	0.7 Nm (6.2 lb-in)
AH7.	3.0 Nm (26.6 lb-in)

7.5 Inspection/maintenance for DR.71-DR.225 motors

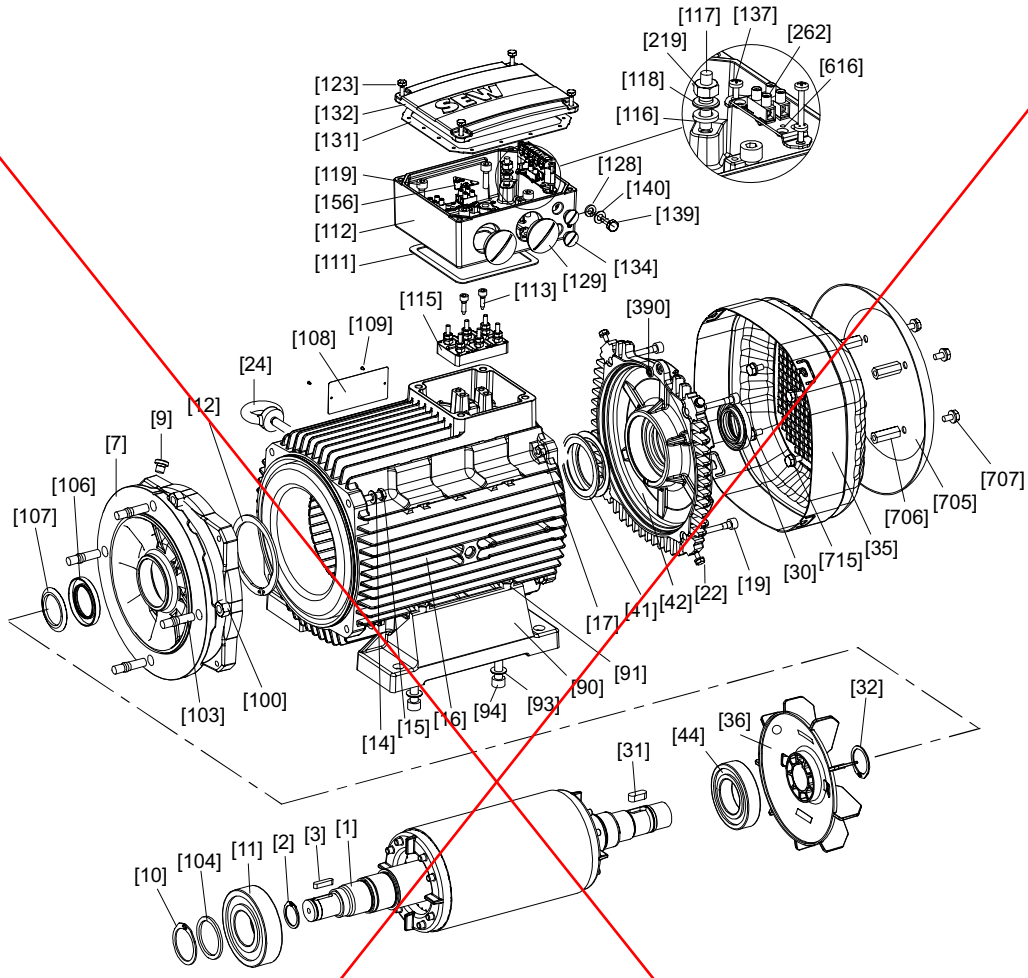
7.5.1 DR.71 - DR.132 – basic structure



173332747

[1] Rotor
[2] Circlip
[3] Key
[7] Flanged end shield
[9] Screw plug
[10] Circlip
[11] Grooved ball bearing
[12] Circlip
[13] Machine screw
[16] Stator
[22] Hex head screw
[24] Lifting eyebolt
[30] Oil seal
[32] Circlip
[35] Fan guard
[36] Fan
[41] Shim washer
[42] B-side endshield
[44] Grooved ball bearing
[90] Base plate
[93] Pan head screw
[100] Hex nut
[103] Stud
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Pan head screw
[115] Terminal board
[116] Terminal clip
[117] Hex head screw
[118] Lock washer
[119] Pan head screw
[123] Hex head screw
[129] Screw plug with O-ring
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug with O-ring
[156] Label
[262] Terminal clip, complete
[392] Sealing
[705] Protective cowl
[706] Spacer
[707] Pan head screw

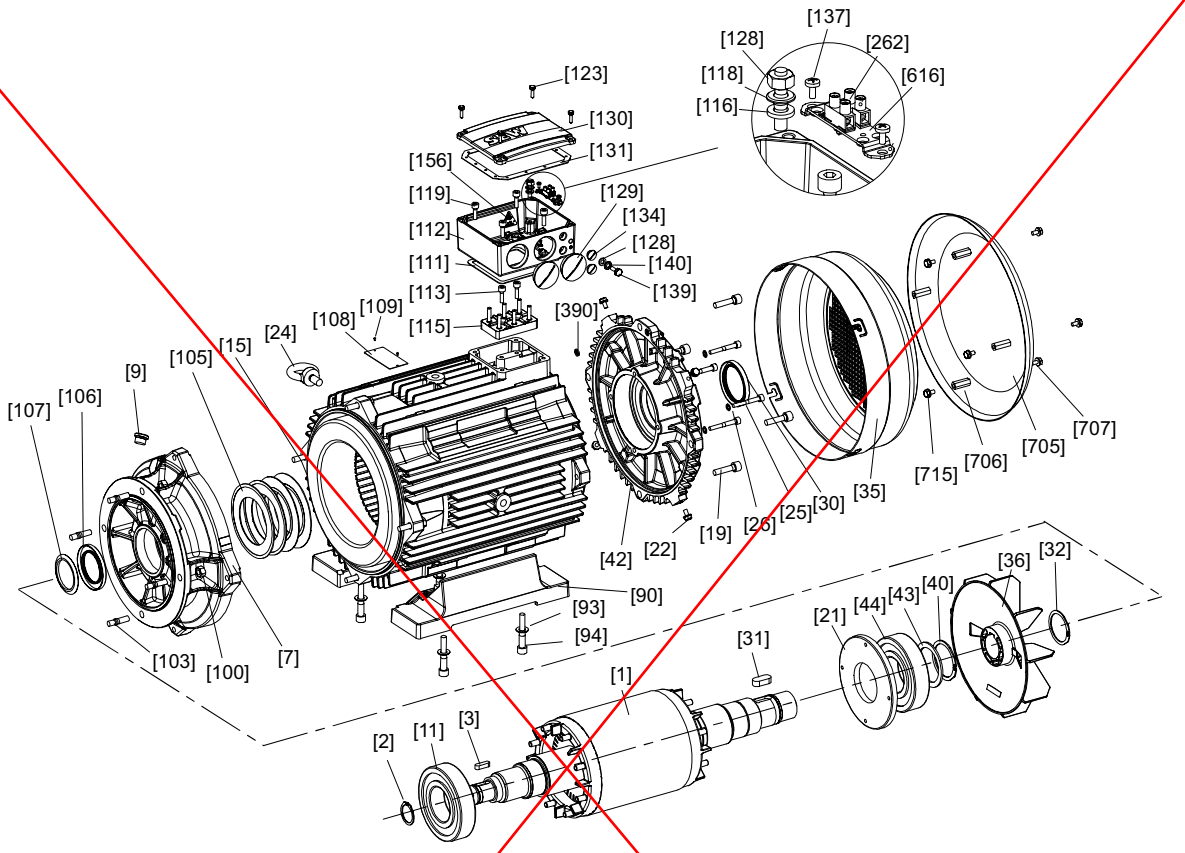
7.5.2 DR.160 - DR.180 – basic structure



527322635

[1] Rotor
[2] Circlip
[3] Key
[7] Flange
[9] Screw plug
[10] Circlip
[11] Grooved ball bearing
[12] Circlip
[14] Washer
[15] Hex head screw
[16] Stator
[17] Hex nut
[19] Machine screw
[22] Hex head screw
[24] Lifting eyebolt
[30] Sealing ring
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[41] Cup spring
[42] B-side endshield
[44] Grooved ball bearing
[90] Foot
[91] Hex nut
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[104] Supporting ring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Machine screw
[121] Grooved pin
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug with O-ring
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug with O-ring
[137] Screw
[139] Hex head screw
[140] Washer
[153] Terminal strip
[156] Label
[219] Hex nut
[262] Terminal clip
[390] O-ring
[616] Retaining plate
[705] Protective cowl
[706] Spacer
[707] Hex head screw
[715] Hex head screw

7.5.3 DR.200 - DR.225 – basic structure



1077856395

[1] Rotor
[2] Circlip
[3] Key
[7] Flange
[9] Screw plug
[11] Grooved ball bearing
[15] Hex head screw
[16] Stator
[19] Machine screw
[21] Oil seal flange
[22] Hex head screw
[24] Lifting eyebolt
[25] Machine screw
[26] Sealing washer
[30] Oil seal
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[40] Circlip
[42] B-side endshield
[43] Supporting ring
[44] Grooved ball bearing
[90] Foot
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[105] Cup spring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Machine screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Machine screw
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug
[137] Screw
[139] Hex head screw
[140] Washer
[156] Label
[219] Hex nut
[262] Terminal clip
[390] O-ring
[616] Retaining plate
[705] Protective cowl
[706] Spacer bolt
[707] Hex head screw
[715] Hex head screw

7.5.4 DR.71-DR.225 – inspection steps

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed).

   See section "Motor and brake maintenance – preliminary work" (page 61).

2. Remove fan guard [35] and fan [36].
3. Remove stator:
   - **Size DR.71-DR.132:** Remove machine screws [13] from flanged endshield [7] and B-side endshield [42]. Remove stator [16] from flanged endshield [7].
   - **Size DR.160-DR.180:** Loosen hex head screw [19] and remove B-side endshield [42]. Loosen hex head screw [15] and remove stator from flanged endshield.
   - **Size DR.200-DR.225:**
     - Loosen hex head screw [15] and remove the flanged endshield [7] from the stator.
     - With gearmotors: Remove oil flinger [107]
     - Loosen hex head screw [19] and remove the complete rotor [1] together with the B-side endshield [42].
     - Loosen hex head screw [25] and remove the complete rotor [1] from the B-side endshield [42].
4. Visual inspection: Is there any moisture or gear unit oil inside the stator?
   - If not, proceed with step 7
   - If there is condensation, proceed with step 5
   - If there is gear oil, have the motor repaired at a specialist workshop
5. If there is moisture inside the stator:
   - With gearmotors: Remove the motor from the gear unit
   - With motors without a gear unit: Remove the A-flange
   - Remove the rotor [1]
6. Clean the winding, dry it and check it electrically (see section "Preliminary work" (page 18)).

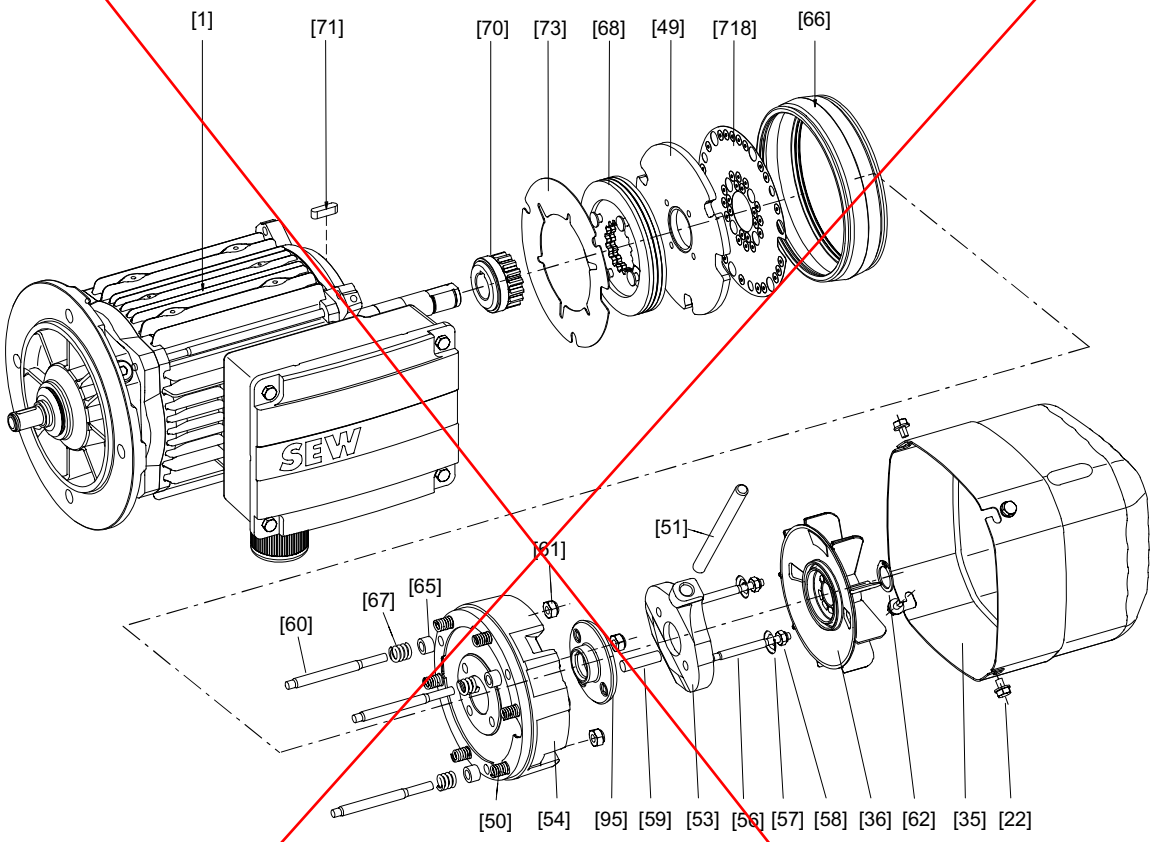
7. Replace the grooved ball bearings [11] [44] with permitted ball bearings.
   See section "Permitted rolling bearing types" (page 115).
8. Reseal the shaft:
   - A-side: Replace the oil seal [106]
   - B-side: Replace the oil seal [30]

     Coat the sealing lip with grease (Klüber Petamo GHY 133).
9. Reseal the stator seat:
   - Seal the sealing surface with duroplastic sealing compound

     (operating temperature -40 °C...+180 °C) e.g. "Hylomar L Spezial".
   - For size DR.71-DR.132: Replace sealing [392].
10. Install the motor and accessory equipment.

7.6 Inspection/maintenance for DR.71-DR.225 brakemotors

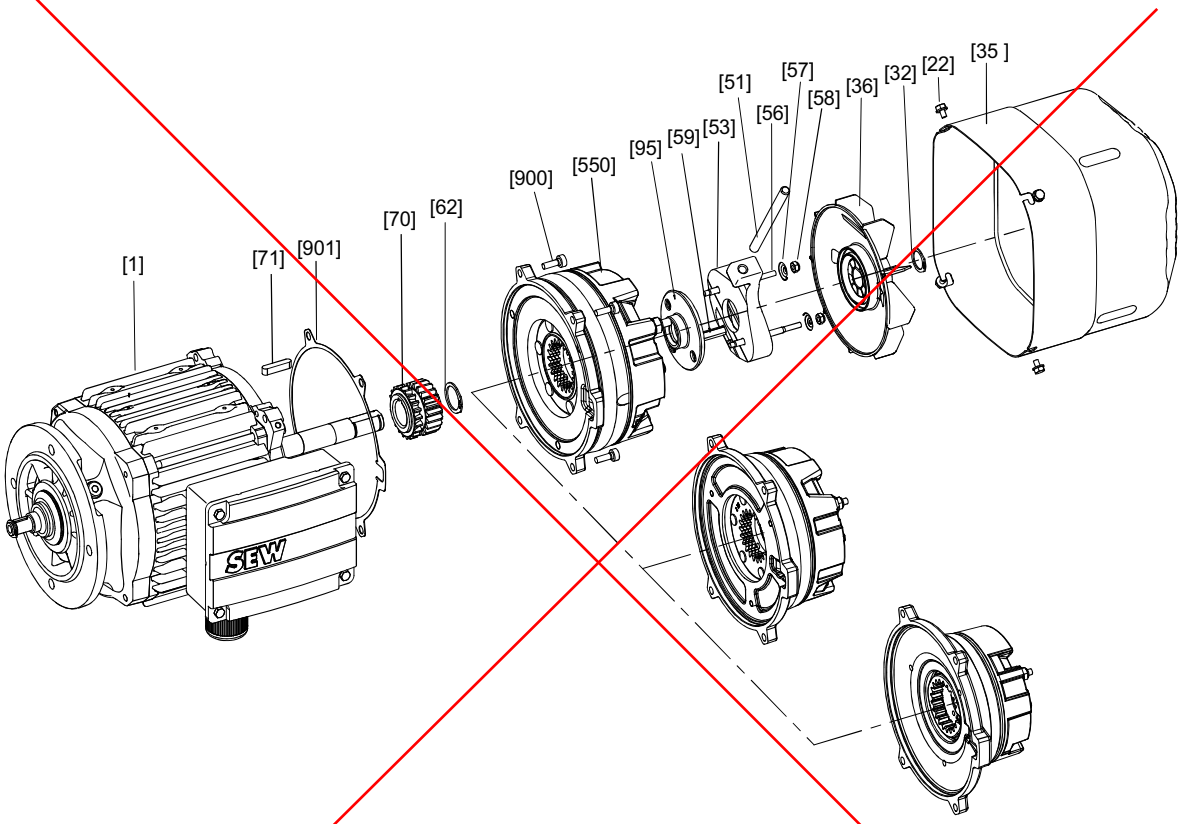
7.6.1 DR.71-DR.80 brakemotor – basic structure



174200971

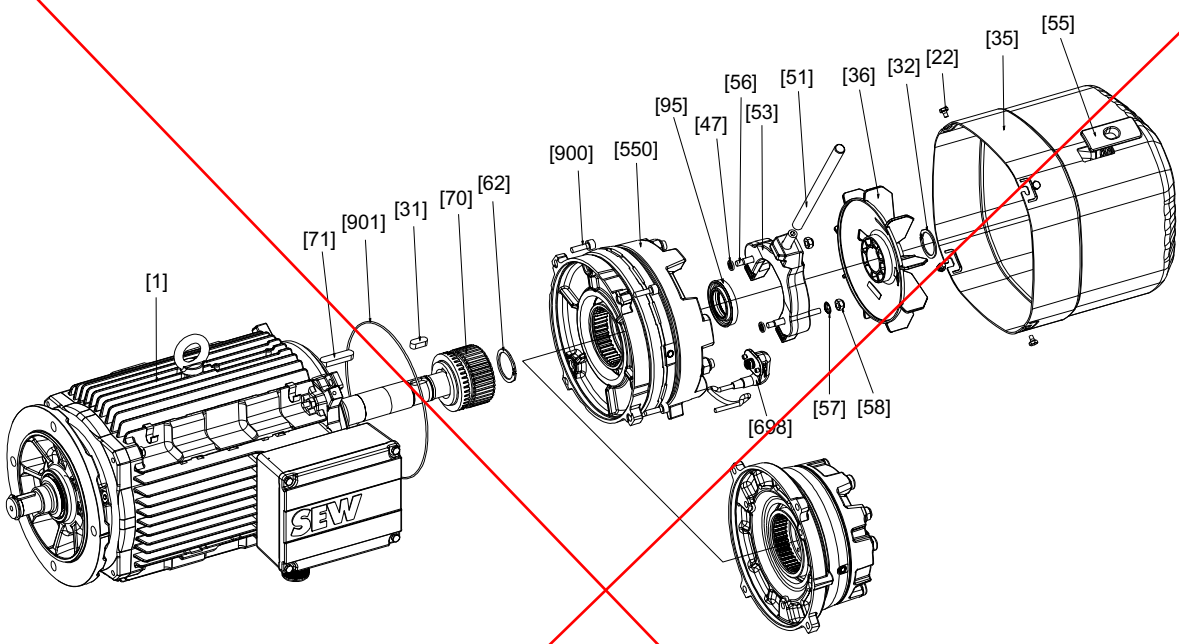
[1] Motor with brake endshield
[22] Hex head screw
[35] Fan guard
[36] Fan
[49] Pressure plate
[50] Brake spring
[11] Magnet, complete
[51] Hand lever
[53] Releasing lever
[54] Magnet, complete
[56] Stud
[57] Conical coil spring
[58] Setting nut
[59] Parallel pin
[60] Stud 3x
[61] Hex nut
[65] Pressure ring
[66] Rubber sealing collar
[67] Counter spring
[68] Brake disk
[62] Circlip
[70] Carrier
[71] Key
[73] Terminal disk
[95] Sealing ring
[718] Damping plate

7.6.2 DR.90-DR.132 brakemotor – basic structure



[1] Motor with brake endshield
[22] Hex head screw
[32] Circlip
[35] Fan guard
[36] Fan
[51] Hand lever
[53] Releasing lever
[56] Stud
[57] Conical coil spring
[58] Setting nut
[59] Parallel pin
[62] Circlip
[70] Carrier
[71] Key
[95] Sealing ring
[550] Pre-assembled brake
[900] Screw
[901] Sealing

7.6.3 DR.160-DR.225 brakemotor – basic structure



527223691

[1] Motor with brake endshield
[22] Hex head screw
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[47] O-ring
[51] Hand lever
[53] Releasing lever
[55] Closing piece
[56] Stud
[57] Conical coil spring
[58] Setting nut
[62] Circlip
[70] Carrier
[71] Key
[95] Sealing ring
[550] Pre-assembled brake
[698] Plug connector complete (only for BE20-BE32)
[900] Screw
[901] O-ring

7.6.4 DR.71-DR.225 brakemotor – inspection steps

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed).

   See section "Motor and brake maintenance – preliminary work" (page 61).

2. Remove fan guard [35] and fan [36].
3. Remove stator:
   - **Size DR.71-DR.132:**Remove machine screws [13] from flanged endshield [7] and brake endshield [42]. Remove stator [16] from flanged endshield [7].
   - **Size DR.160-DR.180:** Loosen hex head screw [19] and remove brake endshield [42]. Loosen hex head screw [15] and remove stator from flanged endshield.
   - **Size DR.200-DR.225:**
     - Loosen hex head screw [15] and remove the flanged endshield [7] from the stator.
     - With gearmotors: Remove oil flinger [107]
     - Loosen hex head screw [19] and remove the complete rotor [1] together with the brake endshield [42].
     - Loosen hex head screw [25] and remove the complete rotor [1] from the brake endshield [42].
4. Remove the brake cable:
   - **BE05-BE11:** Remove the terminal box cover and unfasten the brake cable from the rectifier.
   - **BE20-BE32:** Loosen safety screws of the brake plug connector [698] and remove plug connector.
5. Push the brake off the stator and carefully lift it off.
6. Pull the stator back by about. 3 to 4 cm.
7. Visual inspection: Is there any moisture or gear unit oil inside the stator?
   - If not, proceed with step 10.
   - If there is condensation, proceed with step 8
   - If there is gear oil, have the motor repaired at a specialist workshop
8. If there is moisture inside the stator:
   - With gearmotors: Remove the motor from the gear unit
   - With motors without a gear unit: Remove the A-flange
   - Remove the rotor [1]
9. Clean the winding, dry it and check it electrically (see section "Preliminary work" (page 18)).

10. Replace the grooved ball bearings [11] [44] with permitted ball bearings.

    See section "Permitted rolling bearing types" (page 115).

11. Reseal the shaft:
    - A-side: Replace the oil seal [106]
    - B-side: Replace the oil seal [30]

      Coat the sealing lip with grease (Klüber Petamo GHY 133).

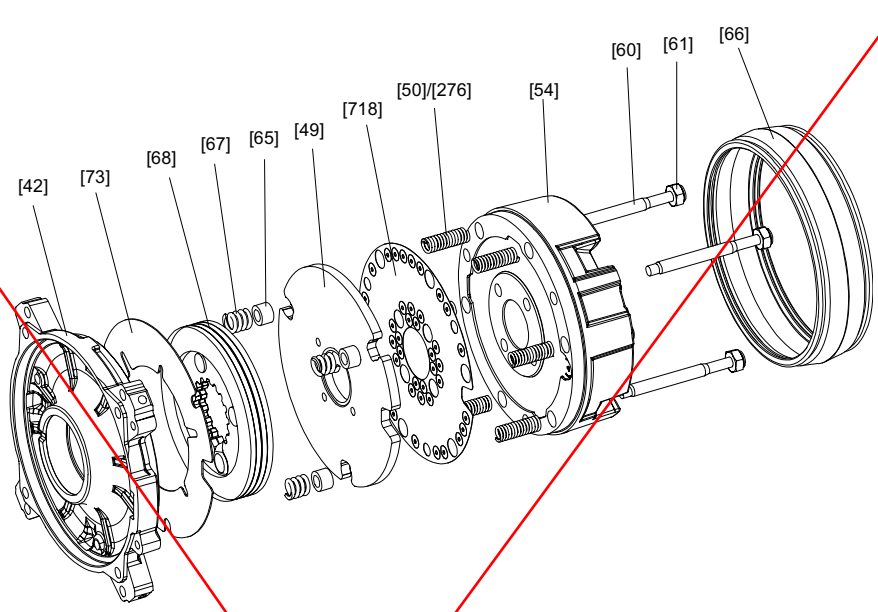
12. Reseal the stator seat:
    - Seal the sealing surface with duroplastic sealing compound

      (Operating temperature - 40 °C...+180 °C) e.g. "Hylomar L Spezial".
    - For size DR.71-DR.132: Replace sealing [392].

13. **Size DR-160-DR.225:** Replace the O-ring [901] between the brake endshield [42] and the pre-assembled brake [550]. Install the pre-assembled brake [550]

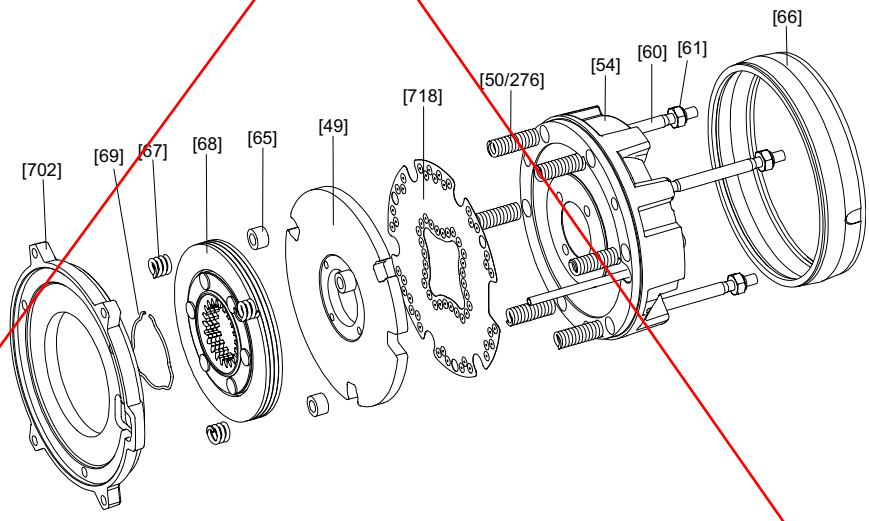
14. Install the motor, the brake and accessory equipment.

7.6.5 BE05-BE2 brakes (DR.71-DR.80) – basic structure



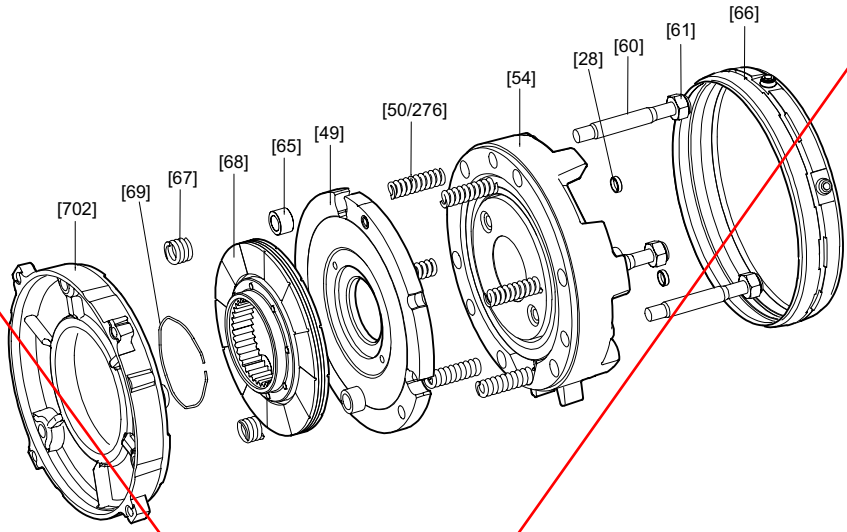
[42] Brake bearing end shield
[49] Pressure plate
[50] Brake spring (normal)
[54] Magnet, complete
[60] Stud 3x
[61] Hex nut
[65] Pressure ring
[66] Rubber sealing collar
[67] Counter spring
[68] Brake disk
[73] Terminal disk
[276] Brake spring (blue)
[718] Dampening plate

7.6.6 BE1-BE11 brake (DR.90-DR.160) – basic structure



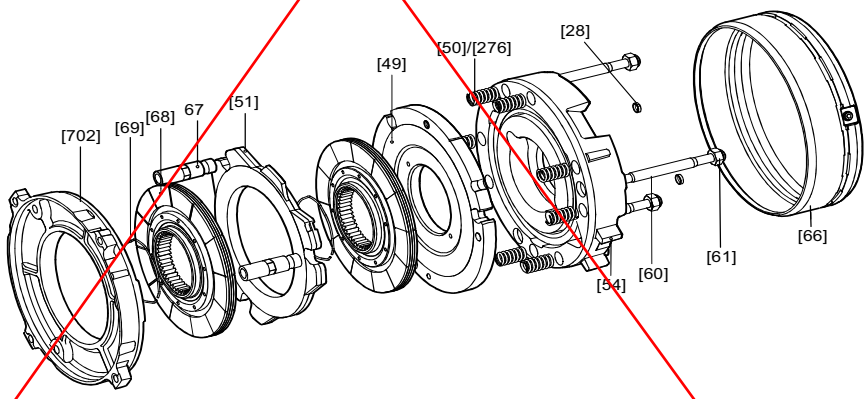
[49] Pressure plate
[50] Brake spring (normal)
[54] Magnet, complete
[60] Stud 3x
[61] Hex nut
[65] Pressure ring
[66] Rubber sealing collar
[67] Counter spring
[68] Brake disk
[69] Circular spring
[276] Brake spring (blue)
[702] Friction disk
[718] Dampening plate

7.6.7 BE20 brake (DR.160-DR.180) – basic structure



[28] Closing cap
[49] Pressure plate, complete
[50] Brake spring (normal)
[54] Magnet, complete
[60] Stud 3x
[61] Hex nut
[65] Pressure ring
[66] Rubber sealing collar
[67] Counter spring
[68] Brake disk
[69] Circular spring
[276] Brake spring (blue)
[702] Friction disk

7.6.8 BE30-BE32 brake (DR.180-DR.225) – basic structure



[28] Closing cap
[49] Pressure plate, complete
[50] Brake spring (normal)
[51] Brake lining
[54] Magnet, complete
[60] Stud 3x
[61] Hex nut
[66] Rubber sealing collar
[67] Setting sleeve
[68] Brake disk
[69] Circular spring
[276] Brake spring (blue)
[702] Friction disk

7.6.9 Setting the working air gap of BE05-BE32 brakes

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

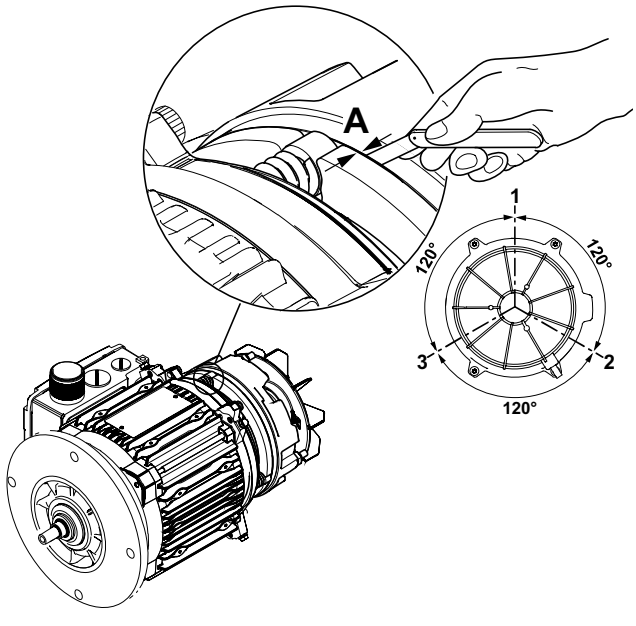
Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35]
2. Push the rubber sealing collar [66] aside,
   - Release the clamping strap, if necessary
   - Suck off any abrasion
3. Measure the brake disk [68]:
   - Minimum brake disk thickness see section "Technical Data" (page 104).
   - Replace brake disk if necessary, see section "Replacing the brake disk of BE05-BE32 brakes" (page 78).
4. **BE30-BE32:** Unfasten the setting sleeves [67] by turning it towards the brake endshield.
5. Measure the working air gap A (see the following figure)

   (use a feeler gauge and measure at three points offset by 120°):
   - between the pressure plate [49] and damping plate [718]



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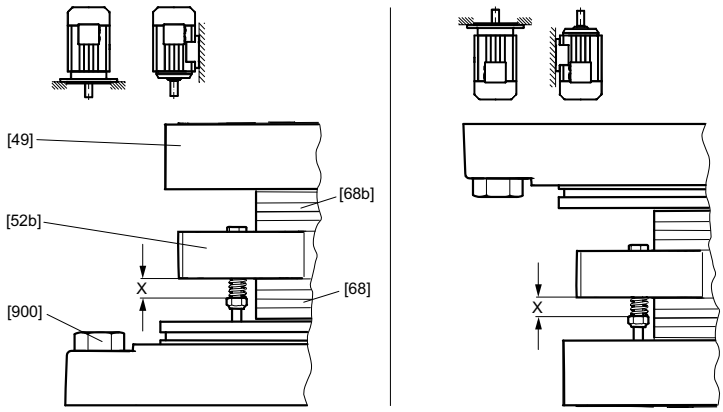
6. **BE05-BE20:** Tighten the hex nuts [61] until the working air gap is set correctly, see section "Technical Data" (page 104)

   BE30-BE32: Tighten the hex nuts [61] until the working air gap is 25 mm.

7. If you are mounting the BE32 in a vertical position, set the 3 springs on the brake stationary disk to the following measurement:

Mounting position	X in [mm]
Brake at the top	7.3
Brake at the bottom	6.5



[49] Pressure plate
[52b] Brake lining (BE32 only)
[68] Brake disk
[68b] Brake disk (BE32 only)
[900] Hex nut

8. **BE30-BE32:** Tighten the setting sleeves [67]
   - towards the magnet
   - until the working air gap is set correctly, see section "Technical Data" (page 104).
9. Put the rubber sealing collar back in place and re-install the dismantled parts.

7.6.10 Replacing the brake disk of BE05-BE32 brakes

When replacing the brake disk, check the other removed parts as well, and replace them if necessary.

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

INFORMATION

- The brake of DR.71-DR.80 motor sizes cannot be removed from the motor because the BE brake is directly installed on the brake endshield of the motor.
- The brake of DR.90-DR.225 motor sizes cannot be removed from the motor for replacing the brake disk because the BE brake is pre-installed on the brake endshield of the motor with a friction disk .

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

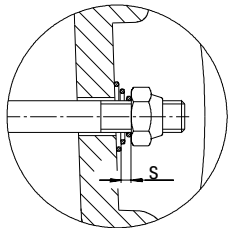
     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Remove the brake cable
   - **BE05-BE11:** Remove the terminal box cover and unfasten the brake cable from the rectifier.
   - **BE20-BE32:** Loosen safety screws of the brake plug connector [698] and remove plug connector.
3. Remove the rubber sealing collar [66]
4. Loosen hex nuts [61], carefully pull off the magnet [54] (brake cable!) and take out the brake springs [50].
5. **BE05-BE11:** Remove the damping plate [718], pressure plate [49] and brake disk [68]

   BE20-BE30: Remove pressure plate [49] and brake disk [68]

   BE32: Remove pressure plate [49], brake disk [68] and [68b]
6. Clean the brake components
7. Install a new brake disk(s).
8. Re-install the brake components,
   - Except for the fan and the fan guard, because the working air gap has to be set first, see section "Setting the working air gap of the BE05-BE32 brakes" (page 76).

9. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5
BE5; BE11, BE20; BE30; BE32	2

10. Put the rubber sealing collar back in place and re-install the dismantled parts.

INFORMATION

- The lockable manual brake release (type HF) is already released when resistance is encountered when operating the grub screw.
- The self-reengaging manual brake release (type HR) can be operated with normal hand pressure.
- In brakemotors with self-reengaging manual brake release, the manual brake release lever must be removed after startup/maintenance. A bracket is provided for storing the lever on the outside of the motor.

INFORMATION

Note: After replacing the brake disk, the maximum braking torque is reached only after several cycles.

7.6.11 Changing the braking torque of BE05-BE32 brakes

The braking torque can be altered in stages.

- by changing the type and number of brake springs
- by changing the complete magnet (only possible for BE05 and BE1)
- by changing the brake (from motor size DR.90).
- by changing to a two-disk brake (BE30 only)

For the possible braking torque steps, please refer to section "Technical Data" (page 104).

7.6.12 Changing the brake spring of BE05-BE32 brakes

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

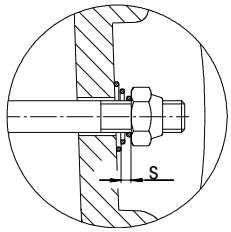
- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Remove the brake cable
   - **BE05-BE11:** Remove the terminal box cover and unfasten the brake cable from the rectifier.
   - **BE20-BE32:** Loosen safety screws of the brake plug connector [698] and remove plug connector.
3. Remove the rubber sealing collar [66] and the manual brake release:
   - setting nuts [58], conical coil springs [57], studs [56], releasing lever [53], spiral dowel pin [59]
4. Unfasten hex nuts [61] and pull off the magnet [54]
   - by approx. 50 mm (watch the brake cable)
5. Change or add brake springs [50/276]
   - Arrange brake springs symmetrically
6. Re-install the brake components
   - Except for the fan and the fan guard, because the working air gap has to be set first, see section "Setting the working air gap of the BE05-BE32 brakes" (page 76).

7. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5
BE5; BE11, BE20, BE30, BE32	2

8. Put the rubber sealing collar back in place and re-install the dismantled parts.

INFORMATION

Replace setting nuts [58] and hex nuts [61] if the removal procedure is repeated.

7.6.13 Changing the magnet of BE05-BE32 brakes

DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

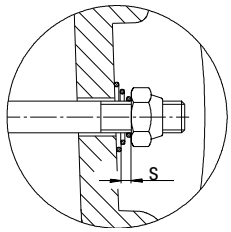
- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Remove the rubber sealing collar [66] and the manual brake release:
   - setting nuts [58], conical coil springs [57], studs [56], releasing lever [53], spiral dowel pin [59]
3. Remove the brake cable
   - **BE05-BE11:** Remove the terminal box cover and unfasten the brake cable from the rectifier.
   - **BE20-BE32:** Loosen safety screws of the brake plug connector [698] and remove plug connector.

4. Unfasten hex nuts [61], remove complete magnet [54], remove brake springs [50/ 276].
5. Install new magnet with brake springs. For the possible braking torque steps, please refer to section "Technical Data" (page 104).
6. Re-install the brake components
   – Except for the fan and the fan guard, because the working air gap has to be set first, see section"Setting the working air gap of the BE05-BE20 brakes" (page 76).
7. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5
BE5; BE11, BE20, BE30, BE32	2

8. Put the rubber sealing collar back in place and re-install the dismantled parts.
9. Replace brake controller in the event of an interturn short circuit or a short circuit to frame.

INFORMATION

Replace setting nuts [58] and hex nuts [61] if the removal procedure is repeated.

7.6.14 Replacing the brake of DR.71-DR.80

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

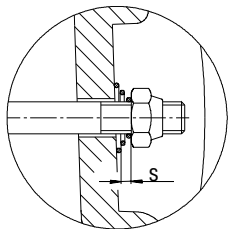
Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Remove the terminal box cover and loosen the brake cable from the rectifier. If necessary, attach trailing wire to brake cables.
3. Loosen machine screws [13] and remove brake endshield with brake from stator.
4. Guide the brake cable into the terminal box.
5. Align the cam of the brake endshield.
6. Mount oil seal [95].
7. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5

7.6.15 Replacing the brake of DR.90-DR.225

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

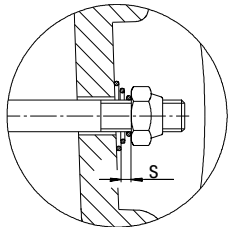
Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Remove the brake cable
   - **BE05-BE11:** Remove the terminal box cover and unfasten the brake cable from the rectifier.
   - **BE20-BE32:** Loosen safety screws of the brake plug connector [698] and remove plug connector.
3. Unfasten screws [900] and remove brake from brake endshield.
4. **DR.90- DR.132:** Observe the alignment of the sealing [901].
5. Connect brake cable.
6. Align the cam of the friction disk.
7. Mount oil seal [95].
8. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5
BE5; BE11, BE20, BE30, BE32	2

7.6.16 Retrofitting HR/HF manual brake release

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

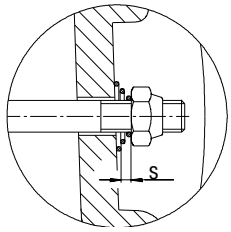
Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove the following:
   - Forced cooling fan and incremental encoder (if installed)

     See section "Motor and brake maintenance – preliminary work" (page 61).
   - Flange cover or fan guard [35], circlip [32/62] and fan [36]
2. Installing manual brake release:
   - **for BE05-BE11:**
     - Remove the sealing ring [95]
     - Screw in studs [56], insert sealing ring for manual brake release [95] and hammer in parallel pin [59].
     - Mount release lever [53], conical coil springs [57] and setting nuts [58].
   - **for BE20-BE32:**
     - Screw in studs [56].
     - Mount release lever [53], conical coil springs [57] and setting nuts [58].
3. Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see the following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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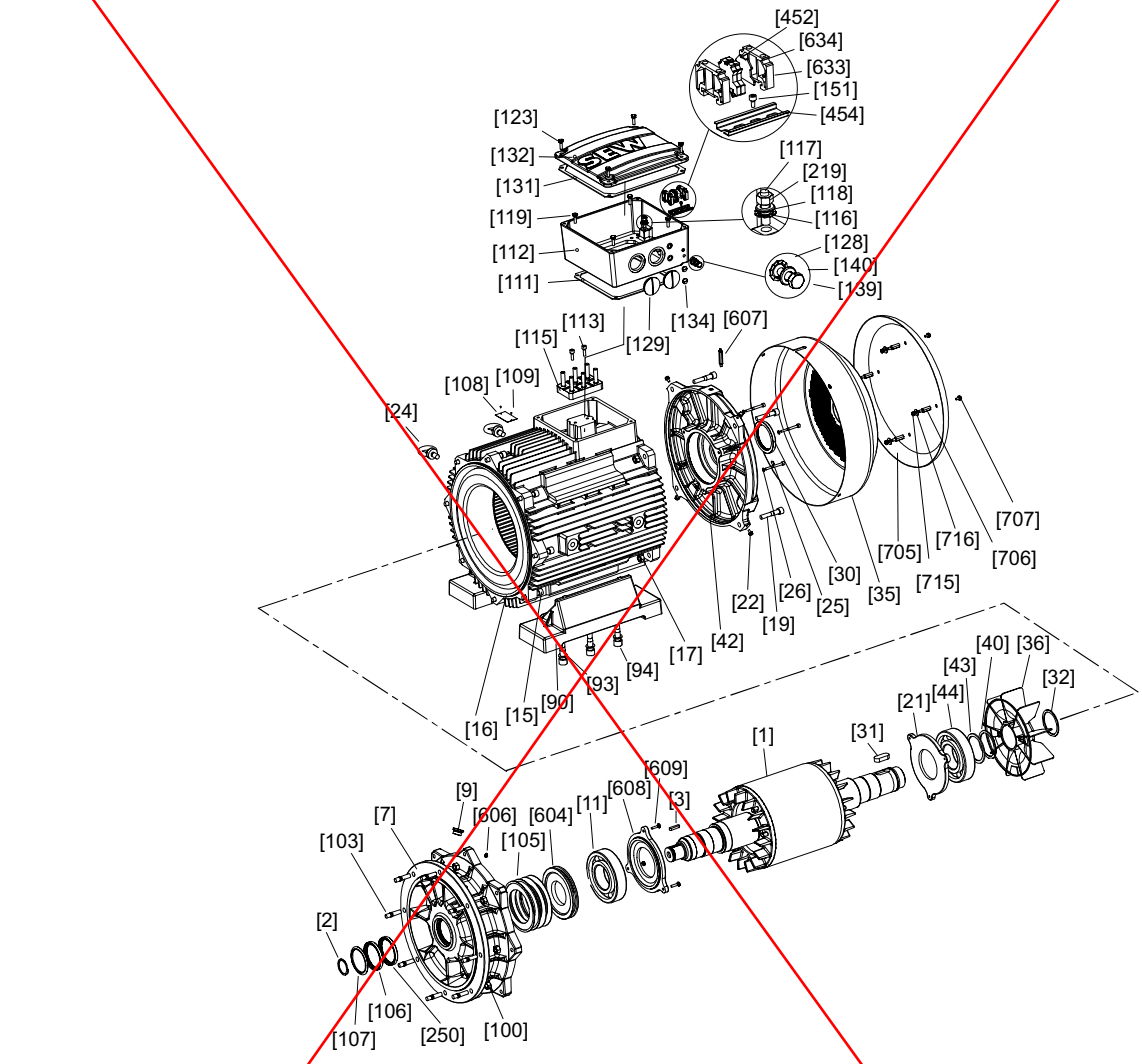
Brake	Floating clearance s [mm]
BE05; BE1; BE2	1.5
BE5; BE11, BE20, BE30, BE32	2

4. Reinstall the removed parts.

7.7 Inspection/maintenance for DR.315 motor

7.7.1 DR.315 – basic structure



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[1] Rotor
[2] Retaining ring
[3] Key
[7] Flange
[9] Screw plug
[11] Rolling bearing
[15] Machine screw
[16] Stator
[17] Hex nut
[19] Machine screw
[21] Oil seal flange
[22] Hex head screw
[24] Lifting eyebolt
[25] Machine screw
[26] Sealing washer
[30] Oil seal
[31] Key
[32] Retaining ring
[35] Fan guard
[36] Fan
[40] Retaining ring
[42] B-side endshield
[43] Supporting ring
[44] Rolling bearing
[90] Foot
[93] Washer
[94] Machine screw
[100] Hex nut
[103] Stud
[105] Cup spring
[106] Oil seal
[107] Oil flinger
[108] Nameplate
[109] Grooved pin
[111] Gasket for lower part
[112] Terminal box lower part
[113] Machine screw
[115] Terminal board
[116] Serrated lock washer
[117] Stud
[118] Washer
[119] Hex head screw
[123] Hex head screw
[128] Serrated lock washer
[129] Screw plug
[131] Gasket for cover
[132] Terminal box cover
[134] Screw plug
[139] Hex head screw
[140] Washer
[151] Machine screw
[219] Hex nut
[250] Oil seal
[452] Terminal strip
[454] Top hat rail
[604] Lubrication ring
[606] Greasing nipple
[607] Greasing nipple
[608] Oil seal flange
[609] Hex head screw
[633] End bracket
[634] End plate
[705] Canopy
[706] Spacer bolt
[707] Hex head screw
[715] Hex nut
[716] Washer

7.7.2 DR.315 – inspection steps

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed).

   See section "Motor and brake maintenance – preliminary work" (page 61).

   With gearmotors: Remove the motor from the gear unit.
2. Remove fan guard [35] and fan [36].
3. Unfasten machine screws [25] and [19], and remove B-side endshield [42].
4. Unfasten machine screws [15] from the flange [7] and remove the complete rotor [1] together with the flange. With gearmotors, pull off the oil flinger [107].
5. Loosen screws [609] and separate the rotor from the flange [7]. Before disassembly, protect the oil seal seat from damage using adhesive tape or a protective sleeve.
6. Visual inspection: Is there any moisture or gear unit oil inside the stator?
   - If not, proceed with step 8.
   - If there is moisture, proceed with step 7
   - If there is gear oil, have the motor repaired by a specialist workshop
7. If there is moisture inside the stator:

   Clean the winding, dry it and check it electrically (see section "Preliminary work" (page 18)).
8. Replace the rolling bearing [11] [44] with permitted rolling bearing types.

   See section"Permitted rolling bearing types" (page 115).

   Fill the bearing with grease until it is two-thirds full.

   See section "DR.315 – bearing lubrication". (page 59)

   Note: Place the oil seal flange [608] and [21] onto the rotor shaft before installing the bearings.
9. Starting on the A-side, mount the motor vertically.
10. Place the cup springs [105] and lubrication ring [604] into the bearing bore of the flange [7].

    Hang the rotor onto the B-side thread, and guide into the flange [7].

    Fasten the oil seal flange [608] to the flange [7] using the hex head bolts [609].

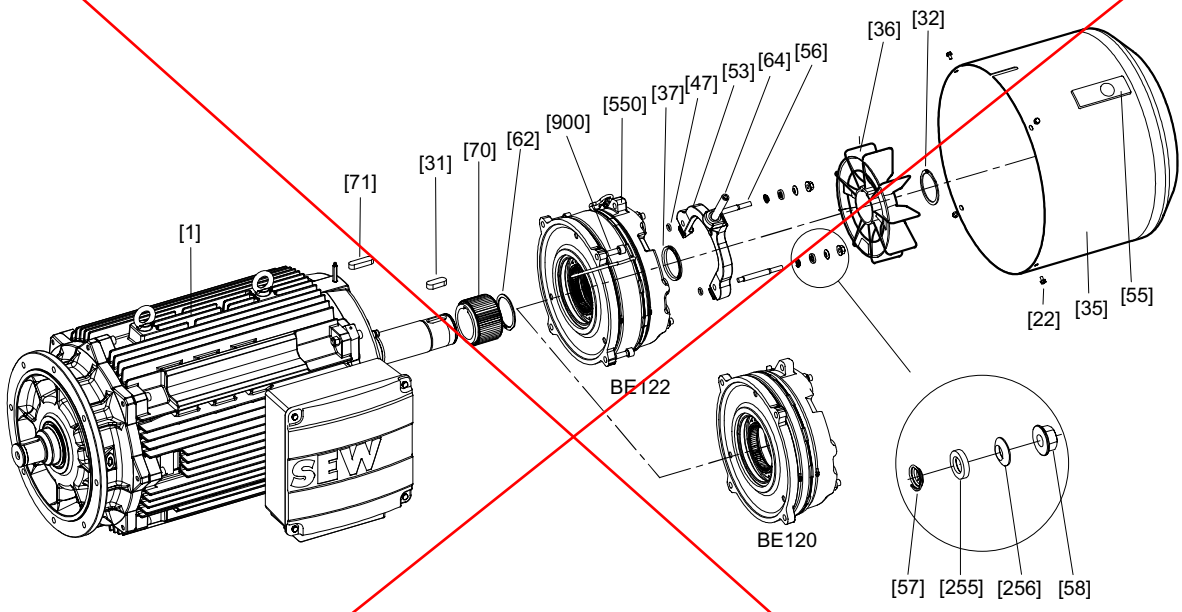
11. Mount the stator [16].
    - Reseal the stator seat: Seal the sealing surface with duroplastic sealing compound (operating temperature: -40 °C...+180 °C) e.g. "Hylomar L Spezial".

      Note: Protect the winding overhang from damage!
    - Screw in the stator [16] and flange [7] with screws [15].
12. Before mounting the B-side endshield [42], screw in the M8 setscrew approximately 200 mm into the oil seal flange [21].
13. Before mounting the B-side endshield [42], feed the setscrew in through a bore for the screw [25]. Screw in the B-side endshield [42] and stator [16] using machine screws [19] and hex nuts [17]. Lift the oil seal flange [21] with the setscrew, and fasten using 2 screws [25]. Remove the setscrew and screw in the remaining screws [25].
14. Renew oil seals
    - A-side: Insert the oil seal [106] and – for gearmotors – the oil seal [250], and replace the oil flinger [107].

      With gearmotors, fill about two-thirds of the space between the two oil seals with grease (Klüber Petamo GHY133).
    - B-side: Insert the oil seal [30], and coat the sealing lip with the same grease.
15. Install the fan [36] and fan guard [35].

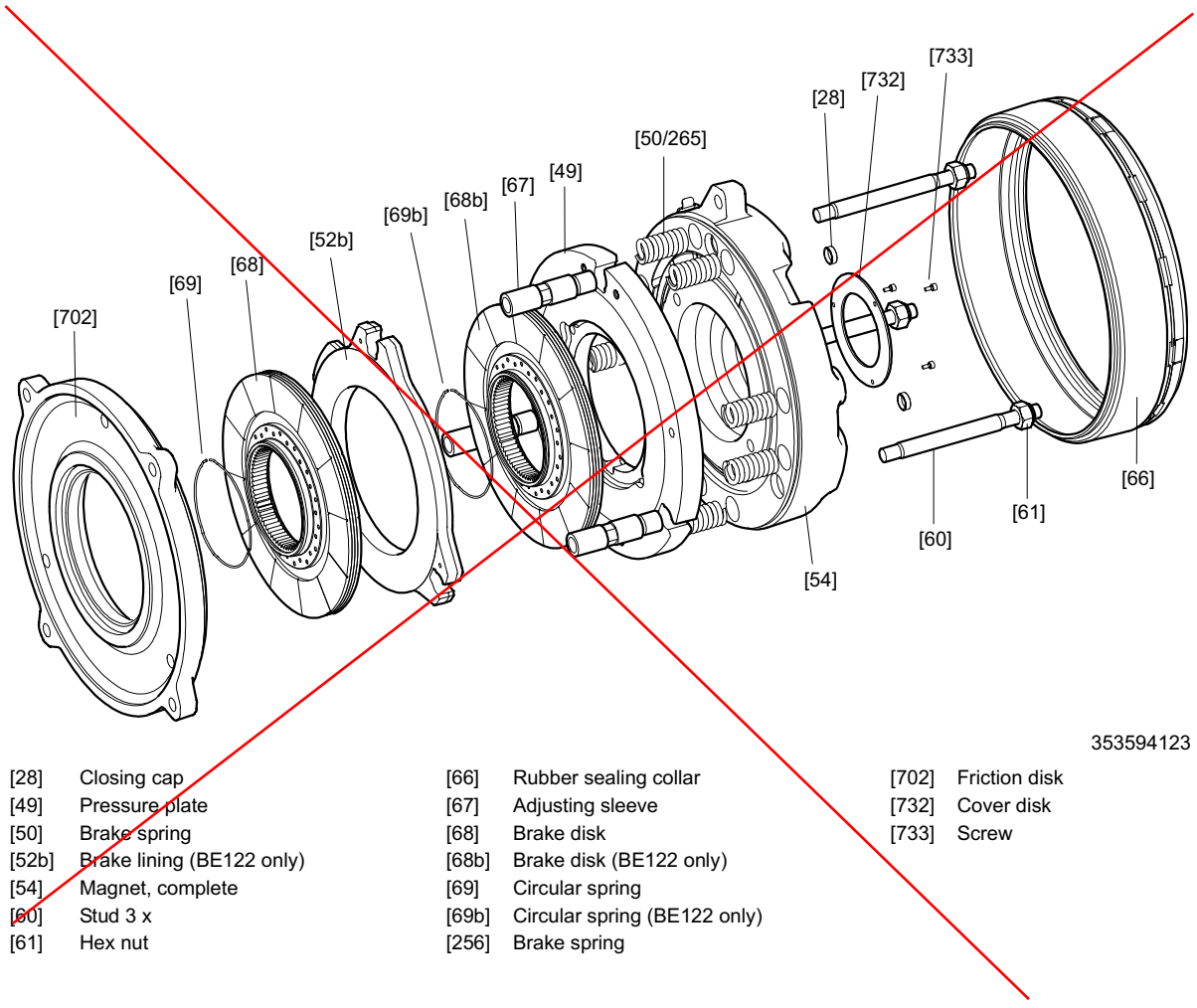
7.8 Inspection/maintenance for DR.315 brakemotors

7.8.1 DR.315 brakemotor – basic structure



[1] Motor with brake endshield
[22] Hex head screw
[31] Key
[32] Retaining ring
[35] Fan guard
[36] Fan
[37] V-ring
[47] O-ring
[53] Releasing lever
[55] Closing piece
[56] Stud
[57] Conical coil spring
[58] Setting nut
[62] Retaining ring
[64] Setscrew
[70] Carrier
[71] Key
[255] Conical seat
[256] Spherical washer
[550] Pre-assembled brake
[900] Screw
[901] Gasket

7.8.2 BE120-BE122 brake – basic structure



[28]	Closing cap	[66]	Rubber sealing collar	[702]	Friction disk
[49]	Pressure plate	[67]	Adjusting sleeve	[732]	Cover disk
[50]	Brake spring	[68]	Brake disk	[733]	Screw
[52b]	Brake lining (BE122 only)	[68b]	Brake disk (BE122 only)		
[54]	Magnet, complete	[69]	Circular spring		
[60]	Stud 3 x	[69b]	Circular spring (BE122 only)		
[61]	Hex nut	[256]	Brake spring		

7.8.3 DR.315 brakemotor – inspection steps

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed)

   See section "Motor and brake maintenance – preliminary work" (page 61).

2. Remove fan guard [35] and fan [36]
3. Unfasten brake connector
4. Loosen screws [900] and remove pre-assembled brake [550] from brake endshield.
5. Unfasten machine screws [25] and [19], and remove B-side endshield [42].
6. Unfasten machine screws [15] from the flange [7] and remove the complete rotor [1] together with the flange. With gearmotors, pull off the oil flinger [107].
7. Loosen screws [609] and separate the rotor from the flange [7]. Before disassembly, protect the oil seal seat from damage using adhesive tape or a protective sleeve.
8. Visual inspection: Is there any moisture or gear unit oil inside the stator?
   - If not, proceed with step 8.
   - If there is moisture, proceed with step 7
   - If there is gear oil, have the motor repaired by a specialist workshop
9. If there is moisture inside the stator:

   Clean the winding, dry it and check it electrically (see section "Preliminary work" (page 61)).
10. Replace the rolling bearing [11] [44] with permitted rolling bearing types.

    See section "Permitted rolling bearing types" (page 115).

    Fill two-thirds of the bearing with grease.

    See section "DR.315 – bearing lubrication" (page 59)

    Note: Place the oil seal flange [608] and [21] onto the rotor shaft before installing the bearings.
11. Starting on the A-side, mount the motor vertically.
12. Place the cup springs [105] and lubrication ring [604] into the bearing bore of the flange [7].

    Hang the rotor onto the B-side thread, and guide into the flange [7].

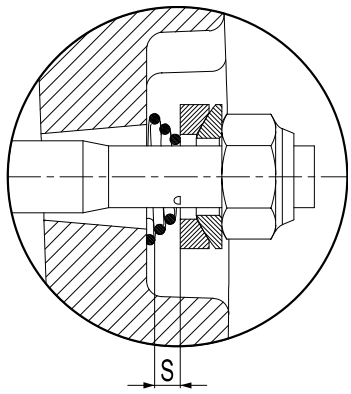
    Fasten the oil seal flange [608] to the flange [7] using the hex head bolts [609].

13. Mount the stator [16].
    - Reseal the stator seat: Seal the sealing surface with duroplastic sealing compound (operating temperature: -40 °C...+180 °C) e.g. "Hylomar L Spezial".

      Note: Protect the winding overhang from damage.
    - Screw in the stator [16] and flange [7] with screws [15].
14. Before mounting the brake endshield, screw in the M8 setscrew approximately 200 mm into the oil seal flange [21].
15. Before mounting the brake endshield [42], feed the setscrew in through a bore for the screw [25]. Screw in the brake endshield and stator [16] using machine screws [19] and hex nuts [17]. Lift the oil seal flange [21] with the setscrew, and fasten using 2 screws [25]. Remove the setscrew and screw in the remaining screws [25].
16. Renew oil seals
    - A-side: Insert the oil seals [106], the oil flinger [107], and the oil seal [250] for gearmotors.

      Fill about two-thirds of the space between the two oil seals with grease (Klüber Petamo GHY133).
    - B-side: Insert the oil seal [30], and coat the sealing lip with the same grease. This applies to gearmotors only
17. Align the cam of the friction disk, and mount the brake onto the brake endshield using a screw [900].
18. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

    This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE120; BE122	2

19. Install the fan [36] and fan guard [35].
20. Install the motor and accessory equipment.

7.8.4 Setting the working air gap for BE120-BE122 brakes

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

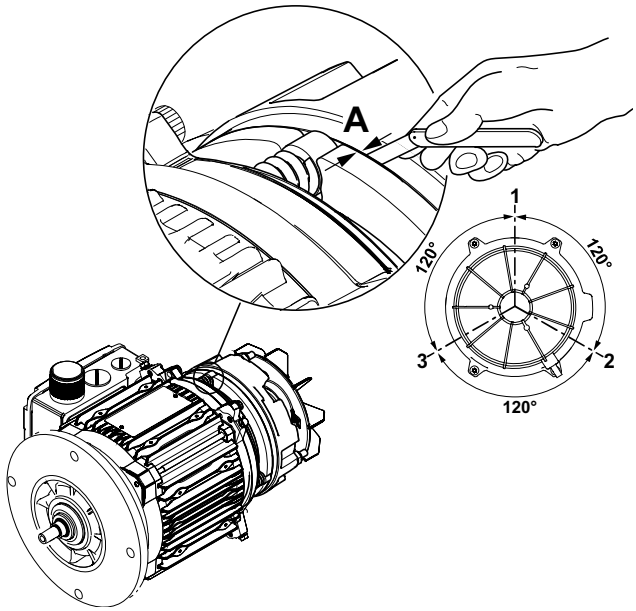
1. Remove forced cooling fan and incremental encoder (if installed)

   See section "Motor and brake maintenance – preliminary work" (page 61)
2. Remove fan guard [35] and fan [36]
3. Push the rubber sealing collar [66] aside,
   - Release the clamping strap, if necessary
   - Suck off any abrasion
4. Measure the brake disk [68, 68b]:

   Replace brake disk if ≤ 12 mm.

   See section "Replacing the brake disk of BE120-BE122 brakes" (page 95)
5. Unfasten the setting sleeves [67] by turning it towards the endshield
6. Measure the working air gap A (see the following figure)

   (use a feeler gauge and measure at three points offset by 120°):



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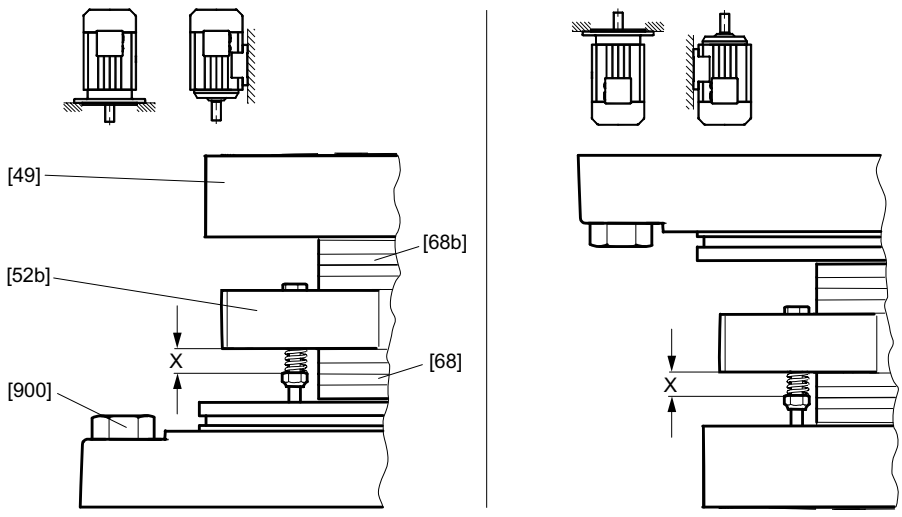
7. Tighten the hex nuts [61]
8. If you are mounting the BE122 in a vertical position, set the 3 springs on the brake stationary disc to the following measurement:

Mounting position	X in [mm]
Brake at the top	10.0
Brake at the bottom	10.5



[49] Pressure plate
[52b] Brake lining (BE122 only)
[68] Brake disk
[68b] Brake disk (BE122 only)
[900] Hex nut

9. Tighten the setting sleeves
   - Towards the magnet
   - Until the working air gap is set correctly, see section "Technical Data" (page 104)
10. Put the rubber sealing collar back in place and re-install the dismantled parts.

7.8.5 Replacing the brake disk of BE120-BE122 brakes

When fitting a new brake disk (thickness ≤ 12 mm), also check the other removed parts replace them if necessary.

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

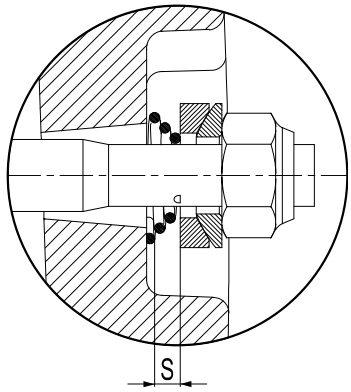
- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the following steps!

1. Remove forced cooling fan and incremental encoder (if installed)

   See section "Motor and brake maintenance – preliminary work" (page 61)
2. Remove the fan guard [35], circlip [32] and fan [36]
3. Loosen the plug connector on the magnet
4. Remove the rubber sealing collar [66] and the manual brake release:
   – Setting nuts [58], conical seat [255], spherical washer [256], conical coil springs [57], studs [56], releasing lever [53]
5. Unfasten hex nuts [61], carefully remove complete magnet [54] and remove brake springs [50/265].
6. Remove the pressure plate [49] and brake disk [68b], and clean the brake components.
7. Install a new brake disk.
8. Re-install the brake components,
   – Except for the fan and the fan guard, because the working air gap has to be set first, see section "Setting the working air gap of the BE120-BE122 brakes" (page 93).

9. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE120; BE122	2

10. Put the rubber sealing collar back in place and re-install the dismantled parts.

INFORMATION

- The lockable manual brake release (type HF) is already released when resistance is encountered when operating the grub screw.
- After replacing the brake disk, the maximum braking torque is reached only after several cycles.

7.8.6 Changing the braking torque of BE120-BE122 brakes

The braking torque can be altered in stages,

- By changing the type and number of brake springs
- By changing the brake

For the possible braking torque steps, please refer to section "Technical Data" (page 104).

7.8.7 Changing the brake spring of BE120-BE122l brakes

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

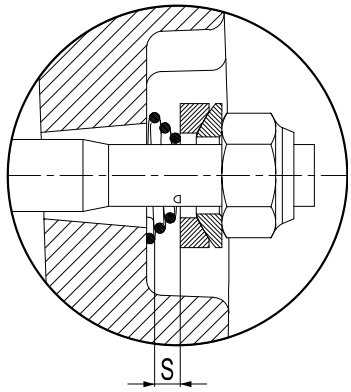
- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed)

   See section "Motor and brake maintenance – preliminary work" (page 61)
2. Remove the flange cover or fan guard [35], circlip [32] and fan [36]
3. Unfasten the plug connector on the magnet [54] and protect it from getting dirty
4. Remove the rubber sealing collar [66] and the manual brake release:
   – Setting nuts [58], conical seat [255], spherical washer [256], conical coil springs [57], studs [56], releasing lever [53]
5. Unfasten hex nuts [61] and pull off the magnet [54]
   – by about 50 mm
6. Change or add brake springs [50/265]
   – Arrange brake springs symmetrically
7. Re-install the brake components
   – Except for the fan and the fan guard, because the working air gap has to be set first, see section "Setting the working air gap of the BE120-BE122 brakes" (page 93).

8. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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Brake	Floating clearance s [mm]
BE120; BE122	2

9. Put the rubber sealing collar back in place and re-install the dismantled parts.

INFORMATION

Replace setting nuts [58] and hex nuts [61] if the removal procedure is repeated.

7.8.8 Replacing the brake of DR.315

INFORMATION

The mounting position for installation should correspond to the specifications on the nameplate; make sure that the intended mounting position is permitted.

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

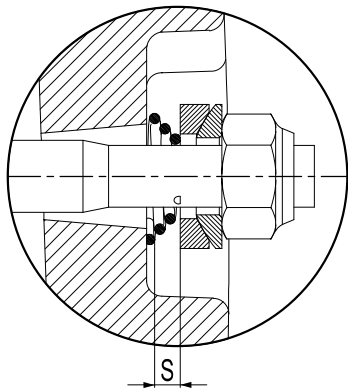
Severe or fatal injuries.

- Isolate the motor, brake, and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Remove forced cooling fan and incremental encoder (if installed)

   See section "Motor and brake maintenance – preliminary work" (page 61)
2. Remove the flange cover or fan guard [35], circlip [32] and fan [36]
3. Unfasten brake connector
4. Unfasten screws [900] and remove brake from brake endshield.
5. Align the cam of the friction disk, and mount the brake onto the brake endshield using a screw [900].
6. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (see following figure).

   This floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.



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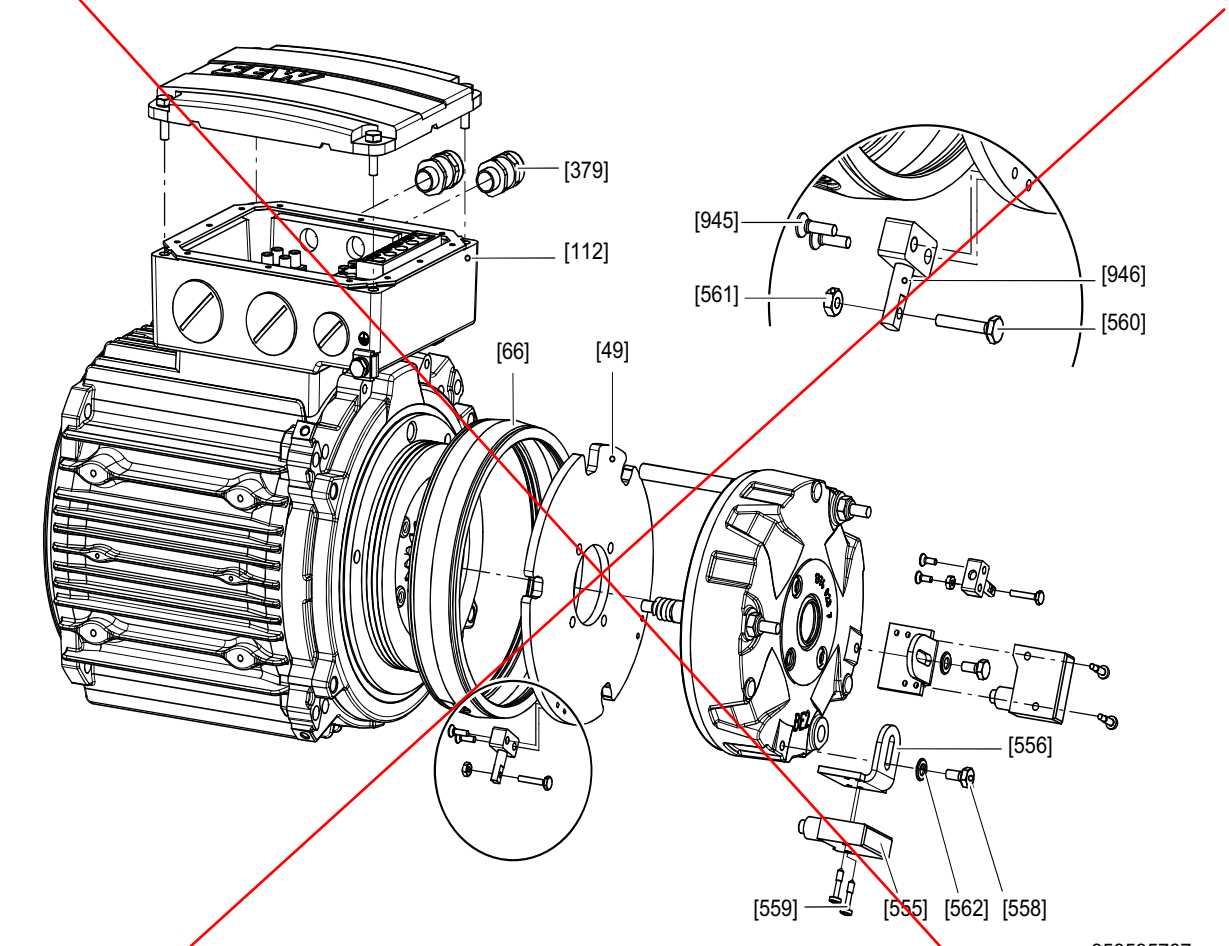
Brake	Floating clearance s [mm]
BE120; BE122	2

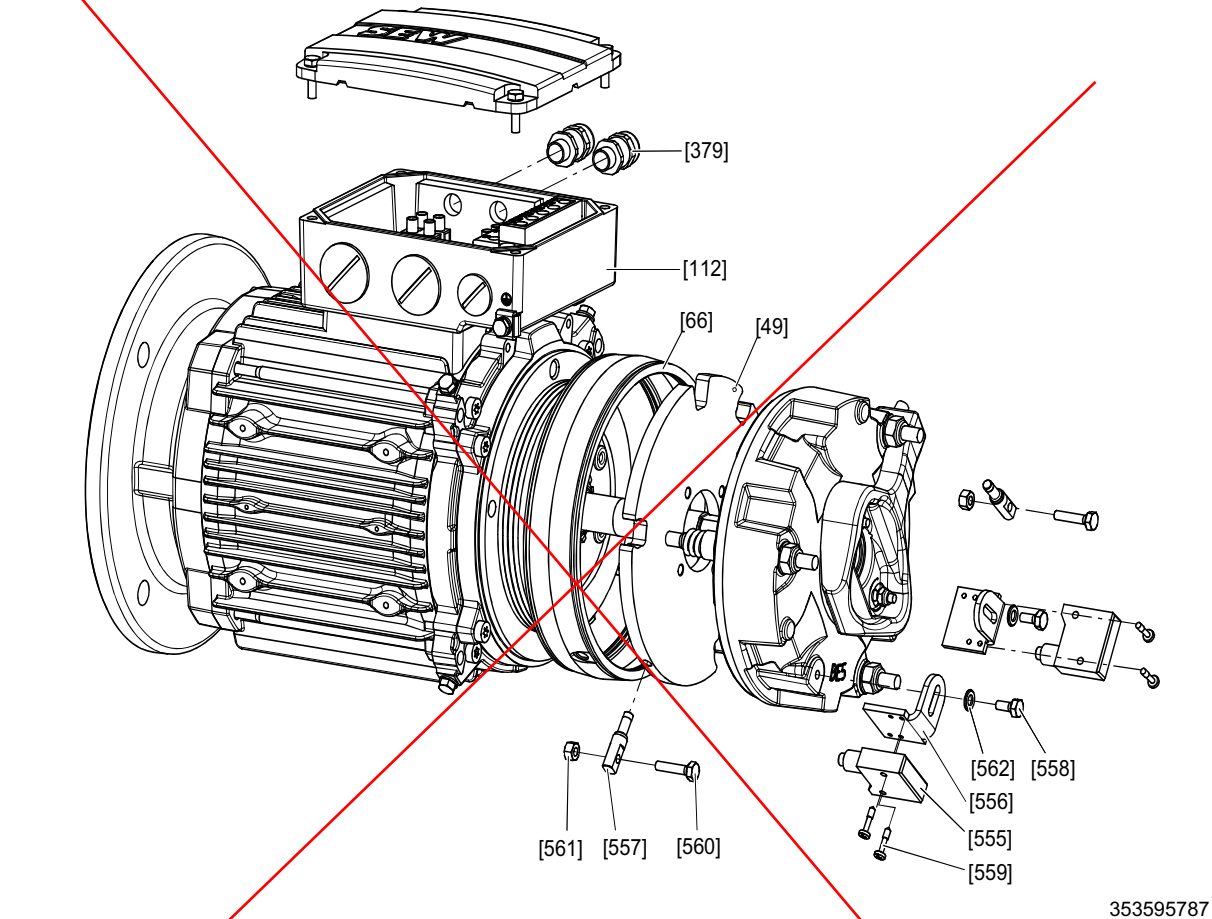
7.9 *Inspection/maintenance – DUB*

7.9.1 DUB connected to DR.90-100 with BE2 – basic structure



[49] Pressure plate for DUB
[66] Rubber sealing for DUB
[112] Terminal box lower part
[379] Cable gland
[555] Microswitch
[556] Angle bracket
[557] Bolts
[558] Hex head screw
[559] Pan head screw
[560] Hex head screw
[561] Stud
[562] Washer
[945] Countersunk screw
[946] Mounting plate, complete

7.9.2 DUB connected to DR.90-315 with BE5-BE122 – basic structure



[49] Pressure plate for DUB
[66] Rubber sealing for DUB
[112] Terminal box lower part
[379] Cable gland
[555] Microswitch
[556] Angle bracket
[557] Bolts
[558] Hex head screw
[559] Pan head screw
[560] Hex head screw
[561] Stud
[562] Washer

7.9.3 Inspection/maintenance – DUB1 for function monitoring

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Check and, if need be, adjust the working air gap according to section "Setting the working air gap for BE.. brake".
2. Screw hex head screw [560] against the actuator of microswitch [555] until it switches over (brown-blue contacts closed).

   While screwing, apply hex nut [561] to eliminate the longitudinal play from the thread.
3. Turn hex head screw [560] back until microswitch [555] switches back (contacts brown-blue open).
4. To ensure operational reliability, turn hex head screw [560] further back by one-sixth of a revolution (0.1 mm)
5. Tighten hex nut [561], while doing so, hold hex head screw [560] to keep it in the correct position.
6. Switch the brake on and off several times. Check whether the microswitch opens and closes reliably in any motor shaft position. Therefore, change the position of the motor shaft manually several times.

7.9.4 Inspection/maintenance – DUB2 for wear monitoring

⚠ DANGER

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Isolate the motor and forced cooling fan, if installed, from the power supply before starting work, safeguarding them against unintentional re-start.
- Carefully observe the steps described below.

1. Check and, if necessary, adjust the working air gap according to section "Setting the working air gap for BE.. brake".
2. Screw hex head screw [560] against the actuator of microswitch [555] until it switches over (brown-blue contacts closed).

   While screwing, apply hex nut [561] to eliminate the longitudinal play from the thread.
3. For BE2-BE5:

   – Loosen hex head screw [560] towards the microswitch [555] by three quarters of a revolution

   (with BE2 by about 0.375 mm / with BE5 by about 0.6 mm)

   With BE11-BE122

   – Loosen hex head screw [560] towards the microswitch [555] by a whole revolution (about 0.8 mm).
4. Tighten hex nut [561], while doing so, hold hex head screw [560] to keep it in the correct position.
5. If the brake lining reaches the wear limit, the microswitch automatically switches back (contacts brown-blue open) and activates a relay or a signal.

7.9.5 Inspection/maintenance – DUB3 for function and wear monitoring

If two DUB are connected to one brake, both monitoring states can be realized. In this case, set the DUB2 for wear monitoring before you set the DUB1 for function monitoring.

8 Technical Data

8.1 Work done, working air gap, braking torques

Brake Type	Braking work until maintenance [10^6 J]	Working air gap [mm] min.[1)]	Working air gap [mm] max.	Brake disk [mm] min.	Braking torque settings: Braking torque [Nm (lb-in)]	Type and number of brake springs: Normal	Type and number of brake springs: Blue	Order number of brake springs: Normal	Order number of brake springs: Blue
BE05	120	0.25	0.6	9.0	5.0 (44) 3.5 (31) 2.5 (22) 1.8 (16)	2 2 - -	4 2 6 3	0135 017 X	1374 137 3
BE1	120	0.25	0.6	9.0	10 (88.5) 7.0 (62) 5.0 (44)	6 4 2	- 2 4	0135 017 X	1374 137 3
BE2	180	0.25	0.6	9.0	20 (177) 14 (124) 10 (88.5) 7.0 (62) 5.0 (44)	6 2 2 - -	- 4 2 4 3	1374 024 5	1374 052 0
BE5	390	0.25	0.9	9.0	55 (487) 40 (354) 28 (248) 20 (177) 14 (124)	6 2 2 - -	- 4 2 4 3	1374 070 9	1374 071 7
BE11	640	0.3	1.2	10.0	110 (974) 80 (708) 55 (487) 40 (354)	6 2 2 -	- 4 2 4	1374 183 7	1374 184 5
BE20	1000	0.3	1.2	10.0	200 (1770) 150 (1328) 110 (974) 80 (708) 55 (487)	6 4 3 3 -	- 2 3 - 4	1374 322 8	1374 248 5
BE30	1500	0.3	1.2	10.0	300 (2655) 200 (1770) 150 (1328) 100 (885) 75 (667)	8 4 4 - -	- 4 - 8 6	0187 455 1	1374 435 6
BE32	1500	0.4	1.2	10.0	600 (5310) 500 (4425) 400 (3540) 300 (2655) 200 (1770) 150 (1328)	8 6 4 4 - -	- 2 4 - 8 6	0187 455 1	1374 435 6
BE120	520	0.4	1.2	12.0	1000 (8851) 800 (7081) 600 (5310) 400 (3540)	8 6 4 4	- 2 4 -	1360 877 0	1360 831 2
BE122	520	0.5	1.2	12.0	2000 (17701) 1600 (14161) 1200 (10621) 800 (7081)	8 6 4 4	- 2 4 -	1360 877 0	1360 831 2

1) Note when checking the working air gap: Parallelism tolerances on the brake disk may cause deviations of ± 0.15 mm after a test run.

8.2 Braking torque assignment

8.2.1 Motor size DR.71-DR.100

Motor type	Brake type	Braking torque steps [Nm (lb-in)]										
DR.71	BE05	1.8 (16)	2.5 (22)	3.5 (31)	5.0 (44)							
	BE1				5.0 (44)	7.0 (62)	10 (88)					
DR.80	BE05	1.8 (16)	2.5 (22)	3.5 (31)	5.0 (44)							
	BE1				5.0 (44)	7.0 (62)	10 (88)					
	BE2				5.0 (44)	7.0 (62)	10 (88.5)	14 (124)	20 (177)			
DR.90	BE1				5.0 (44)	7.0 (62)	10 (88)					
	BE2				5.0 (44)	7.0 (62)	10 (88)	14 (124)	20 (177)			
	BE5							14 (124)	20 (177)	28 (248)	40 (354)	55 (487)
DR.100	BE2				5.0 (44)	7.0 (62)	10 (88)	14 (124)	20 (177)			
	BE5							14 (124)	20 (177)	28 (248)	40 (354)	55 (487)

8.2.2 Motor size DR.112-DR.225

Motor type	Brake type	Braking torque steps [Nm (lb-in)]											
DR.112	BE5	14 (124)	20 (180)	28 (248)	40 (354)	55 (487)							
	BE11				40 (354)	55 (487)	80 (708)	110 (974)					
DR.132	BE5			28 (248)	40 (354)	55 (487)							
	BE11				40 (354)	55 (487)	80 (708)	110 (974)					
DR.160	BE11				40 (354)	55 (487)	80 (708)	110 (974)					
	BE20					55 (487)	80 (708)	110 (974)	150 (1328)	200 (1770)			
DR.180	BE20					55 (487)	80 (708)	110 (974)	150 (1328)	200 (1770)			
	BE30						75 (667)	100 (885)	150 (1328)	200 (1770)	300 (2655)		
	BE32								150 (974)	200 (1770)	300 (2655)	400 (3540)	
DR.200/225	BE30						75 (667)	100 (885)	150 (974)	200 (1770)	300 (2655)		
	BE32								150 (1328)	200 (1770)	300 (2655)	400 (3540)	500 (4425)	600 (5310)

8.2.3 Motor size DR.315

Motor type	Brake type	Braking torque steps [Nm (lb-in)]						
DR.315	BE120	400 (3540)	600 (5310)	800 (7081)	1000 (8851)			
	BE122			800 (7081)		1200 (10621)	1600 (14161)	2000 (17701)

8.3 Operating currents

8.3.1 Brake BE05/1, BE2

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 160 ms) when the brake is released. There is no increased inrush current if a BG or BMS brake rectifier is used or if there is a direct DC voltage supply – only possible with brakes up to size BE2.

	BE05/1	BE2
Max. braking torque [Nm (lb-in)]	5/10 (44/88)	20 (177)
Braking power [W (hp)]	32 (0.043)	43 (0.058)
Inrush current ratio I_B/I_H	4	4

Rated voltage V_N		BE05/1		BE2	
V_{AC}	V_{DC}	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
24 (23-26)	**10**	2,10	2.80	2.75	3.75
60 (57-63)	**24**	0.88	1.17	1.57	1.46
120 (111-123)	**48**	0.45	0.58	0.59	0.78
147 (139-159)	**60**	0,36	0,47	0,48	0.61
184 (174-193)	**80**	0.29	0.35	0.38	0.47
208 (194-217)	**90**	0.26	0.31	0.34	0.42
230 (218-243)	**96**	0.23	0.29	0.30	0.39
254 (244-273)	**110**	0.20	0.26	0.27	0.34
290 (274-306)	**125**	0.18	0.26	0.24	0.30
330 (307-343)	**140**	0.16	0.20	0.21	0.27
360 (344-379)	**160**	0.14	0.18	0.19	0.24
400 (380-431)	**180**	0.13	0.16	0.17	0.21
460 (432-484)	**200**	0.11	0.14	0.15	0.19
500 (485-542)	**220**	0.10	0.13	0.13	0.17
575 (543-600)	**250**	0.09	0.11	0.12	0.15

Key

I_B Acceleration current – brief inrush current
I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier
I_G Direct current with direct DC voltage supply
V_N Rated voltage (rated voltage range)

8.3.2 Brakes BE5, BE11, BE20, BE30, BE32

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 160 ms) when the brake is released. A separate voltage supply is not possible.

	BE5	BE11	BE20	BE30/32
Max. braking torque [Nm (lb-in)]	55 (487)	110 (974)	200 (1770)	300/600 (2655/5310)
Braking power [W (hp)]	49 (0.066)	77 (0.10)	100 (0.13)	130 (0.17)
Inrush current ratio I_B/I_H	5.7	6.6	7	10

Rated voltage V_N		BE5	BE11	BE20	BE30/32
V_{AC}	V_{DC}	I_H [A_{AC}]	I_H [A_{AC}]	I_H [A_{AC}]	I_H [A_{AC}]
60 (57-63)	**24**	1.25	2.08	2.49	-
120 (111-123)	**48**	0.64	1.04	1.25	1.81
147 (139-159)	**60**	0.51	0.83	1.02	1.33
184 (174-193)	**80**	0.40	0.66	0.79	1.15
208 (194-217)	**90**	0.36	0.59	0.70	1.02
230 (218-243)	**96**	0.33	0.52	0.63	0.91
254 (244-273)	**110**	0.29	0.47	0.56	0.81
290 (274-306)	**125**	0.26	0.42	0.50	0.72
330 (307-343)	**140**	0.23	0.37	0.44	0.64
360 (344-379)	**160**	0.21	0.33	0.40	0.57
400 (380-431)	**180**	0.18	0.29	0.35	0.51
460 (432-484)	**200**	0.16	0.26	0.32	0.46
500 (485-542)	**220**	0.15	0.23	0.28	0.41
575 (543-600)	**250**	0.13	0.21	0.25	0.36

Key

I_B Acceleration current – brief inrush current
I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier
I_G Direct current with direct DC voltage supply
V_N Rated voltage (rated voltage range)

8.3.3 Brake BE120, BE122

The current values I_H (holding current) listed in the tables are r.m.s. values. Use only appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 400 ms) when the brake is released. A separate voltage supply is not possible.

	BE120	BE122
Max. braking torque [Nm (lb-in)]	1000 (8851)	2000 (17701)
Braking power [W (hp)]	250 (0.34)	250 (0.34)
Inrush current ratio I_B/I_H	4.9	4.9

Rated voltage V_N		BE120	BE122
V_{AC}	V_{DC}	I_H [A_{AC}]	I_H [A_{AC}]
230 (218-243)	**-**	1.80	1.80
254 (244-273)	**-**	1.60	1.60
290 (274-306)	**-**	1.43	1.43
360 (344-379)	**-**	1.14	1.14
400 (380-431)	**-**	1.02	1.02
460 (432-484)	**-**	0.91	0.91
500 (485-542)	**-**	0.81	0.81
575 (543-600)	**-**	0.72	0.72

Key

I_B Acceleration current – brief inrush current
I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier
I_G Direct current with direct DC voltage supply
V_N Rated voltage (rated voltage range)

8.4 Resistors

8.4.1 Brake BE05/1, BE2, BE5

	BE05/1	BE2	BE5
Max. braking torque [Nm (lb-in)]	5/10 (44/88)	20 (177)	55 (487)
Braking power [W (hp)]	3 2 (0.043)	43 (0.058)	49 (0.066)
Inrush current ratio I_B/I_H	4	4	5.7

Rated voltage V_N		BE05/1		BE2		BE5	
V_{AC}	V_{DC}	R_B	R_T	R_B	R_T	R_B	R_T
24 (23-26)	**10**	0.77	2.35	0.57	1.74	-	-
60 (57-63)	**24**	4.85	14.8	3.60	11.0	2.20	10.5
120 (111-123)	**48**	19.4	59.0	14.4	44.0	8.70	42.0
147 (139-159)	**60**	31.0	94.0	23.0	69.0	13.8	66
184 (174-193)	**80**	48.5	148	36.0	111	22.0	105
208 (194-217)	**90**	61.0	187	45.5	139	27.5	132
230 (218-243)	**96**	77.0	125	58.0	174	34.5	166
254 (244-273)	**110**	97.0	295	72.0	220	43.5	210
290 (274-306)	**125**	122	370	91	275	55.0	265
330 (307-343)	**140**	154	470	115	350	69.0	330
360 (344-379)	**160**	194	590	144	440	87.0	420
400 (380-431)	**180**	245	740	182	550	110	530
460 (432-484)	**200**	310	940	230	690	138	660
500 (485-542)	**220**	385	1180	290	870	174	830
575 (543-600)	**250**	490	1480	365	1100	220	1050

8.4.2 Brakes BE11, BE20, BE30/32

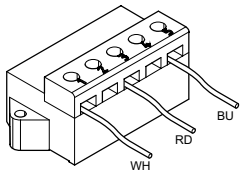
	BE11	BE20	BE30/32
Max. braking torque [Nm (lb-in)]	110 (974)	200 (1770)	600 (5310)
Braking power [W (hp)]	77 (0.10)	100 (0.13)	130 (0.17)
Inrush current ratio I_B/I_H	6.6	7	10

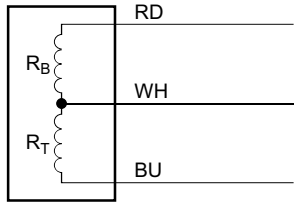
Rated voltage V_N		BE11		BE20		BE30/32	
V_{AC}	V_{DC}	R_B	R_T	R_B	R_T	R_B	R_T
60 (57-63)	**24**	1.20	7.6	1.1	7.1	-	-
120 (111-123)	**48**	4.75	30.5	3.3	28.6	2.1	15.8
147 (139-159)	**60**	7.7	43.5	5.4	36.0	3.7	27.5
184 (174-193)	**80**	12.0	76.0	8.4	57	5.3	39.8
208 (194-217)	**90**	15.1	96	10.6	71.7	6.7	50
230 (218-243)	**96**	19.0	121	13.3	90.3	8.4	63
254 (244-273)	**110**	24.0	152	16.7	134	10.6	79.3
290 (274-306)	**125**	30.0	191	21.1	143	13.3	100
330 (307-343)	**140**	38.0	240	26.5	180	16.8	126
360 (344-379)	**160**	47.5	305	33.4	227	21.1	158
400 (380-431)	**180**	60	380	42.1	286	26.6	199
460 (432-484)	**200**	76	480	52.9	360	33.4	251
500 (485-542)	**220**	95	600	66.7	453	42.1	316
575 (543-600)	**250**	120	760	83.9	570	53.0	398

8.4.3 Resistance measurement BE05-BE32

Cutoff in the AC circuit

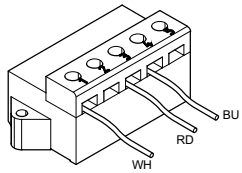
The following illustration shows how to measure resistance with cut-off in the AC circuit.

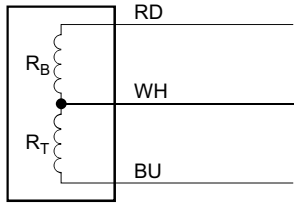




Cut-off in the DC and AC circuits

The following illustration shows how to measure resistance with cut-off in the DC and AC circuits.





BS Accelerator coil
TS coil section
R_B Accelerator coil resistance at 20 °C [Ω]
R_T Coil section resistance at 20 °C [Ω]
U_N Rated voltage (rated voltage range)

RD red
WH white
BU blue

INFORMATION

When measuring the resistance of the coil section (R_{Sec}) or the acceleration coil (R_{Acc}), remove the white conductor from the brake rectifier; if it remains connected, the internal resistance of the brake rectifier will cause erroneous results.

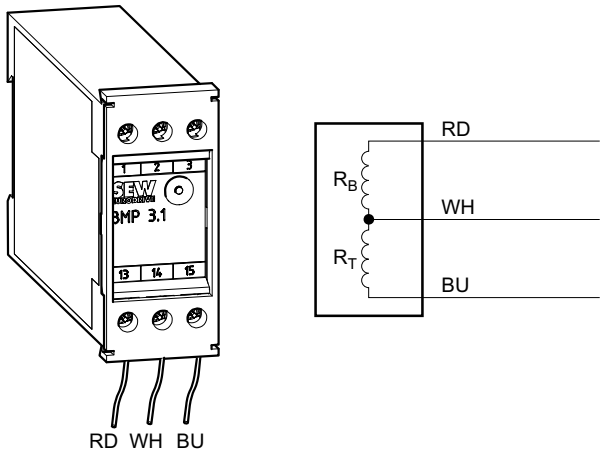
8.4.4 Brake BE120, BE122

	BE120	BE122
Max. braking torque [Nm (lb-in)]	1000 (8851)	2000 (17701)
Braking power [W (hp)]	250 (0.34)	250 (0.34)
Inrush current ratio I_B/I_H	4.9	4.9

Rated voltage V_N		BE120		BE122	
V_{AC}	V_{DC}	R_B	R_T	R_B	R_T
230 (218-243)	-	7.6	29.5	7.6	29.5
254 (244-273)	-	9.5	37.0	9.5	37.0
290 (274-306)	-	12.0	46.5	12.0	46.5
360 (344-379)	-	19.1	74.0	19.1	74.0
400 (380-431)	-	24.0	93.0	24.0	93.0
460 (432-484)	-	30.0	117.0	30.0	117.0
500 (485-542)	-	38.0	147.0	38.0	147.0
575 (543-600)	-	48.0	185.0	48.0	185.0

Resistance measurement BE120, BE122

The following illustration shows how to measure resistance with BMP 3.1.



BS Accelerator coil
TS coil section
R_B Accelerator coil resistance at 20 °C [Ω]
R_T Coil section resistance at 20 °C [Ω]
U_N Rated voltage (rated voltage range)

INFORMATION

When measuring the resistance of the coil section (R_{Sec}) or the acceleration coil (R_{Acc}), remove the white conductor from the brake rectifier; if it remains connected, the internal resistance of the brake rectifier will cause erroneous results.

8.5 Brake rectifier combinations

8.5.1 Brakes: BE05/1, BE2, BE5, BE11, BE20, BE30/32

The table below shows the standard and optional combinations of brakes and brake rectifiers.

		BE05	BE1	BE2	BE5	BE11	BE20	BE30/32
BG	BG 1.5	X[1]	X[1]	X[1]	•	–	–	–
	BG 3	X[2]	X[2]	X[2]	–	–	–	–
BGE	BGE 1.5	•	•	•	X[1]	X[1]	X[1]	X[1]
	BGE 3	•	•	•	X[2]	X[2]	X[2]	X[2]
BS	BS 24	X	X	X	•	–	–	–
BMS	BMS 1.5	•	•	•	–	–	–	–
	BMS 3	•	•	•	–	–	–	–
BME	BME 1.5	•	•	•	•	•	•	•
	BME 3	•	•	•	•	•	•	•
BMH	BMH 1.5	•	•	•	•	•	•	•
	BMH 3	•	•	•	•	•	•	•
BMK	BMK 1.5	•	•	•	•	•	•	•
	BMK 3	•	•	•	•	•	•	•
BMP	BMP 1.5	•	•	•	•	•	•	•
	BMP 3	•	•	•	•	•	•	•
BMV	BMV 5	•	•	•	•	•	•	–
BSG	BSG	•	•	•	X	X	X	–
BSR	BGE 3 + SR 11	•	•	•	•	•	–	–
	BGE 3 + SR 15	•	•	•	•	•	•	•
	BGE 1.5 + SR 11	•	•	•	•	•	–	–
	BGE 1.5 + SR 15	•	•	•	•	•	•	•
BUR	BGE 3 + UR 11	•	•	•	•	–	–	–
	BGE 1.5 + UR 15	•	•	•	•	•	•	•

X Standard design
X[1] Standard design with brake rated voltage of AC 150 - 500 V
X[2] Standard design with brake rated voltage of AC 24/42 - 150 V
• Optional
– Not permitted

8.5.2 Brake BE120, BE122

The table below shows the standard and optional combinations of brakes and brake rectifiers.

	BE120	BE122
BMP 3.1	X	X

8.6 Brake control system

8.6.1 Wiring space of the motor

The following tables list the technical data of brake control systems for installation in the motor wiring space and the assignments with regard to motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Motor size DR.71-DR.225

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BG	One-way rectifier	AC 150...500 V	1.5	BG 1.5	825 384 6	Black
		AC 24...500 V	3.0	BG 3	825 386 2	Brown
BGE	One-way rectifier with electronic switching	AC 150...500 V	1.5	BGE 1.5	825 385 4	Red
		AC 42...150 V	3.0	BGE 3	825 387 0	Blue
BSR	One-way rectifier + current relay for cut-off in the DC circuit	AC 150...500 V	1.0	BGE 1.5 + SR 11	825 385 4 826 761 8	
			1.0	BGE 1.5 + SR 15	825 385 4 826 762 6	
		AC 42...150 V	1.0	BGE 3 + SR11	825 387 0 826 761 8	
			1.0	BGE 3 + SR15	825 387 0 826 762 6	
BUR	One-way rectifier + voltage relay for cut-off in the DC circuit	AC 150...500 V	1.0	BGE 1.5 + UR 15	825 385 4 826 759 6	
		AC 42...150 V	1.0	BGE 3 + UR 11	825 387 0 826 758 8	
BS	Varistor protection circuit	DC 24 V	5.0	BS24	826 763 4	Water blue
BSG	Electronic switching	DC 24 V	5.0	BSG	825 459 1	White

Motor size DR.315

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	Half-wave rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit.	AC 230...575 V	2.8	BMP 3.1	829 507 7	

8.6.2 Control cabinet

The following tables list the technical data of brake control systems for installation in the control cabinet, and the assignment regarding the motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Motor size DR.71-DR.225

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMS	One-way rectifier as BG	AC 150...500 V	1.5	BMS 1.5	825 802 3	Black
		AC 42...150 V	3.0	BMS 3	825 803 1	Brown
BME	One-way rectifier with electronic switching as BGE	AC 150...500 V	1.5	BME 1.5	825 722 1	Red
		AC 42...150 V	3.0	BME 3	825 723 X	Blue
BMH	One-way rectifier with electronic switching and heating function	AC 150...500 V	1.5	BMH 1.5	825 818 X	Green
		AC 42...150 V	3	BMH 3	825 819 8	Yellow
BMP	One-way rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit	AC 150...500 V	1.5	BMP 1.5	825 685 3	White
		AC 42...150 V	3.0	BMP 3	826 566 6	Light blue
BMK	One-way rectifier with electronic switch mode, DC 24 V control input and separation in the DC circuit	AC 150...500 V	1.5	BMK 1.5	826 463 5	Water blue
		AC 42...150 V	3.0	BMK 3	826 567 4	Bright red
BMV	Brake control unit with electronic switching, DC 24 V control input and fast cut-off	DC 24 V	5.0	BMV 5	1 300 006 3	White

Motor size DR.315

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	Half-wave rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit.	AC 230...575 V	2.8	BMP 3.1	829 507 7	

8.7 Permitted rolling bearing types

8.7.1 Rolling bearing types for motor sizes DR.71-DR.225

Motor type	A-side bearing		B-side bearing	
	IEC motor	Gearmotor	AC motor	Brakemotor
DR.71	6204-2Z-J-C3	6303-2Z-J-C3	6203-2Z-J-C3	6203-2RS-J-C3
DR.80	6205-2Z-J-C3	6304-2Z-J-C3	6304-2Z-J-C3	6304-2RS-J-C3
DR.90-DR.100	6306-2Z-J-C3		6205-2Z-J-C3	6205-2RS-J-C3
DR.112-DR.132	6308-2Z-J-C3		6207-2Z-J-C3	6207-2RS-J-C3
DR.160	6309-2Z-J-C3		6209-2Z-J-C3	6209-2RS-J-C3
DR.180	6312-2Z-J-C3		6213-2Z-J-C3	6213-2RS-J-C3
DR.200-DR.225	6314-2Z-J-C3		6314-2Z-J-C3	6314-2RS-J-C3

8.7.2 Rolling bearing types for motor size DR.315

Motor type	A-side bearing		B-side bearing	
	IEC motor	Gearmotor	IEC motor	Gearmotor
DR.315K	6319-J-C3	6319-J-C3	6319-J-C3	6319-J-C3
DR.315S				
DR.315M		6322-J-C3		6322-J-C3
DR.315L				

Motor with reinforced bearing / ERF

Motor type	A-side bearing	B-side bearing	
		IEC motor	Gearmotor
DR.315K	NU319E	6319-J-C3	6319-J-C3
DR.315S			
DR.315M			6322-J-C3
DR.315L			

8.8 Lubricant tables

8.8.1 Lubricant table for rolling bearings

INFORMATION

Using the wrong bearing grease might result in increased motor noise.

Motor size DR.71-DR.225

The bearings are 2Z or 2RS closed bearings and cannot be regreased.

	Ambient temperature	Manufacturer	Type	DIN designation
Motor rolling bearings	-20 °C ... +80 °C	Esso	Polyrex EM[1)]	K2P-20
	+20 °C ... +100 °C	Klüber	Barrierta L55/2[2)]	KX2U
	-40 °C ... +60 °C	Kyodo Yushi	Multemp SRL[2)]	K2N-40

1) mineral lubricant (= mineral-based rolling bearing grease)

2) synthetic lubricant (= synthetic-based rolling bearing grease)

Motor size DR.315

Motors of size DR.315 can be equipped with a relubrication device.

	Ambient temperature	Manufacturer	Type	DIN designation
Motor rolling bearings	-20 °C ... +80 °C	Esso	Polyrex EM[1)]	K2P-20
	-40 °C ... +60 °C	SKF	GXN[1)]	K2N-40

1) mineral lubricant (= mineral-based rolling bearing grease)

8.9 Order information for lubricants and anti-corrosion agents

Lubricants and anti-corrosion agents may be obtained directly from SEW-EURODRIVE using the following order numbers.

Usage	Manufacturer	Type	Quantity	Order number
Lubricant for rolling bearings	Esso	Polyrex EM	400 g	09101470
	SKF	GXN	400 g	09101276
Lubricant for sealing rings	Klüber	Petamo GHY 133	10 g	04963458
Anti-corrosion agent and lubricant	SEW-EURODRIVE	NOCO® FLUID	5.5 g	09107819

8.10 Markings on the nameplate

The following table lists all markings that can occur on a nameplate and an explanation of what they mean:

Mark	Meaning
	CE mark to state compliance with European guidelines, such as the Low Voltage Directive
	ATEX mark to state compliance with the European Directive 94/9/EC
	UR mark to confirm that a component is UL (Underwriter's Laboratory) recognized with registration number E189357
	DoE mark to confirm compliance with US-American efficiency limit values for AC motors.
	UL mark to confirm UL (Underwriters Laboratory) as tested component; also valid for CSA together with registration number E189357
	CSA mark to confirm the Canadian Standard Association (CSA) and the market conformity of AC motors
	CSAe mark to confirm compliance with the Canadian efficiency limit values for AC motors
	CCC mark to confirm compliance with the regulation for small equipment of the People's Republic of China.
	VIK mark to confirm the compliance with the directive of the German Association of Industrial Machines (V.I.K.)
	FS mark with code number to identify functional safety relevant components

8.11 Characteristic values of functional safety

8.11.1 Characteristic safety values of the brakes BE05 – BE32

Definition of the characteristic safety value $B10_d$:

The value $B10_d$ specifies the number of cycles at which 10% of components have failed dangerously (definition according to standard EN ISO 13849-1). Failed dangerously means in this context that the brake is not applied when required. This means the brake does not deliver the necessary braking torque.

Size	$B10_d$ Switching cycles
BE05	16 000 000
BE1	12 000 000
BE2	8 000 000
BE5	6 000 000
BE11	3 000 000
BE20	2 000 000
BE30	1 500 000
BE32	On request

8.11.2 Characteristic safety values of the encoders EG7S, ES7S, AG7W, AG7Y, AS7Y

Definition of the characteristic safety value $MTTF_d$:

The value $MTTF_d$ (Mean Time To Failure) specifies the mean time to dangerous failure / component fault.

Motor size	Designation	$MTTF_d$ [1)] [a]	Service life [a]
DR.71-132	**ES7S**	61	20
	AS7W	41	20
	AS7Y	41	20
DR.160-225, 315	**EG7S**	61	20
	AG7W	41	20
	AG7Y	41	20

1) Based on an ambient temperature of 40 °C

9 Appendix

9.1 Wiring diagrams

INFORMATION

The motor should be connected as shown in the connection wiring diagram or the assignment diagram, which are supplied with the motor. The following section only shows a selection of the common types of connections. You can obtain the relevant wiring diagrams free of charge from SEW-EURODRIVE.

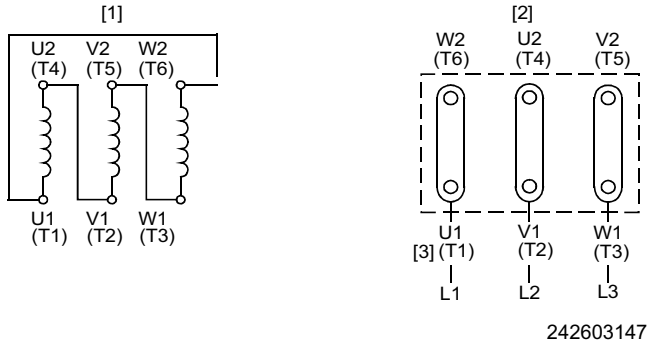
9.1.1 Delta and star connection in wiring diagram R13

AC motor

For all motors with one speed, direct switching-on or ⅄/△ startup.

△ *connection*

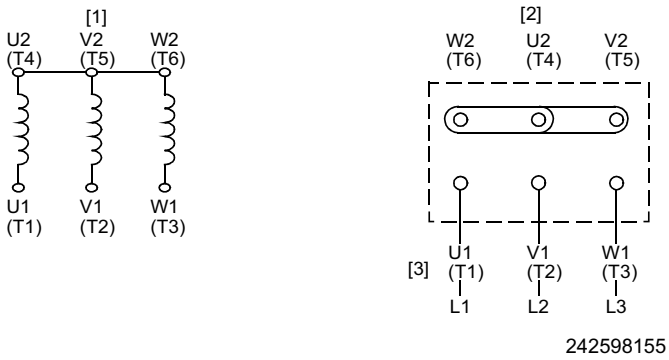
The following figure shows △ connection for low voltage.



[1] Motor winding
[2] Motor terminal board
[3] Supply cables

⅄ *connection*

The following figure shows ⅄ connection for high voltage.



[1] Motor winding
[2] Motor terminal board
[3] Supply cables

Change in direction of rotation: Swap connection of 2 supply cables, L1 - L2

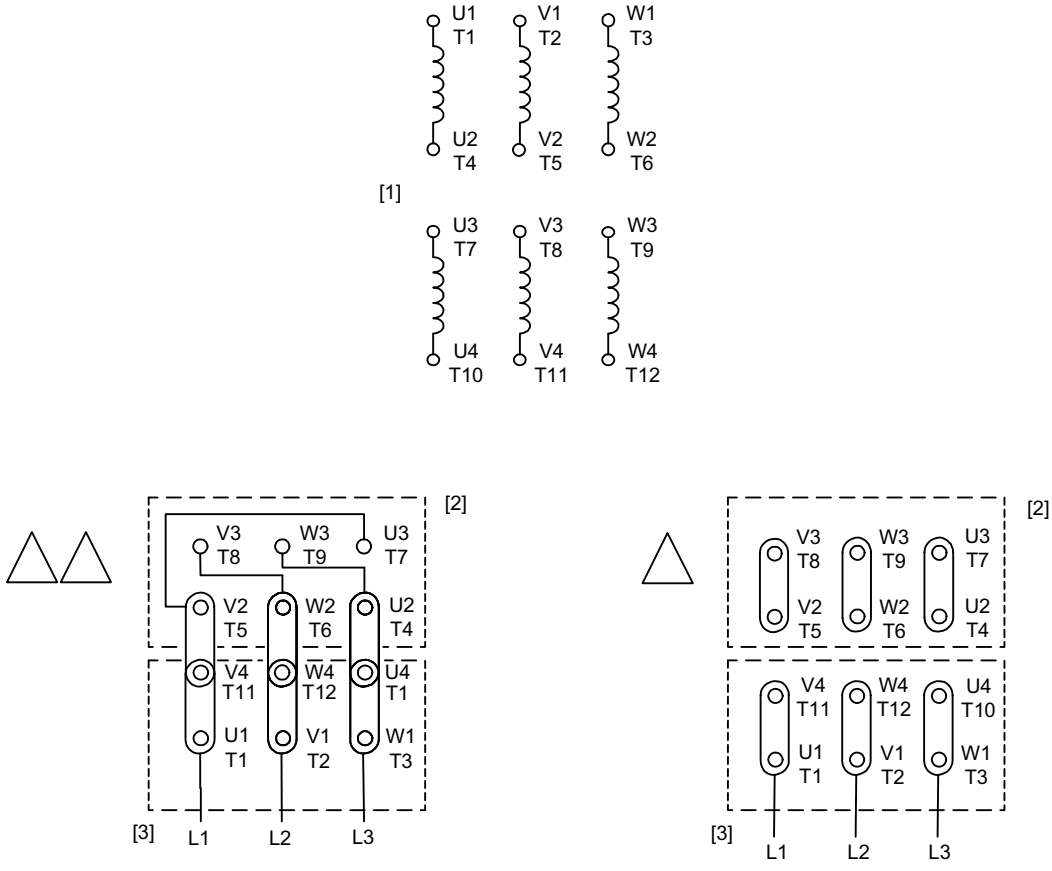
9.1.2 Delta connection in wiring diagram R72

AC motor

For all motors with one speed and direct switching-on.

△ *connection,*
△△ *connection*

The following figure shows △ connection for high voltages and △△ connection for low voltages.



[1] Motor winding
[2] Motor terminal board
[3] Supply cables

Change in direction of rotation: Swap connection of 2 supply cables, L1 - L2

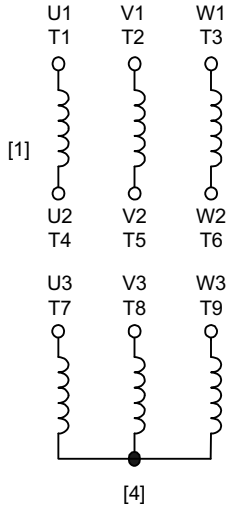
9.1.3 Star connection in wiring diagram R76

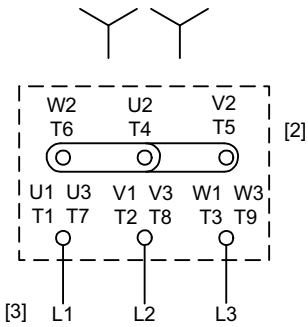
AC motor

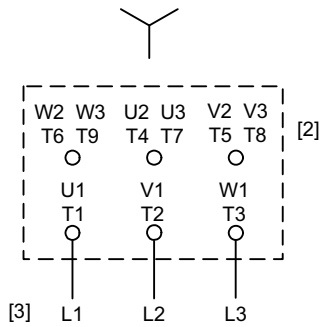
For all motors with one speed and direct switching-on.

人 connection,
人人 connection

The following figure shows 人 connection for high voltages and 人人 connection for low voltages.







[1] Motor winding
[2] Motor terminal board
[3] Supply cables
[4] Star point connected in motor

Change in direction of rotation: Swap connection of 2 supply cables, L1 - L2

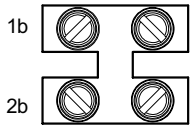
9.1.4 Motor protection with TF or TH for DR.71-DR.225

TF/TH

The following figures show the connection of motor protection with TF PTC thermistor sensors or TH bimetallic thermostats.

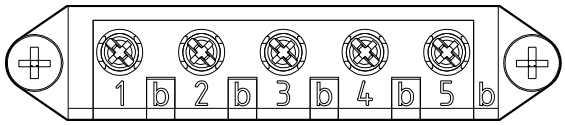
Either a two-pole terminal clip or a five-pole terminal strip is available for connecting to the trip switch.

Example: TF/TH to a two-pole terminal strip



1b	2b
TF/TH	TF/TH

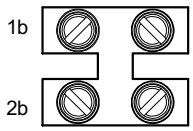
Example: 2 x TF/TH to a five-pole terminal strip



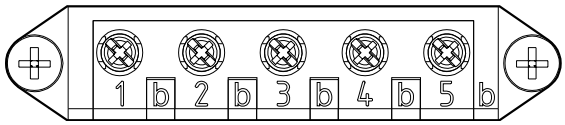
1b	2b	3b	4b	5b
1.TF/TH	1.TF/TH	2.TF/TH	2.TF/TH	-

2xTF/TH / with anti-condensation heating

The following figure shows the connection of motor protection with 2 TF PTC thermistor sensors or TH bimetallic thermostats and Hx anti-condensation heating.



1b	2b
Hx	Hx



1b	2b	3b	4b	5b
1.TF/TH	1.TF/TH	2.TF/TH	2.TF/TH	-

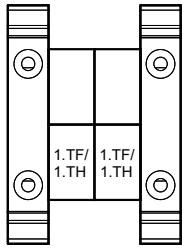
9.1.5 Motor protection with TF or TH for DR.315

TF/TH

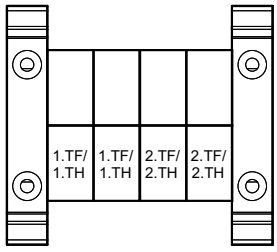
The following figures show the connection of motor protection with TF PTC thermistor sensors or TH bimetallic thermostats.

Depending on the version, an "x-pole" terminal strip is available for connection to the trip switch.

Example: TF/TH to terminal strip



Example: 2 x TF/TH to terminal strip

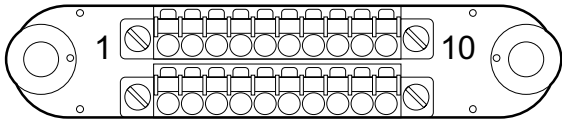


9.1.6 EI7. Built-in encoder

EI7.

The following figure shows the connection of the built-in encoder.

The encoder is equipped with a 10-pole terminal strip.



1e	2e	3e	4e	5e	6e	7e	8e	9e	10e
-	-	-	-	+UB (GY)	GND (PK)	A(cos) (BN)	$\overline{A}(\overline{cos})$ (WH)	B(sin) (YE)	$\overline{B}(\overline{sin})$ (GN)

9.1.7 Brake control BGE; BG; BSG; BUR

BE brake

BGE, BG, BSG, BUR brake control;

Apply voltage to release the brake (see nameplate).

Contact rating of the brake control: AC3 in accordance with EN 60947-4-1.

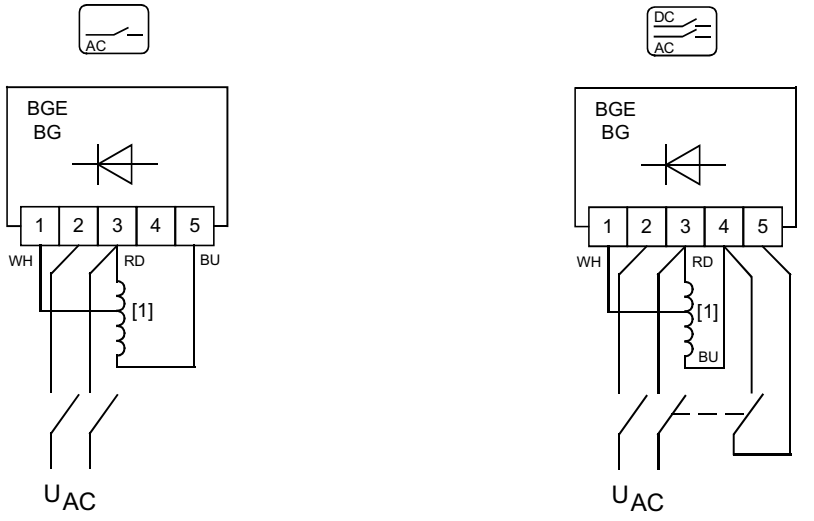
The voltage can be distributed as follows:

- Through a separate supply cable
- From the motor terminal board

This does not apply to multi-speed and frequency-controlled motors.

BG / BGE

The following figure shows the wiring for BG and BGE brake rectifiers for the AC-side cut-off as well as the DC and AC-side cut-off.

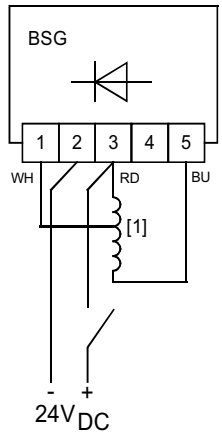


242604811

[1] Brake coil

BSG

The following figure shows the DC 24 V connection of the BSG control unit



242606475

[1] Brake coil

BUR

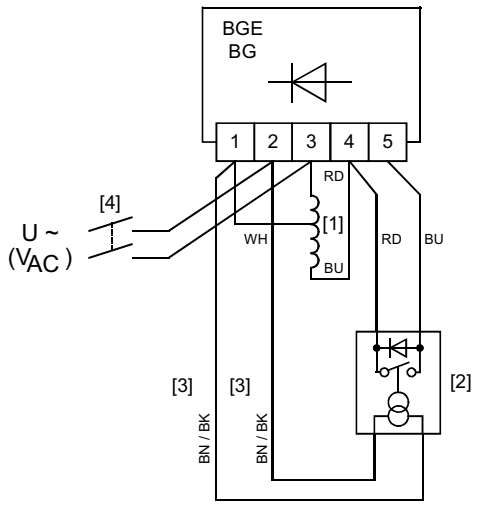
⚠ WARNING

Malfunction caused by incorrect connection for frequency operation.

The drive system might be damaged.

- Do not connect terminal board to motor.

The following illustration shows the wiring for the BUR brake control



242608139

[1] Brake coil
[2] UR11/UR15 voltage relay
UR 11 (42-150 V) = BN
UR 15 (150-500 V) = BK

9.1.8 BSR brake control

BE brake

BSR brake control

Brake voltage = Phase voltage

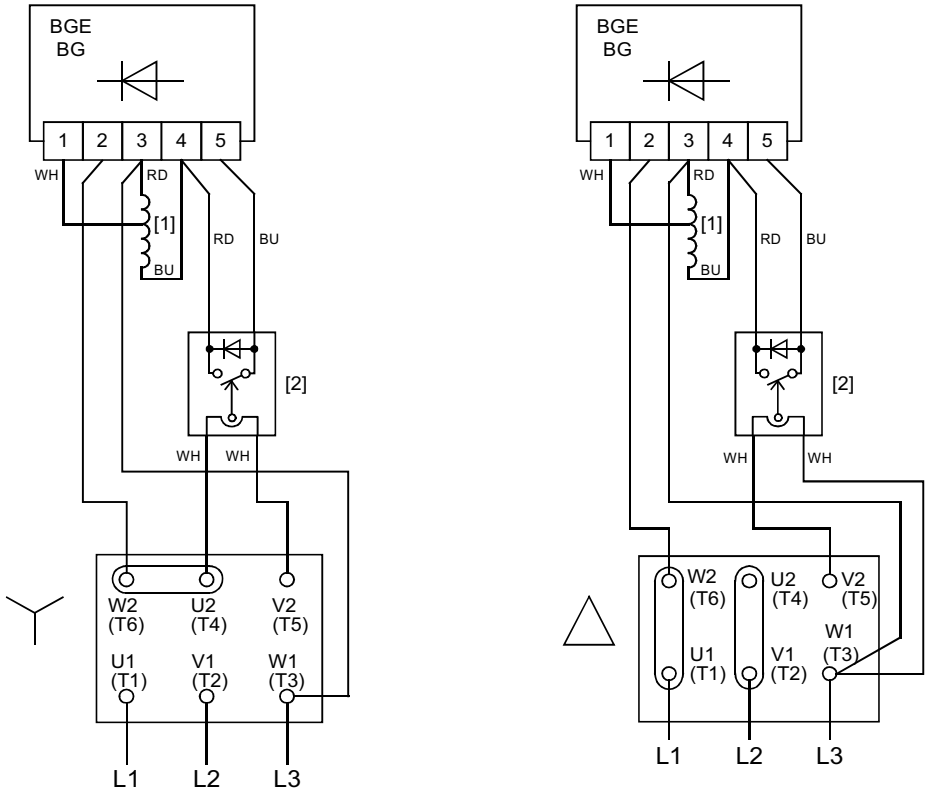
The white connecting leads are the ends of a converter loop and, depending on the motor connection, must be connected to the motor terminal block instead of the △ or ⅄ bridge.

Factory set to ⅄ in wiring diagram R13

The following figure shows the factory wiring for the BSR brake control

Example: Motor: AC 230 V / AC 400 V

Brake: AC 230 V



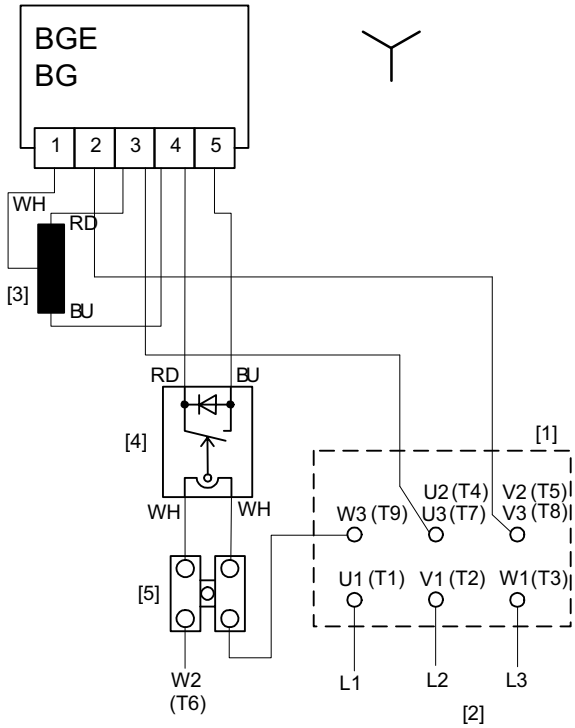
[1] Brake coil
[2] SR11 / 15 current relay

Factory set to ⅄ in wiring diagram R76

The following figure shows the factory wiring for the BSR brake control

Example: Motor: AC 230 V / AC 460 V

Brake: AC 230 V



2319077003

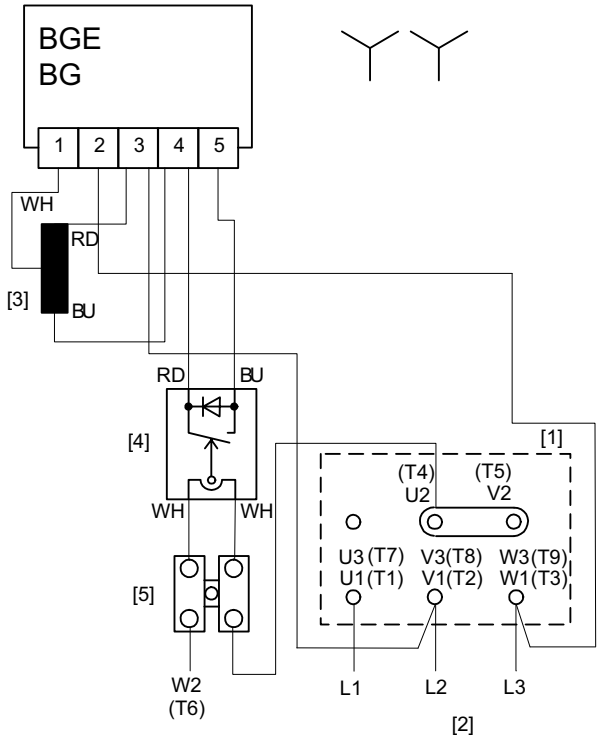
[1] Motor terminal board
[2] Supply cables
[3] Brake coil
[4] SR11 / 15 current relay
[5] Auxiliary terminal

Connection alternative: Factory set to ⅄⅄ in wiring diagram R76

The following figure shows the factory wiring for the BSR brake control

Example: Motor: AC 230 V / AC 460 V

Brake: AC 230 V



2337824139

[1] Motor terminal board
[2] Supply cables
[3] Brake coil
[4] SR11 / 15 current relay
[5] Auxiliary terminal

9.1.9 BMP3.1 brake control in the terminal box

Brake BE120; BE122

BMP3.1 brake control

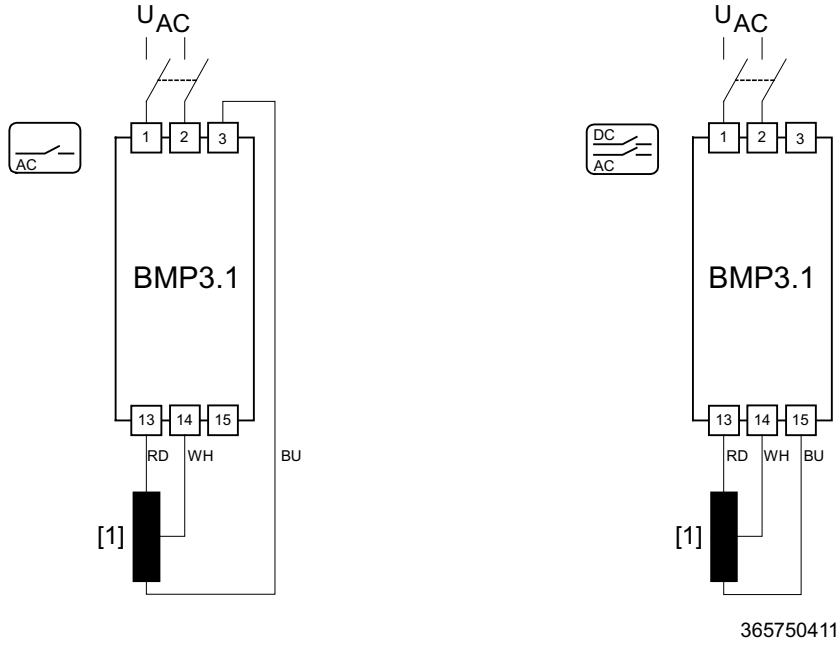
Apply voltage to release the brake (see nameplate).

Contact rating of the brake contactors: AC3 according to EN 60947-4-1

Separate supply cables are required for the voltage supply.

BMP3.1

The following figure shows the wiring for the BMP3.1 brake rectifier for the AC-side cut-off as well as the DC and AC-side cut-off.

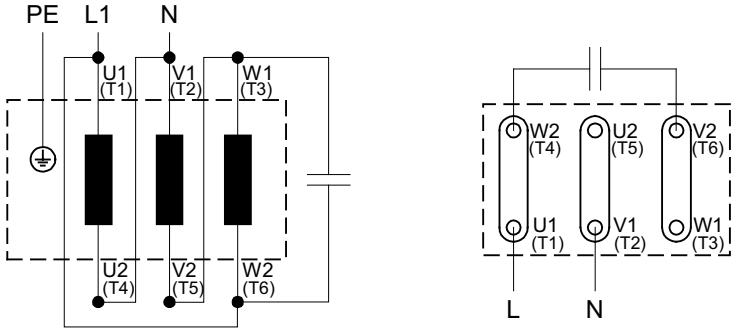


[1] Brake coil

9.1.10 V forced cooling fan

△ - *Steinmetz*

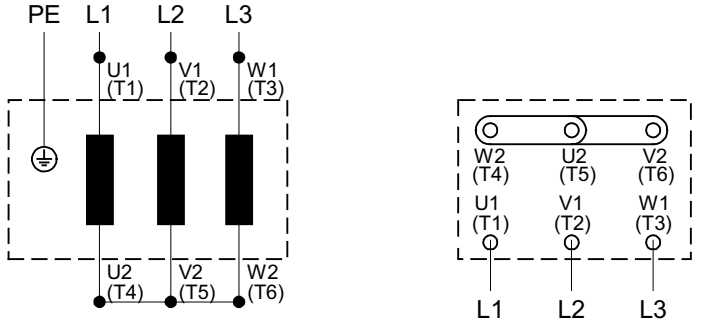
The following figure shows the wiring of the V forced cooling fan for delta-Steinmetz connection for 1-phase operation



523348491

⅄ *connection*

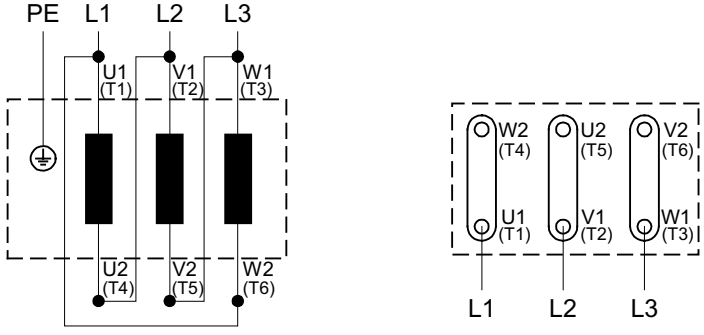
The following figure shows the wiring of the V forced cooling fan for ⅄connection.



523350155

△ *connection*

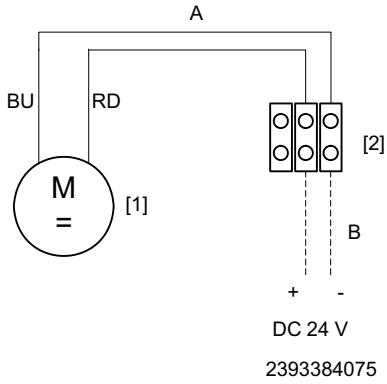
The following figure shows the wiring of the V forced cooling fan with △ connection.



523351819

DC 24 V connection

The following figure shows the wiring of the V forced cooling fan for DC 24 V.



[1]	Forced cooling fan	A	Factory wiring
[2]	Terminal strip	B	Customer

It is essential that you observe the polarity.

10 Malfunctions

10.1 Motor malfunctions

Malfunction	Possible cause	Remedy
Motor does not start up	Supply cable interrupted	Check the connections and (intermediate) terminal points, correct if necessary)
	Brake does not release	See section "Brake malfunctions" (page 134)
	Supply cable fuse has blown	Replace fuse
	Motor protection (switch) has triggered	Check that the motor protection (switch) is set correctly; current specification is on the nameplate
	Motor protection does not trip	Check motor protection control
	Malfunction in control or in the control process	Observe the switching sequence; correct if necessary
Motor only starts with difficulty or does not start at all	Motor power designed for delta connection but connected in star	Correct the connection from star to delta; follow the wiring diagram
	Motor power designed for star-star connection but only connected in star	Correct the connection from star to star-star; follow the wiring diagram
	Voltage or frequency deviate considerably from setpoint, at least while being switched on.	Provide better power supply system; reduce the power supply load; Check cross section of supply cable, replace with cable of larger cross section if need be.
Motor does not start in star connection, only in delta connection	Star connection does not provide sufficient torque	If the delta inrush current is not too high (observe the regulations of the power supplier), start up directly in delta; Check the project planning and use a larger motor or special version if necessary (consult SEW-EURODRIVE)
	Contact fault on star/delta switch	Check the switch, replace if necessary; Check the connections
Incorrect direction of rotation	Motor connected incorrectly	Swap two phases of the motor supply cable
Motor hums and has high current consumption	Brake does not release	See section "Brake malfunctions" (page 134)
	Winding defective	Send motor to specialist workshop for repair
	Rotor rubbing	
Fuses blow or motor protection trips immediately	Short circuit in the motor supply cable	Repair short circuit
	Supply cables connected incorrectly	Correct the wiring, observe the wiring diagram
	Short circuit in motor	Send motor to specialist workshop for repair
	Ground fault on motor	
Severe speed loss under load	Motor overload	Measure power, check project planning and use larger motor or reduce load if necessary
	Voltage drops	Check cross section of supply cable, replace with cable of larger cross section if necessary

Malfunction	Possible cause	Remedy
Motor heats up excessively (measure temperature)	Overload	Measure power, check project planning and use larger motor or reduce load if necessary
	Insufficient cooling	Provide for cooling air supply or clear cooling air passages, retrofit forced cooling fan if necessary. Check the air filter, clean or replace if necessary
	Ambient temperature is too high	Observe the permitted temperature range, reduce the load if necessary
	Motor in delta connection instead of star connection as provided for	Correct the wiring, observe the wiring diagram
	Loose contact in supply cable (one phase missing)	Tighten loose contact, check connections, observe wiring diagram
	Fuse has blown	Look for and rectify cause (see above); replace fuse
	Supply voltage deviates from the rated motor voltage by more than 5% (range A)/ 10% (range B).	Adjust motor to supply voltage.
	Rated operation type (S1 to S10, DIN 57530) exceeded, e.g. through excessive starting frequency	Adjust the rated operating mode of the motor to the required operating conditions; consult a professional to determine the correct drive if necessary
Excessively loud	Ball bearing compressed, dirty or damaged	Re-align motor and the driven machine, inspect rolling bearing and replace if necessary. See section"Permitted rolling bearing types" (page 115).
	Vibration of rotating parts	Look for the case, possibly an imbalance; correct the cause, observe method for balancing
	Foreign bodies in cooling air passages	Clean the cooling air passages

10.2 Brake malfunctions

Fault	Possible cause	Remedy
Brake does not release	Incorrect voltage on brake control unit	Apply the correct voltage; brake voltage specified on the nameplate
	Brake control unit failed	Install a new brake control, check resistors and insulation of the brake coils (see "Resistors" section for resistance values). Check switchgear, replace if necessary
	Max. permitted working air gap exceeded because brake lining worn down.	Measure and set working air gap. See the following sections: • "Setting the working air gap of brakes BE05-BE32" (page 76) "Setting the working air gap of brakes BE120-BE122" (page 93) If the brake disk is too thin, replace the brake disk. See the following sections: • "Replacing the brake disk of BE05-BE32 brakes" (page 78) • "Replacing the brake disk of brakes BE120-BE122" (page 95)
	Voltage drop on supply cable > 10%	Provide correct connection voltage: brake voltage specifications on the nameplate. Check the cross section of the brake supply cable, increase cross section if necessary.
	Inadequate cooling, brake overheats	Provide for cooling air supply or clear cooling air passages, check air filter, clean or replace if necessary. Replace type BG brake rectifier with type BGE.
	Brake coil has interturn short circuit or a short circuit to frame	Check resistors and insulation of the brake coils (see "Resistors" section for resistance values). Replace complete brake and brake control (specialist workshop), Check switchgear, replace if necessary
	Rectifier defective	Replace rectifier and brake coil; it may be more economical to replace the complete brake.
Brake does not brake	Working air gap not correct	Measure and set working air gap. See the following sections: • "Setting the working air gap of brakes BE05-BE32" (page 76) • "Setting the working air gap of brakes BE120-BE122" (page 93) If the brake disk is too thin, replace the brake disk. See the following sections: • "Replacing the brake disk of BE05-BE32 brakes" (page 78) • "Replacing the brake disk of brakes BE120-BE122" (page 95)
	Brake lining worn	Replace entire brake disk. See the following sections: • "Replacing the brake disk of BE05-BE32 brakes" (page 78) • "Replacing the brake disk of brakes BE120-BE122" (page 95)
	Incorrect braking torque.	Check the project planning and change the braking torque if necessary; see section "Work done, working air gap, braking torques" (page 104) • by changing the type and number of brake springs. See the following sections: – "Changing the braking torque of brakes BE05-BE32" (page 80) – "Changing the braking torque of brakes BE120-BE122" (page 97) • by selecting a different brake See section "Braking torque assignment" (page 105)

Fault	Possible cause	Remedy
Brake does not brake	Working air gap so large that setting nuts for the manual release come into contact.	Set the working air gap. See the following sections: • "Setting the working air gap of brakes BE05-BE32" (page 76) • "Setting the working air gap of brakes BE120-BE122" (page 93)
	Manual brake release device not set correctly	Set the setting nuts for the manual release correctly See the following sections: • "Changing the braking torque of brakes BE05-BE32" (page 80) • "Changing the braking torque of brakes BE120-BE122" (page 97)
	Brake locked by manual brake release HF	Loosen the setscrew, remove if necessary
Brake is applied with time lag	Brake is switched only on AC voltage side	Switch both the DC and AC sides (e.g. through retrofitting the current relay from SR to BSR or the voltage relay from UR to BUR); observe wiring diagram
Noises in vicinity of brake	Gearing wear on the brake disk or the carrier caused by jolting startup	Check the project planning, replace the brake disk if necessary See the following sections: • "Replacing the brake disk of BE05-BE32 brakes" (page 78) • "Replacing the brake disk of brakes BE120-BE122" (page 95) Have a specialist workshop replace the carrier
	Alternating torques due to incorrectly set frequency inverter	Check correct setting of frequency inverter according to its operating instructions, correct if necessary.

10.3 Malfunctions when operated with a frequency inverter

The symptoms described in section "Motor malfunctions" may also occur when the motor is operated with a frequency inverter. Please refer to the frequency inverter operating instructions for the meaning of the problems that occur and to find information about rectifying the problems.

10.4 Customer service

Please have the following information available if you require customer service assistance:

- Nameplate data (complete)
- Type and extent of the problem
- Time the problem occurred and any accompanying circumstances
- Assumed cause
- Ambient conditions such as:
  - Ambient temperature
  - Humidity
  - Installation altitude
  - Dirt
  - etc.

10.5 Disposal

Dispose of the motors in accordance with the material structure and the regulations in force:

- Iron
- Aluminum
- Copper
- Plastic
- Electronic components
- Oil and grease (not mixed with solvents)

11 Address List

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service Competence Center	**Central**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte@sew-eurodrive.de
	North	SEW-EURODRIVE GmbH & Co KG Alte Ricklinger Straße 40-42 D-30823 Garbsen (near Hannover)	Tel. +49 5137 8798-30 Fax +49 5137 8798-55 sc-nord@sew-eurodrive.de
	East	SEW-EURODRIVE GmbH & Co KG Dänkritzer Weg 1 D-08393 Meerane (near Zwickau)	Tel. +49 3764 7606-0 Fax +49 3764 7606-30 sc-ost@sew-eurodrive.de
	South	SEW-EURODRIVE GmbH & Co KG Domagkstraße 5 D-85551 Kirchheim (near München)	Tel. +49 89 909552-10 Fax +49 89 909552-50 sc-sued@sew-eurodrive.de
	West	SEW-EURODRIVE GmbH & Co KG Siemensstraße 1 D-40764 Langenfeld (near Düsseldorf)	Tel. +49 2173 8507-30 Fax +49 2173 8507-55 sc-west@sew-eurodrive.de
	Electronics	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal	Tel. +49 7251 75-1780 Fax +49 7251 75-1769 sc-elektronik@sew-eurodrive.de
	Drive Service Hotline / 24 Hour Service		+49 180 5 SEWHELP +49 180 5 7394357
	Additional addresses for service in Germany provided on request!		

France			
Production **Sales** **Service**	**Haguenau**	SEW-USOCOME 48-54 route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocome.com sew@usocome.com
Production	**Forbach**	SEW-EUROCOME Zone Industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62 avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Nantes	SEW-USOCOME ZAC de la Forêt 4 rue des Fontenelles F-44140 Le Bignon	Tel. +33 2 40 78 42 00 Fax +33 2 40 78 42 20
	Paris	SEW-USOCOME Zone industrielle 2 rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
	Additional addresses for service in France provided on request!		

Algeria			
Sales	**Alger**	REDUCOM Sarl 16, rue des Frères Zaghnoune Bellevue 16200 El Harrach Alger	Tel. +213 21 8214-91 Fax +213 21 8222-84 sew-algeria@reducom-dz.com www.reducom-dz.com

Argentina			
Assembly **Sales** **Service**	**Buenos Aires**	SEW EURODRIVE ARGENTINA S.A. Centro Industrial Garin, Lote 35 Ruta Panamericana Km 37,5 1619 Garin	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 sewar@sew-eurodrive.com.ar http://www.sew-eurodrive.com.ar

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au

Austria			
Assembly **Sales** **Service**	**Wien**	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 http://www.sew-eurodrive.at sew@sew-eurodrive.at

Belarus			
Sales	**Minsk**	SEW-EURODRIVE BY RybalkoStr. 26 BY-220033 Minsk	Tel.+375 (17) 298 38 50 Fax +375 (17) 29838 50 sales@sew.by

Belgium			
Assembly **Sales** **Service**	**Brüssel**	**SEW Caron-Vector** Avenue Eiffel 5 BE-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.be info@sew-eurodrive.be
Service Competence Center	**Industrial Gears**	**SEW Caron-Vector** Rue de Parc Industriel, 31 BE-6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 http://www.sew-eurodrive.be service-wallonie@sew-eurodrive.be
	Antwerp	**SEW Caron-Vector** Glasstraat, 19 BE-2170 Merksem	Tel. +32 3 64 19 333 Fax +32 3 64 19 336 http://www.sew-eurodrive.be service-antwerpen@sew-eurodrive.be

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208 Guarulhos - 07251-250 - SP SAT - SEW ATENDE - 0800 7700496	Tel. +55 11 2489-9133 Fax +55 11 2480-3328 http://www.sew-eurodrive.com.br sew@sew.com.br

Bulgaria			
Sales	**Sofia**	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@mail.bg

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137 electrojemba@yahoo.fr

Canada			
Assembly **Sales** **Service**	**Toronto**	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, ON L6T 3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca l.watson@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. Tilbury Industrial Park 7188 Honeyman Street Delta, BC V4G 1G1	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew- eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Lasalle, PQ H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew- eurodrive.ca
	Additional addresses for service in Canada provided on request!		

Chile			
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China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25322611 info@sew-eurodrive.cn http://www.sew-eurodrive.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267891 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478398 Fax +86 27 84478388
	Xi'An	SEW-EURODRIVE (Xi'An) Co., Ltd. No. 12 Jinye 2nd Road Xi'An High-Technology Industrial Development Zone Xi'An 710065	Tel. +86 29 88241718 Fax +86 29 68686296 logistic-xa@sew-eurodrive.cn
	Additional addresses for service in China provided on request!		

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Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Lahti**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 sew@sew.fi http://www.sew-eurodrive.fi
Production **Assembly**	**Karkkila**	SEW Industrial Gears Oy Valurinkatu 6, PL 8 FI-03600 Karkkila, 03601 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

Gabon			
Sales	**Libreville**	ESG Electro Services Gabun Feu Rouge Lalala 1889 Libreville Gabun	Tel. +241 741059 Fax +241 741059 esg_services@yahoo.fr

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 GB-Normanton, West- Yorkshire WF6 1QR	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk

Greece			
Sales **Service**	**Athen**	Christ. Boznos & Son S.A. 12, K. Mavromichali Street P.O. Box 80136 GR-18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 office@sew-eurodrive.hu

India			
Registered Office **Assembly** **Sales** **Service**	**Vadodara**	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 3045200, +91 265 2831086 Fax +91 265 3045300, +91 265 2831087 http://www.seweurodriveindia.com sales@seweurodriveindia.com subodh.ladwa@seweurodriveindia.com
Assembly **Sales** **Service**	**Chennai**	SEW-EURODRIVE India Private Limited Plot No. K3/1, Sipcot Industrial Park Phase II Mambakkam Village Sriperumbudur - 602105 Kancheepuram Dist, Tamil Nadu	Tel. +91 44 37188888 Fax +91 44 37188811 c.v.shivkumar@seweurodriveindia.com

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 info@alperton.ie http://www.alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Milano**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 799781 http://www.sew-eurodrive.it sewit@sew-eurodrive.it

Ivory Coast			
Sales	**Abidjan**	SICA Société industrielle & commerciale pour l'Afrique 165, Boulevard de Marseille 26 BP 1115 Abidjan 26	Tel. +225 21 25 79 44 Fax +225 21 25 88 28 sicamot@aviso.ci

Japan			
Assembly **Sales** **Service**	**Iwata**	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp

Kazakhstan			
Sales	**Almaty**	ТОО "СЕВ-ЕВРОДРАЙВ" 050061, Республика Казахстан г.Алматы, пр.Райымбека, 348	Тел. +7 (727) 334 1880 Факс +7 (727) 334 1881 http://www.sew-eurodrive.kz sew@sew-eurodrive.kz

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 7139253 Fax +371 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 510 532 Fax +961 1 494 971 ssacar@info.com.lb
	Beirut	Middle East Drives S.A.L. (offshore) Sin El Fil. B. P. 55-378 Beirut	Tel. +961 1 494 786 Fax +961 1 494 971 philipppe.acar@medrives.com http://www.medrives.com

Lithuania			
Sales	**Alytus**	UAB Irseva Naujoji 19 LT-62175 Alytus	Tel. +370 315 79204 Fax +370 315 56175 info@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.lu info@caron-vector.be

Malaysia			
Assembly **Sales** **Service**	**Johore**	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my

Mexico			
Assembly **Sales** **Service**	**Quéretaro**	SEW-EURODRIVE MEXICO SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Quéretaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx

Morocco			
Sales	**Casablanca**	Afit 5, rue Emir Abdelkader MA 20300 Casablanca	Tel. +212 522633747 Fax +212 522621588 fatima.haquiq@premium.net http://www.groupe-premium.com

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu
		VECTOR Aandrijftechniek B.V. Gelderhorst 10 NL-7207 BH Zutphen Industrieterrein de Revelhorst	Tel. +31 575 57 44 94 Fax +31 575 57 24 43 oost@vector.nu
		VECTOR Aandrijftechniek B.V. Mercuriusweg 8A NL-5971 LX Grubbenvorst	Tel. +31 77 36 61 873 Fax +31 77 36 62 109 zuid@vector.nu
		VECTOR Aandrijftechniek B.V. Weberstraat 74 NL-1446 VV Purmerend Industrieterrein "De Baanstee"	Tel. +31 299 66 63 38 Fax +31 299 47 60 55 noordwest@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 676 53 00 Fax +48 42 676 53 45 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
	24 Hour Service		Tel. +48 602 739 739 (+48 602 SEW SEW) serwis@sew-eurodrive.pl

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt

Romania			
Sales **Service**	**Bucureşti**	Sialco Trading SRL str. Madrid nr.4 011785 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro

Russia			
Assembly **Sales** **Service**	**St. Petersburg**	ZAO SEW-EURODRIVE P.O. Box 36 195220 St. Petersburg Russia	Tel. +7 812 3332522 +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 338 494 770 Fax +221 338 494 771 senemeca@sentoo.sn http://www.senemeca.com

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor SCG-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.rs

Singapore			
Assembly **Sales** **Service**	**Singapore**	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybničná 40 SK-831 06 Bratislava	Tel. +421 2 33595 202 Fax +421 2 33595 200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. Industry Park - PChZ ulica M.R.Štefánika 71 SK-010 01 Žilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-974 11 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 SK-040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 sew@sew-eurodrive.sk

Slovenia			
Sales **Service**	**Celje**	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 SLO - 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 http://www.sew.co.za info@sew.co.za

South Africa			
	Cape Town	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 cfoster@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaco Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 cdejager@sew.co.za

South Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master@sew-korea.co.kr
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442 00 Fax +46 36 3442 80 http://www.sew-eurodrive.se jonkoping@sew.se

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 79 40 88 77 Fax +216 79 40 88 66 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 / 4419164 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua

USA			
Production **Assembly** **Sales** **Service** **Corporate Offices**	**Southeast Region**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manufacturing +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**Northeast Region**	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net

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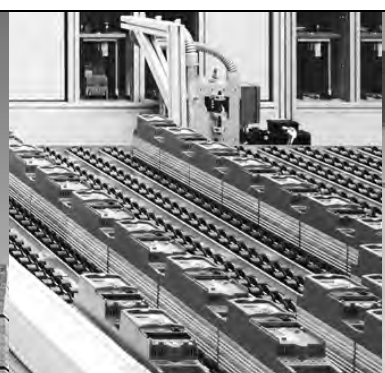

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Polymer System

EQUIPMENT SUMMARY FORM

Owner:	City of Rock Island, WA	**Date:**	1/15/2020
Contractor:	DBJ Construction LLC		
Project Name:	Screw Press Dewatering Equipment Procurement	**Project No.:**	10612

Summary of Equipment

1. Equipment Item: Polymer Makedown System
2. Manufacturer: Velodyne
3. Equipment ID No.(s) Polymer Makedown System SP-PLY
4. Location of Equipment Dewatering Building
5. Weight of Individual Components (Over 100 Pounds)

   None.
6. Nameplate Data:

Horsepower	0.5 HP
Amperage	4.8 A
Voltage	90 VDC
Service Factor (S.F.)	1.0 SF
Speed	1750 rpm
ENC Type	TENV
Capacity	
Other	
7. Manufacturer's Local Representative:

Name:	Victor Pedroni
Address:	4580 Klahanie Dr. SE #271, Issaquah, WA 98029
Phone Number:	1-425-369-6164
8. Maintenance Requirements:

   Pump - ANNUALLY Replace diaphragm, cartridge valves or seal rings/valve balls,
   multi-function valve cap asssemblies & injection check valve spring.
   Mixing Chamber - AS REQUIRED Replace Mechanical Seal if run dry, damaged or leaking.
   Check Valve - WEEKLY Check and clean check valve.
9. Lubrication List:

   None.
10. Spare Parts: (recommendations):

    Qty (1) Polymer Mixing Chamber Motor
    Qty (2) Sets of Brushes for Polymer Mixing Chamber Motor
11. Comments:

    Drain mixing chamber and piping under freezing conditions when not in operation.

VeloBlend

Polymer Activation & Hydration Technologies

Operation & Maintenance Manual

August 30, 2019

Project:	Rock Island, WA
Equipment:	VeloBlend Model: VMN-2D-300-C-0-A-X Liquid Polymer Blending System
Quantity:	1
Sales Order Number:	5475
Serial Number(s):	819-5475-2958
VeloDyne Contacts:	Service Manager Bob Dunkerson 303.530.3298 x205 bdunkerson@velodynesystems.com Project Manager Carolyn Heusel Hyde, PMP 303.530.3298 x209 cheusel@velodynesystems.com
Manufacturer's Representative:	N/A

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1. System Information/Specifications

1.1 The VeloBlend VM Series Blending Technology

Applying high, non-damaging mixing energy to the polymer during the blending process has proven to optimize polymer performance. The VeloBlend VM series accomplishes this in two ways: first, by creating a high velocity water jet that impinges on the polymer as it is metered into the mixing chamber when high water pressure (30 psid or greater) is available. This high velocity water jet maintains high, non-damaging mixing energy over the full flow range as long as the differential pressure between the incoming water pressure and mixing chamber pressure remains high; secondly, when high water pressure is not available or to control the amount of mixing energy applied, the VeloBlend induces hydro-mechanical mixing energy through the specially designed, variable speed mixing impeller.

1.2 Information on Pressure, Differential Pressure and Pressure Loss

The VeloBlend VM Series is a hydro-mechanical device. Its mixing energy is derived from the pressure drop across its water control valve and through the specially designed mixing impeller. The pressure drop is measured by the inlet pressure minus the mixing chamber pressure.

NOTE: A 30 psid pressure (differential) is recommended as a minimum, even though the system will operate with differential pressures lower than this.

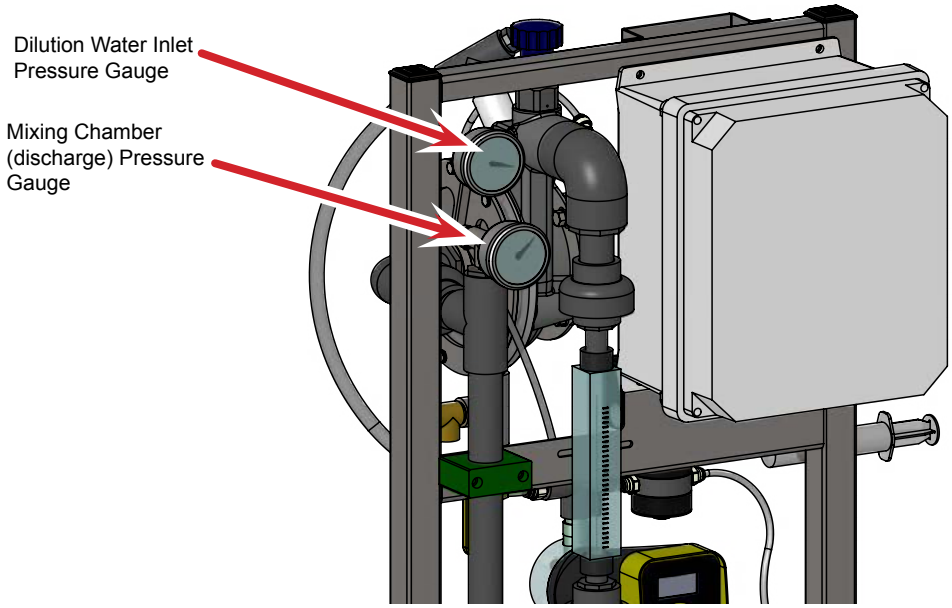
The higher the differential pressure the more mixing energy that is applied to the polymer.

Where does pressure come from?

Dilution water inlet pressure is the available pressure at the water control valve, after any pressure loss through pipes, fittings, and valves up stream of the polymer blending unit.

The mixing chamber pressure is the pressure down stream of the polymer blending unit. The pressure is a result of pressure drop through the polymer solution piping, valves and other devices, such as injection rings or sludge mixing valves, for example. It is also the pressure of the pipe or device the polymer is being injected into, such as a sludge pipe feeding a dewatering device or an influent pipe going to a clarifier.

In the case where polymer is being fed to an open-to-air diffuser or a tank, there may be little or no mixing chamber pressure.



1.3 Equipment Summary

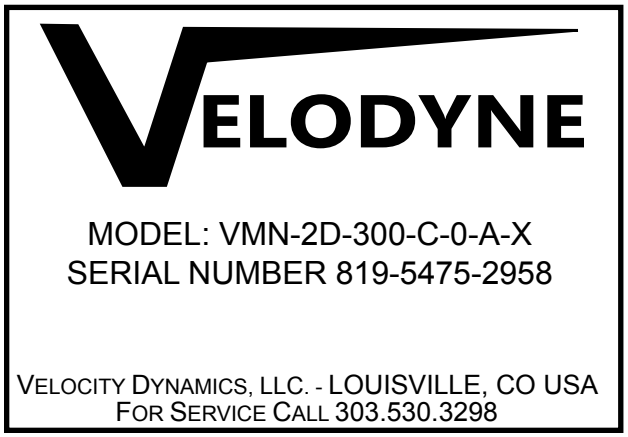
PROJECT:	Rock Island, WA
EQUIPMENT:	VeloBlend Model VMN-2D-300-C-0-A-X
QUANTITY:	1
CONTROLS:	Level C
SELECTOR SWITCHES:	System ON/OFF (reset)/REMOTE Stroke Length / Stroke Speed Adjustment (located on metering pump) One-Turn Potentiometer—Mixer Speed Control
INDICATION LIGHTS:	System Running Indication Main Power ON Indication LCD Display on Metering Pump Rate (located on metering pump) Low Water Differential Pressure Alarm
DISCRETE INPUTS:	Remote Start/Stop (discrete dry contact)
ANALOG INPUTS:	Pacing Signal Based on Process Flow (4-20mA)
DISCRETE OUTPUTS:	System Running (discrete dry contact) System Remote Mode (discrete dry contact) Low Water Differential Pressure Alarm (discrete dry contact)
ANALOG OUTPUTS:	None
FUNCTIONS / MODES:	ON—System Starts OFF/RESET—System Shuts-down REMOTE—System starts and stops when remote dry contacts are closed
RECOMMENDED PRESSURE:	100psi
DILUTION WATER FLOW:	30 to 300 GPH
POLYMER FLOW RANGE:	0.1 to 2.0 GPH

COMMONLY ORDERED PARTS		
ITEM	DESCRIPTION	QTY
248-0576	Solenoid Valve	1
182-0002	Pressure Gauge (0-160 psi), S.S., liquid filled	2
200-0042	Water Control Orifice	1
221-0007	Mixing Chamber Mechanical Seal	1
248-0077	VeloCheck© Check Valve	1
215-0067	Priming Syringe	1

FOR ALL EQUIPMENT SERVICE REQUIREMENTS AND PART AVAILABILITY, CONTACT VELODYNE:

VELOCITY DYNAMICS
543 SOUTH PIERCE AVENUE
LOUISVILLE, CO 80027
303.530.3298
WWW.VELODYNESYSTEMS.COM

EQUIPMENT NAMEPLATE



2. Mechanical

2.1 System Drawings

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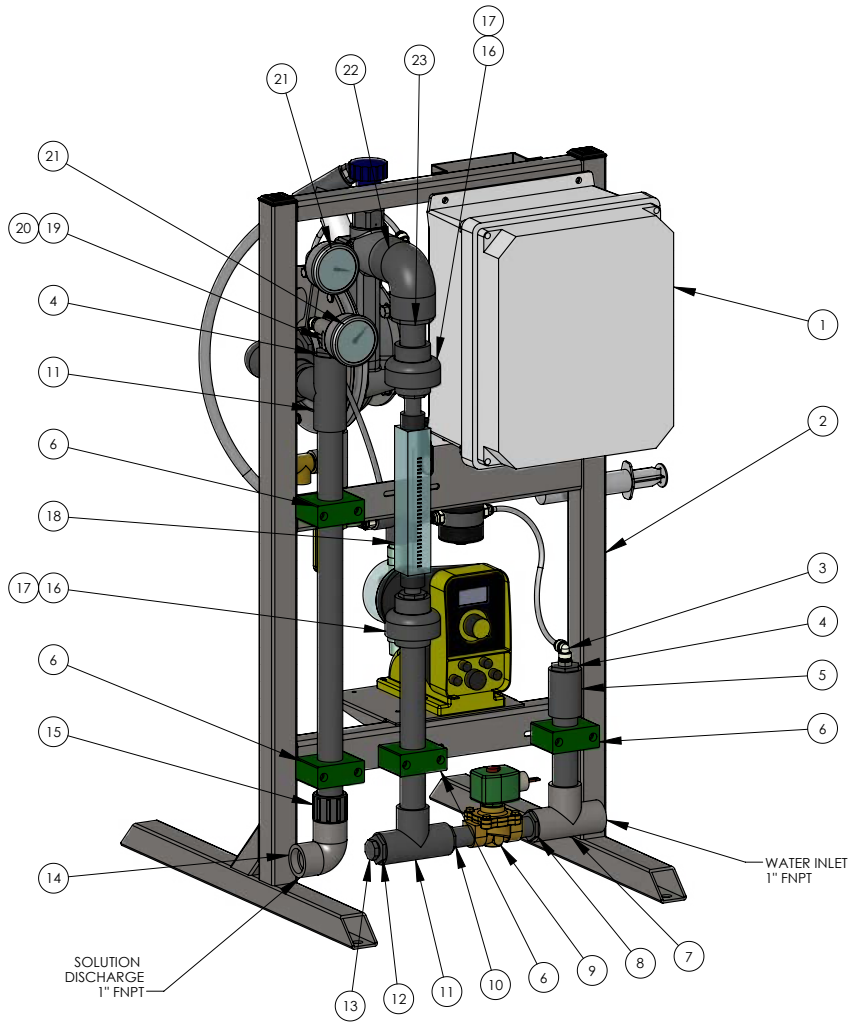
REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A	SO 5475	INITIAL RELEASE	8/7/19	WBV



NOTES -

1) APPROXIMATE DRY WEIGHT 150 LBS

2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT

3) FRAME MATERIAL IS 304 SS AND HARDWARE IS 18-8 SS UNLESS OTHERWISE NOTED

ITEM #	NUMBER	DESCRIPTION	QTY
1	970-3006	CONTROL PANEL ASSY, VMN-D-C STD, 9 SERIES	1
2	158-1575	FRAME, VELOBLEND, NARROW, 304	1
3	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	2
4	194-2012	REDUCER, BUSHING, 1" X 1/4", SXT, SR, SCH 80, PVC	2
5	194-0445	COUPLING, 1", SXS, PVC	1
6	194-0027	CLAMP, PIPE, 1", STAUFF	4
7	194-0442	TEE, 1", FPT, 304 SS	1
8	194-0406	REDUCER, BUSHING, 1" X 3/4", TXT, SCH 80, PVC	1
9	248-0576	VALVE, SOLENOID, 3/4" FNPT, BRASS/NBR, 120 VAC, ASCO	1
10	194-0660	REDUCER, BUSHING, 1" X 3/4", SXS, SCH 80, PVC	1
11	194-0314	TEE, 1" SOC, SCH 80, PVC	2
12	194-0690	REDUCER, BUSHING, 1" X 1/2", SXT, SCH 80, PVC	1
13	194-0407	PLUG, 1/2" , T, SCH 80, PVC	2
14	194-0496	ELBOW, 90, 1" NPT, 304	1
15	194-0618	ADAPTER, MALE, 1", SCH 80, PVC, S X MPT	1
16	194-0642	UNION, 1", SXS, PVC/VITON	3
17	194-0689	REDUCER, BUSHING, 1" X 1/2", SXS, SCH 80, PVC	2
18	182-0086	FLOW METER, ROTAMETER, 5 GPM, 1/2" FNPT, ACRYLIC	1
19	194-0587	TEE, 1/4", T X T X T, 304	1
20	194-0023	NIPPLE, 1/4" X CLOSE, 304	1
21	182-0002	GAUGE, PRESSURE, 2.5", 160 PSI, SS/BRASS, 1/4" MNPT, BACK MNT, GLYCERINE FILL	2
22	194-0137	ELBOW, 90 DEG, 1 1/2" SOC, PVC	1
23	194-0687	REDUCER, BUSHING, 1.5" X 1", SXS, SCH 80, PVC	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS .XX = ±.015 .XXX = ±.005
ANGLES ± 1°
63 MINIMUM
FILLET RADII TO BE .005 MAXIMUM
BREAK ALL EDGES .005/.010
MATERIAL
FILENAME 300-1142
DO NOT SCALE DRAWING

CAD GENERATED DRAWING, INTERPRET DRAWING PER ASME Y14.5M - 2009

APPROVALS	DATE
MODELED WBV	8/7/2019
DRAWN WBV	8/7/2019
PROJECT MGR C HEUSEL	8/7/2019
PURCHASING MGR	
QUAL ENG	

VELODYNE

VELOBLEND, VMN-2D-300-C-0-A-X,
ROCK ISLAND, WA

SIZE B | DWG. NO. 300-1142 | REV. A
SCALE 1:6 | CAD FILE: | SHEET 1 OF 3

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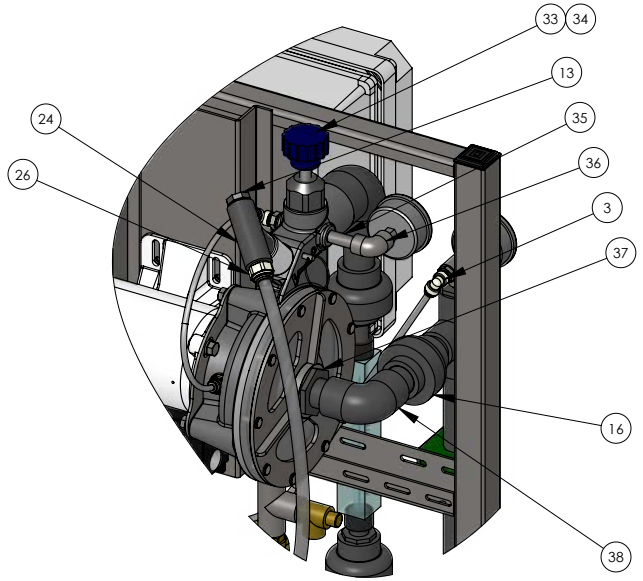
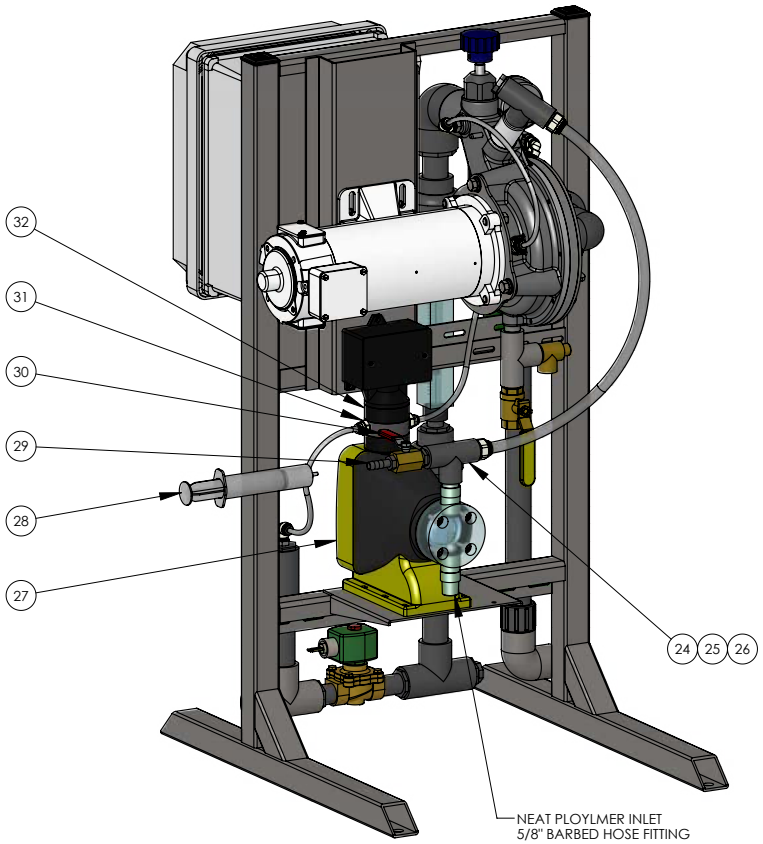
ITEM #	NUMBER	DESCRIPTION	QTY
24	194-0304	TEE, 1/2", T X T X T, SCH 80, PVC	2
25	194-0291	REDUCER, BUSHING, 1/2" X 1/4", TXT, SCH 80, PVC	1
26	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
27	215-0427	PUMP, DIAPHRAGM, 2 GPH, 4-20mA CTRL	1
28	215-0067	SYRINGE, PRIMING, DIAPHRAGM PUMP	1
29	194-0637	HOSE BARB, 1/4" X 1/4", POLY, HOSE X MNPT	1
30	248-0001	VALVE, BALL, 1/4" MNPT - 1/4" FNPT, BRASS	1
31	194-0641	ADAPTER, 1/4" TUBE - 1/4 MNPT, ACETAL	2
32	182-0272	SWITCH, PRESSURE DIFF, ASHCROFT, D4-24-B-60PSI	1
33	200-0399	VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90VDC	1
34	200-0042	ORIFICE, THROTTLE VALVE, .195", 5 GPM, 6" BLENDER	1
35	194-0634	NIPPLE, 1/4" X 2.00 L, 304	1
36	194-0055	ELBOW, 90, 1/4", TXT, 304	1
37	194-0688	REDUCER, BUSHING, 1.5" X 1", TXT, SCH 80, PVC	1
38	194-0621	ELBOW, 90, 1", S X S, SCH 80, PVC	1





VELODYNE

VELOBLEND, VMN-2D-300-C-0-A-X,
ROCK ISLAND, WA

SIZE	DWG. NO.	REV.
B	300-1142	A
SCALE 1:6	DO NOT SCALE DRAWING	SHEET 2 OF 3

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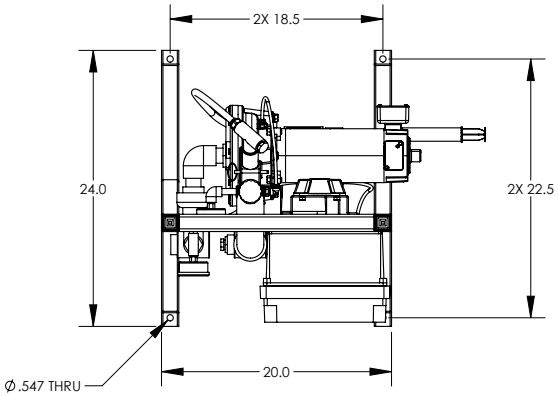

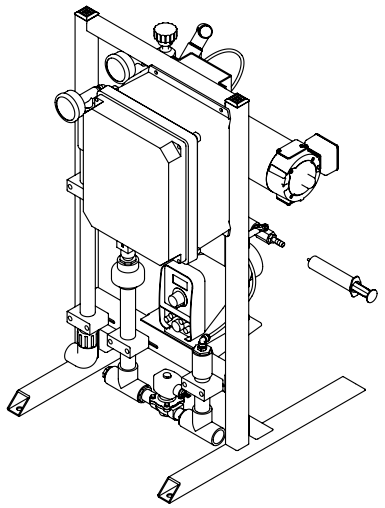

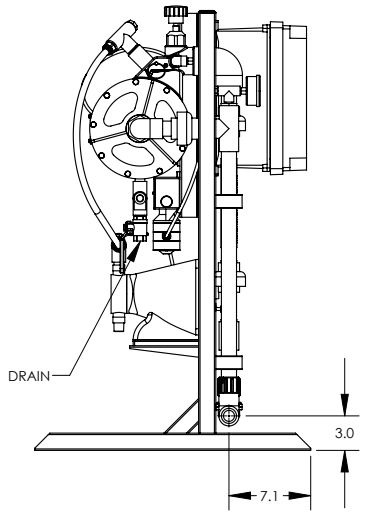

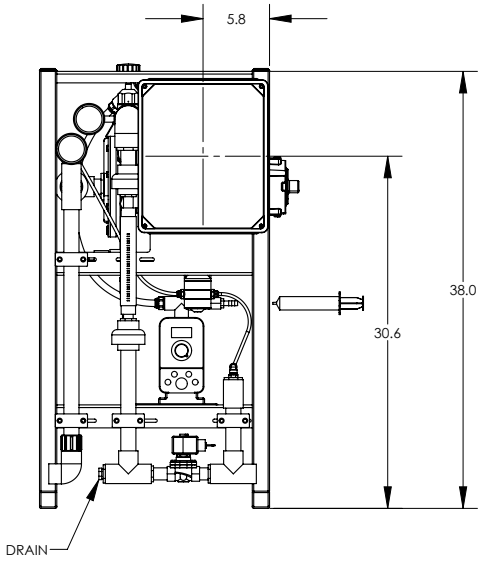

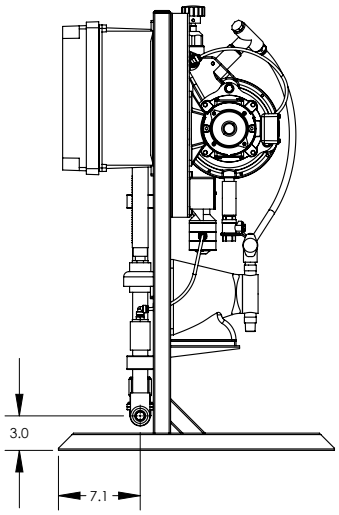

VELODYNE

VELOBLEND, VMN-2D-300-C-0-A-X,
ROCK ISLAND, WA

SIZE	DWG. NO.	REV.
B	300-1142	A
SCALE 1:10	DO NOT SCALE DRAWING	SHEET 3 OF 3

2.2 Mixing Chamber

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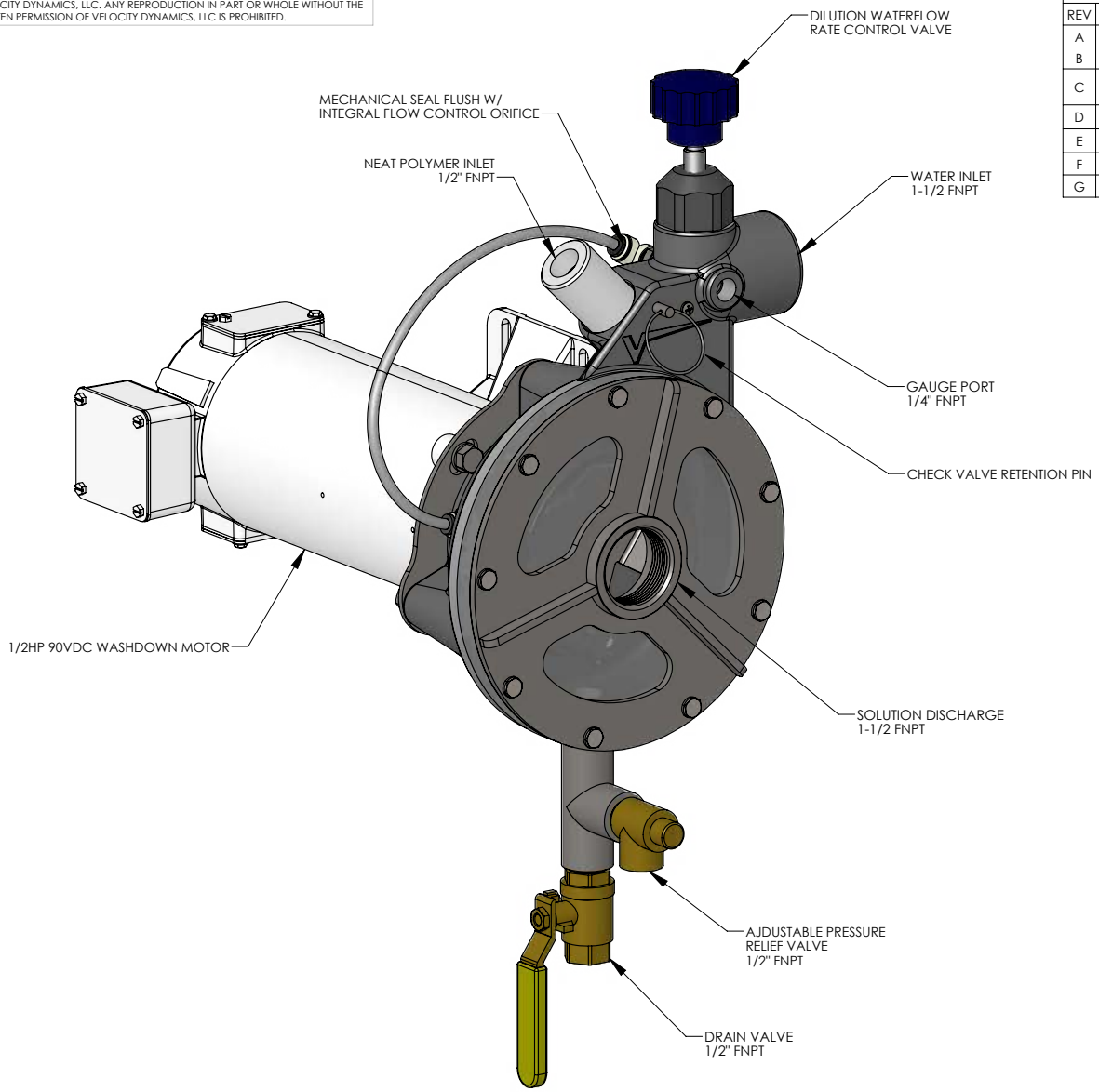

REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A	EC10081	INITIAL RELEASE	9/18/12	J Skuba
B	EC10143	CHANGED LENGTH OF LH BOLT FROM 3/4" TO 5/8"	01/29/13	T MORRIS
C	EC 10158	CHG'D FOR NEW CASTING DESIGN; CHG TO BRASS AND SS DRAIN/RELIEF VALVES	1/13/15	C WELLS
D	EC 10161	CHG COVER O-RING, SHOW NEW MOTOR MNT DESIGN	8/21/15	C WELLS
E	EC 10164	CHG THROTTLE VALVE CAP, COVER, CLAMP RING	1/4/16	B HEALY
F	EC 10169	CHANGE THROTTLE VALVE CAP	3/28/16	B HEALY
G		CORRECT MATERIAL DESCRIPTION	1/18/17	B HEALY

NOTES -

1) APPROXIMATE DRY WEIGHT 55 LBS

2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS .XX = ±.015 .XXX = ±.005
ANGLES ± 1°
63 MINIMUM
FILLET RADII TO BE .005 MAXIMUM
BREAK ALL EDGES .005/.010
MATERIAL
FILENAME 200-0399
DO NOT SCALE DRAWING

CAD GENERATED DRAWING, INTERPRET DRAWING PER ASME Y14.5M - 2009

APPROVALS	DATE
MODELED JB SKUBA	
DRAWN JB SKUBA	
PROJECT MGR C HEUSEL	
PURCHASING MGR J MITCHELL	
QUAL ENG	

VELODYNE

VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90 VDC

SIZE B | DWG. NO. 200-0399 | REV. G+

SCALE 1:2.5 CAD FILE: | SHEET 1 OF 4

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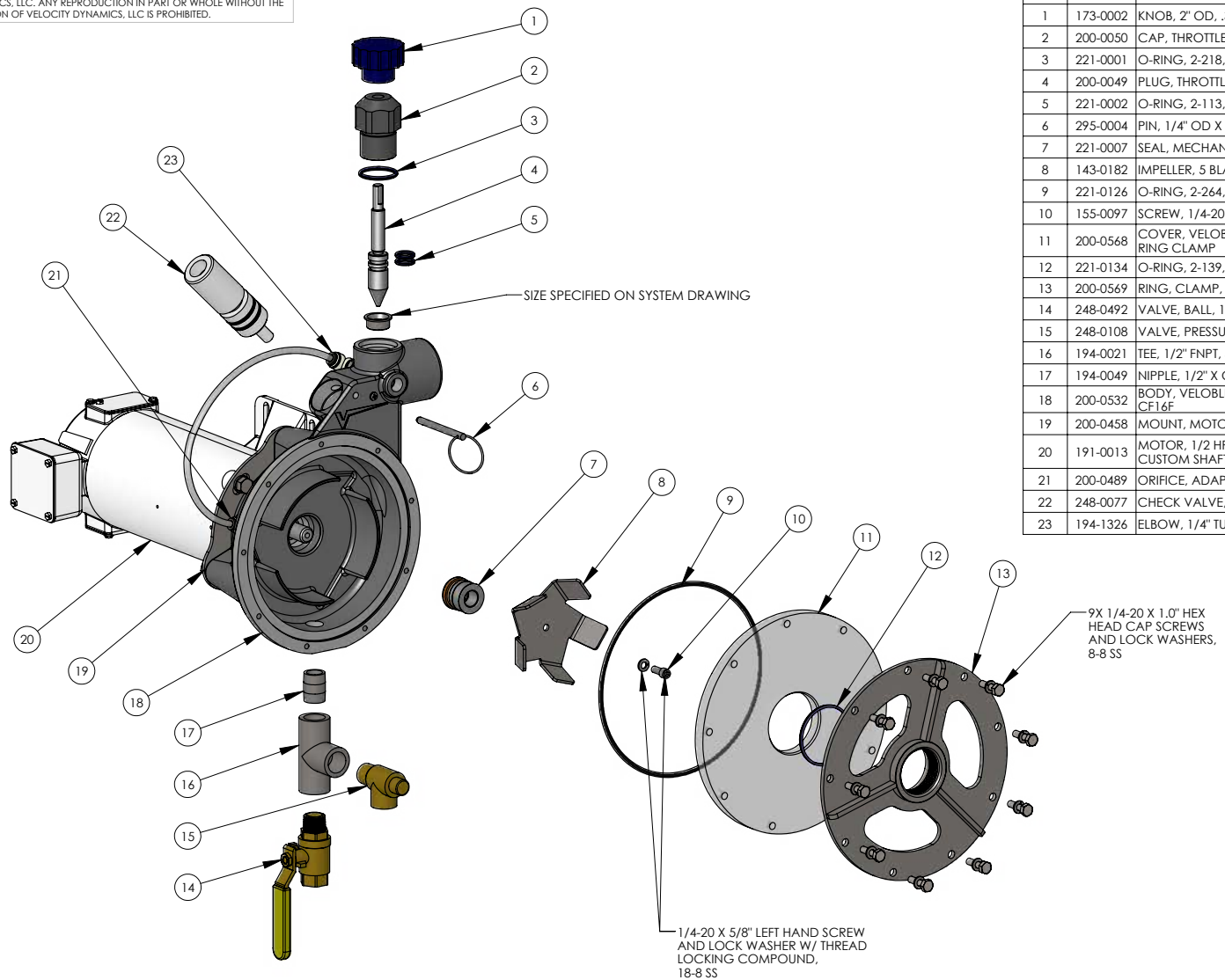

ITEM #	NUMBER	DESCRIPTION	QTY
1	173-0002	KNOB, 2" OD, .375 BORE W/ SET SCREW, PHENOLIC	1
2	200-0050	CAP, THROTTLE VALVE,	1
3	221-0001	O-RING, 2-218, VITON	1
4	200-0049	PLUG, THROTTLE VALVE	1
5	221-0002	O-RING, 2-113, VITON	2
6	295-0004	PIN, 1/4" OD X 2.4" L, W/ RING, 6" LANYARD, 18-8	1
7	221-0007	SEAL, MECHANICAL, ROTARY, 5/8, SHAFT	1
8	143-0182	IMPELLER, 5 BLADE, 6" VELOBLEND	1
9	221-0126	O-RING, 2-264, VITON	1
10	155-0097	SCREW, 1/4-20 LH X 5/8, SKT HD, HEX DRV, 18-8	1
11	200-0568	COVER, VELOBLEND, 6", CASTING, POLYCARBONATE, RING CLAMP	1
12	221-0134	O-RING, 2-139, VITON	1
13	200-0569	RING, CLAMP, DISCHARGE FLANGE, WELDMENT, 304	1
14	248-0492	VALVE, BALL, 1/2" MNPT - 1/2" FNPT, BRASS	1
15	248-0108	VALVE, PRESSURE RELIEF, 1/2" BRASS	1
16	194-0021	TEE, 1/2" FNPT, 304	1
17	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
18	200-0532	BODY, VELOBLEND, 6", ACTIVE, CASTING, MACHINED, CF16F	1
19	200-0458	MOUNT, MOTOR, VELOBLEND, 56C, 304	1
20	191-0013	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56C, WASHDOWN, CUSTOM SHAFT	1
21	200-0489	ORIFICE, ADAPTER 1/4" TUBE X 1/4" MNPT, .026"DIA	1
22	248-0077	CHECK VALVE, VELOBLEND	1
23	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	1

VELODYNE

VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90 VDC

SIZE B | DWG. NO. 200-0399 | REV. G+

SCALE 1:4 | DO NOT SCALE DRAWING | SHEET 2 OF 4

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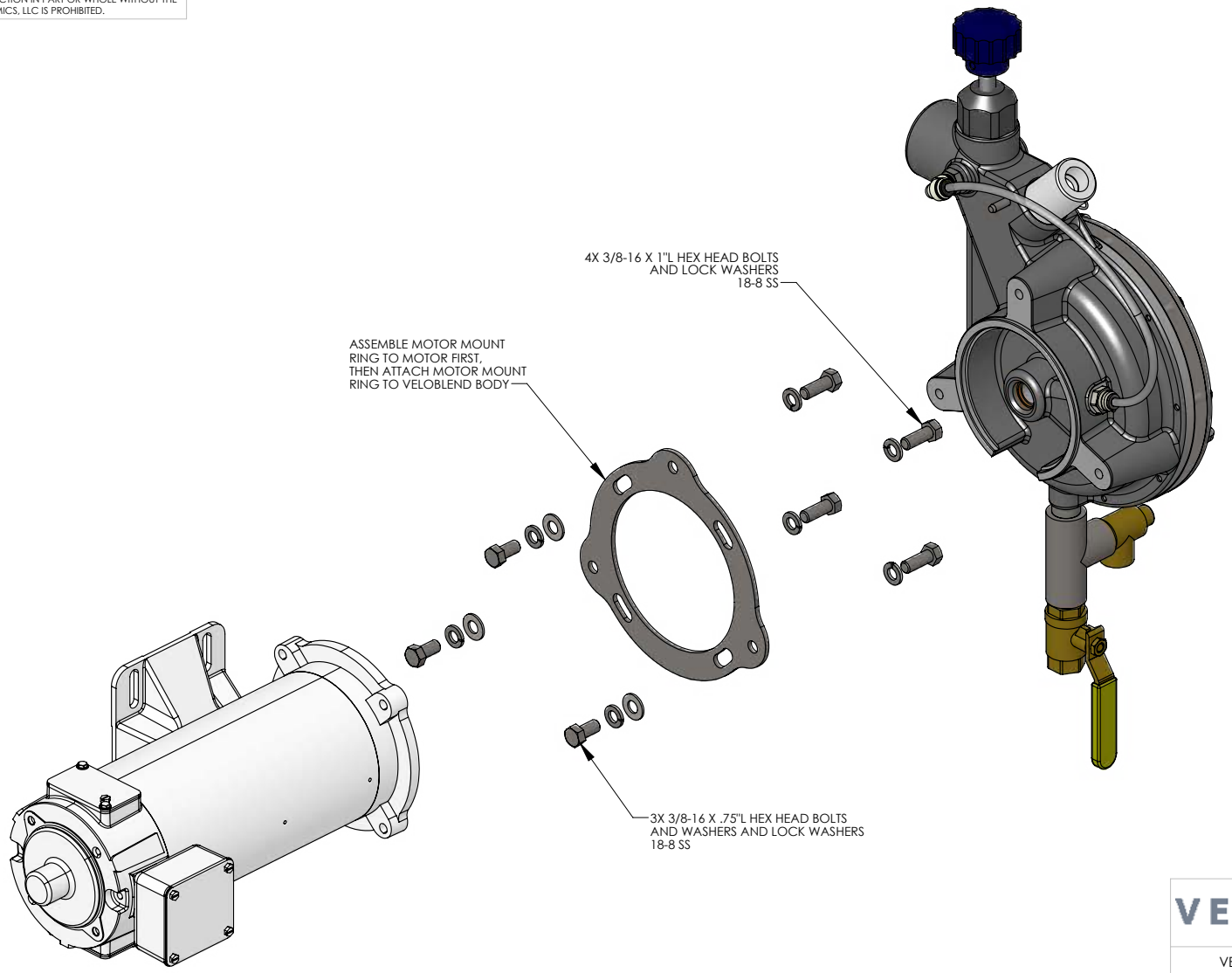

VELODYNE

VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE	DWG. NO.	REV.
B	200-0399	G+
SCALE 1:3	DO NOT SCALE DRAWING	SHEET 3 OF 4

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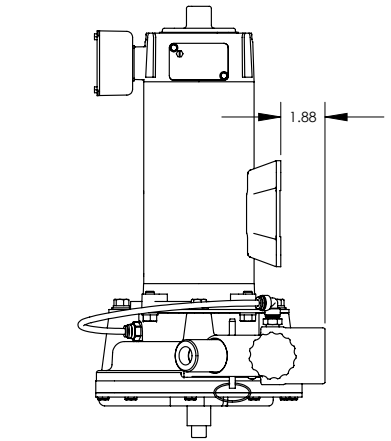
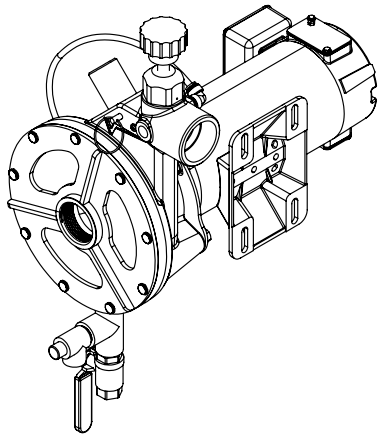
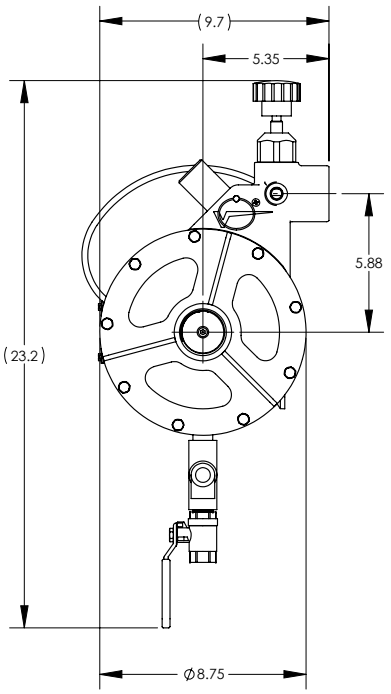
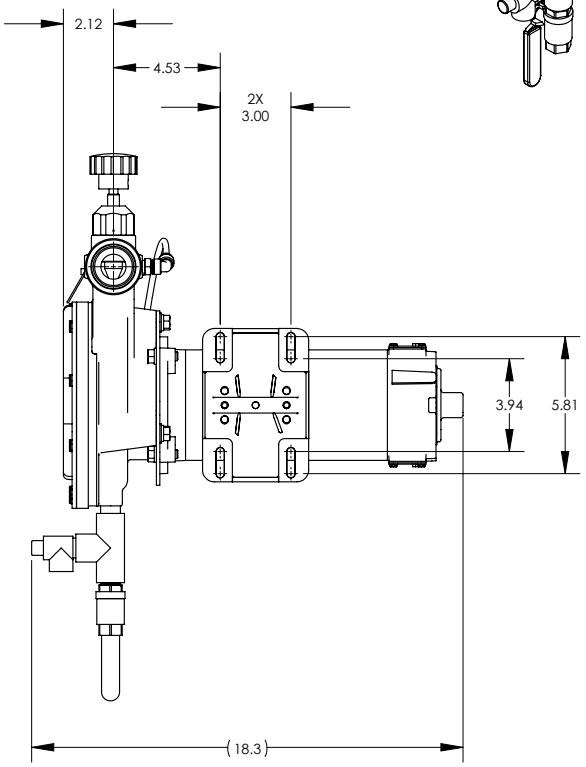








VELODYNE

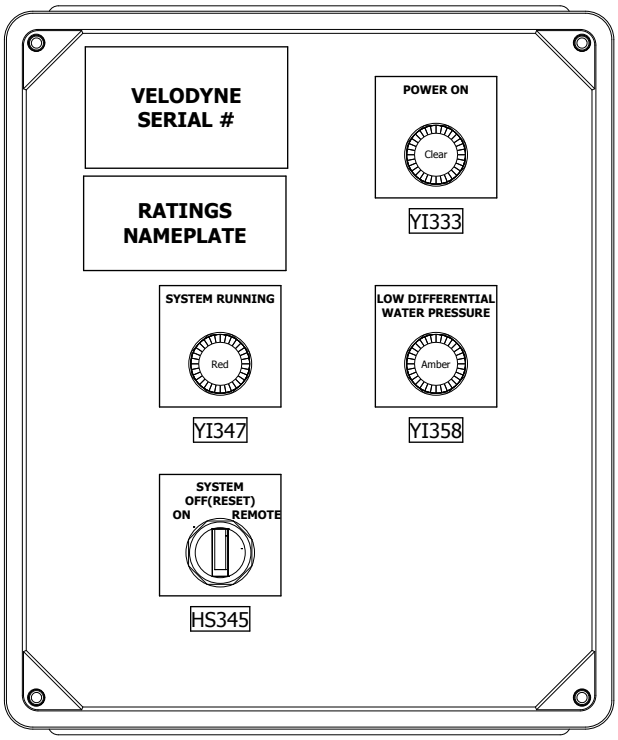
VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE	DWG. NO.	REV.
B	200-0399	G+
SCALE 1:5	DO NOT SCALE DRAWING	SHEET 4 OF 4

3. Electrical

3.1 Control Panel

VELODYNE VELOCITY DYNAMICS, LLC	Velocity Dynamics, LLC 543 S Pierce Ave, Louisville, CO 80027 303-530-3298 www.polymersolution.com	The information contained in this drawing is the sole property of Velocity Dynamics, LLC. Any reproduction in part or in whole without written permission of Velocity Dynamics, LLC is prohibited.



PNL.1
ENCLOSURE, 12x10x6.37, FRP

	Project Name Standard Veloblend	Sales Order	Rev	Revision Description	Date	By		Date	By	VELOBLEND LIQUID POLYMER SYSTEM	
			C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS	VMN-D-C-0-A-X	
			B	UPDATED STANDARD	8/26/14	SS	Modified	09/21/17	SS	Drawing Number 970-3006	ELEC Rev C
			A	ORIGINAL RELEASE	10/24/12	MRB	Checked				Sheet 1 of 5

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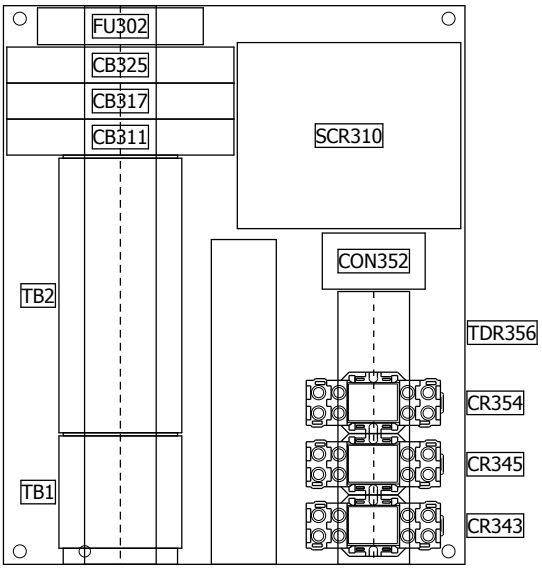
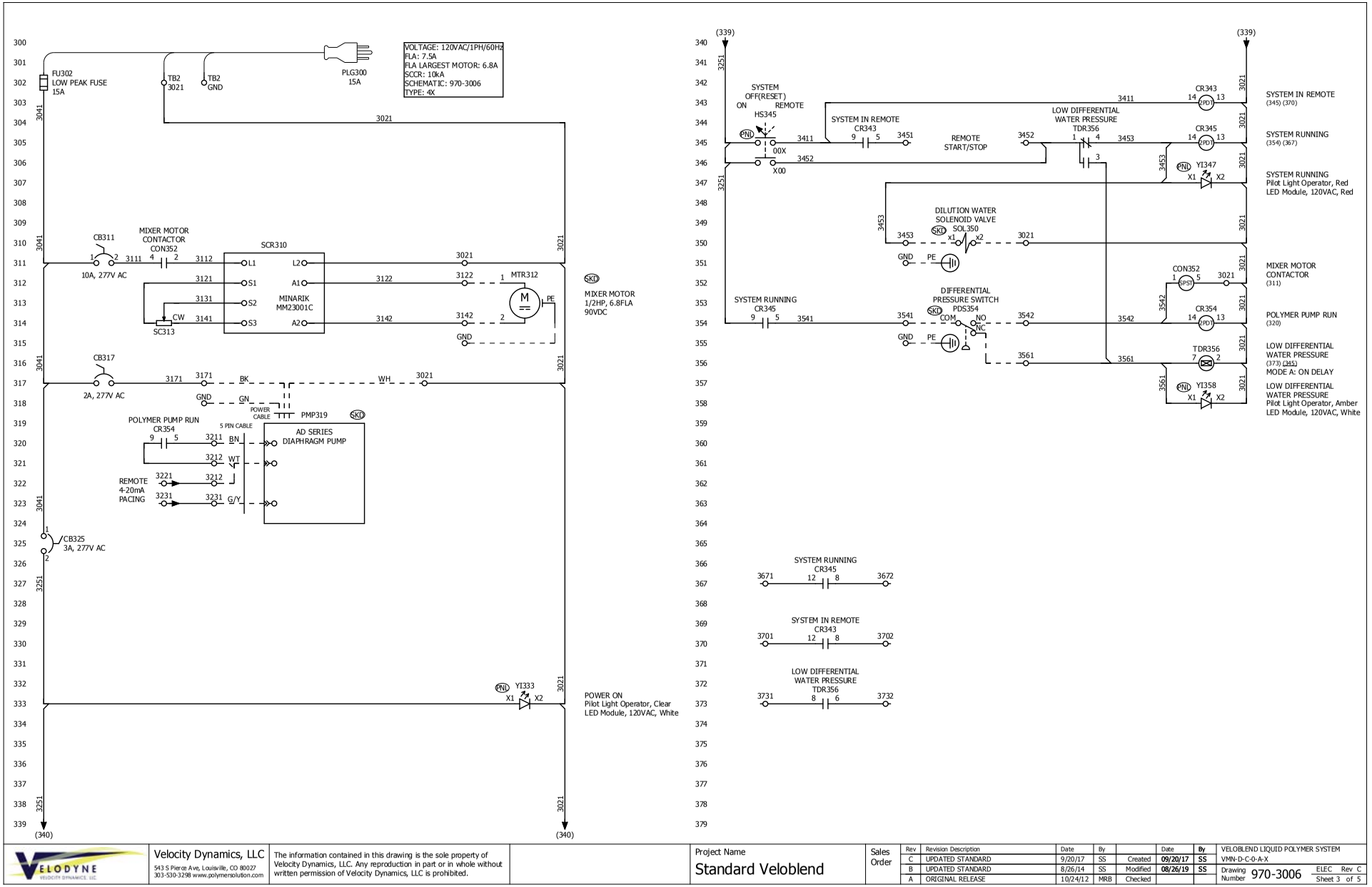


PNL.2
BACK PANEL, 12x10

	Project Name: Standard Veloblend	Sales Order	Rev	Revision Description	Date	By		Date	By	VELOBLEND LIQUID POLYMER SYSTEM	
			C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS	VMN-D-C-0-A-X	
			B	UPDATED STANDARD	8/26/14	SS	Modified	09/21/17	SS	Drawing Number 970-3006	ELEC Rev C
			A	ORIGINAL RELEASE	10/24/12	MRB	Checked				Sheet 2 of 5

3.2 Electrical Schematic



VELODYNE	Velocity Dynamics, LLC 543 S Pierce Ave, Louisville, CO 80027 303-530-3298 www.polymersolution.com	The information contained in this drawing is the sole property of Velocity Dynamics, LLC. Any reproduction in part or in whole without written permission of Velocity Dynamics, LLC is prohibited.	Project Name Standard Veloblend	Sales Order	Rev	Revision Description	Date	By		Date	By	VELOBLEND LIQUID POLYMER SYSTEM
					C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS	VMN-D-C-0-A-X
					B	UPDATED STANDARD	8/26/14	SS	Modified	08/26/19	SS	Drawing Number 970-3006 ELEC Rev C
					A	ORIGINAL RELEASE	10/24/12	MRB	Checked			Sheet 3 of 5

Terminal Legend

DESCRIPTION	TB1	DESTINATION
MIXER MOTOR (90VDC)	3122	SKID
MIXER MOTOR (90VDC)	3142	SKID
DIAPHRAGM PUMP START/STOP	3211	SKID
DIAPHRAGM PUMP START/STOP	3212	SKID
DIAPHRAGM PUMP 4-20	3212	SKID
REMOTE PACING 4-20(+) INPUT	3221	PLANT
REMOTE PACING 4-20(-) INPUT	3231	PLANT
DIAPHRAGM PUMP 4-20	3231	SKID
MIXER MOTOR	GND	SKID

TERMINALS SHOWN ALPHANUMERICALLY FOR REFERENCE. ACTUAL PLACEMENT MAY VARY.

DESCRIPTION	TB2	DESTINATION
120VAC NEUTRAL	3021	PLANT
120VAC NEUTRAL	3021	INTERNAL
DIAPHRAGM PUMP NEUTRAL	3021	SKID
DILUTION WATER SOLENOID	3021	SKID
MIXER MOTOR CONTACTOR	3021	INTERNAL
DIAPHRAGM PUMP LINE	3171	SKID
REMOTE START/STOP INPUT	3451	PLANT
REMOTE START/STOP INPUT	3452	PLANT
DILUTION WATER SOLENOID	3453	SKID
DIFFERENTIAL PRESSURE SWITCH	3541	SKID
DIFFERENTIAL PRESSURE SWITCH	3542	SKID
DIFFERENTIAL PRESSURE SWITCH	3561	SKID
SYSTEM RUNNING OUTPUT	3671	PLANT
SYSTEM RUNNING OUTPUT	3672	PLANT
SYSTEM IN REMOTE OUTPUT	3701	PLANT
SYSTEM IN REMOTE OUTPUT	3702	PLANT
LOW DIFFERENTIAL WATER PRESSURE OUTPUT	3731	PLANT
LOW DIFFERENTIAL WATER PRESSURE OUTPUT	3732	PLANT
GND	GND	PLANT
DIAPHRAGM PUMP	GND	SKID
DILUTION WATER SOLENOID	GND	SKID
DIFFERENTIAL PRESSURE SWITCH	GND	SKID

TERMINALS SHOWN ALPHANUMERICALLY FOR REFERENCE. ACTUAL PLACEMENT MAY VARY.

Velocity Dynamics, LLC
543 S Pierce Ave, Louisville, CO 80027
303-530-3298 www.polymersolution.com

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Project Name: Standard Veloblend

Sales Order

Rev	Revision Description	Date	By		Date	By
C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS
B	UPDATED STANDARD	8/26/14	SS	Modified	09/21/17	SS
A	ORIGINAL RELEASE	10/24/12	MRB	Checked		

VELOBLEND LIQUID POLYMER SYSTEM
VMN-D-C-0-A-X
Drawing Number 970-3006 ELEC Rev C
Sheet 4 of 5

3.3 Bill of Materials

Bill of Materials

VeloDyne BOM 50

Tag	Qty	VDI#	Description	MFR	MFR#
PNL.1	1	131-0011	PLAQUE: VELODYNE S/N, 3.75"x2.25", WHITE WITH BLACK TEXT		
YI333	1	131-0063	PLAQUE: "POWER ON", 2.25"x2.25", 0.88" HOLE, WHITE WITH BLACK TEXT		
YI358	1	131-0067	PLAQUE: "LOW DIFFERENTIAL WATER PRESSURE", 2.25"x2.25", 0.88" HOLE, WHITE WITH BLACK TEXT		
YI347	1	131-0068	PLAQUE: "SYSTEM RUNNING", 2.25"x2.25", 0.88" HOLE, WHITE WITH BLACK TEXT		
HS345	1	131-0069	PLAQUE: "SYSTEM ON/OFF(RESET)/REMOTE", 2.25"x2.25", 0.88" HOLE, WHITE WITH BLACK TEXT		
PNL.2	1	131-0078	PLAQUE: PANEL RATINGS, 3.75"x1.75", WHITE WITH BLACK TEXT		
PNL.2	1	152-0012	BACK PANEL, 12x10, PAINTED STEEL	HOFFMAN	A12P10
PNL.1	1	152-0044	ENCLOSURE, 12x10x6.37, FRP, NEMA 4X	HOFFMAN	RHJ1210HWLG
TB1, TB2	26	700-0000	Feed through screw terminal block 4mm² gray	ALLEN BRADLEY	1492-J4
TB1, TB2	5	700-0010	ground terminal block 4mm² green/yellow	ALLEN BRADLEY	1492-JG4
PLG300	1	711-0500	PLUG, 3-PRONG, 15A, 120VAC	LEVITON	515PV
CB317	1	720-0003	UL489 Miniature Circuit Breaker, 1 pole, rated current: 2A, C curve, 277V AC max	ALLEN BRADLEY	1489-M1C020
CB325	1	720-0004	UL489 Miniature Circuit Breaker, 1 pole, rated current: 3A, C curve, 277V AC max	ALLEN BRADLEY	1489-M1C030
CB311	1	720-0010	UL489 Miniature Circuit Breaker, 1 pole, rated current: 10A, C curve, 277V AC max	ALLEN BRADLEY	1489-M1C100
FU302	1	723-0048	Fuse, Low Peak, Class CC, 15A	BUSSMANN	LP-CC-15
FU302	1	724-0020	1492-FB Fuse Holder with 1 pole, Class CC Type Fuses, 30A, Pkg. Qty. 6	ALLEN BRADLEY	1492-FB1C30
CR343, CR345, CR354	3	730-0000	Relay, 2PDT, 120VAC Coil, 10A Contacts	IDEC	RH2B-UL-AC110-120V
CON352	1	731-1000	SOLID-STATE RELAY, SPDT, 120VAC COIL, 30A CONTACT	AMERICAN-ZETTLER	AZ2280-1A-120-AF
TDR356	1	732-0021	TIMER, MULTIFUNCTION, 2PDT, 120VAC Coil, 10A Contacts	IDEC	RTE-P1AF20
CR343, CR345, CR354	3	734-0000	DIN-mount Socket for 2-pole, RH-series relays.	IDEC	SH2B-05
TDR356	1	734-0004	Socket, TIMER, 8-PIN	IDEC	SR2P-06
YI358	1	740-0004	800F Pilot Light - Round Plas. (IP66, 4/4X/13, IP66), Amber	ALLEN BRADLEY	800FP-P0
YI347	1	740-0006	800F Pilot Light - Round Plas. (IP66, 4/4X/13, IP66), Red	ALLEN BRADLEY	800FP-P4
YI333	1	740-0007	800F Pilot Light - Round Plas. (IP66, 4/4X/13, IP66), Clear	ALLEN BRADLEY	800FP-P7
HS345	1	740-0012	800F 3 Position Selector Switch - Plastic, Maintained, Black, Standard Knob, Standard Orientation	ALLEN BRADLEY	800FP-SM32
HS345, YI333, YI347, YI358	4	741-0001	800F Plastic Mounting Latch	ALLEN BRADLEY	800F-ALP
HS345	2	741-0002	22.5mm PB No Latch, Screw Contact Block, 1 N.O.	ALLEN BRADLEY	800F-X10
YI347	1	741-0009	800F Integrated LED, Latch Mount, 120V AC, Red LED	ALLEN BRADLEY	800F-N5R
YI333, YI358	2	741-0011	800F Integrated LED, Latch Mount, 120V AC, White LED	ALLEN BRADLEY	800F-N5W
SC313	1	743-1010	POTENTIOMETER ASSEMBLY FOR MOUNTING DIRECTLY TO SCR	VELODYNE	743-1010
SCR310	1	767-0000	SCR, 2HP, 115/230VAC INPUT, 0-90/0-180VDC OUTPUT	MINARIK	MM23001C

Velocity Dynamics, LLC
543 S Pierce Ave, Louisville, CO 80027
303-530-3298 www.polymersolution.com

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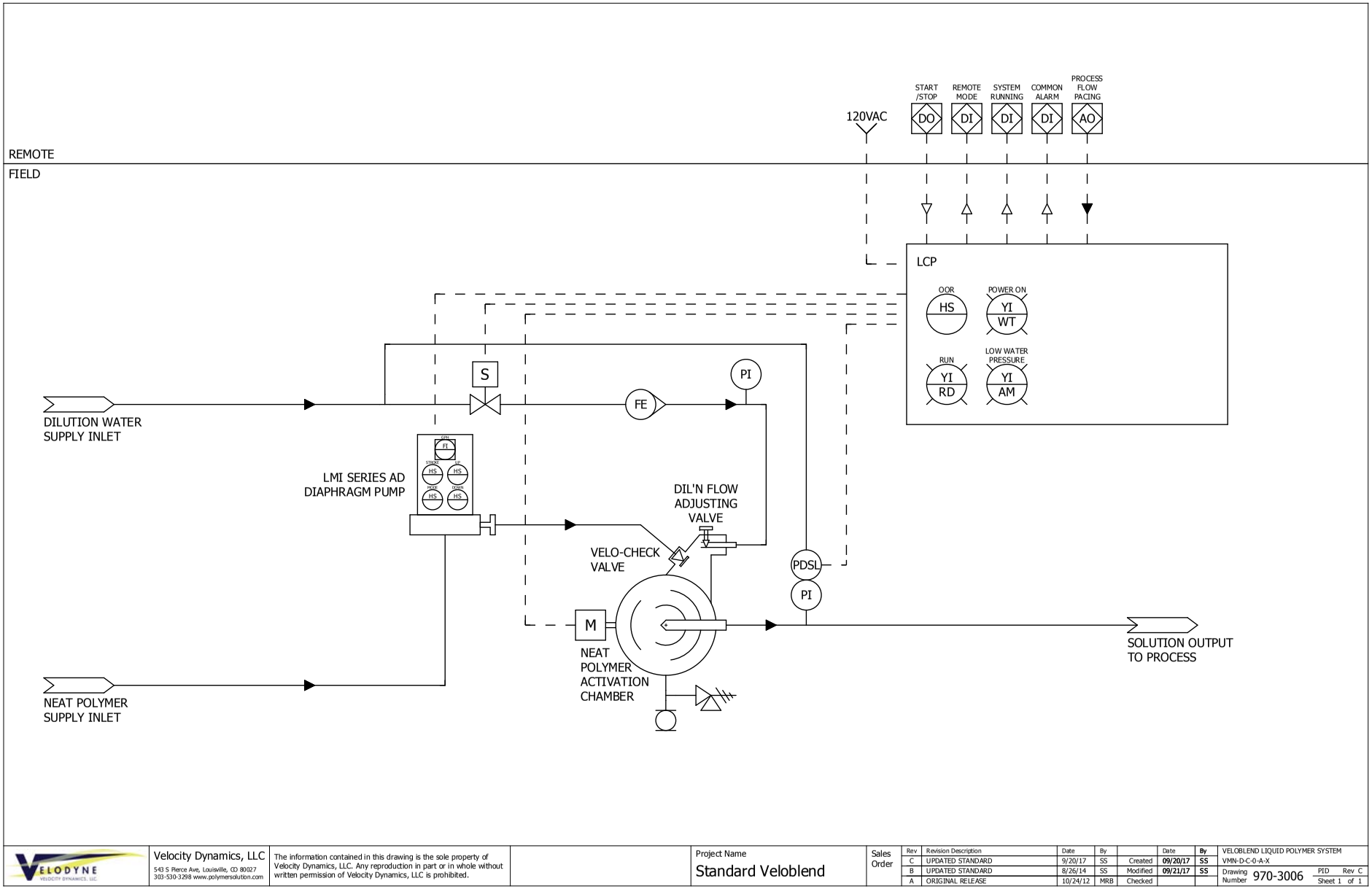
Project Name: Standard Veloblend

Sales Order

Rev	Revision Description	Date	By		Date	By
C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS
B	UPDATED STANDARD	8/26/14	SS	Modified	09/21/17	SS
A	ORIGINAL RELEASE	10/24/12	MRB	Checked		

VELOBLEND LIQUID POLYMER SYSTEM
VMN-D-C-0-A-X
Drawing Number 970-3006 ELEC Rev C
Sheet 5 of 5

3.4 Process & Instrumentation Diagram



VELODYNE VELOCITY DYNAMICS, LLC.	Velocity Dynamics, LLC 543 S Pierce Ave, Louisville, CO 80027 303-530-3298 www.polymersolution.com	The information contained in this drawing is the sole property of Velocity Dynamics, LLC. Any reproduction in part or in whole without written permission of Velocity Dynamics, LLC is prohibited.		Project Name Standard Veloblend	Sales Order	Rev	Revision Description	Date	By		Date	By	VELOBLEND LIQUID POLYMER SYSTEM		
						C	UPDATED STANDARD	9/20/17	SS	Created	09/20/17	SS	VMN-D-C-0-A-X		
						B	UPDATED STANDARD	8/26/14	SS	Modified	09/21/17	SS	Drawing Number 970-3006	PID	Rev C
						A	ORIGINAL RELEASE	10/24/12	MRB	Checked				Sheet 1 of 1	

4. Installation

4.1 Handling and Receiving

Unpacking:

A forklift must be utilized to remove the crate from the delivery truck. After opening the crate, check for signs of physical damage to the system caused during shipping. Notify VeloDyne immediately if any damage is discovered. (VeloDyne main phone # 303-530-3298).

If ordered, two u-bolts located at the top of the skid frame can be used to easily move the system to its desired location. Thread a chain through the bolts and move the system with a forklift, hoist, or crane. Once lifted, the system will tilt. This is expected and will not cause damage to the system. The system can then be lowered and easily pushed into place.

Equipment Placement & Mounting:

Use appropriate hardware for mounting and assembly. All hardware must be stainless steel unless otherwise specifically indicated.

Equipment placement is at the discretion of the Owner.

NOTE: The minimum maintenance clearance requirements for the polymer activation system are:

- ***18 inches from the back of the skid.***
- ***10 inches from the sides of the skid.***
- ***Unobstructed access to the front of the skid.***

Environmental Conditions:

Temperature: 10°C - 40°C (50°F - 104°F)
Humidity: 5% - 95% (without condensation)

DO NOT ALLOW EQUIPMENT TO FREEZE.

NOTE: Operating equipment outside of above specified ranges may cause damage to system components.

4.2 Storage — Before Commissioning

If the system will not be commissioned for a period of 3 months or more, perform the following procedures on the progressive cavity pump:

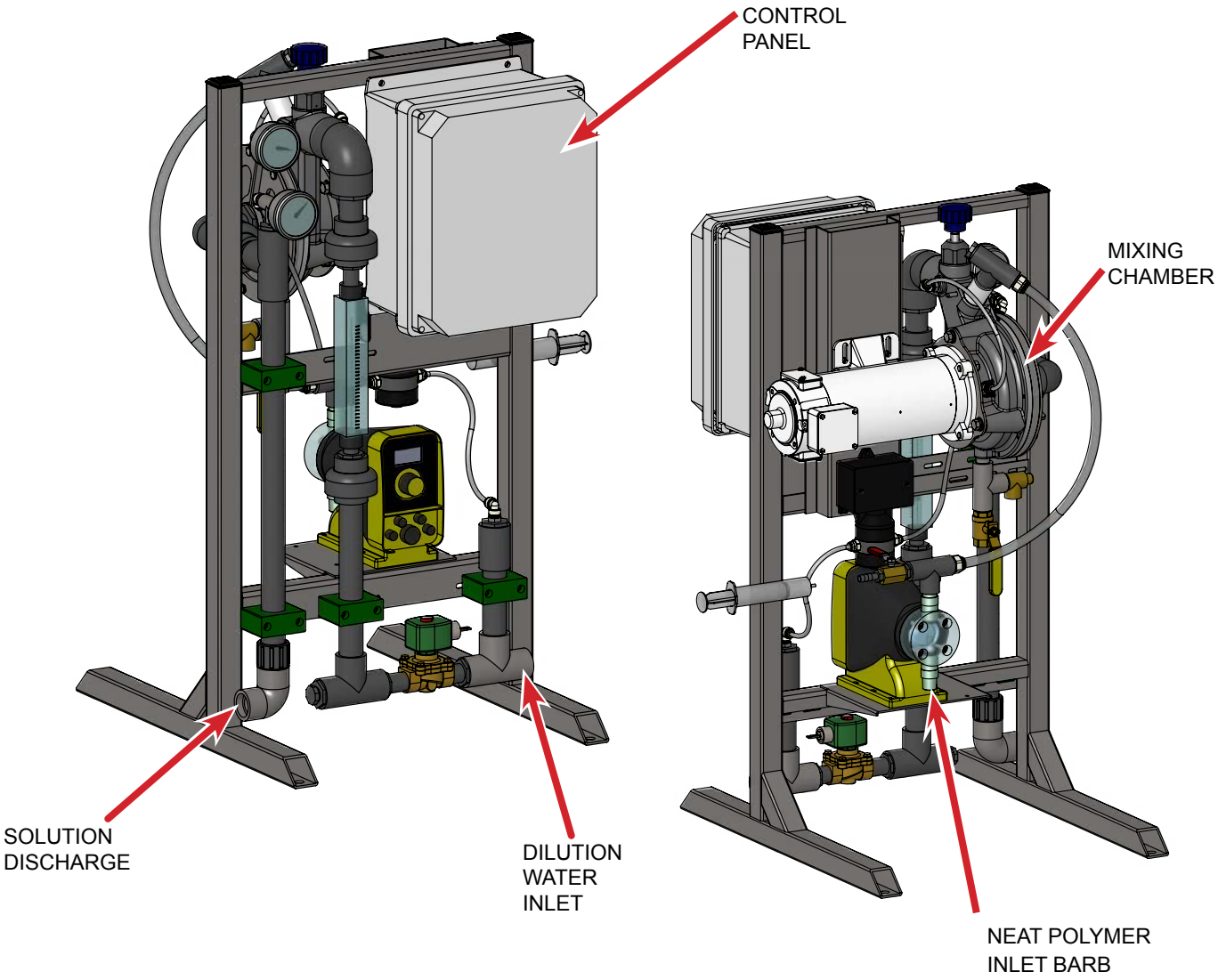
1. Remove the stator. This is to prevent the rotor from damaging (flattening) the stator.
2. Cover the joint sleeves in foil.
3. Completely fill the gear box with the proper type of lubrication/oil.
4. Remove foil, replace the stator and restore the gear box oil to the proper operating level before commissioning.

NOTE: Refer to pump manfacturer's IOM in Section 8 for storage information.

4.3 Mechanical Connections

The system drawing shows the dilution water inlet, polymer inlet, and solution outlet connections.

Avoid decreasing the solution discharge line size from the connection size provided on the unit.



To install the mechanical connections:

1. Ensure the plant's main water supply is functioning.
2. Connect the plant water line to the Dilution Water Inlet.
3. Connect the plant polymer supply line to the Polymer Inlet.
4. Connect the plant solution line to the Solution Discharge.

4.4 Electrical Connections

Refer to the electrical diagram and the terminal block legend for electrical connections.

1. Ensure the plant's main power supply is functioning.
2. Locate the control panel.
3. Connect the polymer unit terminal block connections to the plant main control panel per the Electrical Schematic Terminal Block, Section 3.

5. Operation

WARNING: OBSERVE ALL WARNING AND/OR CAUTION LABELS.
Do not operate equipment without guards in place.
Follow appropriate lockout/tagout procedures before applying power to or servicing equipment.

5.1 Safety Precautions

CAUTION: Polymer can be a harmful chemical and is a slip hazard.

Refer to chemical manufacturers' MSDS sheets for recommended safety precautions and information on treatment if skin or eyes are exposed to polymer or if polymer is ingested. It is always recommended to wear goggles and gloves when working around polymer.

Thoroughly clean polymer spills immediately. It is recommended that polymer spills first be cleaned up with an absorbent such as sand or pet litter. Use wash-down water only as a last resort. A stiff brush and large volume of water combined with absorbent is recommended for final clean-up.

Routine safety precautions should be observed for handling fine-particle-size polymer.

Such precautions may include equipment grounding and bonding, adequate ventilation, good housekeeping, etc.

Store all polymer in a dry, dark, cool area. This keeps excessive moisture away and increases the standard shelf life.

Do not store in direct sunlight.

Do not freeze.

Avoid dust formation. Avoid breathing dust particles.

Sweep up all spills. Avoid using water for clean up as polymer will become extremely slippery. Completely remove spills with sand or binders.

Wear appropriate protective clothing: goggles, gloves and masks.

May be harmful if inhaled. May cause respiratory tract irritation.

May be harmful if swallowed.

May be harmful if absorbed through skin. May cause skin irritations. (Flush thoroughly with water.)

May cause eye irritation. (Flush thoroughly with water.)

WARNING: The equipment supplied may start automatically. Heightened caution must be used when working on or around equipment.

Use proper lock-out procedures before performing maintenance on equipment.

Disconnect power before performing maintenance.

(1) Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

(2) If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).

(3) Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

5.2 Initial Start-Up Procedures

Prior to start-up verify the following:

VELOBLEND® CHECK LIST

Complete the following check list before starting the equipment.

PLUMBING

- ☐ Water Inlet Plumbing Complete
- ☐ Solution Discharge Plumbing Complete
- ☐ Polymer Inlet Plumbing Complete
- ☐ Verify Water Supply Flow Over Full Flow Meter Range Using Control Valve on Mixing Chamber
- ☐ Verify Water Supply Pressure at Maximum Water Flow – Ideally >25psi
- ☐ Verify Plumbing is Leak-Free

MECHANICAL

- ☐ All fasteners verified tightened
- ☐ Motors Aligned
- ☐ Motor Direction Verified
- ☐ All guards are in place and securely fastened

ELECTRICAL

- ☐ Power Connected and Verified
- ☐ Inter-connecting wiring connected and verified (if applicable)
- ☐ Inputs (if applicable):
  - ☐ Remote Start / Stop Dry Contact
  - ☐ 4-20mA Polymer Pump Pacing
  - ☐ Level Sensor(s) (batching systems only)
- ☐ Outputs (if applicable):
  - ☐ System Running
  - ☐ Remote Mode
  - ☐ Alarms
  - ☐ Low Water Differential Pressure
  - ☐ Loss of Polymer Flow
  - ☐ 4-20mA Proportional to Polymer Pump

MISCELLANEOUS

- ☐ Is Polymer supply on site?
- ☐ Check Gear Reducer Oil Level (if applicable)

WARNING: DO NOT RUN PUMPS DRY. DO NOT INTRODUCE WATER TO NEAT POLYMER PIPING OR CALIBRATION COLUMNS. FAILURE TO FOLLOW THESE REQUIREMENTS WILL VOID YOUR WARRANTY.

5.2.1 Optimizing Polymer Solution: VeloBlend Mixing Chamber

The Hydro-Mechanical VM Series VeloBlend produces mixing energy by the pressure drop across its water control valve and by the mechanical impeller. The recommended differential pressure range is from 30 to 100 psid. The pressure is not controlled, but rather is the result of the available water pressure and the pressure down stream of the system. Therefore, simply setting the desired rate of water flow then verifying that adequate differential pressure is available is all that is required to operate the mixing chamber. In the event inadequate pressure exists, the impeller can be utilized by turning on the Mixer and adjusting the speed. The Mixer is turned on by turning the speed potentiometer for the mechanical mixer. The speed potentiometer is located inside the control panel.

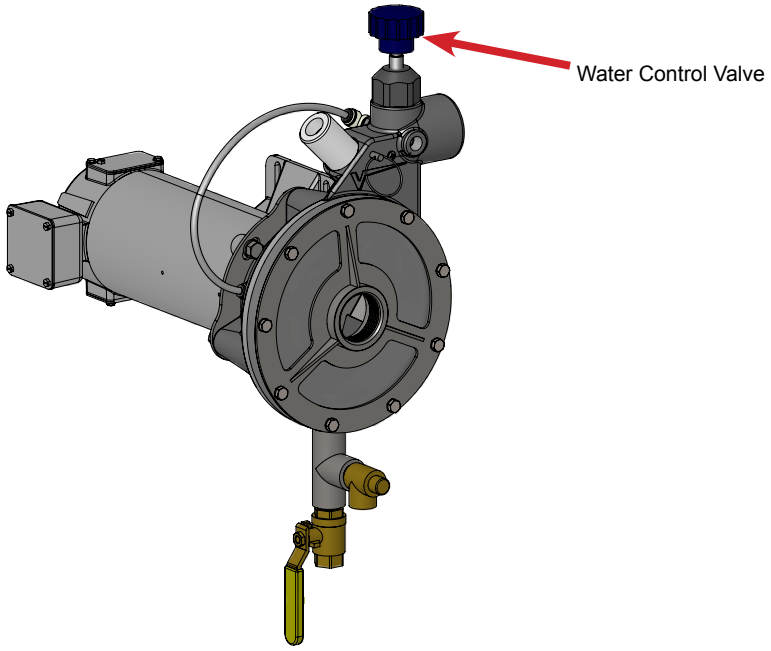
The need and benefit of the impeller must be verified by trial and error. After the system is set up for desired water and polymer flow rate, turn the impeller and set at approximately 10% of the impeller speed by gradually turning the potentiometer on the inside of the control panel. Allow the system to run for enough time to adjust to the changed setting. If the polymer flow rate can be reduced then the impeller is enhancing performance. Continue to increase impeller speed 10% at a time until the performance begins to decline. Your polymer system is optimized.

Step 1:

Set desired water flow using water control valve.

Step 2:

Verify 30 to 100 psid is available—the difference between the two pressure gauges (note: the mixing chamber pressure may read 0).



Step 3:

Pump Calibration:

1. Fill the calibration column just above the start line at the top of the cylinder (mineral oil can be used as a substitute to polymer – **never use water**).
2. Start the pump.
3. Start timing when the polymer reaches the start line.
4. Record the draw-down in GPH from the direct reading scale or for a more accurate calibration, record milliliters after a one minute draw-down.
5. Convert ml's over a one minute draw-down to GPH:

    a. _____ (ml) ÷ 3786 ml per gallon = _____ GPM

    b. _____ gallons per minute * 60 = _____ GPH

Example:

Draw-Down Volume: 438 milliliters in one minute.

438 ÷ 3786 (per gallon) = 0.115 gpm
0.115 gpm * 60 = 6.94 gph

NOTE: If polymer is not available, use mineral oil to prime and calibrate the pump. Never use water as this will cause the polymer to gel and will plug the pump, hose and piping.

NOTE: Please see section 8.1 for original manufacturers' Operation & Maintenance (O&M) Manual for the metering pump.

5.3 Shut-Down Procedures

The system may be shut down by turning the pump off via the **Pump Speed** potentiometer on the control panel; however, this method will cause the mixing chamber to need to be reset.

Once the mixing chamber has been set and the polymer solution fully optimized, the system may be shut-down by turning the **System** selector switch to the "Off" position. The system may then be restarted when desired by turning the **System** selector switch back to the "On" position. When the system is in the **Remote** mode, it may be started and shut-down in the same manner from the main control panel.

6. Maintenance & Troubleshooting

6.1 Preventative Maintenance

6.1.1 Preventative Maintenance Log Sheet

NOTE: No special tools are required for maintenance and lubrication.

Equipment Model: VMN-2D-300-C-0-A-X **Serial Number:** 819-5475-2958

Overall System ___ Housekeeping - Daily Clean any polymer spills with sand or binders.		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Polymer Check Valve ____ Weekly Inspect/Clean Check Valve (Refer to Section 6 in O&M for instructions.)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NOTES:	Week 1												
	Week 2												
	Week 3												
	Week 4												
Motor Brushes (DC Motors) ___ Inspect motor brushes. Clean or replace motor brushes every 600 hours. Replace the brushes if worn half of original length. (Refer to the motor IOM in Section 8 for more information.)													
NOTES:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Week 1												
	Week 2												
	Week 3												
	Week 4												

NOTE: Disconnect power before performing any maintenance.

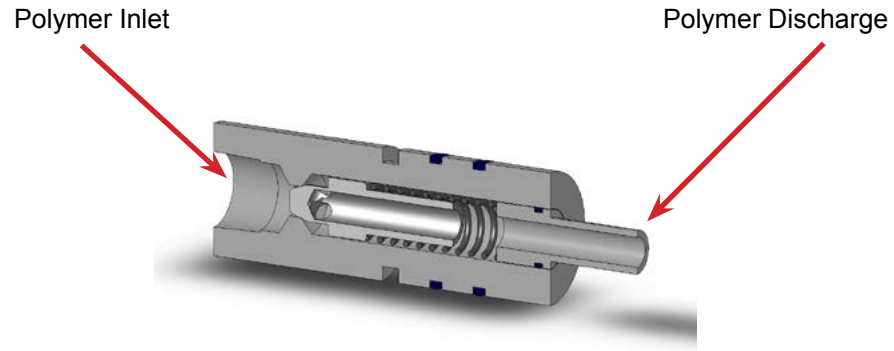
6.1.2 Preventative Maintenance Chart

RECOMMENDED PREVENTATIVE MAINTENANCE & LUBRICATION	
MAINTENANCE RECOMMENDATIONS	FREQUENCY / LUBRICATION
Polymer Check Valve: Periodically check and clean polymer check valve.	The frequency will depend on the polymer being used. Once per week is recommended during equipment commissioning until a well established frequency schedule can be determined. If a different polymer or polymer supplier is used, then it is recommended that a frequency schedule be re-established. Refer to Section 6 for maintenance procedures.
Motor Brushes: Inspect motor brushes (DC Motors Only).	Clean or replace motor brushes every 6-12 months depending on motor usage. During high usage, clean or replace the brushes every 6 months. During low usage, clean or replace the brushes every 12 months. Replace the brushes if worn half of original length. Refer to the motor IOM in Section 8 for more information.
Pump Calibration	Depending on system usage, regular calibration of the pump should be performed to monitor the condition of the pump. For heavy usage (12 or more hours per day), every 90 days is recommended. Significant variations in pump calibration results may indicate damage to the pump.

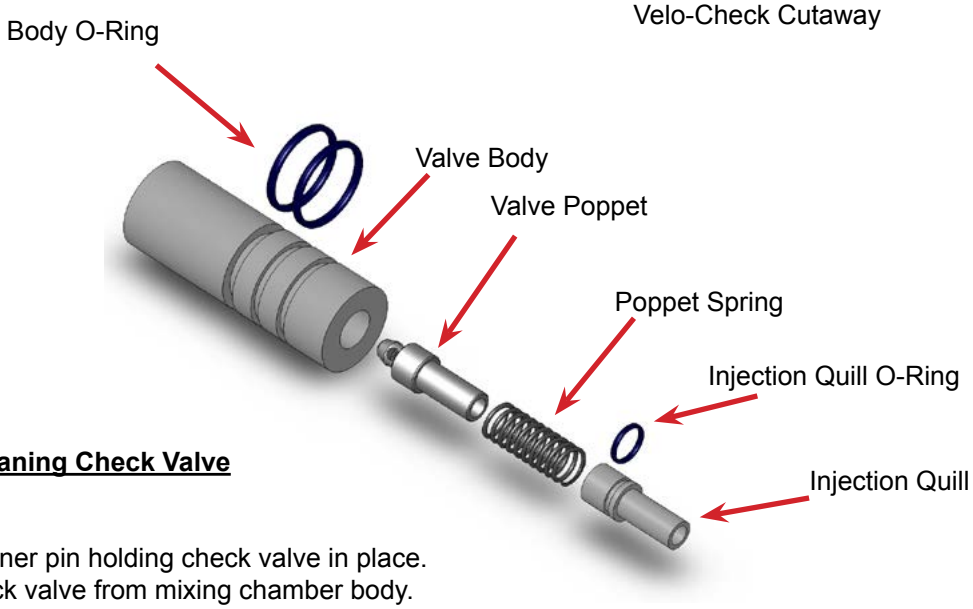
See page 8-8 for more pump maintenance information.

6.1.3 Polymer Check Valve, Inspect & Clean

The VeloBlend technology incorporates a specially designed polymer check valve, the Velo-Check©, designed to enhance polymer performance and check valve reliability and to allow for quick and easy removal, cleaning, and re-installation.



Velo-Check Cutaway



Inspecting / Cleaning Check Valve

Removing Valve:

1. Pull retainer pin holding check valve in place.
2. Pull check valve from mixing chamber body.

Valve Disassembly:

1. Carefully remove injection quill from end of check valve.
2. Remove spring and poppet valve.

Valve Cleaning:

1. Wipe poppet valve and spring clean of any polymer debris.
2. Avoid using water if possible. If rinsing is required, use hot water.

NOTE: Be sure to completely dry all parts that were rinsed with water before reinstalling. Installing wet parts will cause premature polymer build-up on valve.

Valve Re-Installation:

1. Place spring over poppet valve.
2. Re-insert Flow Insert & spring, conical end first, into Inlet Body.
3. Insert injection quill, o-ring end first, into Inlet Body.
4. Insert Valve into Mixing Chamber.
5. Replace retaining pin.

6.1.4 Storage — Long-Term Shut-Down

6.1.4.1 Mineral Oil Procedure

If the system is to be shut down for a prolonged period (two weeks or more), completely flush the polymer lines, calibration column and metering pump using the following mineral oil flushing procedure:

1. Fill the calibration column with a non-water heavy based laxative or food grade type fluid, such as mineral oil.
2. Energize the system and run normally until the mineral oil has evacuated all polymer from the pump suction assembly and pump discharge to the mixing chamber.
3. At the same time, continue flushing the mixing chamber with water until all of the mineral oil is dispersed; at least 5 minutes.
4. Refill the calibration column and repeat as necessary.
5. Completely drain all piping and the mixing chamber.
6. Leave the calibration column empty when complete.
7. Clean the mixing chamber polymer check valve after the flushing procedure is complete.

Do not let pump sit filled with a water solution.

Turn main pump shaft at least two full rotations every four weeks.

Store removed stator in a cool, dark, dry place, coat the metal components with a light oil or rust preventative.

6.1.4.2 Recirculation Procedure

If the system is to be shut down for a prolonged period (two weeks or more) *and has not received proper regular maintenance*, perform the following mineral oil recirculation procedure:

1. Remove the polymer pump discharge hose and install a hose from the pump discharge to the top of the calibration column.
2. Fill the calibration column with mineral oil.
3. Throttle the water flow control knob until the water flow is at 0 flow and close the seal flush kit valve.
4. Disable the low flow water and low flow polymer alarms using the HMI, if applicable.
5. Operate the system in Manual mode with the polymer pump at maximum speed allowing the mineral oil to recirculate through the pump and calibration column assembly for several hours or overnight.
6. Reconnect the pump discharge to the mixing chamber.
7. Re-enable the low water flow and low polymer flow alarms.
8. Reset the mechanical seal flush kit then open the water flow control knob.
9. Perform the mineral oil flush procedure as described above.

NOTE: The piping and mixing chamber may crack in freezing weather if not properly drained.

6.2 Corrective Maintenance Procedures

6.2.1 Replacing the Mechanical Seal

The mechanical seal will require replacement if the seal is run dry or damaged.

To replace the seal:

1. Disconnect union from the solution discharge piping near the flow meter.
2. Remove the nine (9) bolts securing the clear mixing chamber cover. Remove cover.
3. Remove the left-hand threaded bolt on the end of the shaft (to remove, turn clock-wise).
4. Remove the impeller.

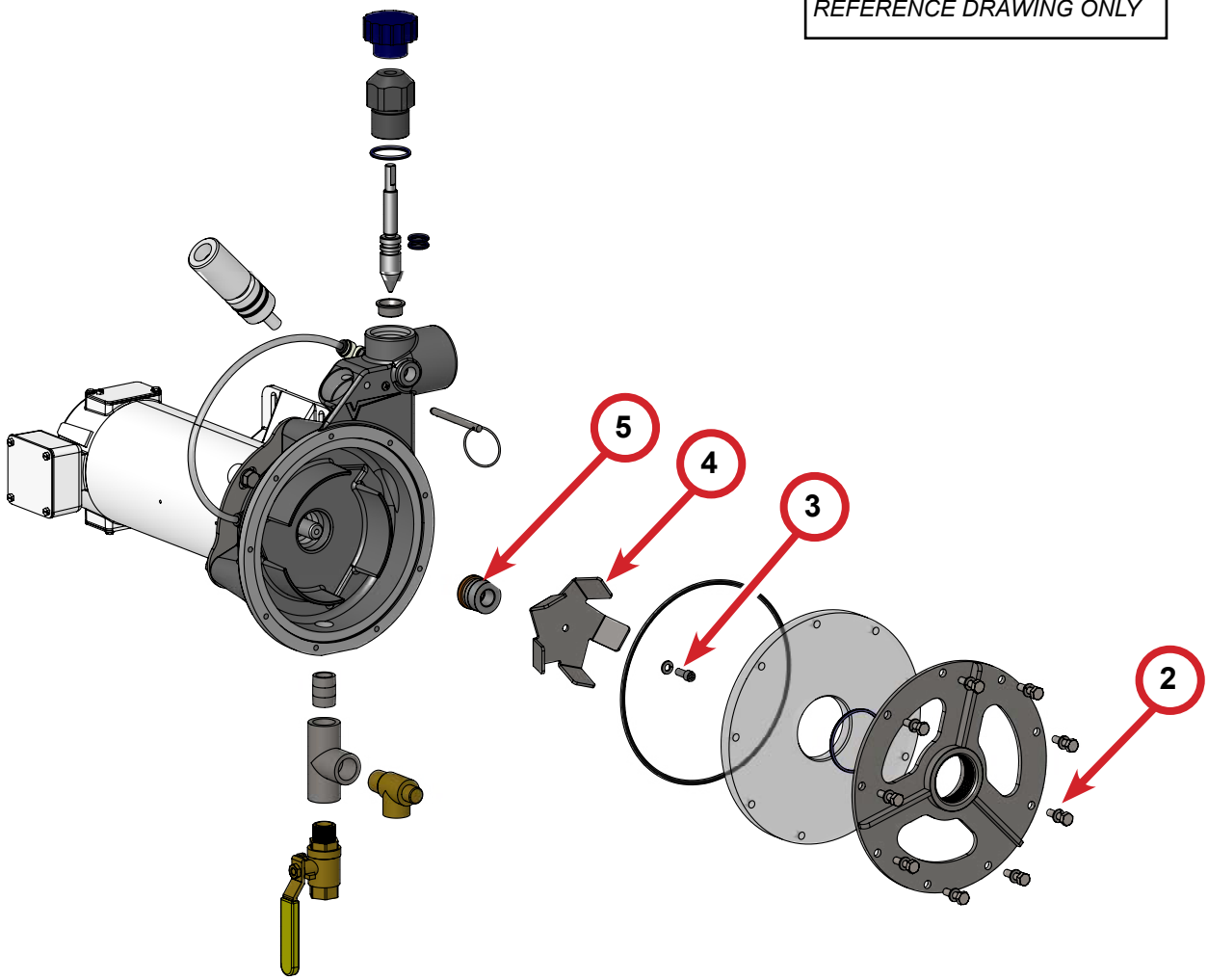
NOTE: Impeller is very sharp. Take proper precautions to avoid injury.

5. Remove the rotary mechanical seal. Replace seal, ensuring all flanged sides in the spring portion are free from obstruction and can be compressed freely in one hand.

NOTE: If the spring portion of the seal is obstructed on any side, serious damage to the mixing chamber will occur. The spring should freely compress on all sides when squeezed in one hand.

6. Replace impeller and left-hand (reverse) threaded bolt, applying loctite to the bolt.
7. Replace clear cover and nine (9) bolts, making sure the o-ring in the cover is properly seated. Always first snug and then tighten the bolts in a crisscross pattern, using no less than 40 inch pounds torque.
8. Reconnect the union on the solution discharge piping.

REFERENCE DRAWING ONLY

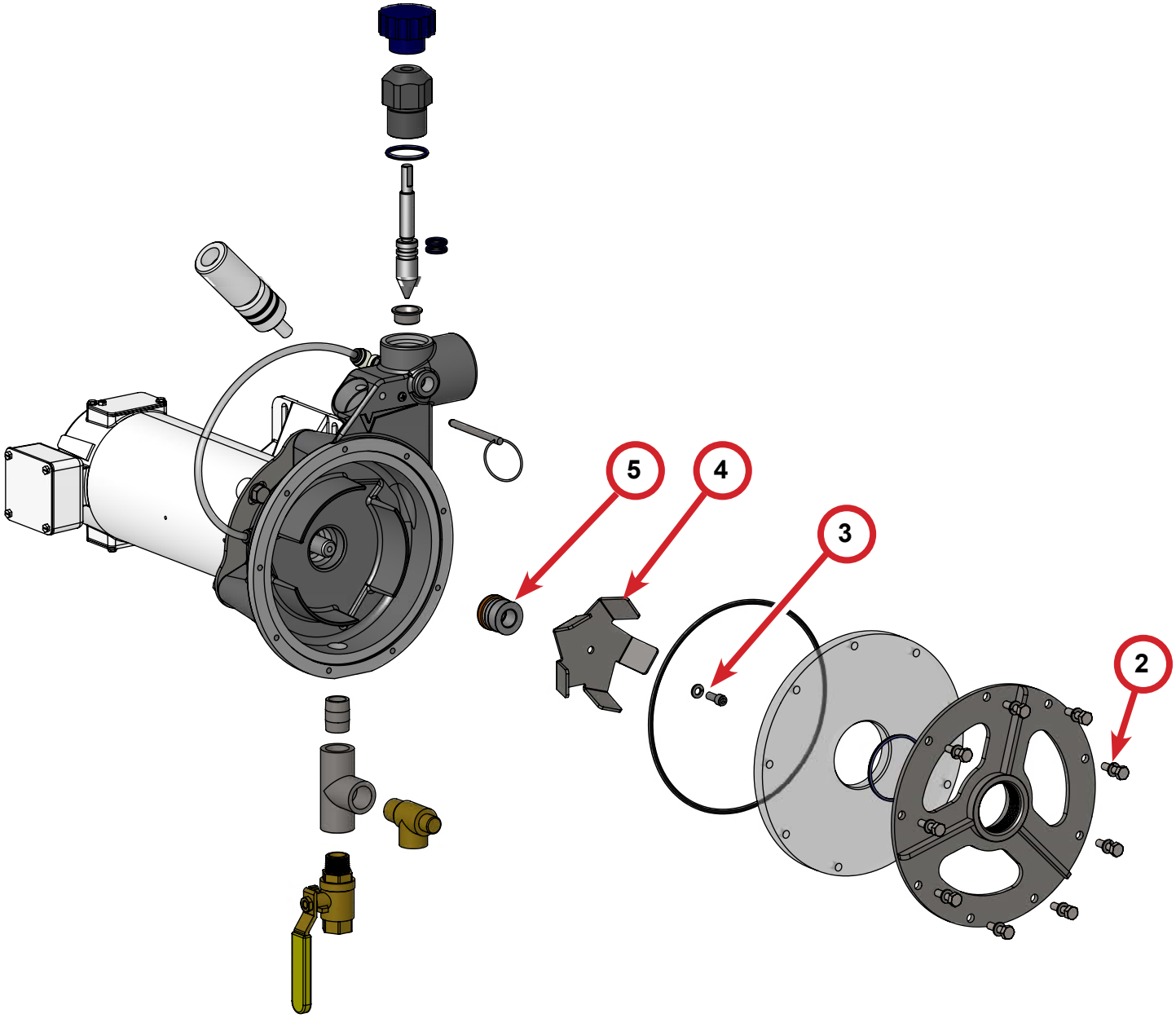


6.2.2 Replacing Mixing Chamber Motor

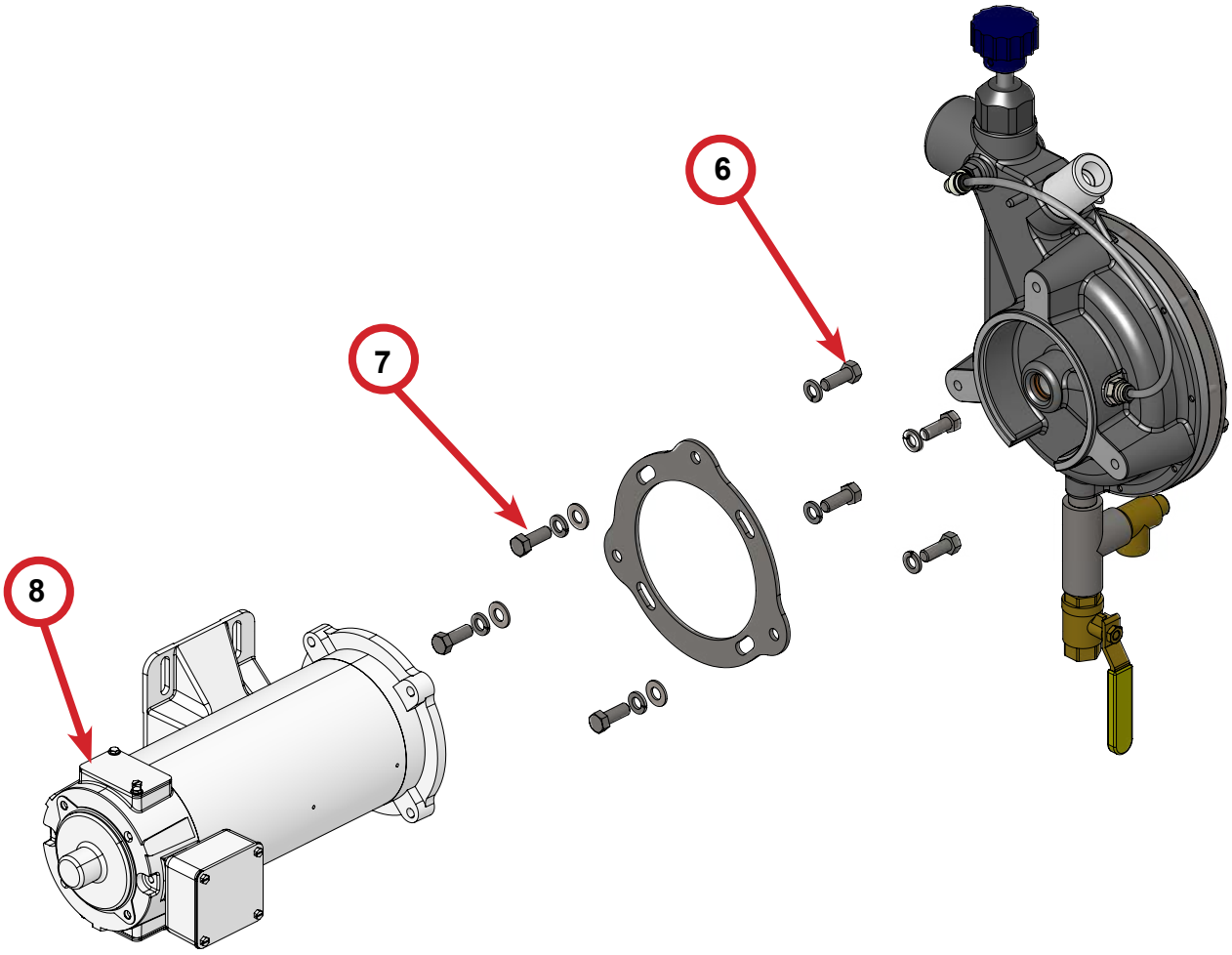
1. Disconnect union from the solution discharge piping near the flow meter.
2. Remove the nine (9) bolts securing the clear mixing chamber cover. Remove cover.
3. Remove the left-hand threaded bolt on the end of the shaft (to remove, turn clock-wise).
4. Remove the impeller.

NOTE: Impeller is very sharp. Take proper precautions to avoid injury.

5. Remove the rotary mechanical seal.



6. Remove four (4) bolts on motor.
7. Remove four (4) bolts on mixer mounting bracket.
8. Remove motor.
9. Place new motor in position.
10. Screw in four (4) bolts into motor and mixer mounting bracket.
11. Replace four (4) bolts on gear reducer/motor.
12. Replace seal, ensuring all flanged sides in the spring portion are free from obstruction and can be compressed freely in one hand.
13. Replace impeller and left-hand (reverse) threaded bolt. Use Loctite on the left-hand threaded bolt.
14. Replace clear cover and nine (9) bolts, making sure the o-ring in the cover is properly seated. Always first snug and then tighten the bolts in a crisscross pattern, using no less than 40 inch pounds torque.
15. Reconnect the union on the solution discharge piping near the flow meter.



6.3 Troubleshooting

Problem	Possible Cause	Reference	Solution
Solenoid valve won't close	1. Hole in diaphragm designed to equalize pressure on up & down stream side of valve is plugged.	Refer to solenoid valve O&M manual	1. Disassemble valve according to instructions. Clean hole in diaphragm to allow equalization of pressure differential.
Metering pump won't pump	1. Check valve(s) 2. Air leak in suction hose / pipe	Refer to metering pump O&M manual	1. Clean check valves 2. Tighten hose clamps, check and fix leaks in piping. 3. Progressive Cavity Pump: Prime pump by filling calibration column until solution drains through suction cavity plug.
Ineffective polymer mixing	1. Low water pressure 2. Excessive solution concentration 3. Too low of dilution water flow		1. Increase water pressure by opening valves upstream of system or increase available pressure by adjusting pressure regulating valve up stream of system. 2. Verify there are no obstructions or closed valves down-stream of polymer system indicated by high mixing chamber pressure. 3. Verify proper solution concentration (not to exceed 1% in most cases) 4. Increase water flow. Utilize Mechanical Impeller to make up for low water pressure.
Impeller wobbling	1. Spring loaded portion of the mechanical seal is not lined up		1. Inspect the spring portion of the mechanical seal to ensure all flanged sides can compress without obstruction

NOTE: For more information on maintenance procedures, refer to the specific component IOM in Section 8 of this Operation & Maintanence manual.

7. Warranty

543 S. Pierce Avenue, Louisville, CO 80027
(PH) 303-530-3298 ♦ (F) 303-530-3368
www.velodynesystems.com

LIMITED WARRANTY

New Polymer Equipment Limited Warranty

Warranty Period: One (1) year from start-up, not to exceed 18 calendar months from date of shipment; Limited.

VeloDyne warrants each new Polymer System of VeloDyne's manufacture to be free from defects in material and workmanship, under normal use and service for one (1) year following the date of equipment start-up not to exceed 18 consecutive calendar months from the date the equipment is shipped to you. This Limited Warranty shall apply to the system's mixing chamber for life, and otherwise only to complete polymer systems of VeloDyne's manufacture; parts are covered by a separate Limited Warranty.

Equipment and accessories not of VeloDyne's manufacture are warranted only to the extent of the original manufacturer's warranty and subject to their allowance to VeloDyne (only if found to be defective by such manufacturer).

Warranty Terms

During the Limited Warranty period, any defect in material or workmanship in any warranted item of VeloDyne's Polymer System not expressly excluded below shall be repaired or replaced at VeloDyne's option without charge, provided that (a) the equipment and parts are used according to the manufacturer's recommended usage and in an ordinary manner, and (b) you give us prompt written notice within the time period set forth herein that the equipment or parts manufactured by us fail to function properly under normal and proper use.

Should your unit prove defective within the warranty period, you must contact our Service Department for a return authorization (RMA) number to submit with the returned equipment. This RMA must be noted prominently on the outside of your packaging and on any correspondence related to the return. VeloDyne's liability under this warranty is limited to the repair of or replacement in kind or credit, in VeloDyne's sole option and discretion, of any items proved to be defective, provided the allegedly defective goods are returned to VeloDyne's factory located at 543 S. Pierce Avenue, Louisville, CO 80027, by Purchaser transportation prepaid.

All costs and expense related to shipping of any replacement parts or goods shall be VeloDyne's expense, but Purchaser shall pay for all installation costs. The foregoing shall not apply to equipment or parts that shall have been altered or repaired after shipment to you by anyone except VeloDyne's authorized agents and/or service employees. Purchaser is responsible for determining the suitability of VeloDyne's equipment for Purchaser's intended use, and VeloDyne shall in no event be liable in this respect. Any equipment or parts manufactured by others but furnished to you by us will be repaired or replaced only to the extent of the original manufacturer's warranty. Purchaser must provide prompt written notice to VeloDyne of any warranty issues to obtain its benefits.

Should VeloDyne determine that the reason or action giving rise to the defect or operational issue with your warranted Equipment is the result of Owner's actions (or actions of Owner's employees, agents, representatives or affiliates), then this warranty shall not apply to the repair or replacement and VeloDyne will invoice the Owner for the cost of all parts, repairs, service calls and travel expenses incurred in investigating or repairing your defective equipment.

Purchaser's Responsibility

This Limited Warranty requires proper start-up maintenance and registration, and periodic inspections of the Polymer System Equipment as indicated in the Operator & Maintenance Manual furnished with each new system. The cost of routine or required maintenance and service(s) is the responsibility of Purchaser, and Purchaser is required to keep documented evidence that routine or required maintenance services were performed.

Warranty Exclusions and Limitations

The warranties contained herein SHALL NOT APPLY TO:

1: New Polymer System Equipment delivered to the Purchaser in which the warranty registration has not been completed and returned to VeloDyne within thirty (30) days from the date of delivery of the Equipment to Purchaser.

2: Any defect which was caused (in VeloDyne's sole judgment) by other than normal use and service of the Polymer System Equipment, or by any of the following:

- Improper handling, storage, operation, interconnection, installation, alteration or repair by anyone other than VeloDyne or those authorized by VeloDyne.
- Parts or accessories installed on the Equipment that were not manufactured or installed by VeloDyne authorized representatives.
- Improper voltage or wiring and/or inconsistent power supply.
- Use of parts that are not 100% compatible with the Equipment.
- Improper exposure to the elements.
- Freezing water or excessive heat.
- Water damage.
- Water pressure surges due to owner system.
- Accidents.
- Damage after delivery to the Shipping Point.
- Lack of reasonable and proper maintenance.
- Misuse or negligence.
- Natural calamities.
- Overloading the system.
- Vandalism.

3: Any Polymer System Equipment whose identification numbers or marks have been altered or removed.

4: Any Polymer System Equipment which any of the required or recommended periodic inspection or services have been performed using parts not manufactured or supplied by VeloDyne or meeting VeloDyne specifications.

5: Any defect which was caused (in VeloDyne's sole judgment) by operation of the Polymer System Equipment not abiding by standard operating procedures outlined in the Operator's Manual.

6: Transportation costs, if any, to or from an authorized VeloDyne rep or supplier.

7: Travel time of VeloDyne's service personnel to make a repair on the Purchaser's site or other approved location.

8: In no event will VeloDyne's liability under this warranty exceed the purchase price of the Polymer System Equipment or component(s).

9: VeloDyne will not be responsible to any person, under any circumstances, for any incidental or consequential damages (including but not limited to loss of profits, out of service time, and the like) occurring for any reason at any time.

10: Diagnostic and overtime labor premiums are not covered under this Limited Warranty Policy.

11: Depreciation damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow operating instructions, misuse, or lack of proper protection during storage.

12: Accessory systems or electronic components not of VeloDyne's manufacture are warranted only to the extent of such manufacturer's respective Limited Warranty, if any.

13: Tools are not covered under this warranty.

14: ***Consumables and Wear Items Not Covered***: Air Filters, Ball Valves, Bearings, Belts, Optional Accessories, Pressure Relief Valves, Screens, Disconnect Valves, Hoses, Rotors, Stators, Pump Diaphragms, Pump Seal Kits, and other customary consumables and wear items typically excluded from warranty coverage.

15: Stators are not covered under warranty if the pump is not installed properly (e.g., improper suction conditions) or is run dry.

Parts Warranty

Parts replaced during the warranty period will receive the balance of the first year New Polymer System Equipment Limited Warranty, during the first twelve (12) months.

Replacement parts after the original Equipment warranty has expired are warranted to be free from defects of material for thirty (30) days or the part will be repaired or replaced (in VeloDyne's sole judgment and option). Removal and reinstallation labor is not covered.

All parts warranty claims must be filed within ten (10) business days of initial part failure or the warranty claim will be void.

Exclusion of Other Warranties

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, OBLIGATIONS AND LIABILITIES OF ANY KIND, EXPRESS OR IMPLIED, EXCEPT AS STATED HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED. VELODYNE'S OBLIGATION TO REPAIR OR REPLACE AS SET FORTH ABOVE IS OUR ENTIRE AND EXCLUSIVE LIABILITY AND YOUR EXCLUSIVE REMEDY FOR ANY CLAIM ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY. IN NO EVENT WILL WE BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES. IF CIRCUMSTANCES CAUSE THE LIMITED REMEDY STATED HEREIN TO FAIL OF ITS ESSENTIAL PURPOSES, OUR LIABILITY FOR DAMAGES SHALL NOT EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. ANY ACTION AGAINST US ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU SHALL BE BROUGHT WITHIN ONE YEAR OF THE DATE SUCH ACTION ACCRUES. THIS WARRANTY IS SOLELY FOR THE BENEFIT OF PURCHASER AND NO OTHERS.

WARRANTY REGISTRATION FORM

LIMITED WARRANTY

Your VeloBlend® or Hydramax® unit is warranted for one (1) year from the date of equipment start-up (not to exceed 18 months from the date your equipment was shipped to you from VeloDyne) against all defects in material and workmanship. Should your equipment prove defective within the warranty period, please contact our Service Department and service representative will create a return authorization (RMA) number for you to submit with the returned unit. If Equipment is being returned to us for repair or replacement, **please send to Velocity Dynamics, LLC, 543 S. Pierce Avenue, Louisville, CO 80027**. Package your unit carefully to avoid damage in transit. VeloDyne is not responsible for any damage caused to the unit in shipment. Shipping insurance should be available from your shipping agent. Under this warranty, VeloDyne undertakes to repair or replace any parts found to be defective. This warranty is only valid if the unit is used solely for equipment purposes in accordance with the instructions. This warranty is invalid if the unit is connected to an unsuitable electrical supply, or dismantled or interfered with in any way or damaged through misuse. You must complete the Warranty Registration Form and return it to VeloDyne to activate your warranty, which gives you specific legal rights. Please refer to your Warranty Agreement for full terms, conditions and exclusions.

This form must be completed and returned to us within thirty (30) days of delivery of your VeloDyne Products to activate your warranty. FAILURE TO COMPLETE THIS REGISTRATION MAY VOID YOUR WARRANTY. Please retain a copy of the completed form for your records. Purchaser acknowledges that the Start-up Equipment Test Form and Checklist items are required to validate this warranty, and regular scheduled maintenance must be performed on the Polymer System Equipment to maintain and ensure optimal performance. VeloDyne reserves the right to request maintenance records on the purchased unit to validate this warranty.

Customer Name (Company):	Contact Name (Person):
Project Name:	Equipment Serial Number:
Equipment Model #:	Equipment Delivery Date:
Location of Equipment (Address):	Service Contract Requested?

By signing below, I verify that I have read and understand the warranty policy of Velocity Dynamics, LLC, and I verify that the information contained on this form is accurate. I understand and agree that all service or start-up retainages are now due in full.

_____ _____

Velocity Dynamics, LLC, 543 S. Pierce Ave., Louisville, CO 80027
www.velodynesystems.com ♦ (PH) 303-530-3298 ♦ (F) 303-530-3368

INTERNAL USE ONLY	Sales Order #:
Invoice #:	Extended Warranty Requested?
Inspection / Installation Date:	Start-up/ Inspection By:

VELODYNE

WARRANTY SERVICE REQUEST FORM

In order to more systematically attend to service requests of your VeloBlend® or Hydramax® system, it is necessary that this form be used. Requests are processed in the order in which they are received. Please fill out the form as specifically as possible for a more accurate interpretation by us. Maintenance matters which are the responsibility of the system owner will not be considered. **Return this form to Velocity Dynamics, LLC, Attn: Warranty Service, 543 S. Pierce Avenue, Louisville, CO 80027 e-mail to service@velodynesystems.com or Fax to 303-530-3368.** For emergency repairs, please call our Service Manager at 303-530-3298.

Customer Name (Company):	Contact Name (Person):
Project Name:	Equipment Serial Number:
Equipment Model #:	Equipment Delivery Date:
Location of Equipment (Address):	Service Contract Requested?
List Specific Needs / Problems / Service Requested:	

By signing below, I verify that I have read and understand the warranty policy of Velocity Dynamics, LLC, and I verify that the information contained on this form is accurate.

OWNER'S SIGNATURE **DATE**

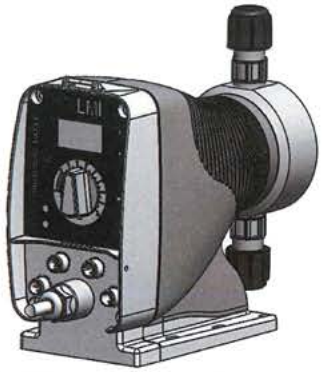
Velocity Dynamics, LLC, 543 S. Pierce Ave., Louisville, CO 80027
www.velodynesystems.com ♦ (PH) 303-530-3298 ♦ (F) 303-530-3368

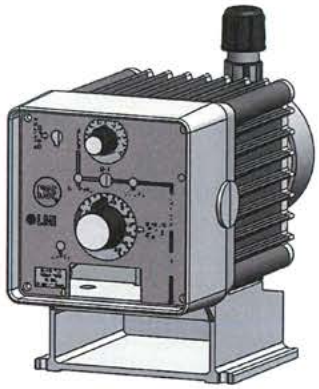
INTERNAL USE ONLY	Sales Order #:
Invoice #:	Extended Warranty Requested?
Inspection / Installation Date:	Start-up/ Inspection By:

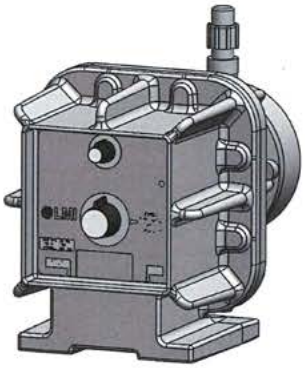
8. Component Operation and Maintenance Manuals

8.1 Pump

LMI
an Accudyne Industries brand







QUICK START GUIDE

For Series P, B, C, E, Roytronic A, and Excel AD

No. : 55383
Rev. : 00
Rev. Date : 04/2017

LMI
an Accudyne Industries brand

Precautions

The following precautions should be taken when working with LMI® metering pumps. Please read this section carefully prior to installation.

Protective Clothing

ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to SDS precautions from your solution supplier.

Water Pre-Prime

All LMI® pumps are pre-primed with water when shipped from the factory. If your solution is not compatible with water, disassemble the Pump Head Assembly. Thoroughly dry the pump head, valves, seal rings, balls and LIQUIFRAM™ diaphragm. Reassemble head assembly tightening screws in a crisscross pattern. Refill the pump head with the solution to be pumped before priming the pump. (This will aid in priming.)

Solution Compatibility

The evaluation performed by UL was tested with water only. LMI® pumps are tested to NSF 50 for use on hydrochloric acid (31%) and sodium hypochlorite (12.5%). These pumps are also certified to NSF / ANSI Standard 61 and 372. Please check our listings with NSF International to confirm certified chemicals and concentrations for use. E Series pumps are not certified to NSF 50, 61 or 372. Always refer to the solution supplier and the LMI® Chemical Resistance Chart for compatibility of your specific LMI® metering pump. Contact your local LMI® distributor for further information.

Tubing Connections

Inlet and outlet tubing or pipe sizes must not be reduced. Make certain that all tubing is SECURELY ATTACHED to fittings prior to start-up. ALWAYS use LMI® supplied tubing with your pump, as the tubing is specifically designed for use with the pump fittings. It is recommended that all tubing be shielded to prevent possible injury in case of rupture or accidental damage. If tubing is exposed to sunlight, black UV resistant tubing should be installed. Check tubing frequently for cracks and replace as necessary.

Fittings and Machine Threads

All fittings should be hand-tightened. An additional 1/8 - 1/4 turn after the fitting contacts the seal ring may be necessary to provide a leak-proof seal. Excessive over tightening or use of a pipe wrench can cause damage to the fittings, seals, or pump head. All LMI® pumps have straight screw machine threads on the head and fittings and are sealed by the seal rings or O-rings. **DO NOT use PTFE tape or pipe dope to seal threads. PTFE Tape may only be used on the 1/2" NPT thread side of the Injection Check Valve as well as stainless steel liquid end connections.**

Plumbing

Always adhere to your local plumbing codes and requirements. Be sure installation does not constitute a cross connection. Check local plumbing codes for guidelines. LMI® is not responsible for improper installations.

Back Pressure / Anti-Syphon Valve

If you are pumping downhill or into low or no system pressure, a back pressure / anti-syphon device such as LMI®'s Four Function Valve (4-FV) should be installed to prevent over pumping or syphoning. Contact your LMI® distributor for further information.

Line Depressurization

To reduce the risk of chemical splash during disassembly or maintenance, all installations should be equipped with line depressurization capability. Using LMI®'s Four-Function Valve (4-FV) is one way to include this feature.

Over Pressure Protection

To ensure safe operation of the pump it is recommended that some type of safety / pressure relief valve be installed to protect the piping and other system components from failing due to excessive pressure.

Chemical Concentration

There is a potential for elevated chemical concentration during periods of no flow, for example, during backwash in the system. Steps, such as turning the pump OFF, should be taken during operation or installation to prevent this. See your distributor about other external control options to help mitigate this risk.

Retightening Components

Plastic materials will typically exhibit creep characteristics when under pressure over a period of time and to insure a proper fit it may be necessary to retighten the head bolts periodically. To insure proper operation, we recommend tightening the bolts to 25 inch-pounds after the first week of operation and on a monthly basis thereafter.

Electrical Connections

To reduce the risk of electrical shock, install only on a circuit protected by a ground-fault circuit-interrupter (GFCI). The metering pump must be plugged into a grounded outlet with ratings conforming to the data on the pump control panel. The pump must be connected to a good ground. DO NOT USE ADAPTERS! All wiring must conform to local electrical codes. If the supply cord is damaged, it must be replaced by the manufacturer, stocking distributor, or authorized repair center in order to avoid a hazard.

Do not hook a US style pump plug into a non-US (UK, Aust, NZ or Swiss) wired power system. The US style 240 VAC power system has two 110 VAC hot legs and one neutral. The European style system has one 240 VAC hot leg and a neutral. Hooking up a US pump to the European wired system will cause pump failure.

For complete product documentation please visit:

support.lmipumps.com

From there, you can quickly access:

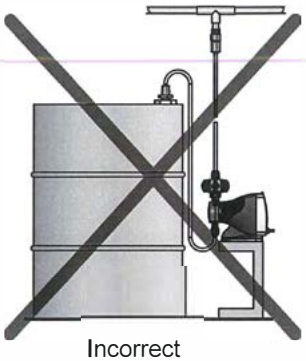
- The latest product manuals and technical documentation
- Sales brochures and promotional material
- Certification and engineering files

Search by keyword, product series, or model number

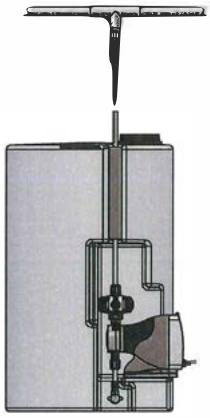
Filter by result type, product, and language

Download to your computer, tablet, or phone for offline access

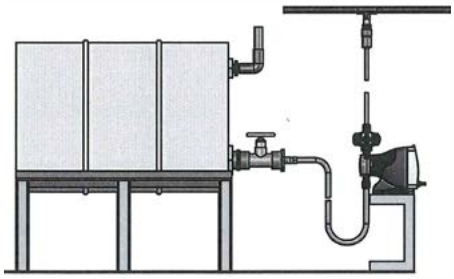
Pump Mounting



Incorrect



Flooded Suction with LMI Tank



Alternative Flooded Suction

⚠CAUTION **When pumping downhill or into a low or no pressure system, a back pressure / anti-syphon device should be installed to prevent overpumping or syphoning.**

Note: *NEVER position pump head and fittings horizontally.*

1. **Flooded Suction**
   The pump is mounted at the base of the storage tank. Recommended for very low outputs, solutions that gasify and high viscosity solutions.

2. **Suction Lift**
   When suction lift is less than 5ft (1.5m) for solutions having a specific gravity of water. For denser solutions, consult distributor. Your LMI® metering pump must be mounted so that the suction and discharge valves are vertical.

   a. Wall Bracket Mount
   The pump may be mounted using an LMI® Wall Mount Bracket Assembly (part no. 34643) directly above the solution tank. A pump mounted in this manner allows for easy changing of solution tanks or drums.

   b. Tank Mount
   The pump may be mounted on a molded tank provided there is a recess to keep the pump stationary. LMI®10-gallon tank (part no. 27421), 35-gallon tank (part no. 27400), and 50-gallon tank (part no. 26350) have molded recesses for pump mounting.

   c. Shelf Mount
   The pump may be mounted on a shelf (customer supplied) maintaining a suction lift of less than 5ft. (1.5m). An LMI® mounting kit (part number 10461) is available for securing the pump to a shelf.

Foot Valve / Suction Tubing Installation

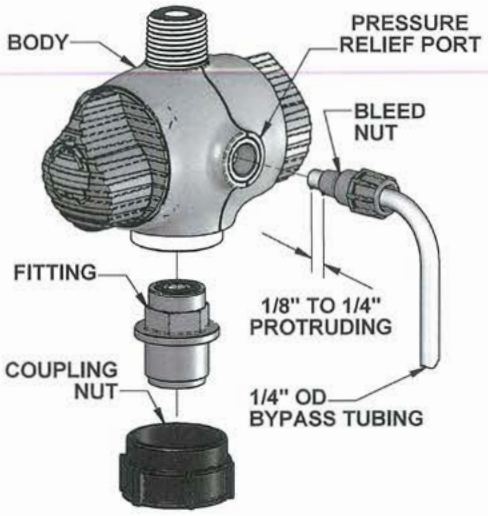
1. Attach the foot valve to one end of the suction tubing.
2. Slide the ceramic weight over the tubing end until it contacts the top of the foot valve coupling nut.
3. Place foot valve and tubing into the solution tank. Check that the foot valve is vertical and approximately 2 inches (50mm) from the bottom of the tank or drum. Connect the other end of the tubing to the suction side of the pump head.

Incorrect

Suction Lift

Four-Function Valve Installation

1. To mount to a pump, remove the discharge fitting from the pump (if present) leaving the cartridges in the pump head. Position the 4-FV coupling nut on pump head over cartridges with threads up, and insert 4-FV fitting and thread into pump head over cartridges. Tighten the fitting to 40in-lbs using a 13/16" or 20mm socket. Insert the large opening on the 4-FV into the 4-FV coupling nut and hand tighten. You can position the valve to have the pressure relief port in any convenient location by tightening the 4-FV coupling nut with the pressure relief port positioned 90º CCW from desired location, then holding the nut stationary while turning the valve the final 90º to desired position.



2. Connect 1/4" tubing to the pressure relief port and route to supply container.

3. Connect discharge line using LMI® tubing connection system or 1/2" pipe thread. The 4-FV is designed for double-ball checks. A second valve cartridge is required when mounting a 4-FV to an existing pump with a 300, 400, 800 or 900 series liquid end.

Tubing Connections

1. Insert tubing through Coupling Nut—Tubing should enter the smaller end of the Coupling Nut first, orienting the larger opening of the Coupling Nut toward the tubing end.
   a. For 1/4" OD tubing: Position the Female Ferrule so that 1/4" to 3/8" (5-10 mm) of tubing protrudes from the Female Ferrule. Orient the raised collar of the Ferrule toward the Coupling Nut.
   b. For 3/8" or 1/2" OD tubing: Position a Female Ferrule about 1 inch (25mm) from end of tubing. Orient the raised collar of the Female Ferrule toward the Coupling Nut. Then, insert the Male Ferrule onto the end of the tube, pushing the tube into the bottom of the groove in the Male Ferrule. Then slide the Female Ferrule down the tubing and with your fingers, press tightly into the Male Ferrule.

2. Firmly hand tighten the Coupling Nut onto the fitting.

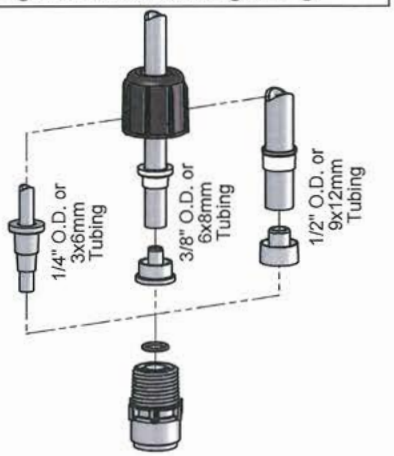
Note: *Tightening with pliers may cause the ferrules to break.*

DO NOT USE PLIERS OR PIPE WRENCH ON COUPLING NUTS OR FITTINGS.

DO NOT REUSE FERRULES—USE ONLY NEW FERRULES.

⚠ CAUTION

1. USE ONLY LMI® TUBING—ALWAYS use LMI® supplied tubing with your pump, as the tubing is specifically designed for use with the pump fittings.
2. DO NOT USE CLEAR VINYL TUBING ON THE DISCHARGE SIDE OF THE PUMP. The pressure created by the pump can rupture vinyl tubing.
3. Before installation, all tubing must be cut with a clean square end.
4. Valve and head connections from the factory are capped or plugged to retain pre-prime water. Remove and discard these caps or plugs before connecting tubing.



Start-up / Priming

⚠ CAUTION **READ THIS ENTIRE SECTION COMPLETELY BEFORE PROCEEDING.**

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may now start priming the pump.

Note: *The pump is normally self-priming if suction lift is 5ft. (1.5m) or less and the steps below are followed.*
Note: *Pumps are shipped from the factory with water in the pump head to aid in priming.*

For *Autoprime*™ Liquid Ends

1. Plug in or switch ON the pump.
2. While the pump is running, set the speed and stroke knob at 100%.
3. The suction tubing should begin to fill with solution from the tank as the AUTOPRIME™ valve purges air from the pump head.
4. Once the solution begins to exit the pump head through both the discharge valve and the AUTOPRIME™ valve, **SHUT THE PUMP OFF**.
5. The pump is now primed.
6. Proceed to output adjustment.

For *Fastprime*™ Liquid Ends

1. Plug in or switch the pump ON.
2. While the pump is running, set the speed and the stroke knob at 100%.
3. Turn the FASTPRIME™ knob 1 to 2 turns counter clockwise.
4. The suction tubing should begin to fill with solution from the tank.
5. A small amount of solution will begin to discharge out the return line of the FASTPRIME™ valve. Once this happens, turn the knob clockwise until hand tight and **SHUT THE PUMP OFF.**
6. The pump is now primed.
7. Proceed to output adjustment.

For LiquiPro™ or Legacy LMI Liquid Ends

***WITHOUT* Multi-Function Valve**

1. Plug in or switch ON the pump.
2. While the pump is running, set the speed and stroke knob at 100%.
3. The suction tubing should begin to fill with solution from the tank.
4. Once the solution begins to exit the pump head on the discharge side, **SHUT THE PUMP OFF**. (If pump is not equipped with an ON / OFF switch, disconnect the power cord).
5. The pump is now primed.
6. Proceed to output adjustment.

Note: *If the pump does not self-prime, remove the fitting on the discharge side of the pump head. Remove the ball and pour water or solution into the port until the head is filled. Replace valve, then follow start up / priming steps.*

***WITH* Multi-Function Valve**

1. & 2. See priming without multi-function valve.
3. Open the relief side (black knob) of the multi-function valve by turning 1/4 turn
4. The suction tubing should begin to fill with solution from the tank.
5. A small amount of solution will begin to discharge out the return line of the multi-function valve. Once this happens, 1/4 turn or return the knob to the 12:00 position and **SHUT THE PUMP OFF**. (If pump is not equipped with an on / off switch, disconnect the power cord.)
6. The pump is now primed.
7. Proceed to output adjustment.

Note: *If the pump does not self-prime, remove the multi-function valve on the discharge side of the pump head. Remove the check valve and pour water or solution into the port until the head is filled. Replace valve, then follow start up / priming steps.*

Output Adjustment

Once the pump has been primed, an appropriate output adjustment MUST be made. Pump output should be calculated and adjustments made accordingly.

Pump Output:

MAX PUMP OUTPUT x % SPEED x % STROKE

Example: P151-392SI

Use MAX Output = 24 GPD (24 gallons per day).

If the pump is set at 60% speed and 70% stroke length, the approximate pump output is:

24.0 x 0.60 x 0.70 = 10.08 GPD

Divide by 24 (hours in one day) to calculate in gallons per hour.

Note: *If pump is not equipped with speed adjustment, calculate by Max Pump Output x % Stroke only.*

Autoprime™ Liquid End

When installing a pump equipped with an AUTOPRIME™ Liquid End, connect the 1/2" OD Polyethylene tubing to the top vertical fitting, and route this line back to the supply tank. To ensure priming, this tubing should not be submerged in the solution. The horizontal fitting is the discharge, and the bottom vertical fitting is the suction.

Fastprime™ Liquid End

The FASTPRIME™ Head is equipped with a valve that allows for opening the head to atmospheric pressure. When installing a pump equipped with a FASTPRIME™ Head connect the 3/8" outer diameter clear vinyl tubing provided with the pump to the barbed nozzle. Route the vinyl return line back to the solution tank. This tubing must not be submerged in the solution.

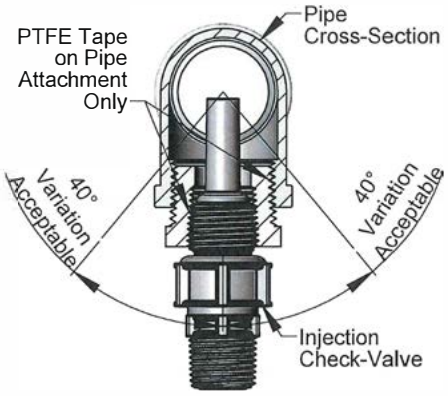
Injection Check Valve And Discharge Tubing Installation

1. Installing Injection Check Valve

a. The Injection Check Valve prevents back flow from a treated line. Install the injection check valve at the location where chemical is being injected into the system.

b. Any size Female NPT fitting or pipe tee with a reducing bushing to 1/2" Female NPT will accept the injection check valve. PTFE tape should only be used on threads that are connected with pipes.

c. When installing the Injection Check Valve, be sure to position it so that the valve enters the bottom of your pipe in a vertical position. Variations 40° left and right are acceptable.



Install Injection Valve Vertically

2. Connecting Discharge Tubing

Note: *Cut tubing to length needed for discharge line.*

a. Route tubing from the injection check valve to the metering pump, making sure it does not touch hot or sharp surfaces, or is bent so sharply that it kinks.

Calibration

The pump should be calibrated to adjust speed and stroke for your actual desired output.

Note: *For pumps equipped with built in calibration, see respective series manual.*

1. Be sure the pump is primed and discharge tubing, and Injection Check Valve are installed as they would be in normal service.

2. Place the Foot Valve in a graduated container with a volume of 1000 ml or more.

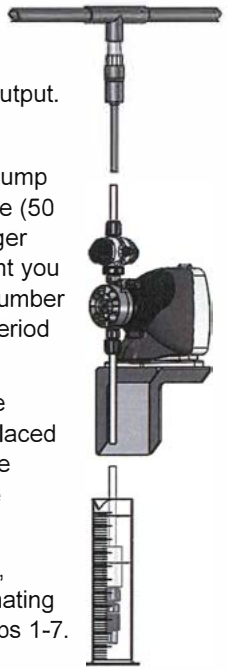
3. Plug in and switch pump to Internal Mode. Pump until all the air is exhausted from the suction line and head.

4. Turn the pump OFF. Refill graduated container to a level starting point.

5. Using a stopwatch or timer, turn pump ON for a measured amount of time (50 pump strokes minimum). The longer the time period, the more confident you can be of the results. Count the number of strokes during the calibration period when making comparisons.

6. Turn the pump OFF. Note the time elapsed in relation to volume displaced in the graduate. Now, calculate the output in the time unit you choose (minutes, hours, days etc.).

7. If the output is too low or too great, adjust speed and / or stroke, estimating required correction and repeat steps 1-7.



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AC & DC Motor Installation & Maintenance

Safety Notice: Be sure to read and understand all of the Safety Notice statements in MN408 or Product Specific manual for your motor. A copy is available at: http://www.baldor.com/support/product_manuals.asp

ACCEPTANCE
Thoroughly inspect this equipment before accepting shipment from the transportation company. If any damage or shortage is discovered do not accept until noted on the freight bill. Report all damage to the freight carrier.

SAFETY
Eye bolts, lifting lugs or lifting openings, if provided, are intended only for lifting the motor and motor mounted standard accessories not exceeding, in total 30% of the motor weight. These lifting provisions should never be used when lifting or handling the motor and driven equipment. Eye bolt lifting capacity rating is based on a lifting alignment coincident with eye bolt center line. Eye bolt capacity reduces as deviation from this alignment is increased. Be sure eye bolts are tight and prevented from turning before lifting.

INSTALLATION OUTSIDE THE USA:
Refer to MN408 and MN1383 for Compliance with European Directives. Copies are available at:
http://www.baldor.com/support/product_manuals.asp

MOTOR ENCLOSURE
ODP, Open drip proof motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure. TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present in indoor and outdoor locations.
Explosion protected motors, as indicated by a Nationally Recognized Testing Laboratory Certification mark and marking with Class, Division and Temperature Code are intended for installation in hazardous locations as described in Article 500 of the NEC. Refer to MN408 for more details.

MOUNTING
Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

Flange mounted machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.
For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.
Direct coupled machines should be carefully aligned and the shaft should rotate freely without binding.

GENERAL
The user must select a motor starter and overcurrent protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or applicable local codes. Special motors for use by United States Government including special specifications, master plans, etc. refer to the applicable master plans and specifications involved. On motors received from the factory with the shaft blocked, remove blocking before operating the motor. If motor is to be reshipped alone or installed to another piece of equipment, the shaft block must be installed to prevent axial movement and prevent brinelling of the bearings during shipment.

TESTING
If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, check the motor insulation resistance with a meg ohm meter. Depending on storage conditions it may be necessary to regrease or change rusted bearings. Contact Baldor District Office if resistance is less than 5 meg ohms.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Electrical shock can cause serious or fatal injury.

INSTALLATION
This motor must be installed in accordance with National Electric Code, NEMA MG-2, IEC standards or local codes.

WIRING
Connect the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. Refer to MN408 for additional details on lead marking. The wiring, fusing and grounding must comply with the National Electrical Code or IEC and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

GROUNDING
Ground the motor according to NEC and local codes. In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

ADJUSTMENT
The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

Noise
For specific sound power or pressure level information, contact your local Baldor representative.

VIBRATION
This motor is balanced to NEMA MG1, Part 7 standard.

BRUSHES (DC Motors)
Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn 1/2, (length specified in renewal parts data), replace the brushes.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

INSPECTION

Before connecting the motor to an electrical supply, inspect for any damage resulting from shipment. Turn the shaft by hand to ensure free rotation. Motor leads must be isolated before the shaft will turn freely on permanent magnet motors.

DRAIN PLUGS

One or more condensation drain plugs are provided on each endplate for various motor mounting configurations. For Washdown and totally enclosed, fan cooled or non-ventilated motors, the plugs in the lowest portion of the ends shields should be removed for operation (unless the motor has special stainless steel drains). All drains are located in the lowest portion of the ends shields.

MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Grease lubricated ball bearing motors may be mounted with the feet at any angle. After careful alignment, bolt motor securely in place. Use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

IP (Ingress Protection)

IP designations include two numerals, the first characteristic numeral is for ingress solid bodies and from dust. The second for ingress protection from liquid - water. Motors marked less than IP23 require additional protection from water.

GUARDING

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure. Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

STARTING

Before starting motor remove all unused shaft keys and loose rotating parts to prevent them from flying off. Check direction of rotation before coupling motor to load. The motor should start quickly and run smoothly and with little noise. If the motor should fail to start the load may be too great for the motor, the voltage is low or the motor has been miswired. In any case immediately shut motor off and investigate the cause.

ROTATION

To reverse the direction of rotation, disconnect and lockout power and interchange any two of the three AC power leads for three phase motors. For two-phase four wire, disconnect and lockout power and interchange the AC line leads on any one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

Maintenance Procedures

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.

Lubrication Information

Refer to motor nameplate for recommended lubricant. If none is shown, the recommended lubricant for anti-friction bearings (-15°F to 120°) is POLYREX EM. For Min Start Temp -100°F use AEROSHELL #7. For roller bearings is ExxonMobil SHC-220.

Relubrication Intervals
(For motors with regrease capability)

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at Table 1 intervals.

LUBRICATION INSTRUCTIONS

Cleanliness is important in lubrication. Any grease used to lubricate anti friction bearings should be fresh and free from contamination. Properly clean the grease inlet area of the motor to prevent grease contamination.

1. Select service conditions from Table 2.
2. Select lubrication interval (Table 1).
3. Adjust lubrication interval with multiplier from Table 3.
4. Select volume of grease from Table 4.

LUBRICATION PROCEDURE

Bearings should be lubricated while stationary and the motor is warm.

1. Locate the grease inlet, clean the area, and replace the pipe plug with a grease fitting.
2. Locate and remove the grease drain plug, if provided.
3. Add the recommended volume of recommended grease or add grease until clean grease appears at the grease drain, at the grease relief, or along the shaft opening.
4. Replace the grease inlet plug and run the motor for 15 minutes.
5. Replace the grease drain plug.

SPECIAL APPLICATIONS

For special temperature applications, consult your Baldor District Office.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 1. It is important to realize that the recommended intervals of Table 2 are based on

average use. Refer to additional information contained in Tables 2, 3 and 4.

Table1 Relubrication Interval

NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
Up to 210 incl. (132)	5500Hrs.	12000Hrs.	18000Hrs.	22000Hrs.
Over 210 to 280 incl. (180)	3600Hrs.	9500Hrs.	15000Hrs.	18000Hrs.
Over 280 to 360 incl. (225)	2200Hrs.	7400Hrs.	12000Hrs.	15000Hrs.
Over 360 to 5800 incl. (400)	2200Hrs.	3500Hrs.	7400Hrs.	10500Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29 ° C **	

* Special high temperature grease is recommended (Dow Corning DC44).

** Special low temperature grease is recommended (Aeroshell 7).

Note: Different grease types are generally incompatible and should not be mixed. Mixing different types can cause lubricant and bearing failure. Thoroughly clean bearing and cavity before changing grease type.

Table3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

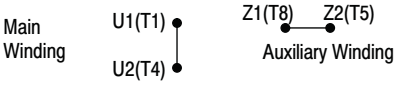
Table4 Amount of Grease to Add

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–400)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–400)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

Typical IEC vs NEMA Lead Marking

Single Phase Non-Reversible
Refer to the connection diagram provided on the Baldor motor.

Single Phase Reversible



Dual Voltage Reversible

DC Motors
Lead markings can be translated between IEC and NEMA designations as follows:

	NEMA	IEC
Armature	A1, A2	A1, A2
Series Field	S1, S2	D1, D2
Shunt Field	F1, F2	E1, E2

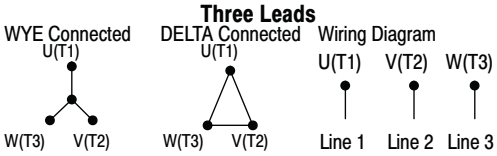
Refer to the connection diagram provided on the Baldor motor.

Three Phase
For single winding 3 phase motors, lead markings can be directly translated between IEC and NEMA designations. For these motors, the lead markings are:

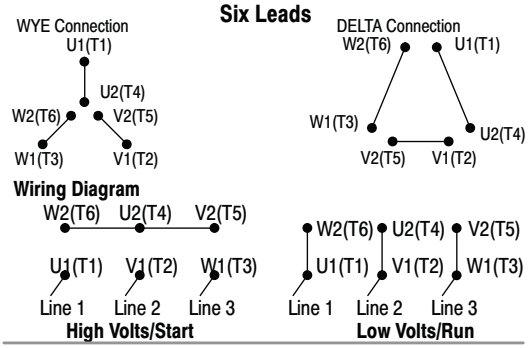
U1=T1 U2=T4 U3=T7 U4=T10
V1=T2 V2=T5 V3=T8 V4=T11
W1=T3 W2=T6 W3=T9 W4=T12

Refer to the connection diagram provided on the Baldor motor. Some examples are as follows:

Three Leads



Six Leads



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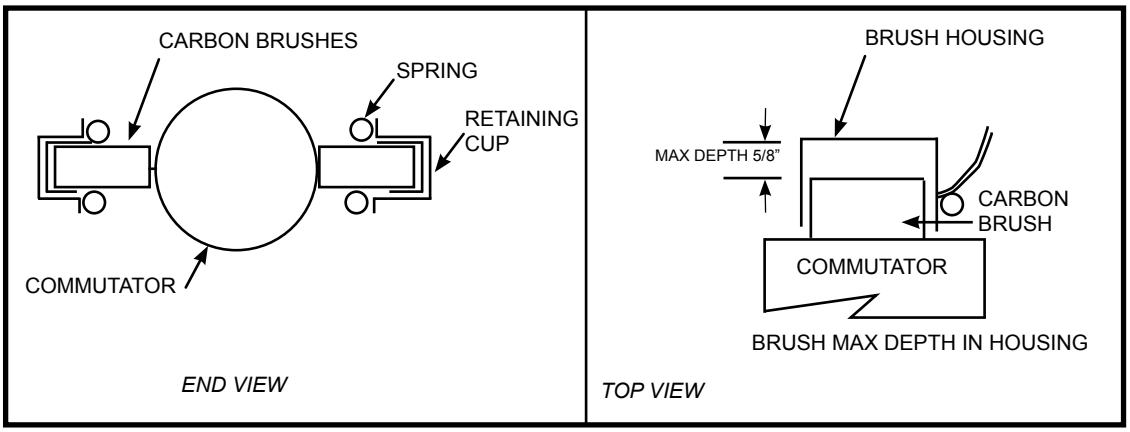
MN416 10/13

DC MOTOR BRUSH REPLACEMENT

Standard Baldor brushes have an initial length of 1 ¼". When brushes are worn to a length of 5/8" they and the brush springs should be replaced. **Operation of a motor with brushes shorter than this will cause the brushes to jam in the brush housing, arcing and wearing the commutator. A worn or damaged commutator will accelerate brush wear and further damage your motor**. It is normal for one brush to wear more than the other. Check them both.



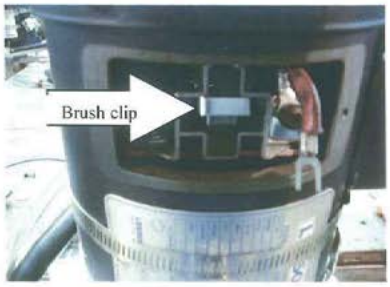
Tip: In a new motor with new brushes the back of the brush will be flush with the brush housing, as the brush wears the distance into the housing will increase. (See top view drawing below.) A quick measurement of the depth will be sufficient. When the brush is 5/8" into the holder it will need replacement. If in doubt change the brushes. Carry spares.

When changing brushes, be sure the Phillips screw holding the brush wire **and power** lead is tightened properly to assure a good electrical connection.

Commutator wear can be measured by installing new brushes and measuring the depth in the housing. A properly maintained motor will show little wear here (brush end flush with the housing). A worn commutator may need to be resurfaced to prevent excessive and rapid wear of replacement brushes.

- Remove brush covers, one on each side of the motor.

- Loosen screw next to the brush assembly.
- ♦ DO NOT REMOVE THE SCREW; just loosen it enough to remove the fork terminal.



- Carefully remove wire from motor case.

- Push inward and down to release the brush clip, then slowly allow clip to slide outward and set it aside.

- Slide brush assembly out of housing.

- Corrosion block will help lubricate and seal out water.

- Clean or replace brushes as needed. Use corrosion block on all motor parts to seal from corrosion and keep brushes from sticking.

- Re-install brush assembly and install fork terminal on screw.

- Re-install brush clip by pushing in then up and slowly releasing and it will clip into place.

- Re-install brush cover and spray it with corrosion block to keep moisture out.

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7200 Series Installation Instructions

FLOW METER LIMITED WARRANTY

Meters are warranted against defects in materials and workmanship to the original user for a period of thirteen (13) months from the date of factory shipment, provided the meter is installed, operated and maintained in accordance with King Instrument Company's instructions and recommendations.

This warranty does not apply if failure is caused or contributed to by any of the following: improper handling, improper storage, abuse, unsuitable application of the product, lack of reasonable and necessary maintenance, use exceeding suggested pressure and temperature maximums, improper packaging for return, or repairs made or attempted to be made by anyone other than King Instrument Company, Inc.

KING INSTRUMENT COMPANY, INC. MAKES NO WARRANTY AS TO THE FITNESS OF ITS PRODUCTS FOR SPECIFIC APPLICATIONS.

This warranty is valid for the original end-user only and does not apply to products that have been damaged or modified. This warranty is non-transferrable and is limited to replacement or repair. The liability of King Instrument Company arising out of its supply of the products, or their use, shall not in any case exceed the cost of correcting defects in the products as set forth above.

THIS WARRANTY IS A LIMITED WARRANTY AND SHALL BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO OTHER WARRANTIES WHICH EXIST BEYOND THE DESCRIPTION OR FACE HEREOF.

IN NO EVENT SHALL KING INSTRUMENT COMPANY BE LIABLE FOR LOSS OF PROFITS, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES.

Products should be returned, prepaid, to King Instrument Company, Inc. with proof of purchase. Call factory for Return Merchandise Authorization (RMA) number and return instructions.

THIS IS IMPORTANT INFORMATION. READ IT CAREFULLY BEFORE BEGINNING WORK.

1) Inspect meter for damage that may have occurred during shipping. Report any damage to the container to the freight carrier immediately.

2) Make sure your pressure, temperature, fluid and other requirements are compatible with the meter.

3) Select a suitable location for installation to prevent excess stress on the meter which may result from:

a) Misaligned pipe.

b) The weight of related plumbing.

c) "Water Hammer" which is most likely to occur when flow is suddenly stopped as with quick closing solenoid operated valves. (If necessary, a surge chamber should be installed. This will also be useful in pressure start-up situations.)

d) Thermal expansion of liquid in a stagnated or valve isolated system.

e) Instantaneous pressurization which will stress the meter and could result in tube failure.

NOTE: In closed thermal transfer or cooling systems, install the meter in the cool side of the line to minimize meter expansion and contraction and possible fluid leaks at the threaded connections.

4) Handle the meter carefully during installation.

a) Use an appropriate amount of teflon tape on external pipe threads before making connections. Do not use paste or stick type thread sealing products.

b) Extreme caution should be exercised when using PVC solvent cement around acrylic. Solvents can cause acrylics to stress crack.

c) Over tightening of plastic connections may result in fitting damage period.

5) Install the meter vertically with the inlet port at the bottom.

6) Meters with stainless steel fittings will support several feet of pipe as long as significant vibration or stress resulting from misaligned pipe are not factors.

7) Meters with plastic fittings must be installed so that fittings are not made to support any part of the associated plumbing. In addition, meter frame should be fastened to bulkhead, panel or column.

8) Meters used in gas service should have suitable valves plumbed in at the inlet and outlet of the meter. These valves should be no more than 1-1/2 pipe diameters from the meter ports. The valve at the outlet should be used to create back pressure as required to prevent float bounce. It should be set initially and then left alone. The inlet valve should be used for throttling purposes. Depending on the installation, valves may not be essential, but they are most useful in many installations. Remember: To get a correct reading of flow in gas service, it is necessary to know the pressure right at the outlet of the meter (before the valve).

9) Pressure and temperature maximums must never be exceeded.

Maximum Non-Shock Pressure and Temperature		
Fluid	**Temperature**	**Pressure**
Water	130° F	150 psig
Air	100° F	100 psig
Ambient Temp. 33° F -125° F		

CAUTION

- 7200 meters are not oxygen cleaned. Use with incompatible fluids may cause o-rings to swell and break.
- O-rings should be replaced if meter is disassembled after it has been in service.
- Extra caution must be exercised when meters are used in high pressure gas cylinder applications. Pressure regulators should be installed at the cylinder and at the inlet of the meter.
- Serious property damage and great personal injury could occur as the result of a meter misused or used in an unsuitable application.

CLEANING

Carefully remove the flowmeter from piping system. Remove the threaded outlet fitting and withdraw the float from the top. All necessary instrument components are now fully accessible for cleaning with a bottle brush and appropriate mild soap solution*. Before the meter is reassembled, inspect all parts for damage. O-rings should be replaced during meter maintenance and cleaning.

To reassemble, carefully guide the float back into the tube. When installing float/guide assembly make certain that the end of the guide fully engages the inlet and/or outlet float stop. Reinstall and tighten fittings in appropriate ports. Reinstall the instrument into the plumbing system after removing the old teflon tape (with a wire brush) and replacing with fresh teflon tape.

*Do not use cleaning agents that will damage float, tube or o-rings.

Meters should be cleaned with a mild soap solution. This will be an effective cleaner of rust stains. Caution must be used so that materials of construction are not damaged by cleaning solutions. Hard water deposits can be removed with 5% acetic acid solution (vinegar).

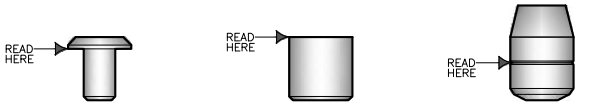
REPAIR

7200 meters that require repair should be sent to the factory. Please call for a Return Merchandise Authorization (RMA) number and return instructions.

WARNING:

Pressure and temperature ratings are based on a study of the engineering data for particular materials used in construction and on the design of individual models. This information is supplemented by destructive test results. Meters with stainless enclosures must never be operated without shields securely in place. Meters exposed to difficult environments such as those created by certain chemicals, excessive vibration or other stress inducing factors could fail at or below the suggested maximums. Never operate meters above pressure and temperature maximums. It is strongly recommended that all meter installations utilize an appropriate pressure relief valve and/or rupture disc. The pressure settings and locations of these devices should be such that meters cannot be over pressurized. Meter failure could result in damage to equipment and serious personal injury. Always use suitable safety gear, including OSHA approved eye protection when working around meters in service. We are happy to pass along chemical compatibility information that has been published by the manufacturer's of raw materials used in our products; however, this information should not be construed as a recommendation made by King Instrument Company, Inc. for a specific application.

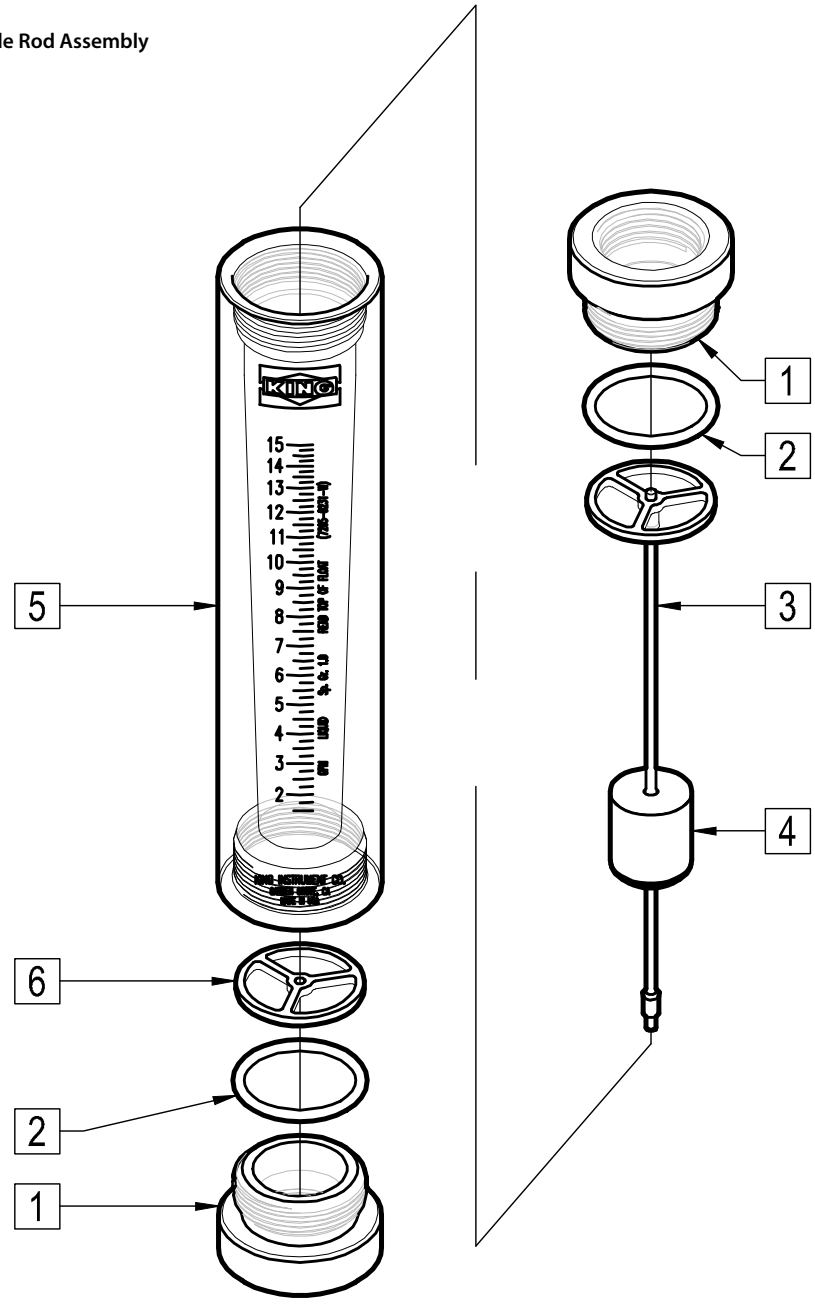
FLOAT TYPES AND ORIENTATIONS



GV FLOAT SL FLOAT SP FLOAT

7200 SERIES ASSEMBLY PARTS LIST:

1. End Fitting
2. End Fitting O-Ring
3. Outlet Float Stop/Guide Rod Assembly
4. Float
5. Acrylic Meter Tube
6. Inlet Float Stop



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Installation & Maintenance Instructions

2–WAY INTERNAL PILOT–OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION — GENERAL SERVICE
1″, 1¼″ OR 1½″ NPT

SERIES 8210 8211

I&M No.V5436R7

NOTICE: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation, Coil or Solenoid Replacement.

DESCRIPTION

Series 8210 valves are 2–way normally closed internal pilot–operated solenoid valves designed for general service. Valves are made of rugged forged brass. Series 8210 valves are provided with a general purpose solenoid enclosure.
Series EF8210 and 8211 are the same as Series 8210 except they are provided with an explosionproof or explosionproof/watertight solenoid enclosure.

OPERATION

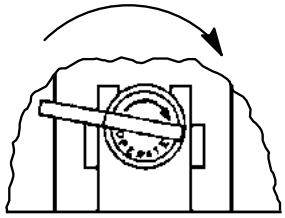
Normally Closed: Valve is closed when solenoid is de–energized; open when energized.

IMPORTANT: Minimum operating pressure differential is 5 psi.

Manual Operator (optional feature)

Manual operator allows manual operation when desired or during an electrical power outage. To engage manual operator (open the valve), turn lever clockwise until it hits a stop. Valve will now be in the same position as when the solenoid is energized. To disengage manual operator (close the valve), turn lever counterclockwise until it hits a stop.

To engage, turn lever clockwise until it hits a stop.



Partial view of Manual Operator

⚠ CAUTION: For valve to operate electrically, manual operator lever must be fully rotated counterclockwise.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number prefix and watt rating on nameplate.

Watt Rating AC/DC	Catalog Number Prefix	Solenoid Class	Maximum Ambient Temp.	Maximum Fluid Temp.
6 AC	None or DF	F	122°F (50°C)	180°F (82°C)
	HT	H	140°F (60°C)	180°F (82°C)
6.1 AC	None, KF, SF or SC	F	125°F (54° C)	180°F (82°C)
	HT, KH, ST or SU	H	140°F (60°C)	180°F (82°C)
11.2 DC	None or HT	F or H	77°F (25°C)	150°F (65°C)
11.6 DC	None, HT, KF, KH, SC, SF or ST	F or H	104°F (40°C)	150°F (65°C)

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Piping

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

⚠ CAUTION: To protect the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

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Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep medium flowing through the valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete rebuild kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

1. Disassemble valve in an orderly fashion using exploded views for identification and placement of parts. Refer to Figure 1 for AC construction; Figure 2 for DC construction. For 1″ or 1 ¼″ NPT valve construction, see Figure 1; for 1 ½″ NPT valve construction, see Figure 2.
2. Remove solenoid enclosure. See separate instructions.

- For valves supplied with optional manual operators, see section on ***Disassembly of Manual Operator***.

3. Unscrew solenoid base sub−assembly from valve body. Then remove core assembly with core spring and solenoid base gasket. For AC construction (Figure 1) core spring is a loose piece.
4. For normal maintenance (cleaning) it is not necessary to remove the valve seat. However, for valve seat removal use a 7/16″ thin wall socket wrench
5. Remove bonnet screws, valve bonnet, diaphragm spring, diaphragm assembly, body gasket, body passage eyelet (present on current valve constructions only) and body passage gasket.
6. All parts are now accessible for cleaning or replacement. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

− Service Notice −

When installing a new ASCO Rebuild Kit, please be aware that the diaphragm assembly may not be identical to the diaphragm assembly in the valve. See Figure 1 for alternate diaphragm constructions. The two diaphragm constructions are interchangeable and will perform equally well.

⚠ CAUTION: To ensure proper valve operation, install all parts supplied in ASCO Rebuild Kit. Do not mix old and new parts.

Valve Reassembly

1. Lubricate body gasket, body passage gasket, bonnet gasket and solenoid base gasket with DOW CORNING® 200 Fluid lubricant or an equivalent high−grade silicone fluid.
2. Install body passage gasket, body passage eyelet, diaphragm assembly, diaphragm spring, valve bonnet and bonnet screws. Hand thread screws as far as possible. Then torque bonnet screws in a crisscross manner to 144 ± 15 in−lbs [16,3 ± 1,7 Nm].
3. If removed, install valve seat in valve body. Apply a small amount of thread compound compatible with valve media to valve seat threads. Torque valve seat to 75 ± 10 in−lbs [8,5 ± 1,1 Nm].

- For valves supplied with optional manual operator, see section on ***Reassembly of Manual Operator***.

4. For AC construction (Figure 1), install core spring in core assembly. Wide end of core spring in core first, closed end protrudes from top of core.
5. Install solenoid base gasket, core assembly with core spring and solenoid base sub−assembly in valve body. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
6. Install solenoid. See separate instructions.

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

7. Restore line pressure and electrical power supply to valve.
8. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* indicates the solenoid is operating.

Disassembly of Manual Operator

1. Unscrew solenoid base sub−assembly from manual operator body.
2. Unscrew manual operator body from valve body. Then remove stem retainer from base of manual operator body and stem/spacer sub−assembly.
3. Pull stem/spacer sub−assembly with stem gasket from side of manual operator body. Then remove core assembly with core spring, solenoid base gasket and manual operator bonnet gasket.
4. For further disassembly refer to section on ***Valve Disassembly*** step 4.

Reassembly of Manual Operator

1. Lubricate stem gasket with DOW CORNING® 111 Compound lubricant or an equivalent high−grade silicone grease.
2. For AC construction (Figure 1), install core spring in core assembly. Wide end of core spring in core first, closed end protrudes from top of core.
3. Holding the manual operator body in a horizontal position, install core assembly with core spring from the bottom end.
4. Insert the stem/spacer sub−assembly with the stem gasket into the side hole of the manual operator body. Rotate the lever of the stem/spacer sub−assembly to the 12 o'clock position.
5. Install stem retainer on base of manual operator body and simultaneously engage it into the slot provided on the stem/spacer sub−assembly.

IMPORTANT: The spacer on the stem/spacer sub−assembly *must be inside* of the stem retainer for AC construction (Figure 1) and *outside* of the stem retainer for DC construction (Figure 2).

6. Install manual operator bonnet gasket and body with preassembled parts into valve body. Torque manual operator body to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
7. Replace solenoid base gasket and solenoid base sub−assembly. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
8. For further reassembly, refer to ***Valve Reassembly*** step 6.

Torque Chart

Part Name	Torque Value Inch–Pounds	Torque Value Newton–Meters
Solenoid base sub–assembly	175 ± 25	19,8 ± 2,8
Manual operator body		
Bonnet screw	144 ± 15	16,3 ± 1,7
Valve seat	75 ± 10	8,5 ± 1,1

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

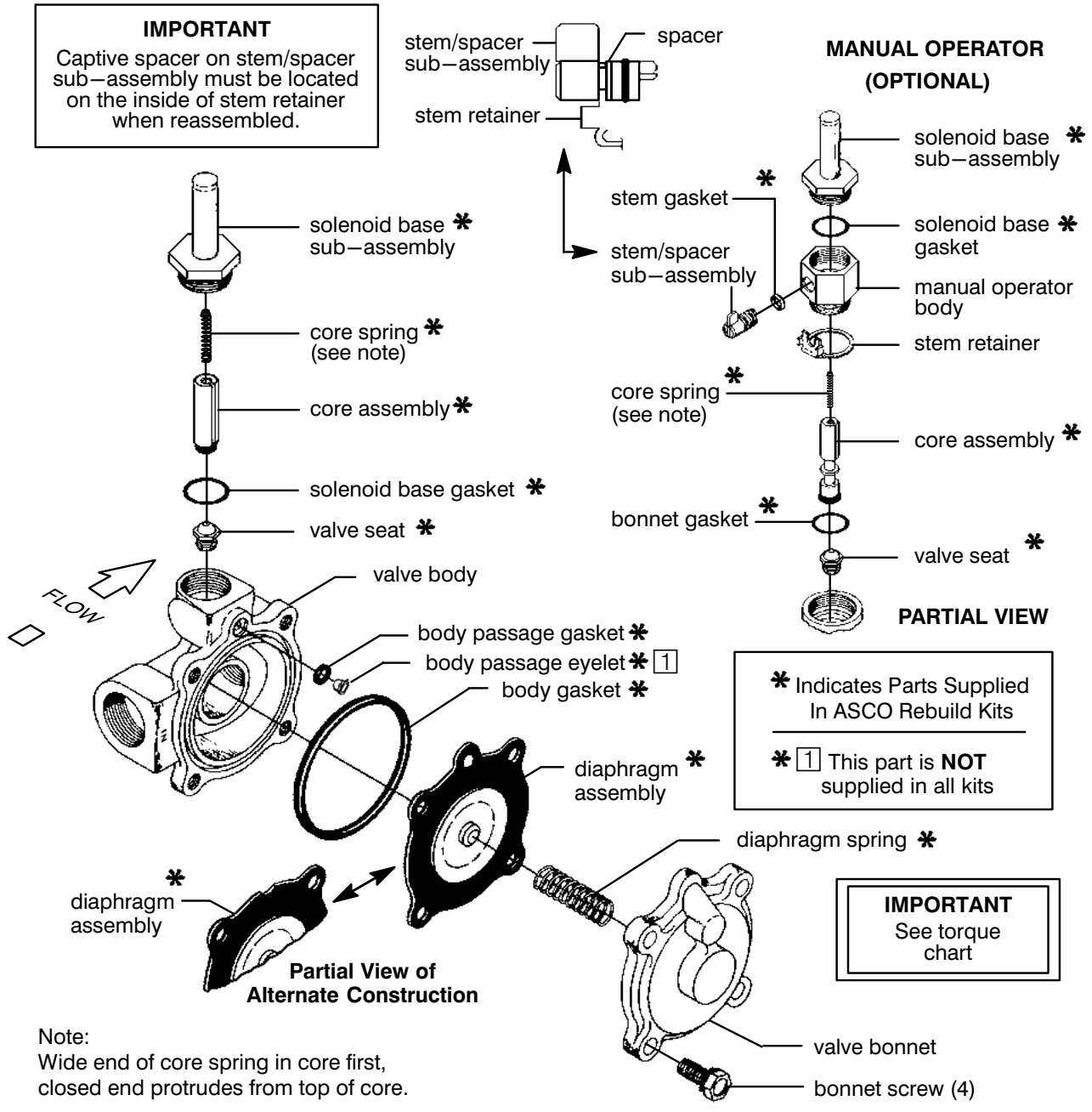

Figure 1. Series 8210 valve without solenoid, AC construction with 1″ or 1 ¼″ NPT valve body shown.

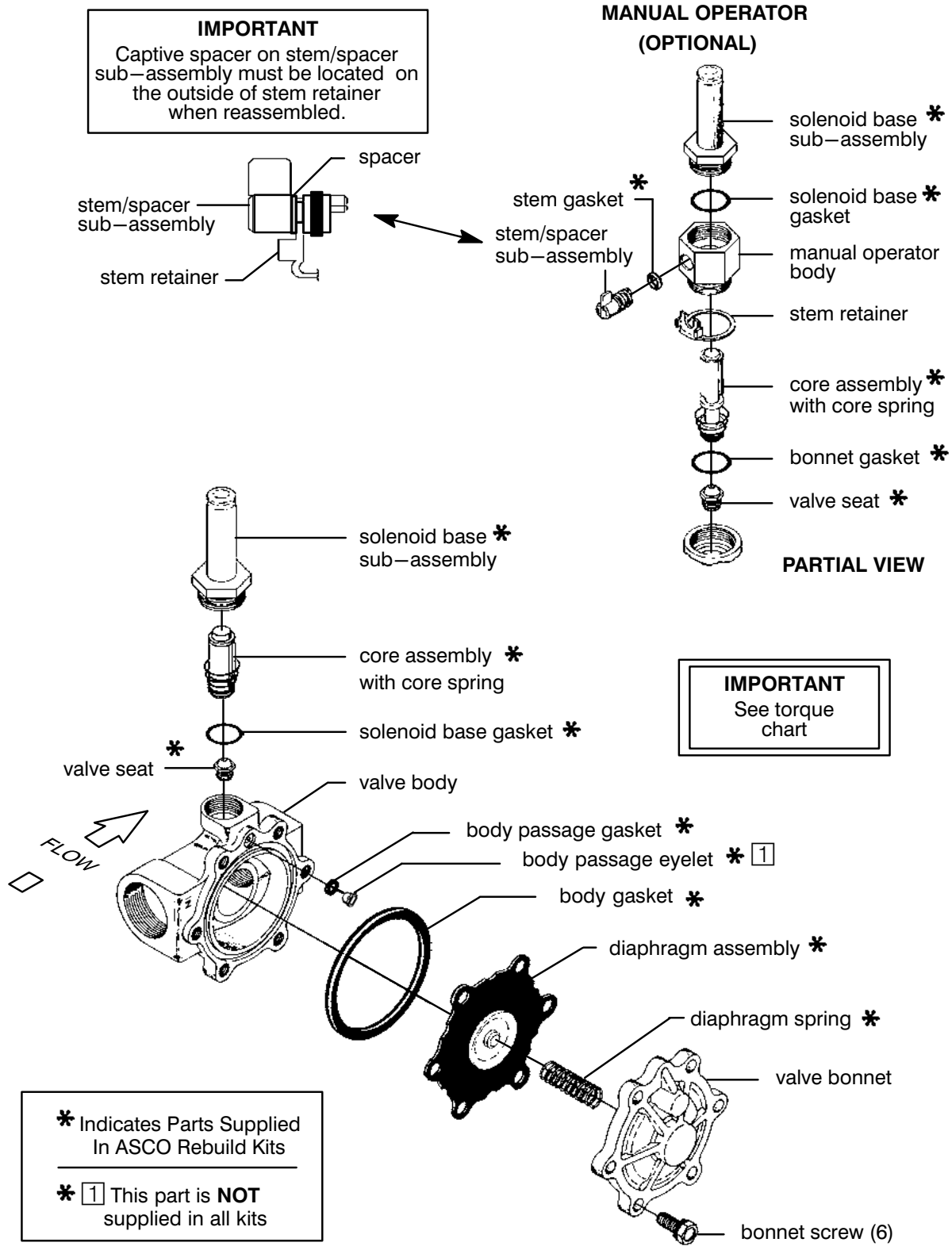

Figure 2. Series 8210 valve without solenoid, DC construction with 1 ½″ NPT valve body shown.

ASCO® 50 Hanover Road, Florham Park, New Jersey 07932 www.ascovalve.com

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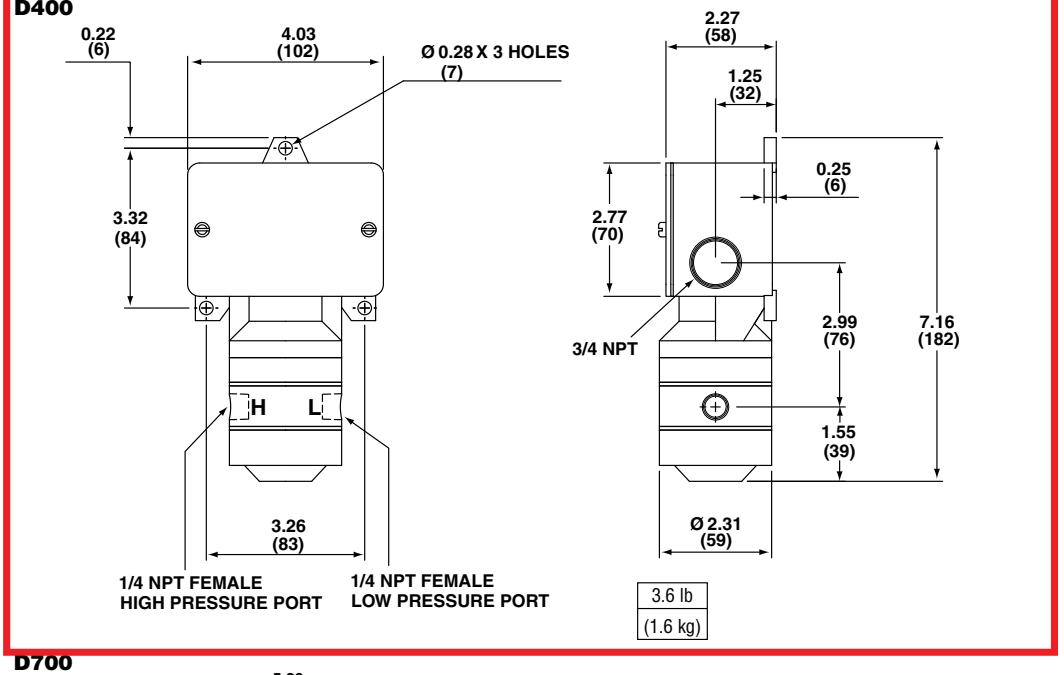
8.5 Differential Pressure Switch

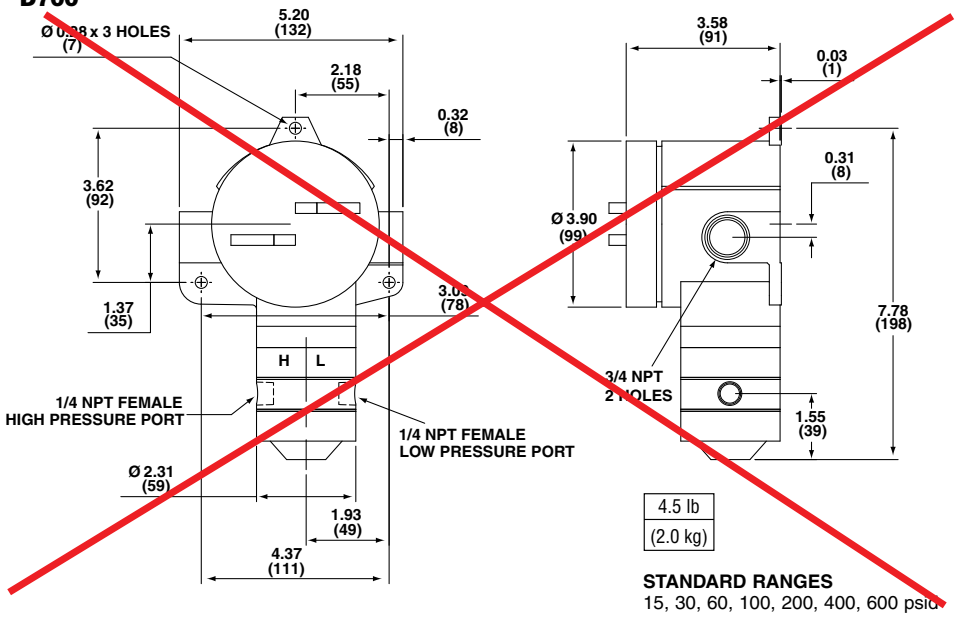
Installation and Maintenance Instructions for D400 & D700 ASHCROFT® Snap Action Switches for Differential Pressure Control

ASHCROFT®

D400



D700



STANDARD RANGES
15, 30, 60, 100, 200, 400, 600 psid

INTRODUCTION

The Ashcroft® differential pressure switch is a precision built U.L. and C.S.A. approved control device which features a mechanical snap action switch. Controllers are available for operation on various pressure differentials with fixed or variable switching differentials. Also, manual reset types are available for operation on increasing or decreasing pressure. The manual reset types remain tripped until reset by pressing a button on the top of the enclosure. The standard electrical switch is SPDT and is available with various electrical characteristics. Two SPDT switch elements mounted together are available except on variable deadband and manual reset types. Various wetted material constructions for compatibility with a wide range of pressure media may be obtained.

The Ashcroft snap action temperature switch is furnished in the standard NEMA 4 and explosion proof NEMA 7 and 9 enclosure styles. Both enclosures are epoxy coated aluminum castings.

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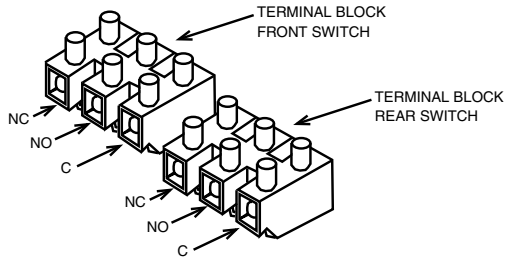
Installation and Maintenance Instructions for D400 & D700 ASHCROFT® Snap Action Switches for Differential Pressure Control

ASHCROFT®

INSTALLATION
These controls are precision instruments and should never be left with internal components exposed. After installation ensure that covers are in place and conduit openings are closed.

MOUNTING D400 AND D700 SERIES
There are three holes external to the enclosures for surface mounting. The locations of these holes is shown on the general dimension drawing. The controls may also be mounted directly on the pressure line using the pressure connections.

ELECTRICAL CONNECTIONS
Remove cover
D400 Series – two screws hold cover to enclosure
D700 Series – cover unscrews



CONDUIT CONNECTIONS
Note – It is recommended that Teflon® tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.
D400 Series standard – one ¾ NPT conduit hole right side.
D700 Series standard – two ¾ NPT conduit holes with one permanent plug. *NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.*
D400 & WT700 Series – XJL variation – two ¾ NPT conduit holes with two ¾ to ½ NPT reducing bushings.
D400 Series – XJK variation – two ¾ NPT conduit holes.

D400 SERIES
SPDT – Wire directly to the switch according to circuit requirements. On controls with pilot lights, wire lights according to circuit diagram on the inside of the cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more pilot lights.

2-SPDT – Dual switching elements consist of two SPDT switches mounted together in a bracket. The switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure, but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads provided on rear switch and leads provided for hermetically sealed switch components are color coded as follows:

Common	– White
Normally Closed	– Red
Normally Open	– Blue

See SPDT instructions for pilot light hook-up.

D700 SERIES
SPDT – Wire directly to the switch according to circuit requirements.

2-SPDT – Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation 5/16″, insert in proper terminal connector and tighten clamping screw to secure.

ADJUSTMENT OF SETPOINT
D400 & D700 Series – A single setpoint adjustment nut (7/8″) is located centrally at the bottom on the inside of the enclosure. The direction of turning is indicated on a label affixed to the inside of the control enclosure.
A typical calibration procedure would be as follows:

Static Working Pressure	– 600 psig
Adjustable Differential Range	– 30/200 psid
Differential Setpoint	– 150 psi above static working pressure

Simultaneously raise the high and low side pressure to 600 psig. Maintain the low side pressure at 600 psig. Raise the high side pressure to 750 psig to obtain 150 psi differential.

Turn the adjustment nut until the switch changes mode at 150 psi differential. When the setpoint has been achieved, raise and lower the high side pressure to ensure that the differential setpoint is correct.

D450 and D750 VARIABLE DEADBAND SWITCHES
Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband – rotation to the right decreases deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 2% to 9% of pressure range depending on range segment and the type of diaphragm.

ADJUSTMENT OF SETPOINT
As received, the differential pressure switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right. This will provide the smallest deadband. Pressurize the system to the required setpoint and turn the adjustment nut until the switch changes mode. Lower the pressure to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper setpoint will be changing upward with this adjustment. Lower the pressure to reset the switch. Increase the pressure to the desired setpoint and turn the adjustment nut until the switch changes mode. Lower the pressure and check the reset point and deadband.

Note – As indicated above, adjustment of setpoint is made by use of 7/8″ nut. The precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

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To download complete manual, visit:
https://www.minarikdrives.com/documents/250-0086.pdf

Minarik DRIVES

MM23000 Series

MM23001C

User's Manual

SCR, Adjustable Speed Drives for DC Brush Motors

Specifications

Model	Max. Armature Current (Amps DC)	HP Range @ 90 VDC	HP Range @ 180 VDC	Enclosure
MM23011C	1.5	1/20 - 1/8	1/10 - 1/4	Chassis
MM23111C				NEMA 1
MM23211C				NEMA 1 w/ Reversing
MM23411C				NEMA 4X
MM23072A				Chassis
MM23001C *	10	1/8 - 1	1/4 - 2	Chassis
MM23101C **				NEMA 1
MM23201C **				NEMA 1 w/ Reversing
MM23401C				NEMA 4X
MM23071A *				Chassis

* Heat sink kit 223-0159 must be used when the continuous output current is above 5 amps.
** Heat sink kit 223-0174 must be used when the continuous output current is above 5 amps.

AC Line Voltage	115 VAC or 230 VAC ±10%, 50/60 Hz, single phase
Armature Voltage (115 VAC Input)	0–90 VDC
Armature Voltage (230 VAC Input)	0–180 VDC
Form Factor	1.37 at base speed
Field Voltage (115 VAC Input)	50 VDC (F1 to L1); 100 VDC (F1 to F2)
Field Voltage (230 VAC Input)	100 VDC (F1 to L1); 200 VDC (F1 to F2)
Max. Field Current	1 ADC
Accel. Time Range:	
for 0–90 VDC Armature Voltage	0.5–11 seconds
for 0–180 VDC Armature Voltage	0.5–22 seconds
Decel. Time Range:	
for 0-90 VDC Armature Voltage	coast to a stop–13 seconds
for 0–180 VDC Armature Voltage	coast to a stop–25 seconds
Analog Input Voltage Range (signal must be isolated; S1 to S2):	
for 0–90 VDC Armature Voltage	0–1.4 VDC
for 0–180 VDC Armature Voltage	0–2.8 VDC

Specifications (Continued)

Input Impedance (S1 to S2)	100K ohms
Load Regulation	1% base speed or better
Vibration	0.5G max (0–50 Hz) 0.1G max (>50 Hz)
Safety Certification	UL Listed Equipment, file # E132235 UL Overload Protection CSA Certified Component, file # LR41380
Ambient Temp. Range (chassis drive)	10°C–55°C
Ambient Temp. Range (cased drive)	10°C–40°C

Suffix Definitions

A: Basic drive with power LED and trim pots are perpendicular to board.

C: Basic drive.

C-H: Basic drive with inhibit style connector for meter. Available on model MM23001C.

C-Q: Basic drive with power LED and quick disconnect terminal. Available on models MM23001C and MM23011C.

Troubleshooting

Warning

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the drive while troubleshooting. High voltages can cause serious or fatal injury.

Before troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the voltage selection switch settings match the AC line and output voltages.
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

For additional assistance, contact your local Minarik Drives distributor or the factory direct at: Tel.: 1-800-MINARIK (646-2745) or Fax: 1-800-394-6334

Problem	Possible Causes	Suggested Solutions
Line fuse blows.	1. Line fuse is the wrong size. 2. Motor cable or armature is shorted to ground. 3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing).	1. Check that the line fuse is correct for the motor size. 2. Check motor cable and armature for shorts. 3. Add a blower to cool the drive components; decrease TORQUE settings, or resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or “jams”. See page 44 for information on adjusting the TORQUE trimpot.

Problem	Possible Causes	Suggested Solutions
Line fuse does not blow, but the motor does not run.	1. Speed adjust pot or speed reference voltage is set to zero speed. 2. INHIBIT terminals are jumpered. 3. S2 is shorted to S1. 4. Drive is in current limit. 5. Drive is not receiving AC line voltage. 6. Motor is not connected.	1. Increase the speed adjust pot or speed reference voltage setting. 2. Remove jumper from the INHIBIT terminals. 3. Remove short. 4. Verify that motor is not jammed. Increase TORQUE setting if they are set too low. See page 44. 5. Apply AC line voltage to L1 and L2. 6. Connect motor to A1 and A2.
Motor does not stop when the speed adjust potentiometer is full CCW.	MIN SPD setting is too high.	Calibrate MIN SPD. See page 43.
Motor runs in the opposite direction (non-reversing drives).	Motor connections to A1 and A2 are reversed.	Reverse connections to A1 and A2.

Problem	Possible Causes	Suggested Solutions
Motor runs too fast.	1. MAX SPD and MIN SPD are set too high. 2. Motor field connections are loose (shunt wound motors only).	1. Calibrate MAX SPD and MIN SPD. See page 43. 2. Check motor field connections.
Motor will not reach the desired speed.	1. MAX SPD setting is too low. 2. IR COMP setting is too low. 3. TORQUE setting is too low. 4. Motor is overloaded.	1. Increase MAX SPD setting. See page 43. 2. Increase IR COMP setting. See page 44. 3. Increase TORQUE setting. See page 44. 4. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load.	1. IR COMP is set too high. 2. Motor bouncing in and out of current limit.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. See page 45. 2. Make sure motor is not undersized for load; adjust TORQUE trimpot CW. See page 44.

Unconditional Warranty

A. Warranty - Minarik Drives warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3,000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, Minarik Drives will repair or replace, at its sole discretion, such products that are returned to Minarik Drives, 14300 De La Tour Drive, South Beloit, IL 61080 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns for special controls will be evaluated on a case-by-case basis. Minarik Drives is not responsible for removal, installation, or any other incidental expenses incurred in shipping the products to and from the repair point.

B. Disclaimer - The provisions of Paragraph A are Minarik Drives's sole oblication and exlude all other warranties of merchantability for use, express or implied. Minarik Drives further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

C. Limitations of Liability - In the event of any claim or breach of any of Minarik Drives's obligations, whether express or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, express or implied, or claim of liability that might, despite Paragraph B, be decided against Minarik Drives by lawful authority, Minarik Drives shall under no circumstances be liable for any consequantial damages, losses, or expense arising in connection with the use of, or inability to use, Minarik Drives product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, Minarik Drives's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, stict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

Any action against Minarik Drives based upon any liability or obligation arising hereunder or under any lap applicable to the sale of equipment or the use thereof, must be commenced within one ear after the cause of such action arises.

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www.minarikdrives.com
Document number 250–0091, Revision 9
Printed in the U.S.A – 10/13

Polymer Activation & Hydration Technologies

Velocity Dynamics, LLC
543 S. Pierce Ave.
Louisville, CO 80027
PH (303) 530-3298 ● FX (303) 530-3368
www.velodynesystems.com

For Service Call 303-530-3298

Sludge Feed Pump

EQUIPMENT SUMMARY FORM

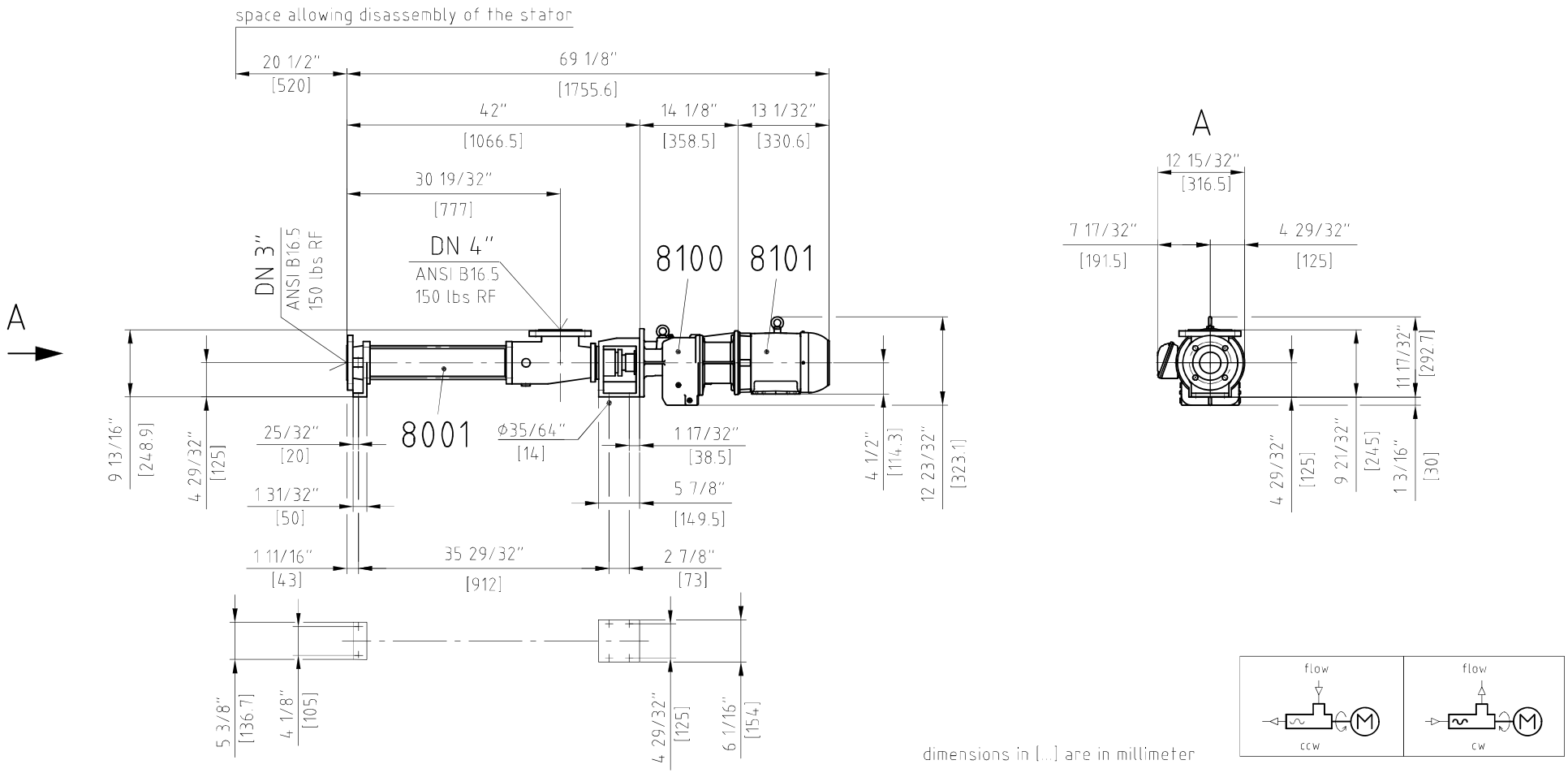
Owner:	City of Rock Island, WA	**Date:**	1/15/2020
Contractor:	DBJ Construction LLC		
Project Name:	Screw Press Dewatering Equipment Procurement	**Project No.:**	10612

Summary of Equipment

1. Equipment Item: Sludge Feed Pump
2. Manufacturer: Seepex
3. Equipment ID No.(s) Sludge Feed Pump SP-PMP
4. Location of Equipment Dewatering Building
5. Weight of Individual Components (Over 100 Pounds)
   Gearbox - 75 lbs. , Motor - 60 lbs.
6. Nameplate Data:
   - Horsepower: 5 HP
   - Amperage: 6.49 A
   - Voltage: 460
   - Service Factor (S.F.): 1.15
   - Speed: 1750
   - ENC Type: TEFC
   - Capacity:
   - Other:
7. Manufacturer's Local Representative:
   - Name: Victor Pedroni
   - Address: 4580 Klahanie Dr. SE #271, Issaquah, WA 98029
   - Phone Number: 1-425-369-6164
8. Maintenance Requirements:
   Change oil every 20,000 hrs or 4 yrs. Replace stator, pin joint and mechanical seal as required.
9. Lubrication List:
   Gearbox - ISO VG220, Mobilgear 600XP220 or equivalent
10. Spare Parts: (recommendations):
    none.
11. Comments:

Copyright: This drawing is our property and patented for us according to the law of copyright and associated rights !

verbindlich für Kommissions-Nr.:
binding for comission-no.: 866021



dimensions in [...] are in millimeter

Quant.	Denomination	Item	Material	Note	Weight / kg
1	motor: WEG 00518ST3QIE184TC-W22	8101			50
1	gear: Nord SK32F-180TC	8100			47
1	pump: BN 10-12 / 17-6L / 30-6LT / 15-12T	8001			57

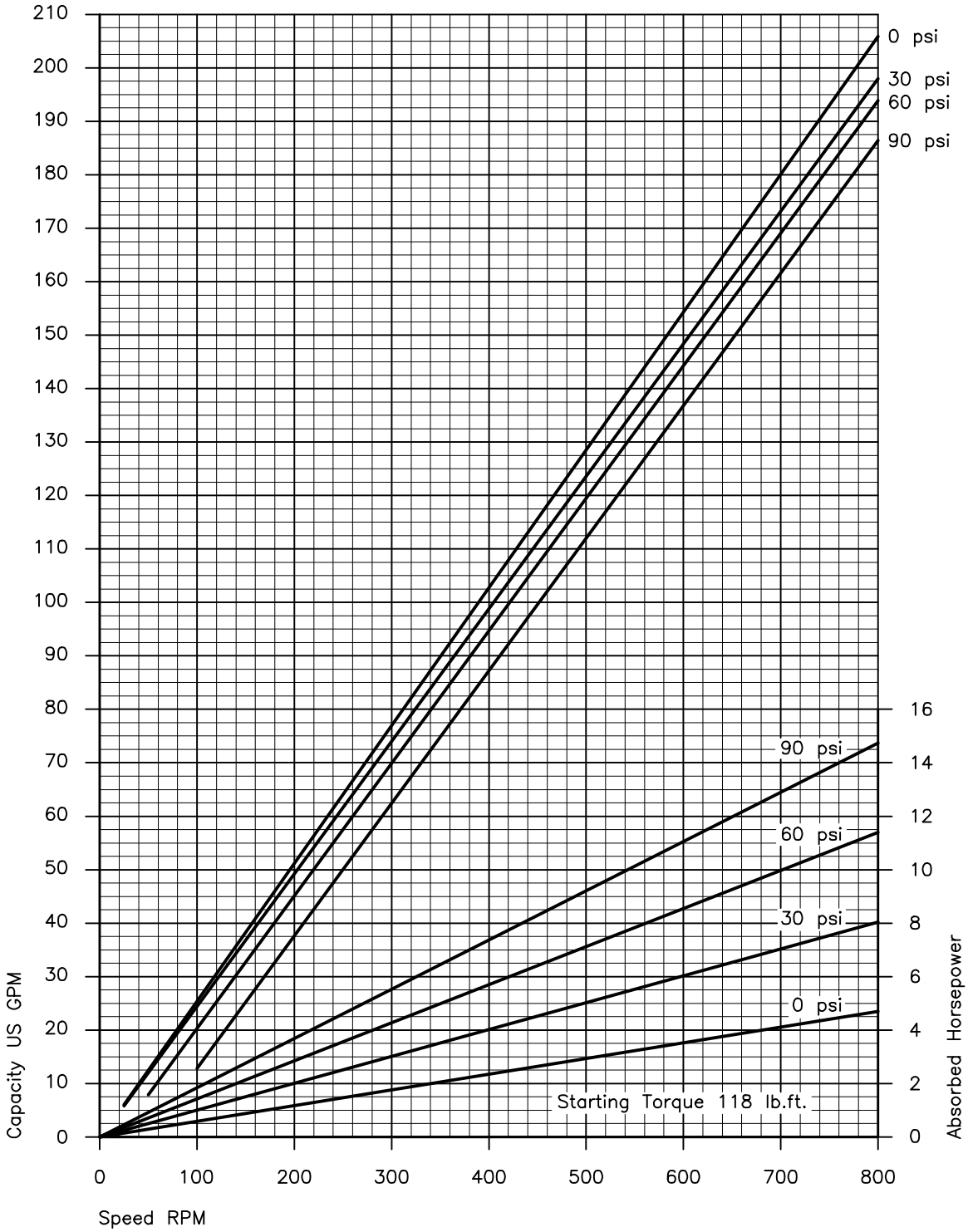
SEEPEX.
ALL THINGS FLOW

		Name	Day	Scale	Weight	Denomination
2018	Drawn	cbo	09.05.	1:20	154 kg	dimensional drawing
	Checked	lsh	10.05	EDP-No. 172218.dwg		Drawing-no. 262-C37/0100-C-701A4

General tolerances for dimensions without specified tolerances acc. to DIN ISO 2768-v

SEEPEX.
ALL THINGS FLOW

Characteristic Curves
Size
17–6L



Values based upon water 68°F ; For notes on drive selection refer to PER

CHA.17–6L_6, B 12.02us

Order No.	**P02003249**
Data sheet	**866021**
Version 1	**Item 10**

SEEPEX.
ALL THINGS FLOW

SEEPEX Inc.
511 Speedway Drive
Enon, OH 45323
Phone (937) 864-7150
sales.us@seepex.com
www.seepex.com

SEEPEX

Order No.	P02003249
Date	8/30/2017
Commission no.	866021
Offer No.	500106066/1 - 10

Customer

FKC Co.Ltd.

Purchase order no.	
Project	Rock Island, WA

qty.: 1

Progressive cavity pump

BN 17-6L / A1-J0-L8-F0-GA

Application data

U 495 SLX011

Conveyed product	thin sludge
Remark	WAS
Flowability	flowable
Viscosity	low viscosity (<500 cP/mPas)
Solids content	1-2%
Size of solids	≤2 mm
Specific gravity	unknown, 1 kg/dm³ assumed
Product temperature	32°F - 113°F
pH value	5-9
Kind of operation	continuous
Operating hours	8h/day
Location	indoor, dry atmosphere
Altitude of installation	up to 1000 m assumed
Surrounding temperature	normal (32-113°F)

Performance data

	Capacity	**Pressure**	**Speed**	
	14 USGPM	15 psi	57 rpm	min
	66 USGPM	15 psi	267 rpm	max

Starting torque	160 lb.ft
Req. power at pump shaft	2.7 HP
Inlet pressure	flooded suction (up to 0,5bar)
NPSHr	8.99 ft

Tolerances according to SEEPEX standards.

Materials and executions

Installation	horizontal
Direction of rotation	counter clockwise (left)
Lantern - Design	with cover plates
Lantern - Material	EN-JL 1040 (gci-25)
Lantern - Flange diameter	250 mm
Suction casing - Design	standard
Suction casing - Material	EN-JL 1040 (gci-25)
Pressure branch - Design	standard
Pressure branch - Material	EN-JL 1040 (gci-25)
Position of branch	position 1
Suction connection	DN 4" ANSI B16.5 Class 150
Pressure connection	DN 3" ANSI B16.5 Class 150
Joint - Design	with rotorsided UJ-sleeve protection 1.4021, divided
Joint - Material	standard
Joint - Universal joint sleeve: material	NBR - Perbunan

Joint - Joint Grease	joint grease SEEPEX 30321
Coupling rod - Design	standard
Coupling rod - Material	1.4404 / AISI 316L
Rotor - Design	standard
Rotor - Material	1.0503 (C45) / AISI 1045
Rotor - Coating	ductile chromium coating
Stator - Design	standard with TSE, sensor sleeve 1.4404 - Chamfered on suction side
Stator - Material	NBR - Perbunan
Shaft sealing	mechanical seal
Code	single acting mech. seal - GA
Shaft diameter	55 mm
Make	Burgmann
Type	MG1-G60 Q1Q1 VGG
Casing - material	1.4408 / ASTM A351 grade CF8M
Casing - connection standard	NPT
Plug-in Shaft - Design	standard
Plug-in Shaft - Material	1.4404 / AISI 316L
Plug-in Shaft - Drilling diameter	40
Plug-in Shaft - Drilling depth	75
Bolting - Design	standard
Painting - Number of colors	single-colored standard
Painting - Painted components	1 complete combination
Painting - Color	Standard Enamel (SEEPEX Blue)

Drive

Drive Type	Gear & Motor at freq. inv.
Type	Gear
Make	Nord
Model	SK32F/180TC
Mounting position	B5
Ratio (i)	6.74
Flange diameter	250 mm
Shaft diameter	40 mm
Shaft length	80 mm
Shaft drawing	716/0100-003B4

	Norm	**Min**	**Max**
Speed	267 rpm	57 rpm	267 rpm
Motor speed	1800 rpm	386 rpm	1800 rpm
Frequency	60 Hz	13 Hz	60 Hz

Type	Motor
Make	WEG
Model	00518ST3QIE184TC-W22-B232
Rated output	5 HP
Rated speed	1800 rpm
Mounting position	NEMA C-face/footed
Starting	direct on frequency inverter
Efficiency class	IE1
Voltage	3x460
Frequency	60Hz
Thermal class	F
Enclosure	TEFC

Order No.	**P02003249**
Data sheet	**866021**
Version 1	**Item 10**

SEEPEX.
ALL THINGS FLOW

Remark for drive	Compete with Aegis Shaft grounding ring- Internal B-232

TSE

Design	standard design, pump sided parts - sensor sleeve fitted to the stator of the pump with temperature sensor installed - connection head (IP55)
Voltage	not available
Temperature coefficient	Pt100
Material sensor sleeve	1.4404
Material connection head	aluminium

Packing

Type of packing	skid (US)

Documentation

Dimensional drawing	262-C37/0100-C-701A4
Sectional drawing	062-004B1
Mechanical seal drawing	262-0GB/0100-0-084A3
Operation Manual	5 x Print English (US)

NOTE: motor will have AEGIS internal shaft grounding ring

EagleBurgmann®
Rely on excellence

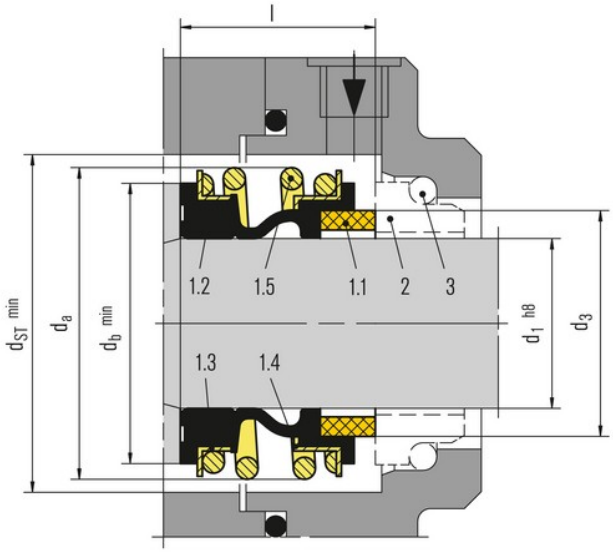
MG1

Features

- For plain shafts
- Single and dual seal
- Elastomer bellows rotating
- Unbalanced
- Independent of direction of rotation
- No torsion on bellows

Advantages

- Shaft protection over the entire seal length
- Protection of the seal face during installation due to special bellows design
- Insensitive to shaft deflections due to large axial movement ability
- Universal application opportunities
- Important material certifications available
- High flexibility due to wide offer on materials
- Suitable for low-end sterile applications
- Special design for hot water pumps (RMG12) available
- Dimension adaptions and additional seats available



Item	Part no. to DIN 24250	Description
1.1	472	Seal face
1.2	481	Bellows
1.3	484.2	L-ring (spring collar)
1.4	484.1	L-ring (spring collar)
1.5	477	Spring
2	475	Seat
3	412	O-Ring or cup rubber

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MG1 (2)

Recommended applications

- Water and waste water technology
- Food and beverage industry
- Pulp and paper industry
- Chemical industry
- Water, waste water, slurries (up to 5 % by weight)
- Pulp (up to 4 % otro)
- Latex
- Dairies, beverages
- Sulfide slurries
- Chemicals
- Oils
- Chemical standard pumps
- Helical screw pumps
- Stock pumps
- Circulating pumps
- Submersible pumps
- Water and waster water pumps
- Oil applications

Standards and approvals

- FDA
- WRAS
- KTW
- ACS
- W270
- NSF
- EN 12756

Notes

The MG1 can also be used as a multiple seal in tandem or in a back-to-back arrangement. Installation proposals can be supplied on request.

Dimension adaptations for specific conditions, e.g. shaft in inches or special seat dimensions are available on request.

Operating range

Shaft diameter: d1 = 10 … 100 mm (0.39" ... 3.94")
Pressure: p1* = 16 bar (230 PSI),
vacuum ... 0.5 bar (7.25 PSI), up to 1 bar (14.5 PSI) with seat locking
Temperature: t = -20 °C … +140 °C (-4 °F … +284 °F)
Sliding velocity: vg = 10 m/s (33 ft/s)
Admissible axial movement: ±2.0 mm

Materials

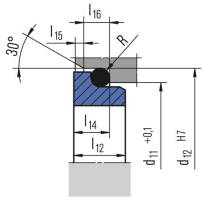
Seal face: Carbon graphite antimony impregnated (A), Carbon graphite resin impregnated (B), Silicon carbide (Q1), Tungsten carbide (U3)
Seat: Silicon carbide (Q1, Q2), Tungsten carbide (U3), Special cast CrMo steel (S), Aluminium oxide (V)
Elastomer: NBR (P), EPDM (E), FKM (V), HNBR (X4)
Metal parts: CrNiMo steel (G), Hastelloy® C-4 (M)

Notes

The MG1 can also be used as a multiple seal in tandem or in a back-to-back arrangement. Installation proposals can be supplied on request.

Dimension adaptations for specific conditions, e.g. shaft in inches or special seat dimensions are available on request.

Seat alternatives



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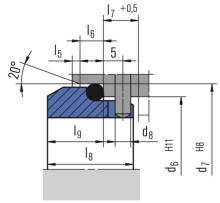

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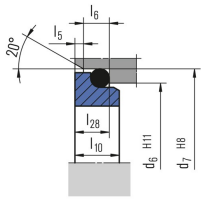
EN 12756



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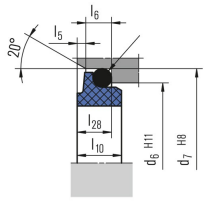
EN 12756



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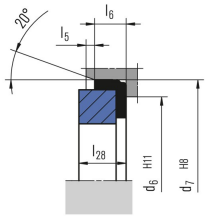
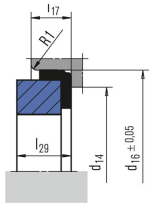
EN 12756 (for RMG12 only)





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MG1 (5)

Dimensions

d_1	d_3	d_6	d_7	d_8	d_{11}	d_{12}	d_{14}	d_{16}	d_a	d_b *)	d_m *)	d_s *)	d_{ST}	l	l_1	l_{1k}	l1N	l_1S	l_2	l_3	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{12}	l_{14}	l_{15}	l_{16}	l_{17}	l_{28}	l_{29}	R
10	15.7	17	21	3	15.5	19.2	11.0	24.60	22.5	20.5	18	18	24	14.5	25.9	32.5	40	34.0	33.4	25	1.5	4	8.5	17.5	10.0	7.5	7.5	6.6	1.2	3.8	7.5	6.6	9.0	1.2
12	17.7	19	23	3	17.5	21.6	13.5	27.80	25.0	22.5	20	20	26	15.0	25.9	32.5	40	34.0	33.4	25	1.5	4	8.5	17.5	10.0	7.5	6.5	5.6	1.2	3.8	7.5	6.6	9.0	1.2
14	19.7	21	25	3	20.5	24.6	17.0	30.95	28.5	26.5	22	22	30	17.0	28.4	35.0	40	35.5	33.4	25	1.5	4	8.5	17.5	10.0	7.5	6.5	5.6	1.2	3.8	9.0	6.6	10.5	1.2
15	20.8	–	–	–	20.5	24.6	17.0	30.95	28.5	26.5	22	22	30	17.0	28.4	–	–	35.5	33.4	25	–	–	–	–	–	–	7.5	6.6	1.2	3.8	9.0	–	10.5	1.2
16	21.0	23	27	3	22.0	28.0	17.0	30.95	28.5	26.5	22	22	30	17.0	28.4	35.0	40	35.5	33.4	25	1.5	4	8.5	17.5	10.0	7.5	8.5	7.5	1.5	5.0	9.0	6.6	10.5	1.5
18	23.7	27	33	3	24.0	30.0	20.0	34.15	32.0	29.0	29	26	33	19.5	30.0	37.5	45	35.5	37.5	25	2.0	5	9.0	19.5	11.5	8.5	9.0	8.0	1.5	5.0	9.0	7.5	10.5	1.5
19	26.7	–	–	–	–	–	20.0	34.15	37.0	33.0	33	28	38	21.5	30.0	–	–	35.5	37.5	25	–	–	–	–	–	–	–	–	–	–	9.0	–	10.5	–
20	26.7	29	35	3	29.5	35.0	21.5	35.70	37.0	33.0	33	28	38	21.5	30.0	37.5	45	35.5	37.5	25	2.0	5	9.0	19.5	11.5	8.5	8.5	7.5	1.5	5.0	9.0	7.5	10.5	1.5
22	27.7	31	37	3	29.5	35.0	23.0	37.30	37.0	33.0	33	28	38	21.5	30.0	37.5	45	35.5	37.5	25	2.0	5	9.0	19.5	11.5	8.5	8.5	7.5	1.5	5.0	9.0	7.5	10.5	1.5
24	31.2	33	39	3	32.0	38.0	26.5	40.50	42.5	38.0	38	32	44	22.5	32.5	40.0	50	35.5	42.5	25	2.0	5	9.0	19.5	11.5	8.5	8.5	7.5	1.5	5.0	9.0	7.5	10.5	1.5
25	31.2	34	40	3	32.0	38.0	26.5	40.50	42.5	38.0	38	32	44	23.0	32.5	40.0	50	35.5	42.5	25	2.0	5	9.0	19.5	11.5	8.5	8.5	7.5	1.5	5.0	9.0	7.5	10.5	1.5
28	35.0	37	43	3	36.0	42.0	29.5	47.65	49.0	44.0	37	37	50	26.5	35.0	42.5	50	45.0	42.5	33	2.0	5	9.0	19.5	11.5	8.5	10.0	9.0	1.5	5.0	10.5	7.5	12.0	1.5
30	37.0	39	45	3	39.2	45.0	32.5	50.80	49.0	44.0	37	37	50	26.5	35.0	42.5	50	45.0	42.5	33	2.0	5	9.0	19.5	11.5	8.5	11.5	10.5	1.5	5.0	10.5	7.5	12.0	1.5
32	40.2	42	48	3	42.2	48.0	32.5	50.80	53.5	46.0	41	41	55	27.5	35.0	42.5	55	45.0	47.5	33	2.0	5	9.0	19.5	11.5	8.5	11.5	10.5	1.5	5.0	10.5	7.5	12.0	1.5
33	40.2	42	48	3	44.2	50.0	36.5	54.00	53.5	46.0	41	41	55	27.5	35.0	42.5	55	45.0	47.5	33	2.0	5	9.0	19.5	11.5	8.5	12.0	11.0	1.5	5.0	10.5	7.5	12.0	1.5
35	43.2	44	50	3	46.2	52.0	36.5	54.00	57.0	50.0	44	44	59	28.5	35.0	42.5	55	45.0	47.5	33	2.0	5	9.0	19.5	11.5	8.5	12.0	11.0	1.5	5.0	10.5	7.5	12.0	1.5
38	46.2	49	56	4	49.2	55.0	39.5	57.15	59.0	53.0	53	47	61	30.0	36.0	45.0	55	45.0	46.0	33	2.0	6	9.0	22.0	14.0	10.0	11.3	10.3	1.5	5.0	10.5	9.0	12.0	1.5
40	48.8	51	58	4	52.2	58.0	42.5	60.35	62.0	55.0	55	49	64	30.0	36.0	45.0	55	45.0	46.0	33	2.0	6	9.0	22.0	14.0	10.0	11.8	10.8	1.5	5.0	10.5	9.0	12.0	1.5
42	51.8	–	–	–	53.3	62.0	46.0	63.50	65.5	58.0	53	53	67	30.0	36.0	–	–	53.0	51.0	41	–	–	–	–	–	–	13.2	12.0	2.0	6.0	10.5	–	12.0	2.5
43	51.8	54	61	4	53.3	62.0	46.0	63.50	65.5	58.0	53	53	67	30.0	36.0	45.0	60	53.0	51.0	41	2.0	6	9.0	22.0	14.0	10.0	13.2	12.0	2.0	6.0	10.5	9.0	12.0	2.5
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48	56.8	59	66	4	59.7	68.4	49.0	66.70	70.5	63.0	58	58	74	30.5	36.0	45.0	60	53.0	51.0	41	2.0	6	9.0	22.0	14.0	10.0	12.8	11.6	2.0	6.0	10.5	9.0	12.0	2.5
50	58.8	62	70	4	60.8	69.3	52.0	69.85	74.0	65.0	60	60	77	30.5	38.0	47.5	60	54.5	50.5	41	2.5	6	9.0	23.0	15.0	10.5	12.8	11.6	2.0	6.0	12.0	9.5	13.5	2.5
53	62.2	65	73	4	63.8	72.3	55.5	73.05	78.5	70.0	63	63	81	33.0	36.5	47.5	70	54.5	59.0	41	2.5	6	9.0	23.0	15.0	12.0	13.5	12.3	2.0	6.0	12.0	11.0	13.5	2.5
55	64.2	67	75	4	66.5	75.4	58.5	76.20	81.0	72.0	65	65	83	35.0	36.5	47.5	70	54.5	59.0	41	2.5	6	9.0	23.0	15.0	12.0	14.5	13.3	2.0	6.0	12.0	11.0	13.5	2.5
58	67.2	70	78	4	69.5	78.4	61.5	79.40	85.5	75.0	68	68	88	37.0	41.5	52.5	70	54.5	59.0	41	2.5	6	9.0	23.0	15.0	12.0	14.5	13.3	2.0	6.0	12.0	11.0	13.5	2.5
60	70.0	72	80	4	71.5	80.4	61.5	79.40	88.5	79.0	70	70	91	38.0	41.5	52.5	70	54.5	59.0	41	2.5	6	9.0	23.0	15.0	12.0	14.5	13.3	2.0	6.0	12.0	11.0	13.5	2.5
65	75.0	77	85	4	76.5	85.4	68.0	92.10	93.5	84.0	77	77	96	40.0	41.5	52.5	80	65.0	69.0	49	2.5	6	9.0	23.0	15.0	12.0	14.2	13.0	2.0	6.0	14.5	11.0	16.0	2.5
68	78.0	81	90	4	82.7	91.5	71.0	95.25	96.5	88.0	80	80	100	40.0	41.2	52.5	80	65.0	68.7	49	2.5	7	9.0	26.0	18.0	12.5	14.9	13.7	2.0	6.0	14.5	11.3	16.0	2.5
70	80.0	83	92	4	83.0	92.0	71.0	95.25	99.5	90.0	82	82	103	40.0	48.7	60.0	80	65.0	68.7	49	2.5	7	9.0	26.0	18.0	12.5	14.2	13.0	2.0	6.0	14.5	11.3	16.0	2.5
75	85.5	88	97	4	90.2	99.0	77.5	101.60	107.0	95.0	87	87	110	40.0	48.7	60.0	80	68.0	68.7	52	2.5	7	9.0	26.0	18.0	12.5	15.2	14.0	2.0	6.0	14.5	11.3	16.0	2.5
80	90.5	95	105	4	95.2	104.0	84.0	114.30	112.0	100.0	92	92	116	40.0	48.0	60.0	90	76.0	78.0	56	3.0	7	9.0	26.2	18.2	13.0	16.2	15.0	2.0	6.0	18.5	12.0	20.0	2.5
85	96.0	100	110	4	100.2	109.0	87.0	117.50	120.0	107.0	97	97	124	41.0	46.0	60.0	90	76.0	76.0	56	3.0	7	9.0	26.2	18.2	15.0	16.0	14.8	2.0	6.0	18.5	14.0	20.0	2.5
90	102.0	105	115	4	105.2	114.0	93.5	123.85	127.0	114.0	104	104	131	45.0	51.0	65.0	90	79.0	76.0	59	3.0	7	9.0	26.2	18.2	15.0	16.0	14.8	2.0	6.0	18.5	14.0	20.0	2.5
95	107.0	110	120	4	111.6	120.3	96.5	127.00	132.0	119.0	109	109	136	46.0	51.0	65.0	90	79.0	76.0	59	3.0	7	9.0	25.2	17.2	15.0	17.0	15.8	2.0	6.0	18.5	14.0	20.0	2.5
100	112.0	115	125	4	114.5	123.3	103.0	133.35	137.0	124.0	114	114	140	47.0	51.0	65.0	90	82.0	76.0	62	3.0	7	9.0	25.2	17.2	15.0	17.0	15.8	2.0	6.0	18.5	14.0	20.0	2.5

Dimensions in millimeter

Fitting length/axial movement tolerances: d_1 10 ... 12 mm ±0.5; d_1 14 ... 18 mm ±1.0; d_1 20 ... 26 mm ±1.5; d_1 = 28 ... 100 mm ±2.0

* Minimum diameter of the mating collar

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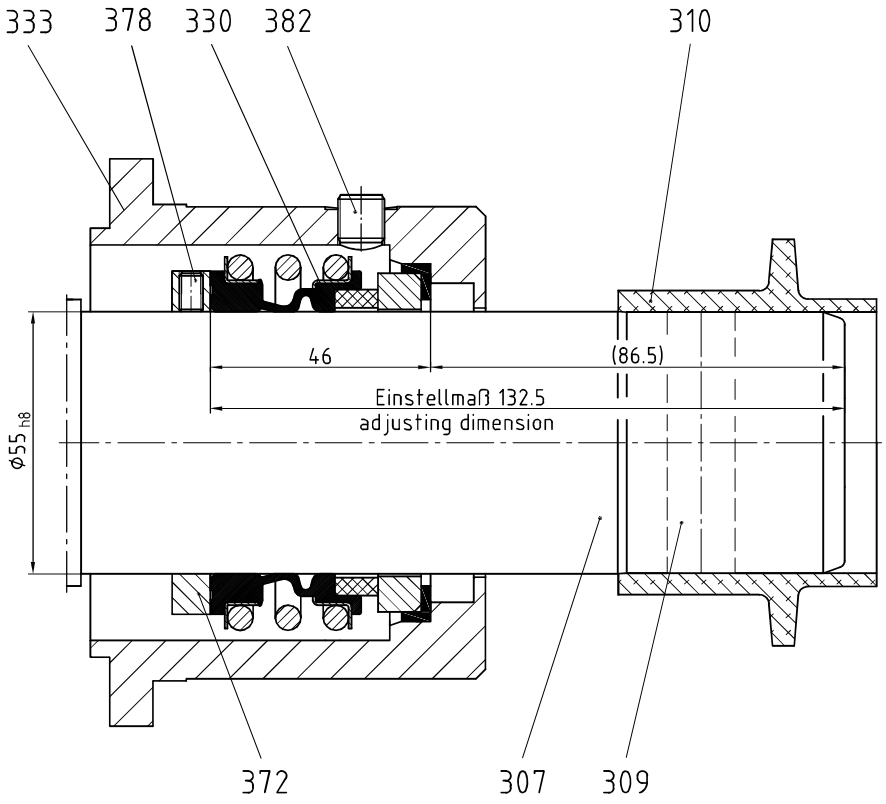

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
1		382	Verschlußschraube / screwed plug		G 1/8"	
3		378	Gewindestift / set screw		M5 x 8	
1		372	Stellring / set collar 062-372/0100-0-001A4			
1		333	GLRD-Gehäuse / mechanical seal casing 262-333/0100-0-043C4			
1		330	GLRD / mechanical seal MG1-Ø55-G60		Fabrikat / make : Burgmann	
1		310	Spritzring / splash ring 062-310/0100-0-001A3			
1		309	Steckwellenbolzen / plug-in shaft pin 062-309/0100-0-001A4			
1		307	Steckwelle / plug-in shaft 262-307/0100-0-001F3			

SEEPEX.
ALL THINGS FLOW

Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel General tolerances for mass without individual tolerance entry DIN ISO 2768-average	Aus-gabe Issue	Änderung Modification	Name Name	Datum Date	Maßstab/Scale 1:1	Werkstoff/Material	Gewicht/Weight
					Bezeichnung/Denomination GLRD-Schnittzeichnung mechanical seal sectional drawing Burgmann MG1-Ø55-G60 spülanschluss / flushing connection 1/8"NPT		
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2 Roughness for surface finish indication DIN ISO 1302 Reihe 2			Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number 262-0GB/0100-0-084A3		
		Bearbeitet/Drawn	hgg	27.03.2000	EDV-Nr./EDP-No. 38257.dwg		
		Geprüft/Checked	kno	27.03.2000	Ersatz für/Replacement for:	Ersetzt durch/Replacement by:	
		Normiert/Standard					
		Gedruckt/Printed					

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seepex

Operating and Maintenance Instructions
Progressive Cavity Pump

index

item	document	denomination
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4.0.0	OM.DES.01e	Description of the seepex pump and Accessories
5.0.0	OM.INS.01e	Assembly and Installation
6.0.0	OM.COM.01e	Commissioning/De-commissioning
7.0.0		**Service and Maintenance**
	OM.MAI.01e	BN 025-12 to 1-6L
	OM.MAI.02e	BN 05-24 to 300-6L
7.1.0		**Pin Joint Assembly**
	OM.PJT.01e	BN 025-12 to 1-6L
	OM.PJT.02e	BN 05-24 to 300-6L
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99.0.0	OM.ADR.01e	**seepex** Subsidiaries

1.
General

1.1
Application

These operating instructions contain basic information on the installation, commissioning and maintenance of **seepex** machines. Compliance with the work steps described in the individual sections is essential.

1.2
Details of the seepex machines

1.2.1
Operating Instructions

The Commission Number (comm. no) assigns the operating instructions to a particular **seepex** machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Point 9.

1.2.2
Manufacturer

The machines were manufactured by **seepex**.

1.2.3
Range, Size, Version

of the machines are stated in the appended data sheet, Point 9.

1.2.4
Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

1.2.5
Release Date of the Operating Instructions

is stated on the cover sheet of the operating instructions.

1.2.6
Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with **seepex**, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

1.2.7
EEC Machine Directive

1.2.7.1
Manufacturer's Declaration

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The **seepex** machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

1.2.7.2
Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/EEC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:
EN 809, EN292T1, EN292T2
Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

CAUTION

This documentation must be kept available for at least 10 years.

1.2.8
Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

1.2.9
Specifications Required for Inquiries and Orders

The following information must be included when inquiring about replacement parts or placing orders:
- comm. no.
- / machine type
This information is given on the type plate mounted the machine.

1.2.10
Technical Data Sheet
see Point 9.

1.2.11
Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Point 9.

1.2.12
Sound Pressure Level

The sound pressure level and/or noise characteris-tics of the **seepex** machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

1.2.13
Operating Range

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Point 9. **seepex** cannot accept liability for damage arising through failure to comply with this operating range.

1.3
Supplementary Information

1.3.1
Accessories, Optional Extras

Please refer to the data sheet, Point 9.

1.3.2
Company Address, Service Addresses

see Point 11

2.
Safety

These operating instructions contain basic require-ments to be observed during the installation, opera-tion and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

2.1
Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:

safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:

safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

CAUTION

Always comply with instructions mounted directly on the machine, e.g.
- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

2.2
Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks. The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Further-more, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

2.3
Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-obser-vance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

2.4
Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules.

2.5
Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer´s premises.

- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.

- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.

- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

2.6
Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machiness or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

2.7
Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

2.8
Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

3.
Transport and Intermediate Storage

3.1
Safety Precautions

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

3.2
Transport

Depending on its weight, the **seepex** machine must be transported manually or with appropriate trans-port means. Comply with the transport instructions on the packing.

3.3
Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

3.4
Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, **seepex** machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with **seepex**.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, **seepex** must be consulted.

CAUTION

Pumps of the range MAP
If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Point 7.

3.5
Protection against Environmental Influences

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

4.
Description of the seepex Progressive Cavity Pump and Accessories

4.1
General Description, Design and Mode of Operation

Like all progressive cavity pumps, **seepex** pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this
sealing between the suction and pressure sides.

4.2
Mechanical Design

Please consult the sectional drawing, Point 9, for the mechanical design of the pump. The data sheet, Point 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. _ _, Point 9 for information on the design of the shaft seal.

The data sheet, Point 9, specifies details of the design of the drive engine. Further details are given in the appended manufacturer's documents, Point 10.

4.3
Accessories

Consult the data sheet in Point 9 for information.

4.4
Dimensions, Weight

Consult the appended dimensional drawing, Point 9.

4.5
Design Variants

Refer to the data sheet, Point 9, for the design of the **seepex** progressive cavity pump. Other design variants are possible, whereby **seepex** must first check whether a particular pump is suitable for the intended purpose.

4.6
Operating Site Specifications

Operating site specifications are listed in the data sheet, Point 9. Details of the space required for installation, operation and maintenance are given in Point 5.2.1.

5.
Assembly / Installation

5.1
Mounting Tools / Hoists

No special tools are required for the assembly and installation of the pump.

The customer must check the dimensions and weight of the **seepex** progressive cavity pump to ascertain whether the available hoisting apparatus is sufficient for the assembly and fitting of the pump.

5.2
Initial Assembly

5.2.1
Inspection Prior to Commencement of Assembly

5.2.1.1
Location

The place of installation for the pump must con-form with the site stated in the data sheet in Point 9. Any change of location must be checked and approved by **seepex**.

5.2.1.2
Space Requirements

Customers are responsible for determining the space requirements; the following factors must be taken into consideration:

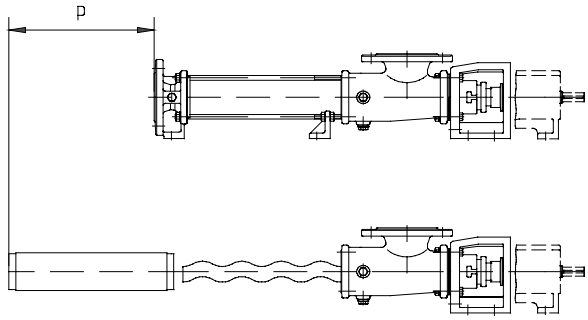
- dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
  operate the drive /
  speed regulation
  read speed and pressure indicators
  adjust a stator retensioning device, if fitted
  operate a buffer fluid supply unit, if fitted
- space required for lubrication / renewal of lubricants
- disassembly of mechanical protective devices, e.g. V-belt or coupling protection
- space required for handling the mounting tools, e.g. sufficient wall clearance

5.2.1.3
Space Allowing Disassembly of Stator P

A specific space must be allowed for exchanging the stator. The required dimension "P" is indicated in the index of these operating instructions or in the appended dimensional drawing, Point 9.

CAUTION

Ensure also that the pipe work can be dismounted at this location too.



5.2.2
Installation of the Fully Assembled Pump

- Installation in conformity with data sheet
  Installation of the pump is permissible only in accordance with the data sheet specifications and the associated basic drawing, see Point 9. Any change in the position must be checked and approved by **seepex**.

- Tension-free mounting of pump
  This rule applies to pumps with and without drives, to versions with and without baseplate, for mounting on the foundation or other bearing elements. The entire area of all bearing surfaces of the machine must rest on the ground. Any unevenness must be corrected by appropriate supports.

- Correct seating of drives
  All drives have been aligned ready for operation and mounted by **seepex**. However, displace-ments may occur during transport or installation. For this reason, check that the alignment and fastening of the drive and coupling are correct.

- Protective devices
  On completion of the assembly and installation work, immediately mount all safety and protective devices in their proper locations and set them in operation.

5.2.3
Protective and Controlling Equipment

Information on equipment of this nature, where fitted, is provided in the data sheet, Point 9. Consult the attached manufacturer's specifications, Point 10, for instructions on assembly and installation.

5.2.4
Electric Connection of Electric Motor and Frequency Converter

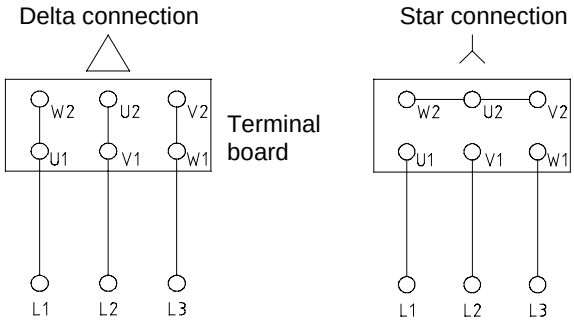
The electric connections must be established in accordance with the manufacturer's specifications, Point 10, as well as the safety specifications applying at the installation site. The mains voltage and frequency must match the ratings indicated on the type and rating plates.

- Switch on electric motor „direct-on-line"

CAUTION

An increased starting torque is necessary due to the clamping between the rotor and stator conveying elements. This means the electric motors that drive the progressive cavity pumps must always be switched on directly. As a rule, star-delta startup is not possible unless special arrangements have been made with **seepex**.

Three-phase cage motor



. . . voltage indicated on rating plate

- Speed regulation via frequency inverter
  When progressive cavity pumps with frequency-controlled drives are started up problems may occur due to unsuitable or wrongly set frequency inverters. For this reason we recommend the purchase of the complete drive, including frequency inverter, from **seepex**, so that the frequency inverter can be tuned on the **seepex** test field along with a trial run.

  Ensure that customer-supplied frequency inverters comply with the starting torque and running power specified in the appended data sheet, Point 9.

  CAUTION

  Consult the appended document TI.FRU.01, see Point 9, for further information on the electric connection and the setting of frequency inverter and variable-speed motor.

5.2.5
Piping

5.2.5.1
Suction and Pressure Flanges

The position, nominal width and standard of the suction and pressure flange of the progressive cavity pump are specified in the dimension drawing, Point 9, and data sheet, Point 9. Always observe the rotational direction and flow direction defined in Point 6.2.5.

5.2.5.2
Piping Dimensioning

CAUTION

The pipe diameters on the suction and pressure sides must be dimensioned in accordance with the customer's pressure-loss calculation in such a way that the pressures specified in the data sheet, Point 9, are not exceeded. The nominal width of the suction pipe should at least match that of the pump suction flange.

5.2.5.3
Residue-free Piping

CAUTION

Prior to starting up the pump, ensure that all pipelines are free from foreign bodies. Installation residues (such as weld spatter, screws, steel chips etc.) will lead to damage of the **seepex** pump for which guarantee claims will not be accepted.

5.2.5.4
Tension-free Mounting

CAUTION

Pipelines and other components requiring to be connected with the pump must be mounted without stresses.

5.2.5.5
Fluid Connections for Optional Extras

Consult the data sheets, Point 9, for information regarding the optional extras, if any, that are fitted. The technical description is given under Point 9.

6.
Commissioning/De-commissioning

6.1
Engineering Data

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Point 9.

To guarantee the correct assignment of documentation to pump, the commission number on the
- cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

6.1.1
See Point 7.2.2 for Lubricant Chart

6.2
Preparation for Operation

6.2.1
Bearing

6.2.1.1

See Point 7.2.1.4 for pump bearing.

6.2.1.2

See manufacturer's documents, Point 10, for drive bearings.

6.2.2
Shaft Sealing

See document OM.SEA.__.

6.2.3
Filling Up of Suction Side to Avoid Dry Running at Startup

6.2.3.1
General

CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

6.2.3.2
Pump with plastic rotor
Pump with plastic rotating unit

CAUTION

Important information about commissioning can be taken from the document OM.ROT.01.

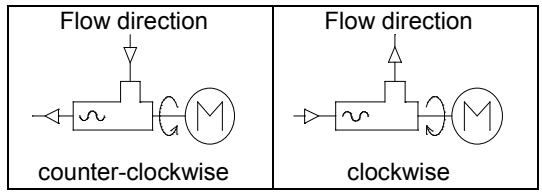
6.2.4
Electric/Hydraulic Connections

The connections are listed in the appended manufacturer's documents, Point 10.

The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.

6.2.5
Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.



Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

6.3
Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Point 10, for information on commissioning.

6.3.1
Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by **seepex** or other manufacturers, see manufacturer's documents.

6.3.2
Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications. Pay attention to the operating specifications in the data sheet.

6.4
Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional. A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.

- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation. Prior to activation of the pump, check the proper function of all protective equipment.

6.5
Commissioning

6.5.1
Initial Startup/Re-starting

CAUTION

Every **seepex** progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the **seepex** pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by **seepex**.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by **seepex**.

6.5.2
Avoid Dry Running of Pump

CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the **seepex** dry running protection device TSE, available as an optional accessory.

6.5.3
Check Pressure at Suction and Pressure Flanges

6.5.3.1
Safeguard Pump Against Excessive Pressure at the Suction Flange

The **seepex** pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.

For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact mano-meters that deactivate the pump.

6.5.3.2
Safeguard Pump Against Excessive Pressure at the Pressure Flange

The **seepex** pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.

6.5.4
Drive Engine

Consult the attached manufacturer's operating instructions, Point 10, for information on commissioning the drive engine.

6.5.5
Establish Clear Passage Through Pipelines

CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

6.6
De-commissioning

6.6.1
De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.

6.6.2
Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

6.6.3
Evacuation of the Pump

The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503).

CAUTION

Coated casings or housings without screw plug have to be drained by the connection branch (SAG and DRS).

Refer to the data sheet and the sectional drawing of the associated operating instruction for information on the pump design.

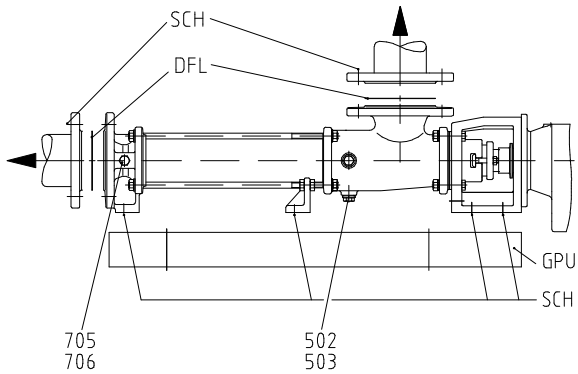
Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. When conveying aggressive or hazardous media, therefore, wear appropriate protective clothes during all installation work.

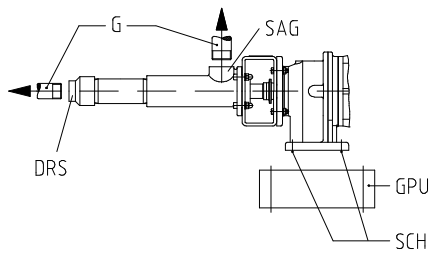
6.6.4
Disassembling the Pump

Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet.

Block-design pumps with direct flange-mounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.





6.6.5
Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

These operating instructions are valid for
range BN
size 025-12, 025-24, 05-12 and 1-6L

7.
Service and Maintenance

Contents
7.1 General Instructions
7.2 Service and Inspection
7.3 Dismantling
7.4 Re-assembly
The sectional drawing and parts list relevant for Points 7.3 and 7.4 can be found in Point 9.

7.1
General Instructions

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instructions and adhere to them meticulously. **seepex** will accept no liability for damages arising through non-observance of these operating instructions.

7.2
Maintenance and Inspection

7.2.1
Lubrication

7.2.1.1
Rotor and Stator

The rotor and stator are lubricated by the conveying medium.

7.2.1.2
Shaft Sealing

Consult document OM.SEA. ___ Point 9 for information on lubricating the shaft seal.

7.2.1.3
Pin Joint

The pin joints are filled with special grease and lubricated for the expected duration of service. The **seepex** joint grease specified in the index of these operating instructions should be used exclusively for any required maintenance work.

CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

7.2.1.4
Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions, Point 10.

7.2.2
Lubricant Filling Levels

Details are specified in the index.

7.2.3
Drives and Optional Extras

For maintenance and inspection specifications, see the appended manufacturer's documents, Point 10.

7.2.4
Supervision during Operation

7.2.4.1
Shaft Sealing

See document OM.SEA.___ Point 9.

7.2.4.2
Optional Extras

These must be monitored in accordance with the separate documents, Point 9/Point 10.

7.2.4.3
Drive Engines

These must be monitored in accordance with the separate manufacturer's documents, Point 10.

7.2.5
Preventive Measures

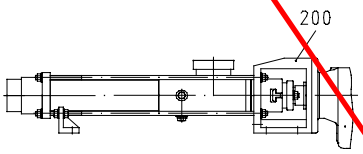
To avoid the expenses incurred by lengthy stop periods of the pump, **seepex** recommends the acquisition of a set of wearing parts and a set of gaskets. The contents are listed in the document OM.WPS.01e, Point 9.

7.3
Dismantling the seepex Progressive Cavity Pump

Tools are required for dismantling and re-assembly. These tools are listed in Point 9 of the document OM.SPT.01.

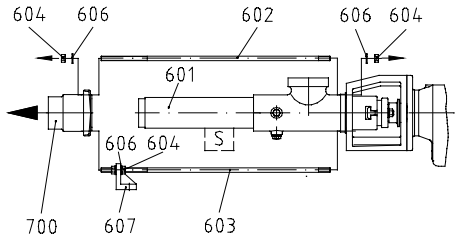
The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (Point 7.3.4) or as individual components (Point 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the lantern (200).



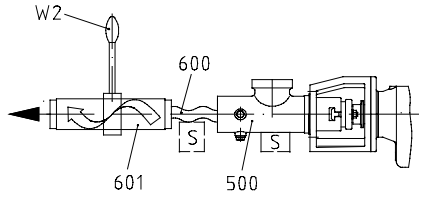
7.3.1
Pressure Flange (700) - Dismantling

Prior to dismantling see Point 7.3.2
Before dismantling the stator (601), provide it with a support (S) to prevent it from falling.



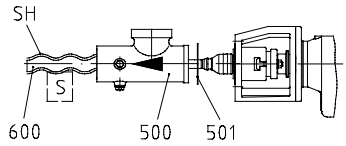
7.3.2
Stator (601) - Dismantling

- Maintenance tip:
  Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.
- Lock drive shaft against rotation.
  While dismantling the stator (601) with tool (W2/see Point 9) prop up the rotor (600) and the suction casing (500) with support (S) to prevent it from falling.



7.3.3
Suction Casing (500) - Dismantling

Fit the rotor (600) with a protective cover (SH) and underprop it with support (S) to prevent it from falling down.

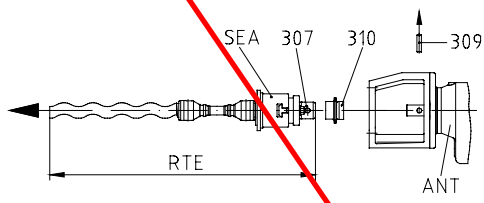


7.3.4
Rotating Unit (RTE) - Dismantling

CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA.__ (Shaft Seal Dismantling).

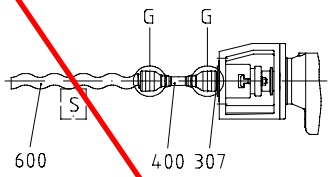
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Point 9 for tool (W10) used for pulling off.
- See in document OM.SEA.__, Point 9, for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5
Rotating Pump Parts - Dismantling

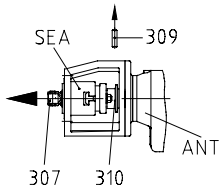
7.3.5.1
Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with Point 7.3.6.



7.3.5.2
Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



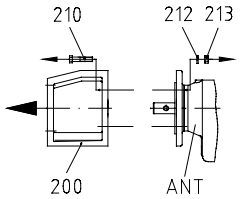
7.3.6
Dismantling of Joint

see document OM.PJT.01e Point 1.

7.3.7
Shaft Sealing

See document OM.SEA.___ Point 9 for information on dismantling the shaft sealing.

7.3.8
Lantern (200)/Drive (ANT) - Dismantling

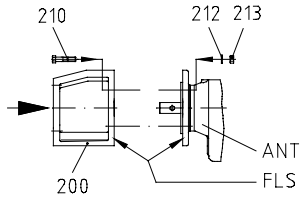


7.4
Re-assembly

Before commencing the re-assembly, fasten the lantern (200) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.

7.4.1
Lantern (200)/Drive (ANT) - Assembly

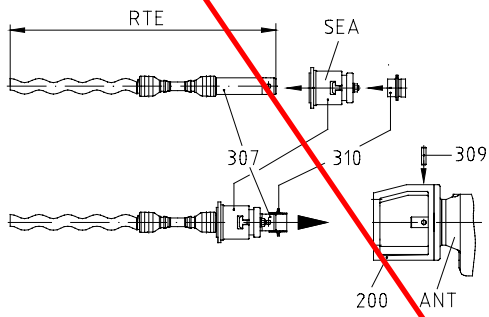
Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).



7.4.2
Rotating Unit (RTE) - Re-assembly

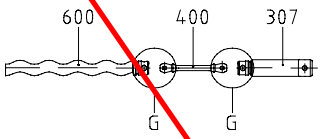
The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.01e

- Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA.__ , see Point 9.
- Moisten splash ring (310) and plug-in shaft (307) with joint grease (see index for type) and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see lettering on the splash ring).
- Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
- Splash ring position (310)
  The collar of the splash ring should be mounted at a distance of 0.5 mm from the lantern (200).



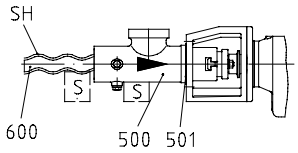
7.4.3
Rotating Pump Parts - Re-assembly

Prepare main components:
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.01e Point 2. to 2.3
Joint (G) re-assembly as described in document OM.PJT.01e Point 3.



7.4.4
Suction Casing (500), Casing Gasket (501) - Re-assembly

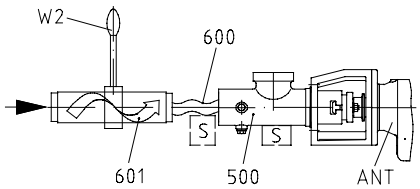
Fit protective cover (SH) on rotor (600) and prop it up with support (S). Prop casing gasket (501) and suction casing (500) by support.



7.4.5
Stator (601) - Assembly / Re-assembly

Maintenance tip:
Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably

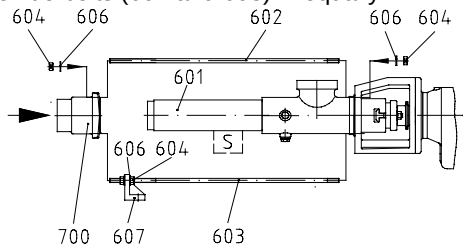
Lock drive (ANT) shaft against rotation. Using tool (W2/see Point 9), turn stator (601) clockwise and simultaneously push it over rotor (600), propping up stator with support (S) at the same time.



7.4.6
Pressure Flange (700) - Assembly

CAUTION

Tighten tie bolts (602 and 603) in equally.



These operating instructions are valid for
range BN
size 05-24 to 300-6L

7.
Service and Maintenance

Contents
7.1 General Instructions
7.2 Service and Inspection
7.3 Dismantling
7.4 Re-assembly
The sectional drawing and parts list relevant for Points 7.3 and 7.4 can be found in Point 9.

7.1
General Instructions

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instruc-tions and adhere to them meticulously. **seepex** will accept no liability for damages arising through non-observance of these operating instructions.

7.2
Maintenance and Inspection

7.2.1
Lubrication

7.2.1.1
Rotor and Stator

The rotor and stator are lubricated by the conveying medium.

7.2.1.2
Shaft Sealing

Consult document OM.SEA. __ Point 9 for information on lubricating the shaft seal.

7.2.1.3
Pin Joint

The pin joints are filled with special grease and lubricated for the expected duration of service. The **seepex** joint grease specified in the index of these operating instructions should be used exclusively for any required maintenance work.

CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

7.2.1.4
Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions, Point 10.

7.2.2
Lubricant Filling Levels

Details are specified in the index.

7.2.3
Drives and Optional Extras

For maintenance and inspection specifications, see the appended manufacturer's documents, Point 10.

7.2.4
Supervision during Operation

7.2.4.1
Shaft Sealing

See document OM.SEA.___ Point 9.

7.2.4.2
Optional Extras

These must be monitored in accordance with the separate documents, Point 9/Point 10.

7.2.4.3
Drive Engines

These must be monitored in accordance with the separate manufacturer's documents, Point 10.

7.2.5
Preventive Measures

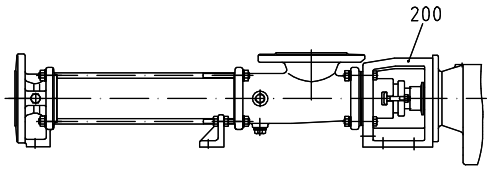
To avoid the expenses incurred by lengthy stop periods of the pump, **seepex** recommends the acquisition of a set of wearing parts and a set of gaskets. The contents are listed in the document OM.WPS.02e, Point 9.

7.3
Dismantling the seepex Progressive Cavity Pump

Tools are required for dismantling and re-assembly. These tools are listed in Point 9 of the document OM.SPT.01.

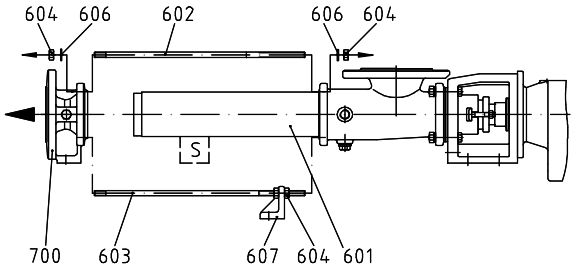
The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (Point 7.3.4) or as individual components (Point 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the lantern (200).



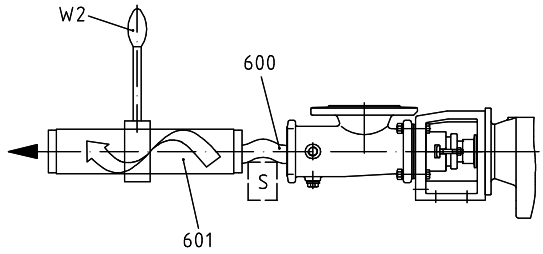
7.3.1
Pressure Flange (700) - Dismantling

Prior to dismantling see Point 7.3.2
Before dismantling the stator (601), provide it with a support (S) to prevent it from falling.



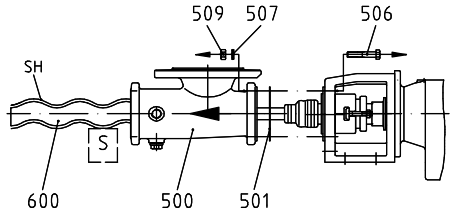
7.3.2
Stator (601) - Dismantling

- Maintenance tip:
  Disassembly of the stator can be made consider-ably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.
- Lock drive shaft against rotation.
  While dismantling the stator (601) with tool (W2/see Point 9) prop up the rotor (600) with support (S) to prevent it from falling.



7.3.3
Suction Casing (500) - Dismantling

Fit the rotor (600) with a protective cover (SH) and underprop it with support (S) to prevent it from falling down.

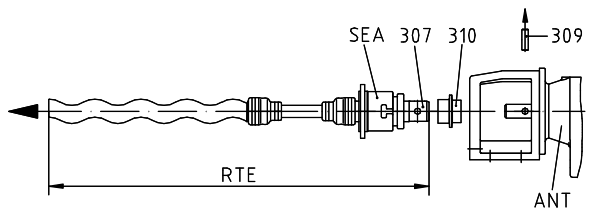


7.3.4
Rotating Unit (RTE) - Dismantling

CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA.__ (Shaft Seal Dismantling).

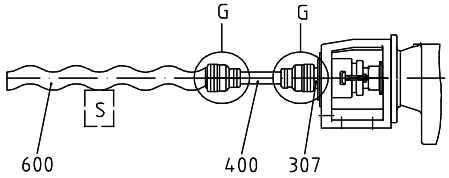
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Point 9 for tool (W10) used for pulling off.
- See in document OM.SEA.__, Point 9, for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5
Rotating Pump Parts - Dismantling

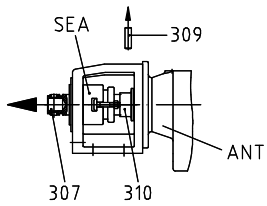
7.3.5.1
Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with Point 7.3.6.



7.3.5.2
Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



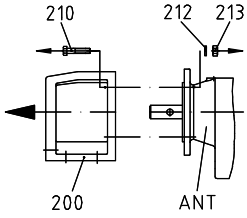
7.3.6
Dismantling of Joint

see document OM.PJT.02e, Point 1.

7.3.7
Shaft Sealing

See document OM.SEA.__, Point 9 for information on dismantling the shaft sealing.

7.3.8
Lantern (200)/Drive (ANT) - Dismantling

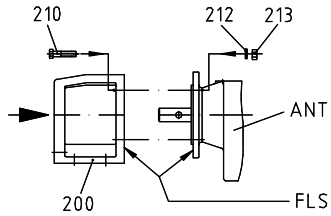


7.4
Re-assembly

Before commencing the re-assembly, fasten the lantern (200) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.

7.4.1
Lantern (200)/Drive (ANT) - Assembly

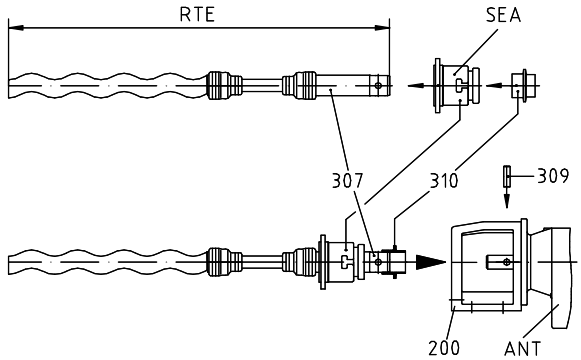
Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).



7.4.2
Rotating Unit (RTE) - Re-assembly

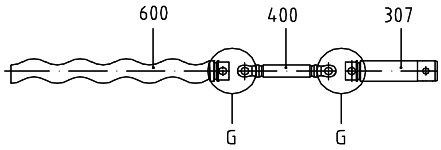
The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.02e.

- Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA __, see Point 9.
- Moisten splash ring (310) and plug-in shaft (307) with joint grease (see index for type) and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see writing on the splash ring).
- Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
- Splash ring position (310)
  The collar of the splash ring should be mounted at a distance of 0.5 mm from the lantern (200).



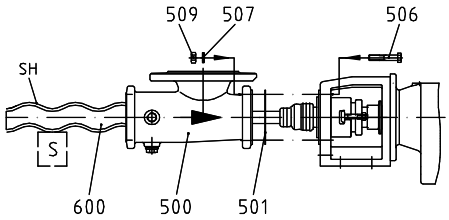
7.4.3
Rotating Pump Parts - Re-assembly

Prepare main components:
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.02e, Point 2. to 2.3
Joint (G) re-assembly as described in document OM.PJT.02e, Point 3.



7.4.4
Suction Casing (500), Casing Gasket (501) - Re-assembly

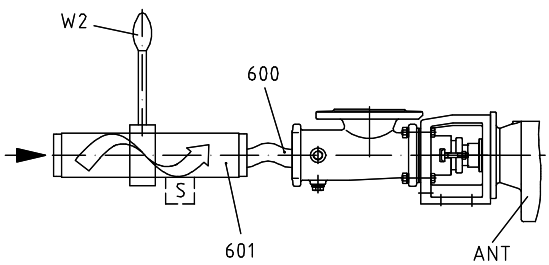
Fit protective cover (SH) on rotor (600) and prop it up with support (S).



7.4.5
Stator (601) - Assembly / Re-assembly

Maintenance tip:
Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.

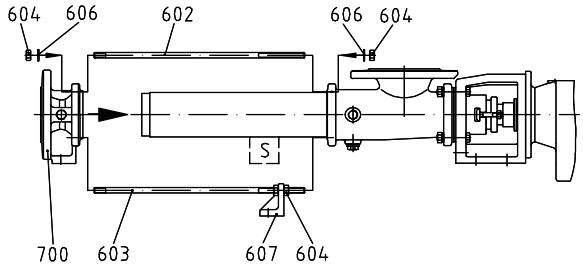
Lock drive (ANT) shaft against rotation. Using tool (W2/see Point 9), turn stator (601) clockwise and simultaneously push it over rotor (600), propping up stator with support (S) at the same time.



7.4.6
Pressure Flange (700) - Assembly

CAUTION

Tighten tie bolts (602 and 603) in equally.



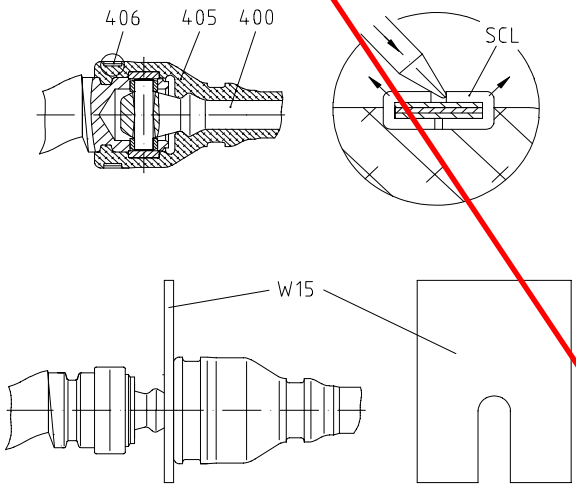
1.
Dismantling of Joint

1.1
Holding Band (406) and Universal Joint Sleeve (405)

Cut through loop (SCL) of the holding band (406) with a metal saw.

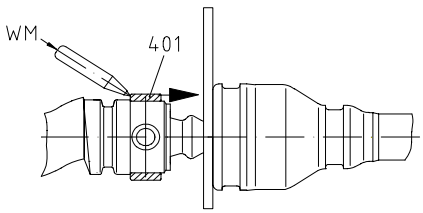
Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

Remove holding band (406). Withdraw universal joint sleeve in coupling rod direction and fix it by using a special maintenance tool (W15/see Point 9)



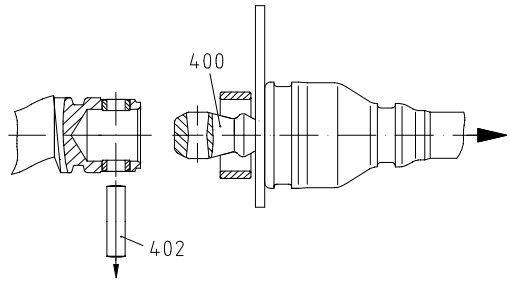
1.2
Retaining Sleeve (401) - Dismantling

Knock back retaining sleeve (401) with tool/chisel (WM).



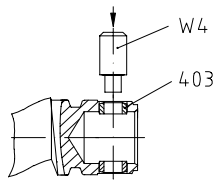
7.3.6.3
Separation of Joint

Eject coupling rod pins (402). Pull coupling rod (400) out of joint top.



1.4
Guide bushes (403) - Dismantling

Press out guide bushes (403) by means of a tool (W4/see Point 9).



2.
Prepare main components for Re-assembly

2.1
Rotor (600) - Preparation for Joint Assembly

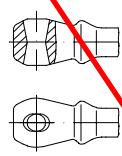
First remove any burr, flaws or similar defects from the rotor, then clean it.

2.2
Coupling Rod (400) - Preparation for the Joint Assembly

Clean coupling rod and check top drilling regarding wear.

CAUTION

If the top drilling shows wear, a new coupling rod will have to be used.



Correct top drilling

2.3
Plug-in Shaft (307) - Preparation for Joint Assembly

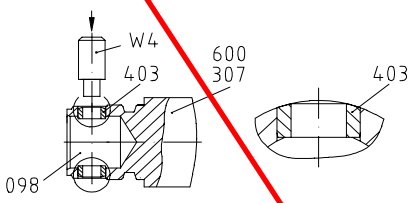
Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.

3.
Joint - Re-assembly

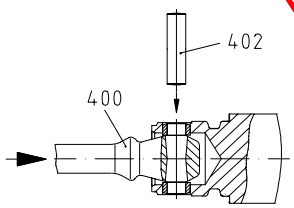
CAUTION

To guarantee the proper function of the joints, it is advisable to renew the coupling rod pins (402), guide bushes (403) all at the same time.

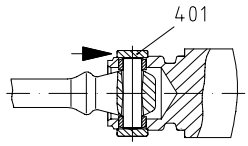
- Joint top on rotor (600) and plug-in shaft (307)
- Press guide bushes (403) in using tool (W4/see Point 9)
- Fill joint top with joint grease (098), see index for special grease



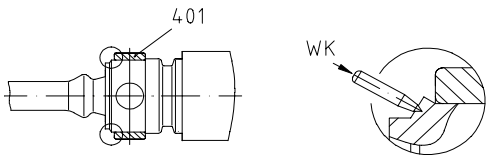
- Coupling rod (400)



- Retaining sleeve (401)

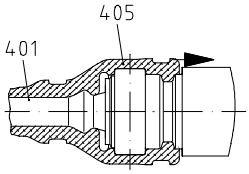


- Securing of retaining sleeve
  Secure offset by 2x180° with tool/center punch (WK)

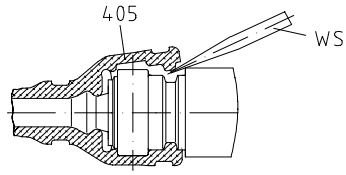


- Universal joint sleeve (405)
  Moisten surface of coupling rod (400) and inner surface of universal joint sleeve with joint grease (see index for special grease).

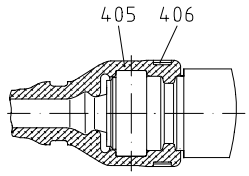
  Slip on universal joint sleeve



De-aerate interior of joint with tool/screw driver (WS)



- Holding band re-assembly
  Mount holding band (406) using tool (W3/see Point 9) as described in document OM.HBD.01e .



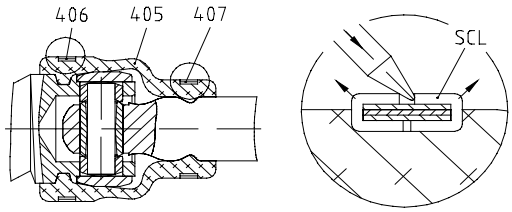
1.
Dismantling of Joint

1.1
Holding Band (406, 407) and Universal Joint Sleeve (405)

Cut through loop (SCL) of the holding bands (406 and 407) with a metal saw.

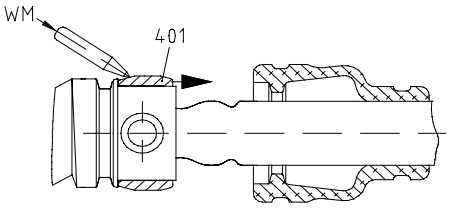
Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

Remove holding bands (406,407). Pull universal joint sleeve (405) off joint.

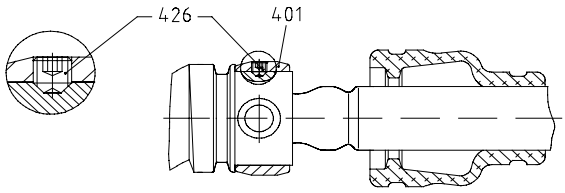


1.2
Retaining Sleeve (401) - Dismantling

- For rotors and plug-in shafts made of hardened and unhardened materials, knock back retaining sleeve (401) with tool/chisel (WM).



- For rotors made of synthetic material, release set screw (426).

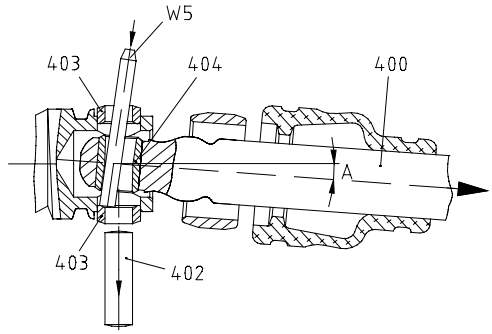


1.3
Separation of Joint

Eject coupling rod pin (402). Position coupling rod (400) at the correct angle (A) and, using tool (W5/see Point 9), drive both guide bushes (403) outwards.This releases the coupling rod (400), which can then be extracted.

CAUTION

To guarantee the proper function of the joints, it is advisable to renew the coupling rod pins (402), guide bushes (403) and coupling rod bushes (404) all at the same time.

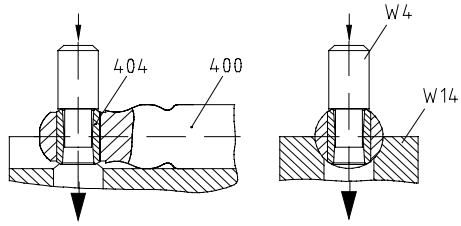


1.4
Coupling Rod Bushes (404) - Dismantling

CAUTION

As a precaution against incorrect re-assembly of coupling rod bushes (404), we recommend the employment of coupling rods (400) whose coupling rod bushes (404) have been pressed in by **seepex**.

The coupling rod bush (404) is pushed out of the coupling rod (400) with tools (W4 and W14/see Point 9).



2.
Prepare main components for Re-assembly

2.1
Rotor (600) - Preparation for Joint Assembly

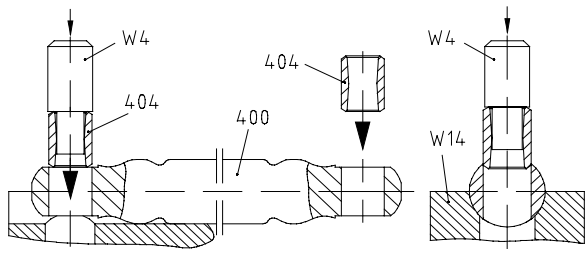
First remove any burr, flaws or similar defects from the rotor, then clean it.

2.2
Coupling Rod (400) - Preparation for the Joint Assembly

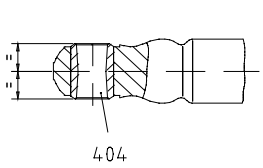
CAUTION

As a precaution against the incorrect re-assembly of coupling rod bushes (404), we recommend the employment of coupling rods (400) whose bushes (404) have been pressed in by **seepex**.

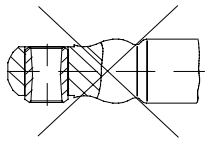
Press in new coupling rod bushes (404 using tool (W4) and (W14/see Point 9).



- Position of coupling rod bush (404)

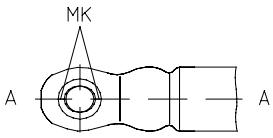


correct
pressed in centrically

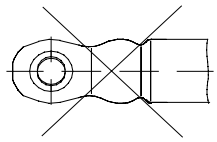


incorrect
pressed in eccentrically
result: joint fracture

Marking notches in (MK) in A-A axis
permissible rotation 1,5°



correct
pressed into A-A axis



incorrect
pressed in rotated
result: joint fracture

2.3
Plug-in Shaft (307) - Preparation for Joint Assembly

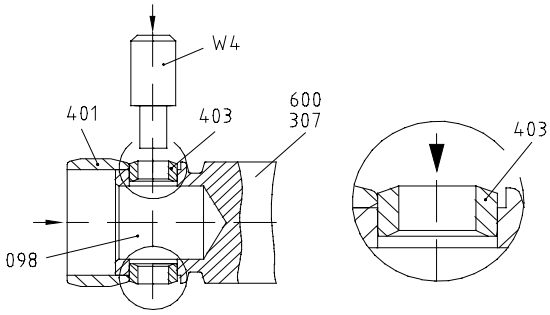
Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.

3.
Joint - Re-assembly

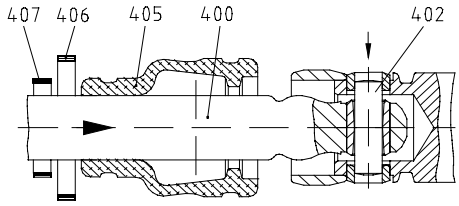
CAUTION

To guarantee the proper function of the joints, it is advisable to renew the coupling rod pins (402), guide bushes (403) and coupling rod bushes (404) all at the same time.

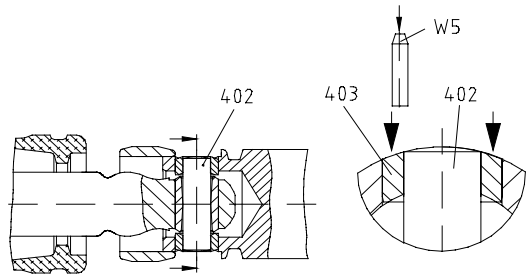
- Joint head on rotor (600) and plug-in shaft (307)
- Press guide bushes (403) in by only 2/3 of their length using tool (W4/see Point 9)
- Fill joint head with joint grease (098), see index for special grease
- Slip on joint sleeve (401)



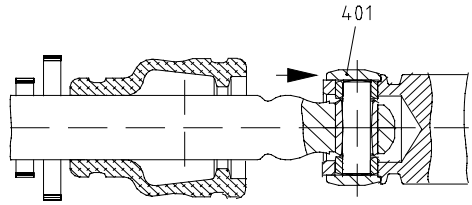
- Coupling rod (400)
  Slide holding bands (406/407).
  Moisten inner surface of universal joint sleeve (405) with joint grease (see index for special grease) and slide it.
  Push coupling rod (400) into joint head.
  Push in coupling rod pin (402).



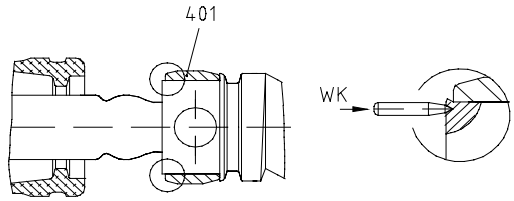
- Guide bush (403)
  Press in with tool (W5/see Point 9)



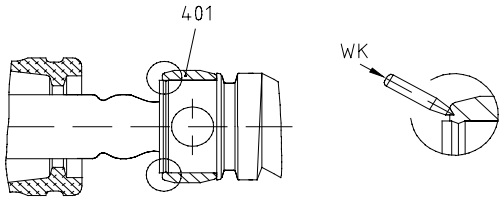
- Retaining sleeve (401)



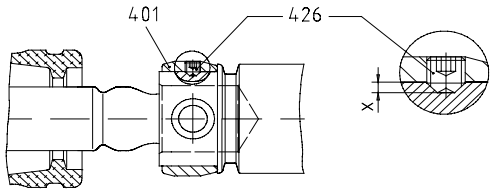
- Securing of retaining sleeve
  For drive shafts, plug-in shafts and rotors made of unhardened materials such as St 70, AISI 304, AISI 316, Hastelloy C, secure 2 x 180° offset indents, with tool/centre punch (WK)



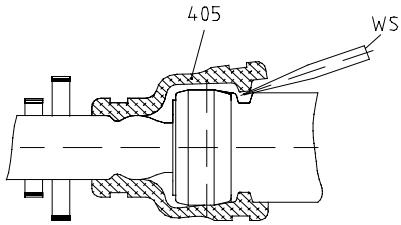
For rotors made of hardened materials such as tool steel (AISI D6), 1.2842, secure 2 x 180° offset indents with tool/centre punch (WK)



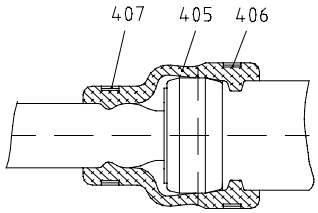
- For rotors made of synthetic material, secure using set screw (426). During this process, point of set screw presses into the synthetic surface (X). Set screw (426) is medium strengh secured by screw locking device /adhesive.



- Universal joint sleeve (405)
  Remove air from interior of joint with tool/screw driver (WS).



- Holding bands re-assembly
  Mount holding bands (406 and 407) using tool (W3/see Point 9) as described in document OM.HBD.01e.



Holding Band (HBD) - Assembly

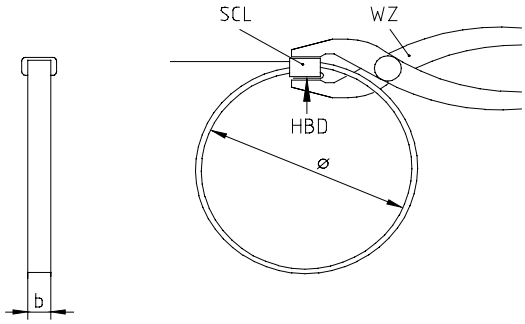
Tools required for the re-assembly, see document OM.STP.01, Point 9.

- Prepare holding band

  Only prefabricated double-band holding bands should be used. The diameter (∅) and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

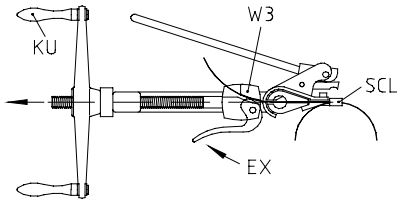
- Test holding band

  The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure with the tool/pliers (WZ).

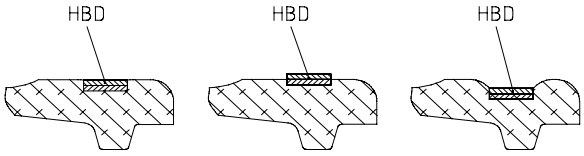


- Assembly of holding band

  Insert holding band in tool (W3/ see Point 9). Hold free end of holding band with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



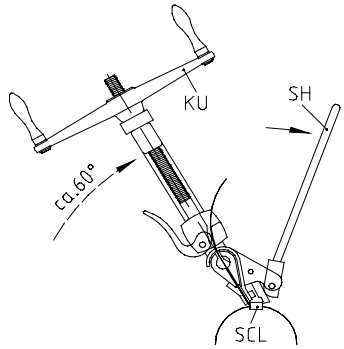
- Correct holding band tension (HBD)



Correct	**Incorrect**	**Incorrect**
Holding band (HBD) has slightly contracted outer form of universal joint sleeve and is stuck in position.	Holding band (HBD) is too slack and liable to slip.	Holding band (HBD) is too tight. Universal joint sleeve will be damaged/sheared off.

- Folding back the holding band (HBD)

  Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).

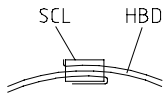


- Shearing off holding band (HBD) made of material AISI 304 and AISI 316

  A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

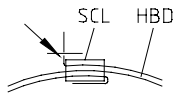
  CAUTION

  Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



- Shearing off holding band (HBD) made of Hastelloy C

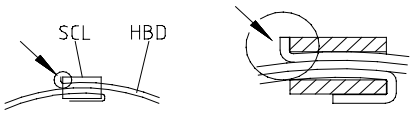
  The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



- Check after mounting of holding band

  The holding band must run all the way round the groove of the universal joint sleeve.

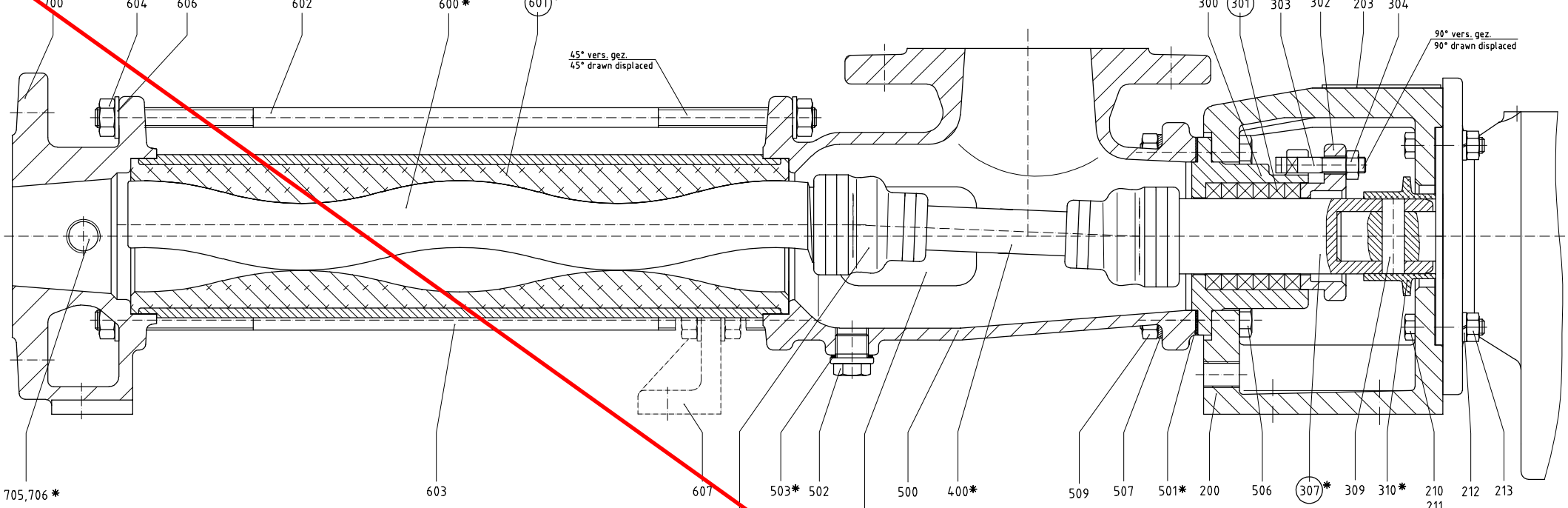
  The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.

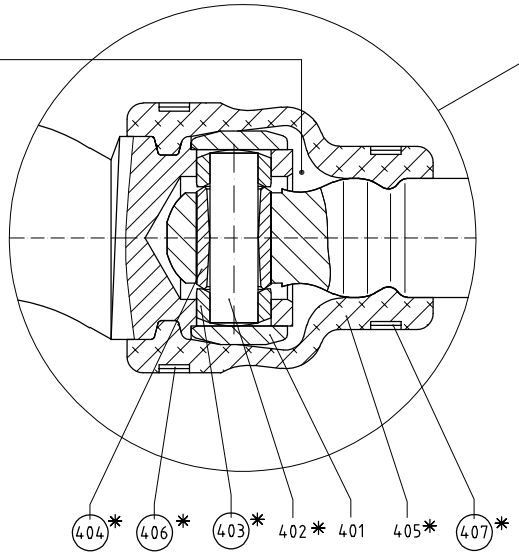


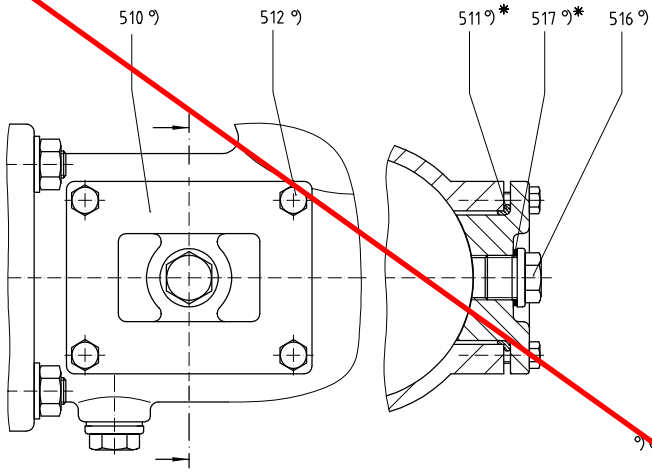
8.
Breakdown, reasons, remedies

Breakdown											
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks		**seepex** progressive cavity pumps will operate trouble-free if they are used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies
				○			○			a	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor. Then turn the pump by means of the tool W2 .
○										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.
○	○	○			○	○				c	Suction pipe or shaft sealing leak. Eliminate the leakage.
○	○	○				○				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve
○	○	○								e	Viscosity of the liquid too high. Check and accommodate per data sheet.
		○		○			○			f	Wrong pump speed. Correct pump speed per data sheet.
	○	○								g	Avoid inclusions of air in the conveying liquid.
		○		○	○		○	○		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.
○	○	○			○			○		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.
						○	○			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.
○		○								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.
○	○					○				l	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.
						○				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT. e item 2.2
○		○		○	○			○		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.
○		○	○		○					o	Stator or rotor worn. Dismantle the pump and replace defective parts.
○		○			○	○				p	Joint parts worn. Replace worn parts and fill with special pin joint grease .
○		○			○			○		q	Suction pipework partially or completely blocked. Clean suction pipework.
○				○	○		○	○		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.
○		○		○			○		○	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.
○				○	○			○		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.
○				○				○	○	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.
○				○	○			○	○	v	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.
				○	○		○	○		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.
						○			○	x	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.
									○	y	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.

9.
Auxiliary seepex documentation







seepex Gelenkfett

Typ und Füllmenge siehe Angaben im Inhaltsverzeichnis der zur Pumpe gehörenden Betriebsanleitung.

seepex joint grease

type and filling quantity see notes indicated on the index of the operating and maintenance instructions belonging to the respective pump.

Werkzeug

für die Demontage und Wiedermontage erforderlich siehe Dokument OM.SPT.01

tool for the dismantling and assembly requested see document OM.SPT.01

* Verschleißteile und Dichtungen

siehe Dokument OM.WPS._

Wearing parts and sealings see document OM.WPS._

°) Option / option

Baugrößen / size 05–24 bis / up to 300–6L "B"

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

seepex GmbH + Co KG
Schaumbÿstrasse 344
D-46240 Bottrop

seepex

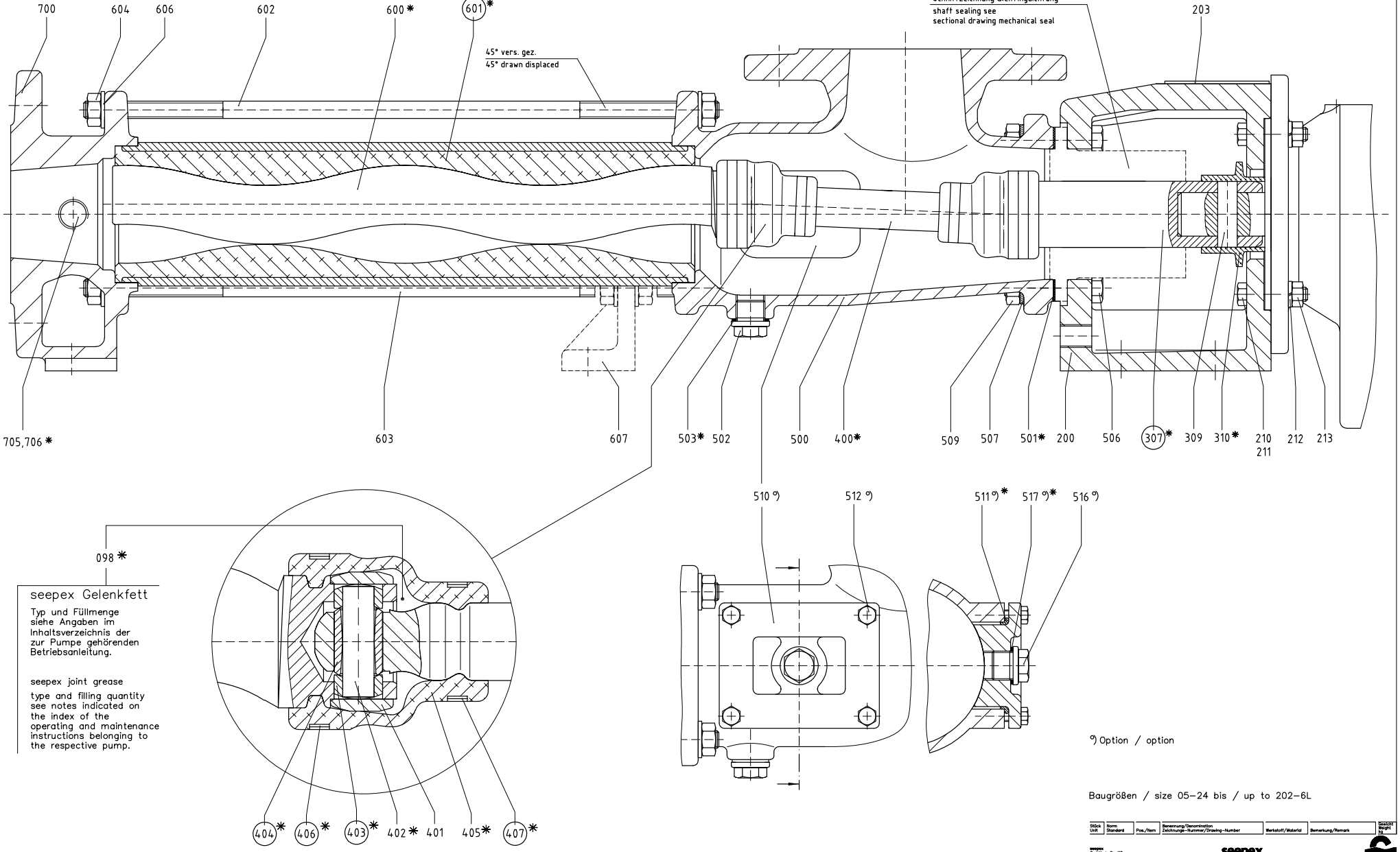
Allgemeintoleranzen für Masse ohne einzelne Toleranzeintragung DIN ISO 2768-mittel	Ausgabe Issue	Änderung Modification	Name Name	Datum Date	Maßstab/Scale	Werkstoff/Material	Gewicht/Weight	Vordruck
General tolerances for mass without individual tolerance entry DIN ISO 2768-average	B	bis 300-6L	av	10.09.1996	1:1			CAD
	C	AD 372	dl	29.10.2002	Bezeichnung/Denomination: Schnittzeichnung Baureihe "BN" / sectional drawing range "BN"			
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2			Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number: 062-002C1			
Roughness for	Bearbeitet/Drawn		haf	06.06.1994	EDV-Nr./EDP-No.: L:\LFDZCHNG.100\10317.dwg			
	Geprüft/Checked		WSC	06.06.1994				

seepex

Stückliste Baureihe BN
Baugrössen 05-24 ... 300-6L
Schnittzeichnung Nr. 062-002C1

document **SL.062.002del**
Ausgabe / issue **C / 29.10.02**
Blatt / sheet **1 (1)**

Stck.	Pos.	d **Stückliste Baureihe BN** **Baugrössen** **Schnittzeichnung Nr.** **Benennung** **Stck. / Pos.**	e **Parts list range BN** **sizes** **sectional drawing No.** **denomination** **Qty. / item**	f **Liste des pièces série BN** **tailles** **plan no.** **désignation** **Qté. / Poste**
1	200	Laterne	lantern	lanterne
2	202	Halbrundkerbnägel	round head grooved pins	rivet
1	203	Typenschild	type plate	plaque signalitique
4	210	6kt-Schraube	hexagon bolt	vis
	211	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1	300	Stopfbuchsgehäuse	gland housing	boitier de presse étoupe
6	301	Packungsring	packing ring	tresses
1	302	Stopfbuchsbrille	packing gland	fouloir
2	303	Hammerschraube	gland bolt	vis de fouloir
2	304	6kt-Mutter	hexagon nut	écrou
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310	Spritzring	splash ring	bague de projection
1	400	Kuppelstange	coupling rod	barre d'accouplement
2	401	Gelenkhülse	retaining sleeve	douille d'articulation
2	402	Kuppelstangenbolzen	coupling rod pin	axe d'articulation
4	403	Führungsbuchse	guide bushing	douille de guidage
2	404	Kuppelstangenbuchse	coupling rod bushing	chemise d'axe
2	405	Manschette	universal joint sleeve	manchette
2	406	Halteband	holding band	collier de serrage
2	407	Halteband	holding band	collier de serrage
1	500	Sauggehäuse	suction casing	carter d'aspiration
1	501	Sauggehäusedichtung	casing gasket	étanchéité du carter d'aspiration
3	502	Verschlussschraube	screwed plug	bouchon de vidange
3	503	Dichtring	sealing ring	joint d'étanchéité
4	506	6kt-Schraube	hexagon bolt	vis
4	507	Fächerscheibe	fan type lock washer	rondelle à dents chevauchantes extérieures
4	509	6kt-Mutter	hexagon nut	écrou
2	°) 510	Reinigungsdeckel	cleanout	couvercle de nettoyage
2	°) 511	Dichtung	gasket	étanchéité
8	°) 512	6kt-Schraube	hexagon bolt	vis
2	°) 516	Verschlussschraube	screwed plug	bouchon de vidange
2	°) 517	Dichtring	sealing ring	joint d'étanchéité
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
2	602	Spannschraube	tie bolt	tirant
2	603	Spannschraube	tie bolt	tirant
8	604	6kt-Mutter	hexagon nut	écrou
8	606	Scheibe	washer	rondelle
1	607	Stützbock	trestle	pied
1	700	Druckstutzen	pressure branch	bride de refoulement
1	705	Verschlussschraube	screwed plug	bouchon de vidange
1	706	Dichtring	sealing ring	joint d'étanchéité
	098	**seepex Gelenkfett** Typ und Füllmenge siehe Angaben im Inhaltsverzeichnis der zur Pumpe gehörenden Betriebsanleitung	**seepex joint grease** for type and filling quantity refer to index of operating instruction belonging to pump	**seepex graisse d´articulations** voir sommaire pour type et quantité
		Verschleissteile und Dichtungen: siehe Dokument OM.WPS.___	**Wear parts and sealings** refer to document OM.WPS.___	**Pièces d´usure et étanchéités** voir document OM.WPS.___
		Werkzeuge: Für Demontage und Wiedermontage erforderlich siehe Dokument OM.SPT.01	**Tools:** required for disassembly and reassembly, refer to document OM.SPT.01	**Outils:** Requis pour le démontage et le rémontage, voir document OM.SPT.01
		versetzt gezeichnet	drawn displaced	plan separé
	°)	Option	option	option



°) Option / option

Baugrößen / size 05–24 bis / up to 202–6L

Werkzeug

für die Demontage und Wiedermontage erforderlich siehe Dokument OM.SPT.01

tool for the dismantling and assembly requested see document OM.SPT.01

* Verschleißteile und Dichtungen

siehe Dokument OM.WPS._

Wearing parts and sealings see document OM.WPS._

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht/Weight kg

seepex GmbH + Co KG
SchaumbURGstrasse 344
D-46240 Bottrop

seepex.

Änd.-Index Mod. No.	Änderung Modification	Name Name	Datum Date
B	AD 372	di	08.11.2002

Allgemeintoleranzen für Masse ohne einzelne Toleranzeintragung DIN ISO 2768-mittel
General tolerances for mass without individual tolerance entry DIN ISO 2768-average

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 3
Roughness for surface finish indication DIN ISO 1302 Row 3

	Name Name	Datum Date
Bearbeitet/Drawn	hof	14.02.1995
Geprüft/Checked	hue	14.02.1995
Normiert/Standard		
Gedruckt/Printed		

Maßstab/Scale: % | Werkstoff/Material | Gewicht/Weight | Vordruck: CAD

Bezeichnung/Denomination
Schnittzeichnung Baureihe "BN"
sectional drawing range "BN"

Zeichnungs-Nummer/Drawing-Number: 062-004B1
EDV-Nr./EDP-No. 10859.dwg
Ersatz für/Replacement for:
Ersetzt durch/Replacement by:

Urheberrechtsschutz: Diese Zeichnung ist unser Eigentum und uns nach dem Gesetz über Urheberrecht und verwandte Schutzrechte geschützt.
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seepex

Stückliste Baureihe BN
Baugrösse 05-24, 1-6, 1-12, 2-6L...202-6L
Schnittzeichnung Nr. 062-004B1

Dokument / document **SL.062.004del**
Ausgabe / issue B / 08.11.02
Blatt / sheet 1 (1)

		d	e	f
		Stückliste Baureihe BN **Baugrössen** **Schnittzeichnung Nr.**	**Parts list range BN** **sizes** **sectional drawing No.**	**Liste des pièces série BN** **tailles** **plan no.**
Stck.	**Pos.**	**Benennung** **Stck. / Pos.**	**denomination** **Qty. / item**	**désignation** **Qté. / Poste**
1	200	Laterne	lantern	lanterne
2	202	Halbrundkerbnägel	round head grooved pins	rivet
1	203	Typenschild	type plate	palque signalitique
4	210	6kt-Schraube	hexagon bolt	vis
	211	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310	Spritzring	splash ring	bague de projection
1	400	Kuppelstange	coupling rod	barre d' accouplement
2	401	Gelenkhülse	retaining sleeve	douille d' articulation
2	402	Kuppelstangenbolzen	coupling rod pin	axe d' articulation
4	403	Führungsbuchse	guide bushing	douille de guidage
2	404	Kuppelstangenbuchse	coupling rod bushing	chemise d' axe
2	405	Manschette	universal joint sleeve	manchette
2	406	Halteband	holding band	collier de serrage
2	407	Halteband	holding band	collier de serrage
1	500	Sauggehäuse	suction casing	carter d' aspiration
1	501	Sauggehäusedichtung	casing gasket	étanchéité du carter d' aspiration
3	502	Verschlussschraube	screwed plug	bouchon de vidange
3	503	Dichtring	sealing ring	joint d' étanchéité
4	506	6kt-Schraube	hexagon bolt	vis
4	507	Fächerscheibe	fan type lock washer	rondelle à dents chevauchantes extérieures
4	509	6kt-Mutter	hexagon nut	écrou
2	°) 510	Reinigungsdeckel	cleanout	couvercle de nettoyage
2	°) 511	Dichtung	gasket	étanchéité
8	°) 512	6kt-Schraube	hexagon bolt	vis
2	°) 516	Verschlussschraube	screwed plug	bouchon de vidange
2	°) 517	Dichtring	sealing ring	joint d' étanchéité
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
2	602	Spannschraube	tie bolt	tirant
2	603	Spannschraube	tie bolt	tirant
8	604	6kt-Mutter	hexagon nut	écrou
8	606	Scheibe	washer	rondelle
1	607	Stützbock	trestle	pied
1	700	Druckstutzen	pressure branch	bride de refoulement
1	705	Verschlussschraube	screwed plug	bouchon de vidange
1	706	Dichtring	sealing ring	joint d' étanchéité
	098	**seepex** Gelenkfett Typ und Füllmenge siehe Angaben im Inhaltsverzeichnis der zur Pumpe gehörenden Betriebsanleitung	**seepex** joint grease for type and filling quantity refer to index of operating instruction belonging to pump	**seepex** graisse d' articulations voir sommaire pour type et quantité
		Verschleissteile und Dichtungen: nach Dokument OM.WPS.__	**Wear parts and sealings** refer to document OM.WPS.__	**pièces d'usure et étanchéités** voir document OM.WPS.__
		Werkzeuge: für Demontage und Wiedermontage nach Dokument OM.SPT.01	**Tools:** required for disassembly and reassembly, refer to document OM.SPT.01	**Outils:** Requis pour le démontage et le rémontage, voir document OM.SPT.01
		versetzt gezeichnet	drawn displaced	plan separé
		Wellenabdichtung siehe Schnittzeichnung Gleitringdichtung	shaft sealing see sectional drawing mechanical seal	dispositif d' etanchéité voir vue éclatée garniture mécanique
	°)	Option	option	option

1.
Safety for Shaft Sealings
(in compliance with DIN EN 809)

Sufficient precautions must be taken to prevent the emergence into the atmosphere of any leakage constituting a hazard due to its toxicity, explosive-ness or combustibility. The leakage must be dis-posed of at a safe location. Always pay due regard to the applicable national standards and specifica-tions.

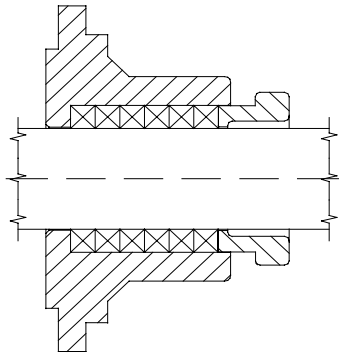
2.
Shaft Sealing

2.1
Operating Conditions

The permissible operating conditions and material combination are matched with the particular application in each case and are indicated in the data sheet of the associated pump.

2.2
Design

- standard
- 6 packing rings



associated operating instructions OM.SEA.01e

Gland Packing seepex Code A, C, E, F, S, V

1.
Commissioning

1.1
Adjusting the Gland Packing

When commissioned the factory-set gland packing is only slightly tightened. For this reason, the packing must be adjusted on-site to suit the prevailing operating conditions.

1.2
Gland Packing at Overpressure in Suction Chamber

50-100 drops per min. leakage is permissible at startup until the packing material has settled (duration: c. 10-15 min.). Following the settle time, the leakage must be reduced to 1-10 drops per min. by uniformly tightening the gland stuffing box. Leaking fluid drains into the drip pan, lantern and/
or drive housing and carried off via a threaded drilling.

1.3
Gland Packing at Partial Vacuum in Suction Chamber

With the low pre-set tightening level, the gland packing requires c. 10-15 minutes before the packing material settles. After this time, tighten
the gland stuffing box uniformly until no more air
is drawn in from the atmosphere.

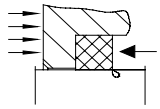
2.
Monitoring during Operation

2.1
Checking for Leaks

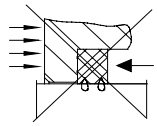
Gland packings must be checked for leaks at regular intervals while the pump is running. In the case of excessive leakage (overpressure in suction chamber) or intake of air (partial vacuum in suction chamber), the gland stuffing box (302) must be tightened until the permissible leakage rate is achieved see Point 1.2 or 1.3. If the gland packing has been tightened to such an extent that the gland stuffing box (302) fits up against the gland housing (300), it is neces-sary to fit a new packing ring (301). If following tightening of the new packing ring the gland stuf-fing box again fits up against the gland housing, then it is advisable to replace the entire gland packing. Timely renewal of the packing will largely rule out the incidence of shaft wear.

2.2
Operating Errors and Consequences

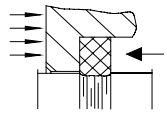
Gland packings are intended to limit, but not pre-vent, the escape of the medium. Some leakage
is necessary to reduce friction and carry off the associated friction heat.



Correct:
lubrication by liquid and antiseize agent



Incorrect:
no liquid lubrication due to excessive stuffing box pressure; impregnation is squeezed out.

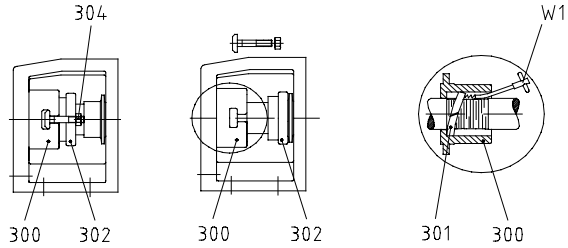


Consequence:
dry running, burning of the packing. Severe shaft wear leading to heavy leakage.

3.
Service and Maintenance

3.1
Renewing Gland Packing

The tool (W1/see Point 9) should be used to remove the individual packing rings (301). Before re-fitting the rings, clean the gland area and replace any damged shafts.
See Point 4.2 for instructions on re-fitting the packing rings (301).

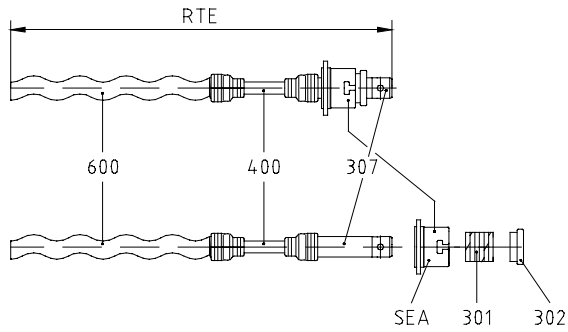


4.
Dismantling / Re-mounting

4.1
Dismantling

Following the dismantling of the rotating unit (RTE) in the manner described in OM.MAI.01 Point 7.3.5, clean the plug-in shaft (307) and remove any pro-jecting edges and burring that could damage the shaft sealing elements.

Remove shaft sealing (SEA) from the plug-in shaft.



4.2
Re-assembly

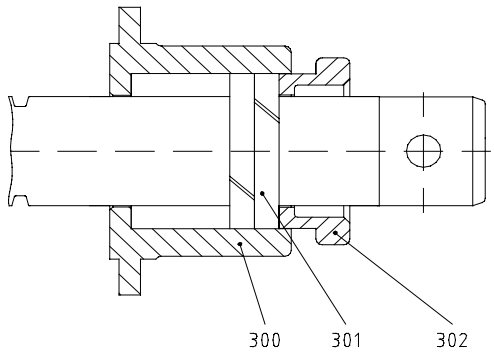
CAUTION

As a basic rule, only packing materials conforming to the operating conditions as well as suitable packing diameters and lengths should be used.

CAUTION

Please refer to the added document OM.SEA.__e “shaft sealing design“ for details of the layout of any seal cage, grease lantern and/or thrust collar, if existent, as well as connection possibilities in the gland housing.

Fit the packing rings (301) with cut ends offset by 90°. Using the gland stuffing box (302), insert the individual rings uniformly into the gland packing chamber (never use a pointed implement, otherwise damage to the shaft could result and the packing material become deformed).



1.
General

- Please take the appertaining drawing from respective pump data sheet.

- The mechanical seal is suitable for the operating conditions indicated in the pump data sheet. Modifications are only admissible after the customer has consulted with **seepex**. Additionally, attention must be paid to the manufacturer's operating manual.

2.
Safety

Any mode of operation impairing the operating safety of the mechanical seal has to be avoided.

The operator is advised to consider the possible effects on the environment which could be caused by a defective mechanical seal and what additional measures must be taken to protect the environment and the public.

The pump must be mounted and operated in such a way that operation with a defective mechanical seal will not result in injury or harm to the public and that any leakage can be safely and properly dealt with.

Mechanical seals are often used to seal hazardous material (chemicals, drugs, etc.). It is essential that rules pertaining to the handling of hazardous materials are adhered to.

Modifications effected by the customer himself and changes influencing the safety of the mechanical seal are not allowed.

3.
Emissions

A mechanical seal is a dynamic seal and leakage is unavoidable.

ATTENTION

Components that may contact leakage must be resistant to corrosion or be protected accordingly.

Mechanical seal leakage must be drained in a safe and proper manner.

4.
Flushing or circulation of single-acting mechanical seals

Single-acting mechanical seals contacting the conveying liquid require no additional flushing or a circulation pipe because sufficient flushing and heat exchange occurs around the seal due to the conveying liquid.

However, in particular cases, a direct flushing pipe can be installed into the flushing connection on the mechanical seal housing.

5.
Commissioning

Regardless of the pump's operating status, the conveying medium to be sealed must always be in liquid form at the mechanical seal. This particularly applies to the pump's commissioning and its placing out of service.

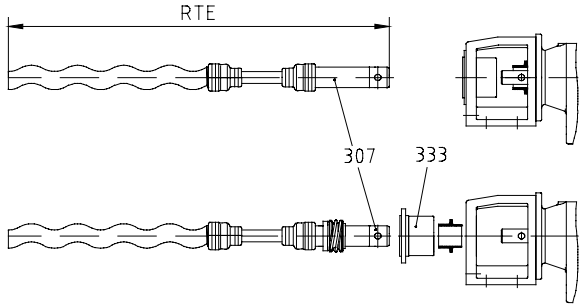
6.
Maintenance

When operating the pump according to the instructions, no maintenance is required.

7.
Disassembly / Reassembly

7.1
Disassembly

- Remove flushing connections at shaft seal housing (SAE).
- Lift / displace splash ring (310) and eject plug-in shaft pin (309) horizontally.
- Withdraw rotating unit (RTE) together with shaft seal parallel from output shaft of drive and avoid chocking.
- Clean plug-in shaft (307) and remove burrs etc., which may damage sealing elements. Moisten plug-in shaft (307) with slip additive (diluted fluid soap).
- Loosen axial safety device of mechanical seal (330 or 372) and withdraw mechanical seal (330) from plug-in shaft (307).
- Remove mechanical seal housing (333) from lantern (200).
- Press counter-ring of mechanical seal with o-ring out of mechanical seal housing (333).



7.2
Reassembly

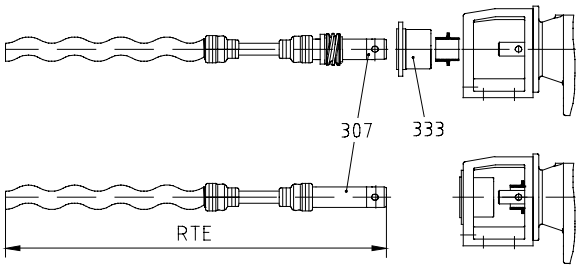
ATTENTION

Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- Clean mechanical seal housing (333)
- Evenly press counter-ring with o-ring into mechanical seal housing (333). To facilitate assembly, the o-ring should be moistened with a lubricant (diluted fluid soap).

ATTENTION

- Oil or grease must not be used to facilitate assembly.
- Install mechanical seal housing (333) to lantern (200) and onsure correct position of flushing connections.
- Remove plug-in shaft (307), burrs and roughness and clean the unit.
- Check / adjust set dimension of mechanical seal on plug-in shaft (307). Moisten plug-in shaft (307) and elastomer parts of mechanical seal with lubricant (diluted fluid soap).
- Slip mechanical seal onto plug-in shaft (307) as far as set ring.
- Lubricate drive shaft (ANT) with antiseize graphite petroleum.
- Moisten splash ring (310) and plug-in shaft (307) with pin joint grease, (for type, please see index) and slip splash ring (310) onto output shaft of drive. Note installating position of splash ring and refer to description on splash ring.
- Move rotating unit (RTE) through mechanical seal housing (333) and splash ring (310) and slip splash ring (310) onto output shaft of drive (ANT). Push in plug-in shaft pin (309) in horizontal position.
- Position of splash ring:
  Collar of splash ring shall be fitted in a distance of about 0.5 mm to lantern (200).



Wearing parts and gaskets

Sizes: 05-12, 025-24, 05-12 and 1-6L
Range: BN

To avoid the expenses incurred by lengthy stop periods of the pump, **seepex** recommend the acquisition of a set of wearing parts and a set of gaskets.
The table below shows the contents of these sets.

Part designation	small set of wearing parts	big set of wearing parts	set of gaskets	Item number acc. to sectional drawing of pump and parts list
	Number			
Rotor		1		600
Stator 2)	1	1		601
Universal joint sleeve		1		405
Coupling rod pin		2		402
Guide bush 2)		4		403
Coupling rod/ with coupling rod bush		1/-		400 / -
Coupling rod bush 2)		-		-
Casing gasket			1	501
Holding band, small 2)		-		-
Holding band, large 2)		2		406
Packing ring set 2)	1	1		301
Mechanical seal			1	330
Sealing ring			3	503
Splash ring			1	310
O-ring/cleanout			-	-
Plug-in shaft 2)		1		307
Special joint grease				098 — 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech. specifications
Tool				Essential for assembly, see Point 9, document OM.SPT.01

2) see tools Point 9., document OM.SPT.01

Wearing parts and gaskets

Sizes: 05-24, 1-6 to 300-6L
Range: BN

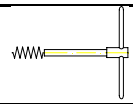
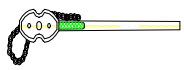
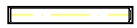
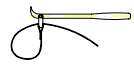
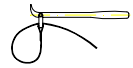
To avoid the expenses incurred by lengthy stop periods of the pump, **seepex** recommend the acquisition of a set of wearing parts and a set of gaskets.
The table below shows the contents of these sets.

Part designation	small set of wearing parts	big set of wearing parts	set of gaskets	Item number acc. to sectional drawing of pump and parts list
	Number			
Rotor		1		600
Stator 2)	1	1		601
Universal joint sleeve		2		405
Coupling rod pin		2		402
Guide bush 2)		4		403
Coupling rod/ with coupling rod bush		1/2		400 / 404
Coupling rod bush 2)		2		404
Casing gasket			1	501
Holding band, small 2)		2		407
Holding band, large 2)		2		406
Packing ring set 2)	1	1		301
Flushing ring	1	1		311
Mechanical seal			1	330
Sealing ring			4	503, 517, 706
Splash ring			1	310
O-ring/cleanout			2	511
Plug-in shaft 2)		1		307
Special joint grease				098 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech. specifications
Tool				Essential for assembly, see Point 9, document OM.SPT.01

2) see tools Point 9., document OM.SPT.01

Allgemeine normierte Werkzeuge

Standardized tools

Werkzeug Nr. tool No.	W1	W2	W5	W6	W9	W11	W13
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general	Mutter für Teflonmanschette nut for teflon universal joint sleeve	Stator stator 1)
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever	Bandschlüssel strap wrench	Bandschlüssel strap wrench
Baugröße size							
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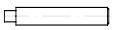
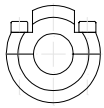
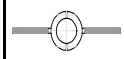
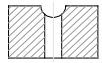
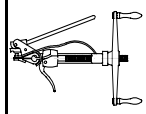
025-12 025-24 05-12 1-6L			DHS 00 020 0000 0 00000				
05-24 1-6 1-12 2-6L 1-24 2-6 2-12 5-6L	PKZ XX 000 0000 0 X0FQ0	KRZ XX Z55 0250 0 00000 KEZ XX Z55 0250 0 00000	DHS 00 050 0000 0 00000	BLZ 00 020 0008 0 00000			
2-24 5-6 5-12 10-6L/15-6LT	PKZ XX 000 0000 0 XOHV0		DHS 00 050 0000 0 00000	BLZ 00 020 0010 0 00000			
5-24 10-6 10-12 17-6L/30-6LT			DHS 00 100 0000 0 00000	BLZ 00 020 0010 0 00000	2 Stück 2 pieces MHL XX SA 610	WKZ SBD 140	
26-6L/40-6LT 10-24 17-6 17-12 35-6L/55-6LT 52-6L/75-6LT 17-24		KRZ XX Z55 0300 6 00000 KEZ XX Z55 0300 6 00000	DHS 00 120 0000 0 00000	BLZ 00 025 0012 0 00000			
52-12 35-6 35-12 70-6L/110-6LT	PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0300 8 00000	DHS 00 160 0200 0 00000	BLZ 00 030 0012 0 00000			
35-24 70-6 70-12 130-6L 200-6L		KEZ XX Z55 0300 8 00000	DHS 00 200 0200 0 00000	BLZ 00 035 0012 0 00000			
70-18 70-24 130-6 130-12 202-6L		KRZ XX Z55 0301 2 00000 KEZ XX Z55	DHS 00 240 0250 0 00000	BLZ 00 040 0015 0 00000			
130-24 240-12 350-6L		0301 2 00000		BLZ 00 040 0015 0 00000			

Die Preise sind dem Preisblatt AL.SPTde zu entnehmen / prices are listed on price sheet AL.SPTde

1) Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

	Empfohlene **seepex** Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. Recommended **seepex** tools Due to the design recommended for certain repairs, these tools partially replace the standardized tools.							Spezialwerkzeuge für bestimmte Montagen unbedingt erforderlich Special tools definitely needed for certain repairs	
Werkzeug Nr. tool No.	W4	W7	W8	W10	W12	W14	W15	W3	
zur Montage von: tool for mounting of:	Gelenk joint	Lager bearing	Schmiernippel lubrication nipple	Steckwelle plug-in-shaft	Teflon-manschette teflon universal joint sleeve	Kuppelstangen-buchsen coupling rod bushing	Manschette universal joint sleeve	Halteband holding band	
Benennung: denomination:	Montagedorn assembly mandrel	Montagehülse mounting sleeve	Einschlag-hülse drive-in sleeve	Demontage Werkzeug dismantling tool	Montage-werkzeug mounting tool	Preßwerkzeug pressing tool	Montage-platte mounting plate	Montagewerkzeug mounting tool	
Baugröße **size**									
0015-24 003-12/-24 006-12/-24 012-12/-24	MTD L2 060 M120 0 XXXXX 2)						MTP A7 703 M120 0 002XX		
025-12 025-24 05-12 1-6L	MTD L2 060 M500 0 XXXXX	MTH M8 060 M500 0 XXXXX		AZV B2 262 M500 0 XXXXX			MTP A7 703 M500 0 002XX		
05-24 1-6 1-12 2-6L 1-24 2-6 2-12 5-6L	MTD L2 060 0020 0 XXXXX	MTH M8 060 0020 0 XXXXX		AZV B2 262 0020 0 XXXXX	MMT M8 060 0020 0 XXXXX	PWZ C6 060 0020 0 XXXXX			
2-24 5-6 5-12 10-6L/15-6LT	MTD L2 060 0050 0 XXXXX	MTH M8 060 0050 0 XXXXX		AZV B2 262 0050 0 XXXXX	MMT M8 060 0050 0 XXXXX	PWZ C6 060 0050 0 XXXXX			
5-24 10-6 10-12 17-6L/30-6LT	MTD L2 060 0100 0 XXXXX	MTH M8 060 0100 0 XXXXX		AZV B2 262 0100 0 XXXXX	MMT M8 060 0100 0 XXXXX	PWZ C6 060 0100 0 XXXXX		MHB WH A00 1WHV 0 01000	
26-6L/40-6LT	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX	ESH N0 000 0000 0 XXXXX	AZV B2 262 0140 0 XF5XX	MMT M8 060 0140 0 XXXXX	PWZ C6 060 1400 0 XXXXX			
10-24 17-6 17-12 35-6L/55-6LT 52-6L/75-6LT	MTD L2 060 0170 0 XXXXX	MTH M8 060 0170 0 XXXXX		AZV B2 262 0170 0 XG0XX	MMT M8 060 0170 0 XXXXX	PWZ C6 060 0170 0 XXXXX			
17-24 52-12 35-6 35-12 70-6L/110-6LT	MTD L2 060 0350 0 XXXXX	MTH M8 060 0350 0 XXXXX			MMT M8 060 0350 0 XXXXX	PWZ C6 060 0350 0 XXXXX			
35-24 70-6 70-12 130-6L 200-6L	MTD L2 060 0700 0 XXXXX	MTH M8 060 0700 0 XXXXX				PWZ C6 060 0700 0 XXXXX			
70-18 70-24 130-6 130-12 202-6L	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX				PWZ C6 060 1300 0 XXXXX			
130-24 240-12 350-6L						PWZ C6 060 2400 0 XXXXX			

Die Preise sind dem Preisblatt AL.SPTde zu entnehmen / prices are listed on price sheet AL.SPTde

2) entfällt ab Pumpen-Herstellungsdatum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)

10.
Manufacturer's documents from sub-supplier

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Your **seepex** agent

Product Overview

We can match our NORDAC AC vector drives with our Inverter/Vector Duty Motors and UNICASE™ Speed Reducers to provide a total AC Motor Drive solution from one trusted source.

UNICASE™ SPEED REDUCERS

HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 205,000 lb-in
- Gear ratios – 1.82:1 to over 300,000:1

NORDBLOC® HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 26,550 lb-in
- Gear ratios – 1.88:1 to over 370:1

PARALLEL HELICAL CLINCHER™
- Shaft, Flange or Foot Mount
- Torque up to 797,000 lb-in
- Gear ratios – 4.26:1 to over 300,000:1

RIGHT ANGLE HELICAL-BEVEL 2-STAGE
- Foot, Flange or Shaft Mount
- Torque up to 5,840 lb-in
- Gear ratios – 4.1:1 to 72:1

RIGHT ANGLE HELICAL-BEVEL
- Foot, Flange or Shaft Mount
- Torque up to 283,000 lb-in
- Gear ratios – 8.04:1 to over 300,000:1

RIGHT ANGLE HELICAL-WORM
- Foot, Flange or Shaft Mount
- Torque up to 27,585 lb-in
- Gear ratios – 4.40:1 to over 300,000:1

MINICASE™ RIGHT ANGLE WORM
- Foot, Flange or Shaft Mount
- Torque up to 3,540 lb-in
- Gear ratios – 5:1 to 500:1

FLEXBLOC™ WORM
- Modular bolt-on options
- Torque up to 4,683 lb-in
- Gear ratios – 5:1 to 3,000:1

HIGH PERFORMANCE MOTORS & BRAKEMOTORS

INVERTER/VECTOR DUTY
- Standard or Energy Efficient
- Integral, NEMA or Metric IEC
- 1/6 to 250 hp

NORDAC AC VECTOR DRIVES

TRIO SK300E
- Motor or remote mounted
- IP55 – washdown
- 380-460V, 3-phase, to 5hp
- 200-240V, 3-phase, to 3hp

SK500/520/530E
- Compact, high performance
- 380-480V, 3-phase, to 10hp
- 200-240V, 3-phase, to 5hp
- 200-240V, 1-phase, to 3hp
- 110-120V, 1-phase, to 1.5hp

SK700E
- Flexible high performance
- 380-460V, 3-phase, to 200hp

DRIVESYSTEMS

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0200104/0909

Intelligent Drivesystems

B1000

Operating & Instruction Manuals For Gear Units

B1000

DRIVESYSTEMS

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BIM 1011 - NORDBLOC Helical Gearboxes Installation & Maintenance Instructions	U10000 - General Instructions U10020 - Safety Notes U10040 - Storage & Commissioning U10060 - Unit Installation U10250 - Solid Shaft Connections U10500 - Reducer Mounting Footed & Flange Mount Gear Units U10750 - Helical & Bevel Reducer Lubrication U11000 - Helical & Bevel Reducer Lubrication Types U12700 - Nordbloc™ Footed Oil Fill Quantities U12800 - Nordbloc™ Flanged Oil Fill Quantities U14600 - Nordbloc™ Oil Plugs & Vent Locations U15600 - Nordbloc™ Parts Lists Drawings
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BIM 1031 - MINICASE Worm Gearboxes Installation & Maintenance Instructions	U10000 - General Instructions U10020 - Safety Notes U10040 - Storage & Commissioning U10250 - Solid Shaft Connections U10500 - Reducer Mounting Footed & Flange Mount Gear Units U10770 - Helical Worm Reducer Lubrication U11040 - Minicase™ Worm Reducer Lubrication Types U13100 - Minicase™ Foot Mount Oil Fill Quantities U13200 - Minicase™ Flange Mount Oil Fill Quantities
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BIM 1001 - Hollow Shrink Disc Shaft Installation & Maintenance Instructions	U10290 - Hollow Shaft with Shrink Disc
BIM 1002 - Keyed Shaft & Fixing Element Installation & Maintenance Instructions	U10270 - Keyed Hollow Shaft U10280 - Shaft Fixing Kit
BIM 1003 - Expansion Chambers Installation & Maintenance Instructions	U10830 - Expansion Chambers Installation & Maintenance Manual
BIM 1009 - Inputs	U45100 - NEMA IEC Inputs & Their Couplings U45250 - NEMA or IEC Input Adapter Lubrication Options U45300 - Solid Input Shaft [W] U45400 - Motor Mount Platform U45500 - Sugar Scoop
BIM 1004 - Motors	U30000 - Motors - AC Induction, Single and Polyphase
BIM 1014 - Motor Brakes	U35000 - Motor Brakes Installation & Maintenance
BIM 1092 - Current Sensing Brake Relay [IR]	U35195 - Identification of Recifier U35200 - Current Sensing Relay U35205 - Current Sensing Relay
BIM 1095 - Fast Brake Rectifier [GPE & GPU]	U35100 - Fast Brake Rectifier
BIM 9002 - GRIPMAXX™	U10310 - NORD GRIPMAXX™

1. Importance of the operating instructions

These operating instructions are intended to provide general information and safety guidelines. It is the responsibility of the buyer, machine builder, installer and user of the NORD product to make sure that all the proper safetynotes and operating instructions have been reviewed and understood. If the contents of this instruction or any applicable operating instructions are not understood, please consult NORD.

> ⚠ *WARNING*
>
> Electric motors, gearmotors, electrical brakes, variable frequency drives, and gear reducers contain potentially dangerous high-voltage, rotating-components and surfaces that may become hot during operation. All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

2. Inspect incoming freight

Before accepting shipment from the freight company, thoroughly inspect the NORD equipment for any shipping and handling damage. If any goods called for in the bill of lading or express receipt are damaged, or if the quantity is short, do not accept until the freight express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once, and request a formal review of your claim.

Claims for loss or damage in shipment must not be deducted from the NORD invoice, nor should payment of the NORD invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery. NORD will try to assist in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material.

3. Obtaining detailed operating instructions

One can receive the detailed installation and maintenance instructions by entering a serial number (or NORD order number) at the appropriate location on the NORD web site.

i. Record the serial number from your gearmotor, gear reducer, or motor nameplate, or record the serial number found on your order confirmation.

ii. Go to **www.nord.com/docs** to download the appropriate operating instructions.

EXAMPLE: www.nord.com/docs

4. Intended use

NORD is a supplier of electric motors, gearmotors, reducers, electromechanical brakes, mechanical variators, and electrical variable frequency drives that are intended for commercial installations on larger systems and machines.

> ⚠ *WARNING*
>
> NORD does not accept any liability for damage or injury caused by:
>
> - Inappropriate use, operation or adaptation of the drive system.
> - Unauthorized removal of housing covers, safety and inspection covers, guarding, etc.
> - Unauthorized modifications to the drive system.
> - Improper servicing or repair work on the drive system.
> - Damage caused during shipment or transportation.
> - Disregard of the important Safety Notes or Operating Instructions.

5. Notes concerning warranty and liability

All units are supplied according to the terms described in our standard "Conditions of Sale." The unit limited warranty is also defined in our "Conditions of Sale" and is located in the back of our product catalogs as well as the back of your order invoice.

All NORD Safety Notes and all related NORD Operating instructions shall be considered up-to-date at the time in which they were compiled by the buyer, machine builder, installer or user. NORD reserves the right to incorporate technical modifications and information updates to any safety/operating instructions that are within the scope of providing additional knowledge or clarification, communicating design changes, or product enhancements. Information updates may include any NORD product, or subsequent products purchased and supplied by NORD; No specific claims can be derived from the information or illustrations and descriptions contained in the safety notes or related operating instructions.

⚠ *WARNING*

NORD assumes no liability for personal injury, equipment damage or malfunctions resulting from failure to comply with any installation safety notes. The applicable national, regional, and local work regulations and safety requirements must also be complied with. Failure to comply with any safety notes or regulations may result in serious injury, damage to property, or even death.

6. Checklist for installation and operation

☑ Verify that the purchased NORD product has been supplied with the expected accessories & options. Check the received goods and packing slip to make sure items are properly received.

☑ Make sure that you have all of the required Operating Instructions for your NORD electric motor, gearmotor, reducer, electromechanical brake, mechanical variable speed drives, or electrical variable frequency drives.

☑ Consult NORD if you feel you are missing any documentation or if you have questions.

SAFETY NOTES

1. Safety & information symbols

All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialists or personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service Department. Instructions related to operational safety will be emphasized as shown.

Symbol	Meaning
⚠	**Danger, Caution or Warning -** Severe risk or danger of personal injury or death by working around dangerously high electrical voltage or moving machinery. Proper safety precautions must be taken.
NOTICE	**Notice -** Care must be taken to avoid the possibility of damaging the drive unit, driven machine, or the environment.
ℹ	**Important Note -** Useful note or tip to help assure trouble-free operation.
♻	**Material Disposal Note -** Important note concerning suggested material disposal.

2. Safety warnings

⚠ *DANGER*

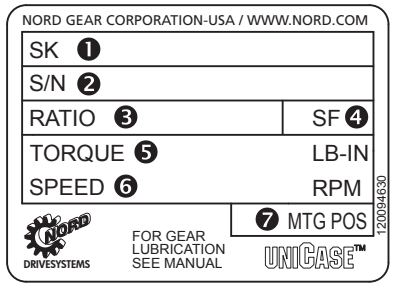
- All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. **NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!**
- Gear unit installation and maintenance work may only be performed when no power is available to the prime mover or motor. Electric motors, electrical brakes, and variable frequency drives, contain potentially dangerous high-voltage. Prior to installation or maintenance, shut down the power at the circuit breaker or power switch. **While working on the drive, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!**
- Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. **Use caution to avoid burns or serious injury!**

3. Observe published performance range & nameplate data

NOTICE

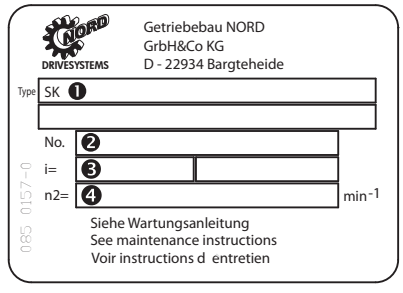
Observe the data on all reducer nameplates and verify published ratings for the NORD item/s in question. Do not operate any NORD equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

U.S. Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Service Factor
❺ Torque Rating
❻ Output Speed RPM
❼ Mounting Position

European Nameplate



❶ Model/Type
❷ Serial Number
❸ Gear Ratio
❹ Speed

4. Transportation and handling

Make sure that all eyebolts and lifting lugs are tight and lift only at designed points. Protect the mounting surface from possible damage during transportation.

⚠ *WARNING*

Do not attach other machinery or loads to the NORD assembly, the supplied lifting bolts are not designed for this purpose and may result in drive damage or personal injury.

If the gearmotor or assembly is equipped with two suspension eye bolts, then both locations should be used for transportation and placement of the unit; in this case the tension force of the slings must not exceed a 45° angle.

In some instances it may be appropriate to use additional lifting straps or slings in order to assure safe transportation of the assembly. Always use sufficiently rated handling equipment and ensure that adequate safety measures are taken to protect personnel from injury during transportation. Once the NORD assembly is properly installed, remove the transportation fixtures.

7. DISPOSAL

MATERIAL DISPOSAL

Properly dispose of all used gear units and internal parts in accordance with all local regulations. In particular, all lubricants must be properly collected and disposed.

For confirmation of specific materials used in a specific reducer or gearmotor assembly, please consult NORD with the appropriate unit identification or serial number.

Components	Material
Gear wheels, shafts, rolling bearings, parallel keys, snap rings, spacers, shims, etc.	Steel
Gear housing and housing components	Cast iron or Aluminum (depending on type and size)
Worm gears	Bronze alloy
Radial seals, sealing caps, and rubber components	Elastomers with some steel
Coupling components	Plastic or Elastomer with Steel
Housing gaskets and flat oil seals	Asbestos-free sealing or gasket material (various types used)
Gear Oil	Mineral, SHC-Synthetic or PG-Synthetic (can vary)

1. Storage

IMPORTANT NOTE

For storage periods longer than 9 months, or for storage in less than desirable conditions, please consult NORD for recommendations.

Storage for up to 9 months is possible, so long as the following conditions are observed:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Whenever possible, rotate the shafts periodically, by hand if necessary, to help prevent brinelling (bearing damage) and to help keep the shaft seals pliable.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.

2. Commissioning

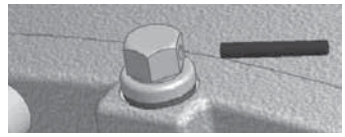
Prior to gear unit start-up, complete the following:

- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.

Sealed vent



Activated vent

- Check the lubricant and be sure the gear unit is filled with the proper oil type, to the proper level, as determined by the mounting position.

IMPORTANT NOTE

Some smaller gear units are supplied as maintenance free/ lubricated for life gear units. Oil level may not be checked on some of these units.

- Check the condition of all shaft seals and all assembled flange gasket areas. If any change is detected in the shape, color, hardness or permeability, or if any leaks are detected, the corresponding shaft seals and/or gaskets must be replaced.
- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

3. Long-Term Storage

By taking special precautions, problems such as seal leakage and reducer failure due to the lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect gear reducers during periods of extended storage:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer full with oil that is compatible with the product normally used or recommended during service.
- Apply grease to all unpainted or unprotected shafts, bores, keyways, flange surfaces, tapped holes, and to the exterior of all oil seals.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Once every few months rotate the input shaft approximately 10-20 revolutions to redistribute the weight of gears and shafts and to prevent brinnelling of the bearings and drying of the seal track.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.)

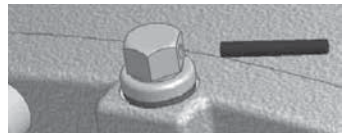
4. Commissioning After Long-Term Storage

• Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.

Sealed vent



Activated vent

- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Drain the reducer and refill it with the proper type and amount of lubricant.
- Observe start-up and initial operation to make sure there are no seal or gasket leaks, or unusual sounds, vibration or heat rise during operation.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

1. Installation site

Drives must be properly installed if they are to produce the rated torque. Improper installation may lead to oil leaks, reduced life, or even catastrophic failure. NORD gear drives and motors are intended to be installed at a suitable mounting site under the following conditions:

- Unimpeded airflow to and around the units.
- Accessibility to oil drain, level and breather plugs.
- On brakemotors, allow adequate space for removing the fan guard and replacing and adjusting the brake.
- Mounting surfaces must be flat, torsionally rigid, and dampened against vibration.
- Unless special measures are taken, the immediate vicinity around the gear drive or motor should not be exposed to any aggressive or corrosive substances, contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.

2. Mounting position

Reducer mounting position charts illustrate the standard mounting positions for horizontal and vertical mounting. All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, **according to the customer-specified mounting position**. For mounting orientations other than shown consult NORD Gear.

NOTICE

Improper oil levels may lead to premature component wear and diminished service life. The gear reducer may not receive proper lubrication if the unit is not mounted in the position for which it is designed. Observe the mounting position designated on the reducer nameplate, or specified in the order acknowledgement. Consult NORD prior to changing mounting position in the field. While it is often possible to simply relocate the oil fill-level and vent locations, and adjust the oil fill amount, in some cases, different mounting positions may lend themselves to different internal construction features.

3. Reducer mounting

- The support foundation must be straight, level and flat. Whether the gear unit is foot-mounted or flange-mounted, NORD recommends that the straightness and flatness of the customer-supplied support foundation follow **Table 1**.
- The gear unit must be properly aligned with the driven shaft of the machine in order to prevent additional stress or load forces from being imposed upon the gear unit.
- To facilitate oil drainage it may be desirable to elevate the gear box foundation above the surrounding support structure.
- All bolting surfaces must be clean and free from contamination and corrosion.

Table 1: Recommended Straightness and Flatness of Customer-Supplied Support Foundation

Above (in)	To & Including (in)	General Tolerance on Straigtness & Flatness ISO 2768-2, Tolerance Class K
0.00	0.39	+/- 0.002 in
0.39	1.18	+/- 0.004 in
1.18	3.9	+/- 0.008 in
3.9	11.8	+/- 0.016 in
11.8	39	+/- 0.024 in
39	118	+/- 0.031 in

Above (mm)	To & Including (mm)	General Tolerance on Straigtness & Flatness ISO 2768-2, Tolerance Class K
0	10	+/- 0.05 mm
10	30	+/- 0.1 mm
30	100	+/- 0.2 mm
100	300	+/- 0.4 mm
300	1000	+/- 0.6 mm
1000	3000	+/- 0.8 mm

Straightness: Based upon the length of the corresponding line.

Flatness: Based upon the longer lateral surface or the diameter of the circular surface.

IMPORTANT NOTE

The responsibility for the design and construction of the support foundation is with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads. ***Motors and drive components mounted on prefabricated base plates can become misaligned during shipment. Always check alignment after installation.***

4. Steel foundation

An engineered structural steel foundation should be designed to provide adequate rigidity and prevent loads from distorting the housing or causing misalignment of internal gears and shafts. When foot-mounting the gear reducer, a base plate or sole plate with suitable thickness (generally equal or greater than the thickness of the drive feet) should be securely bolted to steel supports and extend under the entire gear drive assembly. When flange-mounting the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear unit or gear motor.

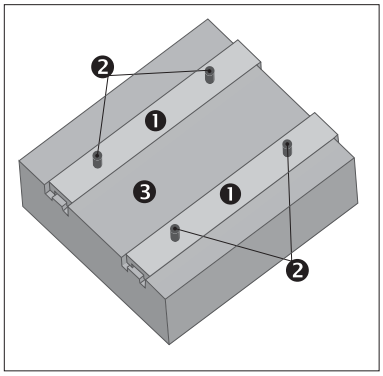
NOTICE

Do not weld on the gear unit or use the gear unit as an earth or ground connection for any welding procedure as this may cause permanent damage to the bearings and gears.

5. Concrete foundation

If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. Grout structural steel mounting pads and bolts of sufficient size into the concrete, to adequately distribute the load stress onto the concrete foundation.

Figure 1: Concrete Foundation



❶ Grouted Structural Steel Mounting Pads
❷ Mounting Bolts
❸ Concrete Foundation

6. Bolt connections for footed & flange mounted units

NORD footed reducers and flange-mount reducers (with B5 flange) have clearance designed into the mounting holes to allow for some minor adjustments in alignment. Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement. Tightening torque for gear reducer mounting bolts, and recommended fastener grades, are provided in Table 2.

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

Thread Size	Grade SAE 5 / ASTM A449		Grade SAE 8	
(in)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
1/4-20	7.1	9.6	10.0	13.6
5/16-18	16	21	22	30
3/8-16	28	37	39	53
1/2-13	69	93	98	132
5/8-11	138	188	195	264
3/4-10	247	334	348	472
7/8-9	396	537	558	757
1-8	592	802	833	1,130
1 1/8-7	-	-	1,233	1,672
1 1/4-7	-	-	1,717	2,327
1 3/8-6	-	-	2,267	3,073
1 1/2-6	-	-	2,983	4,045
1 3/4-5	-	-	4,458	6,045

- Calculated tightening torques are based a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using inch-fasteners, NORD recommends a minimum Grade SAE 5 (ASTM A-449) for sizes up to 1-8 UNC, and Grade SAE 8 for all larger sizes.

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

Above	ISO Grade 8.8		ISO Grade 10.9		ISO Grade 12.9	
(mm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
M4	2.4	3.2	3.5	4.7	4.1	5.5
M5	4.7	6.4	6.9	9.3	8.1	11
M6	8	11	12	16	14	19
M8	20	27	29	39	34	46
M10	39	53	58	78	67	91
M12	68	92	100	135	110	155
M14	107	145	159	215	180	250
M16	170	230	247	335	290	390
M18	240	325	343	465	400	540
M20	339	460	487	660	570	770
M22	465	630	664	900	770	1,050
M24	583	790	848	1,150	960	1,300
M27	848	1,150	1,217	1,650	1,440	1,950
M30	1,180	1,600	1,660	2,250	1,950	2,650
M36	2,050	2,780	2,884	3,910	3,470	4,710
M42	3,297	4,470	4,639	6,290	5,560	7,540
M48	4,940	6,700	7,010	9,500	8,260	11,200

- Calculated tightening torques are based on a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using metric-fasteners, NORD recommends a minimum ISO Grade 8.8 bolt.

7. Mounting the prime mover

When the motor is not flange mounted or integrally mounted to the gearbox, it is important to properly secure and align the gear drive with respect to the driven machine before attempting to align the prime mover or motor.

A. After the main gear drive is properly aligned and bolted in place, align the prime mover with respect to the reducer input shaft.

B. Use shims under the feet of the prime mover as needed, and secure in place with the proper mounting bolts. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.

IMPORTANT NOTE

When using a high speed coupling connection between the prime mover and the reducer, check alignment per the coupling manufacturers recommendations. If the coupling is misaligned, the reducer alignment or shimming is incorrect. Re-align the gear reducer and re-check the high-speed coupling alignment before re-aligning the motor.

SOLID SHAFT CONNECTIONS

1. Solid shaft diameter tolerance

Reducer input and output shaft extensions have a diameter tolerance as specified in **Table 1**.

Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)
0.375	1.750	+0.0000 / -0.0005
1.750	7.500	+0.0000 / -0.0010

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	80	+0.030 / +0.011	m6
80	120	+0.035 / +0.013	m6
120	180	+0.040 / +0.015	m6
180	190	+0.046 / +0.017	m6

2. Fitting drive elements onto the reducer solid shaft

Solid input and output shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

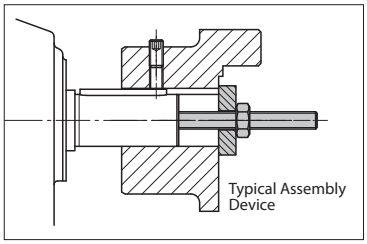


Table 2: Solid Shaft End - Threaded Holes

Above ø (in)	To & Including ø (in)	Tap Size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	3.500	3/4-10 x 1.73 in
3.500	7.500	1-8 x 2.63 in
5.125	8.875	1 1/4 - 7 x 3.15*
6.000	8.875	1 3/8 - 6 x 3.46**

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	85	M20 x 42 mm
85	130	M24 x 50 mm
130	225	M30 x 60 mm*
130	225	M36 x 74 mm**

* Only used on the SK9096.1 Helical-Bevel Gear Unit.

** Only used on the SK10382.1 & SK11382.1 CLINCHER™ gear units.

NOTICE

DO NOT DRIVE or **HAMMER** the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.

⚠ WARNING

To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

3. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).

⚠ WARNING

When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.

IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

4. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

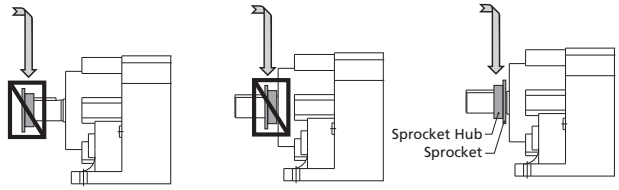
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

5. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in **Figure 2**.

Figure 2: Sprocket or Gear Mounting



Preferred Mounting of Sprocket or Gear

Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.

IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.

6. Outboard pinion gear alignment

Align outboard pinion gears and adjust the gear tooth clearance according to the manufacturer's recommendations, checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the gear unit moved slightly to obtain proper gear tooth contact. After the unit is moved to correct tooth contact, the prime mover may need to be realigned.

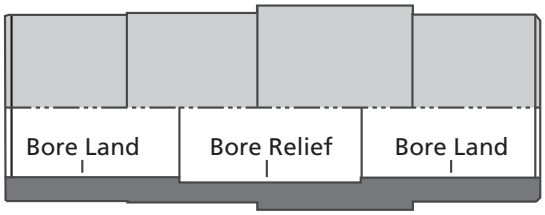
KEYED HOLLOW SHAFT

1. Keyed hollow shaft design

NORD uses high quality carbon steel to manufacture hollow-shafts. Upon request, NORD can provide alternate materials, such as stainless steel. NORD hollow shafts are designed with a bore relief (reduced contact area) between the mating shafts.

The bore relief provides a cavity to hold an anti-seize assembly paste. It also acts as a design feature intended to help prevent corrosion and to facilitate gearbox removal from the solid shaft.

NORD furnishes dual keys designed to be used in each of the bore land areas, as opposed to supplying a single long key. The dual keys are intended to simplify assembly onto the machine's solid shaft.



IMPORTANT NOTE

If a single shaft key or dual shaft keys are supplied by others, the key/s must engage the full bore-land length at each end of the hollow shaft.

2. Key and keyway dimensions

Unless otherwise indicated, inch keys and keyways follow the ANSI B17.1 standard and metric keys and keyways follow the DIN6885-1 standard. Inch bores will typically utilize square keys but in some instances the larger hollow shaft bore sizes utilize the alternate rectangular key shown in the ANSI B17.1 standard.

Key slots for the solid machine shaft should be made with a Class 2, transitional-fit class (slightly loose to slightly tight). Key slots in the female shaft are designed to be a low clearance fit. These suggested practices should allow for easier assembly with the mating solid shaft, without allowing excessive clearance which could cause keys to work loose during reducer operation.

IMPORTANT NOTE

If the key fit is too tight, light filing of the key sides and hand-fitting of the keys may be required.

3. Keyed hollow-shaft bore tolerances

Standard keyed hollow-shaft bore tolerances are shown in the following table.

Table 1 - Keyed hollow bore tolerances

Above ø [in]	To and Including ø [in]	Bore Diameter Tolerance ø [in]
0.4375	1.6250	+0.0010 / -0.0000
1.6250	3.2500	+0.0012 / -0.0000
3.2500	7.0000	+0.0014 / -0.0000

Above ø [mm]	To and Including ø [mm]	Bore Diameter Tolerance ø [mm]
10	18	+0.018 / -0.000
18	30	+0.021 / -0.000
30	50	+0.025 / -0.000
50	80	+0.030 / -0.000
80	120	+0.035 / -0.000
120	180	+0.040 / -0.000
180	190	+0.035 / -0.000

Metric hollow bore tolerances per ISO286-2, Class H7

4. Suggested solid shaft (machine shaft) tolerances

NORD recommends a close fit of the customer-supplied solid shaft or machine-shaft, for the following reasons:

- To help minimize the potential for fretting and corrosion.
- To help prevent excessive free play in the shaft connection that could lead to excessive load stress on the driven system, the gear drive, or both.

Table 2 - Suggested solid shaft tolerances

Above ø [in]	To and Including ø [in]	Shaft Diameter Tolerance Uniform Load ø [in]	Shaft Diameter Tolerance Shock Load ø [in]
0.4375	0.8750	+0.0000 / -0.0005	+0.0000 / +0.0005
0.8750	4.5000	+0.0000 / -0.0010	+0.0000 / +0.0010
4.5000	7.0000	+0.0000 / -0.0012	+0.0000 / +0.0015

Above ø [mm]	To and Including ø [mm]	Shaft Diameter Tolerance Uniform Load ❶ ø [mm]	Shaft Diameter Tolerance Shock Load ❷ ø [mm]
10	18	+0.000 / -0.011	+0.012 / +0.001
18	30	+0.000 / -0.013	+0.015 / +0.002
30	50	+0.000 / -0.016	+0.018 / +0.002
50	80	+0.000 / -0.019	+0.021 / +0.002
80	120	+0.000 / -0.022	+0.025 / +0.003
120	180	+0.000 / -0.025	+0.028 / +0.003
180	190	+0.000 / -0.029	+0.033 / +0.004

❶ **Uniform load: Mating shaft diameter tolerance per ISO286-2, class h6**

❷ **Shock load: Mating shaft diameter tolerance per ISO286-2, class k6**

As indicated in Table 2, different solid shaft tolerances are suggested depending upon the load type.

- If the machine load conditions are considered "Uniform" a clearance fit is allowed.
- If the machine load conditions are considered to have "Shock Load" a light clearance to interference fit condition is suggested.

Typically the machine builder will have good knowledge as to the load type. As an alternate method to classify load type, one could follow the "Mass Acceleration Factor Selection Method" that is discussed in NORD's product catalog/s.

Straightness, roundness, and diameter tolerance variations of both shafts should be controlled as accurately as possible. When mating, solid shaft design features are not controlled, reducer installation may be very difficult without ordering special hollow-bore design features to accomodate.

NOTICE

The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.

5. Suggested solid-shaft mating shaft surface finish

Controlling the mating shaft surface finish helps to assure proper fit and assembly while minimizing the possibility of corrosion and fretting. NORD recommends that the mating solid shaft surface should be at least 125 micro-inches (3.2 microns) or smoother.

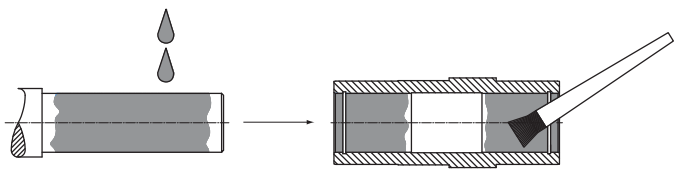
6. Assembly to the machine shaft

A. Clean and remove any dirt, grease, or rust-preventative coatings from both the reducer hollow shaft and the machine shaft.

B. Make sure the edges of both the reducer hollow shaft and machine shaft are free from any nicks or burrs. If nicks or burrs are present remove them using an abrasive material such as an emery cloth.

C. Before installing the gear reducer onto the machine shaft, apply an anti-seize compound or anti-corrosive lubricant to the mating shafts as shown in Figure 1. Assembly and subsequent dismantling will be aided by the anti-seize agent.

Figure 1 – Application of anti-seize to the mating shafts



D. Fit the shaft key/s into place on the machine shaft. Depending upon the key slot design on the machine shaft, it may be necessary to stake or Loctite® the key/s into place so they do not slide axially while fitting the reducer to the shaft.

E. Lift the gear unit assembly into place and align it carefully with respect to the machine shaft.

F. Fit the gear unit assembly onto the machine shaft using a suitable pulling device.

G. Secure the reducer onto the machine shaft in an axial direction, to prevent the reducer from shifting or walking out of place during operation.

NOTICE

Do not use excessive force or try to hammer the gear unit into place. The housing, shafting, bearings or gear wheels may become damaged.

7. Securing the reducer onto the machine shaft

There are slight shaft oscillations during operation in any rotating shaft equipment or any shaft-mounted reducer assembly. Therefore it is important to secure the reducer in an axial direction onto the machine shaft, to prevent the reducer from shifting or walking out of place during operation.

Possible methods to secure the reducer axially to the machine shaft include:

- Using commercial set collars, retaining rings, or snap rings.
- Using the optional "NORD Fixing Element Kit" (see U10280).

The NORD Fixing Element Kit includes all of the necessary parts to secure the shaft by using a tapped hole in the end of the mating male shaft.

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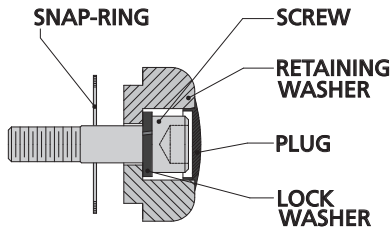
SHAFT FIXING KIT

1. Shaft fixing kit - basic design

The NORD Fixing Kit provides a method for securing the reducer in an axial direction, after the keyed-hollow shaft reducer is mounted onto the machine shaft. The fixing kit prevents the reducer from shifting or walking out of place during operation. NORD offers a variety of standard fixing kits, based upon bore size, as shown on Page 2 of this manual.

Figure 1 – Fixing kit components



IMPORTANT NOTE

For installation of the keyed-hollow bore reducer to the machine-shaft, see user manual U10270.

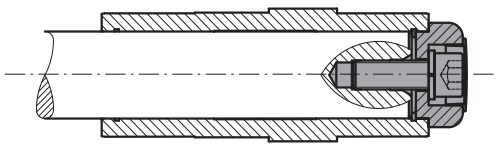
2. Assembly types

There are two types of assembly methods commonly used for securing the fixing kit.

Figure 2 – Fixing kit assembly methods

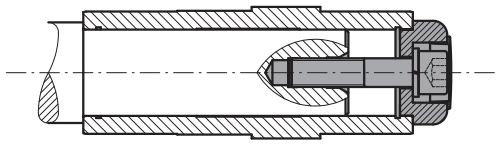
Type 1

The machine-shaft is located against a fixed snap-ring located inside the bore of the reducer.



Type 2

The machine shaft is shouldered and is pulled tight against the hollow-shaft; the snap-ring is no longer required.



NOTICE

The maximum edge break on the solid machine shaft must not exceed the values shown on Page 2 of this manual. Otherwise the load-bearing capacity of the snap-ring will be reduced and may result in failure.

3. Assembly

A. If using a Type 1 assembly, secure the appropriate snap-ring into the bore of the reducer. With Type 2 assembly, no snap-ring is required.

B. Draw the hollow bore gear reducer onto the machine shaft as instructed in U10270. Remember to apply a suitable assembly paste or anti-seize compound to the mating shafts.

C. Install the retaining washer over the end of the hollow bore.

D. Secure the appropriate cap-screw into the machine shaft and tighten the screw based upon the assembly type, as noted below. Then install the protective plug over the screw hole.

Type 1 - Screw tightening

Tighten until lightly snug and secure the screw with a thread-locking compound to prevent the screw from backing out.

NOTICE

Over tightening the retaining screw may cause the snap ring to be pulled out of its seating groove, causing damage to the hollow-bore or snap ring.

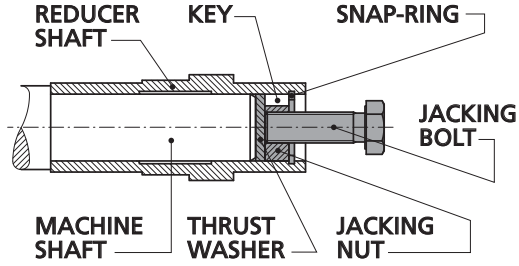
Type 2 - Screw tightening

Follow the cap screw manufactures guidelines and tighten the screw to the proper torque, based upon the bolt grade and material. For reference tightening torque values, also see manual U10060, Table 2.

4. Disassembly

When using Type 2 assembly, it is possible to design a simple disassembly tool to allow easier removal of the hollow-bore reducer. The solid shaft is shouldered to rest against the hollow-bore of the reducer. The machine shaft is supported in both of the hollow bore land areas, but the overall length is reduced compared to Type 1 assembly.

Figure 3 – Disassembly Tool



IMPORTANT NOTE

For suggestions on how to construct a disassembly tool for a particular reducer and bore size, please consult NORD's application engineering department.

SHAFT FIXING KIT

5. Standard fixing kit size offerings

NORD offers a variety of standard fixing kit sizes as shown by the following tables.

Table 1 - Standard fixing kit size offerings

Shaft Bore [in]	Bolt Size	Allowable Thrust Groove ❷ lb [N]	Allowable Thrust Ring ❸ lb [N]	Max. Edge Break ❹ in [mm]
0.500	10-32	730 [3255]	520 [2300]	0.02 [0.5]
0.750	1/4-20	1800 [7905]	560 [2500]	0.04 [1]
1.000	3/8-16	2900 [13020]	1000 [4600]	0.04 [1]
1.188	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.250	7/16-14	5100 [22630]	1000 [4700]	0.04 [1]
1.375	5/8-11	6500 [29140]	1400 [6400]	0.06 [1.5]
1.438	5/8-11	6900 [30690]	1500 [6500]	0.06 [1.5]
1.500	5/8-11	7800 [34875]	1500 [6700]	0.06 [1.5]
1.625	5/8-11	9900 [44020]	1900 [8400]	0.08 [2]
1.688	5/8-11	10500 [46810]	1800 [8200]	0.08 [2]
1.938	5/8-11	11100 [49600]	1900 [8400]	0.08 [2]
2.000	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.063	5/8-11	14100 [62775]	2700 [12100]	0.08 [2]
2.188	5/8-11	16800 [74865]	2900 [13000]	0.08 [2]
2.375	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.438	3/4-10	17400 [77190]	2900 [13000]	0.08 [2]
2.750	3/4-10	19600 [87110]	4700 [21000]	0.10 [2.5]
2.938	3/4-10	20900 [93000]	4700 [21000]	0.10 [2.5]
3.188	3/4-10	27700 [123225]	7000 [31200]	0.12 [3]
3.438	3/4-10	29300 [130200]	7000 [31400]	0.12 [3]
3.625	3/4-10	30900 [137330]	7000 [31400]	0.12 [3]
3.938	7/8-9	32400 [144305]	6900 [30800]	0.12 [3]
4.000	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.063	7/8-9	39000 [173600]	16400 [73000]	0.12 [3]
4.375	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.438	7/8-9	41500 [184450]	16200 [72000]	0.12 [3]
4.750	7/8-9	44200 [196850]	15700 [70000]	0.12 [3]
4.938	7/8-9	48000 [213900]	15500 [69000]	0.12 [3]

Upon request, additional hollow-bore sizes & fixing kit sizes may be offered.

Shaft Bore [mm]	Bolt Size	Allowable Thrust Groove ❷ N [lb]	Allowable Thrust Ring ❸ N [lb]	Max. Edge Break ❹ mm [in]
16	M5	Not applicable ❶		
20	M6	8370 [1900]	5600 [1300]	1.0 [0.04]
25	M10	12400 [2800]	7300 [1600]	1.0 [0.04]
30	M10	17515 [3900]	7200 [1600]	1.0 [0.04]
35	M12	29140 [6500]	8700 [1900]	1.5 [0.06]
40	M16	41850 [9400]	10900 [2400]	2.0 [0.08]
45	M16	46810 [10500]	10700 [2400]	2.0 [0.08]
50	M16	62775 [14100]	19000 [4300]	2.0 [0.08]
60	M20	74865 [16800]	29200 [6600]	2.0 [0.08]
70	M20	87110 [19600]	30300 [6800]	2.5 [0.10]
80	M20	115630 [26000]	56000 [12600]	2.5 [0.10]
90	M24	130200 [29300]	56000 [12600]	3.0 [0.12]
100	M24	144305 [32400]	55000 [12400]	3.0 [0.12]
110	M24	181350 [40800]	71000 [16000]	3.0 [0.12]
120	M24	196850 [44300]	70000 [15700]	3.0 [0.12]

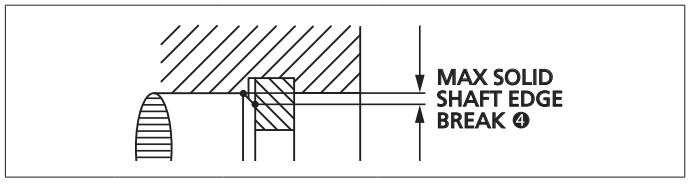
Upon request, additional hollow-bore sizes and fixing kit sizes may be offered.

❶ This fixing kit is not supplied with a snap-ring. A Type 2 machine shaft is required.

❷ Thrust load-bearing capacity of the groove is based upon using a hollow-shaft material with a yield-strength of at least 45,000 psi (310 N/mm²).

❸ Thrust load-bearing capacity of the snap-ring is based upon a typical snap-ring material with a yield-strength of at least 30,500 psi (210 N/mm²).

❹ On the solid machine shaft, observe the maximum edge break (radius or chamfer) shown. A larger edge break will result in reduced load-bearing capacity of the snap-ring.



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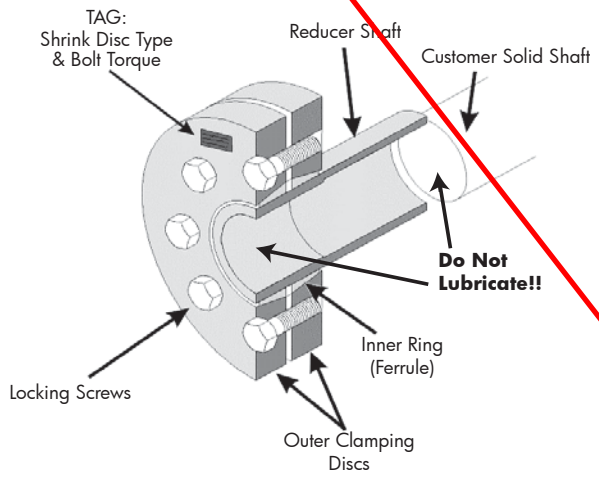
HOLLOW SHAFT WITH SHRINK DISC

1. Shrink disc design concept

A shrink disc option is adaptable to many NORD hollow-bore reducers. The shrink disc applies a high-capacity, zero backlash, interference fit to the driven machine shaft. The double tapered inner ring converts most all of the screw clamping load into radial contact pressure, as the outer clamping discs are pulled together by proper tightening of the locking screws. As the inner ring is contracted, the clearance between the customer solid shaft and reducer shaft is absorbed.

- In their relaxed state, shrink discs provide a generous assembly clearance, thus eliminating the typical assembly and disassembly challenges of using interference fits.
- Shrink discs also reduce solid machine shaft stresses by eliminating the need for shaft keys and keyways.
- When properly applied, high shrink fits help eliminate shaft fretting corrosion and allow for easier shaft mounting and dismounting.



2. Solid (machine) shaft design guidelines

Always use a solid shaft material of adequate strength and apply proper shaft fits in order to establish adequate clamping force during assembly and assure proper shaft release during disassembly.

- Use solid shaft material with yield strength of at least 52,260 psi (360 N/mm²).
- The solid machine shaft should be machined according to ISO 286-2, Class h6 fit tolerances, with a shaft finish of 125 micro inches (3.2 µm) or smoother, per Table 1.
- The solid machine shaft must extend the full length of the reducer hollow shaft.

IMPORTANT NOTE

Contact NORD when using a shrink disc in an application where the shrink disc connection must simultaneously transmit torque and thrust.

3. Safety

NOTICE

- The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.
- The transmissible torque and the gripping capacity of the shrink disc may be reduced if shaft tolerances or clearances are larger than specified.
- Excessive tightening torque can result in permanent deformation of the inner ring and the reducer hollow bore, making disassembly very difficult. Do not over tighten the shrink disc to compensate for excessive clearance between the machine shaft and reducer bore.
- Observe the published ratings and safety factors for both the reducer and shrink disc. Overload conditions or excessively high torque can cause the shrink disc connection to slip. In extreme cases localized galling or welding of components may occur.

4. Shrink disc shaft tolerances

Recommended solid shaft tolerances and reducer bore tolerances are shown in the table below.

Table 1: Shrink disc shaft tolerances

Above & Including ø [in]	To & Including ø [in]	Solid Shaft Tolerance ø [in]	Reducer Bore Tolerance ø [in]	Max. Assembly Clearance [in]
0.7500	1.1250	+0.0000 / -0.0005	+0.0008 / -0.0000	0.0013
1.1250	1.9375	+0.0000 / -0.0006	+0.0009 / -0.0000	0.0015
2.0000	3.1250	+0.0000 / -0.0007	+0.0011 / -0.0000	0.0018
3.1875	4.6875	+0.0000 / -0.0008	+0.0013 / -0.0000	0.0021
4.7500	7.0625	+0.0000 / -0.0009	+0.0015 / -0.0000	0.0024
7.1250	7.5000	+0.0000 / -0.0011	+0.0018 / -0.0000	0.0029

Above ø [mm]	To & Including ø [mm]	Solid Shaft Tolerance ø [mm]	Reducer Bore Tolerance ø [mm]	Max. Assembly Clearance [mm]
18	30	+0.000 / -0.013	+0.021 / -0.000	0.034
30	50	+0.000 / -0.016	+0.025 / -0.000	0.041
50	80	+0.000 / -0.019	+0.030 / -0.000	0.049
80	120	+0.000 / -0.022	+0.035 / -0.000	0.057
120	180	+0.000 / -0.025	+0.040 / -0.000	0.065
180	190	+0.000 / -0.029	+0.046 / -0.000	0.075

Shaft/bore tolerances per ISO 282-6, Class h6/H7.

Solid shaft finish should be 125 micro inches (3.2 micro meters) or smoother.

HOLLOW SHAFT WITH SHRINK DISC

5. Installation

⚠ WARNING

Disconnect all power sources from the equipment before beginning this installation procedure. Gearmotors, variable frequency drives and gear reducers contain potentially dangerous high voltage, rotating components and surfaces that may become hot during operation. Handle the components with care and avoid all sharp machined edges to prevent personal injury.

NOTICE

Do not tighten any of the shrink disc locking screws prior to installing the reducer with shrink disc onto the machine shaft. The inner ring of the shrink disc can become permanently contracted or damaged at relatively low tightening torque.

A. Inspect the gear unit received. Make sure the shrink disc and extended hollow shaft projection is on the side of the reducer where it was specified or ordered.

B. Loosen the shrink disc locking screws but do not take the shrink disc completely apart. Remove and discard any packaging material or transportation spacers that come with the shrink disc.

C. Remove all burrs, rust, corrosion, lubricants, and foreign matter from the surfaces of the solid shaft and hollow-bore.

D. Make sure the shrink disk is positioned onto the hollow shaft until the outer clamping ring is flush with the edge of the hollow shaft.

E. To aid in assembly, it is acceptable to lightly grease the solid shaft, only in the area that will come in contact with the bronze-bushing side of the reducer hollow-shaft. ***The reducer hollow shaft must be completely de-greased and free of lubricant, especially in the area of the shrink disc.***

F. Position the gear reducer onto the solid machine shaft and make certain the area under the shrink disc is completely supported by the solid shaft.

G. After confirming the proper positioning of gear reducer and the shrink disc, hand tighten (3) or (4) equally spaced locking screws to make sure the outer collars of the shrink disc are drawn together in a parallel fashion. Then hand-tighten the remaining screws.

H. Refer to Table 2 for the specified tightening torques for the shrink disc locking screws. Using a properly set torque wrench using approximately ¼ (90°) turns; tighten the locking screws, by working in a circular clockwise or counterclockwise sequence around the shrink disc.

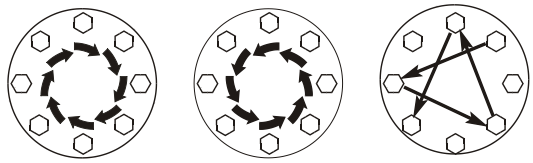
I. Continue the tightening sequence (Step H.) even if some locking screws initially require very low tightening torque to achieve ¼ turns; do this for several passes until ¼ turns can no longer be achieved.

J. Reset the torque wrench to approximately 3-5% over-torque and tighten the locking screws for 1 or 2 more passes. This procedure will compensate for relaxation of the locking screws, since tightening of a given screw will always tend to relax the adjacent screw. Without a slight overtorquing of the screws, an infinite number of passes would be required to reach the desired tightening torque.

Table 2 - Shrink Disc Locking Screw Torque

Screw Size	Wrench Size [mm]	Tightening Torque [Nm]	[lb-in]	[lb-ft]
M5	8	7	62	5.2
M6	10	12	106	8.9
M8	13	30	266	22
M10	17	59	522	44
M12	19	100	885	74
M16	24	250	2213	184
M20	30	490	4337	361
M24	36	840	7435	620
M30	46	1700	15050	1254

BOLT TIGHTENING PATTERN



CLOCKWISE CIRCULAR PATTERN **RIGHT**

COUNTER CLOCKWISE CIRCULAR PATTERN **RIGHT**

STAR PATTERN **WRONG**

K. Reset the torque wrench to the correct tightening torque as indicated in Table 2. Make sure each locking screw has been properly tightened until the screws are no longer turning at the specified torque wrench setting. If necessary repeat Steps G. & H.

6. Removal

A. Loosen the shrink disc locking screws in a circular pattern by using ½ (180°) turns, until the shrink disc hub can be moved or until the shrink disc hub and reducer shaft will return to their original fits.

⚠ WARNING

Do not completely remove the locking screws before the outer clamping disks of the shrink disc are disengaged from the inner ring. A sudden release of the outer collars will create high separating forces and could result in injury or even death.

B. Loosen the outer collars of the shrink disc from the tapered inner ring. This may require tapping the bolts with a **soft faced** hammer or prying lightly between the outer collars.

C. Remove the gear reducer from the machine shaft.

7. Re-installation

A. It may be possible to re-use the shrink disc. However the shrink disk should not be re-used if it becomes damaged during removal, or excessively rusty or corroded. Shrink discs must always be disassembled and thoroughly cleaned before re-using.

B. After cleaning the shrink disc, lubricate between the taper of the outer clamping disks and the outside of the inner ring using MOLYKOTE® G-Rapid Plus Paste (product of Dow Corning) or equivalent. In addition, grease screw threads and head contact area with multi-purpose grease.

NORD GRIPMAXX™

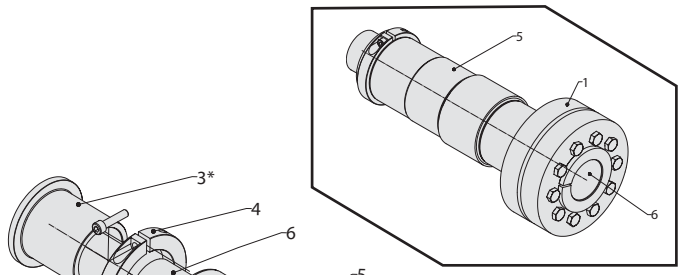
1. General information

The NORD GRIPMAXX™ keyless bushing system is adaptable to most all NORD shaft-mounted reducers. The bushing system offers interchangeable bushings to accommodate a large range of driven machine-shaft sizes.

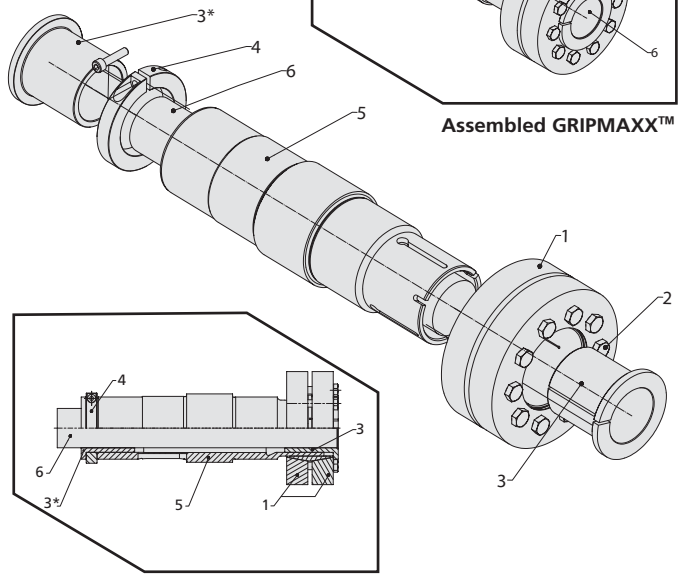
The unique design of the NORD GRIPMAXX™ bushing system offers a number of distinct advantages as follows:

- The NORD GRIPMAXX™ allows the machine builder to utilize standard cold finished shaft stock, without the need for additional shaft machining or shaft keys.
- It uses a NORD shrink disc to apply a high-capacity, zero backlash, interference fit to the driven machine shaft, while eliminating the typical assembly and disassembly challenges of using interference fits.
- The built in clearance between the customer shaft and the bushing system helps to ensure easy installation and removal of the gearbox. To help ensure easy removal, the NORD GRIPMAXX™ bushings are prepared with a special low-wear, corrosion-resistant hardened surface treatment, that minimizes the formation of shaft corrosion and fretting.
- The NORD GRIPMAXX™ is ideal for start-stop operation and bi-directional loading because it does not depend on keys or keyways that transmit torque, which can also can become loose or deform when subjected to these loading conditions.
- Unlike the typical conical or tapered bushing kits, the NORD GRIPMAXX™ design allows a tight fit against a shouldered machine shaft.
- The torque bushing and support bushing are the same part and are fully interchangeable with one another.

2. GRIPMAXX™ assembly detail



Assembled GRIPMAXX™



Sideview of GRIPMAXX™

[1] NORD Shrink Disc
[2] Locking Screw
[3] Bushing (Torque Side)
[3*] Bushing (Support Side)
[4] Clamp Ring
[5] Gear Reducer Hollow Shaft
[6] Machine Shaft

IMPORTANT NOTE

NORD recommends that the machine shaft have a yield strength of at least 52,260psi (360N/mm²)

IMPORTANT NOTE

Observe the recommended machine shaft tolerances in table 1, page 2.

NOTICE

The supporting solid shaft or driven machine shaft must be of adequate size and strength to withstand normal operating loads and peak loads without damage to itself or any of the system components.

3. Installation

⚠ WARNING

Disconnect all power sources from the equipment before beginning this installation procedure. Gearmotors, variable frequency drives and gear reducers contain potentially dangerous high voltage, rotating components and surfaces that may become hot during operation. Handle the components with care and avoid all sharp or machined edges to prevent personal injury.

NOTICE

Do not tighten any of the shrink disc locking screws prior to installing the reducer with shrink disc onto the machine shaft. The inner ring of the shrink disc can become permanently contracted or damaged at a relatively low tightening torque.

Table 1 - Required Machined Shaft Tolerance

Inch Machine Shaft			Metric Machine Shaft		
From ø [in]	To ø [in]	ISO 286-2 Tolerance h11(-) [in]	Over ø [mm]	Including ø [mm]	ISO 286-2 Tolerance h11(-) [mm]
0.4375	0.6875	- 0.004	10	18	- 0.11
0.7500	1.0625	- 0.005	18	30	- 0.13
1.1250	1.9375	- 0.006	30	50	- 0.16
2.0000	3.1250	- 0.007	50	80	- 0.19
3.1875	4.6875	-0.008	80	120	-0.22
4.7500	7.0625	-0.009	120	180	-0.25

A. Carefully inspect the machine shaft [6] and remove all burrs, rust, corrosion, lubricants, and foreign matter from the shaft surface. Verify that the diameter is within the dimensional tolerances shown in Table 1.

B. Inspect the gear unit received to confirm the correct position of the shrink disc [1]. Make sure the hollow shaft [5] projection is on the side of the reducer where it was specified or ordered.

C. In addition to cleaning the machine shaft [6], remove all dirt, grease or oils from the reducer hollow shaft [5], bushings [3], clamp ring [4], and shrink disk [1]. ***Do not apply lubricants, corrosion preventatives, anti-sieze compounds or coatings to the mating surfaces of the shaft, bushings, clamp collars or shrink disc.***

D. Position the clamp ring [4] and support bushing [3*] over the machine shaft [6], making sure the support bushing is in its desired location. Then secure the support bushing [3*] with the clamp ring [4] and tighten the clamp ring screw.

E. Slide the gear reducer onto the machine shaft [6] until the gear reducer stops against the secured support bushing [3*].

F. Without taking the shrink disc [1] apart, loosen the shrink disc locking screws [2]. Slide the shrink disk over the reducer shaft [5] and slide the torque bushing [3] onto the machine shaft, making sure it is seated completely.

G. Confirm the positioning of the shrink disc [1] and torque bushing [3]. ***Do not tighten the shrink disc until the machine shaft and torque bushing are in proper position, or the reducer shaft will be damaged.*** Hand-tighten 3 or 4 or locking screws [2] and make sure the outer collars of the shrink disc are drawn together in a parallel fashion and then hand-tighten the remaining screws.

H. Refer to Table 2 for the specified tightening torques for the shrink disc locking screws. Using a properly set torque wrench using approximately ¼ (90°) turns; tighten the locking screws, by working in a circular clockwise or counterclockwise sequence around the shrink disc.

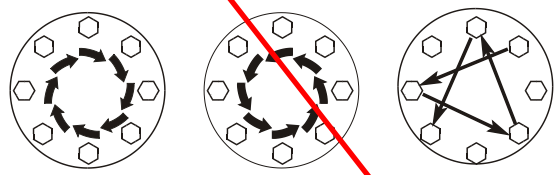
I. Continue the tightening sequence (Step H.) even if some locking screws initially require very low tightening torque to achieve ¼ turns; do this for several passes until ¼ turns can no longer be achieved.

J. Reset the torque wrench to approximately 3-5% overtorque and tighten the locking screws for 1 or 2 more passes. This procedure will compensate for relaxation of the locking screws, since tightening of a given screw will always tend to relax the adjacent screw. Without a slight overtorquing of the screws, an infinite number of passes would be required to reach the desired tightening torque.

Table 2 - Shrink Disc Locking Screw Torque

Screw Size	Wrench Size [mm]	Tightening Torque [Nm]	[lb-in]	[ft-lb]
M5	8	7	62	5.2
M6	10	12	106	8.9
M8	13	30	266	22
M10	17	59	522	44
M12	19	100	885	74
M16	24	250	2213	184
M20	30	490	4337	361

BOLT TIGHTENING PATTERN



K. Reset the torque wrench to the correct tightening torque as indicated in Table 2. Make sure each locking screw has been properly tightened until the screws are no longer turning at the specified torque wrench setting. If necessary repeat Steps G. & H.

5. Bushing kit removal

A. Loosen the shrink disc locking screws [2] in circular pattern by using ½ (180°) turns, until the shrink disc hub can be moved or until the shrink disc hub and reducer shaft will return to their original fits.

> ⚠ ***WARNING***
>
> Do not completely remove the locking screws before the outer clamping disks of the shrink disc are disengaged from the inner ring. A sudden release of the outer collars will create high separating forces and may result in injury or even death.

B. Loosen the outer collars of the shrink disc from the tapered inner ring. This may require tapping the bolts with a **soft faced** hammer or prying lightly between the outer collars.

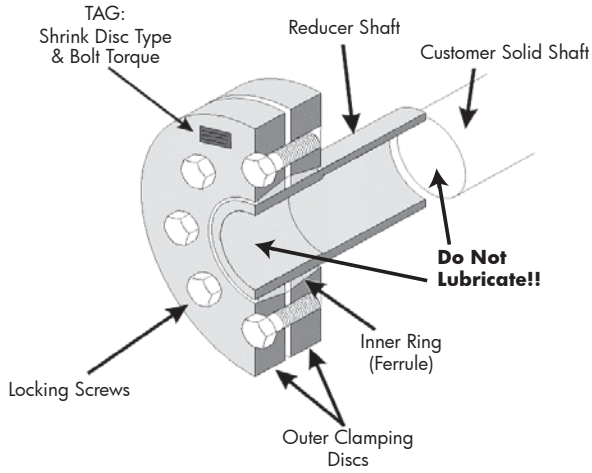
C. Remove the gear reducer from the machine shaft.

6. Re-installation

A. It may be possible to re-use the bushings and shrink disc that are part of the NORD bushing system. However these components should not be re-used if they are damaged during removal, or excessively rusty or corroded.

B. Never re-use any of the bushing kit components without prior cleaning. Shrink discs must always be disassembled and thoroughly cleaned before re-using.

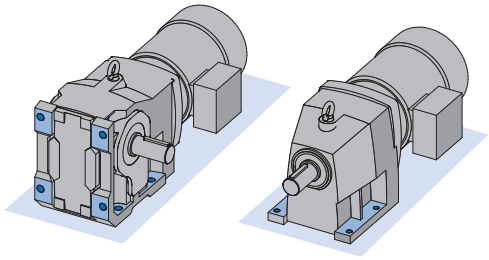
C. After cleaning the shrink disc, lubricate between the taper of the outer clamping disks and the outside of the inner ring using MOLYKOTE® G-Rapid Plus Paste (product of Dow Corning) or equivalent. In addition, grease screw threads and head contact area with multipurpose grease.



REDUCER MOUNTING
FOOTED & FLANGE MOUNT GEAR UNITS

1. Foot-mounted reducers

When installing the foot-mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060 and make sure the mating mounting surface and reducer feet are clean and free of debris. Use of shims under the feet of the gear unit may be required in order to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will cause mis-alignment and may reduce the life of the gear unit or cause component failure. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE

Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an external chain or belt drive, make sure the reducer is sized so that the shaft and bearings have adequate capacity.

2. Flange-mounted reducers (with B5 flange)

When using the B5 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When the mating hole is designed with the proper fit, the flange pilot tenon provides a means of accurately positioning the reducer while the hold-down bolts are properly secured; once the reducer is secured, the tenon helps prevent movement of the reducer and it helps locate the center of the reducer output shaft. The flange centering shoulder tolerance for standard units is listed in table 1. For units with NSD Tuph please see table 2 on the following page.

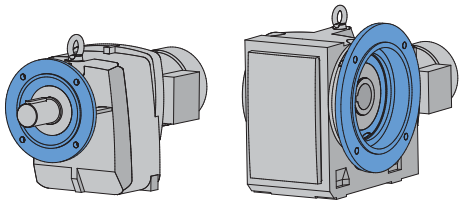


Table 1 : Flange Centering Shoulder Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)	ISO 286-2 Fit Class
1.969	3.150	+0.0005 / -0.0003	j6
3.150	4.724	+0.0005 / -0.0004	j6
4.724	7.087	+0.0006 / -0.0004	j6
7.087	9.055	+0.0006 / -0.0005	j6
9.055	9.843	+0.0000 / -0.0011	h6
9.843	12.402	+0.0000 / -0.0013	h6
12.402	15.748	+0.0000 / -0.0014	h6
15.748	19.685	+0.0000 / -0.0016	h6
19.685	21.654	+0.0000 / -0.0017	h6

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
50	80	+0.012 / -0.007	j6
80	120	+0.013 / -0.009	j6
120	180	+0.014 / -0.011	j6
180	230	+0.016 / -0.013	j6
230	250	+0.000 / -0.029	h6
250	315	+0.000 / -0.032	h6
315	400	+0.000 / -0.036	h6
400	500	+0.000 / -0.040	h6
500	550	+0.000 / -0.044	h6

When installing the flange mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060. Make sure the mating mounting surface and reducer flange are clean and free of debris. Use a straight edge or parallel bar to check for high spots on the mating mounting surface and remove any raised material around the mounting holes.

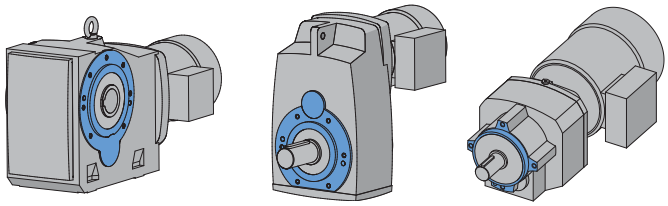
Set the gear unit into place and tighten the bolts until they are snug. Before final bolt-tightening check for any material gaps between the mating surfaces and if shimming is required, use "U" shaped shims at least 2 times the width of the bolt. Avoid over shimming a very irregular surface as this will make it very difficult to achieve proper alignment.

IMPORTANT NOTE

For heavy shock applications, it is advisable to field-install dowel pins through the mounting flange connection (in addition to the mounting bolts). This will help control flange movement or flange rotation and relieve the mounting bolts from this additional stress.

3. Flange-mounted reducers (with B14 flange)

When using the B14 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When properly installed, the output flange of the reducer housing is designed to enable the permissible torques and radial forces to be reliably transmitted by the bolt connections. The flange centering shoulder tolerance for standard units is listed in table 1 on the previous page. For units with NSD Tuph please see table 2 below.



IMPORTANT NOTE

When using the B14 flange-face for mounting, if dowel pin holes are provided in addition to the threaded holes, then it is advisable to also use the proper dowel pins, to help control flange movement or flange rotation and relieve the mounting bolts from this additional stress This is especially important for heavy shock applications.

Table 2 : Flange Centering Shoulder Tolerance on NSD Tuph Units

Above ø (in)	To & Including ø (in)	Tolerance (in)
1.969	3.150	+0.0020 / +0.0013
3.150	4.724	+0.0021 / +0.0012
4.724	7.087	+0.0021 / +0.0011
7.087	9.055	+0.0022 / +0.0011

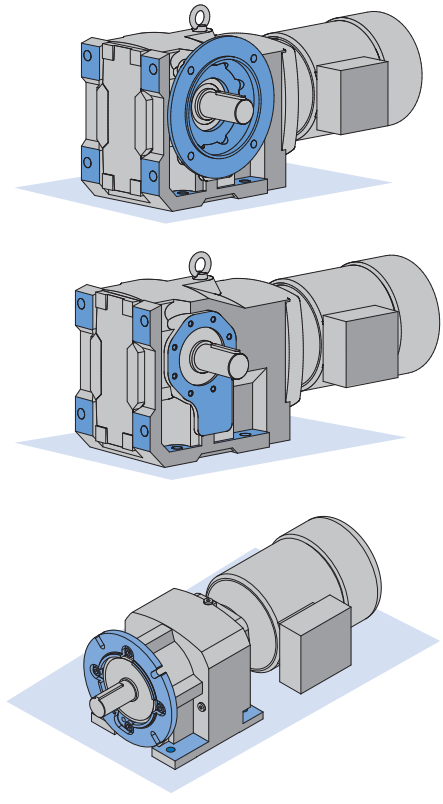
Above ø (mm)	To & Including ø (mm)	Tolerance (mm)
50	80	+0.052 / +0.033
80	120	+0.053 / +0.031
120	180	+0.054 / +0.029
180	230	+0.056 / +0.027

4. Foot & flange reducer housings

Some gear reducer housings are available with a foot and an output flange. Units with a foot and a B5 Flange are designated with the suffix XF after the primary model number and units with a B14 face-flange are designated with the suffix XZ after the primary model number. When a gear unit is provided with both a foot and a flange, the foot is consider the primary mounting surface. The flange is generally considered to be the secondary mounting option and it is intended that this surface be used for auxiliary add on elements that place minimal load stress on the reducer housing.

NOTICE

To prevent overstress on the main gear unit housing, never tighten the reducer mounting feet and the mounting flange against one-another. Auxiliary add-on elements that are mounted to the reducer flange, must not transmit excessive force, torque or vibration to the main gear housing.

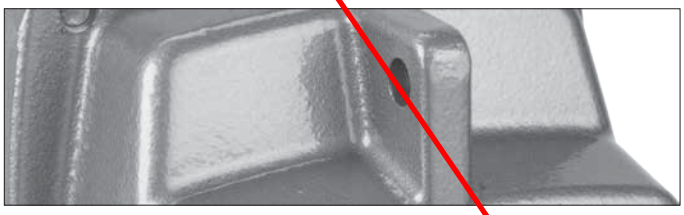


CLINCHER™ SHAFT-MOUNT WITH RUBBER BUFFERS

1. Purpose of the built-in torque arm lug

The preferred method of installing a shaft-mounted Clincher™ reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. In order to restrain the gearbox, react the torque, and keep the gear unit from spinning around the shaft, the Clincher™ gear units have a built in torque arm lug or tab cast into the reducer housing. This torque tab is intended to be used in conjunction with the NORD Rubber Buffers.

Figure 1: Built-in torque lug



2. Rubber buffers

When specified, NORD provides two rubber buffers that are installed on either side of the gear unit's integral torque lug.

When properly used in tandem, on either side of the torque-arm lug, the rubber buffers help isolate and absorb the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the torque of the reducer, keeping the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

For further dampening it is possible to combine several rubber buffers in a row, on either side of the torque lug.

IMPORTANT NOTE

Please reference Table 1 on page 2 of this manual for dimensional information.

NOTICE

Always mount at least one rubber buffer on either side of the reducer's torque-arm lug. When using rubber buffers in tandem, make sure equal numbers are used on both sides of the torque tab. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support

WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

A single customer-supplied machine support bracket, of adequate strength and rigidity, can provide adequate restraint for both directions. This is because when the rubber buffer system is used, the applied load forces are always parallel to the retaining bolt and there are no twisting forces induced onto the bolt in either the clockwise or counter-clockwise direction. In some cases the customer may desire to supply a rigid support on either side of the rubber buffers. In these instances, longer assembly hardware is required.

4. Installation of the rubber buffers

A. Install the Clincher™ hollow bore reducer onto the machine shaft. Line up the hole in the reducer's torque-arm lug with the hole in the machine's support bracket and temporarily hold the reducer in place.

B. Properly secure the gear unit assembly to the driven shaft in an axial direction. If using the NORD Shaft Fixing Kit, follow the instructions in User Manual U10280.

C. Install the rubber buffers on either side of the gear unit's torque-arm lug. Apply a thread locking compound to the end of the fixing bolt. Then place the fixing bolt through the rubber buffers, torque-arm lug and rigid machine support bracket and loosely secure the nut onto the end of the bolt.

D. Tighten the fixing bolt and nut until lightly snug until all of the free play is eliminated from the rubber buffer assembly. Then snug the fixing bolt assembly by tightening an additional 1/4 to 1/2 turn.

NOTICE

To help prevent damage to the rubber buffers, avoid over-tightening.

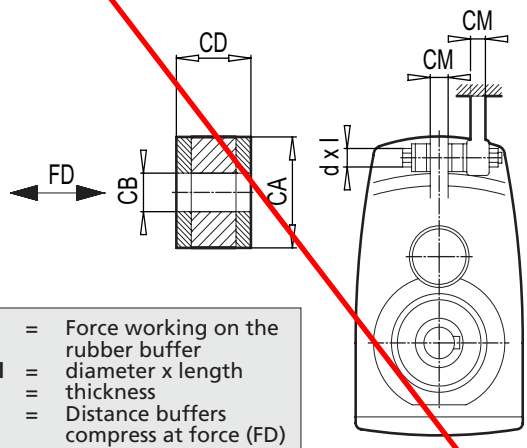
IMPORTANT NOTE

- A min. of (2) rubber buffers are required for each unit.
- For larger size CLINCHER'S™, NORD offers the heavy-duty rubber buffer (Option VG).
- A metric fixing bolt is preferred for rubber buffer assembly. NORD recommends a minimum ISO Grade 8.8 fixing bolt.

CLINCHER™ SHAFT-MOUNT WITH RUBBER BUFFERS

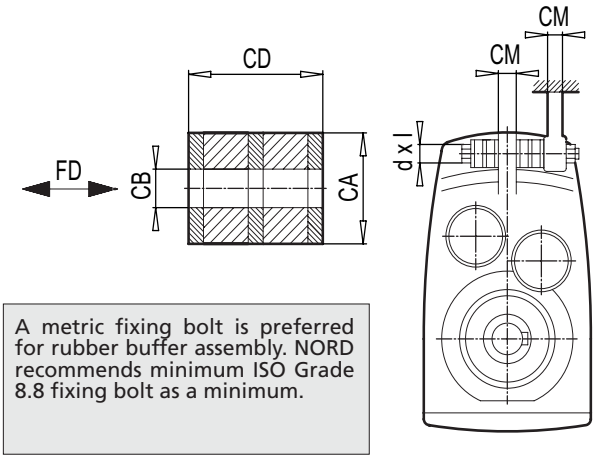
Table 1: Rubber buffer assembly/typical dimensions

Standard Rubber Buffer Assembly Option **(G)**



FD = Force working on the rubber buffer
d x l = diameter x length
c = thickness
S_{FD} = Distance buffers compress at force (FD)

Heavy Duty Rubber Buffer Assembly Option **(VG)**



A metric fixing bolt is preferred for rubber buffer assembly. NORD recommends minimum ISO Grade 8.8 fixing bolt as a minimum.

Type	Rubber Buffer P/N	CB inch [mm]	CA inch [mm]	CD inch [mm]	CM inch [mm]	Bolt d x l [metric]	FD lb [kN]	SFD inch [mm]
SK0182NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.39 [10]	M10 x 70	217 [0.967]	0.06 [1.5]
SK0282NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.47 [12]	M10 x 70	234 [1.04]	0.07 [1.7]
SK1282 G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.55 [14]	M10 x 80	504 [2.24]	0.14 [3.6]
SK1382NB G	29603000	0.43 [11]	1.18 [30]	0.59 [15]	0.55 [14]	M10 x 80	402 [1.79]	0.11 [2.8]
SK2282 G SK2382 G	29604000	0.49 [12.5]	1.57 [40]	0.59 [15]	0.63 [16]	M12 x 90	600 [2.67]	0.07 [1.8]
SK3282 G SK3382 G	29604000	0.49 [12.5]	1.57 [40]	0.59 [15]	0.71 [18]	M12 x 90	935 [4.16]	0.11 [2.9]
SK4282 G SK4382 G	29606000	0.83 [21]	2.36 [60]	1.18 [30]	0.87 [22]	M20 x 150	1661 [7.39]	0.29 [7.3]
SK5282 G SK5382 G	29606000	0.83 [21]	2.36 [60]	1.18 [30]	1.1 [28]	M20 x 150	2133 [9.49]	0.37 [9.4]
SK6282 G SK6382 G	29608000	0.98 [25]	3.15 [80]	1.57 [40]	1.38 [35]	M24 x 190	3779 [16.81]	0.36 [9.2]
SK7282 G SK7382 G	29608000	0.98 [25]	3.15 [80]	1.57 [40]	1.57 [40]	M24 x 200	4676 [20.8]	0.45 [11.4]
SK8282 G SK8382 G	29610000	1.22 [31]	3.94 [100]	1.97 [50]	1.97 [50]	M30 x 260	6382 [28.39]	0.64 [16.3]
SK9282 G SK9382 G	29610000	1.22 [31]	3.94 [100]	1.97 [50]	2.17 [55]	M30 x 260	9777 [43.49]	0.98 [24.9]

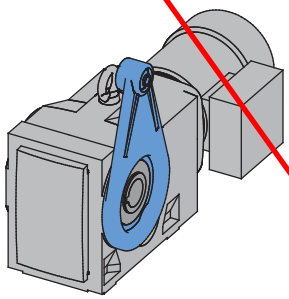
Type	Rubber Buffer P/N	CB inch [mm]	CA inch [mm]	CD inch [mm]	CM inch [mm]	Bolt d x l [metric]	FD lb [kN]	SFD inch [mm]
SK7282 VG SK7382 VG	29620850	0.98 [25]	3.35 [85]	2.36 [60]	1.57 [40]	M24 x 240	4676 [20.8]	0.48 [12.2]
SK8282 VG SK8382 VG	29621100	1.22 [31]	4.33 [110]	3.54 [90]	1.97 [50]	M30 x 340	6382 [28.39]	0.76 [19.3]
SK9282 VG SK9382 VG	29621400	1.22 [31]	5.51 [140]	4.33 [110]	2.17 [55]	M30 x 380	9777 [43.49]	0.83 [21.2]
SK10282 VG SK10382 VG SK10382.1 VG	29621800	1.22 [31]	5.51 [140]	4.33 [110]	3.15 [80]	M30 x 430	12670 [56.36]	1.08 [27.4]
SK11282 VG SK11382 VG SK11382.1 VG	29621800	1.93 [49]	7.09 [180]	5.91 [150]	3.54 [90]	M48 x 550	18185 [80.89]	1.52 [38.5]
SK12382 VG	29621800	1.93 [49]	7.09 [180]	5.91 [150]	3.54 [90]	M48 x 550	23720 [105.51]	1.98 [50.2]

RIGHT-ANGLE SHAFT-MOUNT WITH TORQUE ARM (D)

1. Torque arm (D)

The preferred method of installing a shaft-mounted reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. A torque arm is required in order to restrain the gearbox, react the load torque, and keep the gear unit from spinning around the shaft.

The Torque-Arm (D) bracket is mounted to either side of the right-angle gear unit using mounting screws that thread into the B14 flange-face of the reducer. The anchor hole of the torque-arm bracket is supplied with a resilient rubber bushing.



IMPORTANT NOTE

The side of the reducer that the torque arm is mounted on, and the angular position can be specified at time of order. Consult the appropriate NORD catalog for specific Torque Arm (D) mounting options and ordering guidelines.

2. Purpose of the built-in resilient rubber bushing

The resilient rubber bushing installed into the anchor hole end of the torque-arm helps isolate and absorb all the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the load torque of the reducer, and prevents the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

NOTICE

Always make sure that the Torque Arm (D) has the resilient rubber bushing installed into the anchor hole end of the torque arm. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support

The user must supply a suitably strong and rigid mating machine support that provides load bearing capacity on both sides of the torque-arm bracket.

WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

4. Installation of a right-angle reducer with torque arm

A. Make sure the Torque-Arm (D) is mounted in the correct position on the reducer. Assembled screw heads should always sit flush with the torque arm.
   - To reposition the torque-arm, remove the mounting screws, relocate the torque-arm, and reassemble the mounting screws as noted above.
   - If the torque-arm was shipped loose, position the torque-arm in the correct location on the gear unit, and secure the torque-arm as noted above.

IMPORTANT NOTES

- Torque arm mounting screws should be secured with a thread locking product (ex. Loctite® 242 or Loxeal® 54-03) and tightened per the table on page 2.
- Assembled screw heads should always sit flush with the torque arm.
- The support bracket should provide support on both sides of the torque arm or be in the form of a U-shape.
- Do not force the torque-arm. The torque arm must remain at a right angle to the gear unit.
- If mounting holes do not align properly the machine support may need to be moved.

B. Install the right-angle hollow bore reducer onto the machine shaft. Then line up the hole in the reducer's torque-arm with the hole in the machine's support bracket, and temporarily hold the reducer in place.

C. Apply a thread locking compound such as Loctite® 242 or Loxeal® 54-03 to the end of the anchor bolt that is used to secure the torque arm in place.

D. Place the anchor bolt through the support bracket and the reducer torque-arm. Attach the mating nut to the bolt and tighten the assembly until snug. At least one bolt diameter should protrude from the nut after assembly.

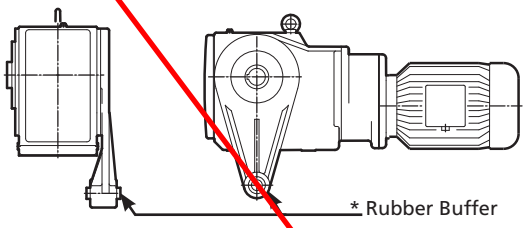
NOTICE

Do not force misalignment of the torque-arm. The torque arm must remain at a right angle to the gear unit or excessive load may be placed on the reducer shaft and bearings.

E. Properly secure the gear unit assembly to the driven shaft in an axial direction.

RIGHT-ANGLE SHAFT-MOUNT WITH TORQUE ARM (D)

Table 1 - Torque Arm (D) with rubber buffer



- For all 90.1 Series Helical-Bevel gear units, NORD also offers a bottom mount Torque Arm (K). See User Manual U10620.
- For the large 90.1 Series Helical-Bevel gear units sizes: SK9082.1, SK9086.1, SK9092.1, and SK9096.1, please use the Torque Arm (K).
- A metric fixing bolt is preferred for fastening the Torque-Arm(D) to the machine support bracket.

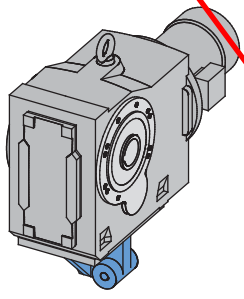
Gear Unit Series	Torque Arm				Torque Arm Mounting Screw					
	Type	Rubber Buffer P/N	Anchor Hole Size	Anchor Bolt Size	Qty	Size	Grade	Torque (Nm)	Torque (lb-ft)	Torque (lb-in)
92.1/93.1 Series Helical-Bevel	SK92072.1AD/SK93072.1AD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 25	8.8	27	20	35
	SK92172.1AD/SK93172.1AD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 25	8.8	27	20	35
	SK92372.1AD/SK93372.1AD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 30	8.8	53	39	35
	SK92672.1AD/SK93672.1AD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 30	8.8	53	39	35
	SK92772.1AD/SK93772.1AD	29603605	16.5 mm [0.65 in]	M16	4	M12 x 30	8.8	92	68	35
92 Series Helical-Bevel	SK92172AZD	29602505	10.5 mm [0.41 in]	M10	8	M6 x 16	8.8	11	8	71
	SK92372AZD	29602505	10.5 mm [0.41 in]	M10	8	M8 x 25	8.8	27	20	71
	SK92672AZD	29602505	10.5 mm [0.41 in]	M10	8	M8 x 25	8.8	27	20	71
	SK92772AZD	29603605	16.5 mm [0.65 in]	M16	8	M8 x 25	8.8	27	20	71
90.1 Series Helical-Bevel	SK9012.1AZD/SK9013.1AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 20	8.8	27	20	62
	SK9016.1AZD/SK9017.1AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 20	8.8	27	20	62
	SK9022.1AZD/SK9023.1AZD	29603605	16.5 mm [0.65 in]	M16	7	M8 x 25	8.8	27	20	62
	SK9032.1AZD/SK9033.1AZD	29603605	16.5 mm [0.65 in]	M16	7	M10 x 30	8.8	53	39	62
	SK9042.1AZD/SK9043.1AZD	29605205	25 mm [0.98 in]	M24	7	M12 x 35	8.8	92	68	62
	SK9052.1AZD/SK9053.1AZD	29605205	25 mm [0.98 in]	M24	7	M12 x 35	8.8	92	68	62
	SK9072.1AZD	29605205	25 mm [0.98 in]	M24	7	M16 x 45	8.8	230	170	62
Helical-Worm	SK02040AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 20	8.8	11	8	35
	SK02050AZD/SK13050AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20	35
	SK12063AZD/SK13063AZD	29602505	10.5 mm [0.41 in]	M10	7	M8 x 22	8.8	27	20	62
	SK12080AZD/SK13080AZD	29602505	10.5 mm [0.41 in]	M10	7	M10 x 25	8.8	53	39	62
	SK32100AZD/SK33100AZD	29603605	16.5 mm [0.65 in]	M16	7	M12 x 30	8.8	92	68	62
	SK42125AZD/SK43125AZD	29603605	16.5 mm [0.65 in]	M16	7	M12 x 30	8.8	92	68	62
MINICASE® SMI Series Worm	SK1SMI31AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 16	8.8	11	8	35
	SK1SMI40AZD/SK2SMI40AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20	35
	SK1SMI50AZD/SK2SMI50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20	35
	SK1SMI50AZD/SK2SMI50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20	35
	SK1SMI63AZD/SK2SMI63AZD	29602505	10.5 mm [0.41 in]	M10	4	M10 x 25	8.8	53	39	35
	SK1SMI75AZD	29602505	10.5 mm [0.41 in]	M10	4	M12 x 30	8.8	92	68	35
MINICASE® SM Series Worm	SK1SM31AZD	29602505	10.5 mm [0.41 in]	M10	4	M6 x 20	8.8	11	8	35
	SK1SM40AZD/SK2SM40AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20	35
	SK1SM50AZD/SK2SM50AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20	35
	SK1SM63AZD/SK2SM63AZD	29602505	10.5 mm [0.41 in]	M10	4	M8 x 20	8.8	27	20	35
"FLECBLOC™ SI Series Worm"	SK1SI31D	29602505	10.5 mm [0.41 in]	M10	4	M6 x 16	8.8	11	8	35
	SK1SI40D	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20	35
	SK1SI50D	29602505	10.5 mm [0.41 in]	M10	4	M8 x 22	8.8	27	20	35
	SK1SI63D	29602505	10.5 mm [0.41 in]	M10	4	M10 x 25	8.8	53	39	35
	SK1SMI75D	29602505	10.5 mm [0.41 in]	M10	4	M12 x 30	8.8	92	68	35

90.1 HELICAL-BEVEL SHAFT-MOUNT WITH BOTTOM MOUNT TORQUE ARM (K)

1. Torque arm (K)

The preferred method of installing a shaft-mounted reducer is to support the weight of the gear unit or gearmotor assembly from the driven solid machine shaft. A torque arm is required in order to restrain the gearbox, react to the load torque, and keep the gear unit from spinning around the shaft.

Table 1 (Page 2) provides a list of Torque-Arm (K) part numbers available for the 90.1 Series Helical-Bevel gear units. The Torque Arm (K) is secured to the base of the reducer. On most sizes there is an integral resilient rubber bushing located at the fastening hole-end of the torque arm. On the larger sizes, rubber buffers are used in conjunction with the torque arm and when properly used they are applied in tandem, on either side of the torque arm lug.



IMPORTANT NOTE

When ordering the Torque Arm (K) one can specify which side of the reducer to mount the fastening hole that bolts to the machine support bracket. Consult the appropriate NORD catalog for specific Torque Arm (K) mounting options and ordering guidelines.

2. Purpose of the rubber bushing or rubber buffers

Regardless if the Torque Arm (K) is supplied with the integral rubber bushing or whether separate rubber buffers are required, the bushing/buffers help isolate and absorb all the load forces present in the system and increase the reducer's service life by reducing cumulative torsional shock loads.

- The primary load force acts in the direction of driven shaft rotation, reacts the load torque of the reducer, and prevents the gearbox from spinning on the shaft.
- Additional forces present themselves in the direction opposite of the shaft rotation, due to the typical slight out-of-round condition present in the machine shaft. This condition is the reason most shaft mounted-reducers have a slight shaft-wobble, which is normal.

NOTICE

Always make sure that the Torque Arm (K) is used in conjunction with the required rubber bushing/s. Failure to do so will not properly cushion the reducer and can result in excessive binding, bearing stress, and damage to the reducer.

3. Machine support

The user must supply a suitably strong and rigid mating machine support that provides load bearing capacity on both sides of the machine support bracket.

⚠ WARNING

It is the responsibility of the machine builder to design a support bracket of adequate strength and rigidity, and supply an appropriate tightening bolt assembly. Failure to do so may result in injury caused from a damaged or broken torque-reaction assembly.

4. Installation of the right-angle reducer with torque arm (K)

A. Make sure the Torque-Arm (K) is mounted so that the machine fastening hole is on the correct side of the reducer.
   - The torque-arm can be repositioned on the as-received unit by removing the fixing screws, re-position the torque-arm in the correct location, and re-securing the fixing screws to the proper tightening torque, as indicated in Table 2 (Page 2).
   - If the torque-arm was shipped loose, position the torque-arm in the correct location on the gear unit, and secure the torque-arm with the proper fixing screws & tightening torque, as indicated in Table 2 (Page 2).

B. Install the right-angle hollow bore reducer onto the machine shaft. Line up the hole in the reducer's torque-arm with the hole in the machine's support bracket ,and temporarily hold the reducer in place

C. Properly secure the gear unit assembly to the driven shaft in an axial direction.

D. Apply thread locking compound to the end of the fixing bolt, then place the fastening bolt through the rigid machine support bracket and reducer torque-arm and loosely secure the nut onto the end of the bolt.

E. If the torque arm has an integral rubber bushing follow step F and skip steps G-H. If the torque arm uses rubber buffers skip forward to steps G-H.

F. Tighten the fixing bolt to the proper tightening torque as indicated in Table 2 (Page 2).

G. Install the rubber buffers on either side of the gear unit's torque-arm lug and place the fixing bolt through the rubber buffers and torque-arm lug and into the rigid machine support bracket.

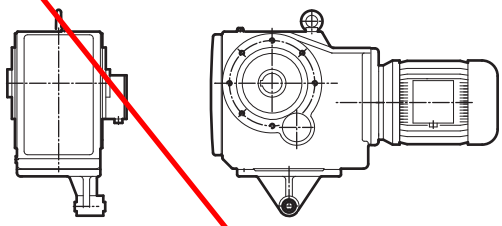
H. Tighten the fixing bolt and nut lightly snug, until all the free-play is eliminated from the rubber buffer assembly. Then snug the fixing bolt assembly by tightening an additional ¼ to ½ turn.

NOTICE

To prevent damage to the rubber buffers, avoid over-tightening.

90.1 HELICAL-BEVEL SHAFT-MOUNT WITH BOTTOM MOUNT TORQUE ARM (K)

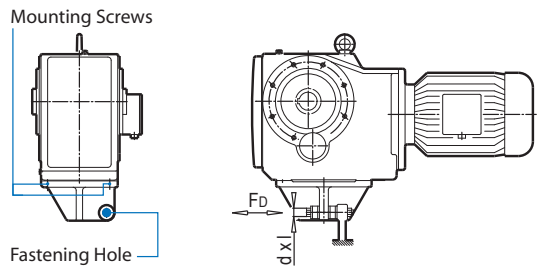
Torque Arm (K) with integrated bushing



Available for Sizes SK9012.1 - SK9072.1

- For most all 90.1 series Helical-Bevel gear units, an optional tear-drop shaped side -mounted torque arm (D) is available. See user manual U10600.

Torque Arm (K) with rubber buffer



Available for Sizes SK9082.1 - SK90906.1

- A metric fixing bolt is preferred for fastening the torque arm (K) to the machine support bracket.

Type	Torque Arm P/N	Reducer Hardware Hex Head Cap Screws + Lock Washer	Mounting Screw P/N	Lock Washer P/N	Rubber Buffer P/N	Fastening Hole In [mm]	Fastening Bolt Size	Bolt d x l [metric]	FD lb [N]	SFD inch [mm]
SK9012.1...K SK9013.1...K	68190600	M10 X 30 + A10 (Qty 3 Ea.)	22010300	28560106	N/A	0.41 [10.5]	M10	N/A	N/A	N/A
SK9016.1...K SK9017.1...K	68190600	M10 X 30 + A10 (Qty 3 Ea.)	22010300	28560106	N/A	0.41 [10.5]	M10	N/A	N/A	N/A
SK9022.1...K SK9023.1...K	68290610	M12 X 35 + A12 (Qty 3 Ea.)	22012350	28560126	N/A	0.65 [16.5]	M16	N/A	N/A	N/A
SK9032.1...K SK9033.1...K	68390610	M12 X 35 + A12 (Qty 3 Ea.)	22012350	28560126	N/A	0.65 [16.5]	M16	N/A	N/A	N/A
SK9042.1...K SK9043.1...K	68490610	M16 X 40 + A16 (Qty 3 Ea.)	22016400	28560166	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9052.1...K SK9053.1...K	68590620	M16 X 40 + A16 (Qty 3 Ea.)	22016450	28560166	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9072.1...K	68690620	M24 X 60 + A24 (Qty 4 Ea.)	22024060	28560246	N/A	0.98 [25]	M24	N/A	N/A	N/A
SK9082.1...K SK9082.1...SHK	68819010	M24 x 65 + A24 (Qty 4 Ea.)	22024650	22024650	29610000	1.22 [31]	M30	M30 x 260	5300 [23.64]	0.53 [13.5]
SK9086.1...K SK9086.1...SHK	68819010	M24 x 65 + A24 (Qty 4 Ea.)	22024650	22024650	29610000	1.22 [31]	M30	M30 x 260	6900 [30.77]	0.69 [17.6]
SK9092.1...SHK	68919010	M36 x 90 + A36 (Qty 4 Ea.)	22036900	28560366	29610000	1.22 [31]	M30	M30 x 260	10300 [45.71]	1.03 [26.2]
SK9096.1...SHK	69019000	M42 x 120 + A42 (Qty 4 Ea.)	22042120	28560426	29621800	1.93 [49]	M48	M48 x 550	12,500 [55.56]	1.06 [27.0]

HELICAL & BEVEL REDUCER LUBRICATION

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

Most NORD reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

The following tables indicate the standard oil fill type used. Please see user manual U11000 for more specific information and for optional helical and bevel gear lubricants:

Serviceable Gear Units	
Helical In-line	Standard Oil Fill: ISO VG 220, Mineral Oil
Clincher Parallel-Shaft	
Right-Angle Bevel	
NORDBLOC® Series In-line	
NORDBLOC®.1 Series In-line	
Standard Series In-line	

IMPORTANT NOTE

For shipping purposes, the following large Clincher™ gear units are supplied without oil:
• Clincher™ Sizes SK11282, SK11382 and SK12382

Maintenance-free / Lubricated For Life Gear Units	
Clincher™ sizes SK0182NB, SK0282NB & SK1382NB	Standard Oil Fill: ISO VG220 SHC/PAO Synthetic Oil
NORDBLOC® Sizes SK172, SK272, SK371F, SK372, SK373, SK320	

IMPORTANT NOTE

Maintenance-free units are supplied as sealed units with no vent-plug. Consult NORD prior to ordering if interested in ordering any of the above sizes as serviceable gear units.

IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

If the gear unit is filled with mineral oil, the lubricant should be replaced at least after every 10,000 operating hours or after every two years. If the gear unit is filled with synthetic oil, the lubricant should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Oil viscosity

Viscosity, or the oil's resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Mineral	80-85°C (176-185°F)	95°C (203°F)
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

6. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

7. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. ***For additional information, please see the seperate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.***

The gearbox nametag will indicate the mounting position that was provided. ***For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.***

IMPORTANT NOTE

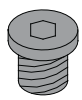
Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

8. Oil plug locations

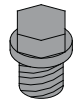
All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

9. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.



Drain Plug



Fill Level Plug

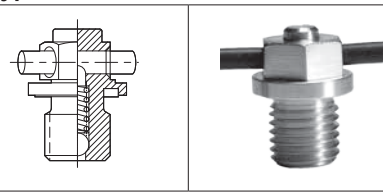
10. Vent plug locations

Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types

Type 1



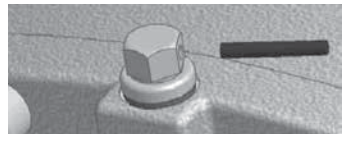
Type 2 with transportation plug

Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.

Sealed vent



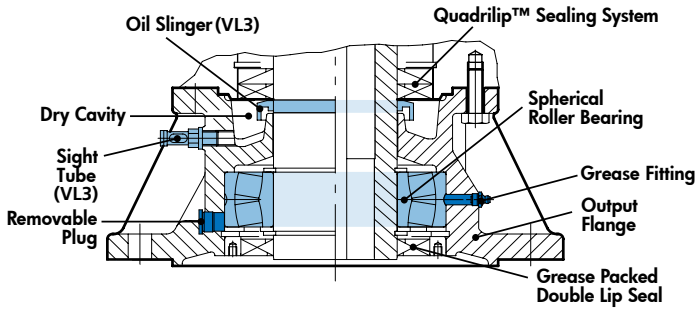
Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.

VL2 & VL3
EXTENDED BEARING LUBRICATION

1. VL2 – Spread Bearing Design

NORD offers reinforced output shaft bearings with increased bearing distance. The lower bearing is a oversized, double row spherical bearing, which absorbs high overhung and thrust loads while providing a longer bearing service life. The spherical roller bearing is especially useful in compensating for alignment errors in long agitator shafts. The VL2 spread bearing design is commonly used for shredders, mixers, overhead conveyors or applications requiring increased bearing load carrying capacities. Included with the VL2 design is a grease fitting for the lower bearing and a removable plug to allow excess grease to purge from the bearing cavity.



2. VL3 – Spread Bearing Design with Oil Safe Dry Cavity

The VL3 dry cavity design adds additional oil leak protective measures to the VL2 spread bearing design. NORD's Quadralip™ sealing system prevents oil from leaking from the gearbox into the VL2 flange. If in any case oil does leak past the Quadralip™ seals, it would flow down to the oil slinger mounted onto the shaft. As the shaft rotates, the oil will sling off into the dry cavity. A sight tube is provided for dry cavity inspection. At the bottom of the spread bearing flange is greased packed, double lip seal.

3. Service Guidelines for the Extended Bearing Flange

The spherical roller bearing on the extended bearing housing should be re-greased with 0.75 to 1.0 ounces (20-25 grams) of grease after every 2,500 hours of service or at least every 6 months. Prior to re-greasing the screw plug located opposite to the grease nipple should be unscrewed. After re-greasing the screw plug must be reinstalled and tightened. The extended bearing is factory assembled with the proper amount and type of grease. The type of grease supplied depends upon the type of oil specified at time of order.

Bearing Grease Options

Reducer Oil Type	NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type
MIN-EP	NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222
PAO	NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220
FG or FG-PAO	NLGI 2	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222

NOTICE

Grease compatibility depends upon the type of thickener or soap complex used, the base oil type suspended within the thickener, and the type of additives used. The user should check with the lubrication supplier before making substitutions in brand and type in order to assure compatibility and to avoid causing possible damage to the extended bearing.

HELICAL-WORM REDUCER LUBRICATION

1. Importance of proper lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

NORD helical-worm reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

NORD helical worm gear reducers are filled with ISO VG 680 synthetic-hydrocarbon/polyalphaolefin (SHC/PAO) worm gear oil.

- SHC/PAO worm gear oils have good high and low temperature stability, are compatible with most paint and seal types, and are miscible with mineral oils.
- SHC/PAO worm gear oils also contain a small amount of organic ester and other antiwear (AW) packages to offer improved lubrication conditions, especially in the worm mesh, where a sideways sliding motion prevails.

Please see user manual U11020 for more specific information and for optional helical worm lubricants.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

IMPORTANT NOTE

Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.

3. Lubrication replacement

The helical-worm gear oil should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Efficiency

Helical worm gears reach efficiencies up to 92% and are generally much more efficient than worm-only gear units. However, it is important to consider the following, when using worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.

IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

5. Oil Viscosity

Viscosity, or the oil's resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

6. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

7. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

NOTICE

NORD suggests replacing the gear oil if oil analysis indicates any of the following. Failure to replace the oil may cause internal damage to gearbox and diminished performance:

- Viscosity has changed by approximately 10% or more.
- Debris particles (silicon, dust, dirt or sand) exceed 25 ppm.
- Iron content exceeds 150-200 ppm.
- Water content is greater than 0.05% (500 ppm).
- The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended.

8. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. ***For additional information, please see the seperate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.***

The gearbox nametag will indicate the mounting position that was provided. ***For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.***

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

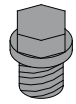
9. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

10. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.

Drain Plug



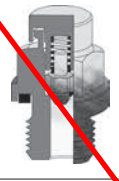
Fill Level Plug

11. Vent plug locations

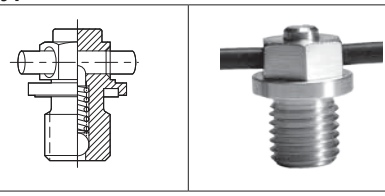
Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

Figure 1 AUTOVENT™ Types



Type 1

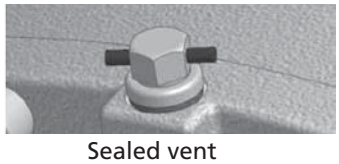


Type 2 with transportation plug

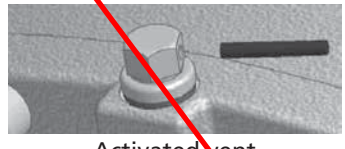
Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal components and cause leakage.



Sealed vent



Activated vent

Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.

MINICASE® (SM SERIES) WORM GEAR LUBRICATION GUIDELINES

1. Importance of proper gearbox lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Maintenance free design

MINICASE® (SM series) worm gear reducers are designed to be maintenance-free and are supplied completely sealed. They are factory oil-filled with a pre-determined oil fill amount in accordance to the specified reducer size and mounting position. The synthetic lubrication used is suitable for the life of the product so the MINICASE™ is inherently maintenance free.

3. Standard oil type

The standard factory oil fill for MINICASE® (SM) worm gear reducers is ISO viscosity VG synthetic hydrocarbon/polyalphaolefin (SHC/PAO oil) food grade oil suitable for NSF-H1 incidental contact and is a factory stocked lubricant. Food grade oil suitable for NSF-H1 incidental contact is a factory stocked option.

See user manual U11040 for specific information and for optional MINICASE® (SM) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when using worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.

IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and/or lowering the oil viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer's maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

6. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduction in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

7. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalphaolefin or ester based products.

MINICASE® (SMI/SMID) WORM GEAR LUBRICATION GUIDELINES

1. Importance of proper gearbox lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Factory Oil-Filled / Maintence-Free

NORD modular worm gear units are inherently maintence-free, factory oil filled, and supplied with a high-quality, long-life, synthetic oil which is intend to be suitable for the life of the gear unit.

MINICASE® (SMI/SMID) worm gear units are assembled at the factory from stocked component parts. They are filled at time of assembly in accordance to the specified reducer mounting position. See user manuals U13150 and U13250 for more info.

3. Standard Oil Types

MINICASE® (SMI/SMID) worm gear units are factory filled with synthetic poly glycol oil. Food-grade polyglycol oil is optional. The specific oil type and viscosity grade are displayed on the reducer nameplate. See user manual 11050 for specific MINICASE® (SMI/SMID) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when ordering worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.

IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

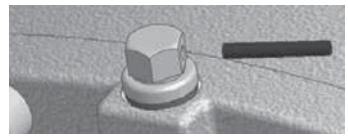
5. Optional Vent Kits

MINICASE® (SMI/SMID) worm gear units are designed to operate sealed or vented. As a standard the modular worm gear units are factory oil filled and supplied with oil plugs in the housing, making vent plugs optional. See user manual U14750.

NORD can supply an AUTOVENT™ or an open vent with each gear unit size. If a vent is desired the type must be specified at the time of order. Reducer vents are sealed with a transportation plug that must be removed prior to gear unit start-up.

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a seperate part number, vent kits include the housing gasket



NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

6. AUTOVENT™

The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

7. Open Vent

A typical gearbox industry open vent option can also be supplied by NORD. This option allows free exchange of air and does not build-up any back pressure inside the gear unit. This option is ideal for many operating conditions where the geared product is used in relatively clean and moisture-free environment.

8. When to Use a Sealed or a Vented Unit

There are many conditions that should be considered when deciding whether to use a sealed or vented unit.

1. If the duty cycle is intermittent, the run times are short, and any build-up of internal pressure or temperature is relatively low, the sealed unit option may be used.
2. If running continuous and under moderate to high load conditions, worm gears can generate higher operating temperatures and a build-up of internal pressure. In these instances a vent is strongly recommended. Consult NORD if operation at high load conditions is required.
3. If running continuous at 4-pole electric motor speeds (1800 rpm at 60 Hz) or higher, then a vent option is usually recommended. Consult NORD if operation at higher speeds is required.
4. Radial shaft seals produce a hydrodynamic pumping action to help push lubricant back into the gear unit, causing a small amount of ingested air and a small pressure increase (1-2 psi) that does not normally require a reducer vent; however when combined with continuous operation under high load (Condition 2), additional operating pressures will result and a vent should be used.
5. When the environment is contaminated with water, dirt, or other objects that may be ingested into the breather, increased wear of bearings, gearing, and lubrication breakdown can result. In these instances the sealed option or an AUTOVENT™ should be considered.

9. Maximum Oil Sump Temperature Limit

To prevent reducer overheating, the reducer's maximum oil-sump temperature limit must not be exceeded for prolonged periods of operation.

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the safe operating temperature limit, please consult NORD to discuss alternatives.

10. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and a better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduc-tion in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

11. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalphaolefin or ester based products.

FLEXBLOC™ (SI/SID SERIES) WORM GEAR LUBRICATION GUIDELINES

1. Importance of Proper Lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

2. Factory Oil-Filled / Maintence-Free

NORD modular worm gear units are inherently maintence-free, factory oil filled, and supplied with a high-quality, long-life, synthetic oil which is intend to be suitable for the life of the gear unit.

FLEXBLOC™ SI worm gear units are filled at time of assembly to a universal oil fill, allowing for many mounting position possibilities. See user manual U13300.

3. Standard oil type

FLEXBLOC™ (SI/SID) worm gear units are factory filled with synthetic poly glycol oil. Food-grade polyglycol oil is optional. The specific oil type and viscosity grade are displayed on the reducer nameplate. See user manual 11060 for specific FLEXBLOC™ (SI/SID) worm lubrication types and options.

NOTICE

In worm gears avoid using extreme pressure (EP) gear oils containing sulfur-phosphorous chemistries; these additives can react adversely with bronze worm gears, and accelerate wear.

4. Efficiency

It is important to consider the following, when ordering worm gears.

- Worm gears reach their peak rated efficiency, after they undergo a natural run-in process (up to 25 hours operating time at maximum rated load). Catalog published power and torque figures are based upon the rated efficiency after the run-in is complete.
- Worm gears have naturally lower startup efficiencies compared to operating efficiencies. As input speed increases the enhanced hydrodynamic effects of the oil result in less tooth friction and increased worm gear efficiency.

IMPORTANT NOTE

Worm gear reducers applied in cold temperature service, may require increased motor power for the following reasons:

- Lower operating temperatures, cause lubrication viscosity to increase in both the gearbox and in the moving areas of the driven machine.
- Worm-gears have naturally lower start-up efficiencies compared to operating efficiencies.
- In extreme cases, one might need to consider increasing the motor power and lowering the oil viscosity

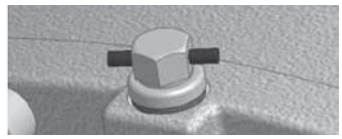
5. Optional Vent Kits

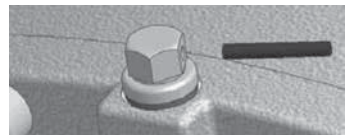
FLEXBLOC™ (SI) worm gear units are designed to operate sealed or vented. As a standard the modular worm gear units are factory oil filled and supplied with oil plugs in the housing, making vent plugs optional. See user manual U14800 for vent locations.

NORD can supply an AUTOVENT™ or an open vent with each gear unit size. If a vent is desired the type must be specified at the time of order. Reducer vents are sealed with a transportation plug that must be removed prior to gear unit start-up.

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a seperate part number, vent kits include the housing gasket





NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

6. AUTOVENT™

The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material and prevent lubrication contamination from dust particles, moisture and air-borne process chemicals. The breather opens at approximately 0.3-0.9 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, while reducing foaming and oxidation.

7. Open Vent

A typical gearbox industry open vent option can also be supplied by NORD. This option allows free exchange of air and does not build-up any back pressure inside the gear unit. This option is ideal for many operating conditions where the geared product is used in relatively clean and moisture-free environment.

FLEXBLOC® (SI/SID SERIES) WORM GEAR LUBRICATION GUIDELINES

8. When to Use a Sealed or a Vented Unit

There are many conditions that should be considered when deciding whether to use a sealed or vented unit.

1. If the duty cycle is intermittent, the run times are short, and any build-up of internal pressure or temperature is relatively low, the sealed unit option may be used.
2. If running continuous and under moderate to high load conditions, worm gears can generate higher operating temperatures and a build-up of internal pressure. In these instances a vent is strongly recommended. Consult NORD if operation at high load conditions is required.
3. If running continuous at 4-pole electric motor speeds (1800 rpm at 60 Hz) or higher, then a vent option is usually recommended. Consult NORD if operation at higher speeds is required.
4. Radial shaft seals produce a hydrodynamic pumping action to help push lubricant back into the gear unit, causing a small amount of ingested air and a small pressure increase (1-2 psi) that does not normally require a reducer vent; however when combined with continuous operation under high load (Condition 2), additional operating pressures will result and a vent should be used.
5. When the environment is contaminated with water, dirt, or other objects that may be ingested into the breather, increased wear of bearings, gearing, and lubrication breakdown can result. In these instances the sealed option or an AUTOVENT™ should be considered.

9. Maximum Oil Sump Temperature Limit

To prevent reducer overheating, the reducer's maximum oil-sump temperature limit must not be exceeded for prolonged periods of operation.

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Synthetic	105°C (220°F)	107°C (225°F)

IMPORTANT NOTE

Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

10. Oil Viscosity

The viscosity rating determines the operating oil's resistance to shear under load conditions. Some important viscosity considerations include the following:

- Lightly loaded gears require lower viscosity oils than highly loaded gears.
- Lower viscosity will provide thin oil film, lower friction, higher mechanical efficiency, and better heat removal conditions.
- Higher viscosity will provide thicker oil film, and better resistance to sliding wear, scuffing wear, and galling at high pressure.
- Higher operating temperatures will cause a reduction in viscosity and lower operating temperatures, cause an increase in viscosity or a thickening of the oil.

The standard oil-fill is considered acceptable for most applications. In certain situations an oil viscosity change may be beneficial.

- If the gear unit is exposed to frequent high load conditions. A higher viscosity oil will have a higher film thickness offering better overall resistance to oil shear, sliding wear and scuffing wear in gears and roller element bearings.
- An oil viscosity correction or lubrication change may improve the overall performance when operating the gear unit at very low or high ambient temperature conditions.

IMPORTANT NOTE

The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

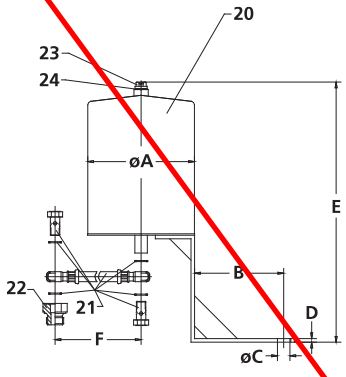
11. Viscosity Index

Viscosity index helps quantify the rate of oil viscosity change with respect to temperature changes. Oils with a reasonably high viscosity index tend to be more stable in a changing temperature environment. The ability of an oil to maintain a small viscosity differential over the operating range of the gearbox provides a more consistent lubricating film and better wear performance.

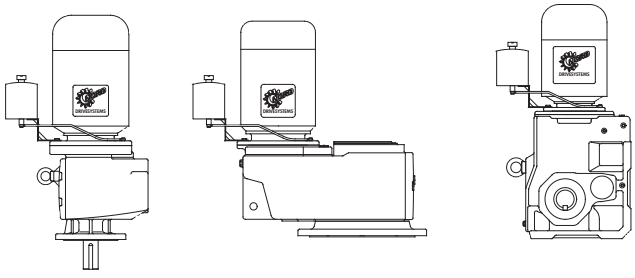
Synthetic oils typically have a higher viscosity index than mineral oils and polyglycol oils tend to have an exceptionally high viscosity index compared to other synthetic oils like polyalphaolefin or ester based products.

Installation Instructions

Sometimes NORD requires the use of an oil expansion chamber when the motor or reducer input is mounted vertically. Consult your NORD catalog for additional information and application considerations.



1. Secure the gear reducer in the proper mounting position for the application and remove the vent plug from the gear reducer. The hose assembly kit (21) will be fitted to the reducer using the housing port provided.
2. When using the larger 2.7 and 5.4 liter chambers, screw the adapter fitting (22) into the reducer housing port. Use all sealing gaskets provided.
3. Mount the overflow tank (20) at the highest location from the reducer, as permitted by the hose assembly kit (21). Typical mounting configurations are represented below. Use one of the input cover's mounting bolts, to mount the chamber support leg to the reducer.



4. Be sure to use the proper fittings. Assemble one end of the vent-hose assembly (21) to bottom of the chamber and one-end to the reducer.
5. Secure the vent-plug (23) and gasket (24) that is supplied with the kit to the top of the expansion chamber.

NOTICE

Remove the protective "rubber element" from the supplied vent prior to use so that an open-vent is formed on top of the overflow tank. Avoid using a pressurized AUTOVENT™ breather on the overflow tank since this may create an undesired pressure-vacuum in the overflow tank.

Expansion Chamber Kit Dimensions & Parts List

Kit Part Number: 28390390 - 0.7 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390390 (0.7 Liter)	3.94	1.97	0.53	0.20	8.50	19.69	inch
	100	50	13.5	5	216	500	mm

Item	Part Number	Description
20	28300390	Overflow Tank - 0.7 Liter
21	28310020	Flexible Vent Hose Assembly - Includes: Hose, metal gaskets & 2 Hollow Bolts (1 Bolt. - M12 X 1.5 and 1 Pc. - G1/4)
22	None	Adapter Fitting
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Kit Part Number: 28390400 - 2.7 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390400 (2.7 Liter)	5.91	4.92	0.69	0.20	15.22	27.56	inch
	150	125	17.5	5	386.5	700	mm

Item	Part Number	Description
20	28300400	Overflow Tank - 2.7 Liter
21	28310030	Flexible Vent Hose Assy - Includes: Hose, metal gaskets & 2 Hollow Bolts (2 Pcs. - G1/4)
22	22024030	Adapter Fitting (M24 X 1.5 to G1/4)
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Kit Part Number: 28390410 - 5.4 Liter Oil Expansion Chamber

Kit P/N	Ø A	B	Ø C	D	E	F	Units
28390410 (5.4 Liter)	7.09	3.54	0.69	0.20	15.18	31.50	inch
	180	90	17.5	5	385.5	800	mm

Item	Part Number	Description
20	28300410	Overflow Tank - 5.4 Liter
21	28310040	Flexible Vent Hose Assy - Includes: Hose, metal gaskets & 2 Hollow Bolts (2 Pcs. - G1/4)
22	22030030	Adapter Fitting (M30 X 1.5 to G1/4)
23	22012004	Normal Style Vent Plug (M12 X 1.5, DIN 910)
24	25312150	Vent Plug Gasket (12 X 15.5 X 1.5)

Please see page 2 for gearbox compatability

Expansion Chamber Compatability Chart

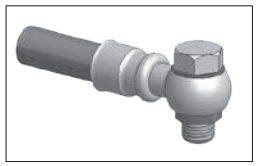
Helical In-line	NORDBLOC™	NORDBLOC.1™	Clincher™	Helical-Bevel	Part Number	[lb]
SK 42/43 SK 52/53 SK 63	SK472/473 SK572/573 SK672/673 SK772/773 SK872/873 SK972/973	SK572.1/573.1* SK672.1/673.1*	SK 4282/4382 SK 5282/5382 SK 6382	SK 9042.1/9043.1 SK 9052.1/9053.1	28390390	11.0
SK 62 SK 72/73			SK 6282 SK 7282/7382	SK 9072.1 SK 9082.1	28390400	13.2
SK 82/83 SK 92/93 SK 102/103			SK 8282/8382	SK 9086.1 SK 9092.1 SK 9096.1	28390410	15.4

* Need to additionally order part #28390380 which is sub-assembly shown below.

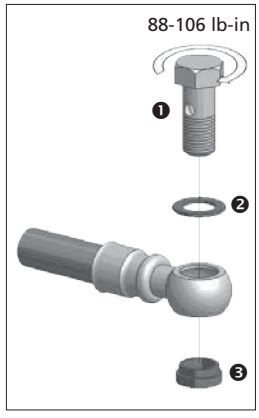
Sub-Assembly P/N 28390380 for NORDBLOC®.1 gear units with M10x1 air vent.

❶	❷	❸	❹
1x DIN 7643 M10x1 283 00380	1x DIN 7603A Cu 10x16x1 253 10166	1x Ring 10x14x5 283 00370	1xDIN 9021 ø8,4 227 10840

Assembly of the expansion unit at the gear unit. Types SK 572.1/573.1, SK 672.1/673.1

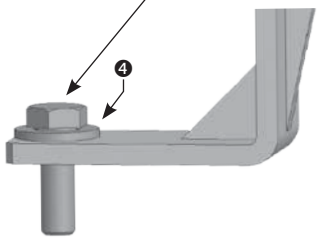


Vent Hose Sub-Assembly

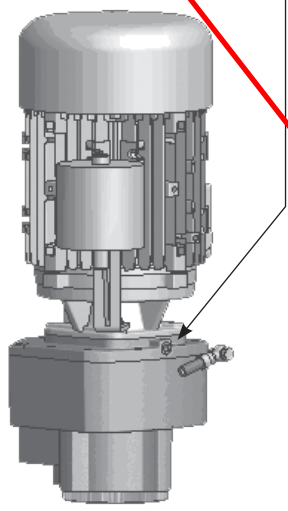


❹ For motor sizes 63, 71, 80, 90, 100 & 112

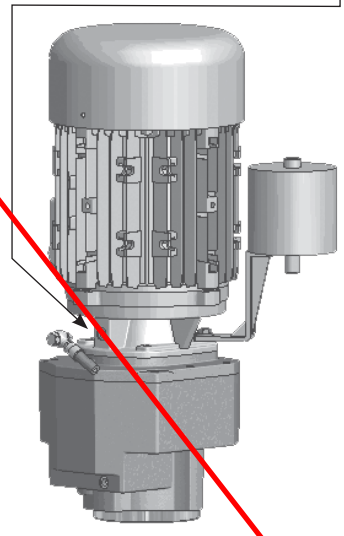
- Motor attachment bolt



Motor Sizes 63, 71 & 80:
Assembly vent-hose to port as shown.



Motor Sizes 90,100 & 112:
Assembly vent-hose to port as shown.



HELICAL & BEVEL REDUCER LUBRICATION TYPES

Lubrication Tables – Helical and Bevel Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG220	MIN-EP	0 to 40°C (32 to 104°)	Mobilgear 600XP220	♦❶
	PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC630	♦❷
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220	♦

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC 634	-
	FG-PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC Cibus 460	-
VG220	FG-PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC Cibus 220	-
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	♦❶
	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	♦❷
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	♦

♦ Stocked Lubricants

❶ Standard product on serviceable gear units

❷ Standard product on maintenance free gear units

IMPORTANT NOTE

- The "Ambient Temperature" is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Mineral Oil: 80-85 °C (176 – 180 °F).
  Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
  - √ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
  - √ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
  - √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
  - √ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

MIN-EP - Mineral Oil with EP Additive
PAO-EP - Synthetic Polyalphaolefin Oil with EP Additive
PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG - Food-Grade Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

HELICAL & BEVEL REDUCER LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala S2 G 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobilgear SHC150	Omala S4 GX 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG	0 to 25°C (32 to 77°F)	Mobil DTE FM 150	N/A	N/A	N/A	N/A
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	MIN-EP	0 to 40°C (32 to 104°)	Mobilgear 600XP220	Omala S2 G 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobilgear SHC220	Omala S4 GX 220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60°C (-22 to 140°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220	N/A
	FG-PAO	-25 to 60°C (-13 to 140°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP460	Omala S2 G 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80°C (-4 to 176°F)	Mobilgear SHC460	Omala S4 GX 460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM460	N/A	N/A	Fuchs FM460	N/A
	FG-PAO	-20 to 80°C (-4 to 176°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-20 to 80°C (-4 to 176°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

HELICAL-WORM REDUCER LUBRICATION TYPES

Lubrication Tables – Helical Worm Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PAO	0 to 60°C (32 to 140°F)	Mobil SHC636	♦

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO	0 to50°C (32 to 122°F)	Mobil SHC 634	-
	FG-PAO	0 to50°C (32 to 122°F)	Mobil SHC Cibus 460	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220	♦
	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222	♦

♦ **Stocked Lubricants**

IMPORTANT NOTE

- The "Ambient Temperature" is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD Gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:

  Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:

√ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
√ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
√ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
√ Fluid grease is required for lubricating the gear unit.

- Observe the general lubrication guidelines outlined in user manual U10770.

Oil Formulation Codes

PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

HELICAL-WORM REDUCER LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-15 to 40°C (5 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	0 to50°C (32 to 122°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	0 to50°C (32 to 122°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	0 to50°C (32 to 122°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	0 to50°C (32 to 122°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	0 to 60°C (32 to 140°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	0 to 60°C (32 to 140°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	0 to 60°C (32 to 140°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	0 to 60°C (32 to 140°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

MINICASE® (SM SERIES) WORM GEAR LUBRICATION TYPES

Lubrication Tables – MINICASE® (SM series) Worm Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	♦

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	♦

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	♦
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klubersynth UH1 14-151	♦

♦ **Stocked Lubricants**

IMPORTANT NOTE

- Observe the general lubrication guidelines in User Manual U17900.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
  √ The gear unit is exposed to frequent high load conditions.
  √ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
  √ Fluid grease is being considered or specified for lubricating the gear unit.
  √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyaolphaolefin (PAO) oils.

MINICASE (SM SERIES) WORM GEAR LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

MINICASE® (SMI/SMID) WORM GEAR LUBRICATION TYPES

Lubrication Tables – MINICASE® (SMI/SMID series) Worm Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	♦

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	♦

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	♦
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klubersynth UH1 14-151	♦

♦ **Stocked Lubricants**

IMPORTANT NOTE

- Observe the general lubrication guidelines in User Manual U10800.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
  √ The gear unit is exposed to frequent high load conditions.
  √ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
  √ Fluid grease is being considered or specified for lubricating the gear unit.
  √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyaolphaolefin (PAO) oils.

MINICASE (SMI/SMIDJ) WORM GEAR LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

FLEXBLOC™ (SI/SID SERIES) WORM GEAR LUBRICATION TYPES

Lubrication Tables – FLEXBLOC™ (SI/SID Series) Worm Gear Units

Standard Oil Lubricants

NORD uses a semi automated assembly process to produce the FLEXBLOC™ gear unit assemblies. During this process the gear units are factory filled in accordance with the following table.

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG680	FG-PG	-25 to 80°C (-13 to 176°F)	Klübersynth UH1 6-680	Inch
	PG	-20 to 40°C (-4 to 104°F)	Klübersynth GH 6-680	Metric
VG220	FG-PG	-25 to 40°C (-13 to 104°F)	Klübersynth UH1 6-220	Inch
	PG	-25 to 40°C (-13 to 104°F)	Klübersynth GH 6-220	Metric

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Li-Complex	PAO	-25 to 80°C (-13 to 176°F)	Kluber / Petamo GHY133N	♦
	Aluminum	FG	-25 to 40°C (-13 to 104°F)	Kluber / Klubersynth UH1 14-151	♦

♦ **Stocked Lubricants**

IMPORTANT NOTE

- Observe the general lubrication guidelines in User Manual U10800.
- Ambient temperature range is a guideline only. The allowed operating temperature range for the gear unit is dependent upon assembly components used, their individual temperature limits, and the actual operating conditions.
- The selected oil type and viscosity is considered appropriate for most applications utilizing the specified NORD gear unit type. Different oil types or viscosity grades may be recommended if the gear unit is exposed to frequent high load conditions or operating under extreme low or high ambient temperature conditions.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Synthetic oil: 105 °C (225 °F).
- Consult NORD for recommendations in the following instances:
  √ The gear unit is exposed to frequent high load conditions.
  √ Ambient temperature conditions exceed 40 °C (104 °F) or approach 0 °C (32 °F) or lower.
  √ Fluid grease is being considered or specified for lubricating the gear unit.
  √ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.

Oil Formulation Codes

PAO - Synthetic Polyalphaolefin Oil
PG - Synthetic Polyglycol Oil
FG-PAO - Food-Grade, Synthetic Poyalphaolefin Oil
FG-PG - Food-Grade, Synthetic Polyglycol Oil

NOTICE

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral or polyaolphaolefin (PAO) oils.

FLEXBLOC® (SI/SID SERIES) WORM GEAR LUBRICATION TYPES

Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG 100	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC627	Morlina S4 B 100	N/A	N/A	Klübersynth GEM 4-100N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth GH 6-100
	FG-PAO	-30 to 25°C (-22 to 77°F)	Mobil SHC Cibus 100	N/A	N/A	N/A	Klüberoil 4 UH 1-100N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 100	N/A	N/A	N/A	Klübersynth UH1 6-100
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	Morlina S4 B 150	Alphasyn T150	N/A	Klübersynth GEM 4-150N
	PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	Omala S4 WE 150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG-PAO	-15 to 25°C (5 to 77°F)	Mobil SHC Cibus 150	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25°C (-13 to 77°F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	PAO	-35 to 40°C (-31 to 104°F)	Mobil SHC630	Morlina S4 B 220	Alphasyn T220	N/A	Klübersynth GEM 4-220N
	PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	Omala S4 WE 220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG-PAO	-25 to 40°C (-13 to 104°F)	Mobil SHC Cibus 220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 40°C (-13 to 104°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH1 6-220
VG460	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC 634	Morlina S4 B 460	Alphasyn T460	N/A	Klübersynth GEM 4-460N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 460	Omala S4 WE 60	Alphasyn PG460	N/A	Klübersynth GH 6-460
	FG-PAO	-5 to 40°C (23 to 104°F)	Mobil SHC Cibus 460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-5 to 40°C (23 to 104°F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460
VG680	PAO	-20 to 40°C (-4 to 104°F)	Mobil SHC636	Morlina S4 B 680	N/A	N/A	Klübersynth GEM 4-680N
	PG	-20 to 40°C (-4 to 104°F)	Mobil Glygoyle 680	Omala S4 WE 680	N/A	N/A	Klübersynth GH 6-680
	FG-PAO	-5 to 40°C (23 to 104°F)	N/A	N/A	N/A	Cassida GL680	Klüberoil 4 UH1-680N
	FG-PG	-25 to 80°C (-13 to 176°F)	Mobil Glygoyle 680	N/A	N/A	Cassida WG680	Klübersynth UH1 6-680

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.

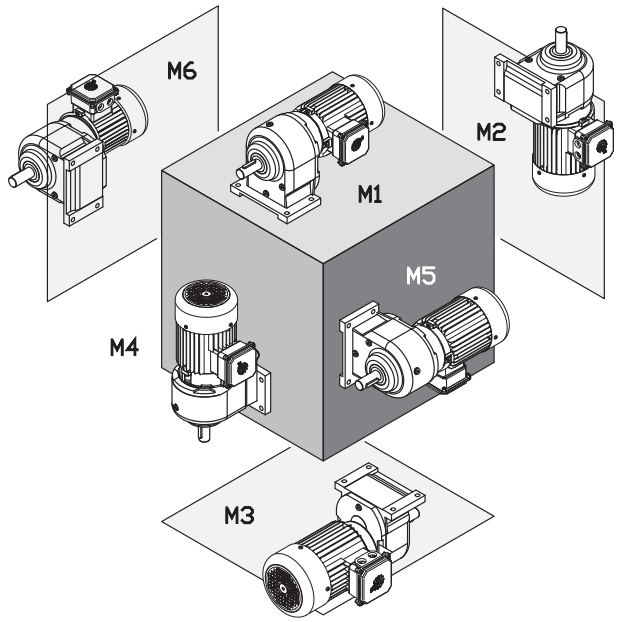
STANDARD IN-LINE FOOTED OIL FILL QUANTITIES

Standard In-line footed lubrication

All Standard In-line reducers are shipped from NORD with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. When filling these gear units the oil must be measured and added until one establishes the proper fill quantity. For additional information please refer to the "Oil & vent plug locations" documentation for your specified gear unit

IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK0 / SK05	0.14	0.13	0.23	0.22	0.14	0.13	0.23	0.22	0.14	0.13	0.14	0.13
SK000	0.25	0.24	0.42	0.40	0.25	0.24	0.42	0.40	0.25	0.24	0.25	0.24
SK01 / SK015	0.23	0.22	0.40	0.38	0.23	0.22	0.40	0.38	0.23	0.22	0.23	0.22
SK010 / SK0105	0.40	0.38	0.63	0.60	0.40	0.38	0.63	0.60	0.40	0.38	0.40	0.38
SK20 / SK205	0.58	0.55	1.06	1.00	0.58	0.55	1.06	1.00	0.58	0.55	0.58	0.55
SK200 / SK2005	0.85	0.80	1.37	1.30	0.85	0.80	1.37	1.30	0.85	0.80	0.85	0.80
SK25 / SK255	0.53	0.50	1.06	1.00	0.53	0.50	1.06	1.00	0.53	0.50	0.53	0.50
SK250 / SK2505	1.27	1.20	1.59	1.50	1.27	1.20	1.59	1.50	1.27	1.20	1.27	1.20
SK30 / SK305	0.95	0.90	1.37	1.30	0.95	0.90	1.37	1.30	0.95	0.90	0.95	0.90
SK300 / SK3005	1.27	1.20	2.11	2.00	1.27	1.20	2.11	2.00	1.27	1.20	1.27	1.20
SK33 / SK335	1.06	1.00	1.69	1.60	1.06	1.00	1.69	1.60	1.06	1.00	1.06	1.00
SK330 / SK3305	1.90	1.80	2.96	2.80	1.90	1.80	2.96	2.80	1.90	1.80	1.90	1.80

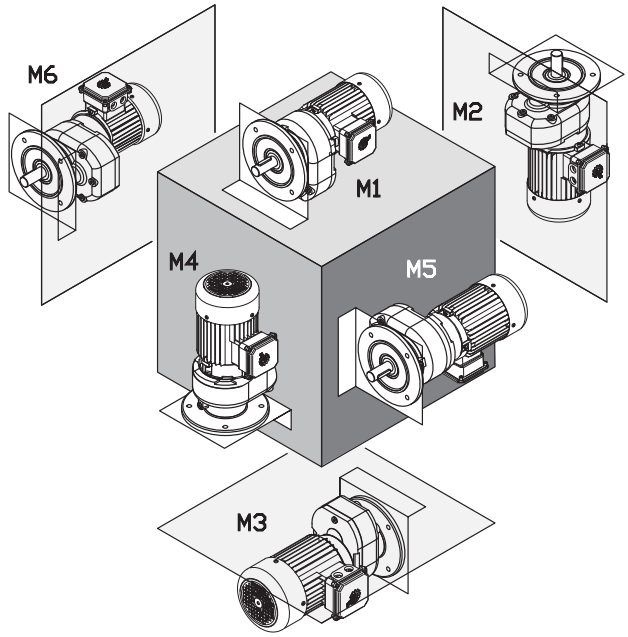
STANDARD IN-LINE FLANGED OIL FILL QUANTITIES

Standard In-line flanged lubrication

All Standard In-line reducers are shipped from NORD with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. When filling these gear units the oil must be measured and added until one establishes the proper fill quantity. For additional information please refer to the "Oil & vent plug locations" documentation for your specified gear unit

IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

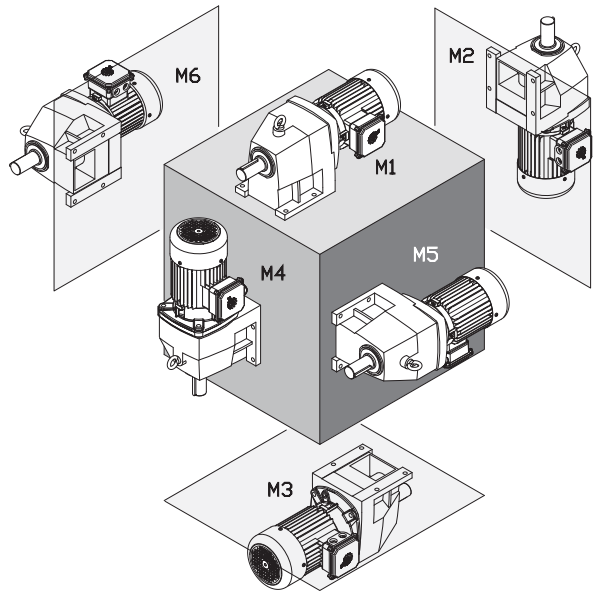


Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK0 F / SK05 F	0.14	0.13	0.23	0.22	0.14	0.13	0.23	0.22	0.14	0.13	0.14	0.13
SK000 F	0.25	0.24	0.43	0.41	0.25	0.24	0.43	0.41	0.25	0.24	0.25	0.24
SK01 F	0.23	0.22	0.40	0.38	0.23	0.22	0.40	0.38	0.23	0.22	0.23	0.22
SK010 F / SK0105 F	0.37	0.35	0.69	0.65	0.37	0.35	0.78	0.74	0.37	0.35	0.37	0.35
SK20 F	0.37	0.35	0.63	0.60	0.37	0.35	0.63	0.60	0.37	0.35	0.37	0.35
SK200 F / SK2005 F	0.69	0.65	1.00	0.95	0.69	0.65	1.16	1.10	0.69	0.65	0.69	0.65
SK25 F	0.53	0.50	1.06	1.00	0.53	0.50	1.06	1.00	0.53	0.50	0.53	0.50
SK250 F / SK2505 F	0.95	0.90	1.48	1.40	0.95	0.90	1.69	1.60	0.95	0.90	0.95	0.90
SK30 F	0.74	0.70	1.16	1.10	0.74	0.70	1.16	1.10	0.74	0.70	0.74	0.70
SK300 F / SK3005 F	1.32	1.25	1.59	1.50	1.32	1.25	1.90	1.80	1.32	1.25	1.32	1.25
SK33 F / SK335F	1.06	1.00	1.59	1.50	1.06	1.00	1.59	1.50	1.06	1.00	1.06	1.00
SK330 F / SK3305 F	1.69	1.60	2.64	2.50	1.69	1.60	3.06	2.90	1.69	1.60	1.69	1.60

HELICAL IN-LINE FOOTED OIL FILL QUANTITIES

Helical In-line footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02	0.21	0.20	0.79	0.75	0.79	0.75	0.69	0.65	0.63	0.60	0.63	0.60
SK 03	0.37	0.35	1.27	1.20	0.85	0.80	1.06	1.00	0.74	0.70	0.74	0.70
SK11E	0.26	0.25	0.53	0.50	0.69	0.65	0.53	0.50	0.42	0.40	0.42	0.40
SK12	0.26	0.25	0.85	0.80	0.90	0.85	0.79	0.75	0.58	0.55	0.58	0.55
SK 13	0.79	0.75	1.37	1.30	1.37	1.30	1.27	1.20	0.79	0.75	0.79	0.75
SK21E	0.63	0.60	1.27	1.20	1.37	1.30	1.06	1.00	1.06	1.00	1.06	1.00
SK22	0.53	0.50	2.01	1.90	2.22	2.10	1.90	1.80	1.48	1.40	1.48	1.40
SK 23	1.27	1.20	2.11	2.00	2.01	1.90	2.54	2.40	1.69	1.60	1.69	1.60
SK31E	1.16	1.10	2.11	2.00	2.32	2.20	1.80	1.70	1.59	1.50	1.59	1.50
SK32	0.95	0.90	2.64	2.50	3.28	3.10	3.28	3.10	2.11	2.00	2.11	2.00
SK 33N	1.85	1.75	3.17	3.00	3.59	3.40	4.23	4.00	2.43	2.30	2.43	2.30
SK41E	1.69	1.60	2.75	2.60	3.49	3.30	2.96	2.80	2.43	2.30	2.43	2.30
SK42	1.48	1.40	4.76	4.50	4.76	4.50	4.54	4.30	3.38	3.20	3.38	3.20
SK 43	3.17	3.00	5.92	5.60	5.49	5.20	6.97	6.60	3.80	3.60	3.80	3.60
SK51E	1.90	1.80	3.70	3.50	4.33	4.10	4.23	4.00	4.02	3.80	4.02	3.80
SK52	2.64	2.50	7.40	7.00	7.19	6.80	7.19	6.80	5.39	5.10	5.39	5.10
SK 53	4.76	4.50	9.19	8.70	8.14	7.70	9.19	8.70	6.34	6.00	6.34	6.00
SK62	6.87	6.50	15.9	15.0	13.7	13.0	16.9	16.0	15.9	15.0	15.9	15.0
SK 63	13.7	13.0	15.3	14.5	15.3	14.5	16.9	16.0	13.7	13.0	13.7	13.0
SK72	10.6	10.0	24.3	23.0	19.0	18.0	27.5	26.0	24.3	23.0	24.3	23.0
SK 73	21.7	20.5	21.1	20.0	23.8	22.5	28.5	27.0	21.1	20.0	21.1	20.0
SK82	14.8	14.0	37.0	35.0	28.5	27.0	46.5	44.0	33.8	32.0	33.8	32.0
SK 83	31.7	30.0	32.8	31.0	35.9	34.0	39.1	37.0	34.9	33.0	34.9	33.0
SK92	26.4	25.0	77.0	73.0	49.7	47.0	80.0	76.0	55.0	52.0	55.0	52.0
SK 93	56.0	53.0	74.0	70.0	62.0	59.0	76.0	72.0	52.0	49.0	52.0	49.0
SK102	38.0	36.0	84.0	79.0	70.0	66.0	108	102	75.0	71.0	75.0	71.0
SK 103	78.0	74.0	75.0	71.0	78.0	74.0	102	97.0	71.0	67.0	71.0	67.0

HELICAL IN-LINE FLANGED OIL FILL QUANTITIES

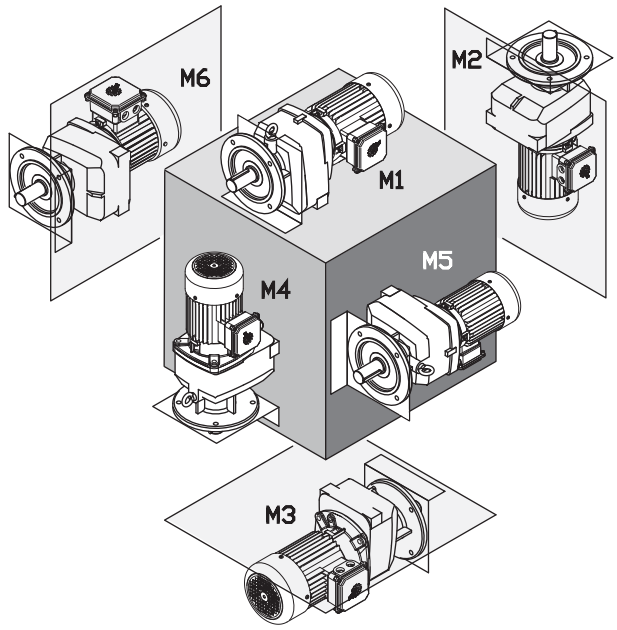
Helical In-line flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

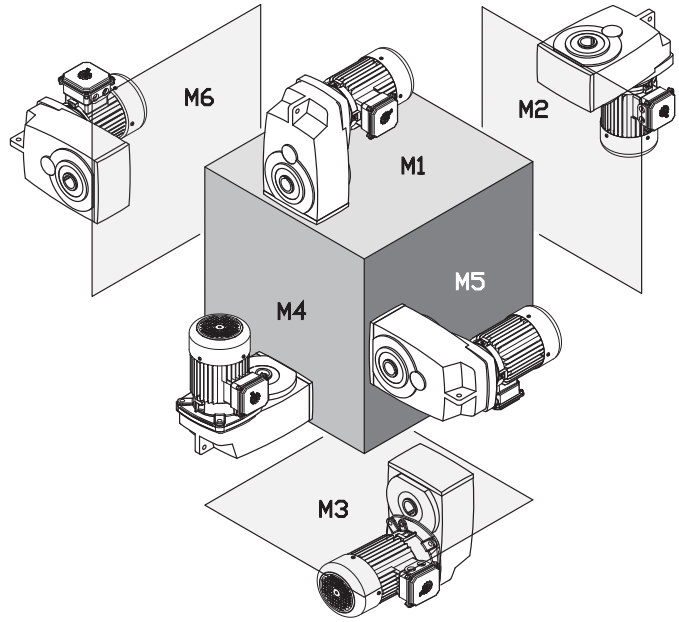


Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02F	0.26	0.25	0.74	0.70	0.74	0.70	0.74	0.70	0.53	0.50	0.53	0.50
SK 03 F	0.58	0.55	1.00	0.95	0.95	0.90	1.27	1.20	0.95	0.90	0.95	0.90
SK11E F	0.32	0.30	0.53	0.50	0.53	0.50	0.48	0.45	0.42	0.40	0.42	0.40
SK12F	0.37	0.35	0.90	0.85	0.95	0.90	0.95	0.90	0.74	0.70	0.74	0.70
SK 13 F	1.06	1.00	1.37	1.30	1.37	1.30	1.27	1.20	1.06	1.00	1.06	1.00
SK21E F	0.53	0.50	1.27	1.20	1.37	1.30	0.63	0.60	0.95	0.90	0.95	0.90
SK22F	0.74	0.70	1.90	1.80	1.90	1.80	1.90	1.80	1.48	1.40	1.48	1.40
SK 23 F	1.48	1.40	2.75	2.60	2.43	2.30	2.96	2.80	2.96	2.80	2.96	2.80
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SK32F	1.27	1.20	2.96	2.80	3.28	3.10	3.28	3.10	2.32	2.20	2.32	2.20
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SK41E F	1.27	1.20	2.43	2.30	2.85	2.70	2.11	2.00	2.01	1.90	2.01	1.90
SK42F	1.90	1.80	4.65	4.40	4.76	4.50	4.23	4.00	3.91	3.70	3.91	3.70
SK 43 F	3.70	3.50	6.02	5.70	5.28	5.00	6.45	6.10	4.33	4.10	4.33	4.10
SK51E F	1.90	1.80	3.70	3.50	4.33	4.10	3.17	3.00	4.02	3.80	4.02	3.80
SK52F	3.17	3.00	7.19	6.80	6.55	6.20	7.82	7.40	5.92	5.60	5.92	5.60
SK 53 F	5.49	5.20	8.88	8.40	7.40	7.00	9.40	8.90	7.08	6.70	7.08	6.70
SK 62 F	7.40	7.00	15.9	15.0	14.8	14.0	19.5	18.5	16.9	16.0	16.9	16.0
SK 63 F	14.3	13.5	14.8	14.0	16.4	15.5	19.0	18.0	14.8	14.0	14.8	14.0
SK 72 F	10.6	10.0	24.3	23.0	19.5	18.5	29.6	28.0	24.3	23.0	24.3	23.0
SK 73 F	23.2	22.0	23.8	22.5	24.3	23.0	29.1	27.5	21.1	20.0	21.1	20.0
SK 82 F	15.9	15.0	39.1	37.0	30.6	29.0	47.6	45.0	36.5	34.5	36.5	34.5
SK 83 F	32.8	31.0	35.9	34.0	37.0	35.0	42.3	40.0	35.9	34.0	35.9	34.0
SK 92 F	27.5	26.0	77.0	73.0	49.7	47.0	82.0	78.0	55.0	52.0	55.0	52.0
SK 93 F	56.0	53.0	74.0	70.0	62.0	59.0	78.0	74.0	52.0	49.0	52.0	49.0
SK 102 F	42.3	40.0	86.0	81.0	70.0	66.0	110	104	76.0	72.0	76.0	72.0
SK 103 F	73.0	69.0	82.0	78.0	82.0	78.0	105	99.0	71.0	67.0	71.0	67.0

CLINCHER OIL FILL QUANTITIES

CLINCHER™ lubrication

Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 0182NB	0.42	0.40	0.58	0.55	0.58	0.55	0.42	0.40	0.42	0.40	0.42	0.40
SK 0282NB	0.74	0.70	1.16	1.10	0.85	0.80	1.16	1.10	0.95	0.90	0.95	0.90
SK 1282	1.00	0.95	1.37	1.30	0.95	0.90	1.37	1.30	1.06	1.00	1.06	1.00
SK 1382NB	1.48	1.40	2.43	2.30	2.32	2.20	2.32	2.20	2.11	2.00	2.11	2.00
SK 1382	1.53	1.45	1.69	1.60	1.22	1.15	1.80	1.70	1.16	1.10	1.16	1.10
SK 2282	1.80	1.70	2.43	2.30	1.80	1.70	2.32	2.20	2.01	1.90	2.01	1.90
SK 2382	2.43	2.30	2.85	2.70	2.22	2.10	3.38	3.20	2.11	2.00	2.11	2.00
SK 3282	2.96	2.80	4.23	4.00	3.49	3.30	4.02	3.80	3.17	3.00	3.17	3.00
SK 3382	4.02	3.80	4.54	4.30	3.17	3.00	5.81	5.50	3.17	3.00	3.17	3.00
SK 4282	4.44	4.20	5.71	5.40	4.65	4.40	5.28	5.00	4.44	4.20	4.44	4.20
SK 4382	6.45	6.10	7.29	6.90	5.18	4.90	8.88	8.40	5.28	5.00	5.28	5.00
SK 5282	7.93	7.50	9.30	8.80	7.93	7.50	9.30	8.80	7.61	7.20	7.61	7.20
SK 5382	13.2	12.5	12.7	12.0	7.08	6.70	14.8	14.0	8.77	8.30	8.77	8.30
SK 6282	18.0	17.0	16.4	15.5	13.2	12.5	18.5	17.5	11.6	11.0	14.8	14.0
SK 6382	16.9	16.0	13.7	13.0	10.6	10.0	19.0	18.0	14.8	14.0	13.2	12.5
SK 7282	26.9	25.5	22.2	21.0	21.7	20.5	28.5	27.0	16.9	16.0	22.2	21.0
SK 7382	23.2	22.0	22.2	21.0	16.9	16.0	26.4	25.0	24.3	23.0	23.2	22.0
SK 8282	39.6	37.5	34.9	33.0	32.2	30.5	46.5	44.0	32.8	31.0	32.8	31.0
SK 8382	36.5	34.5	34.3	32.5	26.4	25.0	40.2	38.0	37.0	35.0	31.7	30.0
SK 9282	79.2	75.0	74.0	70.0	58.1	55.0	76.1 †	72.0 †	63.4	60.0	62.4	59.0
SK 9382	78.2	74.0	74.0	70.0	47.6	45.0	79.2 †	75.0 †	68.7	65.0	63.4	60.0
SK 10282	95.0	90.0	95.0	90.0	42.3	40.0	95.0 †	90.0 †	63.0	60.0	87.0	82.0
SK 10382	90.0	85.0	95.0	90.0	77.0	73.0	106 †	100 †	85	80.0	85.0	80.0
SK10382.1	80.3	76.0	84.5	80.0	75.0	71.0	98.2	93.0	76.1	72.0	70.8	67.0
SK 11282*	174	165	169	160	153	145	206 †	195 †	106	100	148	140
SK 11382*	169	160	164	155	148	140	222 †	210 †	164	155	143	135
SK11382.1*	134.2	127	140.5	133	124.7	118	205	194	131	124	118.4	112
SK 12382*	169	160	164	155	148	140	**222 †**	**210 †**	164	155	143	135

*** For shipping purposes the larger Clincher™ gear units are supplied without oil.**

† Oil quantities shown are for the gearbox only. When the OT (oil tank) option is used, the oil must be filled to the level shown on the dipstick which is located inside of the oil tank. Even when the gear unit is filled by NORD, the user MUST add more oil untill the oil is filled to the proper level.

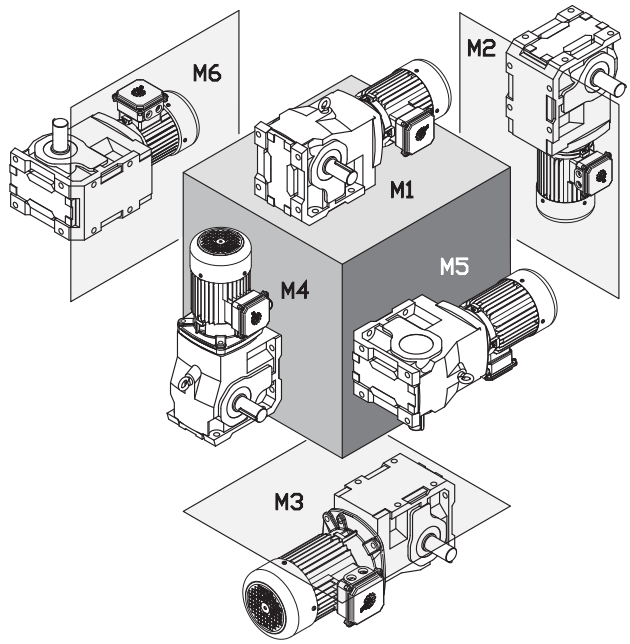
NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

90.1 HELICAL-BEVEL FOOTED OIL FILL QUANTITIES

90.1 Helical-bevel footed lubrication

Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 9012.1	0.74	0.70	1.80	1.70	2.01	1.90	2.22	2.10	1.16	1.10	1.59	1.50
SK 9013.1	1.43	1.35	2.22	2.10	2.27	2.15	2.91	2.75	1.06	1.00	1.90	1.80
SK 9016.1	0.74	0.70	1.80	1.70	2.01	1.90	2.22	2.10	1.16	1.10	1.59	1.50
SK 9017.1	1.37	1.30	2.11	2.00	2.22	2.10	2.85	2.70	1.06	1.00	1.80	1.70
SK 9022.1	1.37	1.30	3.06	2.90	3.49	3.30	4.02	3.80	1.80	1.70	2.96	2.80
SK 9023.1	2.32	2.20	3.38	3.20	3.80	3.60	4.97	4.70	2.32	2.20	3.06	2.90
SK 9032.1	1.90	1.80	5.71	5.40	6.45	6.10	7.19	6.80	3.17	3.00	4.86	4.60
SK 9033.1	3.28	3.10	6.02	5.70	6.66	6.30	8.45	8.00	3.59	3.40	5.07	4.80
SK 9042.1	2.85	2.70	9.51	9.00	10.6	10.0	11.3	10.7	5.49	5.20	8.14	7.70
SK 9043.1	5.28	5.00	10.7	10.1	11.6	11.0	14.1	13.3	6.02	5.70	8.56	8.10
SK 9052.1	6.87	6.50	16.9	16.0	20.1	19.0	22.7	21.5	11.6	11.0	16.4	15.5
SK 9053.1	10.6	10.0	18.0	17.0	21.1	20.0	25.9	24.5	12.2	11.5	17.4	16.5
SK 9062.1	10.6	10.0	29.1	27.5	33.8	32.0	38.0	36.0	19.0	18.0	25.4	24.0
SK 9072.1	10.6	10.0	29.1	27.5	33.8	32.0	38.0	36.0	19.0	18.0	25.4	24.0
SK 9082.1	18.0	17.0	54.0	52.0	66.0	63.0	76.0	72.0	34.9	33.0	49.1	46.5
SK 9086.1	30.6	29.0	77.0	73.0	90.0	85.0	108	102	51.0	48.0	66.0	62.0
SK 9092.1	43.3	41.0	166	157	180	170	182	172	85.0	80.0	95.0	90.0
SK 9096.1	74.0	70.0	198	187	205	194	268	254	115	109	161	152

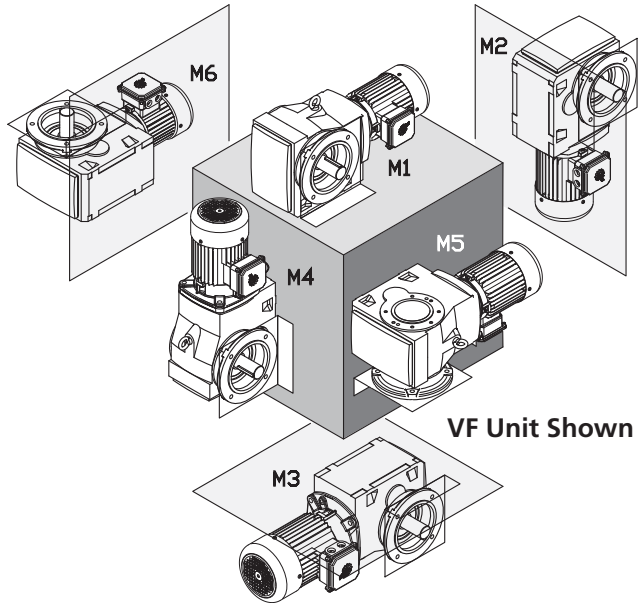
Oil Levels shown apply to base models and gear units ending in LX, AX, & VX.

90.1 HELICAL-BEVEL FLANGED OIL FILL QUANTITIES

90.1 Helical-bevel flanged lubrication

Unless otherwise noted below, the following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

> **IMPORTANT NOTE**
>
> Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.
>
> For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



VF Unit Shown

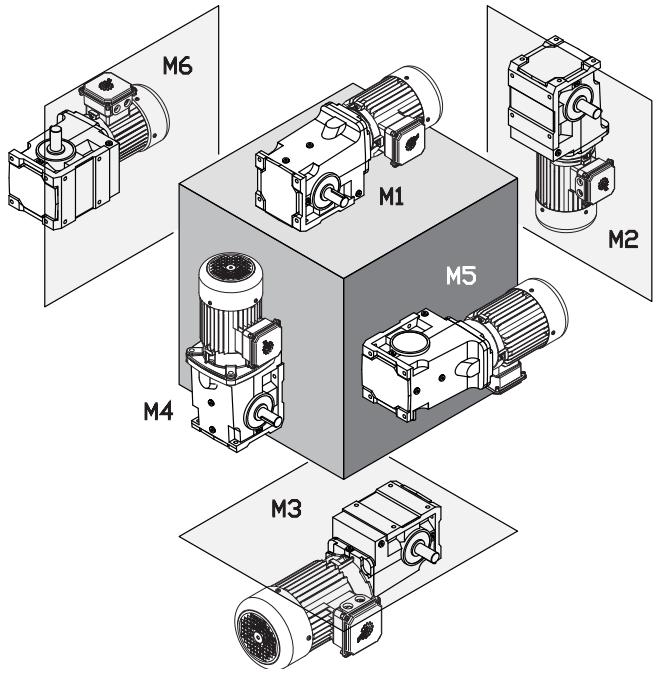
Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 9012.1	1.06	1.00	2.01	1.90	2.01	1.90	2.32	2.20	1.27	1.20	1.80	1.70
SK 9013.1	1.53	1.45	2.43	2.30	2.22	2.10	2.96	2.80	1.11	1.05	1.90	1.80
SK 9016.1	1.06	1.00	2.01	1.90	2.01	1.90	2.32	2.20	1.27	1.20	1.80	1.70
SK 9017.1	1.53	1.45	2.43	2.30	2.22	2.10	2.96	2.80	1.11	1.05	1.90	1.80
SK 9022.1	1.69	1.60	3.70	3.50	3.70	3.50	4.44	4.20	2.43	2.30	2.96	2.80
SK 9023.1	2.43	2.30	3.70	3.50	4.02	3.80	5.60	5.30	2.32	2.20	3.59	3.40
SK 9032.1	2.22	2.10	5.07	4.80	6.76	6.40	7.50	7.10	3.49	3.30	5.39	5.10
SK 9033.1	3.91	3.70	6.02	5.70	7.08	6.70	9.09	8.60	3.80	3.60	5.60	5.30
SK 9042.1	4.76	4.50	10.6	10.0	10.6	10.0	12.2	11.5	6.87	6.50	8.66	8.20
SK 9043.1	6.87	6.50	11.1	10.5	12.6	11.9	15.5	14.7	7.08	6.70	9.83	9.30
SK 9052.1	7.93	7.50	17.4	16.5	21.1	20.0	24.8	23.5	12.2	11.5	19.0	18.0
SK 9053.1	13.7	13.0	19.0	18.0	22.7	21.5	28.0	26.5	13.7	13.0	18.0	17.0
SK 9062.1	12.7	12.0	29.1	27.5	34.9	33.0	40.7	38.5	20.1	19.0	27.5	26.0
SK 9072.1	12.7	12.0	29.1	27.5	34.9	33.0	40.7	38.5	20.1	19.0	27.5	26.0
SK 9082.1	22.2	21.0	57.0	54.0	70.0	66.0	85.0	80.0	40.2	38.0	55.0	52.0
SK 9086.1	38.0	36.0	82.0	78.0	96.0	91.0	113	107	56.0	53.0	80.0	76.0
SK 9092.1	42.3	40.0	137	130	163	154	185	175	87.0	82.0	96.0	91.0
SK 9096.1	85.0	80.0	198	187	204	193	272	257	119	113	165	156

Oil Levels shown apply to base models and gear units ending in AZ, AF, VZ, & VF.

92 SERIES HELICAL-BEVEL FOOTED OIL FILL QUANTITIES

92 Helical-bevel footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 92072	0.42	0.40	0.63	0.60	0.53	0.50	0.58	0.55	0.42	0.40	0.42	0.40
SK 92172	0.63	0.60	0.95	0.90	1.06	1.00	1.16	1.10	1.16	1.10	0.85	0.80
SK 92372	0.95	0.90	1.69	1.60	1.59	1.50	2.01	1.90	1.59	1.50	0.95	0.90
SK 92672	1.90	1.80	3.70	3.50	3.80	3.60	3.59	3.40	2.75	2.60	2.75	2.60
SK 92772	2.43	2.30	4.76	4.50	4.86	4.60	5.60	5.30	4.33	4.10	4.33	4.10

Oil Levels shown apply to base models and gear units ending in LX, AX, & VX.

92.1/93.1 SERIES HELICAL-BEVEL OIL FILL QUANTITIES

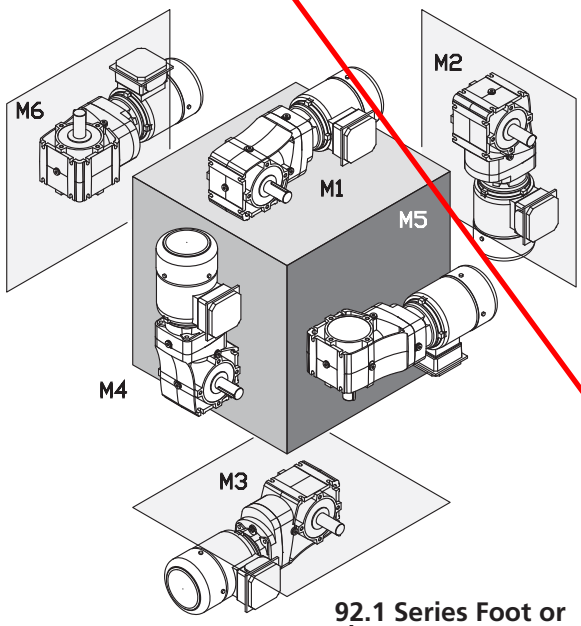
92.1/93.1 Helical-bevel mount lubrication

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size & mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

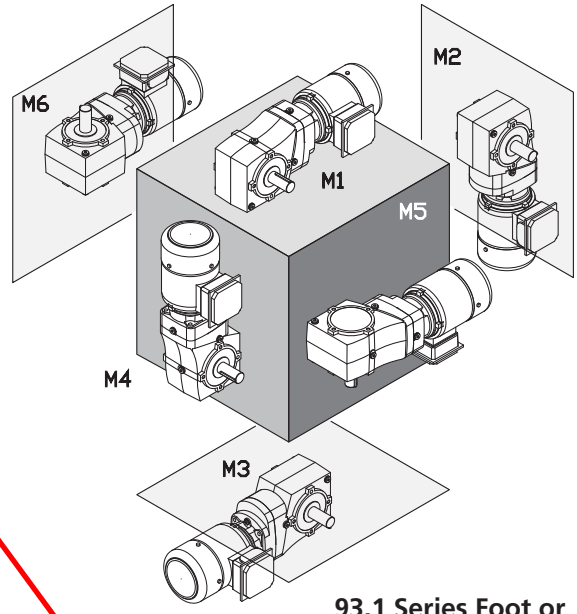
IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



92.1 Series Foot or Flange Mount



93.1 Series Foot or Flange Mount

92.1 Series Oil Fill

	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 92072.1	0.28	0.26	0.52	0.49	0.44	0.42	0.57	0.54	0.31	0.29	0.33	0.31
SK 92172.1	0.36	0.34	0.65	0.61	0.55	0.52	0.71	0.67	0.44	0.42	0.51	0.48
SK 92372.1	0.45	0.43	0.97	0.92	0.77	0.73	0.88	0.83	0.58	0.55	0.65	0.61
SK 92672.1	0.90	0.85	1.69	1.60	1.27	1.20	1.59	1.50	1.08	1.02	1.08	1.02
SK 92772.1	1.37	1.30	2.80	2.65	1.97	1.86	2.85	2.70	1.69	1.60	1.69	1.60

Oil levels shown apply to all foot & flange mounted units.

93.1 Series Oil Fill

	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 93072.1	0.41	0.39	0.98	0.93	0.83	0.79	1.08	1.02	0.52	0.49	0.66	0.62
SK 93172.1	0.63	0.60	1.24	1.17	0.99	0.94	1.29	1.22	0.69	0.65	0.90	0.85
SK 93372.1	1.06	1.00	2.08	1.97	1.74	1.65	2.26	2.14	1.18	1.12	1.42	1.34
SK 93672.1	1.90	1.80	3.41	3.23	2.86	2.71	4.02	3.80	2.13	2.02	2.59	2.45
SK 93772.1	2.87	2.72	4.89	4.63	3.91	3.70	6.13	5.80	3.10	2.93	3.43	3.25

Oil levels shown apply to all foot & flange mounted units.

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

92 SERIES HELICAL-BEVEL FLANGED OIL FILL QUANTITIES

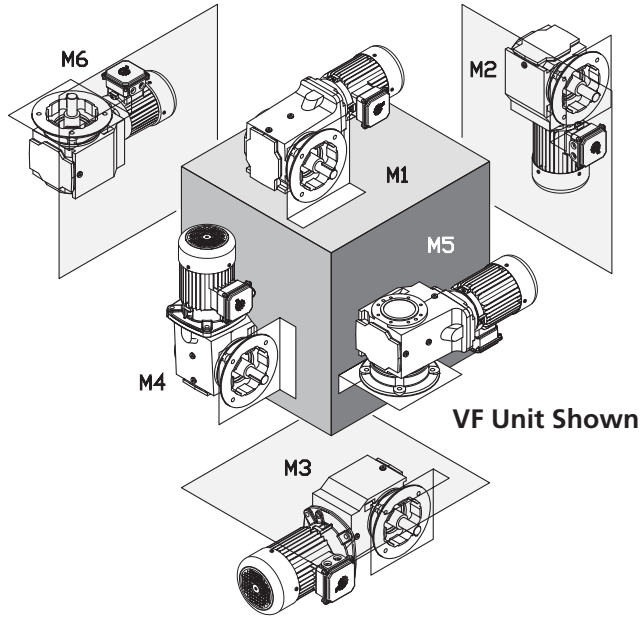
92 Helical-bevel flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



VF Unit Shown

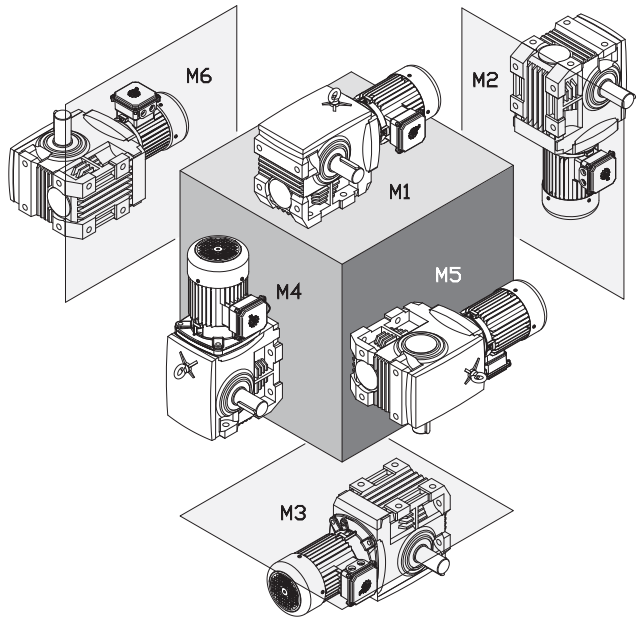
Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 92072	0.42	0.40	0.63	0.60	0.58	0.55	0.58	0.55	0.42	0.40	0.42	0.40
SK 92172	0.53	0.50	1.06	1.00	0.95	0.90	1.11	1.05	0.95	0.90	0.63	0.60
SK 92372	1.27	1.20	1.69	1.60	1.59	1.50	2.01	1.90	1.37	1.30	1.37	1.30
SK 92672	1.69	1.60	2.96	2.80	2.64	2.50	3.49	3.30	2.54	2.40	2.54	2.40
SK 92772	2.96	2.80	4.65	4.40	4.76	4.50	5.81	5.50	3.70	3.50	3.70	3.50

Oil Levels shown apply to gear units ending in AZ, AF, VZ, & VF.

HELICAL-WORM FOOTED OIL FILL QUANTITIES

Helical-worm footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

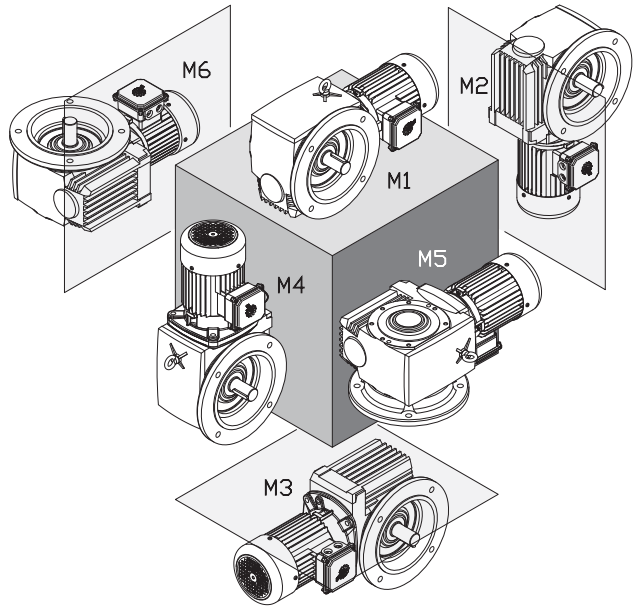
For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040	0.42	0.40	0.85	0.80	0.79	0.75	0.69	0.65	0.53	0.50	0.53	0.50
SK 02050	0.42	0.40	1.48	1.40	1.16	1.10	1.37	1.30	0.74	0.70	0.74	0.70
SK 13050	0.79	0.75	1.85	1.75	1.37	1.30	1.85	1.75	0.79	0.75	0.79	0.75
SK 12063	0.63	0.60	1.90	1.80	1.27	1.20	1.69	1.60	1.06	1.00	1.06	1.00
SK 13063	1.06	1.00	2.43	2.30	1.59	1.50	2.32	2.20	1.16	1.10	1.16	1.10
SK 12080	0.95	0.90	3.28	3.10	2.54	2.40	3.17	3.00	1.90	1.80	1.90	1.80
SK 13080	1.80	1.70	3.70	3.50	3.70	3.50	3.70	3.50	2.11	2.00	2.11	2.00
SK 32100	1.59	1.50	6.66	6.30	5.92	5.60	5.81	5.50	3.80	3.60	3.80	3.60
SK 33100	2.54	2.40	6.76	6.40	5.71	5.40	6.87	6.50	3.59	3.40	3.59	3.40
SK 42125	2.96	2.80	12.5	11.8	10.8	10.2	10.6	10.0	6.55	6.20	6.55	6.20
SK 43125	4.49	4.25	13.7	13.0	11.1	10.5	14.3	13.5	7.61	7.20	7.61	7.20

HELICAL-WORM SOLID SHAFT/FLANGED OIL FILL QUANTITIES

Helical-worm solid shaft/flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040 VF	0.53	0.50	0.85	0.80	0.79	0.75	0.63	0.60	0.53	0.50	0.53	0.50
SK 02050 VF	0.42	0.40	1.59	1.50	1.32	1.25	1.27	1.20	0.95	0.90	0.79	0.75
SK 13050 VF	0.79	0.75	1.90	1.80	1.59	1.50	1.80	1.70	1.11	1.05	0.95	0.90
SK 12063 VF	0.53	0.50	2.06	1.95	1.80	1.70	1.85	1.75	1.27	1.20	1.00	0.95
SK 13063 VF	1.06	1.00	2.43	2.30	2.01	1.90	2.32	2.20	1.43	1.35	1.16	1.10
SK 12080 VF	0.95	0.90	3.91	3.70	3.38	3.20	3.59	3.40	2.64	2.50	2.43	2.30
SK 13080 VF	1.69	1.60	4.02	3.80	3.70	3.50	4.12	3.90	2.85	2.70	2.64	2.50
SK 32100 VF	1.48	1.40	6.66	6.30	6.45	6.10	6.45	6.10	4.23	4.00	3.80	3.60
SK 33100 VF	2.80	2.65	7.61	7.20	6.76	6.40	8.03	7.60	4.54	4.30	4.02	3.80
SK 42125 VF	3.17	3.00	12.2	11.5	12.2	11.5	11.6	11.0	8.88	8.40	7.71	7.30
SK 43125 VF	4.97	4.70	15.9	15.0	13.7	13.0	16.9	16.0	9.51	9.00	8.14	7.70

HELICAL-WORM HOLLOW SHAFT OIL FILL QUANTITIES

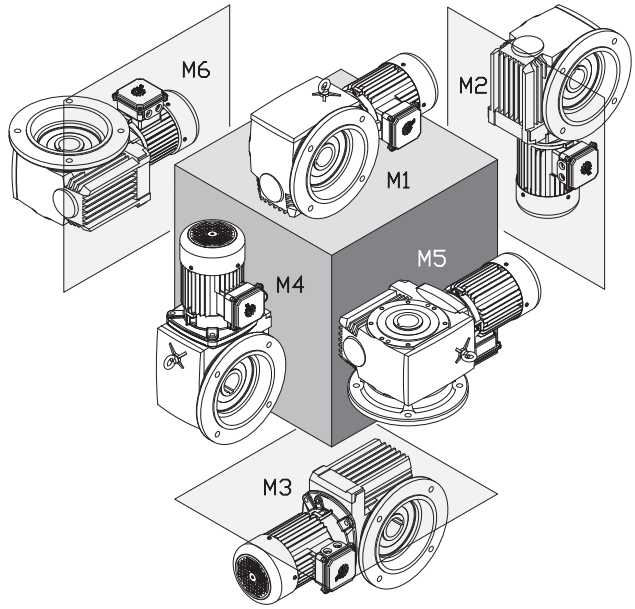
Helical-worm hollow shaft lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fi ll level in accordance to the specifi ed reducer size and mounting position. For additional information, please refer to the “Oil Plug & Vent Locations” documentation for your gear unit.

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fi ll level using the reducer’s oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



AF Unit Shown

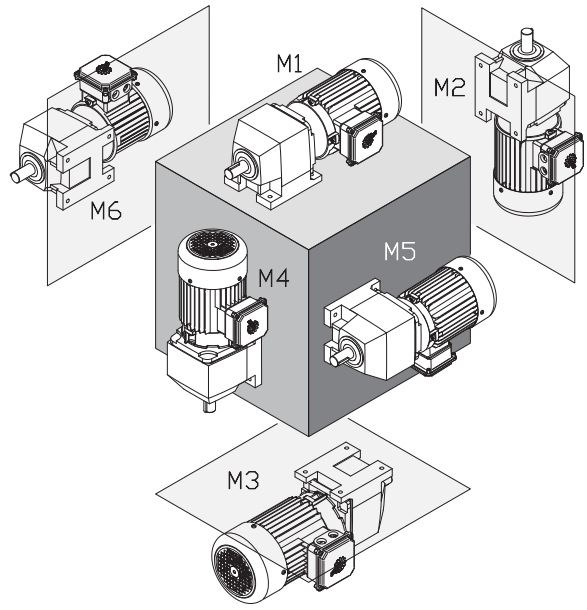
Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 02040	0.42	0.40	0.74	0.70	0.69	0.65	0.69	0.65	0.58	0.55	0.58	0.55
SK 02050	0.48	0.45	1.48	1.40	1.22	1.15	1.16	1.10	0.79	0.75	0.79	0.75
SK 13050	0.95	0.90	1.90	1.80	1.37	1.30	1.74	1.65	1.37	1.30	1.37	1.30
SK 12063	0.58	0.55	1.53	1.45	1.69	1.60	1.69	1.60	1.16	1.10	1.16	1.10
SK 13063	1.11	1.05	2.22	2.10	1.90	1.80	2.22	2.10	1.48	1.40	1.48	1.40
SK 12080	0.85	0.80	3.28	3.10	3.38	3.20	2.96	2.80	1.90	1.80	1.90	1.80
SK 13080	1.69	1.60	3.80	3.60	3.06	2.90	3.96	3.75	2.11	2.00	2.11	2.00
SK 32100	1.59	1.50	5.92	5.60	5.92	5.60	5.60	5.30	4.23	4.00	4.23	4.00
SK 33100	2.75	2.60	6.34	6.00	6.13	5.80	6.34	6.00	3.70	3.50	3.70	3.50
SK 42125	3.17	3.00	13.2	12.5	11.4	10.8	11.4	10.8	6.87	6.50	6.87	6.50
SK 43125	4.86	4.60	14.4	13.6	12.0	11.4	15.1	14.3	8.03	7.60	8.03	7.60

Oil Levels shown apply to gear units ending in AZ, AF.

NORDBLOC® FOOTED OIL FILL QUANTITIES

NORDBLOC® footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 172	0.37	0.35	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50
SK 272	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 273	0.66	0.62	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 372	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 373	0.58	0.55	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 472	1.06	1.00	2.01	1.90	2.01	1.90	2.11	2.00	1.90	1.80	1.90	1.80
SK 473	1.37	1.30	2.64	2.50	2.22	2.10	2.54	2.40	2.22	2.10	2.22	2.10
SK 572	1.06	1.00	2.01	1.90	2.01	1.90	2.11	2.00	1.90	1.80	1.90	1.80
SK 573	1.37	1.30	2.64	2.50	2.22	2.10	2.54	2.40	2.22	2.10	2.22	2.10
SK 672	1.48	1.40	3.59	3.40	3.28	3.10	3.33	3.15	1.53	1.45	3.33	3.15
SK 673	1.90	1.80	4.02	3.80	3.38	3.20	3.59	3.40	3.06	2.90	3.17	3.00
SK 772	2.11	2.00	3.49	3.30	3.70	3.50	4.44	4.20	2.85	2.70	3.49	3.30
SK 773	2.64	2.50	4.76	4.50	3.91	3.70	4.86	4.60	3.49	3.30	3.49	3.30
SK 872	3.91	3.70	10.1	9.60	9.62	9.10	7.71	7.30	4.97	4.70	8.45	8.00
SK 873	6.55	6.20	8.88	8.40	7.93	7.50	9.62	9.10	7.93	7.50	7.93	7.50
SK 972	6.87	6.50	16.9	16.0	16.6	15.7	15.5	14.7	8.98	8.50	14.8	14.0
SK 973	11.6	11.0	16.7	15.8	13.7	13.0	16.9	16.0	14.1	13.3	13.7	13.0

NORDBLOC® FLANGED OIL FILL QUANTITIES

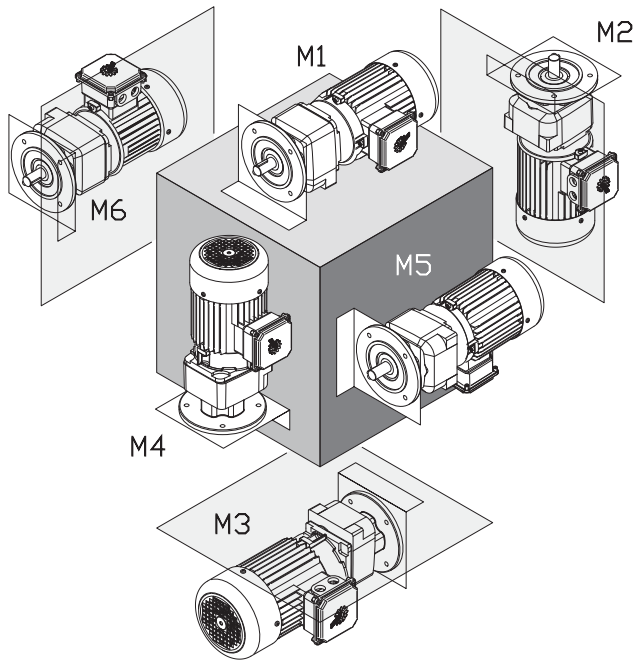
NORDBLOC® flanged lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil fill level using the reducer's oil level plug and drain or add addition oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

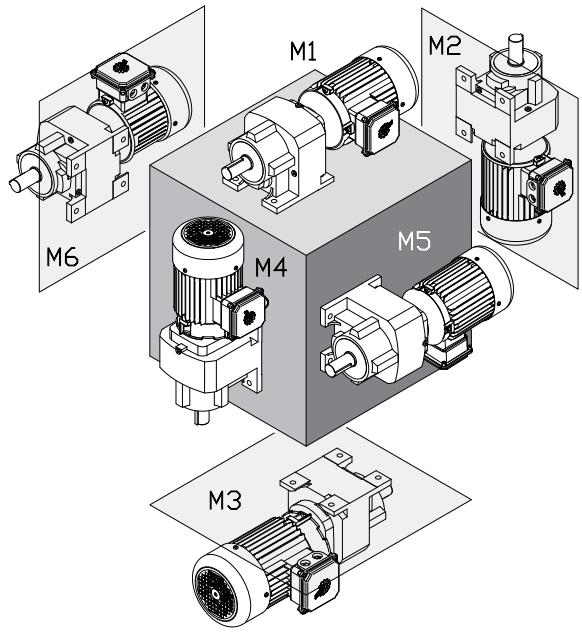


Mounting Position	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 172 F	0.37	0.35	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.53	0.50
SK 272 F	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 273 F	0.66	0.62	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 372 F	0.63	0.60	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00	1.06	1.00
SK 373 F	0.58	0.55	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10	1.16	1.10
SK 472 F	1.06	1.00	2.01	1.90	2.01	1.90	2.01	1.90	2.01	1.90	1.59	1.50
SK 473 F	1.32	1.25	2.54	2.40	2.22	2.10	2.64	2.50	2.22	2.10	2.22	2.10
SK 572 F	1.06	1.00	2.01	1.90	2.01	1.90	2.01	1.90	2.01	1.90	1.59	1.50
SK 573 F	1.32	1.25	2.54	2.40	2.22	2.10	2.64	2.50	2.22	2.10	2.22	2.10
SK 672 F	1.22	1.15	3.59	3.40	2.85	2.70	2.96	2.80	1.32	1.25	2.85	2.70
SK 673 F	1.80	1.70	4.02	3.80	3.17	3.00	3.38	3.20	3.17	3.00	3.17	3.00
SK 772 F	1.69	1.60	3.49	3.30	3.70	3.50	3.49	3.30	3.28	3.10	3.28	3.10
SK 773 F	2.43	2.30	5.28	5.00	3.80	3.60	4.76	4.50	4.12	3.90	4.12	3.90
SK 872 F	3.70	3.50	9.51	9.00	8.35	7.90	8.14	7.70	4.12	3.90	7.61	7.20
SK 873 F	5.28	5.00	9.30	8.80	8.03	7.60	8.45	8.00	8.45	8.00	8.45	8.00
SK 972 F	6.87	6.50	15.9	15.0	13.7	13.0	14.3	13.5	6.87	6.50	12.7	12.0
SK 973 F	10.9	10.3	17.4	16.5	13.7	13.0	16.9	16.0	14.8	14.0	14.8	14.0

NORDBLOC®.1 FOOTED OIL FILL QUANTITIES

NORDBLOC®.1 Fill Quantities (Footed)

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For oil plug & vent locations please see U14700.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil fill level using the reducer's oil level plug and drain or add addition oil as needed. The correct oil level should be located at the lower edge of the oil level hole.

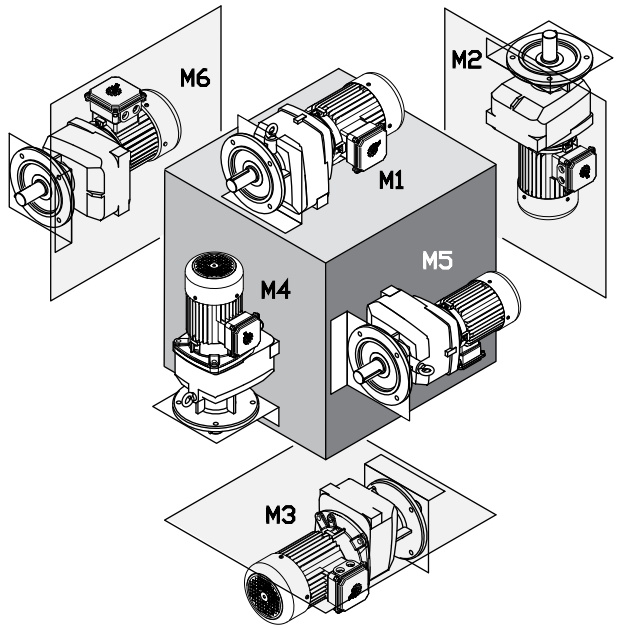
For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 071.1	0.19	0.18	0.42	0.40	0.40	0.38	0.42	0.40	0.32	0.30	0.32	0.30
SK 072.1	0.17	0.16	0.34	0.32	0.22	0.21	0.24	0.23	0.19	0.18	0.21	0.20
SK 171.1	0.23	0.22	0.42	0.40	0.38	0.36	0.42	0.40	0.35	0.33	0.35	0.33
SK 172.1	0.29	0.27	0.62	0.59	0.44	0.42	0.48	0.45	0.34	0.32	0.41	0.39
SK 371.1	0.37	0.35	0.61	0.58	0.58	0.55	0.61	0.58	0.52	0.49	0.52	0.49
SK 372.1	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 373.1	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 571.1	0.51	0.48	0.91	0.86	0.85	0.80	0.97	0.92	0.72	0.68	0.72	0.68
SK 572.1	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 573.1	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 672.1	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 673.1	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 771.1	0.95	0.90	1.60	1.50	1.30	1.20	1.80	1.70	1.20	1.16	1.20	1.16
SK 772.1	1.40	1.30	4.00	3.80	2.50	2.40	3.40	3.20	1.70	1.60	2.60	2.50
SK 772.1 VL	2.10	2.00	4.00	3.80	2.50	2.40	3.40	3.20	1.70	1.60	2.60	2.50
SK 773.1	2.40	2.30	4.00	3.80	3.50	3.30	3.40	3.20	2.50	2.40	3.30	3.10
SK 773.1 VL	2.40	2.30	4.00	3.80	3.50	3.30	3.40	3.20	2.50	2.40	3.30	3.10
SK 872.1	3.10	2.90	8.20	7.80	4.90	4.60	6.80	6.40	2.60	2.50	4.20	4.00
SK 872.1 VL	5.30	5.00	8.20	7.80	4.90	4.60	6.80	6.40	2.60	2.50	4.20	4.00
SK 873.1	4.40	4.20	8.20	7.80	6.20	5.90	6.80	6.40	4.30	4.10	6.20	5.90
SK 873.1 VL	4.40	4.20	8.20	7.80	6.20	5.90	6.80	6.40	4.30	4.10	6.20	5.90
SK 972.1	4.80	4.50	13.00	12.00	7.90	7.50	12.00	11.50	4.40	4.20	7.90	7.50
SK 972.1 VL	9.00	8.50	13.00	12.00	7.90	7.50	12.00	11.50	4.40	4.20	7.90	7.50
SK 973.1	7.90	7.50	13.00	12.00	11.00	10.50	12.00	11.50	7.90	7.50	11.00	10.50
SK 973.1 VL	7.90	7.50	13.00	12.00	11.00	10.50	12.00	11.50	7.90	7.50	11.00	10.50

NORDBLOC®.1 FLANGED OIL FILL QUANTITIES

NORDBLOC®.1 Fill Quantities (Flanged)

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.



IMPORTANT NOTE

Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add addition oil as needed. The correct oil level should be located at the lower edge of the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK 071.1 F	0.19	0.18	0.42	0.40	0.40	0.38	0.42	0.40	0.32	0.30	0.32	0.30
SK 072.1 F	0.17	0.16	0.34	0.32	0.22	0.21	0.24	0.23	0.19	0.18	0.21	0.20
SK 171.1 F	0.23	0.22	0.42	0.40	0.38	0.36	0.42	0.40	0.35	0.33	0.35	0.33
SK 172.1 F	0.29	0.27	0.62	0.59	0.44	0.42	0.48	0.45	0.34	0.32	0.41	0.39
SK 371.1 F	0.37	0.35	0.61	0.58	0.58	0.55	0.61	0.58	0.52	0.49	0.52	0.49
SK 372.1 F	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 373.1 F	0.48	0.45	1.10	1.05	0.79	0.75	1.10	1.00	0.63	0.60	0.69	0.65
SK 571.1 F	0.51	0.48	0.91	0.86	0.85	0.80	0.97	0.92	0.72	0.68	0.72	0.68
SK 572.1 F	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 573.1 F	0.79	0.75	2.00	1.90	1.60	1.50	2.10	2.00	1.20	1.10	1.20	1.15
SK 672.1 F	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 673.1 F	1.20	1.10	2.70	2.60	2.30	2.15	2.90	2.70	1.60	1.55	1.70	1.65
SK 771.1 F	0.95	0.90	1.60	1.50	1.30	1.20	1.80	1.70	1.20	1.16	1.20	1.16
SK 772.1 F	1.40	1.30	4.00	3.80	2.50	2.40	3.50	3.30	1.80	1.70	2.50	2.40
SK 772.1 VL F	2.10	2.00	4.00	3.80	2.50	2.40	3.50	3.30	1.80	1.70	2.50	2.40
SK 773.1 F	2.10	2.00	3.70	3.50	3.40	3.20	3.10	2.90	2.40	2.30	3.20	3.00
SK 773.1 VL F	2.10	2.00	3.70	3.50	3.40	3.20	3.10	2.90	2.40	2.30	3.20	3.00
SK 872.1 F	3.40	3.20	7.90	7.50	5.40	5.10	7.10	6.70	2.70	2.60	4.50	4.30
SK 872.1 VL F	5.30	5.00	7.90	7.50	5.40	5.10	7.10	6.70	2.70	2.60	4.50	4.30
SK 873.1 F	4.30	4.10	8.00	7.60	7.30	6.90	7.00	6.60	5.30	5.00	7.00	6.60
SK 873.1 VL F	4.30	4.10	8.00	7.60	7.30	6.90	7.00	6.60	5.30	5.00	7.00	6.60
SK 972.1 F	4.80	4.50	13.00	12.50	8.50	8.00	13.00	12.50	4.80	4.50	8.10	7.70
SK 972.1 VL F	9.00	8.50	13.00	12.50	8.50	8.00	13.00	12.50	4.80	4.50	8.10	7.70
SK 973.1 F	7.80	7.40	13.00	12.20	12.00	11.10	12.00	11.60	8.50	8.00	12.00	10.90
SK 973.1 VL F	7.80	7.40	13.00	12.20	12.00	11.10	12.00	11.60	8.50	8.00	12.00	10.90

MINICASE® (SM SERIES) WORM GEAR OIL FILL QUANTITIES - FOOT HOUSING

MINICASE® (SM Series) Lubrication

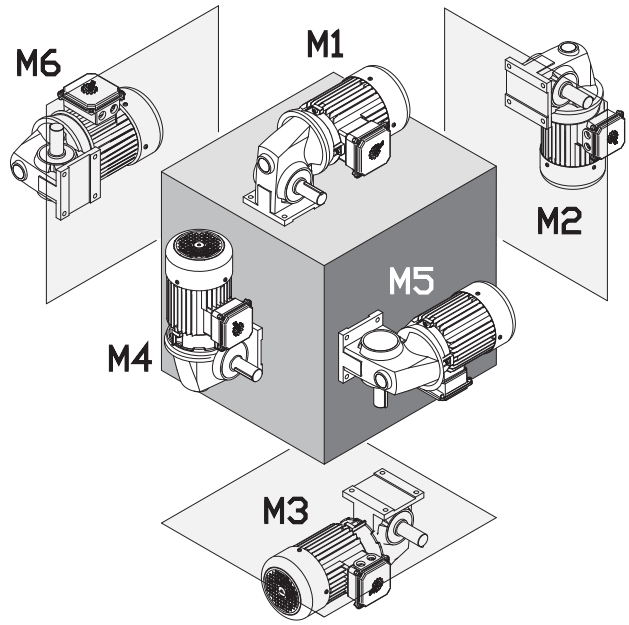
NORD MINICASE® (SM Series) worm gear reducers and worm gearmotors are inherently maintence free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. These gear units are also supplied without oil service plugs or vents.

Related User Manuals

U10790 MINICASE® (SM Series) Worm – Lubrication Guidelines.
U11040 MINICASE® (SM Series) Worm – Lubrication Types.

IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SM31	4.1	120	4.1	120	4.1	120	4.1	120	4.1	120	4.1	120
SK 1SM40	7.4	220	7.4	220	7.4	220	7.4	220	7.4	220	7.4	220
SK 2SM40	11.2	330	11.2	330	11.2	330	12.2	360	11.2	330	11.2	330
SK 1SM50	8.5	250	8.5	250	8.5	250	8.5	250	8.5	250	8.5	250
SK 2SM50	11.8	350	11.8	350	11.8	350	14.2	420	11.8	350	11.8	350
SK 1SM63	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420
SK 2SM63	17.9	530	17.9	530	17.9	530	21.3	630	17.9	530	17.9	530

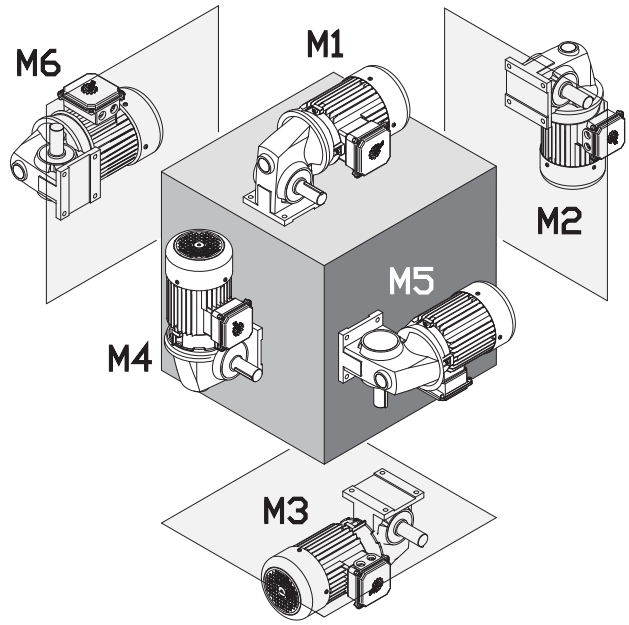
Oil levels shown apply to any foot-mount gear housings including those ending with no suffix or ending with LX or AX.

MINICASE® (SMI/SMID) WORM GEAR OIL FILL QUANTITIES - FOOT HOUSING

MINICASE® (SMI/SMID Series) Lubrication

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are inherently maintence free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see user manual U11050.

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are equipped with oil plugs. Venting the gear unit is optional as discussed in user manual U14750.



Related User Manuals

U10800 - MINICASE® (SMI/SMID Series) Worm – Lubrication Guidelines.
U11050 - MINICASE® (SMI/SMID Series) Worm – Lubrication Types
U14750 - MINICASE® (SMI/SMID Series) Worm – Oil Plug Locations

IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

MINICASE® (SMI Series) Gear Reducer Oil Fill - Foot Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMI31	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45
SK 1SMI40	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80
SK 1SMI50	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SMI63	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 1SMI75	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420

Oil fill level is universal and independent of mounting position
Oil levels shown apply to any foot-mount gear housings including those ending with no-suffix or LX or AX.

MINICASE® (SMID Series) Integral Gearmotor Oil Fill - Foot Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMID31	2.0	60	3.6	105	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SMID40	3.4	100	5.6	165	4.1	120	3.0	90	4.1	120	4.1	120
SK 1SMID50	5.9	175	8.8	260	6.6	195	5.4	160	6.6	195	6.6	195
SK 1SMID63	9.6	285	14.4	425	11.0	325	9.1	270	11.0	325	11.0	325

Oil levels shown apply to any foot-mount gear housings including those ending with no-suffix or LX or AX.

MINICASE® (SM SERIES) WORM GEAR OIL FILL QUANTITIES - FLANGE HOUSING

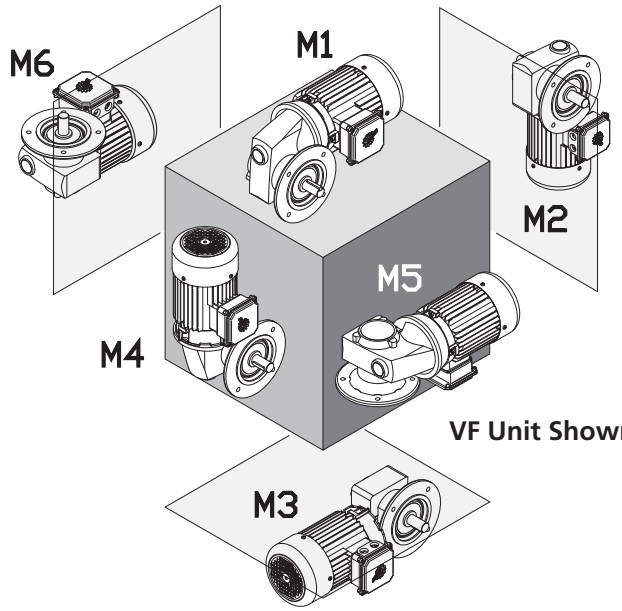
MINICASE® (SM Series) Lubrication

NORD MINICASE® (SM Series) worm gear reducers and worm gearmotors are inherently maintence free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. These gear units are also supplied without oil service plugs or vents.

Related User Manuals

U10790 MINICASE® (SM Series) Worm – Lubrication Guidelines.
U11040 MINICASE® (SM Series) Worm – Lubrication Types.

> *IMPORTANT NOTE*
>
> For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



VF Unit Shown

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SM31	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SM40	8.1	240	8.1	240	8.1	240	8.1	240	8.1	240	8.1	240
SK 2SM40	11.5	340	11.5	340	11.5	340	12.8	380	11.5	340	11.5	340
SK 1SM50	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 2SM50	12.5	370	12.5	370	12.5	370	15.2	450	12.5	370	12.5	370
SK 1SM63	15.2	450	15.2	450	15.2	450	15.2	450	15.2	450	15.2	450
SK 2SM63	20.3	600	20.3	600	20.3	600	24.7	730	20.3	600	20.3	600

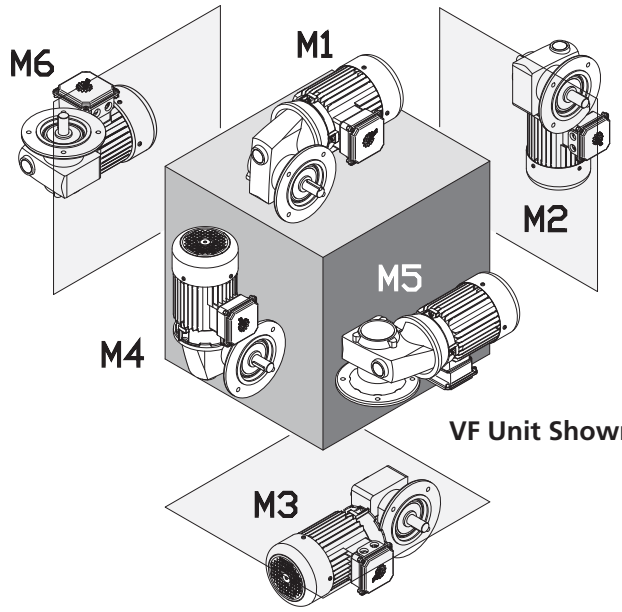
Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

MINICASE® (SMI/SMID) WORM GEAR OIL FILL QUANTITIES - FLANGE HOUSING

MINICASE® (SMI/SMID Series) Lubrication

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are inherently maintence free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see user manual U11050.

NORD MINICASE® (SMI/SMID Series) worm gear reducers and worm gearmotors are equipped with oil plugs. Venting the gear unit is optional as discussed in user manual U14750.



VF Unit Shown

Related User Manuals

U10800 - MINICASE® (SMI/SMID Series) Worm – Lubrication Guidelines.
U11050 - MINICASE® (SMI/SMID Series) Worm – Lubrication Types
U14750 - MINICASE® (SMI/SMID Series) Worm – Oil Plug Locations

IMPORTANT NOTE

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.

MINICASE® (SMI Series) Gear Reducer Oil Fill - Flange Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMI31	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45	1.5	45
SK 1SMI40	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80	2.7	80
SK 1SMI50	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130	4.4	130
SK 1SMI63	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270	9.1	270
SK 1SMI75	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420	14.2	420

Oil Fill is universal and independent of mounting position.
Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

MINICASE® (SMID Series) Integral Gearmotor Oil Fill - Flange Housing

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SMID31	2.0	60	3.6	105	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SMID40	3.4	100	5.6	165	4.1	120	3.0	90	4.1	120	4.1	120
SK 1SMID50	5.9	175	8.8	260	6.6	195	5.4	160	6.6	195	6.6	195
SK 1SMID63	9.6	285	14.4	425	11.0	325	9.1	270	11.0	325	11.0	325

Oil Levels shown apply to flange-mount gear housings with model type ending in AZ, AF, VZ or VF.

FLEXBLOC™ (SI/SID SERIES) WORM GEAR OIL FILL QUANTITIES

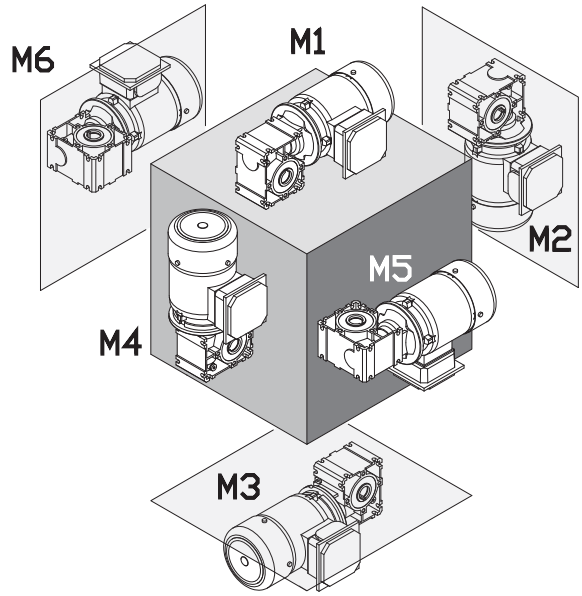
FLEXBLOC™ (SI/SID Series) Lubrication

NORD FLEXBLOC™ worm gear reducers are inherently maintence free, factory oil filled, and supplied with a high quality, long life synthetic gear oil intended to be suitable for the life of the product. For lubrication types see User Manual U11060.

NORD FLEXBLOC™ worm gear reducers are equipped with oil plugs. Venting the gear unit is optional as discussed in User Manual U14800.

Related User Manuals

U10810 FLEXBLOC™ (SI/SID Series) Worm – Lubrication Guidelines
U11060 FLEXBLOC™ Worm (SI/SID Series) – Lubrication Types
U14800 FLEXBLOC™ Worm (SI/SID Series) – Oil Plug Locations



FLEXBLOC™ (SI Series) Gear Reducer Oil Fill

Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SI31	1.0	30	1.0	30	1.0	30	1.0	30	1.0	30	1.0	30
SK 1SI40	1.9	55	1.9	55	1.9	55	1.9	55	1.9	55	1.9	55
SK 1SI50	3.2	95	3.2	95	3.2	95	3.2	95	3.2	95	3.2	95
SK 1SI63	6.1	180	6.1	180	6.1	180	6.1	180	6.1	180	6.1	180
SK 1SI75	12.2	360	12.2	360	12.2	360	12.2	360	12.2	360	12.2	360

Oil Fill is universal and independent of mounting position.

FLEXBLOC™ (SID Series) Gear Reducer Oil Fill

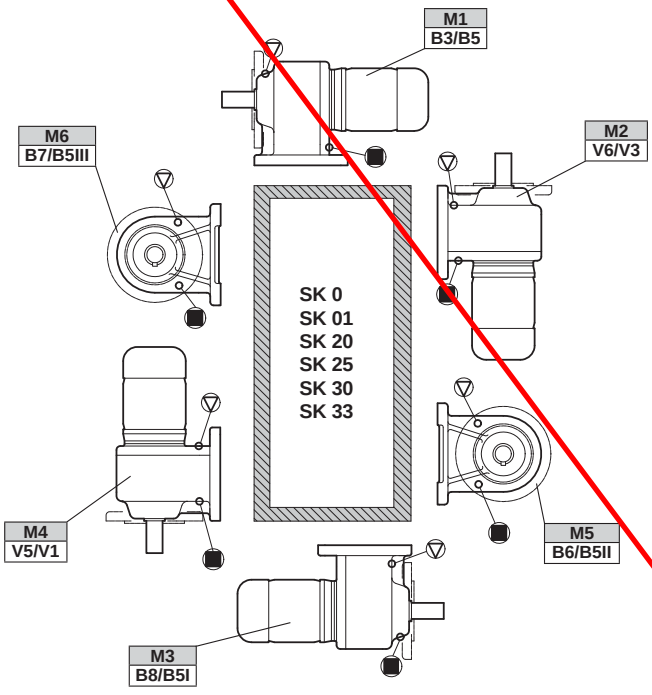
Type	M1		M2		M3		M4		M5		M6	
	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml	oz	ml
SK 1SID31	1.7	50	3.0	90	2.4	70	1.7	50	2.4	70	2.4	70
SK 1SID40	3.0	90	5.1	150	3.7	110	2.7	80	4.1	120	4.1	120
SK 1SID50	5.7	170	6.8	200	5.7	170	5.1	150	6.1	180	6.1	180
SK 1SID63	9.8	280	12.2	360	9.8	290	8.1	240	10.5	310	10.5	310

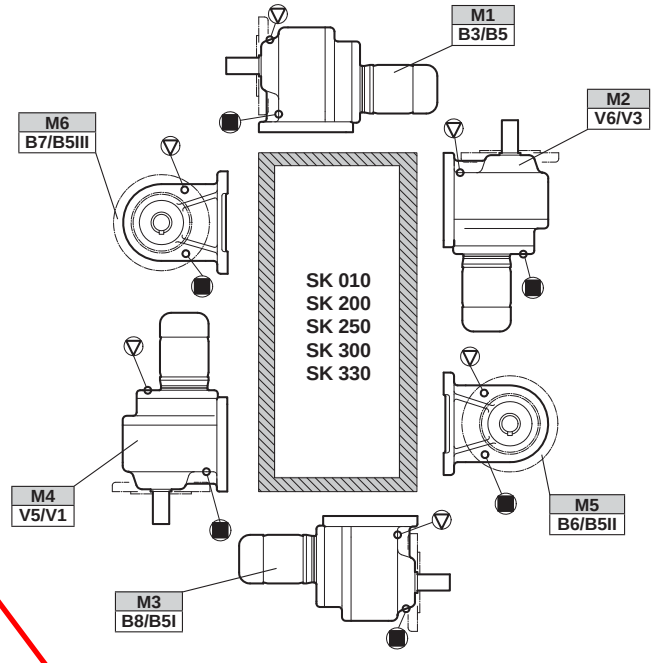
Integral gear motors only available upon special request.

STANDARD IN-LINE OIL PLUG & VENT LOCATIONS

Oil plug connections

All reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***





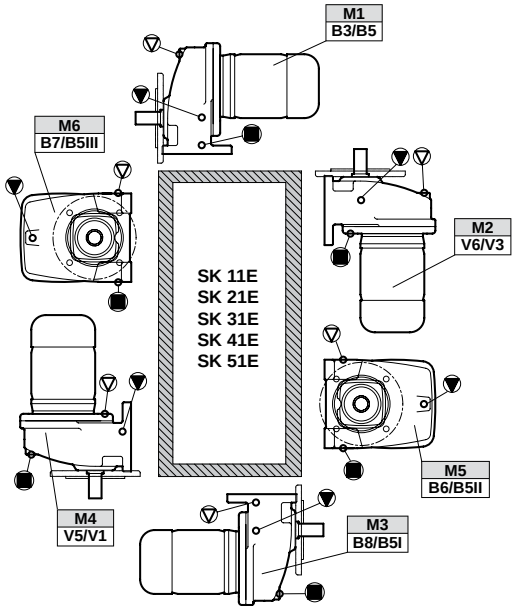
▽ = Vent

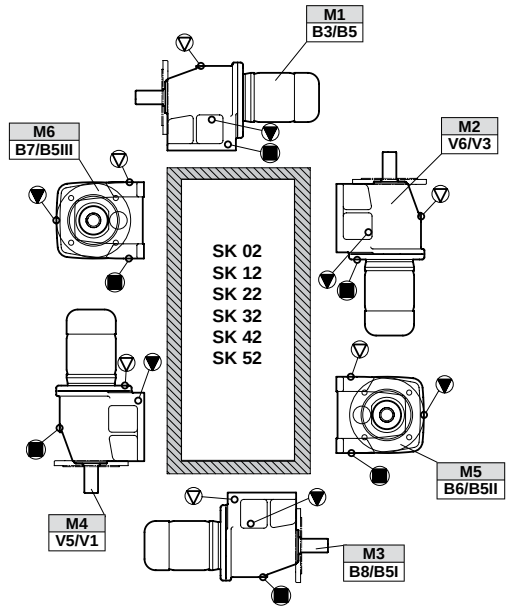
■ = Oil Plug

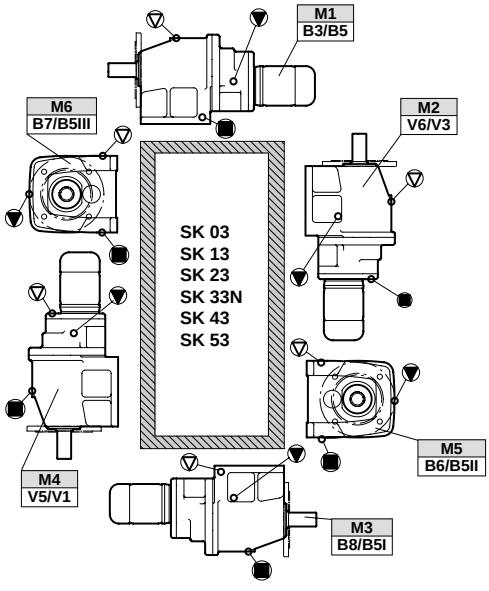
HELICAL IN-LINE
OIL PLUG & VENT LOCATIONS

Oil plug connections

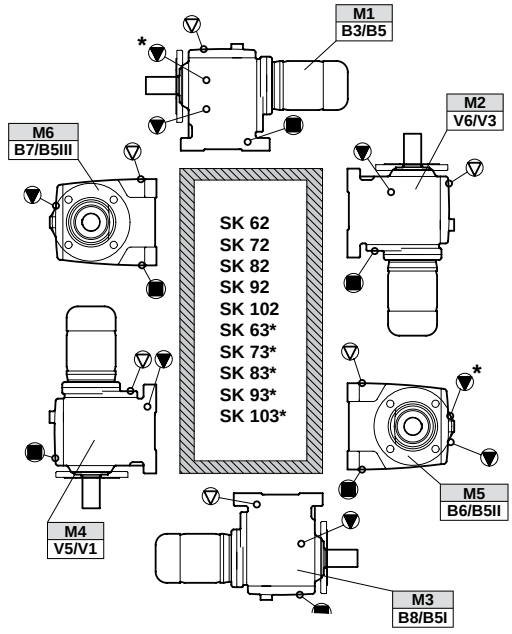
Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***







▽ = Vent
▼ = Oil Level
■ = Oil Plug

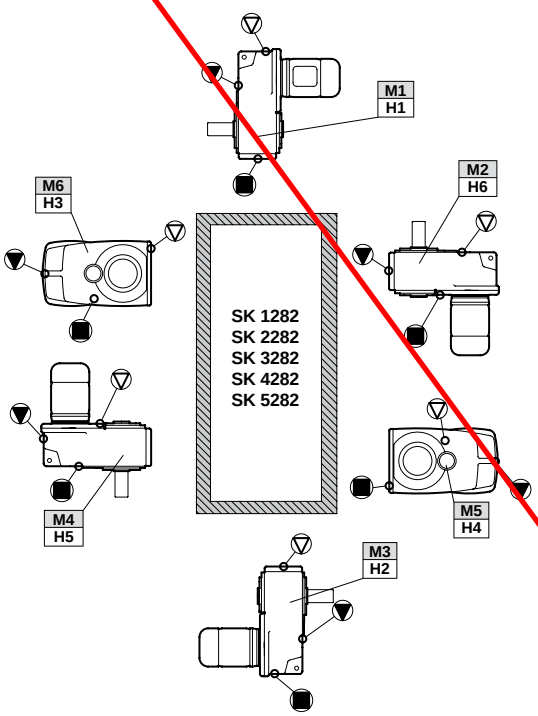


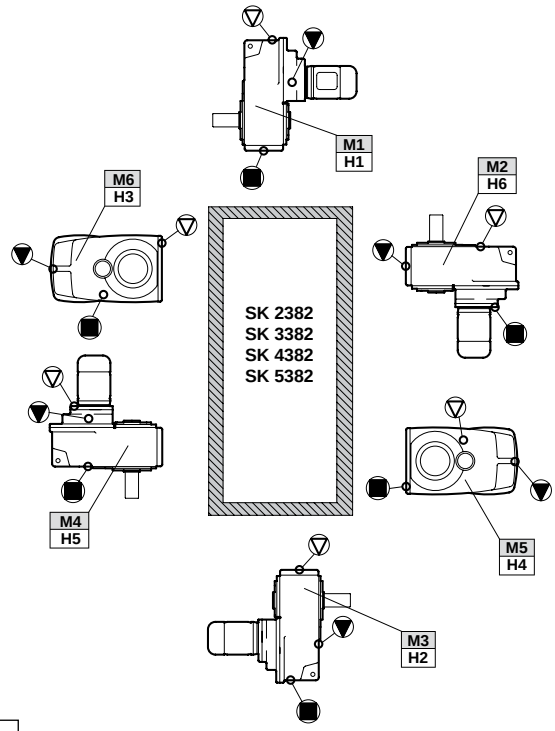
*** Oil level for 3 stage gear units.**

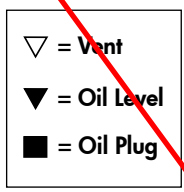
CLINCHER
OIL PLUG & VENT LOCATIONS

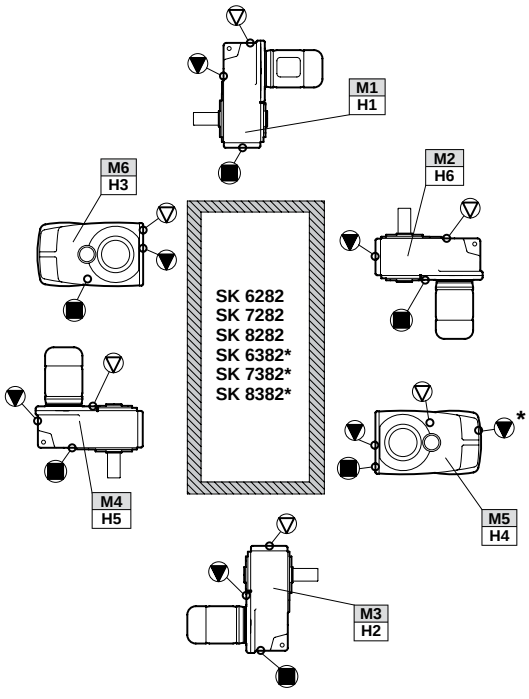
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

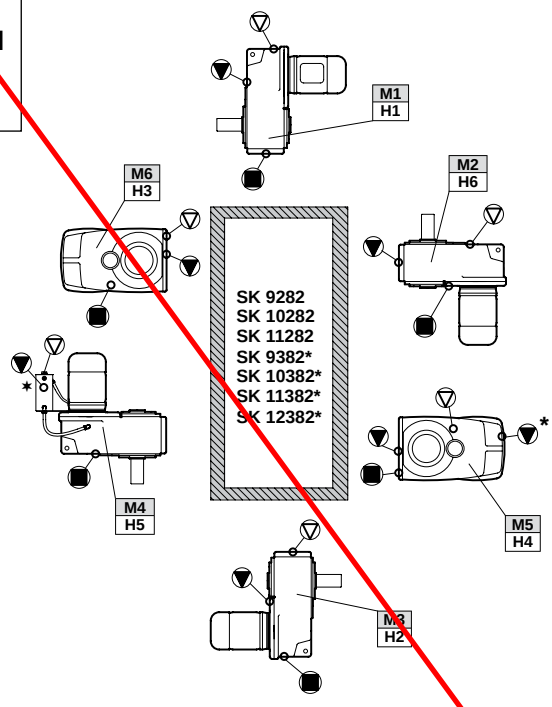








* Oil level for 3 stage gear units

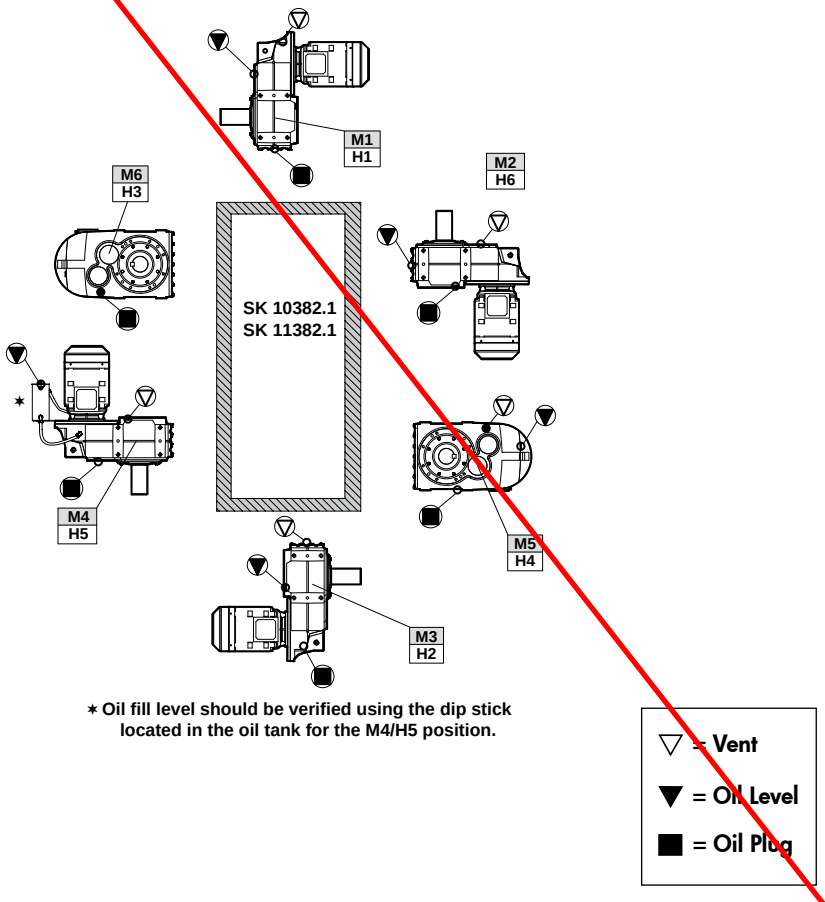


* Oil level for 3 stage gear units

∗ Oil fill level should be verified using the dip stick located in the oil tank for the M4/H5 position.

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

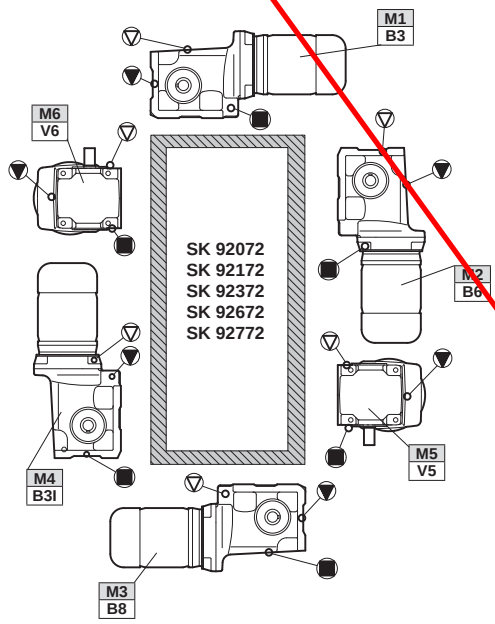


92 SERIES HELICAL-BEVEL OIL PLUG & VENT LOCATIONS

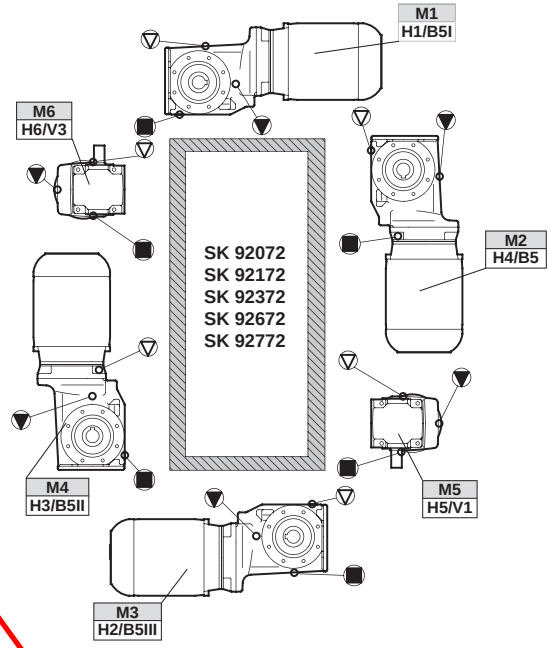
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

Foot Mount



Shaft/Flange Mount



▽ = Vent

▼ = Oil Level

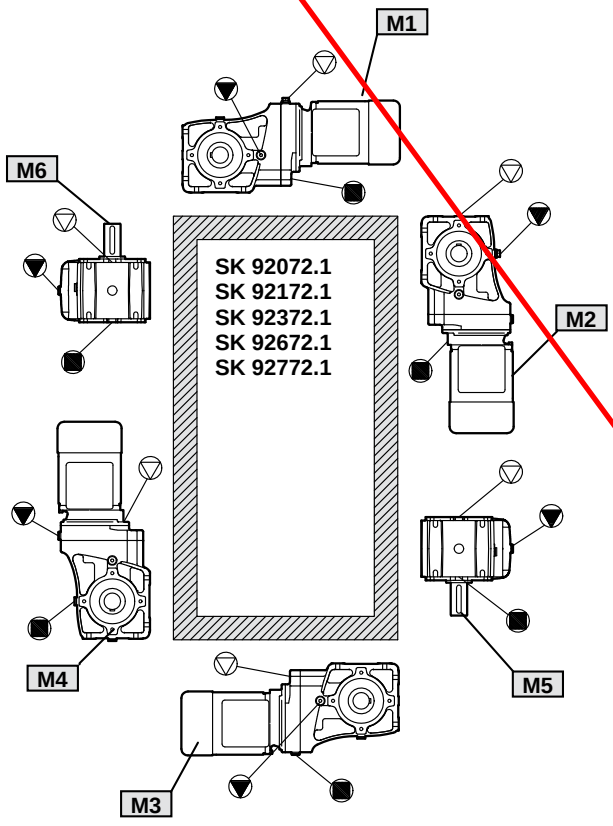
■ = Oil Plug

92.1/93.1 SERIES HELICAL-BEVEL OIL PLUG & VENT LOCATIONS

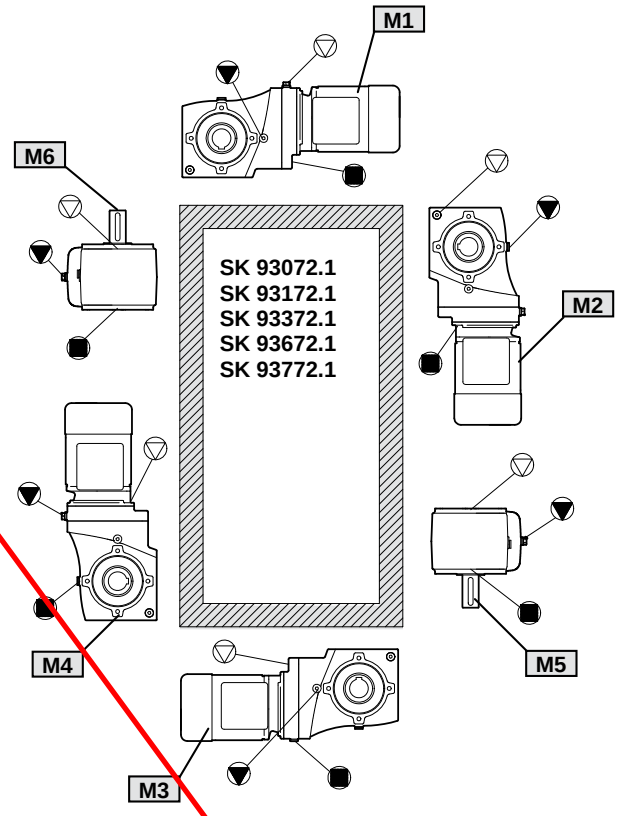
Oil plug locations

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

92.1 Series



93.1 Series



▽ = Vent

▼ = Oil Level

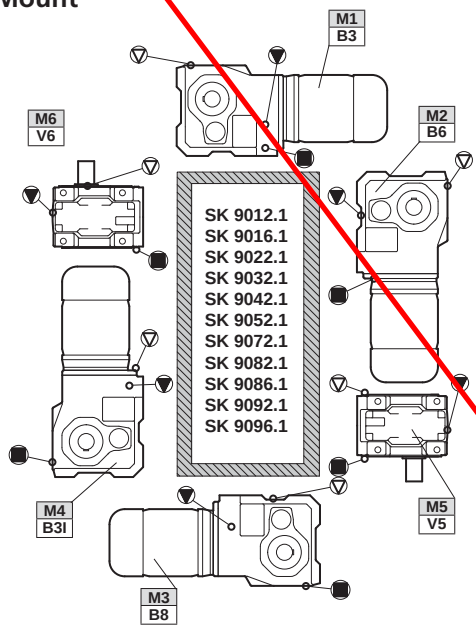
■ = Oil Plug

90.1 HELICAL-BEVEL
OIL PLUG & VENT LOCATIONS

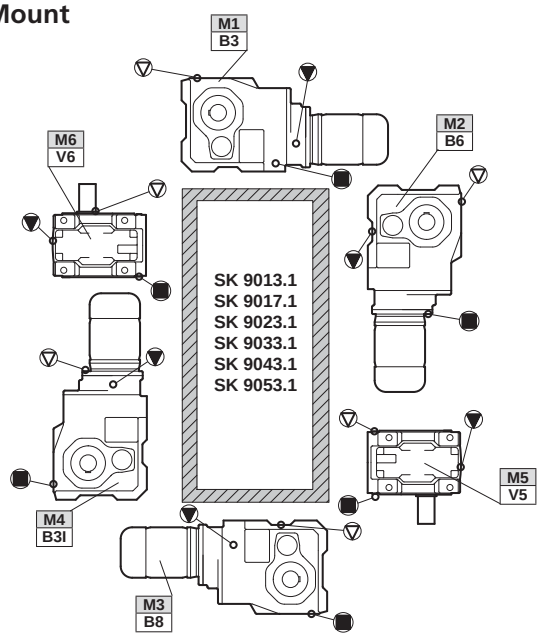
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

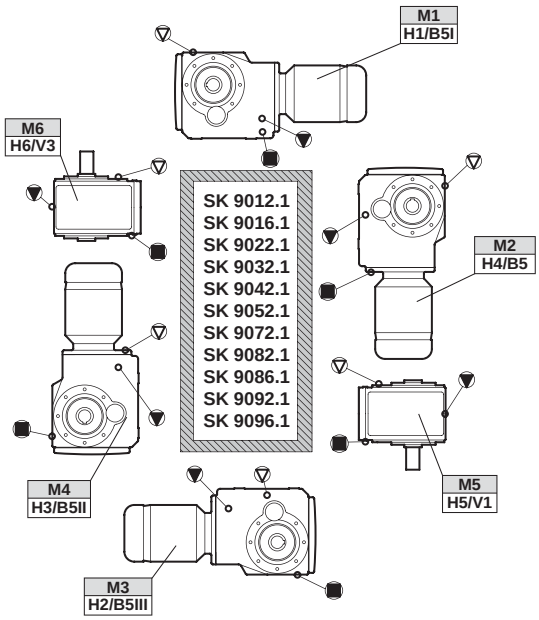
Foot Mount



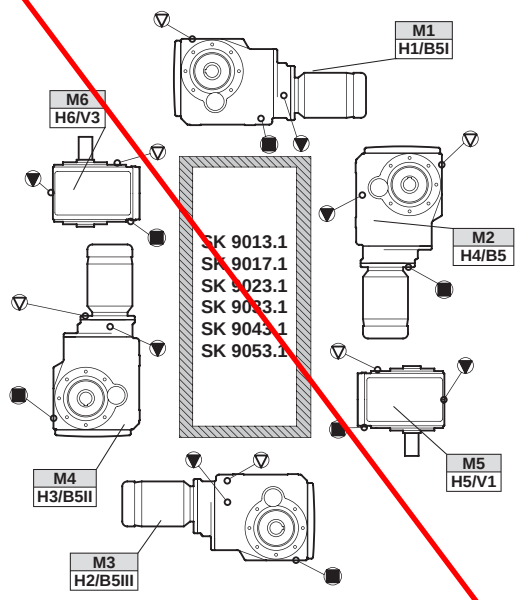
Foot Mount



Shaft/Flange Mount



Shaft/Flange Mount



▽ = Vent

▼ = Oil Level

■ = Oil Plug

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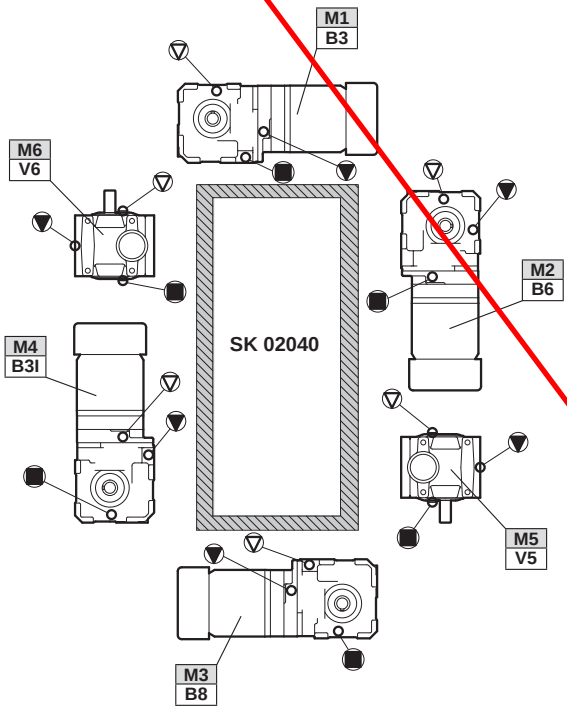
HELICAL-WORM
OIL PLUG & VENT LOCATIONS

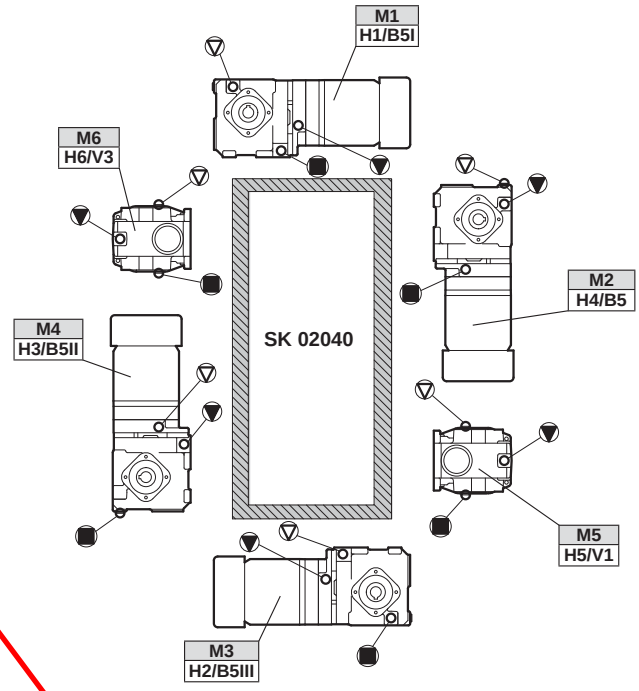
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

Foot Mount



Shaft/Flange Mount



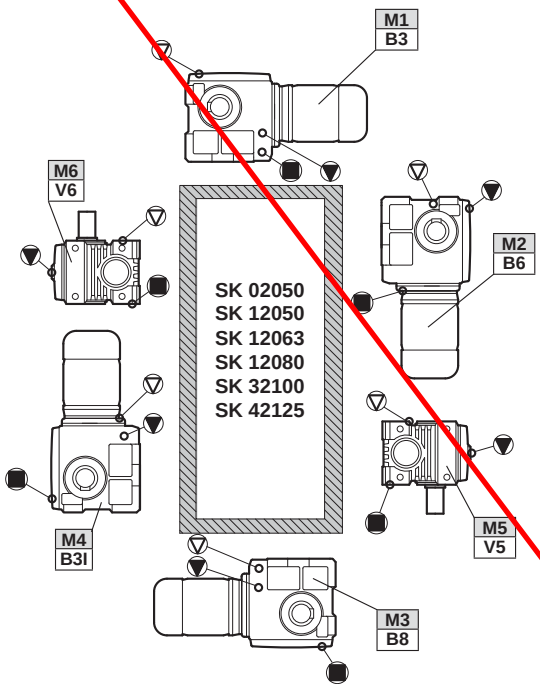
▽ = Vent

▼ = Oil Level

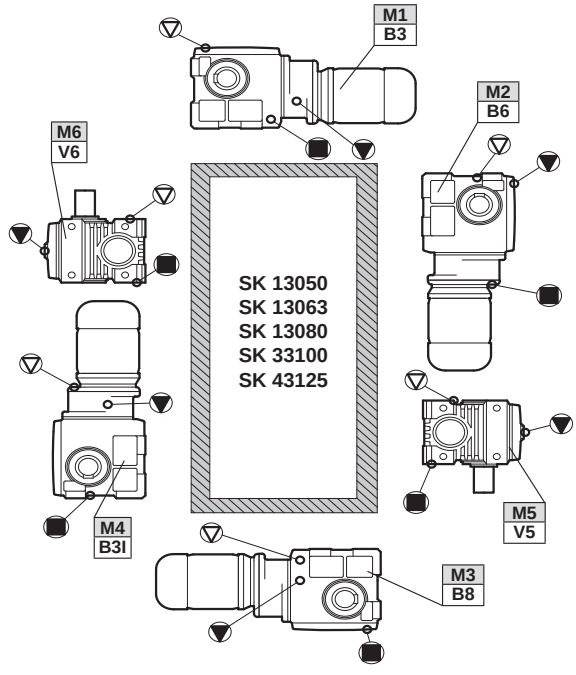
■ = Oil Plug

HELICAL-WORM
OIL PLUG & VENT LOCATIONS

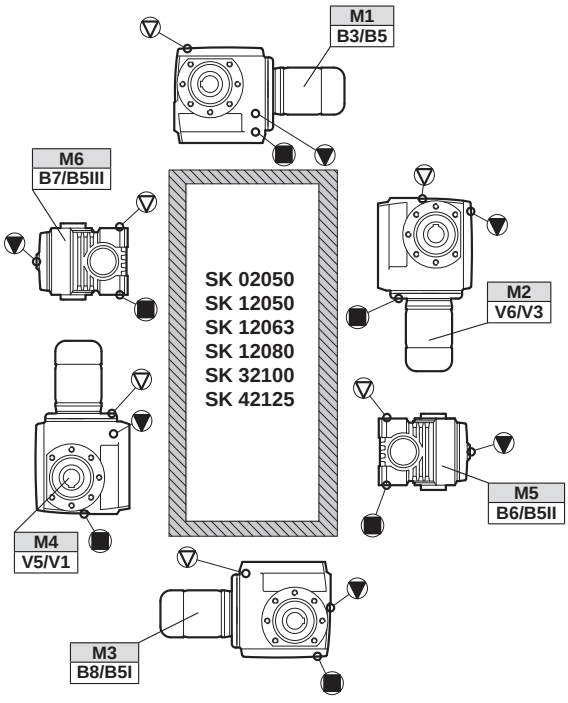
Foot Mount



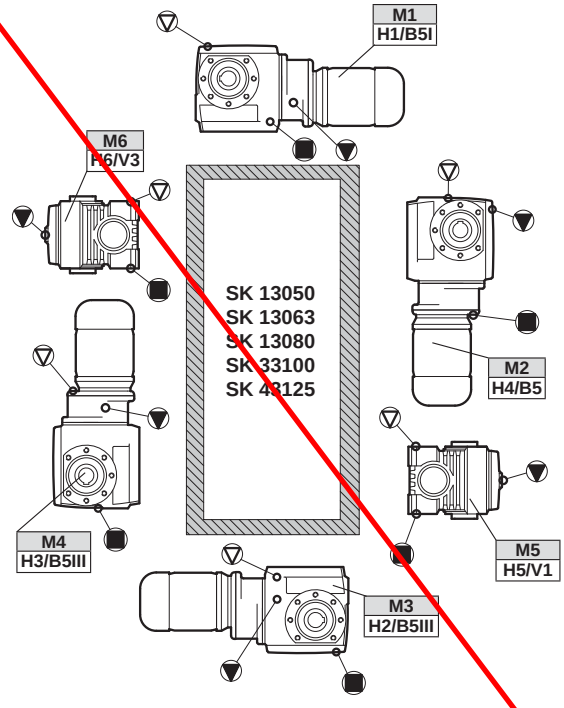
Foot Mount



Shaft/Flange Mount



Shaft/Flange Mount



▽ = Vent

▼ = Oil Level

■ = Oil Drain

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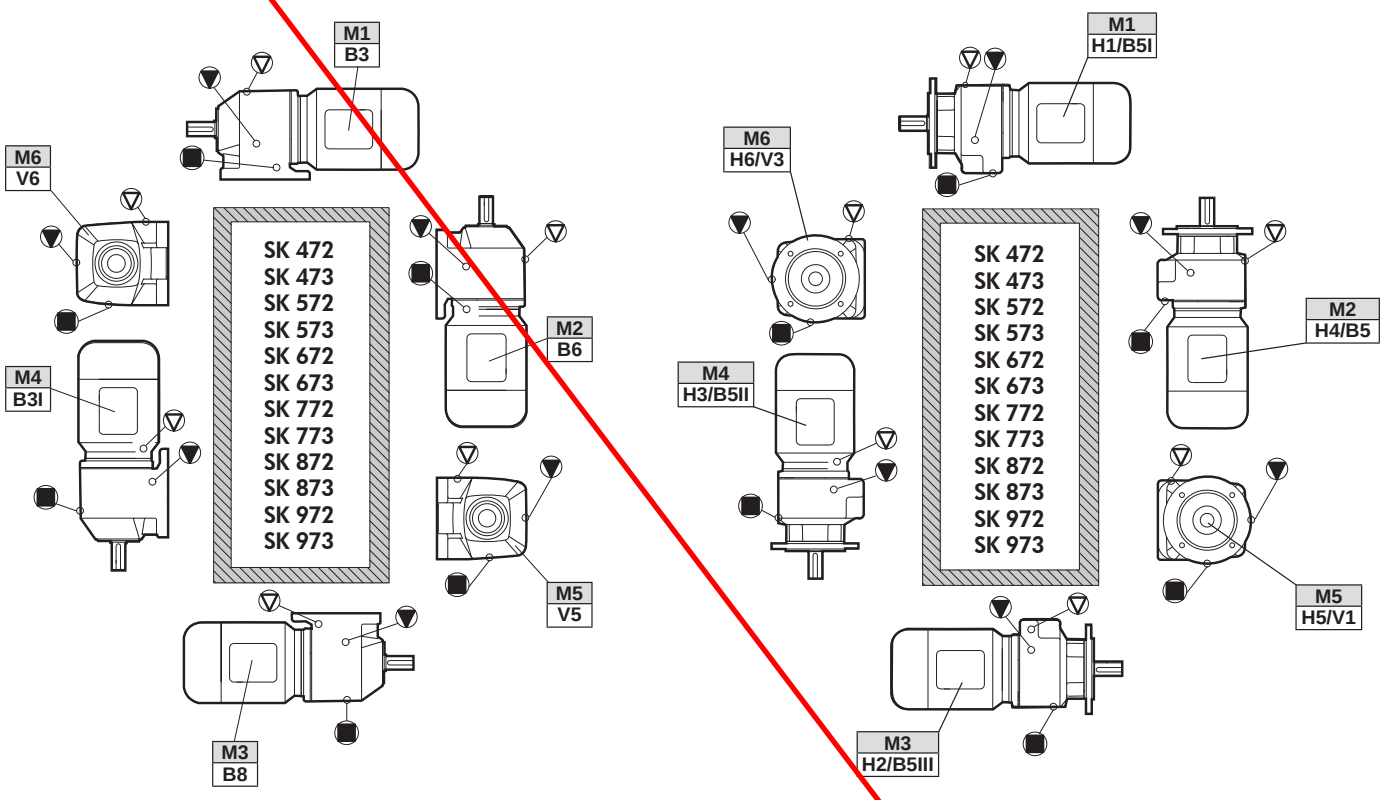
NORDBLOC®
OIL PLUG & VENT LOCATIONS

Oil plug connections

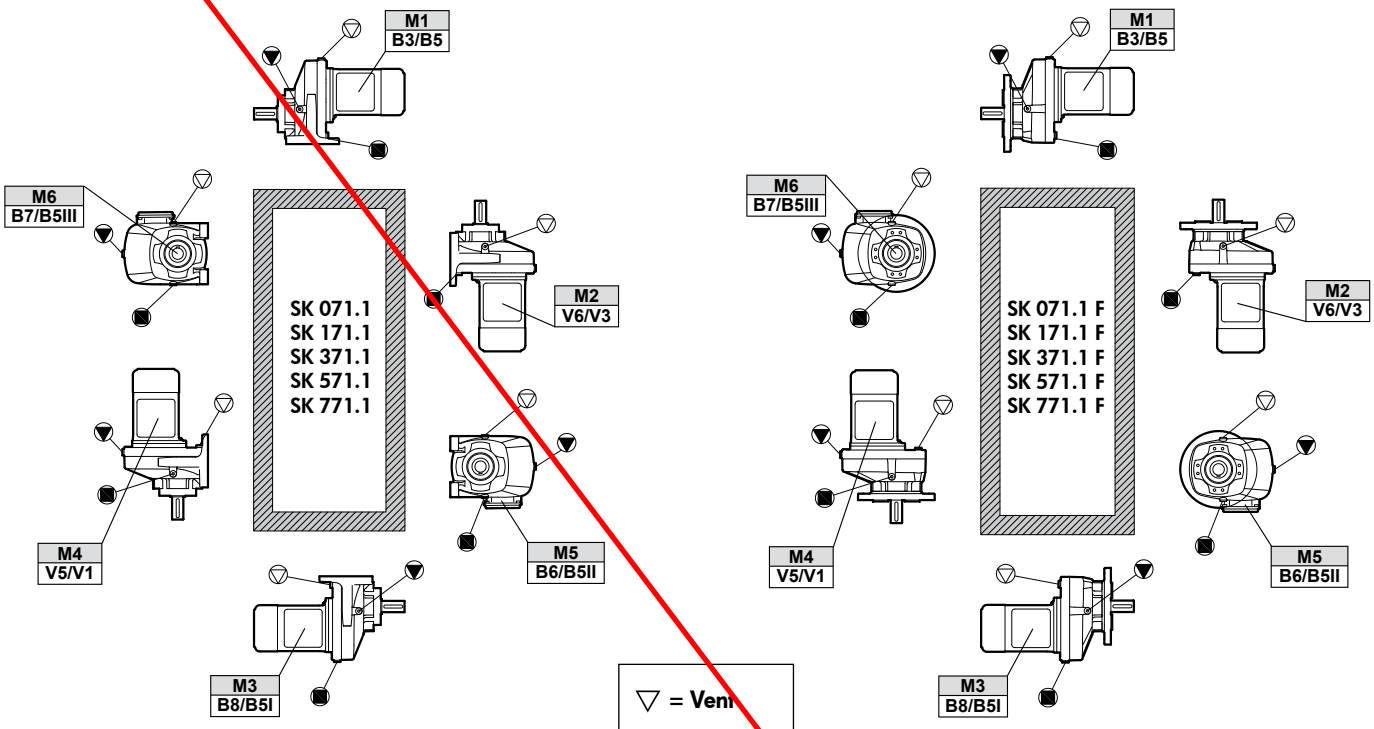
Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***

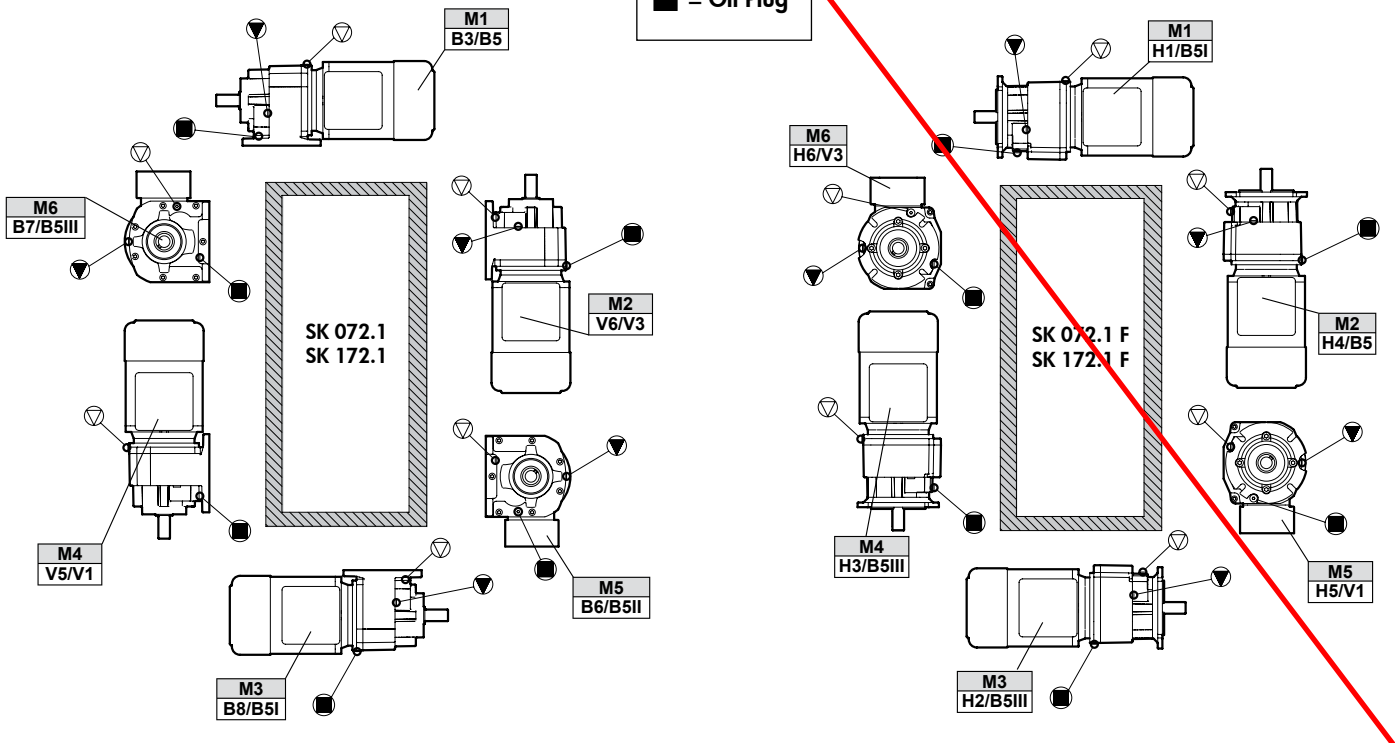


NORDBLOC.1
OIL PLUG & VENT LOCATIONS

Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***





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NORD Gear Corporation
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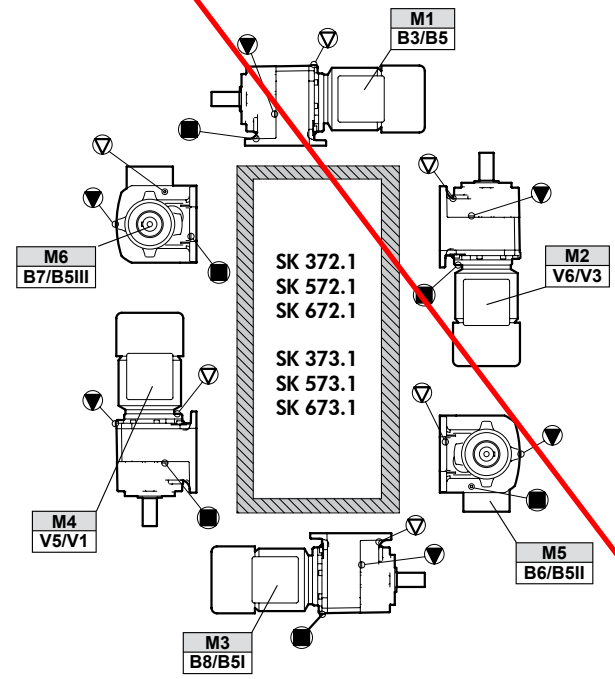
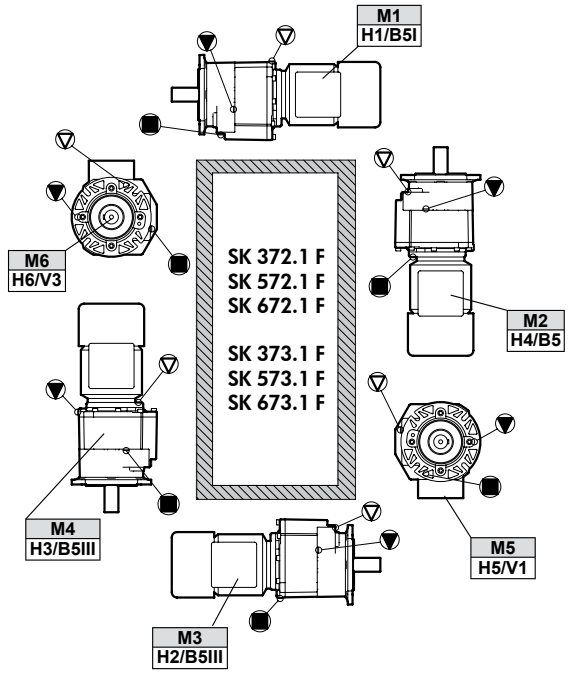
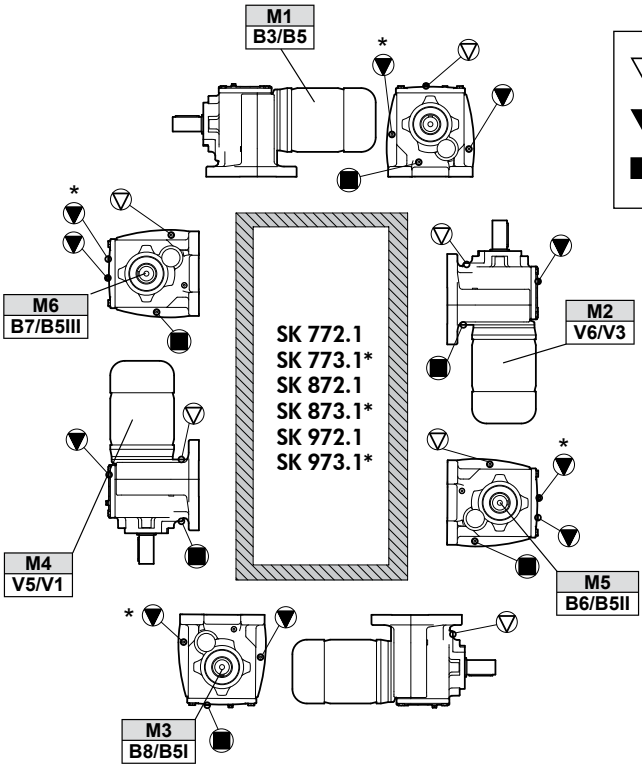
NORDBLOC.1
OIL PLUG & VENT LOCATIONS

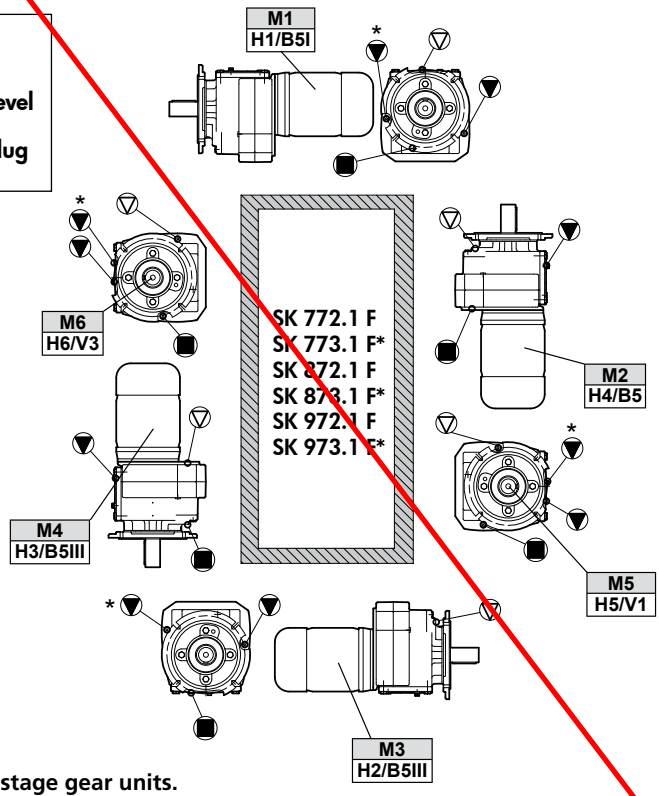
Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The correct oil level should be located at the lower edge of the oil level hole. ***For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.***









▽ = Vent

▼ = Oil Level

■ = Oil Plug

*** Oil fill level for three stage gear units.**

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MINICASE® (SMI/SMID) WORM GEAR OIL PLUG & VENT LOCATIONS

Oil Plug and Vent Locations

MINICASE® (SMI/SMID) reducers and gear motors are fitted with oil plugs to allow for optional venting of the gear unit. NORD can supply either an AUTOVENT™ (valve-type) vent or an open vent. Vent options are available for most gear unit sizes and positions as indicated by the table below. For more complete details on vent options and when to consider reducer venting, see user manual U10800.

Vent Compatability by Unit Size & Mounting Position

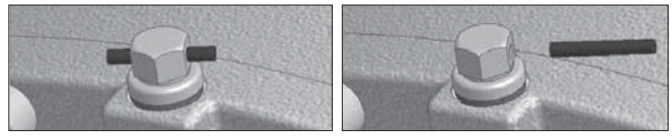
	M1	M2	M3	M4	M5	M6
SMI/SMID 31		✓	✓	✓		✓
SMI/SMID 40		✓	✓	✓		✓
SMI/SMID 50	✓	✓	✓	✓		✓
SMI/SMID 63	✓	✓	✓	✓	✓	✓
SMI/SMID 75	✓	✓	✓	✓		✓

Continuous Input speed ≤ 1800 rpm

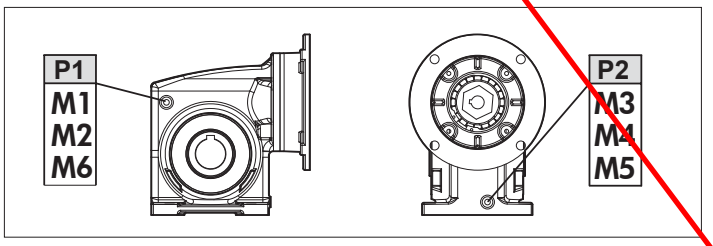
Vent Kit Part Numbers

Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	60693510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a seperate part number, vent kits include the housing gasket



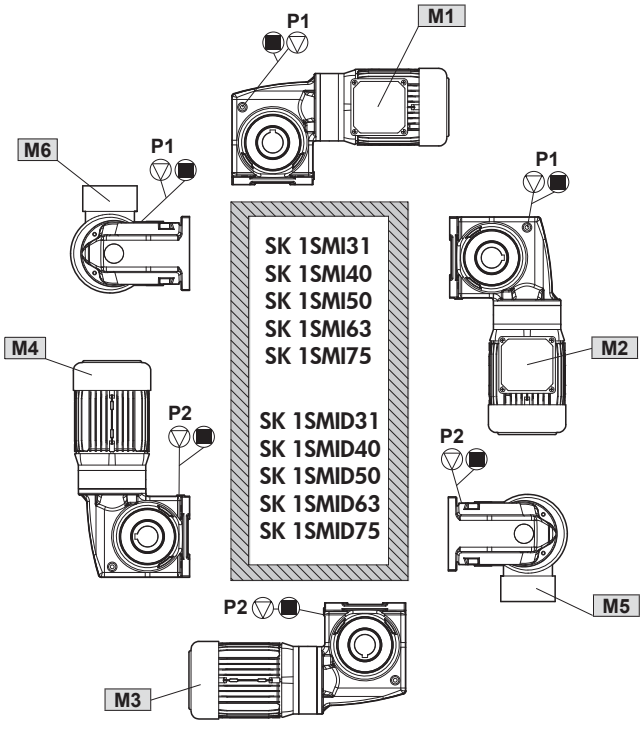
Optional Vent Locations



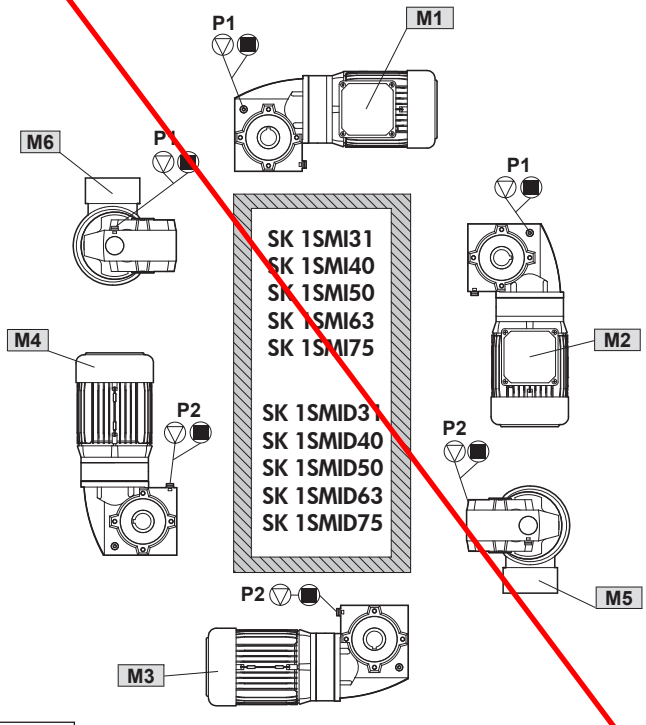
NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

MINICASE® (SMI/SMID) Foot Housing



MINICASE® (SMI/SMID) Flange Housing



▽ = Vent
■ = Oil Plug

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FLEXBLOC™ (SI?SID SERIES) WORM GEAR OIL PLUG & VENT LOCATIONS

Vent locations

FLEXBLOC™ (SI?SID SERIES) reducers are fitted with oil plugs to allow for optional venting of the gear unit. NORD can supply either an AUTOVENT™ (valve-type) vent or an open vent. Vent options are available for most gear unit sizes and positions as indicated by the table below. For more complete details on vent options and when to consider reducer venting, see user manual U10810.

Vent Compatability by Unit Size & Mounting Position

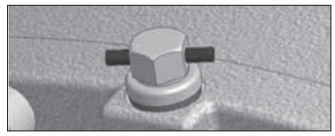
	M1	M2	M3	M4	M5	M6
SI/SID 31		✓	✓	✓		✓
SI/SID 40		✓	✓	✓		✓
SI/SID 50	✓	✓	✓	✓		✓
SI/SID 63	✓	✓	✓	✓	✓	✓
SI/SID 75	✓	✓	✓	✓		✓

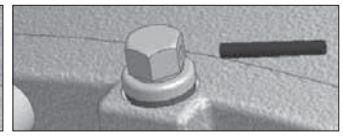
Continuous Input speed ≤ 1800 rpm

Vent Kit Part Numbers

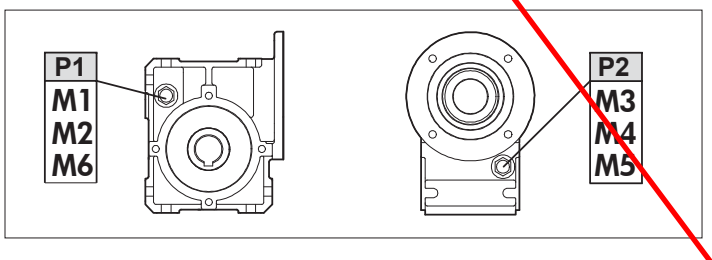
Type	Transportation Seal	Installation	Part Number
AUTOVENT™	Included	Factory or Field site	66093510
Open Vent	None	Field Only	60693500
Open Vent	Included	Factory or Field site	22008004 (vent) 25308120 (gasket)

Unless noted by a seperate part number, vent kits include the housing gasket

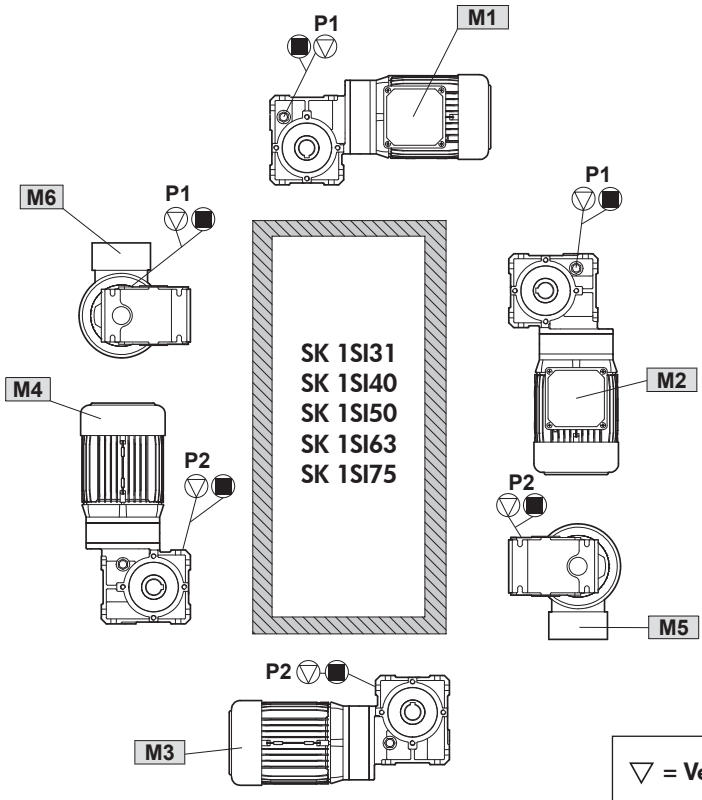




Optional Vent Locations



FLEXBLOC™ (SI Series) Universal Housing



NOTICE

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start-up. Excessive pressure may cause damage to internal components and cause leakage.

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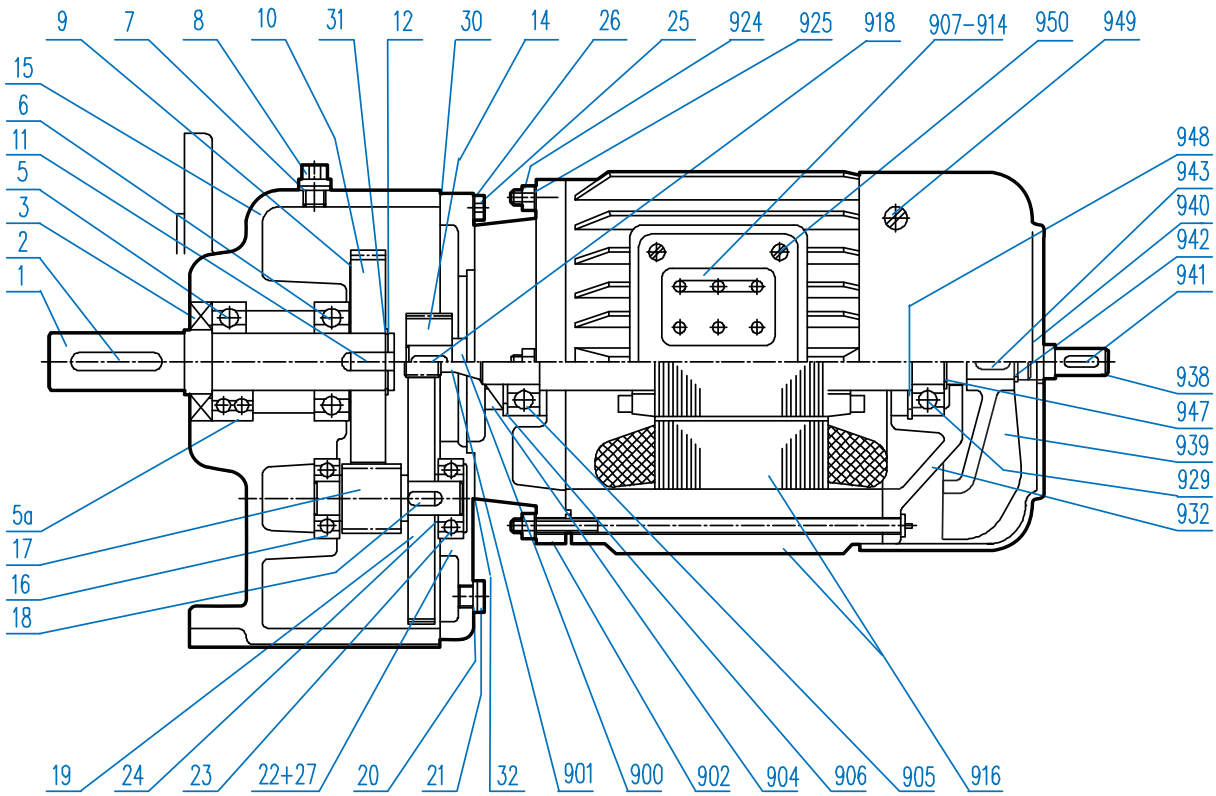
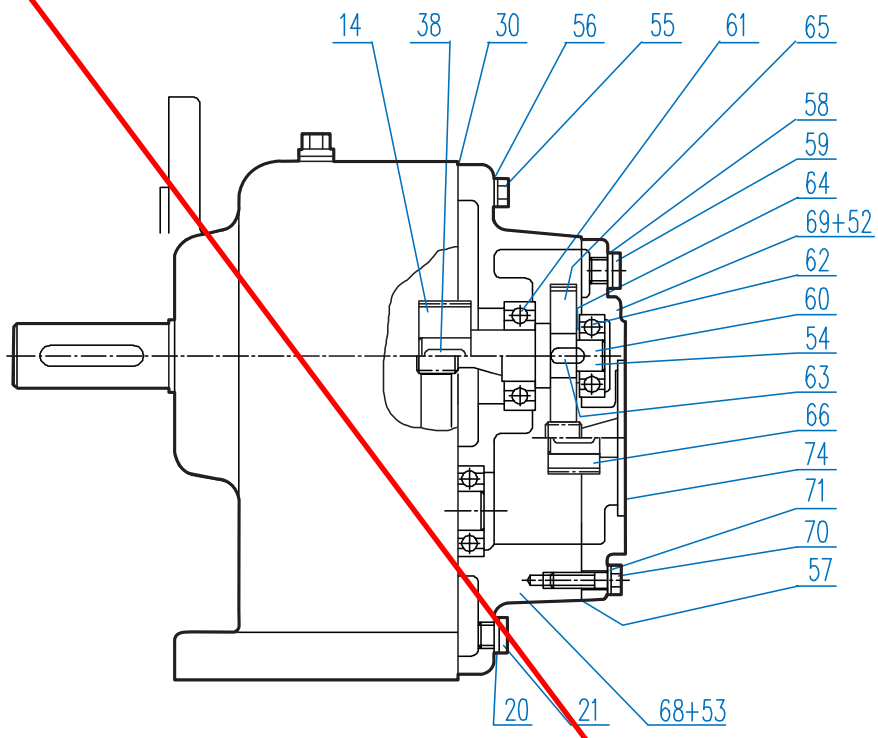


SK 0 - SK 33 Helical Gear Unit

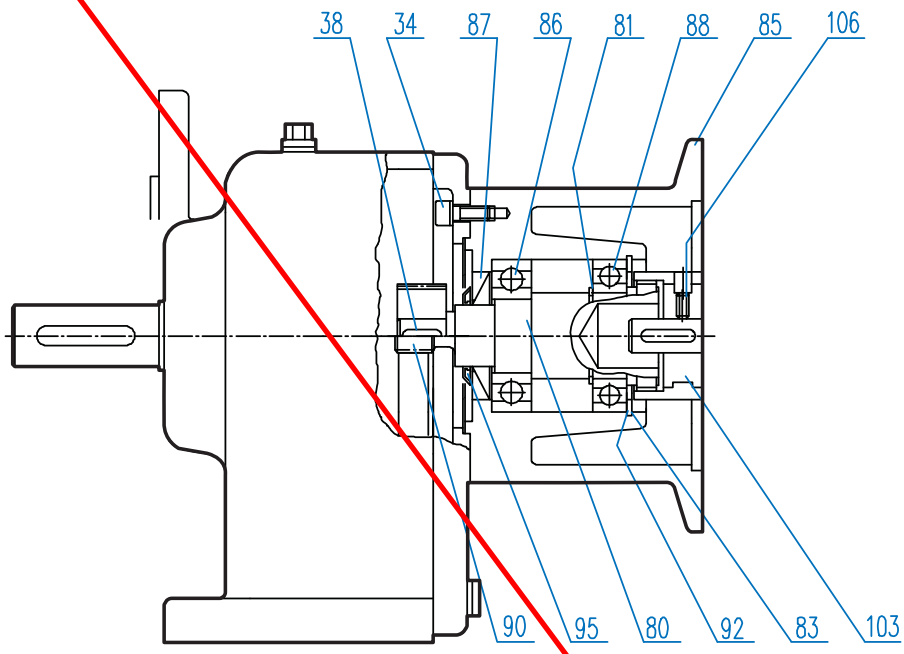
1	Output shaft	21	Plug	910	Terminal box cover gasket
2	Key	22	Gear case cover	911	Terminal board
3	Shaft seal	23	Pinion shaft bearing	914	Cable entry gland
5	Output shaft bearing, normal	24	Shim	916	Stator case
5A	Output shaft bearing, reinforced	25	Hexagon bolt	918	Key
6	Output shaft bearing	26	Washer	924	Collar bolt
7	Seal	27	Spiral pin	925	Hexagonal nut
8	Vent screw	30	Seal	929	Bearing B
9	Shim	31	Shim	932	Endshield B
10	Driven gear	32	Seal	938	Second motor shaft end*
11	Key	900	Rotor with shaft,plain	939	Fan
12	Circlip	901	Rotor with shaft,gearcut	940	Fan cover
14	Driving pinion	902	End shield A	941	Key
15	Gear case	904	Shaft seal	942	Circlip
16	Pinion shaft, bearing	905	Bearing A	943	Key
17	Driven pinion	906	Bearing shim	947	Circlip
18	Key	907	Terminal box frame	948	Circlip
19	Driving gear	908	Terminal box cover	949	Oval flat-head bolt
20	Seal	909	Terminal box frame gasket	950	Oval flat-head bolt

* Optional Part



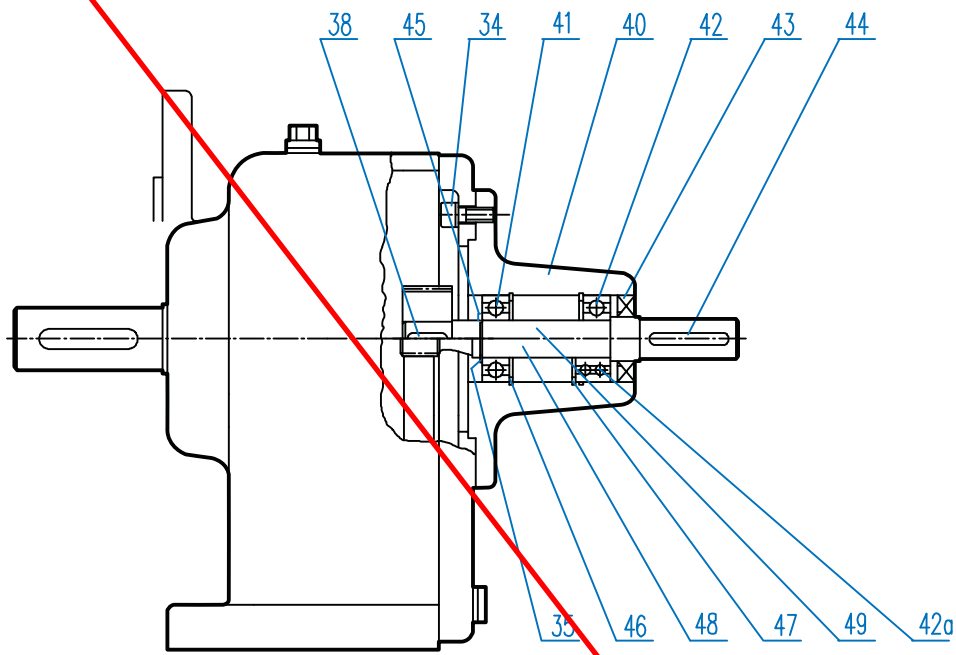
SK 010 - SK 330 Third Stage Reduction Gear

14	Driving pinion	55	Hexagon bolt	64	Shim
20	Seal	56	Washer	65	Driving gear
21	Plug	57	Seal	66	Driving pinion
27	Spiral pin	58	Seal	68	Gear case 3rd. red.
30	Seal	59	Plug	69	Gear case cover
38	Key	60	Intermediate shaft, plain	70	Hexagon bolt
52	Spiral pin	61	Grooved ball bearing	71	Washer
53	Spiral pin	62	Grooved ball bearing	74	Seal
54	Intermediate shaft, gearcut	63	Key		



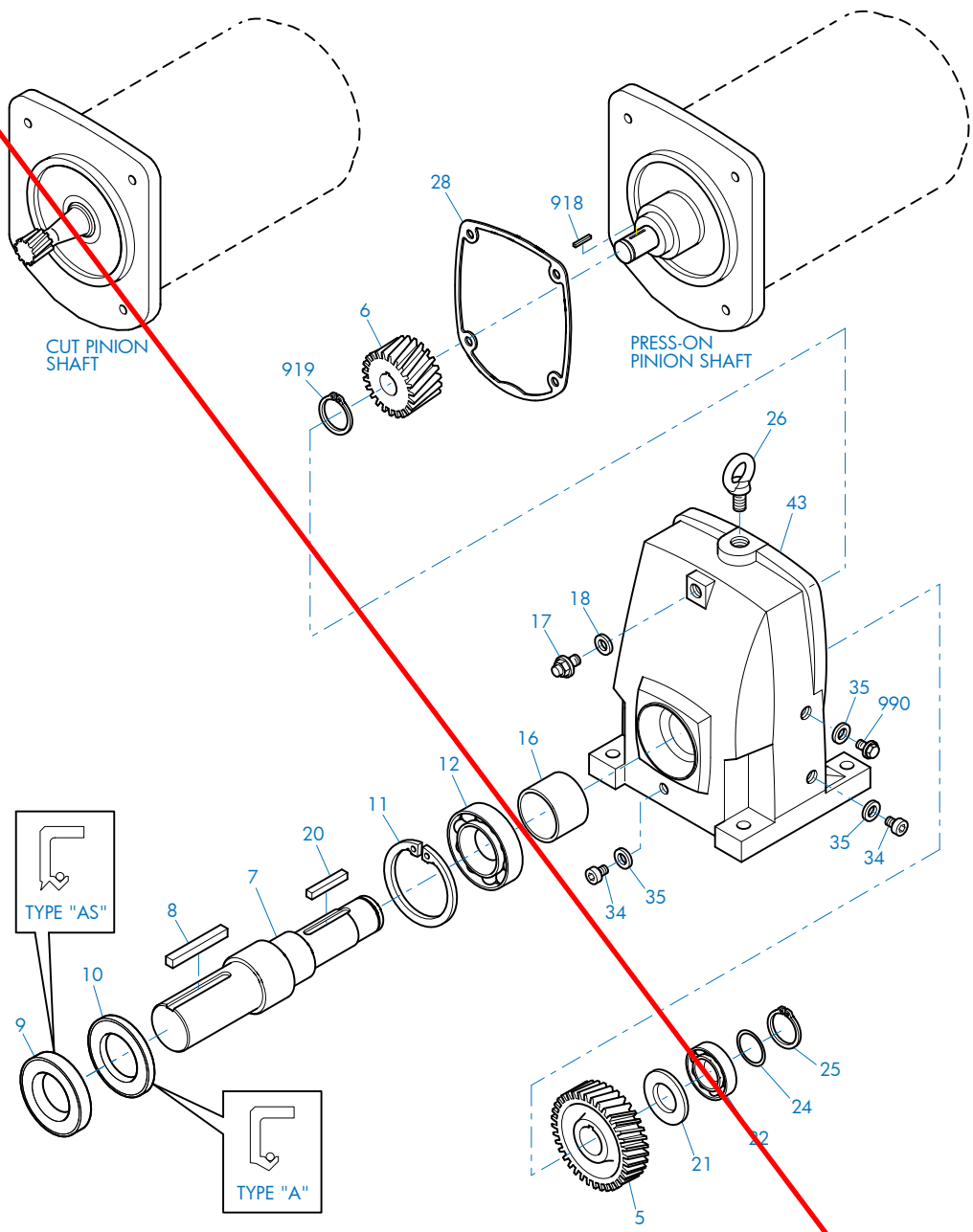
SK 0 - SK 330 IEC Input

34	Socket head bolt	85	IEC adaptor	92	Shim
38	Key	86	Input shaft bearing	103	Coupling
80	Input shaft	87	Shaft seal	106	Set screw
81	Circlip	88	Input shaft bearing		
83	Circlip	90	Pinion shaft		



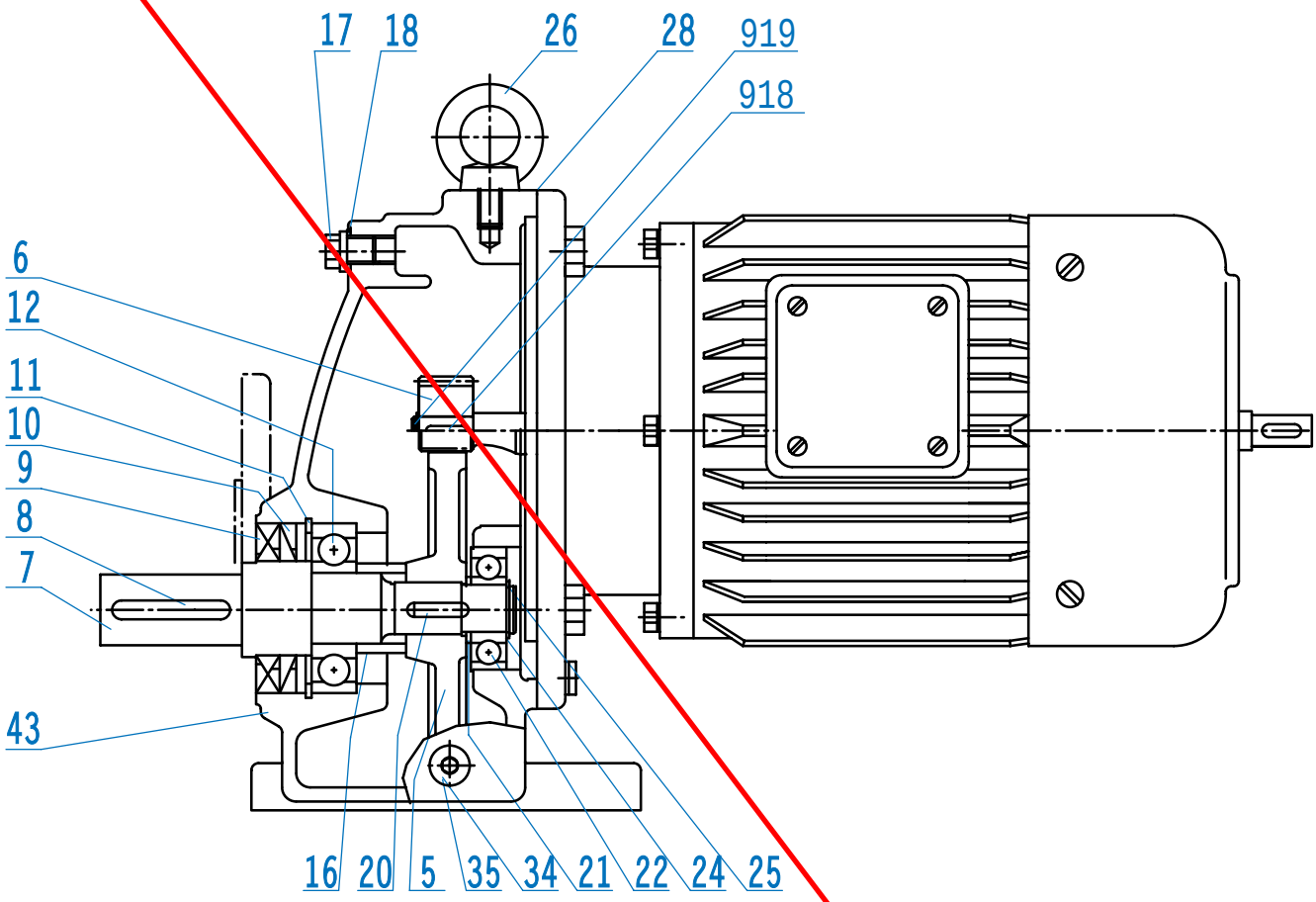
SK 0 - SK 330 Solid Shaft Input (W)

34	Socket head bolt	42	Grooved ball bearing, normal	46	Circlip
35	Shim	42A	Grooved ball bearing, reinforced	47	Circlip
38	Key	43	Shaft seal	48	Input shaft, gearcut
40	Input bearing housing	44	Key	49	input shaft, plain
41	Grooved ball bearing	45	Circlip		



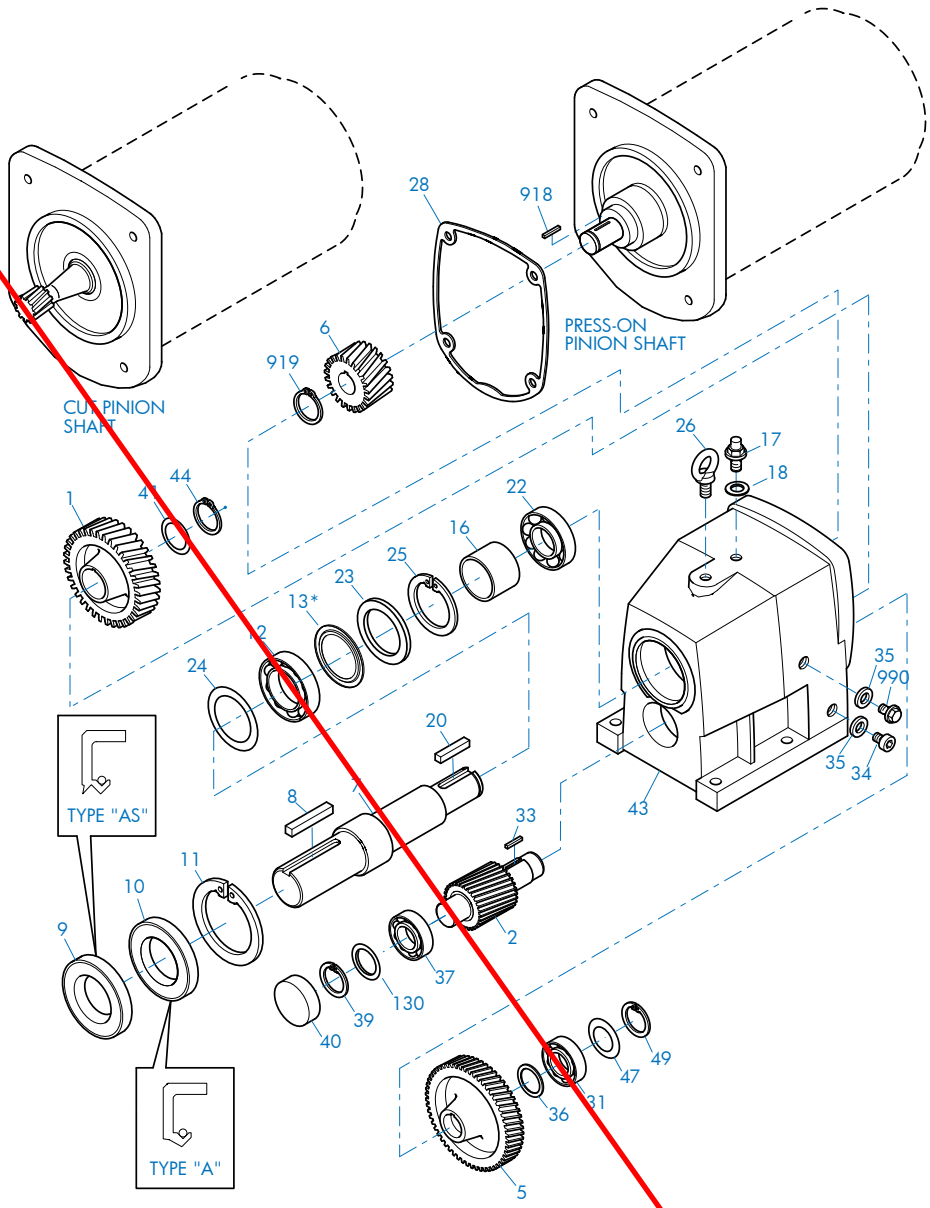
SK 11E - SK 51E Foot Mount

5	Gear	16	Spacer	26	Flanged Eye Bolt
6	Pinion	17	Vent Plug	28	Gasket
7	Output Shaft	18	Seal	34	Drain Plug
8	Key	20	Key	35	Gasket
9	Oil Seal	21	Spacer	43	Gearcase
10	Oil Seal	22	Anti-Friction Bearing	918	Key
11	Snap Ring	24	Shim	919	Snap Ring
12	Anti-Friction Bearing	25	Snap Ring	990	Oil Level Plug



SK 11E - SK 51E Foot Mount

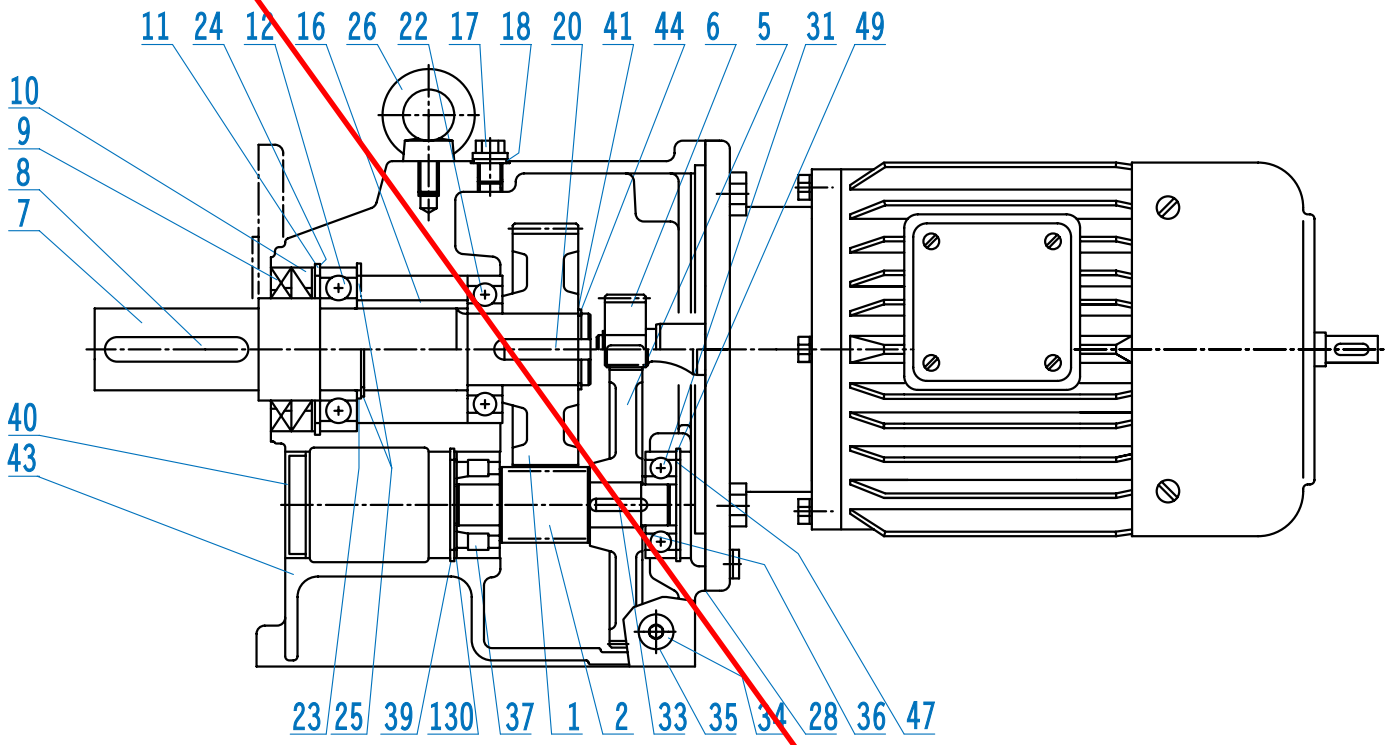
5	Gear	16	Spacer	26	Flanged Eye Bolt
6	Pinion	17	Vent Plug	28	Gasket
7	Output Shaft	18	Seal	34	Drain Plug
8	Key	20	Key	35	Gasket
9	Oil Seal	21	Spacer	43	Gearcase
10	Oil Seal	22	Anti-Friction Bearing	918	Key
11	Snap Ring	24	Shim	919	Snap Ring
12	Anti-Friction Bearing	25	Snap Ring		



SK02 - SK52 Foot Mount

1	Gear	18	Seal	37	Anti-Friction Bearing
2	Pinion Shaft	20	Key	39	Snap Ring
5	Gear	22	Anti-Friction Bearing	40	Bore Plug
6	Pinion	23	Thrust Washer	41	Shim
7	Output Shaft	24	Shim	43	Gearcase
8	Key	25	Snap Ring	44	Snap Ring
9	Oil Seal	26	Flanged Eye Bolt	47	Shim
10	Oil Seal	28	Gasket	49	Snap Ring
11	Snap Ring	31	Anti-Friction Bearing	130	Shim
12	Anti-Friction Bearing	33	Key	918	Key
13	NILOS Ring*	34	Drain Plug	919	Snap Ring
16	Spacer	35	Gasket	990	Oil Level Plug
17	Vent Plug	36	Spacer		

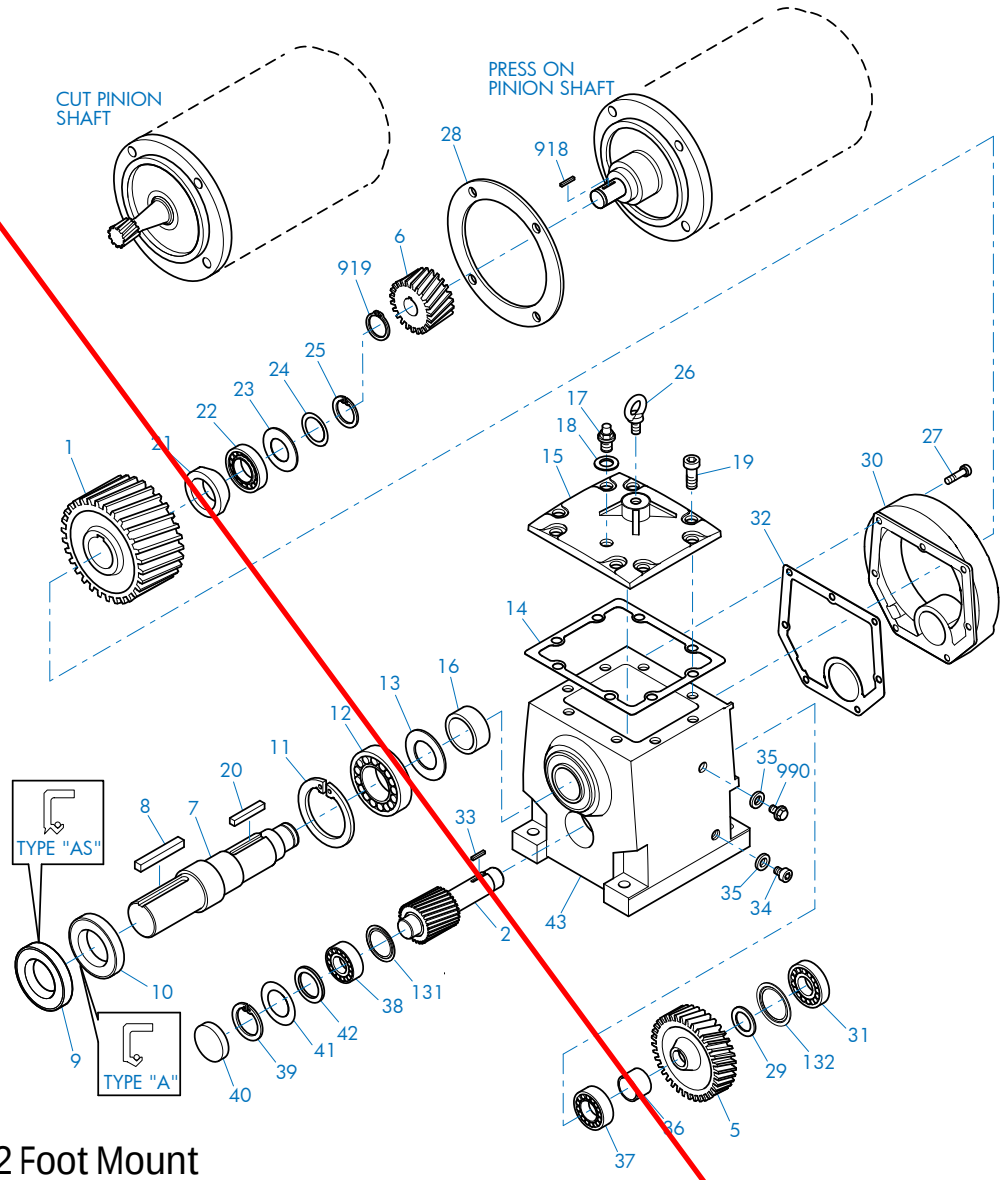
* Conditionally used part



SK02 - SK52 Foot Mount

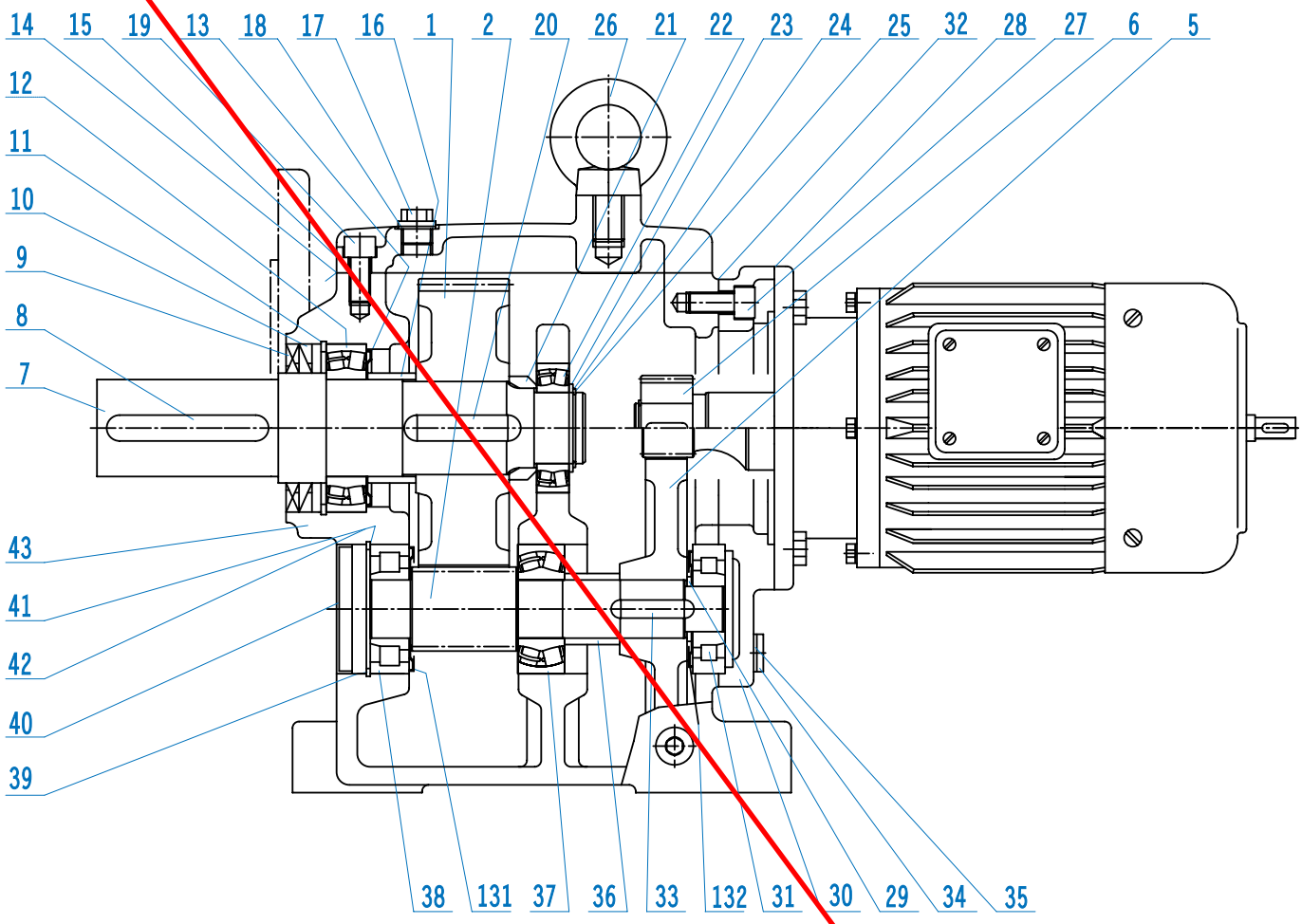
1	Gear	18	Seal	37	Anti-Friction Bearing
2	Pinion Shaft	20	Key	39	Snap Ring
5	Gear	22	Anti-Friction Bearing	40	Bore Plug
6	Pinion	23	Thrust Washer	41	Shim
7	Output Shaft	24	Shim	43	Gearcase
8	Key	25	Snap Ring	44	Snap Ring
9	Oil Seal	26	Flanged Eye Bolt	47	Shim
10	Oil Seal	28	Gasket	49	Snap Ring
11	Snap Ring	31	Anti-Friction Bearing	130	Shim
12	Anti-Friction Bearing	33	Key	918	Key
13	NILOS Ring*	34	Drain Plug	919	Snap Ring
16	Spacer	35	Gasket		
17	Vent Plug	36	Spacer		

* Conditionally used part



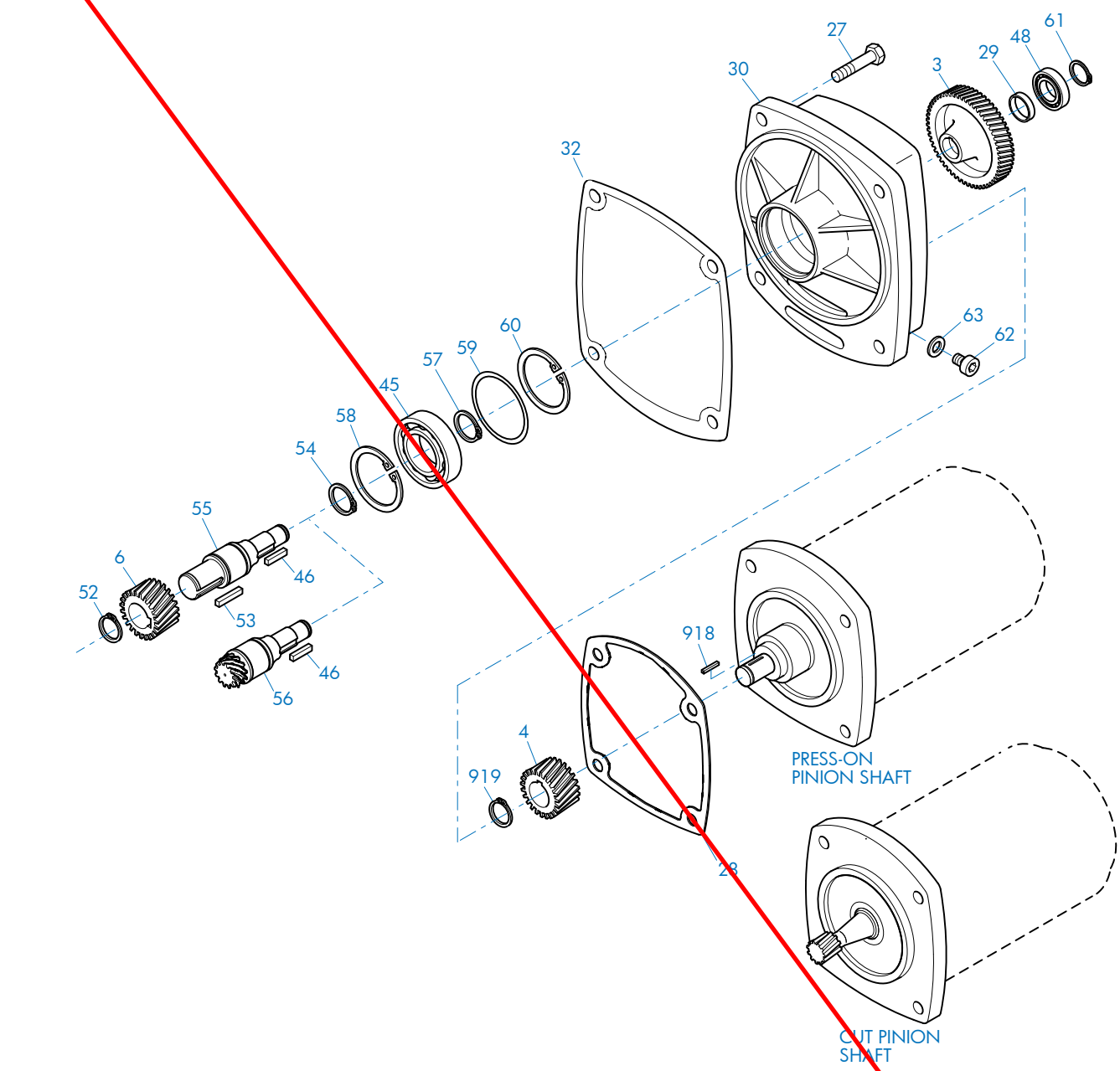
SK62 - SK102 Foot Mount

1	Gear	19	Bolt	35	Gasket
2	Pinion Shaft	20	Key	36	Spacer
5	Gear	21	Spacer	37	Anti-Friction Bearing
6	Pinion	22	Anti-Friction Bearing	38	Anti-Friction Bearing
7	Output Shaft	23	Thrust Washer	39	Snap Ring
8	Key	24	Shim	40	Bore Plug
9	Oil Seal	25	Snap Ring	41	Shim
10	Oil Seal	26	Flanged Eye Bolt	42	Thrust Washer
11	Snap Ring	27	Bolt	43	Gearcase
12	Anti-Friction Bearing	28	Gasket	131	NILOS Ring
13	NILOS ring	29	Spacer	132	NILOS Ring
14	Gasket	30	Input Cover	918	Key
15	Inspection Cover	31	Anti-Friction Bearing	919	Snap Ring
16	Spacer	32	Gasket	990	Oil Level Plug
17	Vent Plug	33	Key		
18	Seal	34	Drain Plug		



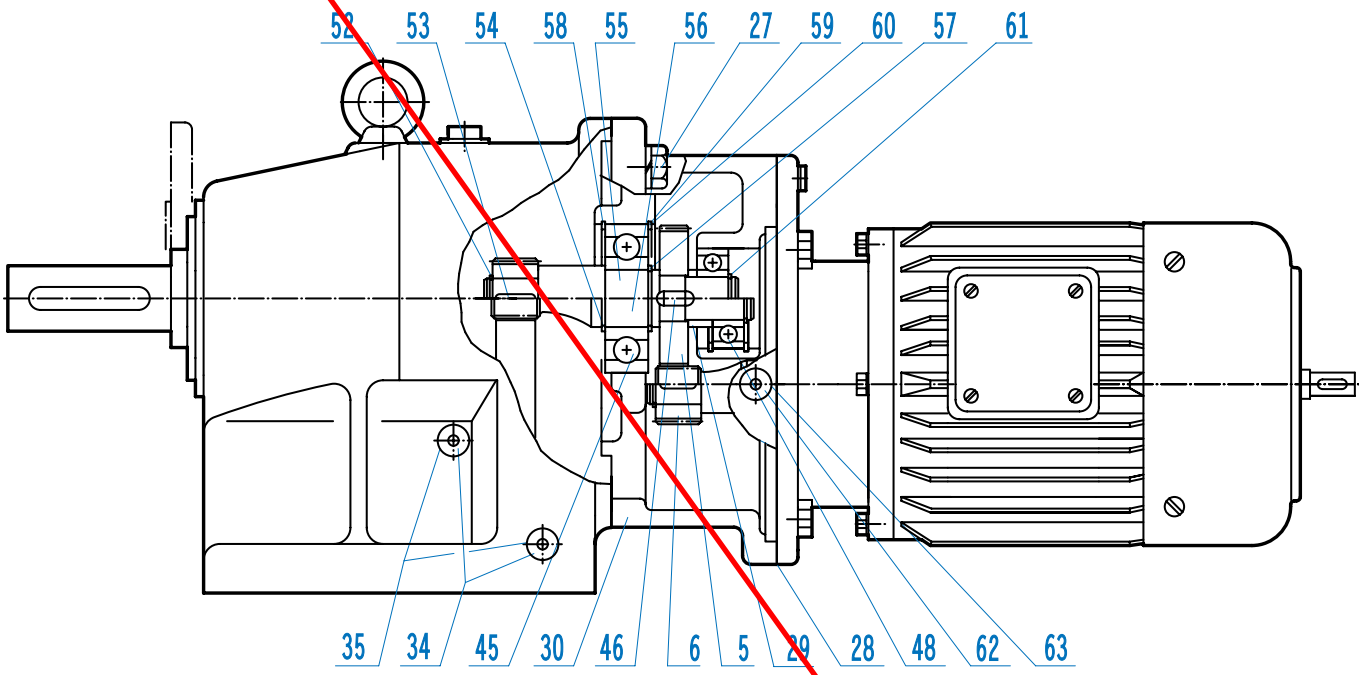
SK62 - SK102 Foot Mount

1	Gear	18	Seal	33	Key
2	Pinion Shaft	19	Bolt	34	Drain Plug
5	Gear	20	Key	35	Gasket
6	Pinion	21	Spacer	36	Spacer
7	Output Shaft	22	Anti-Friction Bearing	37	Anti-Friction Bearing
8	Key	23	Thrust Washer	38	Anti-Friction Bearing
9	Oil Seal	24	Shim	39	Snap Ring
10	Oil Seal	25	Snap Ring	40	Bore Plug
11	Snap Ring	26	Flanged Eye Bolt	41	Shim
12	Anti-Friction Bearing	27	Bolt	42	Thrust Washer
13	NILOS ring*	28	Gasket	43	Gearcase
14	Gasket	29	Spacer	131	NILOS Ring*
15	Inspection Cover	30	Input Cover	132	NILOS Ring*
16	Spacer	31	Anti-Friction Bearing	918	Key
17	Vent Plug	32	Gasket	919	Snap Ring



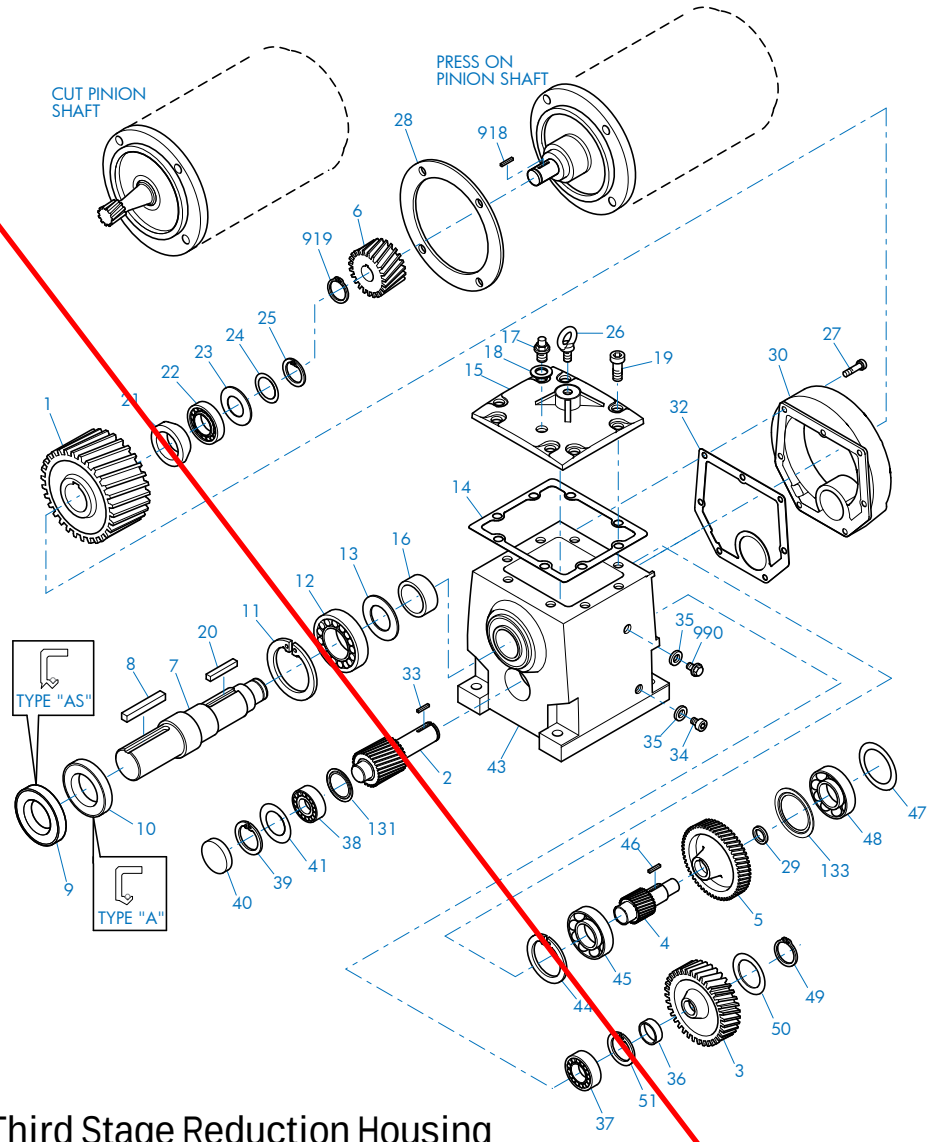
SK03 - SK53 Third Stage Reduction Gear

3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	918	Key
30	Third Reduction Gearcase	56	Intermediate Shaft, Gearcut	919	Snap Ring
32	Gasket	57	Snap Ring		
45	Anti-Friction Bearing	58	Snap Ring		



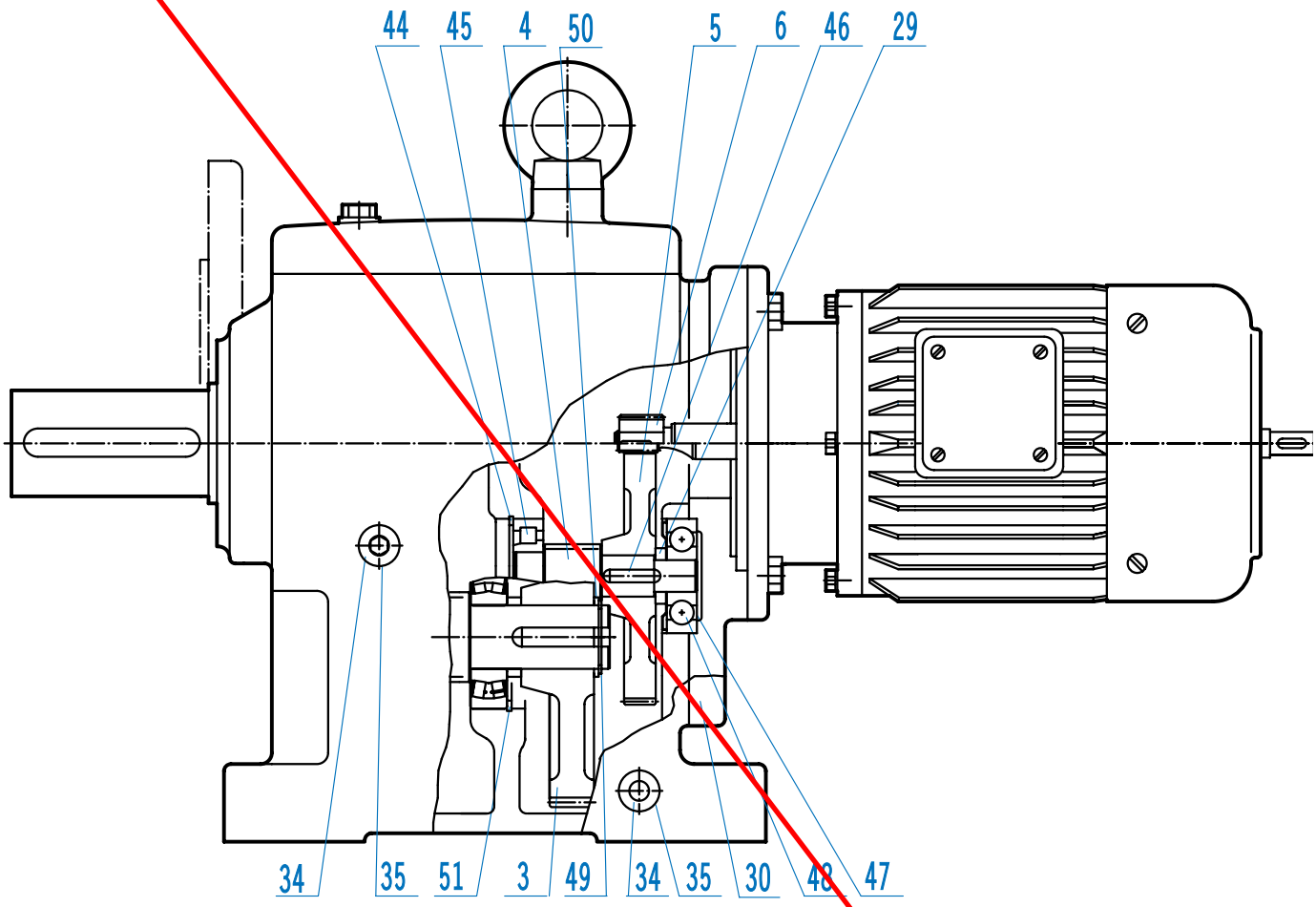
SK03 - SK53 Using Third Stage Reduction Gear

3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	918	Key
30	Third Reduction Gearcase	56	Intermediate Shaft, Gearcut	919	Snap Ring
32	Gasket	57	Snap Ring		
45	Anti-Friction Bearing	58	Snap Ring		



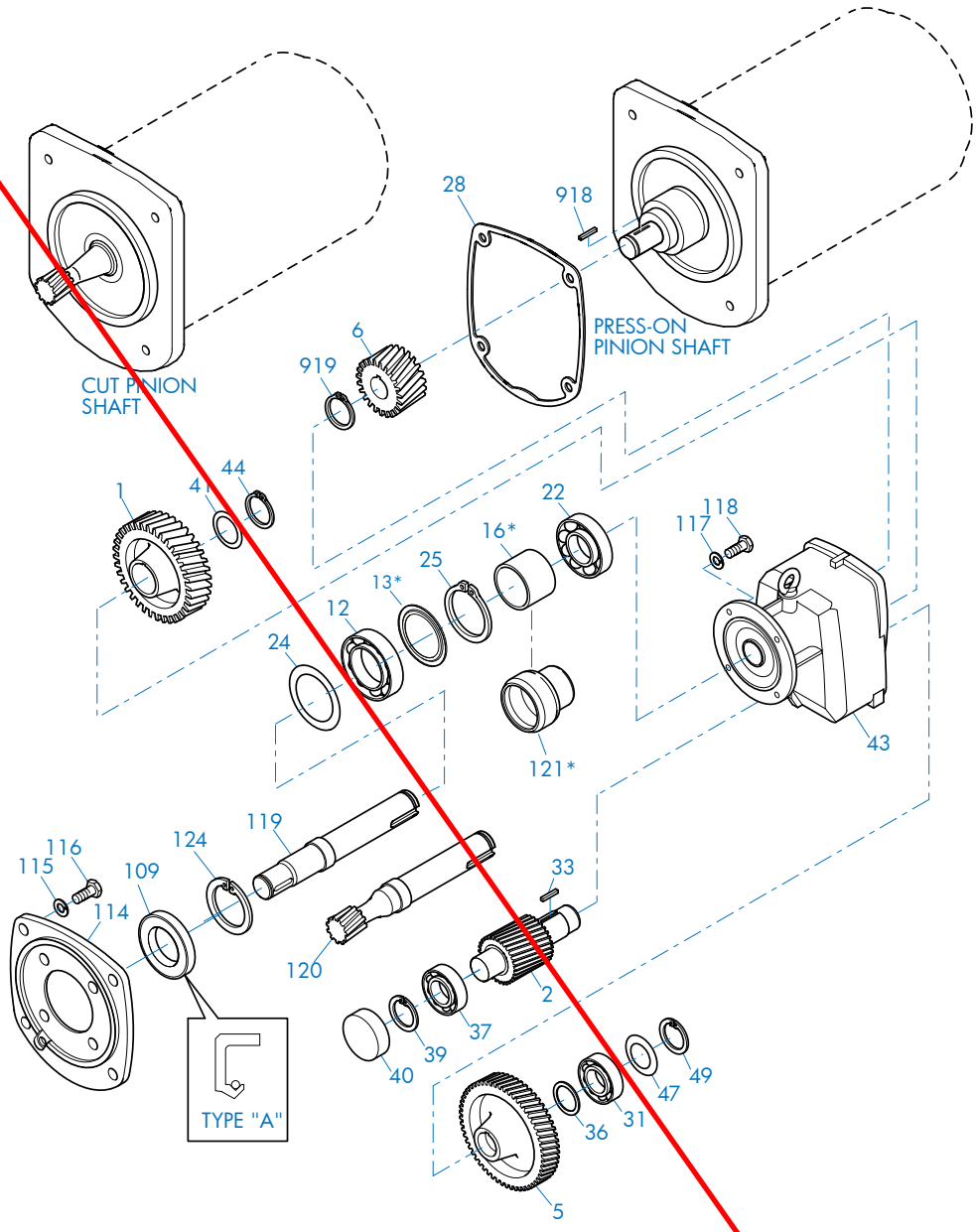
SK63 - SK103 Third Stage Reduction Housing

1	Gear	19	Bolt	38	Anti-Friction Bearing
2	Pinion Shaft	20	Key	39	Snap Ring
3	Gear	21	Spacer	40	Bore Plug
4	Pinion Shaft	22	Anti-Friction Bearing	41	Shim
5	Gear	23	Thrust Washer	43	Gearcase
6	Pinion	24	Shim	44	Snap Ring
7	Output Shaft	25	Snap Ring	45	Anti-Friction Bearing
8	Key	26	Flanged Eye Bolt	46	Key
9	Oil Seal	27	Bolt	47	Shim
10	Oil Seal	28	Gasket	48	Bearing
11	Snap Ring	29	Spacer	49	Snap Ring
12	Anti-Friction Bearing	30	Input Cover	50	Thrust Washer
13	NILOS Ring	32	Gasket	51	Snap Ring
14	Gasket	33	Key	131	NILOS Ring
15	Inspection Cover	34	Drain plug	133	NILOS Ring
16	Spacer	35	Gasket	918	Key
17	Vent Plug	36	Spacer	919	Snap Ring
18	Seal	37	Anti-Friction Bearing	990	Oil Level Plug



SK63 - SK103 Foot Mount

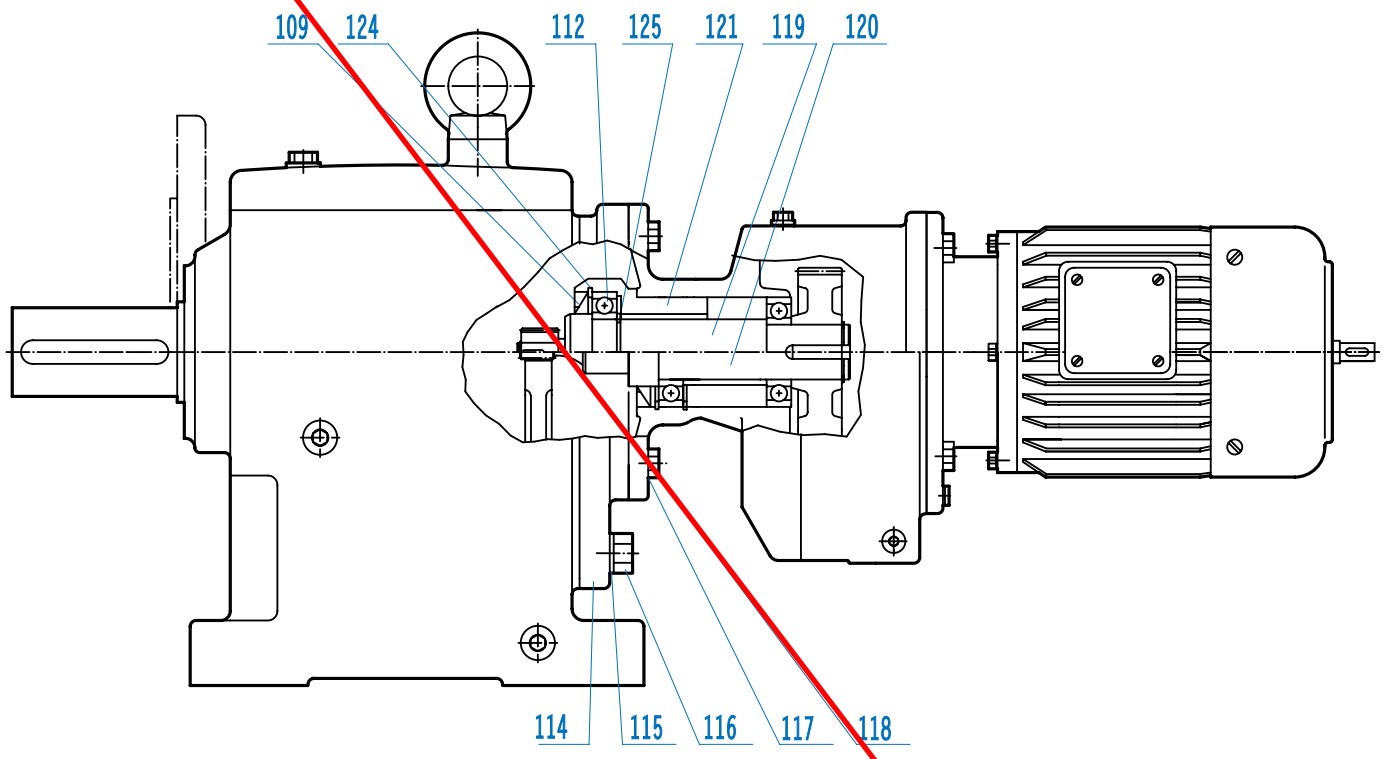
3	Gear	32	Gasket	47	Shim
4	Pinion Shaft	33	Key	48	Bearing
5	Gear	34	Drain plug	49	Snap Ring
6	Pinion	35	Gasket	50	Thrust Washer
28	Gasket	44	Snap Ring	51	Snap Ring
29	Spacer	45	Anti-Friction Bearing	133	NILOS Ring
30	Input Cover	46	Key		



SK12/02 - SK103/52 Input Compound Reduction

1	Gear	33	Key	115	Lock Washer
2	Pinion Shaft	36	Spacer	116	Bolt
5	Gear	37	Anti-Friction Bearing	117	Lock Washer
6	Pinion	39	Snap Ring	118	Bolt
12	Anti-Friction Bearing	40	Bore Plug	119	Intermediate Shaft, Plain
13	Nilos Ring*	41	Shim	120	Intermediate Shaft, Gearcut
16	Spacer*	43	Gearcase	121	Bearing Sleeve*
22	Anti-Friction Bearing	44	Snap Ring	124	Snap Ring
24	Shim	47	Shim	918	Key
25	Snap Ring	49	Snap Ring	919	Snap Ring
28	Gasket	109	Oil Seal		
31	Anti-Friction Bearing	114	Intermediate Flange		

* Conditionally used part

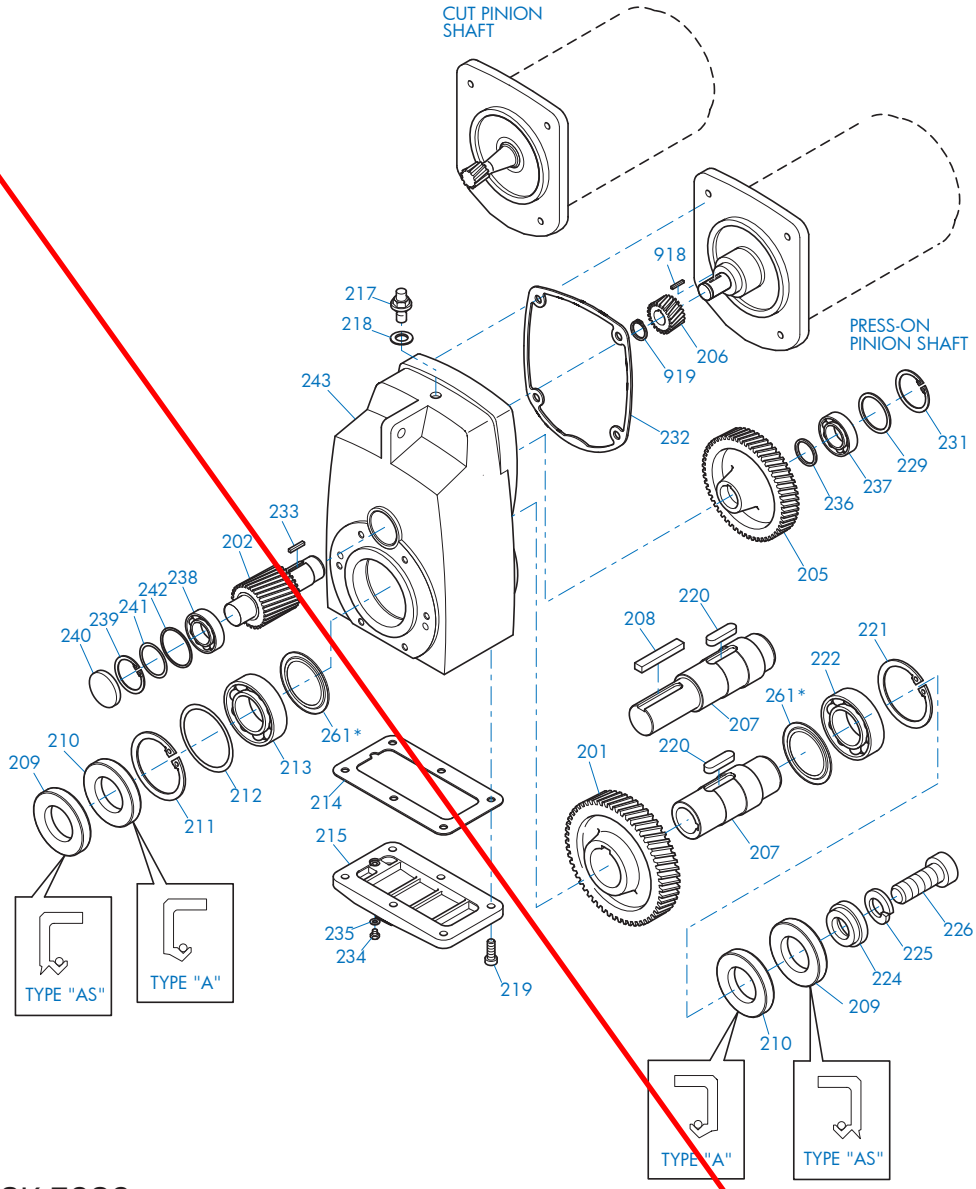


SK12/02 - SK103/52 Input Compound Reduction

12	Anti-Friction Bearing	115	Lock Washer	120	Intermediate Shaft, Gearcut
13	Nilos Ring*	116	Bolt	121	Bearing Sleeve*
16	Spacer*	117	Lock Washer	124	Snap Ring
25	Snap Ring	118	Bolt		
109	Oil Seal	119	Intermediate Shaft, Plain		
114	Intermediate Flange				

* Conditionally used part

CLINCHER
PARTS LIST DRAWINGS



SK 0182NB - SK 5282

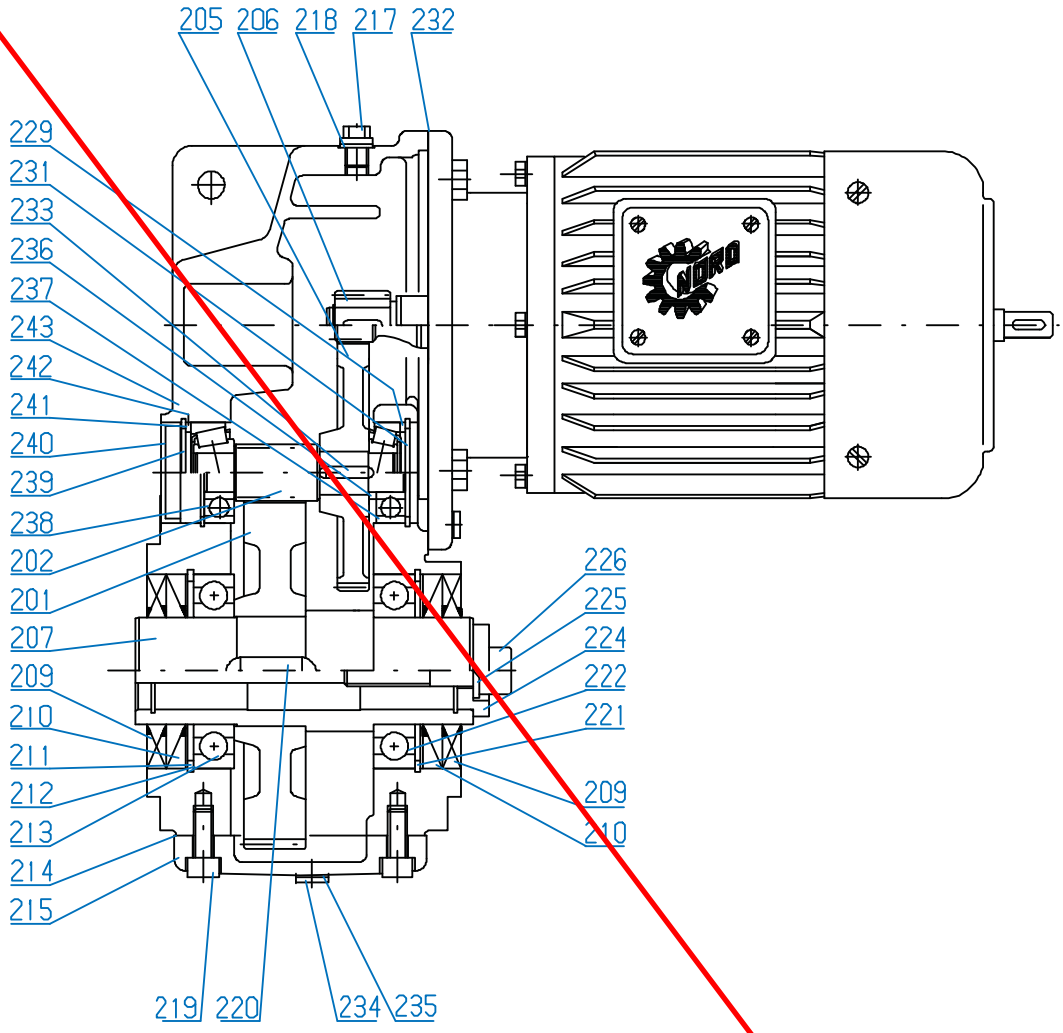
201 Gear	217 Vent Plug	234 Drain Plug
202 Pinion Shaft	218 Gasket	235 Gasket
205 Gear	219 Bolt	236 Thrust Washer
206 Pinion	220 Key	237 Anti-Friction Bearing
207 Output Shaft	221 Snap Ring	238 Anti-Friction Bearing
208 Key	222 Anti-Friction Bearing	239 Snap Ring
209 Oil Seal	224 Retaining Washer	240 Bore Plug
210 Oil Seal	225 Lock Washer	241 Shim
211 Snap Ring	226 Bolt	242 Thrust Washer
212 Shim	229 Thrust Washer	243 Gearcase
213 Anti-Friction Bearing	231 Snap Ring	261 Nilos Ring*
214 Gasket	232 Gasket	918 Key
215 Inspection Cover	233 Key	919 Snap Ring

* Conditionally used part

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

CLINCHER
PARTS LIST DRAWINGS

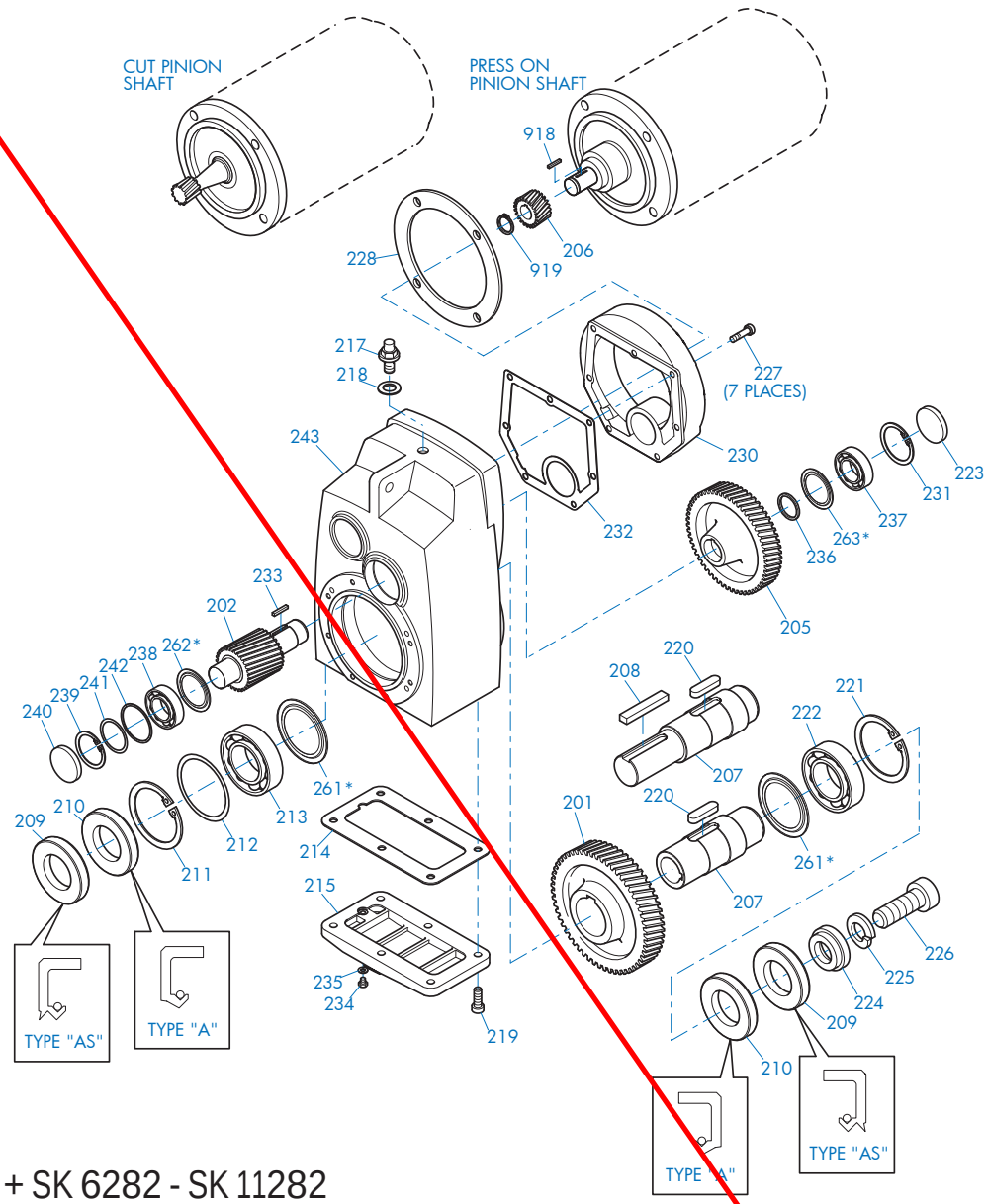


SK 0182NB - SK 5282

201 Gear	217 Vent Plug	233 Key
202 Pinion Shaft	218 Gasket	234 Drain Plug
205 Gear	219 Bolt	235 Gasket
206 Pinion	220 Key	236 Thrust Washer
207 Output Shaft	221 Snap Ring	237 Anti-Friction Bearing
209 Oil Seal	222 Anti-Friction Bearing	238 Anti-Friction Bearing
210 Oil Seal	224 Retaining Washer	239 Snap Ring
211 Snap Ring	225 Lock Washer	240 Bore Plug
212 Shim	226 Bolt	241 Shim
213 Anti-Friction Bearing	229 Thrust Washer	242 Thrust Washer
214 Gasket	231 Snap Ring	243 Gearcase
215 Inspection Cover	232 Gasket	261 Nilos Ring*

* Conditionally used part

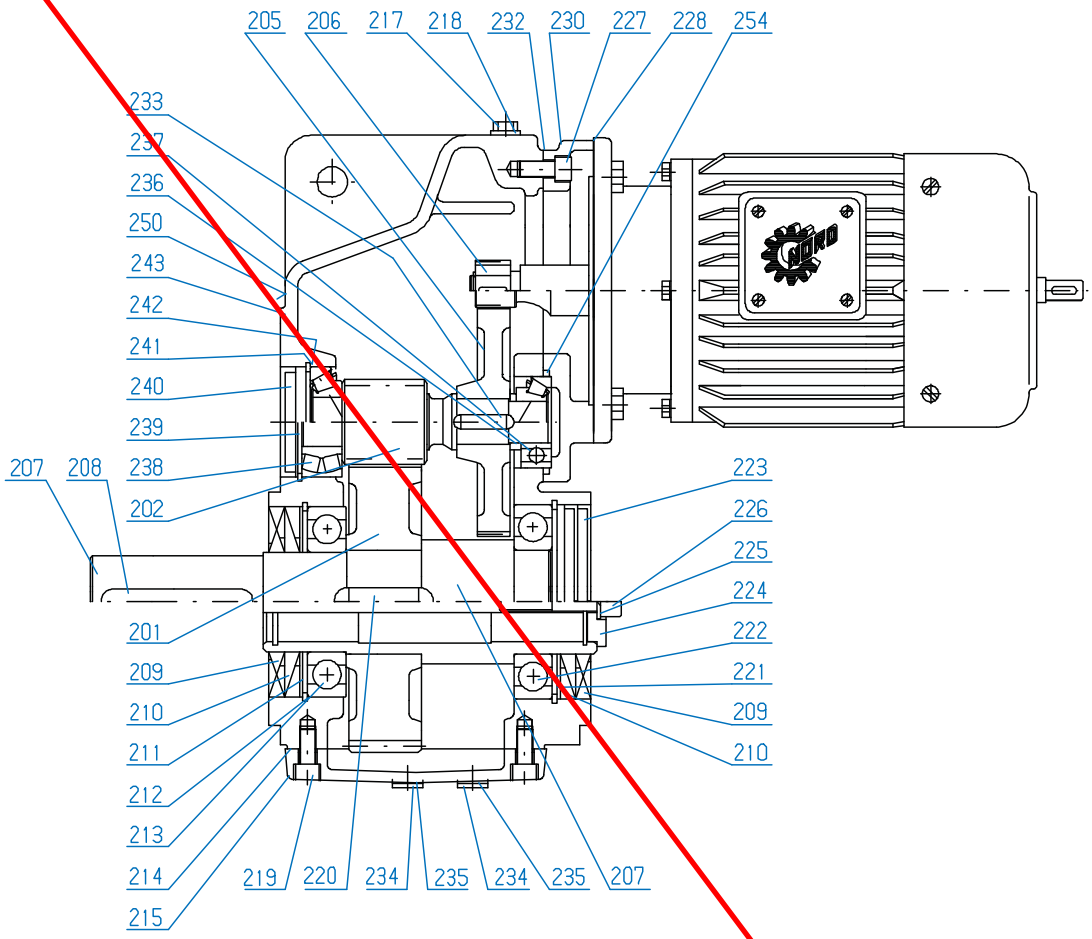
CLINCHER
PARTS LIST DRAWINGS



SK 0282NB + SK 6282 - SK 11282

201 Gear	219 Bolt	236 Thrust Washer
202 Pinion Shaft	220 Key	237 Anti-Friction Bearing
205 Gear	221 Snap Ring	238 Anti-Friction Bearing
206 Pinion	222 Anti-Friction Bearing	239 Snap Ring
207 Output Shaft	224 Retaining Washer	240 Bore Plug
208 Key	225 Lock Washer	241 Shim
209 Oil Seal	226 Bolt	242 Thrust Washer
210 Oil Seal	227 Bolt	243 Gear case
211 Snap Ring	228 Gasket	261 Nilos Ring*
212 Shim	230 Input Cover	262 Nilos Ring*
213 Anti-Friction Bearing	231 Snap Ring	263 Nilos Ring*
214 Gasket	232 Gasket	918 Key
215 Inspection Cover	233 Key	919 Snap Ring
217 Vent Plug	234 Drain Plug	
218 Gasket	235 Gasket	

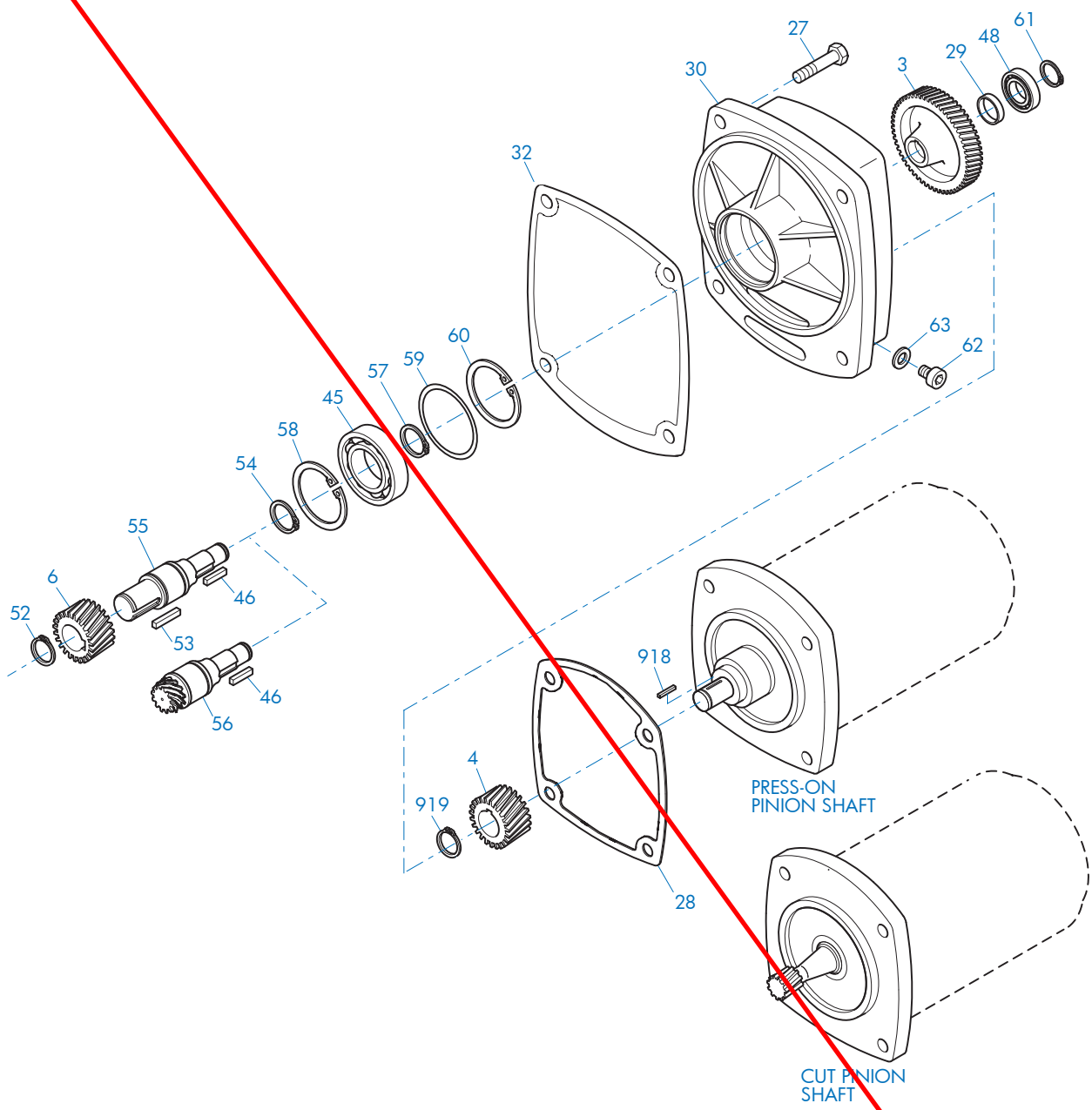
* Conditionally used part



SK 0282NB + SK 6282 - SK 11282

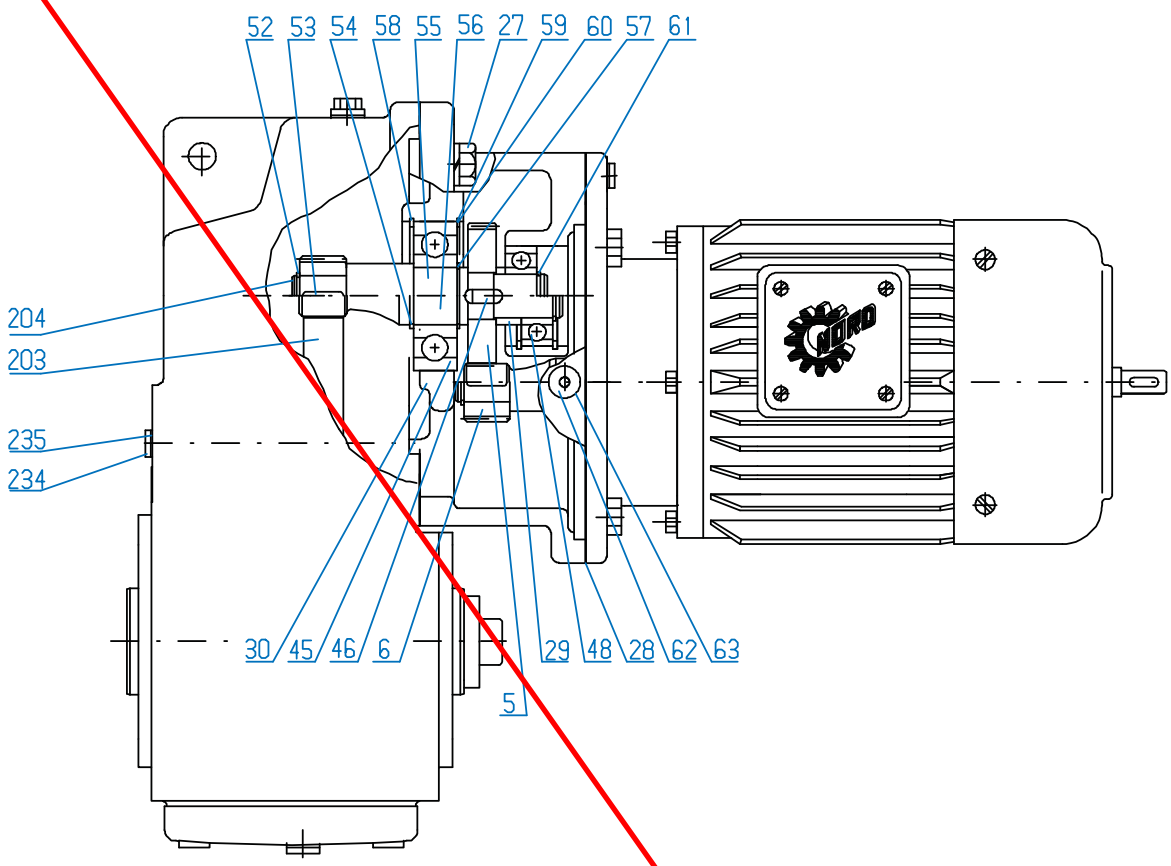
201 Gear	218 Gasket	234 Drain Plug
202 Pinion Shaft	219 Bolt	235 Gasket
205 Gear	220 Key	236 Thrust Washer
206 Pinion	221 Snap Ring	237 Anti-Friction Bearing
207 Output Shaft	222 Anti-Friction Bearing	238 Anti-Friction Bearing
208 Key	223 Bore Plug	239 Snap Ring
209 Oil Seal	224 Retaining Washer	240 Bore Plug
210 Oil Seal	225 Lock Washer	241 Shim
211 Snap Ring	226 Bolt	242 Thrust Washer
212 Shim	227 Bolt	243 Gear case
213 Anti-Friction Bearing	228 Gasket	250 Bore Plug
214 Gasket	230 Input Cover	261 Nilos Ring*
215 Inspection Cover	232 Gasket	262 Nilos Ring*
217 Vent Plug	233 Key	263 Nilos Ring*

* Conditionally used part



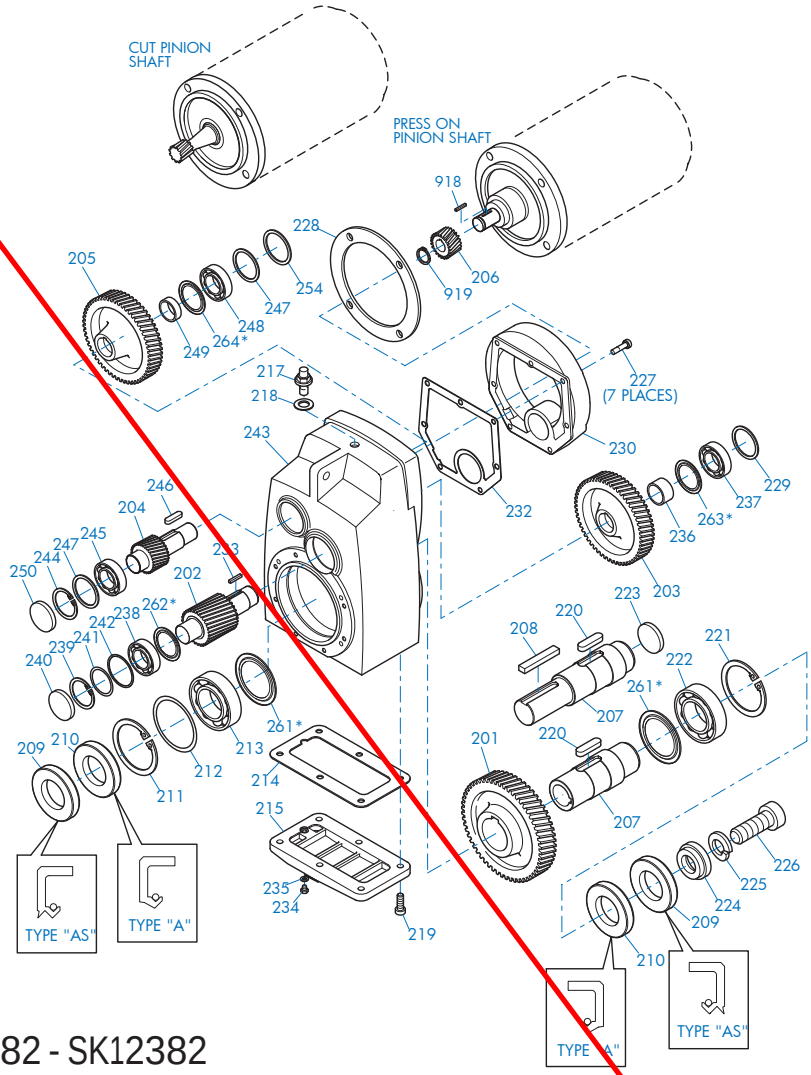
SK 2382 - SK 5382 Third Stage Reduction Housing

3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	918	Key
30	Third Reduction Gearcase	56	Intermediate Shaft, Gearcut	919	Snap Ring
32	Gasket	57	Snap Ring		
45	Anti-Friction Bearing	58	Snap Ring		



SK 2382 - SK 5382 Third Stage Reduction Housing

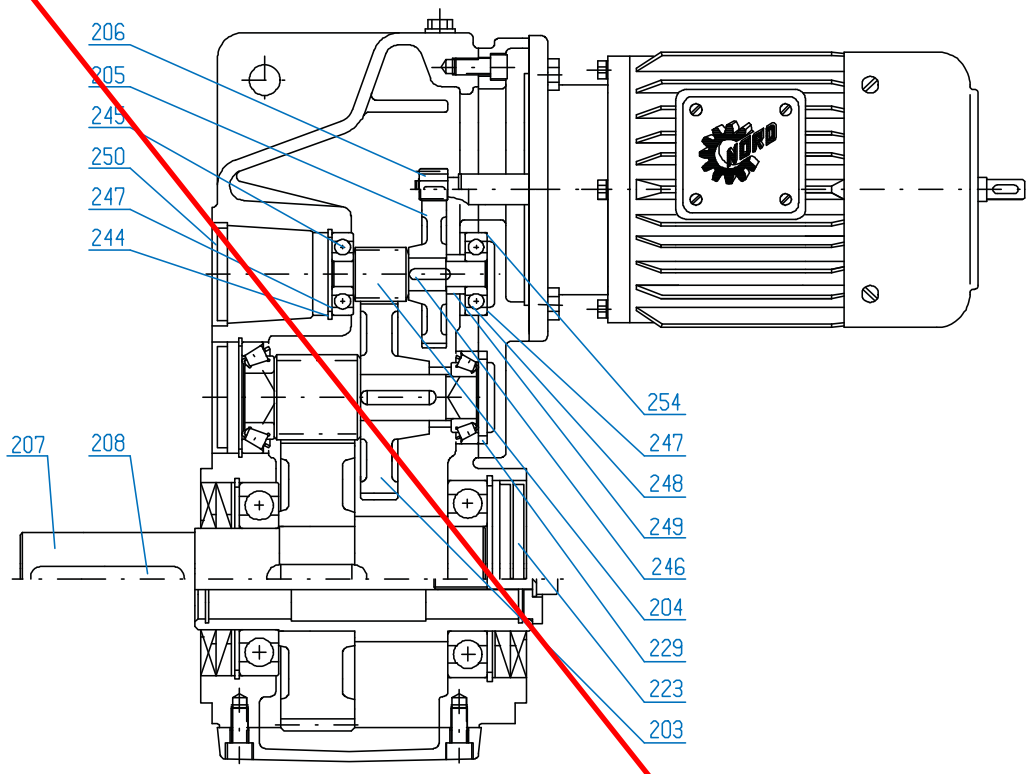
3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	203	Gear
32	Gasket	56	Intermediate Shaft, Gearcut	204	Pinion Shaft
30	Third Reduction Gearcase	57	Snap Ring	234	Oil Plug
45	Anti-Friction Bearing	58	Snap Ring	235	Gasket



SK 1382 NB + SK 6382 - SK12382

201 Gear	221 Snap Ring	241 Shim
202 Pinion Shaft	222 Anti-Friction Bearing	242 Thrust Washer
203 Gear	223 Bore Plug	243 Gearcase
204 Pinion Shaft	224 Retaining Washer	244 Snap Ring
205 Gear	225 Lock Washer	245 Anti-Friction Bearing
206 Pinion	226 Bolt	246 Key
207 Output Shaft	227 Bolt	247 Shim
208 Key	228 Gasket	248 Anti-Friction Bearing
209 Oil Seal	229 Thrust Washer	249 Spacer
210 Oil Seal	230 Input Cover	250 Bore Plug
211 Snap Ring	232 Gasket	254 Thrust Washer
212 Shim	233 Key	261 Nilos Ring*
213 Anti-Friction Bearing	234 Drain Plug	262 Nilos Ring*
214 Gasket	235 Gasket	263 Nilos Ring*
215 Inspection Cover	236 Thrust Washer	264 Nilos Ring*
217 Vent Plug	237 Anti-Friction Bearing	918 Key
218 Gasket	238 Anti-Friction Bearing	919 Snap Ring
219 Bolt	239 Snap Ring	
220 Key	240 Bore Plug	

* Conditionally used part

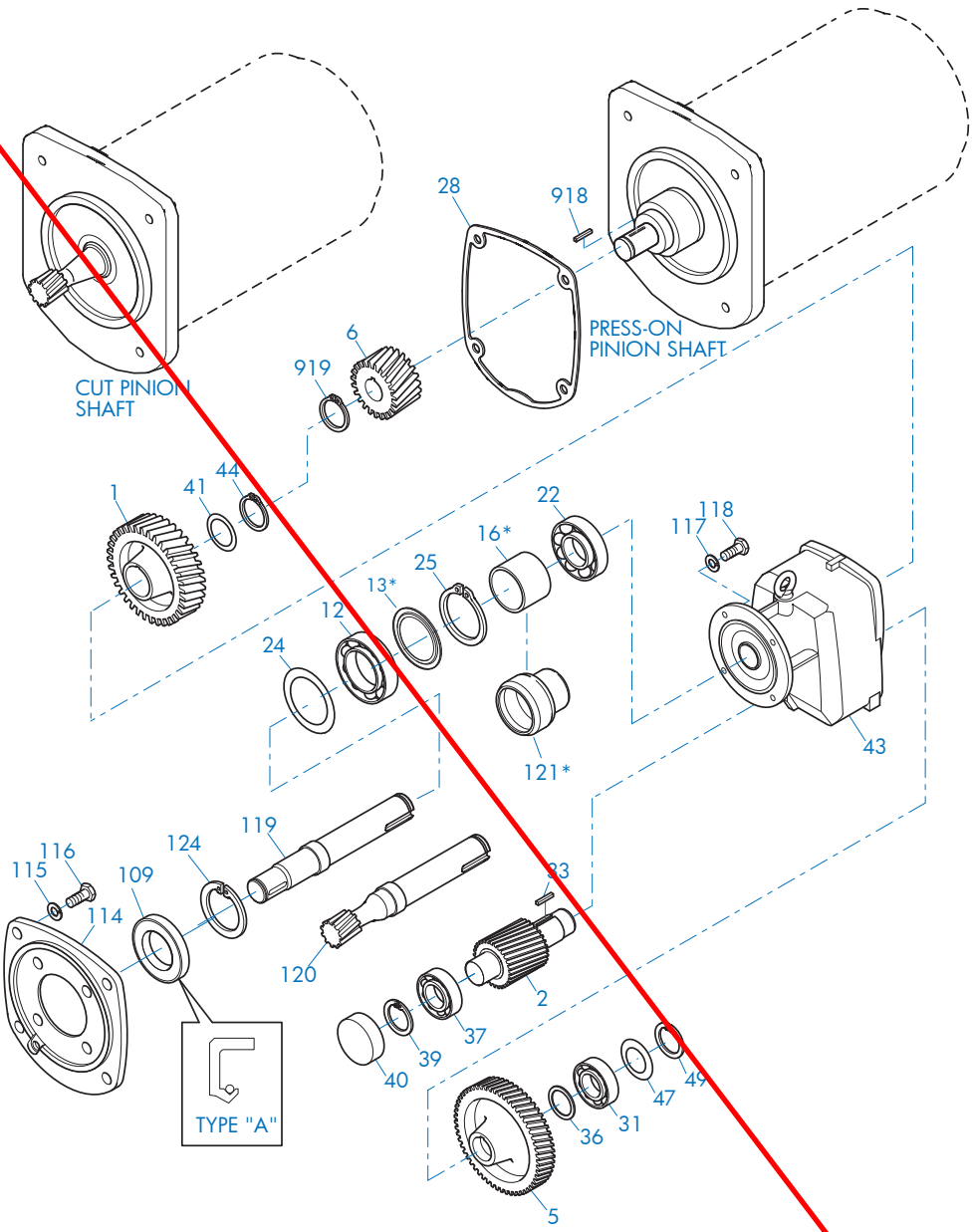


SK 1382 NB + SK 6382 - SK12382

203 Gear	229 Thrust Washer	250 Bore Plug
204 Pinion Shaft	244 Snap Ring	254 Thrust Washer
205 Gear	245 Anti-Friction Bearing	261 Nilos Ring*
206 Pinion	246 Key	262 Nilos Ring*
207 Output Shaft	247 Shim	263 Nilos Ring*
208 Key	248 Anti-Friction Bearing	264 Nilos Ring*
223 Bore Plug	249 Spacer	

* Conditionally used part

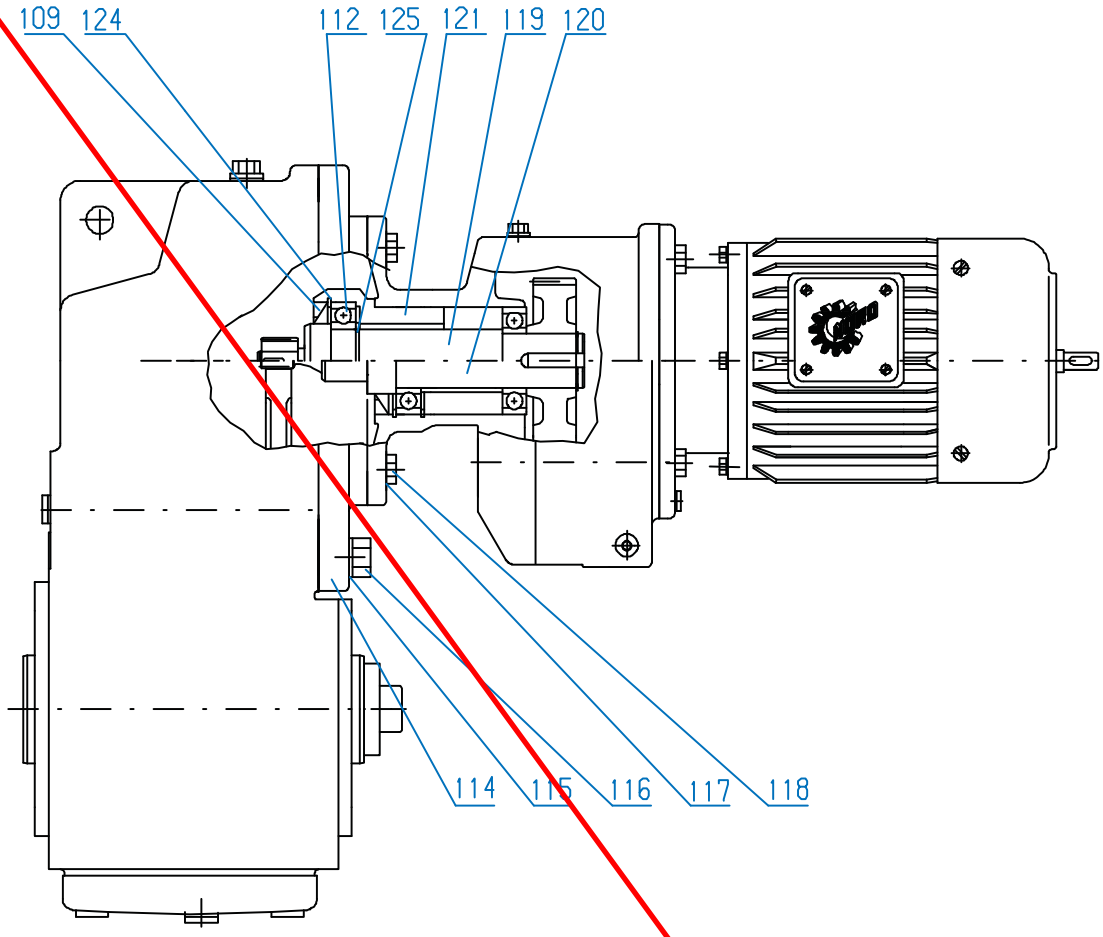
CLINCHER
PARTS LIST DRAWINGS



SK1282/02 - SK11382/52 Multi-stage Reduction Unit

1	Gear	33	Key	115	Lock Washer
2	Pinion Shaft	36	Spacer	116	Bolt
5	Gear	37	Anti-Friction Bearing	117	Lock Washer
6	Pinion	39	Snap Ring	118	Bolt
12	Anti-Friction Bearing	40	Bore Plug	119	Intermediate Shaft, Plain
13	Nilos Ring*	41	Shim	120	Intermediate Shaft, Gearcut
16	Spacer*	43	Gearcase	121	Bearing Sleeve*
22	Anti-Friction Bearing	44	Snap Ring	124	Snap Ring
24	Shim	47	Shim	918	Key
25	Snap Ring	49	Snap Ring	919	Snap Ring
28	Gasket	109	Oil Seal		
31	Anti-Friction Bearing	114	Intermediate Flange		

* Conditionally used part

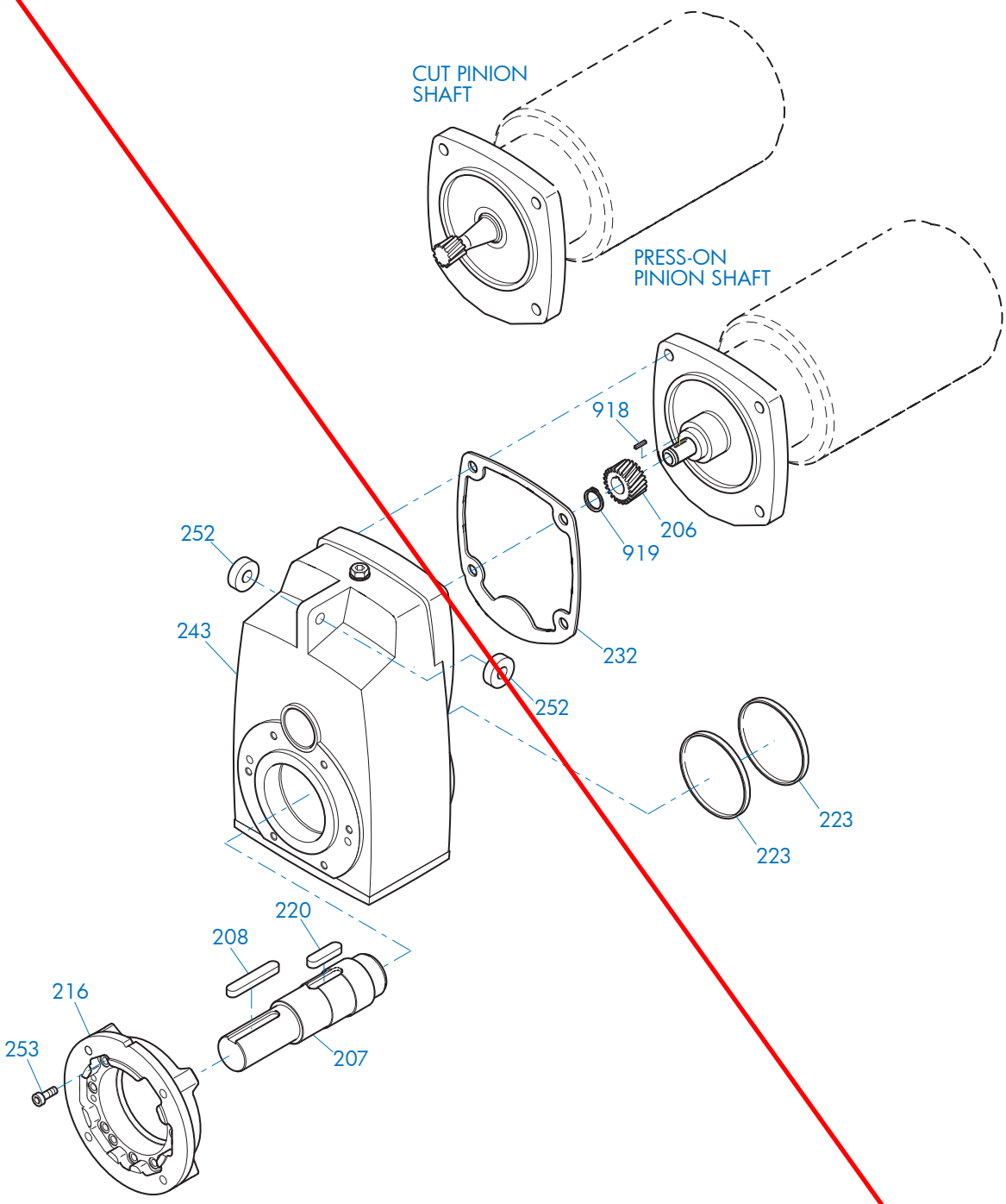


SK 1282/02 - SK 11382/52

12 Anti-friction Bearing	114 Intermediate Flange	119 Intermediate Shaft, Plain
13 Nilos Ring*	115 Lock Washer	120 Intermediate Shaft, Gearcut
16 Spacer	116 Bolt	121 Bearing Sleeve
25 Snap Ring	117 Lock Washer	124 Snap Ring
109 Oil Seal	118 Bolt	

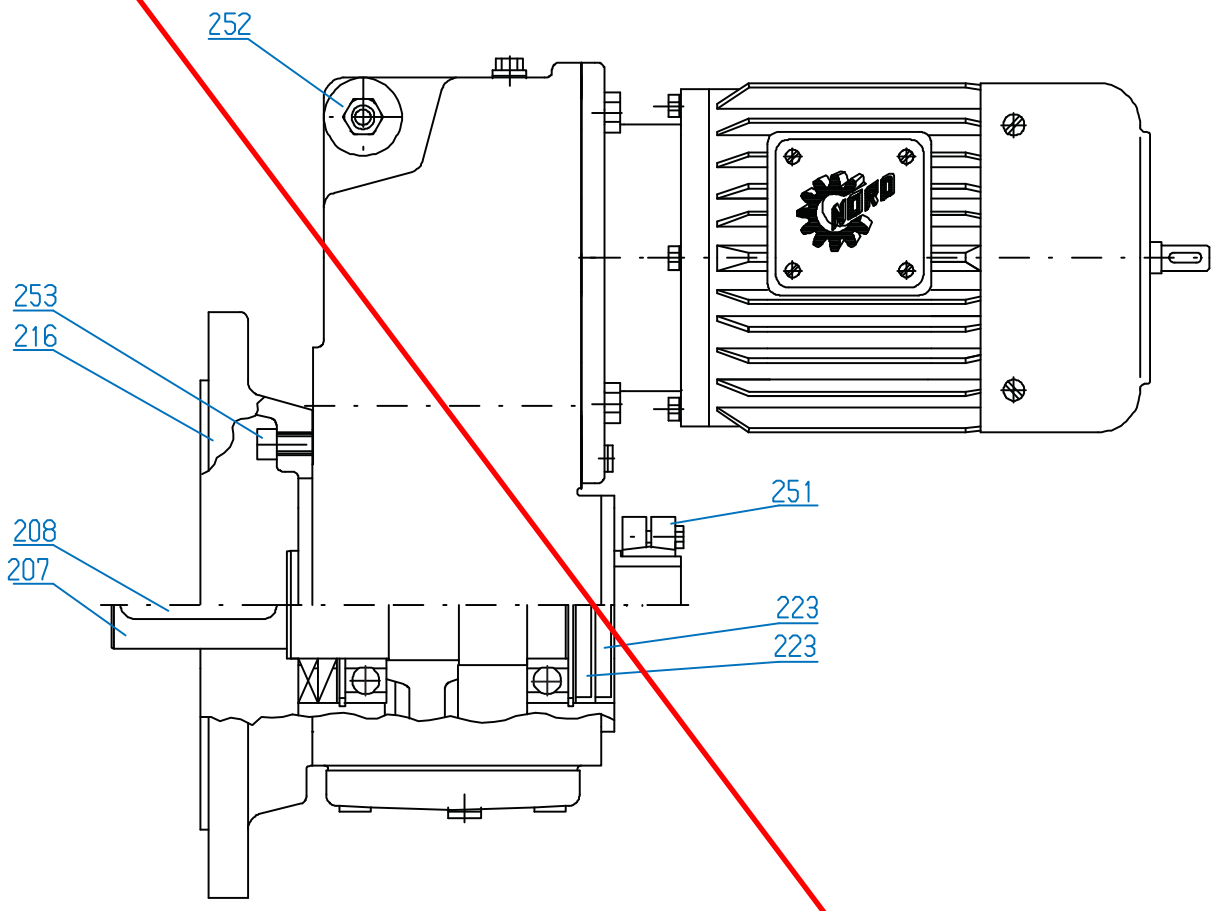
* Conditionally used part

CLINCHER
PARTS LIST DRAWINGS



SK 0182NB - SK 11282 & SK 1382 - SK 11382

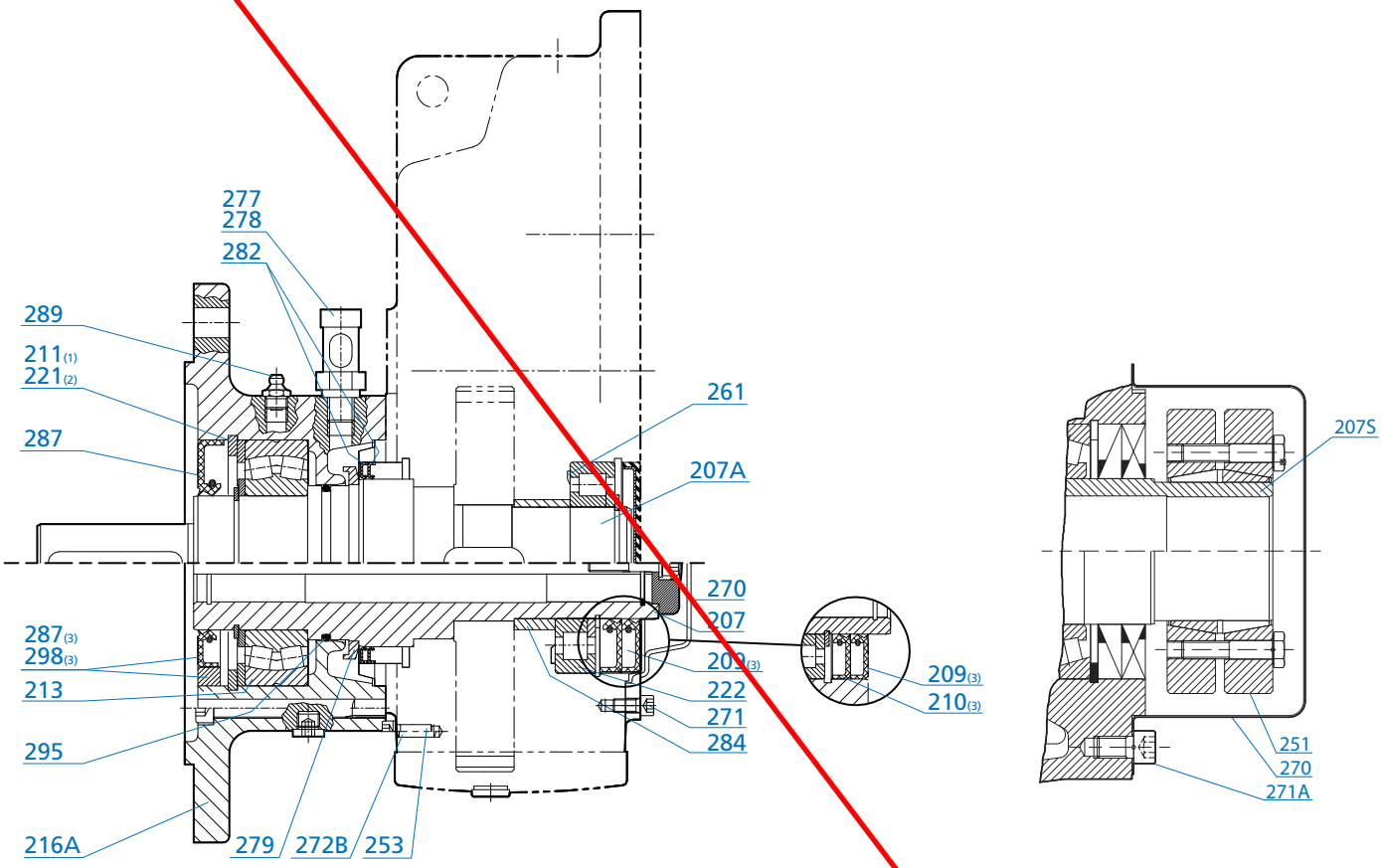
206 Pinion	220 Key	252 Rubber Buffer
207 Output Shaft	223 Bore Plug	253 Bolt
208 Key	232 Gasket	918 Key
216 Flange	243 Gearcase	919 Snap Ring



SK 0182NB - SK 11282 & SK 1382 - SK 11382

207 Output Shaft	223 Bore Plug	253 Bolt
208 Key	251 Shrink Disc	
216 Flange	252 Rubber Buffer	

CLINCHER VL2 & VL3
PARTS LIST DRAWINGS

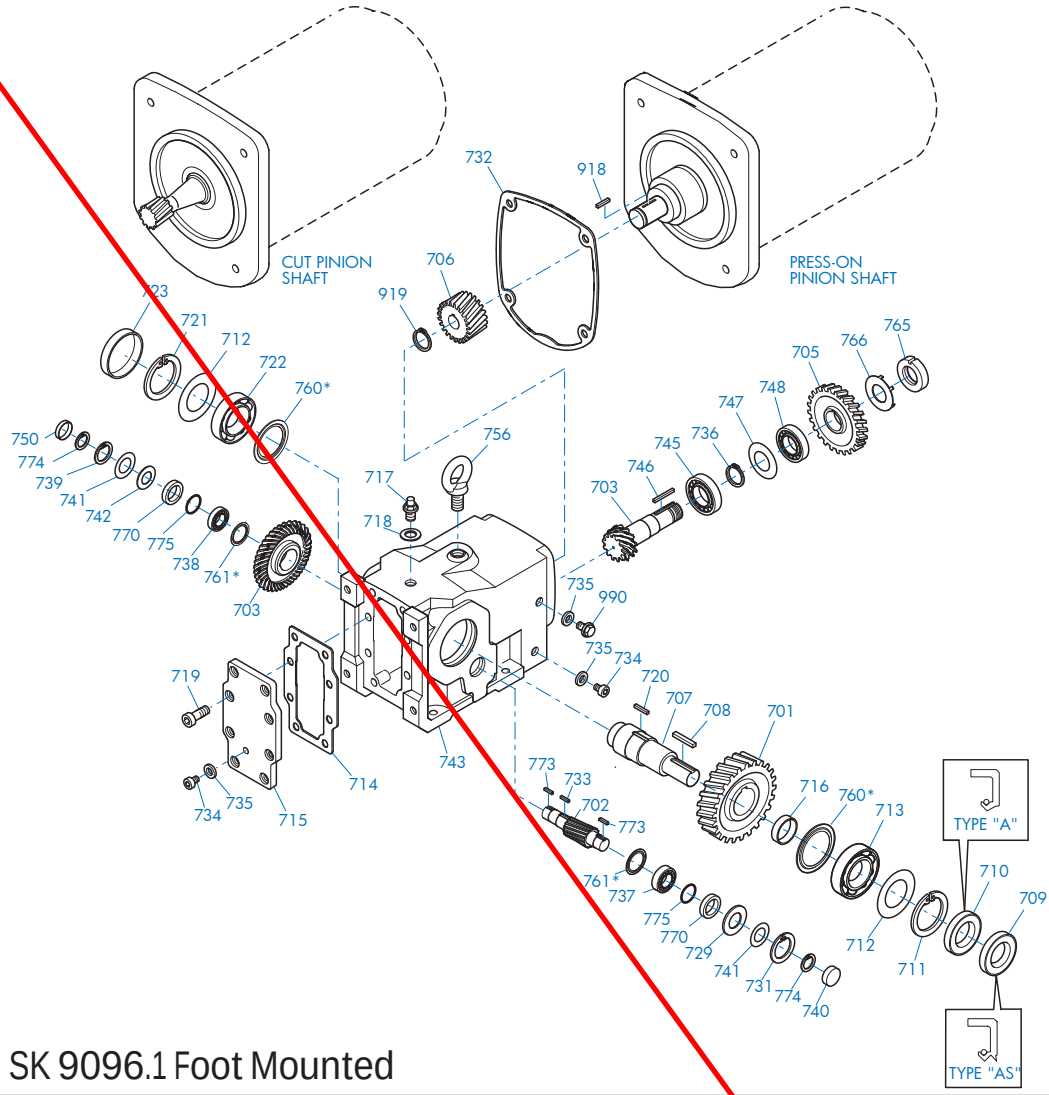


Parallel Helical Clincher VL2 & VL3

207A	Hollow Output Shaft	222	Bearing	278	Plug Gasket
207	Solid Output Shaft	251	Shrink Disk	279	Oil Slinger (VL3)
207S	Shrink Disk Hollow Shaft	253	Screw	282	Seal
209 (3)	Seal	261	NILOS Ring	284	Spacer
210 (3)	Seal	270	Shaft Cover	287 (3)	Seal
211 (1)	Snap Ring	271	Shaft Cover Screw	289	Grease Fitting
213	Bearing	272B	Dowel Pin	295	O-Ring
216A	Flange	277	Drain Plug (VL2)	298 (3)	Bushing
221(3)	Snap Ring	277	Oil Level Indicator (VL3)		

(1) = Needed for 2282/3282 **(3) = Varies By Unit**
(2) = Needed for 3282/3382

90.1 HELICAL-BEVEL PARTS LIST DRAWINGS

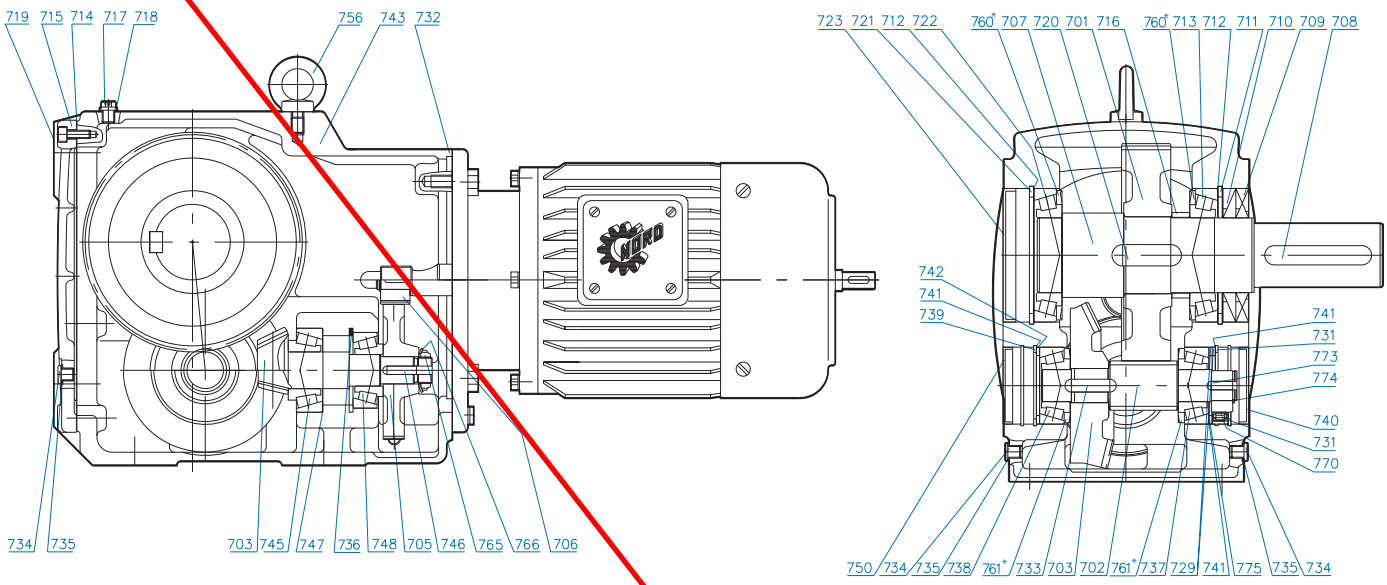


SK 9012.1 - SK 9096.1 Foot Mounted

701 Output Gear	721 Snap Ring	747 Shim
702 Pinion Shaft	722 Anti-Friction Bearing	748 Anti-Friction Bearing
703 Bevel Gearset	723 Bore Plug	750 Bore Plug
705 Gear	729 Thrust Washer	756 Flanged Eye Bolt
706 Pinion	731 Snap Ring	760 Nilos Ring*
707 Output Shaft	732 Gasket	761 Nilos Ring*
708 Key	733 Key	765 Slotted Round Nut
709 Oil Seal	734 Oil Plug	766 Tab Lock Washer
710 Oil Seal	735 Gasket	770 Backstop (If Equipped)
711 Snap Ring	736 Snap Ring	773 Key (w/Backstop)
712 Shim	737 Anti-Friction Bearing	774 Snap Ring (w/Backstop)
713 Anti-Friction Bearing	738 Anti-Friction Bearing	775 Thrust Washer (w/Backstop)
714 Gasket	739 Snap Ring	918 Key
715 Inspection Cover	740 Bore Plug	919 Snap Ring
716 Spacer	741 Shim	990 Oil Level Plug
717 Vent screw	742 Thrust Washer	
718 Gasket	743 Gearcase	
719 Bolt	745 Anti-Friction Bearing	
720 Key	746 Key	

* Conditionally used part

90.1 HELICAL-BEVEL PARTS LIST DRAWINGS

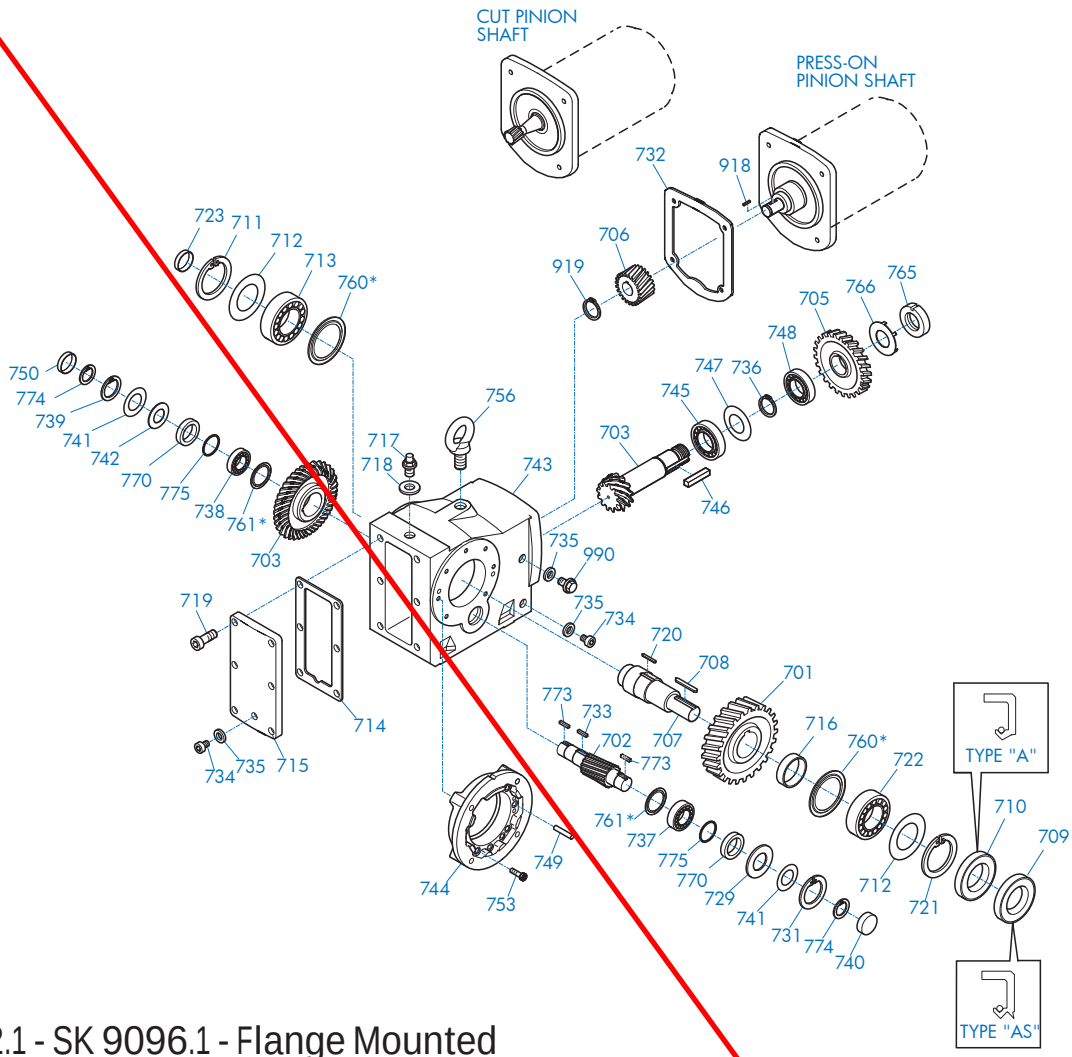


SK 9012.1 - SK 9096.1 Foot Mounted

701 Output Gear
702 Pinion Shaft
703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
708 Key
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
717 Vent
718 Gasket
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
723 Bore Plug
729 Thrust Washer
731 Snap Ring
732 Gasket
733 Key
734 Oil Plug
735 Gasket
736 Snap Ring
737 Anti-Friction Bearing
738 Anti-Friction Bearing
739 Snap Ring
740 Bore Plug
741 Shim
742 Thrust Washer
743 Gearcase
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
750 Bore Plug
756 Flanged Eye Bolt
760 Nilos Ring*
761 Nilos Ring*
765 Slotted Round Nut
766 Tab Lock Washer
770 Backstop (If Equipped)
773 Key (w/Backstop)
774 Snap Ring (w/Backstop)
775 Thrust Washer (w/Backstop)

* Conditionally used part

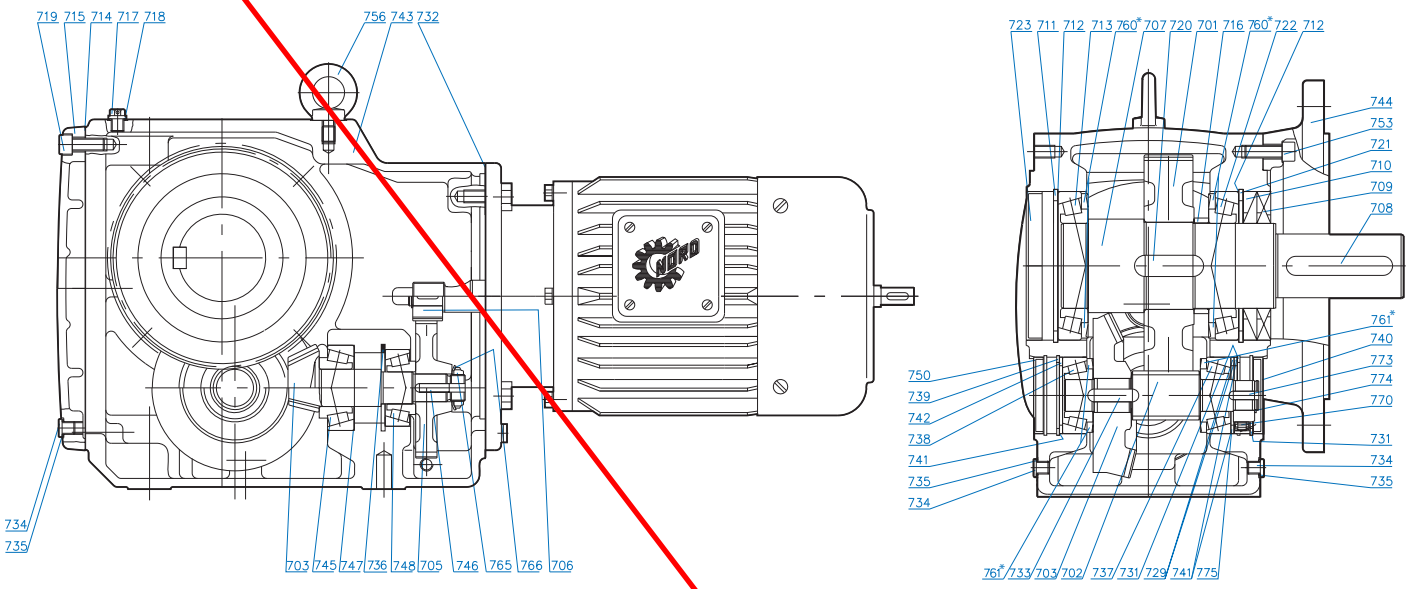
90.1 HELICAL-BEVEL PARTS LIST DRAWINGS



SK 9012.1 - SK 9096.1 - Flange Mounted

701 Output Gear
702 Pinion Shaft
703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
708 Key
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
717 Vent Plug
718 Gasket
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
723 Bore Plug
729 Thrust Washer
731 Snap Ring
732 Gasket
733 Key
734 Oil plug
735 Gasket
736 Snap Ring
737 Anti-Friction Bearing
738 Anti-Friction Bearing
739 Snap Ring
740 Bore Plug
741 Shim
742 Thrust Washer
743 Gearcase
744 Flange
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
749 Dowel Pin
750 Bore Plug
753 Bolt
756 Flanged Eye Bolt
760 Nilos Ring*
761 Nilos Ring*
765 Slotted Round Nut
766 Tab Lock Washer
770 Backstop (If Equipped)
773 Key (w/Backstop)
774 Snap Ring (w/Backstop)
775 Thrust Washer (w/Backstop)
918 Key
919 Snap Ring
990 Oil Level Plug

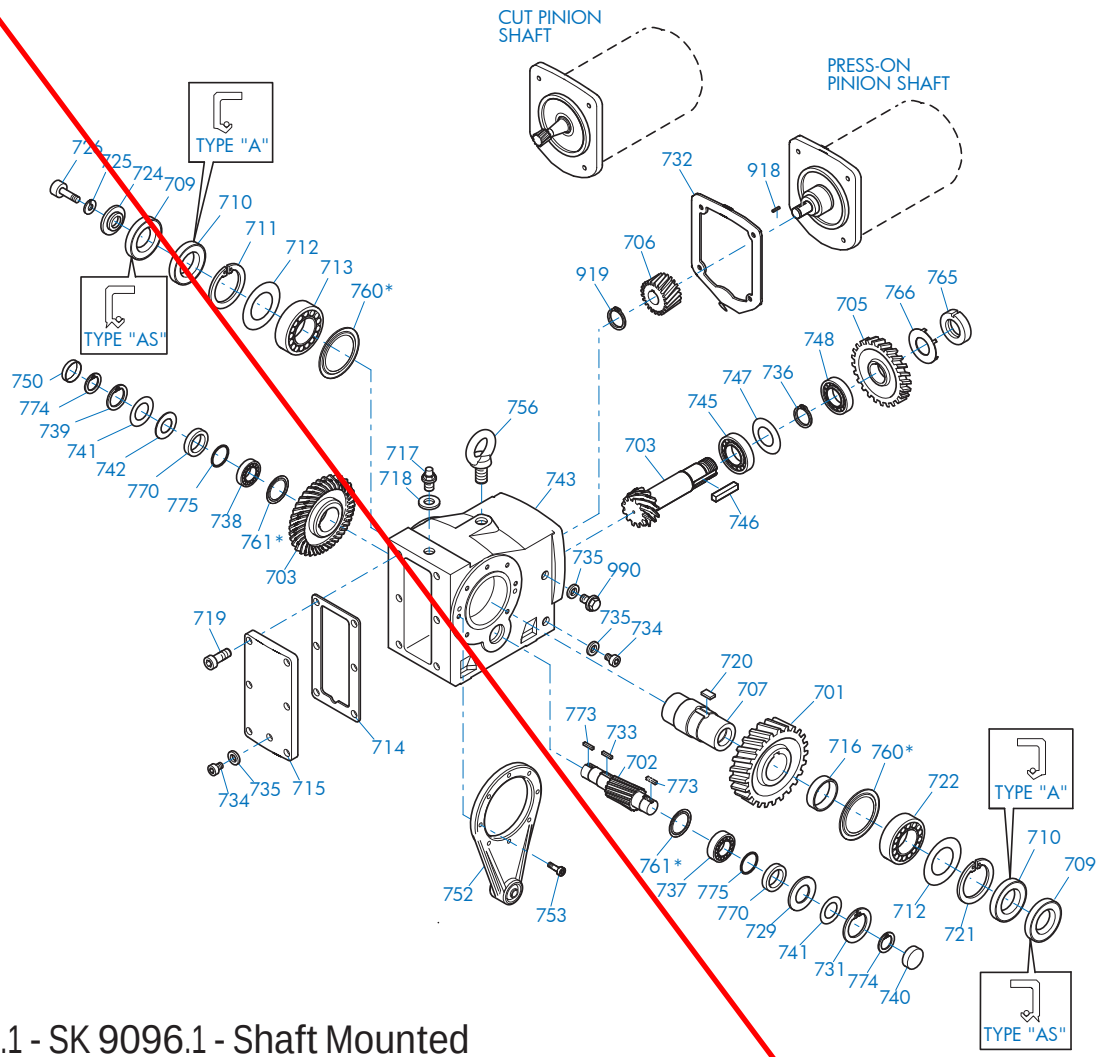
* Conditionally used part



SK 9012.1 - SK 9096.1 - Flange Mounted

701 Output Gear
702 Pinion Shaft
703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
708 Key
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
717 Vent Plug
718 Gasket
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
723 Bore Plug
729 Thrust Washer
731 Snap Ring
732 Gasket
733 Key
734 Oil plug
735 Gasket
736 Snap Ring
737 Anti-Friction Bearing
738 Anti-Friction Bearing
739 Snap Ring
740 Bore Plug
741 Shim
742 Thrust Washer
743 Gearcase
744 Flange
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
750 Bore Plug
753 Bolt
756 Flanged Eye Bolt
760 Nilos Ring*
761 Nilos Ring*
765 Slotted Round Nut
766 Tab Lock Washer
770 Backstop*
773 Key (w/Backstop)
774 Snap Ring (w/Backstop)
775 Thrust Washer (w/Backstop)

* Conditionally used part

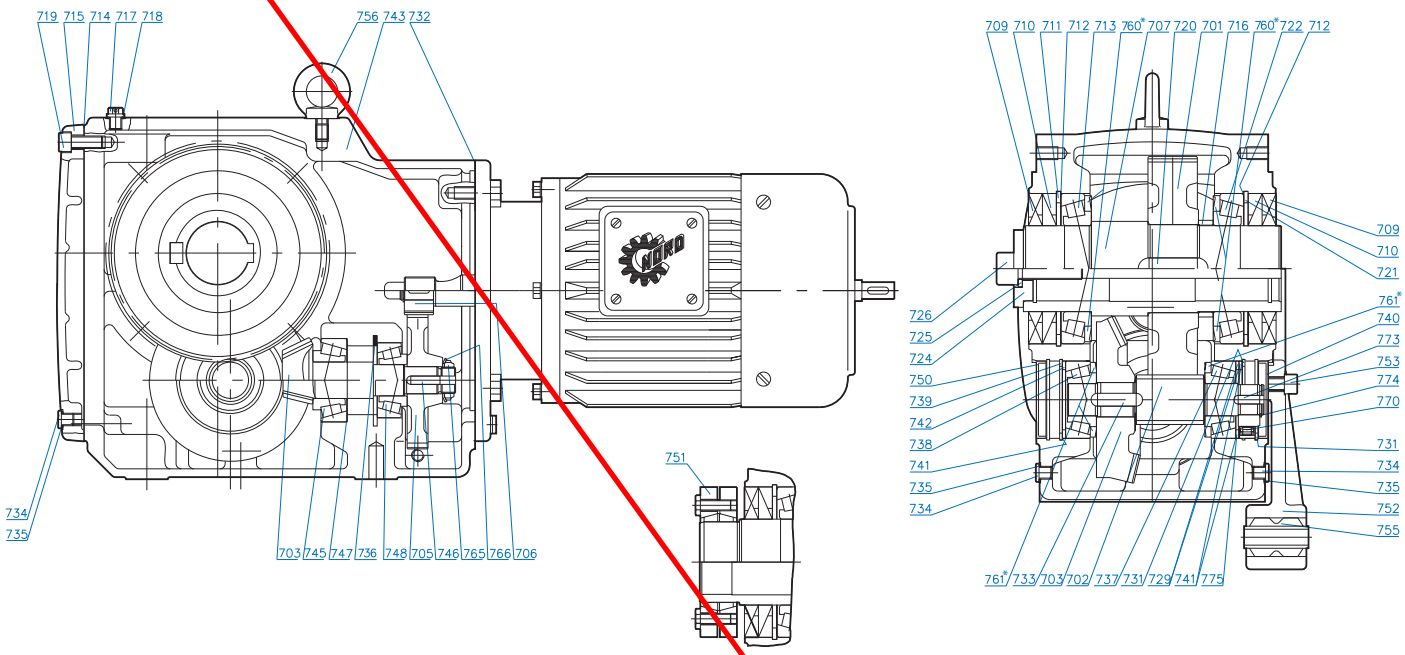


SK 9012.1 - SK 9096.1 - Shaft Mounted

701 Gear
702 Pinion Shaft
703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
717 Vent Plug
718 Gasket
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
724 Retaining Washer
725 Lock Washer
726 Bolt
729 Thrust Washer
731 Snap Ring
732 Gasket
733 Key
734 Oil plug
735 Gasket
736 Snap Ring
737 Anti-Friction Bearing
738 Anti-Friction Bearing
739 Snap Ring
740 Bore Plug
741 Shim
742 Thrust Washer
743 Gearcase
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
750 Bore Plug
752 Torque Arm
753 Bolt
756 Flanged Eye Bolt
760 Nilos Ring*
761 Nilos Ring*
765 Slotted Round Nut
766 Tab Lock Washer
770 Backstop (If Equipped)
773 Key (w/Backstop)
774 Snap Ring (w/Backstop)
775 Thrust Washer (w/Backstop)
918 Key
919 Snap Ring
990 Oil Level Plug

* Conditionally used part

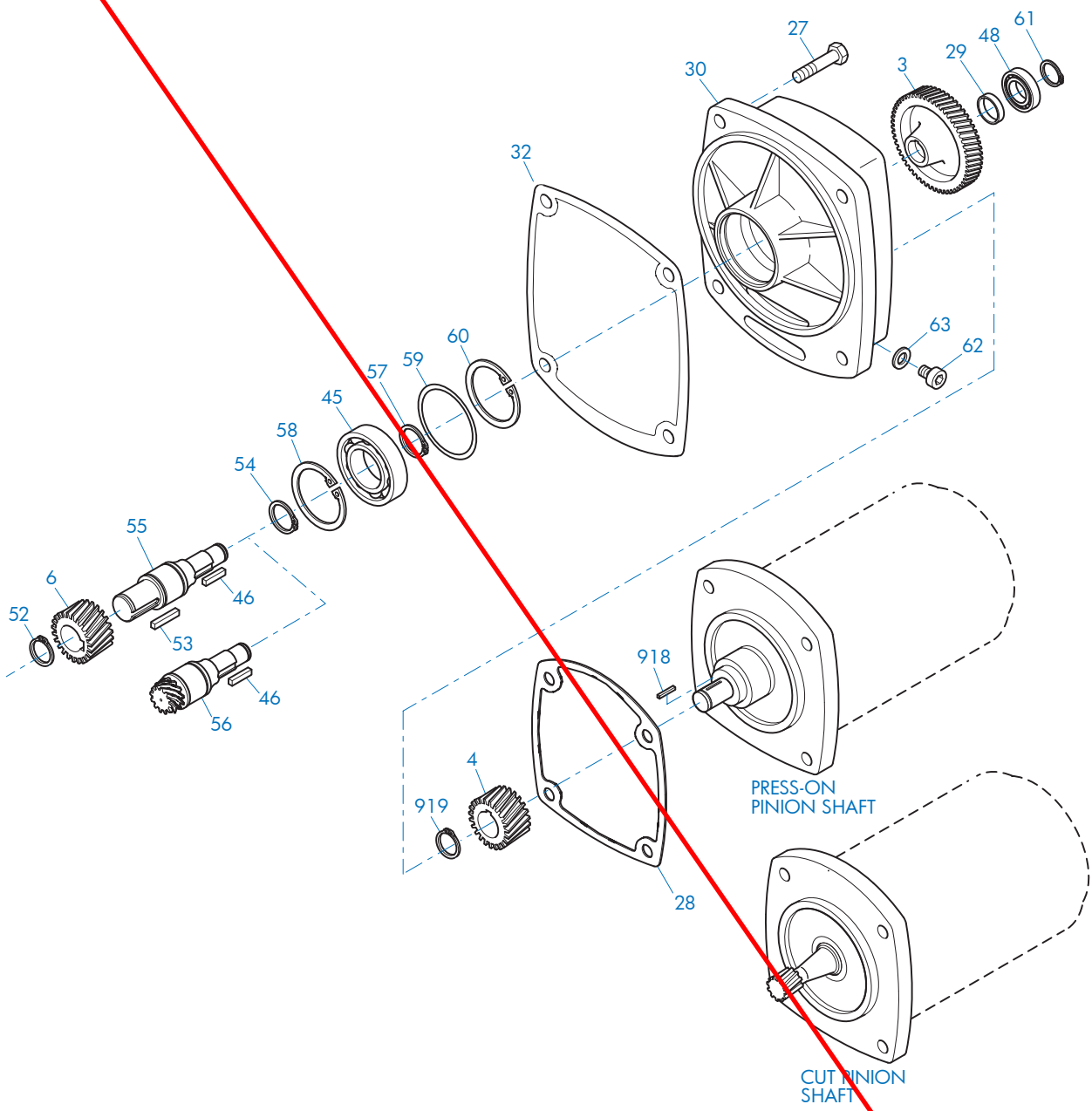
90.1 HELICAL-BEVEL PARTS LIST DRAWINGS



SK 9012.1 - SK 9096.1 - Shaft Mounted

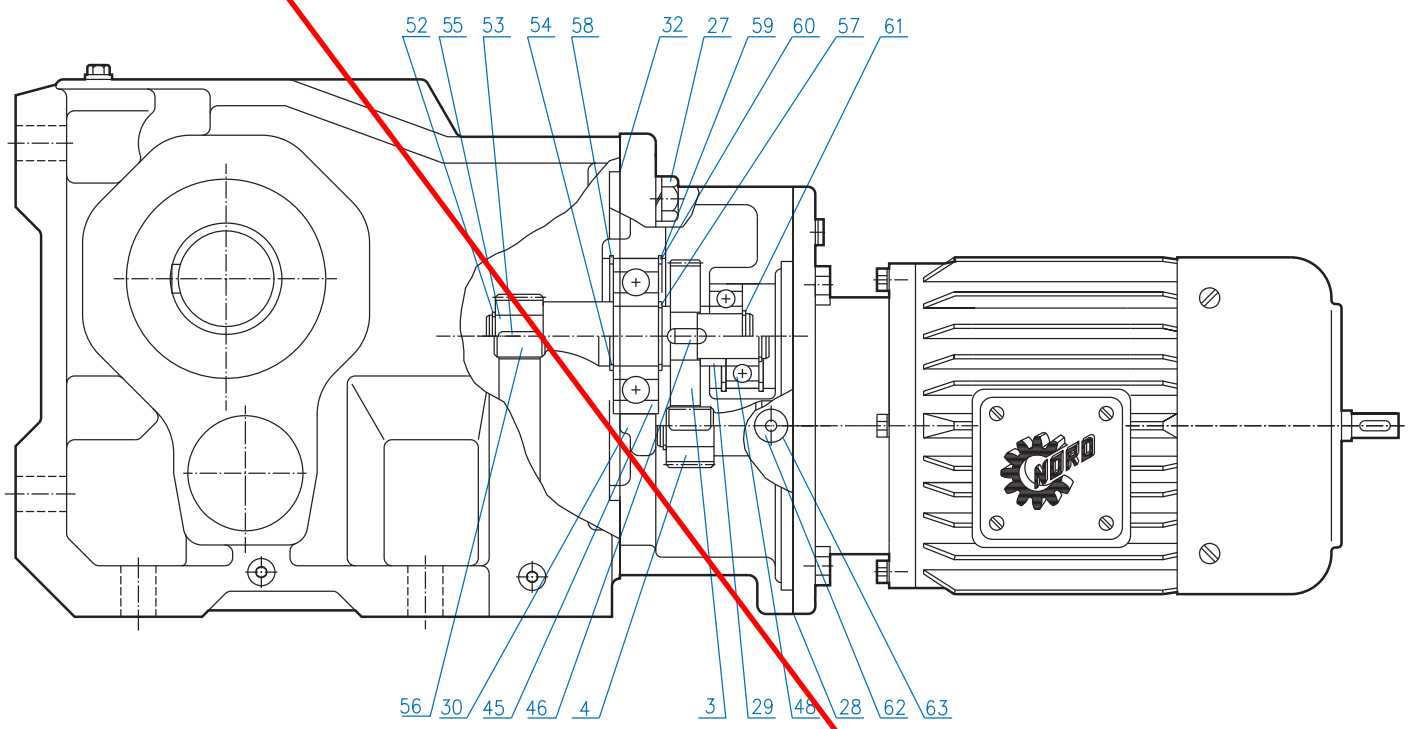
701 Gear
702 Pinion Shaft
703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
717 Vent Plug
718 Seal
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
724 Washer
725 Lock Washer
726 Bolt
729 Thrust Washer
731 Snap Ring
732 Gasket
733 Key
734 Oil plug
735 Gasket
736 Snap Ring
737 Anti-Friction Bearing
738 Anti-Friction Bearing
739 Snap Ring
740 Bore Plug
741 Shim
742 Thrust Washer
743 Gearcase
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
750 Bore Plug
751 Shrink Disc
752 Torque Arm
753 Bolt
755 Rubber Buffer
756 Flanged Eye Bolt
760 Nilos Ring*
761 Nilos Ring*
765 Slotted Round Nut
766 Tab Lock Washer
770 Backstop*
773 Key (w/Backstop)
774 Snap Ring (w/Backstop)
775 Thrust Washer (w/Backstop)

* Conditionally used part



SK9013.1 - SK9053.1 Third Stage Reduction Gear

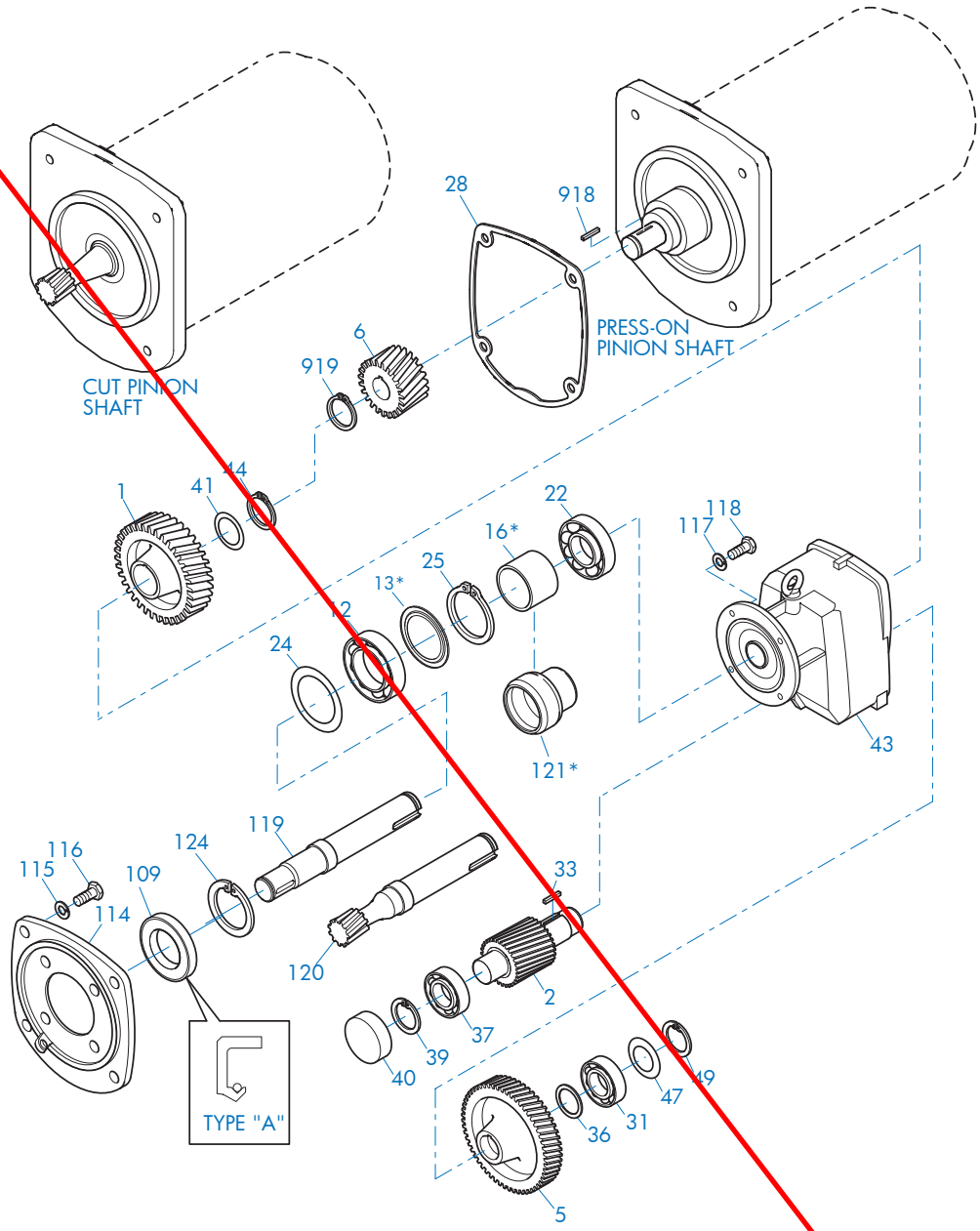
3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	918	Key
30	Third Reduction Gearcase	56	Intermediate Shaft, Gearcut	919	Snap Ring
32	Gasket	57	Snap Ring		
45	Anti-Friction Bearing	58	Snap Ring		



SK9013.1 - SK9053.1 Third Stage Reduction Gear

3	Gear	46	Key	58	Snap Ring
4	Pinion	48	Anti-Friction Bearing	59	Shim
27	Bolt	52	Snap Ring	60	Snap Ring
28	Gasket	53	Key	61	Snap Ring
29	Spacer	54	Snap Ring	62	Oil Plug
30	Third Reduction Gearcase	55	Intermediate Shaft, Plain	63	Gasket
32	Gasket	56	Intermediate Shaft, Gearcut		
45	Anti-Friction Bearing	57	Snap Ring		

90.1 HELICAL-BEVEL PARTS LIST DRAWINGS

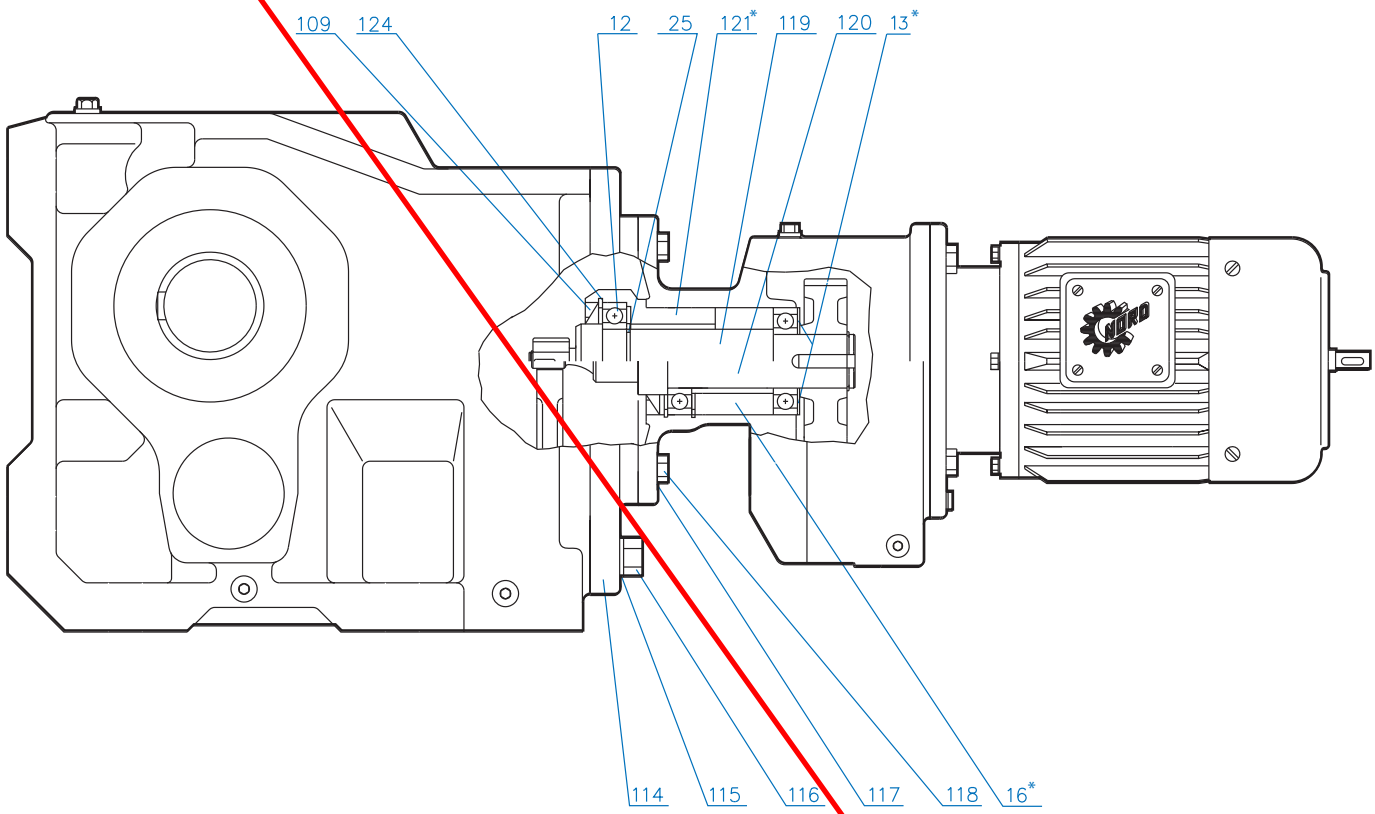


SK9062.1/32 - SK9092.1/52 Input Compound Reduction

1	Gear	33	Key	115	Lock Washer
2	Pinion Shaft	36	Spacer	116	Bolt
5	Gear	37	Anti-Friction Bearing	117	Lock Washer
6	Pinion	39	Snap Ring	118	Bolt
12	Anti-Friction Bearing	40	Bore Plug	119	Intermediate Shaft, Plain
13	Nilos Ring*	41	Shim	120	Intermediate Shaft, Gearcut
16	Spacer*	43	Gearcase	121	Bearing Sleeve*
22	Anti-Friction Bearing	44	Snap Ring	124	Snap Ring
24	Shim	47	Shim	918	Key
25	Snap Ring	49	Snap Ring	919	Snap Ring
28	Gasket	109	Oil Seal		
31	Anti-Friction Bearing	114	Intermediate Flange		

* Conditionally used part

90.1 HELICAL-BEVEL PARTS LIST DRAWINGS

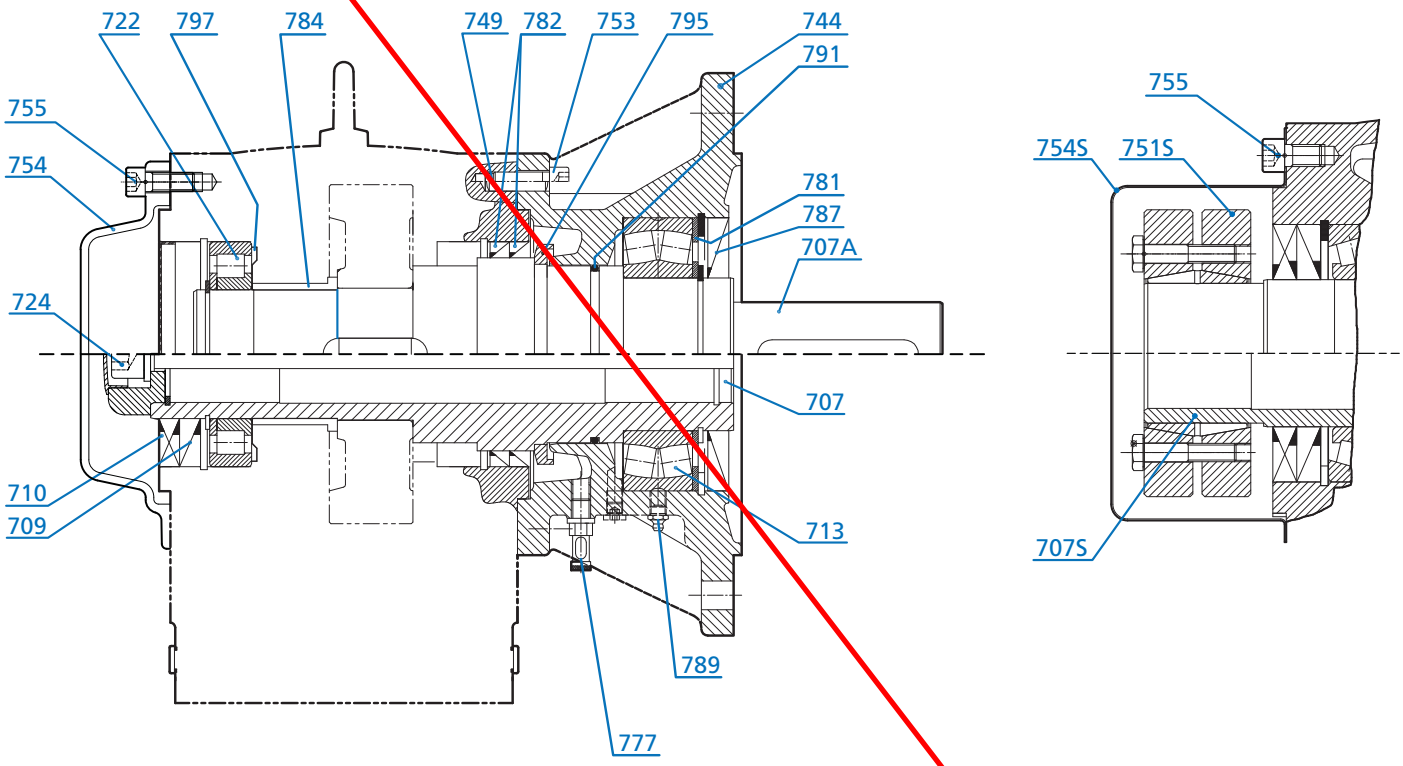


SK9062.1/32 - SK9092.1/52 Input Compound Reduction

11 Bearing	114 Intermediate Flange	119 Intermediate Shaft, Plain
13 Nilos Ring*	115 Lock Washer	120 Intermediate Shaft, Gearcut
16 Spacer*	116 Bolt	121 Bearing Sleeve *
25 Snap Ring	117 Lock Washer	124 Snap Ring
109 Oil Seal	118 Bolt	

* Conditionally used part

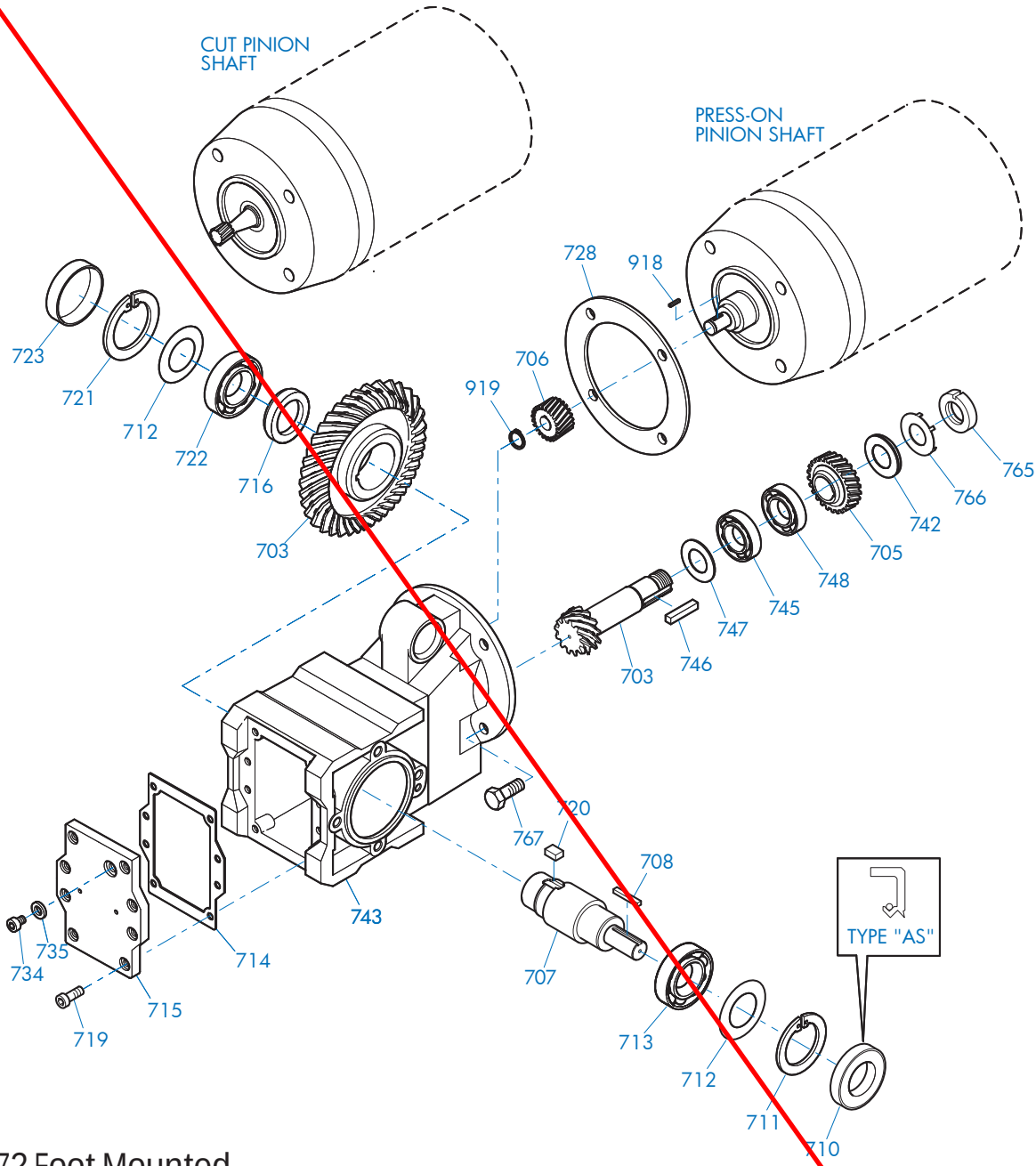
Helical Bevel VL2 & VL3
PARTS LIST DRAWINGS



Helical Bevel VL2 & VL3

707	Hollow Output Shaft	744	Flange VLII & VLIII	782	Seal
707A	Output Shaft	749	Dowel Pin	784	Spacer VLIII
707S	Shrink Disk Hollow Shaft	751S	Shrink Disk	787	Seal
709	Seal	753	Screw	789	Grease Fitting
710	Seal	754	Shaft Cover	791	O-Ring
711	Snap Ring	755	Shaft Cover Screw	795	Oil Slinger (VLIII Only)
713	Bearing	777	Drain Plug (VLII)	797	NILOS Ring
722	Bearing	777	Oil Indicator (VLIII Only)		
724	Fixing Kit	781	Axial Shim		

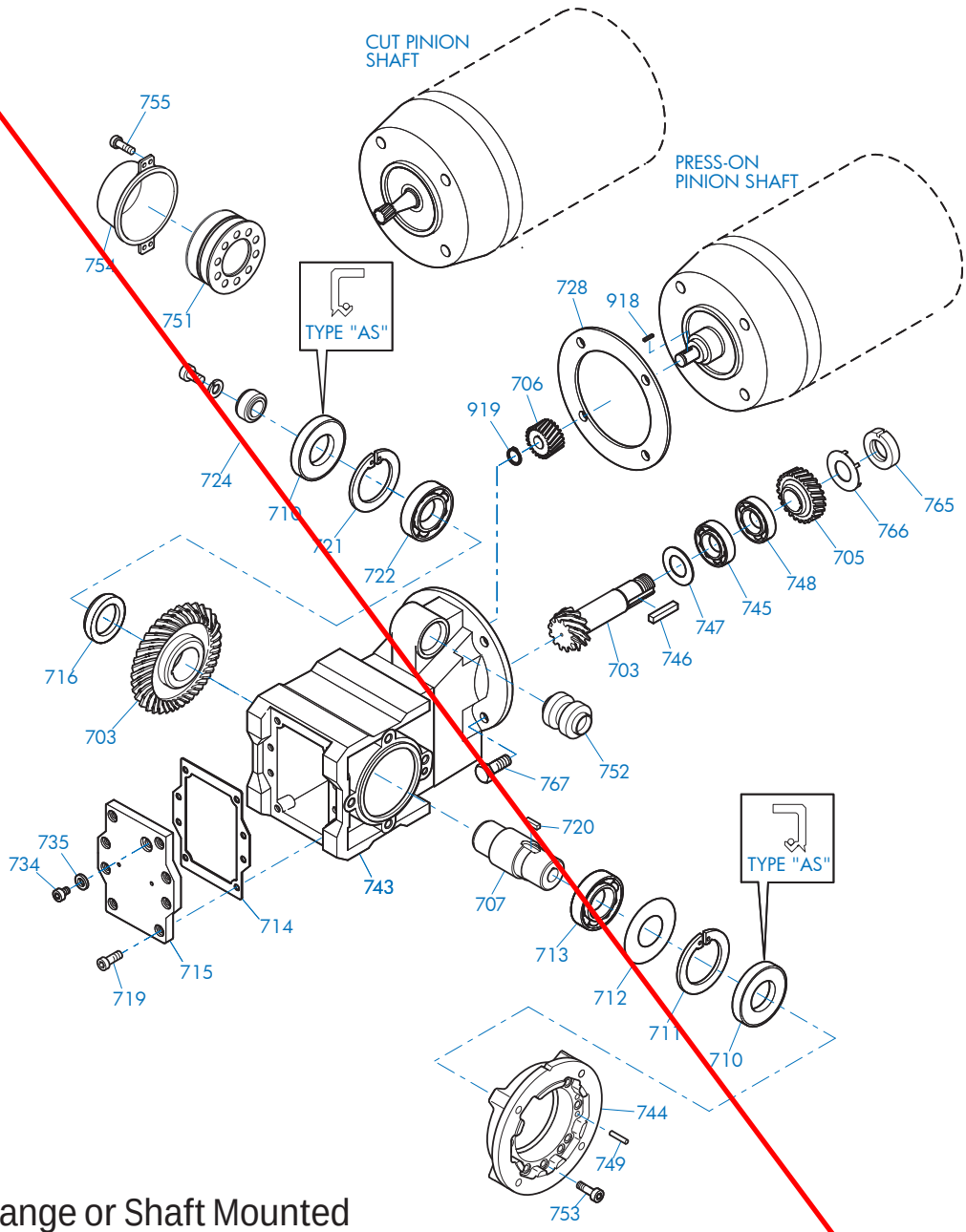
92 SERIES HELICAL-BEVEL PARTS LIST DRAWINGS



SK 92072 Foot Mounted

703 Bevel Gearset	716 Spacer	745 Anti-Friction Bearing
705 Gear	719 Bolt	746 Key
706 Pinion	720 Key	747 Shim
707 Output Shaft	721 Snap Ring	748 Anti-Friction Bearing
708 Key	722 Anti-Friction Bearing	765 Slotted Nut
710 Oil Seal	723 Bore Plug	766 Tab Lock Washer
711 Snap Ring	728 Gasket	767 Bolt
712 Shim	734 Oil Plug	918 Key
713 Anti-Friction Bearing	735 Gasket	919 Snap Ring
714 Gasket	742 Thrust Washer	
715 Inspection Cover	743 Gear case	

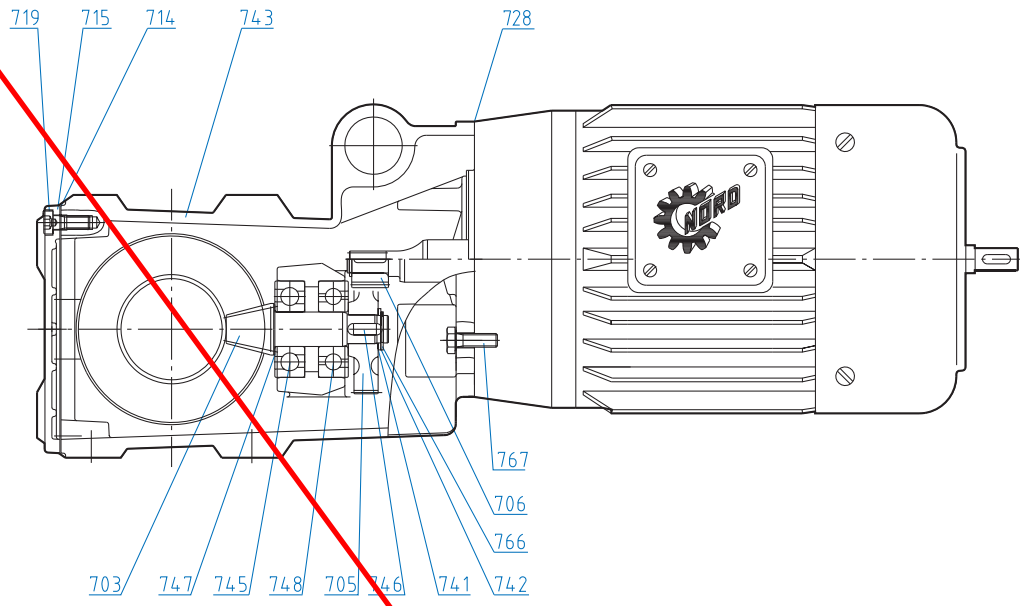
92 SERIES HELICAL-BEVEL PARTS LIST DRAWINGS

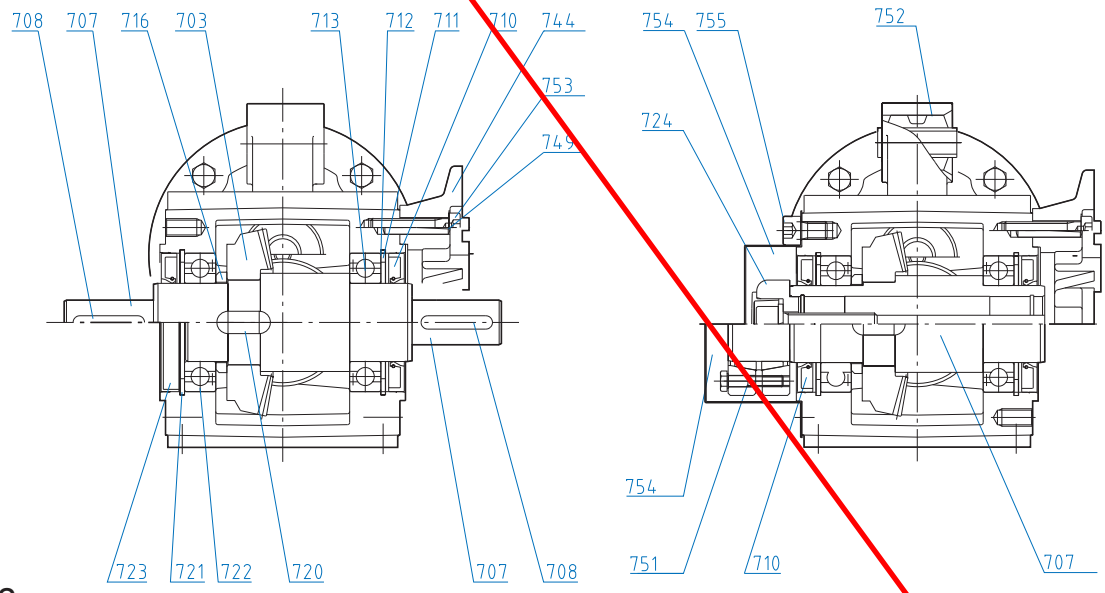


SK 92072 Flange or Shaft Mounted

703 Bevel Gearset	720 Key	748 Anti-Friction Bearing
705 Gear	721 Snap Ring	749 Grooved Pin
706 Pinion	722 Anti-Friction Bearing	751 Shrink Disc
707 Output Shaft	724 Fixing Element Kit	752 Rubber Buffer
710 Oil Seal	728 Gasket	753 Bolt
711 Snap Ring	734 Oil Plug	754 Cover
712 Shim	735 Gasket	755 Bolt
713 Anti-Friction Bearing	743 Gearcase	765 Slotted Round Nut
714 Gasket	744 Flange	766 Tab Lock Washer
715 Inspection Cover	745 Anti-Friction Bearing	767 Bolt
716 Spacer	746 Key	918 Key
719 Bolt	747 Shim	919 Snap Ring

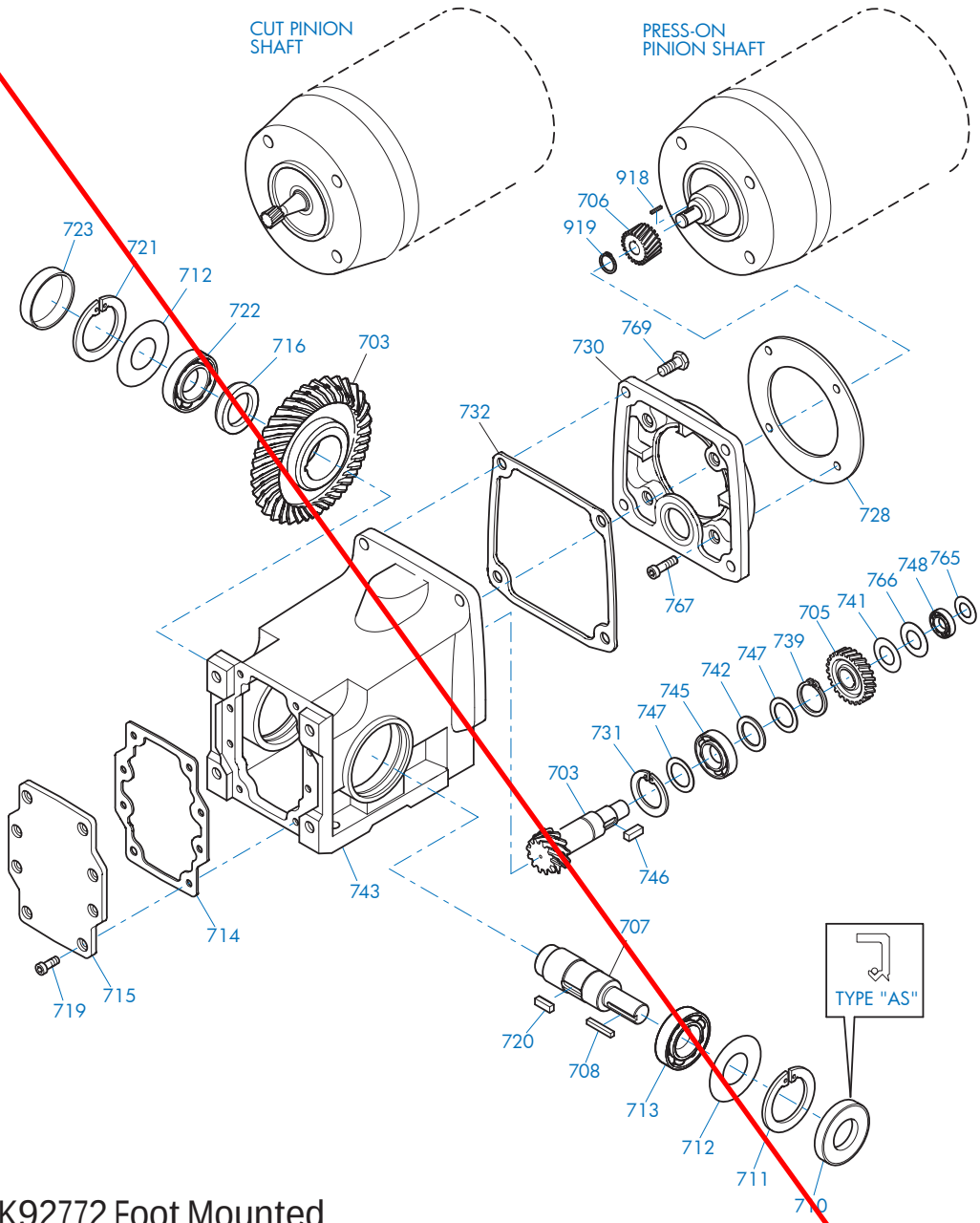
92 SERIES HELICAL-BEVEL PARTS LIST DRAWINGS





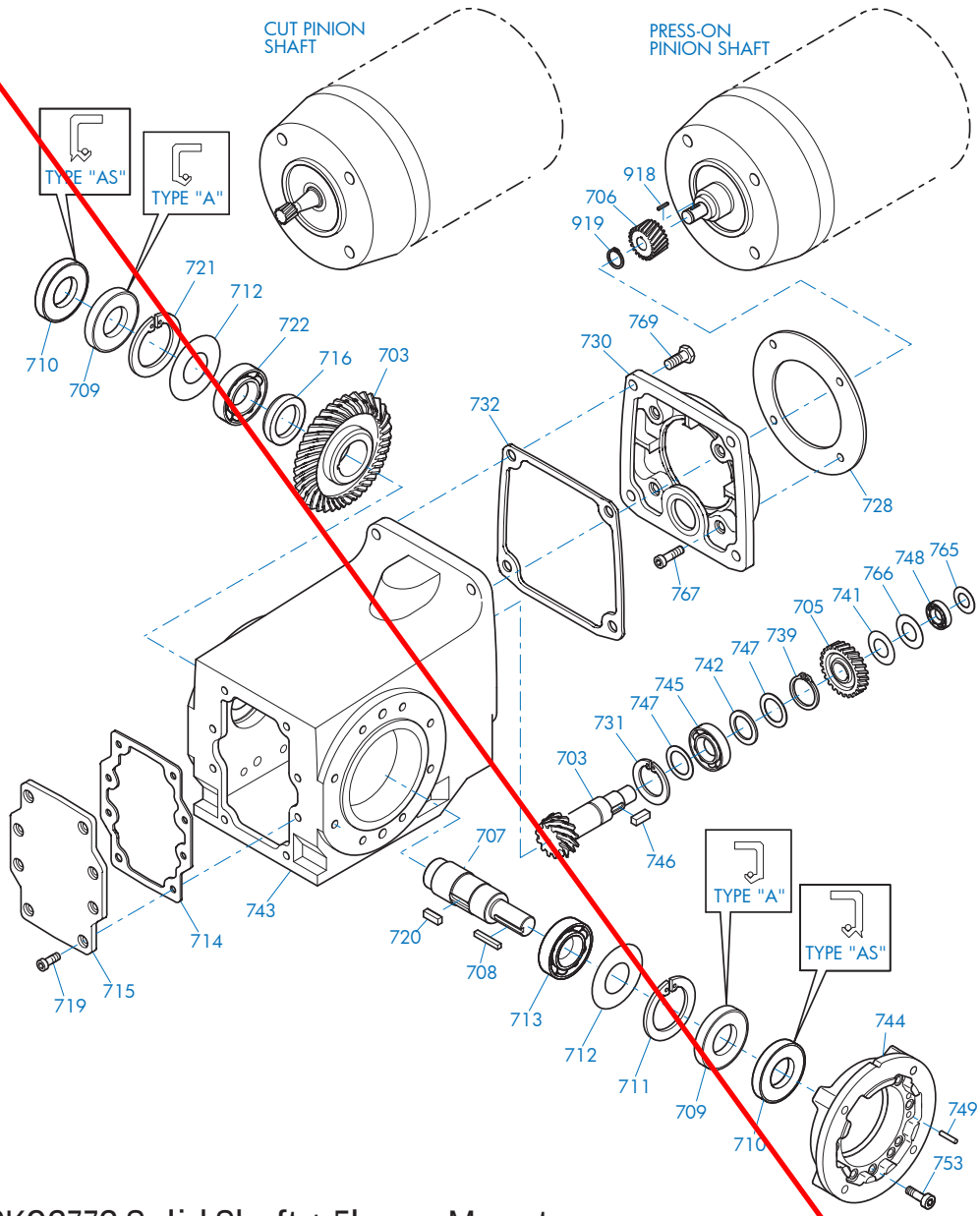
SK 92072

703 Bevel Gearset	719 Bolt	746 Key
705 Gear	720 Key	747 Shim
706 Pinion	721 Snap Ring	748 Anti-Friction Bearing
707 Output Shaft	722 Anti-Friction Bearing	749 Grooved Pin
708 Key	723 Bore Plug	751 Shrink Disc Connector
710 Oil Seal	724 Fixing Element Kit	752 Rubber Buffer
711 Snap Ring	728 Gasket	753 Socket Head Screw
712 Shim	741 Shim	754 Shrink Disc Cover
713 Anti-Friction Bearing	742 Thrust Washer	755 Socket Head Screw
714 Gasket	743 Gear case	766 Tab Lock Washer
715 Inspection Cover	744 Flange	767 Bolt
716 Spacer	745 Anti-Friction Bearing	



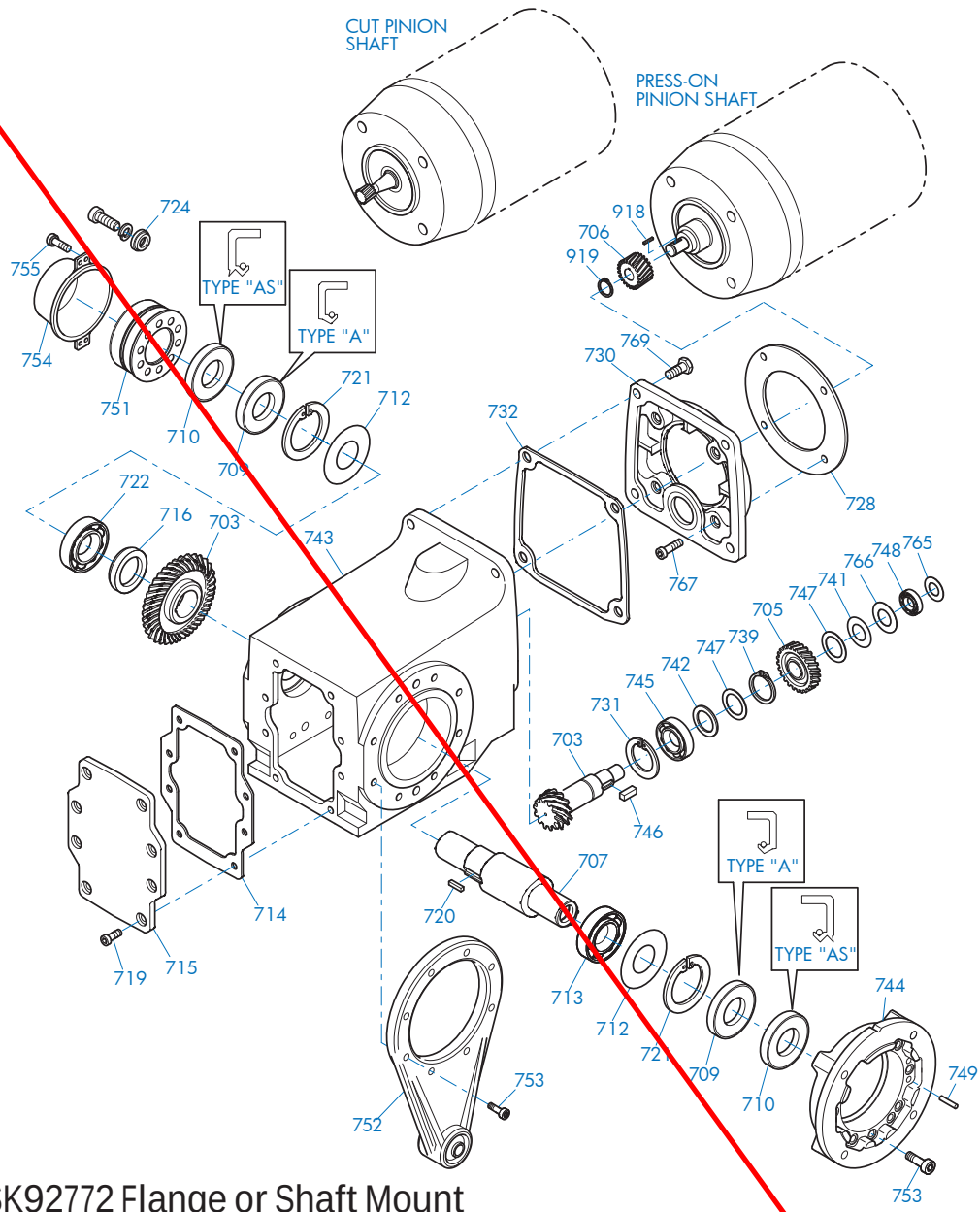
SK 92172 - SK92772 Foot Mounted

703 Bevel Gearset	719 Bolt	743 Gearcase
705 Gear	720 Key	745 Anti-Friction Bearing
706 Pinion	721 Snap Ring	746 Key
707 Output Shaft	722 Anti-Friction Bearing	747 Shim
708 Key	723 Bore Plug	748 Anti-Friction Bearing
710 Oil Seal	728 Gasket	765 Shim
711 Snap Ring	730 Input Cover	766 Snap Ring
712 Shim	731 Snap Ring	767 Bolt
713 Anti-Friction Bearing	732 Gasket	769 Bolt
714 Gasket	739 Snap Ring	918 Key
715 Inspection Cover	741 Shim	919 Snap Ring
716 Spacer	742 Thrust Washer	



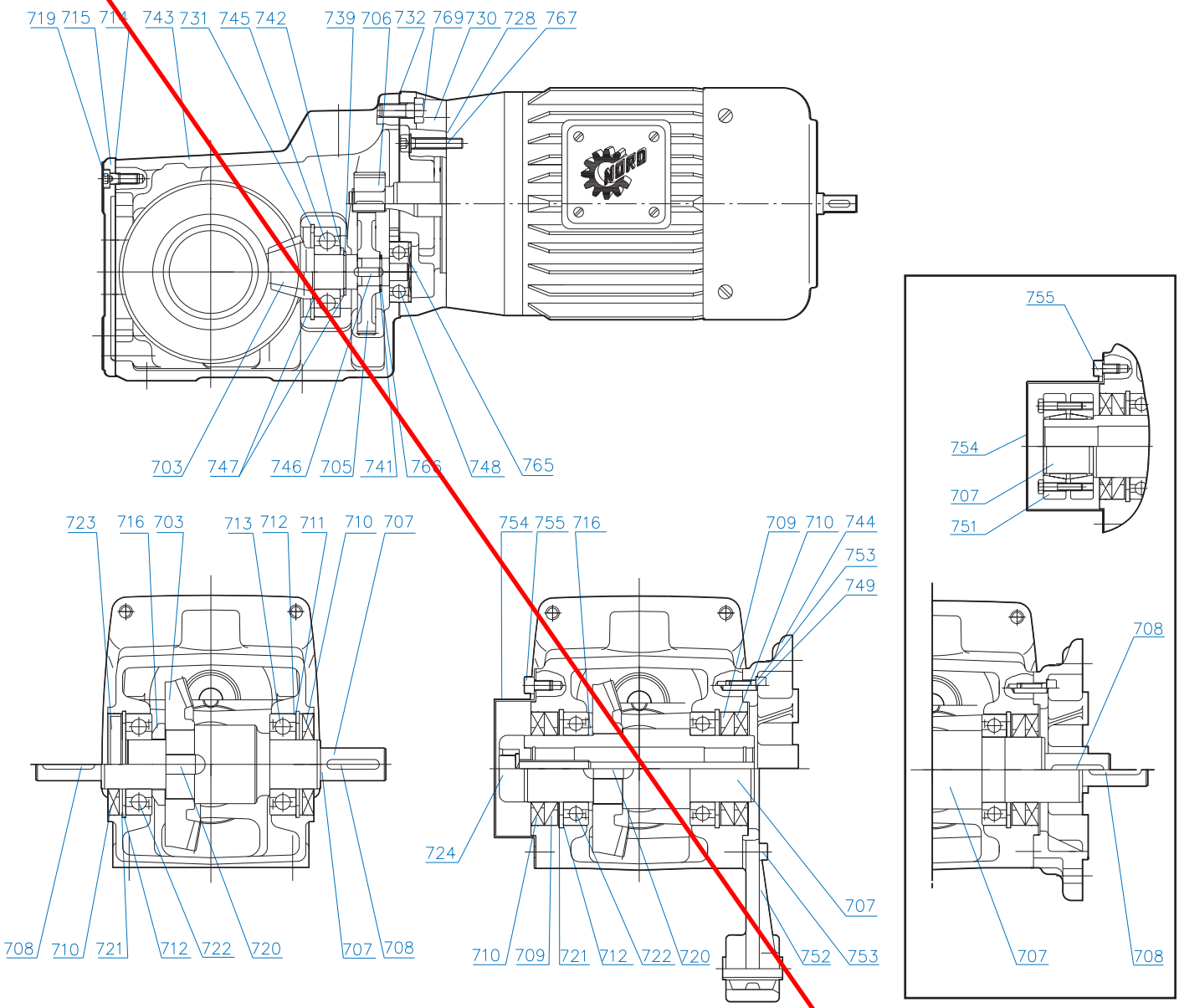
SK 92172 - SK92772 Solid Shaft + Flange Mount

703 Bevel Gearset	719 Bolt	745 Anti-Friction Bearing
705 Gear	720 Key	746 Key
706 Pinion	721 Snap Ring	747 Shim
707 Output Shaft	722 Anti-Friction Bearing	748 Anti-Friction Bearing
708 Key	728 Gasket	749 Grooved Pin
709 Oil Seal	730 Input Cover	753 Bolt
710 Oil Seal	731 Snap Ring	765 Shim
711 Snap Ring	732 Gasket	766 Snap Ring
712 Shim	739 Snap Ring	767 Bolt
713 Anti-Friction Bearing	741 Shim	769 Bolt
714 Gasket	742 Thrust Washer	918 Key
715 Inspection Cover	743 Gearcase	919 Snap Ring
716 Spacer	744 Flange	



SK 92172 - SK92772 Flange or Shaft Mount

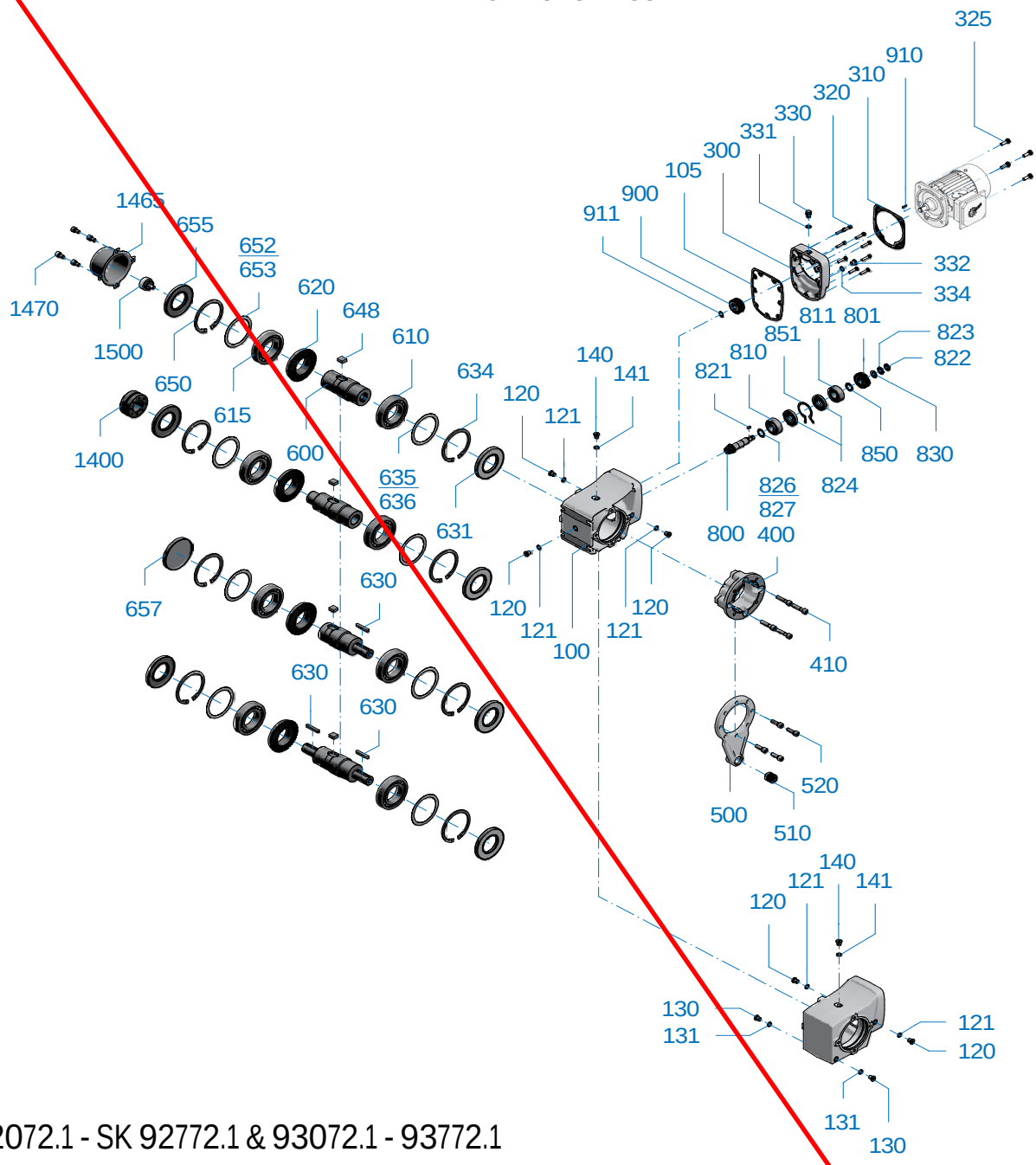
703 Bevel Gearset	722 Anti-Friction Bearing	748 Anti-Friction Bearing
705 Gear	724 Fixing Element Kit	749 Grooved Pin
706 Pinion	728 Gasket	751 Shrink Disc Connector
707 Output Shaft	730 Input Cover	752 Torque Arm
709 Oil Seal	731 Snap Ring	753 Bolt
710 Oil Seal	732 Gasket	754 Cover
712 Shim	739 Snap Ring	755 Bolt
713 Anti-Friction Bearing	741 Shim	765 Shim
714 Gasket	742 Thrust Washer	766 Snap Ring
715 Inspection Cover	743 Gearcase	767 Bolt
716 Spacer	744 Flange	769 Bolt
719 Bolt	745 Anti-Friction Bearing	918 Key
720 Key	746 Key	919 Snap Ring
721 Snap Ring	747 Shim	



SK 92172 - SK 92772

703 Bevel Gearset
705 Gear
706 Pinion
707 Output Shaft
708 Key
709 Oil Seal
710 Oil Seal
711 Snap Ring
712 Shim
713 Anti-Friction Bearing
714 Gasket
715 Inspection Cover
716 Spacer
719 Bolt
720 Key
721 Snap Ring
722 Anti-Friction Bearing
723 Sealing Plug
724 Fixing Element Kit
728 Gasket
730 Gearbox Cover
731 Snap Ring
732 Gasket
739 Snap Ring
741 Shim
742 Thrust Washer
743 Gearcase
744 Flange
745 Anti-Friction Bearing
746 Key
747 Shim
748 Anti-Friction Bearing
749 Grooved Pin
751 Shrink Disc Connector
752 Torque Arm
753 Bolt
754 Cover
755 Bolt
765 Slotted Round Nut
766 Tab Lock Washer
767 Bolt
769 Hexagonal Screw

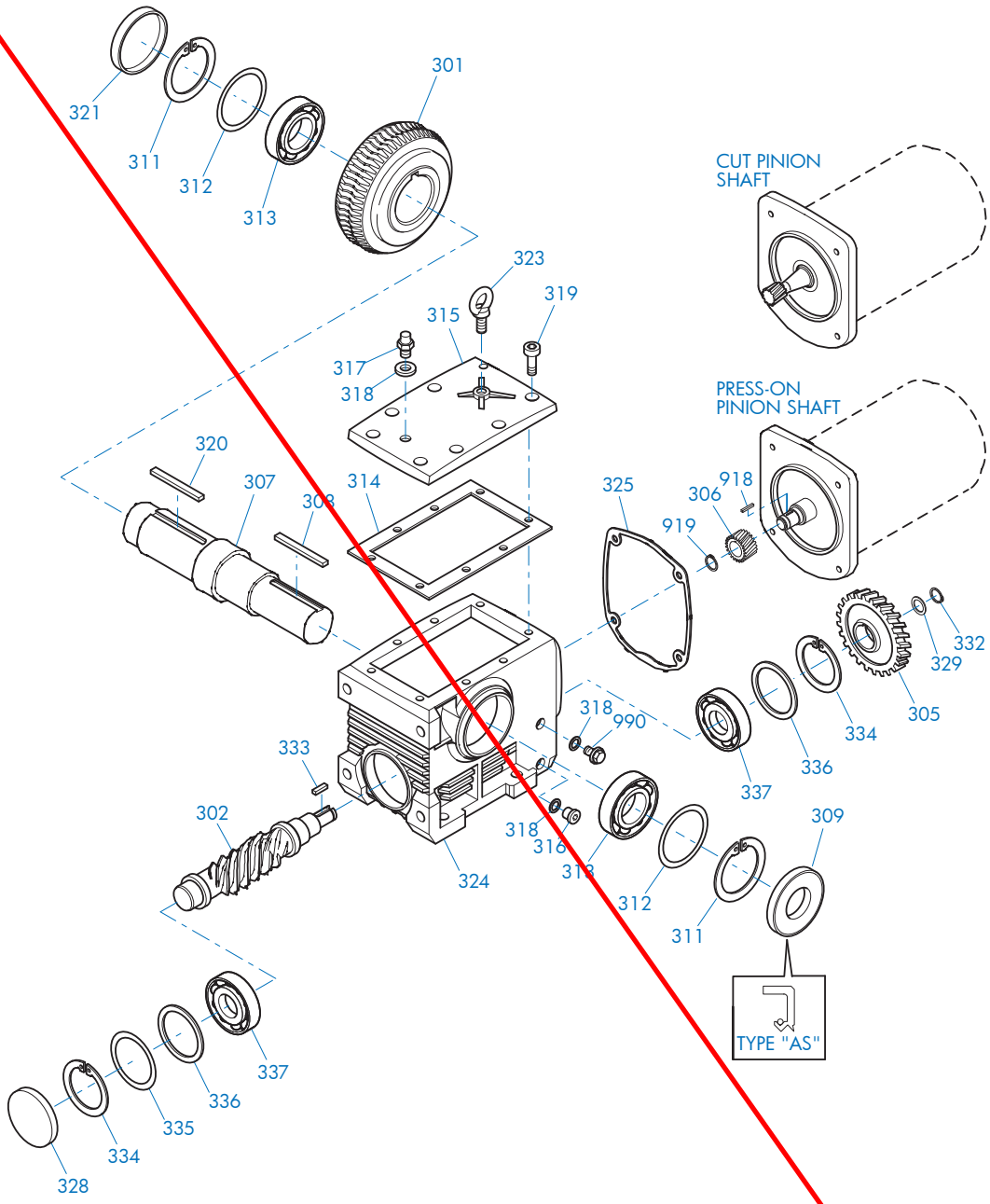
92.1/93.1 SERIES HELICAL-BEVEL PARTS LIST DRAWINGS



SK 92072.1 - SK 92772.1 & 93072.1 - 93772.1

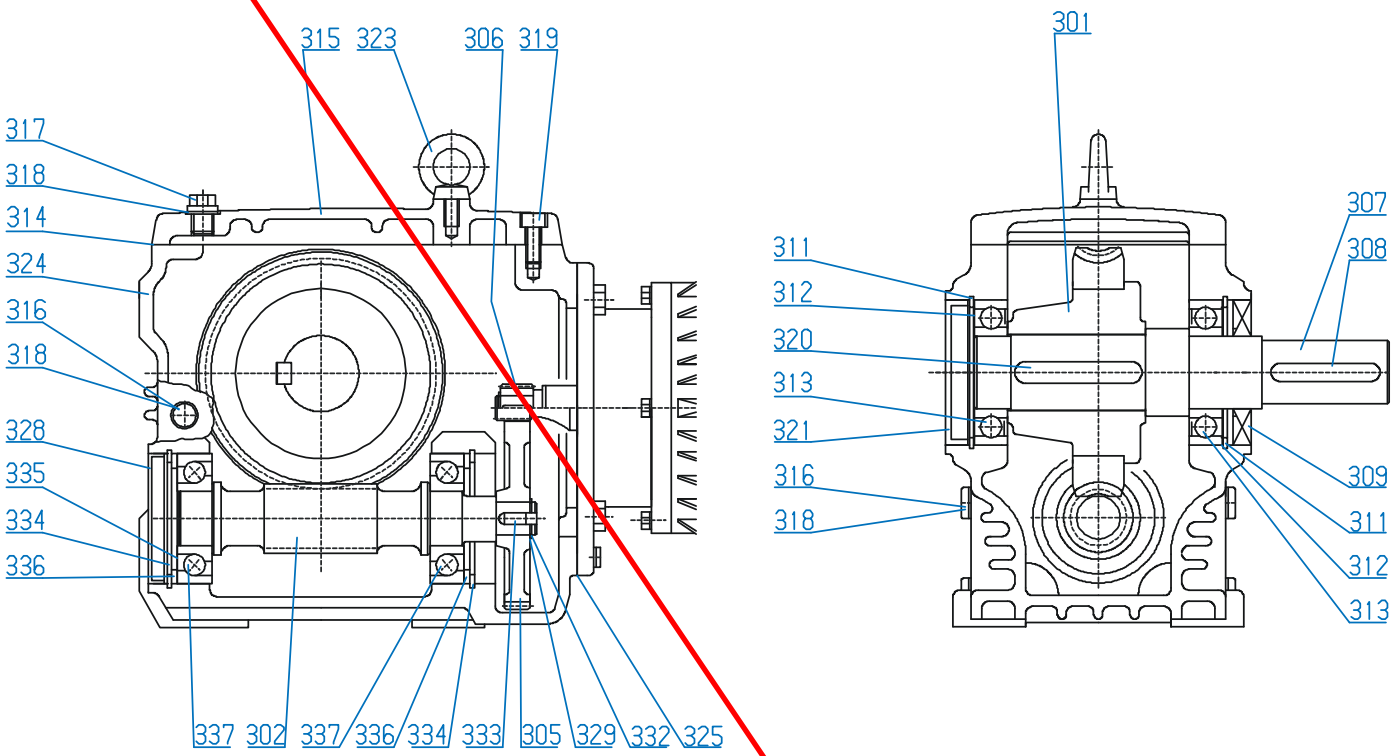
100 Housing	330 Screw	620 Output gear	800 Pinion shaft	850 Socket
105 Seal	331 Seal	630 Key	801 Drive gear	851 Circlip
120 Screw	332 Screw	631 Radial shaft seal	810 Roller bearing	900 Driving pinion
121 Seal	334 Seal	650 Circlip	811 Roller bearing	910 Key
130 Screw	400 Flange	635 Shim	820 Circlip	911 Circlip
131 Seal	410 Screw	636 Shim	630 Key	1400 Shrink disc assembly
140 Screw	500 Torque arm	648 Key	822 Locknut	1465 Cover
141 Seal	510 Socket	650 Circlip	823 Tab washer	1470 Screw
300 Gear unit cover	520 Screw	652 Shim	824 Socket	1500 Fixing element
310 Seal	600 Output shaft	653 Shim	826 Shim	
320 Screw	610 Roller bearing	655 Radial shaft seal	827 Shim	
325 Screw	615 Roller bearing	657 Sealing cap	830 Supporting disc	

HELICAL-WORM
PARTS LIST DRAWINGS



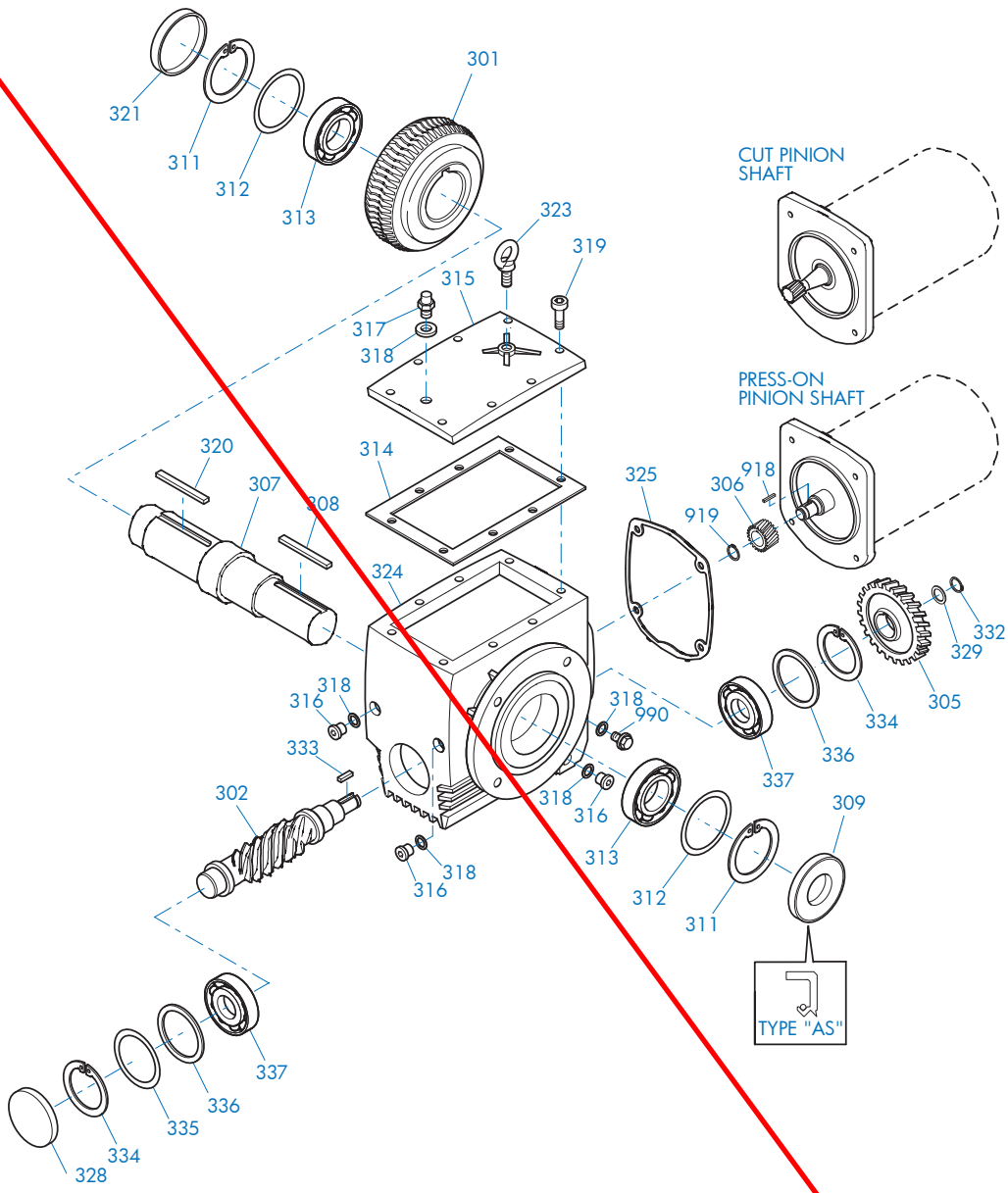
SK 02040 - SK 42125 Foot Mounted

301 Worm Wheel	315 Inspection Cover	329 Thrust Washer
302 Worm	316 Drain Plug	332 Snap Ring
305 Gear	317 Vent Plug	333 Key
306 Pinion	318 Gasket	334 Snap Ring
307 Output Shaft	319 Socket Head Screw	335 Shim
308 Key	320 Key	336 Thrust Washer
309 Oil Seal	321 Bore Plug	337 Anti-Friction Bearing
311 Snap Ring	323 Flanged Eye Bolt	918 Key
312 Shim	324 Gearcase	919 Snap Ring
313 Anti-Friction Bearing	325 Gasket	990 Oil Level Plug
314 Gasket	328 Bore Plug	



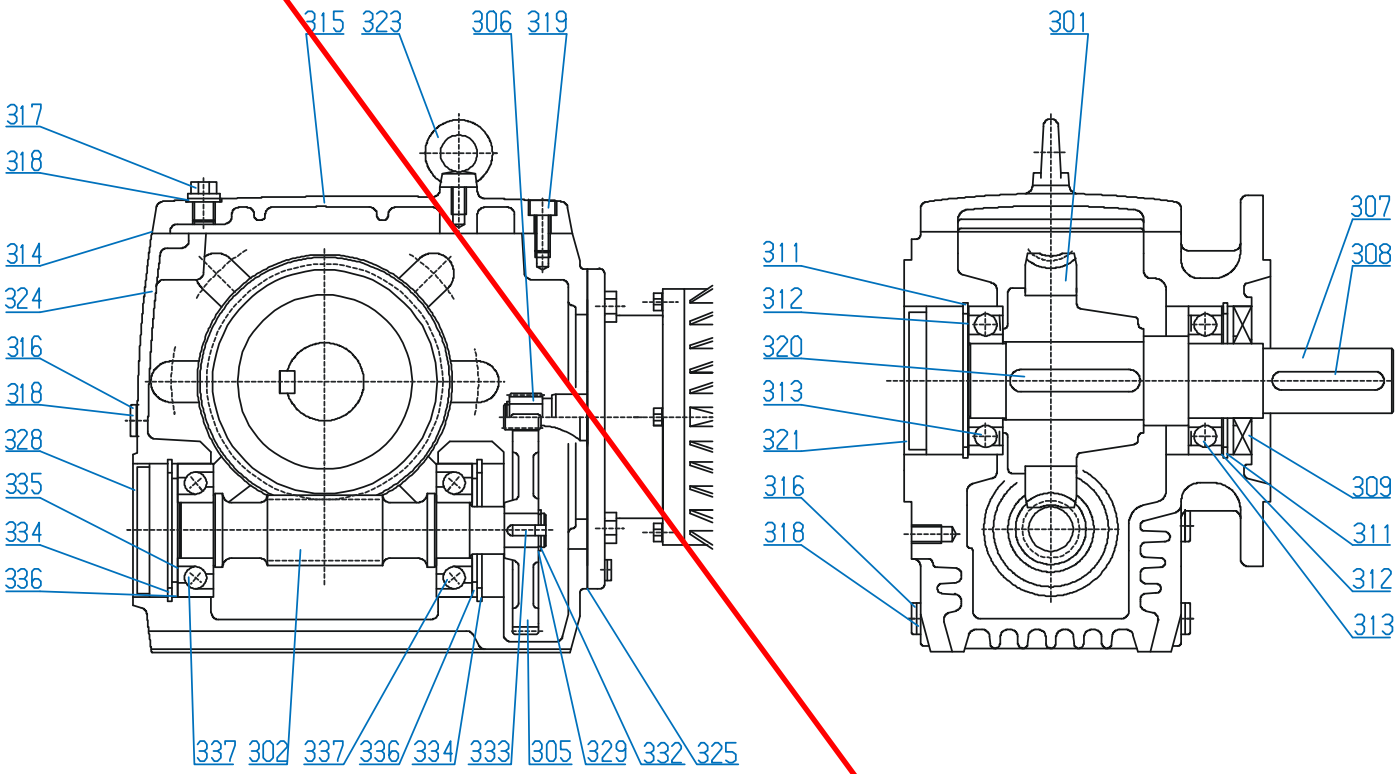
SK 02040 - SK 42125 Foot Mounted

301 Worm Wheel	314 Gasket	325 Gasket
302 Worm	315 Inspection Cover	328 Bore Plug
305 Gear	316 Drain Plug	329 Thrust Washer
306 Pinion	317 Vent Plug	332 Snap Ring
307 Output Shaft	318 Gasket	333 Key
308 Key	319 Socket Head Screw	334 Snap Ring
309 Oil Seal	320 Key	335 Shim
311 Snap Ring	321 Bore Plug	336 Thrust Washer
312 Shim	323 Flanged Eye Bolt	337 Anti-Friction Bearing
313 Anti-Friction Bearing	324 Gearcase	



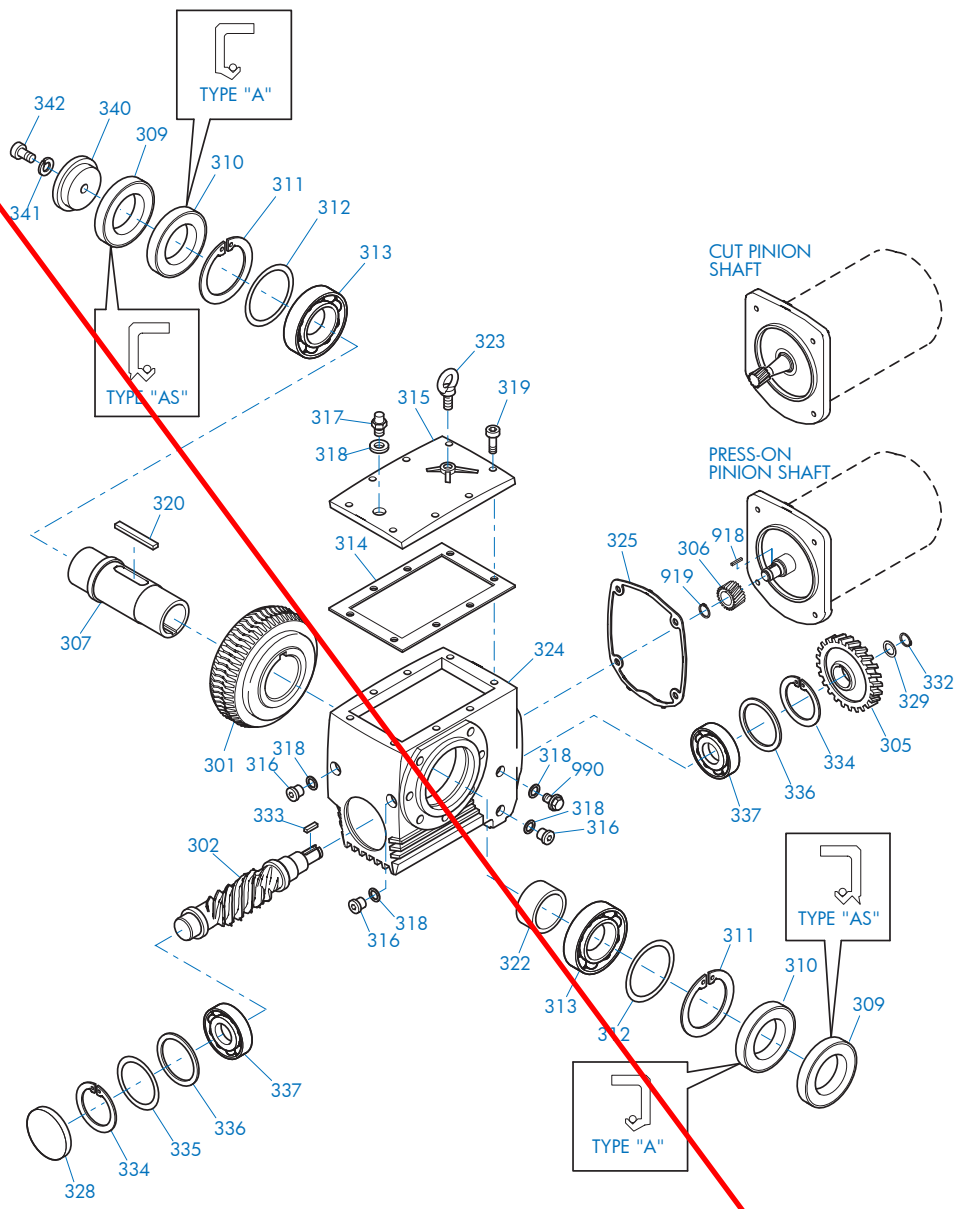
SK 02040 - SK 42125 Flange Mounted

301 Worm Wheel	315 Inspection Cover	329 Thrust Washer
302 Worm	316 Drain Plug	332 Snap Ring
305 Gear	317 Vent Plug	333 Key
306 Pinion	318 Gasket	334 Snap Ring
307 Output Shaft	319 Socket Head Screw	335 Shim
308 Key	320 Key	336 Thrust Washer
309 Oil Seal	321 Bore Plug	337 Anti-Friction Bearing
311 Snap Ring	323 Flanged Eye Bolt	918 Key
312 Shim	324 Gearcase	919 Snap Ring
313 Anti-Friction Bearing	325 Gasket	990 Oil Level Plug
314 Gasket	328 Bore Plug	



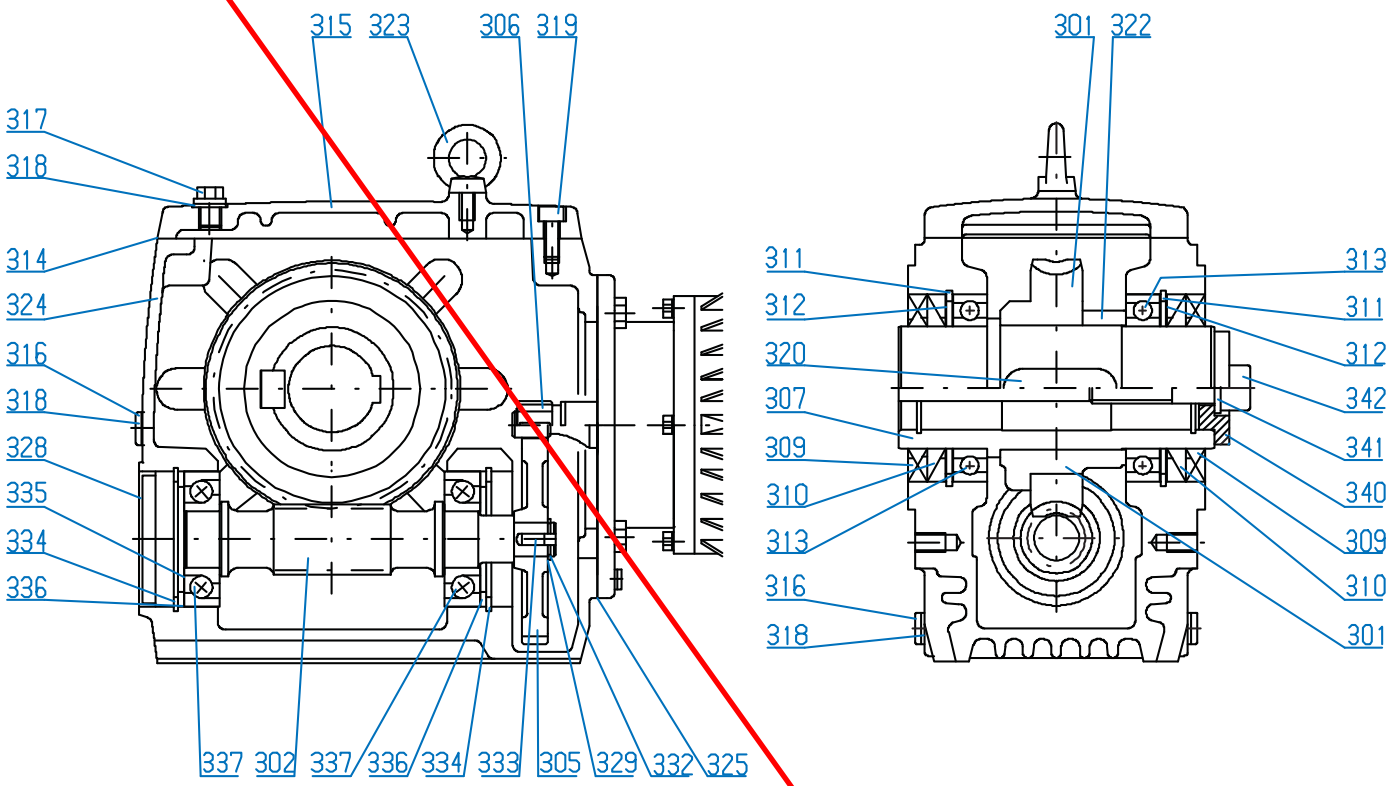
SK 02040 - SK 42125 Flange Mounted

301 Worm Wheel	314 Gasket	325 Gasket
302 Worm	315 Inspection Cover	328 Bore Plug
305 Gear	316 Drain Plug	329 Thrust Washer
306 Pinion	317 Vent Plug	332 Snap Ring
307 Output Shaft	318 Gasket	333 Key
308 Key	319 Socket Head Screw	334 Snap Ring
309 Oil Seal	320 Key	335 Shim
311 Snap Ring	321 Bore Plug	336 Thrust Washer
312 Shim	323 Flanged Eye Bolt	337 Anti-Friction Bearing
313 Anti-Friction Bearing	324 Gearcase	



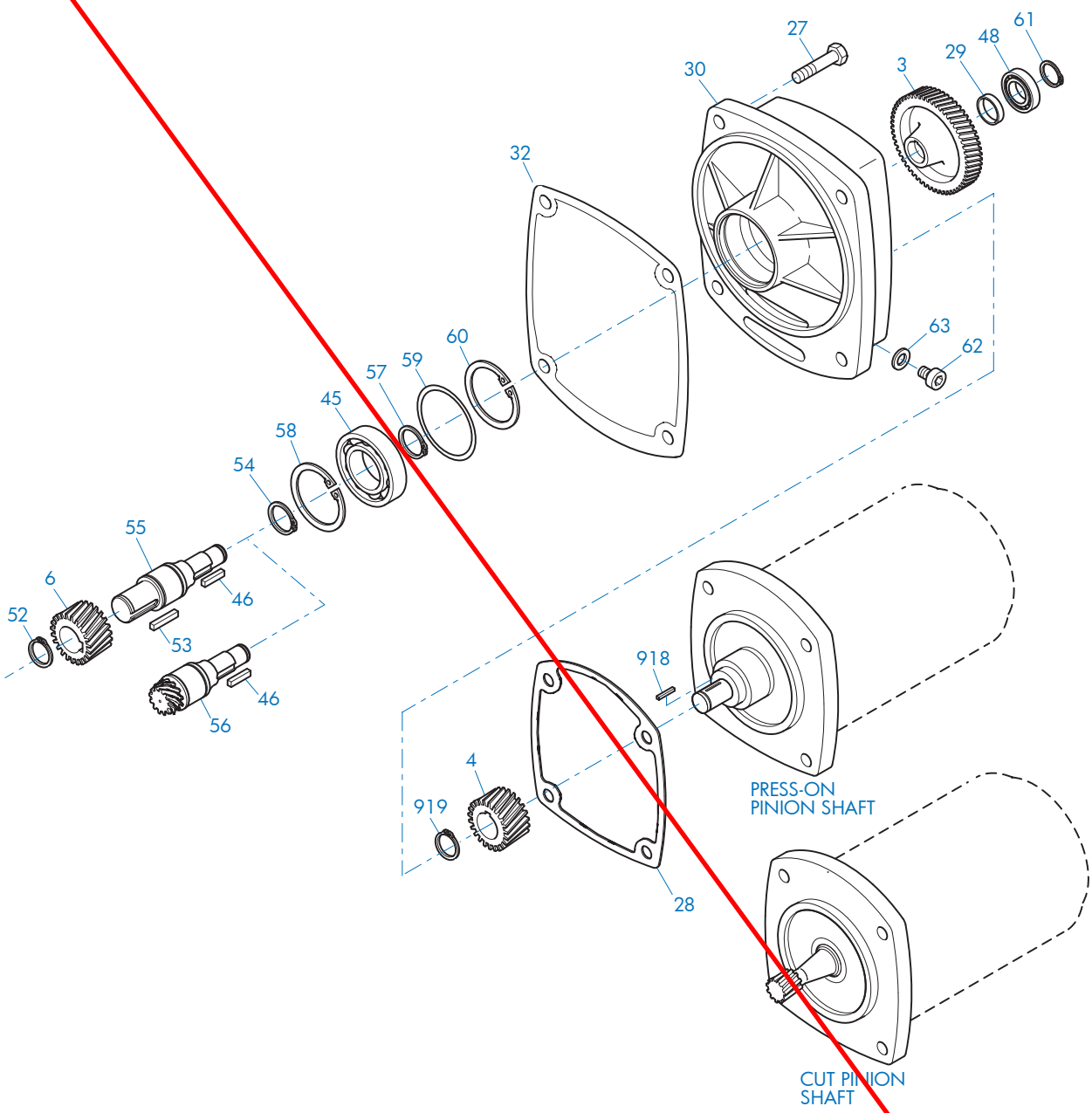
SK 02040 - SK 42125 Shaft Mounted

301 Worm Wheel	317 Vent Plug	335 Shim
302 Worm	318 Gasket	336 Thrust Washer
305 Gear	319 Socket Head Screw	337 Anti-Friction Bearing
306 Pinion	320 Key	340 Retaining Washer
307 Output Shaft	322 Spacer	341 Lock Washer
309 Oil Seal	323 Flanged Eye Bolt	342 Bolt
310 Oil Seal	324 Gearcase	350 Flange
311 Snap Ring	325 Gasket	351 Bolt
312 Shim	328 Bore Plug	918 Key
313 Anti-Friction Bearing	329 Thrust Washer	919 Snap Ring
314 Gasket	332 Snap Ring	990 Oil Level Plug
315 Inspection Cover	333 Key	
316 Drain Plug	334 Snap Ring	



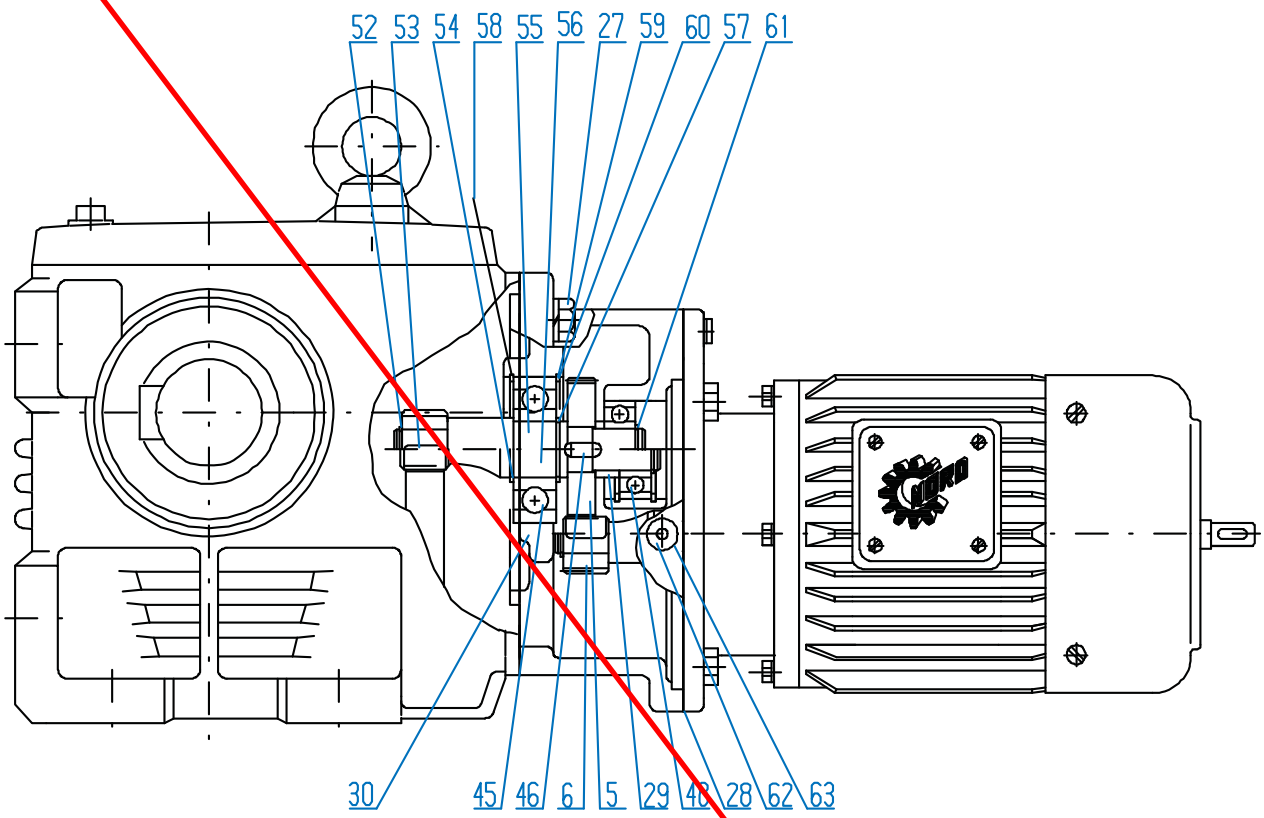
SK 02040 - SK 42125 Shaft Mounted

301 Worm Wheel	316 Drain Plug	333 Key
302 Worm	317 Vent Plug	334 Snap Ring
305 Gear	318 Gasket	335 Shim
306 Pinion	319 Socket Head Screw	336 Thrust Washer
307 Output Shaft	320 Key	337 Anti-Friction Bearing
309 Oil Seal	322 Spacer	340 Retaining Washer
310 Oil Seal	323 Flanged Eye Bolt	341 Lock Washer
311 Snap Ring	324 Gearcase	342 Bolt
312 Shim	325 Gasket	350 Flange
313 Anti-Friction Bearing	328 Bore Plug	351 Bolt
314 Gasket	329 Thrust Washer	
315 Inspection Cover	332 Snap Ring	



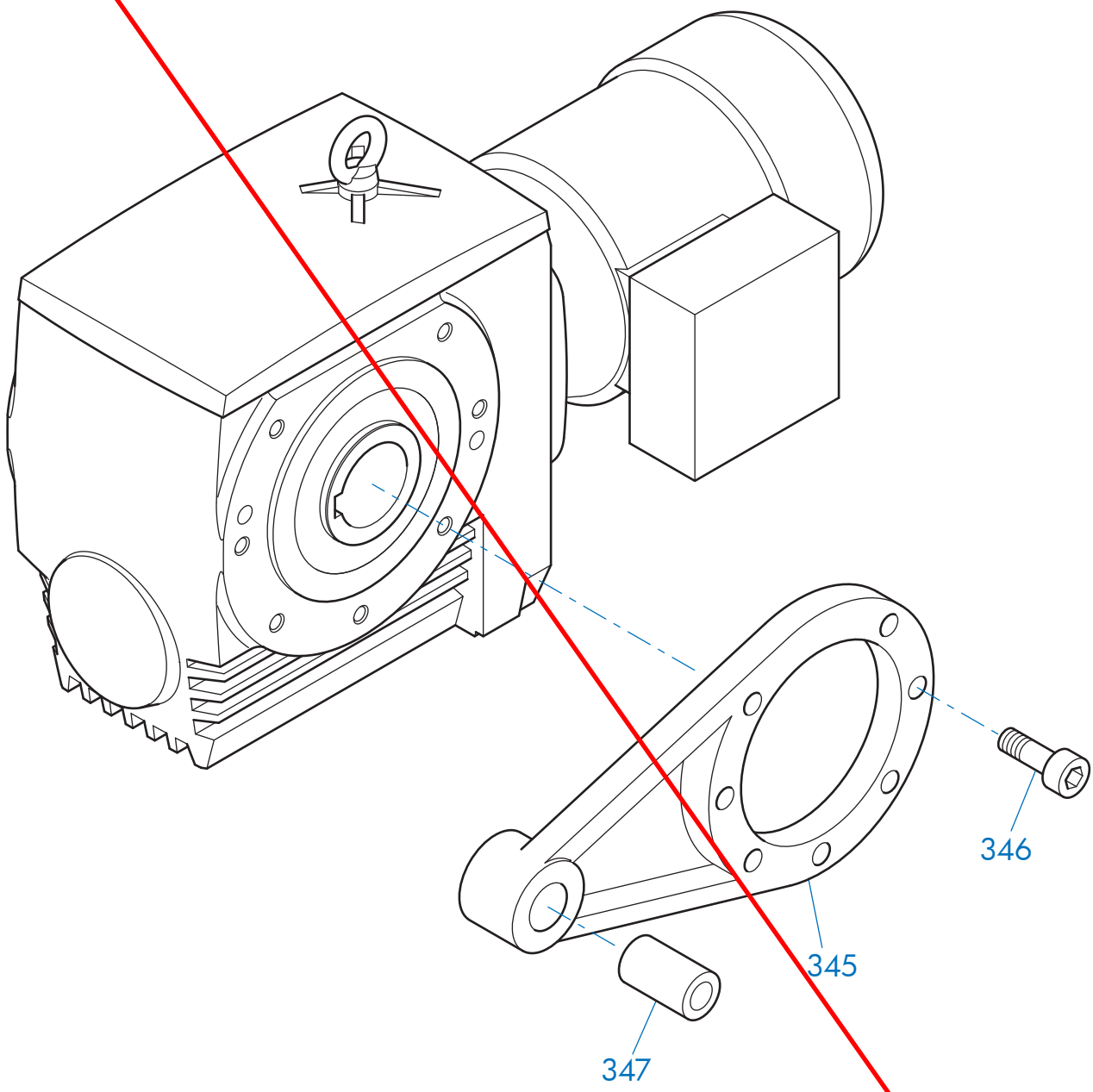
SK13050 - SK43125 Third Stage Reduction Gear

3	Gear	46	Key	59	Shim
4	Pinion	48	Anti-Friction Bearing	60	Snap Ring
6	Pinion	52	Snap Ring	61	Snap Ring
27	Bolt	53	Key	62	Oil Plug
28	Gasket	54	Snap Ring	63	Gasket
29	Spacer	55	Intermediate Shaft, Plain	918	Key
30	Third Reduction Gearcase	56	Intermediate Shaft, Gearcut	919	Snap Ring
32	Gasket	57	Snap Ring		
45	Anti-Friction Bearing	58	Snap Ring		



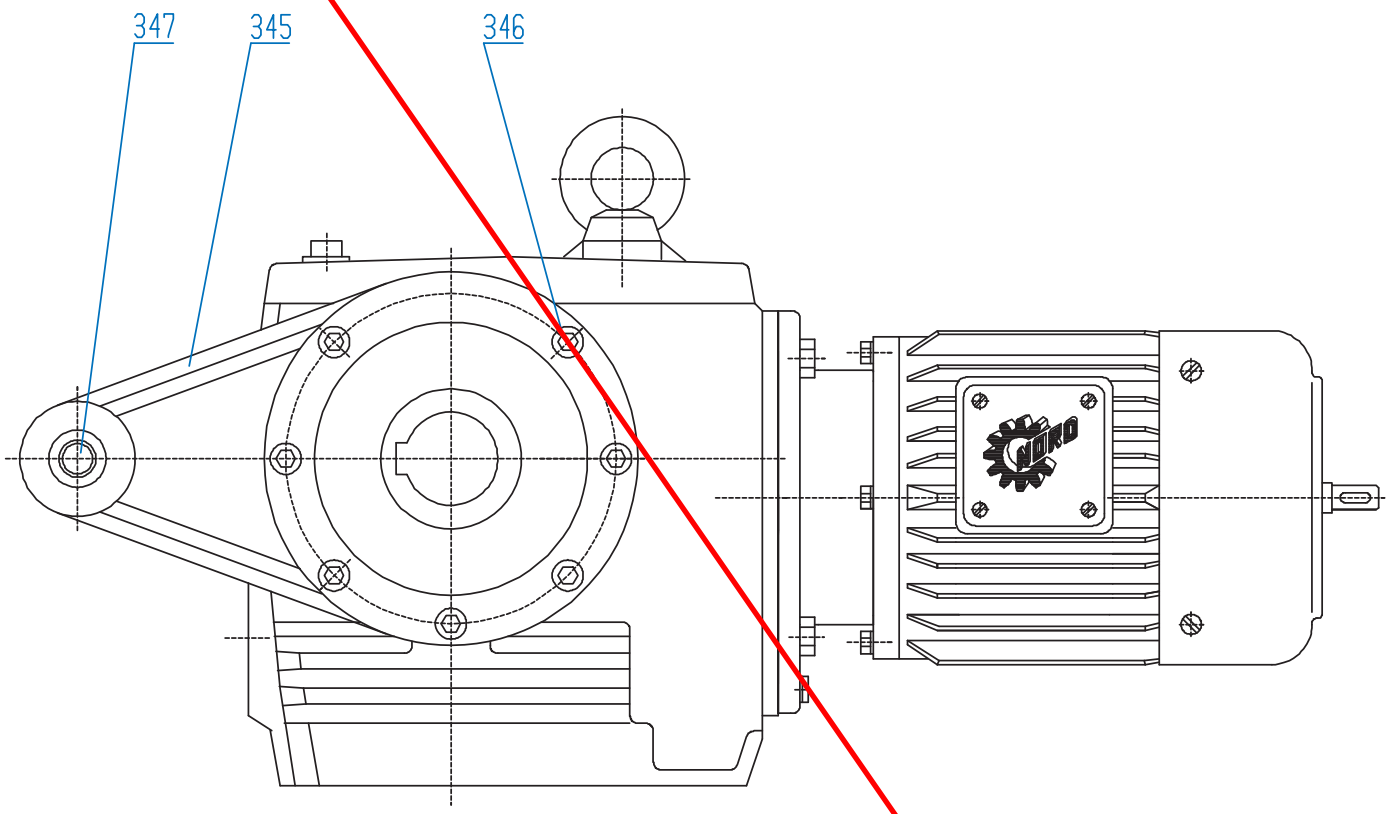
SK13050 - SK43125 Third Stage Reduction Gear

3	Gear	46	Key	58	Snap Ring
4	Pinion	48	Anti-Friction Bearing	59	Shim
27	Bolt	52	Snap Ring	60	Snap Ring
28	Gasket	53	Key	61	Snap Ring
29	Spacer	54	Snap Ring	62	Oil Plug
30	Third Reduction Gearcase	55	Intermediate Shaft, Plain	63	Gasket
32	Gasket	56	Intermediate Shaft, Gearcut		
45	Anti-Friction Bearing	57	Snap Ring		



SK13050 - SK43125 Torque Arm

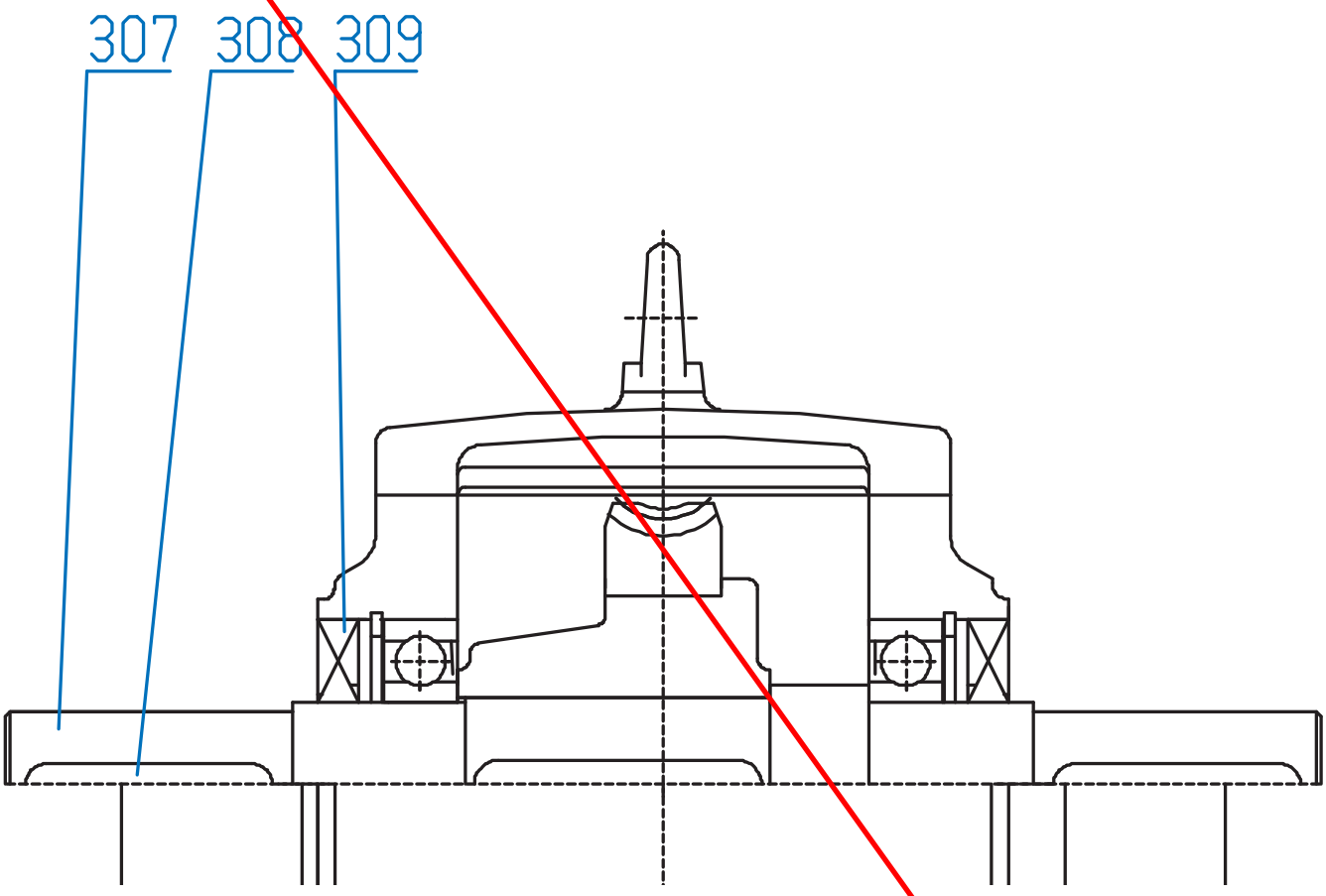
345 Torque Arm	346 Bolt	347 Bushing



SK13050 - SK43125 Torque Arm

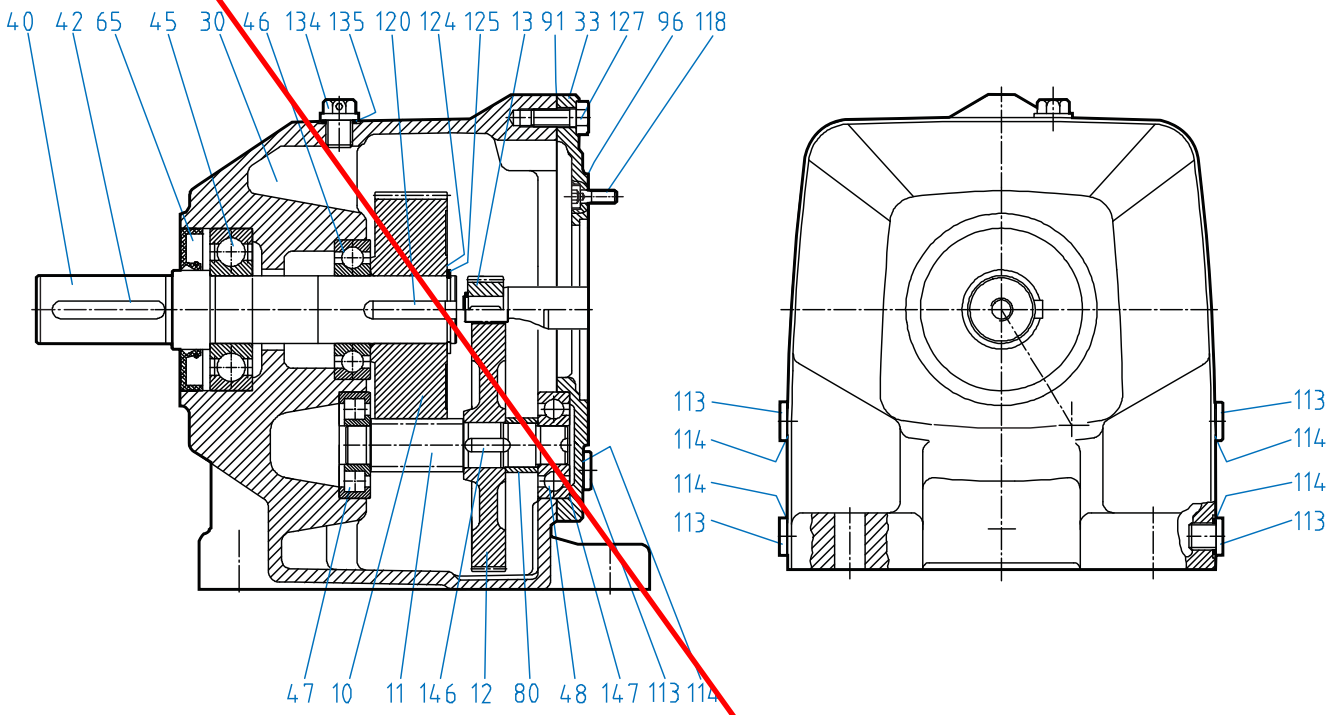
345 Torque Arm	346 Bolt	347 Bushing

HELICAL-WORM
PARTS LIST DRAWINGS



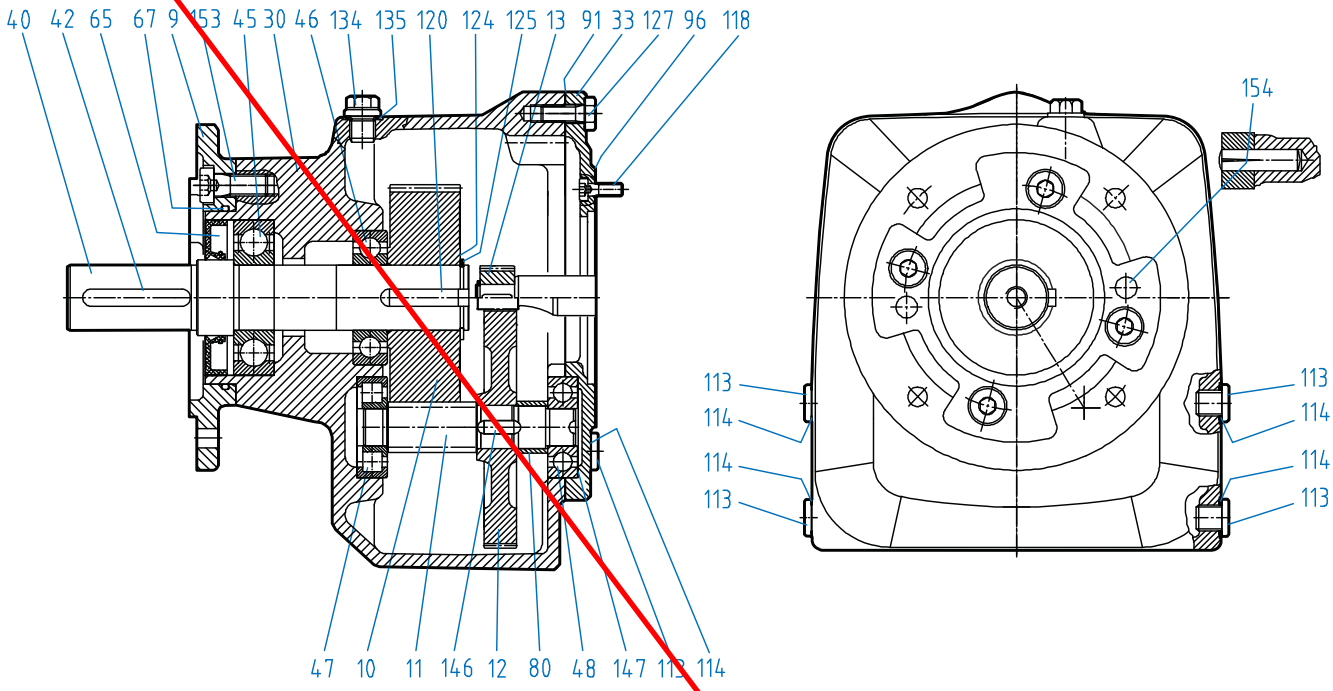
SK13050 - SK43125

307 Output Shaft	309 Oil Seal	350 Flange
308 Key	346 Screw	354 Shrink Disc Connector



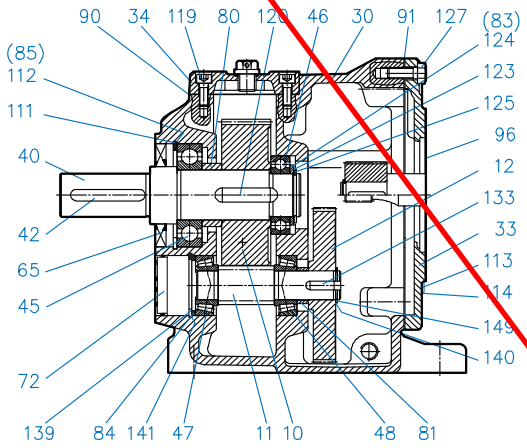
SK 172 - SK 972 Foot Mounted

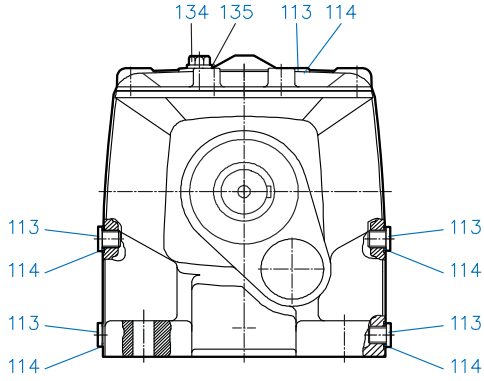
10	Driven gear	46	Output shaft bearing	118	Bolt
11	Pinion shaft	47	Pinion shaft bearing	120	Key
12	Driving gear	48	Pinion shaft bearing	124	Shim
13	Driving pinion	65	Shaft seal	125	Snap ring
30	Gearcase	80	Spacer	127	Bolt
33	Input cover	91	Gasket	134	Vent plug
40	Output shaft	96	Gasket	135	Gasket
42	Key	113	Oil plug	146	Key
45	Output shaft bearing	114	Gasket	147	Shim

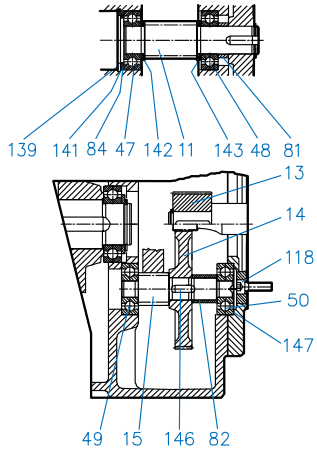


SK 172 - SK 972 Flange Mounted

9	Flange	47	Pinion shaft bearing	124	Shim
10	Driven gear	48	Pinion shaft bearing	125	Snap ring
11	Pinion shaft	65	Shaft seal	127	Bolt
12	Driving gear	67	O-Ring	134	Vent plug
13	Driving pinion	80	Spacer	135	Gasket
30	Gearcase	91	Gasket	146	Key
33	Input cover	96	Gasket	147	Shim
40	Output shaft	113	Oil plug	153	Bolt
42	Key	114	Gasket	154	Grooved dowel pin
45	Output shaft bearing	118	Bolt		
46	Output shaft bearing	120	Key		

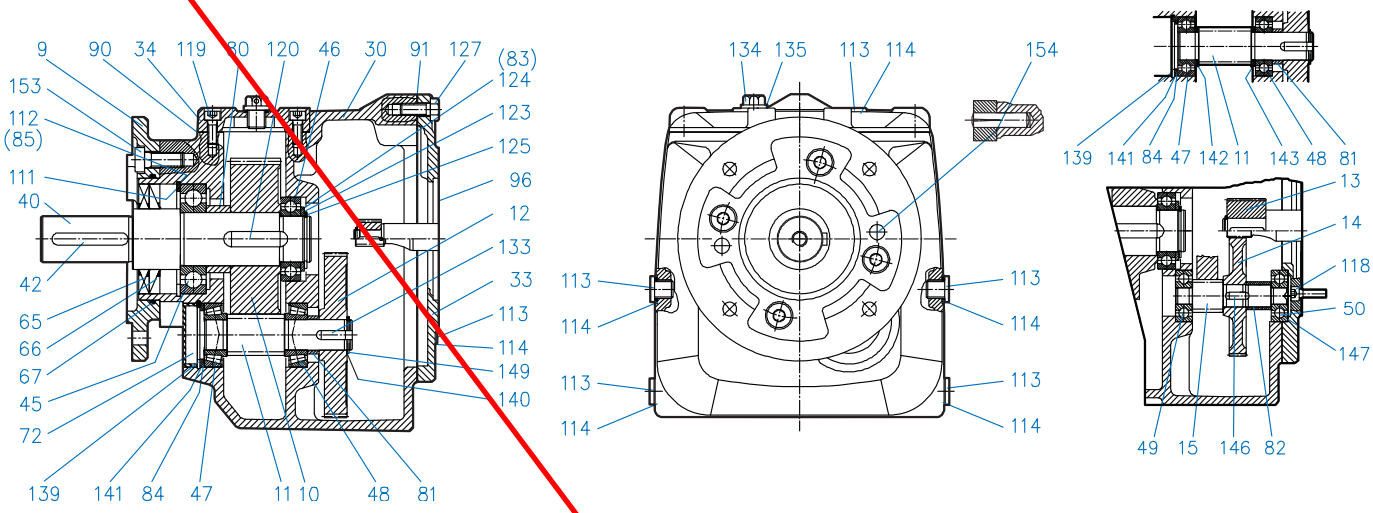






SK 273 - SK 973 Foot Mounted

10	Driven gear	65	Shaft seal	120	Key
11	Pinion shaft	72	Bore plug	123	Thrust washer
12	Driving gear	80	Spacer	124	Shim
13	Driving pinion	81	Spacer	125	Snap ring
14	Driving gear	82	Spacer	127	Bolt
15	Pinion shaft	83	Thrust washer	133	Key
30	Gearcase	84	Thrust washer	134	Vent plug
33	Input cover	85	Thrust washer	135	Gasket
34	Gear case cover	90	Gasket	139	Snap ring
40	Output shaft	91	Gasket	140	Shim
42	Key	96	Gasket	141	Shim
45	Output shaft bearing	111	Snap ring	142	Thrust washer
46	Output shaft bearing	112	Shim	143	Thrust washer
47	Pinion shaft bearing	113	Oil plug	146	Key
48	Pinion shaft bearing	114	Gasket	147	Shim
49	Pinion shaft bearing	118	Bolt	149	Snap ring
50	Pinion shaft bearing	119	Bolt		



SK 273 - SK 973 Flange Mounted

9	Flange	66	Shaft seal	123	Thrust washer
10	Driven gear	67	O-Ring	124	Shim
11	Pinion shaft	72	Bore plug	125	Snap ring
12	Driving gear	80	Spacer	127	Bolt
13	Driving pinion	81	Spacer	133	Key
14	Driving gear	82	Spacer	134	Vent plug
15	Pinion shaft	83	Thrust washer	135	Gasket
30	Gearcase	84	Thrust washer	139	Snap ring
33	Input cover	85	Thrust washer	140	Shim
34	Gearcase cover	90	Gasket	141	Shim
40	Output shaft	91	Gasket	142	Thrust washer
42	Key	96	Gasket	143	Thrust washer
45	Output shaft bearing	111	Snap ring	146	Key
46	Output shaft bearing	112	Shim	147	Shim
47	Pinion shaft bearing	113	Oil plug	149	Snap ring
48	Pinion shaft bearing	114	Gasket	153	Bolt
49	Pinion shaft bearing	118	Bolt	154	Grooved dowel pin
50	Pinion shaft bearing	119	Bolt		
65	Shaft seal	120	Key		

Troubleshooting

This section identifies some of the most common issues involved with NORD Gear speed reducers , and provides recommendations to assist you in defining and answering your questions as you work with our products. You may also contact our Engineering/Application departments if your questions are not answered in the table below.

Problem With the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels.
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts	Tighten bolts
	Failure of bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient lubricant	Level of lubricant in reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output shaft does not turn	Internal parts are broken or missing	Overloading of reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected	Properly allign reducer and coupling. Tighten coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
	Unit runs hot or leaks	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
	Incorrect fill level	Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position on the name tag & verify with mounting chart in manual.

1. Overview

This user manual applies to NORD Motor products and it provides general information for motor operation, installation, maintenance, inspection, repair, and trouble shooting, which is relevant to most of the motor products shipped by NORD. Information and instructions provided in this manual, safety and commissioning information and all other manuals applicable to any items supplied by NORD must be observed.

This instruction manual is not intended to include comprehensive details and information related to all possible design variations or accessories options available with NORD motors. If there is any uncertainty about specific procedures, instructions or motor details, then please refer these questions to NORD for additional information or clarification.

Before installing, operating, or performing maintenance on any electrical motor become familiar with the following:

- The detailed operating instructions and wiring diagrams.
- All applicable national, local and system-specific regulations, codes and practices.
- The national / regional regulations governing safety and accident prevention.
- The proper use of any tools, transportation or hoisting equipment, and safety equipment needed to complete the installation.
- To avoid serious injury or possible damage to the equipment or machine, compliance with all safety and information notes is mandatory!

⚠ *WARNING*

All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws!

⚠ *DANGER*

To avoid electrocution, injury or death, make certain the motor is properly grounded, completely de-energized and brought to a no-voltage condition prior to working on any electrical connections.

2. Motor Types

NORD AC electric induction motors described in this manual generally include the following types:

- Single speed or two-speed design.
- Three phase alternating current or single phase design.
- Enclosure types: TEFC, TENV, and TEBC.

3. Enclosure Types

Totally enclosed fan cooled (TEFC).

TEFC motor designs rely on fan that is mounted on the motor's rotor shaft so the cooling capacity can vary based upon the motor's operating speed.

Totally enclosed, non-ventilated (TENV)

The TENV motor designs rely purely on convection cooling and they have no fan. Often TENV designs are labeled for intermittent or periodic duty or at a lower power rating than is typical for the given motor frame size.

Totally enclosed, blower cooled (TEBC)

The TEBC design uses separate blower or ventilator fan, with its own low wattage motor and a separate power supply, to provide continuous airflow and cooling. The blower can be used to extend the speed range of the motor and allow extreme slow speed operation without causing a concern for overheating. Blower data is provided in Table 6, page 11.

4. Voltage and Frequency Variation

Voltage and frequency variations are based upon the assumption that the nameplate horsepower will not be exceeded and that the motor temperature may increase. Standard allowable deviations are based upon the type of motor labeling.

NEMA and CSA Labeled Motors

Variations are based upon the nominal utilization voltage, and not the service (supply) voltage as per ANSI C84.1.

Service Voltages	Utilization Voltages
120V, 208V, 240V, 480V, 600V	115V, 200V, 230V, 460V, 575V

- Voltage variation at rated frequency = ±10%.
- Frequency variations at rated voltage = ±5%.
- Combined voltage/frequency variation = ±5%.

CE Labeled Motors

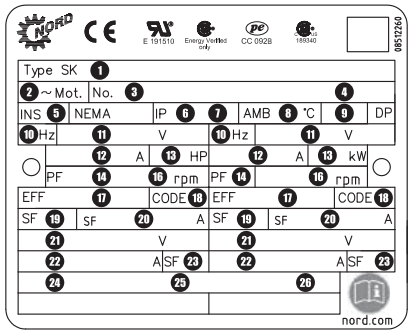
Per IEC 60038, allowable service voltage variations on in the current system, compared to the previous system, are as indicated.

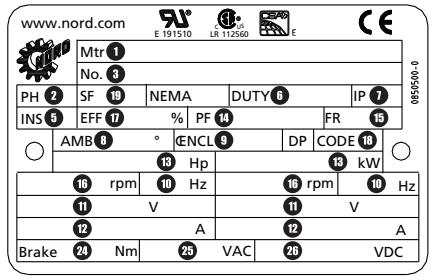
Previous Service Voltages	Current Service Voltages
220V, 380V, 660V	230V, 400V, 690V +6/-10%
240V, 415V	230V, 400V +10/-6%

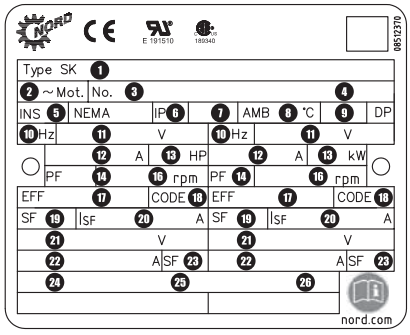
- Per EN 60034-1 a ±5% voltage variation and a ±2% frequency variation can be tolerated.
- The allowed variations are based upon the voltage (or voltage range) indicated on the motor nameplate.

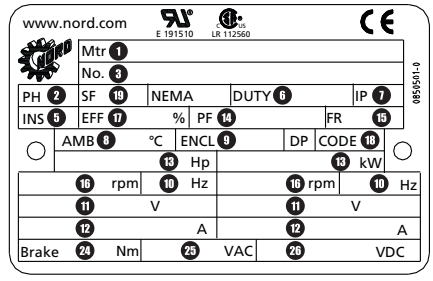
5. Motor Nameplate Information

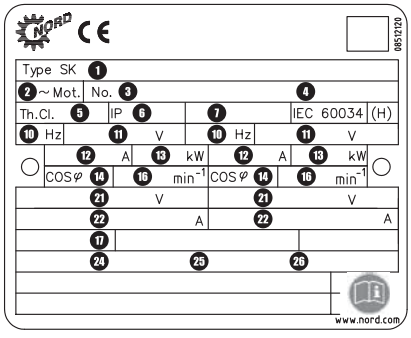
The motor nameplate and the display of technical information may vary slightly depending upon the global standard/s that the motor conforms to and the efficiency level. Please reference the examples below.











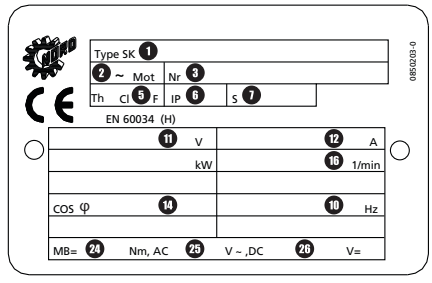


Table 1. Nameplate Data

Field	Definition
1	Model / Type
2	Number of Phases
3	Order Number
4	Serial Number
5	Insulation Class
6	IP (Ingress Protection) Enclosure Rating
7	Duty Cycle
8	Ambient Temperature Rating (°C)
9	Enclosure Type
10	Motor Frequency (Hz)
11	Voltage Rating (V)
12	Current Rating (A)
13	Rated Power (HP or kW)

Field	Definition
14	Power Factor
15	Motor Frame Size
16	Full Load Speed (rpm or 1/min^2)
17	Efficiency
18	NEMA Code Letter
19	Service Factor
20	Current Rating (If Service Factor ≥ 1.15)
21	Operating Voltage Rage (A)
22	Current Rating at Operating Voltage Range (A)
23	Service Factor at Operating Voltage Range (A)
24	Brake Rating (Nm)
25	Brake Supply Voltage (VAC)
26	Brake Coil Voltage (VDC)

MOTORS - AC INDUCTION, SINGLE & POLYPHASE

6. Motor Options And Nomenclature

NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are commonly used options.

Code	Description
AICM	Additional Internal Insulation Coating Applied
BRE	With Brake
EAR	Single Phase, Start Cap/Run Cap
ECR	Single Phase, Start Cap/Run Cap Increased SF
EHB	Single Phase, Run Capacitor Only
EP	Epoxy Dipped Windings
F	Blower Cooling Fan - 3ph & 1ph
FC	Blower Cooling Fan - 1ph
FHL	Brake – Lockable Manual Release
H	Energy Efficient
HL	Brake – Manual Hand Release
IG	Incremental Encoder
IP66	IP66 Environmental Protection
IR	Brake – Current Sensing Relay
KB	Condensation Holes - Removable Plugs
KD	Condensation Holes - Open
MIK	Brake – Microswitch
MS	Power Plug Connector

Code	Description
OL	TENV Motor – Without Fan / With Cover
OL/H	TENV Motor - Without Fan & Cover
P	Premium Efficient Motors
RD	Canopy Cover
RDD	Double Canopy Cover
RG	Brake – Corrosion Protected
RLS	Backstop
SH	Motor Space Heater
SR	Brake – Dust Protected
TF	Thermistor
TW	Thermostat
VN	10:1 Constant Torque Rated Motor
VR	5:1 Constant Torque Rated Motor
VW	20:1 Constant Torque Rated Motor
VZ-F	1000+:1 Constant Torque Rated Motor
WE	2nd Motor Shaft End
WU	High Slip Rotor
Z	High Inertia Motor Fan

Motor Nomenclature

100LP / 4 BRE 40 ...

- ... — Other Options
- 40 — Brake Size Nm
- BRE — Brake
- 4 — Number of Poles
- 100LP — Frame Size

Ordering Examples

100LP / 4 BRE 100 HL RG

- RG — Corrosion Protection
- HL — Hand Release Lever
- 100 — 100 Nm Brake Torque
- BRE — Brake
- 4 — 4 Poles
- 100LP — Motor Frame Size

100 Frame Motor with 4 poles, Brake, 100 Nm with a hand release lever, corrosion protected brake, and a current sensing relay.

63L / 4 BRE 40 FHL SR

- SR — Dust & Corrosion Prot.
- FHL — Locking Hand Release Lever
- 40 — 40 Nm Brake Torque
- BRE — Brake
- 4 — 4 Poles
- 63L — Motor Frame Size

63 Frame motor with 4 poles, a 40 Nm Brake with a locking hand release lever and dust & corrosion protection.

7. Application Conditions

Standard NORD motors are designed to operate in dusty or moist environments and have anti-fungal, thermal class F insulation.

- Enclosure Protection Rating = IP55 (minimum).
- Maximum Installation Height = 3300 ft (1000 m).
- Ambient Temperature = -4 to 104°F (-20 to 40 °C).
- Tropical-proof, Thermal Class F insulation.

The protection level and maximum ambient temperature are stated on the motor nameplate.

IMPORTANT NOTE

NORD can provide motors for an expanded range of applications and service conditions including higher protection levels, extreme ambient conditions and, higher altitudes.

IMPORTANT NOTE

Consult NORD for recommendations if motors are operated under extreme loading conditions, exposed to high inertia loads, or need to operate under unusually high cycling conditions with high starting and stopping frequency.

DANGER

Special design and assembly considerations are needed if NORD motors are subject to any of the following conditions. Environmental conditions may lead to premature damage and/or failure without the proper protective features. Consult NORD for design considerations:

- Outdoor installation with motor in a vertical position.
- Direct contact with aggressive or corrosive materials (acids, bases, salts, certain gases, etc.).
- Exposure to extreme high or low temperatures, high relative humidity, condensation moisture or very wet environments.
- Subject to extreme material build-up on the unit (dirt, dust, sand, etc.).
- Hazardous Locations (risk of fire or explosion).

8. Transportation

During transportation observe the following:

- Make sure that all eyebolts and lifting lugs are tight and firmly against their supporting surface.
- Use all the lifting eyes that are intentionally supplied with the motor.
- Lift only at designed points.
- Protect the mounting surface from possible damage during transportation.
- Always use sufficiently rated handling equipment, lift mechanisms and lifting straps.
- With heavier objects or unbalanced loads, it may be appropriate to use more than one lifting point or an additional strap or sling to assure safe transportation of the assembly. This is especially true of assembled gearmotors and motorized reducers.
- Once the NORD motor or assembly is properly installed, remove the transportation fixtures completely or make certain they are properly re-secured and tightened.

WARNING

Transportation – Use of Lifting Devices

To avoid death, serious injury or equipment damage…

- Hoisting lugs or lifting eyes attached to the motor are designed for the weight of the motor only! Do not attach any additional loads!
- The motor must only be transported and lifted using the lifting eyes, in a position that is appropriate for its type of construction. Otherwise, it could fall over or slip in the lifting tackle.
- During suspended transport, two straps must be able to carry the entire load weight safely.
- When required use additional, suitable means of support for transportation, installation or removal.
- Always secure the support equipment to prevent it from slipping.

9. Storage

If the motor is not in service, store it according to the following conditions:

- Store the motor in a clean, dry, dirt-free, vibration free area.
- Storage temperatures of 10°C (50°F) to 50°C (120°F) must be maintained.
- Relative humidity must not exceed 60%.
- If vibration in the area exceeds 0.002 inch (0.05 mm) at 60 hertz, then vibration isolation pads are suggested to prevent brinelling of the bearings.
- Treat the unprotected shaft end and mating flange surfaces with a corrosion inhibitor that can be cleaned off prior to commissioning.
- Before placing the motor into service, visually inspect the motor exterior for evidence of deterioration during storage. Turn the motor shaft by hand to make sure the shaft turns freely.
- Motor space heaters, when provided, are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional. Remove motor from the storage container when the heater is energized.
- If the motor needs to be stored for extended periods, or if it is stored in less than favorable conditions, it is recommend that the winding insulation resistance be checked prior to commissioning (page 7).
- Even if stored in favorable conditions, the antifriction motor bearings and motor shaft seals may need to be replaced if the storage period is more than 4 years.

10. Safety Considerations

When installing, servicing or replacing electric motors it is important to be working in a “voltage-free” state. Observe the following safety rules.

Safety Rules

1. Disconnect the system. Disconnect the auxiliary circuits (brakes, space heaters, etc.).
2. Prevent reconnection (follow safe lock-out/tag-out practices).
3. Make sure that the equipment is at zero voltage.
4. Make certain the equipment is properly grounded and short-circuited.
5. Cover or isolate nearby components that are still electrically live.

To energize the system, apply the measures in reverse order.

Qualified Personnel

All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

For the purpose of this documentation, a qualified personnel is taken to mean a person or people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the machine by the appropriate person responsible.
- They are responsible for knowing and complying with all applicable national, regional, and local work regulations and safety requirements.

10. Safety Considerations Ctd.

General Warnings and Cautions

⚠ DANGER

To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices carry potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.

⚠ DANGER

Electrical machines contain dangerous voltage levels, electrically live parts, rotating surfaces and hot surfaces. To prevent injury, death or possible equipment damage always observe the following:

- Keep all safety covers and guards in place during operation. Remove and replace covers in compliance with the applicable safety regulations.
- Allow the machine to cool down before starting any work on it.
- Operate the machines properly.
- Perform regular maintenance on the machine.
- Secure and guard free-standing shaft extensions.

⚠ DANGER

Electrically Live Parts

Electrical machines contain electrically live parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

⚠ WARNING

Rotating Parts

Electrical machines contain dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

⚠ WARNING

Hot Surfaces

Electrical machines have hot surfaces. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly. Allow the machine to cool down before starting any work on it.

⚠ WARNING

Maintain Proper Cooling

Operating the motor without the intended cooling fan may cause overheating and result in very hot surfaces, personal injury and material damage. Never commission a motor intended to be fan cooled when it is missing the shaft-driven fan or external blower assembly.

⚠ DANGER

Condensation Drain Holes (Optional)

Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property!

- Before opening sealed drain holes, make sure the motor is in a no-voltage condition. Close the condensation drain holes before re-commissioning.
- Exercise caution around drain holes that are intended to be left open, especially when the motor is energized.

IMPORTANT NOTE

Before start-up check the following:

- All electrical connections are secure, well grounded and properly made.
- The motor is rotating in the correct direction (when de-coupled from the driven load).
- There are no temperature-sensitive parts (cables etc.), in contact with motor enclosure.
- Condensation drain holes are always located at the lowest point of the motor.

11. Checking the Insulation

Before putting the motor into operation for the first time, after a lengthy period of storage or standstill (approx. 6 months), the insulation resistance of the winding should be checked.

WARNING

During or directly after measurement the motor connection terminals carry hazardous voltages. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

A. Control

The insulation resistance of new, cleaned, or repaired motor windings against the grounded housing and against one another should be > 200 Mega-Ohms.

B. Measurement

Using a Mega-Ohm meter apply a DC voltage of 500 VDC to the motor winding for a period of 60 seconds and record the winding insulation resistance compared to ground.

- The 500 VDC test voltage is applicable to low voltage motors up to 1000 VAC.
- When performing this test the temperature of the windings should be 25°C ± 15°C (77°F ± 27°F).

C. Verification

- If the insulation resistance of the winding is less than 50 Mega-Ohms, the cause may be moisture. The windings should be dried and the test should be repeated.
- After any lengthy period of operation the insulation resistance may drop. So long as the measured value does not fall below the critical value of 50 Mega-Ohm, the motor may continue to be operated.
- If the measured value falls below the critical 50 Mega-Ohm level, the cause must be established and the windings or winding sections must be cleaned, dried, repaired, or replaced as needed.

12. Bearing Lubrication

NORD motor frame sizes 63 up to and including 225 are normally supplied with internally grease lubricated bearings and require no lubrication during normal operation.

NORD motor frame sizes 250 and larger are supplied with grease fittings for re-greasing the motor bearings.

IMPORTANT NOTE

Motors with grease fittings are normally supplied with a label indicating the grease type used, the suggested re-lubrication interval, and the amount of new grease to be applied. General bearing maintence guidelines are listed in Table 3.

Typical motor bearing grease is an NLGI No. 2 consistency, high grade product with a polyurea base thickener, synthetic or blended mineral/synthetic oil, and stabilizing agents to protect against heat and oxidation.

Table 3 – Motor Bearing Maintence Guidelines

Frame Size	Power	Poles	Re-greasing Interval
63-225	0.16-60 HP (0.12-45 kW)	All	Maintence Free
250 to 280	75-125 HP (55-75 kW)	2	4000 h
		4 to 8	8000 h
315	150-250 HP (132-200 kW)	2	3000 h
		4 to 8	6000 h

NOTICE

When re-greasing motor bearings do not to mix different greases without verifying the compatibility with a reputable grease lubrication supplier. Mixing incompatible products can lead to bearing failure.

13. Mechanical Installation

Integral motors, NEMA C-face motors, and IEC flange mounted motors must be rigidly secured to their mating connection surface using all fastening screws tightened to the proper bolt torque. It is good practice to apply a medium strength thread- locking agent (Loctite® 242) to the mounting screws.

Foot mounted motors must be securely installed to a rigid and level foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. All mounting hole locations must be utilized. Tighten all hold down screws or bolts to the proper bolt torque.

NOTICE

Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Accurate alignment and proper balancing of output devices (couplings, belts, pulleys, etc.) is required to assure quite, low vibration, trouble free operation. When the motor is directly coupled to a gear drive or a driven machine make sure that the motor shaft and driven machine shaft are aligned with one another axially.

NOTICE

Inaccurate alignment may lead to bearing damage, excessive vibrations and shaft breakage.

IMPORTANT NOTE

For motor replacement guidelines see section 20 on page 15 and section 21 on page 16.

14. Electrical Connections

⚠ DANGER

To avoid electrocution, injury or death, make certain all electrical devices (motors, brakes, variable frequency drives, etc.) are properly grounded, completely de-energized, and brought to a no-voltage condition prior to working on any electrical connections. Remember that most of these devices potentially dangerous energy levels for a period of time after power is removed. Always follow proper lock-out/tag-out procedures.

IMPORTANT NOTE

External motor brakes have their own connection requirements as indicated in the appropriate brake instruction manuals.

⚠ WARNING

If the motor has an integral brake, make certain there is no load connected to the driven equipment before releasing the brake. Otherwise serious injury, death, or damage to the equipment may result.

- The supply voltage and frequency must agree with the motor nameplate data.
- Always feed the connecting leads into the terminal box using appropriate mating cable glands. The mating connection cables and cable glands should be suitable for temperatures ≥ 194°F (90°C).
- Provide the ends of the connecting leads and ground lead with cable lugs or curved ring eyelets before connecting them to the terminal board.
- Make certain that the wiring connections and arrangement of the terminal board jumpers conform to the appropriate wiring diagram as provided in the motor terminal box and/or page 9 of this manual.
- Tighten the terminal board screw connections on the on the main terminal board per the table below.

Table 4 – Tightening Torque: Terminal Board and Grounding Screws

Thread Size	Nut Size [mm]	Tightening Torque [lb-ft]	Tightening Torque [Nm]
M4	7	0.6-0.9	0.8-1.2
M5	8	1.3-1.8	1.8-2.5
M6	10	2.0-3.0	2.7-4
M8	13	4.0-5.9	5.5-8
M10	17	6.6-9.6	9-13
M12	19	11.8-14.8	16-20

- Upon final assembly, the terminal box cover must be sealed so that it is dust-tight and water-tight.

Table 5 – Tightening Torque: Terminal Box Cover Screws

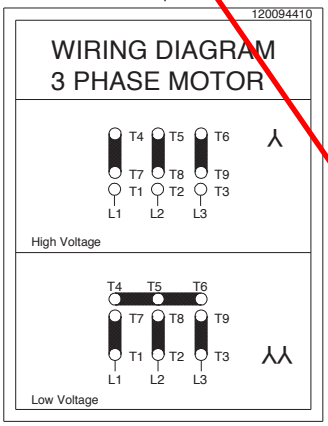
Thread Size	Tightening Torque [lb-ft]	Tightening Torque [Nm]
M4	0.6-0.9	0.8-1.2
M5	0.9-1.3	1.2-1.8
M6	1.1-1.8	1.5-2.5
M8	2.2-3.7	3.0-5.0

15. Direction of Rotation

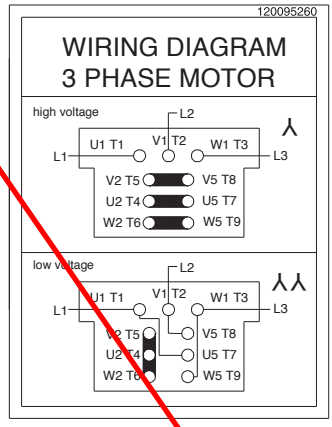
The motor shaft rotation is defined per IEC 600034, Part 8. The motor shaft rotation can be controlled by the way the incoming line power is connected. When connecting the incoming line power in phase order to the terminal block posts, T1 (U1), T2 (V1), and T3 (W1) respectively, the motor shaft rotation will be clockwise when viewing the motor shaft at the drive-end.

15. Wiring Diagrams - Motor & Motor Option Connection Diagrams

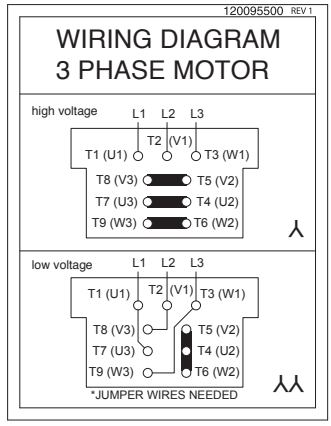
NORD Frames 63-225
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø



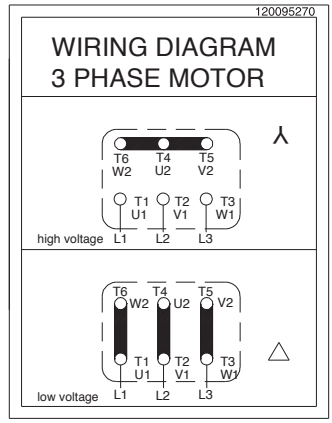
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



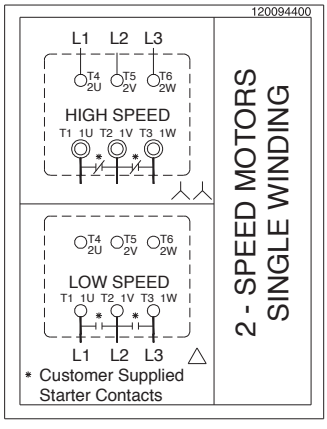
NORD Mfg by Siemens - Frames 200+
230 / 460V, 60Hz, 3Ø | 200 / 400V, 50Hz, 3Ø
190 / 380V, 60Hz, 3Ø



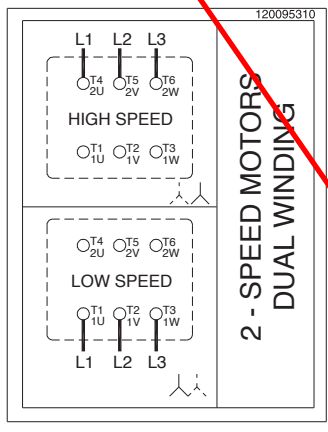
NORD Frames 63-225
460 / 800V, 60Hz, 3Ø | 230 / 400V, 50Hz, 3Ø
208 / 360V, 60Hz, 3Ø | 400 / 690V, 50Hz, 3Ø
332 / 575V, 60Hz, 3Ø

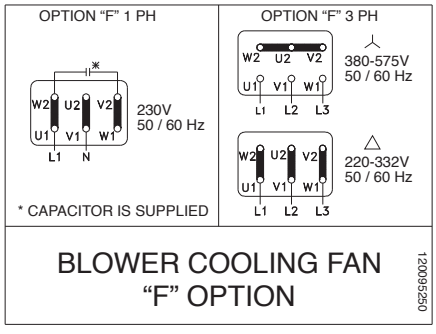


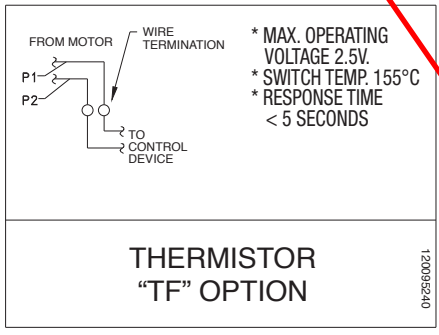
NORD 2 - SPEED MOTORS
SINGLE WINDING (4-2 & 8-4 POLE)

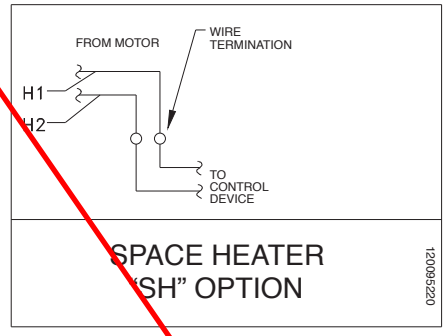


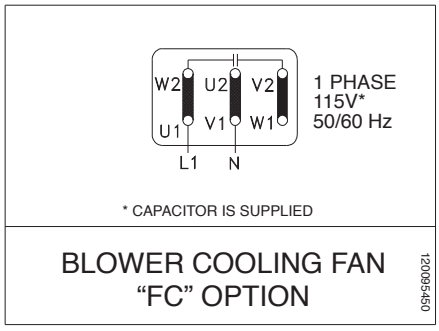
NORD 2 - SPEED MOTORS
DUAL WINDING (8-2 POLE)

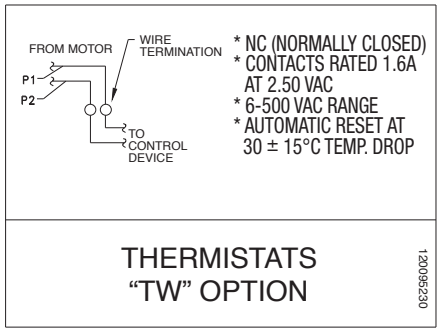






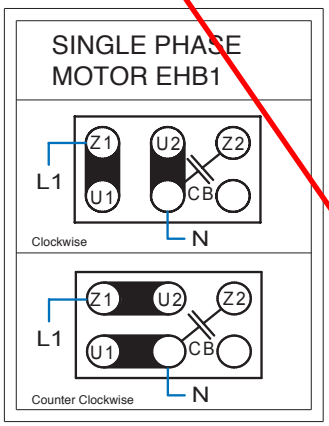




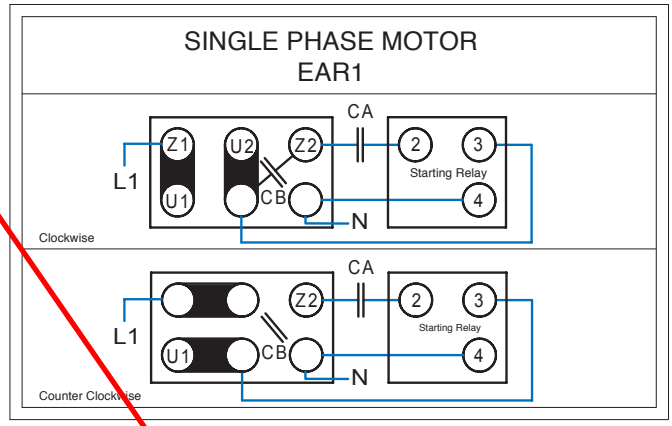


15. Wiring Diagrams Ctd. - Single Phase Motor Connection Diagrams

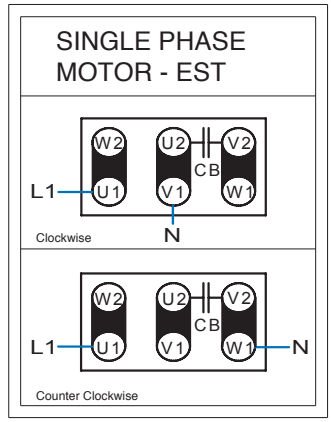
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



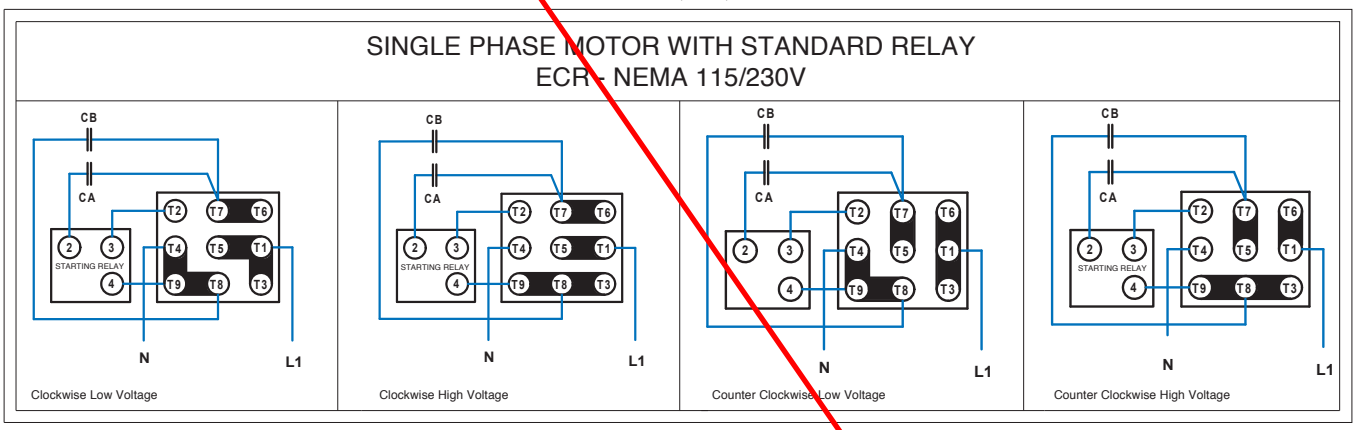
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



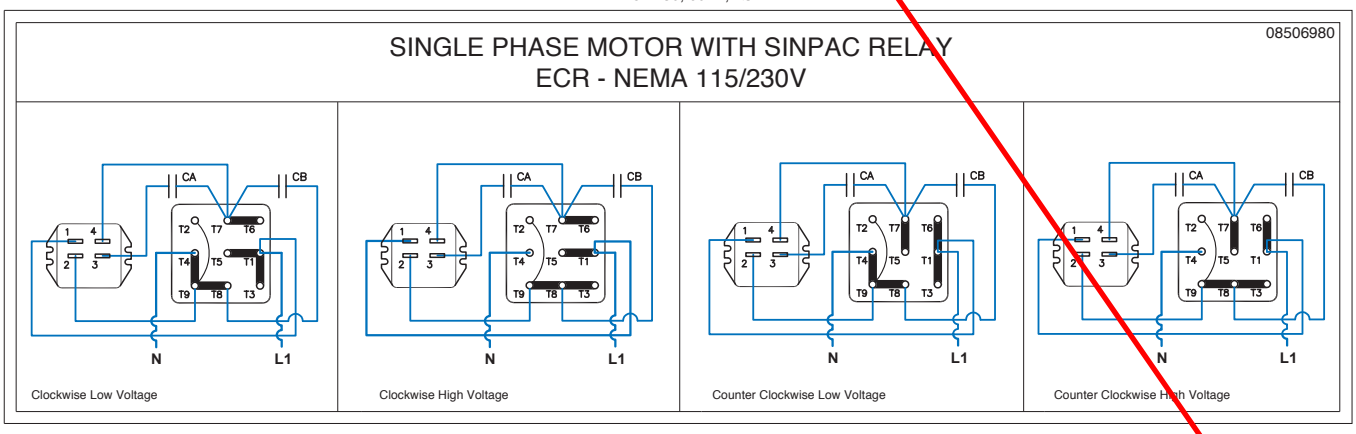
Motor Frame Sizes 63-90
230V, 50Hz, 1Ø



Motor Frame Sizes 63-90
115 / 230, 60Hz, 1Ø



Motor Frame Sizes 63-90
115 / 230, 60Hz, 1Ø



16. Motor Accessories

Blower Cooling Fan (Option F & FC)

- Connection Diagram Shown on page 10
- Option FC is 1-phase, 115V
- Option F has capability of 1 phase by connecting a supplied capacitor

Table 6 – Option F & FC

Option F – 3ph & 1ph 220-575V 50/60Hz

Motor Frame	60Hz Ratings			50Hz Ratings		
	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]
Single phase connection - ⊥ (Δ Delta)						
63	230 – 277	0.11	38	230 – 277	0.10	27
71	230 – 277	0.12	41	230 – 277	0.10	28
80	230 – 277	0.13	44	230 – 277	0.11	29
90	230 – 277	0.25	88	230 – 277	0.26	72
100	230 – 277	0.28	88	230 – 277	0.26	70
112	230 – 277	0.31	107	230 – 277	0.26	73
132	230 – 277	0.27	89	230 – 277	0.29	82
160 - 225	230 – 277	0.41	140	230 – 277	0.45	128
Three phase low-voltage connection - (Δ Delta)						
63	220 – 332	0.08	23	220 – 290	0.10	27
71	220 – 332	0.08	24	220 – 290	0.10	30
80	220 – 332	0.08	25	220 – 290	0.01	29
90	220 – 332	0.21	64	220 – 290	0.28	86
100	220 – 332	0.21	66	220 – 290	0.27	86
112	220 – 332	0.23	70	220 – 290	0.27	85
132	220 – 332	0.25	74	220 – 290	0.32	96
160 - 225	220 – 322	0.49	165	220 – 290	0.52	155
Three phase high-voltage connection - (Y)						
63	380 – 575	0.04	23	380 – 500	0.05	29
71	380 – 575	0.04	25	380 – 500	0.05	30
80	380 – 575	0.04	26	380 – 500	0.05	29
90	380 – 575	0.12	62	380 – 500	0.16	82
100	380 – 575	0.12	66	380 – 500	0.16	83
112	380 – 575	0.13	70	380 – 500	0.16	82
132	380 – 575	0.14	75	380 – 500	0.18	96
160 - 225	380 – 575	0.28	165	380 – 500	0.29	155

Option FC – 115V 50/60Hz 1ph

Motor Frame	60Hz Ratings			50Hz Ratings		
	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]
Single Phase Connection - ⊥ (Δ Delta)						
63	100 – 135	0.23	42	100 – 135	0.30	42
71	100 – 135	0.23	47	100 – 135	0.30	44
80	100 – 135	0.27	57	100 – 135	0.30	43
90	100 – 135	0.46	102	100 – 135	0.57	78
100	100 – 135	0.53	105	100 – 135	0.54	78
112	100 – 135	0.60	115	100 – 135	0.55	80

16. Motor Acc. Ctd. - Motors with Thermal Protection

Effective July 15th, 2016 many newly manufactured NORD motors that require a thermal protection device will use WAGO® Series 221 Series Compact Splicing Connectors. These connectors will be used for splicing the leads of the thermal protection option supplied by NORD to the customer supplied control device.

- The WAGO® connector will facilitate assembly of NORD 63-132 frame, 60Hz, CUS approved motors
- An oversized brake terminal box and secondary 2-post wire termination strip will no longer be required.
- NORD will supply (2) Wago® Series 221, 2 conductor splicing connectors for each motor requiring thermal protection (NORD P/N 18251607)

Table 7 – Motors Receiving the WAGO® Connector

Motor Supplier	NORD
Frame Size	63 to 132
Type	CUS
Thermal Protection Option	TW, TF, PT100, KTY
Motor Connection	Wye-Wye/Wye (YY/Y)
Voltage – Hz	230/460V – 60 Hz
Brake Motors Affected	No
EKK Small Terminal Box	Not possible (space limited

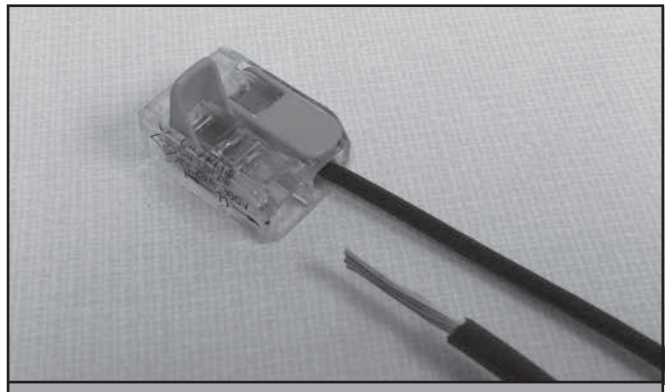
Table 8 – WAGO® Series 221 Connector Ratings

Wire Size	12-24 AWG (solid stranded or fine stranded) 0.14 - 4mm² (fine stranded) 0.2 - 2mm² (solid stranded)
Rated Voltage	600V
Rated Current	20A
Operating Temp.	105°C (221°F)
Global Approvals	cULus, ENC 05, EAC, PSE

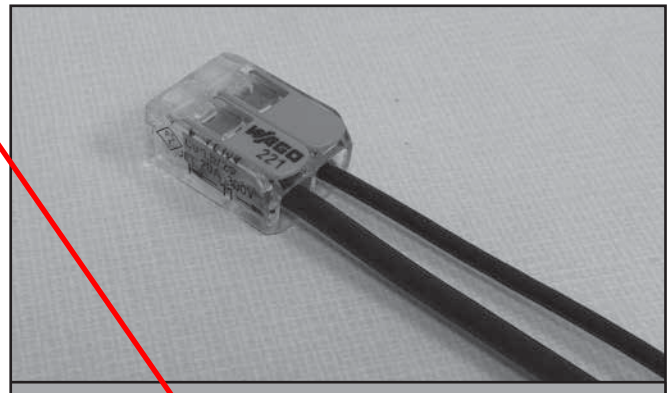
UL Certificate E69654

Operation of WAGO® Series 221 Connector

1. Strip the wire/s to be connected to 11 mm (0.43 in).
2. Open up the lever of the lever-nut, place the wire in the receptical and close the clamp.
3. Repeat for the additional wires being joined.



WAGO® receptical in the open position



WAGO® receptical in the closed position

The WAGO Connector remains optional for the following NORD motors:

Brake Motors - An oversized conduit box is utilized with a secondary 2-post wire termination block for the thermal protection option

Delta/Wye (Δ/Y) Connected Motors - These utilize an 8 post terminal box (6 primary posts for the supply power and 2 auxillary posts for thermal protection)

Motors 160 Frame and Larger - The terminal box is large enough to allow the use of a secondary 2-post wire termination block for your thermal protection device.

Thermostats (TW & 2TW)

Table 9. TW & 2TW options, Thermostats

Standard connection	Series connected, one per phase
Contact	NC (Normally Closed)/ Auto Re-setting
Response Temperature (Option TW)	311 °F (155 °C) Shut-Off Device
Response Temperature (Option 2TW)	311 °F (155 °C) Shut-Off Device + 266°F (130 °C) Alarm Device
Nominal Current	1.6 Amp at 250 V
Resistance	< 50 mΩ
Switch Rebound	< 1ms
Insulation Rating	2000 VAC
Cycles	10,000 max
Lead Identification (inside terminal box)	P1 and P2 or TB1 and TB2 / 2TB1 and 2TB2

Motor thermostats or bi-metallic switches can be wired directly into the control circuit without a separate control module or tripping device. Thermostats operate on a relatively high control voltage so they are less sensitive to voltage interference from the main power supply. Often one can run thermostat leads and motor power leads next to each other when using the appropriate shielded cable. The installer is responsible to wire the thermostats into the motor control circuit. The leads may be labeled as indicated below.

Thermistors (TF)

Table 10. TF option, Thermistors

Standard Connection	Three devices, series connected, one per phase
Type	Positive temperature coefficient (PTC)
Transition Temperature	150°C±5 °C
Resistance	20… 500Ω (below transition) > 4 kΩ (above transition)
Reed Current	< 1mA
Max Voltage	30V
Lead Identification (inside terminal box)	P1 and P2 or TP1 and TP2

With a separate control module or tripping device (ex. Kirwan INT69) thermistors are used to sense motor overload/ over temperature conditions by converting the critical operating temperature limit into large internal resistance change. Due to their small size, heat sink construction, and high change in resistance value, minor resistance variations caused by relatively long lead runs can be tolerated. This feature also allows for one controller to be used for several temperature sensing locations. Many variable frequency drives come with on-board thermistor inputs. NORD does not supply the thermistor control module.

IMPORTANT NOTE

- Thermostats and Thermistors will automatically reset.
- All wiring must be completed by qualified personal and adhere to all local codes.

16. Motor Acc. Ctd. - Space Heaters (Option SH)

- Connection Diagram shown on Page 9
- Space Heaters are mounted directly on the motor winding
- The leads are brought into the terminal box and labeled H1 and H2
- They require a separate voltage supply and must not be energized when the motor is energized
- The heaters will keep the winding of the motor approximately 5°C above the surrounding ambient

Table 11. Space Heater Data

Frame Size	Wattage	Voltages	Heater Strips/MTR
63 & 71	18W	110V 230V 460V	1
80	25W	110V 230V 460V	1
90 – 112	50W	110V 230V 460V	2
132-180	100W	110V 230V 460V	2
200 & 225	120W	110V 230V 460V	2

Encoder (Option IG)

- Most standard encoders will be enclosed inside the fan cover
- Incremental, Quadrature, Differential, Marker Channel
- IP66 Protection
- IG1 = 1024PPR, IG2 = 2048PPR, IG4 = 4096PPR
- TTL/RS422, HTL/Push-Pull, Line Driver.
- 5V or 10-30V available.
- Absolute encoders also available.
- Seperate encoder wiring instructions are provided by NORD.

17. Inspection

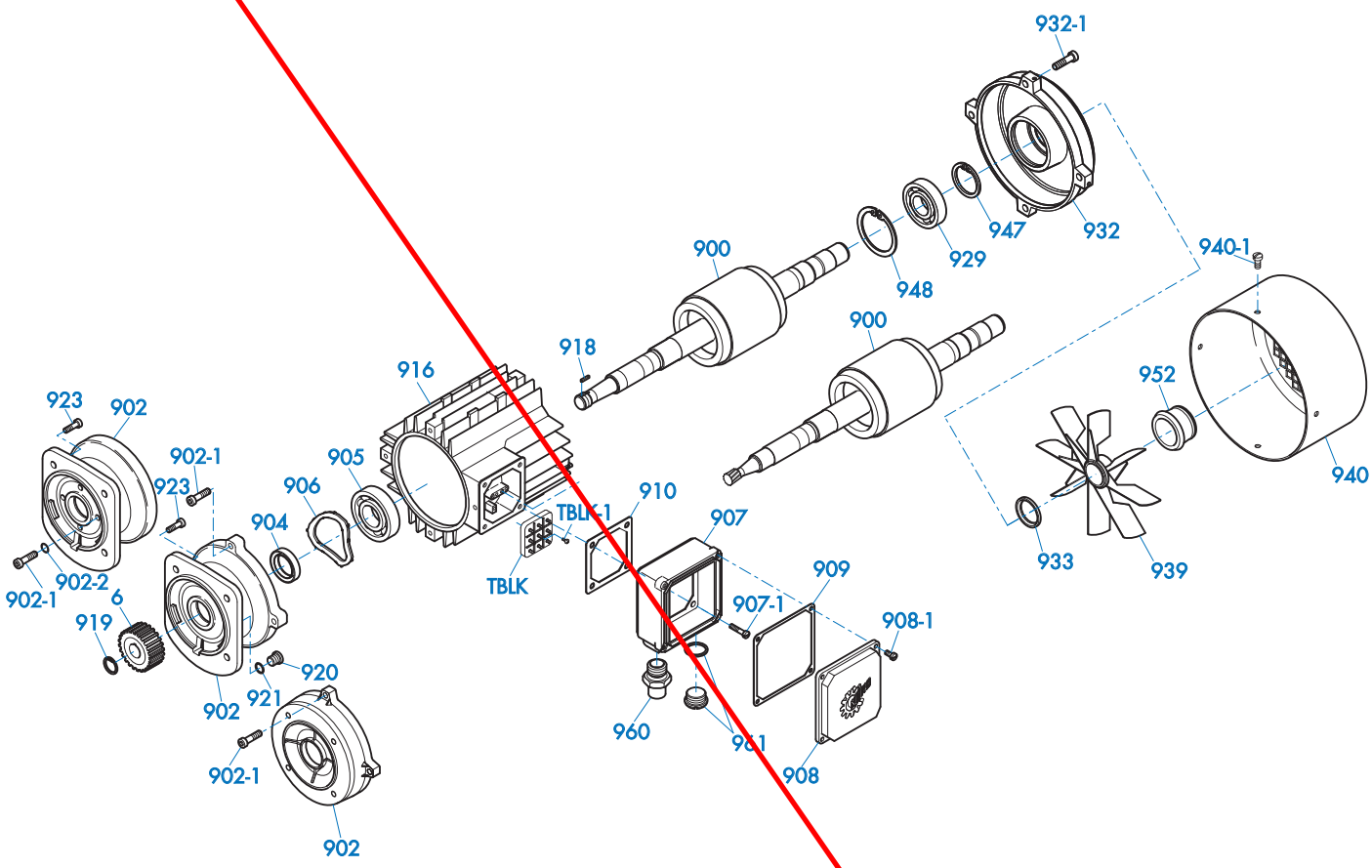
Inspect the motor after every 500 operating hours. Please use table 12 below for inspection guidelines.

⚠ CAUTION

If it is necessary to clean the motor exterior, do not use shop air. Shop air can force contaminents into the motor and may cause parts damage or result in blowing debris causing injury.

Table12. - Motor Inspection Guidelines

Inspect	Check	Action
Motor Exterior	Check the external surfaces for contamination. Accumulation of dirt and fibrous deposits must be removed.	Clean the motor external surfaces using clean, lint-free cloths.
		Clean deposits from between cooling fins using a vacuum cleaner and a stiff-bristled nylon brush.
	Check the external surfaces for oil film and greasy deposits.	Clean the oil film and greasy deposits from the motor surface using clean, lint-free cloths.
		If necessary, moisten the cloth with an approved non-flammable, residue-free solvent. Do not pour solvent on the motor.
	Check for evidence of damage or overheating.	If the motor has physical damage, replace the motor.
Motor Mountings	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
Motor Electrical Connections	Check that all electrical connections are secure.	If the electrical connections are not secure, tighten them.
	Check the electrical connections for evidence of arcing.	Loose electrical connections can cause arcing, which is evident by discoloration and charring. If you find evidence of arcing, replace the damaged connections.
Insulation Resistance	Using an ohmmeter, check and record the resistance of motor winding insulation.	Compare the current resistance reading to previous readings. If the resistance drops significantly, perform an internal inspection for insulation damage or deterioration.
Motor Brake	On motors that have a brake, use a feeler gauge to check the air gap in between the brake pad and the rotor according to the appropriate user manual.	If the air gap exceeds the maximum allowed for that brake configuration provided in the manual, adjust the air gap or replace the brake pad according to user manual U35000.



Part Number	Part Description	Qty per Assembly
6	Input Pinion	1
900	Rotor Assembly	1
902	A-Endbell	1
902-1	Screw	4
902-2	Dubo Seal	4
904	Oil Seal	1
905	Bearing	1
906	Preload Spring	1
907	Terminal Box Frame	1
907-1	Screw	4
908	Terminal Box Cover	1
908-1	Screw	4
909	Gasket - Terminal Box Frame	1
910	Gasket - Terminal Box Cover	1
916	Stator	1
918	Key	1
919	Retaining Ring	1
920	Oil Plug	1

Part Number	Part Description	Qty per Assembly
921	Gasket	1
923	Screw	4
929	Bearing	1
932	B-Endbell	1
932-1	Screw	4
933	Oil Seal	1
939	Fan	1
940	Fan Cover	1
940-1	Screw	4
947	Retaining Ring	1
948	Retaining Ring	1
952	Fan Clip	1
960	NPT Thread Adapter	1
961	Plug (includes O-ring)	1
TBLK	Terminal Block	1
TBLK-1	Screw, Terminal Block Mounting	2
	Jumper Bar (not illustrated)	AR

19. Repair

Reference the parts list drawing on page 14 for clarification.

A. Disassemble the motor according to the general exploded view in PARTS INFORMATION. Disassemble only as far as necessary to replace the failed parts.

B. Whenever the motor is disassembled, clean all dust and contamination from the motor interior using a vacuum cleaner and a soft-bristled nylon brush.

C. The following parts must be replaced if they are removed:

- Oil seal (904), Oil seal (933)
- Gasket (909), Gasket (910), Gasket (921)
- Gasket on plug (961)
- Self-locking screws (907-1, 908-1, 923, 932-1, 940-1)
- Dubo Seals (902-2)

D. If the following parts are removed, inspect them, and replace them if they are deformed or damaged:

- Retaining ring (919), Retaining ring (947), Retaining ring (948)
- Fan clip (952)

20. Removing and Replacing Integral Motors

Reference the parts list on Page 14 for clarification.

A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.

B. Drain the oil from the mating gearbox, or rotate the motor/gearbox assembly so that the motor is up, to prevent oil from spilling from the gearbox when the motor is removed.

C. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.

D. Remove the fastening screws that hold the motor to the reducer input.

IMPORTANT NOTE

Most integral motor installations have mounting bolts accessible from the motor exterior. If the bolts are not clearly visible, unbolt the input flange from the gearbox. Remove the bolts securing the motor to the reducer input flange, and discard the old DUBO sealing rings that were under the screw heads.

E. Maintain motor shaft alignment and move the motor directly away from its mounting surface until the motor shaft and mating input gear clear both the internal gear mesh and reducer input.

F. Remove and discard the old flange gasket.

G. Clean the gasket faces on the motor and gearbox, making sure no cleaning debris enters the gearbox.

H. Check the replacement motor to make sure the motor flange, motor shaft, and motor pinion are identical to the motor that was removed.

I. Place a new gasket between the gearbox and new motor.

J. Position the motor on the gearbox, making sure the input pinion meshes with the input gear. Rotate the motor as necessary to align the bolt holes and seat the motor flange. Make sure the gasket remains properly aligned and seated

K. Apply a medium strength thread locking compound to the bolt threads. Install the bolts and tighten them to the appropriate torque.

IMPORTANT NOTE

If the motor/gearbox installation uses an input flange, first mount the input flange to the motor using the four mounting bolts and NEW DUBO sealing rings under the head of each fastening screw. Make sure the fastening screws are clean and apply new thread sealant if necessary.

L. Check the gearbox oil level in accordance with the appropriate User Manual/s. If necessary fill or add oil to the gearbox.

NOTICE

Do not mix oil types. Mixing oil types may lead to component damage and diminished performance. Consult NORD for assistance or reference oil type listed on gearbox tag.

M. Re-establish the electrical connection to the motor.

N. Observe the subsequent start-up closely to make certain the equipment is operating properly and there are no seal or gasket leaks.

21. Removing and Replacing NEMA C-Face or IEC Fange-Mounted Motors

For further clarification of these instructions, reference the parts list on Page 14 of this manual.

A. Disconnect the power to the electric motor. Make certain the motor is properly grounded, de-energized and secured with a lock-out/tag-out device.

B. Support the motor and prepare it for removal. Steady the motor and support it. For larger motors, use of mechanical lifting or support devices to may be appropriate.

C. Remove the fastening screws that hold the motor to the C-face or IEC mounting flange.

D. Maintain motor shaft alignment, and move the motor directly away from its mounting surface until the motor shaft and mating coupling clear the mounting flange surface of the driven equipment.

E. Measure and record the proper placement of the motor shaft coupling prior to removing it from the old motor.

F. Make sure the new motor shaft, key and key slot are free of all nicks, burrs, and lubrication or grease.

G. Install the new shaft key on the new motor. If the shaft key is not captured or if an open-ended key slot is utilized it is good practice to secure the key into the key slot with a medium strength thread locking agent or alternatively one may stake the key in place.

H. Re-install the coupling on the new motor shaft, making sure the placement of the coupling is in the same location as it was on the old motor (See Step E).

I. Clean all old gasket material, sealants, contamination, and corrosion from the flange surface on the driven equipment.

J. If the motor is utilized in a wet or wash down environment apply a sealing gasket or gasket eliminating compound to the mating flange surface, as would seem most appropriate for the application.

K. Support the new motor and mount it flush against the mating flange surface of the driven equipment.

L. Apply a medium strength thread locking agent to the bolt threads.

M. Install the bolts and tighten them to the appropriate torque.

N. Re-establish the electrical connection to the motor.

O. Observe the subsequent start-up closely to make certain the equipment is operating properly.

22. Testing

IMPORTANT NOTE

NORD electric motors do not require periodic testing. However, if a motor is removed from its installation, NORD recommends that the motor be checked according to the following static and dynamic testing procedures before it is reinstalled. Finding a condition that will require future repair before the motor is reinstalled decreases the overall maintenance time.

This section provides general test information and functional checks for the types of motors covered by this manual. Read and understand the tests and checks before performing them on your motor.

Record and date all measurements taken.

If the motor fails any of the test procedures provided below, use the troubleshooting guide to determine the motor problem.

Static Testing

A. The motor can only be static tested if it is disconnected from the component it drives and securely mounted on a fixture or mounting plate. These tests are usually conducted when a motor has been removed for any reason other than failure

B. Turn the motor shaft slowly by hand. Feel and listen for evidence of a failed bearing, which is indicated by a rough feel as the shaft rotates, and by noise.

C. Check for smooth rotation, with no evidence of binding or catching. If the shaft does not rotate smoothly, or binds or catches, the bearings are worn or failing, lack lubrication, or are contaminated.

D. Check the motor shaft for side play by applying pressure at right angles to the shaft in several places around the circumference. If the shaft moves perceptibly, the front bearing may be worn.

Dynamic Testing

A. Find the motor voltage and rated load current values as listed on the motor nameplate.

B. Using a volt-ohmmeter, verify that the motor power supply is in the correct range.

C. Run the motor with no load. As the motor is operating, listen for unusual motor noise and check for excessive vibration. Vibration and motor noise are indications of bearing contamination, lack of lubrication, damage, or failure.

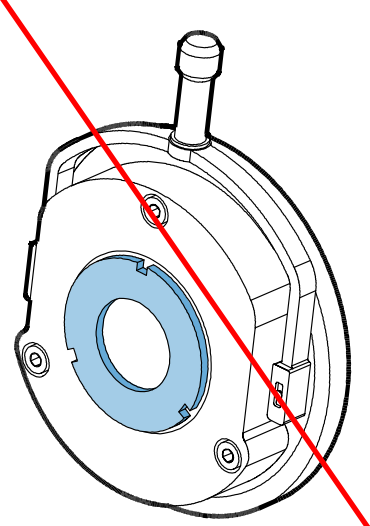
D. Use an ammeter to measure the no-load current. Record the no-load current for comparison with previous readings, and for reference during future testing.

E. If the motor passes the no-load test, operate the motor at rated load and check and record the current.

F. Check the motor operating temperature at rated load. If the motor operates at a higher than normal temperature, the motor may be damaged, overloaded or failing.

23. Troubleshooting

Fault	Likely Cause	Corrective Action
Motor fails to start.	• Motor is mis-wired • Brake is may not be releasing. • Fan guard damaged and contacting fan. • Motor protection device has tripped or does not switch • 1-Ph Capacitor or start switch has failed.	• Verify and correct motor wiring. • Troubleshoot brake per User Manual U35000. • Replace damaged fan guard. • Check motor protection device for correct setting and correct error. • Discharge capacitor and use a volt-ohm meter to check the capacitor for an open circuit - replace if needed. Inspect switch and connections. Replace if contacts look burned or pitted.
Fuses blow or motor protection faults immediately.	• Short circuit in line. • Lines connected incorrectly. • Fuse or circuit breaker tripped. • Motor is overloaded or equipment jammed. • Stator is shorted or went to ground.	• Rectify short circuit. • Check circuit diagram and make corrections. • Replace fuse or circuit breaker. • Make sure load is free. Verify motor amp draw compared to nameplate rating. • A damaged or blown stator will show a burn mark. Stator must be repaired or replaced.
Motor hums and has high current consumption	• Brake may not be releasing. • Rotor may be rubbing stator. • Defective or incorrect stator winding.	• Troubleshoot brake per User Manual U35000. • Send motor to a repair specialist.
Severe speed loss under load or excessive acceleration time.	• Overload. • Excessive voltage drop. • Damaged or failing motor bearings. • Damaged or worn gear unit. • 1-Ph Capacitor or start switch has failed.	• Check load conditions and make certain system is unobstructed. Reduce load or consider a larger motor. • Verify service voltage is within specification. Check if nearby equipment is affecting incoming power. Make sure connection harness and wiring is adequate. • Replace motor bearings. • Replace or repair damaged gear unit. • See instructions under “Motor fails to start”.
Motor runs the incorrect direction.	• Incorrect wiring.	• Rewire motor according to system schematic and/or switch two incoming motor phases.
Motor heats up excessively or thermal overload protection trips	• Overload. • Ambient temperature is too high. • Inadequate cooling. • Operation is outside the allowed duty cycle. • Motor protection device may be defective. • Excessive supply voltage. • System short or damaged stator.	• Make sure load is free. Verify motor amp draw compared to nameplate rating. Reduce load or consider a larger motor. • Do not operate above the rated conditions. • Correct cooling air supply. Open and clear cooling air passages. Retrofit with forced ventilator fan if needed. • Adjust operating duty cycle or contact a specialist to select a suitable motor or drive. • Replace motor protection device. • Adapt motor supply voltage. • Check for loose, cut or damaged wires. Check stator winding for defects or burn damage.
Excessive Noise or Vibration	• Motor bearings contaminated or damaged. • Excessive motor shaft end play. • Misaligned or imbalanced load.	• Test motor by itself. If bearings are bad noise may be heard or roughness detected. Replace bearings. Add lubrication if bearings have grease fittings. • Check shaft endplay with motor and system power disconnected. If shaft movement is excessive replace motor shaft bearings. • Check all mating shaft connections for proper alignment and correct all imbalanced load conditions.
1 Ph Start Capacitor Failures	• Motor is not coming up to speed quickly enough. • Motor is being cycled frequently • Start switch is defective or damaged.	• Verify motor size to load conditions. Motor should come up to speed in no more than 2-3 seconds. • Verify duty cycle and consult specialist for recommendations. • Replace start switch.
1 Ph Run Capacitor Failures	• Possible power surge to motor caused by transient voltage or lightening. • Excessive ambient temperature.	• Install proper surge protection. • Verify ambient conditions do not exceed nameplate value.



General Instructions

This manual describes general operating and maintenance guidelines for a majority of brake products shipped by NORD Gear. This instruction manual is not intended to include a comprehensive listing of all details or procedures required for installation, operation and maintenance.

Brakes covered in this manual are manufactured by PRECIMA. Please feel free to contact NORD with any questions about the supplied brake components.

Safety Notice

Only qualified personnel should attempt installation, operation and maintenance of NORD brakes. Read this manual in its entirety before operating, commissioning, servicing, or assembling the motor brake. If you have a question about a procedure or are uncertain about any detail, seek clarification and DO NOT PROCEED!

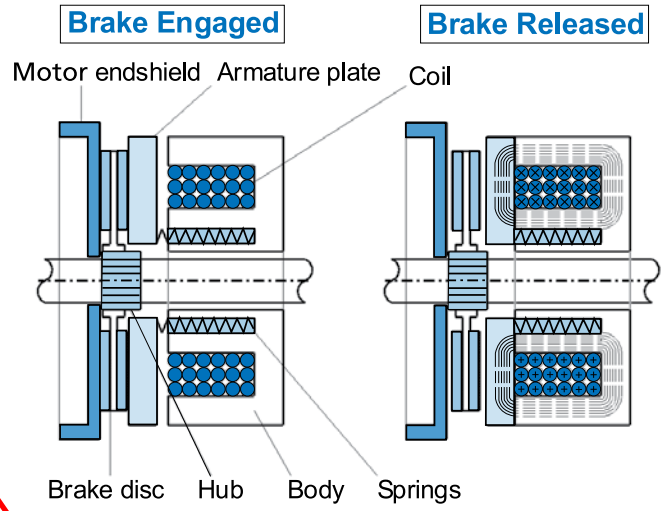
⚠ DANGER

- This equipment contains high electrical voltage. Remove and lockout all power from the electric motor and brake before any work is completed on the brake.
- The user is responsible for conforming to all national and local electrical and safety codes. Wiring practices, proper grounding, disconnects, and over current protection, are of particular importance.
- Make certain the load is supported when servicing the brake. Removing power from the brake or removing the brake from the motor will release the load, which may cause severe injury or death.
- Failure to follow proper procedures and precautions may result in severe bodily injury or death.

Brake Operation

The standard NORD motor brake is “spring-set”. When power is removed and the brake is de-energized (power-off), the brake springs exert a force against the armature plate in turn preventing the brake rotor (or brake disc) from rotating. When the brake coil is energized (power-on), a magnetic field builds and pulls the armature plate across the air gap to the brake casing, which releases the brake rotor and allows the motor shaft to rotate.

Figure 1: Basic Brake Operation



NORD brakes are DC voltage brakes and in most instances are supplied with a motor mounted brake rectifier for easy connections to AC power. AC power is taken directly from the power line or from the terminal block of the motor and converted to DC by the supplied rectifier.

ℹ IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, the AC power must be supplied to the brake rectifier separately from the motor power.

Advantages

- Each NORD motor frame size has a number of brake sizes available, with different torque capacities.
- Brake torque adjustments are possible by changing the brake spring combinations. In addition, brake sizes from 5-40 Nm (3.7-30 lb-ft) are typically supplied with an additional spanner-nut adjustment on the back of the brake.
- NORD brakes provide a high degree of safety because when power is removed the brake will automatically set to hold the load.
- The brake rotor or brake disc is environmentally safe and asbestos-free.
- The connection between the rectifier and the brake coil is completed at the factory and the brake air-gap is factory-set but can be adjusted in the event of wear.

General Selection Considerations

As indicated in the NORD catalog, each NORD motor can be supplied with a number of brake torque sizes.

NORD relies on the equipment builder to specify appropriate brake sizing for their application, while giving consideration to the following:

- For most applications, we advise sizing the brake to 1.5 - 2 times the motor rated torque.
- For vertical applications, it may be advisable to size the brake size up to 3 times the motor rated torque.
- For some applications, it may be necessary to specify a reduced brake torque setting to prevent excessive peak load conditions developed at the reducer output.
- On travel drive applications, excessive brake torque may lead to wheel skid; in addition on crane applications excess hoist-cable swing can result.

IMPORTANT NOTE

- **Brake torque -** The brake torque is measured with a mean friction radius of the brake pad surface with a circumferential speed of 1m/sec (197 fpm).
- **Brake torque tolerance -** For different applications and operating conditions, brake torque can vary from +40/-20% compared to the rated brake torque.
- **Hoisting (lifting/lowering) applications -** must have the brake wired for fast response (DC-switching)
- **Initial operation & wear-in period -** In new condition, the brake will have a reduced torque of up to 30%. In order to achieve full rated brake torque, a short run-in period is required. The run in time will vary depending on system loads.
- **The brake rotor or brake pad -** must be protected against foreign matter, oil and grease. Contaminants of this type can greatly influence wear and reduce breaking torque.

Brake Torque Adjustment

Brake torque adjustments are possible by changing the brake spring combinations or by removing springs (Table 1).

In addition, brake sizes from 5-40 Nm (3.7-30 lb-ft) are typically supplied with a threaded adjustment nut or spanner nut to allow for additional fine torque adjustments of the brake. The braking torque can be adjusted by unscrewing the spanner nut a number of turns or "clicks" with a spanner wrench (Table 2).

Table 1a: Brake Torque Reduction - Spring Removal

"Brake Size"	7 Springs		5 Springs		3 Springs	
	[Nm]	[lb-ft]	[Nm]	[lb-ft]	[Nm]	[lb-ft]
BRE 5	5	3.7	3.5	2.6	2	1.5
BRE10	10	7.4	7	5.2	4	3.0
BRE20	20	14.8	14	10.3	8	5.9
BRE40	40	29.5	28	20.7	17	12.5
BRE60	60	44.3	43	31.7	26	19.2
BRE100	100	73.8	70	51.6	42	31.0
BRE150	150	111	107	78.9	65	47.9

On brake sizes 5-150 Nm (3.7-111 lb-ft) full brake torque is achieved with all (7) springs. The brake springs are placed in such a manner where there are (3) inner and (4) outer springs. When adjusting the brake torque, start by removing the outer springs at opposite corners to prevent uneven brake wear.

Table 1b: Brake Torque Reduction - Spring Removal

"Brake Size"	8 Springs		6 Springs		4 Springs	
	[Nm]	[lb-ft]	[Nm]	[lb-ft]	[Nm]	[lb-ft]
BRE250	250	184	187	138	125	92
BRE400	400	295	300	221	200	148
BRE800	800	590	600	443	400	295
BRE1200	1200	885	900	664	600	443

On brake sizes 250-1200 Nm (184-885 lb-ft) full brake torque is achieved with all (8) springs. The brake springs are placed in such a manner where there are (4) inner and (4) outer springs. When adjusting the brake torque, start by removing the outer springs at opposite corners to prevent uneven brake wear.

Table 2: Spanner Nut Adjustment

"Brake Size"	Torque Reduction*		Max. Turns	Minimum Torque✹	
	[Nm]	[lb-ft]		[Nm]	[lb-ft]
BRE 5	0.2	0.15	6	0.8	0.59
BRE10	0.2	0.15	12	1.6	1.18
BRE20	0.3	0.22	12	4.4	3.25
BRE40	1	0.74	9	8.0	5.90

✹ **With the minimum number of springs and maximum number of turns to the spanner nut.**
* **Per each turn of the spanner nut**

Brake sizes from 5-40 Nm (3.7-30 lb-ft) are typically supplied with a threaded adjustment nut or spanner nut. Additional fine torque adjustment can be made by unscrewing the spanner nut a number of turns or "clicks" with a spanner wrench.

Brake Control Rectifiers

NORD brake control rectifiers convert AC voltage to DC voltage. Rectifiers are used because most applications require AC voltage to power the motor, but DC power is required to power the brake and DC power is not typically available. NORD brake motors typically include the rectifier located inside the terminal box.

Rectifier Advantages

- Individual power source for each brake.
- Compact size, mounted inside the terminal box.
- Multiple types, voltage options and release/engagement modes available.
- Mountable in a separate control cabinet.
- Integral protection against voltage spikes.

Model	Type	Part No.	Color	Input Voltage V_{AC} ± 10%	Rated Current A_{DC} (40°C)	(75°C)
GVE20L	Full-wave	19141000	Black	110-275	1.5	1.0
GVE20V	Full-wave	19141030	Black	110-275	1.5	1.0
GHE40L	Half-wave	19141010	Yellow	200-480	2.0	1.0
GHE40V	Half-wave	19141040	Yellow	200-480	2.0	1.0
GHE50L	Half-wave	19141020	Gray	200-575	2.0	1.0
GHE50V	Half-wave	19141050	Gray	200-575	2.0	1.0
GUE40V	Dual-wave	19140300	Black	190-460	0.7	0.5
PMG500	Push-Hybrid	19140200	Black	200-500	4.0	2.8

Rectifier electronics are sealed for moisture-protection; electronics on models ending with the suffix "V" are resin-encapsulated to provide added protection if water should get into the motor terminal box.

Rectifier Types

Full-wave rectifier [GVE]:
A rectifier in which both the positive and negative half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 90% of the input voltage ($V_{DC} = 0.90 \times V_{AC}$).

Half-wave rectifier [GHE]:
A rectifier in which only alternate half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).

Dual Wave Rectifier [GUE]
A rectifier that can be wired as either a full-wave rectifier or a half-wave rectifier depending upon how it is connected to the AC input signal.

IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then seperate AC power must be supplied to the brake rectifier.

Rectifier Types [Ctd.]

PMG 500 Push-Hybrid rectifier [PMG]:
A fast-acting or push-hybrid brake rectifier provides an initial "push" in the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function. There are two ways to apply these rectifiers as follows:

- "Overexcitation" of the brake coil provides faster brake release or improved cycling capacity. The DC voltage of the brake coil is determined based upon using a half-wave rectifier. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).
- "Reducer-Power Holding" of the brake coil maintains the brake in a released state by using only 25% of the power needed for the initial brake release. This results in very fast brake stopping. The DC voltage of the brake coil is determined based upon using a full-wave rectifier. The output voltage is 90% of the input voltage. ($V_{DC} = 0.90 \times V_{AC}$).

NORD offers additional fast-acting rectifiers besides the PMG 500. For additional details please reference User Manual U35100 – Fast Acting Brake Rectifiers.

NOTICE

In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) and 1200 Nm (885 lb-ft) twin-rotor brakes. The PMG 500 rectifier is wired to "overexcite" the brake during its initial release.

Brake Switching Options

The rectifiers discussed in this manual can be wired to allow brake switching at either the AC power source (input) or the DC power source (output).

- AC switching allows the brake rectifier to be powered directly from the motor's terminal block with no additional wiring. However, this provides a slower brake stopping time due to the additional time needed to de-energize or collapse the motor's magnetic field.
- DC switching directly interrupts the current flow in the DC circuit of the brake rectifier. This method of brake switching guarantees faster brake stopping or brake engagement times.

WARNING

When the moving system undergoes a change in height (such as in a lift or incline conveyor application) or if the system tends to speed up or overhaul during normal operation, then DC-switching of the brake is required in order to prevent excessive load movement, drift or falling loads during stopping.

Figure 2.1: GVE/GHE Dimensions

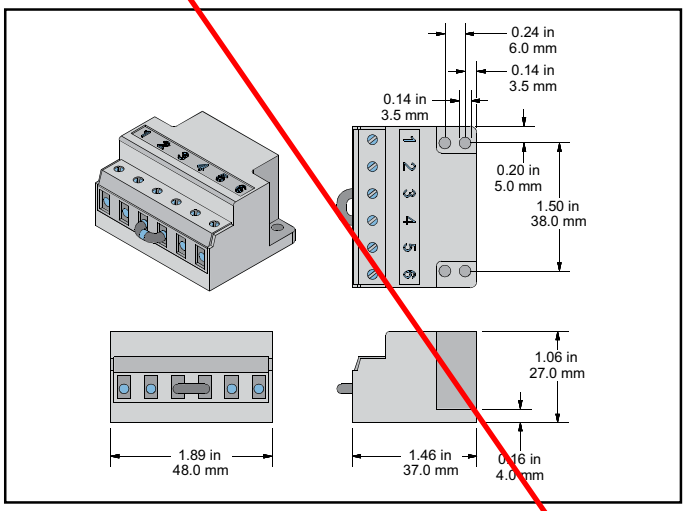


Figure 3.1: GUE Dimensions

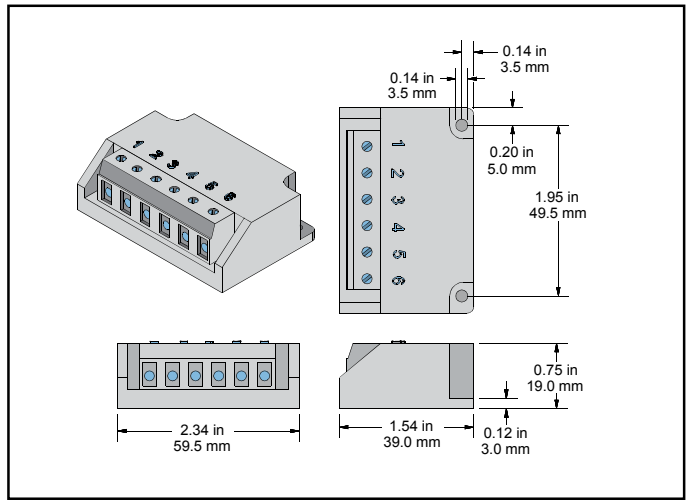
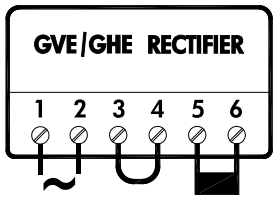


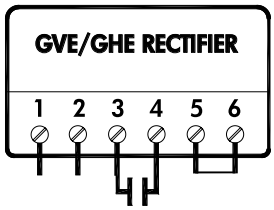
Figure 2.2: GVE/GHE Braking Methods

STANDARD STOPPING AC-SWITCHING



1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	JUMPER	DC BRAKE

FAST STOPPING DC-SWITCHING

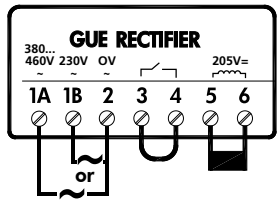


1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	NORMALLY OPEN CONTACT	DC BRAKE

* The normally open contact/s (NO) is not supplied by NORD it must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated at IEC AC3.

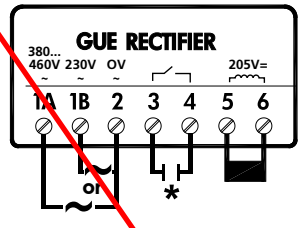
Figure 3.2: GVE/GHE Braking Methods

STANDARD STOPPING AC-SWITCHING



1B & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	JUMPER	DC BRAKE

FAST STOPPING DC-SWITCHING



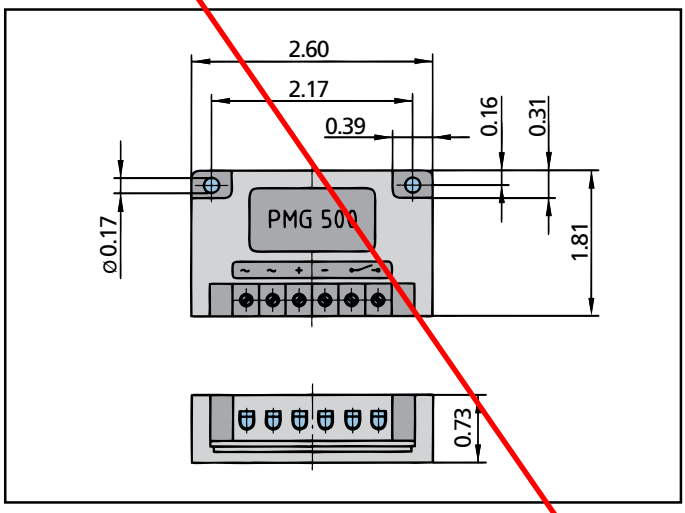
1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	NORMALLY OPEN CONTACT	DC BRAKE

* The normally open contact/s (NO) is not supplied by NORD it must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated at IEC AC3.

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
10	Standard	Standard (AC-Switching)	Motor terminals
15	Standard	Fast (DC-switching)	Motor terminals
20	Standard	Standard (AC-Switching)	Separate power
25	Standard	Fast (DC-switching)	Separate power

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
10	Standard	Standard (AC-Switching)	Motor terminals
15	Standard	Fast (DC-switching)	Motor terminals
20	Standard	Standard (AC-Switching)	Separate power
25	Standard	Fast (DC-switching)	Separate power

Figure 4.1: PMG 500 Dimensions



PMG 500 Push-Hybrid Rectifier

The PMG 500 rectifier provides an initial "push" the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function.

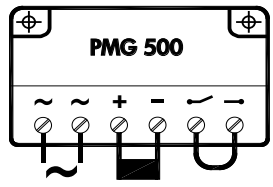
- In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) - and 1200 Nm (885 lb-ft) twin-rotor brakes.
- The PMG 500 rectifier is wired to "overexcite" the brake during its initial release. The DC voltage of the brake coil is determined based upon using a half-wave rectifier.

In some applications the PMG rectifier may be used for "Reduced Power Holding" or very fast brake engagement (See user manual U35100 for details).

> ***IMPORTANT NOTE***
>
> If the motor is connected to an AC drive, soft start, or is a two-speed motor, the AC power must be supplied to the brake rectifier seperately from the motor power.

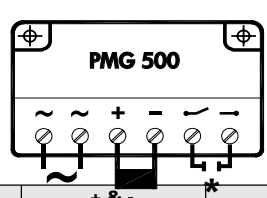
Figure 4.2: PMG 500 Braking Methods

STANDARD STOPPING (AC-SWITCHING)



~ & ~	+ & -	⊷ & ⊸
AC BRAKE VOLTAGE	DC BRAKE	JUMPER

FAST & VERY FAST STOPPING (DC-SWITCHING)



~ & ~	+ & -	⊷ & ⊸
AC BRAKE VOLTAGE	DC BRAKE	NORMALLY OPEN CONTACT

* The normally open contact/s (NO) is not supplied by NORD it must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated at IEC AC3.

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
30	Fast (Overecitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overecitation)	Fast (DC Switching)	Motor terminals
45	Fast (Overecitation)	Standard (AC Switching)	Seperate power
50	Fast (Overecitation)	Fast (DC Switching)	Seperate power

MOTOR BRAKES INSTALLATION & MAINTENANCE

BRAKE SIZE: BRE 5 **BRAKE TORQUE: 5 Nm (3.7 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19010212	-	-	-	-	22	24	0.92	26.0
19010912	230	0.09	115	0.19	22	105	0.21	500
19011902	400	0.05	200	0.11	22	180	0.12	1475
19011912	460	0.05	230	0.10	22	205	0.11	1900
19012212	500	0.04	250	0.08	21	225	0.09	2450
19012512	575	0.04	-	-	22	250	0.09	2850

BRAKE SIZE: BRE20 **BRAKE TORQUE: 20 Nm (15 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19030222	-	-	-	-	34	24	1.42	16.9
19030922	230	0.18	115	0.35	41	105	0.39	270
19031922	400	0.09	200	0.17	34	180	0.19	950
19031932	460	0.07	230	0.13	30	205	0.15	1391
19032222	500	0.07	250	0.15	36	225	0.16	1391
19032522	575	0.06	-	-	35	250	0.14	1780

BRAKE SIZE: BRE 60 **BRAKE TORQUE: 60 Nm (44 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19050252	-	-	-	-	52	24	2.18	11.0
19050952	230	0.27	115	0.54	63	105	0.60	174
19051902	400	0.13	200	0.27	54	180	0.30	602
19051952	460	0.12	230	0.25	57	205	0.28	740
19052252	500	0.10	250	0.20	50	225	0.22	1004
19052552	575	0.09	-	-	48	250	0.19	1300

BRAKE SIZE: BRE 150 **BRAKE TORQUE: 150 Nm (110 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19070252	-	-	-	-	77	24	3.20	7.5
19070952	230	0.39	115	0.79	92	105	0.88	120
19071902	400	0.18	200	0.36	73	180	0.40	445
19071952	460	0.15	230	0.31	70	205	0.34	600
19072252	500	0.15	250	0.30	76	225	0.34	670
19072552	575	0.14	-	-	76	250	0.30	825

BRAKE SIZE: BRE 400 **BRAKE TORQUE: 400 Nm (295 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19092252	-	-	-	-	144	24	6.00	4.0
19092952	230	0.62	115	1.24	145	105	1.38	76
19093902	400	0.35	200	0.70	141	180	0.78	230
19093952	460	0.31	230	0.62	140	205	0.68	300
19093962	500	0.29	250	0.57	143	225	0.63	355
19093972	575	0.26	-	-	142	250	0.57	440

BRAKE SIZE: BRE 1200 **BRAKE TORQUE: 1200 Nm (885 lb-ft) max. ❷**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19099802	230	0.62	-	-	145	105	1.38	76
19099902	400	0.27	-	-	108	180	0.60	300
19099902	460	0.31	-	-	140	205	0.68	300

BRAKE SIZE: BRE 10 **BRAKE TORQUE: 10 Nm (7.4 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19020222	-	-	-	-	28	24	1.17	20.6
19020922	230	0.14	115	0.28	33	105	0.32	332
19021902	400	0.07	200	0.15	29	180	0.16	1100
19021922	460	0.06	230	0.11	26	205	0.13	1620
19022222	500	0.06	250	0.12	30	225	0.13	1700
19022522	575	0.05	-	-	27	250	0.11	2323

BRAKE SIZE: BRE40 **BRAKE TORQUE: 40 Nm (30 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19040232	-	-	-	-	41	24	1.69	14.2
19040932	230	0.21	115	0.42	49	105	0.46	226
19041902	400	0.11	200	0.22	45	180	0.25	723
19041922	460	0.11	230	0.22	50	205	0.24	840
19042232	500	0.09	250	0.18	44	225	0.20	1150
19042532	575	0.08	-	-	44	250	0.18	1425

BRAKE SIZE: BRE 100 **BRAKE TORQUE: 100 Nm (74 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19060252	-	-	-	-	80	24	3.33	7.2
19060952	230	0.39	115	0.79	92	105	0.88	120
19061902	400	0.21	200	0.42	83	180	0.46	390
19061952	460	0.20	230	0.40	91	205	0.44	464
19062252	500	0.16	250	0.32	79	225	0.35	643
19062552	575	0.14	-	-	79	250	0.31	795

BRAKE SIZE: BRE 250 **BRAKE TORQUE: 250 Nm (185 lb-ft) max.**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19080252	-	-	-	-	99	24	4.14	5.8
19080952	230	0.51	115	1.03	120	105	1.14	92
19081902	400	0.27	200	0.54	108	180	0.60	300
19081952	460	0.24	230	0.49	111	205	0.54	380
19082252	500	0.20	250	0.40	100	225	0.44	507
19081962	575	0.17	-	-	95	250	0.38	655

BRAKE SIZE: BRE 800 **BRAKE TORQUE: 800 Nm (590 lb-ft) max. ❶**

NORD Brake P/N	Half-Wave [V_{AC}]	Half-Wave [A_{AC}]	Full-Wave [V_{AC}]	Full-Wave [A_{AC}]	P_C [W]	V_C [V_{DC}]	I_C [A_{DC}]	R_C [Ω]
19094252	-	-	-	-	144	24	6.00	4.0
19094952	230	0.62	-	-	145	105	1.38	76
19095902	400	0.27	-	-	108	180	0.60	300
19095902	460	0.31	-	-	140	205	0.68	300
19095962	500	0.29	-	-	143	225	0.63	355

NOTICE

The PMG500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) - and 1200 Nm (885 lb-ft) twin-rotor brakes. In order to prevent rapid wear, NORD recommends using the PMG500 rectifier to "overexcite" the brake during its release. The brake coil should be sized utilizing the PMG rectifier like a half-wave rectifier.

Half-Wave [V_{AC}] = AC supply voltage with half-wave rectifier

Half-Wave [A_{AC}] = AC supply current to half-wave rectifier

Full-Wave [V_{AC}] = DC supply voltage with full-wave rectifier

Full-Wave [A_{AC}] = AC supply current to full-wave rectifier

Pc [W] = Power to brake coil

Vc [V_{DC}] = DC brake coil voltage (range -30% to +10%)

Ic [A_{DC}] = DC current top brake coil

Rc [V] = Brake coil resistance (±5%)

❶ When used as a stopping brake, evaluation of brake work is essential.

❷ Designed as a holding brake or emergency stop brake only.

Brake coil data based upon ambient conditions of 20°C (68°F).

NORD Gear Limited
Toll Free in Canada: 800 668 4378

NORD Gear Corporation
Toll Free in the United States: 888 314 6673

General Maintenance

Brake Air Gap

In order to obtain optimal brake performance and maximum brake life, it is necessary to periodically check and reset the brake air gap. As the brake rotor wears and decreases in thickness, the air gap will increase. If the air gap is too large, the brake coil may not have enough magnetic force to pull the metal armature disc across the gap and the brake will drag.

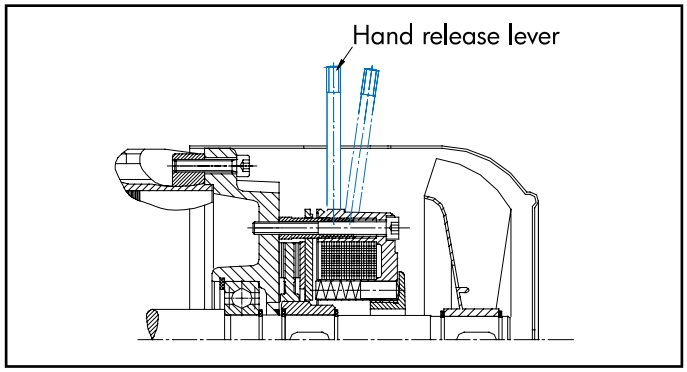
IMPORTANT NOTE

When a complete brake motor is supplied by NORD, the air gap is already set at the factory. If the brake is ordered as a part, the air gap must be set in the field. All brake air gap adjustments must be made with the brake assembled onto the motor and power off (brake engaged).

Hand Release Lever (HL)

It is common to supply the NORD brake with a hand release lever assembly. The hand release lever allows the brake to be manually released without requiring that the brake be energized with voltage. The lever has a spring return that allows the brake to be hand released and returned automatically to its set position. The handle of the hand release lever can be unscrewed for easy removal.

Figure 5

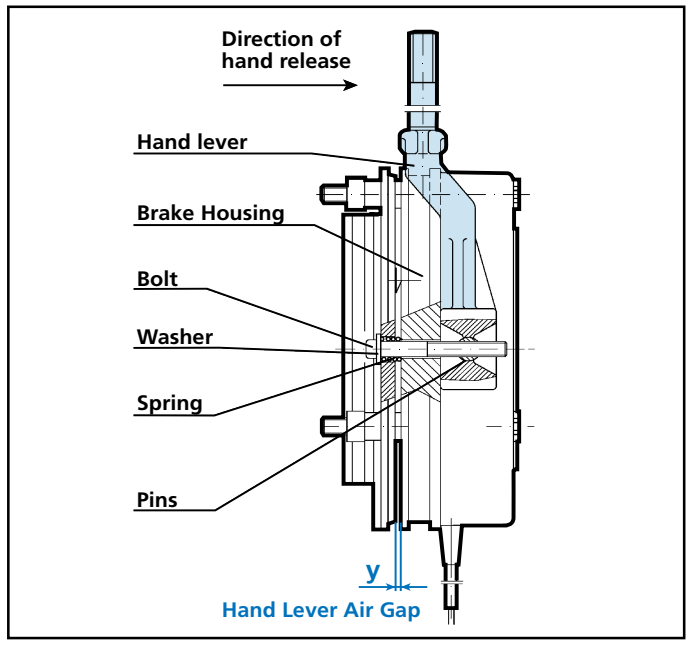


IMPORTANT NOTE

When a brake motor with hand-lever is supplied by NORD, both the hand lever air gap and brake air gap are set at the factory. When ordered as parts, proper hand-lever and air gap adjustments must be made in the field. Hand-lever adjustments must always be made prior to assembling the brake to the motor. All brake air gap adjustments must be made with the brake assembled to the motor and the power off (brake engaged).

Brake Hand-Lever Installation and Adjustment

Figure 6



1. Place the hand-lever over the brake housing (as shown) and align the pins.
2. Screw the bolts with washer and spring into the pins.
3. Using a feeler gage, adjust the hand-lever air gap per Table 5.

Table 5: Hand-Lever Air Gap Setting

Brake Size	Dimension "y" ❶ [mm]	[in]	Brake Size	Dimension "y" ❶ [mm]	[in]
BRE 5	1	0.040	BRE 100	1.2	0.047
BRE 10	1	0.040	BRE 150	1.2	0.047
BRE 20	1	0.040	BRE 250	1.5	0.059
BRE 40	1	0.040	BRE 400	1.5	0.059
BRE 60	1	0.040	BRE 800	1.5	0.059
			BRE 1200	1.5	0.059

❶ Tolerance: + 0.008 in [+ 0.2 mm]

IMPORTANT NOTE

When setting the hand-lever gap or dimension "y" the magnetic brake coil housing and the anchor plate must be kept uniform all around.

IMPORTANT NOTE

- To assure proper assembly and proper functioning of the brake, the hand-lever must be assembled to the brake, and the hand-lever air gap must be adjusted, before the brake is assembled to the motor.
- Once adjusted properly, the hand-lever air gap setting should not be altered, even when readjusting the air gap setting.

Setting the Brake Air Gap

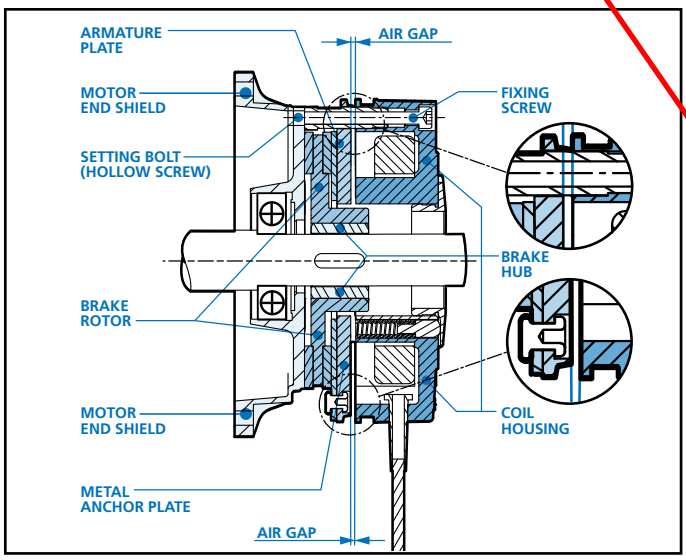
NORD spring-loaded brakes are virtually maintenance free. However, the air-gap of the brake rotor or brake disc must be periodically checked and adjusted. If necessary, the worn brake rotor must be replaced. Table 6 serves as guide to check and set the brake air gap as needed.

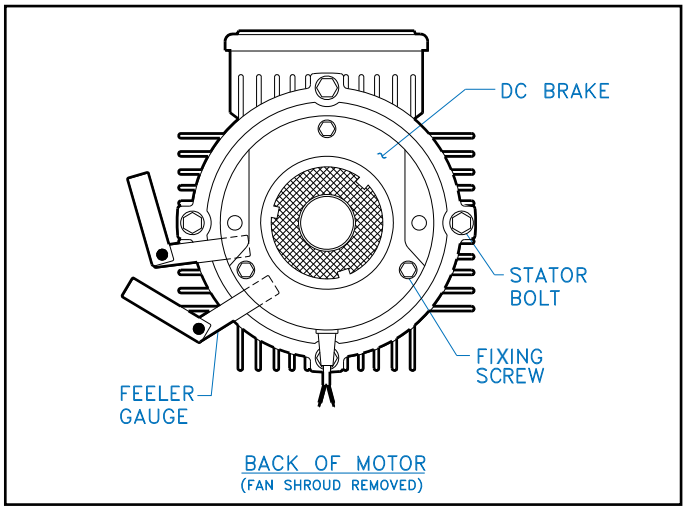
IMPORTANT NOTE

When a complete brake motor is supplied by NORD, the air gap is already set at the factory. If the brake is ordered as a part, the air gap must be set in the field. All brake air gap adjustments must be made with the brake assembled to the motor and the power off (brake engaged).

The brake air gap is checked by placing a feeler gage between metal anchor plate and the brake coil housing as shown in Figure 6. This procedure is identical even for the larger BRE800 and BRE1200 twin rotor brakes.

Figure 7 – Setting the Brake Air Gap





Procedure

1. Loosen the fixing screws that attach the brake to the motor's end-shield by approximately half a turn. The brake assembly may be further loosened by turning the setting bolts or hollow screws counter- clockwise into the brake coil housing.

2. The desired nominal air-gap for each brake size is displayed in Table 6. In the course of making adjustments, the air gap measurement must be checked in several places using a feeler gauge. The feeler gauge should be positioned between the armature plate and the brake coil housing as indicated in Figure 7.

3. Decreasing or Increasing the air gap can be accomplished per the following instructions:

   Decreasing the Air Gap – To decrease the air gap, turn the setting bolts or hollow screws counter-clockwise while securing the fixing screws; alternatively, turn the fixing screws clockwise while securing the setting bolts or hollow-screws.

   Increasing the Air Gap – To increase the air gap, turn the setting bolts or hollow screws clockwise while securing the fixing screws; alternatively, turn the fixing screws counter-clockwise, while securing the setting bolts or hollow screws.

4. Re-tighten the fixing screws to the proper torque as indicated in Table 6.

5. Re-check the air gap in several places and repeat Steps 1-5 as needed until the air gap spacing is uniform and consistent all the way around the brake.

Table 6: Brake Air Gap Settings

Brake Size	Fixing Screw Tightening Torque		Nominal Air Gap Setting ❶		Maximum Air Gap ❷	
	[lb-ft]	[Nm]	[in]	[mm]	[in]	[mm]
BRE 5	2.2	3	0.008	0.2	0.024	0.6
BRE10	4.4	6	0.008	0.2	0.028	0.7
BRE20	7.4	10	0.012	0.3	0.031	0.8
BRE40	7.4	10	0.012	0.3	0.035	0.9
BRE60	18	25	0.012	0.3	0.039	1.0
BRE100 ❸	18	25	0.016	0.4	0.043	1.1
BRE150 ❸	18	25	0.016	0.4	0.043	1.1
BRE250	37	50	0.020	0.5	0.047	1.2
BRE400	37	50	0.020	0.5	0.047	1.2
BRE800	37	50	0.028	0.7	0.047	1.2
BRE1200	37	50	0.028	0.7	0.047	1.2

❶ Tolerance: + 0.004 in [+ 0.1 mm]

❷ Brake air gap must be re-adjusted before the stated value.

❸ When using the stainless steel friction plate (RG) increase the nominal air gap to 0.2 mm (0.008 in.).

Brake Rotor (Brake Disc) Wear Assessment

Periodically the brake rotor or brake disc must also be checked for wear. If the brake rotors wear approaches the minimum allowed thickness, then the part should be replaced. Use Table 7 to determine whether or not the brake rotor requires replacement.

Table 7: Brake Rotor Thickness

Brake Size	Nominal Brake Rotor Thickness ❶		Minimum Brake Rotor Thickness ❷	
	[in]	[mm]	[in]	[mm]
BRE 5	0.295	7.5	0.177	4.5
BRE10	0.335	8.5	0.217	5.5
BRE20	0.406	10.3	0.295	7.5
BRE40	0.492	12.5	0.374	9.5
BRE60	0.571	14.5	0.453	11.5
BRE100	0.630	16	0.492	12.5
BRE150	0.709	18	0.571	14.5
BRE250	0.787	20	0.650	16.5
BRE400	0.787	20	0.650	16.5
BRE800	0.787	20	0.650	16.5
BRE1200	0.866	22	0.689	17.5

❶ As new condition.

❷ Worn condition - brake rotor replacement is required!

Brake Pad Replacement (reference to parts list on page 8)

When the brake pad is worn the pad should be replaced to maintain proper brake operation and ensure safety.

Required Tools

- Phillips head screw drivers (fan shroud removal)
- External snap ring pliers (fan and brake hub removal).
- Large flat head screw driver or small pry bar (fan removal)
- Metric T-handle wrenches and open-end wrenches.

Procedure

1. Remove the fixing screws (946) securing the fan cover (940) to the motor end-shield (932). If the brake has a hand release (937), the lever arm should be removed by unscrewing it.
2. Remove the fan cover (940) and note the position of the hand release slot if applicable.
3. Remove the snap ring holding the cooling fan (939) and carefully remove the cooling fan (939), key and second snap ring (997).
4. If the brake is equipped with a dust boot (992), remove it.
5. Remove the socket head cap screws holding the brake coil (936) to the motor end-shield (932).
6. Remove the brake coil (936), noting the hand release (937) and power cable locations.
7. Slide the brake rotor (993) off the brake hub (938) which is secured to the motor shaft.
8. Clean the brake, install the new brake rotor pad and reassemble the brake in reverse order of the steps outlined.

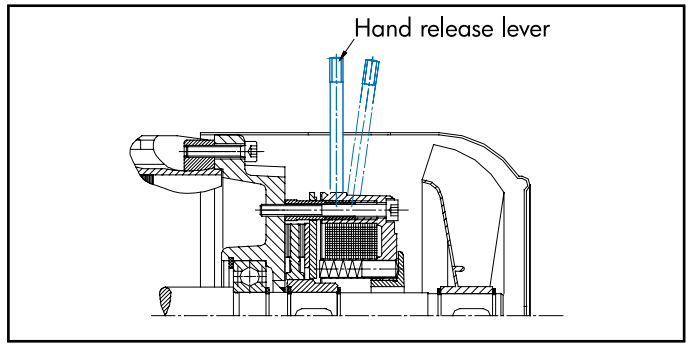
Optional Brake Accessories

NORD can supply a variety of brake options and accessories, of which some of the most common are noted below.

Hand Release Lever (HL)

The hand release lever allows the brake to be manually released without requiring that the brake be energized with voltage. The lever has a spring return that allows the brake to be hand released and returned automatically to its set position. The handle of the hand release lever can be unscrewed for easy removal.

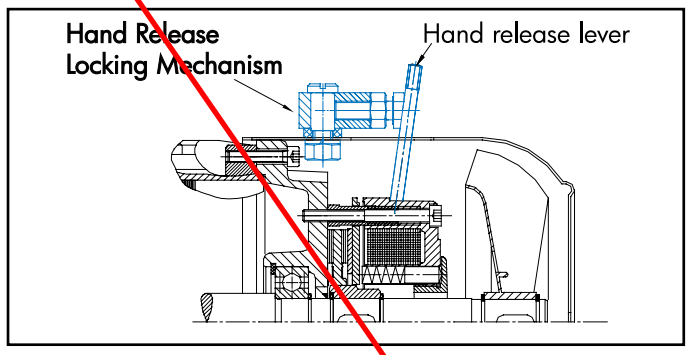
Figure 8



Locking Hand Release Lever (FHL)

This option allows the brake to be manually released and locked off without requiring voltage to the brake. The lock mechanism prevents the spring from returning the brake to a closed state without manual action by the user. The hand release lever can be unscrewed for easy removal.

Figure 9



Corrosion Protected Brake (RG)

The brake is fitted with a stainless steel brake plate to provide additional corrosion protection in severe and wet environments.

Dust & Corrosion Protected Brake (SR)

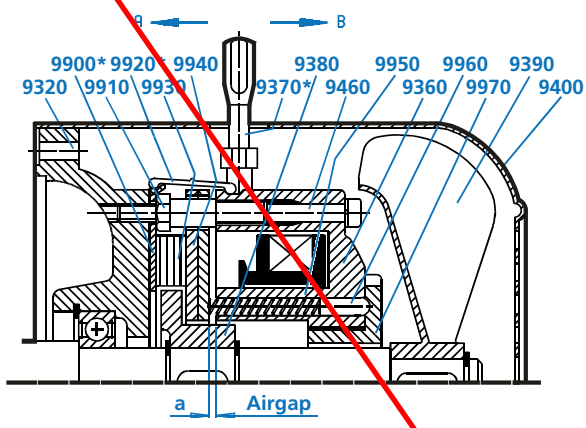
A rubber-sealing boot is installed on the brake to provide additional protection in dusty environments. This feature includes the stainless steel brake plate (RG).

IP66 Brake (IP66)

NORD can also provide an IP66 brake option designed for a bigger degree of protection against severe environments.

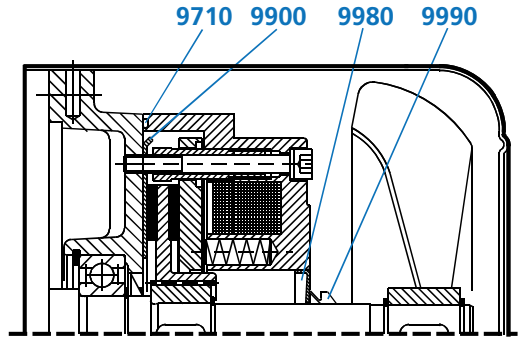
MOTOR BRAKES INSTALLATION & MAINTENANCE

Parts List - Precima Brakes



Normal Design, Enclosure IP55 with following options:

RG – Stainless Steel Disc (Item 9900)
SR – Dust Boot-includes Option RG (Item 9920)
HL – Hand Release (Item 9370)



Optional Brake with optional IP66 enclosure

9320	Non-drive end shield	9710	O-ring - optional	9960	Pressure plate adjustment**
9360	Brake coil	9900	Friction plate - optional	9970	Adjustable ring **
9370	Manual brake lever – optional	9910	Setting bolt	9980	Bushing/seal - optional
9380	Brake hub	9920	Dust protection ring	9990	V-ring - optional
9390	Fan	9930	Brake rotor		
9400	Fan cover	9940	Armature plate		
9460	Fixing screw	9950	Spring		

***** Only for brakes that are 5 Nm to 40 Nm***

Table 8: Spare Parts

Brake Size	NORD Motor Frame	Brake Rotor [Item 9930]	Brake Hub [Item 9380]	Brake Hub Bore / (Style)	Hand Release (HL) [Item 9370]	Stainless Disc (RG) [Item 9900]	Dust Boot (SR) [Item 9920]
BRE5	63/71/80	19120042	19100112	15 mm (hex)	19150042	19130042	19110042
BRE10	63/71	19120082	19100212	15 mm (hex)	19150082	19130082	19110082
BRE10	80/90	19120082	19100222	20 mm (hex)	19150082	19130082	19110082
BRE20	80/90/112	19120162	19100322	20 mm (hex)	19150162	19130162	19110162
BRE20	100	19120162	19100332	25 mm (hex)	19150162	19130162	19110162
BRE40	90/100	19120322	19100452	25 mm (spline)	19150322	19130322	19110402
BRE40	112	19120402	19100442	30 mm (hex)	19150322	19130322	19110402
BRE60	100	19120602	19100532	25 mm (spline)	19150602	19130602	19110602
BRE60	112	19120602	19100542	30 mm (spline)	19150602	19130602	19110602
BRE60	132	19120602	19100552	35 mm (spline)	19150602	19130602	19110602
BRE100	132/160	19120802	19100652	35 mm (spline)	19150802	19130802	19110802
BRE150	132	19121502	19100752	35 mm (spline)	19151502	19131502	19111502
BRE150	160/180	19121502	19100772	45 mm (spline)	19151502	19131502	19111502
BRE250	160/180	19122402	19100872	45 mm (spline)	19152402	19132500	19112502
BRE250	200	19122402	19100882	50 mm (spline)	19152402	19132500	19112502
BRE400	200/225	19124002	19100912	60 mm (spline)	19154003	10114020	19114002

IMPORTANT NOTES

- For brake coil part numbers, listed by brake size and coil voltage, please see page 4.
- The large BRE 800 and BRE 1200 twin rotor brakes are supplied to NORD pre-assembled and complete. For parts list details and spare parts information please contact NORD.

Brake Times & Electrical Selection

Brake timing performance is critical in selecting the optimal brake system. NORD brakes can provide exceptional performance in terms of the release (start) times and engagement (stop) times. Use the following guidelines in order to select the correct brake control components and connections.

1) Determine if the brake needs to be wired directly from the motor terminal block or powered by a separate power source.

- If you are using a frequency inverter, soft-start or a two speed motor you will need to supply the rectifier from a separate power source.

- If the motor is powered direct across-the-line the rectifier power can be supplied from the motor's terminal block.

2) What type of performance do I need?

- Is the standard brake performance OK?

- Is a higher performance required for fast brake release or very fast brake stopping?

3) Determine the brake supply voltage and check the rectifier compatability using the table on page 10?

Selection Suggestions

When Fast Stopping is Recommended

Any applications that require quick stops and positive action at stand-still

Recommended Applications

- conveyors and inclined conveyors
- hoists and lifts
- bulk material handling equipment (bucket elevators, idler conveyor's).

⚠ WARNING

- **Hoisting (lifting/lowering) applications** - must have the brake wired for fast response.

When Fast-Release is Recommended (Overexcitation)

Fast Release is recommended in any application that is very high-cycling with frequent starts and stops. These applications require the brake to release very-quickly in order to avoid excessive heat build-up in the AC motor and brake coil.

Recommended Applications

- Index conveyors
- Diverters
- Storage and retrieval crane systems

Power Source	Brake Release (start)	Brake engagement (stop)	Braking Method *	Rectifier
Motor Terminal Block	Standard	Standard (AC switching)	10	GVE/GHE/GUE
	Standard	Fast (DC switching)	15	GVE/GHE/GUE
	❶ Fast (Overexcitation)	Standard (AC switching)	30	PMG 500
	❶ Fast (Overexcitation)	Fast (DC switching)	35	PMG 500
Separate Power Source	Standard	Standard (AC switching)	20	GVE/GHE/GUE
	Standard	Fast (DC switching)	25	GVE/GHE/GUE
	❶ Fast (Overexcitation)	Standard (AC switching)	45	PMG 500
	❶ Fast (Overexcitation)	Fast (DC switching)	50	PMG 500

* **Braking methods referenced in connection diagrams on pages 11-15.**

❶ **Please see important note below:**

NOTICE

The PMG500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) - and 1200 Nm (885 lb-ft) twin-rotor brakes. In order to prevent rapid wear, NORD recommends using the PMG500 rectifier to "overexcite" the brake during its release. The brake coil should be sized utilizing the PMG rectifier like a half-wave rectifier.

The table below determines the rectifier and DC brake voltage required, based on the AC supply voltage & braking method.

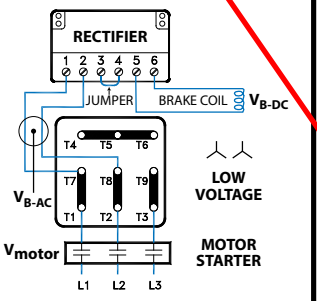
Rectifier Supply Voltage (VAC)	Brake Coil Voltage (VDC)	Braking Method	Rectifier Type	Rectifier P/N	BRE 5	BRE 10	BRE 20	BRE 40	BRE 60	BRE 100	BRE 150	BRE 250	BRE 400	BRE 800	BRE 1200
115	105	20	GVE20L	19141000	X	X	X	X	X	X	X				
	105	25	GVE20L	19141000	X	X	X	X	X	X	X				
208	180	10	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	180	15	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	180	20	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	180	25	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	105	30	PMG500	19140200										X	X
	105	35	PMG500	19140200										X	X
	105	45	PMG500	19140200										X	X
	105	50	PMG500	19140200										X	X
230 or 208-230	105	10	GHE40L	19141010	X	X	X	X	X	X	X				
	205	10	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	205	10	GUE40V	19140300	X	X	X	X	X	X	X				
	105	15	GHE40L	19141010	X	X	X	X	X	X	X				
	205	15	GVE20L	19141000	X	X	X	X	X	X	X	X	X		
	205	15	GUE40V	19140300	X	X	X	X	X	X	X				
	105	20	GHE40L	19141010	X	X	X	X	X	X	X				
	205	20	GUE40V	19140300	X	X	X	X	X	X	X	X	X		
	205	20	GVE20L	19141000	X	X	X	X	X	X	X				
	105	25	GHE40L	19141010	X	X	X	X	X	X	X				
	205	25	GUE40V	19140300	X	X	X	X	X	X	X	X	X		
	205	25	GVE20L	19141000	X	X	X	X	X	X	X				
	105	30	PMG500	19140200										X	X
	105	35	PMG500	19140200										X	X
	105	45	PMG500	19140200										X	X
	105	50	PMG500	19140200										X	X
332	180	30	PMG500	19140200										X	X
	180	35	PMG500	19140200										X	X
400	180	10	GHE40L	19141010	X	X	X	X	X	X	X				
	180	10	GUE40V	19140300	X	X	X	X	X	X	X				
	180	15	GHE40L	19141010	X	X	X	X	X	X	X				
	180	15	GUE40V	19140300	X	X	X	X	X	X	X				
	180	20	GHE40L	19141010	X	X	X	X	X	X	X				
	180	20	GUE40V	19140300	X	X	X	X	X	X	X				
	180	25	GHE40L	19141010	X	X	X	X	X	X	X				
	180	25	GUE40V	19140300	X	X	X	X	X	X	X				
	180	30	PMG500	19140200										X	X
	180	35	PMG500	19140200										X	X
	180	45	PMG500	19140200										X	X
	180	50	PMG500	19140200										X	X
460	205	10	GHE40L	19141010	X	X	X	X	X	X	X	X	X		
	205	10	GUE40V	19140300	X	X	X	X	X	X	X				
	205	15	GHE40L	19141010	X	X	X	X	X	X	X	X	X		
	205	15	GUE40V	19140300	X	X	X	X	X	X	X				
	205	20	GHE40L	19141010	X	X	X	X	X	X	X	X	X		
	205	20	GUE40V	19140300	X	X	X	X	X	X	X				
	205	25	GHE40L	19141010	X	X	X	X	X	X	X	X	X		
	205	25	GUE40V	19140300	X	X	X	X	X	X	X				
	205	30	PMG500	19140200										X	X
	205	35	PMG500	19140200										X	X
	205	45	PMG500	19140200										X	X
	205	50	PMG500	19140200										X	X
575	250	10	GHE50L	19141020	X	X	X	X	X	X	X	X	X		
	250	15	GHE50L	19141020	X	X	X	X	X	X	X	X	X		
	250	20	GHE50L	19141020	X	X	X	X	X	X	X	X	X		
	250	25	GHE50L	19141020	X	X	X	X	X	X	X	X	X		

? Specify Rectifier Model Type _____ And DC Brake Voltage _____

MOTOR BRAKES INSTALLATION & MAINTENANCE

Typical Connection Diagrams

BR101A — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — NORMAL STOPPING (AC-SWITCHING) — 10



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

BR101B — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — NORMAL STOPPING (AC-SWITCHING) — 10

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GVE20	400 VAC	230 VAC	205 VDC

BR103A — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

BR103B — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GVE20	460 VAC	230 VAC	205 VDC

BR103C — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GHE40	460 VAC	460 VAC	205 VDC

BR601A — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — NORMAL STOPPING (AC-SWITCHING) — 10

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GVE20	208 VAC	208 VAC	180 VDC
230Δ/400Y	GVE20	230 VAC	230 VAC	205 VDC
400Δ/690Y	GHE40	400 VAC	400 VAC	180 VDC
460Δ/Y	GHE40	460 VAC	460 VAC	205 VDC

BR601B — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — NORMAL STOPPING (AC-SWITCHING) — 10

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GVE20	400 VAC	230 VAC	205 VDC

BR601C — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — NORMAL STOPPING (AC-SWITCHING) — 10

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GHE40	400 VAC	400 VAC	180 VDC
332Δ/575Y	GHE50	575 VAC	575 VAC	250 VDC

BR603A — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GVE20	208 VAC	208 VAC	180 VDC
230Δ/400Y	GVE20	230 VAC	230 VAC	205 VDC
400Δ/690Y	GHE40	400 VAC	400 VAC	180 VDC
460Δ/Y	GHE40	460 VAC	460 VAC	205 VDC

BR603B — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GVE20	400 VAC	230 VAC	105 VDC

BR603C — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GHE40	400 VAC	400 VAC	180 VDC
332Δ/575Y	GHE50	575 VAC	575 VAC	250 VDC

BR103A — POWERED FROM MOTOR TERMINAL BLOCK — STANDARD RELEASE — FAST STOPPING (DC-SWITCHING) — 15

MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

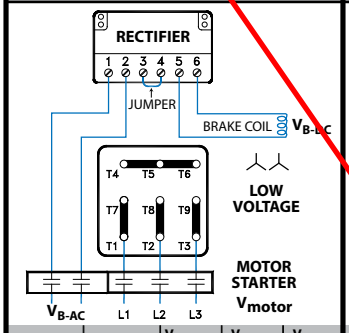
✻ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

MOTOR BRAKES INSTALLATION & MAINTENANCE

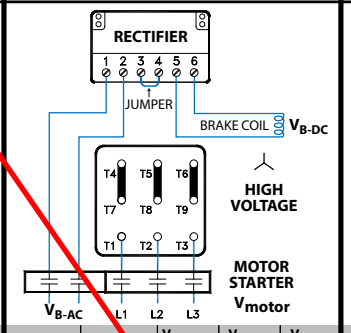
Typical Connection Diagrams

BR102A — 20 — SEPERATE POWER SOURCE, STANDARD RELEASE, NORMAL STOPPING (AC-SWITCHING)



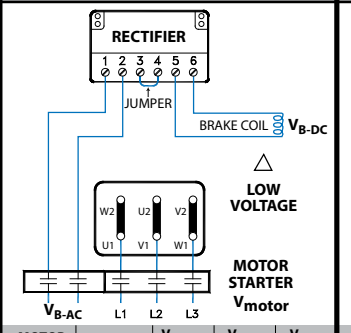
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	115 VAC	105 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

BR102B — 20 — SEPERATE POWER SOURCE, STANDARD RELEASE, NORMAL STOPPING (AC-SWITCHING)



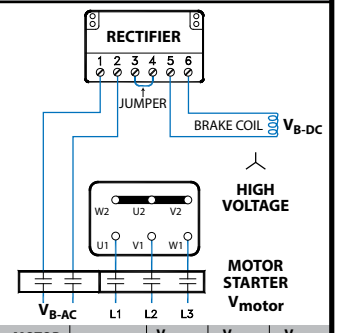
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GVE20	460 VAC	115 VAC	105 VDC
230YY/460Y	GVE20	460 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	460 VAC	460 VAC	205 VDC

BR602A — 20 — SEPERATE POWER SOURCE, STANDARD RELEASE, NORMAL STOPPING (AC-SWITCHING)



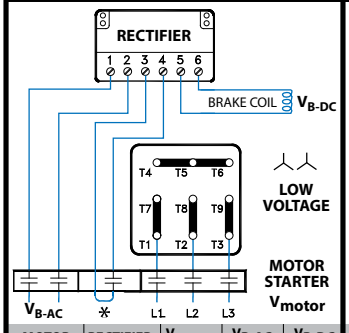
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GVE20	208 VAC	208 VAC	180 VDC
230Δ/400Y	GVE20	230 VAC	230 VAC	205 VDC
400Δ/690Y	GHE40	400 VAC	400 VAC	180 VDC
460Δ/Y	GHE40	460 VAC	460 VAC	205 VDC

BR602B — 20 — SEPERATE POWER SOURCE, STANDARD RELEASE, NORMAL STOPPING (AC-SWITCHING)



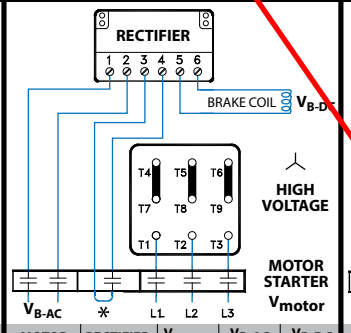
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GHE40	400VAC	230 VAC	105 VDC
230Δ/400Y	GHE20	400VAC	230 VAC	205VDC
230Δ/400Y	GHE40	400 VAC	400 VAC	180 VDC
332Δ/575Y	GHE50	575 VAC	575 VAC	250 VDC

BR104A — 25 — SEPERATE POWER SOURCE, STANDARD RELEASE, FAST STOPPING (DC-SWITCHING)



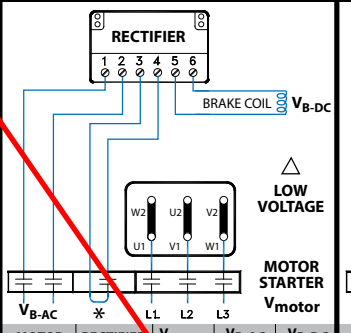
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	115 VAC	105 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

BR104B — 25 — SEPERATE POWER SOURCE, STANDARD RELEASE, FAST STOPPING (DC-SWITCHING)



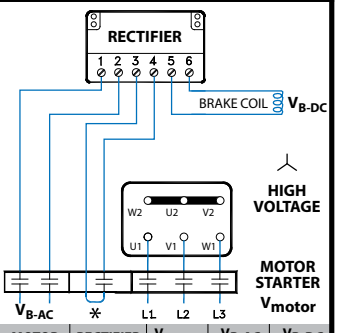
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GVE20	460 VAC	115 VAC	105 VDC
230YY/460Y	GVE20	460 VAC	230 VAC	205 VDC
230YY/460Y	GHE40	460 VAC	460 VAC	205 VDC

BR604A — 25 — SEPERATE POWER SOURCE, STANDARD RELEASE, FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GHE20	208 VAC	208 VAC	105 VDC
230Δ/400Y	GHE20	230 VAC	230 VAC	105 VDC
400Δ/690Y	GHE40	400 VAC	400 VAC	180 VDC
460Δ/Y	GHE40	460 VAC	460 VAC	205 VDC

BR604B — 25 — SEPERATE POWER SOURCE, STANDARD RELEASE, FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GHE40	400VAC	230 VAC	105 VDC
230Δ/400Y	GHE20	400VAC	230 VAC	205VDC
230Δ/400Y	GHE40	400 VAC	400 VAC	180 VDC
332Δ/575Y	GHE50	575 VAC	575 VAC	250 VDC

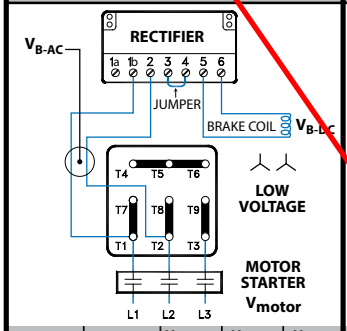
✻ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

MOTOR BRAKES INSTALLATION & MAINTENANCE

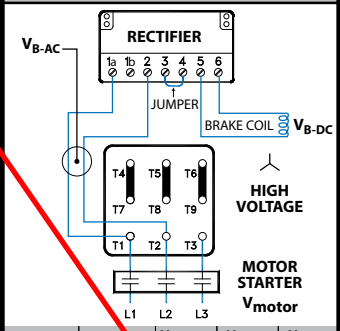
Typical Connection Diagrams

GU101A — 10
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



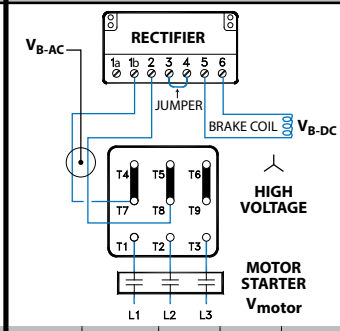
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GUE40V	230 VAC	230 VAC	205 VDC

GU101B — 10
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



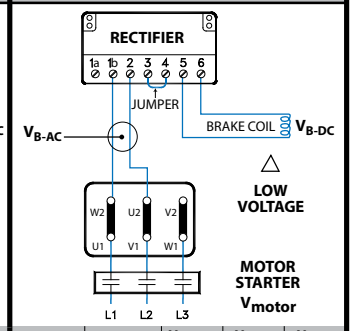
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC
230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC

GU101D — 10
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



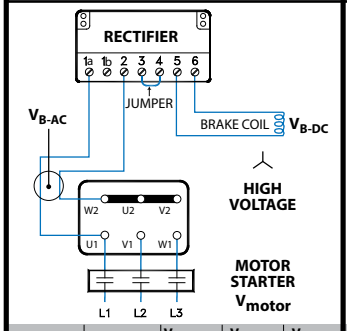
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GUE40V	460 VAC	230 VAC	205 VDC

GU101E — 10
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
NORMAL STOPPING (AC-SWITCHING)



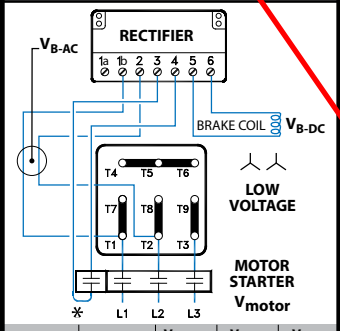
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	230 VAC	230 VAC	205 VDC
400Δ/690Y	GUE40V	400 VAC	400 VAC	180 VDC

GU101F — 10
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
NORMAL STOPPING (AC-SWITCHING)



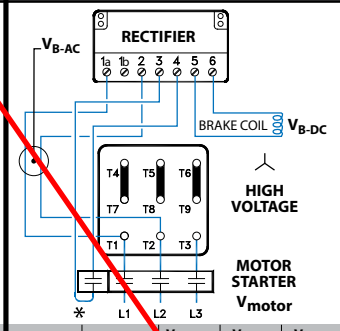
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	400 VAC	400 VAC	180 VDC

GU103A — 15
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



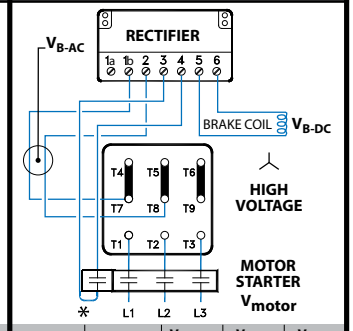
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GUE40V	230 VAC	230 VAC	205 VDC

GU103B — 15
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



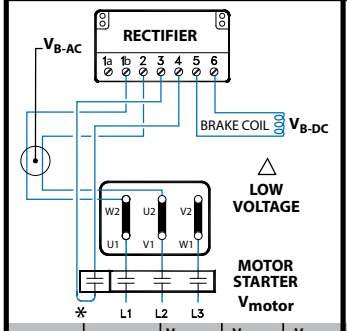
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC
230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC

GU103D — 15
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



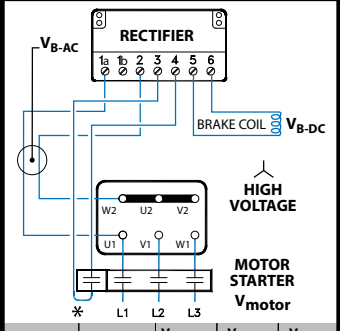
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GUE40V	460 VAC	230 VAC	205 VDC

GU103E — 15
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



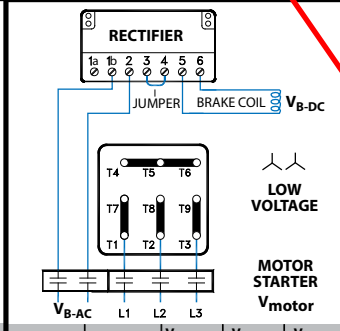
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	230 VAC	230 VAC	205 VDC
400Δ/690Y	GUE40V	400 VAC	400 VAC	180 VDC

GU103F — 15
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



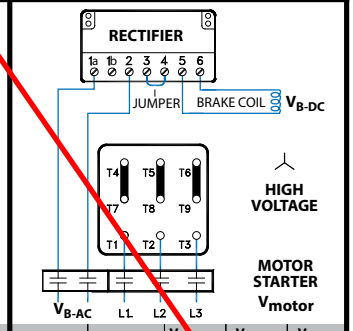
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	400 VAC	400 VAC	180 VDC

GU102A — 20
SEPERATE POWER SOURCE
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GUE40V	230 VAC	230 VAC	205 VDC
208-230YY/460Y	GUE40V	208 VAC	115 VAC	105 VDC
230YY/460Y	GUE40V	230 VAC	115 VAC	105 VDC

GU102B — 20
SEPERATE POWER SOURCE
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC
230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC

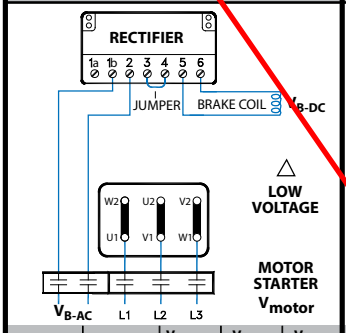
✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

Typical Connection Diagrams

GU102E — 20

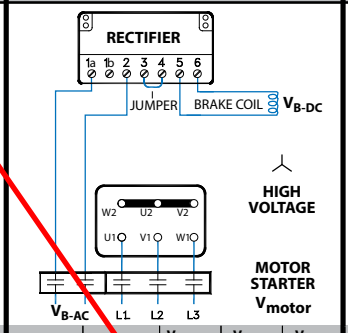
SEPERATE POWER SOURCE
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	230 VAC	230 VAC	205 VDC
400Δ/690Y	GUE40V	400 VAC	400 VAC	180 VDC

GU102F — 20

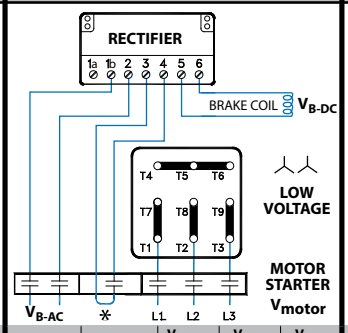
SEPERATE POWER SOURCE
STANDARD RELEASE
STANDARD STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	400 VAC	400 VAC	180 VDC

GU104A — 25

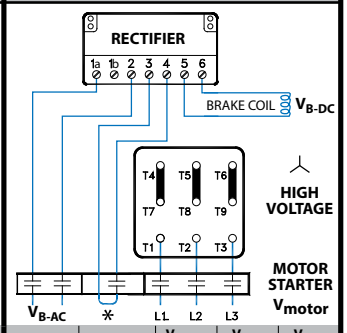
SEPERATE POWER SOURCE
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	208 VAC	208-230 VAC	205 VDC
230YY/460Y	GUE40V	230 VAC	230 VAC	205 VDC
208-230YY/460Y	GUE40V	208 VAC	115 VAC	105 VDC
230YY/460Y	GUE40V	230 VAC	115 VAC	105 VDC

GU104B — 25

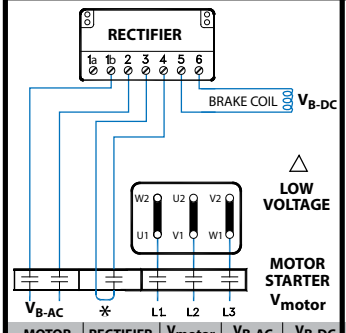
SEPERATE POWER SOURCE
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC
230YY/460Y	GUE40V	460 VAC	460 VAC	205 VDC

GU104E — 25

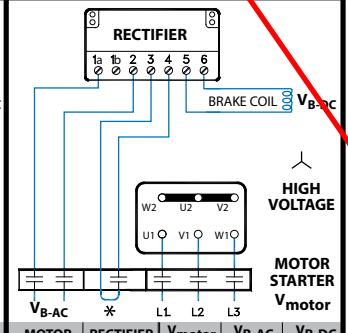
SEPERATE POWER SOURCE
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	230 VAC	230 VAC	205 VDC
400Δ/690Y	GUE40V	400 VAC	400 VAC	180 VDC

GU104F — 25

SEPERATE POWER SOURCE
STANDARD RELEASE
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GUE40V	400 VAC	400 VAC	180 VDC

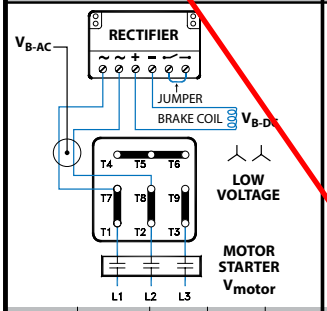
✻ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

MOTOR BRAKES INSTALLATION & MAINTENANCE

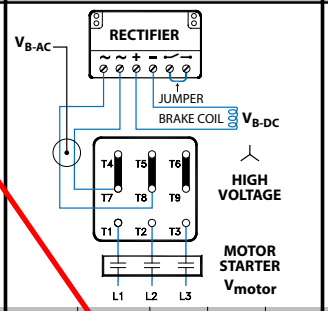
Typical Connection Diagrams

PMG101A — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



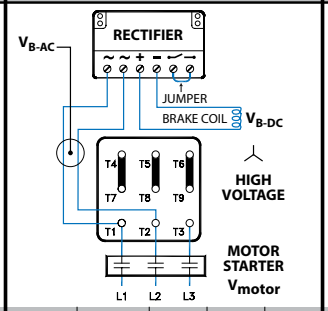
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG101B — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



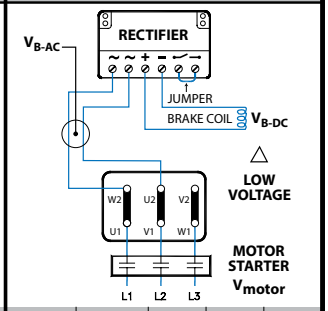
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG101C — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



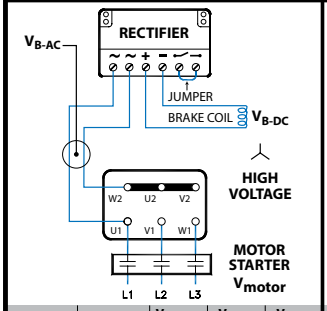
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG101D — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



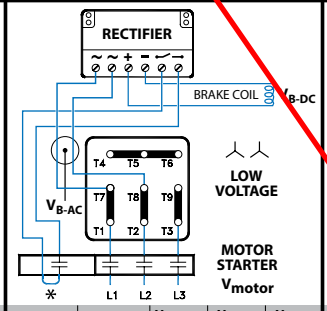
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG101E — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



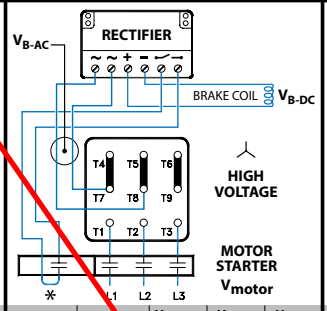
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG102A — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



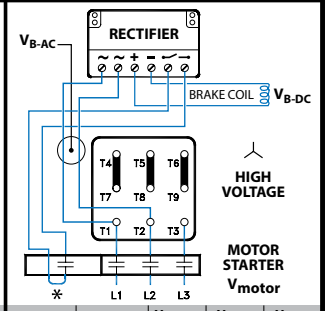
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG102B — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



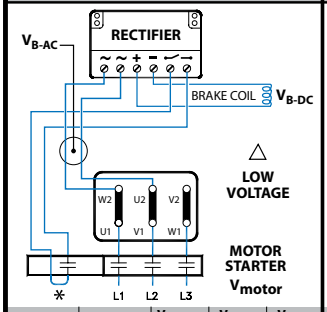
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG102C — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



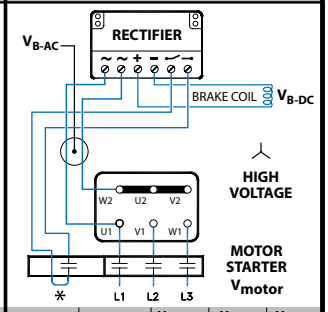
MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG102D — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG102E — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



MOTOR	RECTIFIER	Vmotor	VB-AC	VB-DC
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

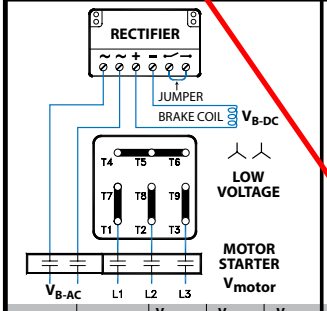
= Braking Method

MOTOR BRAKES INSTALLATION & MAINTENANCE

Typical Connection Diagrams

PMG104A

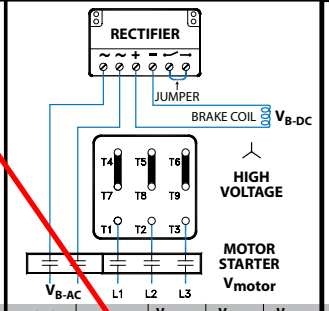
45 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG104B

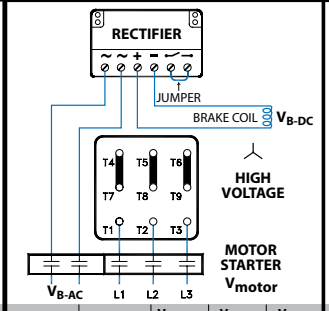
45 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG104C

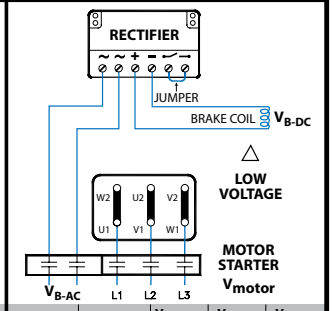
45 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG104D

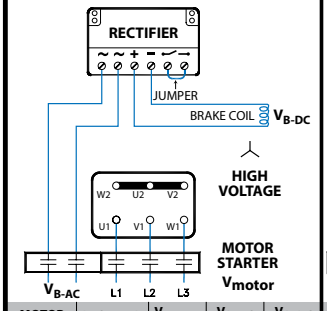
45 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG104E

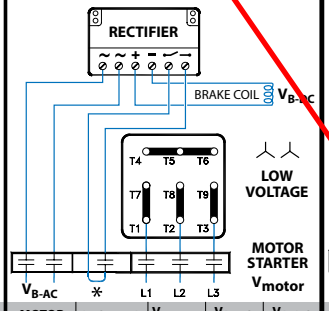
45 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG105A

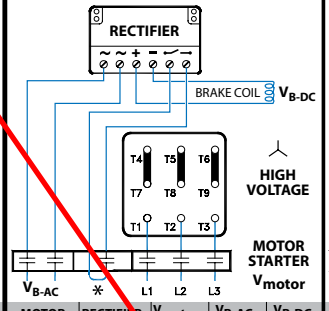
50 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG105B

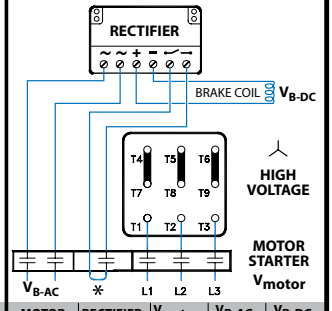
50 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG105C

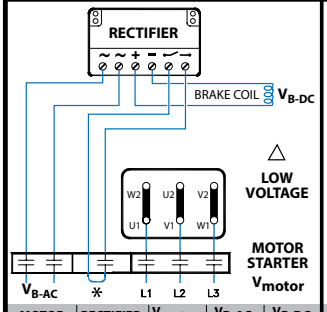
50 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG105D

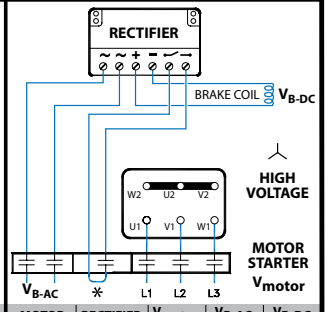
50 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG105E

50 SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

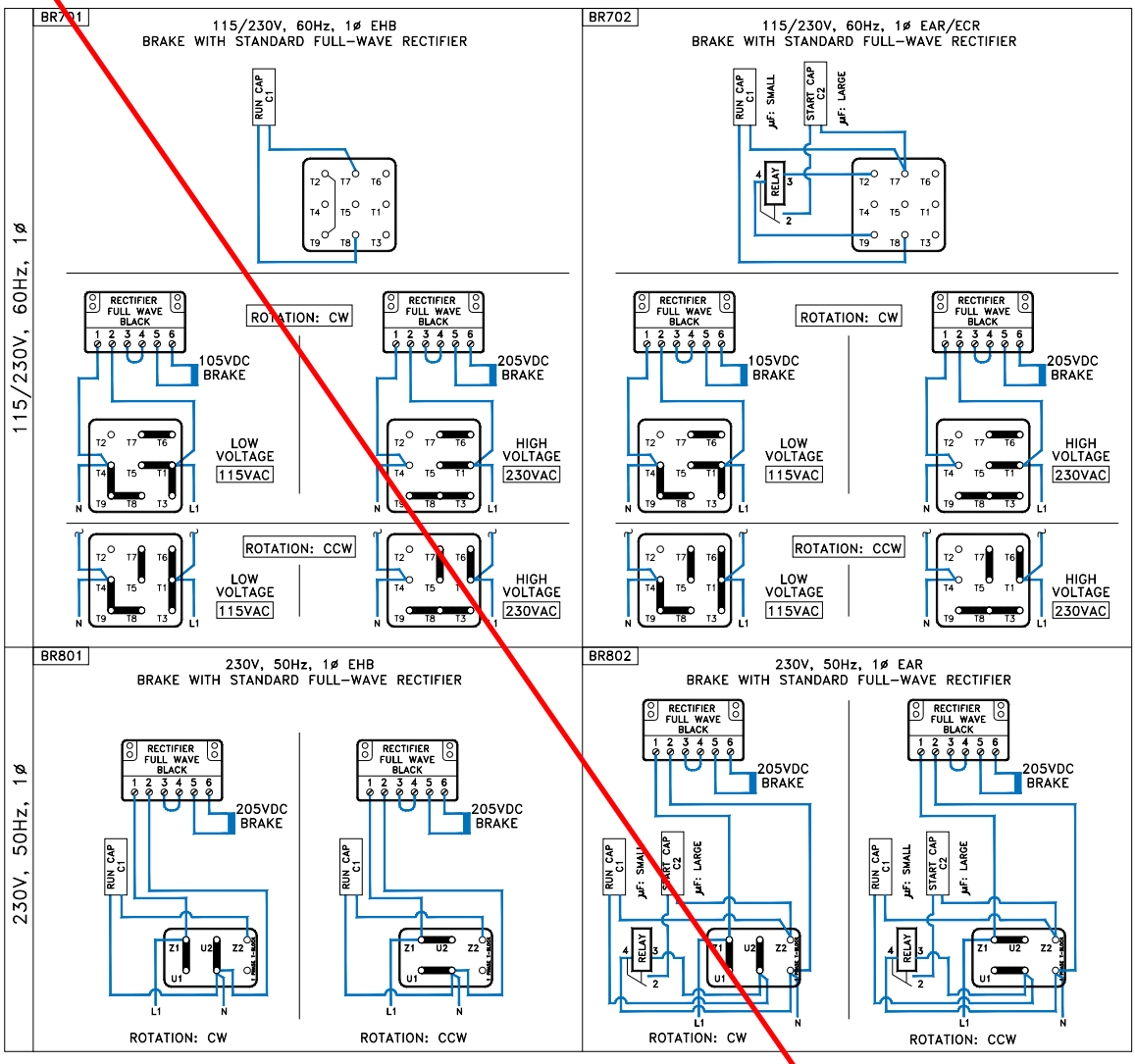


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

✻ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

45 = Braking Method

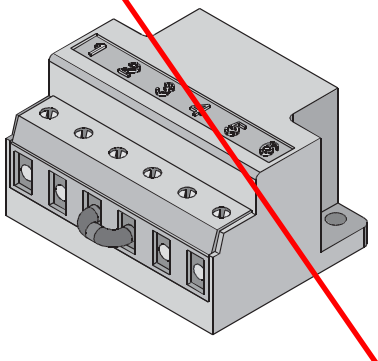
Typical Connection Diagrams - Single Phase Motors



Troubleshooting Information

Troubleshooting	Cause	Remedy
Brake doesn't release	Air gap too large	Check air gap and adjust
	Brake not recieving electrical power	Check electrical connection
	Failed rectifier	Replace rectifier
	Brake is getting too warm	Use fast response (FR) rectifier
	Voltage to brake coil too small	Check connection voltageof brake coil
	Rectifier supply voltage from inverter	Rectifier voltage must be from seperate source. (Inverter output voltage varies)
Brake release is delayed	Air gap too large	Check air gap and adjust
	Voltage to brake coil too small	Check connection voltage of brake coil
Brake does not engage	Voltage to coil too large	Check connection voltages of brake windings
	Hand release is adjusted incorrectly	Adjust to correct air gap
	Anchor plate mechanically blocked	Remove mechanical blockage
Brake engagement is delayed	Voltage to coil too large	Check connection voltage of brake windings
	Brake is switched to AC side	Use DC switching

FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)



General Instructions

This manual provides general operating instructions for the "Fast Acting Brake Rectifiers type "GPE, GPU, and PMG" that are commonly offered by NORD in addition to the standard brake control rectifiers. Please feel free to contact NORD with any questions concerning the supplied brake rectifiers and brake components.

Safety Notice

Only qualified personnel should attempt installation, operation and maintenance of NORD brakes and brake rectifiers. If you have a question about a procedure or are uncertain about any detail, seek clarification and DO NOT PROCEED.

⚠ DANGER

- This equipment contains high electrical voltage. Remove and lockout all power from the electric motor and brake before any work is completed on the brake.
- The user is responsible for conforming to all national and local electrical and safety codes. Wiring practices, proper grounding, disconnects, and over current protection, are of particular importance.
- Make certain the load is supported when servicing the brake. Removing power from the brake or removing the brake from the motor will release the load, which may cause severe injury or death.
- Failure to follow proper procedures and precautions may result in severe bodily injury or death.

Brake Control Rectifiers

NORD brake control rectifiers convert AC voltage to DC voltage. Rectifiers are used because most applications require AC voltage to power the motor, but DC power is required to power the brake and DC power is not typically available. NORD brakemotors typically include the rectifier located inside the terminal box.

Rectifier Advantages

- Individual power source for each brake.
- Compact size, mounted inside the terminal box.
- Multiple types, voltage options and release/engagement modes available.
- Mountable in a separate control cabinet.
- Integral protection against voltage spikes.

Standard Rectifier Types

Full-Wave Rectifier

A rectifier in which both the positive and negative half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 90% of the input voltage ($V_{DC} = 0.90 \times V_{AC}$).

Half-Wave Rectifier

A rectifier in which only alternate half-cycles of the AC input signal are rectified to produce a uni-directional DC current supply to the load or the brake. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).

Dual-Wave Rectifier

A rectifier that can be wired as either a full-wave rectifier or a half-wave rectifier depending upon how it is connected to the AC input signal.

IMPORTANT NOTE

This manual provides general operating instructions for NORD brakes with Fast-Acting brake Rectifiers. For additional brake and brake rectifier information please reference User Manual U35000.

Fast-Acting or Push-Hybrid Rectifiers [GPE, GPU & PMG]

A push-hybrid rectifier or fast-acting brake rectifier provides an initial "push" in the form of a timed full-wave brake-release function, which is then followed by a continuous half-wave brake-holding function. There are two ways to apply these rectifiers as follows:

- "Overexcitation" of the brake coil provides faster brake release or improved cycling capacity. The DC voltage of the brake coil is determined based upon using a half-wave rectifier. The output voltage is 45% of the input voltage ($V_{DC} = 0.45 \times V_{AC}$).
- "Reducer-Power Holding" of the brake coil maintains the brake in a released state by using only 25% of the power needed for the initial brake release. This results in very fast brake stopping. The DC voltage of the brake coil is determined based upon using a full-wave rectifier. The output voltage is 90% of the input voltage. ($V_{DC} = 0.90 \times V_{AC}$).

NOTICE

In order to prevent rapid wear, the PMG 500 rectifier is required when utilizing the larger 800 Nm (590 lb-ft) and 1200 Nm (885 lb-ft) twin-rotor brakes. The PMG500 rectifier is wired to "overexcite" the brake during its initial release.

FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

Push-Hybrid Rectifiers External DC Switching (GPE)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The GPE type rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

GPE rectifiers were designed for external control of the brake's DC-switching. GPE rectifiers are primarily used in across-the-line applications where the brake power is supplied by the motor terminals but they may also be used in situations where the brake power is supplied separately to the brake rectifier.

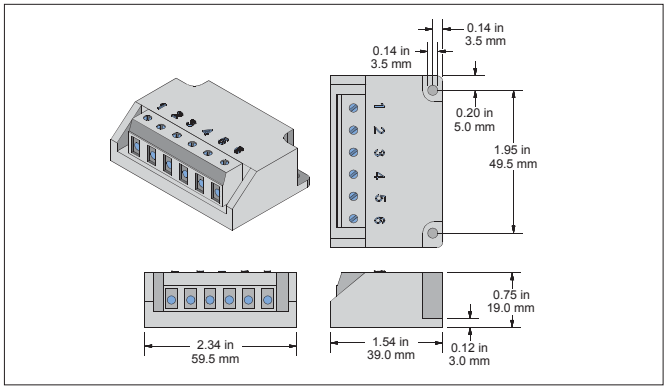
There are two ways to apply the fast acting rectifiers:

- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).

IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then seperate AC power must be supplied to the brake rectifier.

GPE Rectifier Dimensions



Ratings & Part Numbers

Model Type	GPE20L	GPE40L
Part Number	19140230	19140240
Protection (electronics)	Coated	Coated
Color	Black	
Input Voltage (V_{AC})	200V-275V	380V-480V
Output Voltage (V_{DC})	(V_{DC} =0.45 x V_{AC}) - As Half-Wave (V_{DC} =0.90 x V_{AC}) - As Full-Wave	
Rated Current @ 40°C	0.7 A	0.7A
Rated Current @ 75°C	0.5 A	0.5A
Temperature Range	-20°C to 75°C	
DC-Switching via	External Contact or IR Relay	

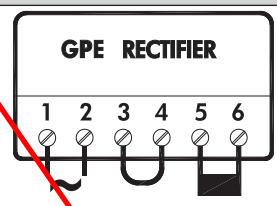
Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
40	Standard	Very Fast (Reduced Power Holding)	Motor terminals
30	Fast (Overecitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overecitation)	Fast (DC Switching)	Motor terminals

Basic Connection (AC & DC Switching)

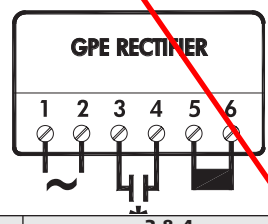
The GPE brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING (AC-SWITCHING)



1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	JUMPER	DC BRAKE

FAST & VERY FAST STOPPING (DC-SWITCHING)



1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	NORMALLY OPEN CONTACT	DC BRAKE

* The normally open contact/s (NO) is not supplied by NORD it must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated at IEC AC3.

FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

Push-Hybrid Rectifiers Integrated DC Switching (GPU)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The GPU rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

GPU rectifiers were designed for integrated control of the brake's DC-switching and are voltage sensing. GPU rectifiers are primarily used in applications where there is a frequency inverter, soft start, or two-speed motor. Seperate AC power must be supplied to the brake rectifier.

There are two ways to apply the fast acting rectifiers:

- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).

IMPORTANT NOTE

The GPU rectifier may also be utilized for across-the-line applications; however it must always be powered separate from the motor and have its own pair of contactors or starters. It is unadvisable to use the motor terminal block to supply the GPU rectifier's AC power due to the motor's slow energy dissipation when switched off.

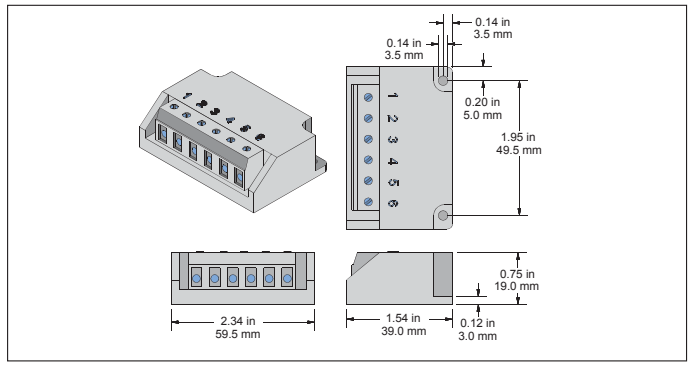
IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then seperate AC power must be supplied to the brake rectifier.

Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
55	Standard	Very Fast (Reduced Power Holding)	Seperate power
45	Fast (Overecitation)	Standard (AC Switching)	Seperate power
50	Fast (Overecitation)	Fast (DC Switching)	Seperate power

GPU Rectifier Dimensions



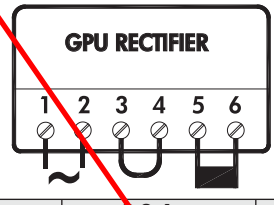
Ratings & Part Numbers

Model Type	GPU20L	GPU40L
Part Number	19140090	19140170
Protection (electronics)	Coated	Coated
Color	Black	
Input Voltage (V_{AC})	200V-275V	380V-480V
Output Voltage (V_{DC})	(V_{DC} =0.45 x V_{AC}) - As Half-Wave (V_{DC} =0.90 x V_{AC}) - As Full-Wave	
Rated Current @ 40°C	0.7A	0.7A
Rated Current @ 75°C	0.5A	0.5A
Temperature Range	-20°C to 75°C	
DC-Switching via	Internal Activation	

Basic Connection (AC & DC Switching)

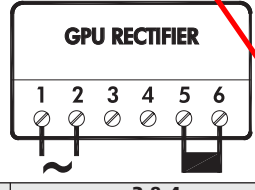
The GPU brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING AC-SWITCHING



1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	JUMPER	DC BRAKE

FAST & VERY FAST STOPPING DC-SWITCHING



1 & 2	3 & 4	5 & 6
AC BRAKE VOLTAGE	-	DC BRAKE

FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

Push-Hybrid Rectifiers External DC Switching (PMG)

Like the standard NORD brake control rectifiers, NORD's fast acting brake control rectifiers convert AC voltage to DC voltage. The "Fast Acting Brake Rectifiers" are utilized to improve brake performance and are often recommended in order to provide shorter brake release times or to provide faster stopping times.

The fast acting rectifiers are a two-stage "push" design. When power is first applied these rectifiers operate like a full-wave rectifier and then after a relatively short period of time they act like a half-wave rectifier. The PMG type rectifiers start out in full-wave mode when power is first applied and then after approximately 250 ms they switch to half-wave mode.

PMG rectifiers were designed for external control of the brake's DC-switching. PMG rectifiers are primarily used in across-the-line applications where the brake power is supplied by the motor terminals, but they may also be used in situations where the brake power is supplied separately from the brake rectifier.

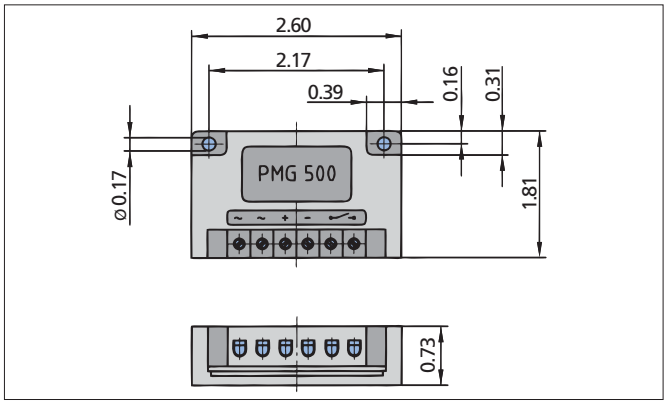
There are two ways to apply the fast acting rectifiers:

- The first method, known as "Overexcitation," provides fast brake release. The brake coil is selected like a half-wave system (45% of the AC supply voltage).
- The second method, known as "Reduced Power Holding," provides very fast brake stopping. The brake coil is selected like a full-wave system (90% of the AC supply voltage).

IMPORTANT NOTE

If the motor is connected to a frequency inverter, soft start, or is a two-speed motor, then seperate AC power must be supplied to the brake rectifier.

PMG Rectifier Dimensions



Ratings & Part Numbers

Model Type	PMG 500
Part Number	19140200
Protection (electronics)	Coated
Color	Black
Input Voltage (V_{AC})	200-500V_{AC} +/- 10%
Output Voltage (V_{DC})	(V_{DC}=0.45 x V_{AC}) - As Half-Wave (V_{DC}=0.90 x V_{AC}) - As Full-Wave
Rated Current @ 40°C	4.0 A
Rated Current @ 75°C	2.8 A
Temperature Range	-15°C to 80°C
DC-Switching via	External Contact

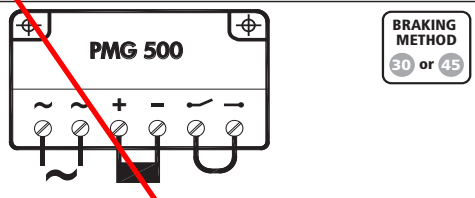
Braking Method

Braking Method	Break Release (Start)	Brake Engage (Stop)	Power Source
40	Standard	Very Fast (Reduced Power Holding)	Motor terminals
30	Fast (Overecitation)	Standard (AC Switching)	Motor terminals
35	Fast (Overecitation)	Fast (DC Switching)	Motor terminals
55	Standard	Very Fast (Reduced Power Holding)	Seperate power
45	Fast (Overecitation)	Standard (AC Switching)	Seperate power
50	Fast (Overecitation)	Fast (DC Switching)	Seperate power

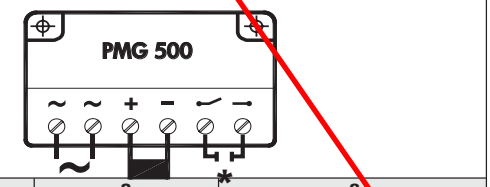
Basic Connection (AC & DC Switching)

The PMG brake system can be connected for standard stopping (AC-Switching), fast stopping (DC-Switching) and very fast stopping (Reduced power holding & DC-Switching). Fast brake release can also be achieved by selecting a different brake coil combination.

STANDARD STOPPING (AC-SWITCHING)



FAST & VERY FAST STOPPING (DC-SWITCHING)



* The normally open contact/s (NO) is not supplied by NORD it must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated at IEC AC3.

Brake Times & Electrical Selection

Brake timing performance is critical in selecting the optimal brake system. NORD brakes can provide exceptional performance in terms of the release (start) times and engagement (stop) times. Use the following guidelines in order to select the correct brake control components and connections.

1) Determine if the brake needs to be wired directly from the motor terminal block or powered by a separate source.

- If you are using a frequency inverter, soft-start or a two speed motor you will need to supply the rectifier from a separate power source.

- If the motor is powered direct across-the-line the rectifier power can be supplied from the motor's terminal block.

2) What type of performance do I need?

- Is the standard brake performance OK?

- Is a higher performance required for fast brake release or very fast brake stopping?

3) Determine the brake supply voltage and check the rectifier compatability using the table on the page 6.

Selection Suggestions

When Fast or Very Fast Stopping is Recommended

Any applications that require quick stops and positive action at stand-still

Recommended Applications

- conveyors and inclined conveyors
- hoists and lifts
- bulk material handling equipment (bucket elevators, idler conveyor's).

⚠ WARNING

Hoisting (lifting/lowering) applications - must have the brake wired for fast response (DC-switching) Hoisting (lifting/lowering) applications must have the brake wired for fast response to protect against injury or damage to the equipment.

When Fast-Release is Recommended (Overexcitation)

Any application that is very high-cycling with frequent starts and stops. These applications require the brake to release very-quickly in order to avoid excessive heat build-up in the AC motor and brake coil.

Recommended Applications

- Index conveyors
- Diverters

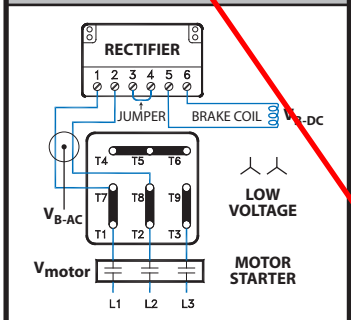
Power Source	Brake Release (start)	Brake engagement (stop)	Braking Method *	Rectifier
Motor Terminal Block	Standard	Very Fast (Reduced power holding)	40	GPE or PMG 500
	Fast (Overexcitation)	Standard (AC switching)	30	GPE or PMG 500
	Fast (Overexcitation)	Fast (DC switching)	35	GPE or PMG 500
Seperate Power Source	Standard	Very Fast (Reduced power holding)	55	GPU or PMG 500
	Fast (Overexcitation)	Standard (AC switching)	45	GPU or PMG 500
	Fast (Overexcitation)	Fast (DC switching)	50	GPU or PMG 500

*** Braking methods referenced in connection diagrams on pages 7-11.**

Rectifier Supply Voltage (VAC)	Brake Coil Voltage (VDC)	Braking Method	Rectifier Type	Rectifier P/N	BRE 5	BRE 10	BRE 20	BRE 40	BRE 60	BRE 100	BRE 150	BRE 250	BRE 400	BRE 800	BRE 1200
208 (200-208)	105	30	GPE20L	19140230	X	X	X	X							
	105	30	PMG500	19140200					X	X	X	X	X	X	X
	105	35	GPE20L	19140230	X	X	X	X							
	105	35	PMG500	19140200					X	X	X	X	X	X	X
	180	40	GPE20L	19140230	X	X	X	X	X	X	X				
	180	40	PMG500	19140200								X	X	X	X
	105	45	GPU20L	19140090	X	X	X	X							
	105	45	PMG500	19140200					X	X	X	X	X	X	X
	105	50	GPU20L	19140090	X	X	X	X							
	105	50	PMG500	19140200					X	X	X	X	X	X	X
	180	55	GPU20L	19140090	X	X	X	X	X	X	X				
	180	55	PMG500	19140200								X	X	X	X
230 (220-240)	105	30	GPE20L	19140230	X	X	X	X							
	105	30	PMG500	19140200					X	X	X	X	X	X	X
	105	35	GPE20L	19140230	X	X	X	X	X	X	X				
	105	35	PMG500	19140200								X	X	X	X
	205	40	GPE20L	19140230	X	X	X	X	X	X	X				
	205	40	PMG500	19140200								X	X	X	X
	105	45	GPU20L	19140090	X	X	X	X							
	105	45	PMG500	19140200					X	X	X	X	X	X	X
	105	50	GPU20L	19140090	X	X	X	X							
	105	50	PMG500	19140200					X	X	X	X	X	X	X
	205	55	GPU20L	19140090	X	X	X	X	X	X	X				
	205	55	PMG500	19140200								X	X	X	X
332	180	30	GPE40L	19140240	X	X	X	X	X	X	X				
	180	30	PMG500	19140200								X	X	X	X
	180	35	GPE40L	19140240	X	X	X	X	X	X	X				
	180	35	PMG500	19140200								X	X	X	X
	180	45	GPU40L	19140170	X	X	X	X	X	X	X				
	180	50	GPU40L	19140170	X	X	X	X	X	X	X				
400 (380-415)	180	30	GPE40L	19140240	X	X	X	X	X	X	X				
	180	30	PMG500	19140200								X	X	X	X
	180	35	GPE40L	19140240	X	X	X	X	X	X	X				
	180	35	PMG500	19140200								X	X	X	X
	180	45	GPU20L	19140090	X	X	X	X	X	X	X				
	180	45	PMG500	19140200								X	X	X	X
	180	50	GPU20L	19140090	X	X	X	X	X	X	X				
	180	50	PMG500	19140200								X	X	X	X
460 (440-480)	205	30	GPE40L	19140240	X	X	X	X	X	X	X				
	205	30	PMG500	19140200								X	X	X	X
	205	35	GPE40L	19140240	X	X	X	X	X	X	X				
	205	35	PMG500	19140200								X	X	X	X
	205	45	GPU40L	19140170	X	X	X	X	X	X	X				
	205	45	PMG500	19140200								X	X	X	X
	205	50	GPU40L	19140170	X	X	X	X	X	X	X				
	205	50	PMG500	19140200								X	X	X	X

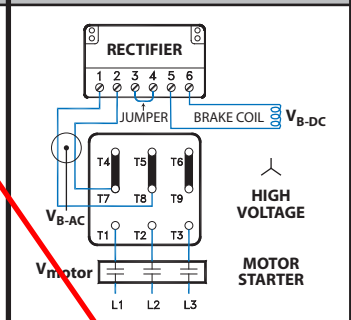
FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

GP101A — POWERED FROM MOTOR TERMINAL BLOCK — 30
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



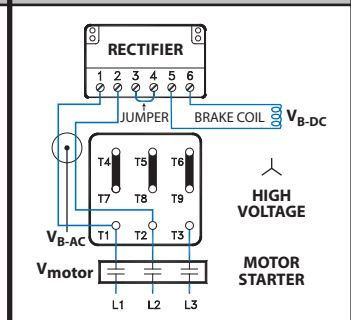
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	230 VAC	230 VAC	105 VDC

GP101B — POWERED FROM MOTOR TERMINAL BLOCK — 30
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



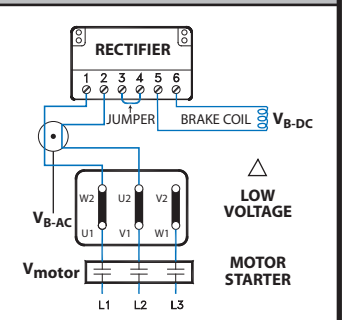
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	460 VAC	230 VAC	105 VDC

GP101C — POWERED FROM MOTOR TERMINAL BLOCK — 30
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



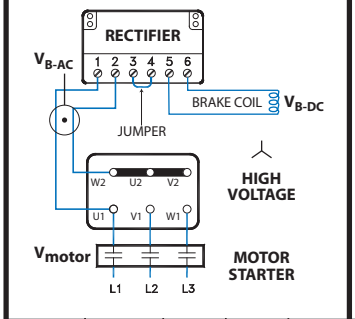
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE40L	460 VAC	460 VAC	205 VDC

GP101D — POWERED FROM MOTOR TERMINAL BLOCK — 30
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



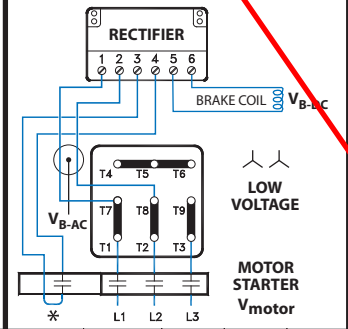
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPE20L	208 VAC	208 VAC	105 VDC
230Δ/400Y	GPE20L	230 VAC	230 VAC	105 VDC
400Δ/690Y	GPE40L	400 VAC	400 VAC	180 VDC
460Δ/Y	GPE40L	460 VAC	460 VAC	205 VDC

GP101E — POWERED FROM MOTOR TERMINAL BLOCK — 30
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



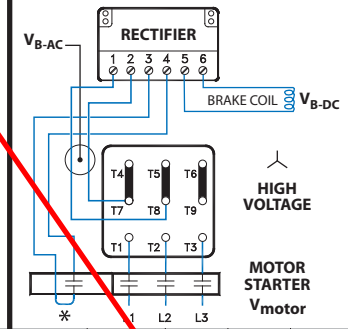
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPE20L	400 VAC	230 VAC	105 VDC
332Δ/575Y	GPE40L	575 VAC	332 VAC	180 VDC

GP102A — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



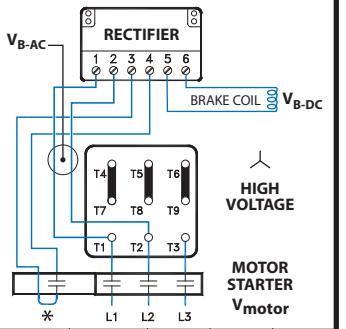
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	230 VAC	230 VAC	105 VDC

GP102B — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



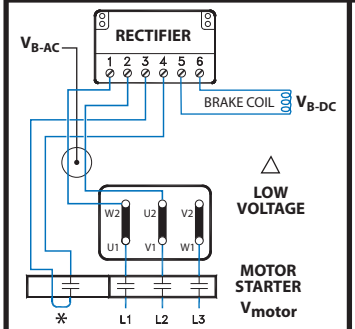
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	460 VAC	230 VAC	105 VDC

GP102C — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



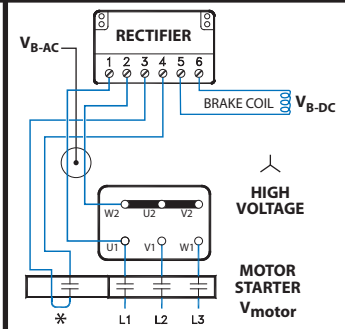
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE40L	460 VAC	460 VAC	205 VDC

GP102D — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



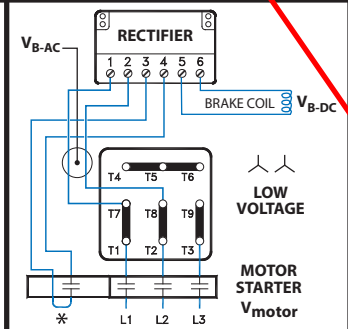
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPE20L	208 VAC	208 VAC	105 VDC
230Δ/400Y	GPE20L	230 VAC	230 VAC	105 VDC
400Δ/690Y	GPE40L	400 VAC	400 VAC	180 VDC
460Δ/Y	GPE40L	460 VAC	460 VAC	205 VDC

GP102E — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



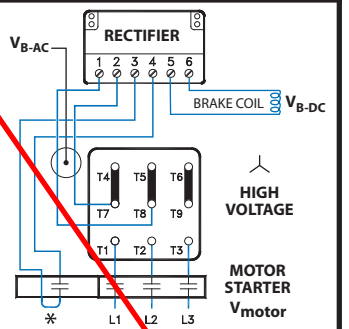
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPE20L	400 VAC	230 VAC	105 VDC
332Δ/575Y	GPE40L	575 VAC	332 VAC	180 VDC

GP103A — POWERED FROM MOTOR TERMINAL BLOCK — 40
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	230 VAC	230 VAC	205 VDC

GP103B — POWERED FROM MOTOR TERMINAL BLOCK — 40
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	460 VAC	230 VAC	205 VDC

✻ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

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NORD Gear Corporation
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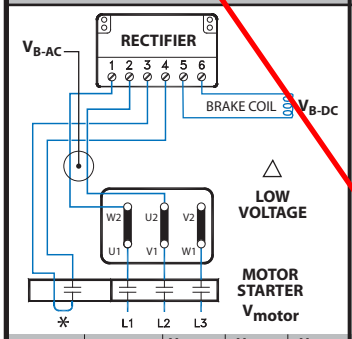
FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

GP103C — 40

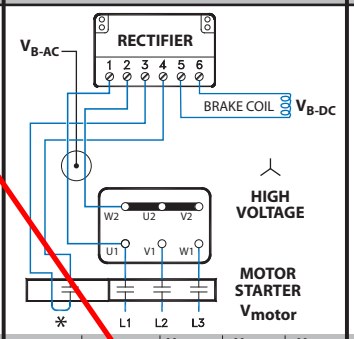
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPE20L	208 VAC	208 VAC	180 VDC
230Δ/400Y	GPE20L	230 VAC	230 VAC	205 VDC

GP103D — 40

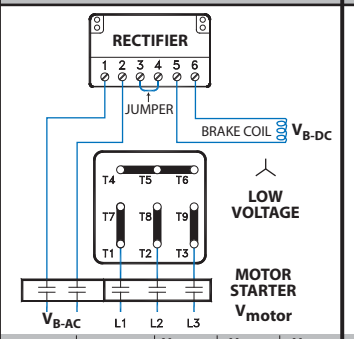
POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPE20L	400 VAC	230 VAC	205 VDC

GP104A — 45

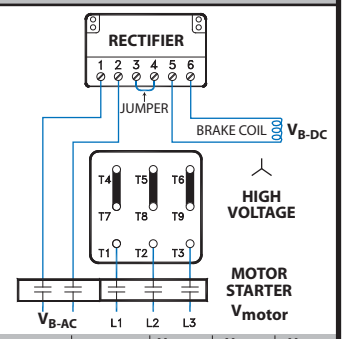
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	230 VAC	230 VAC	105 VDC

GP104B — 45

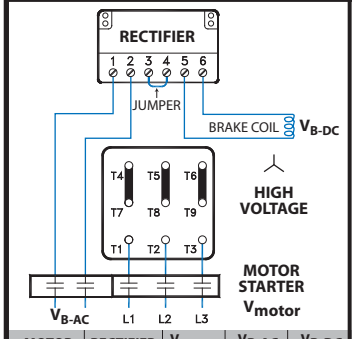
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	460 VAC	230 VAC	105 VDC

GP104C — 45

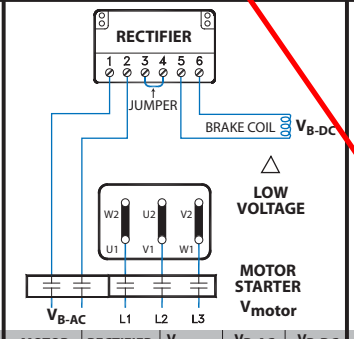
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU40L	460 VAC	460 VAC	205 VDC

GP104D — 45

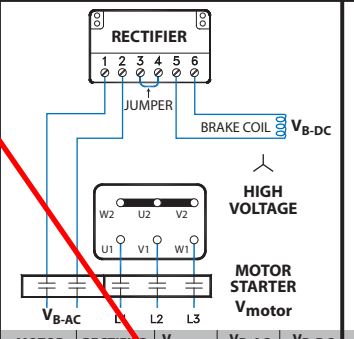
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPU20L	208 VAC	208 VAC	105 VDC
230Δ/400Y	GPU20L	230 VAC	230 VAC	105 VDC
400Δ/690Y	GPU40L	400 VAC	400 VAC	180 VDC
460Δ/Y	GPU40L	460 VAC	460 VAC	205 VDC

GP104E — 45

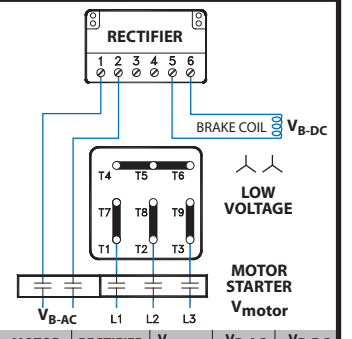
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPU20L	400 VAC	230 VAC	105 VDC
332Δ/575Y	GPU40L	575 VAC	332 VAC	180 VDC

GP105A — 50

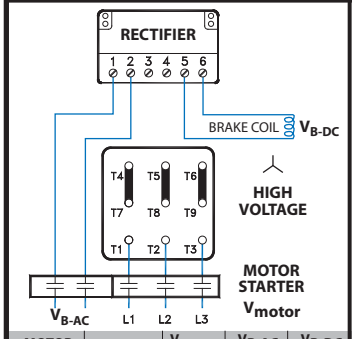
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	230 VAC	230 VAC	105 VDC

GP105B — 50

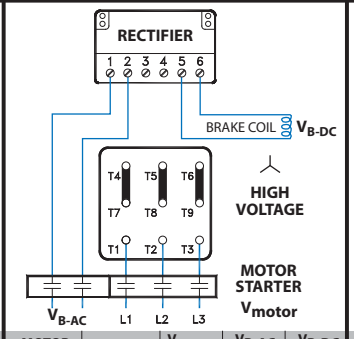
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	460 VAC	230 VAC	105 VDC

GP105C — 50

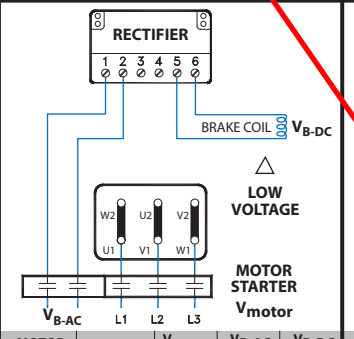
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU40L	460 VAC	460 VAC	205 VDC

GP105D — 50

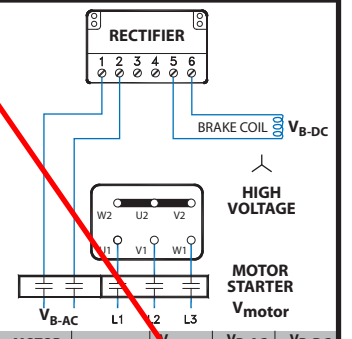
SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPU20L	208 VAC	208 VAC	105 VDC
230Δ/400Y	GPU20L	230 VAC	230 VAC	105 VDC
400Δ/690Y	GPU40L	400 VAC	400 VAC	180 VDC
460Δ/Y	GPU40L	460 VAC	460 VAC	205 VDC

GP105E — 50

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPU20L	400 VAC	230 VAC	105 VDC
332Δ/575Y	GPU40L	575 VAC	332 VAC	180 VDC

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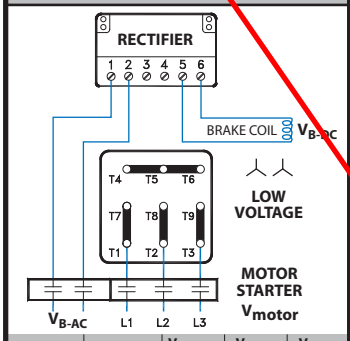
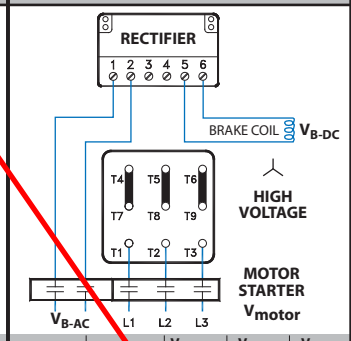
FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

GP106A — SEPERATE POWER SOURCE — STANDARD RELEASE — VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING) — 55



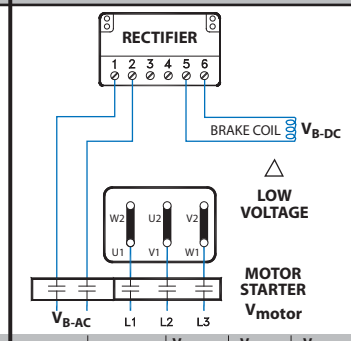
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	230 VAC	230 VAC	205 VDC

GP106B — SEPERATE POWER SOURCE — STANDARD RELEASE — VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING) — 55



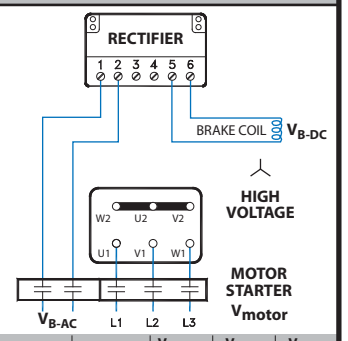
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPU20L	460 VAC	230 VAC	205 VDC

GP106C — SEPERATE POWER SOURCE — STANDARD RELEASE — VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING) — 55



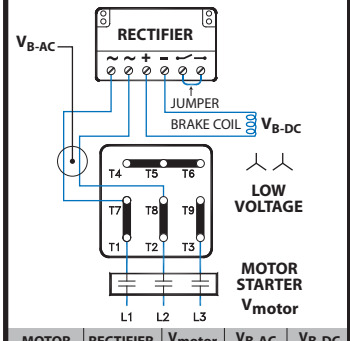
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GPU20L	208 VAC	208 VAC	180 VDC
230Δ/400Y	GPU20L	230 VAC	230 VAC	205 VDC

GP106D — SEPERATE POWER SOURCE — STANDARD RELEASE — VERY FAST STOPPING (DC-SWITCHING + REDUCED POWER HOLDING) — 55



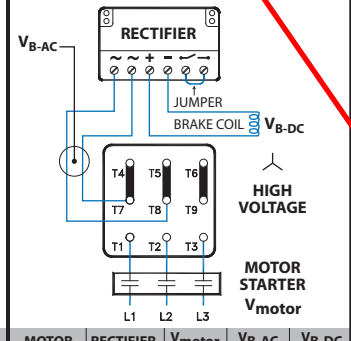
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GPU20L	400 VAC	230 VAC	205 VDC

PMG101A — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



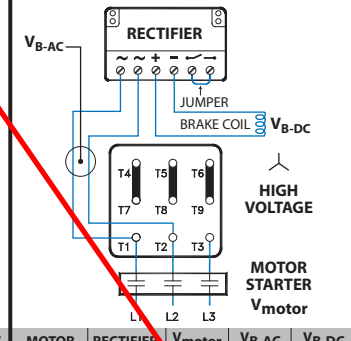
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG101B — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



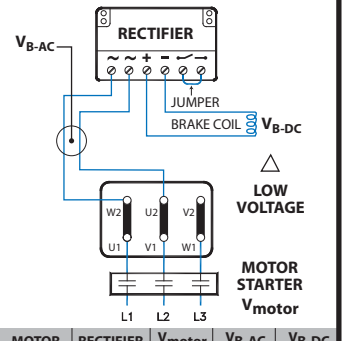
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG101C — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



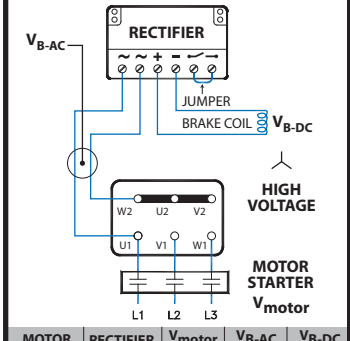
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG101D — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



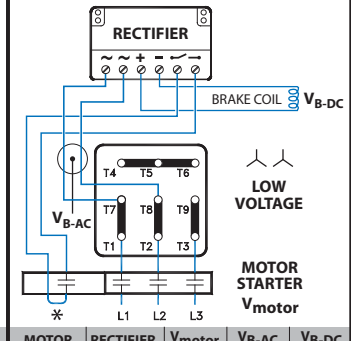
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG101E — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — NORMAL STOPPING (AC-SWITCHING) — 30



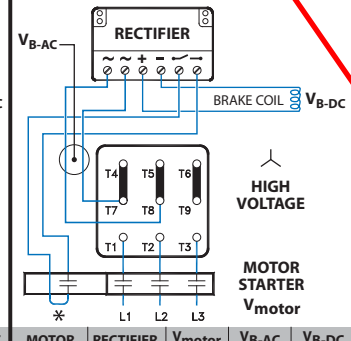
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG102A — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



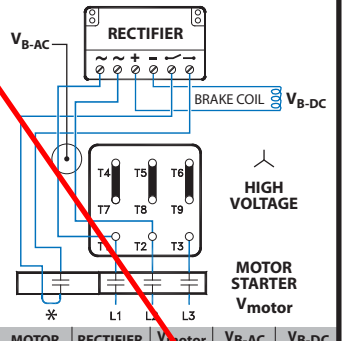
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG102B — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG102C — POWERED FROM MOTOR TERMINAL BLOCK — FAST-RELEASE (OVER EXCITATION) — FAST STOPPING (DC-SWITCHING) — 35



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

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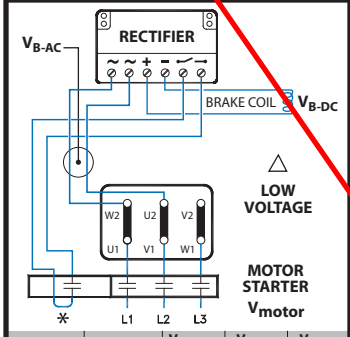
FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

PMG102D

POWERED FROM MOTOR TERMINAL BLOCK
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

35

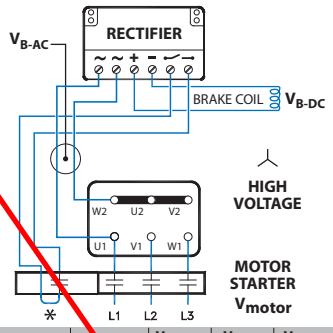


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG102E

POWERED FROM MOTOR TERMINAL BLOCK
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

35

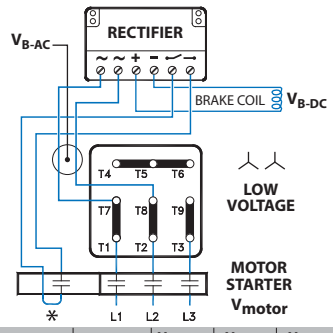


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG103A

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

40

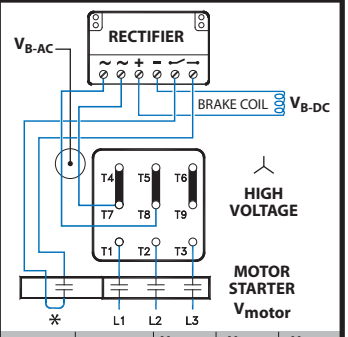


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	205 VDC

PMG103B

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

40

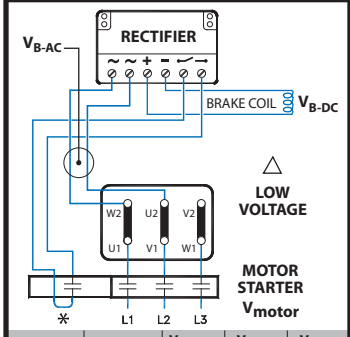


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	205 VDC

PMG103C

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

40

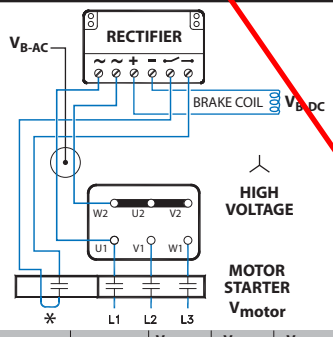


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	180 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	205 VDC

PMG103D

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

40

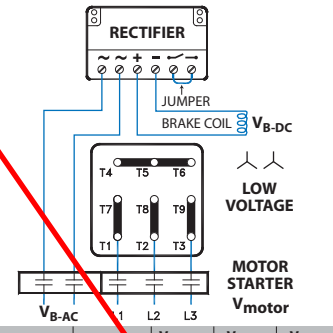


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	205 VDC

PMG104A

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)

45

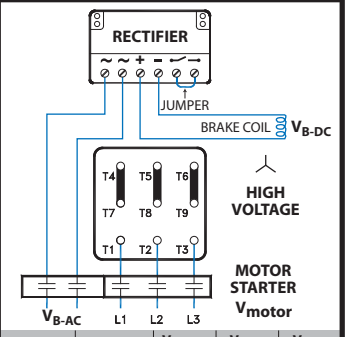


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	105 VDC

PMG104B

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)

45

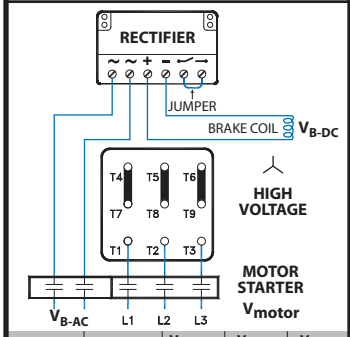


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG104C

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)

45

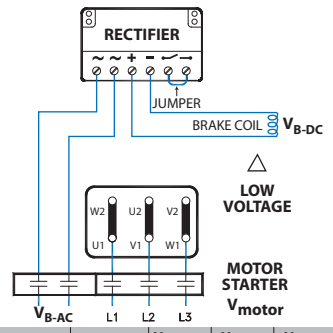


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG104D

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)

45

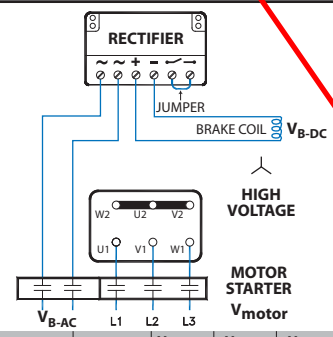


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG104E

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
NORMAL STOPPING (AC-SWITCHING)

45

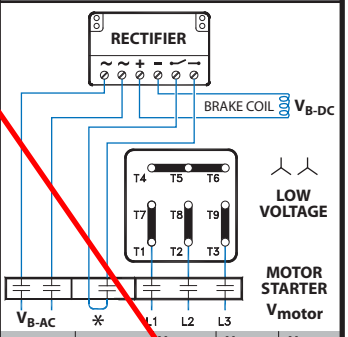


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG105A

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

50



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	2[illegible] VAC	230 VAC	105 VDC

✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

NORD Gear Limited
Toll Free in Canada: 800.668.4378

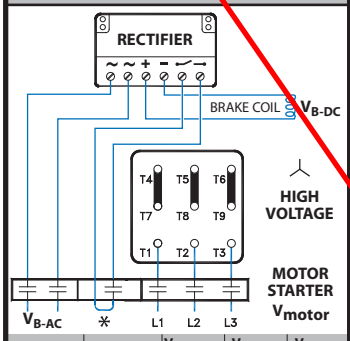
NORD Gear Corporation
Toll Free in the United States: 888.314.6673

FAST ACTING BRAKE RECTIFIERS (GPE, GPU & PMG)

PMG105B

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

50

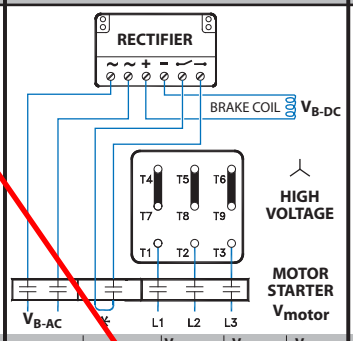


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	105 VDC

PMG105C

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

50

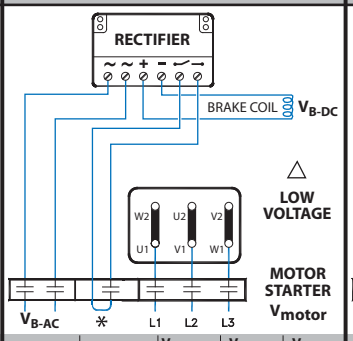


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	460 VAC	205 VDC

PMG105D

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

50

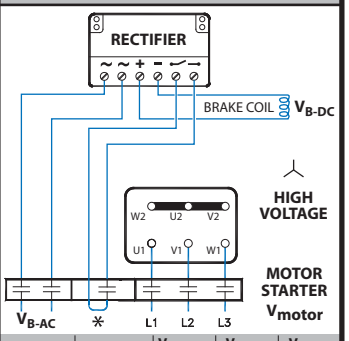


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	105 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	105 VDC
400Δ/690Y	PMG500	400 VAC	400 VAC	180 VDC
460Δ/Y	PMG500	460 VAC	460 VAC	205 VDC

PMG105E

SEPERATE POWER SOURCE
FAST-RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)

50

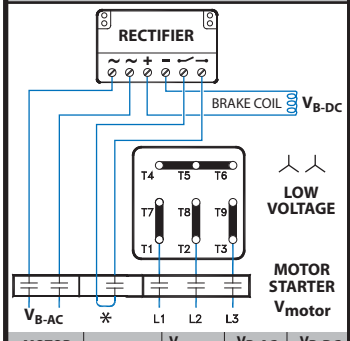


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	105 VDC

PMG106A

SEPERATE POWER SOURCE
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

55

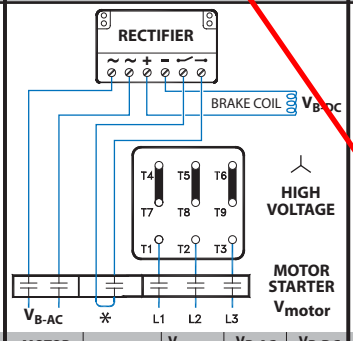


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	230 VAC	230 VAC	205 VDC

PMG106B

SEPERATE POWER SOURCE
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

55

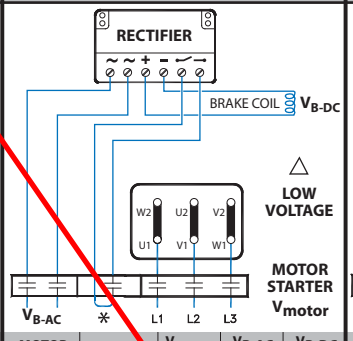


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	PMG500	460 VAC	230 VAC	205 VDC

PMG106C

SEPERATE POWER SOURCE
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

55

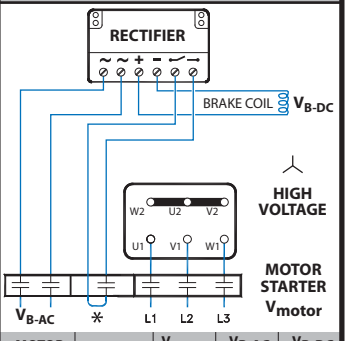


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	PMG500	208 VAC	208 VAC	180 VDC
230Δ/400Y	PMG500	230 VAC	230 VAC	205 VDC

PMG106D

SEPERATE POWER SOURCE
STANDARD RELEASE
VERY FAST STOPPING
(DC-SWITCHING + REDUCED POWER HOLDING)

55



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	PMG500	400 VAC	230 VAC	205 VDC

✱ The normally open contact/s (NO) is not supplied by NORD. It must close at the same time power is supplied to the brake. The contact must be capable of switching inductive loads and/or be rated IEC AC3.

= Braking Method

NORD Gear Limited
Toll Free in Canada: 800.668.4378

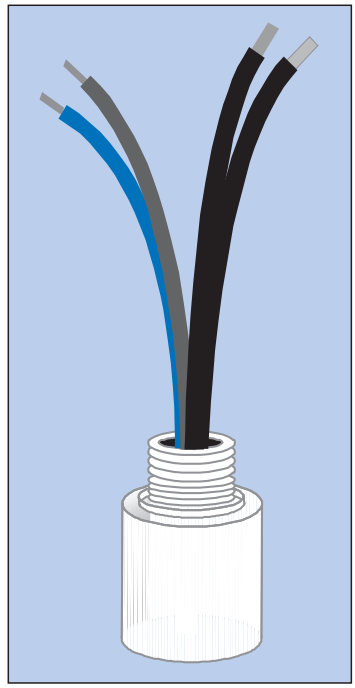
NORD Gear Corporation
Toll Free in the United States: 888.314.6673

CURRENT SENSING BRAKE RELAY (IR) INSTALLATION & MAINTENANCE

Current Sensing Relay (IR)

Modify

The current sensing relay, is used to achieve a fast brake engagement (stopping) without the use of external control equipment or additional wiring. The relay is mounted directly on the conduit box, and is powered from the motor's terminal block. The power leads for the relay replace one of the brass jumper bars on the terminal block of any single speed motor. The switch leads are connected to terminals 3 and 4 of the rectifier. When the power to the motor is shut off, the IR relay opens the brake circuit on the DC side which allows the brake to de-magnetize quickly.



IMPORTANT NOTE

Current Sensing Relay Requirements

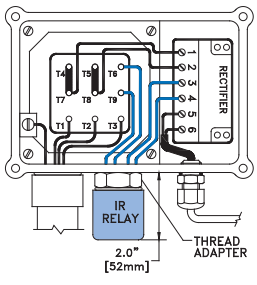
- Brake must be powered from the motor's terminal block (not seperately powered)
- Motor must be single speed and should not be powered by a frequency inverter or soft starter.

Part number	18556010	18556020
Reissmann Part Number	RSR 25-46	RSR 50-46
Primary Current Rating (black/white wires)	25A_{AC}	50 A_{AC}
Maximum Primary Current (black/white wires)	75A_{AC}	150 A_{AC}
Maximum Time at Maximum Primary Current	0.2 s	0.2 s
Maximum Cycles per hour	500	500
Switching Voltage	42 - 550 V_{DC}	42 - 550V_{DC}
Switching Current (red/blue wires)	1.0 A_{DC}	1.0 A_{DC}
Holding Current ❶	< 0.7 A_{AC}	< 0.7 A_{AC}
Delay Time ❷	18 ms	18 ms
Enclosure Rating	IP65	IP65
Ambient Temp.	- 25 to 90 °C (- 40 to 167 °F)	- 25 to 90 °C (- 40 to 167 °F)

❶ Relative to the distortion created by the magnetising current of the motor.

❷ Additional setting time delay added to the DC-setting time of the brake circuit.

IR Relay Wiring Diagram



Rectifier			IR-Relay Wires to Rectifier	
Model Type	Part Number	Design	Red	Blue
GVE20L	1914000	Full-wave	4	3
GHE40L	19141010	Half-wave	4	3
GHE50L	19141020	Half-wave	4	3
GPE20L	19140230	Push-hybrid	4	3
GPE40L	19140240	Push-hybrid	4	3

Conduit Box Thread Adapter

Thread	Motor Frame	Part Number	O-Ring
M20	63-71	18542006*	25501615
M25	80-90	18522253	25501615
M32	100-132	18522320	25501615
M40	160-180	18522400 + 18522253	25501615

* Spacer

IR Relay Selection Table for 4-Pole Motors

Type	Efficiency	230/460 V 60 Hz	460V D 60 Hz	332/575V 60 Hz	208/360 V 60 Hz	230/400V 50 Hz	400/690V 50 Hz
63S/4	SE (IE1)	25A	-	25A	25A	25A	-
63SP/4	PE (IE3)	25A	-	25A	-	25A	-
63L/4	SE (IE1)	25A	-	25A	25A	25A	-
63LP/4	PE (IE3)	25A	-	25A	-	25A	-
71S/4	SE (IE1)	25A	-	25A	25A	25A	-
71SP/4	PE (IE3)	25A	-	25A	-	25A	-
71L/4	SE (IE1)	25A	-	25A	25A	25A	-
71LP/4	PE (IE3)	25A	-	25A	-	25A	-
80S/4	SE (IE1)	25A	-	25A	25A	25A	-
80SH/4	EE (IE2)	-	-	-	-	25A	-
80SP/4	PE (IE3)	25A	-	25A	-	25A	-
80L/4	SE (IE1)	25A	-	25A	25A	25A	-
80LH/4	EE (IE2)	25A	-	25A	-	25A	-
80LP/4	PE (IE3)	25A	-	25A	-	25A	-
90S/4	SE (IE1)	25A	-	25A	25A	25A	-
90SH/4	EE (IE2)	25A	-	25A	-	25A	-
90SP/4	PE (IE3)	25A	-	25A	-	25A	-
90L/4	SE (IE1)	25A	-	25A	25A	25A	-
90LH/4	EE (IE2)	25A	-	25A	-	25A	-
90LP/4	PE (IE3)	25A	-	25A	-	25A	-
100L/4	SE (IE1)	25A	-	25A	25A	-	25A
100LH/4	EE (IE2)	25A	-	25A	-	-	25A
100LP/4	PE (IE3)	25A	-	25A	-	-	25A
100LA/4	SE (IE1)	25A	-	25A	25A	-	25A
100AH/4	EE (IE2)	-	-	-	-	-	25A
100AP/4	PE (IE3)	-	-	-	-	-	25A
112M/4	SE (IE1)	-	-	-	-	-	25A
112MH/4	EE (IE2)	25A	-	25A	-	-	25A
112MP/4	PE (IE3)	25A	-	25A	-	-	25A
132S/4	SE (IE1)	25A	-	25A	25A	-	25A
132SH/4	EE (IE2)	25A	-	25A	-	-	25A
132SP/4	PE (IE3)	25A	-	25A	-	-	25A
132M/4	SE (IE1)	25A	-	25A	25A	-	25A
132MH/4	EE (IE2)	25A	-	25A	-	-	25A
132LH/4	EE (IE2)	-	-	-	-	-	25A
132MA/4	SE (IE1)	-	-	-	-	-	25A
132MP/4	PE (IE3)	25A	-	25A	-	-	25A

25 A (P/N 18556010) – IR Relay is rated for 25 Amp motor phase current.

50 A (P/N 18556020) – IR Relay is rated for 50 Amp motor phase current.

N/A – IR Relay option is not available.

Observe the efficiency law requirements for the country that the motor will be utilized in.

IR Relay Selection Table for 4-Pole Motors Ctd.

Type	Efficiency	230/460 V 60 Hz	460V D 60 Hz	332/575V 60 Hz	208/360 V 60 Hz	230/400V 50 Hz	400/690V 50 Hz
160SH/4	EE (IE2)	-	-	-	-	-	25A
160SP/4	PE (IE3)	-	-	-	-	-	25A
160M/4	SE (IE1)	25A	-	25A	-	-	25A
160MH/4	EE (IE2)	25A	-	25A	-	-	25A
160MP/4	PE (IE3)	25A	-	25A	-	-	25A
160L/4	SE (IE1)	25A	-	25A	-	-	25A
160LH/4	EE (IE2)	25A	-	25A	-	-	50 A
160LP/4	PE (IE3)	25A	-	25A	-	-	50 A
180MX/4	SE (IE1)	50 A	-	25A	-	-	25A
180MH/4	EE (IE2)	50 A	-	25A	-	-	50 A
180MP/4	PE (IE3)	50 A	-	25A	-	-	50 A
180LX/4	SE (IE1)	50 A	-	50 A	-	-	25A
180LH/4	EE (IE2)	50 A	-	50 A	-	-	50 A
180LP/4	PE (IE3)	50 A	-	50 A	-	-	50 A
200LX/4	SE (IE1)	50 A	-	50 A	-	-	50 A
200XH/4	EE (IE2)	N/A	-	50 A	-	-	N/A
225RP/4	PE (IE3)	-	50 A	50 A	-	-	N/A
225SH/4	EE (IE2)	-	50 A	50 A	-	-	N/A
225SP/4	PE (IE3)	-	50 A	50 A	-	-	N/A
225MH/4	EE (IE2)	-	50 A	N/A	-	-	N/A
225MP/4	PE (IE3)	-	50 A	N/A	-	-	N/A
250WH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
250WP/4	PE (IE3)	-	50 A	N/A	-	-	N/A
280SH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
280SP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
280MH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
280MP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315SH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315SP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315MH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315MP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315RH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315RP/4	PE (IE3)	-	N/A	N/A	-	-	N/A
315LH/4	EE (IE2)	-	N/A	N/A	-	-	N/A
315LP/4	PE (IE3)	-	N/A	N/A	-	-	N/A

25 A (P/N 18556010) – IR Relay is rated for 25 Amp motor phase current.

50 A (P/N 18556020) – IR Relay is rated for 50 Amp motor phase current.

N/A – IR Relay option is not available.

Observe the efficiency law requirements for the country that the motor will be utilized in.

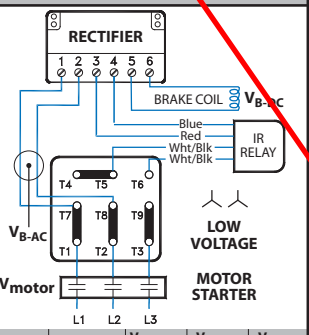
CURRENT SENSING BRAKE RELAY (IR) INSTALLATION & MAINTENANCE

IR Relay Typical Connection Diagrams

IR101A

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

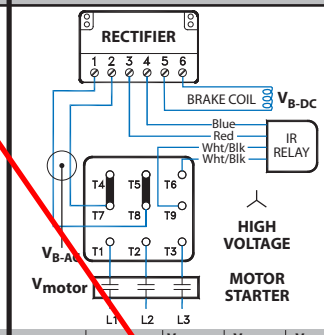


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GVE20	208VAC	230 VAC	205 VDC
230YY/460Y	GVE20	230 VAC	230 VAC	205 VDC

IR101B

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

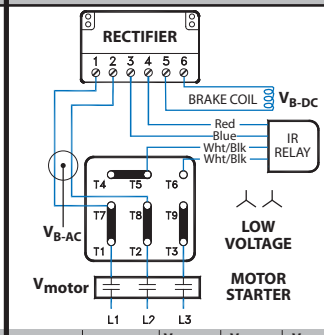


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GVE20	460 VAC	230 VAC	205 VDC

IR102A

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

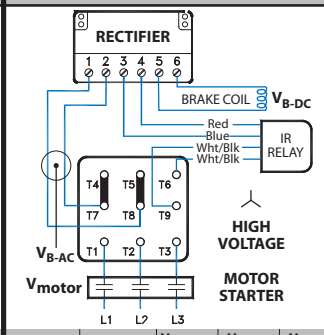


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208-230YY/460Y	GHE40	208VAC	230 VAC	105 VDC
230YY/460Y	GHE40	230 VAC	230 VAC	105 VDC

IR102B

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

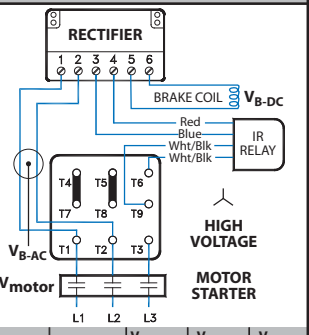


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GHE40	460 VAC	230 VAC	105 VDC

IR103

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

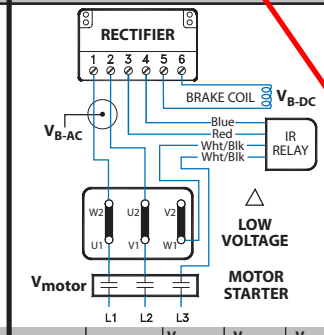


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GHE40	460 VAC	460VAC	205 VDC

IR301

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

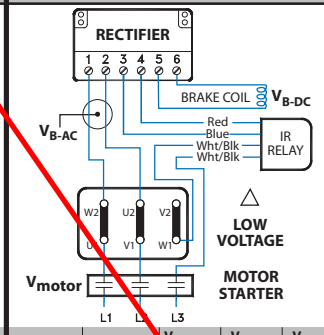


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
208Δ/360Y	GVE20	208 VAC	208 VAC	180 VDC
230Δ/400Y	GVE20	230 VAC	230 VAC	205 VDC

IR401

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

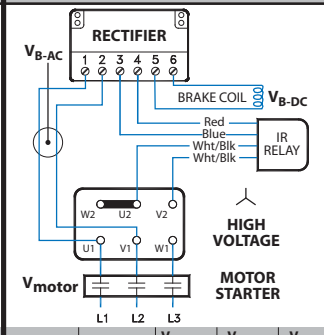


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
460Δ/800Y	GHE40	460 VAC	460 VAC	205 VDC

IR501

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

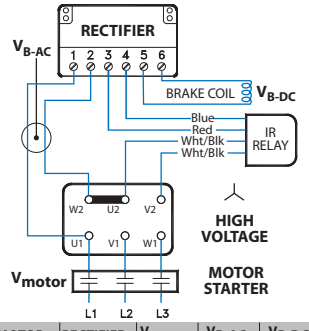


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
332Δ/575Y	GHE50	575 VAC	575 VAC	250 VDC

IR601

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15

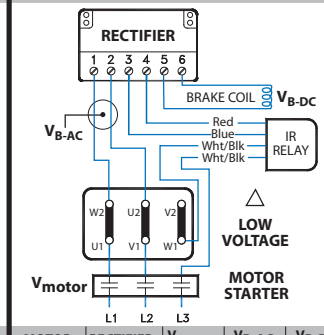


MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230Δ/400Y	GVE20	400 VAC	230 VAC	205 VDC
230Δ/400Y	GHE40	400 VAC	230 VAC	105 VDC

IR602

POWERED FROM MOTOR TERMINAL BLOCK
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)

15



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
400Δ/690Y	GHE40	400 VAC	400 VAC	180 VDC

IMPORTANT NOTE

Requirements

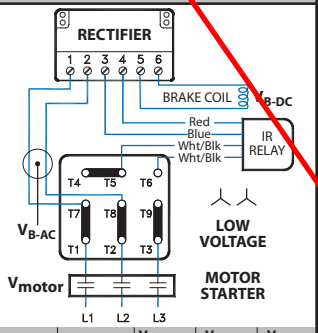
- Brake must be powered from the motor's terminal block (not seperately powered)
- Motor must be a single speed and should not be powered by a frequency inverter or soft starter.

= Braking Method

CURRENT SENSING BRAKE RELAY (IR) INSTALLATION & MAINTENANCE

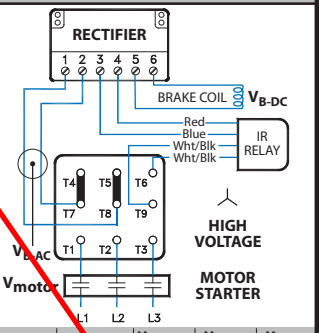
GPE Rectifier for External DC-Switching with IR Relay

IR151A — POWERED FROM MOTOR TERMINAL BLOCK — 35
FAST RELEASE (OVER EXCITATION)
FAST STOPPING (DC-SWITCHING)



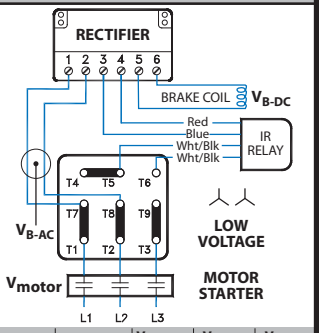
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	230 VAC	230 VAC	105 VDC

IR151B — POWERED FROM MOTOR TERMINAL BLOCK — 35
STANDARD-RELEASE
FAST STOPPING (DC-SWITCHING)



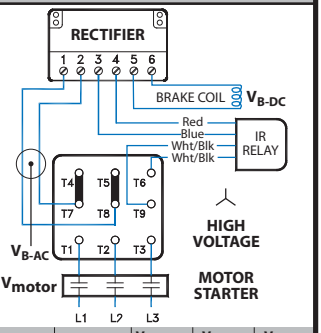
MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	460 VAC	230 VAC	105 VDC

IR152A — POWERED FROM MOTOR TERMINAL BLOCK — 40
STANDARD-RELEASE
VERY FAST STOPPING
(REDUCED POWER HOLD)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	230 VAC	230 VAC	205 VDC

IR152B — POWERED FROM MOTOR TERMINAL BLOCK — 40
STANDARD-RELEASE
VERY FAST STOPPING
(REDUCED POWER HOLD)



MOTOR	RECTIFIER	V_{motor}	V_{B-AC}	V_{B-DC}
230YY/460Y	GPE20L	460 VAC	230 VAC	205 VDC

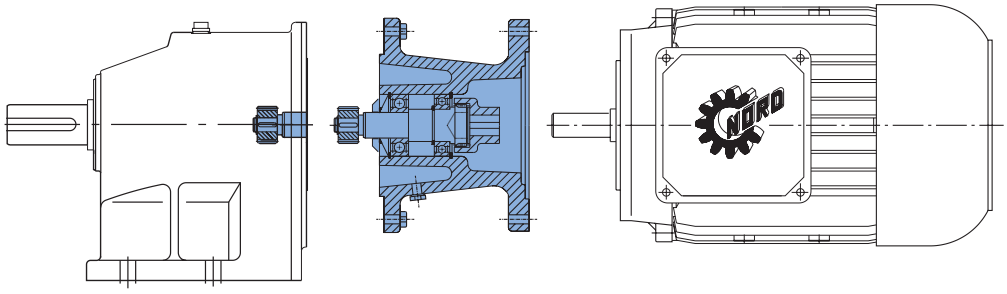
IMPORTANT NOTE

Requirements

- Brake must be powered from the motor's terminal block (not seperately powered)
- Motor must be a single speed and should not be powered by a frequency inverter or soft starter.

= Braking Method

NEMA/IEC/SERVO INPUT ADAPTERS & THEIR COUPLINGS



⚠ WARNING

While working on the gear drive system, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!

NEMA/ IEC Motor Adapters

Motor adapters allow for easy installation and removal of industry standard motors. Motor adapters consist of a coupling and an adapter housing that connects the motor to the gear reducer.

NORD Gear supplies a coupling that is to be mounted on the motor shaft. It is important that the coupling is properly positioned.

- For NEMA Input Adapters, follow the Motor Installation Instructions on pages 3-4.
- For IEC Input Adapters, the supplied coupling will mount directly against the motor shaft shoulder. No locating measurements need to be taken.

IMPORTANT NOTE

Some of the larger IEC inputs will have a coupling spacer included to help locate the coupling. Slide the spacer against the motor shaft shoulder, slide the coupling against the spacer and tighten set screw(s).

IMPORTANT NOTE

For the larger motor adapters (IEC160 / N250TC and larger), an Automatic Lubricator is supplied. This will need to be activated at the time of startup. For operation and activation instructions, refer to user manual U45200.

NEMA/IEC Motor Weight Limits

When mounting a motor to a NORD NEMA C-face motor adapter it is important to consider the motor's weight. Following is a table that includes the maximum motor weight the NEMA adapter can support. If the motor exceeds the listed weight is must be externally supported. When a C-face mounted motor is externally supported care must be taken to ensure that the support system does not impose additional pre-loads on the NEMA motor adapter.

NEMA Motor Weight Limit

Motor FRAME	56C	143TC	145TC	182TC	184TC	210TC
Max Weight [lb]	66	88	110	130	175	220
Motor FRAME	**250TC**	**280TC**	**324TC**	**326TC**	**365TC**	
Max Weight [lb]	440	550	770	1100	1540	

IEC Motor Weight Limit

Motor FRAME	63	71	80	90	100	112	132
Max Weight [lb]	55	66	88	110	130	175	220
Motor FRAME	**160**	**180**	**200**	**225**	**250**	**280**	**315**
Max Weight [lb]	440	550	770	1100	1540	1540	3300

Couplings

Couplings are made with tough abrasion resistant materials, which resist most chemicals and petroleum products. They are electrically isolated (prevent metal to metal contact) and require no lubrication or maintenance. Depending upon the size of the C-face input, NORD provides either a gear or a jaw type coupling.

NORD supplies three different types of couplings depending on the size of input: "J" style, "M" style and "Jaw" style coupling. Following are instructions on how to properly mount each type of coupling onto the motor.

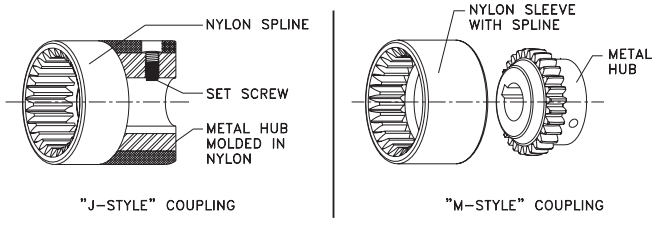
Couplings for the NEMA and IEC Adapters

Depending on the size of the input adapter to the gearbox, NORD Gear supplies two styles of couplings - BoWex® (gear tooth) and Rotex® (jaw) couplings.

BoWex® Couplings

NORD C-face adapter input shafts have a machined spline on the end. NORD incorporates two styles of BoWex® couplings, the "J" and "M" styles. The "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling – the metal hub and a nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.

- Nylon sleeves resist dirt, moisture, most chemicals and petroleum products
- No lubrication required
- Operating Conditions: -22°F - 212°F (-30°C - 100°C)
- Higher temperature coupling sleeve available up to 250°F (120°C)
- Special bore available



BoWex® Couplings Mechanical Ratings "J" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
BoWex® J14	44.3 lb-in 5 N-m	88.5 lb-in 10 N-m	N56C IEC63, IEC71	5/8" 11mm, 14mm
BoWex® J24	106 lb-in 12 N-m	212 lb-in 24 N-m	N56C, N140TC IEC80, IEC90	5/8", 7/8" 19mm, 24mm
BoWex® J28	398 lb-in 45 N-m	1,195 lb-in 135 N-m	N180TC IEC100, IEC112	1-1/8" 28mm

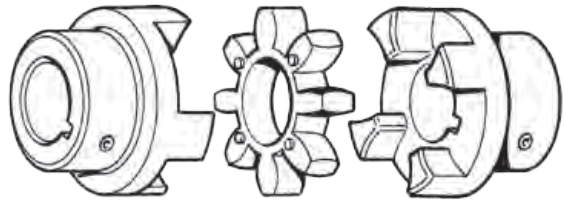
BoWex® Couplings Mechanical Ratings "M" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
BoWex® M38	708 lb-in 80 N-m	2,124 lb-in 240 N-m	N180TC, N210TC IEC132	1-1/8", 1-3/8" 38 mm
BoWex® M42	885 lb-in 100 N-m	2,655 lb-in 300 N-m	N250TC IEC160	1-5/8" 42 mm
BoWex® M48	1,239 lb-in 140 N-m	3,717 lb-in 420 N-m	N280TC IEC180	1-7/8" 48 mm

Rotex® Couplings

The cast iron jaw type couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

- Excellent shock and vibration dampening
- Excellent resistance to oils and most chemicals
- No metal-to-metal contact
- Operating Conditions: -22°F - 195°F (-30°C - 90°C)
- Higher temperature material (Hytrel) spider available up to 230°F (110°C)
- Low temperature materials available upon request
- Special bores available



Rotex® Couplings Mechanical Ratings "R" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Bore Size
Rotex® R65	5,532 lb-in 625 N-m	11,063 lb-in 1,250 N-m	N320TC IEC200, IEC225	2-3/8" 55mm, 60mm
Rotex® R90	21,242 lb-in 2400 N-m	42,484 lb-in 4800 N-m	N360TC IEC250, 280, 315	1-5/8" 65, 70, 80 mm

Couplings for Servo Adapters

NORD Gear supplies Rotex® (jaw) couplings for SERVO adapter connections.

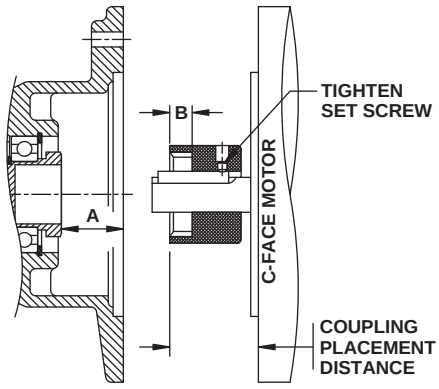
Rotex® Couplings Mechanical Ratings (Servo Adapter)

Coupling Type	Rated Torque Cont.	Rated Torque Peak	Input Adapter Sizes	Reducer Input Flange	Bore Size
Rotex® R19 GS	150 lb-in 17 Nm	301 lb-in 34 Nm	-SEP100, -SEK100	160S	19 mm
Rotex® R24 GS	531 lb-in 60 Nm	1062 lb-in 120 Nm	-SEP130, -SEK130	160S, 250S	24 mm
Rotex® R28 GS	1416 lb-in 160 Nm	2832 lb-in 320 Nm	-SEP165, -SEK165, -SEP215, -SEK215	160S, 250S 250S	32 mm 38 mm
Rotex® R48 GS	4647 lb-in 525 Nm	9293 lb-in 1050 Nm	-SEP215, -SEK215 -SEP300, -SEK300 -SEP300, -SEK300	300S 300S 350	38 mm 48 mm

SEP adapter couplings are for keyed motor shafts.
SEK adapter couplings are clamping style for shafts without key.
Alternate bores upon request.

"J" Style Coupling NEMA C-face Motor Installation

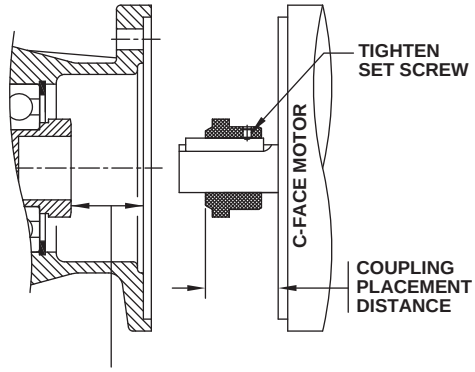
1. Measure the distance from the face of the input adapter to the face of the splined shaft and record that measurement as A in the equation below.
2. Measure depth of coupling engagement zone and record the measurement as "B" in the equation below.
3. Add "A" + "B" and subtract 0.08" (~2mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.
5. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCES A + B		SUBTRACT DISTANCE	COUPLING PLACEMENT DISTANCE
___ +	___	- 0.080" (2mm) =	___

"M" Style Coupling NEMA C-face Motor Installation

1 Measure the distance from the face of the input adapter to the face of the splined shaft & record that measurement.
2. Subtract 0.31" (~8mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
5. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCE	SUBTRACT DISTANCE	COUPLING PLACEMENT DISTANCE
___	- 0.310" (8mm) =	___

"Jaw" Style Coupling NEMA C-face Installation

1. Measure the distance from the face of the input adapter to the face of the coupling as shown and record that measurement.

2. Subtract the "X" dimension from the measured distance. This needs to be done so that the coupling will not be preloaded after installation!

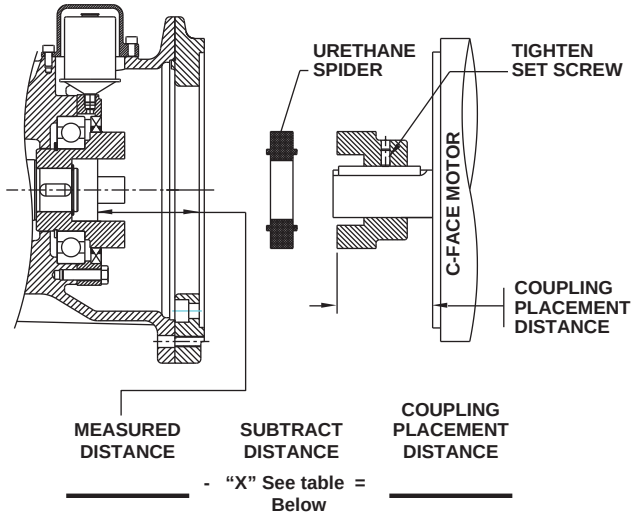
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.

4. The metal portion of the coupling should be heated up prior to assembly, generally 250°F to 300°F (120°C to 150°C).

> *IMPORTANT NOTE*
>
> DO NOT HEAT THE URETHANE SPIDER.

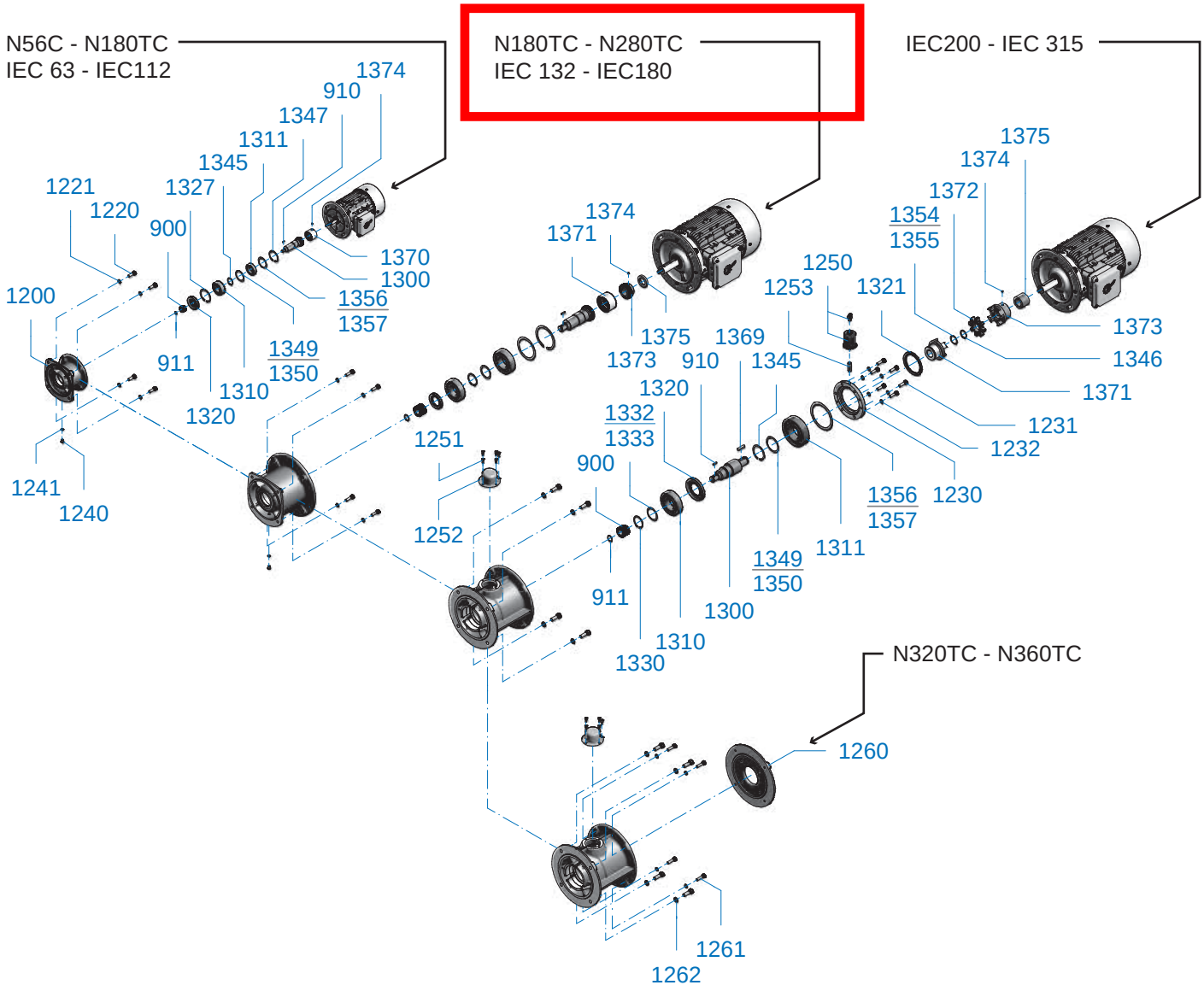
5. Once in place, tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.

6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



Coupling Size	"X" (Subtract this value from measured distance)
R14	0.06" (1.5 mm)
R19 & R24	0.08" (2.0 mm)
R28	0.10" (2.5 mm)
R38 & 42	0.12" (3.0 mm)
R48	0.14" (3.5 mm)
R65	0.18" (4.5 mm)
R90	0.22" (5.5 mm)

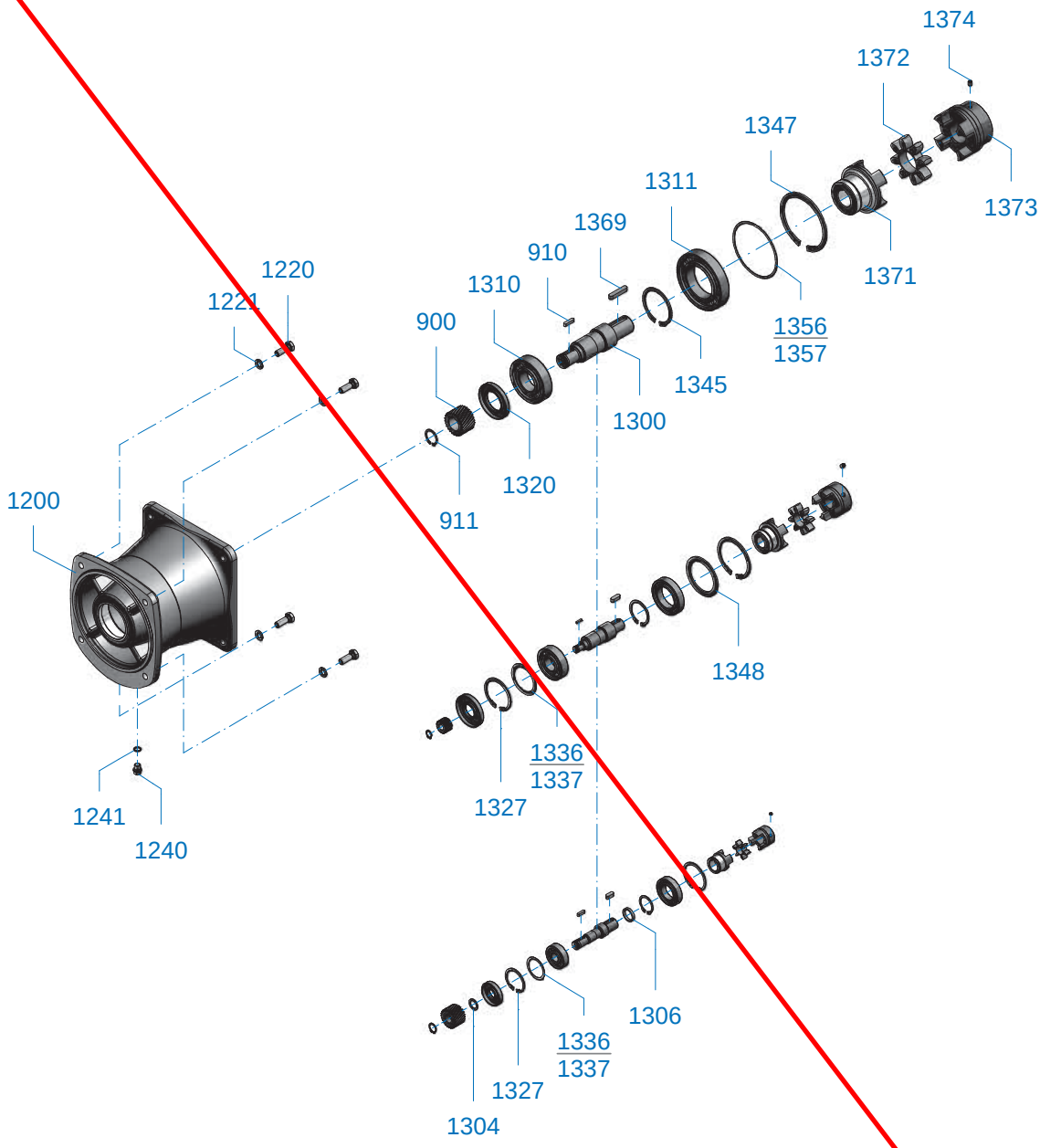
IEC 63-112 / IEC132-180 / IEC 160-315 &
NEMA 56C-180TC, NEMA 180TC-N280TC, NEMA 320TC-360TC



NEMA/IEC Parts List

900	Drive pinion	1231	Screw	1305	Parallel key	1332	Shim
910	Parallel key	1232	Spring lock washer	1310	Bearing	1333	Shim
911	Circlip	1234	Shim	1311	Bearing	1345	Circlip
1200	Housing	1235	Shim	1312	Bearing	1346	Circlip
1210	Gasket	1240	Screw	1320	Radial packing ring	1348	Support disc
1220	Screw	1241	Gasket	1321	Radial packing ring	1356	Shim
1221	Spring lock washer	1245	Lubricating nipple	1330	Circlip	1357	Shim
1230	Lid	1300	Drive Shaft	1331	Circlip	1380	Gamma ring

SERVO SEP/SEK 100, SEP/SEK 130, SEP/SEK 165, SEP/SEK 215, SEP/SEK 300



SERVO Parts List

900	Drive pinion	1241	Gasket	1327	Circlip	1357	Shim
910	Parallel key	1300	Drive Shaft	1336	Shim	1369	Parallel key
911	Circlip	1304	Support disc	1337	Shim	1371	Coupling half
1200	Housing	1306	Support disc	1345	Circlip	1372	Ring gear
1220	Screw	1310	Bearing	1347	Circlip	1373	Half-coupling
1221	Spring lock washer	1311	Bearing	1348	Support disc	1374	Screw
1240	Screw	1320	Radial packing ring	1356	Shim		

AUTOMATIC LUBRICATOR

Automatic Lubricator

Some NORD gear units with NEMA (or IEC) adapters ranging in size from N250TC-N400TC (or IEC160-IEC315) are supplied with a factory-installed, field-activated, PERMA® Classic Automatic Lubrication Cartridge. The automatic lubricator is used to dispense lubricant to the outer most roller bearing of the input NEMA (or IEC) input assembly. The lubrication cartridge must be activated prior to commissioning the gear unit. (Figures 1 & 2)

Some newer versions of the NEMA (or IEC) adapters also include a grease purge. The grease purge area is sealed for transportation; however, it is recommended that the G1/4 sealing screw be removed and that the grease collection container provided by NORD be installed just prior to activating the automatic lubricant dispenser. (Figure 3)

Principle of Operation

First the activation screw is threaded into the lubrication canister. Then the ring-eyelet on top of the activation screw is tightened until its breaking point. This causes a zinc-molybdenum gas generator to drop into a citric acid liquid electrolyte, which is contained within an elastic bladder. An electrochemical reaction slowly releases small amounts of hydrogen gas and gradually pressurizes the bladder, pushing the piston towards the lubrication chamber.

Grease is continuously injected into the lubrication point until the bearing cavity is full. Any back pressure from the bearing will cause the system to neutralize. The bladder inside the canister will continue to slowly build pressure so that once the equipment resumes normal operation; the lubricator will also resume its normal function.

The lubricator contains approximately 120 cm^3 or 120 ml (4.8 oz) of grease. For reference, a single stroke of a typical grease gun delivers approximately 1.0-1.2 cm^3 (0.03–0.04 oz) of grease. This means the canister contains approximately 100 strokes of grease. See Figure 1 for a detailed view of the PERMA® Lubricator.

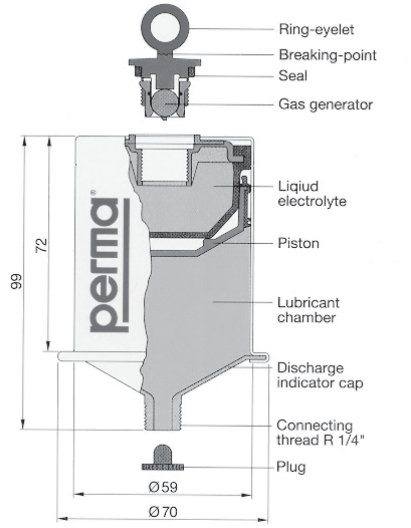


Figure 1 - PERMA® Automatic Lubrication Canister

NOTICE

- To prevent premature bearing failure, the lubrication dispenser must be activated prior to commissioning the gear reducer.
- The lubricator must only be used once and should never be opened or taken apart or permanent damage will result.
- Never unscrew the PERMA® canister from the lubrication point after activation or during the discharge period. This would cause a permanent pressure loss in the lubricator and would justify replacing the lubricator.

⚠ WARNING

- Avoid swallowing the gas generator, the liquid electrolyte, and the lubricant.
- Avoid contact of, the liquid electrolyte, and the lubricant with the eyes, skin or clothing.
- Observe all applicable MSDS sheets.
- Follow applicable local laws and regulations concerning waste disposal.

PERMA® Automatic Lubricator Options Supplied by NORD

NORD Part Number	28301000	28301010
Lubrication Option	Synthetic (standard)	Food Grade (optional)
PERMA® Classic Temperature Range ♦	0 to 40 °C (32 to 104 °F)	0 to 40 °C (32 to 104 °F)
Lubrication Volume	120 cm^3 or 120 ml (4.8 oz)	120 cm^3 or 120 ml (4.8 oz)
Grease Lubrication Mfg. / Type	Klüber / Petamo GHY 133	Lubriplate / FGL-1
Lubrication Temperature Range ♦	-30 to 120 °C (-22 to 248 °F)	-18 to 120 °C (0 to 248 °F)

♦ The temperature range values shown do not apply to other components and/or lubricants within the gear reducer.

Lubricator Service Interval

The Automatic lubricator should be inspected approximately every 6 months. At the end of the lubrication period the piston becomes clearly visible through the clear nylon discharge indicator cap located at the bottom of the PERMA® canister (Figure 1); this helps indicate that the lubricant has been fully discharged at which time the lubricator should be replaced. When operating the gear unit 8 hours/day or less a replacement interval of 12 months or 1 year is possible. Ambient temperature will influence the discharge rate and may extend or shorten the replacement interval.

Ambient Considerations

The grease discharge rate is affected by the ambient temperature. PERMA® indicates that the lubricator contents will dispense for a 12 month period when the average temperature is 20 °C (68 °F). Grease dispensing rates depend primarily on average ambient conditions and not extreme highs and lows. Lower ambient temperatures will lead to slower dispensing rates and higher ambient temperatures will lead to faster dispensing rates.

Average Ambient Temperature	Discharge Period Months ♦
0 °C (32 °F)	>18
10 °C (50 °F)	18
20 °C (68 °F)	12
30 °C (86 °F)	6
40 °C (104 °F)	3

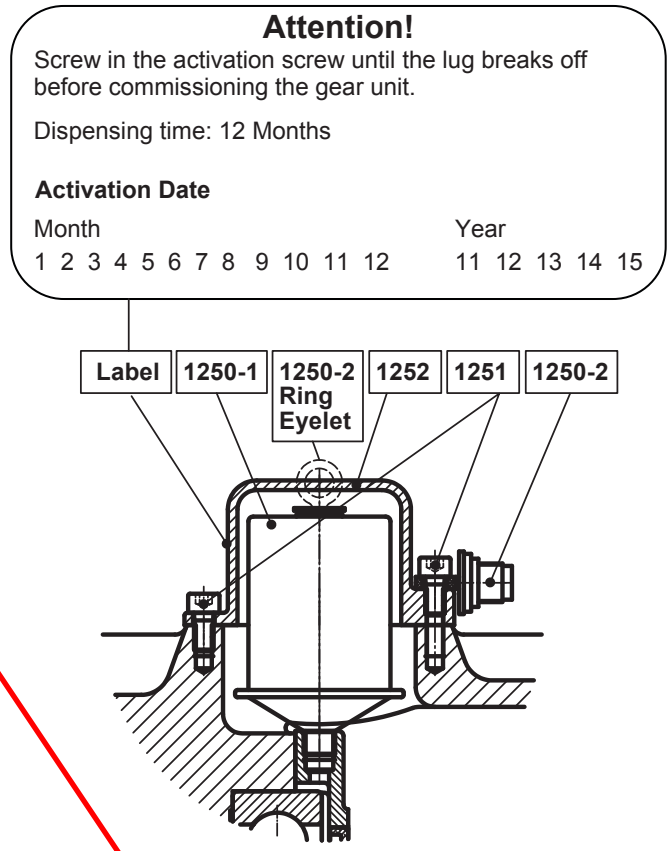
♦ Values are approximate.

Discharge can also be influenced by type of lubricant, vibration, and by the mating connecting parts in the lubrication system.

Activating the Automatic Lubricator

1. Loosen and remove the M8x16 assembly socket head cap screws (1251).
2. Carefully remove the protective cover (1252) installed over the automatic lubricator (1250-1).
3. Screw the activation screw (1250-2) into the automatic lubricator (1250-1) and twist the ring-eyelet until it reaches its breaking point.
4. Re-fit the cartridge cover (1250-1) and re-install and tighten the assembly screws (1251).
5. Mark the activation date on the adhesive label that is provided.

Figure 2 - Activating the Automatic Lubricator



1250-1 Automatic Lubricator
1250-2 Activation Screw
1251 Socket Head Cap Screws
1252 Protective Cover

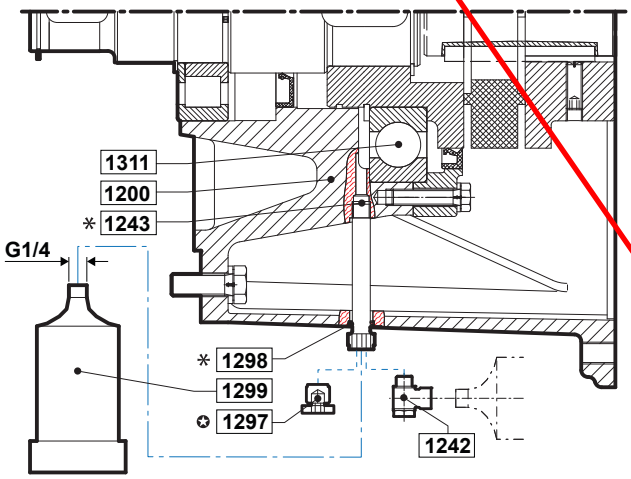
Grease Purge and Grease Drain Cup

Some versions of the NEMA (or IEC) adapters also include a grease purge and a grease drain cup (1299) for collecting old grease. The grease purge area is sealed for transportation.

It is recommended that the G1/4 sealing screw (1297) be removed and that the grease drain cup be installed after the automatic lubricant dispenser is activated.

The swivel fitting (1242) that NORD supplies allows the grease cup to be positioned at a 90° angle from its typical mounting. The swivel fitting allows the grease cup to be rotated so that it remains clear of any gear unit mounting obstructions.

Figure 3 – Grease Purge and Grease Cup Assembly



1200 NEMA or IEC Input Cylinder
1242 Swivel Fitting (P/N) 22006359)
1243 Extension*
1297 Screw Plug ✪
1298 Seal Ring*
1299 Grease Drain Cup (P/N 2830100)
1311 Bearing

* Supplied on certain input assembly sizes as needed.

✪ Remove the screw plug to install either the grease drain cup or the swivel fitting with the grease drain cup.

Grease Cup Servicing

NORD suggests that with every second replacement of the automatic lubricator, the grease collection cup (NORD Part No. 28301210) should be emptied or replaced with a new one. Follow the steps below to service the grease cup.

1. Unscrew the grease drain cup (1299) from either the outlet port of the NEMA or IEC input cylinder or from the extension (1243) that is secured to the NEMA or IEC input cylinder.
2. To empty the grease drain cup (1299) insert a stiff rod through the hole in the grey cap-end of the drain cup and push the internal plunger towards the thread-end of the drain cup. Please note that the dark gray end cap is bonded into place and cannot be removed.
3. Collect and properly dispose of the grease being pushed out of the drain cup. Due to the design of the container a residual amount of grease may remain in the container.
4. After emptying and cleaning the grease cup it can be fitted back onto the grease outlet port of the NEMA or IEC adaptor.
5. In the event the grease cup becomes damaged or it should be replaced with a new container. Consider replacing the grease cup (P/N 2830100) with every second replacement of the automatic lubricator.

Replacing the Automatic Lubricator

A new automatic lubricator can be ordered from NORD by specifying the appropriate Part Number from the table at the bottom of Page 1 of this manual. Reference Figure 2 and follow the steps below to replace the automatic lubricator.

1. Loosen and remove the M8x16 socket head cap screws (1251) holding the protective cover (1252) in place.
2. Unscrew the automatic lubricator (1250-1) from the bearing cover area of the NEMA or IEC input cylinder.
3. Install the new automatic lubricator and activate per the instructions on page 2.
4. Re-install the protective cover (1252) and the assembly screws (1251).
5. Note the activation date of the newly installed automatic lubricator

NEMA OR IEC INPUT ADAPTER WITH GREASE FITTING

Application

NORD gear units listed in the table below that are supplied with a NEMA 250TC or IEC 160 and larger input adapter, may be supplied with an external grease fitting. The grease fitting allows the user to service the outboard bearing of the reducer's input assembly.

Helical Inline	SK62, SK72, SK73, SK82, SK83, SK92, SK93, SK102 and SK103
Parallel-Shaft CLINCHER™	SK6282, SK7282, SK7382, SK8282, SK8382, SK9282, SK9382, SK10282, SK10382, SK11282, SK11382 & SK12382
90.1 Series Helical-Bevel	SK9072.1, SK9082.1, SK9086.1, SK9092.1 & SK9096.1

The grease fitting is an option which must be specified upon ordering, otherwise NORD will normally supply a PERMA Automatic Lubricator (See User Manual U45250).

Factory Supplied Grease

The bearing grease applied at the factory is as follows:

Brand	Mobil Polyrex EP 2
Thickener	Polyurea
NLGI Grade	2
Temperature Range	40°C to 120°C (-40°F to 250°F

IMPORTANT NOTE

It is the user's responsibility to ensure that if replacement grease is used, that it is fully compatible with the factory supplied grease.

Service Instructions

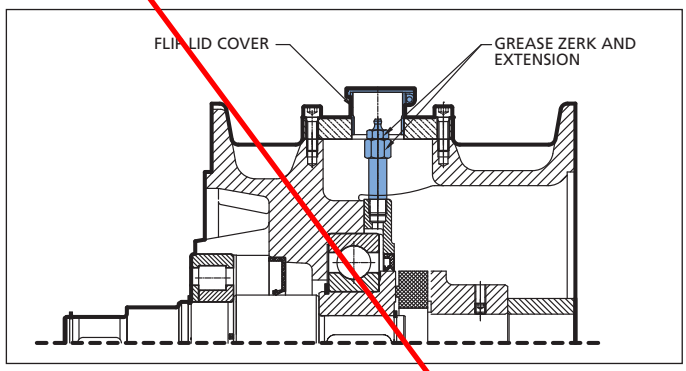
WARNING

- While working on the gear drive system, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury!
- Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. Use caution to avoid burns or serious injury!

1. It is best to re-grease the bearing within a short period after the gear unit was operational because the old grease will be more viscous and will flow easier.
2. Ensure that the grease gun contains the right lubricant for the bearing to be re-greased.
3. Open the protective flip cover and clean the areas around the grease fitting to ensure that contaminants are not introduced into the bearing cavity.
4. Using a grease gun, apply 0.75 ounces (20-25 grams) of compatible bearing grease every 1,000 service hours.

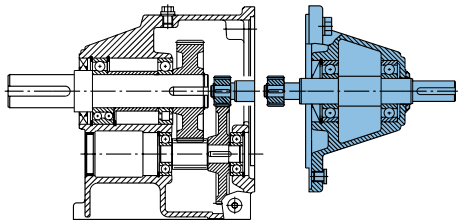
IMPORTANT NOTE

Re-greasing should be carried out while the bearing is still warm from operation and/or while rotating (if it is safe).



1. Solid Input Shaft (W)

The shaft will be inch or metric, depending on how the unit was ordered. Measure and verify the shaft before mounting anything on the shaft. Below are the tolerances used for the solid shafts.



2. Solid shaft diameter tolerance

Reducer input shaft extensions have a diameter tolerance as specified in **Table 1**.

Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)
0.375	1.750	+0.0000 / -0.0005
1.750	2.750	+0.0000 / -0.0010

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	70	+0.030 / +0.011	m6

3. Fitting drive elements onto the reducer solid shaft

Solid input shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

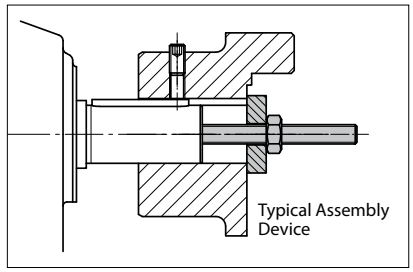


Table 2: Solid Input Shaft End - Threaded Holes

Above ø (in)	To & Including ø (in)	Tap size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	2.750	3/4-10 x 1.73 in

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	70	M20 x 42 mm

NOTICE

DO NOT DRIVE or **HAMMER** the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.

⚠ *WARNING*

To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

4. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).

⚠ *WARNING*

When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.

ℹ *IMPORTANT NOTE*

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

5. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

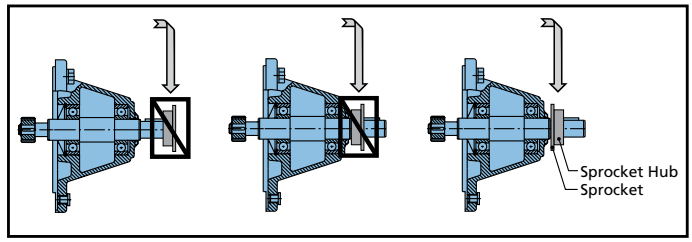
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

6. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in **Figure 2**.

Figure 2: Pully or Sprocket Mounting



Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.

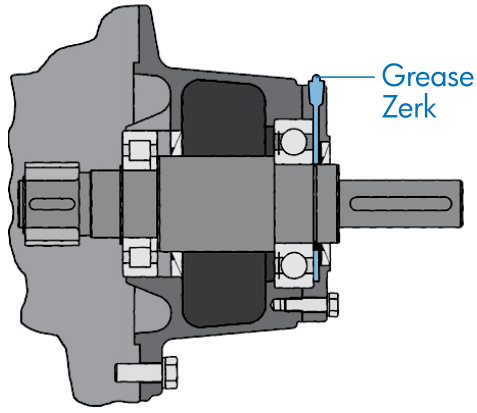
ℹ *IMPORTANT NOTE*

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.

7. Service Guidelines for W-Shaft Input with Grease Fitting

On some solid shaft input (Type W) gear units, the outer roller bearing needs to be re-greased at regular service intervals. This is necessary for double-stage gearboxes sizes SK62 or SK6282 and larger, and triple-stage gearboxes from size SK73, SK7382 or SK9072.1 and larger.

To lubricate the bearing of the input shaft, approximately 0.75 to 1.0 ounces (20-25 grams) grease should be added by the grease fitting approximately after every 2,500 hours of service or at least every 6 months. The W-shaft input is factory assembled with the proper amount and type of grease. The type of grease supplied depends upon the type of oil specified at time of order.



Bearing Grease Options

Reducer Oil Type	NLGI Grade	Grease Thickener	Grease Base Oil	Ambient Temperature Range	Manufacturer Brand/Type
MIN-EP	NLGI 2	Li-Complex	MIN	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222
PAO	NLGI 2	Li-Complex	PAO	-40 to 80°C (-40 to 176°F)	Mobil / Mobilith SHC 220
FG or FG-PAO	NLGI 2	Polyurea	FG-PAO	-30 to 80°C (-22 to 176°F)	Mobil SHC Polyrex 222

NOTICE

Grease compatibility depends upon the type of thickener or soap complex used, the base oil type suspended within the thickener, and the type of additives used. The user should check with the lubrication supplier before making substitutions in brand and type in order to assure compatibility and to avoid causing damage to the extended bearing.

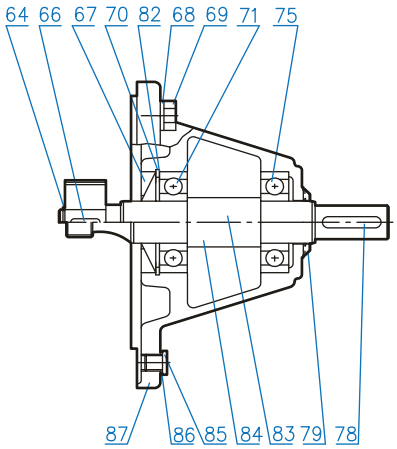
W-Type Input Parts List for UNICASE Gearboxes

SK 02 - SK 52
SK 03 - SK 63

SK 0182NB - SK 6382

SK 02040 - SK 42125
SK 13050 - SK 43125

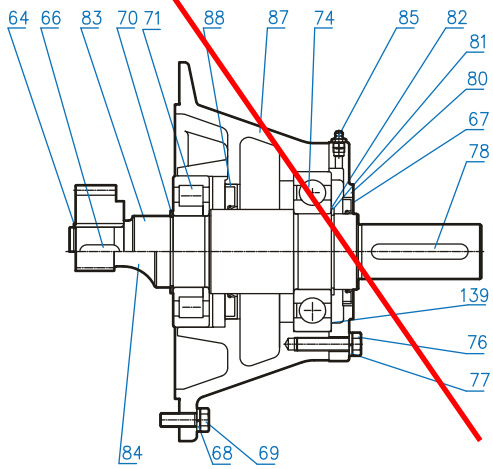
SK 9012.1 - SK 9052.1
SK 9013.1 - SK 9053.1



SK 62 - SK 72
SK 73 - SK 93

SK 6282 - SK 7282
SK 7382 - SK 9382

SK 9072.1

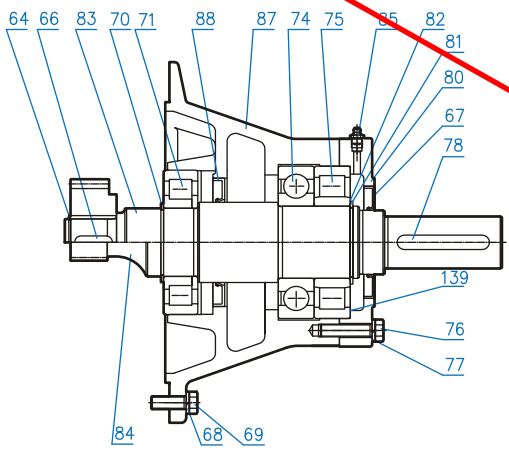


64	Circlip
66	Key
67	Shaft Seal
68	Washer
69	Hexagon Screw
70	Circlip
71	Input Shaft Bearing
74	Ball Bearing
75	Input Shaft Bearing
76	Washer
77	Hexagon Screw
78	Key
79	Oil Flinger
80	Bearing Cover
81	Circlip
82	Shim
83	Input Shaft, Plain
84	Input Shaft, Gearcut
85	Drain Plug
86	Seal
87	Input Bearing Housing
88	Shaft Seal (Oil Flinger)
139	Shim

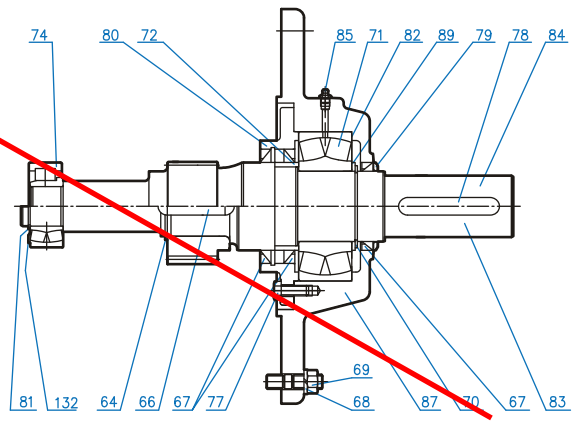
SK 82 - SK 102
SK 103

SK 8282 - SK 9282

SK 9082.1 - SK 9092.1



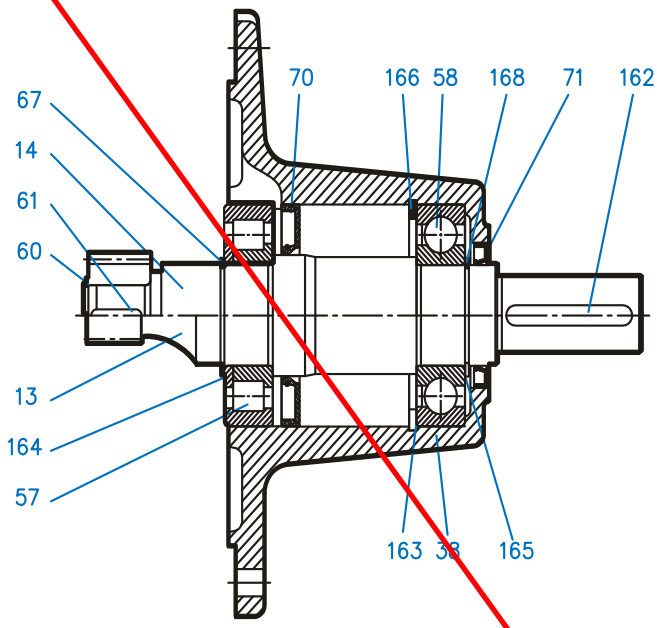
SK 10282 - SK 12382



SOLID INPUT SHAFT (W)

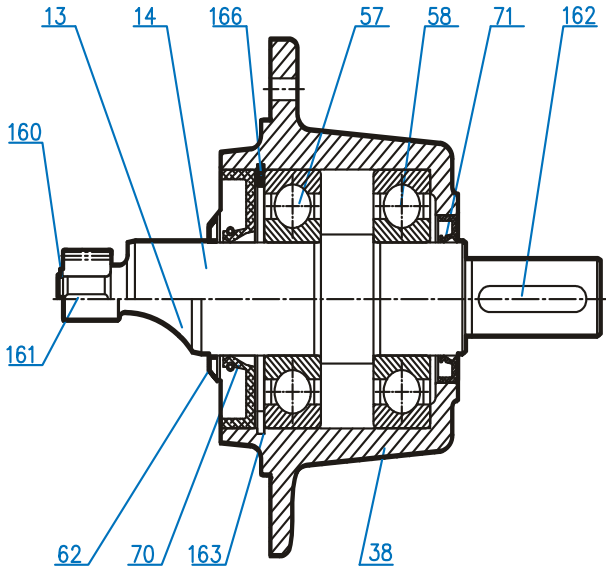
W-Type Inputs for Parts List for Nordbloc / 92 Bevel Gearboxes

SK172 - SK673
SK92072 - SK92372



13	Pinion Shaft
14	InputShaft
38	IEC Adapter
57	Bearing
58	Bearing
62	Oil Flinger
70	Shaft Seal
71	Shaft Seal
160	Snap Ring
161	Key
162	Key
163	Shim
164	Snap Ring
165	Set Screw
166	Snap Ring
167	Snap Ring
168	Snap Ring

SK772 - SK973
SK92672 - SK92772



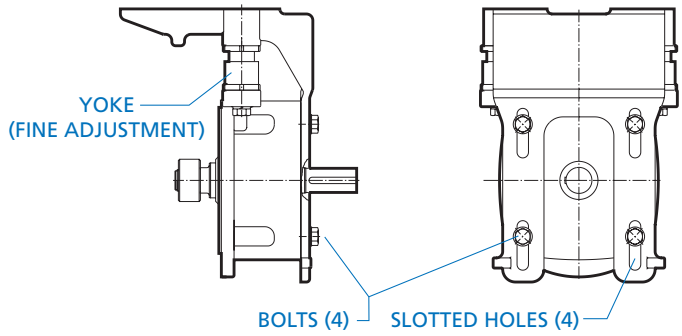
MOTOR MOUNT PLATFORM (MK)

Motor Mount Platform (MK)

For proper installation of the belt drive, consult the manufacturer. NORD MK motor mounts are adjustable in two ways. Slotted holes are provided at the input cylinder for the initial height adjustment. There are two fine adjustments at the yoke to increase/decrease tension. Two spanner head wrenches will be needed to tighten/loosen the fine adjustments. The four bolts holding the motor platform to the input cylinder must be loosened in order to use the fine adjustments.

The motor mounting platform has tapped holes to accept the foot pattern of the standard footed NEMA or IEC motor. All MK mounting input shaft diameters are metric.

Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure. After a period of operation, recheck alignment and adjust as required.

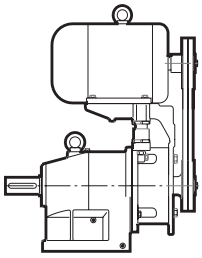


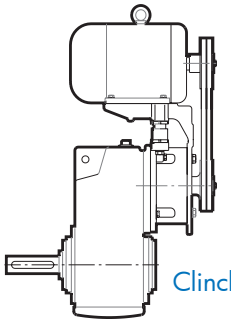
CAUTION

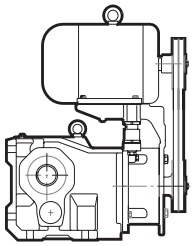
NORD Gear does not furnish the safety guards for the belt drive. It is the responsibility of the customer to install a safety guard to conform to OSHA standards.

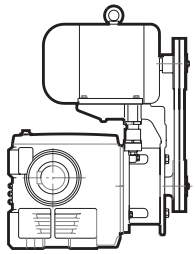
IMPORTANT NOTE

When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.


In-Line Unit


Clincher™ Unit


Bevel Unit

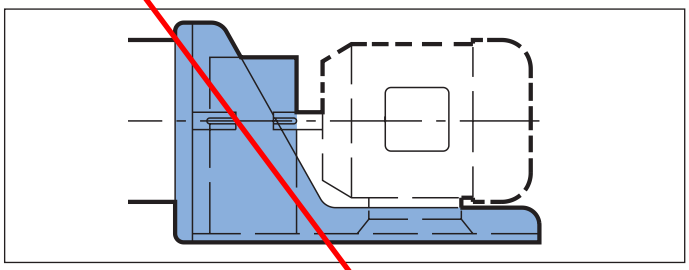

Worm Unit

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

SUGAR SCOOP

Sugar Scoop



Each scoop bracket includes the coupling for the motor and the coupling guard.

- NORD's standard supplied coupling is the jaw-type coupling with elastomeric spider element.
- The reducer-side (driven) coupling hub is mounted by NORD.
- The motor-side (driver) coupling hub must be mounted by the party responsible for supplying or mounting the motor.
- The supplied coupling guard must be mounted after coupling installation.

Coupling Mounting Instructions

1. Make sure that the motor shaft is clean and free of burrs or defects.

2. Check the motor shaft, coupling hub bores, key and key seat dimensions to make sure they are the proper dimensions.

3. Mount the coupling onto the motor by placing the coupling so that the inside face is flush with the end of the motor shaft and tightening the set screws to hold it in place (Figure 1).

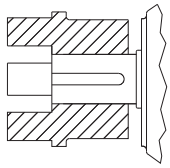


Figure 1. Place coupling flush with end of motor shaft and tighten setscrew.

IMPORTANT NOTE

Heating the coupling hub slightly, up to 176°F (80°C) will help facilitate installation onto the motor shaft.

WARNING

Wear appropriate safety gloves to handle the heated coupling hubs to avoid serious burns or injury.

NOTICE

DO NOT DRIVE or HAMMER coupling hubs into place. An endwise blow to the reducer or motor shaft can generate damaging axial forces and cause damage to the reducer or motor housing, bearings, or internal components.

4. Let the coupling cool down before mounting the spider into the jaws. The spider should not be under axial compression when installed.

5. Place the motor onto the scoop and engage the couplings together. The scoop has slotted holes to help accommodate axial alignment. Secure the motor to the scoop bracket but do not completely tighten the fasteners.

IMPORTANT NOTE

Before tightening the motor to the scoop bracket, the alignment of the coupling must be checked. Shimming of the motor feet may be needed to properly align the couplings. Careful coupling alignment extends the life of not only the coupling but all the components of the drive train.

6. Check the parallel alignment by placing a straight edge or level across the two coupling hubs, and measure the maximum offset at various points around the circumference of the coupling, without rotating the coupling. The maximum parallel alignment should not exceed 0.015 inches (4 mm).

7. Check the angular alignment of the coupling without rotating the hubs. The maximum angular displacement should not exceed 1.0°.

8. After both angular and parallel alignment is within specified limits, tighten all motor mounting hardware to the appropriate torque specification.

9. Re-check the critical alignment and repeat steps 6 and 7 if needed.

10. Mount the coupling guard to the scoop.

CAUTION

It is the customer responsibility to properly guard the rotating shaft and coupling connection and make sure the system meets all local safety regulations.

IMPORTANT NOTE

After a period of operation, it is suggested that the system be checked to make sure coupling alignment is being maintained.

TOUCH-UP KIT

Items included in the touch-up kit

I. No Rinse Alodine® Touch-N-Prep pen.

II. Color matched sealer pen

IMPORTANT NOTE

- Always wear Personal Protective Equipment (PPE), including gloves and safety glasses with side shields.
- When opening individual pens, pull safety caps straight out from pen. Do not twist or torque the cap to avoid damaging the applicator assembly.
- Do not use fingers to prime the applicator tip. Priming takes 15-30 seconds.
- Make sure the surface is clean and dry.

IMPORTANT NOTE

I. Metal temperature must be above 50° F

II. Do not excessively use abrasive pad while removing surface oxidation. Oxidation only needs to be removed from areas with exposed aluminum.

III. Use enough product to wet surface but avoid pooling.

IV. Do not rinse or wipe Alodine coating before the product is allowed to dry.

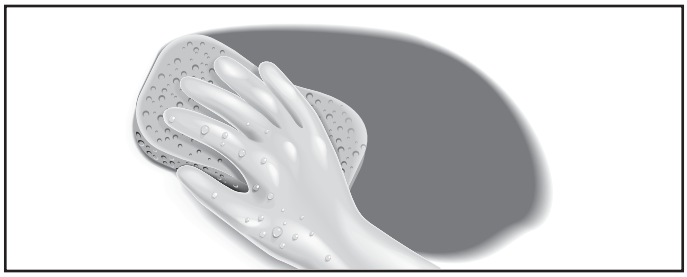
V. Allow to air dry or use a blow dryer. Do not use a heat gun. Maximum drying temperature is 140°F.

VI. Dry color will appear opaque.

Part I: Allodine® 871 Touch-N-Prep® Pen Instructions

Touch-N-Prep® pens are designed for easy and safe repair of clean, bare, or previously painted aluminum surfaces. It is a non-rinse, dry-in-place application that can be applied using the following steps:

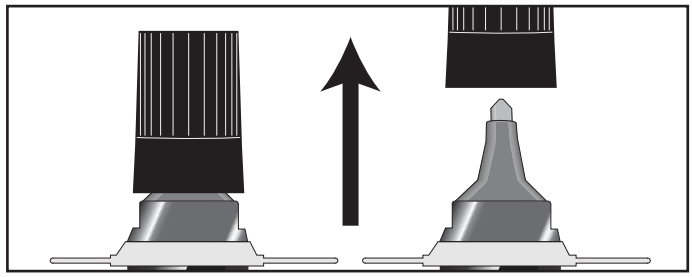
1. Surface Preperation



Before applying the coating, the treated surface must be cleaned using the following process:

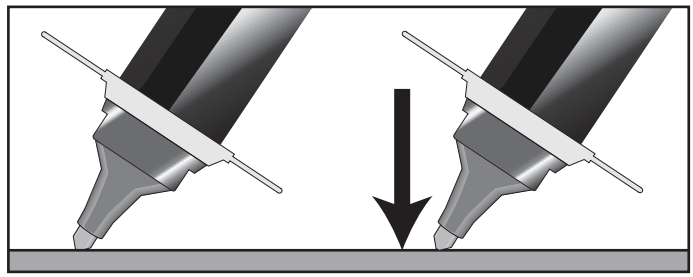
- If the scratch is more than 24 hours old use a moistened abrasive pad to remove oxides from the surface of the metal.
- Wipe substrate with a damp lint-free cloth to ensure complete removal of soils and dislodged oxides generated from the previous step.
- Allow Surface to dry before Touch-N-Prep® application.

2. Prime Applicator Tip

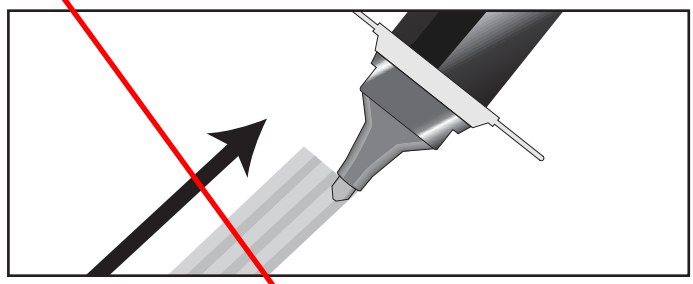


To activate, hold the Touch-N-Prep® pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

3. Application

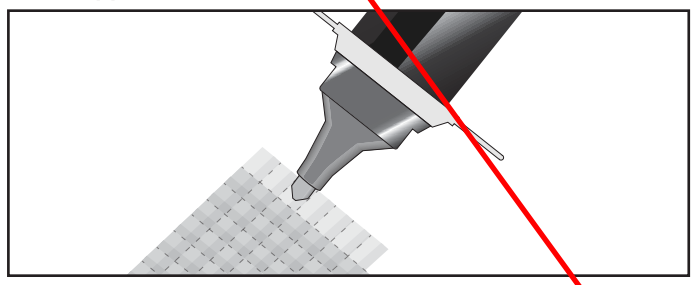


Press the pen tip down on the surface until solution fills the pen tip. Apply the Alodine® 871™ solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.



Frequent short jabs to re wet the application rip are preferred to maintain constant coating weights and avoid over-wetting the felt tip.

4. Re-Application



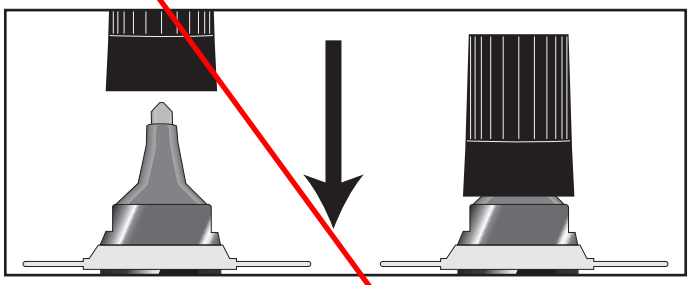
Within 5 minutes of the first coat, apply a second coat at a 90° angle to the first coat with the same smooth, firm stroke.

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

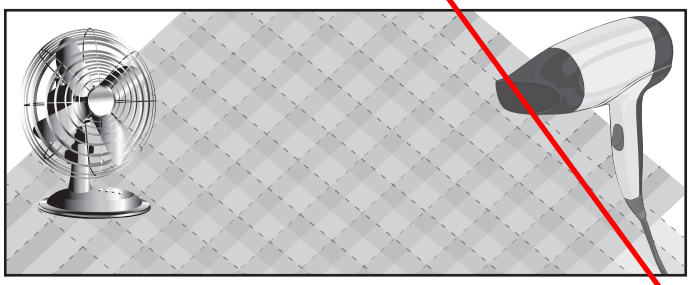
nsd tupH TOUCH-UP KIT

5. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

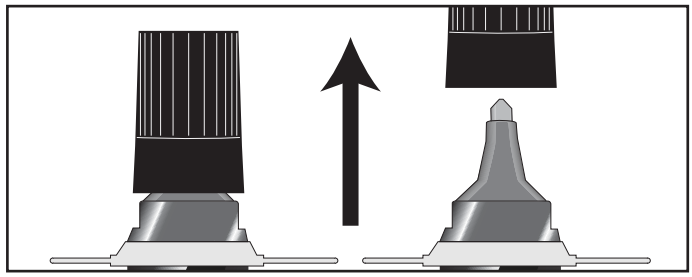
6. Drying



Allow the Alodine Touch-N-Prep® coating to air dry thoroughly.

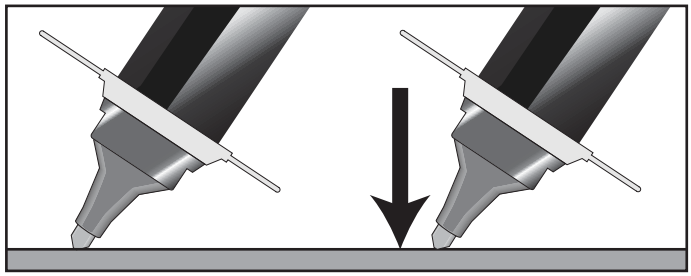
Part II: Sealer Application

1. Prime Applicator Tip



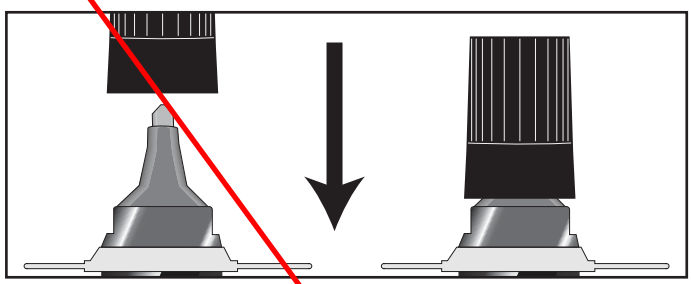
To activate, hold the pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

2. Application



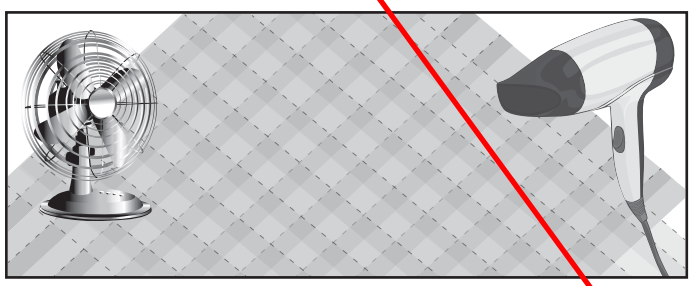
Press the pen tip down on the surface until solution fills the pen tip. Apply the sealer pen solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.

3. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

4. Drying



Allow the sealer pen coating to air dry thoroughly.

1. CONTRACT

Any contract between Nord Gear Corporation, hereinafter designated as Seller, and the Buyer is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller. Accordingly, the Buyer and Seller acknowledge and agree that the terms and conditions set forth below and on the face hereof shall govern Buyer's purchase of the goods described on the face hereof and shall take precedence over and represents the final agreement between Buyer and Seller, notwithstanding any inconsistent, contradictory or other prior or further conditions contained in any oral or written request or purchase order issued by Buyer or any other document furnished by Buyer in connection with its purchase of the Goods, regardless of whether such document or documents are exchanged simultaneously with this Invoice or prior or subsequent thereto. Any additional or different terms or conditions which may appear in any communicaiton, oral or written, from Seller, its officers, employees, agents or representatives, are hereby expressly rejected and shall not be effective or binding upon the Seller, unless specifically hereafter agreed to in writing by Seller and no such additional or different terms or conditions in any document submitted to Seller by Buyer shall become part of the contract between Buyer and Seller, unless such written acceptance by Seller specifically recognizes and assents to their inclusion. Any objection by Buyer to the terms and conditions hereof shall be ineffective unless Seller is advised in writing thereof within two (2) days of the date of this Invoice.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Corporation's home office in Waunakee, Wisconsin, and upon such confirmation the order shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Waunakee, Wisconsin. Prices and discounts are subject to change without notice until order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller hereby warrants that the goods sold hereunder shall be free from material defects in material and workmanship, if properly installed and used under normal operating conditions, for a period of twelve (12) months from the date of installation or eighteen (18) months from date of shipment, whichever comes first (the "Warranty Period"). With respect to gears and housings only, the Warranty Period is extended to thirty-six (36) months from the date of invoice or twenty-four (24) months from the date of installation, whichever comes first. The limited warranty shall not apply to any components or parts which are subject to normal operational wear and tear, including, but not limited to, belts and traction discs. Should any goods fail to comply with the foregoing limited warranty, Buyer shall provide written notice to Seller of the claimed defect and all relevant details within thirty (30) days of Buyer's discovery of the claimed defect. Buyer shall return the allegedly defective goods to Seller at its facilities in Waunakee, Wisconsin or to such other location within the USA as may be designated by Seller in its sole discretion, with all shipping and transportation charges prepaid by Buyer. Seller shall then examine the returned goods to determine if the claimed defect is covered by the limited warranty. If the claimed defect is covered by the limited warranty, Buyer's sole and exclusive remedy shall be to have Seller repair or replace, at Seller's option, the defective goods or components in accordance with the terms of this limited warranty. Seller shall have a commercially reasonable time to make such repairs or replacements and may use new or reconditioned components. Any repair or replacement shall not extend the Warranty Period unless otherwise agreed by Seller. Buyer shall pay all shipping costs and any costs of removal and re-installation of goods or components.

The foregoing limited warranty shall not apply with respect to any goods or components (i) which are not installed, used, operated, serviced or maintained in accordance with manufacturer's instructions or which are otherwise not properly installed, used, operated, serviced or maintained, or (ii) which are misused, neglected, damaged, altered, repaired, reconfigured or incorrectly wired. Seller makes no representations as to the specifications, capacity or performance of the goods sold hereunder, except as may be specifically set forth in the invoice's written specifications, and any such representations are expressly conditioned upon the accuracy and completeness of the data and information furnished by the buyer and upon the goods being properly installed, used, serviced and maintained by Buyer. Any description or model of the goods is for identification or illustrative purposes only and shall not be deemed to create any warranty, express or implied.

THE FOREGOING LIMITED WARRANTY SHALL EXTEND SOLELY TO BUYER AND NOT TO ANY OTHER PARTY. THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. SELLER HEREBY EXCLUDES AND DISCLAIMS ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IF BUYER SHALL FAIL TO PAY WHEN DUE ANY PORTION OF THE PURCHASE PRICE OR ANY OTHER PAYMENT REQUIRED FROM BUYER TO SELLER UNDER THIS CONTRACT, ALL WARRANTIES AND REMEDIES SET FORTH HEREIN SHALL BE DEEMED NULL AND VOID, AB INITIO. THE PARTIES ACKNOWLEDGE AND AGREE THAT THE EXCLUSIVE REMEDY UNDER THE FOREGOING LIMITED WARRANTY SHALL NOT HAVE FAILED OF ITS ESSENTIAL PURPOSE (AS THAT TERM IS USED IN THE UNIFORM COMMERCIAL CODE) PROVIDED THAT SELLER REMAINS WILLING TO REPAIR OR REPLACE DEFECTIVE GOODS WITHIN A COMMERCIALLY REASONABLE TIME. BUYER SPECIFICALLY ACKNOWLEDGES AND AGREES THAT THE PRICE CHARGED BY SELLER FOR THE GOODS IS BASED UPON THE LIMITATIONS OF SELLER'S WARRANTY OBLIGATIONS AND OTHER LIABILITIES AS SET FORTH HEREIN.

LIMITATION OF LIABILITY. NOTWITHSTANDING ANY OTHER PROVISION HEREOF, IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR TO ANY OTHER PARTY FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOST PROFITS, OR FOR ANY LOSSES, CLAIMS OR DAMAGES RELATING TO OR ARISING FROM THE USE OR OPERATION OF THE GOODS, AND IN NO EVENT SHALL ANY CLAIM OR RECOVERY OF ANY KIND EXCEED THE PURCHASE PRICE OF THE GOODS IDENTIFIED IN THE RELATED INVOICE.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. Buyer may not return any goods claimed to be in non-conformity without Seller's prior written authorization. Goods returned without permission will not be accepted, including for credit, and will be returned to Buyer, F.O.B. Sellter's plant. Any claim based on the receipt of damaged Goods must be filed with the carrier which delivered the goods. The samples, measurements, dimensions and weights contained in the Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. The Seller reserves the right to make any change which the Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications or standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries, In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, the Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the case may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business or good will. The liability of the Seller to Buyer, if any hereunder, for breach of warranty, contract, negligence or otherwise, shall in no event exceed the amount of the purchase price of the goods sold with respect to which any damages are claimed. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of the Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order or contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by the Buyer: provided, however, that if the Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, the Seller may, on fifteen (15) days written notice to the Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or treat the entire contract or contracts with Buyer as breached by the Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchases at public or private sale, and hold the Buyer liable for any difference between (a) the contract price of the goods, and (b) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for a state court receivership is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to the Buyer, provided that if Buyer is then indebted to Seller, the amount of any such damage claim shall be abated to the extent that the indebtedness of Buyer to Seller, as actually paid in money, is abated by any order of judgement entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice the Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganizing or if a state court receivership is filed against Buyer, then, at its option Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(a) Any indicated dates of delivery are approximate only, but NORD Gear will attempt to meet them whenever possible. (b) NORD Gear will not be liable for any penalty clausess contained in any specifications or order submitted unless agreed to in writing by an authorized officer of NORD Gear Corporation. (c) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to the Buyer, and thereafter the risk of loss or damage to the goods shall be upon the Buyer. (d) If the Buyer does not give delivery instructions to the Seller at least (10) days prior to the delivery date ex factory confirmed by the Seller, the Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option, may store the goods on the pier or any warehouse, at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Unless otherwise provided, terms of payment are 30 days net from the date of invoice with a 1% discount if paid within 10 days of date of invoice. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if the Buyer becomes bankrupt or insolvent, or any petition for reorganization or for a state court receivership is filed against Buyer, or if the Buyer makes any assignment for the benefit of it's creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason the Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of the Seller.

12. BUYER'S DEFAULT

Upon the Buyer's default, the Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. The Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods, reasonable attorney's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to the Buyer. If a deficiency results after the resale, the Buyer agrees to pay such forthwith, together with reasonable attorney's fees, for the recovery of the goods incurred by the Seller. If upon the Buyer's default, the Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable attorney's fees, shall forthwith be due and payable from Buyer to Seller. Buyer agrees to pay all reasonable costs and reasonable attorneys' fees incurred by Seller in enforcing Seller's rights against Buyer, including Seller's right to payment of the purchase price of the goods and Buyer's payment of all other amounts owing to Seller required under this Invoice and Conditions of Sale.

13. SECURITY INTEREST AND TITLE

In states and localities which are governed by the Uniform Commercial Code, this contract shall serve as security agreement, reserving in Seller a security interest until full payment of purchase price. The provisions of the Uniform Commercial Code regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale. In states and localities where the Uniform Commercial Code does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under the Uniform Commercial Code with the proper registers or offices, or for filing or recording the conditional sales contract.

14. SALES AND USE TAX

Buyer agrees to bear and pay any sales or use tax in connection with the purchase herein, and to hold the Seller harmless from payment. At the option the Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

The Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until the Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by the Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of the Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

The Buyer will be charged for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. CHANGES/CANCELLATION

NORD Gear will not accept changes in specifications to a confirmed order unless such changes are requested in writing and confirmed back in writing. In addition, the purchaser must to agree to any additional charges that may arise from the change. Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

20. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operation procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to defend, indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to defend, indemnify and save Seller harmless from any such claims arising from such accident.

21. MISCELLANEOUS PROVISIONS

(a) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and affect, except that the parties shall try to replace such invalid provision closest to their original mutual intentions. (b) This Invoice and these Conditions of Sale constitute the entire agreement between the parties regarding the subject matter hereof and supercedes all prior agreements, understandings and statements, whether oral or written, regarding such subject matter. No modification to, change in or departure from, the provisions of this Invoice and Conditions of Sale shall be valid or binding on Seller, unless approved in writing by Seller. No course of dealing or usage of trade shall be applicable unless expressly incorporated into this Invoice and Conditions of Sale. Any amendments to any contract or contracts between the parties shall be valid only upon the written consent of both parties.

22. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by the Buyer without prior written consent of the Seller.

23. APPLICABLE LAW AND VENUE

All contracts and their interpretation are governed by the applicable, substantive laws of the State of Wisconsin. Any litigation brought by the Buyer regarding this Invoice or goods purchased hereunder may only be brought in the Circuit Court for Dane County, Wisconsin.

NORD GEAR LIMITED

DRIVESYSTEMS — TERMS & CONDITIONS OF SALE — WWW.NORD.COM

1. CONTRACT
Any contract between Nord Gear Limited, hereinafter designated as "Seller", and the party or parties accepting these terms and conditions of sale and any agent, officer, servant, employee or subcontractor of such party or parties, hereinafter designated as "Buyer", is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller.

2. CONFIRMATION
An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Limited's home office in Brampton, Ontario, and upon such confirmation the orders shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES
Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Brampton, Ontario. Prices and discounts are subject to change without notice until the order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY
Seller warrants the goods sold hereunder to be free from defects in material and workmanship under normal use and service not arising from misuse, negligence, or accident, including but not limited to the use, installation, and transportation of the goods by Buyer, its agents, servants, employees, or by carriers. This warranty shall pertain to any part or parts of any goods to which Buyer or its assigns has within one year from date of delivery given written notice of claimed defects to Seller. Buyer shall be required to furnish Seller with details of such defects and this warranty shall be effective as to such goods which Seller's examination shall disclose to its satisfaction to have been defective and which at Seller's option shall promptly thereafter be returned to Seller or its nominees. EXCEPT FOR THE EXPRESS WARRANTIES SET FORTH ABOVE, SELLER HAS MADE NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE GOODS SOLD HEREUNDER, INCLUDING, BUT NOT LIMITED TO THEIR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. ANY DESCRIPTION OR MODEL OF THE GOODS IS FOR IDENTIFICATION OR ILLUSTRATIVE PURPOSES ONLY AND SHALL NOT BE DEEMED TO CREATE AN EXPRESS WARRANTY. The Buyer's exclusive remedy for claims arising from defective or nonconforming goods shall be limited to the repair or replacement thereof at the Seller's sole option. THE SELLER SHALL NOT BE RESPONSIBLE OR LIABLE FOR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY, USE, PERFORMANCE, OR SERVICE OF THE GOODS SOLD UNDER THIS AGREEMENT. SELLER SHALL NOT BE LIABLE FOR ANY LOST PROFITS OR FOR ANY CLAIM OR DEMAND AGAINST SELLER BY ANY PARTY. IN NO EVENT WILL SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SELLER'S AGGREGATE LIABILITY FOR DAMAGES UNDER THIS AGREEMENT, WHETHER ARISING FROM OR BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, TORT OR OTHER CAUSE OF ACTION, SHALL IN NO CASE EXCEED THE PURCHASE PRICE THAT BUYER PAYS FOR THE PARTICULAR GOODS INVOLVED. Seller shall in no event be liable to any person or firm (including any assignee or Buyer) except Buyer and its successors. Unless specifically authorized by Seller in writing, Seller shall not become responsible for any repair work done by Buyer or any other party on any goods sold. Any costs of the return of such goods to Seller shall be borne by Buyer. Goods sold but not manufactured by Seller are being warranted as to defects in material and workmanship consistent with the limited warranty policy of the original manufacturer of the goods and if there is not such a limited warranty policy, the warranty shall be limited to the provisions of Article 4 herein. Standards for the operating characteristics of the gearboxes and the gear motors are in conformity with Seller's tests. THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE SELLER DOES NOT ASSUME, NOR DOES IT AUTHORIZE ANY PERSON TO ASSUME, ON ITS BEHALF, ANY OTHER OBLIGATION OR LIABILITY.

5. SHORTAGE AND NONCONFORMITY
Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. The samples, measurements, dimensions and weights contained in Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. Seller reserves the right to make any changes which Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications of standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the cause may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business of good will. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE
The obligation of Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order of contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT
Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by Buyer; provided, however, that if Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, Seller may, on fifteen (15) days written notice to Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or to treat the entire contract or contracts with Buyer as breached by Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF D ELIVERY
If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for Buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold Buyer liable for any difference between (A) the contract price of the goods, and (B) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT
If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for appointment of a receiver is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to Buyer, to Seller, as actually paid in money, is abated by any order of judgment entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganization or if a state court receivership is filed against Buyer, then, at its option, Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10.DELIVERY
(A)Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to Buyer, and thereafter the risk of loss or damage to the goods shall be upon Buyer. (B) If Buyer does not give delivery instructions to Seller at least ten (10) days prior to the delivery date ex factory confirmed by Seller, Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option may store the goods on the pier or on any warehouse at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE
Time of payment is of the essence under the contract. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if Buyer becomes bankrupt or insolvent, or any petitions for reorganization or for appointment of a receiver is filed against Buyer, or if Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of Seller. Interest on the delinquent payment from the due date thereof until paid shall be at a rate of two (2%) percent per month.

12. BUYER'S DEFAULT
Upon Buyer's default, Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods; reasonable solicitor's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to Buyer. If a deficiency results after the sale, Buyer agrees to pay such forthwith, together with reasonable solicitor's fees, for the recovery of the goods incurred by Seller. If upon Buyer's default, Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable solicitor's fees, shall forthwith be due and payable from Buyer to Seller.

13. SECURITY INTEREST AND TITLE
In provinces which are governed by a Personal Property Security Act, this contract shall serve as a security agreement, reserving in Seller a security interest until full payment of the purchase price. The provisions of the Personal Property Security Act regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale herein. In provinces where a Personal Property Security Act does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under a Personal Property Security Act with the proper registers or offices, or for filing or recording the Conditional Sales Contract herein.

14. SALES AND USE TAX
Seller's prices do not include sales, use, excise or other taxes payable to any governmental authority in respect of the sale of Seller's goods. Buyer shall pay, in addition to Seller's price, the amount of any such taxes or shall reimburse Seller for the amount thereof that Seller may be required to pay. At the option of Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE
Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER
Any contract may be assigned or transferred by Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS
No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING
Seller does not charge for standard packaging for domestic shipment. Buyer will be charged, however, for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. EXPORT ORDER
Export orders are to be accompanied by a confirmed irrevocable Letter of Credit in Seller's favor, in Canadian currency, with an accredited Canadian bank, subject to Seller's draft, with shipping documents attached.

20. CANCELLATION
Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

21. BUYER'S RESPONSIBILITY AS TO MAINTENANCE
Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operating procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to indemnify and save Seller harmless from any such claims arising from such accident.

22. MISCELLANOUS PROVISIONS
(A)If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and affect, except that the parties shall try to replace such invalid provision with a provision closest to their original mutual intentions. (B) Any amendments to any contract or contracts require the consent in writing by both parties. Headings in this document are for ease of reference only.

23. NON ASSIGNMENT BY BUYER
Contract or contracts may not be assigned by Buyer without prior written consent of Seller.

24. APPLICABLE LAW
This agreement shall be governed by the laws of the Province of Ontario and the applicable laws of Canada. Buyer and Seller agree that any judicial proceeding with respect to this agreement must be brought and maintained in the City of Toronto, In the Province of Ontario.

25.
This instrument sets forth the entire understanding and agreement of the parties hereto in respect of the subject matter hereof, and all prior undertaking between the parties hereto, together with all representations and obligations of such parties in respect of such subject matter, shall be superseded by and merged into this instrument.

26.
The provisions of this agreement shall bind and ensure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and (subject to any restrictions or assignment herein above set forth) assigns, as the case may be.

27.
The parties acknowledge that they have requested this document and all notices or other documents relating thereto be drafted in the English language.

Les parties reconnaissent qu'ils ont requis que ce contrat et tous les avis ou autres documents qui s'y rapportent soient rédiges en langue anglaise.

"Terms and Conditions in French available upon request."

Product Overview

We can match our NORDAC AC vector drives with our Inverter/Vector Duty Motors and UNICASE™ Speed Reducers to provide a total AC Motor Drive solution from one trusted source.

UNICASE™ SPEED REDUCERS

HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 205,000 lb-in
- Gear ratios – 1.82:1 to over 300,000:1

NORDBLOC® HELICAL IN-LINE
- Foot or Flange Mount
- Torque up to 26,550 lb-in
- Gear ratios – 1.88:1 to over 370:1

PARALLEL HELICAL CLINCHER™
- Shaft, Flange or Foot Mount
- Torque up to 797,000 lb-in
- Gear ratios – 4.26:1 to over 300,000:1

RIGHT ANGLE HELICAL-BEVEL 2-STAGE
- Foot, Flange or Shaft Mount
- Torque up to 5,840 lb-in
- Gear ratios – 4.1:1 to 72:1

RIGHT ANGLE HELICAL-BEVEL
- Foot, Flange or Shaft Mount
- Torque up to 283,000 lb-in
- Gear ratios – 8.04:1 to over 300,000:1

RIGHT ANGLE HELICAL-WORM
- Foot, Flange or Shaft Mount
- Torque up to 27,585 lb-in
- Gear ratios – 4.40:1 to over 300,000:1

MINICASE™ RIGHT ANGLE WORM
- Foot, Flange or Shaft Mount
- Torque up to 3,540 lb-in
- Gear ratios – 5:1 to 500:1

FLEXBLOC™ WORM
- Modular bolt-on options
- Torque up to 4,683 lb-in
- Gear ratios – 5:1 to 3,000:1

HIGH PERFORMANCE MOTORS & BRAKEMOTORS

INVERTER/VECTOR DUTY
- Standard or Energy Efficient
- Integral, NEMA or Metric IEC
- 1/6 to 250 hp

NORDAC AC VECTOR DRIVES

TRIO SK300E
- Motor or remote mounted
- IP55 – washdown
- 380-460V, 3-phase, to 5hp
- 200-240V, 3-phase, to 3hp

SK500/520/530E
- Compact, high performance
- 380-480V, 3-phase, to 10hp
- 200-240V, 3-phase, to 5hp
- 200-240V, 1-phase, to 3hp
- 110-120V, 1-phase, to 1.5hp

SK700E
- Flexible high performance
- 380-460V, 3-phase, to 200hp

DRIVESYSTEMS

www.nord.com

NORD Gear Corporation
National Customer Service Toll-Free: 888.314.6673
info.us@nord.com

NORD Gear Limited
Toll-Free in Canada: 800.668.4378
info.ca@nord.com

WEST
Corona, CA (Los Angeles)

MIDWEST
Waunakee, WI (Madison)

EAST
Charlotte, NC

CANADA
Brampton, ON (Toronto)

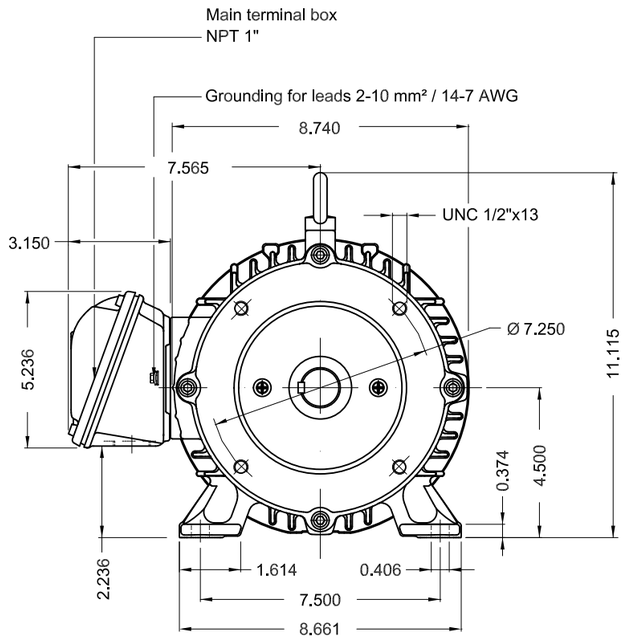
Intelligent Drivesystems

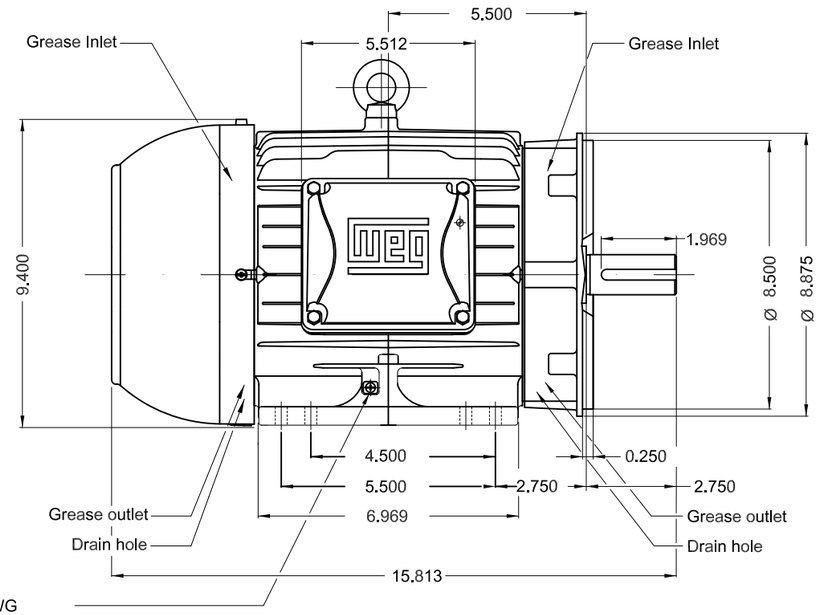
B1000

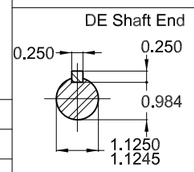
Operating & Instruction Manuals For Gear Units

B1000

DRIVESYSTEMS







Color RAL 5009

Painting plan 202E

Mounting B34R(D)

5 HP 04 Poles 60Hz | A

ECM	LOC	SUMMARY OF MODIFICATIONS	EXECUTED	CHECKED	RELEASED	DATE	VER

EXECUTED	USERADMIN	THREE PH. W22 NEMA P.EFF MOTOR IEEE841	PREVIEW	
CHECKED		FRAME 182/4TC IP55 TEFC	WDD	
RELEASED				
REL DT		WMO Jaragua do Sul Product Engineering	SHEET 1 / 1	

Dimensions in inches

A3

XME

DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11433391
		Catalog # :	00518ST3QIE184TC-W22

Frame	: 182/4TC	Locked rotor time	: 27s (cold) 15s (hot)
Output	: 5 HP (3.7 kW)	Temperature rise	: 80 K
Poles	: 4	Duty cycle	: Cont.(S1)
Frequency	: 60 Hz	Ambient temperature	: -20°C to +40°C
Rated voltage	: 460 V	Altitude	: 1000 m.a.s.l.
Rated current	: 6.45 A	Protection degree	: IP55
L. R. Amperes	: 48.4 A	Cooling method	: IC411 - TEFC
LRC	: 7.5x(Code J)	Mounting	: F-1
No load current	: 3.20 A	Rotation¹	: Both (CW and CCW)
Rated speed	: 1755 rpm	Noise level²	: 56.0 dB(A)
Slip	: 2.50 %	Starting method	: Direct On Line
Rated torque	: 14.8 ft.lb	Approx. weight³	: 113 lb
Locked rotor torque	: 229 %		
Breakdown torque	: 320 %		
Insulation class	: F		
Service factor	: 1.25		
Moment of inertia (J)	: 0.4003 sq.ft.lb		
Design	: B		

Output	25%	50%	75%	100%
Efficiency (%)	88.2	88.5	89.5	89.5
Power Factor	0.37	0.62	0.74	0.80

Foundation loads	
Max. traction	: 290 lb
Max. compression	: 404 lb

		Drive end	Non drive end
Bearing type	:	6207 C3	6206 C3
Sealing	:	Inpro/Seal	Inpro/Seal
Lubrication interval	:	20000 h	20000 h
Lubricant amount	:	7 g	5 g
Lubricant type	:	Mobil Polyrex EM	

Notes

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

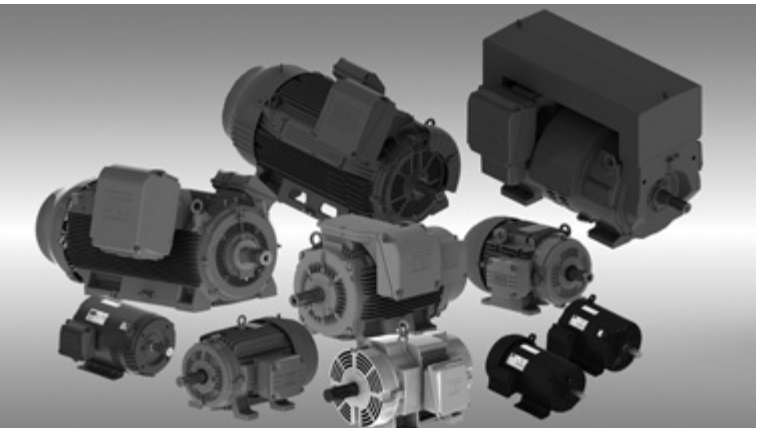
Performed by			
Checked by		Page	Revision
Date	10/09/2018	1 / 1	

Low and high voltage electric motors

Instructions manual for installation, operation and maintenance of electric motors

EN
03

More languages see website www.weg.net



EU DECLARATION OF CONFORMITY

Manufacturers:

WEG EQUIPAMENTOS ELÉTRICOS S.A.
Av. Prefeito Waldemar Grubba, 3000
89256-900 - Jaraguá do Sul – SC – Brazil
www.weg.net

WEG Linhares Equipamentos Elétricos S.A.
Rod. BR 101, Km 161,5, s/n.
Distrito Industrial Rio Quartel. Bairro Rio Quartel de Baixo
29915-500 – Linhares – ES – Brazil
www.weg.net

WEG MEXICO, S.A. DE C.V
Carretera Jorobas - Tula Km 3.5,
Manzana 5, Lote 1, Fraccionamiento Parque Industrial Huehuetoca, Municipio de Huehuetoca, C.P. 54680, CD. de Mexico y Área Metropolitana – Mexico
www.weg.net/mx

WEG (JIANGSU) ELECTRIC EQUIPMENT CO., LTD.
No. 15 Group, North City Street,
Dengyuan Community
Rugao City, Jiangsu Province – China
www.weg.net/cn

WEG (NANTONG) ELECTRIC MOTOR
Manufacturing CO., LTD.
No. 128# - Xinkai South Road, Nantong Economic & Technical Development Zone, Nantong, Jiangsu Province – China
www.weg.net/cn

WEGEURO – INDUSTRIA ELECTRICA S.A.
Headquarters:
Rua Eng Frederico Ulrich,
Apartado, 6074
4476-908 – Maia – Porto – Portugal
www.weg.net/pt
CONTACT PERSON: Luís Filipe Oliveira Silva Castro Araújo
Authorised Representative in the European Union
(Single Contact Point)

Branch – Santo Tirso:
Parque Industrial da Ermida
Avenida Luis Areal – Sta Cristina do Couto
4780-165 – Santo Tirso – Portugal
www.weg.net/pt

The manufacturer declares under sole responsibility that:

WEG electric motors and components used for following motor lines:
W01, W11, W20, W21, W22, W40, W50, HGF, Roller Table, W21 Magnet, W22 Magnet and W22 Quattro
……

when installed, maintained and used in applications for which they were designed, and in compliance with the relevant installation standards and manufacturer's instructions, comply with the provisions of the following relevant European Union harmonisation legislation, wherever applicable:

Low Voltage Directive 2014/35/EU*
Regulation (EC) No 640/2009*, Regulation (EU) No 4/2014* and Directive 2009/125/EC*
Machinery Directive 2006/42/EC**

EMC Directive 2014/30/EU (electric motors are considered inherently benign in terms of electromagnetic compatibility)

The fulfilment of the safety objectives of the relevant European Union harmonisation legislation has been demonstrated by compliance with the following standards, wherever applicable:

EN 60034-1:2010 + AC:2010/ EN 60034-2-1:2007/ EN 60034-5:2001 + A1:2007/ EN 60034-6:1993/ EN 60034-7:1993 + A1:2001/ EN 60034-8:2007 + A1: 2014/ EN 60034-9:2005 + A1:2007/ EN 60034-11:2004/ EN 60034-12:2002 + A1:2007/ EN 60034-14:2004 + A1:2007/ EN 60034-30:2009/ EN 60204-1:2006 + A1:2009 + AC:2010 and EN 60204-11:2000 + AC:2010

CE marking in: **1996**
* Electric motors designed for use with a voltage rating higher than 1000V are not considered under the scope.
** Low voltage electric motors are not considered under the scope and electric motors designed for use with a voltage rating higher than 1000V are considered partly completed machinery and are supplied with a

Declaration of Incorporation:

The products above cannot be put into service until the machinery into which they have been incorporated has been declared in conformity with the Machinery Directive.
A Technical Documentation for the products above is compiled in accordance with part B of annex VII of Machinery Directive 2006/42/EC.
We undertake to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery identified above through WEG authorised representative established in the European Union. The method of transmission shall be electronic or physical method and shall be without prejudice to the intellectual property rights of the manufacturer.

Jaraguá do Sul, April 04th, 2018

Signed for and on behalf of the manufacturer:
Milton Oscar Castella

1. INTRODUCTION

The installation, operation and maintenance of the motor must be always performed by qualified personnel using proper tools and methods and following the instructions contained in the documents supplied with the motor.

The instructions presented in this document are valid for WEG motors with the following characteristics:

- Three-phase and single-phase induction motors (squirrel cage rotor);
- Three-phase permanent magnet motors;
- Three-phase hybrid motors (squirrel cage rotor + permanent magnets);

The objective of this manual is to provide important information, which must be considered during the shipment, storage, installation, operation and maintenance of WEG motors. Therefore, we advise to make a careful and detailed study of the instructions contained herein before performing any procedures on the motor. The noncompliance with the instructions informed in this manual and others mentioned on the website *www.weg.net* voids the product warranty and may cause serious personal injuries and material damages.

Electric motors have energized circuits and exposed rotating parts which may cause injuries to people.

2. SHIPMENT, STORAGE AND HANDLING

Check the conditions of the motor immediately upon receipt. When any damage is noticed, this must be reported in writing to the transportation company, and immediately communicated to the insurance company and to WEG. In this case, no installation job can be started before the detected problem has been solved. Check if the nameplate data matches the invoice data and the environmental conditions in which the motor will be installed. If the motor is not immediately installed, it must be stored in a clean and dry room protected against dust, vibrations, gases and corrosive agents, and with relative humidity not exceeding 60%.

In order to prevent water condensation within the motor during the storage period, it is recommended to keep the space heater ON (where provided). In order to prevent oxidation of the bearings and ensure an even distribution of the lubricant, rotate the motor shaft at least once a month (at least five turns), always leaving it in a different position. For bearings with oil mist lubrication systems, the motor must be stored horizontally, independently from the mounting configuration, with ISO VG 68 oil in the bearing, (the amount is indicated in the motor manual available on the website *www.weg.net*) and the shaft must be turned weekly. If motors with open bearings are stored longer than six months, the bearings must be relubricated with the amount of grease indicated on the nameplate before the commissioning of the motor. If the motors are stored for more than two years, it is recommended to change the bearings, or to remove, wash, inspect and relubricate them before the motor is started. After this storage period, it is also recommended to change the start capacitors of single-phase motors since they loss their operating characteristics.

Handle the motor always carefully in order to prevent impacts and damages to the bearings and always install the shaft transportation/locking device (if supplied) when transporting the motor.

Use only the eyebolts to lift the motor. However these eyebolts are designed for the motor weight only. Thus never use these eyebolts to lift the motor with additional loads coupled to it. The lifting eyebolts of the terminal box, fan cover, etc., are intended to handle only these parts when disassembled from the motor. For multimounting motors (with removable feet/base), the eyebolts must be positioned according to the motor mounting position so that the lifting angle is vertically aligned (lifting at 0°). Additional information regarding the maximum allowable angle-of-inclination is indicated in the general manual available on the website *www.weg.net*.

Periodically and mainly before the initial star-up, measure the insulation resistance of the motor winding. Check the recommended values and the measuring procedures in the website.

3. INSTALLATION

During the installation, the motors must be protected against accidental energization. Check the motor direction of rotation, turning it without load before it is coupled to the load.

Remove the transportation devices and shaft locking device (if supplied) before starting the motor installation. Motors must be only installed in places compatible with their mounting features and in applications and

Those motors with feet must be installed on bases duly planned in order to prevent vibrations and assure perfect alignment. The motor shaft must be properly aligned with the shaft of the driven machine. Incorrect alignment, as well as improper belt tension, will certainly damage the bearings, resulting in excessive vibrations and even causing the shaft to rupture. The admissible shaft radial and axial loads indicated in the general manual of the website must be respected. Use flexible coupling whenever possible. When motors are fitted with oil lubricated bearings or oil mist lubrication systems, connect the cooling and lubrication tubes (where provided).
For oil lubricated bearings, the oil level must be in the center of the sight glass.
Only remove the corrosion protection grease from the shaft end and flange immediately before the motor installation.
Unless specified otherwise in the purchase order, WEG motors are dynamically balanced with "half key" and without load (uncoupled). The driving elements, such as pulleys, couplings, etc., must be balanced with "half key" before they are mounted on the shaft of the motors.
Observe the correct assembly position of the drains as indicated in the manual on the website ***www.weg.net***

Do not cover and block the motor ventilation openings. Ensure a minimum clearance of ¼ (25%) of the diameter of the air intake of the fan cover from the walls. The air used for cooling the motor must be at ambient temperature, limited to the temperature indicated on the motor nameplate.
Motors installed outdoors or in the vertical position require the use of additional shelter to protect them from water; for instance, use of a drip cover.
To prevent accidents, ensure that the grounding connection has been performed according to the applicable standards and that the shaft key has been securely fastened before the motor is started. Connect the motor properly to the power supply by means of safe and permanent contacts, always considering the data informed on the nameplate, such as rated voltage, wiring diagram, etc.
For power cables and grounding system connections, terminal box and drip cover assembly, the tightening torques indicated on Table 3.1 must be respected.

Table 3.1 - Tightening torques for fixing elements [Nm]

Component	M4	M5	M6	M8	M10	M12	M14	M16	M20	UNF 8x32	UNF 10x32	UNC 10x24
Terminal block pins	1 to 1,5	2 to 4[1)]	4 to 6,5	6,5 to 9	10 to 18	15,5 to 30	-	30 to 50	50 to 75	1 to 2	-	-
Grounding	1,5 to 3	3 to 5	5 to 10	10 to 18	28 to 40	45 to 70	-	115 to 170	-	-	-	2,5 to 3
Terminal box cover	-	3 to 5	4 to 8	8 to 15	18 to 30	25 to 40	30 to 45	35 to 50	-	-	-	2,5 to 3
Drip cover installed in the fan cover	1,5 to 2,3	3,5 to 5	6 to 9	14 to 20	-	-	-	-	-	-	1 to 1,5	-
Drip cover installed in NDE shield	-	3,5 to 5	6 to 9	14 to 20	-	-	-	-	-	-	1,5 to 2	2,5 to 3

1) For 12-pin terminal block, the tightening torque range allowed is: minimum 1.5 Nm and maximum 2.5 Nm.
For power cables, switching and protection devices dimensioning, consider the rated motor current, the service factor, and the cable length, among others. For motors without terminal block, insulate the motor terminal cables by using insulating materials that are compatible with the insulation class informed on the nameplate. The minimum insulation distance between the non-insulated live parts themselves and between live parts and the grounding must meet the applicable standards and regulations for each country.

Take the required measures in order to ensure the degree of protection indicated on the motor nameplate:
- unused cable inlet holes in the terminal boxes must be properly closed with blanking plugs;
- the cable entries used must be fitted with components, such as, cable glands and conduits;
- components supplied loose (for example, terminal boxes mounted separately) must be properly closed and sealed;
- fixing elements mounted in the threaded through holes in the motor enclosure (for example, the flange) must be properly sealed.

The motor must be installed with overload protection devices. For three-phase motors, it is recommended to install a phase failure protection device. When motor is fitted with temperature-monitoring devices in the stator windings and/or bearings, they must be connected during the operation and even during tests. Ensure the correct operation of the accessories (brake, encoder, thermal protection, forced ventilation, etc.) installed on the motor before it is started.

Motors fitted with Automatic Thermal Protectors will reset automatically as soon as the motor cools down. Thus, do not use motors with Automatic Thermal Protection in applications where the auto-reseting of this device may cause injuries to people or damage to equipment. Motors fitted with Manual Thermal Protectors require manual reset after they trip. If the Automatic Thermal Protector or the Manual Thermal Protector trip, disconnect the motor from the power supply and investigate the cause of the thermal protector tripping. W22 Magnet motors must be driven by WEG variable frequency drives only.

For information about the use of variable frequency drives, follow the instructions in the documents 50033244 ("Installation, Operation and Maintenance Manual of Electric Motors") and 50029350 ("Induction motors fed by PWM frequency inverters") in the website *www.weg.net* and in the manual of the variable frequency drive.

4. OPERATION

During operation, do not touch the non-insulated energized parts and never touch or stay too close to rotating parts.
Ensure that the space heater is always OFF during the motor operation.

The rated performance values and the operating conditions are specified on the motor nameplate. The voltage and frequency variations of the power supply should never exceed the limits established in the applicable standards.
Occasional different behavior during the normal operation (actuation of thermal protections, noise level, vibration level, temperature and current increase) must always be assessed by qualified personnel. In case of doubt, turn off the motor immediately and contact the nearest WEG service center.
Do not use roller bearings for direct coupling. Motors fitted with roller bearings require radial load to ensure their proper operation.
For motors fitted with oil lubrication or oil mist systems, the cooling system must be ON even after the machine is OFF and until the machine is at complete standstill.
After complete standstill, the cooling and lubrication systems (if any exist) must be switched OFF and the space heaters must be switched ON.

5. MAINTENANCE

Before any service is performed, ensure that motor is at standstill, disconnected from the power supply and protected against accidental energization. Even when the motor is stopped, dangerous voltages may be present in space heater terminals.
If motors are fitted with capacitors, discharge them before any handling or service is performed. Motor disassembly during the warranty period must be performed by a WEG authorized service center only.
For motors with permanent magnet rotor (lines W22 Quattro and W22 Magnet), the motor assembly and disassembly require the use of proper devices due to the attracting or repelling forces that occur between metallic parts. This work must only be performed by a WEG Authorized service center specifically trained for such an operation. People with pacemakers cannot handle these motors. The permanent magnets can also cause disturbances or damages to other electric equipment and components during maintenance.
For the W50 and HGF motor lines provided with axial fans, the motor and the axial fan have different markings for indicating the direction of rotation for prevent incorrect assembly. The axial fan must be assembled so that the indicative arrow for direction of rotation is always visible, viewing the non-drive end side. The marking indicated on the axial fan blade, CW for clockwise direction of rotation or CCW for counterclockwise direction of rotation, indicates the direction of rotation of the motor viewing the drive end side.

Regularly inspect the operation of the motor, according to its application, and ensure a free air flow. Inspect the seals, the fastening bolts, the bearings, the vibration and noise levels, the drain operation, etc.

6. ADDITIONAL INFORMATION

For further information about shipment, storage, handling, installation, operation and maintenance of electric motors, access the website ***www.weg.net***.
For special applications and operating conditions (for example, smoke extraction motors, totally enclosed air over (TEAO), motors for high thrust applications, motors with brake) refer to the applicable manual on the website ***www.weg.net*** or contact WEG.
When contacting WEG, please, have the full description of the motor at hand, as well as the serial number and manufacturing date, indicated on the motor nameplate.

7. WARRANTY TERM

WEG Equipamentos Elétricos S/A, Motors Business Unit ("WEG"), offers warranty against defects in workmanship and materials for its products for a period of 18 months from the invoice date issued by the factory or distributor/dealer, limited to 24 months from the date of manufacture.
Motors of the HGF Line are covered for a period of 12 months from the invoice date issued by the factory or distributor / dealer, limited to 18 months from the date of manufacture.
The paragraphs above contain the legal warranty periods.
If a warranty period is defined in a different way in the commercial/technical proposal of a particular sale, that will supersede the time limits set out above.
The warranty periods above are independent of the product installation date and the startup.
If any defect or abnormal occurrence is detected during machine operation, the customer must immediately notify WEG in writing about the occurred defect, and make the product available for WEG or its Authorized Service Center for the period required to identify the cause of the defect, check the warranty coverage, and perform the proper repairs.
In order for the warranty to be valid, the customer must be sure to follow the requirements of WEG's technical documents, especially those set out in the product Installation, Operation and Maintenance Manual, as well as the applicable standards and regulations in force in each country.
Defects arising from the inappropriate or negligent use, operation, and/or installation of the equipment, non-execution of regular preventive maintenance, as well as defects resulting from external factors or equipment and components not supplied by WEG, will not be covered by the warranty.
The warranty will not apply if the customer at its own discretion makes repairs and/or modifications to the equipment without prior written consent from WEG.
The warranty will not cover equipment, components, parts and materials whose lifetime is usually shorter than the warranty period. It will not cover defects and/or problems resulting from force majeure or other causes not imputable to WEG, such as, but not limited to: incorrect or incomplete specifications or data supplied by the customer; transportation, storage, handling, installation, operation and maintenance not complying with the provided instructions; accidents; defects in the construction works; use in applications and/or environments for which the machine was not designed; equipment and/or components not included in the scope of WEG supply. The warranty does not include disassembly services at the buyer's premises, product transportation costs and travel, lodging and meal expenses for the technical staff of the Service Centers, when requested by the customer.
The services under warranty will be provided exclusively at WEG authorized Service Centers or at one of its manufacturing plants. Under no circumstances will the warranty services extend the equipment warranty period.
WEG's Civil Liability is limited to the supplied product; WEG will not be liable for indirect or consequential damages, such as losses of profit and revenue losses and alike which may arise from the contract signed between the parties.

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*** European Union Importers**

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PUMP DRY RUN PROTECTION

1. Functioning of the dry-running protection device (TSE)

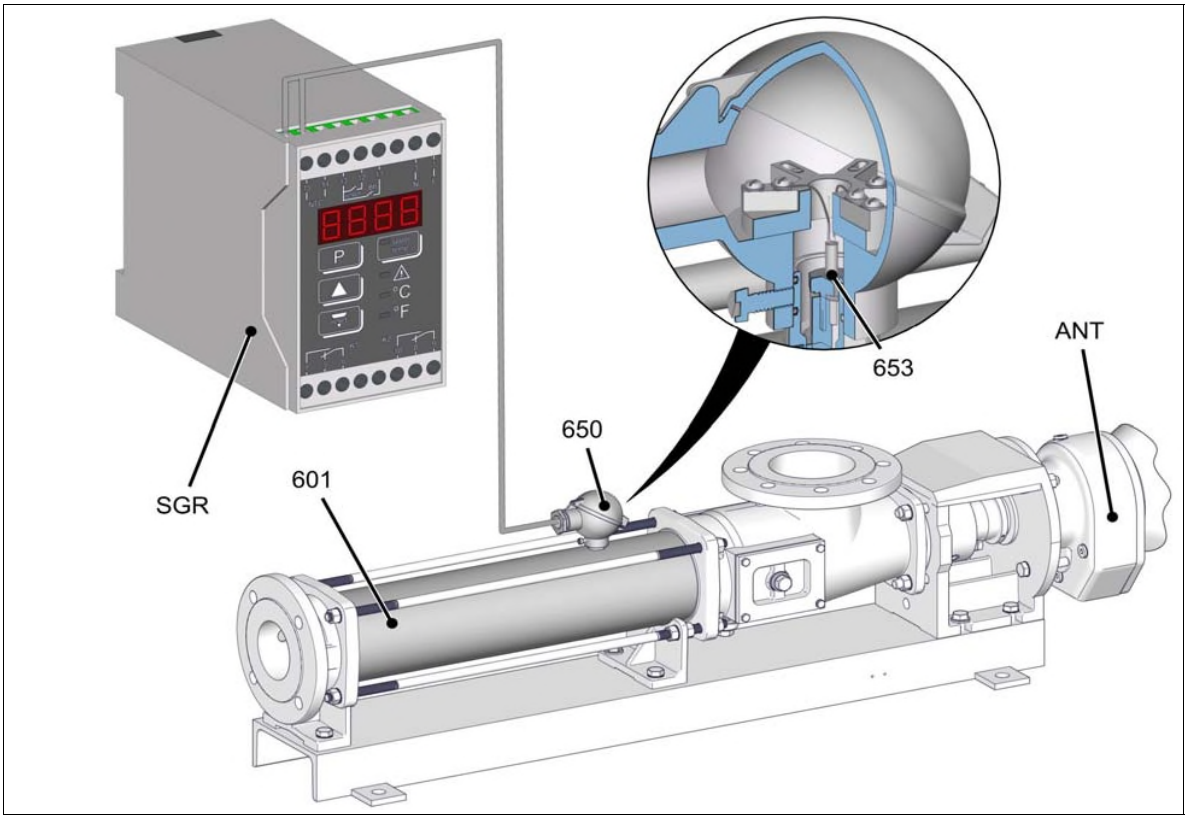


Figure similar

Item	Designation	Item	Designation
SGR	Control device	653	Thermistor sensor
601	Stator	ANT	Drive
650	Connection head		

- The temperature in the stator **(601)** is continuously compared with the set shut-off temperature at the TSE control device **(SGR)**.
- The temperature in the stator **(601)** is measured using a thermistor sensor **(653)** in the connection head **(650)**.
- Two relays switch in parallel within the TSE control device **(SGR)** on reaching the shut-off temperature.
  - An error message is triggered and the drive **(ANT)** of the pump can be shut off using potential-free change-over contacts.
- Automatic restart of the pump is prevented by a necessary acknowledgement of the error message.

2. Technical data of the dry-running protection device (TSE)

2.1. Structural design connection head (650)

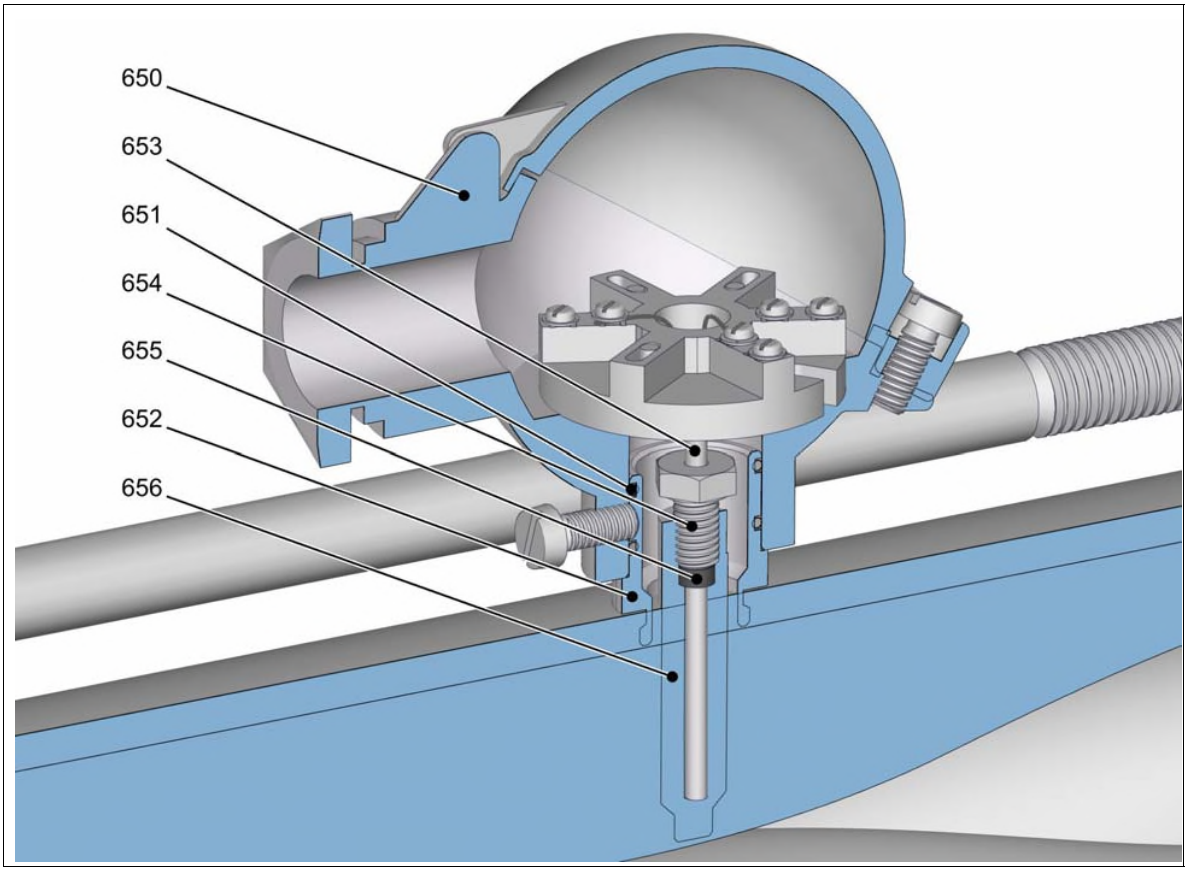


Figure similar

Item	Designation	Item	Designation
650	Connection head	654	Clamping screw
651	O-ring	655	Rubber ring
652	Screw socket	656	Sensor sleeve
653	Thermistor sensor		

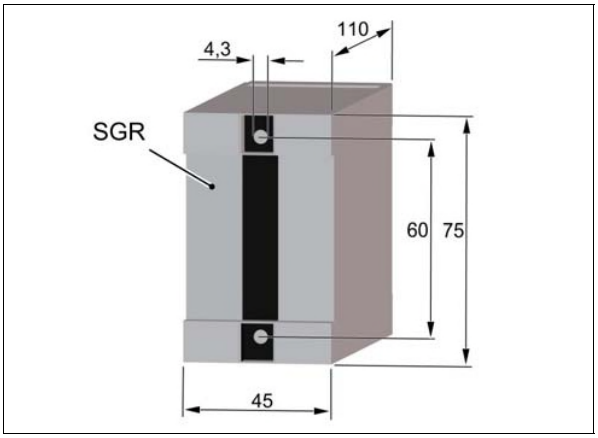
Thermistor sensor

- The temperature is measured at the stator through an NTC resistor (thermistor sensor) with a protective sleeve.
  - Permissible temperature range: 0-150 °C
  - Standard resistor: 10 kΩ at 25 °C
- For more thermistor sensor resistance values (→ chapter 9.).

2.2. TSE control device

➢ Install TSE control device **(SGR)** on the basis of the IP protection in a suitable casing (e.g., switch cabinet).

➢ Install TSE control device **(SGR)** on DIN rail or with screw connection on mounting plate in the switch cabinet.



Types:	– SGRTSE 230 V ACB – SGRTSE 115 V ACB – SGRTSE 24 V ACB – SGRTSE 24 V DCB
Relay output:	2 potential-free changeover contacts (K1, K2), switching capacity 500 VA at 110-230 V resistive load
Input:	NTC thermistor sensor 10 kΩ at 25 °C, with sensor breakage guard at -25 °C
Temperature range:	0 to 150 °C
Power consumption:	maximum 4 VA
Sensor circuit:	– Open-circuit voltage maximum 2.5 V DC – Short-circuit current maximum 0.5 mA DC
Display at the device:	– Malfunction (dry running) – Shut-off temperature
Operation at the device:	– Setup shut-off temperature – Reset alert
Protection:	– Casing IP 40 – Terminals IP 20
Ambient temperature:	0 to 50 ° C

3. Connect TSE control device

DANGER

Risk of fatal injury from electrical current.
There is an immediate danger of fatal electric shock as a result of contact with live parts.
- Observe safety regulations.
- Disconnect the control device from all energy sources before working on terminals.
- Prevent electrical connections from being switched on again.
- Ensure that residual voltage is not present at any electrical connections of the pump.

3.1. Check line voltage

- Check the line voltage/nominal voltage according to type plate of the control device before connecting and commissioning.
  - Permissible mains voltage variations of the nominal device voltage +/- 10 %.

NOTICE

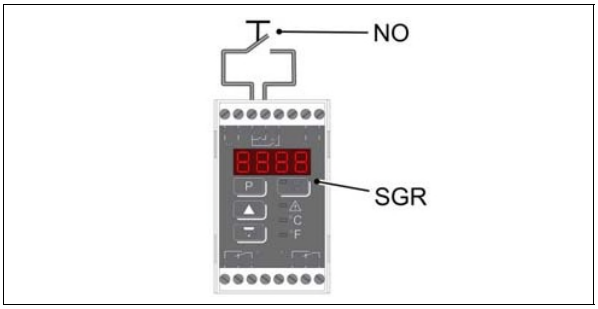
Mains power failure.
Malfunction and/or irreparable damage to the pump.
- Install the thermistor sensor leads shielded.
- Ground the shield on one side.

3.2. Terminal connections

1, 3	Operating voltage
11, 13	Operating hours counter of potential-free contact
12, 13	Button (NO) - external fault reset
14, 15	Thermistor sensor
5, 6, 7	Relay output K1 (malfunction message)
8, 9, 10	Relay output K2 (malfunction message)

3.3. Connecting button (NO) (optional)

- Connect button **(NO)** to terminal 12 and 13 of the TSE control device **(SGR)**.
- After dry running, release TSE control device **(SGR)** with button **(NO)**
  - See chapter Operation of the dry-running protection device (→ chapter 5.).



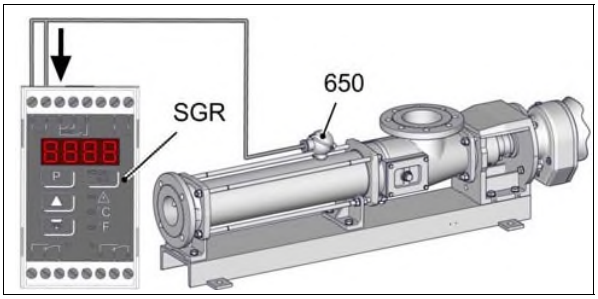
3.4. Use relay function

Actual temperature > shut-off temperature	Malfunction (dry-running)
Contact 6, 5 and 9, 8	closed
Contact 6, 7 and 9, 10	open

- Relays K1 and K2 are in parallel and they work together.
  - K1: Switch-off condition integrated in motor contactor control.
  - K2: optional connection to the fault sensor or process computer (reserve).

3.5. Connect thermistor sensor

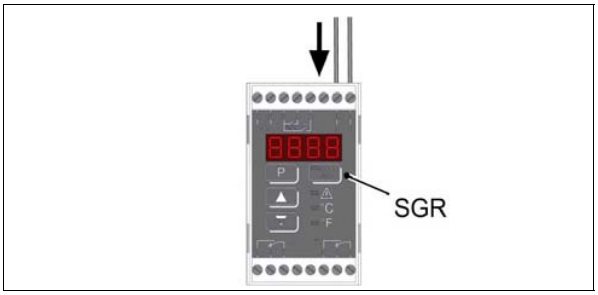
- Connect the connection cable of thermistor sensor of the connection head **(650)** to terminals 14 and 15 of the TSE control device **(SGR)**.



Similar illustration

3.6. Connect operating voltage

- Connect operating voltage to terminals 1 and 3 of the TSE control device **(SGR)**.
  - See technical data of TSE control device **(SGR)** (→ chapter 2.2.).
  - Note the regulations of the local power supply company and country-specific regulations.



4. Commissioning the dry-running protection device (TSE)

NOTICE

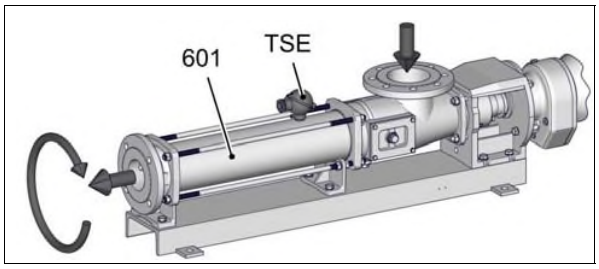
Conveying product temperature different from technical pump data (→ chapter 3).
Malfunction and/or irreparable damage to the pump can occur.
➢ Consult with SEEPEX.

4.1. Note the fitting position of the dry-running protection device (TSE)

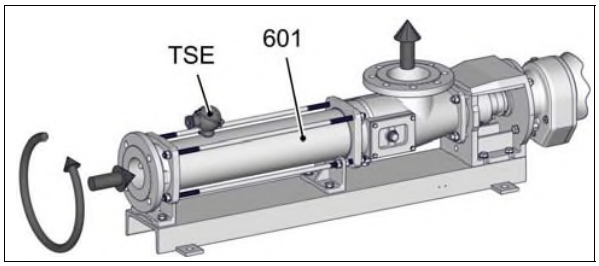
- The dry-running protection device **(TSE)** is always installed on the suction side during delivery.

DANGER Installation of the dry-running protection device **(TSE)** on the pressure side.

➢ Note the fitting position of the dry-running protection device **(TSE)**.
  – The drilling for the dry-running protection device **(TSE)** in the stator **(601)** should always be on the suction side.



counter clockwise rotating pump

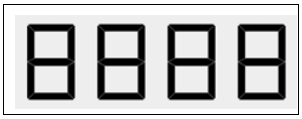


clockwise rotating pump

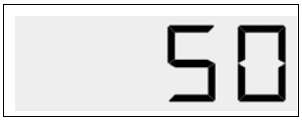
Figures similar

Check the functionality

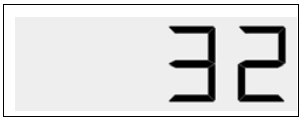
➢ Switch on TSE control device.
  – Digital display lights up.



➢ TSE control device starts self-test.
  – Currently set shut-off temperature is displayed.



➢ Keep **(stator temp.)** button pressed.
➢ Read temperature value.



- Functionality is present if the display is in accordance with the existing temperature.

➢ In the case of any discrepancies and functional failures, see chapter Malfunctions, Causes and Rectification (→ Chapter 8).

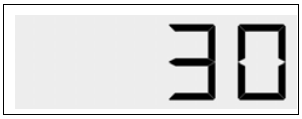
Set the switch-off temperature

Determining stator operating temperature

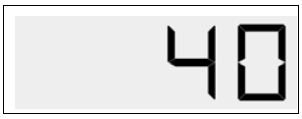
- Shut-off temperature is set at 50 °C when delivered.
- During commissioning, maintain shut-off temperature of 50 °C.

➢ Commission the pump for 30 to 60 minutes to stabilise the stator operating temperature.

➢ Hold **(stator temp.)** button with the pump running.
– Read operating temperature to set the final shut-off temperature.



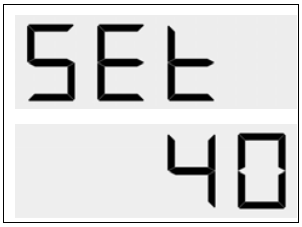
➢ Set shut-off temperature at the TSE control device.
– Set shut-off temperature 10 °C higher than the displayed or maximum operating temperature during operation.



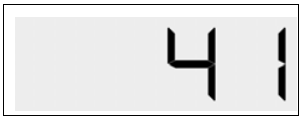
Fine adjustments

- Confirm modification of the corrected shut-off temperature within 10 seconds with button **(P)** , otherwise TSE control device will change without saving the corrected shut-off temperature.

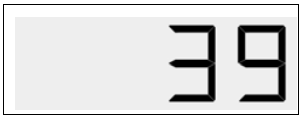
➢ Press button **(P)** briefly.
– Setup mode is displayed.
– The display shows alternating "SET" and the category temperature set last.



➢ Increase shut-off temperature.
– Value changes initially by +1 °C at a time, after approx. 3 s in +10 °C steps.



➢ Reduce shut-off temperature.
– Value changes initially by -1 °C at a time, after approx. 3 s in -10 °C steps.

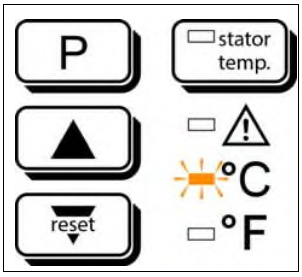


➢ Press button **(P)** briefly.
– Operating mode is displayed.
– Adjusted shut-off temperature is transmitted to the permanent memory and shown on the display.

Change the temperature unit

- Changing the temperature unit from °C (degree Celsius) to °F (Fahrenheit):

➢ To change the temperature unit from °C to °F, press **(▲)** button for 10 s.
➢ Yellow LED next to the symbol °C or °F lights up.

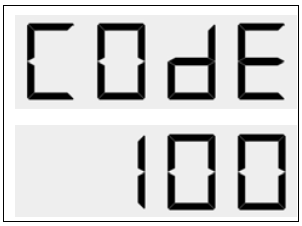


5. Operation of the dry-running protection device (TSE)

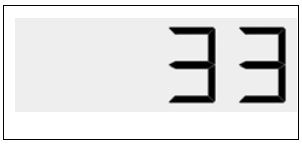
5.1. Call operating hour counter

- The TSE control device includes an operating hour counter.
➢ Activate operating hour counter.
  – Bridge terminal 11 and 13.
- The operating hours can be called on the service level. The access to the service level is possible only after a code number has been entered.

➢ Press **(P)** button for approx. 5 s, until display “CodE” appears.
  – The display shows alternating "CodE" and “100”.



➢ Using the arrow keys **(▼/▲)** set code “33”.



➢ Press button **(P)** briefly.
  – Code will be acknowledged.
  – Access into the service level.

Display alternating: “¯Hi¯” and “value” • No function

➢ Press button **(P)** briefly.
  – Change to next parameter/display value.

Display alternating: “bh.Hi” and “value” • Operating hour counter (displayed value x 10000)

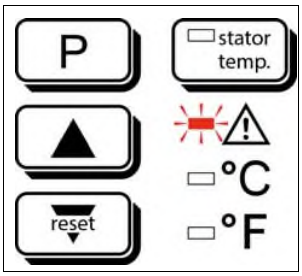
➢ Press button **(P)** briefly.
  – Change to next parameter/display value.

Display alternating: "bh.Lo" and “value” • Operating hour counter (displayed value x 1)

➢ Press button **(P)** briefly.
– Change to the operating mode.

5.2. Release TSE control device after dry running

➢ The installed relays switch off and remain locked in this position if the set shut-off temperature at the TSE control device is exceeded.
– Red LED lights up and signals an alert.



➢ Acknowledge alert/release relay:
– Press button on the TSE control device or external button (closer) on terminal 12 and 13 for at least 1 s, in order to release TSE control device.

➢ Shut-off operating voltage at the TSE control device (terminal 1 and 3).
– Press external contact (button, closed for at least 1 s).

6. Functional failure

NOTICE Thermistor sensor or wire break. Short-circuit in the thermistor sensor or in the line. Overshooting or undershooting of the measuring range (-25-150 °C). Alert **(Err I)** is displayed and drive of the pump shuts off.

➢ Inspection of the TSE control device and sensor circuit including thermistor sensor.

6.1. Thermistor sensor performance check

➢ Remove thermistor sensor supply line from the connection head **(650)**.

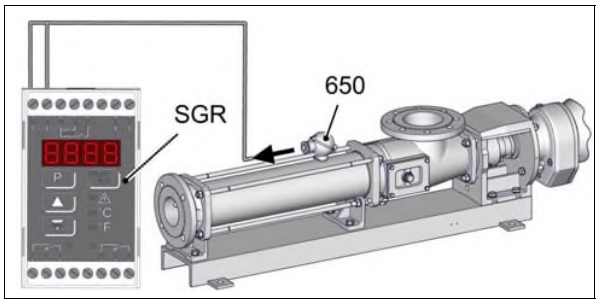


Figure similar

➢ Connect resistor measuring unit **(MTT)** to connection head **(650)**.

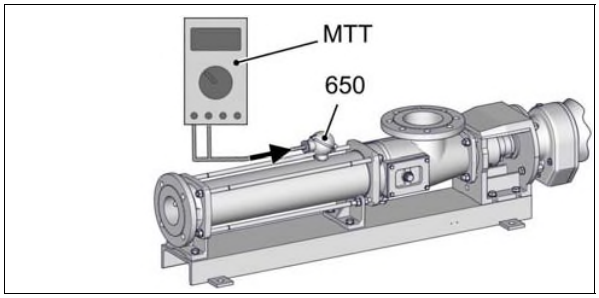


Figure similar

➢ Determine electrical resistance and compare with temperature of the pump:

Ttemperature °C	0	10	20	25	30	40	50	60
Resistor Ω	32650	19900	12490	10000	8057	5327	3603	2488

Ttemperature °C	70	80	90	100	110	120	130	140
Resistor Ω	1752	1255	950	678	510	389	301	235

- For more thermistor sensor resistance values (→ chapter 9.).
- In the case of discrepancies in the resistor value > 10 % of the set value, there is a defect in the thermistor sensor.
  - Replace thermistor sensor (→ chapter 7. /8. , Dismantling/Assembly of Dry-running protection device).
- In the case of correct values, there is a defect in the thermistor sensor supply line or the connection terminals.
  - Check connections.

6.2. Performance check TSE control device

➢ Disconnect thermistor sensor supply line from terminals 14 and 15 of the TSE control device **(SGR)**.

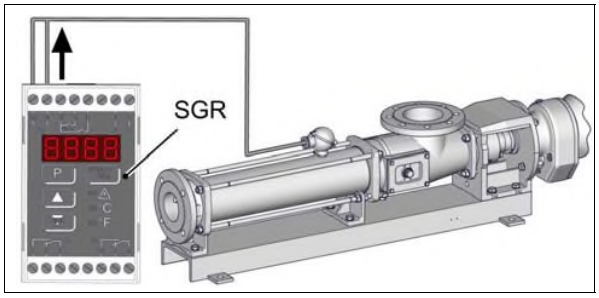
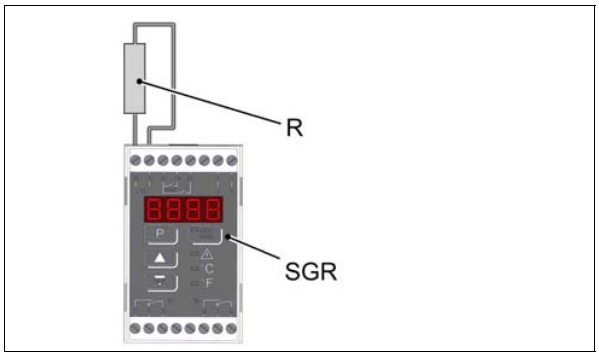


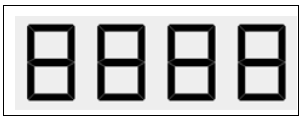
Figure similar

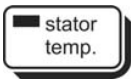
➢ Connect commercially available carbon film or metal film resistor **(R)** in accordance with the following values to terminals 14 and 15 of the TSE control device **(SGR)**:



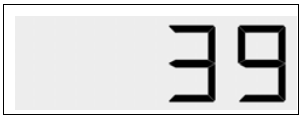
Resistor Ω	10000	5600	2200	1000	560	220
Switching temperature °C	25	39	63	87	107	143

➢ Switch on TSE control device.
  – Digital display lights up.





➢ Keep **(stator temp.)** button pressed and read temperature value.
  – Read value must correspond with the switching temperature allocated to the resistor used.



➢ In the case of a display deviation of more than 5-10 °C or in the case of no display, replace TSE control device.

7. Dismantle pump-sided parts of dry-running protection device (TSE)

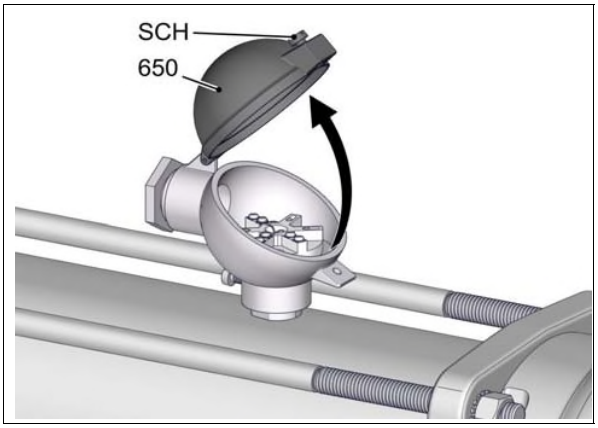
➢ Follow the instructions in the chapter Shut-down (→ chapter 6).

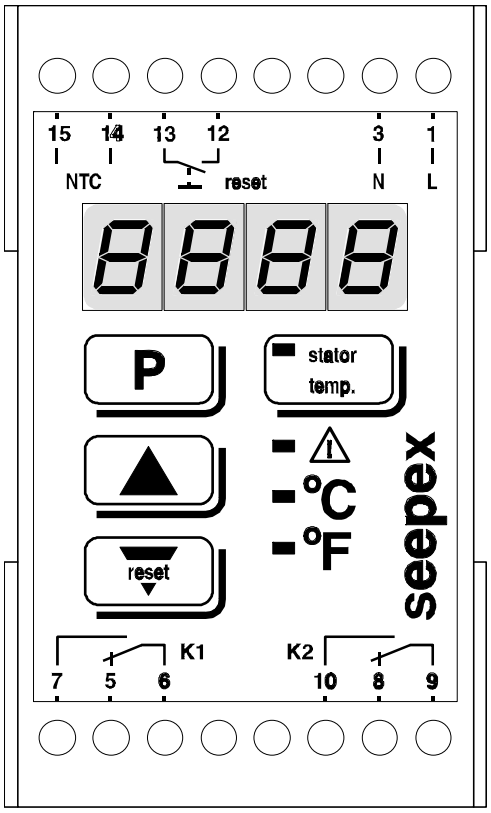
NOTICE

Adjusting the sensor sleeve (656) assembled at the factory.
Damage caused by incorrect readings of the dry-running protection device **(TSE)**.
➢ Retain the location and position of the sensor sleeve **(656)**.
➢ The pump-side parts of the dry-running protection device **(TSE)** should be assembled / dismantled only by SEEPEX trained personnel.

7.1. Dismantle connection head (650) and thermistor sensor (653)

➢ Loosen screw **(SCH)** on the cover of the connection head **(650)**.
➢ Open the cover of the connection head **(650)**.





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1.2 Function

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3.0 Electrical Connection of the TSE

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3.2 Connection Diagram of TSE Control Device
3.3 Relay Function

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4.2 Function Check
4.3 Approximate Adjustment of Trip Temperature

5.0 Commissioning and Operation

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. 8.3 Additional Information ZU.TSE.02 for TSE Motor Control
. 8.4 Additional Information ZU.TSE.03 for TSE in Explosion Proof Construction

1.0 General

1.1 Introduction

Progressive cavity pumps should generally be protected against dry-running. Due to the increased friction between the main conveying elements ie. rotor and stator, which occurs in the event of dry-running the pump, the temperature at the internal surface of the stator can quickly rise depending on the pump speed.
When exceeding the max. permissible operating temperature the internal surface of the stator will burn and cease operation. If this occurs the stator needs to be replaced. The possible malfunction of an progressive cavity pump can be easily avoided by using the patented dry-running protection device TSE.

1.2 Function

The general operating principle of the dry-running protection device TSE is to continuously monitor the temperature in the stator and to trip the pump when reaching a limit temperature. The temperature in the pump stator is compared with the pre-set trip temperature via a NTC temperature sensor, which is fitted in the stator of the pump as well as the TSE control device, which is positioned in the control panel. In case of dry-running of the pump and a temperature increase in the stator up to the pre-set switch-off value, two relays will switch.

The drive motor of the pump will be switched-off via the potential-free changeover contacts and a fault message will be released. After rectification of the cause of the dry-running and the cooling down of the stator, the fault message at the TSE device can be acknowledged and the pump can be switched on again.

By acknowledging the fault message an automatic re-connection without inspection and correction of the cause of the dry-running is avoided.

2. 0 Technical Data

2.1 Temperature Sensor

The NTC thermister is installed in a stainless steel protection sleeve in the stator of the pump.
Permissible Temperature Range: 0-150 ºC
Standard Resistance: 10 kOhm at 25 ºC

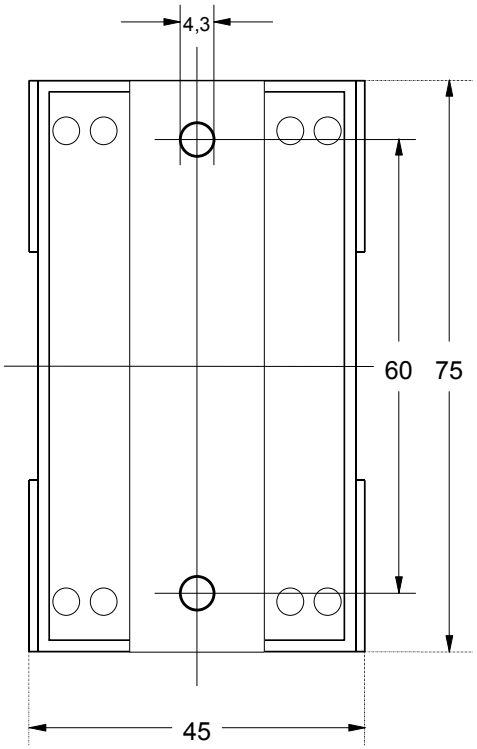
Temp. °C	Resistance Ohm	Temp. °C	Resistance Ohm
0	32.650	70	1.752
10	19.900	80	1.255
20	12.490	90	915
25	**10.000**	100	678
30	8.057	110	510
40	5.327	120	389
50	3.603	130	301
60	2.488	140	235

2.2 TSE Control Device for Installation in Control Panel

2.2.1 Technical Data

Type:	SGRTSE 230 AC, SGRTSE 115 AC, SGRTSE 24 AC, SGRTSE 24 DC
Temperature Range:	0-150 ºC
Input:	NTC temperature sensor 10 kOhm (at 25 ºC) with sensor breaking protection at - 25 ºC.
Relay Output: changeover	2 potential-free contacts (K1,K2), breaking capacity 500 VA at 110/230 V Ohmic load.
Deliverable Operating Voltage:	24V, 115V, 230V AC; 24V DC
Power Consumption:	max. 4VA
Sensor Circuit:	No load voltage max. 2.5 VDC Short circuit current 0.5 mA DC
Display at Device:	Fault/Dry Running Trip temperature Stator temperature
Operation at Device:	Adjustment of trip temperature. Reset of fault message.
Casing Material:	ABS
Fastening:	Mounting on standard rail 35 mm acc. to standards or screw fixings acc. to standards
Kind of Protection:	Casing IP 40 Terminals IP 20
Ambient Temperature:	0-50 ºC
Dimension:	45x75x110 mm (WxHxD)
EMV (89/336/EEC)	CE conform acc. to standards

2.2.2
Dimensions and Wall Mounting



Installation Depth = 110 mm

3.0
Electrical Connection of the TSE

3.1
Installation Instructions

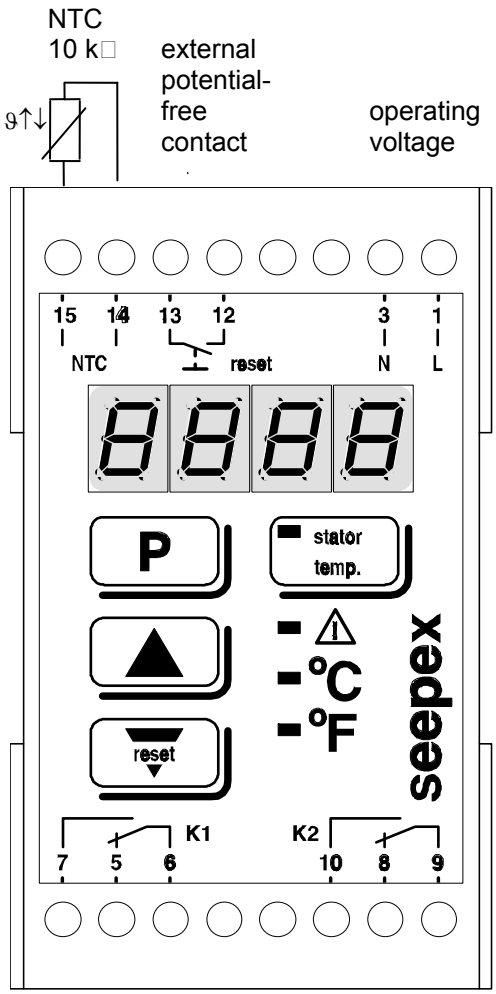
Prior to the connection and the commissioning of the device it has to be ensured that the supply voltage corresponds to the nominal voltage shown on the name plate. Nominal voltage fluctuations are permissible in the range of +/- 10 % of the device's nominal voltage.

The electrical connections have to be carried out in accordance with the wiring diagram and the regulation of the local EVV or the VDE directions.

In case of power fluctuations which lead to a malfunction of the device, adequate procedures have to be taken to avoid its reoccurrence. Alternatively these errors could be filtered out by an external supply filter. The device has to be provided with an internal supply filter.

Sensor leads have to be shielded. The shield has to be earthed at one end.

3.2
Connection Diagram of TSE Control Device



Should the TSE control device be reset after a dry-running from the control panel door or another remote position, a button ("make contact") at the terminals 12 +13 can be used.

3.3.
Relay Function

Actual temperature ‹ trip temperature
(trouble free operation)
Contacts 6 to 7 and 9 to 10 closed
Contacts 6 to 5 and 9 to 8 open

Actual temperature › trip temperature
(Malfunction/Dry Running)
Contacts 6 to 5 and 9 to 8 closed
Contacts 6 to 7 and 9 to 10 open

Relays K1 and K2 are switched parallel to each other and operate simultaneously. K1 is integrated in the motor contactor control serving as a switch-off provision. K 2 is optional as stand by for additional connection to a fault indicator or as a reserve to the process control computer.

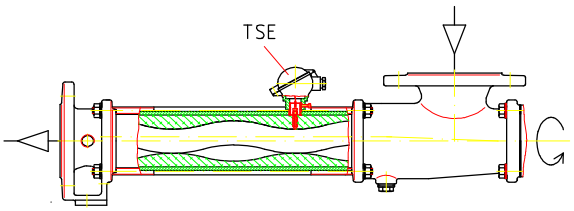
4.0 Procedures prior to Commissioning

4.1 Check Position of the Temperature Measuring Point at the Pump

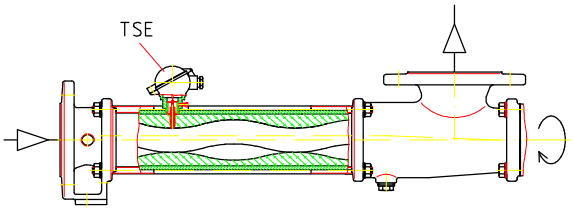
Considering the rotating direction and thus the conveying direction of the pump, the temperature sensor is fitted in our factory as per the following figures.

When changing direction of the pump and when replacing the stator the specified installation position of the temperature measuring point has to be checked. The temperature sensor must always be installed at the product entry side of the stator as the quickest temperature increase in case of dry-running will arise at this point.

4.1.1 Pump "counter clockwise rotation" - standard construction



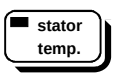
4.1.2 Pump "clockwise rotation" special construction



4.2 Function Check

After the electrical connection of the TSE and prior to the initial operation of the pump the following function check has to be carried out.

Switch-on control voltage at terminals 1 and 3 (Digital display at the TSE control device illuminates).



Press and hold button "stator temp" and read the temperature value.

If the shown temperature correspond to the ambient temperature in the pump the TSE is functioning correctly. In case of deviation proceed as per paragraph 7 - Malfunctioning.

4.3 Approximate Adjustment of Trip Temperature

The TSE control device is pre-set to a trip temperature of 50 ºC prior to leaving our factory. In order to achieve the shortest trip time after a dry-run and thus the max. protection of the pump stator, the trip temperature at the TSE control device has to be set as low as possible.

For the initial commissioning the temperature value pre-set in our factory should be maintained. Should the product have higher temperatures the value has to be adjusted to 20 to 30 ° C above the temperature of the conveying product.

Switch on control voltage. After self-check of the control device the actual pre-set temperature will show at the display.

.

Press and release button. Adjusting Mode is activated. The displays shows alternately "set" and the last set trip temperature.

Increasing the trip temperature - press button and release.
The adjusted temperature increases by + 1ºC. Press button and hold approx. 3 seconds in + 10 ° C steps.

Decreasing of trip temperature - press button and release.
The adjusted temperature decreases by - 1° C. Press button and hold approx. 3 sec. in - 10° C steps.

Press and release button. Return the unit to the operating mode. The adjusted trip temperature is transferred to a continuous memory and shown on the display.

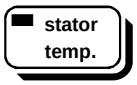
Note: During the adjusting mode, if a button is not pressed within 10 seconds the controller automatically returns to the operating mode and disregards any previous adjustment.

Following the above approximate instruction, the seepex pump can operate for a limited period of time (approx. 1 hour). Then a correction of the adjustment according to paragraph 5 - Fine Adjustment - has to be carried out.

5.0 Commissioning and Operation

5.1 Fine Adjustment of the Trip Temperature

Following the instruction for approximate adjustment in paragraph 4.3 the seepex pump has to operate for at least 30 to 60 minutes to allow the operating temperature in the stator become stable.



While the pump is in operation the temperature of the pump is shown on the display of the TSE controller by continuously pressing the button.

The final trip temperature has now to be set 10 ºC higher then the indicated operating temperature according to the instructions in paragraph 4.3.

Attention

For all adjustments the max. product temperature occurring during operation has always to be considered. In case of a product temperature higher than 40 ºC, it always has to be checked if this is mentioned in the data sheet of the pump and has therefore been considered in the rotor/stator design. If the temperature shown on the data sheet does not correspond to the actual temperature, please contact seepex.

5.2 Resetting of the Control Device after Dry-Running

In the event of dry-running of the pump and temperature increase in the stator above the pre-set limit value, the installed relays trip and maintain locked in this position. After the pump has cooled down the remaining fault message (red LED) has to be acknowledged using one of the following procedures, so that the relay will be reset.

5.2.1

Press at the TSE control device for at least 1 sec.

5.2.2

Switch-off operating voltage at TSE control device (terminals 1-3).

5.2.3

With external contact (reset button, closed for at least 1 sec.)

5.3 Changeover of the Display from ºC to ºF.

Press and hold button for 10 secs. until display changes over.

The selected temperature units are shown via an LED next to the Symbol ºC or ºF.

6.0 Replacement of Stator

6.1 Order of Replacement Stator

When ordering a replacement stator for a seepex pump, please quote:

Stator drilled for TSE fitted with sensor sleeve in 1.4571.

If the pump is used to convey highly corrosive products where 1.4571 material is not resistant, a sensor sleeve made of 2.4610 (Hastelloy C4) has to be ordered.

Attention

The sensor sleeve is fitted in our factory. It is pre-set for operation and may not be adjusted.

6.2 Dismantling/Re-Assembly of the Connection Head and Temperature Sensor.

The following drawings apply:

- For TSE in elastic stators:
  Drawing No. 702-007__ for pump sizes 006-12 and 025-6L.

  Drawing No. 702-006__ for pump sizes 025-12 to 500-6LA.

- For TSE in firm stators:
  Drawing No. 702-008 __

6.2.1 Dismantling

Lift the cover of the connection head and disconnect wires of the temperature sensor. After having loosened the side screw slide the connection head off the threaded sleeve. Remove threaded sleeve from the stator and remove clamping ring, rubber ring and temperature sensor from sensor sleeve. The temperature sensor cannot be re-used and can thus be disposed off with the damaged stator.

6.2.2
Re-Assembly

The items mentioned in paragraph 6.2.1 have to be re-installed into the new stator. It is vital to consider the temperature measuring point when installing the stator (refer to paragraph 4.1).

Do not further adjust or change the sensor sleeve setting as this has already been done in our factory.

Remove protective pipe (protective transport packaging).

Push the thermistor sensor with clamping screws and rubber ring to the bottom of the sensor sleeve and adjust.

Screw the threaded sleeve with 2 O-Rings in the tapped hole at the stator.

When installing the connection head, the connection wires of the thermistor sensor must be threaded through the hole in the junction box. After fastening the connection head on the threaded stator barred, recannect wires and put the cover back onto the connection head.

7.0
Malfunction

7.1
General

Fault messages and switch-off of the pump without actual dry-running or overload might be caused by a defect in the temperature sensor wire, the TSE control device or other electrical switch devices.

The following reasons might have caused this error alarm at the TSE control device:

break of sensor or line
short circuit of sensor or line
measuring range (-25 ...150°C) is exceeded or remained under

The following procedure is recommended to check the TSE control device and the sensor circuit including temperature sensor:

7.2
Function Check of Sensor Circuit

Disconnect the temperature sensor wire at the TSE control device terminals 14 and 15 and connect a resistance measuring device (Multimeter or Ohmmeter). The measured electrical resistance must conform with the value in the table shown in paragraph 2.1 in accordance with the pump temperature. In case of deviations of the resistance value of more than 10% of the set value, measure the resistance at the connection head of the TSE at the pump. To do this the wire to the control device at the connection head of the pump needs to be removed. If the same deviations occur when measuring the resistance at the temperature sensor
directly at the pump, the temperature sensor is damaged and needs to be replaced (refer to paragraph 6.2 and 6.3).

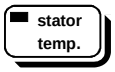
Should the resistance check at the temperature sensor show correct values, then damage to the connection cable or the connection terminal is the cause of malfunction.

7.3
Function Check of TSE Control Device

If an trouble-free sensor circuit has been determined during the testing according to paragraph 7.2, damage to the TSE control device is most likely. In order to carry out the check, remove the sensor wires at terminals 14 and 15 and connect a commercial deposited carbon or metal film resistor as per the following list.:

Resistance (Ohm)	Switching Temp. °C
10.000	25
5.600	39
2.200	63
1.000	87
560	107
220	143

Switch-on control voltage at terminal 1+3
(Digital Display at the TSE device illuminates)



Press and hold button “stator temp.” and read the temperature value.

The shown value must correspond to the switch temperature, which applies to the resistance used. Should the shown value deviate by more than 5-10 ºC or should the value be absent at all, the TSE control device must be sent to seepex for repair.

Devlac® 1433

Alkyd

PRODUCT DESCRIPTION

A quick drying, high gloss alkyd enamel available in a wide range of colors.

INTENDED USES

Used as a high gloss enamel finish for interior and exterior applications. Suitable for mild industrial and commercial environments. Particularly suited for fabrication facility application.

PRACTICAL INFORMATION FOR DEVLAC 1433

Color	Wide range via the Chromascan® system
Gloss Level	Gloss
Volume Solids	37%
Typical Thickness	1.5-2 mils (38-50 microns) dry equivalent to 4.1-5.4 mils (103-135 microns) wet
Theoretical Coverage	390 sq.ft/US gallon at 1.5 mils d.f.t and stated volume solids 9.70 m²/liter at 38 microns d.f.t and stated volume solids
Practical Coverage	Allow appropriate loss factors
Method of Application	Airless Spray, Roller, Brush

Drying Time

			Overcoating interval with self	
Temperature	**Touch Dry**	**Hard Dry**	*Minimum*	*Maximum*
50°F (10°C)	1.5 hours	20 hours	24 hours	Extended[1]
59°F (15°C)	1 hour	16 hours	24 hours	Extended[1]
77°F (25°C)	30 minutes	5 hours	20 hours	Extended[1]
104°F (40°C)	15 minutes	2 hours	6 hours	Extended[1]

[1] See International Protective Coatings Definitions & Abbreviations

REGULATORY DATA

Flash Point (Typical)	79°F (26°C)	
Product Weight	10.0 lb/gal (1.2 kg/l)	
VOC	4.49 lb/gal (539 g/lt)	EPA Method 24

See Product Characteristics section for further details

SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application, all surfaces should be assessed and treated in accordance with ISO 8504:2000.

Devlac 1433 should always be applied over a recommended anti-corrosive coating scheme. The primer surface should be dry and free from all contamination, and Devlac 1433 must be applied within the overcoating intervals specified (consult the relevant product data sheet).

Areas of breakdown, damage etc., should be prepared to the specified standard (e.g. SSPC-SP6 or Sa2½ (ISO 8501-1:2007), Abrasive Blasting, or SSPC-SP11, Power Tool Cleaning) and patch primed prior to the application of Devlac 1433.

APPLICATION

Mixing	This material is a one component coating and should always be mixed thoroughly with a power agitator before application.	
Mix Ratio	Not applicable	
Airless Spray	Recommended	Tip Range 13-19 thou (0.33-0.48 mm) Total output fluid pressure at spray tip not less than 2005 psi (141 kg/cm²)
Air Spray (Pressure Pot)	Not suitable	
Brush	Recommended	Typically 1.0-1.6 mils (25-40 microns) can be achieved
Roller	Recommended	Typically 1.0-1.6 mils (25-40 microns) can be achieved
Thinner	T-5 Thinner	Do not thin more than allowed by local environmental legislation
Cleaner	T-5 Thinner	

Work Stoppages

Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with T-5 Thinner. Partially filled containers may show surface skinning and/or a viscosity increase of the material after storage.

Clean Up

Clean all equipment immediately after use with T-5 Thinner. It is good working practice to periodically clean equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays.

All surplus material and empty containers should be disposed of in accordance with appropriate regional regulations/legislation.

PRODUCT CHARACTERISTICS

Level of sheen and surface finish is dependent on application method. Avoid using a mixture of application methods whenever possible.

As with all alkyd systems, Devlac 1433 has limited chemical and solvent resistance and is not suitable for use in immersion situations or in conditions of continuous condensation.

Devlac 1433 is not designed for application over epoxies or polyurethanes, and should not be applied over zinc based primers becasue of dangers of saponification of the alkyd resin and consequent adhesion loss.

For brush and roller application, and in some colors, two coats of Devlac 1433 may be required to give uniform coverage.

If applying Devlac 1433 in enclosed maintenance conditions ensure adequate ventilation.

Surface temperature must always be a minimum of 5°F (3°C) above dew point.

Note: VOC values are typical and are provided for guidance purpose only. These may be subject to variation depending on factors such as differences in color and normal manufacturing tolerances.

Low molecular weight reactive additives, which will form part of the film during normal ambient cure conditions, will also effect VOC values determined using EPA Method 24.

SYSTEMS COMPATIBILITY

Devlac 1433 is only suitable for application over alkyd or oleoresinous priming systems, e.g.:

Devprime 1401
Devprime 1403
Devprime 1405
Devprime 1407

For other suitable primers consult International Protective Coatings.

Devlac 1433 is only suitable for overcoating with itself, and should not be topcoated with any other product.

ADDITIONAL INFORMATION

Further information regarding industry standards, terms and abbreviations used in this data sheet can be found in the following documents available at www.international-pc.com:

- Definitions & Abbreviations
- Surface Preparation
- Paint Application
- Theoretical & Practical Coverage

Individual copies of these information sections are available upon request.

SAFETY PRECAUTIONS

This product is intended for use only by professional applicators in industrial situations in accordance with the advice given on this sheet, the Material Safety Data Sheet and the container(s), and should not be used without reference to the Material Safety Data Sheet (MSDS) which International Protective Coatings has provided to its customers.

All work involving the application and use of this product should be performed in compliance with all relevant national, Health, Safety & Environmental standards and regulations.

In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation.

If in doubt regarding the suitability of use of this product, consult International Protective Coatings for further advice.

PACK SIZE	Unit Size	Vol	Pack
	5 US gal	5 US gal	5 US gal
	For availability of other pack sizes contact International Protective Coatings		
SHIPPING WEIGHT (TYPICAL)	Unit Size		
	5 US gal	53.8 lb	
STORAGE	Shelf Life	24 months minimum at 77°F (25°C). Subject to re-inspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.	

Disclaimer

The information in this data sheet is not intended to be exhaustive; any person using the product for any purpose other than that specifically recommended in this data sheet without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at their own risk. All advice given or statements made about the product (whether in this data sheet or otherwise) is correct to the best of our knowledge but we have no control over the quality or the condition of the substrate or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing to do so, we do not accept any liability at all for the performance of the product or for (subject to the maximum extent permitted by law) any loss or damage arising out of the use of the product. We hereby disclaim any warranties or representations, express or implied, by operation of law or otherwise, including, without limitation, any implied warranty of merchantability or fitness for a particular purpose. All products supplied and technical advice given are subject to our Conditions of Sale. You should request a copy of this document and review it carefully. The information contained in this data sheet is liable to modification from time to time in the light of experience and our policy of continuous development. It is the user's responsibility to check with their local International Paint representative that this data sheet is current prior to using the product.

This Technical Data Sheet is available on our website at www.international-marine.com or www.international-pc.com, and should be the same as this document. Should there be any discrepancies between this document and the version of the Technical Data Sheet that appears on the website, then the version on the website will take precedence.

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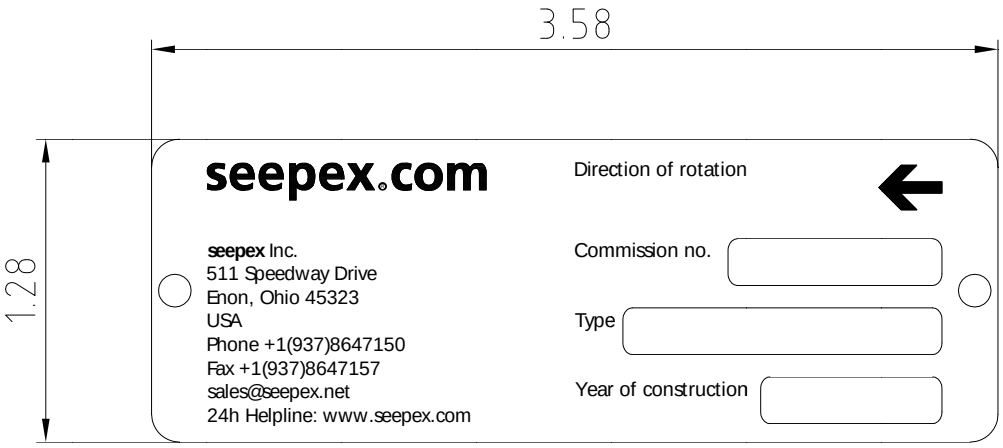
3.58
1.28
seepex.com
seepex Inc.
511 Speedway Drive
Enon, Ohio 45323
USA
Phone +1(937)8647150
Fax +1(937)8647157
sales@seepex.net
24h Helpline: www.seepex.com
Direction of rotation
Commission no.
Type
Year of construction

1 Scope

- **Size:** 0005-24 ... 500-6L
- **Range:** BN, NS, N, MD
- **Storage period:** > 3 months ≤ 24 months
- **Preservation/storage**
  - Pump components at risk of corrosion, per pt. 2.1.1
  - Pump components not at risk of corrosion, per pt. 2.1.2

2 Description

Pumps intended for a storage period of > 3 months are prepared for long-term storage before delivery by means of appropriate preservation actions. The following chapters are to be observed for storage at the customer's location.

2.1 Preservation/storage

Storage period: > 3 months ≤ 24 months

Correctly stored and with the preservation actions taken, the pump can be stored up to a maximum of 24 months.

When storing elastomers, changes in size and shore grade may occur.

The function of the pump can be affected.

2.1.1 Pump components at risk of corrosion

Characteristic features of preservation

- Pump is completely assembled.
- Casing parts are protected from corrosion with wax spray.
- Coupling rod, plug-in shaft or drive shaft and exposed surfaces of the coupling (if present) are protected from corrosion with wax spray.
- Rotor is installed in the stator and protected from corrosion with silicone oil or glycerine (for EPDM stators). Abutting surface is protected from corrosion with wax spray.
- Casing openings are closed with a plastic cover.
- In the case of an adjustable belt drive the belts are delivered separately.

Storage at customer's location

- **Storage of the pump/pump parts**
  - In dry, enclosed, frost-free spaces.
  - Low vibration.
- **Protection measures for pump and drive**

  To protect pump components and drive components, e.g. rotor, stator, shaft seal and bearing:
  - Remove the fan cover on the motor and turn the fan shaft.
  - Change the position of the rotor/stator every month by means of a 1/4 turn of the pump shaft.

NOTICE

Damage to fan shaft/fan wheel.
Function of the drive can be impaired.

➢ If necessary, remove fan wheel; protect shaft from damage.

Particular environmental influences must be specified by the customer and checked and approved by seepex before storage.

Recommissioning

➢ Before recommissioning, observe the pump's operating instructions.
  – Remove protective materials/coverings.
  – Make sure that the disassembled/separately stored components are correctly reassembled.

2.1.2 Pump components not at risk of corrosion (stainless steel/coated components)

Characteristic features of preservation

- Pump is completely assembled.
- Casing openings are closed with a plastic cover.
- Exposed surfaces of the coupling (if present) are protected from corrosion with wax spray.
- In the case of an adjustable belt drive the belts are delivered separately.

Storage at customer's location

- **Storage of the pump/pump parts**
  – In dry, enclosed, frost-free spaces.
  – Low vibration.
- **Protection measures for pump and drive**
  To protect pump components and drive components, e.g. rotor, stator, shaft seal and bearing:
  – Remove the fan cover on the motor and turn the fan shaft.
  – Change the position of the rotor/stator every month by means of a 1/4 turn of the pump shaft.

NOTICE
Damage to fan shaft/fan wheel. Function of the drive can be impaired. ➢ If necessary, remove fan wheel; protect shaft from damage.

Particular environmental influences must be specified by the customer and checked and approved by seepex before storage.

Recommissioning

➢ Before recommissioning, observe the pump's operating instructions.
  – Remove protective materials/coverings.
  – Make sure that the disassembled/separately stored components are correctly reassembled.

3 Notes and comments

When storing the pump for over 24 months, because of potential corrosion and natural aging of elastomers, greases and oils, we recommend having seepex Customer Service assess the pump before recommissioning it.

4 Documents

seepex internal manufacturing instructions for long-term storage/preservation: HA.LKO.01

5 Revision service

This document is subject to the revision service of the Technical Division (TE) and the respective valid version will be released by Quality Assurance (QA). Change requests shall be processed and checked by the technical department.

Inspection Reports

ELECTRICAL SYSTEM TESTING REPORT
PAGE 1 OF 2

DESCRIPTION: _____

_____

SERVICE DESCRIPTION:

☐ Nominal Voltage ☐ Phase to Neutral Number of Conductors: _____

☐ Phase to Phase ☐ Single or 3-phase

SERVICE CONDUCTORS:

Phase Size: _____ Insulation Type: _____

Neutral Size: _____ Insulation Type: _____

Ground Size: _____ Insulation Type: _____

SERVICE DISCONNECT DESCRIPTION:

☐ Circuit Breaker Size (amps): _____

☐ Disconnect Switch Fuse (amps): _____

MEASURED CONDITIONS*		DATA					
Operating Load Voltage	Volts	Vab	_____	Vbc	_____	Vca	_____
Operating Load Feeder Current	Amps	la	_____	lb	_____	lc	_____
Conductor Insulation	Megohms	a-b	_____	b-c	_____	c-a	_____
Resistance							
1. Service Feeder	Megohms	a-g	_____	b-g	_____	c-g	_____
2. Pump Feeders	Megohms	a-g	_____	b-g	_____	c-g	_____

All testing shall be done in the presence of the Engineer

_____ _____
CONTRACTOR'S REPRESENTATIVE DATE

_____ _____
OWNER'S REPRESENTATIVE DATE

TO BE FILLED OUT

MOTOR DATA AND TEST REPORT

PAGE 2 OF 2

EQUIPMENT NAME: _____ **NUMBER**: _____

EQUIPMENT SPECIFICATION SECTION: _____

MOTOR STARTER LOCATION: _____

MOTOR NAMEPLATE DATA

MFR Name:		MFR Model No.:	
Voltage:		Phase:	
HP:		Service Factor:	
Efficiency Index (or %):		NEMA Design:	
Code Letter:		Insulation Type:	
Temperature Rise:		Ambient Temp:	
RPM:		Enclosure:	
Thermal Trip Setting:		Space Htr Watts:	
Other Data:		Space Htr Volts:	

MOTOR STARTER INFORMATION

Manufacturer / Type _____

Overload Heater No.: _____

MEASURED CONDITIONS*		DATA					
Full Load Operating Voltage**	Volts	a-g	_____	b-g	_____	c-g	_____
Full Load Operating Voltage	Volts	a-b	_____	b-c	_____	c-a	_____
Full Load Operating Current	Volts	a	_____	B	_____	c	_____
Insulation Resistance (deengerized)	Megohms	a-g	_____	b-g	_____	c-g	_____
Motor Circuit Resistance	Ohms	a-b	_____	b-c	_____	c-a	_____

All testing shall be done in the presence of the Engineer
****Voltage and current readings shall be taken at the closest accessible point to the load.***

_____ _____

CONTRACTOR'S REPRESENTATIVE DATE

_____ _____

OWNER'S REPRESENTATIVE DATE

TO BE FILLED OUT

MANUFACTURER FINAL INSPECTION REPORT
PAGE 1 OF 1

CHECK POINTS

Installation *(fasteners, dimensions, plumb / level)*	**Mechanical** *(adequate piping, support, valving)*	**Functional Test** *(rotation, electrical, motor)*
☐ Pass ☐ Fail	☐ Pass ☐ Fail	☐ Pass ☐ Fail

REMARKS:

_____

_____

_____

_____

ITEMS REMAINING TO COMPLETION

The below described areas and items have been found to be deficient. No guarantee can be issued until they are corrected. These items will also require re-inspection:

_____

_____

_____

_____

_____

I have inspected the above described _____ and:

☐ Recommend a warranty be issued.

☐ Feel the _____ will require additional work before a warranty is issued.

_____ _____
MANUFACTURER'S REPRESENTATIVE DATE

_____ _____
OWNER'S REPRESENTATIVE DATE

Warranty

FKC CO., LTD.

2708 West 18th Street
Port Angeles, WA 98363

(360) 452-9472
FAX (360) 452-6880

STATEMENT OF WARRANTY

Owner: City of Rock Island
Project: Screw Press Dewatering Equipment Procurement
Equipment: Section 11350 Dewatering Screw Press and Section 14555 Shaftless Screw Conveyor
Completion Date of Substantial Completion: == To Be Determined ==

FKC warrants the equipment supplied per Sections 11350 and 14555 including screw press, flocculation tank, polymer makedown system, sludge feed pump, local control panel SP-LCP, instrumentation, skid, conveyor and instrumentation for a period of twelve (12) months after substantial completion or 18 months after delivery, whichever comes first.

FKC also warrants the polymer mixing chamber motor, the spare polymer mixing chamber motor, and two sets of brushes & springs for maintenance for a period of thirty-six (36) months after start-up.

FKC warranty includes all parts, labor, shipping and coatings for repairing or replacing equipment that fails during the warranty period. Defects occurring within the warranty period shall be repaired or replaced by FKC at no cost to the Owner.

FKC warranty also includes an Extended Mechanical Warranty for all the mechanical components of the dewatering screw press. The Extended Mechanical Warranty shall be for 10 years after start-up. The following mechanical items on the screw press will be covered by this warranty:

1. All screw shaft bearings and seals.
2. Screens and drums on the screw press.
3. The screw shaft, shell, and flights, i.e. the entire screw.
4. The Sumitomo Cyclo drive reducer.
5. Screw press base, inlet stand, and discharge box.

This Extended Mechanical Warranty requires that the WWTP staff document that the equipment is lubricated according to the Manufacturer's recommendations as follows.

a. The screw shaft bearings will be lubricated per the FKC supplied O&M manual.
b. The Sumitomo Cyclo drive reducer will have the recommended oil and the oil will be changed as specified in the Sumitomo maintenance manual.

This Extended Mechanical Warranty does not cover the following items:

a. Flocculation tank SEW agitator assembly.
b. Control Panel, motors, field instrumentation, power control, logic control, or any other electronic components.
c. Routine maintenance such as lubrication, washing & cleaning, and periodic dismantling (once or twice in the ten-year period) for screw inspection and screw flight to screen clearance adjustment.
d. Painting and coatings.
e. Corrosion caused by the sludge being processed or the local environmental conditions.
f. Damage due to:
    1) Large foreign objects (wood, metal, rocks, etc.) getting into the screw press.
    2) Processing any material not conforming to the original design specification the unit was purchased under, this includes but is not limited to 100% primary sludge, 100% septic tank sludge, sludge with a high grit content that exceeds 50% non-volatile solids content, etc.

(To be signed and included in the final O&M manual after start-up completion)

_____ _____

Roger J. Olson, President Date