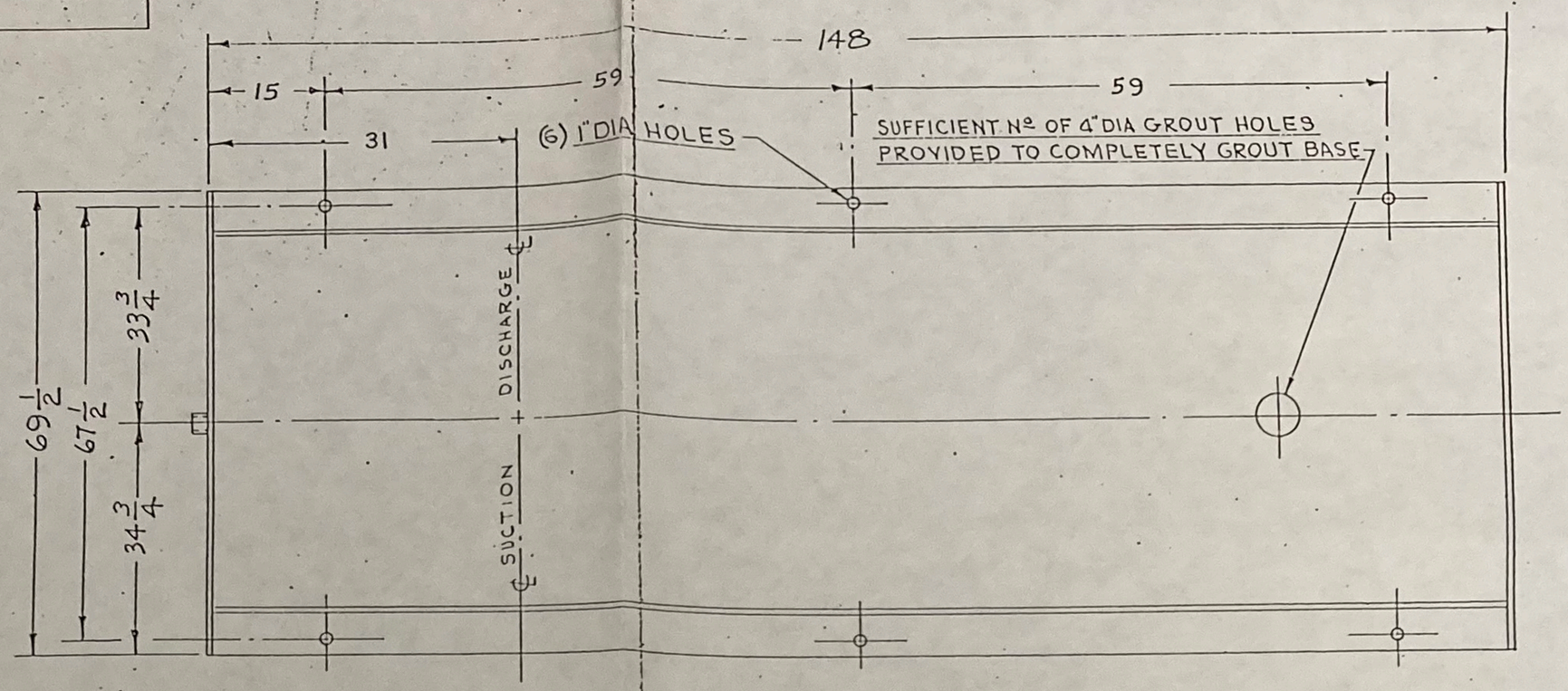
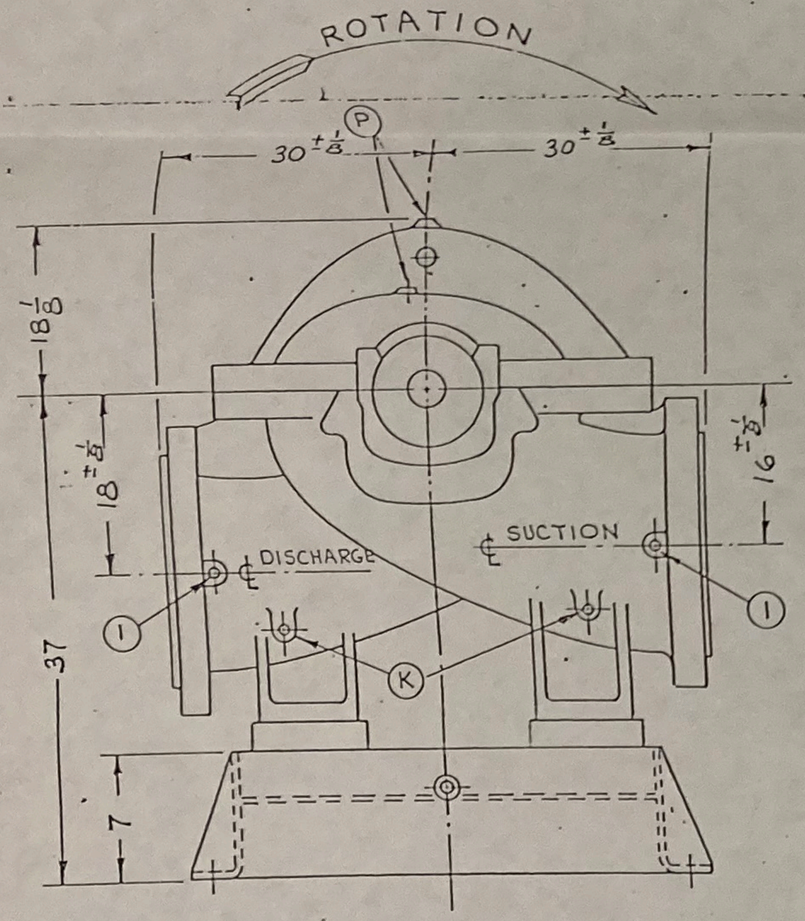
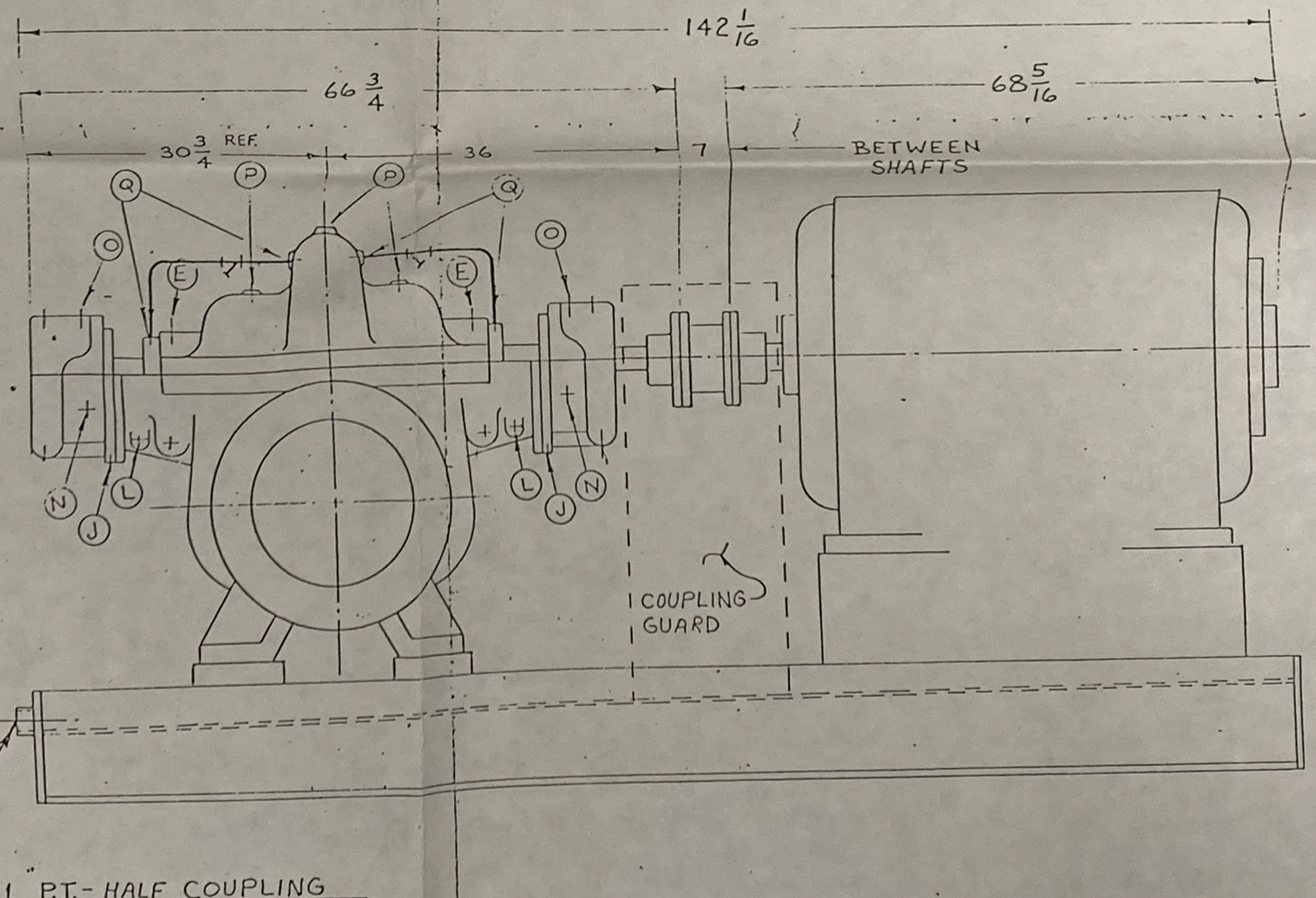
ITEM	LEGEND	PIPE TAP
A		
B		
C		
D		
E	Sealing Liquid Inlet	A 1/2
F		
G		
H		
I	Gage Connection	A 1/2
J	Oil Drain	A 3/4
K	Pump Drain	A 1/2
L	Bearing Bracket Drain	A 3/4
M		
N	Constant Level Oiler	
O	Oil Inspection Hole Cover	
P	Pump Vent	A 1/2
Q	SEAL CIRCULATION	⊙ 1/2
R		
S		

▲ PIPE PLUG ■ PROTECTIVE CAP
⊙ PIPED BY BPCO







UNIT DATA

PUMP SPECIFICATIONS

SIZE & TYPE	16 x 20 x 17 HSL
NO. STAGES	1 RPM 1770
ROTATION	CCW (Seen from Driver)
DISCH FLG.	16" - 250# ASA F.F.
SUCT. FLG.	20" - 250# ASA F.F.
MECH SEAL	JOHN CRANE
TYPE	1B CODE BP 191
COUPLING	
TYPE	WALDRON SIZE 3 1/2 W
GUARD BY	BINGHAM
	NON-SPARK

DRIVER SPECIFICATIONS

MOTOR	LOUIS ALLIS Co.
FRAME	7100CS
HP	500 RPM 1800
VOLTS	4000 PHASE 3 CYCLES 60
DIMEN. PRINT	S-4288-B
FURNISHED BY	BINGHAM

WEIGHTS

PUMP	5440 # APPROX.
BASE	1900 # APPROX.
DRIVER	
TOTAL	

CUSTOMER DATA

USER: TEXACO, INC.

FOR INSTALLATION AT:
ANACORTES, WASH.
PURCHASER: TEXACO, INC.

PURCH. ORD. NO.	LA 11245-C
ITEM NO.	
BINGHAM SER. NO.	14230136
SERVICE	SHIP UNLOADING - CRUDE OIL
PUMP SIZE & TYPE	16 x 20 x 17 HSL

CAUTION: Carefully check alignment before starting unit. All holes in flanges straddle centerlines. Unit should be relieved of excess piping strains.

Revisions	BY	DATE
1		
2		
3		
4		

CERTIFIED FOR CONSTRUCTION
BY DATE
DRDJC DATE 4/1/74 CKWGS

Bingham PUMP CO.
PORTLAND, ORE. VANCOUVER, BC

FD-14230136
D-86886X

22-G16-1-0

MATCH LINE E-7200.28

MATCH LINE E-7399.28

MATCH LINE N13509.74

E-7236.28

E-7265.00

N10167.74

22RG2

22RG3

20"x16" ECC. RED.

19" FIREWATER

E DISCHARGE

E SUCTION

E FUTURE PUMP

13'-2" FACE OF FLGS

22'-6"

E 100 DIA. O PIPEWAY

E ERIE OF 60'O' PIPEWAY

DWG. 22-AL-18

DWG. 22-AL-10

SEE DWG. 22-AL-10 FOR CONTINUATION

REFERENCE DRAWINGS

NO.	DESCRIPTION
1	22-AL-1
2	22-AL-2
3	22-AL-3
4	22-AL-4
5	22-AL-5
6	22-AL-6
7	22-AL-7
8	22-AL-8
9	22-AL-9
10	22-AL-10
11	22-AL-11
12	22-AL-12
13	22-AL-13
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99	22-AL-99
100	22-AL-100

REVISION NOTE 1-9
ADDED (1) 19"FW, (2) 16"x8" RED. (3) 8"x6" RED. (4) 6"x4" RED. (5) 4"x3" RED. (6) 3"x2" RED. (7) 2" GLOBE VALVE (8) 2" GATE VALVE (9) 2" GLOBE VALVE

BECHTEL CORPORATION
SAN FRANCISCO

THE TEXAS COMPANY
PUGET SOUND WORKS

CRUDE OIL BOOSTER PUMPS
PIPING PLAN
BLOCK 1

DRAWING NO. 2525 22-AL-9

DESIGNED BY A. TENG
DRAWN
CHECKED
SCALE 1/4" = 1'-0"

SUBSTITUTION
64000-Q
APPROVED BY THE TEXAS CO.

SIZE A

201

Appendix B

3.13.0

Pump Specification Data
22RG2/22RG-13/22RG-16 & 22NG5
Replacement in Kind
Cast Iron to Carbon Steel

SULZER BINGHAM

PORTLAND SERVICE CENTER • 2800 N.W Front Avenue • Portland, Oregon 97210 • (503) 226-5203 • FAX (503) 226- 5598

FAX INFORMATION SHEET

Page: 1 of 2 Telecopier No.: 206 293-1584

Date: 1-12

COMPANY NAME: Texaco Refining + Mktg

LOCATION:

ATTENTION: Jess Close

REFERENCE: PO# RA12323301

MESSAGE: Our Job # L1978

"Certs"

Jess -

I talked to Rich B. in Pmts this AM. We tried to pull old order but the clerk is out today and I couldn't find the L1000 series orders. Rich looked at original order (microfiche) and said certs were not required. If we were not asked to buy order with certs, we usually wouldn't. I will have clerk pull file tomorrow and take a look to double check. Your purchasing dept. may be able to give you copy of P.O. # above to help you.

FROM: DARCI L. HERING / PORTLAND SERVICE CENTER
PHONE: (503) 226-5549
FAX: (503) 226-5598

Copy of our job remove/replacement attached

SULZER BINGHAM

2800 N. W FRONT AVENUE • P.O. BOX 10247
PORTLAND, OREGON 97210

DATE RECEIVED	PAGE NUMBER
3/06/91	1

ENTERED BY	CODE	S.O. NO.	B/L NO.
RB	28	L1978	

CUSTOMER ORDER NO. RA12323301

QUOTATION NO. 10498 | SCHEDULED DATE 4/17/91

S. OFFICE	SALESPERSON	DEST. OFFICE	SERV. CENTER
067	370	067	067

F.O.B. FACTORY: Collect | FREIGHT PAYABLE BY: Customer

SHIP VIA INSTRUCTIONS: MOTOR

Domestic Shipment - U.S.A.

Thank you for your order. It is now in process. If you have any questions, please contact the sales office in your area.

SULZER BINGHAM

ORTLAND SERVICE CENTER 0003
800 N.W. FRONT AVE.

PORTLAND OR 97210

TEXACO REFINING & MKTG 765000
PO BOX 622
C/O MR. J.C. HARWOOD

ANACORTES WA 982210622

N 33080/081 SIZE/TYPE 16.000 x 20.000 x 17.000 HSL
SECT. B-9002 STGS. 1 ROT CCW RPM 1760

LINE NO.	QTY. ORDERED	DESCRIPTION	MTL.	DWNG ITEM NUMBER	UNIT PRICE	QUANTITY B.O.	QUANTITY SHPD	NET AMOUNT
		CUSTOMER P.O. / CUSTOMER PART NO.						
1	1	114 -CASE,VOLUTE RA12323301 955183	4031	E06414 1652813	49870.00			49870.00
		*** ORDER TOTAL ***						49870.00

ACKNOWLEDGEMENT

SHIPPED TO SERVICE CENTER TO INSTALL RE-BUILT ROTOR

SUBJECT TO TERMS & CONDITIONS

ACKNOWLEDGEMENT

PO-11B PURCHASE ORDER ITEM DETAIL 01/12/94
15:43

Function [PRINT]

P.O./REPAIR: RA12323301 NO REV: 0 NO RCPT: 1 P.O./REPAIR DATE: 03/06/91
VENDOR NO: SUBIP3 SULZER BINGHAM PUMPS F BLANKT NO:
USE CODE: MA COST CENTER: 449

	P.O. ITEM	CATALOG NO	ORD QTY	APPR QTY RECEIVED	QTY INVOIC	IS UT	SHORT DESCRIPTION
1	1	955183	1	1	1	EA	BINGHAM A216GR WCB CARBON STEEL
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

PO-11C Manual Purchase Order Item View 01/12/94 15:43

Function: [PRINT]

Purchase Order Number: RA12323301 Purchase Order Date: 03/06/91 F
Vendor Code: SUBIP3 Vendor Name: SULZER BINGHAM PUMPS
Route: MOTOR FR Freight: P Div/Dpt: 023-918 Del Date: 04/09/91

Po Item Number: 1
Item Type: N Stock Item No: Catalog Number: 955183

Commodity Code: 41
Qty: 1 U/I: EA Purchase Order PRice: $ 49870.0000
Spec Number:

Description BINGHAM A216GR WCB CARBON STEEL PUMP CASE
FOR CRUDE UNLOADING PUMP CASE S/N 33081 SM: TX

Mfgr Part No: NA Order Request Number: 123233
Mfgr Drawing No: NA Inspection Code: NOT

PO-11A

PO HEADER DETAIL
Function: [PRINT]

PO No: RA12323301 Rev: 0 Mods: 0 Status: C PO Date: 03/06/91
Vendor: SUBIP3 SULZER BINGHAM PUMPS F Deliv Date: 04/09/91
Phone: 503-226-5203 Rte: MOTOR FRT COLL FOB: SH PT PO Code: L
Gen Rem: SHIP DATE 04/17/91 PER ACK

Notes:

Blind
Notes:

WO No: 9102156 Equip No: 22 INCIDENT Cost Center: 449 Urgency: E
EC No: 0 I & T No: 0 Incident: 5384 Use Code: MA
Bill of Mat:

Req By: Keith W. Brashler Dept: PWR Required By: 04/09/91
Auth By: Jeff A. Krafve Auth Date: 03/05/91
Buyer: BILL HOOVER Seller's Contact:
Deliver To: MACHINE SHOP
NO ITEMS: 1 $ESTIMATED: 49870.00 $COMMITTED: 49870.00 $ACTUAL: 53610.25

INSTRUCTIONS

Installation - Operation - Maintenance

—for—

16 x 20 x 17 HSL PUMP NO. 33080/81

USER The Texas Company LOCATION March Point, Wash.

ORDER NO. Estimate JOB NO. 6400 ITEM NO.

PURCHASER Bechtel Corporation LOCATION 134 California St. San Francisco 11, Calif.

ORDER NO. 2525-22-G-1 JOB NO. ITEM NO. 22-R-G-2 22-R-G-3

One copy of this book should be forwarded to the Supt. of Construction and the operating Department.

Bingham PUMP COMPANY

Portland, Oregon

Series 10324

Pumps No. 33080 & 81

UNIT DATA

TYPE OF SERVICE Crude boosters LIQUID Arabian Crude @ 80 °F. P.T.

CAPACITY 12,250 GPM HEAD 161 FEET 0.845 SP. GR. @ P.T.

~~TURBINE~~
MOTOR General Electric TYPE _____ HP 500 RPM 1760

COUPLING Waldron 4A mill type 6" between shafts

PACKING _____ NO. RINGS EA. BOX _____ I.D. _____ SIZE _____

ARRANGEMENT _____

CASE GASKETS Anchor Touril 1/32" thick

BEARINGS (DRIVE END ND-2318-L1A; OUTBOARD END ND-5317-L1A)

BEARING LOCKNUTS & WASHERS (DRIVE END N-18, W-18; OUTBOARD END N-17, W-17)

BEARING LUBRICATION Turbine type oil vis. 150 SSU @ 100°F. Oil level 2-3/4" below shaft centerline

MECHANICAL SEAL John Crane type 1B code BP-191 per dwg. F-SP-5109

CONTENTS

Title Page	Series	10324
Unit Data	"	10324A
General Instructions	"	40914
Instructions For Type HSL	"	50320
Cross Section		B-9002
Performance Curve		16262, 16263
Mechanical seal drawing		F-SP-5109

SECTION I

INSTALLATION INSTRUCTIONS

FOUNDATIONS

Prior to installation of the pump, prepare a foundation, preferably of concrete, and of ample proportions to form a permanent, rigid support for the pumping unit. Embed foundation bolts in the foundation structure at time of construction, these bolts to be located from a drawing or template of the pump base.

The pumping unit, when installed on the foundation, should be properly leveled by using steel wedges or shims placed at each foundation bolt and in between as necessary to evenly support the weight. The nuts on the foundation bolts should then be evenly tightened, so as not to cause any bending strain in the base plate. Carefully check alignment after tightening each nut to see that the base is not being distorted. Allow approximately ¾" space between bottom of base plate and top of concrete for grouting. The actual grouting should not be done until after the piping is installed and connected to the pump, followed by a check of alignment of pump and driver.

ALIGNMENT

Correct alignment is essential to successful operation.

The alignment may be disturbed either in transit, due to improper handling, or by improper leveling on the foundation. All base plates are slightly elastic; therefore it is necessary to re-establish true alignment on the foundation. Whenever the pump or driver, or both, is heated in operation (steam turbine and/or pumps handling hot liquids), the alignment may change; therefore final alignment should be made after the unit has been in operation long enough to have reached full operating temperature.

The driver and driver base of vertical pumps have alignment facilitated by means of a rabbet fit, machined to close tolerance, thereby lessening the possibilities of misalignment. However, the alignment should be checked by the method described under "Method of Alignment" to assure proper alignment.

METHOD OF ALIGNMENT

(A) Standard Flexible Couplings:

Tools required: Straight edge, finished steel wedge, and thickness gauges. (A combination taper and thickness gauge, Starrett #245 or equal, is ideal.)

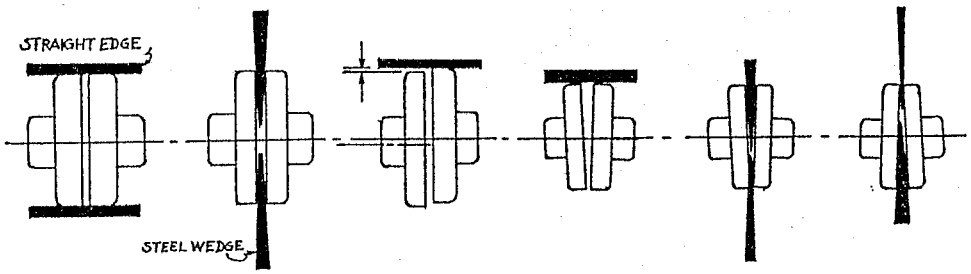


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

(1) To test for concentricity: Place a straight edge squarely across the coupling hubs at 4 points 90° apart. If no gap shows under the straight edge, the hubs are concentric. (Fig. 1.)

(2) To test for parallelism: Insert a finished steel wedge between the faces of the coupling at same 4 points 90° apart. If the wedge enters the same distance, the faces are parallel. (Fig. 2.)

(3) To allow for heat rise in the pump or driver: Line up the coupling hubs so predetermined allowance can be measured with straight edge and thickness gauges at top and bottom of the coupling (Fig. 3), the sides of the coupling being perfectly true. The finished steel wedge inserted same distance as before indicates true parallelism. (Fig. 2.)

(4) A case of misalignment is illustrated by Figs. 4, 5 and 6. In Fig. 4 the straight

cowl-type glands. They may be water jacketed, having an inlet and outlet connection to water jacket and lantern ring.

The lantern ring is drilled to facilitate easy removal from the stuffingbox. Engage a stiff wire, with hook on the end, in each of the two holes in the face of the lantern ring and pull ring out of the stuffingbox.

To properly pack the stuffingbox, the packing rings should be cut slightly short, to prevent butting of ends and buckling. In case of high pressures, the packing rings should be die formed. Each ring is inserted separately and pushed into the stuffingbox with the gland. Joints of successive rings should be staggered at least 90° apart. Insert a sufficient amount of packing to properly locate the lantern ring (if used) with respect to seal supply lines, then add additional packing to properly fill the stuffingbox so gland can be loosely drawn up. Do not cinch gland up tight; this may cause the packing to burn and damage the shaft sleeve.

If stuffingboxes are supplied with mechanical seals, instructions pertaining thereto will be included with this booklet.

LUBRICATION

(A) Horizontal Pumps: Pumps equipped with ball radial and ball thrust bearings have oil ring, flinger spool, or bath lubrication systems. The bearing housings are fitted with adjustable constant level oilers. Adjust the constant level oiler to maintain the oil level in accordance with instructions attached to bearing housing. Use a high grade turbine type lubricating oil having a viscosity of approximately 150 SSU at 100°F.

Under normal operating conditions oil should only have to be added at long intervals, but it is recommended that a complete change of oil be made every 6 months. Inspection to determine if oil is being carried to the bearings should be daily routine.

(B) Vertical Pumps: The lubrication of vertical pumps may be oil, grease, water or pumpage, depending on type and service of the pump. Specific instructions will be given on the Unit Data Sheet.

(C) Couplings: Flexible couplings generally require some form of lubrication. The lubrication depends entirely upon the type of coupling used, and the coupling manufacturer's specifications should be followed.

FREEZING

Care should be taken to prevent the pump from freezing in cold weather when not in operation. It may be necessary to remove drain plugs and leave pump volute and water jackets drained during this period of shut-down.

SECTION II

STARTING AND OPERATION

STARTING FOR THE FIRST TIME

It is good practice before starting the first time to have made a thorough inspection of all piping. Inspect strainers, if installed, making sure strainer baskets are in place, check over installation of auxiliary piping, try out bearing cooling water and gland sealing liquid. Fill all bearing oil reservoirs and constant level oilers to recommended level. Remove refuse, dirt, and loose tools not required for operation, from the pump and its immediate vicinity.

ROTATION

Check the direction of rotation of driver preferably with the coupling disconnected. The direction of rotation is relative to the impeller vane curvature and is indicated by direction arrow on pump casing as shown by Fig. 8.

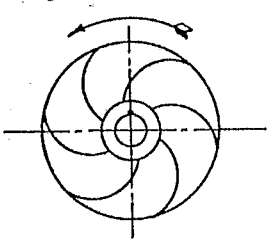


Fig. 8

PRIMING

The pump should not be started unless it is fully primed, for in addition to the impossibility of a pump performing properly when operated dry or partially filled, there is a great danger of serious damage to all parts due to seizure.

SECTION IV

MAINTENANCE INSTRUCTIONS

TYPE HS DOUBLE SUCTION SPLIT CASE PUMPS.

It is recommended that the pump be dismantled in a shop with proper facilities for doing the work.

PROCEDURE FOR DISMANTLING:

1. Remove auxiliary piping, etc.

2. Remove dowel pins and casing stud nuts. Release tension on stuffingbox gland.

3. Insert jack screws in tapped holes in flange of top case and tighten equally to break joint between top and bottom halves of casing. Remove jack screws. Top half case may now be removed and rotating element inspected. CAUTION: Be sure case is free before lifting.

4. If it is desired to dismantle the bearing housings without removal of the top half case, disconnect the coupling and remove driver. Thenfollow instructions 2, 5, 6, 7, & 8 in the section titled "Removal of Rotating Element."

   If the pump is furnished with a Spacer Type Coupling, the bearings and mechanical seals (when used) may be removed without disturbing the driver.

REMOVAL OF ROTATING ELEMENT:

1. Disconnect the flexible coupling.

2. Drain oil from bearings.

3. Remove cap screws and dowel pins holding the bearing housings to bottom half of casing. Use a suitable rope sling for lifting the rotating element, which is now free to be removed from the casing. Apply a slight strain to sling and use a bar under the shaft to free the case wearing rings, so no part of the element binds and shaft is not distorted.

4. Lift the complete rotating element free of the casing.

5. Remove pump half of coupling, using suitable puller.

6. Remove cap screws holding bearing covers to bearing housings. Bearing Housings may now be removed. NOTE: Care should be taken not to damage oil ring if used.

7. Loosen set screw in deflector disc; remove locknut and washer and pull bearings with a suitable puller. Remove oil ring and oil ring sleeve if used, bearing covers and deflector discs.

8. Remove packing glands and packing or mechanical seals if used, lantern rings, used with packing, and packing rings.

9. The shaft sleeves are right and left-hand threaded respectively and are locked against reverse rotation by hollow set screws. Remove set screws and use a spanner wrench to unscrew shaft sleeves.

REMOVAL OF IMPELLER

The impeller is positioned on the shaft by shaft sleeves, and keyed to shaft by a straight key. An accurate measurement should be taken to locate impeller, before the impeller is moved.

Apply penetrating oil liberally to shaft at impeller hub, then proceed with one of the following methods for removal of impellers:

Method 1 - Press off in a suitable press.
Method 2 - Stand shaft on end and bump on a block of wood.
Method 3 - Apply heat. Use an acetylene torch. Start heating at the rim of the impeller applying heat to both sides alternately. Heat the hub last and keep shaft as cool as possible. Tapping the impellers lightly will indicate when they are loose. Remove from shaft and allow to cool slowly.

REMOVAL OF IMPELLER WEARING RINGS:

New impeller wearing rings can be installed without removing impeller from shaft by either of the following methods:

To remove wearing rings (not hardened):
Method 1 - Turn the old ring off in a lathe and remove radial dowel screws.
Method 2 - Drill out radial dowel screws and pull off; heat if necessary.

To remove wearing rings (hardened):
Method 1 - Drill out radial dowel screws and strike ring a sharp blow at any dowel hole to split the ring.

Method 2 - Grind ring on emery wheel until almost cut through; finish cutting by hand. CAUTION: Care should be exercised not to damage impeller.

ASSEMBLY:

Prepare for assembly by thoroughly cleaning and inspecting all parts. The shaft should be polished and any burrs removed at locations of impellers, bearings, and shaft sleeves. Never USE old gaskets. Use new gaskets of same quality and thickness of those originally used.

ROTATING ELEMENT ASSEMBLY:

1. Fit new wearing rings to impeller eye and use screw dowels to hold in place.

2. Press impeller on shaft (if removed).

3. Assemble shaft sleeve gaskets and shaft sleeves on shaft, locate impeller in proper place, tighten shaft sleeves with spanner wrench and lock in place with hollow set screws.

4. Place case wearing rings, packing rings, and lantern rings on the shaft.

5. Assembly of bearings;

   a. Place deflector discs, bearing cover, bearing cover gaskets, oil ring mounting sleeves, and oil rings on shaft.

b. Assemble bearings on shaft and lock in place with lockwashers and locknuts.

c. Assemble bearing housings on shaft and bolt bearing covers to bearings. NOTE: Take care not to damage oil ring during assembly.

6. Assemble pump half of coupling on shaft. (Heat coupling in hot oil bath.)

PUMP ASSEMBLY:

1. Assemble complete rotating element in bottom half of casing, locating casing, wearing rings, packing rings, and lantern rings in their proper place.

2. Assemble bearing housings to bottom half of casing, locating by the dowel pins, and bolt in place with cap screws. Locate deflector discs and fasten in place with hollow set screws.

3. Check to see that impeller is centrally located in pump case.

4. Place new casing gasket on bottom half of case and assemble with top half of casing. Insert dowel pins and tighten all bolts equally to insure against distorting the case.

5. Turn rotating element by hand to check free rotation.

6. Assemble auxiliary piping, repack stuffingboxes, and fill bearing reservoirs.

7. Check alignment of pump and driver and connect coupling. (Refer General Instructions.)

8. Same precautions should be observed in starting up as in starting a new installation

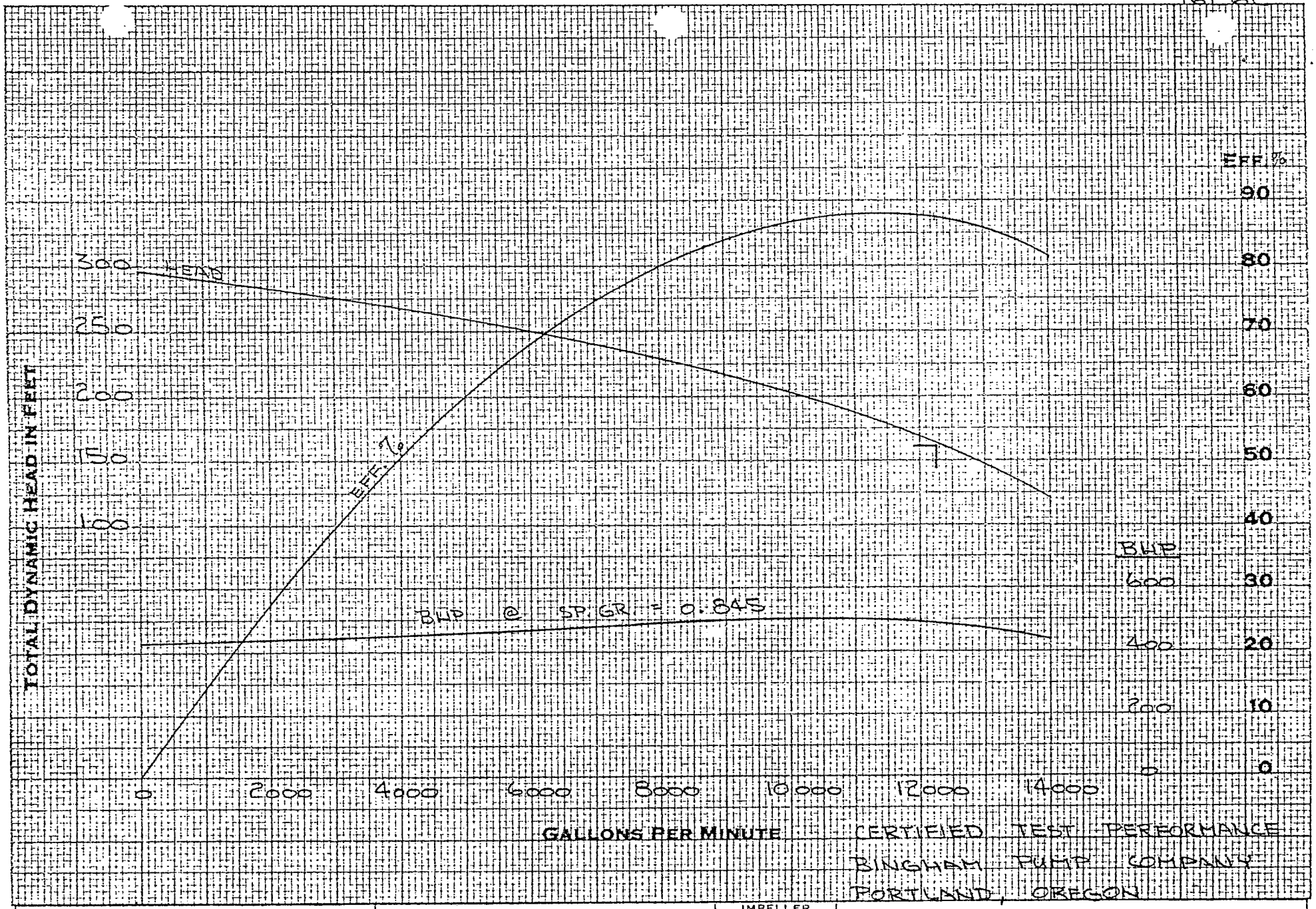
SPARE PARTS:

It is recommended that spare parts be purchased as an insurance against costly delays. The service in which the particular pump is used will determine the number of spare parts that may be required. The minimum spare parts recommended are:

1 Set of Shaft Sleeves (Parts 71 A & B)
1 Set of Case Wearing Rings (Parts 76)
1 Set of Packing Rings (Part 85)
1 Set of Impeller Wearing Rings (Part 74)
1 Set of Bearings (Parts 100 & 101)
1 Set of Bearing Lockwashers (Part 104)

If several duplicate units are installed, or if service is critical, it is recommended that in addition to the above, one complete rotating assembly be carried in stock.

When ordering spare parts, give SERIAL NUMBER AND TYPE of pump which is stamped on nameplate also PART NUMBER AND PARTS LIST DRAWING NUMBER.



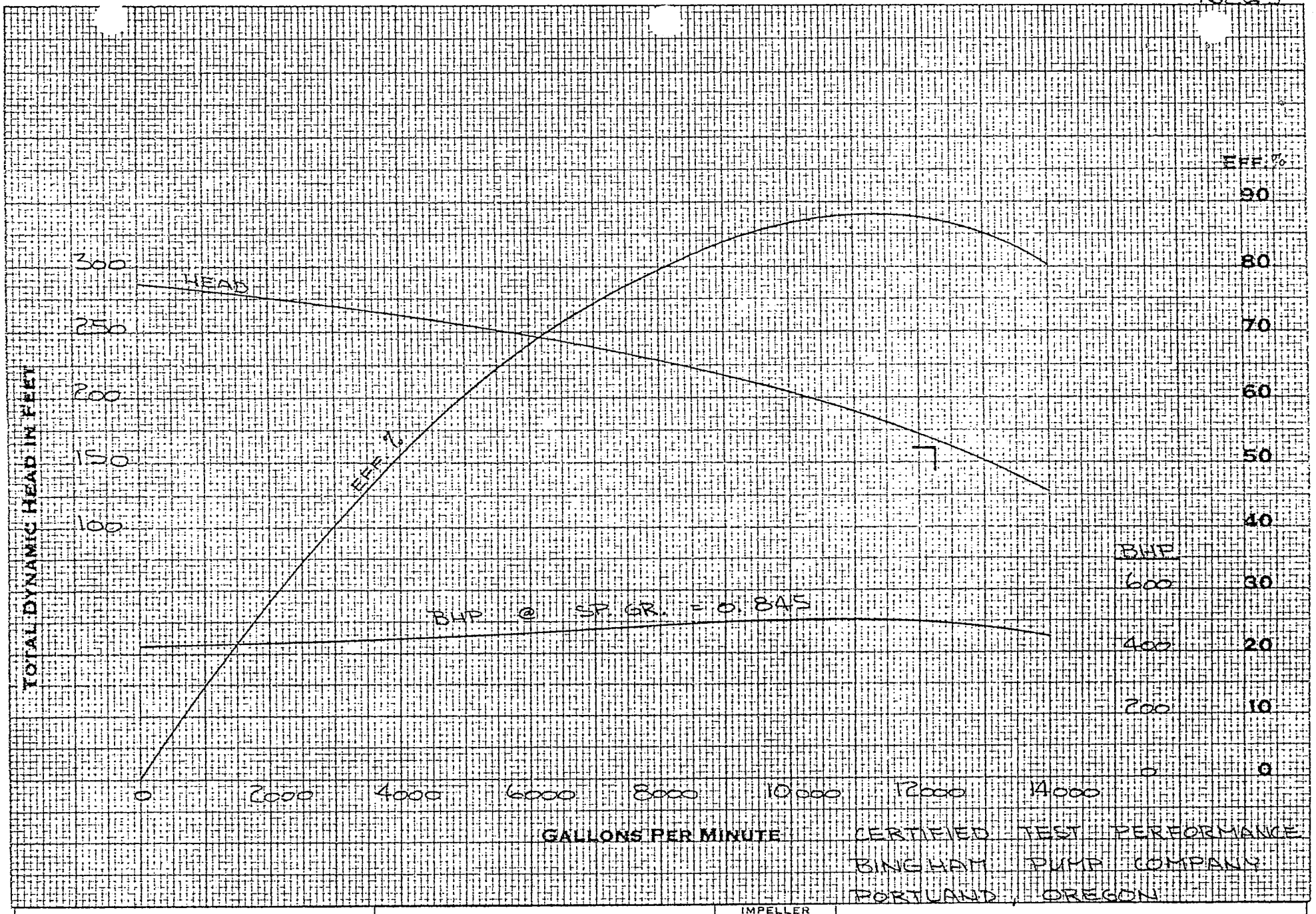
THE TEXAS COMPANY
ITEM NO. 22R-G2
PUMP NO. 33080

CHARACTERISTIC CURVE SHEET
BINGHAM PUMP CO.
PORTLAND OREGON
4-15-58 DEM

IMPELLER MAX. DIA. 17½ IN.	16 × 20 × 17 HSL PUMP		
MIN. DIA.	DIA. IMPELLER 17" × 16½"	IMPELLER PATT.	1760 R.P.M.
EYE SQ AREA 203.4 IN.	N.P.S.H. REQUIRED	REFERENCE	CURVE No. 16262

C-102

16263



THE TEXAS COMPANY ITEM NO. 22R-G3 PUMP NO. 33081	CHARACTERISTIC CURVE SHEET BINGHAM PUMP CO. PORTLAND OREGON 4-15-58 DEM	IMPELLER MAX. DIA. 17½ IN.	16 × 20 × 17 HSL	PUMP
		MIN. DIA.	DIA. IMPELLER 17" × 16½"	IMPELLER PATT.
		EYE AREA 203.4 SQ IN.	N.P.S.H. REQUIRED	REFERENCE
				1760 R.P.M.
				CURVE NO. 16263

CAGGIANI 22RGLS

CENTRIFUGAL PUMP DATA SHEET

POWER: VOLTS, 440
60 CYCLES, 3 PHASES,
STEAM: LBS./SQ. IN. GA.

SPECIFICATION NO. 2525-G-2-2. B. M. No. 2525-226-5

PUMP NO.	22R-G-13						
PLANT EQUIP. NO.							
A. LIQUID CHARACTERISTICS INTERMIT., SERVICE	75% PETROX 25% GASOLINE						
1. LIQUID PUMPED	HC						
2. GPM AT FLOW TEMP.	40						
3. SPEC. GRAV. AT FLOW TEMP.	0.730						
4. FLOW TEMP. °F.	80						
5. VISCOSITY AT FLOW TEMP. (SUS)	50						
6. VAPOR PRESS AT FLOW TEMP. (LBS./SQ. IN. ABS.)							
B. PRESSURES: (LBS./SQ. IN.)							
1. SUCTION AT PUMP (INCL. B-5) PSI ABSOLUTE	16.0						
2. DIFFERENTIAL PSI	100.0						
3. DISCHARGE PSI ABSOLUTE	116.0						
4. HYDROSTATIC TEST ON CASE (BY SUPPLIER)							
5. NET POSITIVE SUCTION HEAD (FT.)	FLOODED						
6. DIFFERENTIAL HEAD (FT.)	257	4					
C. OPERATION							
1. EFFICIENCY AT RATING	31						
2. BHP AT RATING	7.55						
3. MINIMUM IMPELLER DIA. (INS.)	5½						
4. BID IMPELLER DIA. (INS.)	8⅛						
5. MAXIMUM IMPELLER DIA. (INS.)	8½						
6. MAX. BHP FOR BID IMP. DIA.	12.2	4					
7. MAX. BHP FOR MAX. IMP. DIA.	13.8						
8. ENTRANCE VEL. AT RATING (FT./SEC.)	3.0						
9. NET POSITIVE SUCTION HEAD REQUIRED, FT.	4.7						
10. RPM	3550						
11. DIRECTION OF ROTATION: (FACING PUMP COUPLING) CCW CW	CCW						
11A NEMA MOTOR FRAME NO	3564						
12. NUMBER OF STAGES	1						
13. MAX. CASING WORKING PRESS (LBS./SQ. IN. GA.)	450						
D. CONSTRUCTION AND MATERIAL							
1 CASE: INNER							
OUTER	CI						
2. IMPELLER WEAR RINGS	BRONZE						
3. CASE WEAR RINGS	BRONZE						
4. SHAFT	SAE 4140 H.T.						
5. SHAFT SLEEVES	BRONZE						
6. IMPELLER	C.I.						
7. PACKING: TYPE. JOHN CRANE	MECH SEAL						
8. LANTERN RING	NONE						
9. THROAT BUSHING	BRONZE						
10. CASING GASKET	18-8 ASBESTOS FILLED						
11. CASING STUDS	SAE 4140						
12. GLAND BOLTS	18-8 SS						
13. FLEXIBLE COUPLING	FALK						
14. BASE PLATE EXTENDED FOR DRIVER	C.I.						
15. STAGE PIECES	NONE						
16. GLANDS	—						
17. SHAFT DIAMETER	2 1/16"						
18. SHAFT SLEEVES EXTEND THRU GLAND	YES						
MANUFACTURER'S TYPE & SIZE WILSON-SNYDER	1½x2x8 KL ES						

PUMP NO.	22R-G-13						
PLANT EQUIP. NO.							
SERVICE	75% PETROX 25% GASOLINE						
19. COUPLING GUARD NON SPARKING	YES						
20. STUFFING BOXES (JACKETED OR PLAIN)	JACKETED						
21. STUFFING BOXES - LENGTH INCHES	3 3/4						
22. STUFFING BOXES - INSIDE DIAM. INCHES	2 7/16						
23. DIAM. SHAFT SLEEVE INCHES	1 11/16						
24. WIDTH OF LANTERN RING INCHES	—						
25. C. L. LANTERN RING TO OPEN END OF STUFF. BOX IN.	1 15/16						
26. PACKING: NO. RINGS AND SIZE	—						
E. BEARINGS AND LUBRICATION							
1. THRUST: (SAE NO. ON FINAL DATA SHEET)	BALL						
2. RADIAL: (SAE NO. ON FINAL DATA SHEET)	BALL						
3.	GREASE PACKED	FLOOD OILING	RING OILING				
THRUST	A	B	C	C			
RADIAL	A	B	C	C			
4. TYPE OF CLOSURES	LABYRINTH						
5. METHOD OF SEALING	DEFLECTOR						
6. VISIBLE LUBRICATORS: TYPE	GITS						
7. VISIBLE LUBRICATORS: CAPACITY	4 OZ						
8. BEARINGS WATER COOLED	NO (COOL BY RECIRCULATION TO SEAL)						
F. CONNECTIONS							
1.A SUCTION: SIZE	2"						
1.B SUCTION: RATING	250 #						
1.C SUCTION: FACING	FF						
2.A DISCHARGE: SIZE	1½"						
2.B DISCHARGE: RATING	250 #						
2.C DISCHARGE: FACING	FF						
3. VENTS AND DRAINS ½" MINIMUM	½"						
G. TESTING STATE EXTRA COST, IF ANY, FOR EACH							
1. DYNAMIC BALANCING OF IMPELLERS	NO						
2. ~~WITNESSED~~ PERFORMANCE TEST NOT WITNESSED	YES						
3. HYDROSTATIC TEST	NO						
4. INSPECTION	NO						
5. RUNNING TEST WITH ACTUAL DRIVER	NO						
H. MISCELLANEOUS							
1. PRICE EACH FOB FAS AT BLADDOCK, PA	BOHEN						
2. WEIGHT (LBS.) NET	550						
2.A WEIGHT, BOXED FOR SHIPMENT	600						
3. SHIPMENT FROM RCPT. OF ORDER, WEEKS	14-16 WKS.						
4. SUCTION: DOUBLE OR SINGLE	SINGLE						
5. DRIVER HP	15						
6. TYPE OF DRIVER: MOTOR ~~GAS ENGINE~~	G.E. EXP. PROOF - FURN. BY PURCHASER.						
7. DRIVER: INTEGRAL, COUPLED	COUPLED						
8. PERFORMANCE CURVE (MANUFACTURER'S NO.)	R 973						
8.A " " (FOREIGN PRINT NO.)							
9. OUTLINE DRAWING (MANUFACTURER'S NO.)	S-50005						
9.A " " (FOREIGN PRINT NO.)							
10. CROSS SECTION DWG. (MANUFACTURER'S NO.)	S-50000						
10.A " " " (FOREIGN PRINT NO.)							
11. MFRS. SERIAL NO. (ON FINAL DATA SHEET)	6685	4					

APPROVED
FOR CONSTRUCTION
JAN 1 1 1958
BECHTEL CORPORATION
S. F. REFINERY DIVISION

INSTRUCTIONS TO BIDDERS — FILL IN EVERY SPACE FOR EACH PUMP TO MAKE BID COMPLETE.

FORM 129 REV. 7-56-2M JPCO.

BECHTEL CORPORATION SAN FRANCISCO	REV.	DATE				DATE			
	3	9-5-57	REINSTATED PER TW-2003-R & ISSUED FOR QUOTATIONS	JAT	VP	1/10/57	REV. PER FINAL MFRS. DATA SHEET	VP	
	2	7/29/57	DWG. CANCELLED JUNE 1956 NOTES	LWT	VP	11/6/57	REV. WHERE NOTED & ADDED MFGR'S DATA - ISSUED FOR PURCHASE	VP	
	1	6/28/57	ISSUED FOR APPROVAL & QUOTES	LWT	VP				

WHARF PETROX PUMP 22RG-13
THE TEXAS Co. PUGET SOUND WORKS

JOB NO. 2525 REV.
DWG. NO. DS-226-6 4

*THIS DATA SHEET WAS APPROVED PER TL-879-R

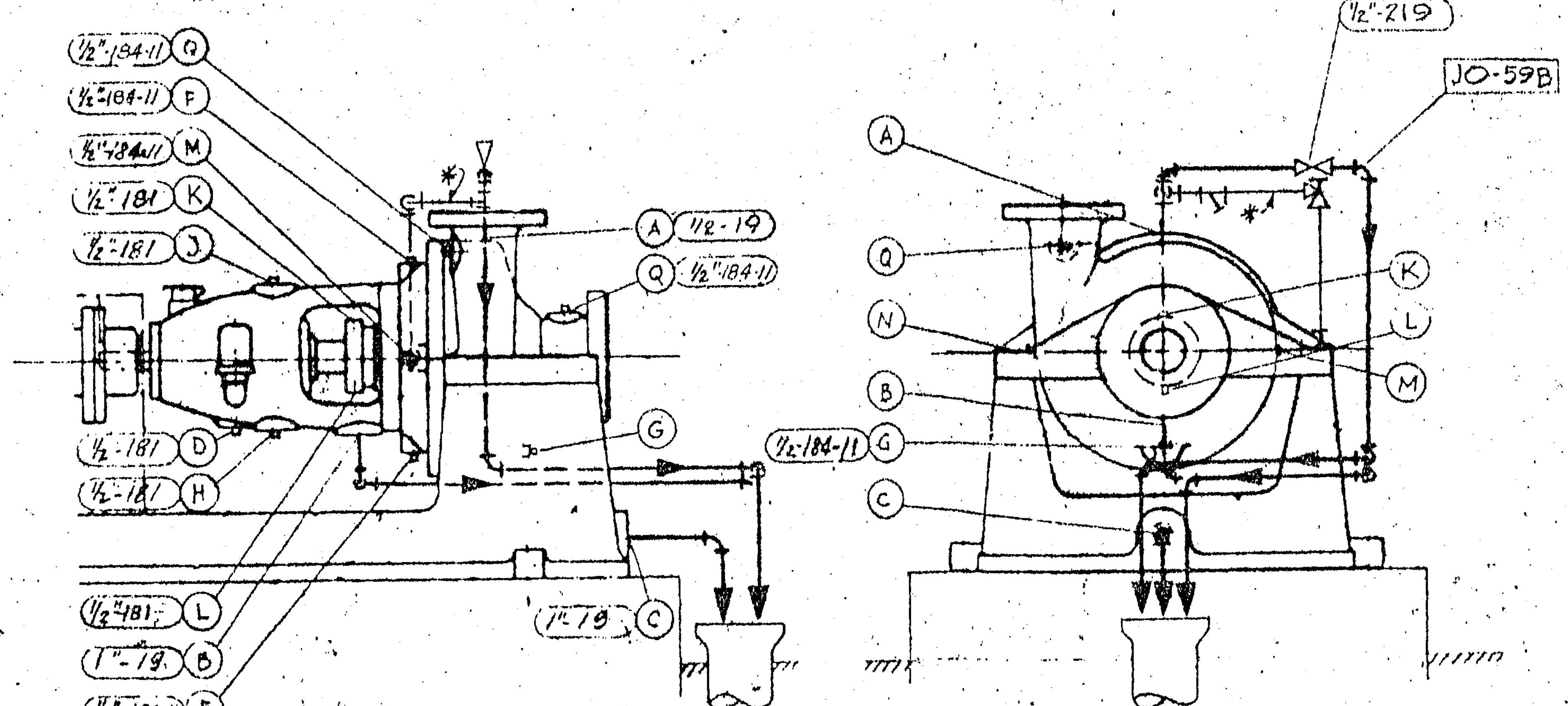
WIL-SNY 'ES'

PUMP (B)

JO-51B

* RECIRCULATION PIPING SUPPLIED BY VENDOR

J. BEARING COOLING WATER OUTLET
K. MECH. SEAL QUENCH INLET
L. MECH. SEAL QUENCH OUTLET
M. LANTERN RING INLET
N. LANTERN RING OUTLET
Q. GAGE CONN.

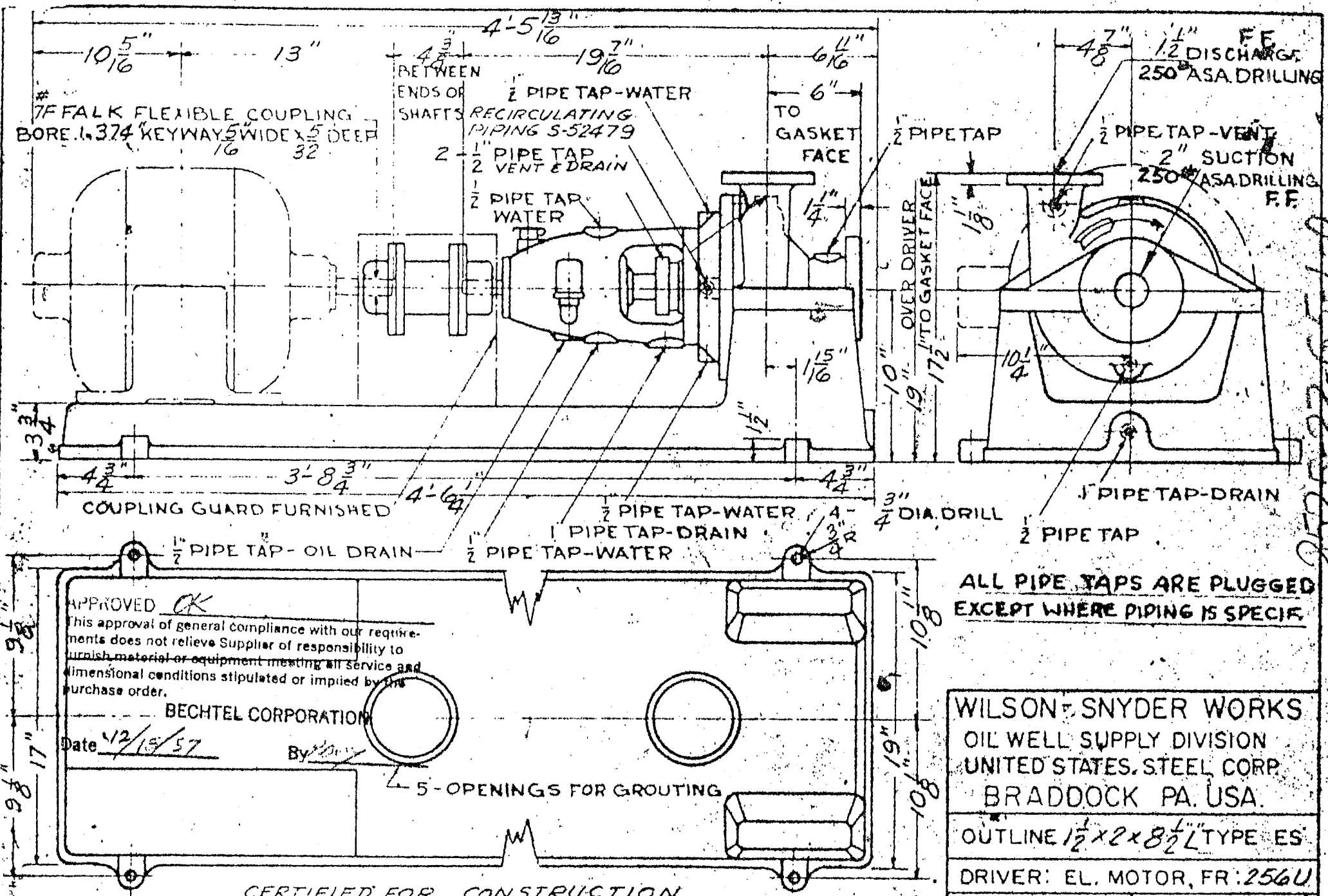


AUXILIARY

BECHTEL

THE T
PUG

REV.				REV.							PLANT NO.	BLOCK NO.	AREA NO.	JOB NO.
△				△	3/	ISSUED FOR CONSTRUCTION	M	WJH	VP		22			2525



APPROVED OK
This approval of general compliance with our requirements does not relieve Supplier of responsibility to furnish material or equipment meeting all service and dimensional conditions stipulated or implied by the purchase order.
BECHTEL CORPORATION
Date 12/18/57 By

ALL PIPE TAPS ARE PLUGGED EXCEPT WHERE PIPING IS SPECIF.

WILSON-SNYDER WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL CORP.
BRADDOCK PA. USA.

OUTLINE 1 1/2 x 2 x 8 1/2 L TYPE ES		
DRIVER: EL. MOTOR, FR: 256U		
BASE 50148-8	CASE: 51092	
DRN. NLK	CKD. NLK	DATE 11-29-57

S-52639 1/8

CERTIFIED FOR CONSTRUCTION
BECHTEL CORP. FOR THE TEXAS CO.
BECHTEL JOB NO: 2525-22-G-5 ITEM NO: 22R-G13
W.S. JOB NO: 7J-9601 PUMP NO: 6685 SERVICE: PETROX ADDITIVE
NOVEMBER 29 1957 PER: W.L. Klasnick

CENTRIFUGAL PUMP PERFORMANCE CURVE

APPROVED ✓ Date 5/7/58 By

This approval of general compliance with our requirements does not relieve Supplier of responsibility to furnish material or equipment meeting all service and dimensional conditions stipulated or implied by the purchase order.

BECHTEL CORPORATION

CUSTOMER BECHTEL FOR
CUSTOMER ORDER No THE TEXAS CO
CUSTOMER JOB No 2525-22-G-5
CUSTOMER ITEM No 22R-G13

CERTIFIED
W.O. Bradley
3-19-58

F.P. 2525-22-G-5-7-0

DIFFERENTIAL HEAD IN FEET

300
250
200
150
100

Characteristic

EFF %

BHP at Sp. Gr. - 90

NPSH WATER

20 40 60 80 100

GALLONS PER MINUTE 6400 R

90 80 70 60 50 40 30 20 10 0

EFFICIENCY - PER CENT

10 20 0

BRAKE HORSE POWER

15 10 5 0

REQD NPSH IN FEET

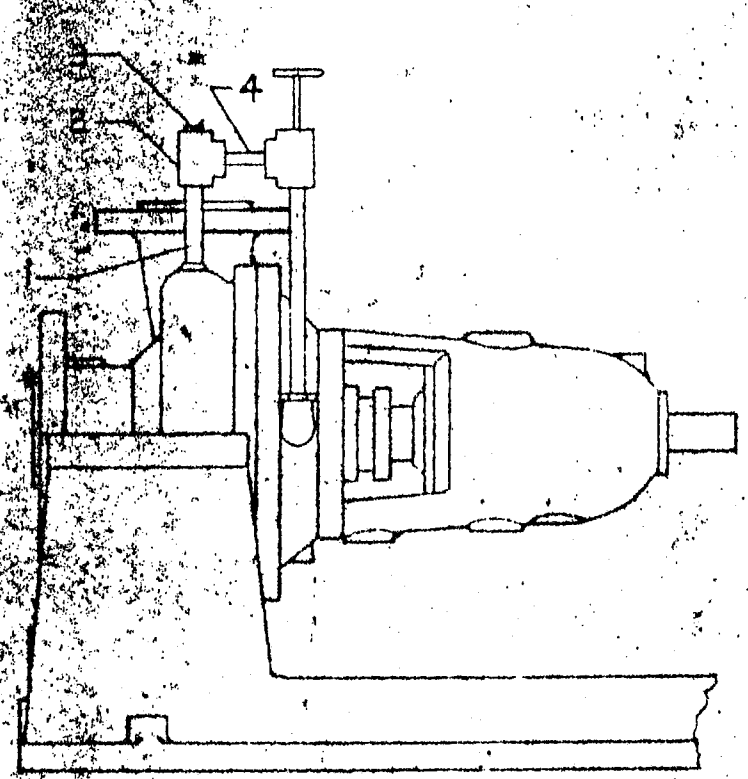
SIZE & TYPE 1½ x 2 x 8½ LCS
R. P. M. 3550
IMPELLER 5 1/16 DIA. 8 5/8
EYE AREA

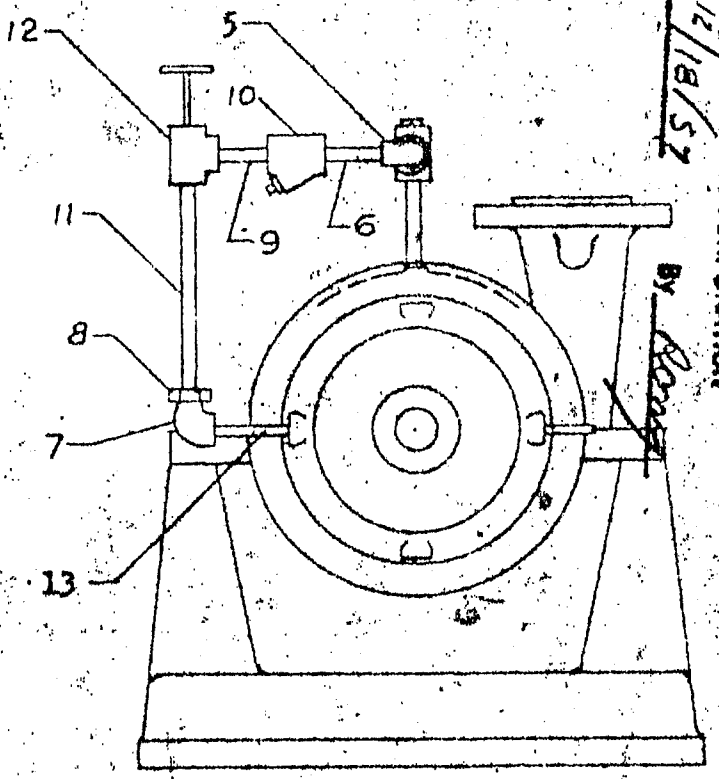
WILSON-SNYDER WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL CORPORATION
BRADDOCK, PA.

J 7601
DATE 3-14-1958
PUMP SERIAL No. 6685
CURVE No. T6685

2525-22-G5-2-0

ALL PIPING SCHEDULE 160
FITTINGS 3000#





APPROVED
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Date 12/18/57 OK
BECHTEL CORPORATION
By

Sym.	Pc.	DESCRIPTION	Sym.	Pc.	DESCRIPTION	Sym.	Pc.	DESCRIPTION
1	1	1/2"Nipple,Lgth. to suit -Stl.	5	1	1/2" Elbow F.S.	11	1	1/2"Nipple,Lgth.to Suit Stl.
2	1	1/2" Screw End Tee F.S.	6	1	1/2"Nipple,Lgth. to suit Stl.	12	1	1/2"Angle Valve Chr.Trim F.S.
3	1	1/2"Pipe Plug -Vent Conn. F.S	7	1	1/2" Street Ell F.S.	13	1	1/2"Nipple, Lgth. to suit Stl.
4	1	1/2"Nipple,Lgth.to suit Stl.	9	1	1/2"Nipple,Lgth. to suit Stl.			
A	1	1/2" Female Union Stl.	10	1	1/2"Y"Type Strainer,Alloy Basket F.S.			

MATERIAL

UNLESS OTHERWISE SPECIFIED
DECIMAL ± .005 FRACTIONAL ± 1/64

SYM	WAS ORIGINALLY	CHG. BY	DATE

REVISIONS

FROM | REFERENCE DRAWING NO.
TO FOLLOWING DRAWING NO. | SUPERSEDED BY DRAWING NO.

WILSON-SNYDER WORKS OILWELL SUPPLY DIV.
BRADDOCK, PA. U.S.A.

Recirculating Piping with Needle Pt. Valve for Single Mechanical Seals

DRAWN	CHKD
NLK	NLK
DATE 11-20-57	SCALE NTS

S-52479 1/8

INSTRUCTIONS TO BIDDERS – FILL IN EVERY SPACE FOR EACH PUMP TO MAKE BID COMPLETE.

5. VISCOSITY AT FLOW TEMP. (SUS)						
6. VAPOR PRESS AT FLOW TEMP. (LBS./SQ. IN. ABS.)	.21	7.0	27.5	7.2	1.25	2.8
B. PRESSURES: (LBS./SQ. IN.)						
1. SUCTION AT PUMP (INCL. B-5) PSI ABSOLUTE	31.5	14.9	39.6	21.9	24.9	15.6
2. DIFFERENTIAL	650	81.6	56.9	77.8	74.8	84.1
3. DISCHARGE PSI ABSOLUTE	965	96.5	96.5	99.5	99.7	99.7
4. HYDROSTATIC TEST ON CASE (BY SUPPLIER)	600	600	600	600	600	600
5. NET POSITIVE SUCTION HEAD (FT.)	Flooded	27	8.6	Flooded	Flooded	Flooded
6. DIFFERENTIAL HEAD (FT.)	183	276	234	268	245	274
C. OPERATION						
1. EFFICIENCY AT RATING	72.5	65	52	65	72.5	65
2. BHP AT RATING	26	29.2	6.42	27.9	24.1	15.1
3. MINIMUM IMPELLER DIA. (INS.)	6 1/2	8 1/2	5 1/2	8 1/2	5 1/2	
4. BID IMPELLER DIA. (INS.)	7 3/4	8 1/2	8	8 3/4	7 3/4	8 1/16
5. MAXIMUM IMPELLER DIA. (INS.)	8 1/2	10 1/2	8 1/2	10 1/2	8 1/16	8 1/16
6. MAX. BHP FOR BID IMP. DIA.	33	37.5	7.5	36	27	19
7. MAX. BHP FOR MAX. IMP. DIA.	41	46	44.8	68	33.5	28.8
8. ENTRANCE VEL. AT RATING (FT./SEC.)	10.4	8.9	7.7	8.9	14.1	12.4
9. NET POSITIVE SUCTION HEAD REQUIRED, FT. (WATER)	9	8	6	8	14	12.5
10. RPM	3550	3550	3550	3550	3500	3500
11. DIRECTION OF ROTATION: CCW (FACING PUMP COUPLING) CW	CCW	CCW	CCW	CCW	CCW	CCW
11A MOTOR NEMA FRAME No.	324S	405S	215	405S	326S	256U
12. NUMBER OF STAGES	1	1	1	1	1	1
13. MAX. CASING WORKING PRESS (LBS./SQ. IN. GA.)	400	400	400	400	400	400
D. CONSTRUCTION AND MATERIAL						
1 CASE: INNER						
OUTER	CI					
2. IMPELLER WEAR RINGS	Brz					
3. CASE WEAR RINGS	Brz.					
4. SHAFT	SAE 4140H				STEEL	
5. SHAFT SLEEVES	Brz.					
6. IMPELLER	CI					
7. PACKING: TYPE. JOHN CRANE	Mech Seal					
8. LANTERN RING	NONE					
9. THROAT BUSHING	Brz.					
10. CASING GASKET	ARMORED				ALUMINUM	
11. CASING STUDS	SAE 4140					
12. GLAND BOLTS	18-8 S.S.				18 CR.	
13. FLEXIBLE COUPLING SPACER TYPE	FALK				WOODRON	
14. BASE PLATE Extended for Driver	CA				WELD STL.	
15. STAGE PIECES	NONE					
16. GLANDS	SAE 1040	Bronzed Bushed				
17. SHAFT DIAMETER	2 9/16	2 9/16	2 9/16	2 9/16	1.31	1.31
18. SHAFT SLEEVES EXTEND THRU GLAND	Yes					
MANUFACTURER'S TYPE & SIZE	3x4x8 VS	3x4x10½ VS	1½x2x8½ VS	3x4x10½ VS	3 BF LM 1P	2 EF LM 1-R

24. WIDTH OF LANTERN RING INCHES	5/8	5/8				
25. C. L. LANTERN RING TO OPEN END OF STUFF. BOX IN.	2 3/8	2 3/8				
26. PACKING: NO. RINGS AND SIZE	MECH. SEAL					
E. BEARINGS AND LUBRICATION						
1. THRUST: (SAE NO. ON FINAL DATA SHEET)	5311	5311	5311	5311	5311	5311
2. RADIAL: (SAE NO. ON FINAL DATA SHEET)	6207	6307	6307	6307	6307	6307
3. THRUST: GREASE PACKED A / FLOOD OILING B / RING OILING C	C	C				
RADIAL: A / B / C	C	C				
4. TYPE OF CLOSURES	LABYRINTH	LABYRINTH				
5. METHOD OF SEALING	DEFLECTO					
6. VISIBLE LUBRICATORS: TYPE	GLASS					
7. VISIBLE LUBRICATORS: CAPACITY	1 OZ					
8. BEARINGS WATER COOLED	NONE	NONE				
F. CONNECTIONS						
1.A SUCTION: SIZE	4"	4"				
1.B SUCTION: RATING	250#	250#				
1.C SUCTION: FACING	FF	FF				
2.A DISCHARGE: SIZE	3"	3"				
2.B DISCHARGE: RATING	250#	250#				
2.C DISCHARGE: FACING	FF	FF				
3. VENTS AND DRAINS ½" MINIMUM	1/2"	1/2"				
G. TESTING						
STATE EXTRA COST, IF ANY, FOR EACH						
1. DYNAMIC BALANCING OF IMPELLERS	Yes					
2. ~~WITNESSED~~ PERFORMANCE TEST (Non witnessed)	Yes					
3. HYDROSTATIC TEST (Non witnessed)	Yes					
4. INSPECTION	Yes					
5. RUNNING TEST WITH ACTUAL DRIVER	No					
H. MISCELLANEOUS						
1. PRICE EACH ** FOB PUMP PEBBLE HILL, N.J. ~~FOB~~ ~~FAS~~ * BERWICK, PA.	*$1076.00	*$1119.00				
2. WEIGHT (LBS.) NET	900	1000				
2.A WEIGHT, BOXED FOR SHIPMENT	950	1050				
3. SHIPMENT FROM RCPT. OF ORDER, WEEKS	1-4-16	14-16				
4. SUCTION: ~~DOUBLE OR~~ SINGLE END	SINGLE					
5. DRIVER HP	30	40				
6. TYPE OF DRIVER: MOTOR OR TURBINE (by purchaser)	M	M				
7. DRIVER: INTEGRAL, COUPLED	C	C				
8. PERFORMANCE CURVE (MANUFACTURER'S NO.)	T-5595	T-5595	T-			
8.A " " (FOREIGN PRINT NO.)	24-GIA-27	24-GIA-35	24			
9. OUTLINE DRAWING (MANUFACTURER'S NO.)	S-58559	S-58561	S-			
9.A " " (FOREIGN PRINT NO.)	24-GIA-1	24-GIA-2	24-			
10. CROSS SECTION DWG. (MANUFACTURER'S NO.)	S-50005					
10.A " " " (FOREIGN PRINT NO.)	46-GI-4					
11. MFRS. SERIAL NO. (ON FINAL DATA SHEET)	6565	6566	6			

FORM 129 REV. 7-58-2M JFCO.

BECHTEL CORPORATION
SAN FRANCISCO

REV.	DATE							DATE						
3	4-3-58	COMPLETE MFG. DATA ISSUED FOR RECORD	GDH		WSF	TWF	3							
2	8/16/57	ISSUED FOR PURCHASE ITEM TW-1143-A	EKB	MS	WSF	TWF	2	4-11-74	REVISED 3600 RPM	JPL				
1	6/12/57	Issued for Approval & Quote	HPB	MS	WSF		1							

PRODUCT BLENDING PUMP
THE TEXAS CO. PUGET SOUND

FORM ENG-4 (9-68) 300M

TEXACO INC.

SHEET NO.

DATE 9-15-20

LOCATION EST. NO. BY

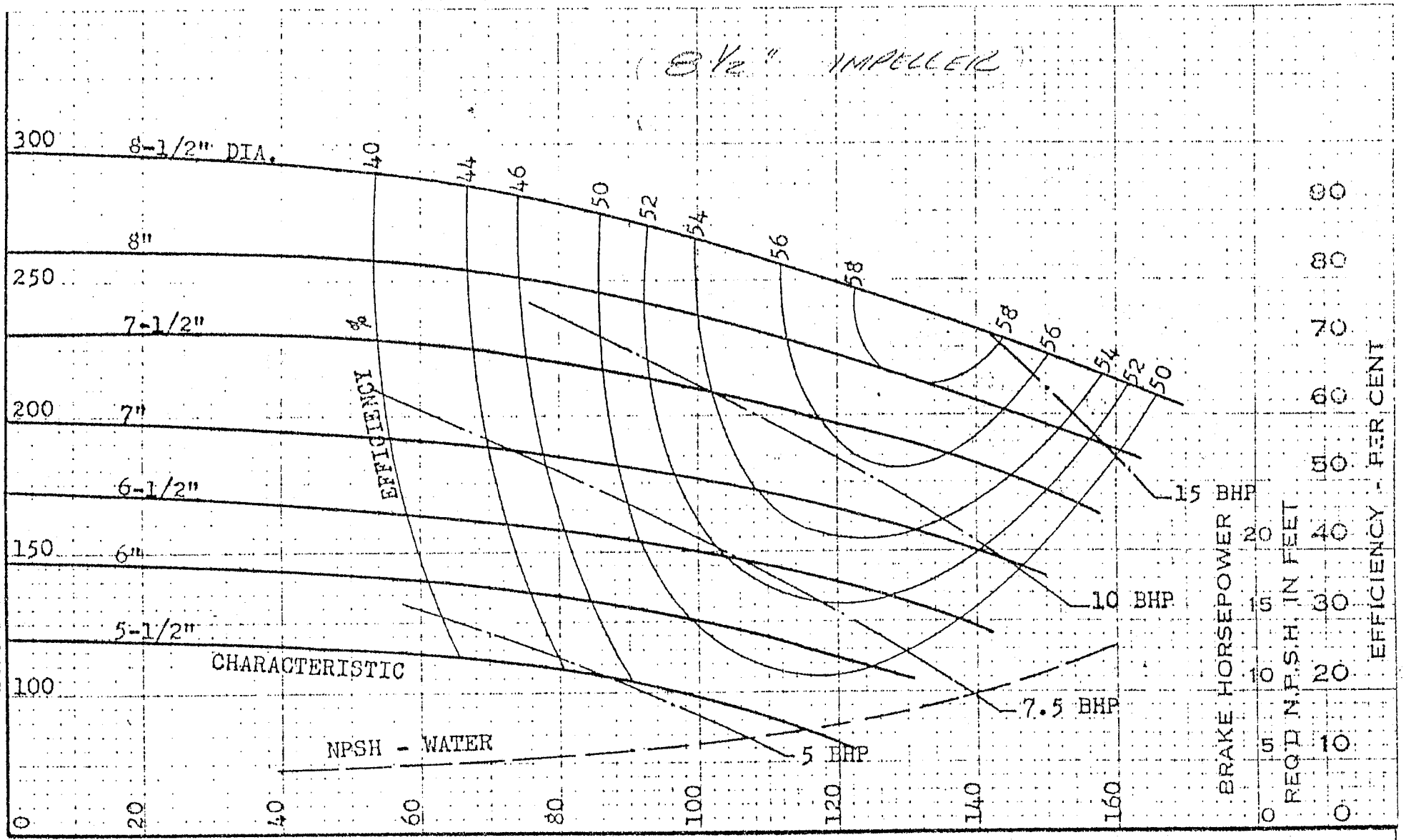
SUBJECT C'K'D

APP'D

CHANGED TO 22R-G16

PER BM 1483-A

CENTRIFUGAL PUMP PERFORMANCE CURVE

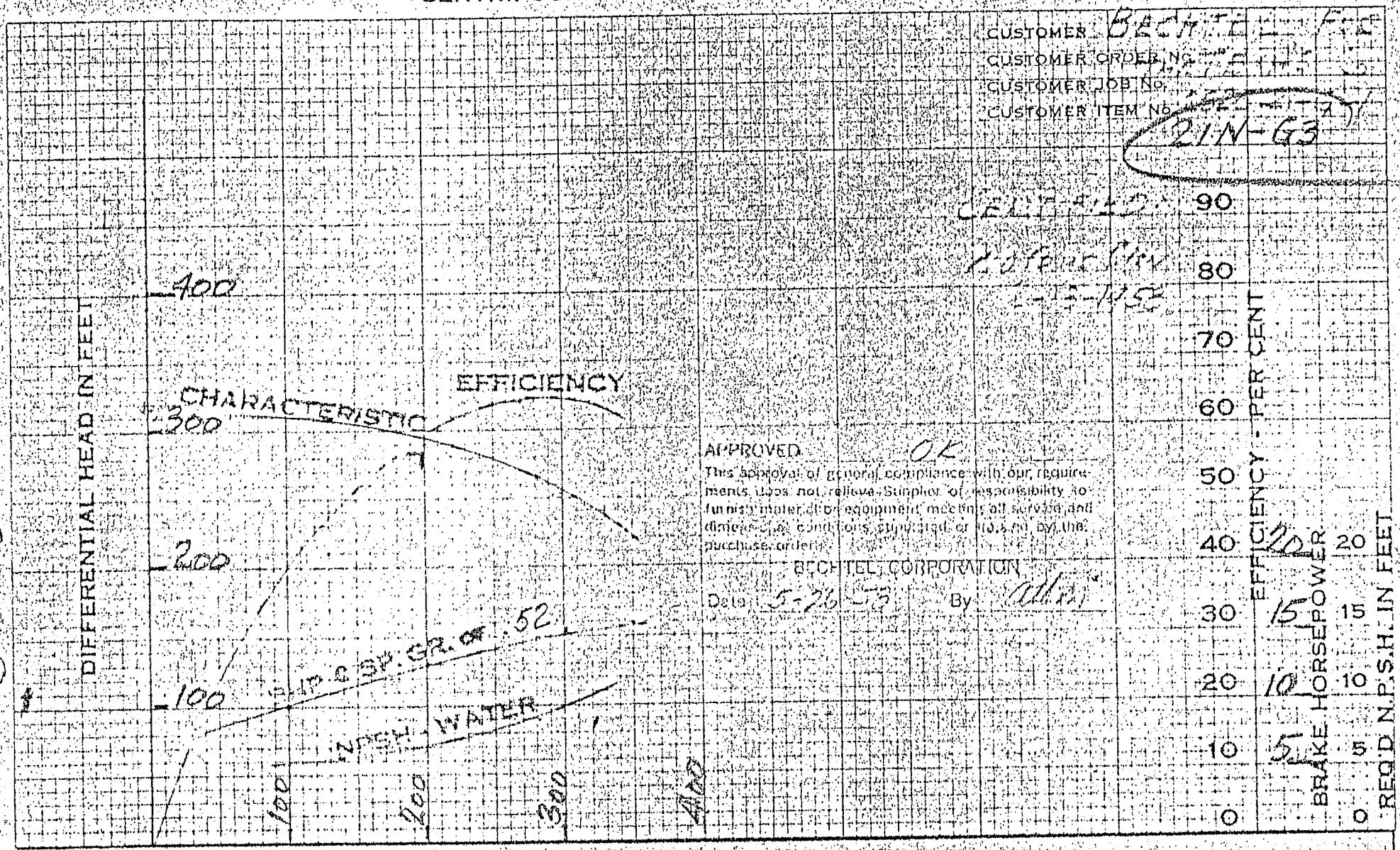


WILSON-SNYDER WORKS OIL WELL SUPPLY DIVISION UNITED STATES STEEL CORP. BRADDOCK, PA.	SIZE 1½ x 2 x 8½ "L"	RPM 3550	CUSTOMER TEXACO
	TYPE ES	IMPELLER 29-010-064 DIA. VAR.	ORDER NO. LA-36217
	ITEM NO. 24N-G3	EYE AREA 3.7 SQ. IN.	CERTIFIED BY EST. 7261 BM-229
	DATE 7-15-58	DRIVER HORSEPOWER	CURVE NO. 29-010-302

NOTE: THIS CURVE REPLACES ORIGINAL W-S CURVE NO. T-6597

O-10-A-10-72-2252

CENTRIFUGAL PUMP PERFORMANCE CURVE



CUSTOMER Bechtel

CUSTOMER ORDER No.

CUSTOMER JOB No.

CUSTOMER ITEM No. 21N-G3

CELL 4-2

APPROVED OK

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BECHTEL CORPORATION

Date 5-28-53 By

SIZE & TYPE 2X3X10½ ES

R.P.M.

IMPELLER DIA 8 5/8

EYE AREA

WILSON-SNYDER WORKS

OIL WELL SUPPLY DIVISION

UNITED STATES STEEL CORPORATION

BRADDOCK, PA.

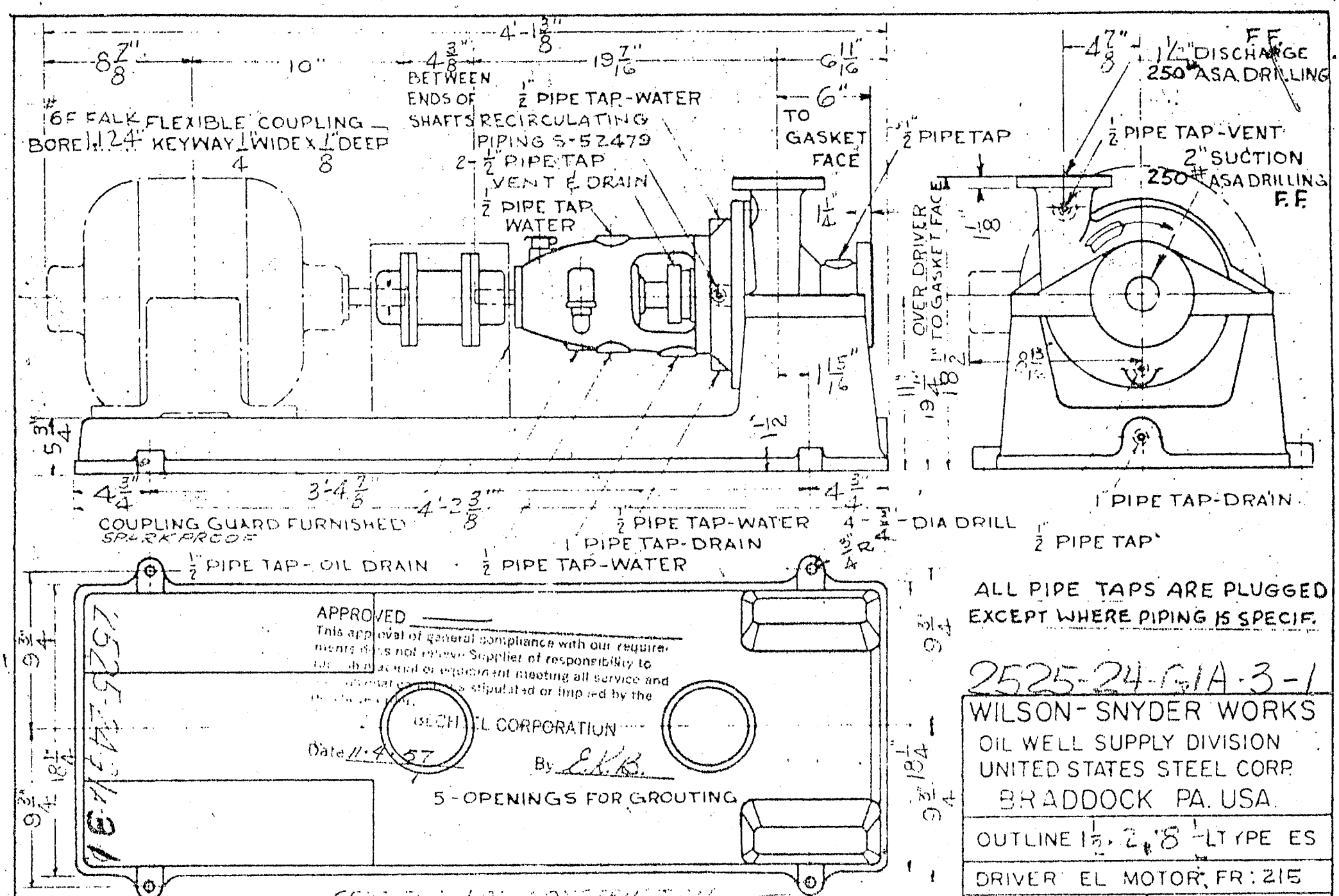
DATE 2-12-53

PUMP SERIAL No. 6630

CURVE No. T6630

W 384 REV. 15-

1-8-1-5-12-52



ALL PIPE TAPS ARE PLUGGED EXCEPT WHERE PIPING IS SPECIF.

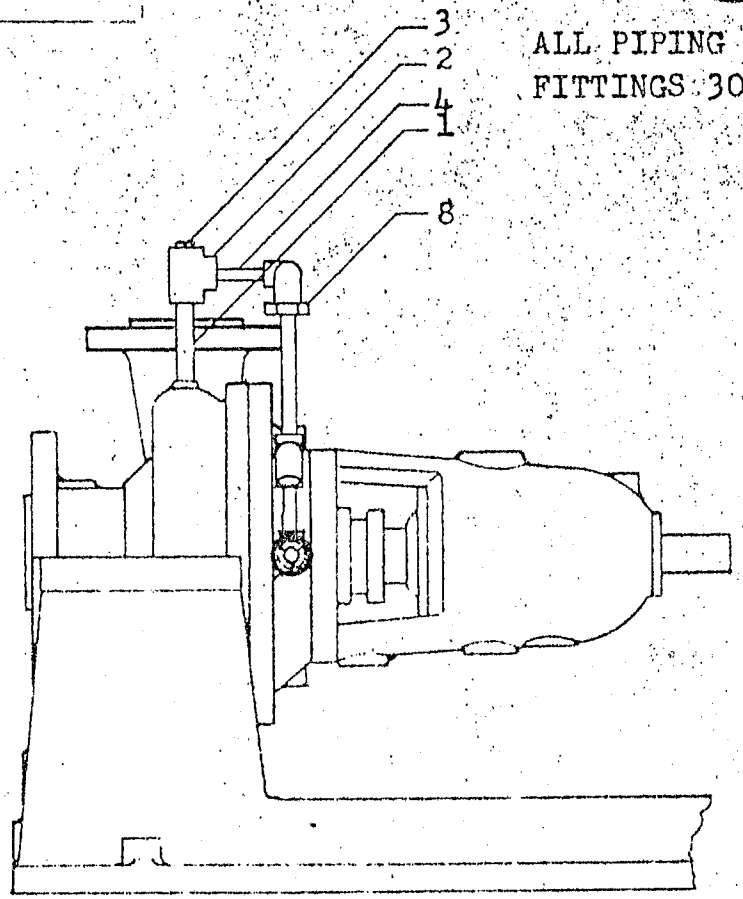
2525-24-G1A-3-1

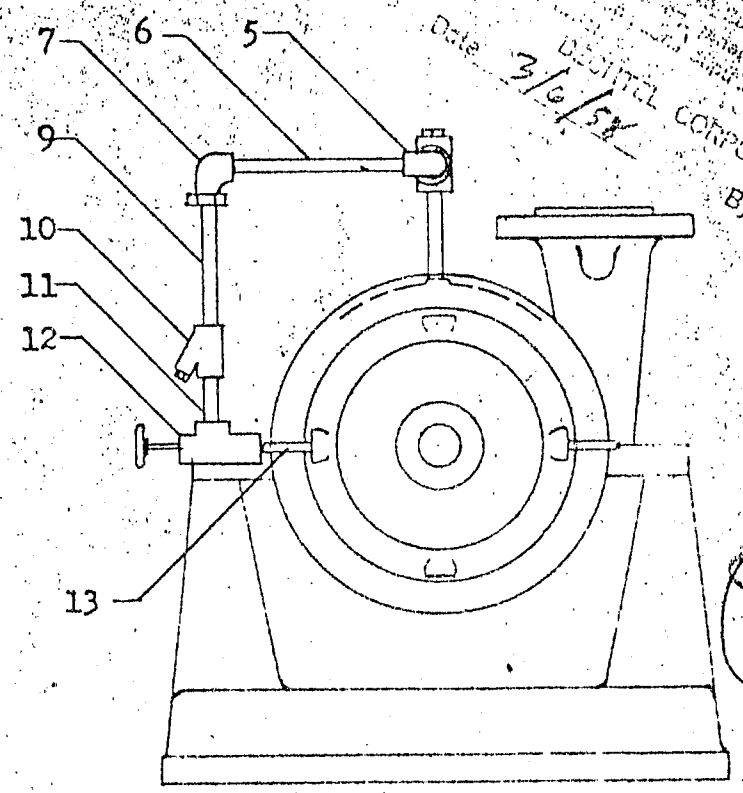
WILSON-SNYDER WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL CORP
BRADDOCK PA. USA

OUTLINE 1 1/2 - 2 - 8 1/2 - LT YPE ES		
DRIVER EL MOTOR, FR: 215		
BASE SO...		CASE 5...92
DR'N.	CK'D. N.K.	DATE 10-25-57

S-52609 1/8

ALL PIPING SCHEDULE 160
FITTINGS 3000#





APPROVED
This approval of Buyer's requirements does not relieve Seller of responsibility to furnish correct dimensions and
Date 3/6/58
DEMING CORPORATION
By

24N-G3
24N-G7

Sym.	Pc.	DESCRIPTION	Sym.	Pc.	DESCRIPTION	Sym.	Pc.	DESCRIPTION
1	1	1/2"Nipple, Lgth. to suit -Stl.	5	1	1/2" Elbow. F.S.	11	1	1/2"Nipple, Lgth. to Suit Stl.
2	1	1/2" Screw End Tee F.S.	6	1	1/2"Nipple, Lgth. to suit Stl.	12	1	1/2"Angle Valve Chr. Trim F.S.
3	1	1/2"Pipe Plug -Vent Conn. F.S.	7	1	1/2" Street Ell F.S.	13	1	1/2"Nipple, Lgth. to suit Stl.
4	1	1/2"Nipple, Lgth. to suit Stl.	9	1	1/2"Nipple, Lgth. to suit Stl.			
8	1	1/2" Female Union Stl.	10	1	1/2""Y"Type Strainer, Alloy Basket F.S.			

6400 N

WILSON-SNYDER WORKS

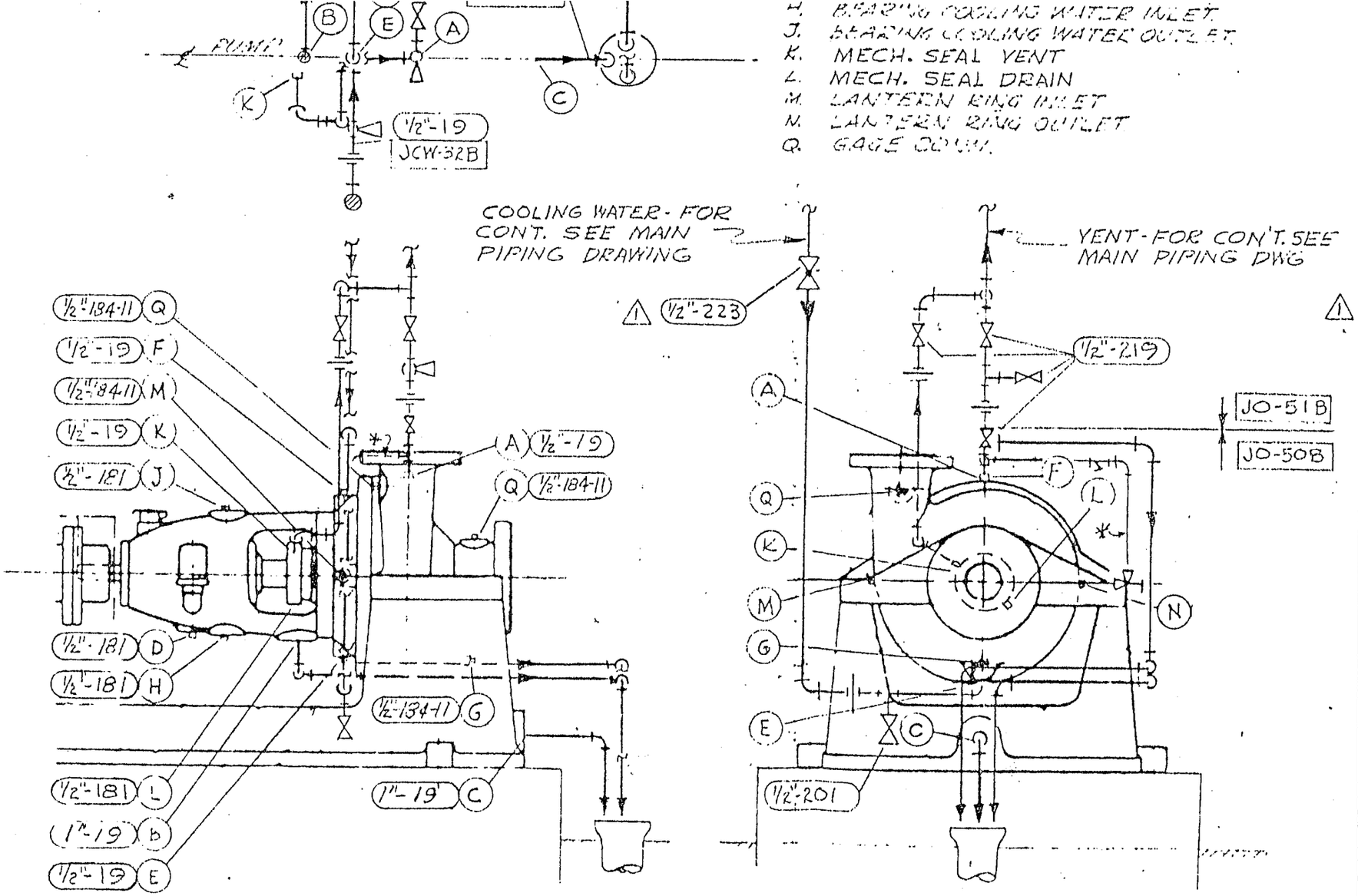
Recirculating Piping with Needle Pt. Valve for Single Mechanical Seals.

R.R.K.
8-6-57 NTS

S-52479

25525-21A-G1-1

WIL - SNY '55



H. BEARING COOLING WATER INLET
J. BEARING COOLING WATER OUTLET
K. MECH. SEAL VENT
L. MECH. SEAL DRAIN
M. LANTERN RING INLET
N. LANTERN RING OUTLET
Q. GAGE CONN.

NOTE: LOCATE ALL VALVES & UNIONS FOR ACCESS TO & DISMANTLING OF PUMP

4 1 10 3
4 2 19
4 1 18
4 1 23
4 1 87 7
4 1 61
4 1 68
4 2 01
4 1 16
4 2 23

APPROVED FOR CONSTRUCTION
MAR 25 1958
BECHTEL CORPORATION
S. F. REFINERY DIVISION
ENGINEERING DEPT.

AUXILIARY

BECHTEL

BECH

THE TE
PUGE

REV.							REV.											
	△							△	2	ADDED GLOBE ON C.W. INLET	DJ			PLANT NO.	BLOCK NO	AREA NO.	JOB NO	
	△							△	1	ISSUED FOR CONSTRUCTION	DJM			24	20		2525	

Replacement 22R-G13-PSP 4606
22R-G16-PSP 4608

RETROFIT SECTIONAL

PART NO.	NAME OF PART
1	CASING
3	IMPELLER
4A	WEARING IMP. FRONT
4B	WEARING IMP. BACK
6A	WEARING CASING & CASING COVER
10	SHAFT
11	KEY - IMPELLER
12	KEY - COUPLING
31	OIL RING
50	OIL THROWERS
82	LOCK SCREW
88	STUFFING BOX BUSHING
118A	HEX. CAP SCREWS - END COVER TO BEARING HOUSING - PUMP END
118B	HEX. CAP SCREWS - END COVER TO BEARING HOUSING - CPLG END
118C	HEX. CAP SCREWS - BEARING HOUSING TO CASING COVER
157	FLINGER - PUMP SIDE & COUPLING SIDE
159	BEARING HOUSING
160A	END COVER - BEARING HOUSING - PUMP END
160B	END COVER - BEARING HOUSING - CPLG END
177	IMPELLER CAP SCREW
178A	STUDS - MAIN BOLTING
178B	STUDS - GLAND
204	BALL BEARING - THRUST
205	BALL BEARING - RADIAL
216A	GASKET - END COVER - PUMP END
216B	GASKET - END COVER - CPLG END
240	LOCK NUT - THRUST BEARING
241A	LOCKWASHER - IMPELLER
241B	LOCKWASHER - THRUST BEARING
246	WASHER - IMPELLER
257A	SHIM - THRUST BEARING
257B	SHIM - THRUST BEARING
257C	SHIM - THRUST BEARING
259A	SET SCREWS WEARING
259B	SET SCREWS - FLINGERS
259C	SET SCREWS - OIL THROWERS
363	GASKET - CASING COVER TO CASING
394	CASING COVER
429	MECH SEAL - SEE SEAL ASSEMBLY DRAWING
766A	CAP NUT MAIN BOLTING
766B	HEX. NUTS - GLAND BOLTING

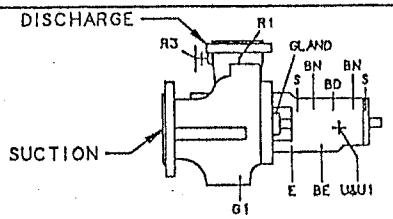
2F P. 22-620-8

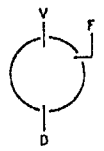
-PUMP CONNECTIONS FURNISHED AS FOLLOWS:

2.00 - 300# ANSI R.F. SUCTION
1.50 - 300# ANSI R.F. DISCHARGE

-AUXILIARY PUMP CONNECTIONS FURNISHED AS FOLLOWS:
••• PIPED BY IDP CO.
•• PIPED BY PURCHASER (PLUGGED FOR SHIPMENT)
• PLUGGED

••• BD	Ø.25NPT	BRG HSG-VENT/BREATHER CAP
• BE	Ø.5ØNPT	BEARING HOUSING DRAIN
• BN	Ø.5ØNPT	BRG HSG OIL FILL W/OIL RING INSP. PORT
D	Ø.5ØNPT	MECH. SEAL GLAND-DRAIN - MUST REMAIN OPEN DURING OPERATION
•• E	Ø.5ØNPT	BEARING BRACKET DRAIN
••• F	Ø.5ØNPT	MECH. SEAL-FLUSH INLET
• G1	Ø.75NPT	CASING DRAIN
• R1	Ø.75NPT	CASING VENT
••• R3	Ø.5Ø FLG.	DISCHARGE-SEAL PIPING CONN.
• S	Ø.25NPT	NON-FUNCTIONAL
• U	Ø.5ØNPT	NON-FUNCTIONAL
• U1	1.5ØNPT	NON-FUNCTIONAL
•• V	Ø.5ØNPT	MECH. SEAL GLAND-VENT OR QUENCH





MECHANICAL SEAL GLAND

-ALL DIMENSIONS IN INCHES.
TOLERANCE ± .12 UNLESS OTHERWISE SPECIFIED.
-THIS DRAWING IS NOT TO SCALE - WORK FROM DIMENSIONS.
-READ INSTRUCTION BOOK BEFORE LIFTING, INSTALLING, ALIGNING, AND STARTING (OR ROTATING) EQUIPMENT.
-ALL FLANGE CONNECTIONS ARE 300# ANSI R.F.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

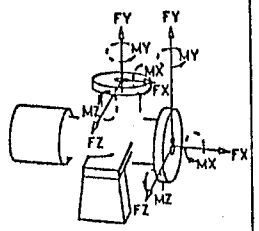
	F_X	F_Y	F_Z	F_R
SUCT	200	130	160	290
DISCH	160	200	130	290

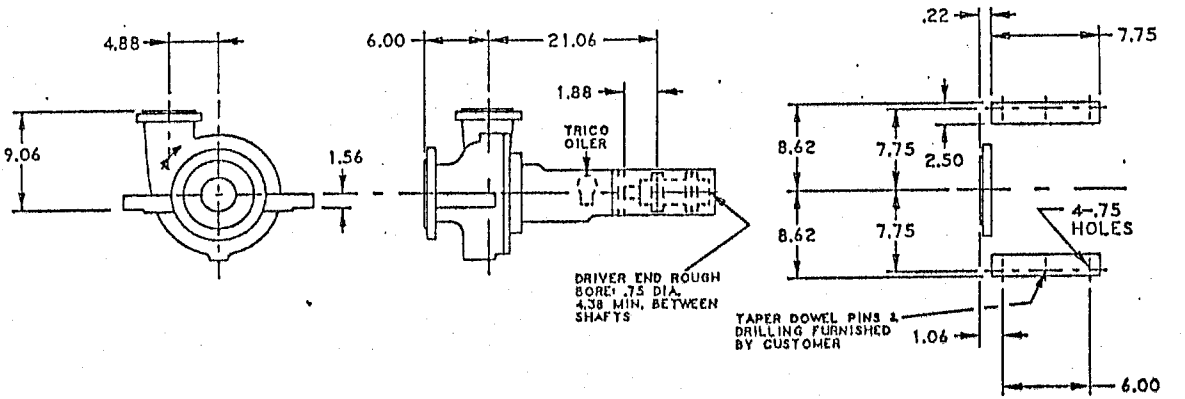
FORCES lbs

	M_X	M_Y	M_Z	M_R
SUCT	340	240	170	460
DISCH	340	260	170	460

MOMENTS ft-lbs

MAXIMUM ALLOWABLE NOZZLE LOADING





PLAN VIEW OF PUMP FEET

ROTATION: CCW-HI
SERVICE: SYSTEM #3 LOADING

MECH. SEAL: JOHN CRANE
ARRANGEMENT: SINGLE
COUPLING: METASTREAM
TYPE: TSCS SIZE: 0011
COUPLING GUARD: IDP STANDARD
TYPE: ALUMINUM

DRIVER: BY CUSTOMER H.P.: 15

CUSTOMER INFORMATION

CUSTOMER: TEXACO
CUST. ITEM: 22R-G13
P3F 4606

WEIGHTS

PUMP 320lbs
DRIVER N/A N/A
BASEPLATE N/A N/A
TOTAL 320lbs

SEAL PIPING PER API PLAN 11
RECIRCULATION FROM PUMP DISCHARGE TO SEAL GLAND
REFER TO I.R. DWG. NO. 62565445

ORDER NO.	489-75278
ITEM NO.	04
DATE	29DE92
DRAWN	PIAZZA
CHECKED	SHERMAN
CERTIFIED	D.WHITE

Ingersoll-Dresser Pump Company
ENGINEERED PUMP DIVISION PHILLIPSBURG N.J. 08865

GENERAL ARRANGEMENT

CODE IDENT. NO.	88032
PUMP SIZE	1.50X2X8AWS
SIZE	C
DWG. NO.	62587373
REV.	00
THIRD ANGLE PROJECTION	
SCALE	NONE
SHEET	1 OF 1

CAD

92-529 3540 F.P. 22-G20-2 (1 of 6)

JS AND SIZE	DATE	I.R. ORD. NO.	I. ITEM	CUST. ITEM
150X2X8AWS	02SE92	489-75278	04	22R-G13
SOLD TO		QUANTITY	SERIAL NO.	PSP 4606
TEXACO		1	1092042	
SHIPPED TO		ROTATION-H.I.		
ANACORTES, WASHINGTON		CCW		

LIST NO.	PAGE	REISSUE DATE
92A-153	1	
DATE SHIPPED	MASTER LIST	
DATE MICROFICHE	ASSEMBLY JOB NO.	
DATE B/M TO BRANCH	DYNAMIC BAL. JOB NO.	
EST. NO.	PAINT UNIT / TOTAL	
SPECIAL REQUIREMENTS: PG. 1-1, NO PTI, NO COCM	PACK UNIT / TOTAL	
INST. BOOK QUANTITY REQ'D: 5		
SECTIONAL DWG.	TEST UNIT / TOTAL	
GEN. ARRANGEMENT DWG.		

MATERIAL COL.: DR1	EXCEPTIONS
SERVICE: SYSTEM #3 LOADING	[ ] SEE REMARKS
CURVE NO.: 150X8A-1-3	LIQUID
SPEED (rpm): 3540	BHP DESIGN/MAX: 8.3 / 13.4 — DRIVER H.P.: 15
DESIGN (psig): 650	SUCT. FLG. RATING 300# [ ] F.F. [X] R.F. [ ] RTJ [ ] T&G
HYDRO (psig): 975	DISCH. FLG. RATING 300# [ ] F.F. [X] R.F. [ ] RTJ [ ] T&G
DISCH (psig): 101.8	TAPS [ ] GAGE [X] VENTS [X] DRAINS
FLOW @ PT (gpm): 40	BEARINGS BALL / BALL
TOTAL HEAD (ft): 257	RAD. 6310 THRUST 7311 DB
SUCTION (psig): 1.8	[X] STD [ ] SPL [SEE REMARKS]
DESIGN EFF (%): 28	TEMP. DETECTORS
PUMP TEMP (°F): 80	[ ] YES [X] NO [SEE REMARKS]
SP GR @ PT: .90	CONSTANT LEVEL OILER [X] YES [ ] NO
VISC @ PT: 50 SSU	BEARING LUBE [X] STD [ ] SPL [SEE REMARKS]
CONSISTENCY	[ ] PUMP [ ] AUX [ ] OTHER
VP @ PT (psia)	FORCED FEED TO [ ] KTB [ ] BOTH BRGS [ ] DRIVER
PH	SUMP [ ] YES [ ] NO
SUCTION LIFT (ft)	QUANTITY OF DRIVER OIL REQ'D: gpm / psi
NPSHR(ft): 4 — NPSHA(ft): FLOOD	STUFFING BOX ARRANGEMENT: PACKING GLAND [ ] STD [ ] SMO
F.W.D.S ATTACHED [ ]	MAKE JOHN CRANE
	MODEL 8B1
	CODE XF(51)10(15)1
	SEAL CHAMBER SKETCH 7/8A64X1

PRIMARY SEAL PIPING PLAN NO.	[ ] NONE 11-00 (SPECIAL)
SECONDARY SEAL PIPING PLAN NO.	[X] NONE
COOLING WATER PIPING PLAN NO.	[X] NONE
LUBE OIL PIPING PLAN NO.	[X] NONE
BEDPLATE	[X] NONE [ ] STD [ ] SPL [ ] SEE REMARKS
COUPLING MAKE, TYPE	METASTREAM TSCS
	[ ] NONE [ ] NON-SPACER [X] SPACER [ ] LIMITED END FLOAT
COUPLING GUARD	[ ] NONE [X] STD [ ] HINGED [SEE REMARKS] [X] NON-SPARK [ ] SPL

DRIVER TYPE	FURNISHED BY	MOUNTED BY
MOTOR	CUST.	CUST.
TURBINE		
ENGINE		
GEAR		
HY'D COUPLING		
DRIVER FRAME		MFGR
DRIVER SPEED (rpm)		
DRIVER ENCL.	ELECT. COND.	
DRIVER SERIAL NO.		
PRINT NO.		

TEST OR SPECIALS	YES	NO	WITNESS
API 7th REQUIRED	X		
HYDRO TEST	X		
HYDRO TEST CERTIFICATE		X	
PERFORMANCE TEST		X	
CERT. TEST CURVE		X	
CERT. TEST DATA		X	
HOTWELL/LIFT TEST		X	
SURFACE INSPECTION		X	
DISMANTLE INSPECTION		X	
CALIPERED CASE THICKNESS		X	
DYNAMIC BALNCED IMPELLERS	X		
DYNAMIC BALANCED ROTOR		X	
MATERIAL COMPLIANCE		X	
MILL TEST CERTIFICATE		X	
NON DESTRUCTIVE TEST		X	
O. C. PACKAGE		X	
SPECIAL PAINT		X	
SPECIAL PACK		X	

MIN. FLOW ORIFICE TO BE INCLUDED IN DESIGN FLOW: [ ] YES [X] NO / [ ] YES [X] NO
TYPE — NBR. PLATES
HOLE SIZE — MIN. FLOW — GPM
TO: HEATER [ ] SUCTION [ ]

USE PAGE 1-1 FOR REMARKS

NO REMARKS [ ]

Ingersoll-Dresser Pumps
P.O. Box 482
Phillipsburg, NJ 08865

P.8/13

NOV 12 '92 03:27PM I R PBURG ENGRG

F.P 22-620-2 (2of6)

CLASS AND SIZE	DATE	I.R. ORD. NO.	ITEM	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	02SE92	489-75278	04	92A-153	1-1	

REMARKS FROM PG. 1

1) IMPELLER DIA.: SHROUD DIA. 7.81" X VANE DIA. 7.81".

2) SEAL FLUSH PIPING 11-00 BEING SUPPLIED WITHOUT ORIFICE IN LINE.

3) COMPLETE PUMP IS BEING SUPPLIED TO THE CUSTOMER TO REPLACE WILSON SNYDER PUMP MODEL 1.5X2X8.5 ES NEW CASING DESIGNED TO FIT CUSTOMERS EXISTING SUCTION AND DISCHARGE PIPING AND PUMP FEET TO MATCH CUSTOMERS EXISTING BEDPLATE. PUMP SHAFT LENGTH HAS BEEN SHORTENED AT COUPLING END. OTHERWISE STANDARD 7TH ED. MECH. SEAL, BEARING HOUSING AND COMPONENTS HAVE BEEN UTILIZED.

Ingersoll-Dresser Pumps
P.O. Box 482
Phillipsburg, NJ 08865

F.P. 22-620-2 (3 of 8)

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	04	92A-153	2	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
			1	1	1	CASING	150X2X8AWS1AX1	102-000	
	1	1	6A	2	1	CASING RING	450D6KX1	20-K	
	1	1	82	3	1	LOCK SCREW - CASING RING	025D82X1	379	
			178A	4	8	.75X3.25" STUDS	62A3J464	314	
			766A	5	8	.75" HEX.NUTS	38A4K8	377	
				6		TORQUE 166 TO 195 FT. LBS.			
				7	2	.75" BULL PLUGS	60448495	9	
				8	1	.50" FLANGES - SEAL FLUSH CONNECTION	80A8F1	ASTM-A105	
				9	1	.50" X 4.00" SCHED 160 PIPE - SEAL FLUSH CONN.	22A7J004X0004ONT	709	
1	1	1	363	10	1	GASKET	875D363CX1	AISI 316L/FLEXICARB	
				11					
				12					
			264	13	1	CASING END COVER	8A394AXG1	521-Z	
	1	1	88	14	1	STUFFING BOX BUSHING	178D88AXG1	20	
	1	1	6A	15	1	CASING RING	450D6KX1	20-K	
	1	1	82	16	1	LOCK SCREW - CASING RING	025D82X1	379	
			178B	17	4	.50 X 3.50" STUDS - GLAND	62A3J256	314	
			766B	18	4	.50" HEX.NUTS - GLAND	38A4K5	377	
				19		TORQUE 26 TO 30 FT. LBS.			
				20	2	.50"X3.00" JACK SCREWS	102A2H100	319	
				21					
				22					
				23					
				24					
				25					
				26					
				27					
				28					
				29					
				30					
				31					
				32					
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42			CONTINUED ON PAGE #3		

F.P. 22-620-2 (4 of 6)

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	04	92A-153	3	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
				1					
		1	3	2	1	IMPELLER,	150X8A3BX1	813	
	1	1	4A	3	1	IMPELLER RING (FRONT)	387D4EX1	829X300	
	1	1	4B	4	1	IMPELLER RING (BACK)	387D4EX1	829X300	
	6	6	259A	5	6	#10-24X.50" SET SCREW - RINGS	109A2T315	379	
				6					
				7					
			159	8	1	BEARING HOUSING	311B159SX2	102-000	
				9	5	.25" PIPE PLUGS	30A7S3	STEEL	
				10	5	.50" PIPE PLUGS	30A7S5	STEEL	
				11	1	1.50" PIPE PLUG	30A7S9	STEEL	
				12	1	BREATHER	62348529	STEEL	
			118C	13	4	.50X1.25" CAP SCREWS - EXTENSION	119A2A251	318	
				14		TORQUE 13 TO 16 FT. LBS.			
				15					
			160A	16	1	END COVER - INBOARD	311B160EXG1	241	
1	1	1	216A	17	1	GASKET	311B216AX1	HYDROIL	
			118A	18	4	.38X.75" CAP SCREWS	35A2C109	175	
				19		TORQUE 6 TO 8 FT. LBS.			
				20					
2	2	2	257A	21	2	.005" SHIMS	91A11-S-424-E-444	669	
2	2	2	257B	22	2	.010" SHIMS	91A11-S-424-H-444	669	
1	1	1	257C	23	1	.030" SHIMS	91A11-S-424-L-444	669	
				24					
			160B	25	1	END COVER - OUTBOARD	311B160HXG1	241	
1	1	1	216B	26	1	GASKET	311B216AX2	HYDROIL	
			118B	27	4	.38X1.50" CAP SCREWS	35A2C115	175	
				28		TORQUE 6 TO 8 FT. LBS.			
				29					
				30	1	OILER/GUARD	#3 TRICO		
				31	2	.25X1.50" NIPPLES	18A7W20	252	
				32	1	.25" UNION	88A7MA1	BRASS/IRON	
				33		ASSEMBLE OILER ON BRG. HSG. PER	311B95BX2		
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42			CONTINUED ON PAGE #4		

FP 22-620-2 (5546)

CLASS AND SIZE	DATE	I-R ORDER NO.	IT	LIST NO.	PAGE	REISSUE DATE
150X2X8...	17 OC 92	489-75278	U4	92A-153	4	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
		1	10	1	1	SHAFT 2.60" X 21.19"	8A10X14	814	
				2					
				3					
	2	2	204	4	2	BEARING (THRUST)	62321823		
	1	1	205	5	1	BEARING (PLAIN)	62348545		
	1	1	240	6	1	LOCK NUT FOR BEARING	95200929		
				7		TORQUE 73 TO 77 FT. LBS			
	1	1	241B	8	1	LOCKWASHER FOR BEARING	95201026		
				9					
				10					
		1	11	11	1	.25"SQ. X 1.88" IMPELLER KEY	11A9G84	20-CF	
		1	12	12	1	.25"SQ. X 1.75" COUPLING KEY	11A9C83	266	
		2	50	13	2	OIL THROWERS	311B50CX1	228-AC	
		2	259C	14	6	#10-24X.50" SET SCREWS	109A2A315	318	
		2	31	15	2	OIL RINGS	82938671	ASTM-B505 GR. C93200	
		2	157	16	2	FLINGERS	311B157AX1	228-AC	
		6	259B	17	6	#10-24X.38" SET SCREWS	109A2A313	318	
				18					
				19					
		1	177	20	1	CAP SCREW - IMPELLER	050D177AX1	379	
1	1	1	241A	21	1	WASHER - IMPELLER	056D241AX1	379	
		1	246	22	1	WASHER - IMPELLER	056D246KX1	379	
				23					
				24					
		1	429	25	1	JOHN CRANE MECHANICAL SEAL 881H	SEAL DRG TO COME	MAT'L CODE XF(51)10(15)1	
				26		(STUFF. BOX SKETCH-7/8A64X1)		API CODE BSTFN	
				27	4	.50" PIPE PLUGS - SEAL	30A7T5	379	
				28					
				29					
				30					
				31					
				32					
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42			CONTINUED ON PAGE #5		

F.P 22-G20-2 (6 of 6)

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	04	92A-153	5	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
				1					
				2	1	NAMEPLATE	7A16X262A	669	
				3	1	ROTATION NAMEPLATE	8A16X158	669	
				4					
			131	5	1	COUPLING GUARD	419C131CX1	ALUMINUM	
				6		GUARD TO BE SECURED TO BRG. HSG. WITH THREE			
				7		CAP SCREWS AND IS TO BE EXPANDED TO WITHIN			
				8		.50" OF DRIVER BEARING AND SECURED WITH THREE			
				9		SELF-TAPPING SCREWS			
				10	3	.25"X.50" SELF-TAPPING SCREWS	132A2S94	AISI-1016	
				11	3	.38"X.50" CAP SCREWS	35A2C107	175	
				12					
				13	1	COUPLING	62580824		
				14					
				15	1	SEAL PIPING (PLAN 11-00-SPL) PER	62565445		
				16		CONSISITING OF THE FOLLOWING			
			1	17	3	.50" SOCKET WELD FLANGE 300#	80A8F1	ASTM-A105	
			2	18	8	.50" X 2.75" STUD	62A3J253	314	
			3	19	16	.50" NUTS	38A4K5	377	
			4	20	2	.50" GASKET 300#	76A11DX3BR	AISI-316L/FLEXITE SUPER	
			5	21	4	.50" 90 DEG. ELBOW	216A8F4	ASTM-A105	
			6	22	8	.50" SCH 80 PIPE	27A7J004	709	
				23					
				24					
				25					
				26					
				27					
				28					
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				37					
				38					
				39					
				40					
				41					
				42					

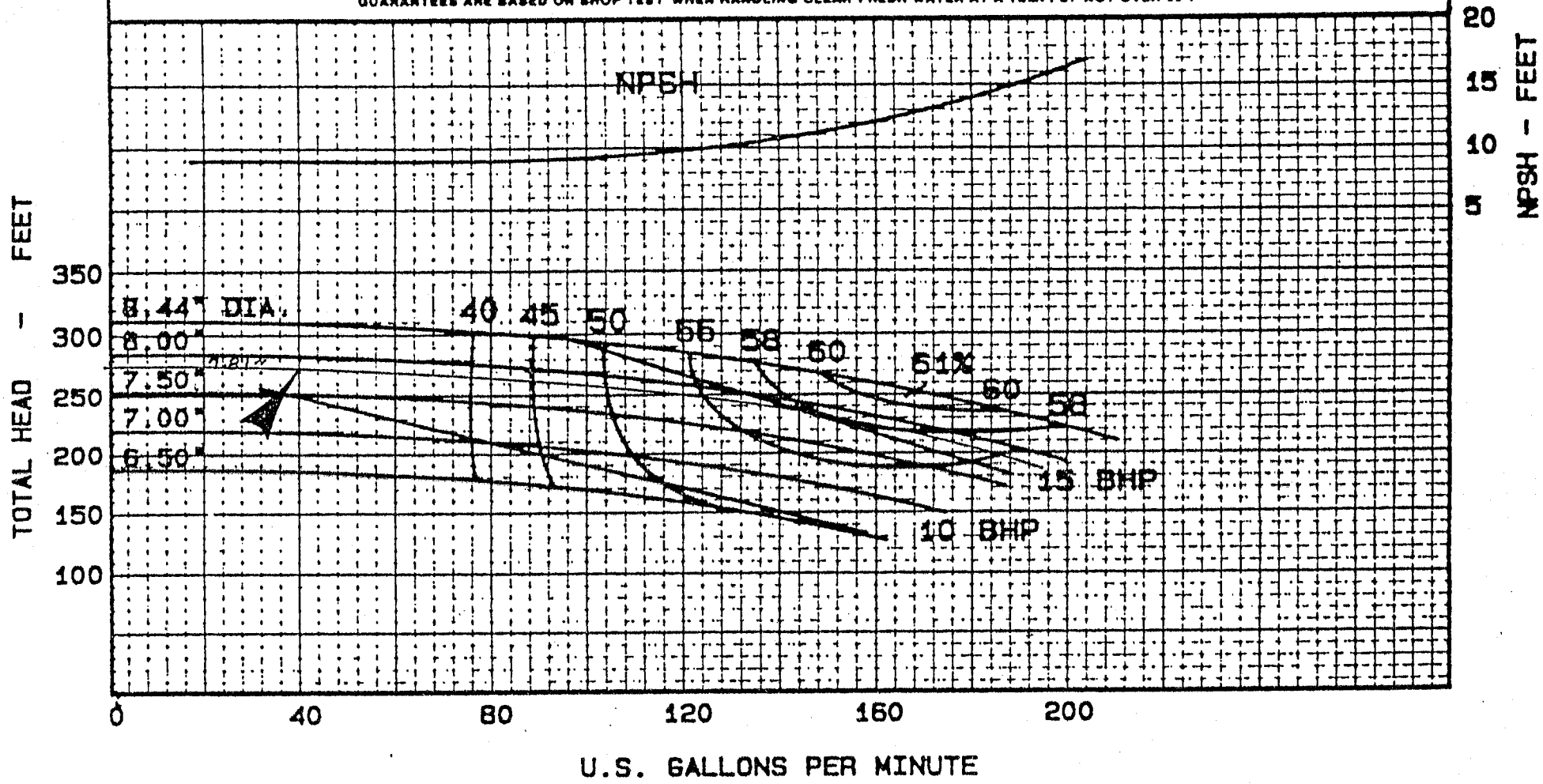
F.P 22-620-3
22R-613
PSP 4604

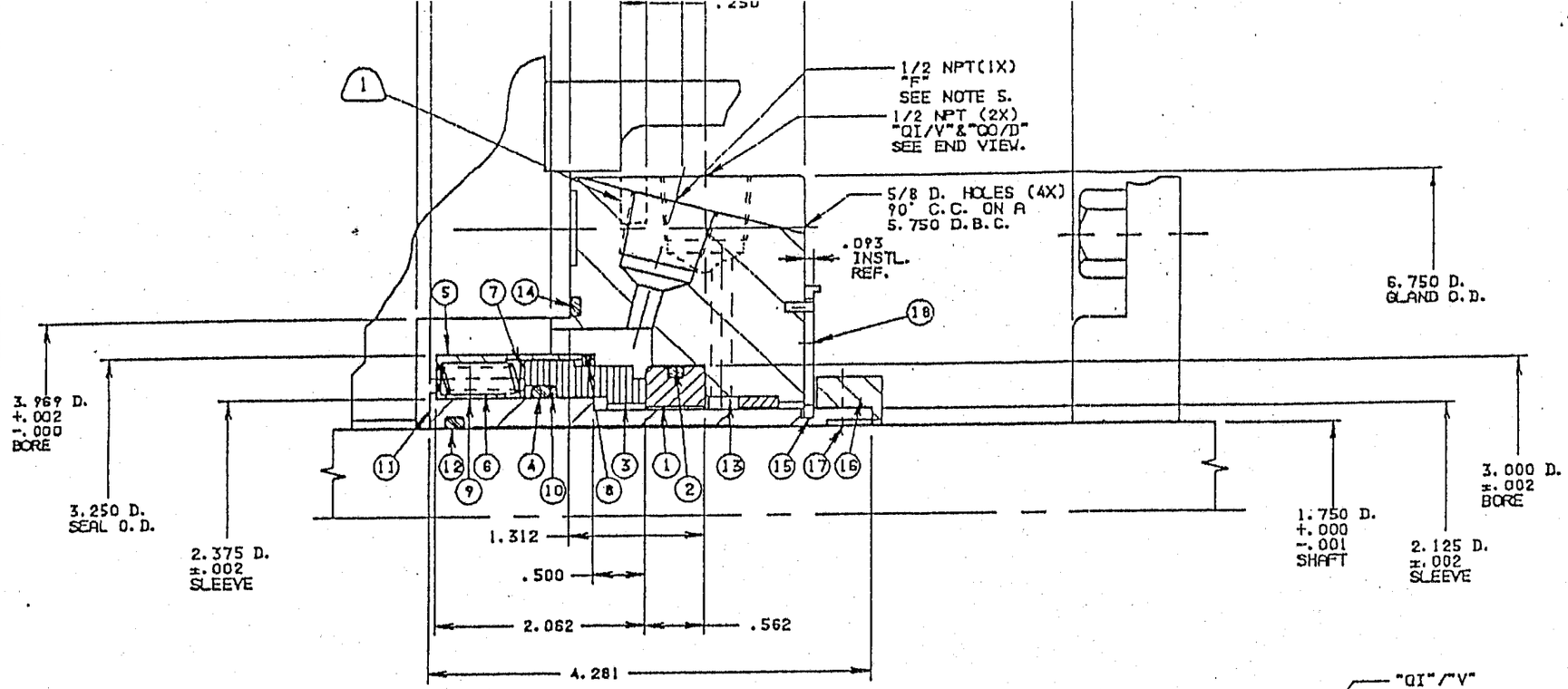
SYSTEM #3 LOADING

S/N 1092-042 40 GPM @ 257 FT. .90 SP. GR.

INGERSOLL-RAND. PUMPS	RPM	CASING	IMPELLER		CURVE NO.
	3500	1L	150X8A3B/C		150X8A-1-3
					BHP SHOWN FOR SP. GR. = 1.0
DATE 12 OC 90	RING DIA. 4.483 IN	N_s	EYE AREA	N_{ss}	PUMP SIZE & TYPE
CURVES BASED UPON I. R. STANDARD CLEARANCES	RING CLEAR. .016 IN	700	5.8 IN^2	6650	1.5X2X8A

CURVES ARE APPROXIMATE. PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS. CAPACITY, HEAD AND EFFICIENCY GUARANTEES ARE BASED ON SHOP TEST WHEN HANDLING CLEAR FRESH WATER AT A TEMP. OF NOT OVER 90°F

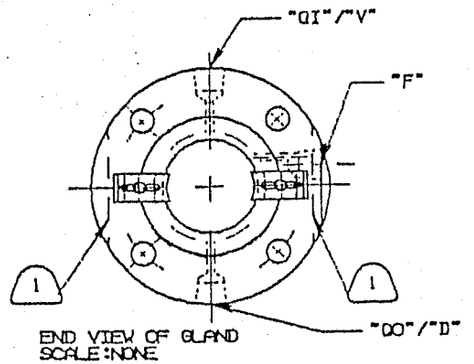




13. SPACERS (ITEM H15) ARE FOR THE PURPOSE OF PROPERLY LOCATING THE SEAL AFTER THE GLAND, SLEEVE, SHAFT, AND BEARINGS HAVE BEEN LOCKED IN PLACE. THESE ITEMS MUST BE DIS-ENGAGED FROM THE SLEEVE. MOVED CLEAR OF ROTATING PARTS, AND LOCKED IN PLACE.

14. THE GLAND MUST BE IN CONTACT WITH THE HOUSING. DO NOT OVERSTRESS.

15. TO AVOID MOVEMENT OF THE SEAL IN RELATION TO THE SHAFT, SPOT FACE THE SHAFT UNDER A MINIMUM OF TWO SET SCREWS EQUALLY SPACED.

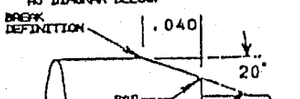


END VIEW OF GLAND
SCALE:NONE

(1) DISMANTLING GROOVES

THE FOLLOWING NOTES ARE IMPORTANT AND MUST BE OBSERVED FOR CORRECT SEAL INSTALLATION AND OPERATION

1. REMOVE ALL SHARP EDGES ON SHAFT &/OR SLEEVE BEFORE INSTALLATION OF SEAL.
2. SURFACE OF SHAFT OR SLEEVE ON WHICH SEAL IS INSTALLED MUST BE MACHINED TO 63 RA FINISH OR BETTER.
3. LUBRICATE SHAFT/SLEEVE & SEAL WEDGE RING/O-RING/BELLOWS TO ASSIST INSTALLATION OF SEAL WITH LIGHT OIL, GLYCERINE, SOAPY WATER.
4. LUBRICATE MATING RING (SEAT), BORING MEMBER & HOUSING TO ASSIST INSTALLATION.
5. PRODUCT MUST BE CIRCULATED AROUND PRIMARY RING (SEAL FACE)/THROUGH MATING RING (SEAT) (AT NOT LESS THAN 3 GPM), IN ORDER TO REMOVE HEAT GENERATED, OR FAILURE MAY OCCUR.
6. WHEN SHAFT IS SLEEVED THROUGH STUFFING BOX, SLEEVE MUST BE LIQUID TIGHT THROUGH BORE.
7. SHAFT OR SLEEVE MUST BE OF CORROSION RESISTANT MATERIAL WITH A HARDNESS OF 125 BRINELL MINIMUM & BE MACHINED TO DIMENSIONS & TOLERANCES STATED.
8. END OF SEAL CHAMBER & FACE OF SHAFT MUST BE AT 90° TO EACH OTHER WITHIN .002 F.I.M.
9. PRESSURE IN SEAL CHAMBER MUST BE MAINTAINED AT N/A MINIMUM ABOVE MAXIMUM PRESSURE GENERATED AT INNER SEAL.
10. BEFORE COMPLETING SEAL INSTALLATION WIPE LAPPED SURFACES OF MATING RING (SEAT) & PRIMARY RING (SEAL FACE) PERFECTLY CLEAN.
11. VENT GAS ENTRAPMENT BEFORE STARTUP.
12. ALL SHOULDERS OVER WHICH SEAL MUST PASS WHEN FITTING, TO BE PREPARED AS DIAGRAM BELOW.



FOR IDP ORDER NBR.
489-75278-02/03/04/0
489-75319-01/02
489-75323-02/03
489-75332-01/02/03

SEAL ASS'Y NO. IN- A8-2375-054 OUT-	COMPLETE SEAL NO.
MTG. RG. ASS'Y NO. IN- OUT-	MTG. RG. ASS'Y.
EQUIPMENT REFERENCE:	CU
UNIT BY: INGERSOLL-RAND CO.	CUSTOMER
EQUIPMENT TYPE: APJ 610 7TH ED.	P.O. NO.
☒ PUMP ☐ AGITATOR	END USER
☐ COMPRESSOR ☐ OTHER	LOCATION
MODEL/SIZE 7"&8" A-LINE /	REQ. NO.
SERIAL NO.	INSTALLED

SEAL DATA

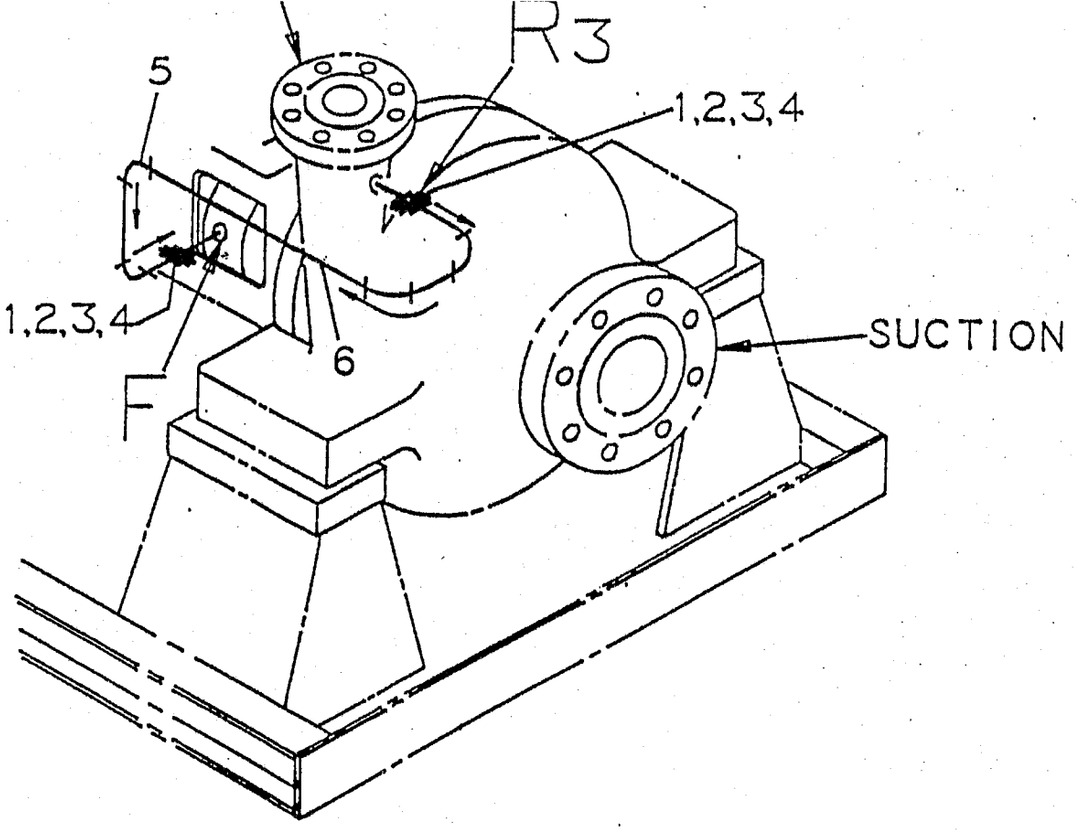
SEAL DESCRIPTION A082	MATERIAL X E51
A.P.I. CODE B3IFM	A.P.I. PL

SERVICE DAT

FLUID HYDROCARBON			
SEAL PRESS. 300 PSIG MAX.	SUCT. PRESS.		
TEMPERATURE 350 F MAX.	DISCH. PRESS.		
SHAFT SPEED 3600 RPM MAX.	SP. GR. 0.6 - 0.9		
REFERENCE DATA	DRAWN	DATE	CH
PDX92124 H-SP-17453 BY JCI	PDX	111892	G.
	FILE REFERENCE		CAT
#7/8A64X1 BY I-R	PDX 73		D
CAD ENGINEERED			

SEAL SIZE: 2.375 D.
SEAL TYPE: T-881 CARTRIDGE SEAL FOR A

JOHN CRANE
International Sea
6400 Oakton Stree
Horton Grove, Il 6
A member of the T



RECIRCULATION FROM PUMP D
TO SEAL GLAN

ARROWS INDICATE DIRECTION

SHOP NOTES:

1. KEEP ALL PIPING AS CLOSE
   AS POSSIBLE.

2. PIPING TO BE CLEANED AND
   PER Q.C. PLAN HLM-26,LATE

3. PIPING TO BE HYDROTESTED

FOR IDP ORDER NBR.
489-75278-01/02/03/04/05/06/07/08/09
489-75323-01/02/03
489-75327-01/02
489-75328-01/02
489-75332-01/02/03

PA
62565445

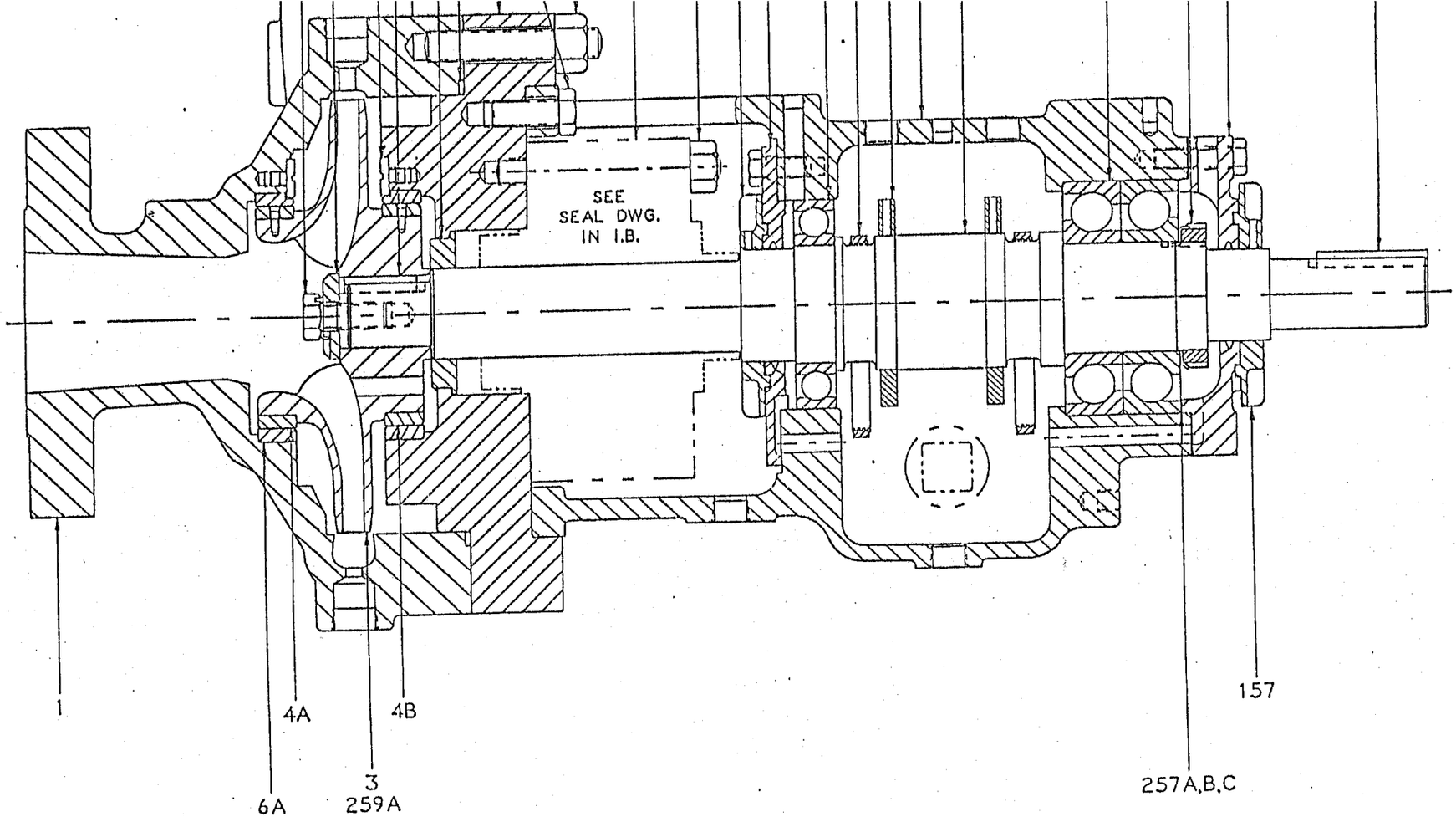
NOUN CODE	0321		
THIRD ANGLE PROJ.			
DRN	D.W.	DATE	70C92
CKD	PIAZZA		0C92
APP	JAL.		70C92
ENG APPVL	D.WHITE		210C92

INGERSOLL-RA
ENGINEERED PUMP
PHILLIPSBURG N.J.

TITLE: SEAL

SIZE	CODE IDENT. NO.	PART NO.
B	88032	6

SCALE NONE



FOR IDP
489
48
22R
PSP

– CAU
READ
ATTEN
OR OF

FIRST ORDER

HOUR CODE
0500

THIRD ANGLE PROJECTION

DRN	C.TILWICK	13-NV92
CHD	TRLINDEN	14/4/92
APP		DEC 7.92
ENGRG'G.	DON WHITE	7DE92

TITLE

SIZE D

SCALE

8 7 6 5 4 3 2

INDUSTRY MATERIAL SPEC: AISI-316L/FLEXITE SUPER

3	16.00	95076402 38A4K5	377
		DESCRIPTION: NUT .50	
		INDUSTRY MATERIAL SPEC: ASME-SA-194 GR.2H	
4	2.00	66518921 76A11DX3BR	S-316-1
		DESCRIPTION: GASKET .50-300#	
		INDUSTRY MATERIAL SPEC: AISI-316L/FLEXITE SUPER	
5	4.00	95244190 216A8F4	M-105-3
		DESCRIPTION: ELBOW .50-90 DEG	
		INDUSTRY MATERIAL SPEC: ASTM-A105	
6	8.00	95492351 27A7J004	709
		DESCRIPTION: PIPE .50 SCH 80	
		INDUSTRY MATERIAL SPEC: ASTM-A106 GR.B	

NOTE: WHEN ORDERING PARTS, BE SURE TO REFERENCE THE CON PART NUMBER

INGERSOLL-RAND COMPANY
SIZE: A 7TH ED SYMBOL: 1100-SPLNOUN: 321
DESCRIPTION: SEAL PIPING
DRAWING NUMBER: 62565445 MATL SPEC: STEEL REV.: 0
SHEET 2 OF 2

Replacement Pumps
22RG 13/16
23 NG 5

INSTALLATION OPERATION & MAINTENANCE

WILSON SNYDER

ITEM NOS. 21N-G8 (ITEM 01); 21N-G26 (ITEM 02); 21N-G27 (ITEM 03)

ITEM NOS. 22R-G13 (ITEM 04); 22R-G16 (ITEM 05); 23N-G5 (ITEM 06)

ITEM NOS. 24N-G12 (ITEM 07); 24N-G25 (ITEM 08); 24N-G28 (ITEM 09)

BUTANE TRANSFER PUMP

SLOP OIL PUMP

SKIM OIL PUMP

SYSTEM #3 LOADING PUMP

SYSTEM #3 ADDITIVE PUMP

OFF TEST PROPANE PUMP

CHEMICAL UNLOADING PUMPS

Ingersoll-Dresser Order 489-75278-01 Thru 09

Pump Serial Nos.	1092039	(Item 01)
	1092040	(Item 02)
	1092041	(Item 03)
	1092042	(Item 04)
	1092043	(Item 05)
	1092044	(Item 06)
	1092045	(Item 07)
	1092046	(Item 08)
	1092047	(Item 09)

(Models 150X2X8AWS)

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Mechanical Seal Drawing	Crane H-SP-22862-1
Mechanical Seal Instructions	Crane Form S-2015
Seal Piping Drawing & Parts List	62565445
Coupling Complete Drawing	62580824
Metastream Coupling Instructions	CTI 200/201

TAB 2
(Item 21N-G26/IDP Item 02)

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Pump Performance Curve & Data	Curve No. C1192028
Mechanical Seal Drawing	Crane H-SP-22859-1
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Mechanical Seal Drawing	Crane H-SP-22859-1
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Coupling Complete Drawing	62580824
Coupling Instructions	See Tab 1

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TAB 7
(Item 24N-G12/IDP Item 07)

Retrofit Sectional Assembly Drawing & Parts List	62587571
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Mechanical Seal Drawing	Crane H-SP-22859-1
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(Item 24N-G25/IDP Item 08)

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Mechanical Seal Drawing	Crane H-SP-22859-1
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Coupling Instructions	See Tab 1

INSTALLATION
OPERATION &
MAINTENANCE

UPGRADE/RETROFIT PACKAGE

FOR

TEXACO/WILSON SNYDER TYPE "ES" PUMPS

REIDENTIFIED UNITS AS "AWS" PUMPS

(Upgraded To API 7th Edition Standards)

FOR SERVICE ASSISTANCE CALL:

908-859-7242

INGERSOLL-DRESSER, PHILLIPSBURG, NEW JERSEY

NOTE

DURING INITIAL START-UP OF THIS EQUIPMENT, IT IS ESSENTIAL THAT ALL OF THE INSTRUCTIONS IN THIS MANUAL BE ADHERED TO STRICTLY. IT IS RECOMMENDED THAT THE SERVICES OF AN INGERSOLL-DRESSER SERVICE SUPERVISOR BE OBTAINED TO ASSURE TROUBLE-FREE OPERATION. IN SOME CASES, START-UP IN THE PRESENCE OF AN INGERSOLL-DRESSER SERVICE SUPERVISOR MAY BE A CONTRACTUAL REQUIREMENT FOR CONTINUATION OF WARRANTY. CHECK YOUR CONTRACT.

TO SCHEDULE A SERVICE SUPERVISOR, CONTACT INGERSOLL-DRESSER'S ENGINEERED PUMP DIVISION, CUSTOMER SERVICE DEPARTMENT (1-800-346-8100 OR 908-859-7242) *OR CONTACT YOUR LOCAL INGERSOLL-DRESSER SALES OFFICE.*

READ THIS BEFORE PROCEEDING FURTHER

1. Throughout this manual you will encounter the words **WARNING, CAUTION,** and NOTE. These are intended to emphasize certain areas in interest of operator safety and satisfactory pump operation/maintenance. The definitions of these words are as follows:

WARNING

An operating procedure, practice, etc. which, if not correctly followed could result in personal injury, or loss of life.

CAUTION

An operating procedure, practice, etc. which if not strictly observed, could result in damage to, or destruction of, equipment.

NOTE

An operating procedure, condition, etc. which is essential to highlight

WARNING

2.

IN THE INTEREST OF OPERATOR SAFETY, THE UNIT MUST NOT BE OPERATED ABOVE THE NAMEPLATE CONDITIONS. SUCH OPERATION COULD RESULT IN UNIT FAILURE CAUSING INJURY TO OPERATING PERSONNEL. CONSULT INSTRUCTION BOOK FOR PROPER OPERATION AND MAINTENANCE OF THE PUMP AND ITS SUPPORTING COMPONENTS.

CAUTION

3.

UNDER NO CIRCUMSTANCES IS THE PUMP TO BE OPERATED WITH ANY SAFETY DEVICES RENDERED INOPERATIVE.

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SECTION 1
INTRODUCTION

INTRODUCTION

This manual contains instructions for installation, operation, maintenance and servicing of your Ingersoll-Dresser Centrifugal Pump. It has been designed to provide safe and reliable service. It is both, a pressure vessel, and a rotating machine; therefore, the operator(s) must exercise good judgement and proper safety practices to avoid damage to the equipment and surroundings and prevent personal injury.

The instructions in this manual are intended for the guidance of personnel with a general training in operation and maintenance of centrifugal pumps. It is our hope that you will become acquainted with its content as an aid to better pump performance. This manual should be read in its entirety before installing, and/or operating the equipment. The Sectional Assembly Drawing and General Arrangement Drawing should be consulted for accurate details and determination of specific optional features that are furnished with your pump. All numbers in parentheses ( ) following part names correspond with Sectional Assembly Parts List.

SAFETY

It is assumed that your safety department has established a safety program based upon a thorough analysis of industrial hazards. Before installing and operating or performing maintenance on the pump and associated components described in this manual, the safety program must be reviewed to ensure that it covers the hazards arising from high speed rotating machinery.

It is important that due consideration be given to those hazards which arise from the presence of electrical power, hot oil, high pressure, high temperature liquids, toxic liquids, toxic gases, flammable liquids and flammable gases. Proper installation and care of protective guards, shutdown devices and over-pressure protection equipment shall also be considered an essential part of any safety program.

Also essential are special precautionary measures to prevent the possibility of applying power to the equipment at any time when maintenance work is in progress. The prevention of rotation due to reverse flow must not be overlooked.

In general, all personnel should be guided by all the basic rules of safety associated with the equipment and the process.

CONSTRUCTION

The Type "AWS" are horizontally mounted, vertically split, back pull-out, single-stage, single-suction overhung process pumps. They are a heavy duty API process pump designed for continuous duty service in all process industries and industrial application within the pressure and temperature limitations.

PARTS DESCRIPTION

CASING

The casing is off center supported with end suction and top discharge. It provides for the immediate containment of the liquid being pumped as the liquid is directed from the suction nozzle through the impeller and then through the volute to the discharge nozzle. A wear ring is mounted in the casing to provide a close running clearance with the impeller wear ring.

IMPELLER

The impeller is single suction, radial flow, closed design, precision cast to assure the highest attainable efficiencies. The impeller is dynamically balanced, keyed to the shaft and secured by a capscrew and tab washer. Renewable wear rings are press fit on the impeller and secured with radial setscrews.

CASING COVER

The casing cover contains a stuffing box (throat) bushing and provides an envelope for the mechanical seal. A wear ring is mounted in the casing cover to provide a close running clearance with the impeller wear ring.

SHAFT

The high strength shaft is of stiff shaft design ground over its entire length for close tolerances. The shaft transmits the required power without vibration.

BEARING HOUSING

The bearing housing is air cooled with fan type flingers provided at inboard and outboard ends. The bearing housing contains the thrust and radial ball bearings and serves as the oil reservoir for the bearing lubricating oil. A "Trico" type oiler is provided for maintaining required oil level. Labyrinth type flingers help to seal the bearing housing to prevent contamination of the lubricating oil. Bearing seal guards are optional.

A finned type cooling insert is available as an option for cooling of the lubricating oil.

BEARINGS

Heavy duty, oversize, single row radial bearing and duplex angular contact thrust bearing ensure long life under the most severe operating conditions. The bearings are a slight press fit on shaft and slide fit into bearing housing. Lubrication of the bearings is provided by oil rings. Provisions for purge oil mist or pure oil mist lubrication are optional.

MECHANICAL SEAL

A mechanical seal is used to control liquid leakage to the atmosphere where the shaft passes through the pressure boundary component (Casing Cover).

COUPLINGS/COUPLING GUARDS

Flexible spacer couplings are provided in various makes and models to suit customer preference. Couplings manufactured to API tolerances and dynamic balanced couplings are optional.

Fabricated heavy gauge sheet metal, or aluminum hinged or non-hinged guards are provided to suit customer specified needs.

CHECK UPON ARRIVAL

Your pump upgrade/retrofit package was carefully checked at our shops prior to shipment to assure its meeting the requirements of your order.

It is suggested that the pump upgrade/retrofit package be inspected upon arrival and that any irregularities arising due to shipping be reported immediately to the carrier and Ingersoll-Dresser. Parts Distribution Center in Moosic PA.

CARE DURING STORAGE

If the equipment is not to be installed immediately it should be stored in a clean, dry, vibration-free area and covered.

LIFTING EQUIPMENT

WARNING

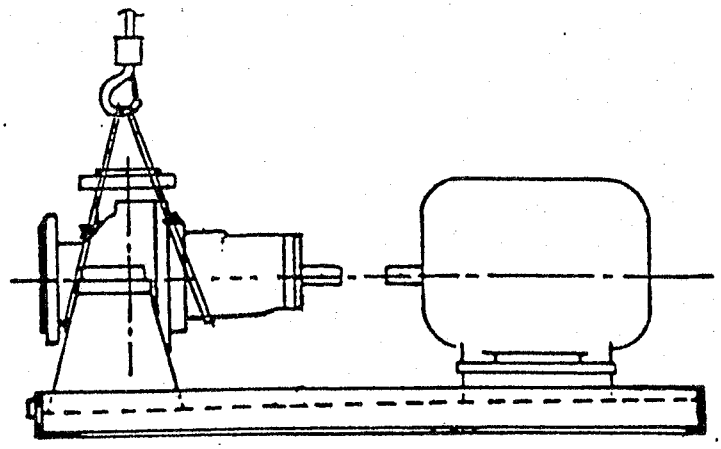
MAKE SURE THAT ANY EQUIPMENT USED TO LIFT THE PUMP OR ANY OF ITS COMPONENTS IS CAPABLE OF SUPPORTING THE WEIGHTS ENCOUNTERED. MAKE SURE THAT ALL PARTS ARE PROPERLY RIGGED BEFORE ATTEMPTING TO LIFT.

TO LIFT DRIVER:

Refer to driver manufacturer's instructions.

TO LIFT PUMP UPGRADE/RETROFIT PACKAGE

Rig lifting straps as shown. Make sure straps are adjusted to obtain an even lift.



Rig lifting straps through any of the outer drilled through holes when lifting only casing cover (394).

EXTENDED STORAGE REQUIREMENTS FOR HORIZONTAL PUMPS

GENERAL

During extended periods of storage prior to installation and from the time of installation until commercial operation, precautions must be taken to protect the pump from deterioration. The various parts of the pump are protected prior to shipment by applying varying grades of preservatives and paint. However, during shipment and handling, the preservatives are subjected to conditions that can cause their removal. Also, during extended periods of time, the preservatives may deteriorate. The following procedures should be followed to prevent deterioration of the pump during the extended storage period. These procedures may also be supplemented by the experience of the person(s) performing the tasks.

It should be noted, that unless otherwise agreed to, full responsibility and costs associated with the storage and inspection of this equipment rests with the customer.

CAUTION

IF A MECHANICAL SEAL IS STORED FOR 1 YEAR OR MORE, IT MUST BE REMOVED BEFORE START-UP AND FACES RE-LAPPED TO GUARD AGAINST THE POSSIBILITY OF SEAL LEAKAGE. WHEN REINSTALLING THE SEAL, NEW "O" RINGS AND GASKETS MUST BE USED.

INSPECTION UPON ARRIVAL

When the pump upgrade/retrofit package is received, it should be inspected for damage or other signs of rough handling. Any damage that is found should be reported to the carrier immediately.

Inspect the preservative coating on the various parts. If necessary, renew the preservative in areas where it has been rubbed off or scraped.

STORAGE AREA

When selecting a storage area, the following should be taken into consideration:

1. The deterioration of the equipment will be proportionate to the class/type of storage provided.

2. The expenses involved in restoring the equipment at time of operation will be proportionate to the class/type of storage provided.

STORAGE PREFERRED (DRY)

GENERAL

If at all possible, the components should be stored indoors where they will be protected from the elements. If it is not possible to store the components indoors, precautions must be taken to protect them from the elements. Regardless of whether storage is inside or outside, the storage area should be vibration-free. The pump components when stored outdoors should be protected from dirt, dust, rain, snow or other unfavorable conditions by coverings of heavy-gauge plastic sheets, canvas, waterproof burlap or other suitable coverings.

All equipment must be placed upon skids or blocks to prevent contact with the ground and surface contaminants. Equipment must be adequately supported to prevent distortion and bending.

INSPECTION AND MAINTENANCE

Customer Inspection And Maintenance.

The stored equipment is to be placed on a periodic inspection schedule by the customer.

NOTE

The responsibility for setting up an inspection and maintenance schedule rests with the customer and will be dependent upon the class/type of storage provided. It would be expected that initially inspection would occur weekly, then depending upon the inspection reports being favorable or unfavorable, inspection would continue weekly, monthly or quarterly, as may be determined. Inspection reports must be kept on file.

Each inspection should consist of a general surface inspection.

(a) Equipment supports are firmly in place.

(b) Pump covering, plastic or tarps, is firmly in place. Any holes or tears must be repaired to prevent entrance of dirt or water.

(c) covers are periodically removed from openings and interior accessible areas inspected. If surface rusting has occured, clean and repaint or recoat with preservative.

(d) If rusting occurs on exterior surfaces, clean and repaint or recoat with preservative.

(e) If applicable, periodically remove bearing covers and inspect for accumulation of moisture, rust and foreign material. As required, clean bearings and bearing housing and represerve. Install bearing cover and secure to assure maximum protection. Bearings removed for storage should be coated with preservative, wrapped in oil/wax paper, and stored in a warm dry area.

(f) Check individually wrapped parts for signs of deterioration. If necessary, renew preservative and wrapping.

START-UP

Prior to and during start-up, any requirement for the services of an Ingersoll-Dresser Pump Company Representative will revert to the original contract agreement for the equipment purchased.

SECTION 2
INSTALLATION

INSTALLATION CHECK LIST

1. Piping installed - Proper Vent, Gauge, Valve, Suction Strainer Locations?
2. All flange bolting properly torqued with proper gaskets in place?
3. Alignment Shaft/Coupling?
4. Coupling guard properly installed?

SHAFT/COUPLING ALIGNMENT

CAUTION

SHAFT ALIGNMENT MUST BE CORRECT FOR SUCCESSFUL OPERATION. RAPID WEAR, NOISE, VIBRATION AND ACTUAL DAMAGE TO THE EQUIPMENT MAY BE CAUSED BY SHAFT MISALIGNMENT. THE SHAFTS MUST BE ALIGNED WITHIN THE LIMITS GIVEN WITHIN THIS SECTION.

NOTE

Adjustments to correct the alignment in one direction may alter the alignment in another direction. Always check in all directions after making any adjustment.

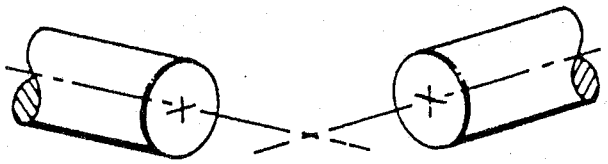
Coupled equipment must be aligned to minimize unnecessary stresses in shafts, bearings and coupling. Flexible couplings will not compensate for appreciable misalignment. Foundation settling, thermal expansion or nozzle loads resulting in baseplate/foundation deflection and vibration during operation may require the full coupling misalignment capability.

TYPES OF MISALIGNMENT

There are two types of shaft misalignment: Angular and offset. Therefore, two sets of measurements and corrections are required. Both types of misalignment can occur in horizontal and vertical planes and are present in most applications.

A. Angular Misalignment

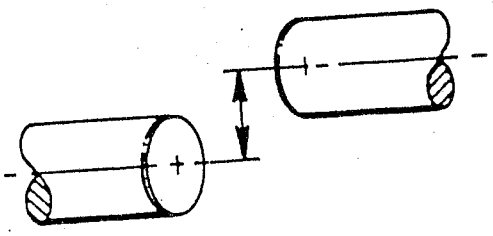
In angular misalignment, the centerline of the shafts intersect, but are not on the same axis.



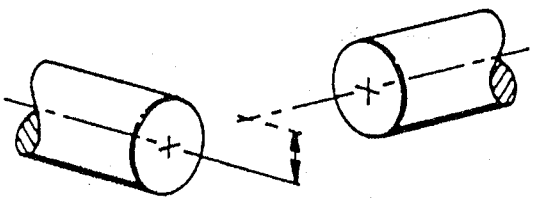
Angular Misalignment

B. Offset Misalignment

In offset misalignment, the shaft centerlines are parallel but do not intersect.



OFFSET MISALIGNMENT



COMBINATION OFFSET
AND
ANGULAR MISALIGNMENT

ALIGNMENT

A. Measure Gap

The first step in shaft/coupling alignment is to bring the pump and driver shafts into their proper axial position. The shaft gap, or distance between coupling hubs, must be in accordance with the certified General Arrangement Drawing and must be measured with pump and driver shafts in the center of their axial end float. Motor with sleeve bearings is to be aligned with rotor at magnetic center.

Move driver to insure proper gap distance.

NOTE

It is recommended that the pump hold-down bolting be torqued and the pump be dowelled before taking any alignment measurements. This makes the pump the fixed machine and the driver the movable machine. In certain cases, however, it may be impractical to move the driver; therfore, the pump may have to be moved. When this case exists, the pump should not be dowelled until after final alignment.

B. Measure Angular Misalignment

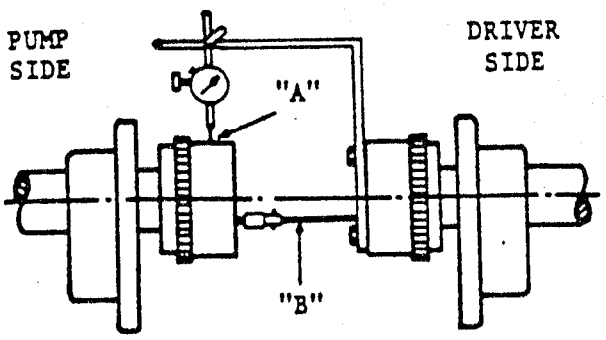
Refer to "ALIGNMENT DATA SHEET" and examples.

CAUTION

PUMP SHAFT SHOULD NOT BE ROTATED UNLESS BEARINGS ARE PRE-LUBED BEFORE ALIGNING STARTS. REFER TO LUBRICATION SECTION.

The angular misalignment can best be determined by the use of a hand-held inside micrometer, marked "B" on sketch. All measurements should be taken at the same radial distance from the shaft centerline, as close as possible to the hub outside diameter. The location of these measurements is defined as the "D" dimension on the "ALIGNMENT DATA SHEET" (pgs. 2-8/2-9). Do not move the shafts axially while rotating the shafts and taking measurements. Both hubs must be rotated together to cancel possible hub face runout. The relative measurement (top minus bottom, right minus left) is the important number.

1. Mark both coupling hubs at 3,6,9 and 12 o'clock positions so they can be rotated together and at 90-degree intervals.



2. Starting with the 12 o'clock markings of both hubs in the top center position, measure the gap at top, bottom, right and left side. Record these dimensions on "ALIGNMENT DATA SHEET" Sheet 1, Part 1 in the 0° Column.

NOTE

Right side and left side are determined when viewing the driver coupling from the pump.

3. Rotate both shafts 90 degrees in the direction of pump rotation. Measure gap dimensions at the four locations as in Step 2. Record on "ALIGNMENT DATA SHEET" Sheet 1, part 1 in the 90° Column.

4. Repeat Step 3 until measurements have been taken at the four positions (0,90,180,270°).

5. Rotate both shafts to the starting position (12 o'clock markings at top center) and recheck dimension recorded in Step 2.

6. For 0,90,180,270° Columns, subtract the bottom from the top and left from right. Record in their respective blocks on Data Sheet. Watch sign notations.

7. Total the different numbers (reading across), divide by 4 and record the "Average_____" Record in "Open At_____" the shaft relative angular position.

NOTE

The inside faces of the driver and pump half hubs must be parallel within .001".

C. Measure Offset Misalignment

Offset misalignment is measured using a dial indicator on the outside diameter of the coupling hubs and rotating the hubs together to cancel rim surface inaccuracies.

1. Starting with the 12 o'clock markings of both hubs on top center, fasten or clamp an indicator on driver hub, marked "A" on sketch, with dial indicator button contacting alignment surface on the pump hub.

2. Zero the dial indicator.

3. Rotate both coupling hubs (in the direction of pump rotation) 90° and take a reading. Record on "ALIGNMENT DATA SHEET" Sheet 1, Part 2 in the proper right side or left side blank (right or left sides are determined when viewing the driver half coupling from the pump).

4. repeat Step 3 until readings have been taken at the four 90° positions (top center, right, bottom and left).

5. Rotate both shafts to the starting position (12 o'clock markings at top center) and verify indicator returns to zero.

NOTE

The sum of the top and bottom readings should always equal the sum of the left and right readings. If the sums are not equal, check for indicator bracket deflection, hub surface irregularity or loose radial bearings.

6. Using the formula on "ALIGNMENT DATA SHEET" Sheet 1, Part 2, subtract the top from the bottom indicator reading, divide by 2. This will yield the vertical misalignment.

7. Using the formula on "ALIGNMENT DATA SHEET" Sheet 1, Part 2, subtract the left from the right indicator reading, divide by 2. This is the horizontal misalignment.

8. Circle the proper high or low and left or right position of the driver hub, using the rules given on the Data Sheet.

NOTE

The outside diameters of pump and driver coupling hubs must be aligned with .003" TIR.

D. Movement Calculations ("ALIGNMENT DATA SHEET"-Sheet 2).

1. Sketch the relative driver shaft position in the side and top views. These sketches will assist visualizing the required equipment move.

2. Alignment depends upon the relationship between D, L_1 and Lo.

Use the formula $\frac{GXL}{D}$ to determine the required move.

NOTE

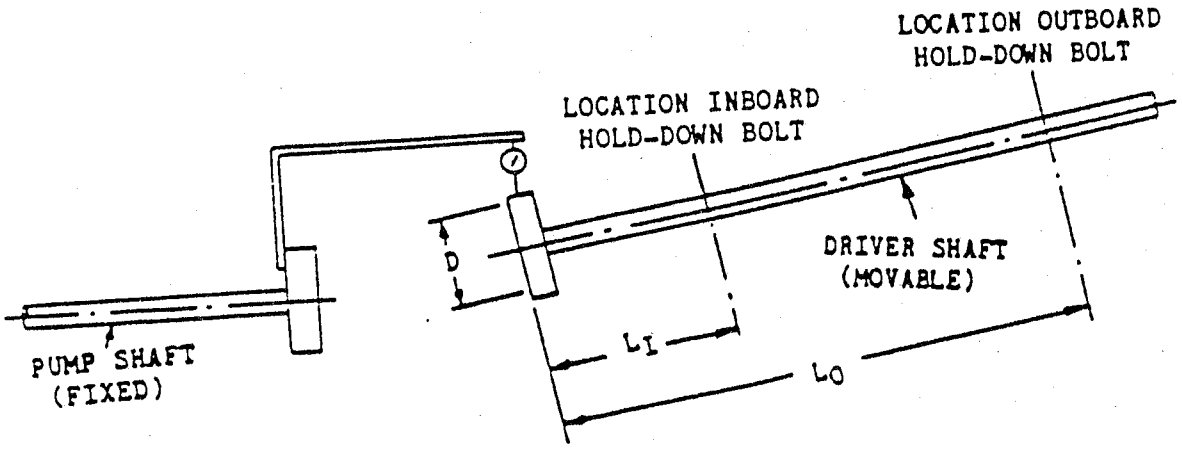
D = Diameter of the circle at which angular misalignment readings were taken (not coupling diameter).

G_Y = Gap difference (top minus bottom) taken from Sheet 1, Part 1.

G_H = Gap difference (right minus left) taken from Sheet 1, Part 1.

L_I = Distance from driver coupling hub to centerline of driver inboard hold-down bolt.

Lo = Distance from driver coupling hub to centerline of driver outboard hold-down bolt.



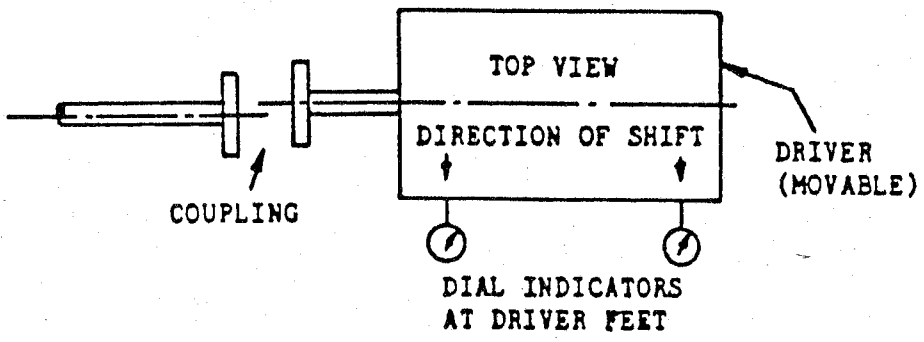
3. Record vertical offset from Sheet 1, Part 2 and vertical move obtained from calculations in the "INBOARD", and "OUTBOARD DRIVER PEDESTAL SHIFT" columns. Also record the required direction of shift (raise or lower).

4. Record horizontal offset from Sheet 1, Part 2 and horizontal move obtained from calculations in the "INBOARD, AND OUTBOARD DRIVER PEDESTAL SHIFT" columns. Also record the required direction of shift (right or left).

5. Total the move requirements (watch move direction). This will yield the required horizontal move (right or left) and the vertical move (raise or lower) required at each mounting foot.

HORIZONTAL MOVE

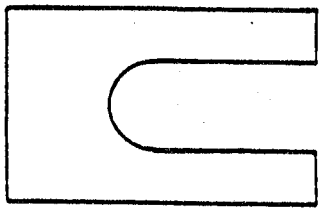
The dial indicators shown below are required to accurately measure the move in the horizontal direction. Move the driver by bumping with soft hammer/mallet or using the jackscrews (if provided). The amount of horizontal relocation required is the total of the horizontal move calculation (bottom of Sheet 2).



VERTICAL MOVE

Before moving the equipment vertically, it is important that the vertical thermal expansion be taken into consideration. The preceeding vertical move calculations are based on pump and driver shafts being set on the same plane. Refer to General Arrangement Notes and/or driver instructions for recommended cold vertical setting (if thermal expansion is a factor).

The shims between the equipment feet and mounting surface should be clean and dry. This is expecially critical for pumps that have been in service for some time and need to be realigned. Water, dirt and rust may change the height of the shim pack over a period of time. Shims should be made large enough to support the weight of the equipment on its mounting foot. Do not use many thin shims, as this may result in a spongy mounting.



RECOMMENDED SHIM DESIGN

Move the equipment vertically by adding or removing the calculated thickness of shims. Torque equipment hold-down bolting to required values.

NOTE

It is recommended, the completed "ALIGNMENT DATA SHEET" be retained as part of your permanent maintenance file.

CHECK COUPLING ALIGNMENT

The angular and offset coupling alignment must be rechecked.

1. Coupling faces are to be parallel within .001" TIR.

2. Coupling outside diameters are to be aligned within .003" TIR.

3. "Bump" the motor and check motor rotation.

ASSEMBLE AND LUBRICATE COUPLING

1. Assemble and lubricate (unless disc type) coupling per the manufacturer's instructions included in rear portion of this manual.

2. Install coupling guard.

HOT ALIGNMENT CHECK

A hot check can only be made after the unit has been in operation a sufficient length of time to assume its NORMAL operating temperature and conditions. If the unit has been properly cold set, the offset misalignment will be within .005" TIR and the angular misalignment will be within .0025" TIR when in operation. If not make adjustments.

WARNING

DO NOT ATTEMPT ANY MAINTENANCE, INSPECTION, REPAIR OR CLEANING IN THE VICINITY OF ROTATING EQUIPMENT. SUCH ACTION COULD RESULT IN INJURY TO OPERATING PERSONNEL.

WARNING

BEFORE ATTEMPTING ANY INSPECTION OR REPAIR ON THE PUMP, THE DRIVER CONTROLS MUST BE IN THE "OFF" POSITION, LOCKED AND TAGGED TO PREVENT RESTARTING EQUIPMENT AND INJURY TO PERSONNEL PERFORMING SERVICE ON THE PUMP.

ALIGNMENT DATA SHEET
HORIZONTAL PUMPS

NAME _____ DATE _____ TIME _____

ALIGNMENT DATA FOR _____ SERIAL NUMBER _____

PUMP TEMPERATURE _____

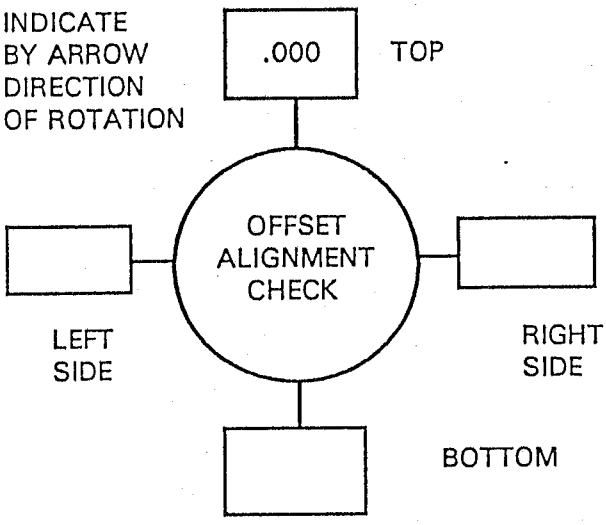
PART 1 ANGULAR ALIGNMENT CHECK

	POSITION	0°	90°	180°	270°	TOTALS	
VERTICAL	TOP						Open At _____
	BOTTOM						Average _____
	DIFF. (T-B)						
HORIZONTAL	*RIGHT SIDE						Open At _____
	*LEFT SIDE						Average _____
	DIFF. (R-L)						

* Right and Left side are determined when viewing the driver hub from the pump.

PART 2 OFFSET ALIGNMENT CHECK

TOTAL INDICATOR READINGS



VIEW OF DRIVER HALF COUPLING
HUB VIEWED FROM PUMP

RULES TO APPLY TO THE RESULTS BELOW:

When Indicator Mounted On The Driver Reads

Negative = Driver Coupling Is High & Left

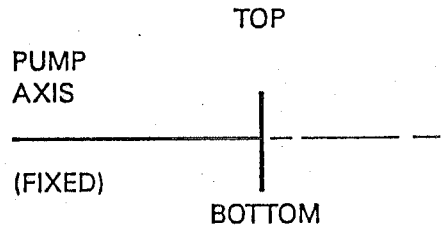
Positive = Driver Coupling Is Low & Right

Driver Coupling Is (Circle Correct One):
High Or Low And Right Or Left

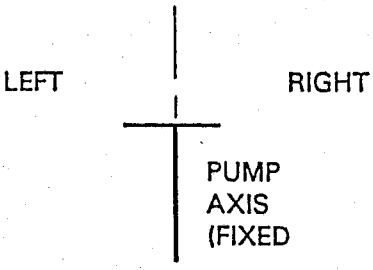
Vertical Offset Misalignment = $\frac{\text{Bottom - Top}}{2}$ = _____ = _____ = _____

Horizontal Offset Misalignment = $\frac{\text{Right - Left}}{2}$ = _____ = _____ = _____

ALIGNMENT DATA SHEET
HORIZONTAL PUMPS



SIDE VIEW (VERTICAL MOVE)



TOP VIEW (HORIZONTAL MOVE)

VERTICAL ANGULAR MOVE CALCULATION — MOVE DRIVER TO CORRECT ALIGNMENT

Driver Inboard Pedestal Shift = $\frac{G_V X L_I}{D}$ = _____ = _____

Driver outboard Pedestal Shift = $\frac{G_V X L_O}{D}$ = _____ = _____

	INBOARD DRIVER PEDESTAL SHIFT		OUTBOARD DRIVER PEDESTAL SHIFT	
	MILS	DIRECTION	MILS	DIRECTION
OFFSET MOVE				
ANGULAR MOVE				
TOTAL				

HORIZONTAL ANGULAR MOVE CALCULATION — MOVE DRIVER TO CORRECT ALIGNMENT

Driver Inboard Pedestal Shift = $\frac{G_H X L_I}{D}$ = _____ = _____

Driver Outboard Pedestal Shift = $\frac{G_H X L_O}{D}$ = _____ = _____

	INBOARD DRIVER PEDESTAL SHIFT		OUTBOARD DRIVER PEDESTAL SHIFT	
	MILS	DIRECTION	MILS	DIRECTION
OFFSET MOVE				
ANGULAR MOVE				
TOTAL				

EXAMPLE

ALIGNMENT DATA SHEET
HORIZONTAL PUMPS

SHEET 1 OF 2

NAME R. LAWRENCE DATE 28SEP89 TIME 4:00 PM

ALIGNMENT DATA FOR 36 X 32 S PUMP SERIAL NUMBER 117825

PUMP TEMPERATURE 74°F.

PART 1 ANGULAR ALIGNMENT CHECK

	POSITION	0°	90°	180°	270°	TOTALS
VERTICAL	TOP	375	378	370	391	
	BOTTOM	377	382	376	395	
	DIFF (T-B)	-2	-4	-6	-4	-16
HORIZONTAL	*RIGHT SIDE	375	380	371	390	
	*LEFT SIDE	378	381	374	395	
	DIFF (R-L)	-3	-1	-3	-5	-12

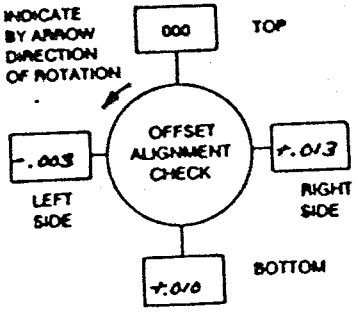
Open At BOTTOM
Average 4

Open At LEFT
Average 3

* Right and Left side are determined when viewing the driver hub from the pump.

PART 2 OFFSET ALIGNMENT CHECK

TOTAL INDICATOR READINGS



VIEW OF DRIVER HALF COUPLING HUB VIEWED FROM PUMP

RULES TO APPLY TO THE RESULTS BELOW

When Indicator Mounted On The Driver Reads

Negative - Driver Coupling Is High & Left

Positive - Driver Coupling Is Low & Right

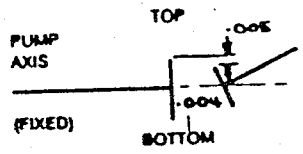
Driver Coupling Is (Circle Correct One)
High Or Low And Right Or Left

Vertical Offset Misalignment = $\frac{\text{Bottom} - \text{Top}}{2} = \frac{10-0}{2} = \frac{10}{2} = +5$

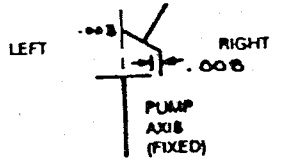
Horizontal Offset Misalignment = $\frac{\text{Right} - \text{Left}}{2} = \frac{13-(-3)}{2} = \frac{16}{2} = +8$

ALIGNMENT DATA SHEET
HORIZONTAL PUMPS

SHEET 2 OF 2



SIDE VIEW (VERTICAL MOVE)



TOP VIEW (HORIZONTAL MOVE)

VERTICAL ANGULAR MOVE CALCULATION — MOVE DRIVER TO CORRECT ALIGNMENT

Driver Inboard Pedestal Shift = $\frac{G_V \times L_I}{D} = \frac{.004 \times 10}{10} = .004$

Driver Outboard Pedestal Shift = $\frac{G_V \times L_O}{D} = \frac{.004 \times 55}{10} = .022$

	INBOARD DRIVER PEDESTAL SHIFT		OUTBOARD DRIVER PEDESTAL SHIFT	
	MILS	DIRECTION	MILS	DIRECTION
OFFSET MOVE	.005	RAISE	.005	RAISE
ANGULAR MOVE	.004	LOWER	.022	LOWER
TOTAL	.001	RAISE	.017	LOWER

HORIZONTAL ANGULAR MOVE CALCULATION — MOVE DRIVER TO CORRECT ALIGNMENT

Driver Inboard Pedestal Shift = $\frac{G_H \times L_I}{D} = \frac{.003 \times 10}{10} = .003$

Driver Outboard Pedestal Shift = $\frac{G_H \times L_O}{D} = \frac{.005 \times 55}{10} = .016$

	INBOARD DRIVER PEDESTAL SHIFT		OUTBOARD DRIVER PEDESTAL SHIFT	
	MILS	DIRECTION	MILS	DIRECTION
OFFSET MOVE	.008	LEFT	.008	LEFT
ANGULAR MOVE	.003	LEFT	.016	LEFT
TOTAL	.011	LEFT	.024	LEFT

SECTION 3
OPERATION
(START-UP & CONTINUOUS)

TECHNICAL DATA

These pumps are furnished for a particular service condition. Changes in the hydraulic system may affect the pump's performance adversely. This is especially true if the changes reduce the pressure at the suction flange or if the liquid temperature is increased. In case of doubt, contact the nearest Ingersoll-Dresser Office.

EFFECTS OF SPECIFIC GRAVITY

The capacity and total head developed by a centrifugal pump are fixed for every point on the curve and are always the same for the same speed. Neither capacity nor total head will be affected by a change in the specific gravity of the liquid pumped. However, since the developed pressure in PSIG (pounds per square inch gauge) and the brake horsepower to drive the pump are a function of the specific gravity of the liquid, both will be affected in direct proportion by any change in specific gravity. Therefore, a change in specific gravity will affect the discharge gauge pressure. Any changes should be noted, in that they may overload the pump's driver.

EFFECTS OF VISCOSITY

The pump is designed to deliver rated capacity at rated head for a liquid with a particular viscosity.

When contemplating operation at some viscosity other than for which the pump was originally designed and/or applied, the changed conditions should be referred to Ingersoll-Dresser Pump Company for our recommendations.

CHANGING PUMP SPEED

Changing the speed of a centrifugal pump changes the capacity, total head and brake horsepower. The capacity will vary in a direct ratio with the speed, whereas the total head will vary as the ratio of the speed squared. The brake horsepower will vary as the ratio of the speed cubed, except in cases where the speed change also reduces the efficiency of the pump. When contemplating speed other than of the original condition, refer to Ingersoll-Dresser Pump Company for recommendations.

NET POSITIVE SUCTION HEAD (NPSH)

Any liquid, hot or cold, must be pushed into the impeller of the pump by some absolute pressure, such as the atmosphere or the vessel pressure from which the pump takes its suction.

The head necessary to push the required flow into the pump is called the Net Positive Suction Head. This value, more commonly called NPSH, is measured above the vapor pressure of the liquid at the pumping temperature.

There are two kinds of NPSH: the NPSH required by the pump, as shown on the pump curve, is the head needed to cover the losses in the pump suction; the second NPSH is that available in the system, taking into account friction loss in suction piping, valves, fittings, etc. In all cases the NPSH Available (measured above vapor pressure) must exceed the NPSH Required, in order to push the liquid into the pump. Failure to meet this will result in both performance and mechanical deformation of the pump, and in certain cases, actual pump failure.

MINIMUM CONTINUOUS STABLE FLOW

When specified, the vibration limits in API can be extended to apply throughout the operating range from "mimimum continuous stable flow" (MCSF) to 110% of rated capacity. Increased vibration is inherent in off-peak operation, therefore, extreme care must be exercised in defining MCSF.

OPERATING PRECAUTIONS

WARNING

DO NOT CLEAN PUMP IN THE VICINITY OF ROTATING PARTS WHEN PUMP IS OPERATING. IF UNUSUAL NOISE OR VIBRATIONS OCCUR, SECURE THE PUMP AS SOON AS POSSIBLE.

1. Never operate the pump with suction valve closed.

2. Never operate the pump with the discharge valve closed.

3. Never operate pump unless it is completely filled with liquid and vented.

4. Never operate the pump unless a proper liquid source is available.

5. Never operate the pump on fluids other than the one specified on the pump data sheet.

PRE-OPERATIONAL CHECKS

The following steps should be followed at initial start-up and after the equipment has been overhauled:

1. Prior to installing the pump, flush the suction side of the system to remove all deposits (slag, bolts, etc.)

2. Ensure pump and piping are clean. Before putting the pump into operation, the piping should be thoroughly back flushed to remove any foreign matter which may have accumulated during installation.

Take all possible care not to contaminate your system.

3. Fill the bearing housing with the proper oil to the proper level. Bearings must receive a small amount of oil prior to starting to insure adequate lubrication at start-up. (Refer to "LUBRICATION" section 4-1.)

4. Ensure pump rotor is properly aligned within casing (refer to "MAINTENANCE" section).

5. Turn pump rotor by hand or with strap wrench to make sure it turn smoothly.

6. Assure that proper seal piping has been installed and has not been damaged.

7. Prior to coupling installation, "bump start" motor to check proper rotation. If rotation is not correct refer to motor manual for proper connections to change rotation (Secure all power prior to change).

8. Ensure coupling is properly aligned and lubricated, and pump and driver are properly dowelled (refer to "SHAFT/COUPLING ALIGNMENT" procedure).

9. Ensure coupling guard is properly installed.

WARNING

THE UNIT MUST NOT BE OPERATED UNLESS COUPLING GUARD IS SECURELY AND COMPLETELY BOLTED IN PLACE. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN INJURY TO OPERATING PERSONNEL.

10. Check torque of all bolting and plugs for tightness.

INITIAL START-UP PROCEDURE

1. Close discharge valve if valve is not already closed, and then crack open to assure minimal flow. (Do not start unit with fully closed valve.) On first starts care must be taken not to cause a system water hammer.

2. Prepare the driver for start-up in accordance with the driver manufacturer's instructions.

3. Warm-Up Pump

Avoid severe thermal shocks to the pump as a result of sudden liquid temperature changes. The pump must be preheated prior to start-up. Unless otherwise specified the external temperature of the casing must be within 100 degrees F of the temperature of the liquid to be pumped at time of start-up. Due to the heavy metal sections, the casing will lag the liquid temper- ature during such changes, and severe temperature stresses and subsequent misalignment of machined fits may result. Preheating is accomplished by circulating a small amount of hot fluid through the casing by utilizing vents, drains or bypass from discharge. Preheat pump slowly at a rate not to exceed 100 degrees F per hour.

4. Prime pump and ensure pump suction valve is open.

CAUTION

BEFORE STARTING OR WHILE OPERATING THE PUMP, THE CASING AND SUCTION LINE MUST BE COMPLETELY FILLED WITH THE LIQUID BEING PUMPED. THE ROTATING PARTS DEPEND ON THIS LIQUID FOR LUBRICATION AND THE PUMP MAY SEIZE IF OPERATED WITHOUT LIQUID.

5. Ensure pump recirculating line (if required) is open, clear and free of obstructions.

6. Check that pump is vented by observing leakage from casing vent and seal piping vent. Close vent when liquid is emitted.

7. Turn on cooling liquid and assure proper flow exists (to cooler, insert gland etc.) as specified.

8. Double check pump rotation by starting unit momentarily. The direction of input shaft rotation is counterclockwise when facing pump shaft from coupling end. Note that the pump coasts to a gradual stop.

CAUTION

IF PUMP STOPS ABRUPTLY WHEN DRIVER IS SHUT DOWN, INVESTIGATE FOR PUMP BINDING. TAKE NECESSARY REMEDIAL ACTION BEFORE RESUMING OPERATION.

9. Start the driver and bring it up to speed quickly.

10. As soon as pump is up to rated speed, slowly open discharge valve. This will avoid abrupt changes in velocity and prevent surging in the suction line.

11. Perform the operating checks.

OPERATING CHECKS

WARNING

IN THE INTEREST OF OPERATOR SAFETY THE UNIT MUST NOT BE OPERATED ABOVE THE NAMEPLATE CONDITIONS. SUCH OPERATION COULD RESULT IN UNIT FAILURE CAUSING INJURY TO OPERATING PERSONNEL.

CAUTION

OPERATION AT LOW FLOWS RESULTS IN PUMP HORSEPOWER HEATING THE LIQUID. A BYPASS MAY BE REQUIRED TO PREVENT VAPORIZATION AND SUBSEQUENT PUMP DAMAGE. REFER TO LOCAL INGERSOLL-RAND BRANCH TO DETERMINE IF A BYPASS IS REQUIRED. MECHANICAL DAMAGE MAY RESULT FROM CONTINUOUS OPERATION AT FLOWS LESS THAN THE SPECIFIED MINIMUM CONTINUOUS STABLE FLOW.

Immediately after start-up, and frequently during running, check the following:

1. Check suction and discharge pressure gauges.

2. Check pressure gauges on each side of suction strainer.

3. Check for excessive leakage at seal areas.

4. Check for unusual noises.

5. Check oil level in bearing housing. (Refer to "LUBRICATION" section.)

WARNING

OPERATION OF THE UNIT WITHOUT PROPER LUBRICATION CAN RESULT IN OVERHEATING OF THE BEARINGS, BEARING FAILURES, PUMP SEIZURES AND ACTUAL BREAKUP OF THE EQUIPMENT EXPOSING OPERATING PERSONNEL TO INJURY.

6. Check for adequate flow of cooling liquids.

7. After unit (particular to services 100°F above ambient) has been operated a sufficient length of time to reach normal operating temperature and condition, the unit is to be shut down and a "HOT" coupling alignment check must be made (refer to "SHAFT/COUPLING ALIGNMENT" procedure).

NORMAL START-UP

The starting procedure to be followed for normal start-up is the same as that for initial starting with the exception that Step 8 "CHECK ROTATION" does not have to be repeated as long as driver systems have not been changed since last pump operation.

SECURING THE PUMP

1. Shut down driver.

The pump should be shut down rapidly to protect the internal wearing parts which are lubricated by the liquid being pumped.

NOTE

If pump stops abruptly when driver is shut down, investigate for pump binding. Take necessary remedial action before restarting pump.

2. Close the pump suction and discharge valve.

3. Close valve in bypass line.

4. Turn off cooling liquid.

5. If pump is subjected to freezing temperatures, the pump must be drained of liquid to prevent damage to pump.

TROUBLE SHOOTING

This chart presents the probable troubles that can occur to the pump along with the probable causes and remedies for the troubles.

TROUBLE SHOOTING CHART

TROUBLE	CAUSE	REMEDY
Insufficient capacity and/or pressure	Suction pressure or speed too low	Open suction valve wide. Check power supply for correct voltage.
	Incorrect direction of rotation	Check driver instruction book.
	Excessive amount of air or vapors in the fluid	Check suction system for air leakage and correct. Vent air. Tighten flange bolts.
	Foreign material in impeller	Dismantle pump and remove any foreign material.
	Foreign material in suction line	Dismantle suction line and remove foreign material.
	Mechanical Causes: Impeller damaged by foreign material. Broken or damaged coupling.	Dismantle pump and correct
Pump loses prime after starting	Insufficient liquid supply	Ensure that suction valve is wide open. Check for proper liquid level. Blocked suction strainer.
	Excessive amount of air or vapors in the liquid	Check suction system for air leakage and correct.
	Clogged impeller	Dismantle pump and correct.
	Suction pipe clogged	Remove foreign material.
Pump vibration	Loose mounting or coupling bolts.	Tighten bolts.
(cont'd)	Coupling	Check alignment and correct.

TROUBLE	CAUSE	REMEDY
(cont'd) Pump vibration	Air or gas in liquid	Vent air and check suction for leaks. Tighten flange bolts.
	Improper installation	Baseplate not evenly and properly supported along rails.
	Foreign material in impeller causing unbalance	Dismantle pump and remove any foreign material.
	Mechanical Causes: Shaft Bent	Dismantle pump and replace part or parts causing vibration.
Pump overloads driver	False overload signal	Check starter controls.
	Wire/connections faulty	Check for hot spots in lines.
	Speed too high	Check driver instruction book.
	Specific gravity too high	Check rated conditions.
	Pump bearings seize or rotating element binds	Dismantle pump and replace part or parts causing seizures, or binding.
Pump stops abruptly	Pump binding at running fits	Dismantle pump and realign rotor in casing.
High pump thrust bearing temperature rise	Improper lubrication, including improper cooling	Replenish oil with proper grade lubricant and assure cooling capacity.
	Insufficient oil. Contaminated oil.	Add oil. Drain and refill with clean oil.
	High oil temperature	Assure proper cooling capacity is supplied.
Excessive seal leakage	Dirt across seal faces.	Replace seal.

TROUBLE	CAUSE	REMEDY
Pump is noisy	Cavitation	Check that pump is primed, check for high suction temperature, increase static head, check for obstruction in suction line.
	Loose parts	Tighten or replace defective part.
	Noise in driver	Check driver with stethoscope.

Check driver instruction book for trouble-shooting instructions.

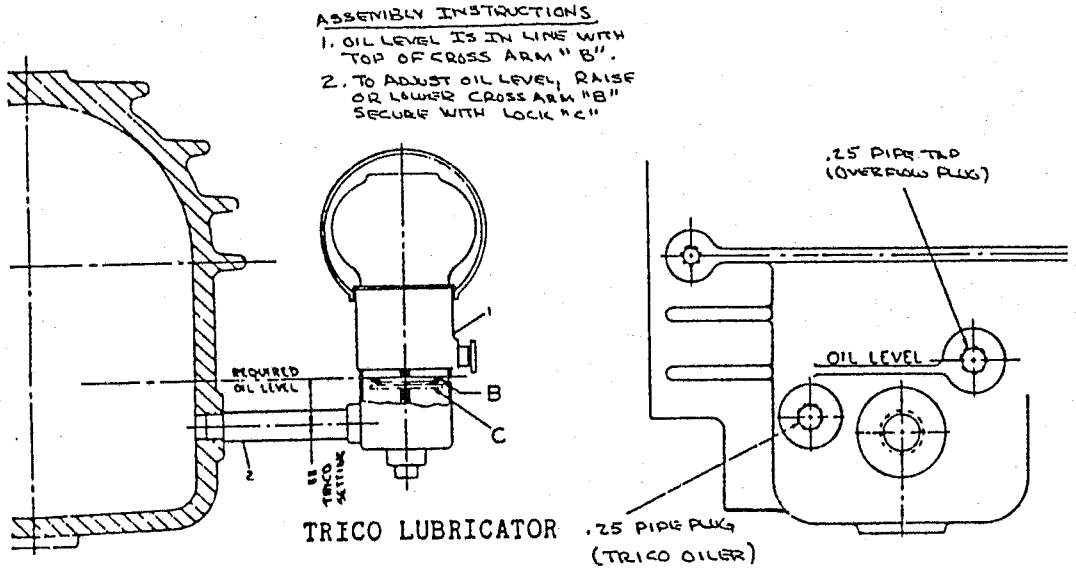
SECTION 4
LUBRICATION

LUBRICATION

A "Trico" Oiler is normally furnished with the pump unless otherwise specified.

PREPARING BEARING HOUSING

Before filling the bearing housing reservoir, flush the housing thoroughly with safety solvent and good grade of flushing oil compatible with the lubricating oil that will be used. Fill the reservoir to the proper level indicated on bearing housing.



TRICO LUBRICATOR

The oil level must be maintained at the proper level. The constant level oiler can be adjusted by changing the height of the cross arms which support the glass reservoir.

INSPECTION

Inspect the oil level in the bearing housing at least once a day. Inspect the condition of the oil at least weekly. Oil is always subject to gradual deterioration from use and contamination from dirt and moisture which causes premature bearing wear.

REPLENISHMENT

Oil requires frequent replenishment at normal temperatures and very frequent replenishment at high temperatures.

OIL CHANGE

Frequency of oil change is dependent on pump service and environmental conditions. As a general practice, oil in the bearing housing should be changed every 4000 operating hours or every six months.

IDEAL LUBRICANT

The ideal bearing lubricant is a straight well refined, neutral mineral oil, preferably of the turbine type. It should not contain free acid, chlorine, sulphur or more than a trace of free alkali. It is suggested that the oil conform to the following physical characteristics, based on tests by ASTM Standard Methods.

ASTM STANDARDS

Oil Characteristics	Napthene Base	Paraffin Base
Flash Point	300°F Min.	360°F Min.
Saybolt Viscosity 100°F	150 (Min.) Seconds	140 (Min.) Seconds
	200 (Max.) Seconds	185 (Max.) Seconds

In a majority of instances SAE 10 Motor Oil will meet the above specifications. Oil must be compatable with all parts requiring lubrication.

TRICO OILER SETTING

Release thumbscrew and remove bottle. Establish a measurement from the centerline of the oiler connection in bearing housing, to the upper cross arm ("B" on Trico Oiler Illustration pg. 4-1) of .88".

Fill bottle with recommended oil and install on holder. Remove and fill bottle as many times as is required to fill the bearing housing to the cross arm level and no air bubbles appear in the bottle.

Remove bottle and ascertain that the oil level is .88" from the centerline of oiler connection. Adjust upper cross arm as required and lock in place with lower arm.

BEARING HOUSING OIL LIMITATIONS

Bearing Housing Size	311	313	316
Maximum Oil Temperature	180°F	180°F	180°F
Min. Oil Temp. At Start-Up	60°F	60°F	60°F
Desirable Operating Temperature	140-160°F	140-160°F	140-160°F
Housing Capacity	3 pts.	4 pts.	5 pts.
Oil Level-Above Oiler Connection Centerline	.88"	.88"	.88"

SECTION 5
MECHANICAL SEALS

MECHANICAL SEALS

DESCRIPTION

A cartridge type mechanical seal is provided to seal the shaft against leakage. All seals used on the "AWS" line pump are of similar construction with small design differences for sealing against specific liquids and conditions.

Long seal life with minimal leakage can only be obtained if the seals are provided with clean, cool liquid. Even tiny solids that may be suspended in the liquid being pumped can damage the seal faces and cause the seal to leak, making an external flush or a different seal arrangement necessary. Seal balancing and arrangement provided for each pump are designed and fitted for the specific order requirements.

The "AWS" line pump can be arranged with either a single, double or tandem mechanical seal. Refer to the General Arrangement Notes for piping connections to be used with your pump.

SERVICING MECHANICAL SEAL

Mechanical seal replacement or servicing requires that the pull-out element be removed from the casing.

For removal of pull-out element refer to page 6-3.

SECTION 6
MAINTENANCE
DISASSEMBLY

DISASSEMBLY - GENERAL

Avoid serious or troublesome problems by systematic maintenance checks. Study the "TROUBLE SHOOTING CHART" (pg. 3-6) as an aid to your maintenance program.

Your pump is a precision machine. Take every precaution to avoid damage or even slight burrs to the shaft bearing areas, as well as any other ground finished surface when dismantling your pump.

It should be understood that the information contained in this manual does not relieve operating and maintenance personnel of the responsibility of exercising normal good judgement in operation and care of the pump and its components.

Before performing any disassembly, maintenance and/or inspection on the unit, the following steps should be taken and warnings observed.

1. Tag driver controls in the "off" position.

WARNING

BEFORE ATTEMPTING ANY INSPECTION OR REPAIR ON THE PUMP, THE DRIVER CONTROLS MUST BE IN THE "OFF" POSITION, LOCKED AND TAGGED TO PREVENT INJURY TO PERSONNEL PERFORMING SERVICE ON THE PUMP.

2. Isolating pump.

WARNING

BEFORE ATTEMPTING TO DISASSEMBLE PUMP, PUMP MUST BE ISOLATED FROM SYSTEM, BY CLOSING SUCTION AND DISCHARGE SYSTEM VALVES, DRAINED OF LIQUID AND COOLED, IF PUMP IS HANDLING HOT LIQUID.

3. Draining pump.

A. If handling hot liquids.

WARNING

WHEN PUMP IS HANDLING "HOT" LIQUID, EXTREME CARE MUST BE TAKEN TO ENSURE SAFETY OF PERSONNEL WHEN ATTEMPTING TO DRAIN PUMP. HOT PUMPS MUST BE ALLOWED TO COOL BEFORE DRAINING.

B. If handling caustic liquids.

WARNING

WHEN PUMP IS HANDLING "CAUSTIC" LIQUID, EXTREME CARE MUST BE TAKEN TO ENSURE SAFETY OF PERSONNEL WHEN ATTEMPTING TO DRAIN PUMP. PROTECTIVE DEVICES OF SUITABLE PROTECTIVE MATERIALS MUST BE WORN WHEN DRAINING PUMP.

C. If on vacuum service.

WARNING

BEFORE ATTEMPTING ANY MAINTEANCE WORK ON PUMPS IN VACUUM SERVICE, PUMPS MUST BE ISOLATED FROM SUCTION AND DISCHARGE SYSTEM THEN CAREFULLY VENTED TO RETURN PRESSURE IN PUMP CASING TO ATMOSPHERIC PRESSURE.

4. Draining lubricating oil

WARNING

USE CAUTION WHEN DRAINING HOT OIL FROM BEARING HOUSING TO PREVENT BURNS/INJURY TO PERSONNEL.

PUMP DISASSEMBLY INSTRUCTIONS FOR MAINTENANCE

DISASSEMBLY OF PULL-OUT ELEMENT

This is a pull-from-rear design, so it is not necessary to remove casing, or to detach suction or discharge piping, coupling hubs or to remove driver.

Refer to parts explosion drawing for identification of parts.

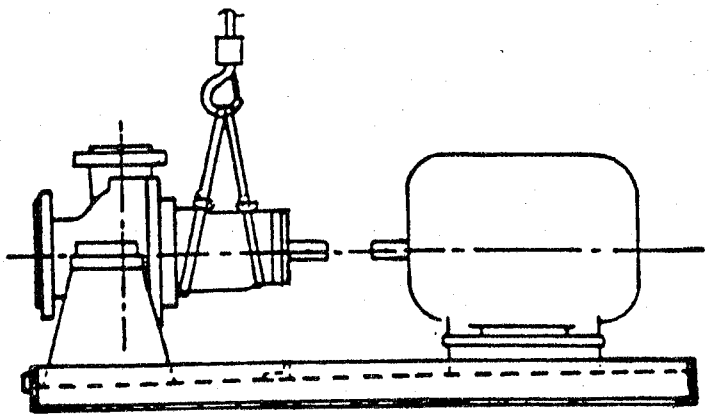
1. Remove all seal piping, related instrumentation and electrical equipment that will interfere with disassembly.

WARNING

USE EXTREME CAUTION NOT TO EXPOSE MAINTENANCE PERSONNEL TO HOT OR CAUSTIC LIQUIDS WHEN REMOVING AUXILIARY PIPING OR WHEN DRAINING PUMP.

2. Disassemble and remove coupling guard and coupling spacer.

3. Place lifting straps around pump at coupling end of bearing housing (159) and at casing cover (394/bearing housing (159) area. Take a slight strain on slings.



LOCATION OF LIFTING STRAPS FOR REMOVING PUMPING ELEMENT.

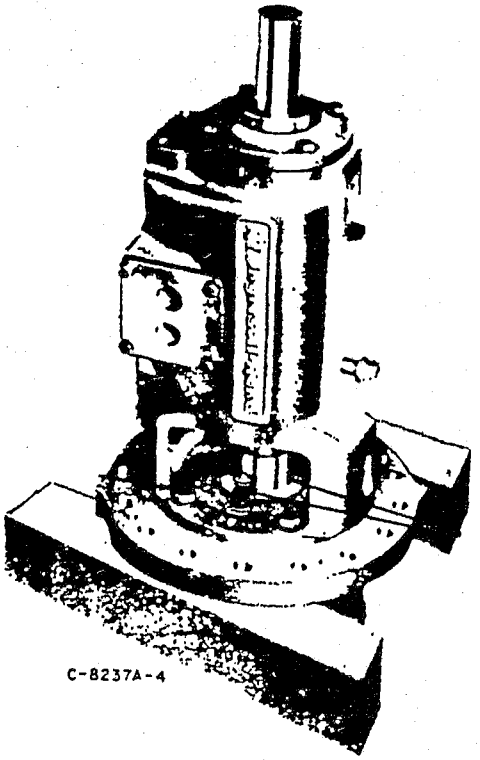
4. Remove casing cover (394) to casing (1) main flange bolting (766A). Install two jackscrews (provided) in casing cover. Tighten jackscrews evenly to separate joint between casing cover and casing.

5. Carefully withdraw pumping element from casing until impeller (3) is clear of casing. Move pumping element to area where disassembly will be performed.

6. With pumping element in horizontal position and properly supported, release locking tab(s) on impeller tab washer (241A). Remove impeller capscrew (177) or capnut (179), tab washer (241A) and washer (246).

7. Remove impeller (3) and impeller key (11).

8. Place the remaining assembly in a vertical position (coupling end up) on blocking. Blocking must be of sufficient height to prevent shaft end from contacting floor.



9. Remove hex nuts (766B) from the gland studs (178B).

10. Loosen mechanical seal lock collar setscrews from shaft.

11. Remove the capscrews (118) which secure the bearing housing (159) to the casing cover (394).

Carefully pull the bearing housing (159) and shaft assembly from the casing cover (394) and cartridge seal assembly (429).

12. Lower bearing housing assembly to a horizontal position and place on supports.

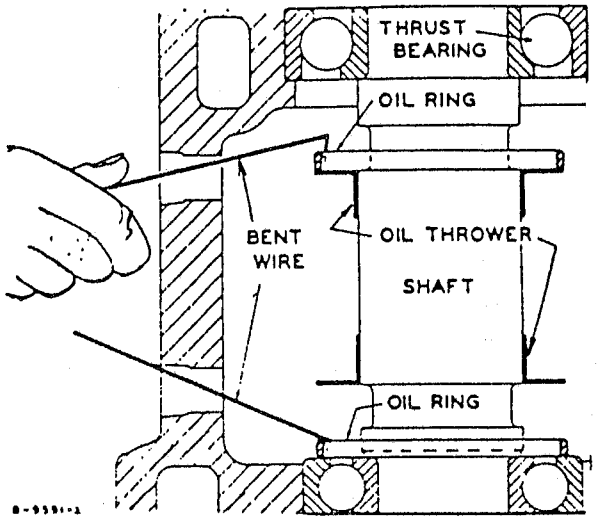
13. Loosen setscrews (259B) and remove coupling end flinger (157B) from the shaft (10).

14. Remove capscrews (118B) from bearing housing end cover (160B).

15. Release setscrew (259B) in pump end flinger (157A) and remove flinger.

16. Remove capscrews (118A) from bearing end cover (160A). Remove bearing end cover and gasket (216A) from the shaft (10).

17. Place bearing housing assembly in vertical position with coupling end up. To avoid damage to the oil rings (31), position them as shown.



18. Remove the shaft assembly from coupling end of bearing housing (159).

CAUTION

TAKE CARE NOT TO DAMAGE THE OIL RINGS (31).

19. Release locking tab of lockwasher (241B). Remove locknut (240) and lockwasher (241B).

20. Bearings (204/205) can be removed by the use of a press or puller. Bearing must be installed in the same manner as removed. It is suggested that each bearing be marked for sequence and direction.

NOTE

When removing bearings (204/205) exert pressure on inner race only. Do not exert any pressure on outer bearing race. (See page titled "BEARING HANDLING INFORMATION".)

21. Remove oil rings (31) and oil throwers (50) from the shaft (10).

This completes disassembly.

SECTION 7
MAINTENANCE
INSPECTION AND RENEWAL OF PARTS

INSPECTION AND RENEWAL OF PARTS

GENERAL

Having dismantled the rotor, check the shaft for runout using "V" blocks or rollers placed under the bearing areas. Runout of shaft is not to exceed .002" TIR.

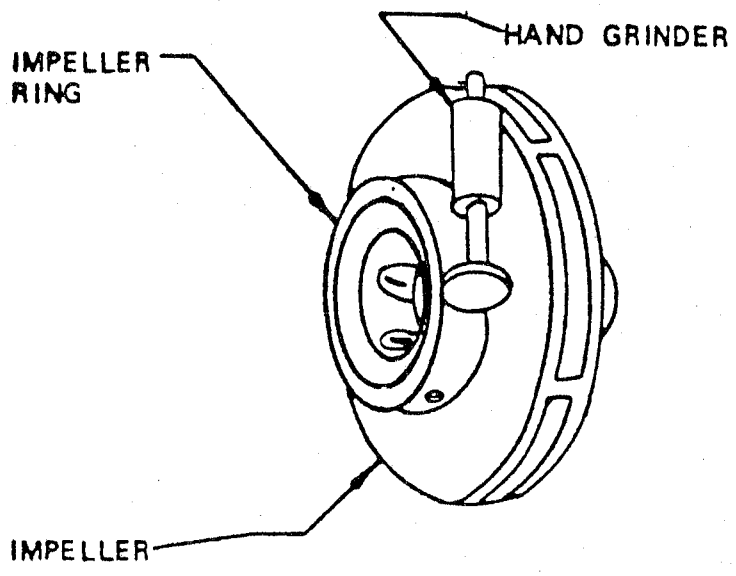
Wire brush the pump parts thoroughly. Clean off all scale, carbon, etc. Examine parts for wearing, corrosion and erosion.

Check shaft sleeve for wear and replace as required.

WEAR RINGS (4A/4B)

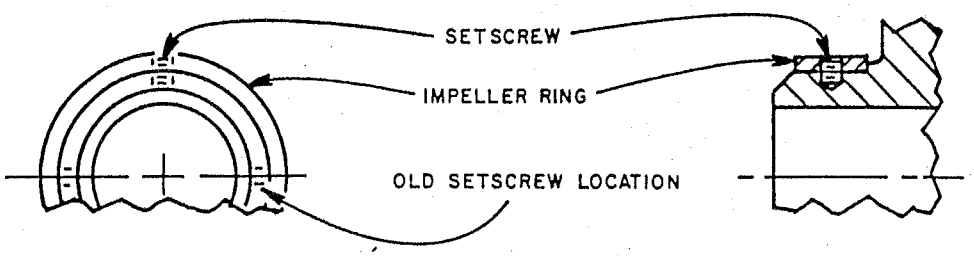
The impeller wear rings are renewable and should be replaced when badly grooved, and/or when pump performance does not meet the system requirements. Whenever it becomes necessary to replace either wear ring, both rings involved (impeller and casing/stuffing box extension) must be ordered and replaced as a set, as they are furnished standard size only (impeller rings approximately .08 inch oversize). Be sure to re-establish the original running clearance between the two wear rings involved.

To remove impeller wear rings (4A/4B) first remove setscrews (259A). Rings can be machined off or grind two slots diametrically opposite across the width of the ring so it can be split apart. Use caution if ring is removed by grinding, so as not to damage impeller hubs.



Impeller Ring Removal

Make sure ring fits on impeller are free of nicks or burrs. Heat new ring to 225°F and install on impeller. Drill and tap new holes in impeller, (located from clearance holes in ring) for 10-24X1/2" setscrews spaced half the circular distance from the previously used holes in the impeller. See sketch.



Typical Screw Installation For Impeller Rings

NOTE

Impeller wear rings (4A/4B), when installed, must be machined to establish original diameter and running clearance.

NOTE

Whenever an impeller has new wear rings installed, it must be dynamically balanced before being reassembled.

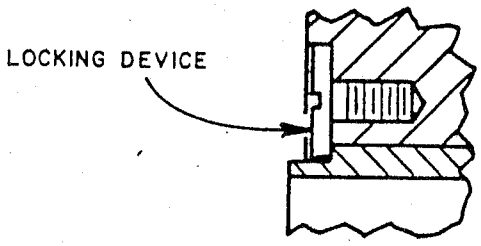
WEAR RINGS (6A/6B)

Each wear ring (6A/6B) is locked against rotation with a lock screw (82) which is secured in place by the edge of the counterbore in the casing (1) and casing cover (394). The lock screw is removed with the use of a screwdriver.

To remove a wear ring (6A/6B) first remove the lock screw (82) and then press out the wear ring. If this method does not easily effect removal of the ring, it can be split apart. First, however, drill one or more holes in the face of the worn ring.

New rings to be installed must be shrunk by freezing then installing in casing or casing cover. When installing new ring, make sure the counterbore in the ring lines up with the counterbore in the casing or casing cover.

Replacement wear rings are furnished standard size in the bore. If required, machine the new wear rings to "true up" bore and restore original running clearance.



Locking Device For Wear Ring In Casing And Casing Cover

MECHANICAL SEAL (429)

Mechanical seal stationary and rotating faces should be inspected for signs of wear or cracks, and replaced as necessary.

It is recommended that new "O" rings and gaskets be used when reassembling mechanical seal.

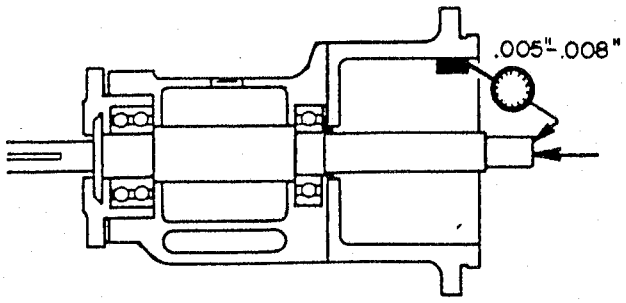
Refer to manufacturer's drawing for assembly of mechanical seal.

STUFFING BOX BUSHING (88)

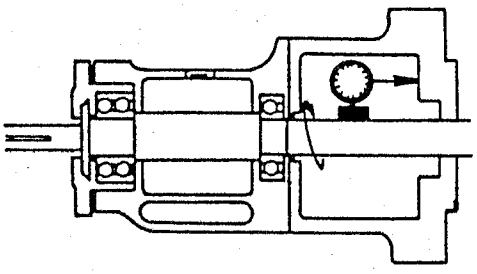
Check the stuffing box bushing (88A) and replace if required. To remove, grind the tack weld and drive the bushing from its fit in the casing cover (394). Take care not to damage bushing fit in the casing cover.

To replace, chill the new bushing to 0°F and install in the stuffing box extension using an approved press/puller. Tack weld in position, then check to determine that satisfactory diametral running clearance is restored.

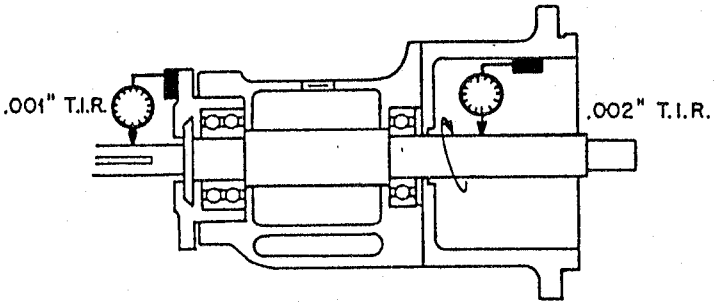
SHAFT/SEAL CHAMBER RUNOUT CHECKS (LIMITS)



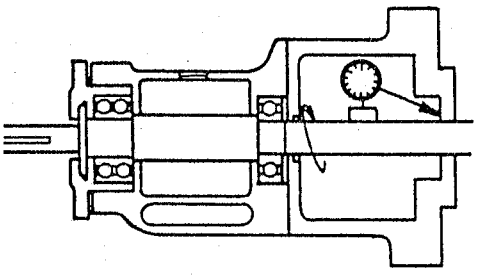
Measuring Shaft End Play



Measuring Seal Chamber Face Run-Out



Measuring Shaft Run-Out



Measuring Seal Gland Register

BEARING HANDLING INFORMATION

The ball bearings (204/205) require proper handling and installation to ensure optimum performance. The following information is intended as a minimum to ensure that the bearings are handled and installed properly.

BEARING HANDLING

1. Do not remove new bearings from their storage package except to inspect the bearings, when stored for a long period of time or just prior to their installation.

2. Work area must be clean to ensure that no dirt or other contaminates will enter the bearings. Handle bearings with clean, dry hands and with clean, lint-free rags. Lay bearing on clean paper and keep covered. Never expose bearings on a dirty bench or floor.

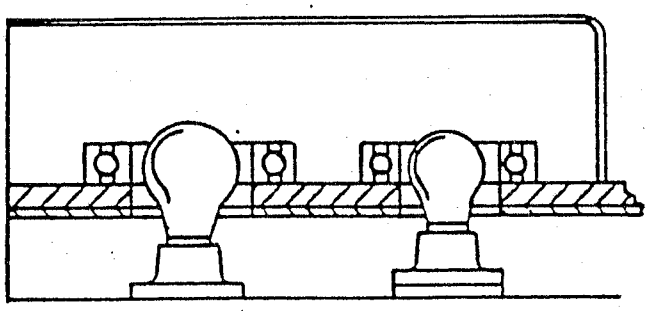
3. Do not wash a new bearing. It is already clean, and the preservative should not be removed.

4. Before mounting, be sure shaft bearing areas are clean and free of nicks and burrs. Check the dimensions of these areas to ensure proper fit of bearings.

BEARING INSTALLATION

1. There are two simple methods of providing a heat source for expanding the inner race of the bearings to facilitate mounting. In the first method, bearings (still wrapped in their original intimate wrap) are placed on a shelf in a temperature-controlled oven, or in an enclosure lined with foil and heated with electric light bulbs. A temperature of 150°F for one half hour should be sufficient.

A second method consists of locating a light bulb (100 to 150 watt) in the bore of the bearing. The light bulb primarily will heat the inner ring and bearing can usually be handled by the outer ring without special gloves. Care must be taken to keep the bearing clean and uncontaminated.



LIGHT BULBS ARE LOCATED IN THE BORE OF THE BEARING AS A HEAT SOURCE FOR EXPANDING THE INNER RACES OF BEARINGS FOR MOUNTING.

NOTE

The old and popular method of heating bearings in an oil bath is DEFINITELY DISCOURGED. HEATING INNER RING WITH A GAS TORCH IS PROHIBITED. In either case, it is difficult to control the heating rate and final temperature, and even more difficult to keep the oil and/or bearing clean.

2. When bearings are installed on shaft, make sure bearing is installed squarely and is firmly seated. Hold bearing in place until it has cooled sufficiently so that it will not move from position. Cover bearings to protect them from dirt.

TORQUE VALUES

Main Flange Bolting (Casing To Stuffing Box Extension)		
Stud Size	Material	Torque Value (Ft./Lbs.)
.88	314	264 - 310
1.00	314	404 - 475

Bearing Housing To Stuffing Box Extension		
Bolt Size	Material	Torque Value (Ft./Lbs.)
.50	175	13 - 16
.62	175	27 - 33
.75	175	47 - 55

Bearing End Covers And Cooling Cartridge To Bearing Housing		
Bolt Size	Material	Torque Value (Ft./Lbs.)
.38	175	6 - 8
.50	175	13 - 16

Gland Studs (Mechanical Seal Only)		
Stud Size	Material	Torque Value (Ft./Lbs.)
.50	314	26 - 30
.62	314	43 - 50
Used On Stainless Steel Fitted Pumps		
.50	314	17 - 20
.62	379	21 - 25

Impeller Capscrews	
Impeller Capscrew Size	Torque Value (Ft./Lbs.)
.50	17 - 20
.62	34 - 40
.75	51 - 60
.88	68 - 80
1.25	119 - 140
1.50	153 - 180

Thrust Bearing Lock Nut	
Bearing Size (Stamped On Bearing)	Torque Value (Ft./Lbs.)
7311	73 - 77
7313	102 - 107
7316	155 - 163

Torque Values listed above are selected to achieve proper amount of pre-stress in the threaded fastener. Maintenance personnel must insure that threads are in good condition (free of burrs, galling, dirt, etc.) and that commercial thread lubricant is used. Torque should be periodically checked to assure that it is at the recommended value.

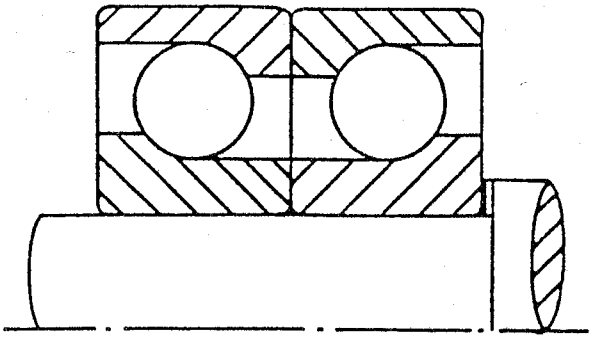
ASSEMBLY

1. Install oil throwers (50) and oil rings (31) onto shaft (10). Secure oil throwers to shaft by tightening setscrews (259C).

2. Install the thrust (204) and radial (205) bearings in the same sequence and direction as removed.

CAUTION

INNER THRUST BEARING (204) MUST BE ASSEMBLED AGAINST SHOULDER ON THE SHAFT (10) WITH THE WIDE FLANGE OF THE OUTER RACE TOWARDS THE COUPLING. THE OUTER THRUST BEARING IS TO BE PLACED ON THE SHAFT WITH THE WIDE FLANGE OF THE OUTER RACE TOWARDS THE INNER BEARING.



NOTE

When installing bearings on shaft, a slight heat is required to expand the inner bearing race. The use of a 150 watt light bulb with an aluminum foil cover to contain heat is recommended. Place bulb near inner race of bearing and use foil cover over bearing and light bulb. Heat for approximately 20 - 30 minutes.

3. Install lockwasher (241B) and locknut (240).

4. Place the bearing housing (159) in a vertical position on blocks in preparation for installation of shaft assembly. Make sure blocking is of sufficient height so that shaft will not hit floor.

5. Rig shaft to overhead hoist and suspend vertically for installation into bearing housing (159). Position oil rings (31) on shaft (10) to prevent damage as they enter bearing housing.

6. Install gasket (216A) and end cover (160A). Lower the shaft assembly into the bearing housing (159). Install gasket (216B) and end cover (160B).

NOTE

Check the end play of the bearings. End play should be between .005" to .008". Adjust the thickness of shims (257A/B/C) as required until this tolerance is maintained.

7. Install coupling and pump-end flingers (157A/B) onto shaft (10). Position flingers approximately .040" to .050" from their respective end covers (160A/B) and set the setscrews (259B) in each flinger.

8. Place bearing housing (159) in a horizontal position.

18. Check to see if rotor runs freely by turning the shaft with a strap wrench or by hand. Make any corrections or adjustments.

19. Check driver rotation. Driver rotation must coincide with direction indicated by arrow on pump.

20. Align pump - motor coupling per "SHAFT/COUPLING ALIGNMENT" instructions and install spacer piece.

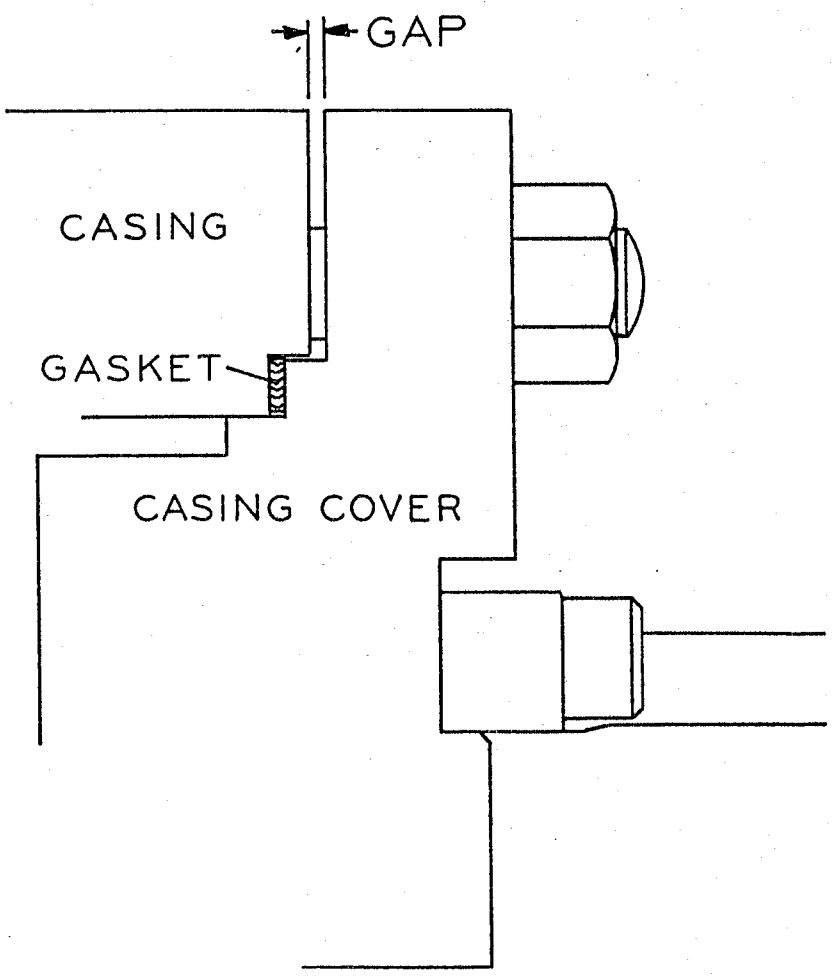
Lubricate coupling per manufacturer's coupling instructions.

Install coupling guard.

21. Replace all auxiliary piping.

1.50X2X10.5AWS (BACK PULLOUT DESIGN)

When reassembling the pump it is advisable to use new gaskets. The casing cover should be drawn up sufficiently tight to prevent leakage, and the flange "GAP" should be even all around as measured with feelers. If for any reason the main parting flange bolting is retorqued, coupling alignment must be rechecked.



INSTRUCTIONS TO BIDDERS — FILL IN EVERY SPACE FOR EACH PUMP TO MAKE BID COMPLE

B. PRESSURES: (LBS./SQ. IN.)					
1. SUCTION AT PUMP (INCL. B-5) psi ABSOLUTE	13.0	15.5	103.7	16.5	104.0
2. DIFFERENTIAL	19.3	19.6	56.1	21.6	65.2
3. DISCHARGE psi ABSOLUTE	32.3	35.1	159.8	38.1	169.2
4. HYDROSTATIC TEST ON CASE (BY SUPPLIER)	1200	1200	1200	1200	1200
5. NET POSITIVE SUCTION HEAD (FT.)	10.3	18.7	55.9	21.6	45.0
6. DIFFERENTIAL HEAD (FT.)	62.2	63.7	288.0	69.5	264.7
C. OPERATION					
1. EFFICIENCY AT RATING	53	54	56	54	54
2. BHP AT RATING	1.06	2.04	5.9	2.34	7.1
3. MINIMUM IMPELLER DIA. (INS.)	6½	8½	5½	8½	5½
4. BID IMPELLER DIA. (INS.)	8	9	7¾	9⅜	8⅛
5. MAXIMUM IMPELLER DIA. (INS.)	8½	10½	8½	10½	8½
6. MAX. BHP FOR BID IMP. DIA.	1.49	2.3	7.6	2.6	9.2
7. MAX. BHP FOR MAX. IMP. DIA.	1.85	3.65	11.4	3.65	11.2
8. ENTRANCE VEL. AT RATING (FT./SEC.)	3.9	7.65	7.65	7.65	7.65
9. NET POSITIVE SUCTION HEAD REQUIRED, FT.	5	6	7	6	7
10. RPM	1750	1750	3550	1750	3550
11. DIRECTION OF ROTATION: (FACING PUMP COUPLING) CCW ~~CW~~	CCW	→	→	→	→
IIA NEMA FRAME NO.	184	213	215	213	254U
12. NUMBER OF STAGES	ONE	ONE	ONE	ONE	ONE
13. MAX. CASING WORKING PRESS (LBS./SQ. IN. GA.)	750	750	750	750	750
D. CONSTRUCTION AND MATERIAL					
1. CASE: INNER					
OUTER	CI	→	→	→	→
2. IMPELLER WEAR RINGS	BRZ	→	→	→	→
3. CASE WEAR RINGS	BRZ	→	→	→	→
4. SHAFT	416 SS	→	→	→	→
5. SHAFT SLEEVES	BRZ	→	→	→	→
6. IMPELLER	CI	→	→	→	→
7. PACKING: TYPE.	MECH SEAL (John Crane 1B)	→	→	→	→
8. LANTERN RING					
9. THROAT BUSHING	BRZ	→	→	→	→
10. CASING GASKET	GAR 702 OR EQUAL	→	→	→	→
11. CASING STUDS	SAE 4140	→	→	→	→
12. GLAND BOLTS	18-8 SS	→	→	→	→
13. FLEXIBLE COUPLING	FALK	→	→	→	→
14. BASE PLATE (Extended for driver)	CI	→	→	→	→
15. STAGE PIECES	NONE	→	→	→	→
16. GLANDS	BRONZE	→	→	→	→
17. SHAFT DIAMETER	2 7/16	→	→	→	→
18. SHAFT SLEEVES EXTEND THRU GLAND	YES	→	→	→	→
MANUFACTURER'S TYPE & SIZE	WILSON SNYDER TYPE ES	1½x2x10½	1½x2x8½	1½x2x10½	1½x2x8½

25. C. L. LANTERN RING TO OPEN END OF STUFF. BOX IN.	1 15/16		
26. PACKING: NO. RINGS AND SIZE			
E. BEARINGS AND LUBRICATION			
1. THRUST: (SAE NO. ON FINAL DATA SHEET)	BALL	5209	
2. RADIAL: (SAE NO. ON FINAL DATA SHEET)	BALL	6206	
3.	GREASE PACKED A / FLOOD OILING B / RING OILING C		
THRUST	C		
RADIAL	C		
4. TYPE OF CLOSURES	LABYRINTH		
5. METHOD OF SEALING	DEFLECTOR		
6. VISIBLE LUBRICATORS: TYPE	GITS		
7. VISIBLE LUBRICATORS: CAPACITY	4oz		
8. BEARINGS WATER COOLED	JACKETED		
F. CONNECTIONS			
1.a SUCTION: SIZE	2"		
1.b SUCTION: RATING	250#		
1.c SUCTION: FACING	FF		
2.a DISCHARGE: SIZE	1½"		
2.b DISCHARGE: RATING	250#		
2.c DISCHARGE: FACING	FF		
3. VENTS AND DRAINS ¼" MINIMUM	½"		
G. TESTING			
STATE EXTRA COST, IF ANY, FOR EACH			
1. DYNAMIC BALANCING OF IMPELLERS	YES	YES	
2. WITNESSED PERFORMANCE TEST (NON-WITNESSED)	YES	YES	
3. HYDROSTATIC TEST (NON-WITNESSED)	YES	YES	
4. INSPECTION	YES	YES	
5. RUNNING TEST WITH ACTUAL DRIVER	NO	NO	
H. MISCELLANEOUS			
1. PRICE EACH FOB ~~Factory~~ Pgh. PA	$964.00	$951.00	
2. WEIGHT (LBS.) NET	550	600	
2.a WEIGHT, BOXED FOR SHIPMENT	600	650	
3. SHIPMENT FROM RCPT. OF ORDER, WEEKS	14-16		
4. SUCTION: DOUBLE OR SINGLE	Single		
5. DRIVER HP	1½	3	
6. TYPE OF DRIVER: MOTOR OR TURBINE (By Purchaser)	M	M	
7. DRIVER: INTEGRAL, COUPLED	coupled	coupled	
8. PERFORMANCE CURVE (MANUFACTURER'S NO.)	T-6225	T-6580	
8.a " " (FOREIGN PRINT NO.)	23-61-7	23-61-11	
9. OUTLINE DRAWING (MANUFACTURER'S NO.)	5-52511	5-52512	
9.a " " (FOREIGN PRINT NO.)	23-61-1	23-61-2	
10. CROSS SECTION DWG. (MANUFACTURER'S NO.)	8-50000		
10.a " " (FOREIGN PRINT NO.)	46-61-3		
11. MFRS. SERIAL NO. (ON FINAL DATA SHEET)	6579	6580	

BECHTEL CORPORATION
SAN FRANCISCO

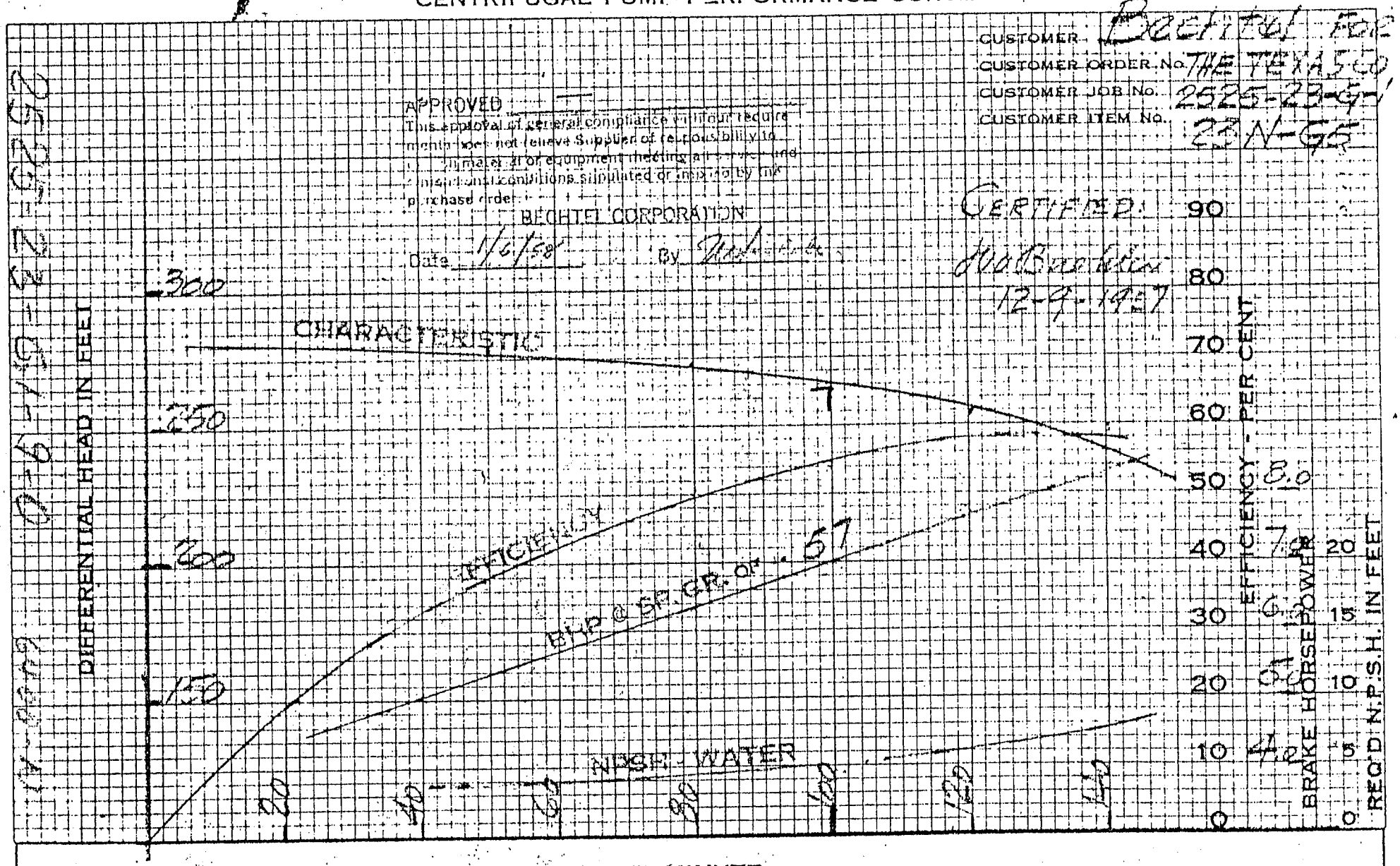
REV.	DATE				
1	11-2-57	Issued For Construction	EKB	MS	
2	7-23-58	Issued For Purchase	EKB	MS	
3	6/5/67	Issued For Quote & Approval		MS	

COMPLETED MFG. DATA ISSUED FOR CONSTRUCTION 6-11-68

Miscl. Pumps Thermal
The Texas Co

FORM 129, REV. 7-56-2M JPCO.

CENTRIFUGAL PUMP PERFORMANCE CURVE



SIZE & TYPE 12 12x8 2 ES

R.P.M. 3550

IMPELLER 50574 DIA. 8 1/4

EYE AREA

WILSON-SNYDER WORKS

OIL WELL SUPPLY DIVISION

UNITED STATES STEEL CORPORATION

BRADDOCK, PA.

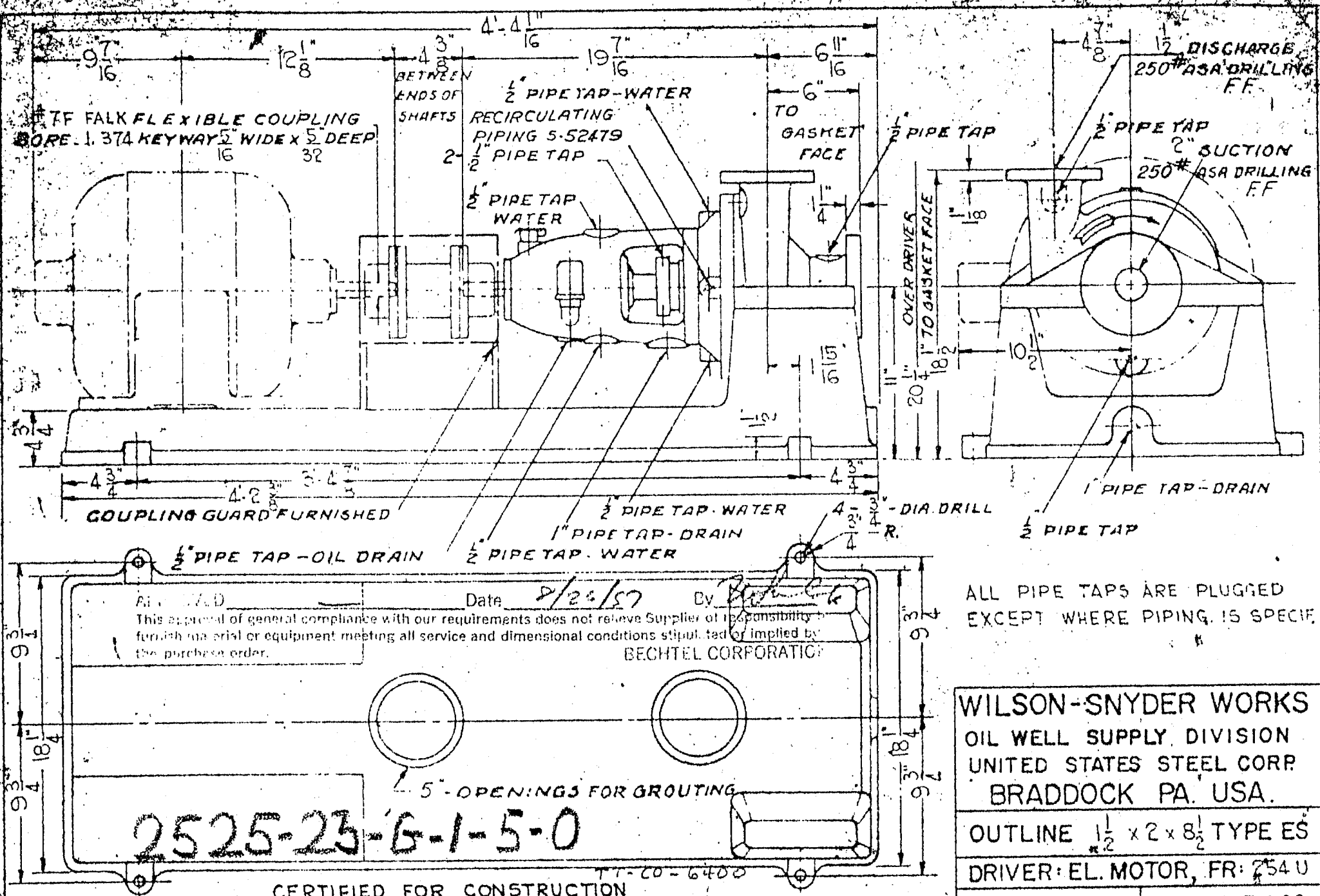
TO 2501

DATE 12-7-1957

PUMP SERIAL No. 6583

CURVE No. T 0583

W 354 REV. 151



A: ...D Date 8/25/57 By

This approval of general compliance with our requirements does not relieve Supplier of responsibility to furnish material or equipment meeting all service and dimensional conditions stipulated or implied by the purchase order.

BECHTEL CORPORATION

ALL PIPE TAPS ARE PLUGGED EXCEPT WHERE PIPING IS SPECIF...

2525-23-G-1-5-0

CERTIFIED FOR CONSTRUCTION
FOR THE BECHTEL CORP. FOR THE TEXAS CO.
BECHTEL JOB NO: 2525-23-G-1 ITEM NO: 23N-G-5
W.S. JOB: 7J-9501, PUMP NO: 6583, SERVICE: BAD ORDER LPG. TRK. UNLDS
AUG. 15, 1957 PER:

WILSON-SNYDER WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL CORP.
BRADDOCK PA. USA.

OUTLINE 1½ x 2 x 8½ TYPE ES		
DRIVER: EL. MOTOR, FR: 254 U		
BASE: S-50632-4	CASE: S-51093	
DRN. M.C.Z	CKD.	DATE 8-15-57

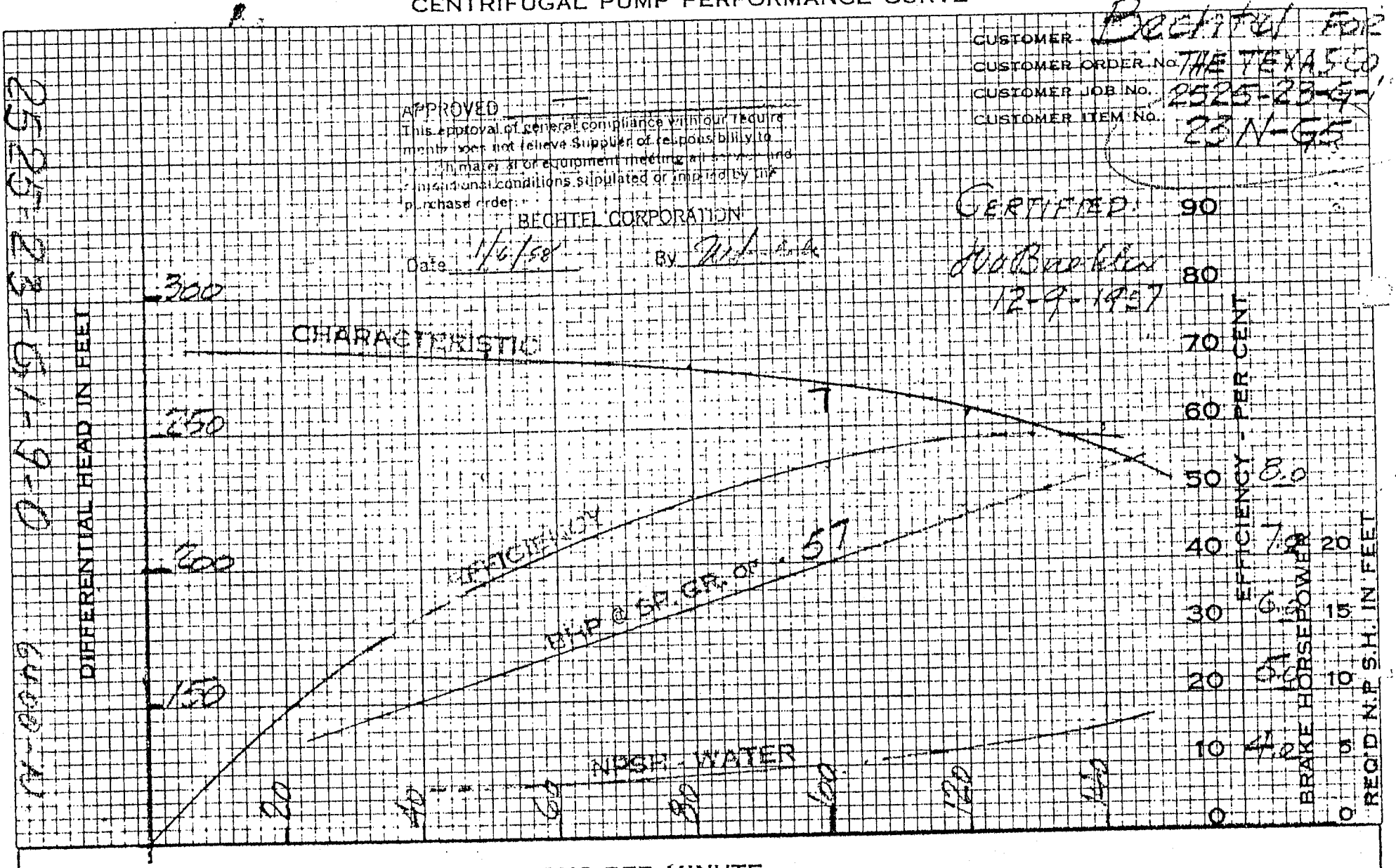
S-52510 1/8

CENTRIFUGAL PUMP PERFORMANCE CURVE

CUSTOMER Bechtel for
CUSTOMER ORDER No. The Texas Co
CUSTOMER JOB No. 2525-23-5
CUSTOMER ITEM No. 22 N-65

APPROVED
This approval of general compliance with our require-
ments does not relieve Supplier of responsibility to
furnish proper equipment meeting all ratings and
operational conditions stipulated or implied by the
purchase order.
BECHTEL CORPORATION
Date 1/6/58 By

CERTIFIED
H.A. Bracken
12-9-1957



GALLONS PER MINUTE

SIZE & TYPE 12 x 12 x 82 ES
R.P.M. 3550
IMPELLER 50574 DIA. 8¼
EYE AREA

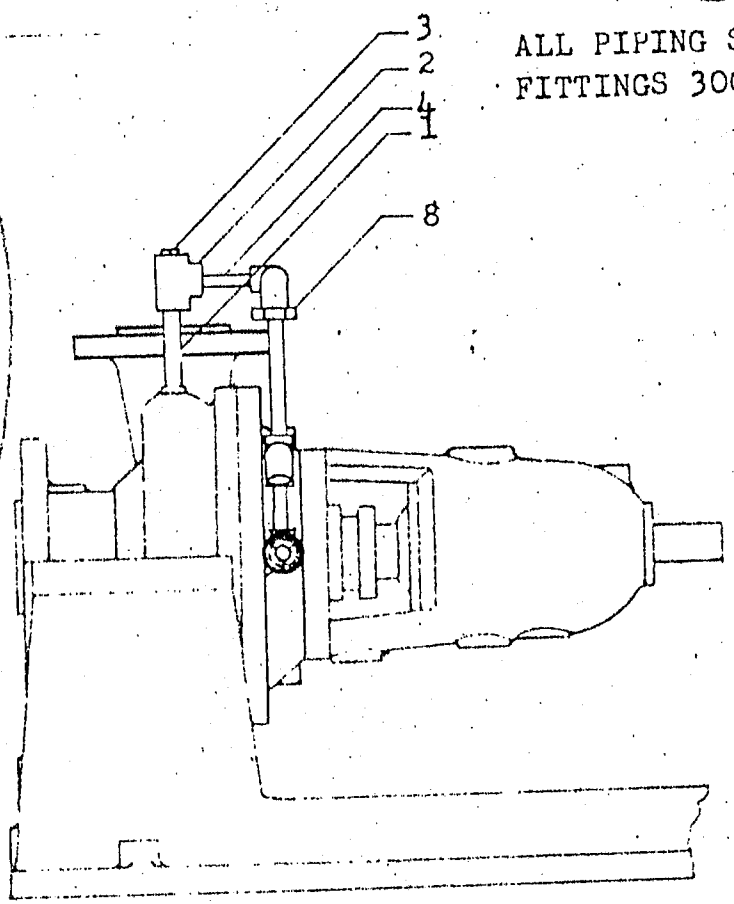
WILSON-SNYDER WORKS
OIL WELL SUPPLY DIVISION
UNITED STATES STEEL CORPORATION
BRADDOCK, PA.

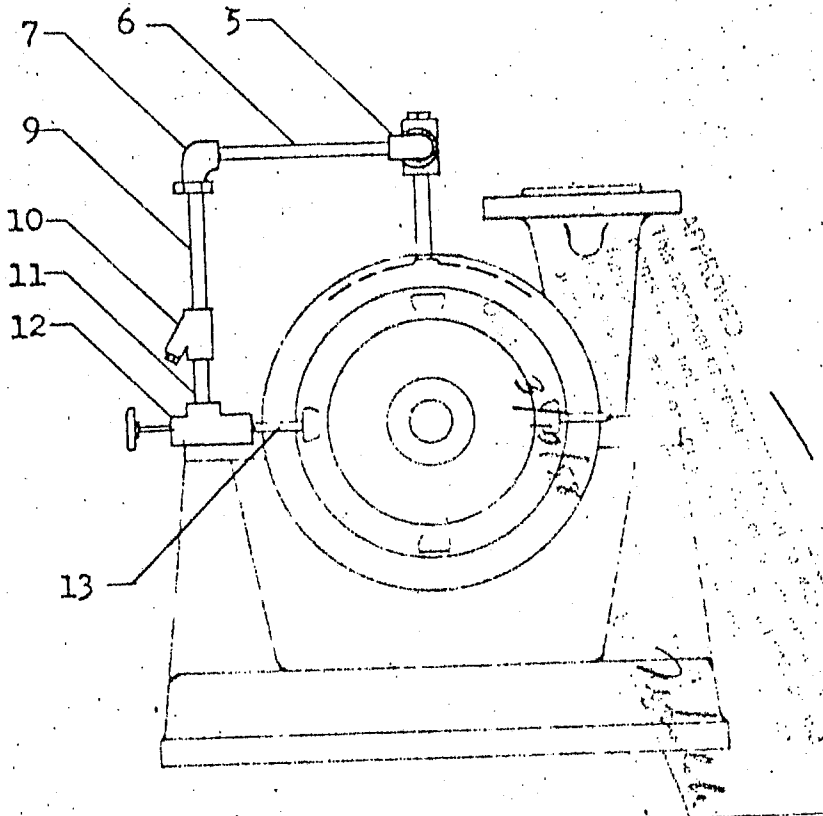
TO 3501
DATE 12-9-1957
PUMP SERIAL No. 6583
CURVE No. T0583

W 354 REV. 153

ALL PIPING SCHEDULE 160
FITTINGS 3000#

23N-GF2
23N-GF51





Sym.	Pc.	DESCRIPTION
1	1	1/2"Nipple,Lgth. to suit -Stl.
2	1	1/2" Screw End Tee F.S.
3	1	1/2"Pipe Plug -Vent Conn. F.S.
4	1	1/2"Nipple,Lgth.to suit Stl.
8	1	1/2" Female Union Stl.

Sym.	Pc.	DESCRIPTION
5	1	1/2" Elbow F.S.
6	1	1/2"Nipple,Lgth. to suit Stl.
7	1	1/2" Street Ell F.S.
9	1	1/2"Nipple,Lgth. to suit Stl.
10	1	1/2""Y"Type Strainer,Alloy Basket F.S.

Sym.	Pc.	DESCRIPTION
11	1	1/2"Nipple,Lgth.to Suit Stl.
12	1	1/2"Angle Valve Chr.Trim F.S.
13	1	1/2"Nipple, Lgth. to suit Stl.

WILSON-SNYDER WORKS 6400 N.

Recirculating Piping with Needle Pt. Valve for Single Mechanical Seals

R.R.K.
8-6-57 NTS

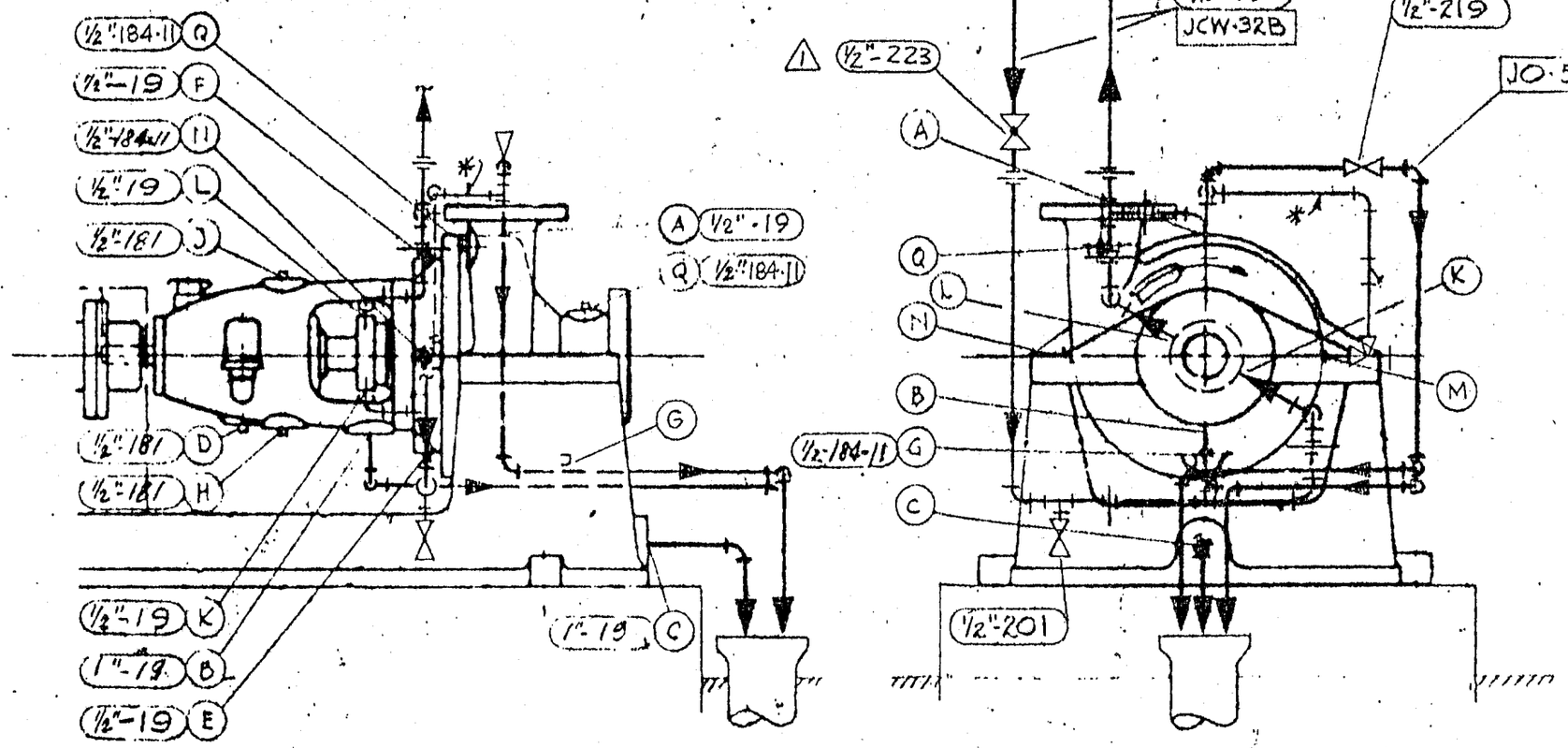
S-52479

* RECIRCULATION PIPING SUPPLIED BY VENDOR

NOTE: LOCATE ALL VALVES & UNIONS FOR ACCESS TO & DISMANTLING OF PUMP

K. MECH. SEAL INLET
L. MECH. SEAL OUTLET
M. LANTERN RING INLET
N. LANTERN RING OUTLET
Q. GAGE CONN.

COOLING WATER - FOR CONTINUATION SEE MAIN PIPING DWG.



JO-51B

REV.					REV.											
	△					△	3/23	ADDED GLOBE ON C.W. INLET		DD		WJH		PLANT NO.	BLOCK NO.	AREA NO.	JOB NO.
	△					△	4/1	ISSUED FOR CONSTRUCTION	M	WJH	MS			23			2525

AUXIL

THE

Ingersoll-Dresser Pumps
P.O. Box 482
Phillipsburg, NJ 08865

CLASS AND SIZE	DATE	I.R. ORD. NO.	ITEM	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	02SE92	489-75278	03	92A-152	1-1	

REMARKS FROM PG. 1

1) IMPELLER DIA.: SHROUD DIA. 7.25" X VANE DIA. 7.25".

2) SEAL FLUSH PIPING 11-00 BEING SUPPLIED WITHOUT ORIFICE IN LINE.

3) COMPLETE PUMP IS BEING SUPPLIED TO THE CUSTOMER TO REPLACE WILSON SNYDER PUMP MODEL 1.5X2X8.5 ES NEW CASING DESIGNED TO FIT CUSTOMERS EXISTING SUCTION AND DISCHARGE PIPING AND PUMP FEET TO MATCH CUSTOMERS EXISTING BEDPLATE. PUMP SHAFT LENGTH HAS BEEN SHORTENED AT COUPLING END. OTHERWISE STANDARD 7TH ED. MECH. SEAL, BEARING HOUSING AND COMPONENTS HAVE BEEN UTILIZED.

Replacement 93 NGS

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	03	92A-152	2	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
			1	1	1	CASING	150X2X8AWS1AX1	102-000 Carbon Steel	
	1	1	6A	2	1	CASING RING	450D6KX1	20-K	
	1	1	82	3	1	LOCK SCREW - CASING RING	025D82X1	379	
			178A	4	8	.75X3.25" STUDS	62A3J464	314	
			766A	5	8	.75" HEX NUTS	38A4K8	377	
				6		TORQUE 166 TO 195 FT. LBS.			
				7	2	.75" BULL PLUGS	60448495	9	
				8	1	.50" FLANGES - SEAL FLUSH CONNECTION	80A8F1	ASTM-A105	
				9	1	.50" X 4.00" SCHED 160 PIPE - SEAL FLUSH CONN.	22A7J004X00040NT	709	
1	1	1	363	10	1	GASKET	875D363CX1	AISI 316L/FLEXICARB	
				11					
				12					
			264	13	1	CASING END COVER	8A394AXG1	521-Z	
	1	1	88	14	1	STUFFING BOX BUSHING	178D88AXG1	20	
	1	1	6A	15	1	CASING RING	450D6KX1	20-K	
	1	1	82	16	1	LOCK SCREW - CASING RING	025D82X1	379	
			178B	17	4	.50 X 3.50" STUDS - GLAND	62A3J256	314	
			766B	18	4	.50" HEX NUTS - GLAND	38A4K5	377	
				19		TORQUE 26 TO 30 FT. LBS.			
				20	2	.50"X3.00" JACK SCREWS	102A2H100	319	
				21					
				22					
				23					
				24					
				25					
				26					
				27					
				28					
				29					
				30					
				31					
				32					
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42					

-CONTINUED-ON-PAGE-#3-

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	03	92A-152	3	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
				1					
		1	3	2	1	IMPELLER.	150X8A3BX1	813 Cast Iron	
	1	1	4A	3	1	IMPELLER RING (FRONT)	387D4EX1	829X300	
	1	1	4B	4	1	IMPELLER RING (BACK)	387D4EX1	829X300	
	6	6	259A	5	6	#10-24X.50" SET SCREW - RINGS	109A2T315	379	
				6					
				7					
			159	8	1	BEARING HOUSING	311B159SX2	102-000	
				9	5	.25" PIPE PLUGS	30A7S3	STEEL	
				10	5	.50" PIPE PLUGS	30A7S5	STEEL	
				11	1	1.50" PIPE PLUG	30A7S9	STEEL	
				12	1	BREATHER	62348529	STEEL	
			118C	13	4	.50X1.25" CAP SCREWS - EXTENSION	119A2A251	318	
				14		TORQUE 13 TO 16 FT. LBS.			
				15					
			160A	16	1	END COVER - INBOARD	311B160EXG1	241	
1	1	1	216A	17	1	GASKET	311B216AX1	HYDROIL	
			118A	18	4	.38X.75" CAP SCREWS	35A2C109	175	
				19		TORQUE 6 TO 8 FT. LBS.			
				20					
2	2	2	257A	21	2	.005" SHIMS	91A11-S-424-E-444	669	
2	2	2	257B	22	2	.010" SHIMS	91A11-S-424-H-444	669	
1	1	1	257C	23	1	.030" SHIMS	91A11-S-424-L-444	669	
				24					
			160B	25	1	END COVER - OUTBOARD	311B160HXG1	241	
1	1	1	216B	26	1	GASKET	311B216AX2	HYDROIL	
			118B	27	4	.38X1.50" CAP SCREWS	35A2C115	175	
				28		TORQUE 6 TO 8 FT. LBS.			
				29					
				30	1	OILER/GUARD	#3 TRICO		
				31	2	.25X1.50" NIPPLES	18A7W20	252	
				32	1	.25" UNION	88A7MA1	BRASS/IRON	
				33		ASSEMBLE OILER ON BRG. HSG. PER	311B95BX2		
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41			CONTINUED ON PAGE #4		
				42					

CLASS AND SIZE	DATE	I-R ORDER NO	I"	LIST NO.	PAGE	REISSUE DATE
150X2X8AWS	17 OC 92	489-75278	03	92A-152	4	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
		1	10	1	1	SHAFT 2.60" X 21.19"	8A10X14	814	
				2					
				3					
	2	2	204	4	2	BEARING (THRUST)	62321823		
	1	1	205	5	1	BEARING (PLAIN)	62348545		
	1	1	240	6	1	LOCK NUT FOR BEARING	95200929		
				7		TORQUE 73 TO 77 FT. LBS			
	1	1	241B	8	1	LOCKWASHER FOR BEARING	95201026		
				9					
				10					
		1	11	11	1	.25"SQ. X 1.88" IMPELLER KEY	11A9G84	20-CF	
		1	12	12	1	.25"SQ. X 1.75" COUPLING KEY	11A9C83	266	
		2	50	13	2	OIL THROWERS	311B50CX1	228-AC	
		2	259C	14	6	#10-24X.50" SET SCREWS	109A2A315	318	
		2	31	15	2	OIL RINGS	82938671	ASTM-B505 GR. C93200	
		2	157	16	2	FLINGERS	311B157AX1	228-AC	
		6	259B	17	6	#10-24X.38" SET SCREWS	109A2A313	318	
				18					
				19					
		1	177	20	1	CAP SCREW - IMPELLER	050D177AX1	379	
1	1	1	241A	21	1	WASHER - IMPELLER	056D241AX1	379	
		1	246	22	1	WASHER - IMPELLER	056D246KX1	379	
				23					
				24					
		1	429	25	1	JOHN CRANE MECHANICAL SEAL 8B1H	SEAL DRG TO COME	MAT'L CODE XF(51)10(15)1	
				26		(STUFF. BOX SKETCH-7/8A64X1)		API CODE BSTFN	
				27	4	.50" PIPE PLUGS - SEAL	30A7T5	379	
				28					
				29					
				30					
				31					
				32					
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42			CONTINUED ON PAGE #5		

CLASS AND SIZE	DATE	I-R ORDER NO	IT	LIST NO	PAGE	REISSUE DATE
150X2X8HMS	17 OC 92	489-75278	03	92A-152	5	

RECOMMENDED SPARES CLASS 1	2	3	PART NO.	LINE NO.	QUAN.	NAME OF PART	PART NO.	MATERIAL	MATERIAL LOCATION
				1	1	NAMEPLATE	7A16X262A	669	
				2	1	ROTATION NAMEPLATE	8A16X158	669	
				3					
			131	4	1	COUPLING GUARD	419C131CX1	ALUMINUM	
				5		GUARD TO BE SECURED TO BRG. HSG. WITH THREE			
				6		CAP SCREWS AND IS TO BE EXPANDED TO WITHIN			
				7		.50" OF DRIVER BEARING AND SECURED WITH THREE			
				8		SELF-TAPPING SCREWS			
				9	3	.25"X.50" SELF-TAPPING SCREWS	132A2S94	AISI-1016	
				10	3	.38"X.50" CAP SCREWS	35A2C107	175	
				11					
				12	1	COUPLING	62580824		
				13					
				14	1	SEAL PIPING (PLAN 11-00-SPL) PER	62565445		
				15		CONSISITING OF THE FOLLOWING			
			1	16	3	.50" SOCKET WELD FLANGE 300#	80A8F1	ASTM-A105	
			2	17	8	.50" X 2.75" STUD	62A3J253	314	
			3	18	16	.50" NUTS	38A4K5	377	
			4	19	2	.50" GASKET 300#	76A11DX3BR	AISI-316L/FLEXITE SUPER	
			5	20	4	.50" 90 DEG. ELBOW	216A8F4	ASTM-A105	
			6	21	8	.50" SCH 80 PIPE	27A7J004	709	
				22					
				23					
				24					
				25					
				26					
				27					
				28					
				29					
				30					
				31					
				32					
				33					
				34					
				35					
				36					
				37					
				38					
				39					
				40					
				41					
				42					

RETROFIT SECTIONAL

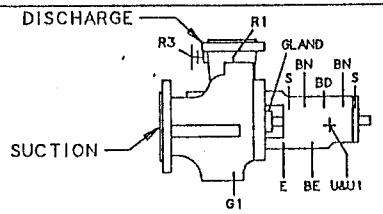
PART NO.	NAME OF PART
1	CASING
3	IMPELLER
4A	WEARING IMP. FRONT
4B	WEARING IMP. BACK
6A	WEARING CASING & CASING COVER
10	SHAFT
11	KEY - IMPELLER
12	KEY - COUPLING
31	OIL RING
50	OIL THROWERS
82	LOCK SCREW
88	STUFFING BOX BUSHING
118A	HEX. CAP SCREWS - END COVER TO BEARING HOUSING - PUMP END
118B	HEX. CAP SCREWS - END COVER TO BEARING HOUSING - CPLG END
118C	HEX. CAP SCREWS - BEARING HOUSING TO CASING COVER
157	FLINGER - PUMP SIDE & COUPLING SIDE
159	BEARING HOUSING
160A	END COVER - BEARING HOUSING - PUMP END
160B	END COVER - BEARING HOUSING - CPLG END
177	IMPELLER CAP SCREW
178A	STUDS - MAIN BOLTING
178B	STUDS - GLAND
204	BALL BEARING - THRUST
205	BALL BEARING - RADIAL
216A	GASKET - END COVER - PUMP END
216B	GASKET - END COVER - CPLG END
240	LOCK NUT - THRUST BEARING
241A	LOCKWASHER - IMPELLER
241B	LOCKWASHER - THRUST BEARING
246	WASHER - IMPELLER
257A	SHIM - THRUST BEARING
257B	SHIM - THRUST BEARING
257C	SHIM - THRUST BEARING
259A	SET SCREWS WEARING
259B	SET SCREWS - FLINGERS
259C	SET SCREWS - OIL THROWERS
363	GASKET - CASING COVER TO CASING
394	CASING COVER
429	MECH SEAL - SEE SEAL ASSEMBLY DRAWING
766A	CAP NUT MAIN BOLTING
766B	HEX. NUTS - GLAND BOLTING

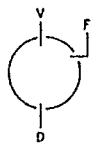
-PUMP CONNECTIONS FURNISHED AS FOLLOWS:

2.00 - 300# ANSI R.F. SUCTION
1.50 - 300# ANSI R.F. DISCHARGE

-AUXILIARY PUMP CONNECTIONS FURNISHED AS FOLLOWS:
••• PIPED BY IDP CO.
•• PIPED BY PURCHASER (PLUGGED FOR SHIPMENT)
• PLUGGED

•••	BD	Ø.25NPT	BRG HSG-VENT/BREATHER CAP
•	BE	Ø.5ØNPT	BEARING HOUSING DRAIN
•	BN	Ø.5ØNPT	BRG HSG OIL FILL W/OIL RING INSP. PORT
	D	Ø.5ØNPT	MECH. SEAL GLAND-DRAIN - MUST REMAIN OPEN DURING OPERATION
••	E	Ø.5ØNPT	BEARING BRACKET DRAIN
•••	F	Ø.5ØNPT	MECH. SEAL-FLUSH INLET
•	G1	Ø.75NPT	CASING DRAIN
•	R1	Ø.75NPT	CASING VENT
•••	R3	Ø.5Ø FLG.	DISCHARGE-SEAL PIPING CONN.
•	S	Ø.25NPT	NON-FUNCTIONAL
•	U	Ø.5ØNPT	NON-FUNCTIONAL
•	U1	1.5ØNPT	NON-FUNCTIONAL
••	V	Ø.5ØNPT	MECH. SEAL GLAND-VENT OR QUENCH





MECHANICAL SEAL GLAND

-ALL DIMENSIONS IN INCHES.
TOLERANCE ± .12 UNLESS OTHERWISE SPECIFIED.
-THIS DRAWING IS NOT TO SCALE - WORK FROM DIMENSIONS.
-READ INSTRUCTION BOOK BEFORE LIFTING, INSTALLING, ALIGNING, AND STARTING (OR ROTATING) EQUIPMENT.
-ALL FLANGE CONNECTIONS ARE 300# ANSI R.F.

ZONE	LTR	DESCRIPTION	DATE	APPROVED

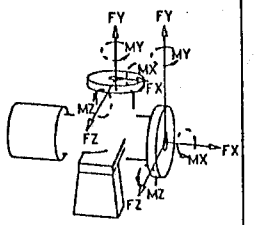
	F_X	F_Y	F_Z	F_R
SUCT	200	130	160	290
DISCH	160	200	130	290

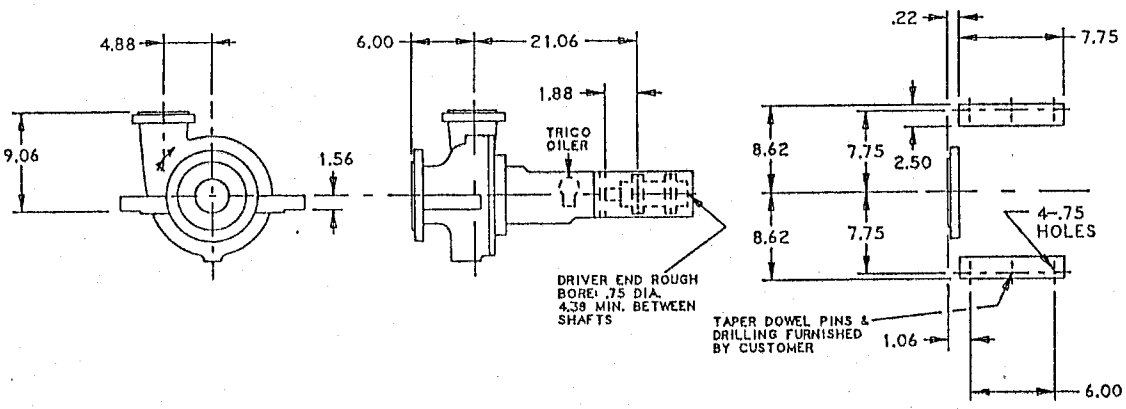
FORCES lbs

	M_X	M_Y	M_Z	M_R
SUCT	340	240	170	460
DISCH	340	260	170	460

MOMENTS ft-lbs

MAXIMUM ALLOWABLE NOZZLE LOADING





PLAN VIEW OF PUMP FEET

ROTATION: CCW-HI
SERVICE: OFF TEST PROPANE

MECH. SEAL: JOHN CRANE
ARRANGEMENT: SINGLE
COUPLING: METASTREAM
TYPE: TSCS SIZE: 0011
COUPLING GUARD: IDP STANDARD
TYPE: ALUMINUM

DRIVER: BY CUSTOMER H.P.: 10

SEAL PIPING PER API PLAN 11
RECIRCULATION FROM PUMP DISCHARGE TO SEAL GLAND
REFER TO I.R. DWG. NO. 62565445

CUSTOMER INFORMATION

CUSTOMER: TEXACO
CUST. ITEM: 23N-G5

WEIGHTS

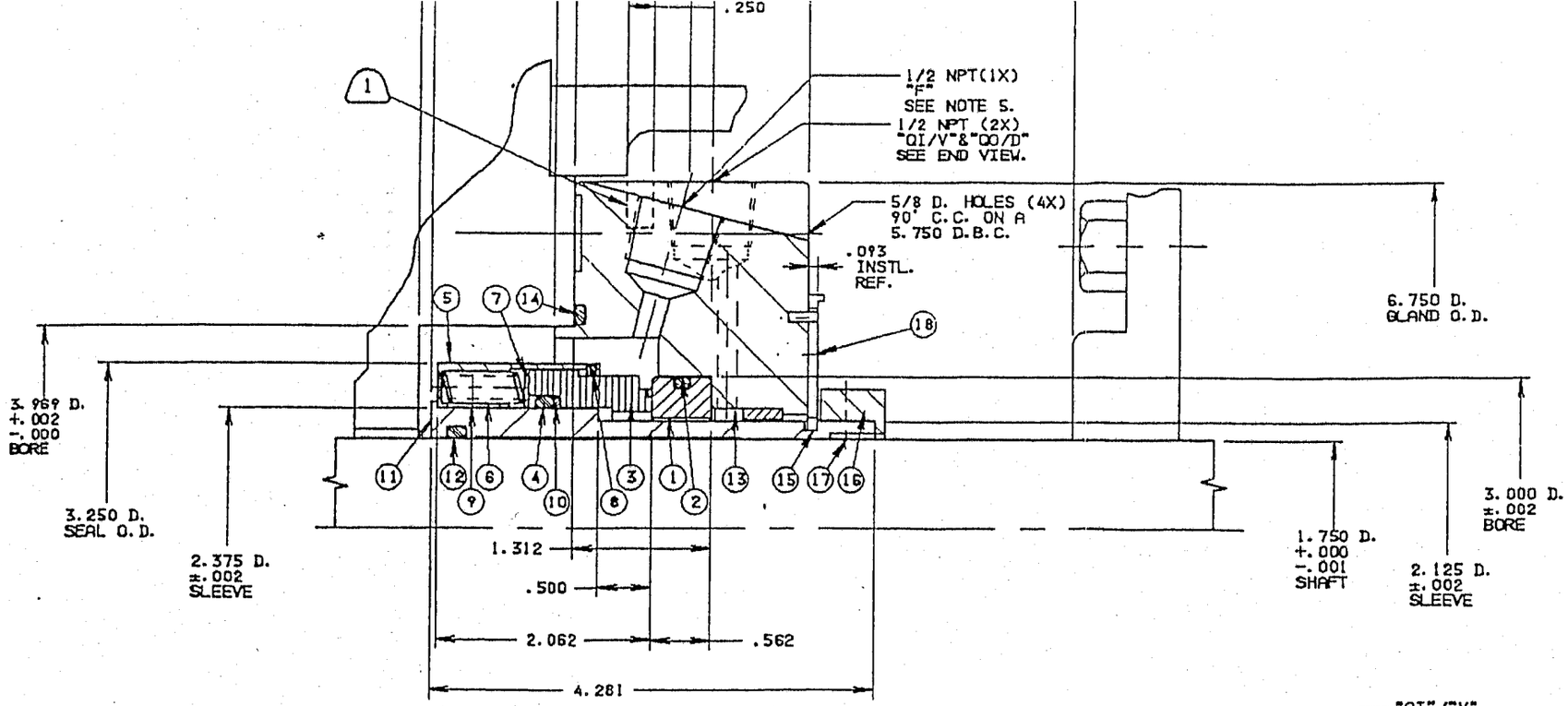
PUMP 320lbs
DRIVER N/A N/A
BASEPLATE N/A N/A
TOTAL 320lbs

ORDER NO	489-75278
ITEM NO	06
DATE	29DE92
DRAWN	PIAZZA
CHECKED	SHERMAN
CERTIFIED	

Ingersoll-Dresser Pump Company
ENGINEERED PUMP DIVISION PHILLIPSBURG N.J. 08865

GENERAL ARRANGEMENT

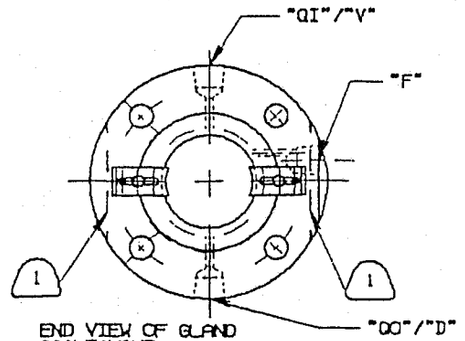
CODE IDENT. NO.	88032
PUMP SIZE	1.50X2X8AWS
SIZE	C
DWG. NO.	62587399
REV.	00
THIRD ANGLE PROJECTION	
SCALE	NONE
SHEET	1 OF 1



13. SPACERS (ITEM #15) ARE FOR THE PURPOSE OF PROPERLY LOCATING THE SEAL AFTER THE GLAND, SLEEVE, SHAFT, AND BEARINGS HAVE BEEN LOCKED IN PLACE. THESE ITEMS MUST BE DIS-ENGAGED FROM THE SLEEVE, MOVED CLEAR OF ROTATING PARTS, AND LOCKED IN PLACE.

14. THE GLAND MUST BE IN CONTACT WITH THE HOUSING. DO NOT OVERSTRESS.

15. TO AVOID MOVEMENT OF THE SEAL IN RELATION TO THE SHAFT, SPOT FACE THE SHAFT UNDER A MINIMUM OF TWO SET SCREWS EQUALLY SPACED.



END VIEW OF GLAND
SCALE:NONE

(1) DISMANTLING GROOVES

FOR IDP ORDER NBR
489-75278-01/06
489-75319-03
489-75323-01

SEAL ASS'Y NO. IN- A8-2375-242 OUT-	BI
MTG.RG.ASS'Y NO. IN- OUT-	COMPLETE
	SEAL HD.
	MTG. RG.
	ASS'Y.
EQUIPMENT REFERENCE:	CU
UNIT BY: INGERSOLL-RAND CO.	CUSTOMER:
EQUIPMENT TYPE: API 610 7TH ED.	P.O.NO.
☒ PUMP ☐ AGITATOR	END USER:
☐ COMPRESSOR ☐ OTHER	LOCATION:
MODEL/SIZE 7"&8" A-LINE /	REQ.NO.
SERIAL NO.	INSTALLED

SEAL DATA

SEAL DESCRIPTION A082	MATERIAL X FS1
A.P.I. CODE B3TFN	A.P.I. PLA 11

SERVICE DATA

FLUID HYDROCARBON	
SEAL PRESS. 300 PSIG MAX.	SUCT. PRESS.
TEMPERATURE 350 F MAX.	DISCH. PRESS.
SHAFT SPEED 3600 RPM MAX.	SP. GR. 0.45 - 0.59

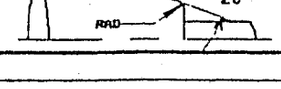
REFERENCE DATA	DRAWN	DATE	CHK
PDX92125 H-SP-17453 BY JCI	PDX	111892	G.
	FILE REFERENCE		CAT
#7/8A64X1 BY I-R	PDX 73		D
CAD ENGINEERED			

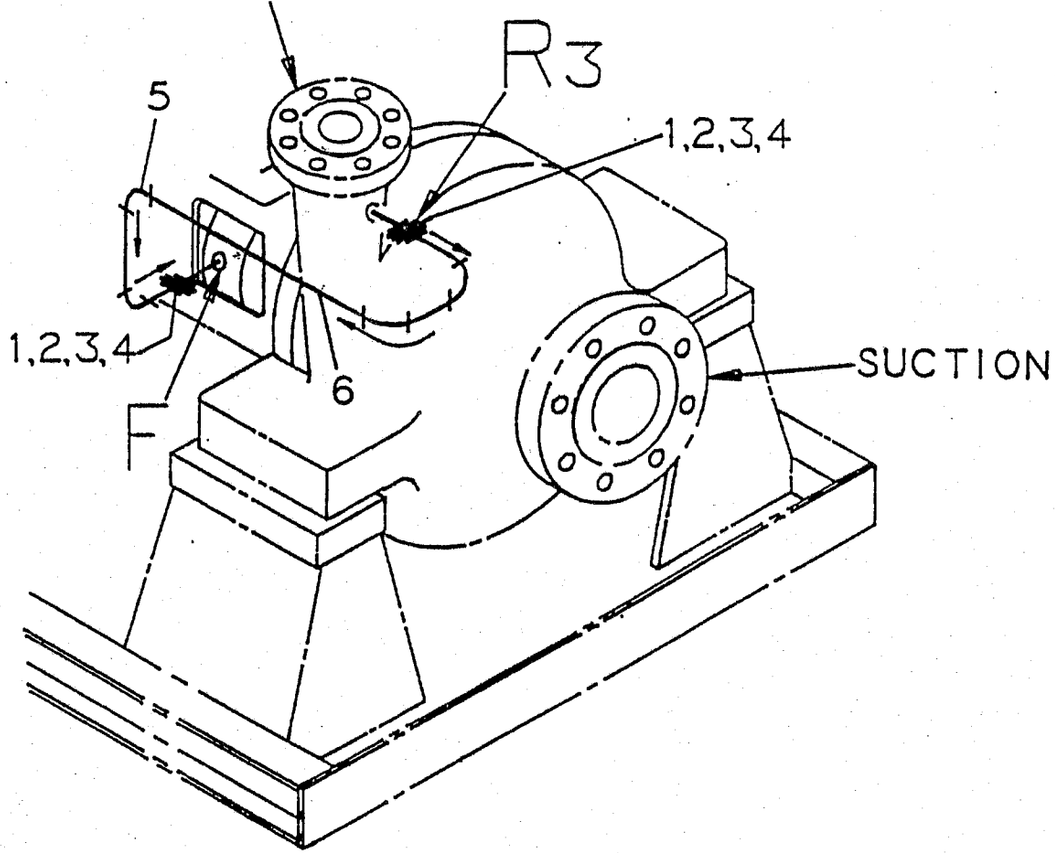
SEAL SIZE: 2.375 D.
SEAL TYPE: T-8B1H CARTRIDGE SEAL FOR A

JOHN CRANE
International Seal
6400 Oakton Stree
Morton Grove, Il 60
A member of the T

THE FOLLOWING NOTES ARE IMPORTANT AND MUST BE OBSERVED FOR CORRECT SEAL INSTALLATION AND OPERATION

1. REMOVE ALL SHARP EDGES ON SHAFT &/OR SLEEVE BEFORE INSTALLATION OF SEAL.
2. SURFACE OF SHAFT OR SLEEVE ON WHICH SEAL IS INSTALLED MUST BE MACHINED TO 63 RA FINISH OR BETTER.
3. LUBRICATE SHAFT/SLEEVE & SEAL WEDGE RING/O-RING/BELLOWS TO ASSIST INSTALLATION OF SEAL WITH LIGHT OIL, GLYCERINE, SOAPY WATER.
4. LUBRICATE MATING RING (SEAT), SEALING MEMBER & HOUSING TO ASSIST INSTALLATION.
5. PRODUCT MUST BE CIRCULATED AROUND PRIMARY RING (SEAL FACE)/THROUGH MATING RING (SEAT) (AT NOT LESS THAN 3 GPM) IN ORDER TO REMOVE HEAT GENERATED, OR FAILURE MAY OCCUR.
6. WHEN SHAFT IS SLEEVED THROUGH STUFFING BOX, SLEEVE MUST BE LIQUID TIGHT THROUGH BORE.
7. SHAFT OR SLEEVE MUST BE OF CORROSION RESISTANT MATERIAL WITH A HARDNESS OF 125 BRINELL MINIMUM & BE MACHINED TO DIMENSIONS & TOLERANCES STATED.
8. END OF SEAL CHAMBER & FACE OF SHAFT MUST BE AT 90° TO EACH OTHER WITHIN .002 F.I.M.
9. PRESSURE IN SEAL CHAMBER MUST BE MAINTAINED AT N/A MINIMUM ABOVE MAXIMUM PRESSURE GENERATED AT INNER SEAL.
10. BEFORE COMPLETING SEAL INSTALLATION WIPE LAPPED SURFACES OF MATING RING (SEAT) & PRIMARY RING (SEAL FACE) PERFECTLY CLEAN.
11. VENT GAS ENTRAPMENT BEFORE STARTUP.
12. ALL SHOULDERS OVER WHICH SEAL MUST PASS WHEN FITTING, TO BE PREPARED AS DIAGRAM BELOW.





RECIRCULATION FROM PUMP DIS
TO SEAL GLAND

ARROWS INDICATE DIRECTION O

SHOP NOTES:

1. KEEP ALL PIPING AS CLOSE T
   AS POSSIBLE.

2. PIPING TO BE CLEANED AND
   PER Q.C. PLAN HLM-26,LATEST

3. PIPING TO BE HYDROTESTED

FOR IDP ORDER NBR.
489-75278-01/02/03/04/05/06/07/08/09
489-75323-01/02/03
489-75327-01/02
489-75328-01/02
489-75332-01/02/03

PART
62565445

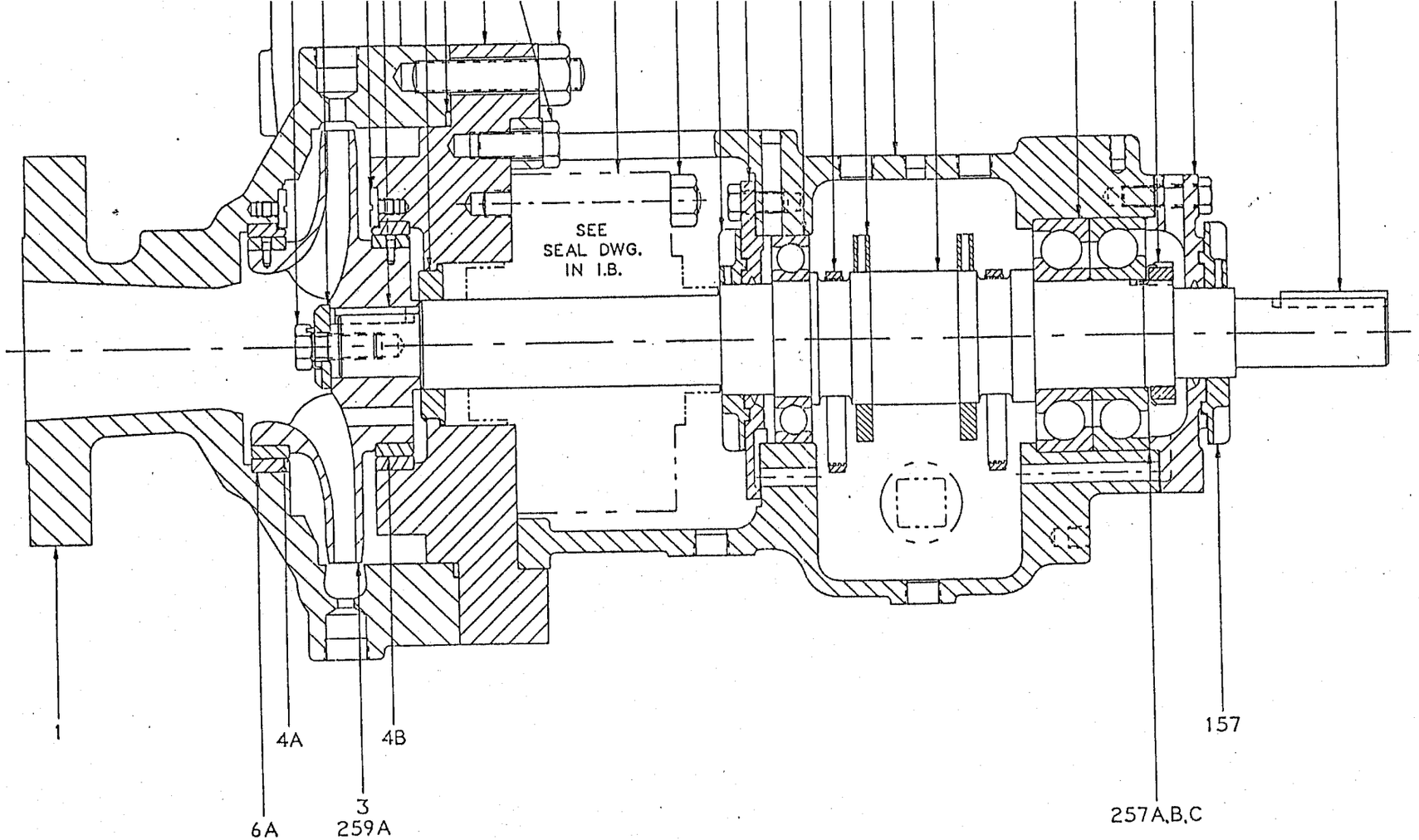
NOUN CODE 0321		INGERSOLL-RAND	
THIRD ANGLE PROJ.		ENGINEERED PUMP DIV PHILLIPSBURG N.J. 08	
DRN D.W.	DATE 70C92	TITLE SEAL P	
CKD PIAZZA	0C92		
APP JAL	70C92	SIZE B	CODE IDENT. NO. 88032
ENG.APPVL. D.WHITE	210C92	SCALE NONE	PART NO. 62

INDUSTRY MATERIAL SPEC: AISI-4140(BARS & FORGINGS) OR ASME-SA193 GR.B7(FASTNERS

3	16.00	95076402 38A4K5	377
		DESCRIPTION: NUT .50	
		INDUSTRY MATERIAL SPEC: ASME-SA-194 GR.2H	
4	2.00	66518921 76A11DX3BR	S-316-1
		DESCRIPTION: GASKET .50-300#	
		INDUSTRY MATERIAL SPEC: AISI-316L/FLEXITE SUPER	
5	4.00	95244190 216A8F4	M-105-3
		DESCRIPTION: ELBOW .50-90 DEG	
		INDUSTRY MATERIAL SPEC: ASTM-A105	
6	8.00	95492351 27A7J004	709
		DESCRIPTION: PIPE .50 SCH 80	
		INDUSTRY MATERIAL SPEC: ASTM-A106 GR.B	

NOTE: WHEN ORDERING PARTS, BE SURE TO REFERENCE THE CCN PART NUMBER

INGERSOLL-RAND COMPANY
SIZE: A 7TH ED SYMBOL: 1100-SPLNOUN: 321
DESCRIPTION: SEAL PIPING
DRAWING NUMBER: 62565445 MATL SPEC: STEEL REV.
SHEET 2 OF 2



FOR IDP
489
489

- CAU
READ
ATTEN
OR OF

FIRST ORDER

HOUR CODE	0500
	THIRD ANGLE PROJECTION
DWN C.TILWICK	DATE 13NV92
CHD TKRLINDEN	14/2/92
APP	DEC.7.92
MFG APPVL DON WHITE	DATE 7DE92
TITLE	
SIZE D	DWG NO 8
SCALE	

8 7 6 5 4 3 2