FINAL REPORT

Dole Fresh Vegetables, Inc.

Engineering Design Report and Work Plan

Former Birchmount Orchard Facility
3717 Crestview Road
Wenatchee, Washington

August 2009

Project No. 0086525.01

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(for:)

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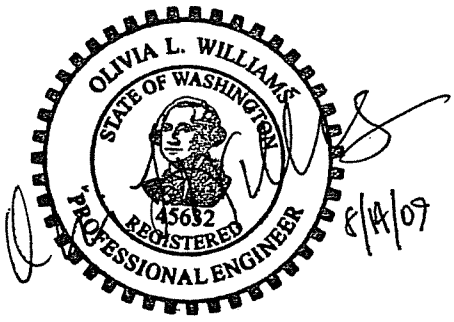
ENGINEER'S CERTIFICATION

I, Olivia Williams, Professional Engineer in the State of Washington, hereby certify to the best of my knowledge and belief that this design document is true and correct and has been prepared in accordance with general industry standards and applicable federal, state, and local requirements, and hereunto set out hand and affix my seal this 14th day of August, 2009.

Olivia L Williams, PE — Date 8/14/09

Washington Registered Professional Engineer

No. 45632



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LIST OF ACRONYMS

bgs	Below ground surface
DPE	Dual phase extraction
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
GAC	Granular activated carbon
ft	foot, feet
gpm	Gallons per minute
IDW	Investigation derived waste
lbs/yr	Pounds per year
LUST	Leaking underground storage tank
MTCA	Model Toxics Control Act
NOC	Notice of Construction
OWS	Oil water separater
PVC	Polyvinyl chloride
SSI	Supplemental site investigation
SVE	Soil vapor extraction
TPH-D	Total petroleum hydrocarbons as diesel
TPH-G	Total petroleum hydrocarbons as gasoline
WAC	Washington Administrative Code
VOC	Volatile organic compound
UST	Underground storage tank

1.0 INTRODUCTION

ERM-West, Inc. (ERM) performed this Engineering Design Report (EDR) which provides information regarding the remedial system design and construction plans, describes applicable regulatory requirements, the remedial scope of work, equipment specifications, procedures, and health and safety requirements for system installation, operation, maintenance, and monitoring for implementation of a dual phase extraction (DPE) system. DPE is the selected remedial alternative for the site presented in the Corrective Action Plan (ERM 2008). This design report was developed in accordance with the requirements of the Washington Department of Ecology's (Ecology's) Model Toxics Control Act Cleanup Regulation (MTCA), Chapter 173-340-400 of the Washington Administrative Code (WAC).

The objectives of the system installation and initial one-year operational period outlined in this EDR are to:

- Remove free-phase (floating) petroleum hydrocarbons from the ground water in the near-source area;
- Reduce dissolved-phase petroleum hydrocarbon concentrations in ground water toward concentrations that are compliant with applicable regulations and are protective of human health and the environment; and
- Provide data to assist in the development of an effective remedial approach to address residual dissolved-phase petroleum contamination in ground water.

Note that the primary objective of the remediation program outlined in this EDR is removal of free-phase petroleum product from the near-source area, and although reduction in dissolved-phase contaminant mass will also occur within the schedule included in this EDR, it is anticipated that additional remedial action will be required to establish site-wide compliance with regulatory requirements for ground water quality.

1.1 SITE DESCRIPTION

1.1.1 Site Location

The project site is located at 3717 Crestview Road in Wenatchee, Washington, in the southeast quarter of Section 17, Township 23 North, Range 20 East, Willamette Meridian (Site), see Figure 1. The climate in the area is semi-arid. Topography in the Site vicinity generally slopes moderately to the south with intermittent surface water flow pathways along ditches and gullies. The nearest perennial surface water, the Wenatchee River, is approximately one mile to the south.

The ground surface at the Site is generally graveled driveway and barren ground covered with seasonal grasses and forbs and scattered deciduous trees. A former office/shop building is present on the Site, as are the foundations of three former storage buildings that were previously demolished. Site features are shown on Drawing C-1 in Appendix A.

Dole Fresh Vegetables, Inc. (Dole) previously owned and operated the Birchmount Orchard facility on the Site. Dole sold the Site in approximately 2001, and it is currently owned by Mr. Al Lorenz. The Site and surrounding property are awaiting development as a subdivision for single-family residential housing units.

1.1.2 Geologic and Hydrogeologic Setting

The local geology of the Site generally consists of a medium dense silt with fine- to coarse-grained sand from the ground surface to 8 to 9.5 feet below ground surface (bgs). This silty unit is underlain by a dense fine to coarse sand with varying amounts of fine gravel and silt to a depth of approximately 32 feet bgs. Below the sand layer is weathered bedrock consisting of arkosic sandstone and siltstone.

Ground water at the Site is semi-confined and is generally encountered at a depth of approximately 18 to 23 feet bgs in monitoring wells MW-2, MW-3, and RW-1, which are the wells nearest to the former underground storage tank (UST) locations that are the focus of current and historical remedial efforts. Ground water elevation at the Site has fluctuated historically due to irrigation practices related to the previous orchard activities. Figure 2 shows the locations of the existing wells and the former USTs. Ground water flow at the Site is toward the southwest. The maximum thickness and concentrations of free-phase petroleum

hydrocarbon encountered were at well MW-3, south of the former UST locations. The free product thickness measured at this well has ranged from 0.01 to 0.5 feet.

1.2 SITE BACKGROUND AND PREVIOUS INVESTIGATIONS

The Site was historically operated as an agricultural orchard where fruit trees were planted, grown, and harvested. The USTs were used to store fuel for agricultural equipment.

In 1992, two 550-gallon steel gasoline USTs and one 550-gallon steel diesel UST were removed from the Site. Petroleum-contaminated soil was encountered during the UST removal activities and approximately 600 cubic yards of soil were excavated from the UST area. Residual petroleum hydrocarbon concentrations greater than the MTCA Method A soil cleanup levels were detected in soil samples collected at and below the water table in the completed remedial excavation (Sage, 1993). Petroleum-impacted soils were treated on-site by landfarming. ERM constructed and maintained the landfarms and confirmed that the treated soils were compliant with MTCA Method A soil cleanup levels prior to reusing the soil for on-site fill material in 1994 (ERM, 1994a).

In 1994, ERM conducted site characterization activities that evaluated the extent of petroleum hydrocarbons in ground water near the former USTs. Gasoline-range hydrocarbons were detected at concentrations greater than applicable cleanup levels in ground water samples collected from a boring in the backfilled remedial excavation area and at monitoring well MW-3 immediately south of the former USTs (ERM, 1994b).

In June and July 1994, a ground water extraction pilot study was completed at monitoring well MW-3 to evaluate the feasibility of ground water extraction for site remediation (ERM, 1994c). In August 1994, construction of a ground water extraction system began with the installation of recovery well RW-1. ERM completed a remediation system design document in October 1994 (ERM, 1994d). In December 1994, ERM installed a ground water remediation system consisting of a submersible ground water pump, an air stripper unit, an effluent water infiltration gallery, and controls. Once construction of the remediation system was completed, the system operation was tested. After wastewater disposal and air emissions permitting requirements were met, the system was started for continuous operation in February 1995 (ERM, 1995). During the first year of system operation, a small volume (less than one gallon) of

floating product was recovered from extraction well RW-1 along with impacted ground water. Ground water extraction and treatment was terminated in November 1998 because of sustained low levels of contaminant mass recovery and because petroleum contaminant concentrations in ground water were near or below remedial goals at the points of compliance (ERM, 1999).

Ground water monitoring completed by ERM between 1998 and 2000 indicated that gasoline-related contaminant concentrations in ground water remained above the MTCA Method A cleanup levels. In December 2000, ERM conducted an in-situ chemical oxidation program that consisted of the injection of approximately 1,000 gallons of 2.5% potassium permanganate solution into ground water at well RW-1 and at three temporary injection points in the vicinity of the former USTs (ERM, 2001). Subsequent ground water monitoring indicated significant contaminant mass reduction near well RW-1; however, contaminant concentrations at well MW-3 remained above MTCA Method A cleanup levels through the ground water sampling event completed in June 2005 (ERM, 2005). Concentrations measured in June 2005 indicated a substantial increase over previous sampling events. Floating petroleum product was detected in monitoring wells RW-1 and MW-3 in May 2006, and in well MW-3 in April 2007 (ERM, 2007).

Because of the increase in contaminant concentrations in wells MW-3 and RW-1, ERM completed a geophysical survey at the Site in May 2006 to screen for the presence of possible USTs or other fueling infrastructure that may not have been identified and removed as part of the 1992 UST decommissioning effort. Although the geophysical survey identified several possible anomalous subsurface features, test excavations completed by ERM at each geophysical anomaly location in April 2007 showed no additional USTs or fueling infrastructure (ERM, 2007).

ERM conducted a supplemental site investigation (SSI) in June and July of 2007 to further evaluate the nature and extent of the soil and ground water contamination identified during previous investigations and to evaluate site hydrogeologic conditions affecting contaminant fate and transport. The SSI consisted of installing 4 additional ground water monitoring wells, advancing 4 soil borings, collecting soil and ground water samples, and completing slug tests in 2 monitoring wells. The results of the SSI indicated that ground water is present under confined or semi-confined conditions in areas of the Site. Available soil data indicates that residual petroleum hydrocarbon constituents in vadose zone soils are less than the project screening goals (MTCA Method A soil cleanup levels for

unrestricted land use). However, based on the available data, petroleum hydrocarbons in site ground water remain above the project screening goals. Figure 3 illustrates the distribution of petroleum hydrocarbons in ground water based on the SSI results.

2.0 REMEDIAL ACTION PLAN

2.1 TECHNICAL DESCRIPTION OF REMEDIAL TECHNOLOGIES

DPE is a technology in which soil vapor extraction (SVE) and enhanced fluid recovery are combined in the same well to effectively remove a combination of contaminated ground water, free-phase hydrocarbon product, and soil vapors from the subsurface. DPE removes impacted ground water for treatment while also maximizing the effect of SVE by lowering the water table and exposing contaminated vapors in the saturated soils for extraction by the vapor recovery system.

The DPE technology applied at the Site will include installing air-powered submersible pumps in each of the wells to draw down the surrounding water table. A vacuum will be applied to the wells to draw impacted soil vapors within the vadose zone using a rotary claw blower at the ground surface. Ground water, free-product, and vapors within the soil pore space are induced toward and extracted from the wells for treatment at the ground surface. Vertical extraction wells are typically used at depths greater than 5 feet and have been successfully applied to depths up to 300 feet. At the Site, extraction wells will be installed to a depth of between 40 and 50 feet bgs.

At the ground surface, the extracted liquids and vapors will be conveyed to an aboveground remediation system for treatment and discharge. Vapors extracted from the subsurface are anticipated to be vented directly to the atmosphere. If emissions concentrations are determined to exceed air permitting thresholds, vapors may be treated by adsorption with granular activated carbon (GAC). The liquids will be processed through an oil water separator (OWS) to remove free product for storage onsite and eventual off-site disposal. The ground water will be treated by stripping contaminants from the ground water phase using an air stripper unit. The treated water will be disposed of onsite by pumping to an existing infiltration trench.

The design basis for the extraction and remediation system includes Site-specific and equipment parameters that govern the sizing and installation of the system components. This includes the performance standards, site geology and hydrogeology, nature of contamination, desired mass removal rates, and results of previous site investigations and remedial actions.

2.2 CLEANUP STANDARDS

Cleanup standards consist of a numerical cleanup level (i.e. concentration) and a point of compliance (i.e. the location where the cleanup levels must be met). Method A cleanup levels will be used for ground water at this Site because: (1) the Site has few hazardous substances; and (2) Method A numerical standards are available for all indicator hazardous substances in the ground water (Total Petroleum Hydrocarbons as Gasoline [TPH-G] and, Total Petroleum Hydrocarbons as Diesel [TPH-D], and benzene). As such, the Site meets the criteria established in WAC 173-340-704 for use of the Method A cleanup standards. Method A cleanup levels are conservative cleanup levels for common contaminants at sites undergoing routine cleanup actions, such as cleanup of petroleum releases.

A standard point of compliance as defined by WAC 173-340-720(8) (b) is applicable for ground water at the Site. The standard ground water point of compliance is established throughout the Site from the uppermost level of the saturated zone extending vertically to the lowest depth that could potentially be affected. The applicable Method A cleanup levels for confirmed or suspected petroleum-related contaminants at the Site are summarized in Table 1.

Free product in the source area will be removed to the maximum extent practicable using normally accepted engineering practices, in accordance WAC 173-340-360(2)(c)(ii)(A).

If these cleanup standards are determined to be technically unachievable during implementation of the cleanup action, the cleanup standards or points of compliance may be modified based on an evaluation of available Site data and an evaluation of exposure pathways.

2.3 REMEDIATION SCHEDULE

The selected remedial alternative will be implemented in general accordance with the following schedule:

Task	Estimated Timeframe	Estimated Calendar Schedule
Construction and Start-Up of Remediation System	6 weeks	Summer 2009
Operation and Maintenance of Remediation System	1 year	Summer 2009 – Summer 2010
Remedial Effectiveness Monitoring (concurrent with previous task)	1 year	Summer 2009 – Summer 2010
Closure, Reporting, and Site Restoration	15 months	Summer 2010 – Fall 2011

The system operation will be assessed after one year of operation to evaluate the effectiveness of meeting remedial objectives of free-phase product removal and reduction of dissolved-phase petroleum concentrations in ground water. Recommendations for system modifications, if required, will be made at this time.

2.4 SUMMARY OF REMEDIATION SYSTEM

The remediation approach is a DPE system that consists of extraction, treatment, and discharge stages for vapor and liquid phase contaminants. The ground water extraction will create a hydrostatic surface (ground water level) drawdown to enhance the removal of floating free-phase product and vapors from impacted soil below the natural water table.

Three extraction wells will remove vapor and liquid phases and convey the respective media to the treatment system. The vapor phase treatment system consists of a knock-out tank to remove condensate from the vapor and discharge of the treated vapors into the atmosphere. GAC adsorption of contaminants from the vapor stream may be added if required based on measured discharge vapor concentrations.

The enhanced field recovery, or liquid phase treatment, includes an OWS and a storage tank to remove and contain free-phase petroleum hydrocarbons from the ground water, an equalization tank for treating ground water in batches, an air stripper to remove dissolved contaminants from the water, and an existing onsite infiltration trench to which treated water will be discharged. The system is expected to operate at an overall air flow rate of 100 cubic feet per minute and a ground water flow rate of 1.5 gallons per minute (gpm).

The following sections describe the major components of the DPE system, their function, and key process control equipment and parameters associated with these components. Construction drawings showing the layout and details of the various system components are included in Appendix A.

2.5 EXTRACTION AND MONITORING WELLS

Three DPE wells (DPE-1, DPE-2, and DPE-3) will be installed in the vicinity of the former USTs, and one new monitoring well (MW-11) will be installed south of the location of the former USTs (Drawing C-1, Appendix A). The extraction wells will be 4-inch diameter polyvinyl chloride (PVC) wells with varying screen lengths depending on the appropriate extraction interval for vapor and ground water. The wells will be screened within the semi-confined aquifer to remove ground water and enhance soil vapor removal within the saturated soils. An air-powered positive displacement pump will be placed in each of the wells to extract ground water and create a lowering of the ground water table as shown on Drawing C-3, Appendix A.

The new monitoring well (MW-11) will be installed south of the extraction wells to monitor downgradient ground water conditions in the southwest portion of the existing area of petroleum-impacted ground water as shown on Drawing C-1, Appendix A. The monitoring well will be approximately 45 feet deep and will be constructed using 2-inch diameter PVC casing and 10-foot screen.

The extraction and monitoring wells will be installed as described in Section 3.2.1 and 3.2.2, respectively.

2.6 CONVEYANCE PIPING

The vapor and water phases will be extracted and conveyed in separate pipes from the extraction wells to the treatment system located outside the historical vehicle storage building location. A 2-inch diameter PVC pipe rated at 75 pounds per square inch, minimum, will connect each extraction well head to a 4-inch diameter main extraction trunk line, and then to the treatment system. All outdoor piping will be placed in a trench at a depth of at least 3 feet bgs for frost protection. Pipeline vacuum pressures will be monitored using vacuum gauges at the DPE well heads, at the entrance to the treatment system, and before and after

the water phase bag filters (Drawing P-1, Appendix A). 2-inch diameter PVC piping will convey treated water to the infiltration trench for onsite discharge (see Section 2.8 and Drawing C-1, Appendix A).

2.7 TREATMENT SYSTEM

The remedial treatment system will be located in a treatment trailer located outside the historical vehicle storage building location. The vapor and liquid phases will be treated separately prior to discharge. The treatment system will be constructed offsite and brought to the Site in an enclosed, secure trailer for installation.

2.7.1 Vapor Treatment

A knockout tank (moisture separator) will be installed upstream of the vacuum blower to separate the liquid condensate from the extraction system. The knockout tank will be fitted with a positive centrifugal pump to discharge collected fluids to the water treatment system.

Current extracted vapor concentrations are unknown, but anticipated emissions were calculated based on June 2007 ground water contaminant concentration removal with an air stripper conservatively, assuming 100% of contaminants are stripped from ground water into the air. Estimated emissions calculations are provided in Appendix B. An estimated annual volatile organic compound (VOC) discharge rate of 47 pounds per year (lbs/yr) was calculated. Ecology's New Source Review regulations (WAC 173-400-110) include exemptions from the requirement to file a Notice of Construction (NOC) application for projects with emissions levels below a specified threshold. The estimated emissions rate of 47 lbs/year is well below the threshold for VOCs of two tons per year presented in WAC 173-400-110(5)(d). However, the anticipated benzene discharge rate of 0.75 lbs/yr is greater than the de minimis value of 0.331 lbs/yr presented in WAC 173-460-150. As such, an NOC would need to be submitted to Ecology, and implementation of best available control technologies (BACT) would be required to minimize contaminant discharge to the atmosphere. Instead, the extracted soil vapors at the Site will be treated using GAC to reduce the contaminant discharge rate to below the de minimis benzene threshold so that an NOC is not required. GAC typically has contaminant removal rates of over 90%. Application of GAC on the Site soil vapors would decrease the anticipated benzene discharge rate to below 0.075 lbs/yr, i.e. below the de minimis benzene value. Although an NOC is not anticipated to be required, Ecology will be notified of the

project prior to beginning construction of the DPE system in accordance with WAC 173-400-110(5)(b).

The extracted air flow will be treated using two GAC vessels in series to allow influent, midpoint, and effluent monitoring to prevent breakthrough from the system while using the first carbon vessel to its maximum effective contaminant adsorption capacity. If VOC breakthrough is detected after the primary GAC vessel the secondary GAC vessel will replace the primary vessel, and a new GAC vessel will become the secondary GAC vessel. During system startup and standard operation, VOC concentrations will be monitored routinely at the point of discharge to ensure effluent vapor concentrations remain below the regulatory threshold.

2.7.2 Water Treatment

Treatment of ground water will be completed using an OWS, filters, a polyphosphate dispenser, and a 4-tray air stripper. The free product will be removed from the ground water via a 100-gallon OWS and will be stored in a 55-gallon stainless steel drum. The water will be pumped through the OWS into a 150-gallon equalization tank. When triggered by a float switch in the equalization tank, the water will be pumped in batches through two parallel cartridge filters, through a polyphosphate dispenser to prevent scaling in the equipment and piping, and then to the sliding tray, stainless steel air stripper (Drawing P-1, Appendix A). Batch treatment allows for the air stripper to operate more efficiently running only as required at a higher ground water flow rate rather than operating continuously at a lower flow rate. The VOC concentrations will be monitored upstream and downstream of the stripping unit to monitor influent water quality and treated water conditions prior to discharge.

2.8 WATER DISCHARGE

Treated ground water will be discharged onsite via an existing infiltration trench located upgradient of the extraction wells, north of the former vehicle storage building (Drawing C-1, Appendix A). The existing infiltration trench, utilized in a previous remedial effort, is approximately 12 feet deep and is filled with pea gravel to approximately 7 feet bgs to allow treated ground water to infiltrate into the subsurface and down to the water table approximately 18 to 23 feet bgs. The pea gravel is overlain by native backfill (Drawing C-4, Appendix A). The trench includes two vertical, 12-inch diameter, Schedule 40 PVC pipes that will be connected

to the conveyance pipes from the treatment system. The lowest three feet of the standpipes are perforated to discharge treated water into the pea gravel. The new conveyances pipe from the treatment system will be valved such that one standpipe will be used as the primary discharge line and the other will be the back-up if the primary line gets fouled or plugged. The standpipes include removable caps to allow for monitoring of the water level in the trench. Additionally, a high level float switch will be installed in the eastern (primary) standpipe to automatically shut off the remediation system if the water level in the trench nears the ground surface.

Based on observations made at the Site during pilot aquifer pump tests in 1995, a hydraulic radius of influence of approximately 100 feet was observed when pumping from a single well at 0.46 gpm, similar to the anticipated pump rate for the DPE project (0.5 gpm), so the current reinjection scenario is anticipated to be hydraulically contained. Figure 4 shows the approximate area of anticipated hydraulic containment at the Site. Water discharge quality will be required to meet the effluent limits presented in the 20 November 1995 Memo from Ecology's Water Quality and Toxics Cleanup Programs entitled "Wastewater Discharges from Independent LUST sites", included in Appendix D. Table B in the Memo presents two permitting options for long-term (greater than 60 days) projects that discharge to ground water that is hydraulically contained onsite. A temporary permit is required for dischargers that meet the effluent limits in Table C, Level 1. Underground injection control registration only (no permit) is required for dischargers that are able to meet the more stringent discharge limits presented in Table C, Level 2. Based on effluent water quality achieved during a ground water pump and treat system operated at the Site from 1995 to 1998, it is anticipated that the more stringent Level 2 discharge limits are achievable with the proposed DPE treatment system. Therefore, the Site will be registered in Ecology's underground injection control program. However, if effluent water monitoring during system startup indicates that Level 2 limits are not achieved, the system will be modified to increase contaminant removal efficiency, or an application will be submitted for a temporary permit.

2.9 VAPOR DISCHARGE

It is currently assumed that the vapor stream will be discharged directly to the atmosphere. If required, based on concentrations from emissions sampling during system startup, an NOC and Washington State

Environmental Policy Act checklist will be submitted to the Central Regional Air Quality Office.

2.10 CONTROLS

A programmable logic control system will be located in the treatment trailer to automatically control various treatment system operating parameters (i.e. blower speed, auto shut-offs, etc.). Onsite controls for the system will include the following:

- Blower (vacuum) control;
- Transfer pump control (multiple);
- Hour meter; and
- System power (start-up/shut-down).

A supervisory control and data acquisition telemetry system will be used to remotely monitor system operation. The cellular autodialer will alert ERM, as the operational contractor, to major mechanical issues, such as power interruption, blower shutoff, and loss of emission control. System alarms will include:

- Vacuum pump high-temperature alarm;
- Knock-out tank high-level alarm;
- Infiltration trench high-level alarm;
- Product tank high-level alarm;
- OWS high-level alarm;
- Equalization tank high-level alarm; and
- System shutdown alarm.

The remediation system will be configured to automatically shut down operation if any alarms are triggered.

2.10.1 Weather Protection and Noise Suppression

Aboveground equipment (such as blowers, knock-out tanks, instrumentation, and emission controls) will be located inside a treatment trailer near this historical vehicle storage building location. The trailer will provide weather protection and noise suppression. Additionally, a sound enclosure for the extraction blower will be installed to provide an

additional noise barrier. Where possible, piping and conduits will be installed in trenches to prevent freezing. Aboveground piping and conduits containing water will be fitted with heat tape or otherwise insulated to prevent freezing.

2.10.2 Power Supply

Electric utility for the DPE systems must be provided for the vacuum pump, the treatment system conveyance pumps, and the supervisory control and data acquisition control system. The vacuum pump is expected to require a three-phase, 230 volt, 60 Hertz frequency power supply. New three-phase power will be brought to the Site by the Chelan County Public Utility District, and a power drop will be installed for the treatment system near the planned trailer location.

2.10.3 Anticipated System Performance

Site ground water analytical data from June 2007 were used to estimate the contaminant mass removal rate from the liquid phase during DPE system operation. A copy of the mass removal calculations at the assumed ground water extraction rate of 1.5 gpm are provided in Appendix B.

A copy of the conservative vapor phase mass removal calculations estimated based on June 2007 ground water data and an anticipated vapor extraction rate of 100 cubic feet per minute are provided in Appendix B (not including direct SVE removal as soil vapor concentrations are unknown). As no soil vapor data is currently available, the extraction wells will be tested during system startup to determine the optimum SVE system performance including flow rate, vacuum pressure levels, and estimated radius of influence. Analytical data will be collected for both ground water and vapor, as shown in Tables 2 and 3, respectively. Updated calculations for mass removal from the vapor phase will be based on measured soil vapor concentrations and the actual vapor extraction rate.

The estimated mass removal rates will be calculated based on several assumptions, including the assumptions that the emission concentrations will remain constant and that the DPE system will operate continuously throughout the year. Typically, in-situ mass varies over time, and contaminant mass extraction rates decrease as system operation progresses. The system shall be monitored to determine when removal rates reach asymptotic levels, at which point the system will be re-

evaluated to determine the operation schedule. Monthly removal rates and cumulative mass removal will be calculated and presented in the system summary report.

3.0 SYSTEM INSTALLATION WORK PLAN

ERM personnel will oversee the remediation system installation and construction. In accordance with WAC 173-340-400(6) (b), oversight will be provided by or under the direct supervision of a professional engineer registered in the State of Washington. System installation activities will be performed in accordance with the Site-specific Health and Safety Plan, generated to meet the provisions of WAC 173-340-810.

3.1 UNDERGROUND UTILITY CLEARANCE

Prior to mobilization of the drilling subcontractor to the Site, underground utilities in the vicinity of the proposed extraction and monitoring wells and conveyance trenches will be located by an independent utility location subcontractor. Planned well and trench locations will be marked with paint in the field prior to utility location. If it is determined that drilling or excavation at any of the planned locations could interfere with underground utilities, the planned well or trench will be relocated a safe distance away from the utilities, but as close as possible to the original planned location.

3.2 WELL INSTALLATION

3.2.1 Extraction Wells

The DPE wells will be installed using a hollow-stem auger drilling rig operated by a Washington state-licensed well driller. Soil samples will be collected using a 24-inch split spoon sampler from at least each 2.5-foot interval of the well boring for lithologic logging. The DPE wells will be completed to depths ranging from approximately 40 to 50 feet bgs. The wells will be constructed of 4-inch diameter, threaded, flush-joint, Schedule 40 PVC casing with at least 15 feet of 0.010-inch machine-slotted PVC screen. The screened interval will be positioned so that the top of the screen is at least 3 feet below the sand/siltstone interface, and at least 2 feet of bentonite seal is present below the interface.

The annular space between the well screen and the borehole wall will be backfilled with a clean silica sand filter pack up to one foot above the top of the well screen. The wells will be sealed from the top of the sand pack to approximately 2 feet bgs with hydrated bentonite chips. The wellhead

assembly installed at the top of the well casing will include compression fittings for the bladder pump air supply, air exhaust, and water discharge lines, a vacuum gauge, flow sensor pressure gauge, sample port, and PVC ball valve. Each wellhead assembly will be completed within a flush-mount 3-foot (ft) x 2-ft x 1.5 ft vault set into a concrete pad. An additional length of suspension cable, air supply tubing, air exhaust tubing, and water discharge hose will be coiled in-line and placed inside the vault to allow for the elevation of the pump to be manually adjusted inside the well based on water level fluctuations. The additional length required is estimated to be approximately 12 feet, but will be determined in the field after the DPE wells are installed.

The extraction wells will be developed at least 24 hours after well installation to remove accumulated fine-grained material from the well casing and filter pack, and to ensure proper hydraulic communication with the surrounding aquifer. Wells will be developed by repeated pumping and bailing water from the well until turbidity has been reduced to at least 100 Nephelometric turbidity units with a target of less than 10 Nephelometric turbidity units. A minimum of three and a maximum of 10 well casing volumes of water will be removed from each well during development.

3.2.2 Monitoring Well

The ground water monitoring well will be installed using a hollow-stem auger drilling rig operated by a Washington state-licensed well driller. Soil samples will be collected using a 24-inch split spoon sampler from at least each 2.5-foot interval of the well boring for lithologic logging. The monitoring well is expected to be completed to approximately 45 feet bgs. The well will be constructed of two-inch diameter, threaded, flush-joint, Schedule 40 PVC casing with 10 feet of 0.010-inch machine-slotted PVC screen. The screened interval will be positioned to extend from approximately five feet above the water table to five feet below the water table.

The annular space between the well screen and the borehole wall will be backfilled with a clean silica sand filter pack to two feet above the top of the well screen. The wells will be sealed from the top of the sand pack to approximately 2 feet bgs with bentonite chips. The well will be completed by installing a flush-mounted steel protective casing. A lockable compression cap will be installed to secure the well.

The monitoring well will be developed at least 24 hours after well installation. Development will be conducted as described in Section 3.2.1.

3.2.3 Ground Water Sampling

After installing and developing the new monitoring well, a baseline ground water sampling event will be conducted at monitoring wells, MW-2, MW-3, RW-1, MW-7, MW-8, MW-10, and new well MW-11, for laboratory analysis of the parameters listed in Table 2. Samples will be collected using a PVC bailer and nylon rope after three well casing volumes have been purged from the well. Prior to sampling, an electronic water level indicator will be used to measure the static water level in the monitoring wells. Historically dry monitoring wells MW-4, MW-5, and MW-9 will be inspected and samples will be collected from the wells if sufficient ground water is present.

3.2.4 Investigation Derived Waste

Drill cuttings, well purge water, and decontamination water generated during drilling and monitoring activities will be contained in segregated 55-gallon drums. The investigation derived waste (IDW) drums will be clearly marked with a description of the contents and the accumulation date and stored in or near the Former Office/Shop Building. The contents of each IDW drum will be designated as Washington dangerous waste or non-dangerous waste in accordance with Washington State Dangerous Waste Regulations, Chapter 173-303 WAC. The IDW will be disposed appropriately as non-dangerous or dangerous waste based on its characteristics.

3.3 PIPING

The vacuum extraction branch piping from the DPE wells to the main conveyance line will be 2-inch diameter, Schedule 80 PVC pipe with a minimum pressure rating of 75 pounds per square inch (psi). The 2-inch diameter branch pipes will tie into a 4-inch diameter, Schedule 80 PVC main line that conveys the ground water to the treatment system. All outdoor piping will be placed in a trench for freeze protection. The 3/8-inch diameter compressed air supply hose and 5/8-inch diameter bladder pump discharge hose will both be contained in a two-inch diameter Schedule 40 PVC conduit. The treated water discharge to the infiltration trench will be a 2-inch diameter Schedule 80 PVC pipe. All piping will be pressure tested before backfilling is completed. The electrical cable from

the treatment system to the infiltration trench for the water level pressure transducer will be contained in a conduit and installed per applicable electrical code. All trench details are shown on Drawing C-4 in Appendix A. Piping sizes and materials used in the treatment system are specified on Drawing P-1.

3.4 TREATMENT SYSTEM

All components of the remediation system treatment equipment will be installed per the manufacturer's instructions by a qualified installer.

3.5 INFILTRATION TRENCH

The existing infiltration trench from previous remedial efforts is located south and west of MW-1. The existing trench includes two 12-inch diameter vertical PVC standpipes, one for primary use and one for backup. Prior to reaching the existing trench, the treated water discharge pipe will tee into two lines, each with a ball valve, to allow the discharge flow to transfer between the primary and secondary standpipes. The ball valve will be placed in a valve box so that it can be operated from above ground with a t-handle. The new piping will be tapped into the existing standpipes using a saddle, tee, or other watertight connection method. The connection will be tested for leaks before backfilling the trench. If biofouling or plugging of the primary standpipe occurs, the discharge pipes can be valved to discharge treated water to the secondary standpipe. If significant plugging of the drainage media in the trench occurs, an anti-microbial agent or other scalant remover may be used in compliance with the permit conditions, if appropriate. A high-level float switch will be installed in the eastern (primary) standpipe to automatically shut off the remediation system if the water level in the trench nears the ground surface.

3.6 SURVEY

A Washington state-licensed surveyor will survey the locations and elevations of the new extraction and monitoring wells. The locations and elevations will be referenced to the horizontal and vertical benchmarks established during previous phases of work at the Site. The survey results will be accurate to ± 0.01 ft vertically and ±0.1 ft horizontally.

Locations of the new equipment, and trenches, including all pipe elbows, tees, and valves will be measured in the field to develop "as-built" drawings of the DPE system. All field measurements will be taken with a measuring wheel, tape measure, or other means of providing accurate measurements and will be documented in the field book as described in Section 3.7. An "as-built" set of drawings will be developed based on the measurements taken in the field during construction.

3.7 FIELD DOCUMENTATION

A qualified ERM consultant will be present at the drill rig to log samples, monitor drilling operations, record soil and ground water data, monitor and record well installation procedures, and monitor and record installation of trenches and remediation system equipment. ERM personnel will have sufficient experience and proper equipment in operable condition to efficiently perform these duties. For installation and construction activities, the consultant will be a professional engineer registered in the State of Washington or a qualified technician under the direction supervision of a professional engineer registered in the State of Washington.

The technician will maintain a field notebook during all onsite activities. The field notebook will be a weather-resistant, bound, survey-type field book. Entries in the field notebook will be made in ink and will include:

- Name of field personnel;
- Daily weather conditions;
- Subcontractors and vendors on Site;
- Daily activities;
- Construction techniques;
- Materials used and items installed;
- Tests and measurements performed;
- Data generated during drilling and construction activities; and
- Other applicable comments or notes.

4.0 OPERATION AND MAINTENANCE

This section discusses key aspects of system operation, including startup procedures and ongoing maintenance necessary to establish and maintain the desired soil vapor and ground water flow. Also discussed are the parameters, measurement methods, and frequency of measurement for monitoring the DPE system performance.

4.1 SYSTEM STARTUP

Upon completion of construction, the remediation system will undergo a 2-week period of system start-up and optimization. During this time, water level measurements, vacuum, and flow rate readings will be collected at the monitoring wells, extraction wells, and within the treatment system three times per week. Additionally, ground water samples will be collected at sampling ports upstream and downstream of the air stripper three times per week and analyzed for VOCs, TPH-G, and TPH-D using the methods specified in Table 2 to monitor treatment effectiveness. Samples of the vapor emissions at the discharge point will be collected using a Summa canister and analyzed for VOCs using U.S. Environmental Protection Agency Method TO-15 as shown in Table 3 to monitor regulatory compliance. Total vapor VOC concentrations at the individual wellheads and discharge point will also be measured with a photoioniation detector.

4.2 SYSTEM MONITORING

During operation, the performance of the DPE system will be periodically assessed to evaluate whether changes to the system operation are necessary to maximize contaminant removal efficiency. Such changes can include, but are not limited to, reductions or increases in system extraction rate and conversions from a steady to a "pulsed" vacuum scenario (discontinuous operation).

During the four weeks following the initial two-week startup period, system monitoring will be conducted on a weekly basis. After that, a long-term system monitoring schedule will be developed based on system performance. Based on pervious experience, ERM anticipates that long-term system monitoring will require monthly to bi-monthly monitoring. It is assumed that the system will operate for a period of one year. All

system readings will be recorded in the Site field book as described in Section 3.7.

4.2.1 Airflow and Ground Water Flow Monitoring Points

The vapor stream flow rate and vacuum will be monitored as it exits each of the three DPE wellheads. The ground water flow rate will also be monitored as it exits the DPE wellheads using a pump cycle counter located in the wellhead vault on the discharge line. Additionally, the flow rate of the vapor phase will be measured at the discharge location.

4.2.2 Effects on Water Level

Water levels in all monitoring wells will be measured during system start up, during selected system monitoring events during the first two months of operation, and during routine ground water monitoring events to observe the impact of the operation of the DPE system on the aquifer. Ground water pumping rates may be varied based on the results of ongoing water level monitoring.

4.2.3 Ground Water Monitoring

After the initial baseline monitoring event conducted after installation of MW-11, ground water monitoring will be conducted on a quarterly basis during the operation of the clean up action, assumed to be one year. Ground water samples will be collected and analyzed for VOCs, TPH-G, and TPH-D as listed in Table 2. Samples will be collected at each of the 11 Site monitoring wells if sufficient ground water is present.

To evaluate potential alternative remedial actions (i.e. natural attenuation) after the first year of DPE system operation, additional ground water samples will be collected and analyzed for new parameters during the final quarterly monitoring event of the first year of operation as shown in Table 2.

4.2.4 Soil Vapor Monitoring

Regular vapor stream sampling and analysis will be used to evaluate the total contaminant quantities being extracted. Additionally, this vapor stream monitoring will provide data concerning the rate of degradation of petroleum hydrocarbons occurring within the soil. Vapor samples will be collected at the GAC influent, midpoint, and discharge points using

Summa canisters and analyzed for VOCs using U.S. Environmental Protection Agency Method TO-15 as shown in Table 3.

4.2.5 Discharge and Emission Control Effectiveness

Water discharge and air emission control effectiveness will be measured by sampling and monitoring contaminant concentrations before and after treatment for water and at the discharge point for air. A VOC removal efficiency of up to 99% is expected during ground water treatment using an air stripping unit. Water discharge quality will be required to meet the discharge limits presented in Table C, Level 2 of Ecology's Independent LUST Memo (Appendix D). Otherwise, a temporary discharge permit will be required. Air emissions quality will be required to remain below Ecology's NOC exemption emissions thresholds, based on the results of the vapor sampling during system startup.

4.3 SYSTEM MAINTENANCE

During system operation, system maintenance will be performed on a schedule similar to monitoring: three times weekly during the initial two weeks of operation, weekly during the following four weeks and on the monitoring schedule selected based on system performance thereafter. Maintenance will also occur on an as-needed basis should any system alarms occur (see Section 2.10).

Equipment maintenance on the treatment and discharge system, including the submersible ground water pumps, vacuum pump, OWS, filters, air stripper, and transfer pumps will be conducted by a person familiar with the equipment and in accordance with manufacturer's recommendations to maintain proper equipment operation. All maintenance activities will be documented in the field book as described in Section 3.7.

4.3.1 Preventative Maintenance

The remediation system includes key maintenance items that will be completed on a routine or as-needed basis to maintain continuous operation of the DPE system to the maximum extent practicable. The extraction wells will require periodic maintenance to maintain their flow capacity. Extraction wells can lose capacity with time as a result of biological growth, mineral scaling, or capture of particulates by the well screen and annular filter pack. Maintenance activities, as required, will consist of taking the individual well offline and attempting to restore

adequate well capacity using techniques (individually or in combination) such as surging, water jetting, or chemical cleaning.

4.4 SAMPLE IDENTIFICATION AND SHIPMENT

All air and water samples collected for analysis will be properly labeled with:

- The date;
- The time;
- Required analysis; and
- Sample name based on location (i.e. MW-3, VAP-1).

All information listed on the sample bottles will also be listed on the chain of custody that correlates to each sample cooler. All samples submitted to the laboratory will be preserved and chilled, as required, packed in a cooler to minimize the risk of breakage, and delivered or shipped to the analytical laboratory. If shipped, sample coolers will be properly packed and sealed and will include a signed custody seal to confirm the cooler was not opened during transport.

4.5 SYSTEM EFFECTIVENESS EVALUATION

The goals of remediating the environmental media impacted at the site are to remove free-phase product from the ground water table and to reduce residual concentrations in ground water to levels which are acceptable from a regulatory and public risk perspective. This section discusses the criteria that will be measured to evaluate the effectiveness of the remediation system operation in meeting the remedial objectives of free-phase product removal and reduction of dissolved-phase petroleum concentrations in ground water to below cleanup levels.

To evaluate removal of free-phase product from the ground water in the remediation area, volumes of recovered product will be measured and recorded during each monitoring and maintenance event. Also, during each event where ground water levels will be measured, an oil/water interface probe will be used to evaluate the thickness of any free-phase product accumulated in wells RW-1 and MW-3.

Ground water samples will be used to evaluate progress of removal of dissolved-phase contamination toward the ground water cleanup standards discussed above. Quarterly sampling and analysis of ground water from the Site monitoring wells will be completed to evaluate ground water quality. These samples will be analyzed for the parameters identified in Table 2.

In order to eventually discontinue use of the remediation system at the Site, the regulatory cleanup levels must be attained across the Site. It is currently assumed that the MTCA Method A cleanup standards may not be achieved during the initial one-year period of system operation, and the clean up action may be extended. If cleanup standards are determined to be technically unachievable during implementation of the cleanup action, the cleanup standards may be modified based on an evaluation of available Site data and an evaluation of exposure pathways.

4.6 REPORTING

ERM will prepare and submit a Remedial Progress Evaluation Report (Evaluation Report) following one year of system operation. This report will, as part of the evaluation of effectiveness of the cleanup action, include the following:

- Summary of construction, monitoring, and maintenance observations;
- As-built construction drawings;
- Operational information on the DPE system performance;
- Quarterly water/product level measurement data and potentiometric surface maps;
- Tables summarizing ground water and soil vapor field parameter measurements and analytical data;
- Analytical reports from the laboratory; and
- Conclusions and recommendations for future remedial effort based on the system operation.

5.0 REFERENCES

Environmental Resources Management (ERM), 2008. *Corrective Action Plan* prepared for Dole Fresh Vegetables, Inc. August 2008.

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ERM, 1994d. *Ground Water Remediation Design Document for Environmental Restoration at Wells & Wade Fruit Company Birchmount Orchards Facility*. October 1994

Figures

Project No. 0064384.00

Date: 07/30/07

Drawn By: R. Olson

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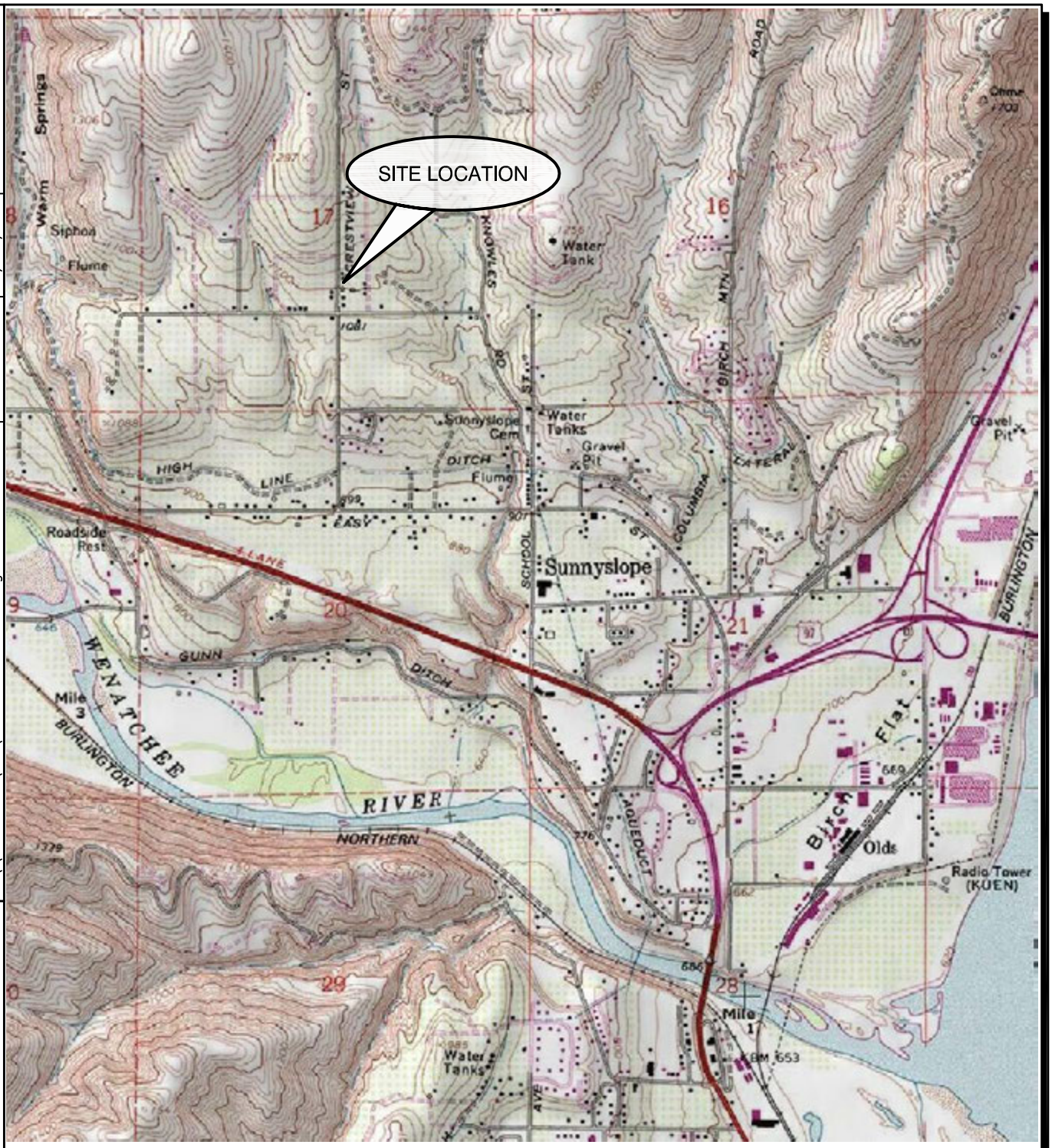

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References:
TOPO!® Software
U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle, Wenatchee, WA
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Figure 1

Site Location Map

Former Birchmount Orchard Facility

Wenatchee, Washington

ERM *07/07*

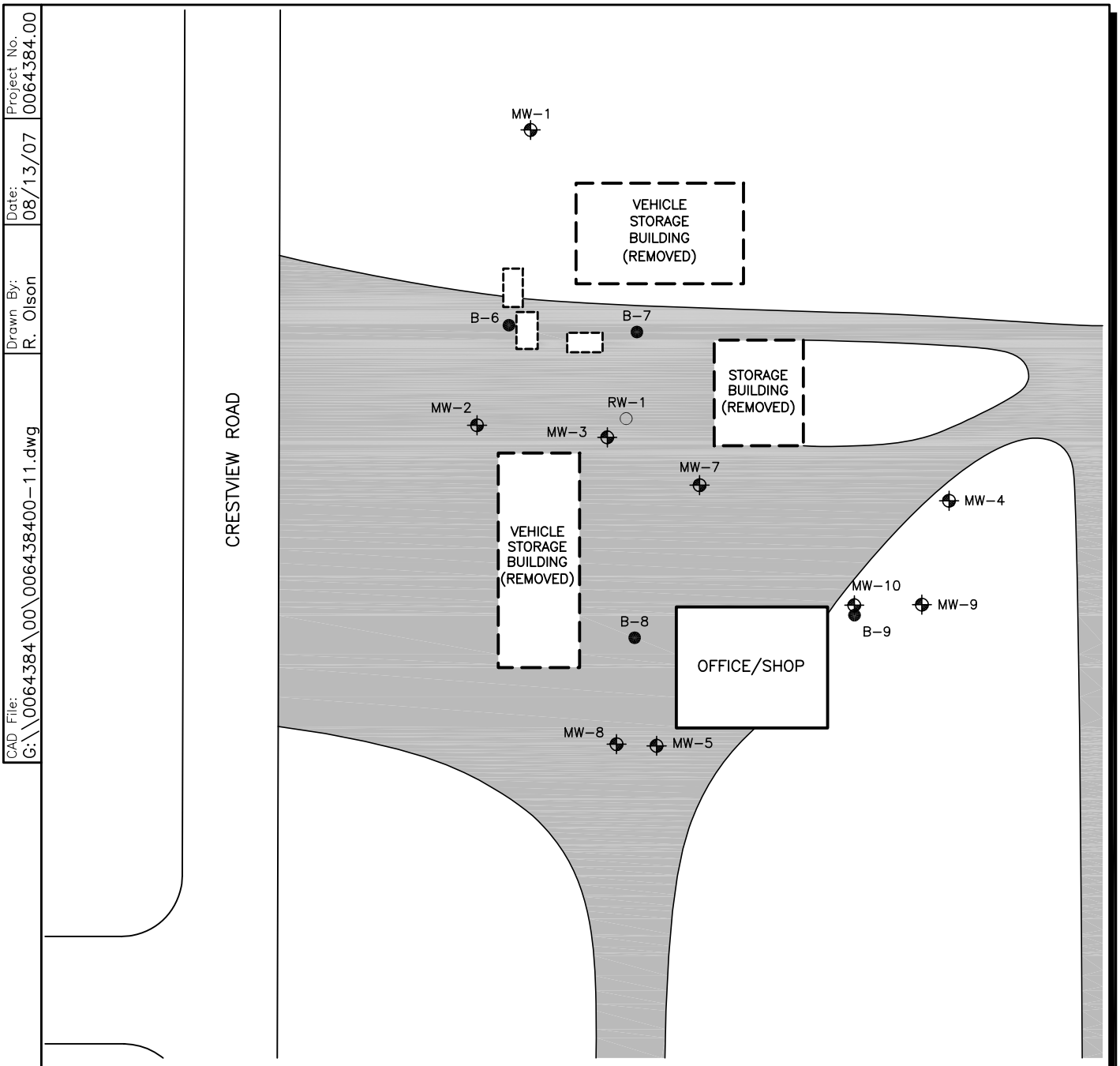
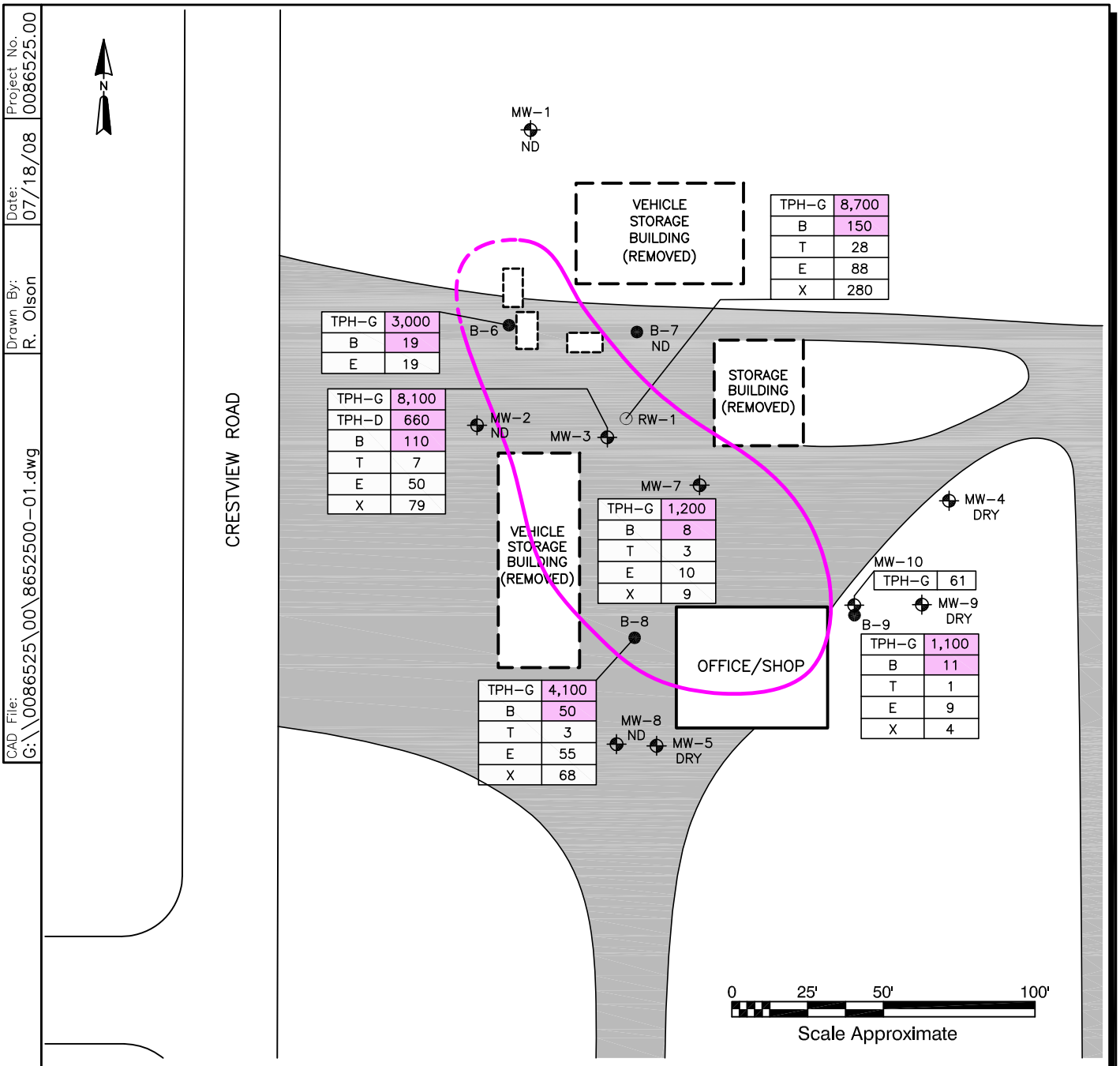


Figure 2
Site Plan
Former Birchmount Orchard Facility
Wenatchee, Washington

ERM *08/07*



LEGEND

MW-1	Existing Monitoring Well
RW-1	Existing Recovery Well
B-6	Soil Boring
	Former USTs (Removed 1992)
	Gravel/Dirt Driveway

Note: UST locations shown are approximate

Approximate Limit of Groundwater Contaminant Concentrations Greater than Regulatory Standards

Shading Indicates Concentrations Above Applicable MTCA Method A Groundwater Cleanup Level

TPH-G	Gasoline-Range Petroleum Hydrocarbons
TPH-D	Diesel-Range Petroleum Hydrocarbons
B	Benzene
T	Toluene
E	Ethylbenzene
X	Total Xylenes
ND	No Analytes Detected

Concentrations in micrograms per liter.

Figure 3

Summary of Groundwater Sampling Results
June 2007
Former Birchmount Orchard Facility
Wenatchee, Washington

ERM 07/08

Project No. 0086525
Date: 08/12/09
Drawn By: C.Tallada
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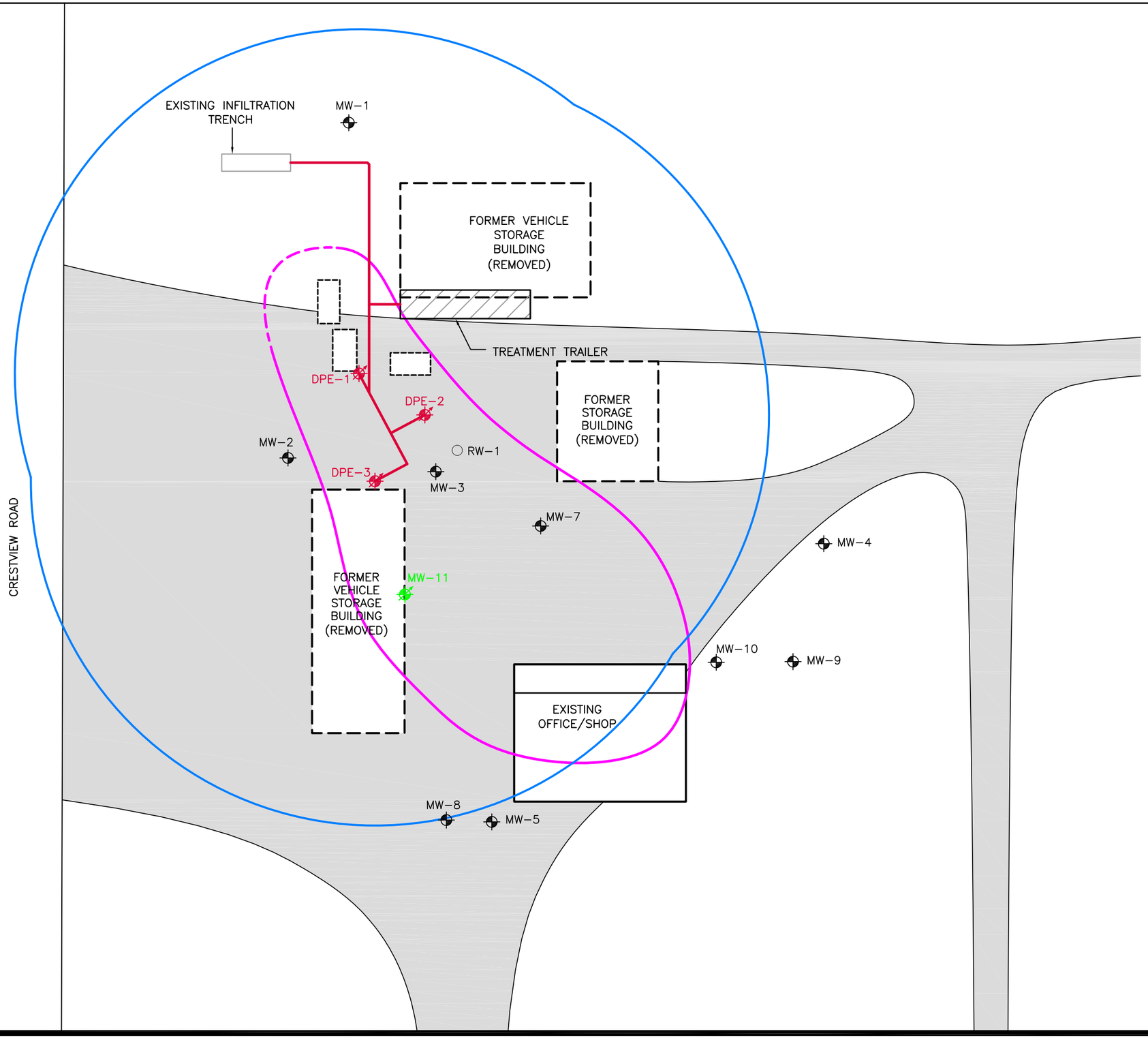


LEGEND

- MW-1 — EXISTING MONITORING WELL
- RW-1 — EXISTING RECOVERY WELL
- MW-11 — NEW MONITORING WELL
- DPE-1 — NEW DPE WELL
- DPE SYSTEM PIPING
- FORMER UST (REMOVED 1992)
- GRAVEL/DIRT DRIVEWAY
- APPROXIMATE LIMIT OF GROUNDWATER CONTAMINANT CONCENTRATIONS GREATER THAN CLEANUP STANDARDS
- APPROXIMATE LIMITS OF ANTICIPATED HYDRAULIC CONTAINMENT

NOTES:
1. FORMER UST LOCATIONS SHOWN ARE APPROXIMATE.
2. ANTICIPATED HYDRAULIC CONTAINMENT BASED ON OBSERVATIONS MADE DURING 1994 PILOT STUDY AQUIFER PUMP TEST.

N

0 15' 30' 60'
SCALE IN FEET

Figure 4
Estimated Hydraulic Containment
Former Birchmount Orchard Facility
Wwenatchee, Washington

ERM 08/09

Tables

TABLE 1

Summary of Method A Ground Water Cleanup Levels
Former Dole-Birchmount DPE System
Wenatchee, Washington

Contaminant	Project Screening Levels: Ground Water[1]
Gasoline-range Petroleum Hydrocarbons (TPH-G)	800 micrograms per liter (µg/L)
Diesel-range Petroleum Hydrocarbons (TPH-D)	500 µg/L
Benzene	5 µg/L
Toluene	1,000 µg/L
Ethylbenzene	700 µg/L
Total Xylenes	1,000 µg/L

Notes:

[1] MTCA Method A Cleanup Levels for Ground Water
(Chapter 173-340-900 WAC, Table 720-1)

TABLE 2

Ground Water and Soil Sampling and Analysis Plan
Former Dole-Birchmount DPE System
Wenatchee, Washington

		Ground Water											Soil
		Depth to Groundwater Measurement	Field Parameters (pH, temp, cond)	BTEX by USEPA Method 8260B	Volatile Petroleum Products by Method NWTPH-Gx	Semi-Volatile Petroleum Products by Method NWTPH-Dx	Dissolved Iron by USEPA Method 6010/6020	Nitrates by USEPA Method 353.3	Sulfates by USEPA Method 375.4	Alkalinity by USEPA Method 310.1	Hardness by USEPA Method 200.7	Additional Field Parameters (ORP, DO)	NOD by ASTM D 7262-07A
STARTUP AND ROUTINE SAMPLING													
Wells	MW-1	X	X	X	X	X	---	---	---	---	---	---	---
	MW-2	X	X	X	X	X	---	---	---	---	---	---	---
	MW-3	X	X	X	X	X	---	---	---	---	---	---	---
	MW-4	X	X	X	X	X	---	---	---	---	---	---	---
	MW-5	X	X	X	X	X	---	---	---	---	---	---	---
	MW-7	X	X	X	X	X	---	---	---	---	---	---	---
	MW-8	X	X	X	X	X	---	---	---	---	---	---	---
	MW-9	X	X	X	X	X	---	---	---	---	---	---	---
	MW-10	X	X	X	X	X	---	---	---	---	---	---	---
	MW-11[1]	X	X	X	X	X	---	---	---	---	---	---	X[2]
	RW-1	X	X	X	X	X	---	---	---	---	---	---	---
	DPE-1	X	---	---	---	---	---	---	---	---	---	---	X[2]
	DPE-2	X	---	---	---	---	---	---	---	---	---	---	X[2]
	DPE-3	X	---	---	---	---	---	---	---	---	---	---	X[2]
Treatment System	Pre-Treatment	---	X	X	X	X	---	---	---	---	---	---	---
	Post-Treatment	---	X	X	X	X	---	---	---	---	---	---	---
FINAL QUARTERLY MONITORING EVENT													
Wells	MW-1	X	X	X	X	X	---	---	---	---	---	---	---
	MW-2	X	X	X	X	X	X	X	X	X	X	X	---
	MW-3	X	X	X	X	X	X	X	X	X	X	X	---
	MW-4	X	X	X	X	X	---	---	---	---	---	---	---
	MW-5	X	X	X	X	X	---	---	---	---	---	---	---
	MW-7	X	X	X	X	X	X	X	X	X	X	X	---
	MW-8	X	X	X	X	X	---	---	---	---	---	---	---
	MW-9	X	X	X	X	X	---	---	---	---	---	---	---
	MW-10	X	X	X	X	X	X	X	X	X	X	X	---
	MW-11[1]	X	X	X	X	X	---	---	---	---	---	---	---
	RW-1	X	X	X	X	X	---	---	---	---	---	---	---
Treatment System	Pre-Treatment	---	X	X	X	X	X	X	X	X	X	X	---
	Post-Treatment	---	X	X	X	X	X	X	X	X	X	X	---

Notes:
[1] New well installed during remediation system construction.
[2]Soil samples to be collected during well installation.

ASTM = American Society for Testing and Materials
BTEX = Benzene, toluene, ethylbezene, and xylenes
DO = Dissolved oxygen

NOD = Natural oxidant demand
ORP = Oxidation-reduction potential
USEPA = United States Environmental Protection Agency
VOCs = Volatile organic compounds

TABLE 3

Vapor Sampling and Analysis Plan
Former Dole-Birchmount DPE System
Wenatchee, Washington

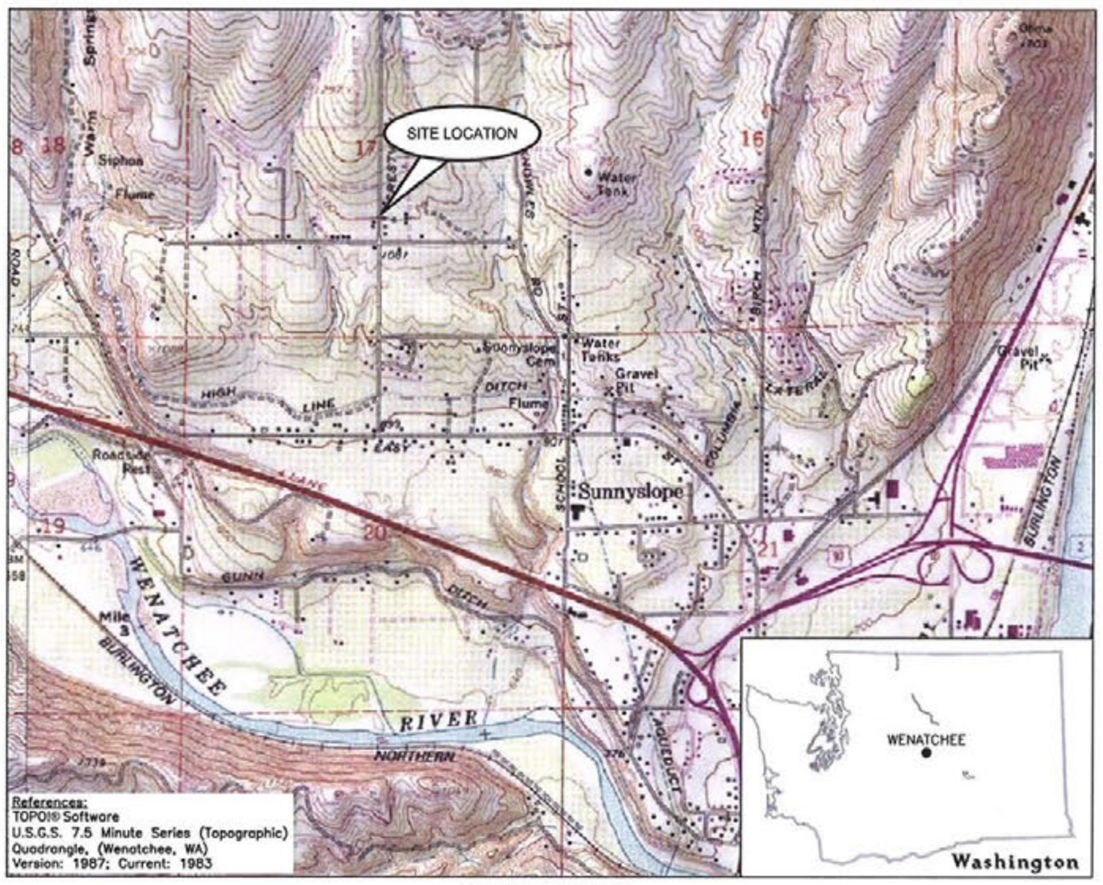
Sample Location	Flowrate (cfm)	Vacuum (inches Hg)	Volatile Organics by USEPA Method TO-15
STARTUP SAMPLING			
DPE-1	X	X	
DPE-2	X	X	
DPE-3	X	X	
GAC Influent	X	X	X
GAC Midpoint	X	X	X
GAC Effluent	X	X	X
ROUTINE SAMPLING			
DPE-1	X	X	
DPE-2	X	X	
DPE-3	X	X	
GAC Influent	X	X	X
GAC Midpoint	X	X	X
GAC Effluent	X	X	X

Notes:
cfm = Cubic feet per minute
DPE = Dual phase extraction
Hg = Mercury
USEPA = United States Environmental Protection Agency

Appendix A
Construction Drawings

FORMER BIRCHMOUNT ORCHARD FACILITY
WENATCHEE, WASHINGTON
DUAL PHASE EXTRACTION REMEDIATION SYSTEM DESIGN
APRIL 2009

LOCATION MAP



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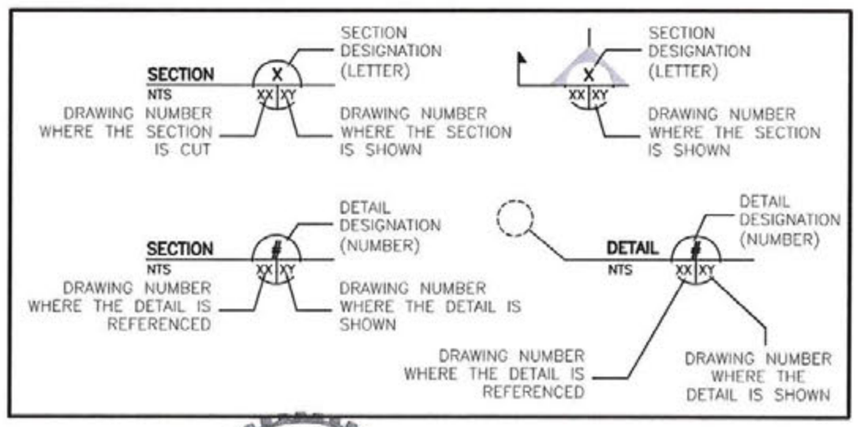
INDEX OF DRAWINGS

DRAWING NO.	DISC. NO.	DESCRIPTION
0086525-01	T-1	SITE LOCATION MAP AND INDEX OF DRAWINGS
0086525-02	G-1	GENERAL NOTES
0086525-03	C-1	SITE AND SYSTEM LAYOUT
0086525-04	C-2	SUBSURFACE SCHEMATIC
0086525-05	C-3	SYSTEM DETAILS
0086525-06	C-4	TRENCH DETAILS
0086525-08	P-1	PROCESS FLOW DIAGRAM

LEGEND



ERIK CHRISTIAN IPSEN
STATE OF WASHINGTON
38339
REGISTERED
PROFESSIONAL ENGINEER

REV	DATE	REVISION	APPR'D	REV BY
1	04/10/09	ISSUED FOR CONSTRUCTION	E.I.	C.T.

ERM

SITE LOCATION MAP AND INDEX OF DRAWINGS

SCALE	DESIGNED	DRAWN	CHECKED	APPROVED	DRAWING NUMBER	SHEET
AS NOTED	D. WILLIAMS	C.TALLADA	E. IPSEN		0086525-01	1 of 8
DATE 04/10/09					JOB NUMBER 0086525	

FORMER BIRCHMOUNT ORCHARD FACILITY
WENATCHEE, WASHINGTON

DISCIPLINE NO. T-1

ENVIRONMENTAL RESOURCES MANAGEMENT

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DESCRIPTION OF WORK

SOIL AND GROUNDWATER REMEDIATION SYSTEM
FORMER BIRCHMOUNT ORCHARD FACILITY
3717 CRESTVIEW ROAD
WENATCHEE, WASHINGTON

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE UNIFORM BUILDING CODE, 2006 EDITION, LOCAL CODES AND APPLICABLE STATE AND FEDERAL REGULATIONS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL FIELD DIMENSIONS AND IDENTIFYING ALL CONFLICTING UTILITIES PRIOR TO BEGINNING ANY WORK. AS-BUILT DRAWINGS OF EXISTING FACILITIES OR STRUCTURES ARE NOT AVAILABLE. DAMAGE TO EXISTING PIPING, CONDUIT OR OTHER ITEMS SHALL BE REPAIRED OR REPLACED TO ORIGINAL CONDITION BY THE CONTRACTOR.
3. ENGINEER SHALL BE RESPONSIBLE FOR BUILDING AIR DISCHARGE AND INFILTRATION TRENCH DISCHARGE PERMITS: CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING OTHER PERMITS, AS REQUIRED.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING THE CONSTRUCTION AREA AGAINST ENTRY BY UNAUTHORIZED PERSONNEL FOR THE DURATION OF THE PROJECT.
5. UTILITY TRENCHES SHALL BE EXCAVATED A MINIMUM OF FOUR INCHES DEEPER THAN THE BOTTOM OF INSTALLED PIPES OR CONDUITS. ALL LINES SHALL HAVE A MINIMUM COVER OF 12 INCHES OF COMPACTED SAND AND A MINIMUM BURIAL DEPTH OF 36 INCHES, UNLESS NOTED OTHERWISE.
6. TRENCHES SHALL BE BACKFILLED WITH CLEAN SAND WITH A MAXIMUM LOOSE LIFT OF 8 INCHES BEFORE COMPACTION. COMPACTION SHALL BE TO A DENSITY OF NO LESS THAN 95% OF MAXIMUM.
7. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 2000 PSI. MINIMUM THICKNESS OF CONCRETE TO BE 6 INCHES. FINISH SHALL BE STEEL TROWEL SMOOTH OR TO MATCH SURROUNDINGS.
8. SURFACING MATERIALS SHALL MATCH SURROUNDINGS UNLESS NOTED OTHERWISE. GRADE TO DRAIN AWAY FROM VAULT BOXES.
9. ALL LIQUID CARRYING LINES SHALL BE PRESSURE TESTED TO 75 PSI BEFORE BACKFILL. ALL CONTAINMENT CONDUIT SHALL BE PRESSURE TESTED TO 5 PSI BEFORE BACKFILL. ENGINEER SHALL BE NOTIFIED OF AND WITNESS PRESSURE TESTING. UTILITY INSPECTOR SHALL ALSO BE NOTIFIED AND WITNESS PRESSURE TESTING, AS REQUIRED.
10. ELECTRICAL CONDUIT TO TERMINATE WITH AT LEAST 10 FEET OF RIGID METALLIC AT ALL PENETRATIONS, STUB-UPS OR EXPLOSION PROOF SEAL-OFFS.
11. ALL ELECTRICAL PANELS, METERS, CONDUIT, AND PIPING NOT PENETRATING THE TREATMENT TRAILER SHALL BE MOUNTED A MINIMUM OF 36 INCHES ABOVE GRADE. ALL PANELS, METERS, PIPES AND CONDUITS SHALL BE MOUNTED ON A BACKBOARD OF 3/4 INCH EXTERIOR PLYWOOD MOUNTED ON UNISTRUT INSTALLED VERTICALLY 6 FOOT CENTERS OR ON UNISTRUT ALONE INSTALLED VERTICALLY ON 2 FOOT CENTERS.

CONSTRUCTION NOTES

1. ALL UNDERGROUND CONTAINMENT CONDUIT AND ELECTRICAL CONDUIT SHALL USE LONG SWEEPS FOR ALL BENDS. VAULTS MAY BE USED AS JUNCTION BOXES WITH APPROVAL FROM THE ENGINEER AND AS REQUIRED BY ELECTRICAL CODE.
2. PULL ROPES WILL BE INSTALLED IN ALL CONDUIT AND CONTAINMENT CONDUIT.
3. AN EXTERNAL 12 GAUGE STRANDED COPPER BOND WIRE WILL BE INSTALLED PARALLEL TO ALL BURIED PVC CONDUIT AND BE MECHANICALLY BONDED TO THE RIGID STEEL CONDUIT WHICH TERMINATES AT EACH END.
4. A WARNING TAPE SHALL BE INSTALLED IN THE TRENCH BACKFILL AT LEAST 6 INCHES ABOVE THE UPPERMOST PIPING.
5. ALL VAULTS SHALL BE SET TOTALLY IN CONCRETE. VAULTS WITH A DEPTH GREATER THAN 12 INCHES SHALL BE SET IN TWO OR MORE POURS WITH THE UPPERMOST LIFT A MAXIMUM OF 10 INCHES THICK. TOPS OF VAULTS SHALL BE SET 1/2 INCH ABOVE GRADE IN COLLARS OF CONCRETE WITH A MINIMUM COLLAR WIDTH OF 12 INCHES. CONCRETE SHALL BE SLOPED FROM TOP OF VAULT TO EXISTING GRADE.
6. THE EFFLUENT DISCHARGE LINE TO THE INFILTRATION TRENCH SHALL HAVE A MINIMUM SLOPE OF 2%.
7. NEW 3-PHASE/240V POWER DROP WILL BE INSTALLED BY OTHERS. THE METER SHALL BE MOUNTED OUTSIDE OF THE TREATMENT ENCLOSURE.
8. DPE WELLS AND MONITORING WELL TO BE INSTALLED BY OTHERS.

ABBREVIATIONS

Ø	DIAMETER, PHASE
%	PERCENT
#	GAUGE
ACFM	ACTUAL CUBIC FEET PER MINUTE
Bgs	BELOW GROUND SURFACE
DPE	DUAL PHASE EXTRACTION
FT	FOOT, FEET
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON
GPM	GALLONS PER MINUTE
GND	GROUND
GW	GROUNDWATER
Hg	MERCURY
HP	HORSEPOWER
MAX	MAXIMUM
MIN	MINIMUM
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
PG	PRESSURE GAUGE
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
SS	STAINLESS STEEL
TEFC	TOTALLY ENCLOSED, FAN COOLED
TYP	TYPICAL
UST	UNDERGROUND STORAGE TANK
V	VOLT

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1	04/10/09	ISSUED FOR CONSTRUCTION	E.I.	C.T.

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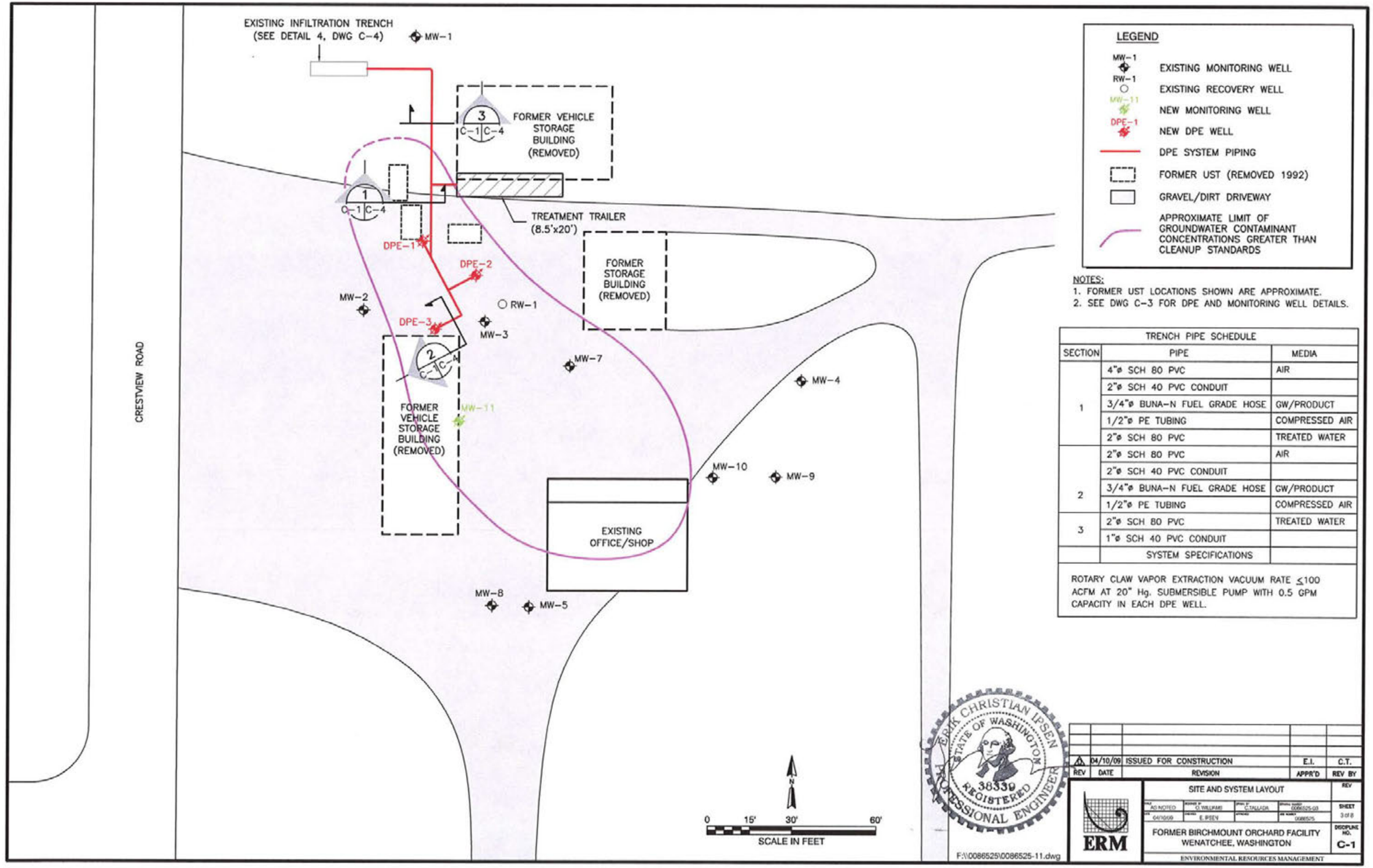
GENERAL NOTES

SCALE	DESIGNED BY	DRAWN BY	DRAWING NUMBER
AS NOTED	O. WILLIAMS	C.TALLADA	0086525-02
DATE	CHECKED	APPROVED	JOB NUMBER
04/10/09	E. IPSEN		0086525

FORMER BIRCHMOUNT ORCHARD FACILITY
WENATCHEE, WASHINGTON

ENVIRONMENTAL RESOURCES MANAGEMENT

REV
SHEET 2 of 8
DISCIPLINE NO. G-1



NOTES:
1. FORMER UST LOCATIONS SHOWN ARE APPROXIMATE.
2. SEE DWG C-3 FOR DPE AND MONITORING WELL DETAILS.

TRENCH PIPE SCHEDULE		
SECTION	PIPE	MEDIA
1	4"ø SCH 80 PVC	AIR
	2"ø SCH 40 PVC CONDUIT	
	3/4"ø BUNA-N FUEL GRADE HOSE	GW/PRODUCT
	1/2"ø PE TUBING	COMPRESSED AIR
	2"ø SCH 80 PVC	TREATED WATER
2	2"ø SCH 80 PVC	AIR
	2"ø SCH 40 PVC CONDUIT	
	3/4"ø BUNA-N FUEL GRADE HOSE	GW/PRODUCT
	1/2"ø PE TUBING	COMPRESSED AIR
3	2"ø SCH 80 PVC	TREATED WATER
	1"ø SCH 40 PVC CONDUIT	
	SYSTEM SPECIFICATIONS	

ROTARY CLAW VAPOR EXTRACTION VACUUM RATE ≤100 ACFM AT 20" Hg. SUBMERSIBLE PUMP WITH 0.5 GPM CAPACITY IN EACH DPE WELL.

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SITE AND SYSTEM LAYOUT

SCALE	DESIGNED BY	DRAWN BY	PROJECT NUMBER
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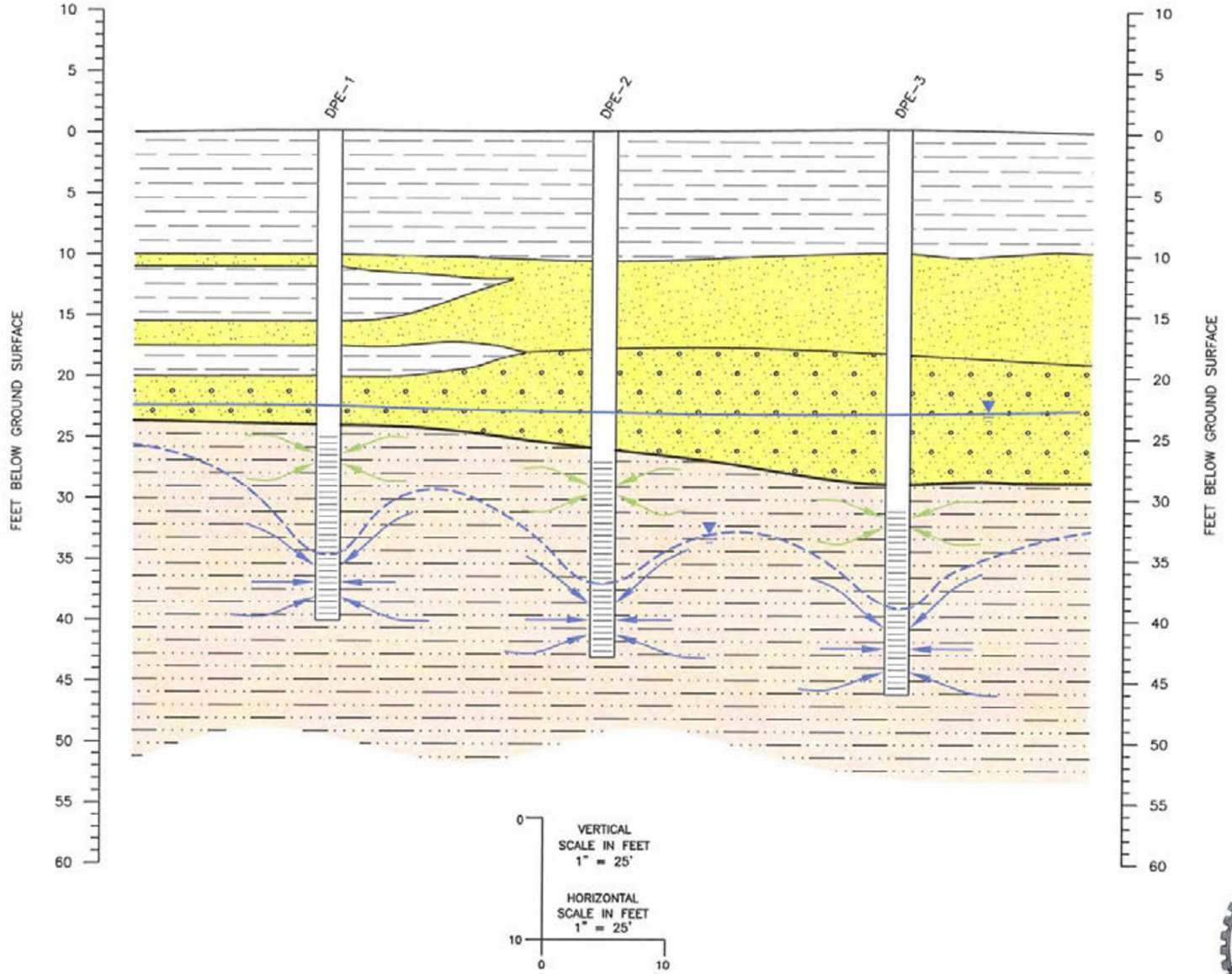
REV: SHEET 3 of 8 | DISCIPLINE NO. C-1

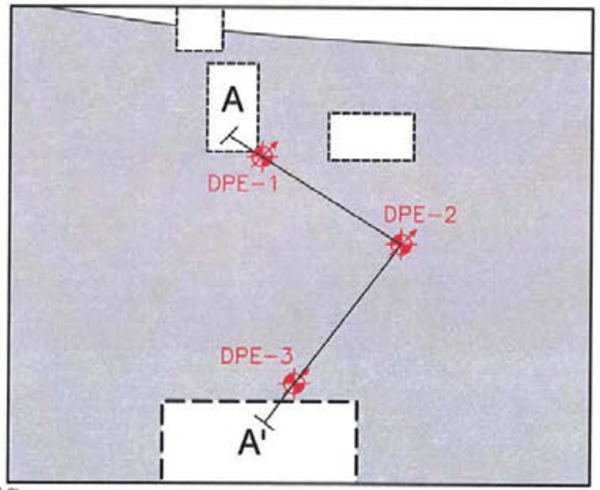


LEGEND

- SILTY SAND, SANDY SILT
- FINE SAND
- MEDIUM TO COARSE SAND
- SILT/SILTSTONE
- UNCONFORMITY
- POTENTIOMETRIC SURFACE
- ESTIMATED WATER TABLE UNDER VACUUM
- GROUNDWATER FLOW
- SOIL VAPOR FLOW

NOTE:
SCREENED INTERVALS MAY BE FIELD ADJUSTED BASED ON ACTUAL GROUND WATER ELEVATIONS.

PLAN VIEW



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SUBSURFACE SCHEMATIC

REV

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SHEET 4 of 8

FORMER BIRCHMOUNT ORCHARD FACILITY
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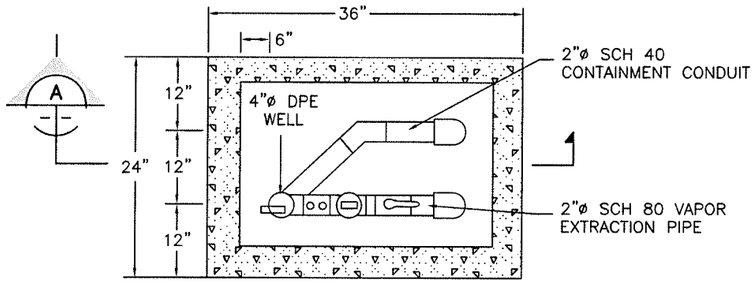
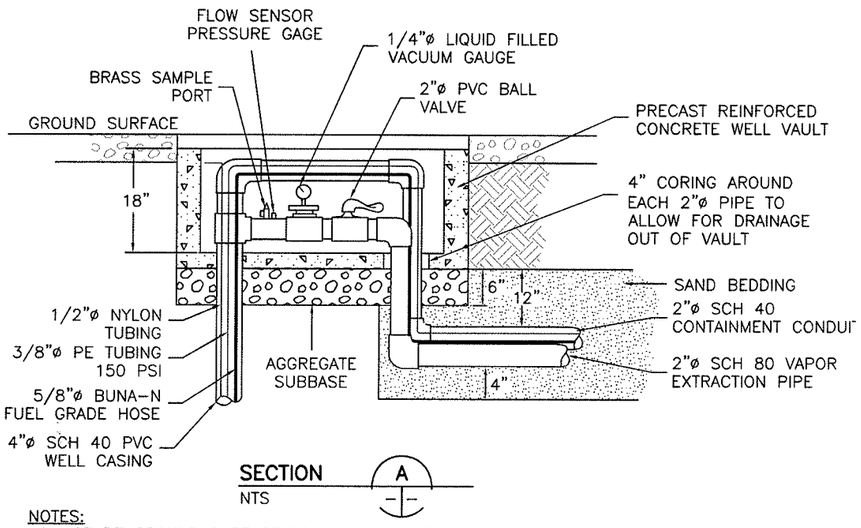
DISCIPLINE NO. C-2

ENVIRONMENTAL RESOURCES MANAGEMENT



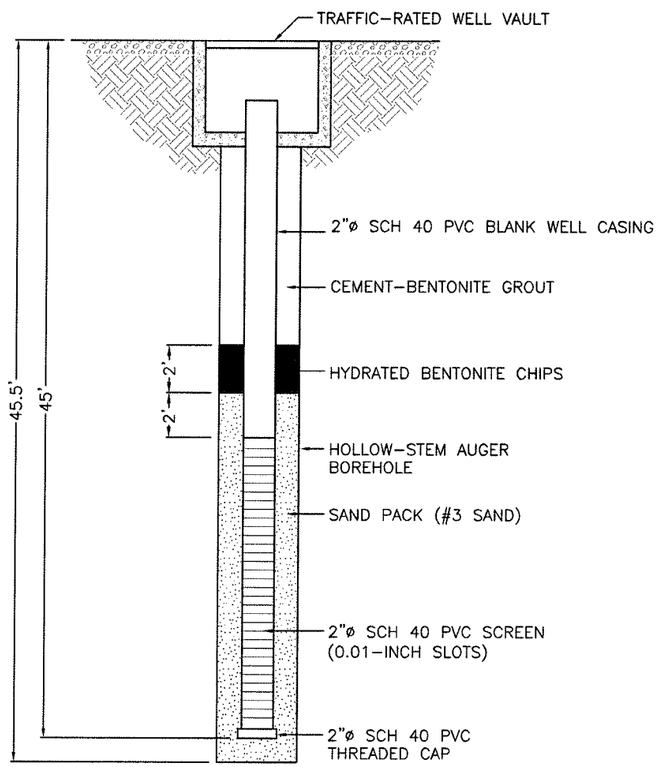
DPE WELL VAULT
(TYP FOR WELLS DPE-1 THROUGH DPE-3)

DETAIL 2
NTS



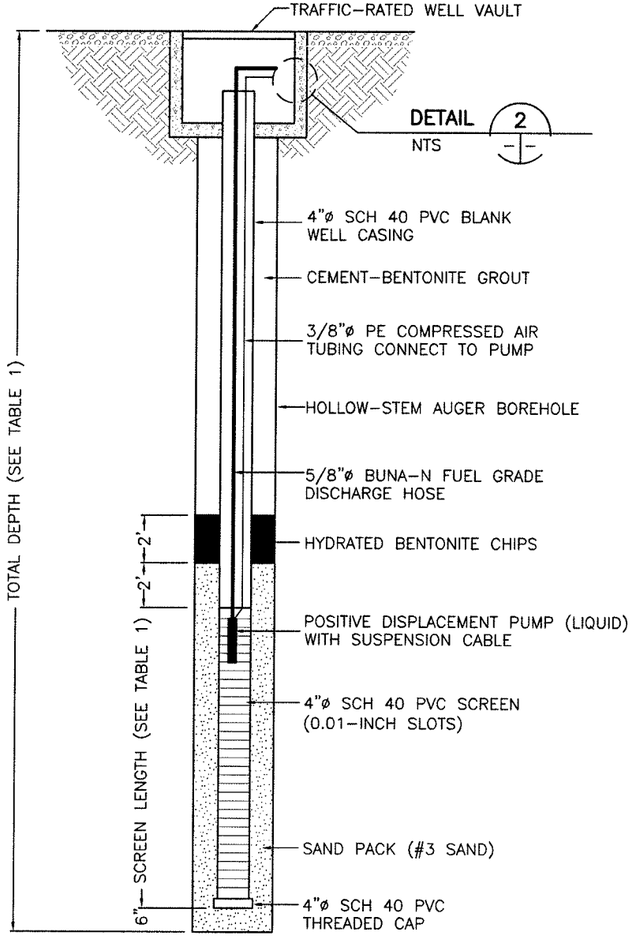
SECTION A
NTS

NOTES:
1. GRADE GROUND SURFACE TO DRAIN AWAY FROM VAULT.
2. PROVIDE 12 ADDITIONAL FEET OF SUSPENSION CABLE, 3/8"ø PE AIR SUPPLY TUBING, 5/8"ø DISCHARGE HOSE, AND 1/2"ø AIR DISCHARGE TUBING TO ALLOW FOR MANUAL PUMP ELEVATION ADJUSTMENT IN WELL.



MONITORING WELL

DETAIL 3
NTS

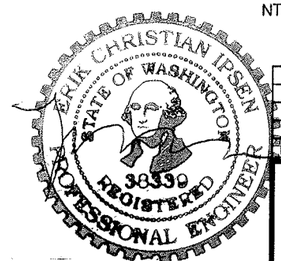


DPE WELL
(TYP FOR DPE-1 THROUGH DPE-3)

DETAIL 4
NTS

TABLE 1				
DPE WELL DIMENSIONS*				
WELL	TOTAL DEPTH (FEET)	TOP OF SCREEN (FEET BGS)	BOTTOM OF SCREEN (FEET BGS)	SCREEN LENGTH (FEET)
DPE-1	40	25	40	15
DPE-2	43	26	43	17
DPE-3	46	31	46	15

* WELL DIMENSIONS MAY BE FIELD ADJUSTED TO ENSURE TOP OF SCREEN IS MIN 3 FT BELOW SAND/SILT INTERFACE



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SYSTEM DETAILS

SCALE	DESIGNED BY	DRAWN BY	DRAWING NUMBER	REV
AS NOTED	O. WILLIAMS	C.TALLADA	0086525-05	
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04/10/09	E. IPSEN		0086525	5 of 8

FORMER BIRCHMOUNT ORCHARD FACILITY
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DISCIPLINE NO. C-3

ENVIRONMENTAL RESOURCES MANAGEMENT

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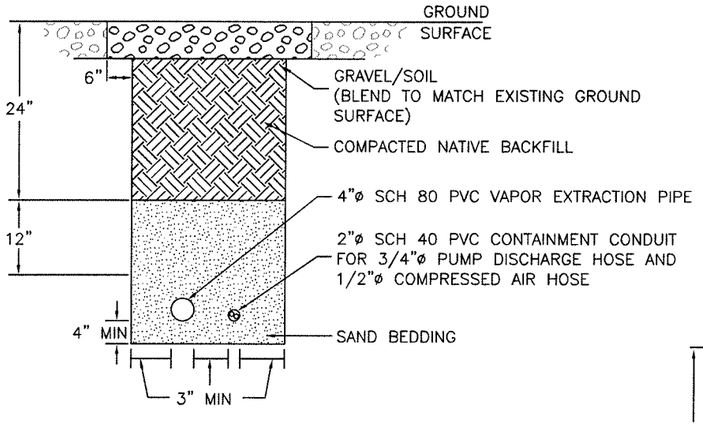
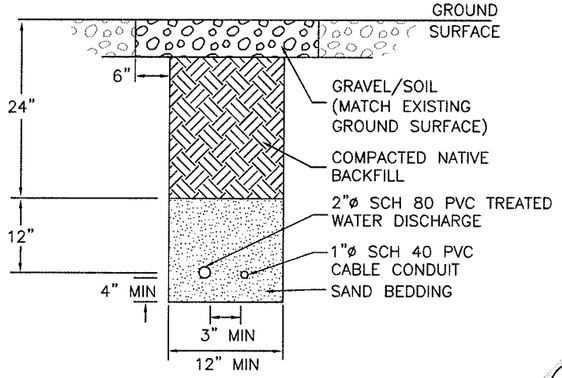


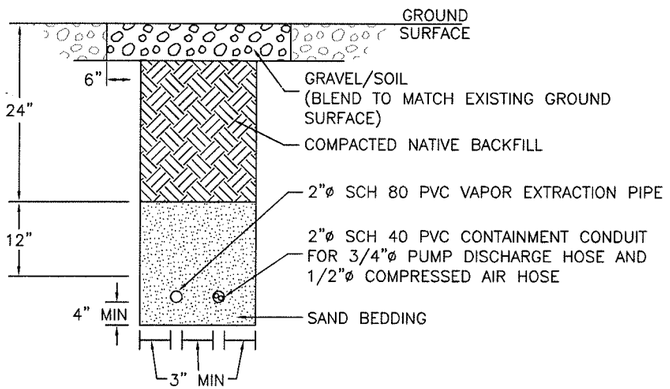
DPE MAIN TRENCH

SECTION 1 / NTS / C-1 | C-4

NOTE:
3" SPACING REQUIRED BETWEEN ALL PIPES IN TRENCH.

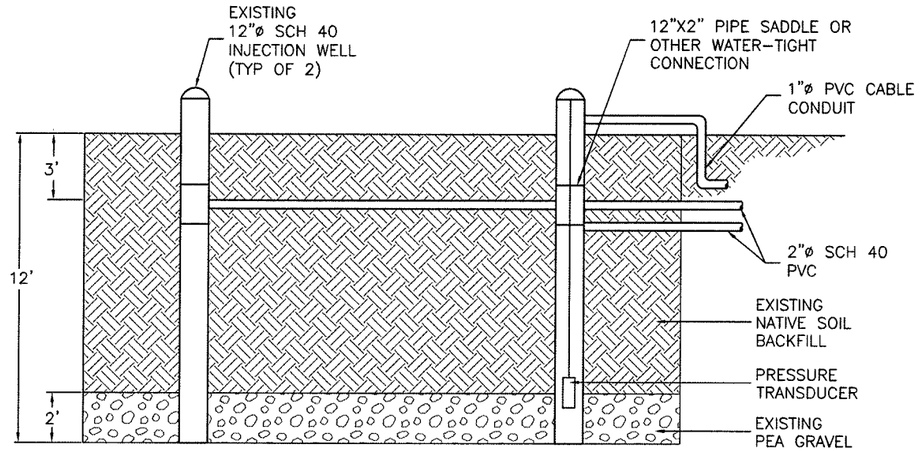


SECTION 3 / NTS / C-1 | C-4

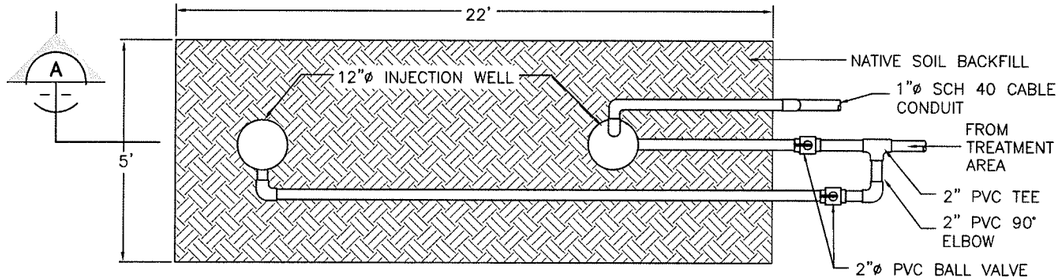


DPE BRANCH TRENCH

SECTION 2 / NTS / C-1 | C-4



SECTION A / NTS



INFILTRATION TRENCH

SECTION 4 / NTS / C-1 | C-4

NOTE:
2"ø PVC BALL VALVES TO BE INSTALLED IN VAULT WITH T-HANDLE OR OTHERWISE ABLE TO BE CONTROLLED FROM GROUND SURFACE.

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TRENCH DETAILS

SCALE	DESIGNED BY	DRAWN BY	DRAWING NUMBER
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REV
SHEET 6 of 8
DISCIPLINE NO. C-4

FORMER BIRCHMOUNT ORCHARD FACILITY
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ENVIRONMENTAL RESOURCES MANAGEMENT

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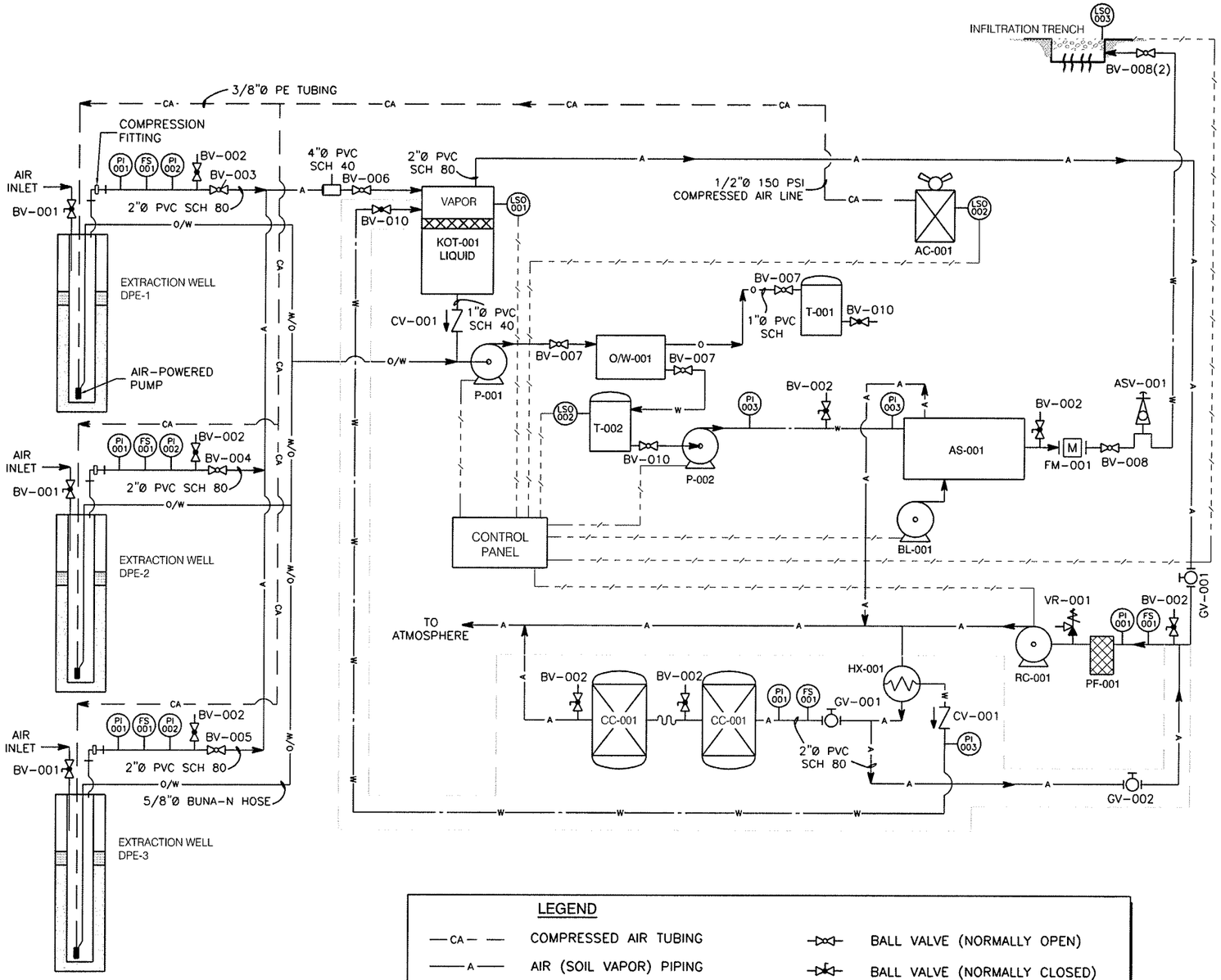

EQUIPMENT LIST		
ITEM	**DESCRIPTION**	**SPECIFICATION**
AC-001	AIR COMPRESSOR	5 CFM AT 160 PSI; REGENERATIVE DESSICANT DRYER 5 HP 80 GAL TANK
AS-001	AIR STRIPPER	QED EZ 4-TRAY, 1-25 GPM
ASV-001	ANTI-SIPHON VALVE	1/4-INCH, BRASS
BL-001	AIR BLOWER	3HP, 210 CFM @ 22.3"
BV-001 (3)	AIR INLET	3/4-INCH, FULL PORT, BRASS
BV-002 (9)	SAMPLE PORT	1/4-INCH, BRASS, BALL VALVE
BV-003 BV-004 BV-005 BV-006	BALL VALVE	2-INCH, FULL PORT, PVC, VITON SEAL
BV-007 (2) BV-008 (3)	BALL VALVE	1-INCH, FULL PORT, PVC 2-INCH, PVC
CC-001 (2)	ACTIVATED CARBON VESSEL	200-LB, 200 CFM CAPACITY
CV-001 (2)	CHECK VALVE	3/4 INCH, BRASS, BALL CHECK, FULL PORT
HX-001	HEAT EXCHANGER	100 ACFM, AIR DRAIN LINE
FS-001 (5)	FLOW SENSOR	DWYER MODEL DS-200-2" FLOW SENSOR
KOT-001	KNOCKOUT TANK	100 GAL
PI-001 (5) PI-002 (3) PI-003 (4)	PRESSURE GAUGE PRESSURE GAUGE PRESSURE GAUGE	PRESSURE GAUGE, 0-5 INCHES W.C. DWYER MODEL 2150, MAGNEHELIC PRESSURE GAUGE, 0-150 INCHES W.C. 1/4 INCH, 0-100 PSI, 2 INCH DIAL, 1/4" NPT, STAINLESS OUTER CASE, 2" LIQUID FILLED. AMETEK MODEL PL551G-5HK58
FM-001 (1)	FLOW METER	5/8 X 3/4 INCH, BRASS BODY, HYDROCARBON TOLERANT INTERNALS, POSITIVE DISPLACEMENT, NON-RESETABLE TOTALIZER KENT METER MODEL C-700 KM0750VR
LSO-001 LSO-002 LSO-003	LEVEL SWITCH LEVEL SWITCH LEVEL SWITCH	LEVEL SWITCHES, FLOAT TYPE SS INTEGRAL WITH KOT-001 AIR COMPRESSOR AUTO DRAIN SWITCH 0-15' RANGE SS LIQUID LEVEL
P-001 P-002	PUMP	3/4 HP 1-DIA 120V CENTRIFUGAL PUMP, GOULDS, GT07
O/W-001	OIL/WATER SEPARATOR	100 GAL; HIGHLAND R-HTC 100
RC-001	VACUUM PUMP	ROTARY CLAW 3HP, 240V TEFC MOTOR M11152 100 ACFM AT 20"Hg
T-001	WASTE OIL TANK	55 GAL SS
T-002	WATER BATCH TANK	150 GAL PE
GV-001	GATE VALVE	2" BRASS
GV-002	GATE VALVE	1 BRASS

NOTE: ENGINEER APPROVED ALTERNATIVES MAY BE SUBSTITUTED FOR SPECIFIED EQUIPMENT.

LEGEND

—CA—	COMPRESSED AIR TUBING
—A—	AIR (SOIL VAPOR) PIPING
—W—	WATER PIPING
—O—	OIL PIPING
—O/W—	COMBINED OIL/WATER PIPING
—-/--	ELECTRICAL
	BALL VALVE (NORMALLY OPEN)
	BALL VALVE (NORMALLY CLOSED)
	CHECK VALVE
	GATE VALVE
	OPTIONAL EQUIPMENT

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PROCESS FLOW DIAGRAM

REV

SCALE: AS NOTED | DESIGNED BY: O.WILLIAMS | DRAWN BY: C.TALLADA | DRAWING NUMBER: 0086525-04 | SHEET: 8 of 8
DATE: 04/10/09 | CHECKED: E.IPSEN | APPROVED | JOB NUMBER: 0086525

FORMER BIRCHMOUNT ORCHARD FACILITY
WENATCHEE, WASHINGTON

DISCIPLINE NO. P-1

ENVIRONMENTAL RESOURCES MANAGEMENT

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Appendix B
Engineering Calculations

Environmental Resources Management

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Dok

Project Birch mount Orchard | Project No. 86525 | Sheet 1 of 2

Subject Wenatchee, WA | By | Date 10/10/07

P. Bowman | Chkd. by | Date

Estimating air flow requirements for DPE system

# of SVE wells: 3

Soil type: Silt stone possibly fractured

est ROI: 15 ft

well spacing:

As field data was not available, vacuum levels at distance from extraction wells are estimated to be 0.1-inch of Hg. Air flow is estmated as follows:

$$Q_v = \frac{\pi r^2 b n}{t}$$

Q_v = volume of air flow at blower: (cfm)

r = radius of treatment zone (15 ft)

b = vadose zone thickness (30 ft)

n = air filled porosity (estimate Hiim 0.3) or (0.2)

t = time 1 pore volume exchange (day)

Ideally 2-5 Pore volume exchange per day.

$$Q_{v\,(1\text{-well})} \text{ 5 pore volume} = \frac{(3.141)(15)^2(30)(.3)}{(0.2\ day)\left(\frac{24\text{-hr}}{day}\right)\left(\frac{60\ min}{hr}\right)} = 225\ cfm$$

Three wells require 66 cfm

$$Q_{v\,(1\ well)} \text{ 2 pore volumes} \quad \frac{(3.141)(15)^2(30)(.3)}{(0.5)(24)(60)} = 95\ scfm$$

or 265 scfm for 3 wells.

At 20" Hg Vacuum

$$ACfm = scfm \cdot \left(\frac{P_{std}}{P_{act}}\right)\left(\frac{T_{act}}{T_{std}}\right) = 26\ scfm\left(\frac{14.8\ psi}{4.8\ psi}\right)\left(\frac{540}{520}\right)$$

$$= 84\ acfm$$

Table 2
Groundwater Dissolved Mass Removal
Wenatchee Dual-Phase Extraction System

O. Williams
10/13/2008

Parameter	ug/L[a]	ppm
TPH-G	6000	6
TPH-D	660	0.66
Benzene	280	0.28
Toluene	12	0.012
Ethylbenzene	52	0.052
Xylenes	120	0.12
TOTAL:	7124	7.124

Notes:

a - average concentrations from 2007 SSI, ERM

CALCULATIONS:

Daily Mass Removal:

Assume 1.5 gpm flow rate (0.5 gpm for 3 wells)

= (1.5 gpm)(3.785L/gal)(7124 ug/L)(1g/1000000ug)
* (0.002205lb/g)(60 min/hr)(24 hr/day)
0.13 lbs VOCs/day removed

Annual Mass Removed

= (0.13 lbs VOCs/day)(365 days/year)
47 lbs VOCs/year removed
= **0.02** tons VOCs/year removed

Estimated Emissions Concentrations
Wenatchee Dual-Phase Extraction System

O. Williams
3/31/2009
Revised: 7/22/2009

AIR STRIPPING

Air Flow	140 cfm
Water Flow	1.5 gpm
A/W Ratio	698 ft^3/ft^3
% Removal	100

Constituent	Influent Concentration ug/L	Removal Ratio (lbs/gallon H_2O)	Discharge Rate (lbs/hr)	Annual Discharge Rate (lbs/year)
Benzene	72	5.99E-07	5.3885E-05	0.47
Toluene	12	1.00E-07	9.0121E-06	0.08
Ethylbenzene	52	4.34E-07	3.9052E-05	0.34
Xylenes	120	1.00E-06	9.0121E-05	0.79
TPH-G	6000	5.01E-05	4.5060E-03	39.47
TPH-D	660	5.51E-06	4.9566E-04	4.34
TOTAL	**6,916**	**5.77E-05**	**5.1938E-03**	**45.50**

SOIL VAPOR EXTRACTION

Air Flow	100 cfm

Constituent	Influent Concentration ug/L	Henry's Constant (atm/M)	Molecular Weight g/M	Partial Pressure (atm)	Estimated Vapor Concentration (mg/m^3)	Discharge Rate (lbs/hr)	Annual Discharge Rate (lbs/year)
Benzene	72	5.55	78.1	5.12E-06	5.12	3.195E-05	0.28
Toluene	12	6.7	92.1	8.73E-07	0.87	5.450E-06	0.05
Ethylbenzene	52	6.44	106.2	3.15E-06	3.15	1.969E-05	0.17
Xylenes	120	5.1	106.2	5.76E-06	5.76	3.598E-05	0.32
TPH-G	6000	---	---	---	---	---	---
TPH-D	660	---	---	---	---	---	---
TOTAL	**6916**	**---**	**---**	**---**	**---**	**9.3065E-05**	**0.82**

	Annual Discharge Rate (lbs/year)
Benzene	0.75
Toluene	0.13
Ethylbenzene	0.51
Xylenes	1.10
TPH-G	39.47
TPH-D	4.34
TOTAL	46.31

Appendix C
Equipment Specifications

PV® Series Liquid Phase Adsorbers

PV-500, PV-1000, PV-2000

Applications

The PV® Series adsorbers are designed for use in a wide range of low/high flow and pressure applications.

- Groundwater remediation
- Wastewater filtration
- Tank rinse water treatment
- Pilot testing
- Underground storage tank clean up
- Leachate treatment
- Dechlorination
- Spill cleanup
- Hydrotesting

Installation, Startup and Operation

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our reactivation facilities.

At the time of purchase or rental of the adsorbers, arrangements should be made for the reactivation of the spent carbon. Siemens will provide instructions and assistance on how to obtain acceptance of the spent carbon at our reactivation facilities. Spent carbon cannot be accepted for reactivation until the acceptance process is completed.

Benefits & Design Features

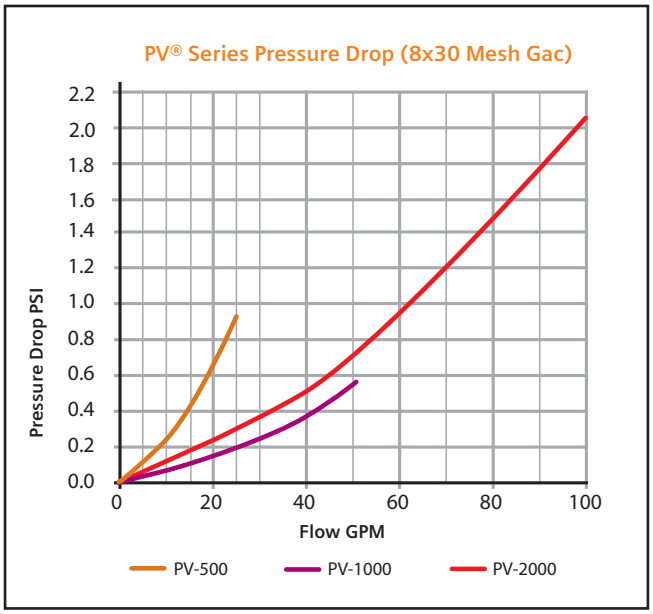
- Durable, carbon steel construction includes internally/externally welded seams.
- SSPC-SP5 sandblasted, baked epoxy interior coating; urethane exterior finish.
- Approved for the transport of hazardous spent carbon.
- Top and side manways permit easy access and inspection of vessels internals and linings.
- Skid-mounted for easy handling and installation.
- Optimized underdrain system for low pressure drop operation.

Piping Manifold (Optional)

- 2"/3" sch 80 PVC piping and valves that allow either adsorber to be used in the lead or lag position (optional carbon steel and stainless steel piping).
- Series or parallel operation.
- Clean utility water connection for manual backflush.
- Sampling ports and pressure gauges.
- Flexible hoses with Kamlock fittings allow easy installation and removal during service exchange operations.
- Available for purchase or rental.

Specification/Typical Properties			
	PV®-500	PV®-1000	PV®-2000
Dimensions (Dia. x Overall Height – Approx.)	30" x 5'7"	48" x 5'7"	48" x 8'8"
Inlet Connection, (Top)	2"	3" NPT (Female)	3" NPT (Female)
Outlet Connection, (Bottom)	2"	3" NPT (Male)	3" NPT (Male)
Manway, Top & Lower Side	11" X 15" (top only)	11" X 15"	11" X 15"
Internal Piping	PVC	PVC	PVC
Interior Coating (All Units)	Epoxy	Epoxy	Epoxy
Exterior Coating (All Units)	Epoxy/Urethane	Epoxy/Urethane	Epoxy/Urethane
Carbon Fill Volume (Cu.ft.)	18.5	34	68
Vessel Weight (lbs.):			
Shipping (With Carbon)	1050	1910	3200
Operating (Approx.)	1750	4300	7500
Flow, GPM (Nominal)	25	50	100
Pressure, PSIG (Maximum)1	75	75	75
Temperature °F. (Maximum)	140	140	140
Pounds Of Activated Carbon	500	1000	2000
Contact Time @ Max Flow/Min	5	5	5
Backflush rate (GPM) @ 55°F	15-20	40-50	40-50

1The PV® Series adsorbers are not ASME code stamped. Pressure rating applies to liquid only.
For detailed dimensional information or drawings, contact your local Siemens sales representative.
For information on the HP® Series ASME code stamped adsorbers, contact your local Siemens representative.



Safety Note: Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. Siemens makes no warranties as to completeness of information. Users are responsible for evaluating individual product suitability for specific applications. Siemens assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.

Siemens
Water Technologies
2430 Rose Place
Roseville, MN 55113
800.525.0658 phone

WS-PV2dr-DS-0608

AP2T

Top Inlet, Short

Max. Flow	**1.6 gpm (6 lpm)**
O.D.	**1.75 in (4.45 cm)**
Length	**35 in. (89 cm)**

Description

The AP2 Top Inlet Short AutoPump provides maximum capabilities and flow in a top inlet pump for 2" (50 mm) diameter wells having shorter water columns and/or the need to pump down to lower water levels, compared to full-length pumps. It is designed for applications requiring an elevated inlet, such as pumping total fluids from wells contaminated with LNAPLs. It is offered in optional versions to handle even the most severe remediation and landfill pumping applications, and delivers flow rates up to 1.6 gpm (6 lpm). The AP2 Long Bottom Inlet AutoPump is complemented by the most comprehensive selection of accessories to provide a complete system to meet site specific requirements. Call QED for prompt, no-obligation assistance on your pumping project needs.

The AutoPump Heritage

The AP2 Top Inlet Short AutoPump is part of the famous AutoPump family of original automatic air-powered pumps, developed in the mid 1980s specifically to handle unique pumping needs at remediation and landfill sites. Over the years they've proven their durability at thousands of sites worldwide. AutoPumps are designed to handle difficult pumping challenges that other pumps can't, such as solvents, suspended solids, corrosives, temperature extremes, viscous fluids and frequent start/stop cycles. Beyond just the pump, AutoPump systems offer the most complete range of tubing, hose, connectors, caps and accessories to help your installation go smoothly. This superior pumping heritage, application experience and support back up every AutoPump you put to work on your project.

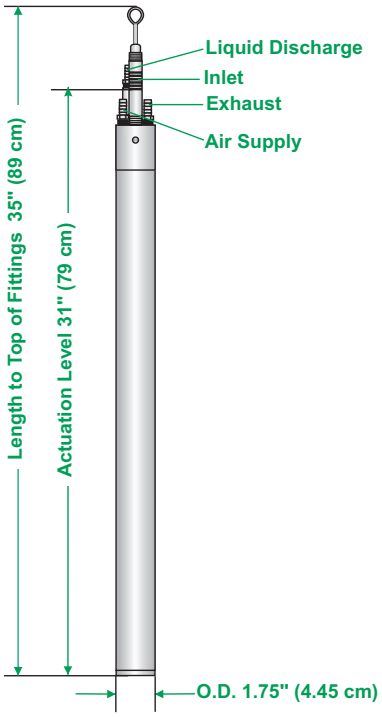
Advantages

1. **The original 2" automatic air-powered well pump, proven worldwide over 15 years**
2. **The industry leader in reliability, durability, flow rate and depth capability in an automatic pump for 2-inch wells**
3. **Handles solids, hyrocarbons, solvents, corrosive conditions, viscous fluids and land fill liquids**
4. **One-year warranty**

AutoPump®

Top Inlet, Short AP2T

Pump Dimensions



Specifications & Operating Requirements

Model	**2" - Short AP2 Top Inlet**
Liquid Inlet Location	Top
OD	1.75 in. (4.45 cm)
Length Overall (pump & fittings)	35 in. (89 cm)
Weight	5.7 lbs (2.6 kg)
Max. Flow Rate	1.6 gpm (6.0 lpm) .05 - .08 gal (.19 - .30 l)
Pump Volume / Cycle	
Max. Depth	300 ft (91.4 m)
Air Pressure Range	5 - 130 psi (0.4 - 9.2 kg/cm2)
Min. Actuation Level	31 in. (79 cm)
Air Usage	0.39 - 2.59 scf/gal (2.9 - 19.3 liters/fluid liter)
	See air usage chart
Min. Liquid Density	0.7 SpG (0.7 g/cm3)
Standard Construction Materials[1]	
Pump Body	Stainless Steel
Pump Ends	Stainless Steel
Internal Components	Stainless Steel, Viton, PVDF[3]
Tube & Hose Fittings	Brass or Stainless Steel
Fitting Type	Barbs or Quick Connects
Tube & Hose Options	
Tubing Material	Nylon
Sizes[2] - Liquid Discharge	5/8 in. (16 mm) OD
Pump Air Supply	3/8 in. (9.5 mm) OD
Air Exhaust	1/2 in. (13 mm) OD
Hose Material	Nitrile
Sizes - Liquid Discharge	1/2 in. (13 mm) ID
Pump Air Supply	1/4 in (6.4 mm) ID
Air Exhaust	3/8 in. (9.5 mm) ID

[1] Material upgrages available
[2] Applies to QED supplied tubing; other tubing sources may not conform to QED fittings.
[3] PVDF - Polyvinylidene Fluoride

Application Limits (base model)

Base model AP2 AutoPumps are designed to handle the application ranges described below. For applications outside this range, consult QED about AP2 upgrades.

Maximum Temperature: 150°F (65°C)
pH Range: 4-9
Solvents and Fuels: diesel, gasoline, JP1-JP6, #2 heating oils, BTEX, MTBE, landfill liquids

AP-2 AutoPumps are warranted for one (1) year: 100% materials and workmanship.

P.O. Box 3726 Ann Arbor, MI 48106-3726 USA **1.800.624.2026** **F 1.734.995.1170** info@qedenv.com www.qedenv.com

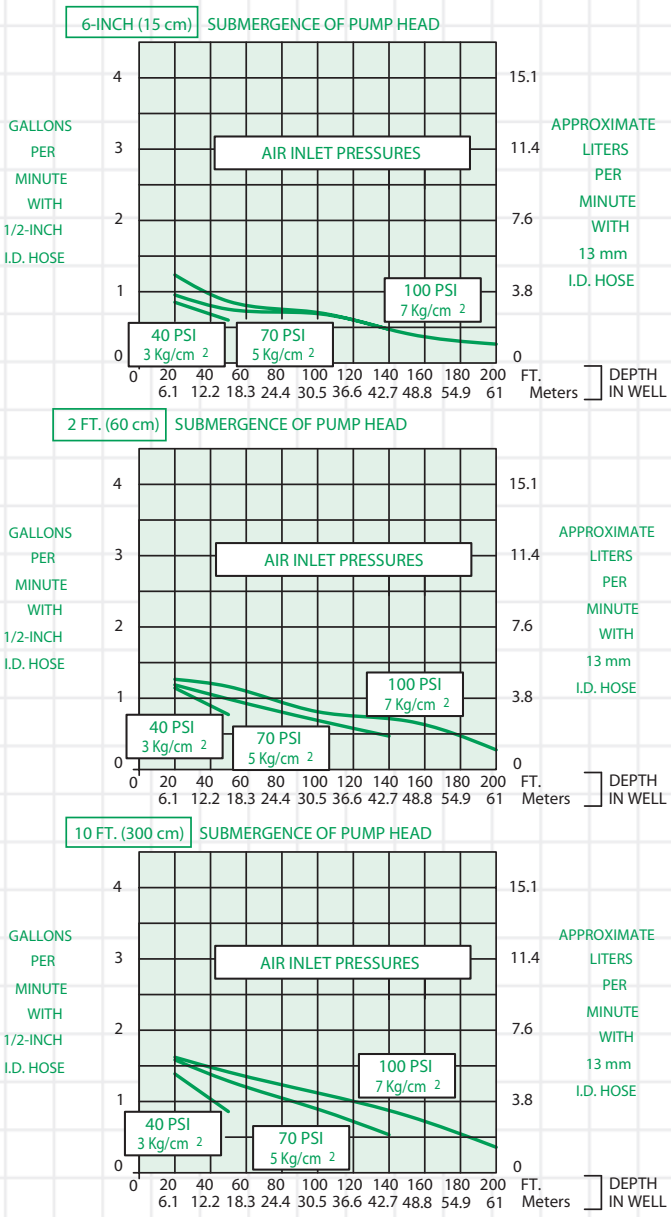
AP2T

AutoPump®

Top Inlet, Short

Flow Rates[1]

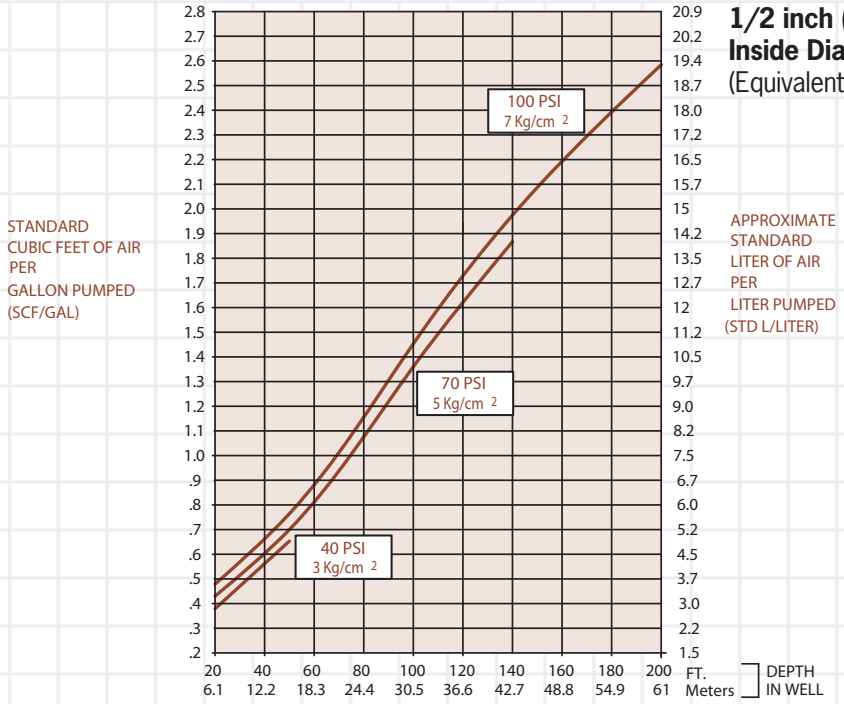
1/2 inch (13 mm)
Inside Diameter Discharge Hose
(Equivalent to 5/8-Inch O.D. Tubing)



[1] FLOW RATES MAY VARY WITH SITE CONDITIONS. CALL QED FOR TECHNICAL ASSISTANCE.

Top Inlet, Short AP2T

Air Consumption



1/2 inch (13 mm)
Inside Diameter Discharge Hose
(Equivalent to 5/8-Inch O.D. Tubing)

P.O. Box 3726 Ann Arbor, MI 48106-3726 USA **1.800.624.2026** **F 1.734.995.1170** info@qedenv.com www.qedenv.com

QED Environmental Systems

6155 Jackson Ave. Ann Arbor, MI 48103 Phone: 800-624-2026 Fax:734-995-1170

QED EZ-Stacker™ 2.XP Air Stripper
System Operations and Maintenance Manual

QED Treatment Equipment, P.O.Box 3726, Ann Arbor, MI 48106
Phone: (800)-624-2026, Fax: (734)-995-1170
QED p/n 95165 February 16, 1996 Rev 3/18/04

QED Environmental Systems

6155 Jackson Ave. Ann Arbor, MI 48103 Phone: 800-624-2026 Fax:734-995-1170

IMPORTANT—PLEASE READ

Thank you for choosing QED treatment equipment to handle your air stripping needs. This manual contains information relating to equipment commonly ordered as part of a QED stripper system. This manual is generic, and your specific order may not include all the equipment listed within this manual. Upon receipt of this equipment, it is important for the customer to do the following:

1. Inspect all the pieces of equipment shipped to verify the order is complete,
2. Confirm that vendor-specific instructions are included for each piece of equipment,
3. Remove any additional instructions that have been included in this manual which are not part of your specific sales order. This will avoid future confusion.

A specific example of this relates to the transfer pumps. This manual includes operation and maintenance instructions for centrifugal transfer pumps, although sometimes pumps are not part of the customer's specific order. Upon inspection of equipment, if the customer finds that pumps are not part of their order, the pump instructions should be removed from this manual. The other pieces of equipment should similarly be inspected and checked that the associated instructions are included in this manual, and any non-relevant instructions are removed.

Should you have any questions about your QED equipment, please contact the QED Service Department at 1-800-624-2026 or 734-995-2547. Thank you for your order and good luck with startup.

QED EZ-Stacker™ Operations and Maintenance Manual

Introduction

This manual contains instructions for installing, start-up and operation of a QED EZ-Stacker™ Air Stripper for the treatment of dissolved-VOC-contaminated waters. The EZ-Stacker™ Air Stripper is a sieve tray type of stripper which accomplishes mass transfer by creating a large amount of fine air bubbles into which volatile organics are stripped. Efficient stripping with this type of a unit is affected by:

- Water temperature-- higher temperature allows better stripping
- Specific compound being stripped--higher Henry's Law constant equals better stripping
- Air to water ratio--the higher the air to water ratio (air flow for a given water flow) the better the stripping
- Stripper efficiency--certain design elements, such as tray design affect stripping efficiency
- Surfactants (soaps, cleaning agents, etc.) and oil/grease can negatively impact stripping efficiency

From an operation standpoint the single most important factor is ensuring that the recommended amount of clean air is flowing through the stripper. Air flow is most affected by tray fouling (typically with precipitated iron oxides) which creates back pressure on the blower and causes it to operate at a lower air flow point on its curve. Maintaining clean trays and using the excess capacity on the blower can help control fouling conditions. Occasional gasket replacement can be anticipated depending on the frequency of stripper disassembly and reassembly. The stripper blowers and any transfer pumps should be regularly maintained based upon the manufacturer's maintenance schedule. All other stripper components are largely maintenance free. Please refer to Figure 1 at the end of this manual for understanding terminology.

Installation

<u>Installing Skid Mounted Systems</u>

Complete skid mounted systems arrive at your site as shown in Figure 1. A system of this type is mounted, piped and optionally wired at the factory. All components and functions are 100% wet checked.

> **Influent piping**. Connect system influent piping to the influent feed pump or directly to the stripper at the piping connection located on the top of the stripper. Factory piped influent feed pump systems use flexible pressure hose between the pump and the stripper influent piping connection and includes a check valve to prevent air backup into a transfer tanks or oil water separator. If the stripper

influent is plumbed directly on site, a flexible hose connection is recommended to ease stripper disassembly and reassembly during use.

Effluent piping. Factory piped effluent discharge pump systems use flexible pressure hose between the stripper discharge piping connection, located at the bottom of the stripper sump and the effluent discharge pump. Factory installed gravity discharge piping connects at the same discharge point on the stripper sump and utilizes a gravity drain kit which includes a siphon break and water head seal. If the stripper is plumbed on site connect the discharge pump to the stripper sump at the discharge connector. Gravity drain piping should be a minimum of 2-3" in diameter (depends on the model) and designed as shown in Figures 4 or 5.

Blower piping. *Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.* The blower piping that connects the blower to the air stripper are typically of an inverted-U shape, with a high leg to reduce the chance of flooding the blower in the event of an unforeseen flood condition.

On EZ-2.xP models, QED typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures may cause the blower motor to run above full-load-amp condition and cause the blower motor to overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow.

Stripper Air Discharge Stack. The stripper discharge pipe is located on top of the air stripper and is 4"or 6" in diameter (depending upon model). The wider section of the discharge porting contains the demister element which removes entrained water droplets from the air exiting the stripper. Coalesced water droplets collect on the demister and then fall back into the stripper top tray. Piping or ducting for the stripper discharge stack should be of equal diameter or larger to avoid creating excess back pressure on the stripper blower. A flexible coupling, such as a Fernco brand, is recommended to connect the discharge pipe to the stripper air discharge stack to ease unit disassembly for cleaning. It is also important to pipe the air stripper air discharge such that it is not in proximity with the air stripper blower inlet; this minimizes the risk of sending already-contaminated air back into the air stripper and reducing stripper performance.

Sensors. Normal sensors used with this type of air stripper include a sump high level alarm float sensor, sump low air pressure sensor and optional discharge pump on-off float sensor. If these sensors are supplied with the stripper they will be installed in the stripper sump and piping. Often the system control panel must be mounted in a remote location from the stripper (in cases where the location is classified as an explosion hazard area.) If the panel is to be remotely-mounted a licensed electrician should hook the stripper sensors up to the panel. It is

important that these sensors be tested prior to operating the stripper. A frequent cause of improperly operating systems are float sensors which act in the opposite sense of that which the control panel expects (normally-open vs. normally-closed). It is also important to conform to electrical code requirements for classified areas; sensors may require intrinsically safe barriers.

Installing Bare Stripper Sump and Tray Systems

Bare stripper sump and tray systems are provided in cases where the contractor will mount the stripper to a user supplied skid or concrete pad. These systems are supplied with a second gasket compression ring that anchors the gasket compression rods at the bottom of the stripper. The bottom gasket compression ring has tabs protruding around its circumference which allow mounting of the ring to a skid or concrete pad.

If the blower is purchased from the factory it is recommended that the blower piping package also be purchased. If the contractor is supplying their own blower it must meet the typical performance specifications listed below to achieve the desired contaminant removals. If the air stripper is built to non-standard parameters, the performance specifications below may not apply.

Air Flow:	140 cfm (for EZ-2.xP) or 280 cfm (for EZ-4.xP) at maximum system back pressure
Pressure:	Sufficient to over come tray, piping and air treatment process back pressures at a flow rate of 140cfm. *Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.*
Tray Back Pressures	16-20"H_2O for 4-trays; 24-30"H_2O for 6-trays (assuming no add'l pressure from equipment downstream of air stack).

The blower piping should include a high leg which acts to reduce the risk of flooding the blower if the high sump level sensor was to malfunction in the stripper sump. See Figures 2 and 3 (for models EZ-2.xP and EZ-4.xP, respectively) for examples of proper blower piping configurations.

The EZ-2.xP models typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures can cause the blower motor to run above full-load-amp conditions and overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow. A throttle valve is shown in Figure 1; a dilution/bleed valve is not shown.

Influent and effluent piping and sensor hook-up should be as described in the section on skid mounted systems, above.

Startup

The EZ-Stacker™ stripper is designed to start up dry without priming the sealpot or throttling the blower. The stripper blower should be running before water is introduced to the stripper. Water flows into the top tray and proceeds tray by tray to the stripper sump. Stripper seal pots fill with water and allow complete start up during intermittent operation. IMPORTANT: Before starting the system verify correct blower motor rotation (plus any other motors within the treatment system).

Verify that the sump air pressure is 16-20" H_2O for 4-tray systems or 24-30" H_2O for 6-tray systems (it is normal to see lower sump pressures at the very start of operation before the seal pots and trays fill with water.) Sump pressures lower than these values may indicate either a blower throttle which is not sufficiently open or insufficiently-compressed tray seal gaskets. *If the system configuration includes additional backpressure (from vapor phase carbon, for example), the sump pressures will be greater than these values. it is important that the blower is sized to accommodate the added pressures, being careful that air stripper sump pressures never exceed 50" WC. Total sump pressures exceeding 50" WC will void QED Warranty!* Check the blower piping throttle valve and make sure the hold-down rods are tightened firmly, but not over tightened. The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.

Step by step startup includes:

1. Power the main control panel on.
2. Turn the blower on. For QED supplied control panels set the motor operation switch to AUTO.
3. Turn the stripper feed pump on (allow water to enter the stripper for gravity feed systems.) For QED supplied control panels set the motor operation switch to AUTO (some systems have a delay timer on the feed pump--check control panel documentation for details.)
4. Turn the discharge pump on. For QED supplied control panels set the motor operation switch to AUTO.
5. Open or close the blower air flow throttle and air dilution valve (if required) to produce a sump pressure reading of 16-20"H_2O for 4-tray systems or 24-30"H_2O for 6-tray systems (these are typical values, but these may differ depending whether any other pressures need to be accounted for. NOTE: It is normal to see

lower sump pressures at the very start of operation due to sealpots and trays filling with water.

Operation

Stripper operation is normally automatic. One option for QED supplied control panels is a blower time-out relay which continues to run the blower for several minutes after the feed pump stops. Continued blower operation insures that any residual water left on the stripper trays has sufficient time to strip before the blower shuts down. A time of at least 15 minutes is recommended. Strippers with start-stop cycles of more than 2-4 times per hour should be set to run continuously.

For sites with high dissolved iron content stripper cleaning may be required. Tray fouling is evidenced by increasing sump back pressure. Opening the blower air flow throttle will allow continued operation in some situations and will lengthen the time between tray cleanings. It is most important to maintain an air flow of 140cfm through the unit. If the stripper air flow decreases the stripping efficiency decreases. Below 100 cfm air flow the stripper will start begin to "weep" water through the tray holes from upper trays to lower trays before the water has had sufficient residence time for removal. If stripper performance falls off, check for tray fouling or a blower air flow throttle that is not opened sufficiently.

Maintenance

Tray fouling due to iron precipitation, solids loading, or bio-fouling is evidenced by increased sump pressures, decreased stripper performance (removal rates not being met) or noticeable discoloration on the trays. Stripper cleaning is required when trays are fouled.

<u>Step by step cleaning includes</u>:

1. Before working on any equipment lock-out power to the unit.
2. Disconnect the stripper discharge pipe from the stripper exhaust stack piping.
3. Unscrew the hold-down rod nuts (cranks) and remove the gasket hold-down ring.
4. Remove the stripper trays. Please note the tray seal pots will have some water remaining in them.
5. Using a pressure washer and medium bristle brush clean any residue from the trays surfaces, concentrating on the sieve holes. DO NOT USE SOAP or cleaning agents unless they will be thoroughly rinsed from the trays; soap residue can affect stripper performance.

6. For hard to remove scales and precipitates a dilute (5%-10%) muriatic acid and water solution can be used to rinse or soak the trays. Be certain to completely rinse the solution off the trays before reassembling the unit.
7. Reassemble the trays--note that they are numbered and that a mark is used to assist in proper alignment of the trays during reassembly. Check to make sure the gasket is still seated correctly and undamaged.
8. Reinstall the gasket hold-down ring and retension the hold-down rod nuts (cranks.) The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.
9. Reattach any pipe and exhaust stack connections.
10. Follow Start-Up instructions, above.

Other stripper maintenance items include:

1. Periodically check blower for vibration. Bearings may require eventual service or conditions of excessive motor start / stop cycles may lead to premature motor or blower failure.
2. Check gasket condition during disassembly for cleaning. The gasket is designed to allow numerous assembly and disassemblies before requiring replacement. Contact QED for information and pricing about gasket replacement kits.
3. The stripper demister element is essentially maintenance free, although dried inorganic residue can build up within the demister and affect demister operation. This condition is evidenced in water droplets not being removed by the demister and blowing out of the stripper exhaust stack--occasionally on start-up water is discharged from the stripper stack, which is normal. The demister may be cleaned with a dilute muriatic and water solution (5%-10%) as instructed for tray cleaning.
4. Solids may build up in the sump. These solids can be suctioned out during tray cleaning operations.
5. Periodically check the structural integrity of the stripper sump, trays and top. Check bulkhead nuts for snugness. Cracks or loose fittings will normally be evidenced by water leakage.

Troubleshooting

Some common problems include:

1. *Leaks*. Leaks around trays or at the sump indicate an insufficiently compressed tray gasket. Make sure the hold-down tensioning springs are compressed to a length of 3-1/2 inches for proper gasket sealing. Also check for damaged gaskets (over compressed gaskets, cut gaskets, loose gaskets, etc.) Damaged gaskets

should be replaced with new gaskets. Contact QED for information and pricing about gasket replacement kits. For leaks at fittings, check for fitting tightness.

2. *Stripper not meeting removal requirements*. Contaminated stripper air is the most common reason for poor stripping performance within the low-ppb concentration range--make sure that the stripper blower intake is drawing in clean, uncontaminated air. Check for sufficient air flow through the stripper. Check that trays are clean. Check that demister is not clogged or causing increased blower back pressure. Check any stripper air discharge treatment units for increased back pressure. Check that stripper influent flow or concentration has not increased beyond the design basis used to predict stripper performance. Make sure that the influent does not have surfactants (soaps, etc.), oils, grease, or other immiscible phases in the influent stream. Surfactants are evidenced by increased foaming through the stripper unit.

3. *Sump pressure not at recommended levels*. Check sump pressure gauge tubing for accumulated water that could impair gauge performance. Check gaskets for damage and proper seating. Check for proper hold-down spring tensioning. Check blower piping connections for leakage. Check blower for proper rotation. Check design of gravity drain piping if piping is not QED-supplied. Check blower intake filter / silencer (if included) for clogging. Order new filter elements from QED.

4. *Stripper cleaning frequency seems excessive*. At sites with high iron loading, consider iron sequestering agents or other technology which will reduce/prevent iron precipitation or allow for easier cleaning.

Please investigate all the above-mentioned items while troubleshooting. For additional problem solving assistance contact QED Service at:

Phone: **1-800-624-2026**
FAX: **1-734-995-1170**
24 Hour Service Hot Line: **1-800-272-9559**

Please have the following information ready for the QED Service person:

1. Identify the product or system involved by QED order number.
2. Specify where, when, and from whom the product was purchased.
3. Describe the nature of the defect or malfunction.

QED TREATMENT EQUIPMENT WARRANTY

QED Environmental Systems Inc. (QED) warrants to the original purchaser of its products that, subject to the limitations and conditions provided below, the products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

QED warrants the equipment components of its manufacture for a period of one (1) year from date of delivery. Our sole obligation during this warranty will be to repair or replace (at our option) the defective components. We are not responsible for consequential damages. Labor costs are not included.

Purchaser's exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defects in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to Purchaser, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Purchaser. If QED for any reason, cannot repair a product covered hereby within four (4) weeks after receipt of the original Purchaser's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Purchaser, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement or refund are conditioned upon the Purchaser's return of the defective product to QED.

IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.

The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties supplied by their respective manufacturers. In the event of failure of any such product or accessory, QED will give assistance to Purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY, and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products, materials and/or workmanship.

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty.

The equipment is warranted to perform as specified under the conditions specified here and within the air stripper model or QED will make the necessary changes at no cost to the owner. Some restrictions apply. Requirements for warranty consideration include, (but are not limited to):

1. Current operating conditions do not differ from the previously-modeled conditions.
2. The system should be cleaned regularly to maintain system performance.

3. The equipment is installed, operated and maintained according to QED's instruction or non-QED manufactured subassembly manufacturer's instructions.
4. Air stripper influent air is not "dirty" (does not contain VOC's, etc.).
5. No surfactants, oils, greases, or other immiscible phases are present in the water.
6. Each influent contaminant does not exceed 25% of its maximum solubility under modeled conditions.

QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the consent of QED. If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts and labor as authorized by owner hereunder shall be borne by the Purchaser.

In the event of air stripper performance issues, QED may require customer to conduct a variety of troubleshooting steps. These include, but are not limited to, modifying operational parameters, cleaning air stripper system, modifying (temporarily or permanently) process piping, and obtaining reasonable and necessary influent/effluent samples. These steps are the responsibility of the customer and will be conducted by customer prior to consideration by QED for a site visit. These steps and the associated costs incurred are the responsibility of the customer, regardless of future action. Should customer request a site visit by QED or accept a site visit offer by a QED-trained technician, the visit and associated costs: a) will be the responsibility of the customer at $500/day, plus travel, lodging, and meals, if the visit finds improper sampling, process piping installation, or equipment operation inconsistent with QED's Operation and Maintenance Manual; or b) will be the responsibility of QED if the visit finds QED responsible for the performance issue(s) raised.

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identify the product or system involved by QED order number.
2. Specify where, when, and from whom the product was purchased.
3. Describe the nature of the defect or malfunction covered by this warranty.
4. If applicable, send the malfunctioning component, ***after receiving a Return Authorization Code (RAC) Number by the QED Service Department, to:***

QED Environmental Systems Inc.
6241 Jackson Road
Ann Arbor, MI 48103

Attn: ***R.A.C. No.****(Return Authorization Code Number provided by QED Service Dept.)*

rev 12/21/98

Figure 1. Typical Configuration of EZ-Stacker 2 Series (actual configuration will vary)

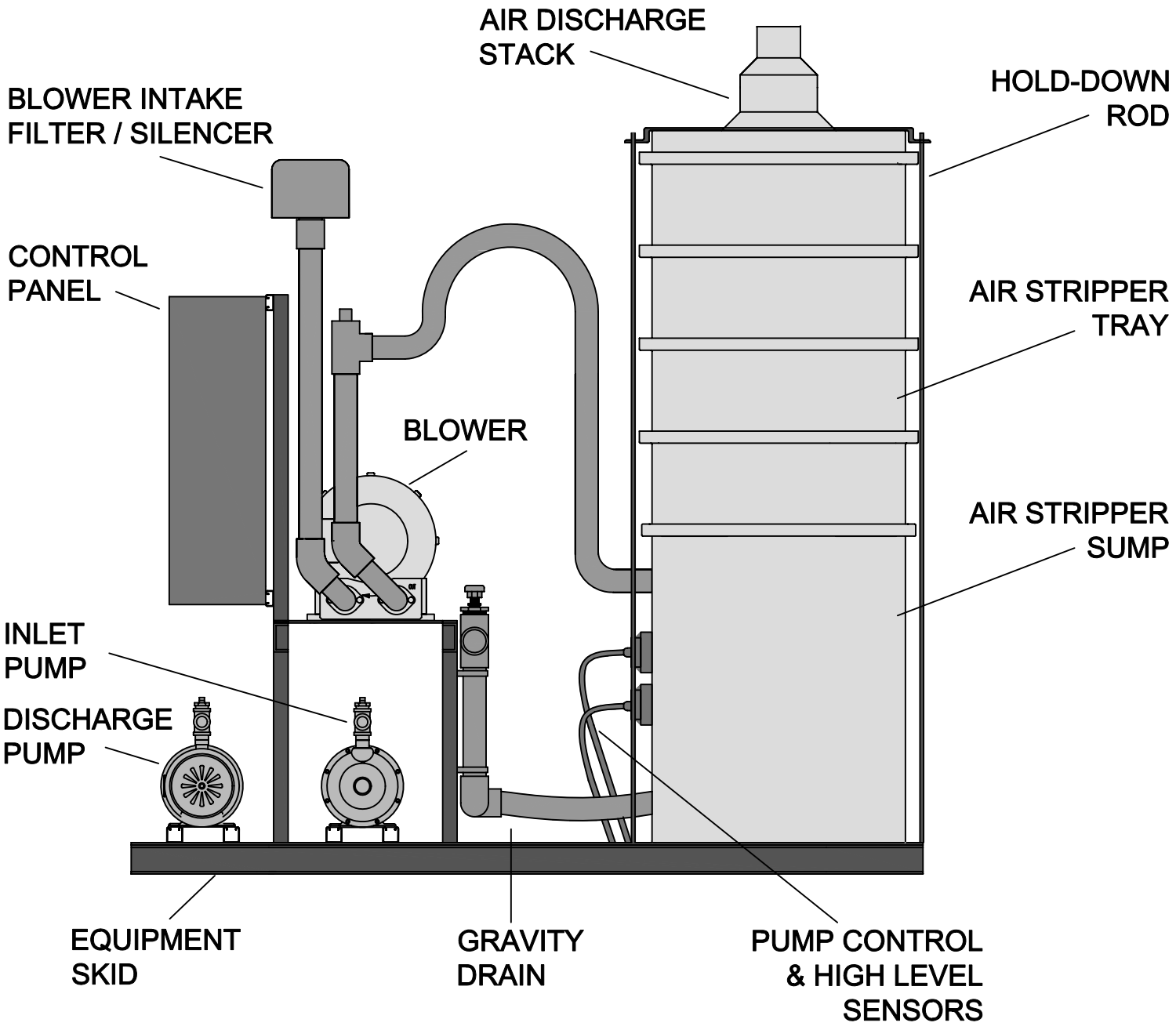
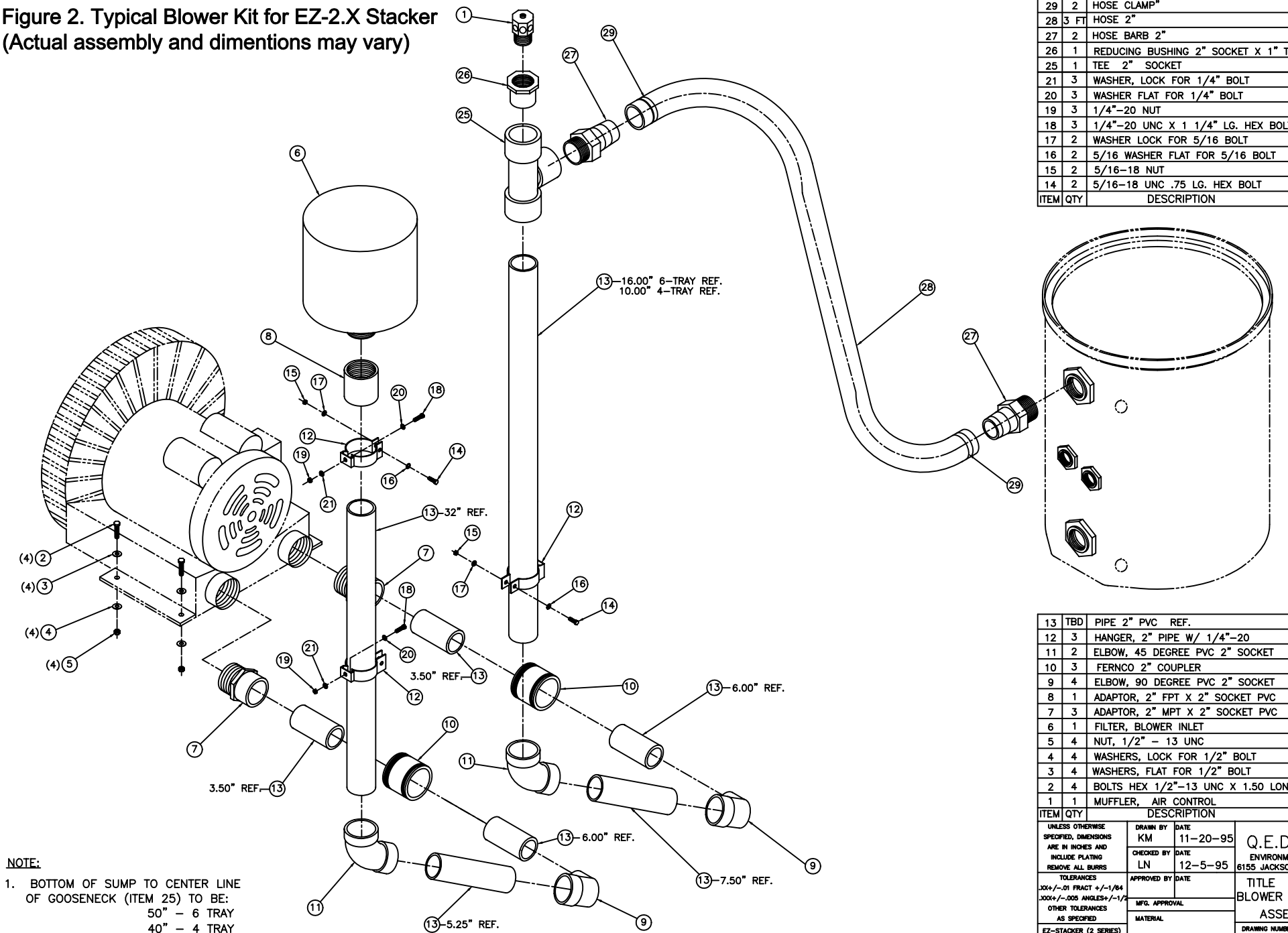


Figure 2. Typical Blower Kit for EZ-2.X Stacker
(Actual assembly and dimentions may vary)



ITEM	QTY	DESCRIPTION	PART #
29	2	HOSE CLAMP"	805084
28	3 FT	HOSE 2"	805204
27	2	HOSE BARB 2"	805071
26	1	REDUCING BUSHING 2" SOCKET X 1" THD	802051
25	1	TEE 2" SOCKET	802021
21	3	WASHER, LOCK FOR 1/4" BOLT	EXPENSED
20	3	WASHER FLAT FOR 1/4" BOLT	EXPENSED
19	3	1/4"–20 NUT	EXPENSED
18	3	1/4"–20 UNC X 1 1/4" LG. HEX BOLT	EXPENSED
17	2	WASHER LOCK FOR 5/16 BOLT	EXPENSED
16	2	5/16 WASHER FLAT FOR 5/16 BOLT	EXPENSED
15	2	5/16–18 NUT	EXPENSED
14	2	5/16–18 UNC .75 LG. HEX BOLT	EXPENSED

ITEM	QTY	DESCRIPTION	PART #
13	TBD	PIPE 2" PVC REF.	802159
12	3	HANGER, 2" PIPE W/ 1/4"–20	805088
11	2	ELBOW, 45 DEGREE PVC 2" SOCKET	802038
10	3	FERNCO 2" COUPLER	802167
9	4	ELBOW, 90 DEGREE PVC 2" SOCKET	802030
8	1	ADAPTOR, 2" FPT X 2" SOCKET PVC	802009
7	3	ADAPTOR, 2" MPT X 2" SOCKET PVC	802046
6	1	FILTER, BLOWER INLET	805053
5	4	NUT, 1/2" – 13 UNC	EXPENSED
4	4	WASHERS, LOCK FOR 1/2" BOLT	EXPENSED
3	4	WASHERS, FLAT FOR 1/2" BOLT	EXPENSED
2	4	BOLTS HEX 1/2"–13 UNC X 1.50 LONG	EXPENSED
1	1	MUFFLER, AIR CONTROL	805233

NOTE:

1. BOTTOM OF SUMP TO CENTER LINE OF GOOSENECK (ITEM 25) TO BE:
   50" – 6 TRAY
   40" – 4 TRAY

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS
TOLERANCES .XX+/-.01 FRACT +/-1/64 .XXX+/-.005 ANGLES+/-1/2
OTHER TOLERANCES AS SPECIFIED
EZ-STACKER (2 SERIES)
NEXT ASS'Y | USED ON

DRAWN BY KM DATE 11-20-95
CHECKED BY LN DATE 12-5-95
APPROVED BY DATE
MFG. APPROVAL
MATERIAL
FINISH

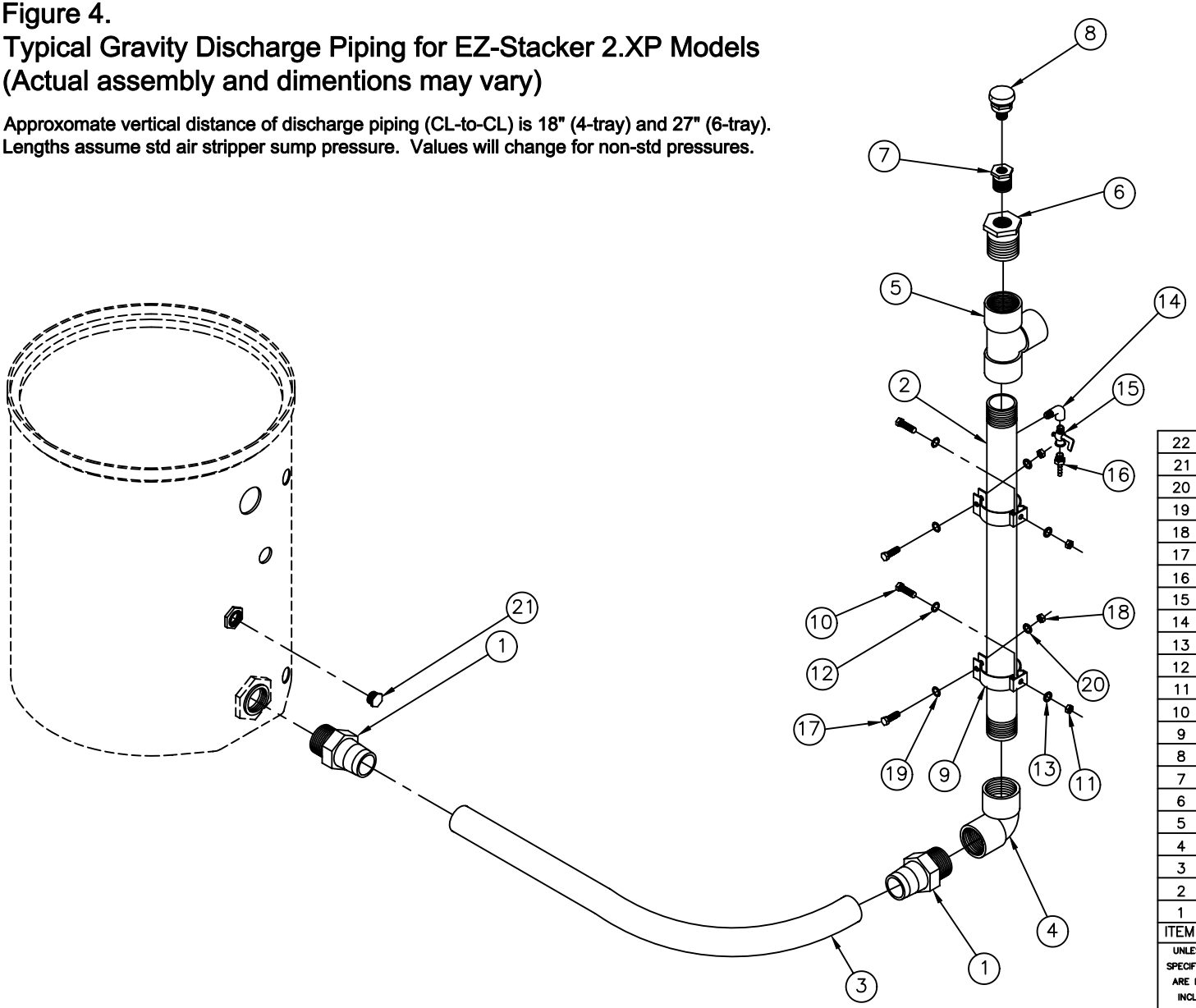
Q.E.D.
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

TITLE
BLOWER KIT W/O BLOWER ASSEMBLY/BOM/KIT

DRAWING NUMBER BLKIT2 REV C
SCALE N.T.S. SHEET 1 OF 1

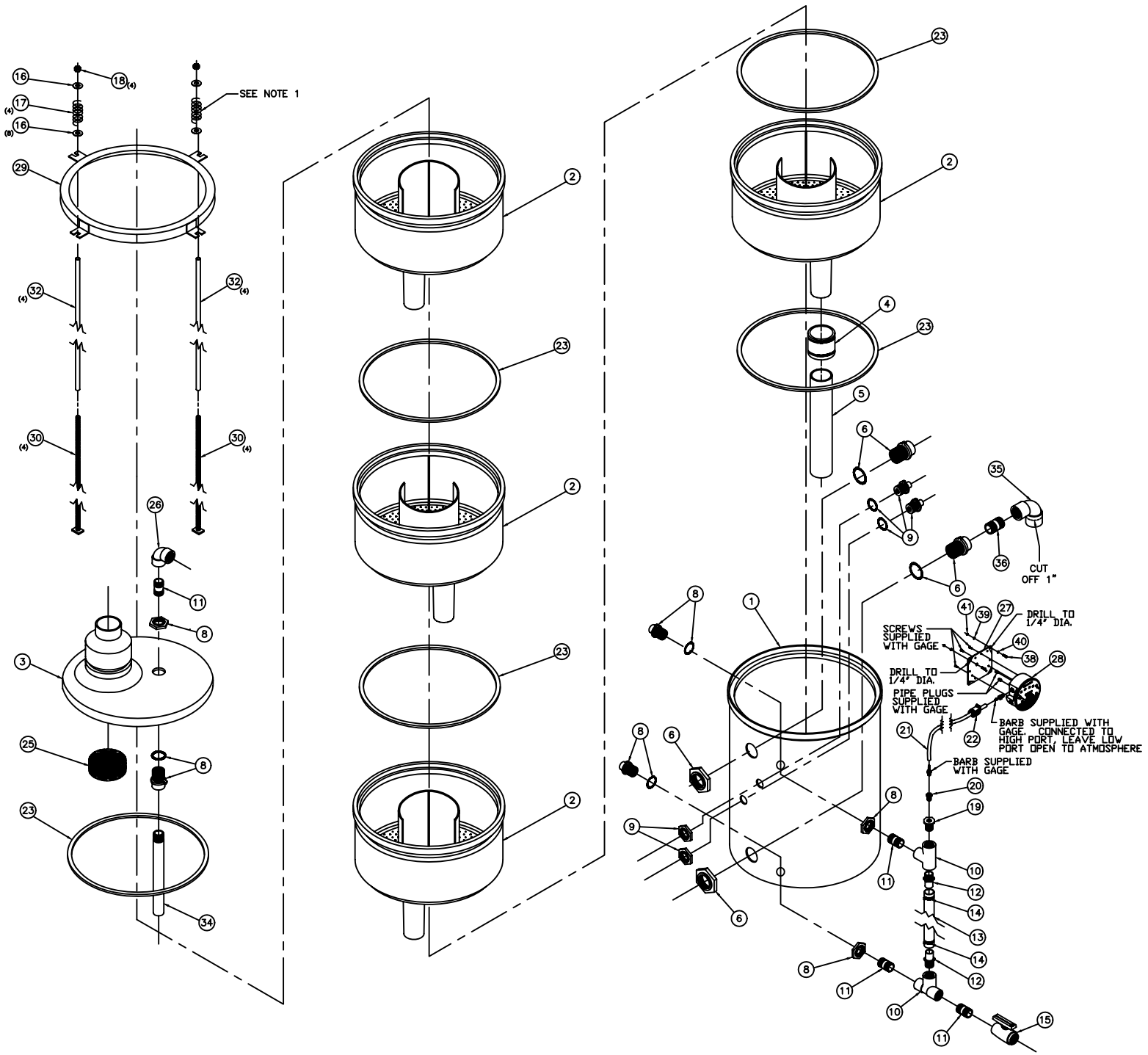
Figure 4.
Typical Gravity Discharge Piping for EZ-Stacker 2.XP Models
(Actual assembly and dimentions may vary)

Approxomate vertical distance of discharge piping (CL-to-CL) is 18" (4-tray) and 27" (6-tray). Lengths assume std air stripper sump pressure. Values will change for non-std pressures.



ITEM	QTY	DESCRIPTION	PART #
22	2	SPRING NUT 5/16" (NOT SHOWN)	805122
21	1	1/2" PLUG SCH 80	802073
20	2	LOCK WASHER FOR 1/4" BOLT	EXPENSED
19	2	FLAT WASHER FOR 1/4" BOLT	EXPENSED
18	2	1/4"–20 NUT	EXPENSED
17	2	1/4"–20 UNC HEX BOLT 1 1/4" LG.	EXPENSED
16	1	BARB 1/8"MPT X 3/16" BARB	803094
15	1	COCK, SHUTOFF 1/8"MPT X 1/8"FPT BRASS	803095
14	1	ELBOW, STREET 1/8" FPT BRASS	34149
13	2	LOCK WASHER FOR 5/16/BOLT	EXPENSED
12	2	FLAT WASHER FOR 5/16 BOLT	EXPENSED
11	2	5/16–18 UNC NUT	EXPENSED
10	2	5/16–18 UNC HEX. HD. BOLT .75 LG.	EXPENSED
9	2	HANGER 2" PIPE	805088
8	1	BREAKER, VACUUM 1/2" MPT	805026
7	1	BUSHING, PVC 1 1/4" X 1/2"	802067
6	1	BUSHING, PVC 2" X 1 1/4"	802187
5	1	TEE, PVC 2" THD	802025
4	1	ELBOW, PVC 2" THD	802034
3	2'	2" HOSE	805204
2	1.2'	PIPE 2" PVC	802159
1	2	2" HOSE BARBS	805071

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS	DRAWN BY KM	DATE 11–30–95	QED ENVIRONMENTAL SYSTEMS INC. 6155 JACKSON ROAD, ANN ARBOR, MI.
	CHECKED BY LN	DATE 12–5–95	
TOLERANCES .XX+/–.01 FRACT +/–1/64 .XXX+/–.005 ANGLES+/–1/2 OTHER TOLERANCES AS SPECIFIED	APPROVED BY	DATE	TITLE GRAVITY DRAIN ASSEMBLY/BOM/KIT
	MFG. APPROVAL		
EZ–STACKER (2 SERIES)	MATERIAL		DRAWING NUMBER GDKIT2S REV C
NEXT ASS'Y / USED ON	FINISH		SCALE N.T.S. SHEET 1 OF 1



ITEM	QTY	DESCRIPTION	PART #
41	2	NUT 1/4"	EXPENSED
40	2	WASHER, FLAT 1/4"	EXPENSED
39	2	WASHER, LOCK 1/4"	EXPENSED
38	2	BOLT, 1/4" HEX HD.	EXPENSED
37			
36	1	NIPPLE, CLOSE 2" PVC	802074
35	1	ELBOW 2" 90 DEGREE PVC THREADED	802034
34	1	PIPE 1" PVC 12.50 LG (THD. ONE END)	802162
33			
32	4	TUBING, NYLON 1/2" OD X 3/8" ID 69" LG	35097
31			
30	4	TIE ROD ASSEMBLY	804042
29	1	RING, TOP HOLD DOWN 27.63 OD	804040
28	1	MAGNEHELIC DIFFERENTIAL PRESSURE GAGE INCLUDES THE FOLLOWING: SCREWS, 6-32 RD. HD. (2) PIPE PLUG 1/8" (2) BARBS, 1/8" MPT X 3/16" BARB (2)	EZPGAUGE
27	1	BRACKET MOUNTING	805179
26	1	ELBOW 90 DEGREES PVC 1" MPT SCH 80	802037
25	1	DEMISTER 3 PADS OF 37/97 3.60 HIGH X 7.50 DIA.	804052
24			
23	5	GASKET, ROUND	804038
22	1	PINCH VALVE	36559
21	TBD	TUBING, CLEAR 5/16" O.D. X 3/16" I.D.	802248
20	1	REDUCER, BUSHING 1/4" X 1/8" BRASS	34103
19	1	REDUCER, BUSHING 1" X 1/4" BRASS	803054
18	4	NUT, 3/8-16 ZINC PLATED STEEL	805180
17	4	SPRING, NICKEL PLATED	805214
16	8	WASHER, FLAT 3/8 ZINC PLATED STEEL	805181
15	1	VAVLE, BALL PVC 1" FPT X 1" FPT	802196
14	2	CLAMPS, HOSE 13/16 X 1 1/2"	805055
13	.66 FT	TUBING, CLEAR PVC 1" I.D. 3/16" WALL	802236
12	2	BARB, NYLON 1" MPT X 1" BARB	805020
11	4	NIPPLE, CLOSE PVC 1" SCH 80	802103
10	2	TEE, PVC 1" FPT SCH 80	802028
9	2	BULKHEAD FITTING (RAVEN) 1/2" FPT	802169
8	3	BULKHEAD FITTING (RAVEN) 1 FPT	802171
7			
6	2	BULKHEAD FITTING 2" FPT (RAVEN)	802174
5	1	PIPE, PVC 3" 17.50 LG REF.	802156
4	1	FERNCO 3" COUPLER	802166
3	1	TRAY, TOP	804067
2	4	TRAYS, WITH SECONDARY PARTS	804068
1	1	SUMP	804069

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS
TOLERANCES
.XX+/-.01 FRACT +/-1/64
.XXX+/-.005 ANGLES+/-1/2
OTHER TOLERANCES AS SPECIFIED
2.4 EZ STACKER
NEXT ASS'Y | USED ON

DRAWN BY KM | DATE 11-14-95
CHECKED BY LN | DATE 12-5-95
APPROVED BY | DATE
MFG. APPROVAL
MATERIAL
FINISH

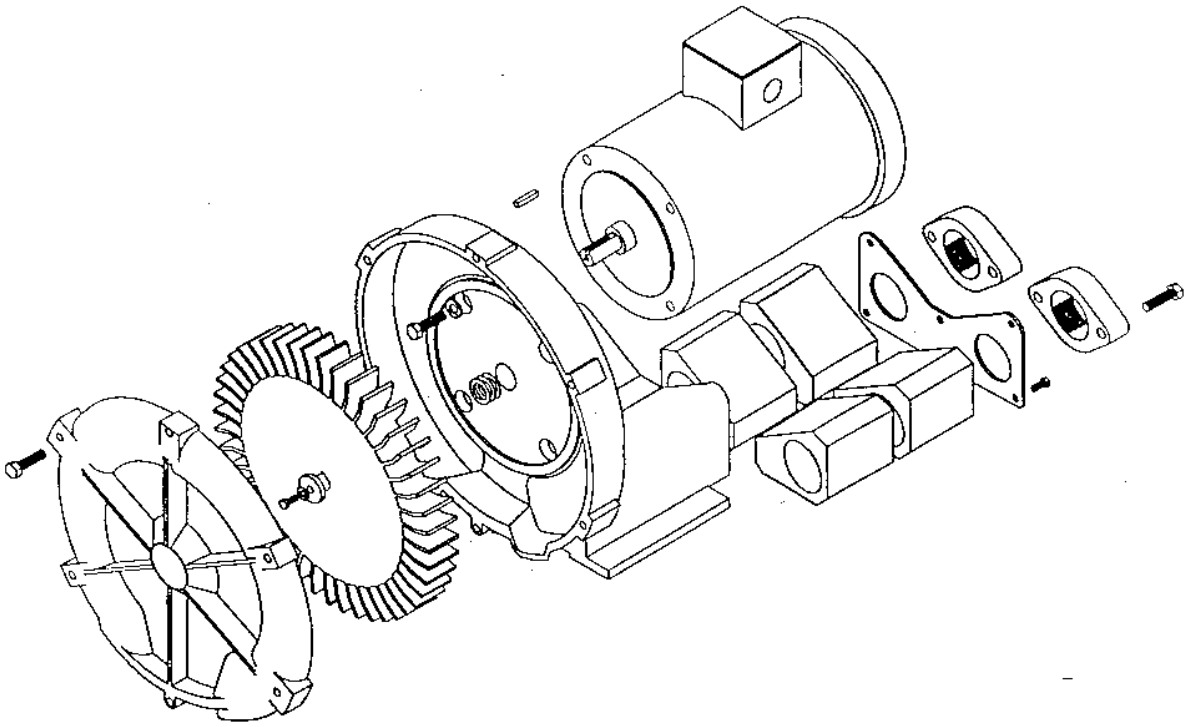
Q.E.D.
ENVIRONMENTAL SYSTEMS INC.
6155 JACKSON ROAD, ANN ARBOR, MI.

TITLE
EZ-2.4 P
ASSEMBLY/BOM/KIT

DRAWING NUMBER EZ-2.4P | REV G
SCALE N.T.S. | SHEET 1 OF 1

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

EN454 – EN656
DR404 – DR656



Technical & Industrial Products
627 Lake Street, Kent, OH 44240 U.S.A.
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: info@ametektmd.com
internet: www.ametektmd.com

Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS

Technical & Industrial Products
627 Lake Street, Kent, OH 44240 U.S.A
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: info@ametektmd.com web site: internet: www.ametektmd.com

1. **No Fault Policy** - AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment.) to the original purchaser only. Should the blower fail, **regardless of the cause of failure**, we will at our option repair or replace the blower.

2. **Standard Policy** - AMETEK Rotron Minispiral, Revaflow, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, we will evaluate the failure. If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.

3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

Corrective Action - A written report will be provided indicating reason(s) for failure, with suggestions for corrective action. Subsequent customer failures due to abuse, misuse, misapplication or repeat offense will not be covered. AMETEK Rotron will then notify you of your options. Any failed unit that is tampered with by attempting repair or diagnosis will void the warranty, unless authorized by the factory.

Terms and Conditions - Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, outbound and inbound shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Out-of -warranty product and in warranty product returned for failures determined to be caused by abuse, misuse, or repeat offense will be subject to an evaluation charge. Maximum liability will in no case exceed the value of the product purchased. Damage resulting from mishandling during shipment is not covered by this warranty. It is the responsibility of the purchaser to file claims with the carrier. Other terms and conditions of sale are stated on the back of the order acknowledgement.

Installation Instructions for SL, DR, EN, CP, and HiE Series Blowers

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

   Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller

imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

3. **Support the Piping** - The blower flanges and nozzles are designed as connection points only and are not designed to be support members.

   Caution: Plastic piping should not be used on blowers larger than 1 HP that are operating near their maximum pressure or suction point. Blower housing and nearby piping temperatures can exceed 200ºF. Access by personnel to the blower or nearby piping should be limited, guarded, or marked, to prevent danger of burns.

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

   Note: Remote Drive (Motorless) Blowers - Properly designed and installed guards should be used on all belts, pulleys, couplings, etc. Observe maximum remote drive speed allowable. Due to the range of uses, drive guards are the responsibility of the customer or user. Belts should be tensioned using belt gauge.

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all standard models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearing should be changed after 15,000 to 20,000 hours, on average. Replacement bearing information is specified on the chart below.

Bearing Part Number	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% +/- 5% Fill	Yes – 325 F
510449 516440 516648	203 202 307	Buna N	Exxon Polyrex Grease	NO
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	Buna N	Exxon Polyrex Grease	NO

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	1. * One phase of power line not connected 2. * One phase of stator winding open 3. Bearings defective 4. Impeller jammed by foreign material 5. Impeller jammed against housing or cover 6. ** Capacitor open	1. Connect 2. Rewind or buy new motor 3. Change bearings 4. Clean and add filter 5. Adjust 6. Change capacitor
	No Sound	1. * Two phases of power line not connected 2. * Two phases of stator winding open	1. Connect 2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity 2. Short circuit	1. Use time delay fuse of proper rating 2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage 2. * Operating in single phase condition 3. Bearings defective 4. Impeller rubbing against housing or cover 5. Impeller or air passage clogged by foreign material 6. Unit operating beyond performance range 7. Capacitor shorted 8. * One phase of stator winding short circuited	1. Check input voltage 2. Check connections 3. Check bearings 4. Adjust 5. Clean and add filter 6. Reduce system pressure/vacuum 7. Change capacitor 8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover 2. Impeller or air passages clogged by foreign material 3. Bearings defective	1. Adjust 2. Clean and add filter 3. Change bearings
	Performance Below Standard	1. Leak in piping 2. Piping and air passages clogged 3. Impeller rotation reversed 4. Leak in blower 5. Low voltage	1. Tighten 2. Clean 3. Check wiring 4. Tighten cover, flange 5. Check input voltage

*** 3 phase units**

**** 1 phase units**

***** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.**

Blower Disassembly:

WARNING: Attempting to repair or diagnose a blower may void Rotron's warranty. It may also be difficult to successfully disassemble and reassemble the unit.

1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.

2) Remove or separate piping and/or mufflers and filters from the unit.

3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.

4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.

5) Carefully note the number and location of the shims. Remove and set them aside. NOTE: If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

6) Remove the housing bolts and remove the motor assembly (arbor/.housing on remote drive models).

7) Arbor disassembly (Applicable on remote drive models only):
   a) Slide the bearing retraining sleeve off the shaft at the blower end.
   b) Remove the four (4) screws and the bearing retaining plate from the blower end.
   c) Lift the shaft assembly far enough out of the arbor to allow removal of the blower end snap ring.
   d) Remove the shaft assembly from the arbor.
   e) If necessary, remove the shaft dust seal from the pulley end of the arbor.

Muffler Material Replacement:

1) Remove the manifold cover bolts and them manifold cover.

2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.

3) Reassemble by reversing the procedure.

NOTE: On DR068 models with tubular mufflers it is necessary to remove the cover and impeller accessing the muffler material from the housing cavity.

Blower Reassembly:

1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.

2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.

3) If blower had a seal replace the seal with a new one.

4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.

5) Replace the cover and fasten with bolts.

6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	**Torque**
1/4-20	**6.25 +/- 0.25**
5/16-18	**11.5 +/- 0.25**
3/8-16	**20.0 +/- 0.5**
½-13	**49.0 +/- 1**
5/8 –11	**90.0 +/- 2**

Impeller Shimming Procedure:

WARNING: This unit may be difficult to shim. Extreme care may be exercised.

Tools Needed: Machinist's Parallel Bar
Vernier Caliper with depth measuring capability
Feeler gauges or depth gauge

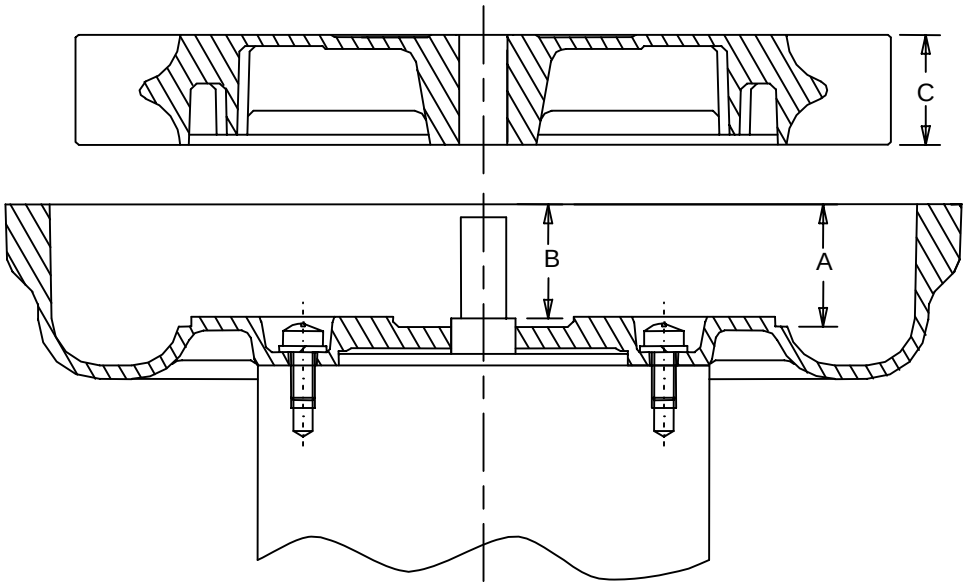
Measure the Following:

Distance from the flange face to the housing (A)
Distance from the flange face to the motor shaft shoulder (B)
Impeller Thickness (C)

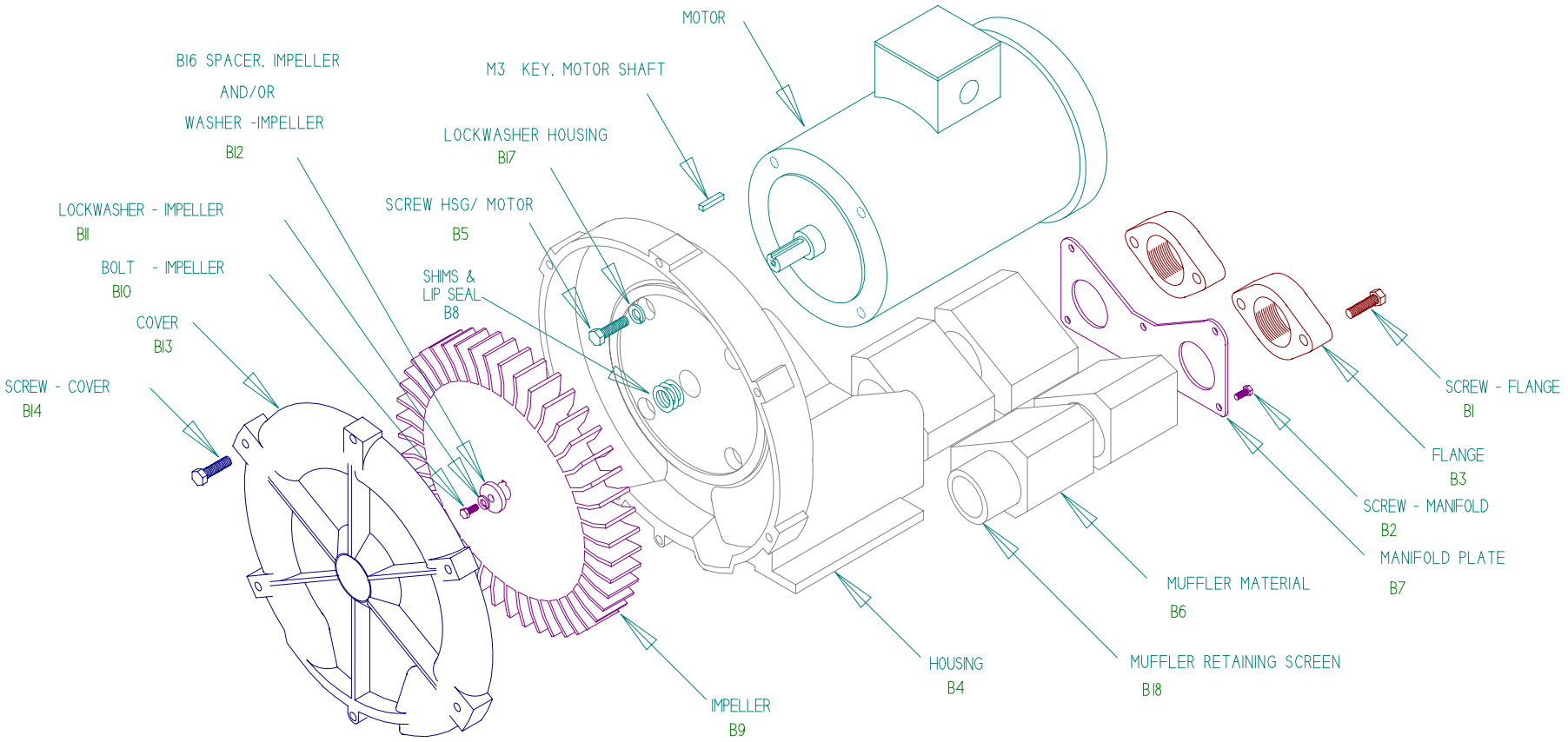
Measurements (A) and (B) are made by laying the parallel bar across the housing flange face and measuring to the proper points. Each measurement should be made at three points, and the average of the readings should be used.

Shim Thickness = B – (A+C)/2

After the impeller installation (step #4 above) the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be (A+C)/2.



ASSEMBLY DIAGRAM
EN454 EN513 EN523 EN505
EN555 EN606 EN656



Parts Breakdown

Item No.	Qty. Req'd	Description	EN454 038175 038176	EN454 080487 080488	EN513 038183 038037	EN523 038223 038184	EN505 038177 038178 038445	EN555 038045	EN606 038179 038222 038437 038536 038538	EN656 080058 080059 080060
M3	1	Key Motor Shaft	510629	510629	510629	155099	510629	510629	510629	510629
B1	4	Screw, Flange	120162	120162	120162	120162	120162	120162	155095	120255
B2	6	Screw, Manifold	155496	155496	(10 pcs) 120214	(10 pcs) 120214	155170	155176	155176	155170
B3	2	Flange	510354	510354	510354	510354	510354	510354	511480	511480
B4	1	Housing	515737	551001	523419	523420	See Next Page	516721	See Next Page	550195
B5	4	Screw, Hsg /Motor	251791	155128	251791	251791	155128	251791	251791	251791
B6	4	Muffler Material	515743	515743	516560	516560	(6 pcs) 515743	515743	See Next Page	(10 pcs.) 551585
	2	Muffler Insert	Not Used	551006	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B7	1	Manifold Plate	516410	516410	529868	529868	517460	515482	516392	See Next Page
B8	*	Shim .002"	510356	510356	510356	500664	510356	510356	510356	510356
	*	Shim .005"	510357	510357	510357	500665	510357	510357	510357	510357
	*	Shim .010"	510358	510358	510358	500666	510358	510358	510358	510358
	*	Shim .020"	510359	510359	510359	500667	510359	510359	510359	510359
	*	Shim .030"	Not Used	Not Used	Not Used	510292	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller	515675	551067	516557	(2 pcs) 516562	517433	516678	511272	550305
B10	1	Bolt, Impeller	120214	120214	120325	120214	120214	120214	120325	120325
B11	1	Lockwasher, Impeller	120203	120203	120203	120203	120203	120203	120203	120203
B12		Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover	517807	551065	516559	516559	517808	516675	511274	550249
B14	6	Screw, Cover	155236	155129	(8 pcs) 120255	(8 pcs) 155098	155236	(7 pcs) 155236	155236	(8 pcs) 155236
B16	1	Spacer, Impeller Bolt	510355	510355	510355	510355	510355	510355	510355	510355
B17		Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1	Screen, Muffler Retaining, Right (**)	510362	551087	511718	511718	See Next Page	510362	See Next Page	517436
	1	Screen, Muffler Retaining, Left (**)	510362	551087	511718	511718	See Next Page	510362	See Next Page	517436
B19		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B20		Muffler Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Bolt, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lockwasher, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Washer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Spacer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B23		Bolt, Mounting Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B24		Lockwasher, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B25		Nut, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B26		Rail Mounting	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
	1	Lip Seal	516587	516587	516587	516587	516587	516587	516587	516587

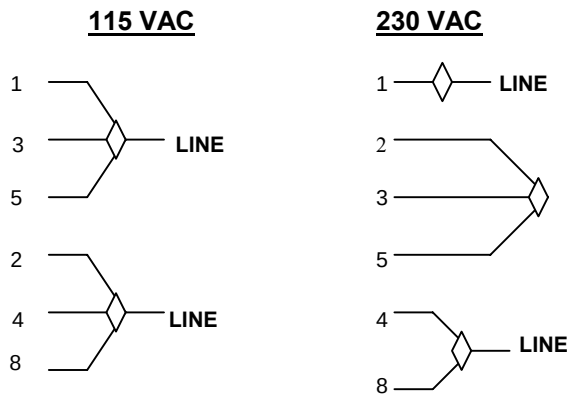
*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

Model	Part No.	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
EN454W58L	038175	515747	H + L			
EN454W72L	038176	515746	K + L			
EN454W58ML	080487	515747	H + L			
EN454W72ML	080488	515746			510449	510217
EN513W58L	038183	515747	H + L			
EN513W72L	038037	515746	K + L			
EN523M72L	038184	517675	K + L			
EN523M5L	038223	551373	M + L	B13 516555 1 pc Center Annulus	510217	510218
EN505AX58ML	038177	510326	H + L			
EN505AX72ML	038178	510325	K + L	B4 517419 B18 517435 2 pcs	510449	510217
EN505CJML	038445	529622	M + L	B4 529654 B18 517436 2 pcs		
EN555M72L	038045	516686	K + L			
EN606M72L	038179 ***	516687	K + L	B4 511276 1 pc	510449	510217
EN606M5L	038222 **	551366	M + L	B6 511285 4 pcs	510217	510218
EN606M86L	038437	529630	N + L	B4 529790 1 pc	510449	510217
EN606M72ML	038536	516687	K + L	B6 529781 4 pcs		
EN606M5ML	038538	551366	M + L	B18 529782 2 pcs	510217	510218
EN656M86XL	080058	529630	N + L		510449	510217
EN656M72XL	080059	516687	K + L			
EN656M5XL	080060	551366	M + L	B7 Muffler extension 550253 1 pc	510217	510218

*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

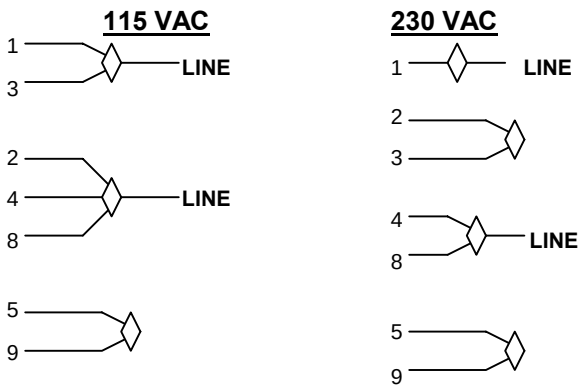
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE



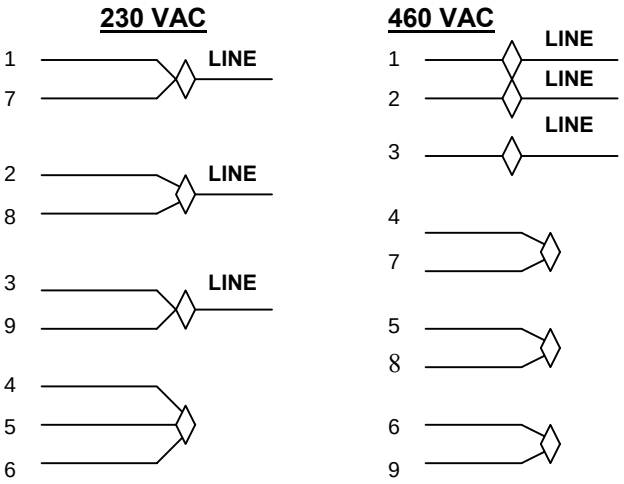
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE



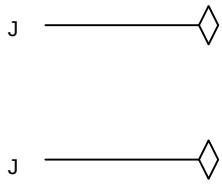
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

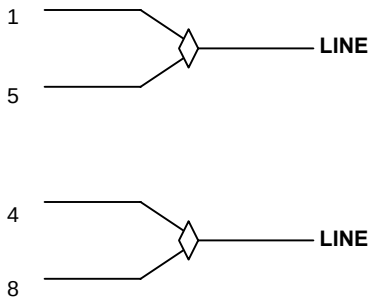
L. PILOT DUTY THERMAL OVERLOADS



HOOK J LEADS TO CONTROL CIRCUITRY

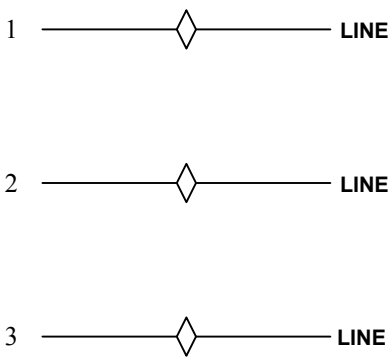
M. 1Ø 230 VAC

SINGLE VOLTAGE



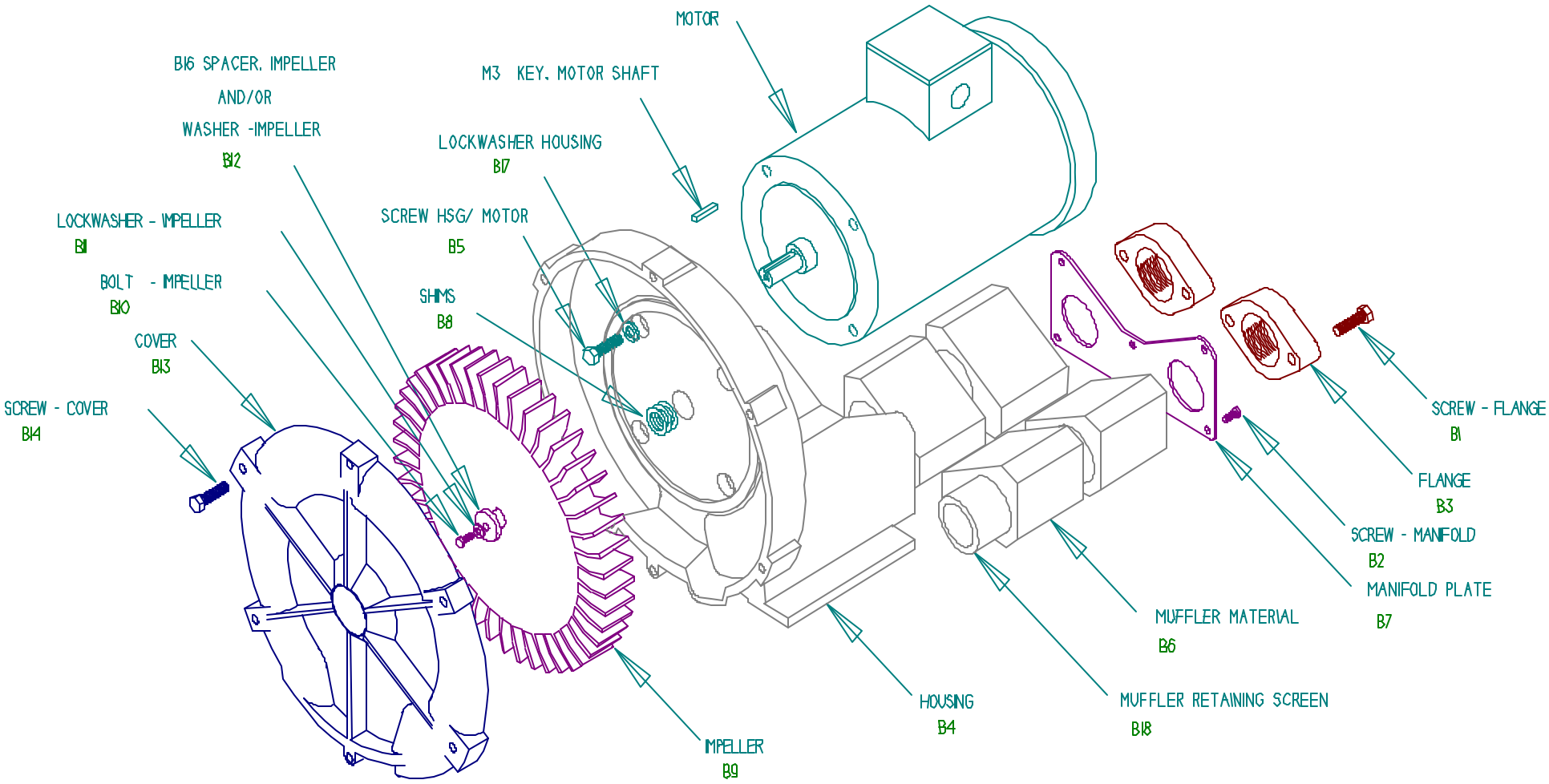
INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

N. 3Ø 575 VAC



INTERCHAGE ANY TWO LEAD LINES TO REVERSE ROTATION

ASSEMBLY DRAWING
DR404 DR454 DR513
DR523 DR505 DR555
DR606 DR656



Parts Breakdown

Item No.	Qty. Req'd	Description	DR404	DR454	DR454	DR513	DR523	DR505	DR555	DR606	DR656
		Model:	**DR404**	**DR454**	**DR454**	**DR513**	**DR523**	**DR505**	**DR555**	**DR606**	**DR656**
		Part No.:	**037406**	**036855**	**080480**	**037217**	**037210**	**037542**	**037308**	**038526**	**080582**
			037408	**036856**	**080481**	**037209**	**037211**	**037543**	**037306**	**038527**	**080583**
			037407	**036949**	**080482**	**037773**	**037772**	**037544**	**037305**	**038530**	**080604**
				038808				**037545**	**037546**	**037547**	**080584**
								037546	**037309**	**038529**	**080585**
										080077	**080602**
											080603
M3	1	Key Motor Shaft	510629	510629	510629	510629	155099	510629	510629	510629	510629
B1	4	Screw, Flange	120162	120162	120162	120162	120162	120162	120162	120255	120255
B2	6	Screw, Manifold	155130	155477	155477	(10 pcs)120214	(10 pcs)120214	155130	155477	155477	155170
B3	2	Flange	510962	510354	510354	510354	510354	510354	510354	511480	511480
B4	1	Housing	517002	515737	551001	516552	516551	517419	516721	529790	550195
B5	4	Screw, Hsg /Motor	155128	251791	155128	251791	251791	155128	251791	251791	251791
B6	4	Muffler Material	(6 pcs) 517015	515743	515743	516560	516560	(6 pcs) 515743	515743	529781	(10 pcs) 551585
B7	1	Manifold Plate	517008	515744	515744	529868	529868	517458	517458	511284	Not Used
B8	*	Shim .002"	510356	510356	510356	510356	500664	510356	510356	510356	510356
	*	Shim .005"	510357	510357	510357	510357	500665	510357	510357	510357	510357
	*	Shim .010"	510358	510358	510358	510358	500666	510358	510358	510358	510358
	*	Shim .020"	510359	510359	510359	510359	500667	510359	510359	510359	510359
	*	Shim .030"	Not Used	Not Used	Not Used	Not Used	510292	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller	516987	515675	551067	516557	(2 pcs) 516562	517433	516678	511272	550305
B10	1	Bolt, Impeller	120214	120214	120214	120325	120214	120214	120214	120325	120325
B11	1	Lockwasher, Impeller	120203	120203	120203	120203	120203	120203	120203	120203	120203
B12	1	Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover	516990	515702	551065	516559	516559	517431	516675	511274	550249
B14	6	Screw, Cover	155129	155236	155129	(8 pcs) 120255	(8 pcs) 155098	155236	(7 pcs) 155236	155236	(8 PCS) 155236
B16	1	Spacer, Impeller Bolt	510355	510355	510355	510355	510355	510355	510355	510355	510355
B17	4	Lockwasher, Housing	251787	251787	251787	251787	Not Used	251787	251787	251787	251787
B18	1	Screen, Muffler Retaining Right (**)	517016	510362	551006	511718	511718	See Next Page	510362	529782	517436
	1	Screen, Muffler RetainingLeft (**)	517016	510362	551006	511718	511718	See Next Page	510362	529782	517436
B19		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B20		Muffler Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lip Seal	Not Used	Not Used	Not Used	Not Used	516587	Not Used	Not Used	Not Used	Not Used

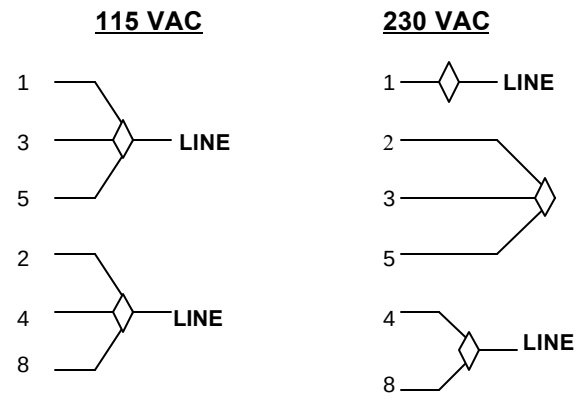
*As needed **Viewed looking at inlet/outlet ports

Model	Part #	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
DR404AL72M	037406	510438	C		510449	510217
DR404AL86M	037408	510700	G			
DR404AL58M	037407	510439	A			
DR454R72	036855	510317	C			
DR454R58	036856	510319	A			
DR454R86	036949	516034	G			
DR454CD72	038808	510763	C			
DR454R72M	080480	510317	C	Muffler - Liner (2 pcs) 551087		
DR454R58M	080481	510319	A			
DR454R86M	080482	516034	G			
DR513R72	037217	510317	C			
DR513R58	037209	510319	A			
DR513R86	037773	516034	G			
DR523K72	037210	516571	C	B13A Center Annulus (1 pc) 516555		
DR523K58	037211	516572	A			
DR523K86	037772	551131	G			
DR505CD58M	037546	510762	A	B18 R517436		
DR505CD72M	037545	510763	C	R517436		
DR505AS86M	037544	510701	G			
DR505AS72M	037543	510318	C	B18 R517435		
DR505AS58M	037542	510320	A	R517435		
DR555CK72	037308	510895	C	B2A Washer Manifold (6 pcs) 120222		
DR555K72	037306	511306	C			
DR555K58	037305	511307	A			
DR555CK86	037310	511305	G			
DR555K86	037309	516686	G			
DR606CK72M	038526	510895	C			
DR606K72M	038527	511306	C			
DR606K58M	038529	511307	A			
DR606CK86M	038530	511305	G			
DR606CK5M	038532	516848	F			
DR606D72M	030077	550689	C			
DR656CK72X	080582	510895	C	B7* Muffler Extension 550253		
DR656CK5X	080584	516848	F			
DR656CK86X	080583	511305	G			
DR656K72X	080602	511306	C			
DR656K58X	080603	511307	A			
DR656D72X	080585	550689	C			
DR656D86X	080604	550694	G			

*As needed **Viewed looking at inlet/outlet ports

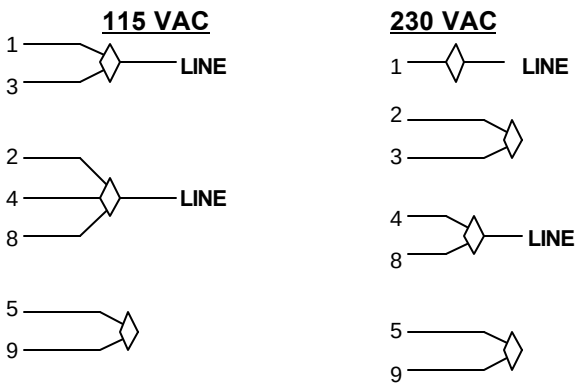
WIRING DIAGRAMS, TEFC and ODP MOTORS

A. 1Æ, 6 WIRE



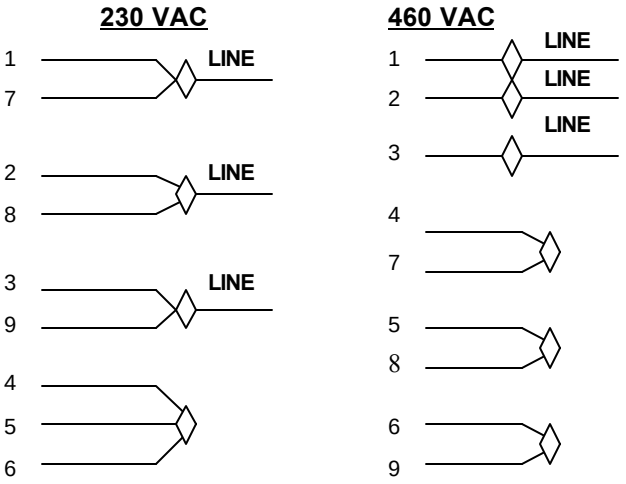
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

B. 1Æ, 7 WIRE



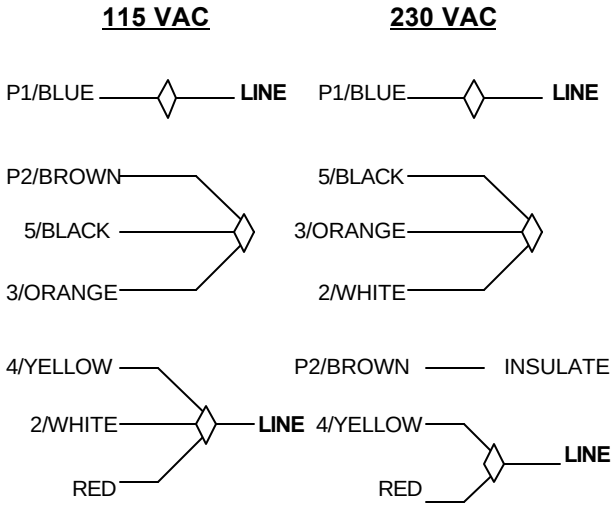
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

C. 3Æ, 9 WIRE



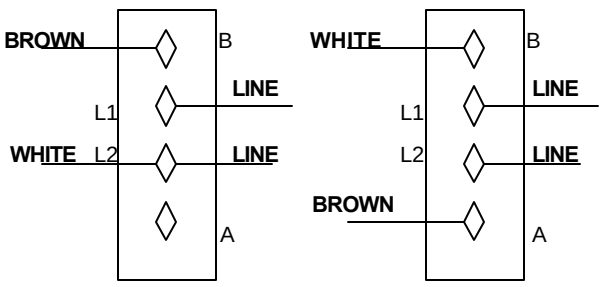
INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

D. 1Æ, EMERSON 1/8 HP MOTOR



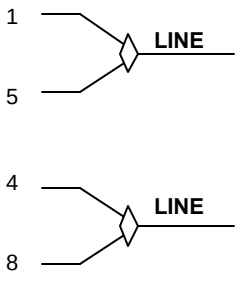
INTERCHANGE RED AND BLACK TO REVERSE ROTATION

E. 1Æ, SPA DUTY WITH TERMINAL STRIPS



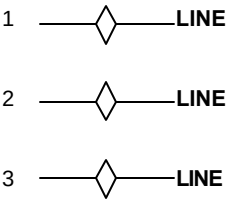
F. 1Æ, 230 VAC

SINGLE VOLTAGE



INTERCHANGE LEAD WIRES 5 & 8 TO REVERSE ROTATION

G. 3Æ, 575 VAC

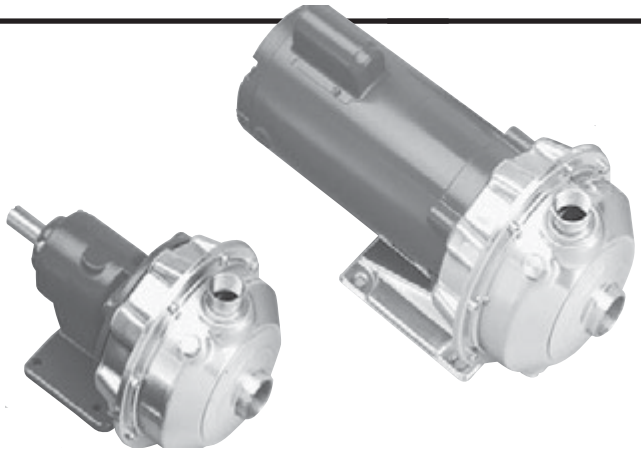


INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

G&L Pumps

Installation, Operation and Maintenance Instructions

Model NPE/ NPE-F



DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. Important:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

CAUTION

Always disconnect electrical power when handling pump or controls.

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	212° F (100° C) with standard seal. 250° F (120° C) with optional high temp seal.
Pressure:	75 PSI.
Starts Per Hour:	20, evenly distributed.

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. Installation:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

CAUTION

Never draw piping into place by forcing the pump suction and discharge connections.

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units:

2.2.1. Units may be installed horizontally, inclined or vertically.

CAUTION

Do not install with motor below pump. Any leakage or condensation will affect the motor.

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units:

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Fig.1.

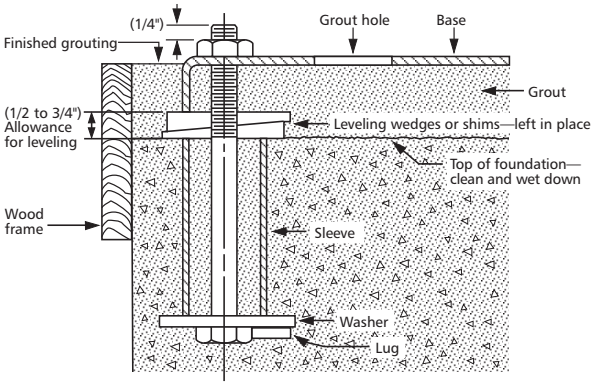


Figure 1

Goulds Pumps

ITT Industries

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. Suction Piping:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

CAUTION

Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figs. 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

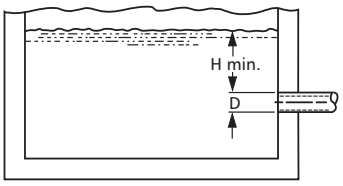


Figure 2

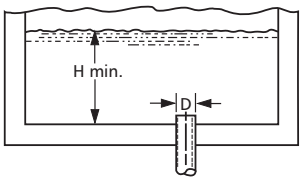


Figure 3

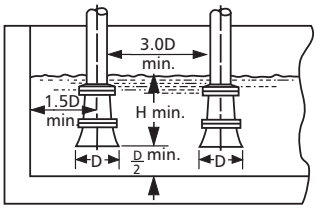


Figure 4

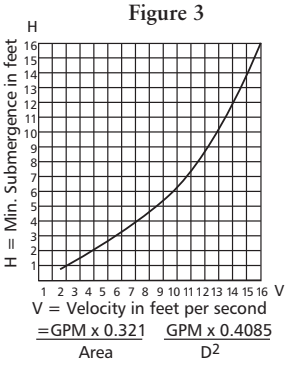


Figure 5

4. Discharge Piping:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. Motor-To-Pump Shaft Alignment:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Fig. 6.

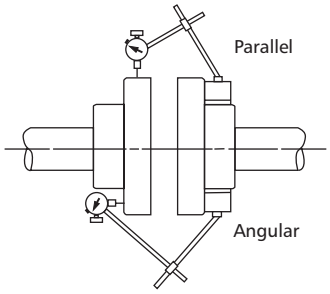


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

CAUTION

Always recheck both alignments after making any adjustment.

6. Rotation:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. Operation:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

CAUTION

Pumped liquid provides lubrication. If pump is run dry,rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. Maintenance:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. Disassembly:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

CAUTION

Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

CAUTION

Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 & 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 & 168).

10. Reassembly:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame:

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

CAUTION

Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. Trouble Shooting Chart:

MOTOR NOT RUNNING
(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:
(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:
(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:
(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

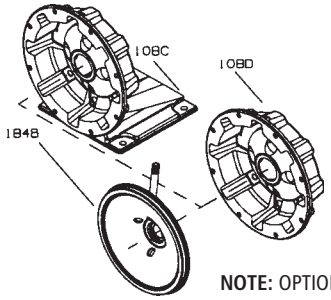
PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
    Suction lift too high or suction losses excessive.
    Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

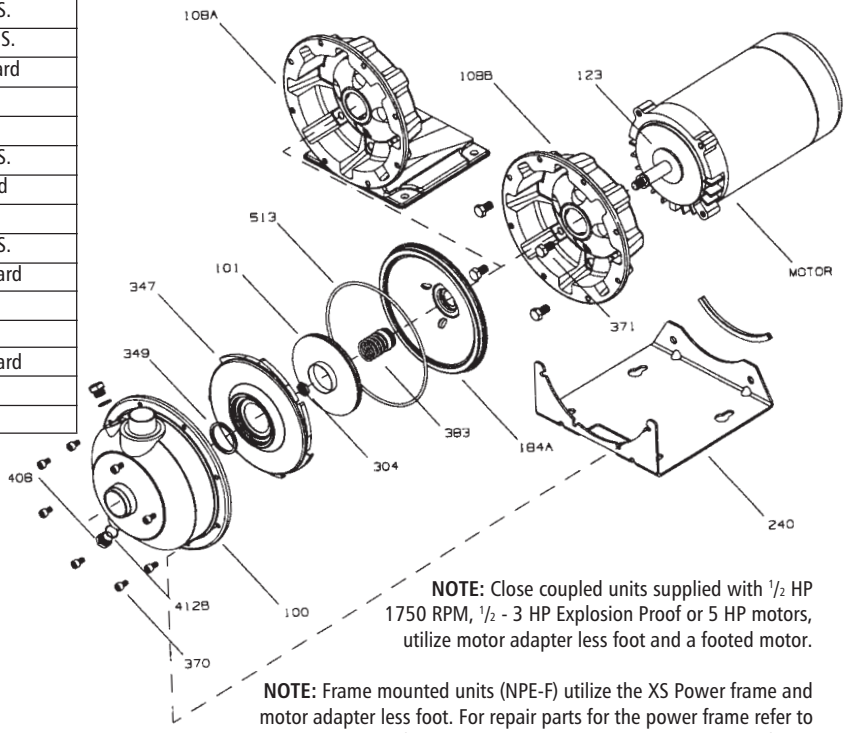
NPE Standard Repair Parts List

Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton Standard
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton, standard
		EPR
		BUNA
513	O-Ring, casing	Viton, standard
		EPR
		BUNA

Item 383 Mechanical Seal (⅝" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



NOTE: Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

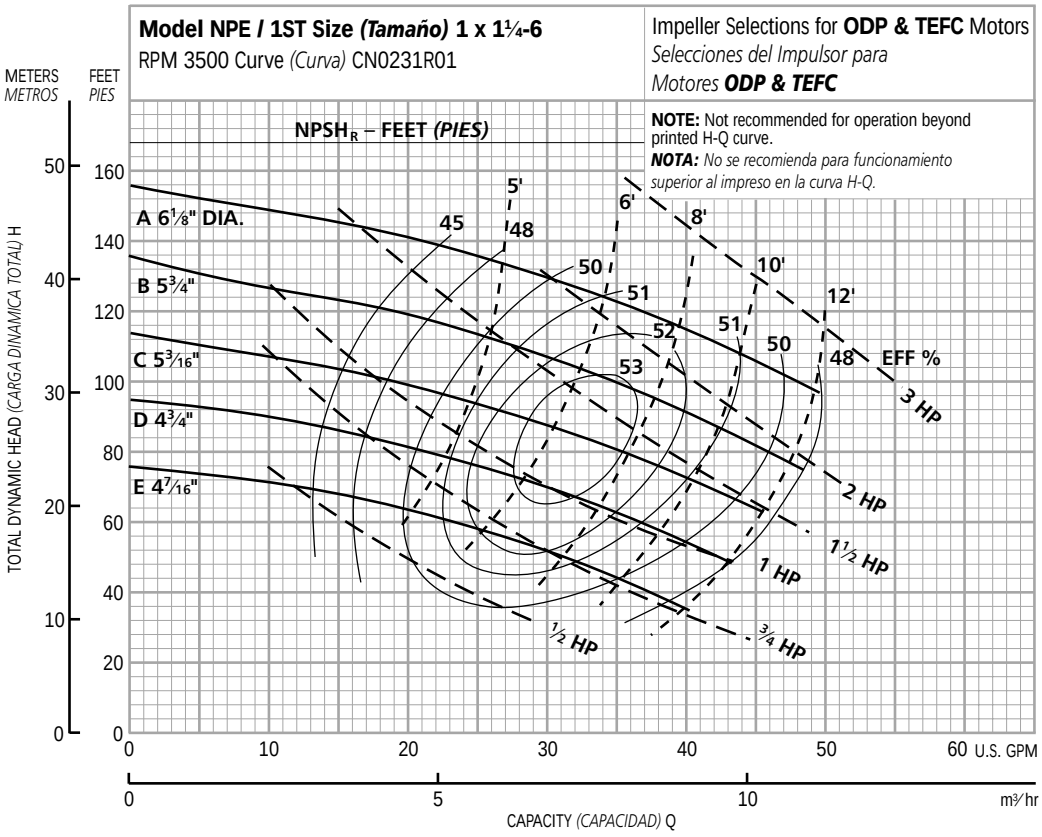
THIS WARRANTY EXTENDS TO THE DEALER ONLY.

Visit us at www.goulds.com

Printed in USA

Goulds Pumps
ITT Industries

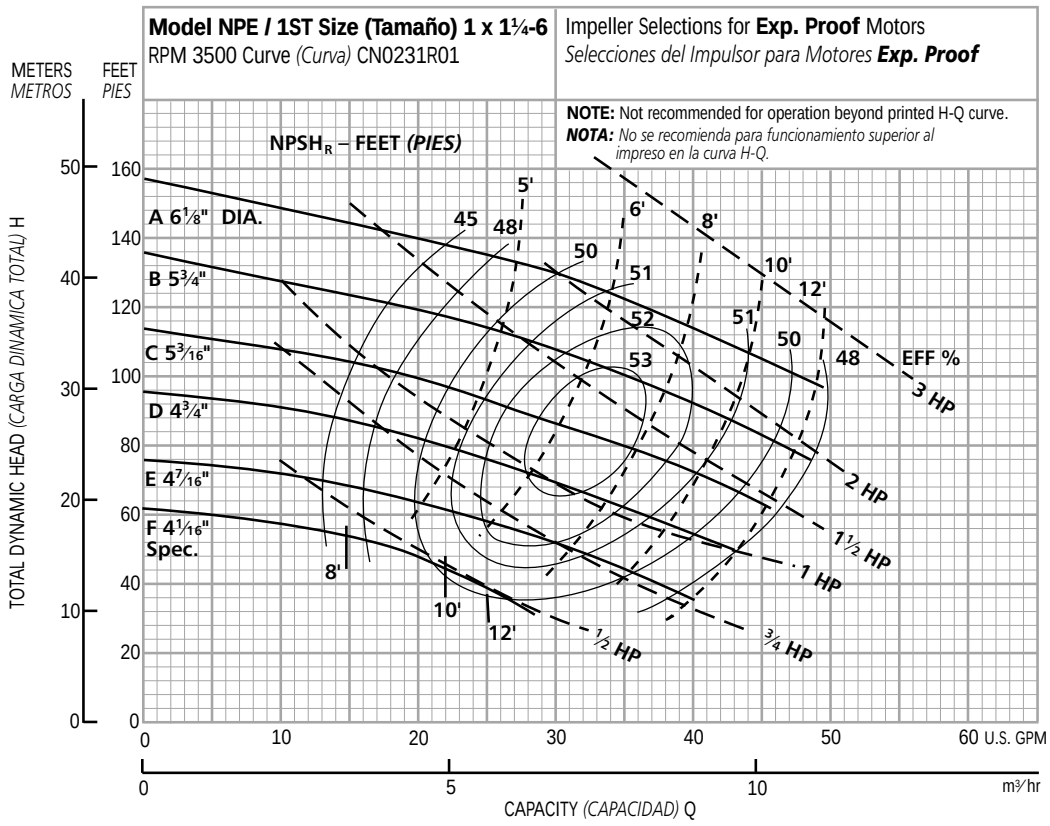
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".*

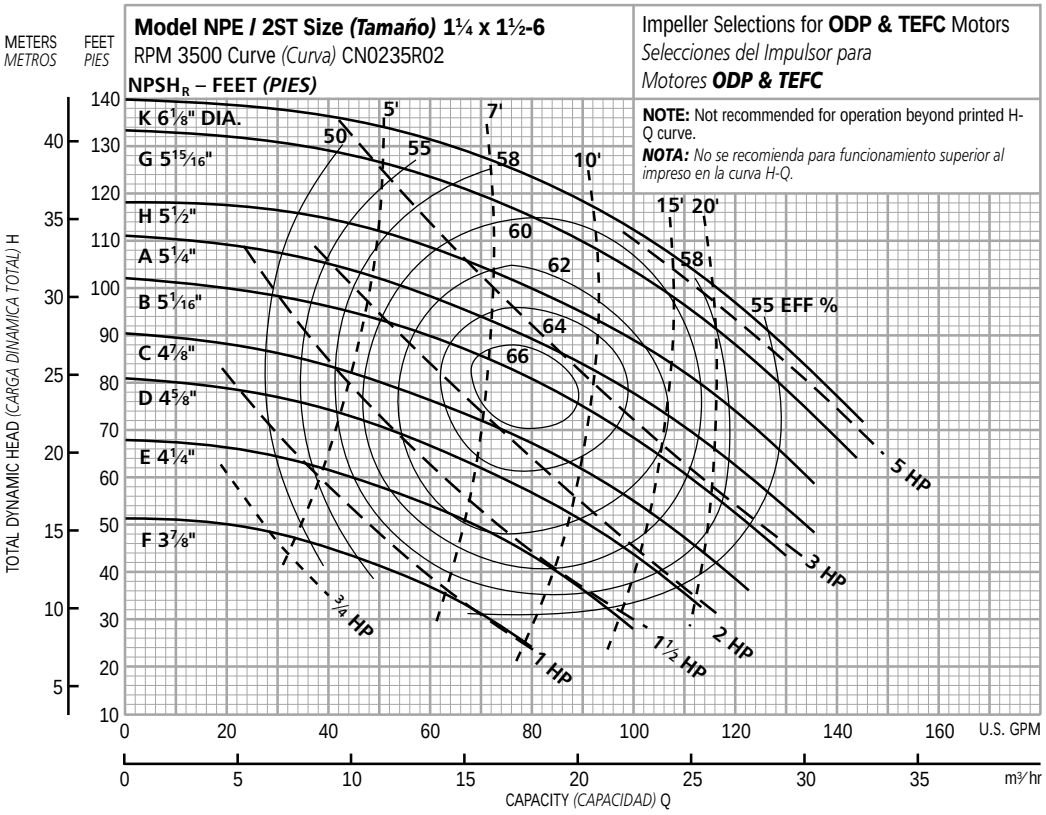


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4¹⁄₁₆" spec.
E	¾	4⁷⁄₁₆
D	1	4¾
C	1½	5³⁄₁₆
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".*

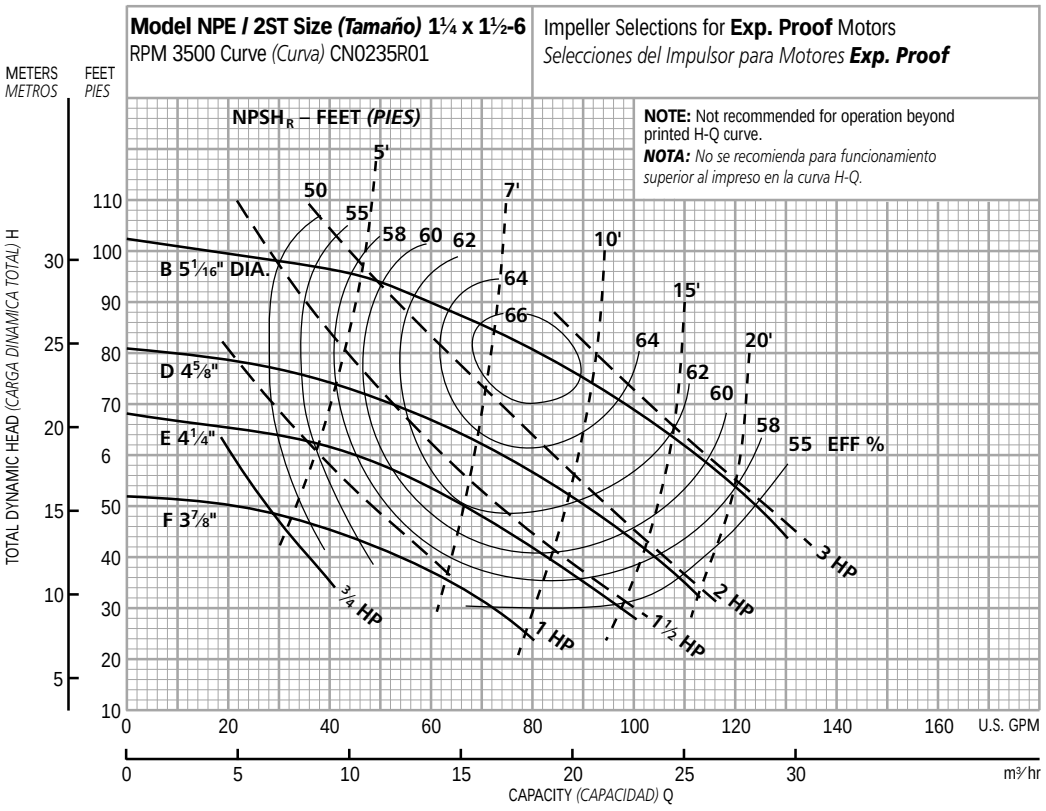
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3⅞"
E	1	4¼
D	1½	4⅝
C	2	4⅞
B	3	5 1/16
A	3	5¼
H	5	5½
G	5	5 15/16
K	5	6⅛

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

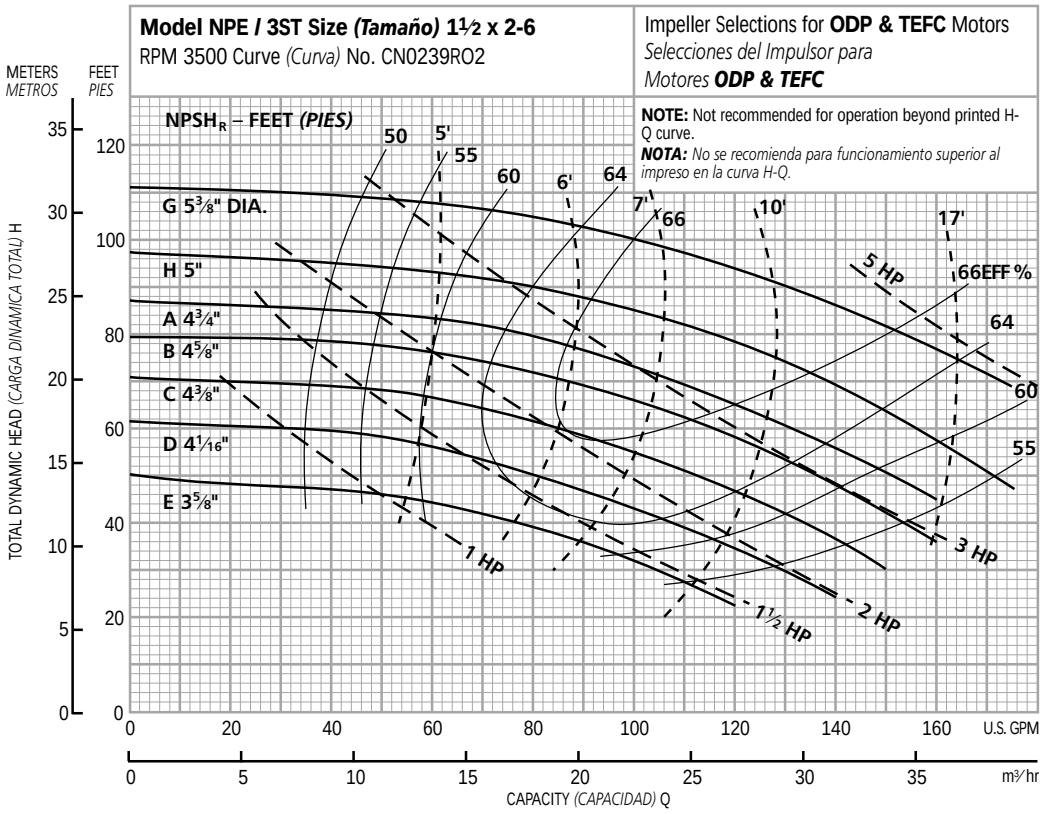


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3⅞"
E	1½	4¼
D	2	4⅝
B	3	5 1/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

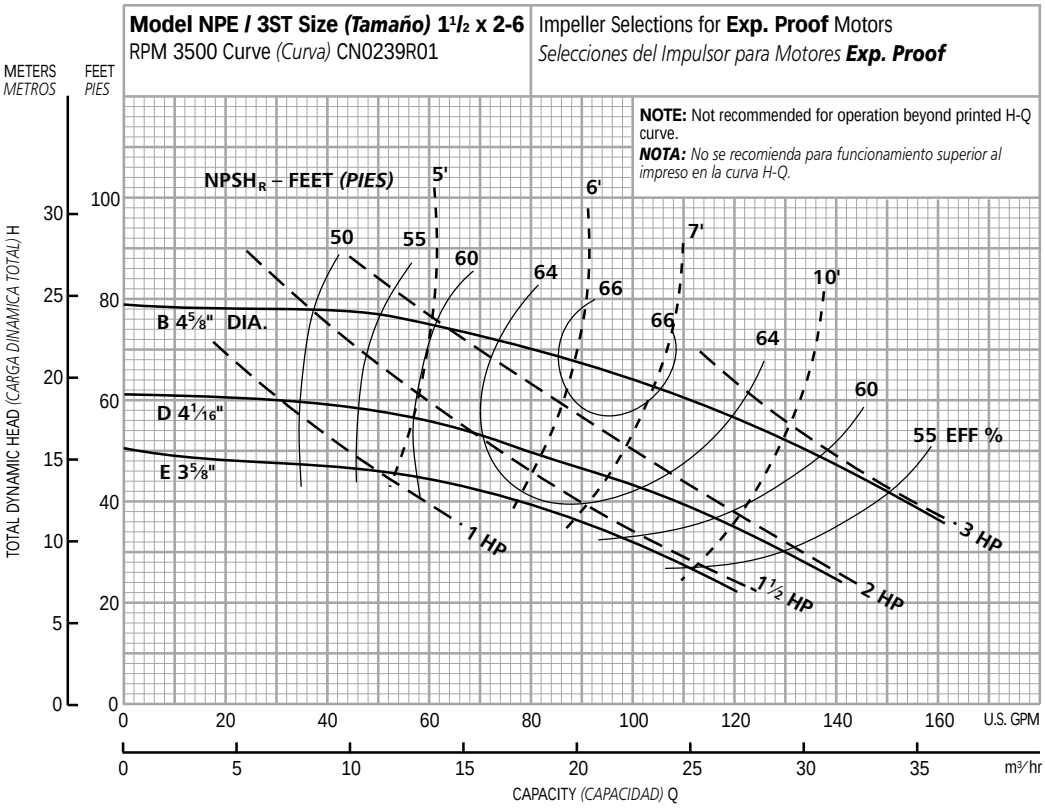
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1	3⅝"
D	1½	4¹⁄₁₆
C	2	4⅜
B	3	4⅝
A	3	4¾
H	5	5
G	5	5⅜

NOTE: Although not recommended, the pump may pass a 11⁄32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11⁄32".*



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1½	3⅝"
D	2	4¹⁄₁₆
B	3	4⅝

NOTE: Although not recommended, the pump may pass a 11⁄32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11⁄32".*

G&L Pumps

Repair Parts

MODEL

NPE/NPE-F

Goulds Pumps

ITT Industries

Effective February, 2003
RNPE

TABLE OF CONTENTS

NPE END SUCTION

NOTE:
For units built before September, 1997
The following upgrades are interchangeable.

(1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.

(2) Pump Components have been upgraded from 304 SS to 316L SS

(3) Mechanical Seal upgrades as noted on page 1

(4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

SEAL VENT/FLUSH OPTION

MECHANICAL SEAL and O-RING

4 = Pre-Engineered Standard

For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (⅝" seal)						
Seal Code	**Rotary**	**Stationary**	**Elastomers**	**Metal Parts**	**Part No.**	**Casing O-Ring**
2	Carbon	Sil-Carbide	EPR	316 SS	10K18*	EPR
4			Viton		10K55***	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62**	Viton

Note: *Replaces obsolete 10K56 **Replaces obsolete 10K29 ***Replaces obsolete 10K46 and 10K24

Impeller Option Code . . . No Adder Required

For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.

Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	**1¼ x 1½-6**	**1½ x 2-6**
	Diameter	**Diameter**	**Diameter**
K		6⅛	
G		5 15/16	5⅜
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

DRIVER

1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING

C = ½ HP F = 1½ HP J = 5 HP
D = ¾ HP G = 2 HP
E = 1 HP H = 3 HP

DRIVER: HERTZ/POLE/RPM

1 = 60 HZ, 2 pole, 3500 RPM
2 = 60 HZ, 4 pole, 1750 RPM
3 = 60 HZ, 6 pole, 1150 RPM
4 = 50 HZ, 2 pole, 2900 RPM
5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL

ST = Stainless Steel

PUMP SIZE

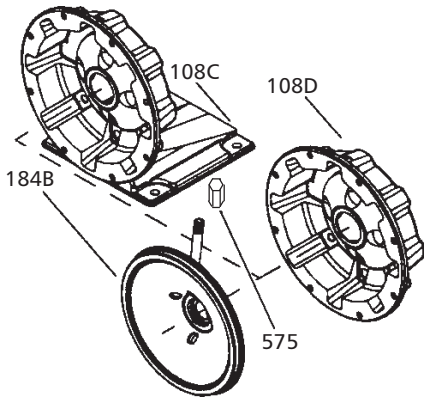
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

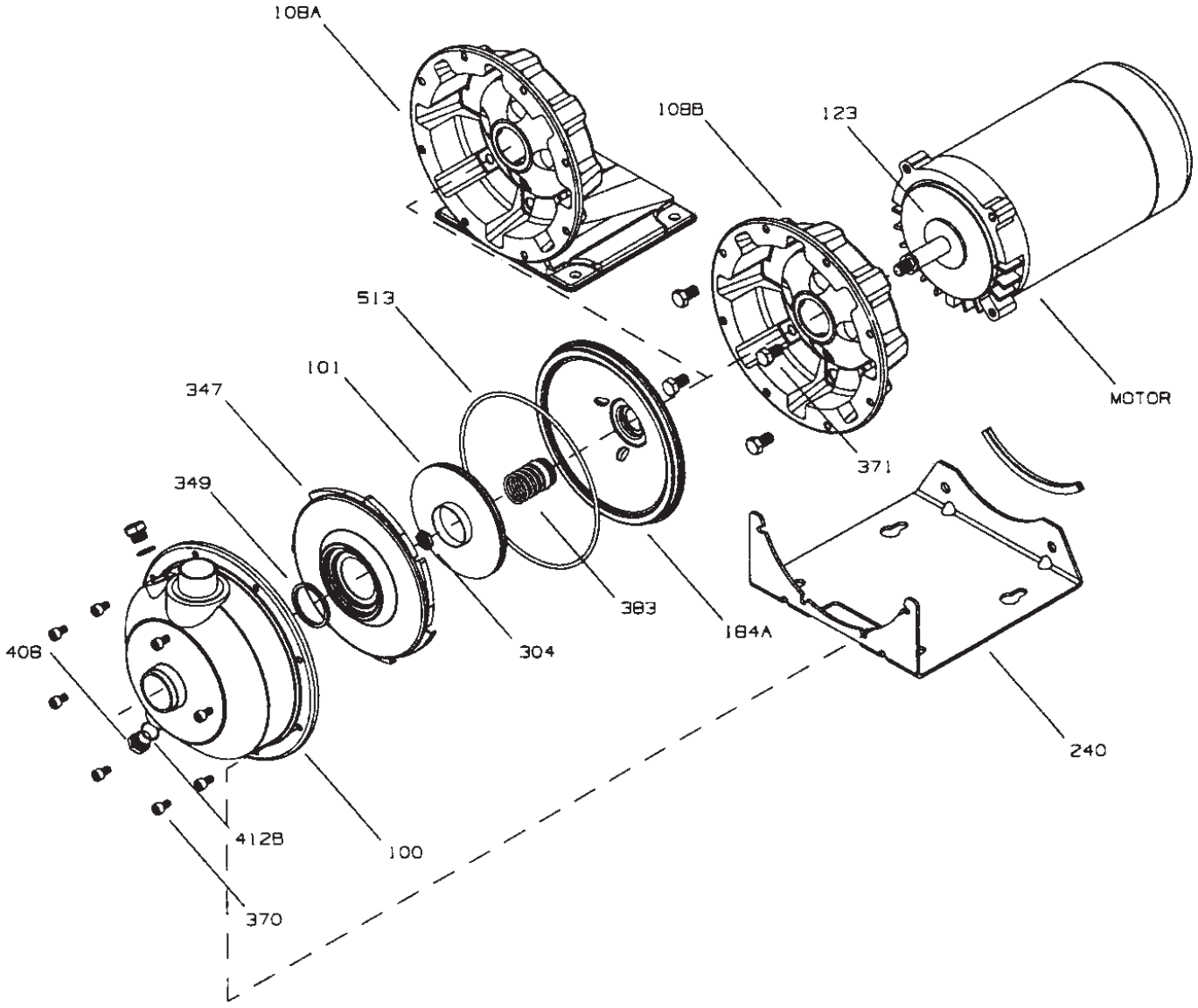
Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QTY.
100	Casing	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller		See Impeller chart on page 4			1
108A	Motor adapter with foot		1L80			1
108B	Motor adapter less foot		1L87			
108C	Motor adapter with foot & flush		1L334			
108D	Motor adapter less foot with flush		1L335			
123	Deflector	BUNA-N	5K7			1
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush		1L333			
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 1			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS



NOTE:
Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE:
Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1¼-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6 1/8	2L885		
G			5 15/16	2L700	5 3/8	2L702
H			5 1/2	2L699	5	2L701
A	6 1/8	2L47	5 1/4	2L48	4 3/4	2L49
B	5 3/4	2L44	5 1/16	2L54	4 5/8	2L58
C	5 3/16	2L46	4 7/8	2L53	4 3/8	2L57
D	4 3/4	2L42	4 5/8	2L52	4 1/16	2L56
E	4 7/16	2L45	4 1/4	2L51	3 5/8	2L55
F	4 1/16	2L59	3 7/8	2L50		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST	3ST
			ODP/TEFC	ODP/TEFC	ODP/TEFC
½	C	Repair #	2L45		
		Dia.	4 7/16		
		Imp. Code	E		
¾	D	Repair #	2L42	2L50	
		Dia.	4 3/4	3 7/8	
		Imp. Code	D	F	
1	E	Repair #	2L46	2L51	2L55
		Dia.	5 3/16	4 1/4	3 5/8
		Imp.Code	C	E	E
1½	F	Repair #	2L44	2L52	2L56
		Dia.	5 3/4	4 5/8	4 1/16
		Imp. Code	B	D	D
2	G	Repair #	2L47	2L53	2L57
		Dia.	6 1/8	4 7/8	4 3/8
		Imp. Code	A	C	C
3	H	Repair #	2L47	2L48	2L49
		Dia.	6 1/8	5 1/4	4 3/4
		Imp. Code	A	A	A
5	J	Repair #		2L700 / 2L885	2L702
		Dia.		5 15/16 / 6 1/8	5 3/8
		Imp. Code		G / K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST		3ST	
			ODP	TEFC/EXP	ODP	TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2L45	2L59				
		Dia.	4 7/16	4 1/16				
		Imp. Code	E	F				
¾	D	Repair #	2L42	2L45	2L50			
		Dia.	4 3/4	4 7/16	3 7/8			
		Imp. Code	D	E	F			
1	E	Repair #	2L46	2L42	2L51	2L50	2L55	
		Dia.	5 3/16	4 3/4	4 1/4	3 7/8	3 5/8	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2L44	2L46	2L52	2L51	2L56	2L55
		Dia.	5 3/4	5 3/16	4 5/8	4 1/4	4 1/16	3 5/8
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2L47	2L44	2L53	2L52	2L57	2L56
		Dia.	6 1/8	5 3/4	4 7/8	4 5/8	4 3/8	4 1/16
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2L47	2L47	2L48	2L54	2L49	2L58
		Dia.	6 1/8	6 1/8	5 1/4	5 1/16	4 3/4	4 5/8
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2L700 / 2L885		2L702	
		Dia.			5 15/16 / 6 1/8		5 3/8	
		Imp. Code			G / K		G	

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854	26.8/13.4	36	E08821	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854	14.0	40	E09821	11.89	44			
5	E10754	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873	2.6/1.3	19	E04876	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873	3.4/1.7	19	E05876	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873	4.2/2.1	22	E06876	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878	5.8/2.9	25	E07876	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874	6.9/3.3	39	E08876	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874	7.2/3.6	31	E09876	7.6/3.8	37			
5	E10774	7.2/14.4	50	E10876	6.2/12.4	48			

① For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS

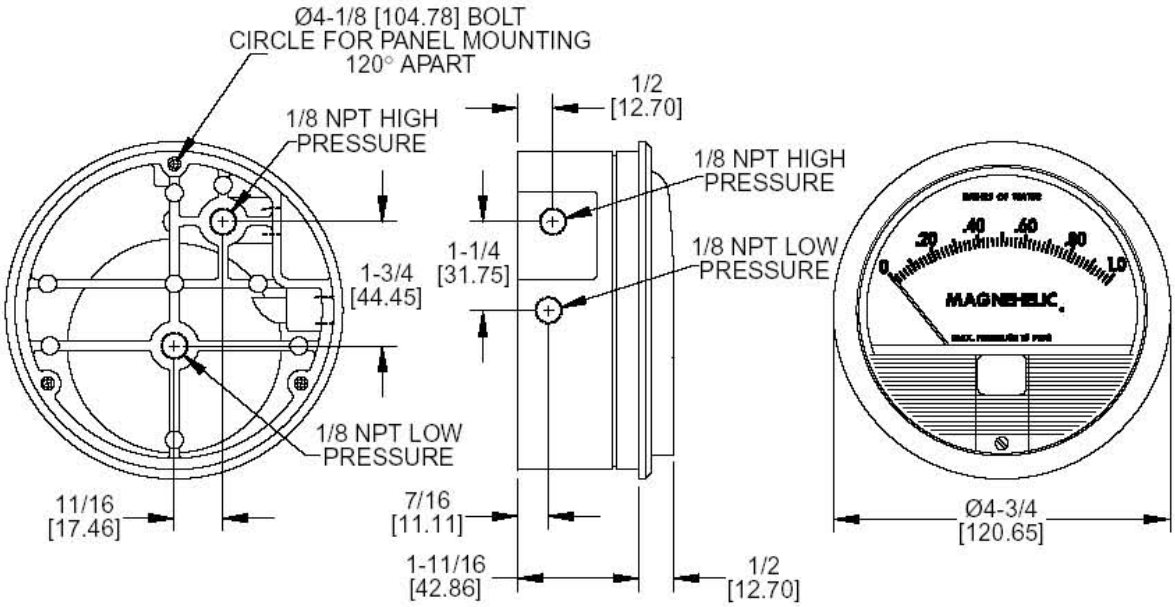
SPECIFICATIONS

Dimensions: 4-3/4″ dia. x 2-3/16″ deep.
Weight: 1 lb. 2 oz.
Finished: Baked dark gray enamel.
Connections: 1/8″ NPT high and low pressure taps, duplicated, one pair side and one pair back.
Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).
Pressure Rating: 15 PSI (0,35 bar)
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).
Standard gage accessories include two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



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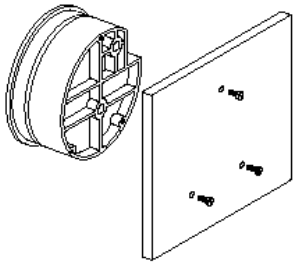
MAGNEHELIC® INSTALLATION

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines my be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

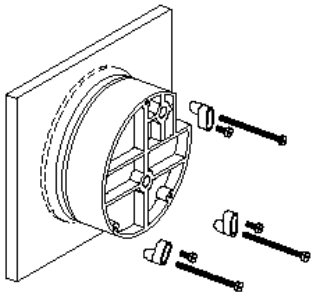
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8″ dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16″ dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4″-2″ pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8″ pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4″ O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warrenty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

Trouble Shooting Tips:

•*Gage won't indicate or is sluggish.*

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F, order gage with low temperature, (LT) option.

•Pointer stuck-gage can't be zeroed.

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.
3. **Metallic particles clinging to magnet and interfering with helix movement.**
4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

Printed in U.S.A. 4/01 FR# 12-440212-00 Rev. 3

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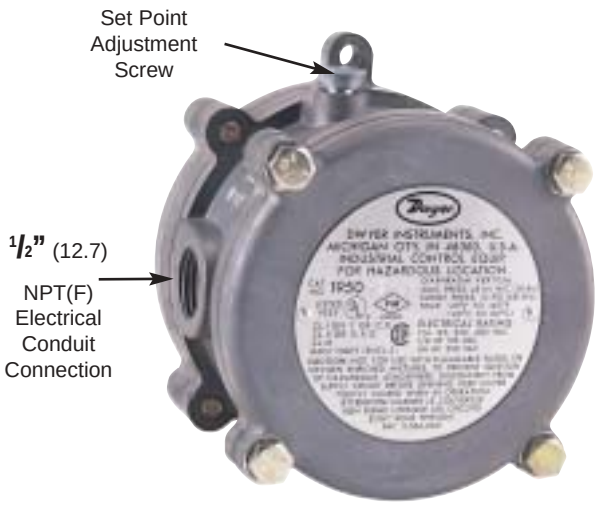
QED p/n EZ-LOWP - Dwyer p/n 1950-1

Kit Includes Pressure Switch, Fitting, Barb & Tubing

Series 1950 – Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Dwyer Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION

For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

NOTE: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6
Model Number	**Operating Range: PSI**	**Approximate Dead Band**	
		Min. Set Point	Max. Set Point
1950P-2	0.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

PHYSICAL DATA

Temperature Limits: -40° to 140°F (-40° to 60°C); 1950P-8, -15, -25, -50: 0° to 140°F (-17.8° to 60°C); 1950-02: - 30° to 130°F (-34.4° to 54.4°C).
Rated Pressure: 1950: 45 in. w.c. (0.1 bar); 1950P: 35 psi (2.4 bar); 1950P-50 only: 70 psi (4.8 bar).
Maximum Surge Pressure: 1950: 10 psi (0.7 bar); 1950P: 50 psi (3.4 bar); 1950P-50 only: 90 psi (6.2 bar).
Pressure Connections: 1/8″ NPT(F).
Electrical Rating: 15A, 125, 250, 480 volts, 60 Hz. AC Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. AC.
Wiring Connections: 3-screw type; common, normally open and normally closed.
Conduit Connections: 1/2″ NPT(F).
Set point adjustment: Screw type on top of housing, field adjustable.
Housing: Anodized cast aluminum.
Diaphragm: Molded fluorosilicone rubber, 02 model: silicone on Nylon.
Calibration Spring: Stainless Steel
Installation: Mount with diaphragm in vertical position.
Weight: 3 1/4 lbs (1.5 kg), 02 model; 4 lbs, 7 oz. (2 kg).

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

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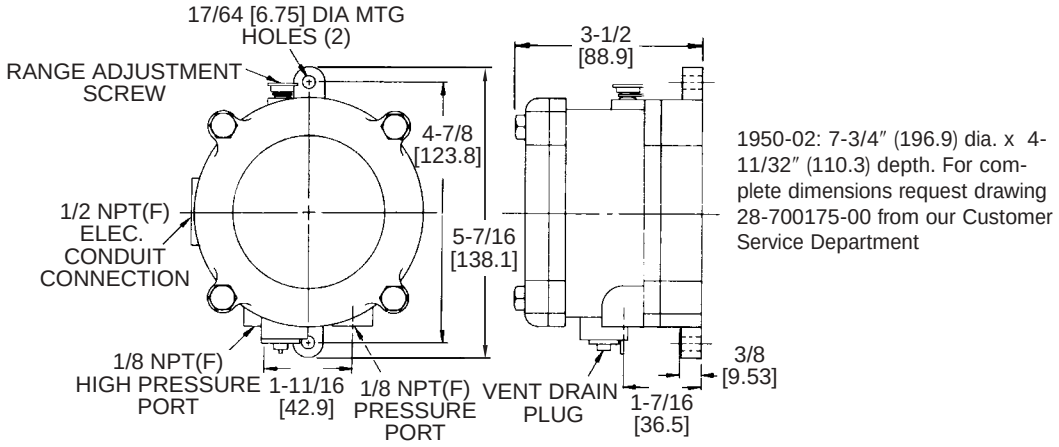
Series 1950 – Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4″ O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8″ NPT(F) pressure ports as noted below:

A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked “COM” (common), “NO” (norm open), “NC” (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counter-clockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a “T” assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.

 Printed in U.S.A. 6/01 FR# 26-440332-00 Rev. 9

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Form 237
Sheet P/N 7801165
Rev. B

Warrick®
Series M Mechanical Tilt Float Switch
Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)

Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Tether-Weight (Fig 2)

Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Notes:

1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.

2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.

3. When using Tether Weight - Place the tension-band over the cord prior to installation.

Determine tether point using charts below as a reference

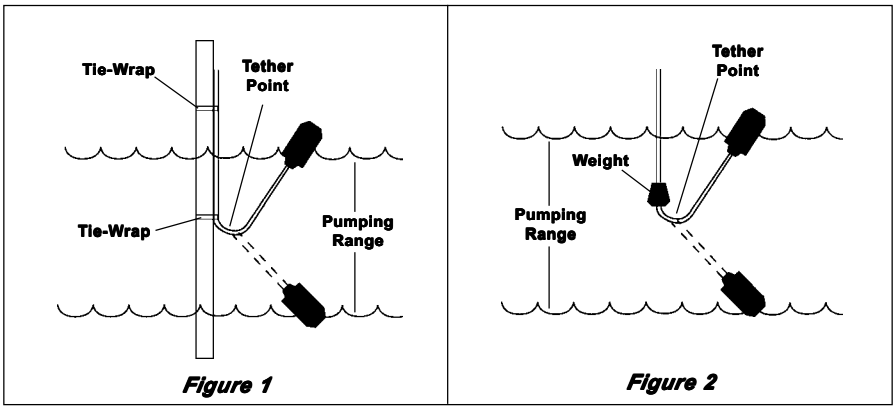
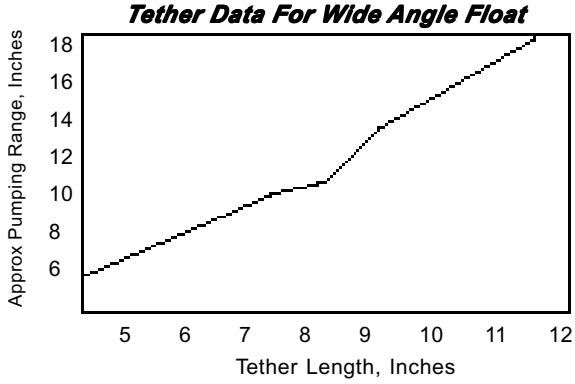
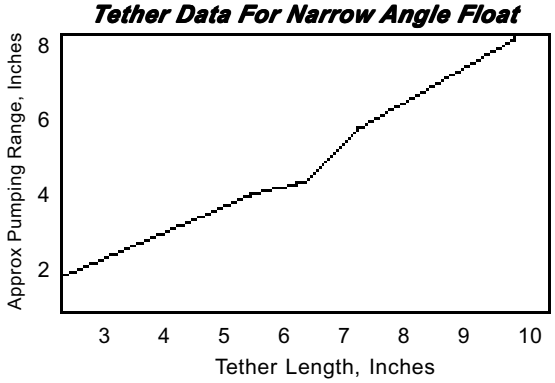


Figure 1 *Figure 2*

Tether Data For Wide Angle Float



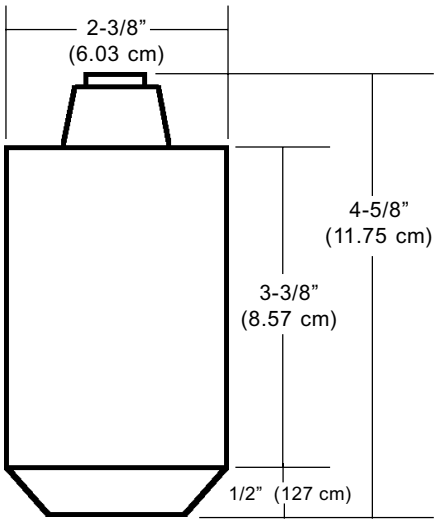
Tether Data For Narrow Angle Float



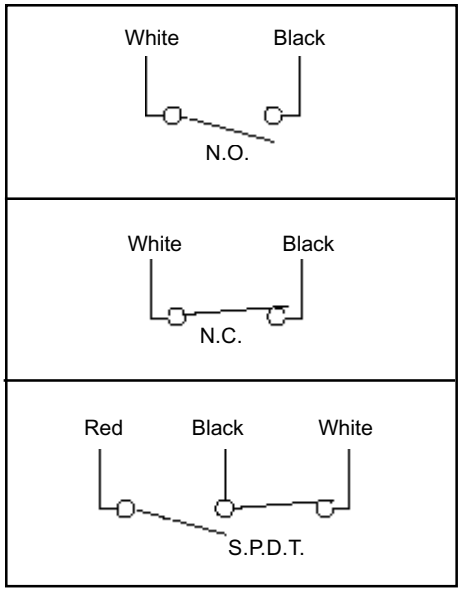
Notes:

1. Narrow angle pumping range is approximately 2 Ft. to 8 Ft.
2. Wide angle pumping range is approximately 5 Ft. to 18 Ft.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applica tions according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580

CT Series

High Pressure Centrifugal Pumps
½ - 2½ HP
Heads to 140 Feet
Capacities to 95 GPM

MYERS CT SERIES LINE OF HIGH PRESSURE CENTRIFUGAL PUMPS PROVIDES QUALITY AT A COMPETITIVE PRICE. The complete line of ½ to 2½ HP units provide strong pressures up to 140 feet and flows up to 95 gpm.

The rugged cast iron body construction is available with either a corrosion resistant composite or brass impeller. The brass impeller unit is equipped with a high temperature, viton seal for more demanding applications. The heavy duty motor features a double ball bearing, 50° C ambient, dual voltage design for dependable service. The compact, back pullout design provides easy installation and serviceability.

The quality features of the CT series will provide dependable service for a wide variety of applications.

SPECIFICATIONS

HP	Catalog No. Composite Impeller	Catalog No. Brass Impeller	Pipe Tapping Sizes Suction (NPT)	Pipe Tapping Sizes Discharge (NPT)	Motor Voltage	Phase	Approx. Wt. Lbs.
½	CT05	CT05B	1¼"	1"	115/230	1	30
	CT053	CT05B3	1¼"	1"	208/230/460	3	30
¾	CT07	CT07B	1¼"	1"	115/230	1	32
	CT073	CT07B3	1¼"	1"	208/230/460	3	32
1	CT10	CT10B	1¼"	1"	115/230	1	35
	CT103	CT10B3	1¼"	1"	208/230/460	3	35
1½	CT15	CT15B	1¼"	1"	115/230	1	40
	CT153	CT15B3	1¼"	1"	208/230/460	3	40
2	CT20	CT20B	1½"	1¼"	115/230	1	57
	CT203	CT20B3	1½"	1¼"	208/230/460	3	57
2½	CT25	CT25B	2"	1½"	115/230	1	62
	CT253	CT25B3	2"	1½"	208/230/460	3	62

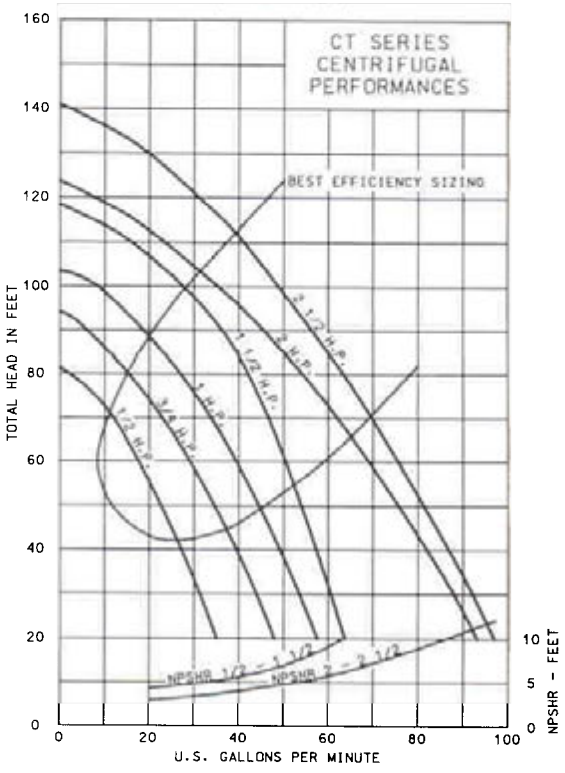
ADVANTAGES BY DESIGN

- Heavy duty cast iron construction.
- Back pull-out design.
- Dependable double ball bearing motor
- Continuous duty rating motor.
- Choice of brass or composite impeller.
- Brass impeller pumps rated 212° F.
- Composite impeller pumps rated 140° F.
- Maximum working pressure of 125 psi.
- CSA listed.

Applications

- Booster service
- Irrigation
- Circulating
- Cooling towers
- Air conditioning
- Liquid transfer
- Sprinkling systems
- General industrial service

PUMP PERFORMANCE



WHERE INNOVATION MEETS TRADITION

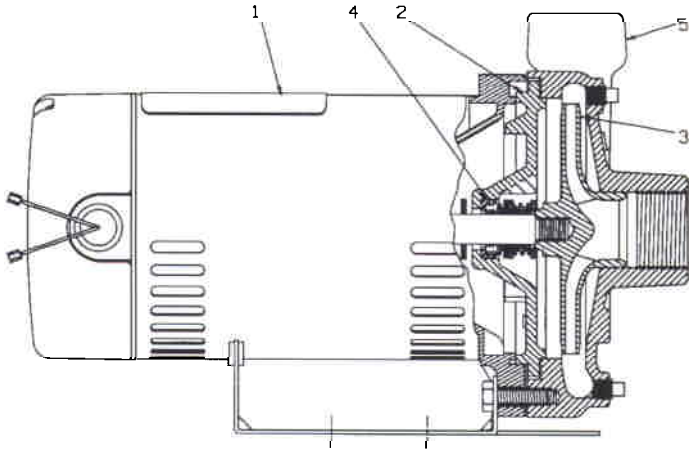
Myers®
Pentair Pump Group

ISO 9001 Registered Quality System

CT Series

High Pressure Centrifugal Pumps
½ - 2½ HP
Heads to 140 Feet
Capacities to 95 GPM

1. MOTOR
- NEMA standard
- Double ball bearing
- Open drip proof
- 60 Hz, 3450 rpm
- Stainless steel shaft
- Single phase with built-in overload protection
- Three phase require overload protection in starter unit
- Non-overloading
- Continuous duty
- Strong capacitor start design

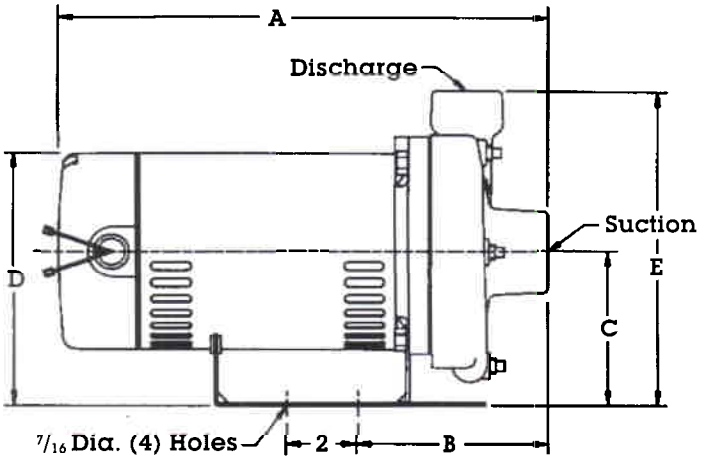


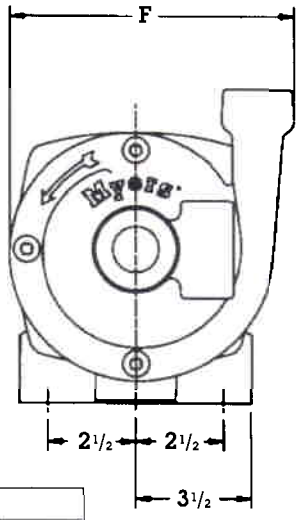
2. SEAL PLATE
- Heavy duty cast iron for dependable service and long life

3. IMPELLER
- Reinforced composite for applications to 140° F.
- Threaded SST insert on composite impellers
- Brass for applications to 212° F.
- Enclosed design for high efficiencies
- Balanced for smooth operation

4. MECHANICAL SEAL
- Standard carbon/ceramic faces, Buna elastomers, 300 series SST components (standard for pumps with composite impellers)
- High temperature carbon/ceramic faces, viton elastomers, 300 series SST components (standard for pumps with brass impellers)

5. CASING
- Heavy duty cast iron construction
- Back pull-out design
- Discharge can be rotated in four positions
- Tapped openings for priming, venting and draining.
- Vertical discharge standard





HP	Dimensions, inches							
	A	B	C	D	E	F	Suct.	Disch.
½	13⅞	5½	4⅜	7¼	9	8	1¼	1
¾	14⅝	5½	4⅜	7¼	9	8	1¼	1
1	15⅜	5½	4⅜	7¼	9	8	1¼	1
1½	15⅜	5½	4⅜	7¼	9	8	1¼	1
2	16½	6¼	4½	7½	9½	8⅞	1½	1¼
2½	16½	6¼	4½	7½	9½	8⅞	2	1½

K3807 3/01
Printed in U.S.A.

Myers®
Pentair Pump Group

F. E. Myers, 1101 Myers Parkway, Ashland, Ohio 44805-1969
419/289-1144, FAX: 419/289-6658, www.femyers.com

Myers (Canada), 269 Trillium Drive, Kitchener, Ontario N2G 4W5
519/748-5470, FAX: 519/748-2553

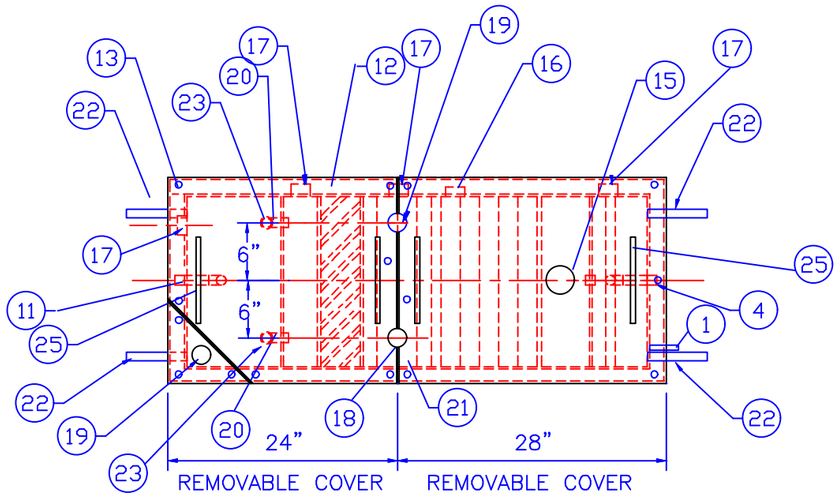
GENERAL SPECIFICATIONS

NO. REQ'D: (1)
CAPACITY: 100 GALLONS
SPILL CAPACITY : 40 GALLONS
TYPE: RECTANGULAR, HTC, ABOVEGROUND, SINGLEWALL
MATERIAL: MILD CARBON STEEL
APPROX. WEIGHT: 700 LBS.
FLOW RATE: 5 GPM
GAUGE:
SHELL– 10 GA
HEADS– 10 GA
SURFACE PREP:
SSPC NO.10 BLAST ALL INTERIOR SURFACES
SSPC NO.6 BLAST ALL EXTERIOR SURFACES

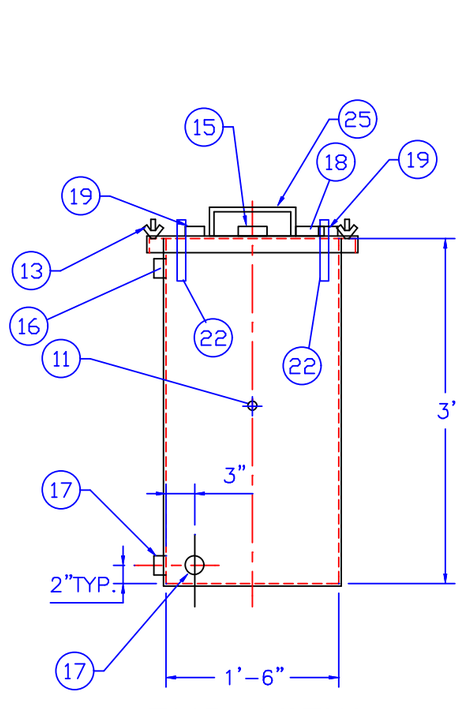
COATING:	**MATERIAL**	**THICKNESS**
EXTERIOR–	FINISH PAINT WHITE	(3 MILS)
INTERIOR–	POLYURETHANE	(15 MILS)

CONSTRUCTION:
BUTT FIT & WELD ALL CORNERS IN & OUT

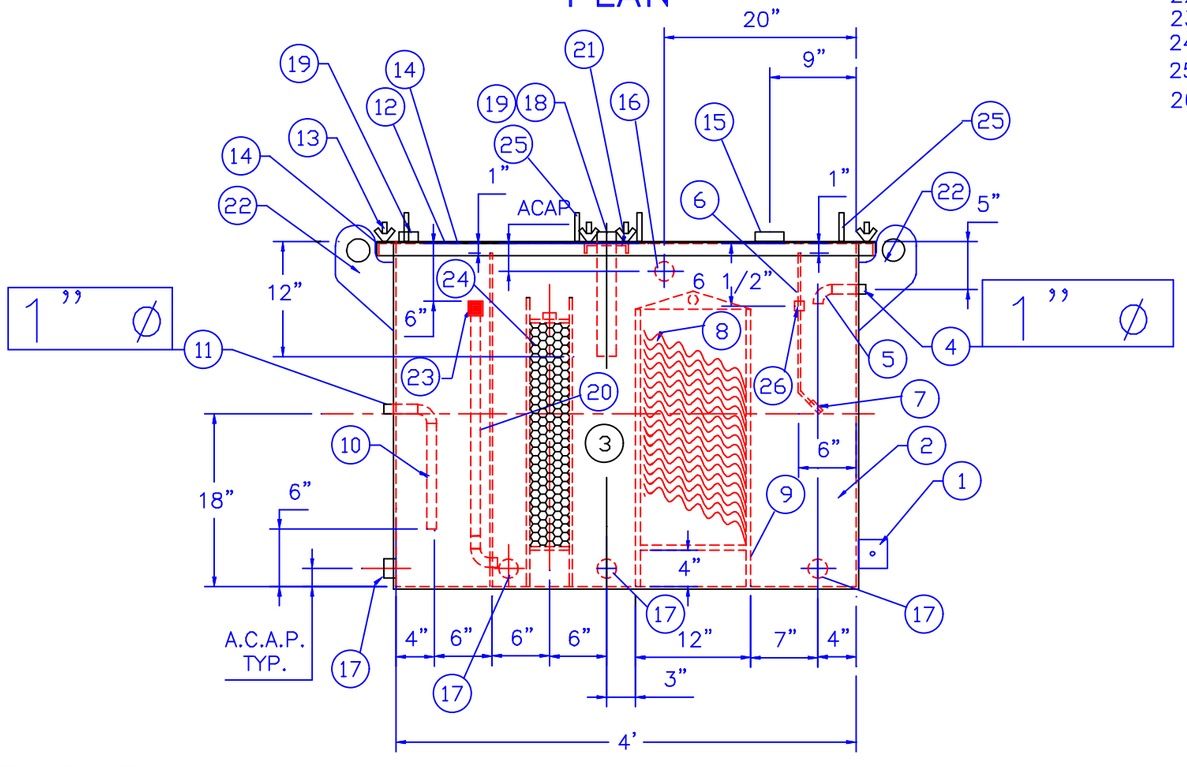
NOTES:
1. ALL INTERNAL MATERIAL IS 10 GA
2. ALL FITTINGS MUST SHIP W/ STEEL PLUGS INSTALLED
3. LIFTING LUGS DO NOT HAVE REINFORCING PLATES



PLAN



END VIEW



ELEVATION

PROVIDED EQUIPMENT

1. 3"X3"X1/4" FLAT W/ 1/2"ø HOLE DRILLED IN CENTER (GROUNDING LUG)
2. SEDIMENT CHAMBER
3. OIL WATER SEPARATOR CHAMBER
4. THREADED INLET
5. PVC INLET ELBOW PIPING
6. VELOCITY HEAD DIFFUSION BAFFLE – 10GA
7. WEAR PLATE – 1/4"
8. REMOVABLE PARALLEL CORRUGATED PLATE COALESCER (GALVANIZED PLATES) 1" PLATE SPACING
9. SLUDGE BAFFLE – 10GA
10. PVC OUTLET DOWNCOMER PIPE
11. THREADED OUTLET
12. (2) PIECE COVER – 10 GA
13. NUTS & BOLTS W/ LARGE WING NUTS–TYP. (CORROSION RESISTANT)
14. GASKET MATERIAL (FOR EACH REMOVABLE COVER)
15. 3"ø NPT (CLEAN–OUT)
16. 2"ø NPT (FITTING FOR VENT)
17. 2"ø HALF COUPLING (DRAIN) W/ STEEL PLUG
18. 2"ø FULL COUPLING W/ 2"ø INTERNAL PVC PIPE
19. 2"ø HALF COUPLING (FITTING FOR LEVEL SENSOR)
20. 1"ø 90 ° ELBOW W/ 1" HALF COUPLING ON TOP WITH PVC RISER PIPE
21. 7 GA BRACING ACROSS TOP OF TANK W/ SENSOR & PUMP–OUT FITTINGS
22. LIFTING LUGS
23. 1"ø FERNCO COUPLING
24. 6" THICK COALESCER MATERIAL
25. HANDLES PER H.T. STANDARD
26. 1"ø COUPLING W/ PLUG

REVISIONS

Highland Tank

100 GALLON OIL WATER SEPARATOR
RECTANGULAR, HTC, SINGLE WALL

CUSTOMER:

PROJECT:

QUOTE NO:

SCALE:	DATE:	DWG. BY:	CHK'D BY	DWG. NO.:
3/4"=1'–0"				100 RHTCSW

BGT

ITT

Residential Water Systems

Goulds Pumps

GT IRRI-GATOR™ Self-Priming① Centrifugal Pumps – 60 Hz

New base on 1½ – 3 HP models.

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

FEATURES

① ■ **Self-Priming Design:** Once pump is primed, filled with water, it never needs priming again even if water level drops below the end of the suction pipe. Pumping resumes once the water level rises above the end of the suction pipe.

■ **Serviceable:**
- Back pullout design allows disassembly of pump for service without disturbing piping.
- Two compartment motor for easy access to motor wiring and replaceable components.

■ **Diffuser (Guidevane):** Bolt down diffuser provides positive alignment with impeller. Diffuser has stainless wear ring for extended performance in abrasive conditions. F.D.A. compliant, injection molded, food grade, glass filled Lexan® for durability and abrasion resistance.

■ **Impeller:** F.D.A. compliant, glass filled Noryl®. Corrosion and abrasion resistant.

■ **Corrosion Resistant:** Electro-coat paint process is applied inside and out, then baked on.

■ **Casing:** Cast iron construction. Four (4) bolt, back pull-out design. Tapped openings provided for vacuum gauge and casing drain.

■ **Powered for Continuous Operation:** Pump ratings are within the motor manufacturer's recommended working limits. Can be operated continuously without damage.

■ **Mechanical Seal:** Carbon/ceramic faces, BUNA elastomers. 300 series stainless steel metal parts. Pump design prevents the seal from running dry.

APPLICATIONS

Specifically designed for the following uses:

- Lawn sprinkling
- Irrigation
- Air conditioning systems
- Heat pumps
- Water transfer
- Dewatering

SPECIFICATIONS

Pump:

- Pipe connections: 1½" NPT suction 1½" NPT discharge
- Capacities: to 110 GPM at 5 foot suction lift.
- Heads: to 128 feet.
- Reprime capabilities: to 25 feet suction lift.
- Maximum working pressure: 125 PSIG.
- Maximum water temperature: 140° F (60° C).
- Rotation: clockwise when viewed from motor end.

Motor:

- NEMA standard open drip proof.
- 60 Hz, 3500 RPM.
- Stainless steel shaft.
- Single phase: ¾–1½ HP, 115/230 V; 2 and 3 HP, 230 V only. Built-in overload with automatic reset.
- Three phase: 230/460 V. Overload protection must be provided in starter unit. Starter and heaters (3) must be ordered separately.
- Optional TEFC motors are available. See price book for order numbers.

AGENCY LISTINGS

Canadian Standards Association

Underwriters Laboratories

Goulds Pumps is ISO 9001 Registered.

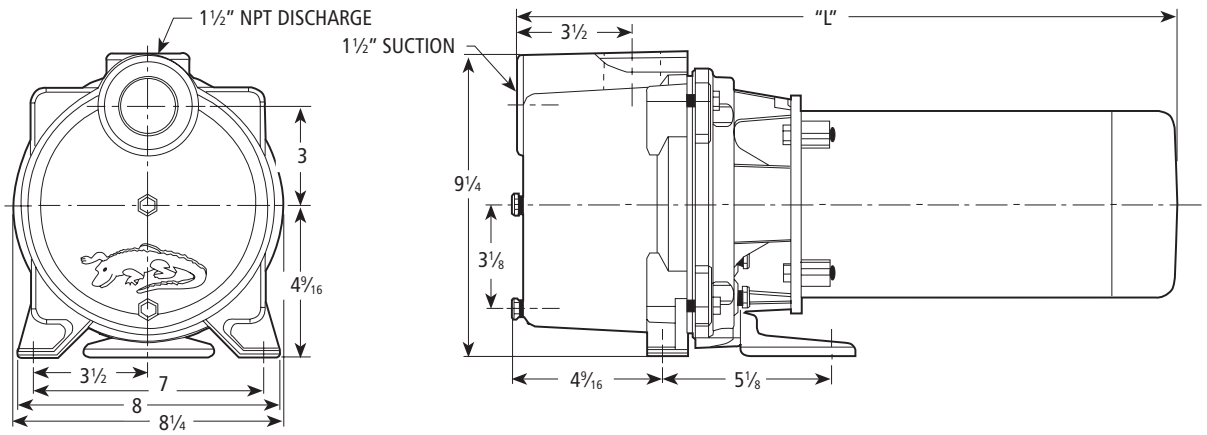
STANDARD ODP MODELS

Model	HP	Phase
GT07	¾	
GT10	1	
GT15	1½	1
GT20	2	
GT30	3	
GT073	¾	
GT103	1	
GT153	1½	3
GT203	2	
GT303	3	

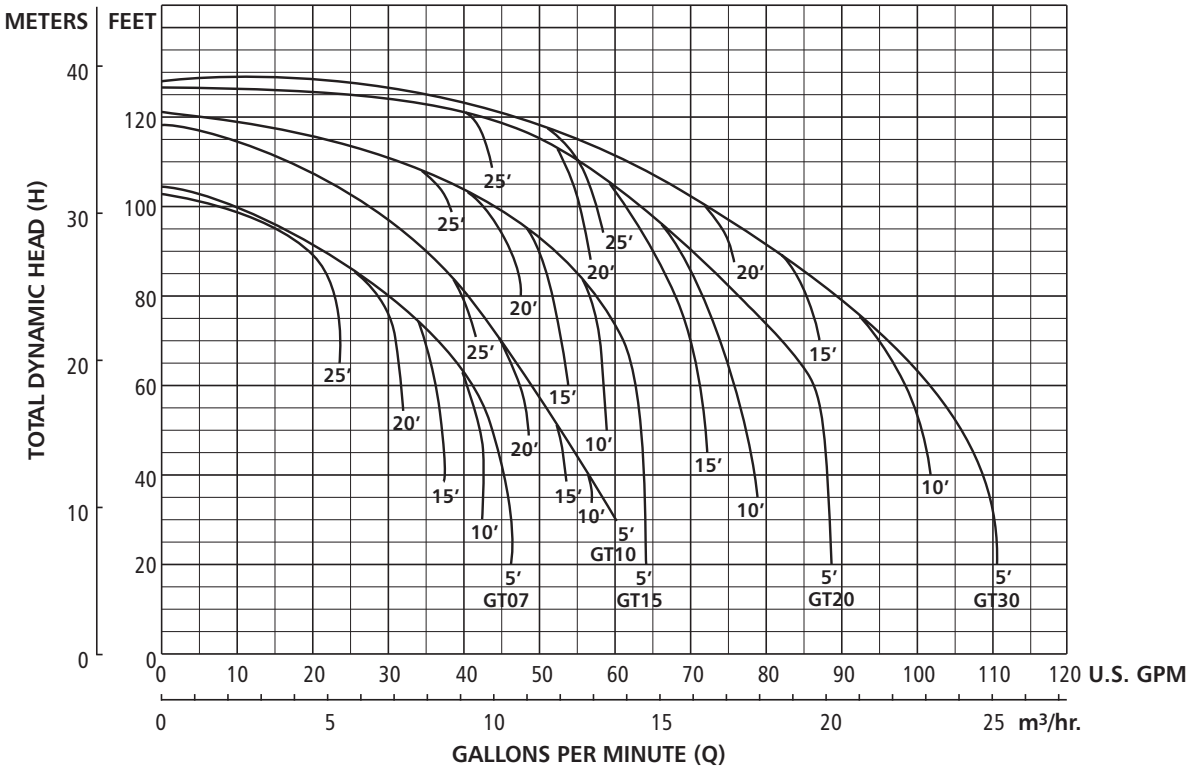
DIMENSIONS AND WEIGHTS

Model	GT07	GT10	GT15	GT20	GT30	GT073	GT103	GT153	GT203	GT303
HP	¾	1	1½	2	3	¾	1	1½	2	3
Length "L"	19 3/16	19 7/8	21 3/16	20 9/16	21 11/32	19	19 3/4	20 1/16	20 13/16	21 3/16
Width	8¼									
Height	9¼									
Weight (lbs.)	48	52	60	65	76	49	52	55	69	71
Phase	Single					Three				

(All dimensions are in inches and weights in lbs. Do not use for construction purposes.)



PERFORMANCE CURVE



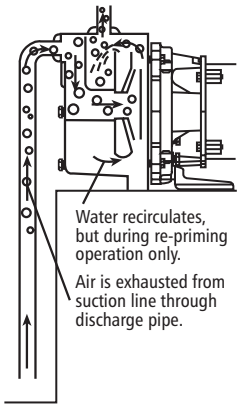
Single and three phase have same performance.

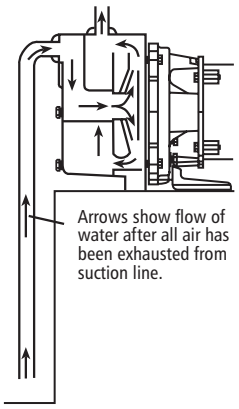
PERFORMANCE RATINGS

Model	PSI Discharge Pressure	Suction Lift in Feet				
		5	10	15	20	25
GT07/ GT073	20	44	41	36	31	24
	30	34	31	26	22	14
	40	10	4	0	0	0
GT10/ GT103	20	53	51	49	46	41
	30	43	41	38	36	32
	40	29	22	16	8	0
GT15/ GT153	20	63	59	54	49	39
	30	60	55	51	46	37
	40	45	38	33	20	14
GT20/ GT203	20	86	77	70	59	46
	30	80	72	67	57	44
	40	65	60	57	50	43
GT30/ GT303	20	105	100	88	76	60
	30	92	90	84	75	57
	40	73	67	62	55	50

Performance ratings are in GPM.

SELF-PRIMING (AFTER INITIAL PRIME)①



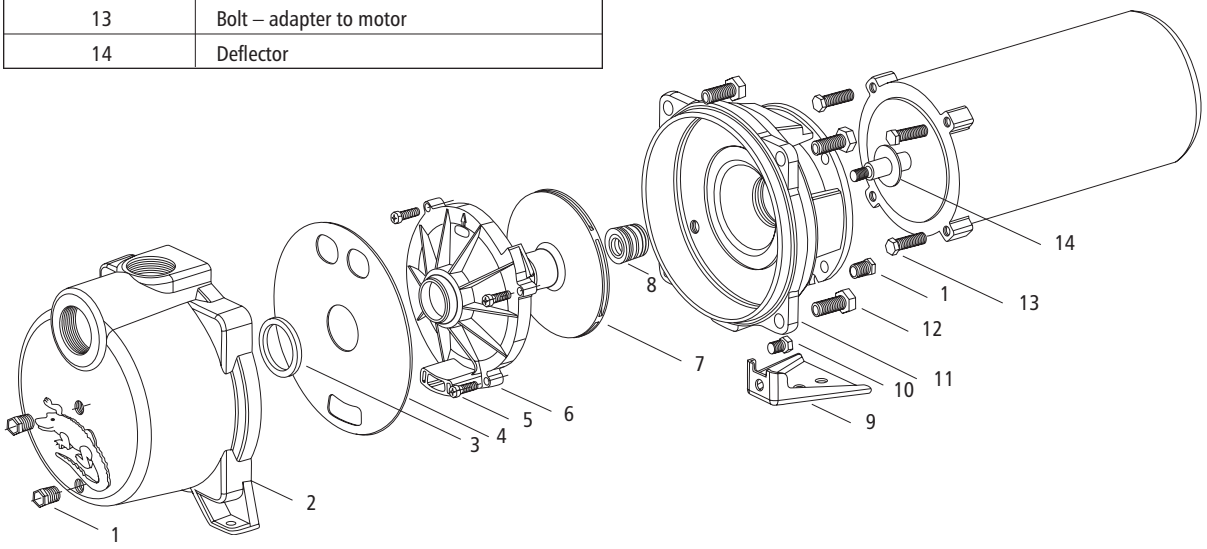


ITT

Residential Water Systems

COMPONENTS

Item No.	Description
1	Plug – ¼" NPT
2	Casing
3	Seal ring – diffuser
4	Diaphragm
5	Machine screw
6	Diffuser
7	Impeller
8	Mechanical seal
9	Foot
10	Bolt – foot to adapter
11	Motor adapter
12	Bolt – casing to adapter
13	Bolt – adapter to motor
14	Deflector



GOULDS PUMPS

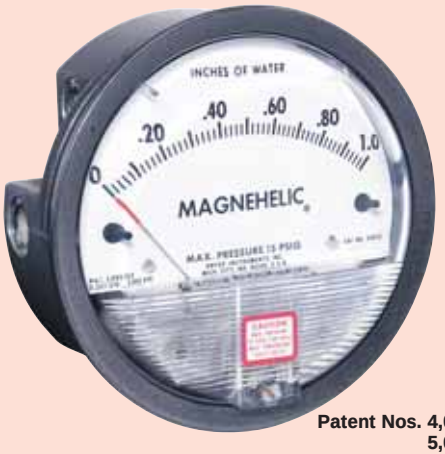
BGT June, 2008

Engineered for life

Series 2000

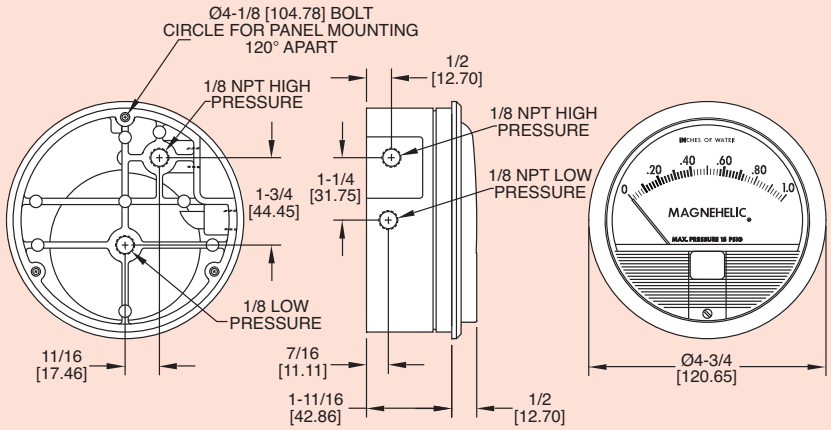
Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Patent Nos. 4,030,365
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

Flush ...Surface...or Pipe Mounted

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional **A-610** Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1-1/4˝ - 2˝ pipe. Although calibrated for vertical position, many ranges above 1˝ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16˝ hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4-13/16˝ hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20˝ Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4˝ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8˝ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8˝ NPT plugs for duplicate pressure taps, two 1/8˝ pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable Signal Flag
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

A-432 Portable Kit
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16˝ I.D. rubber tubing, standhang bracket and terminal tube with holder.

A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4˝ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

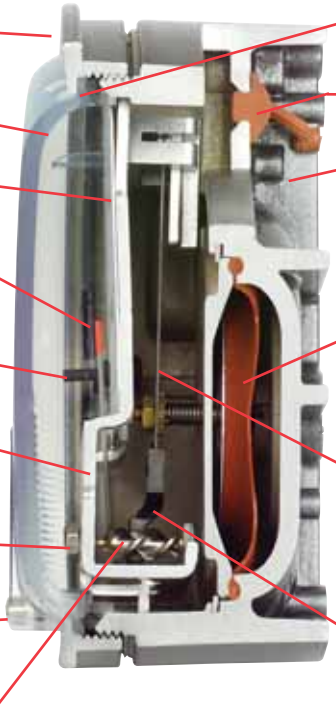
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Dual Scale English/Metric Models		
Model Number	**Range, In. W.C.**	**Range, Pa or kPa**
2000-OD	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® GAGE — MODELS AND RANGES

The models below will fulfill most requirements. Page V also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2150	0-150

Model Number	Range Zero Center Inches of Water
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model Number	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range in W.C. Velocity, F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2010AV	0-10/2000-12500

For use with pitot tube.

Model Number	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-25MM	0-25
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100

Zero Center Ranges

2300-20MM†	10-0-10

Model Number	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300

Zero Center Ranges

2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model Number	Range,Pascals
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750

Model Number	Range,Pascals
Zero Center Ranges	
2300-60PA	30-0-30
2300-100PA	50-0-50
2300-120PA	60-0-60
2300-250PA	125-0-125
2300-500PA	250-0-250

Model Number	Range, Kilopascals
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-3KPA	1.5-0-1.5

Accessories
A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-605, Air Filter Kit
A-610, Pipe Mount Kit

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator)

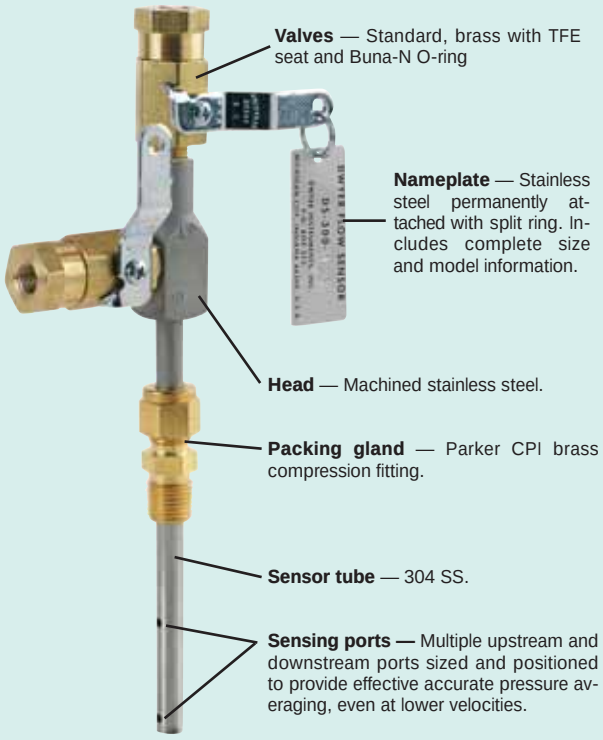
Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

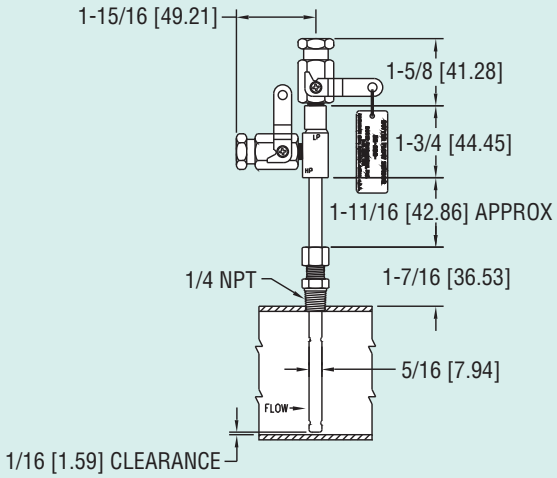
†These ranges calibrated for vertical scale position.
• Accuracy +/-3%. • • Accuracy +/-4%

1011R01-0298P

Series DS In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters





In-Line Flow Sensors are averaging Pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer® Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.

Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer® flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

The Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® gage kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1″ to 10″.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Select model with suffix which matches pipe size

DS-300-1″
DS-300-1-1/4″
DS-300-1-1/2″
DS-300-2″
DS-300-2-1/2″
DS-300-3″
DS-300-4″
DS-300-6″
DS-300-8″
DS-300-10″

DS-400-6″
DS-400-8″
DS-400-10″
DS-400-12″
DS-400-14″
DS-400-16″
DS-400-18″
DS-400-20″
DS-400-24″

Options and Accessories

A-160 Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi

A-161 Brass Bushing, 1/4″ x 3/8″

DS-300 Less Valves. To order, add suffix **-LV**

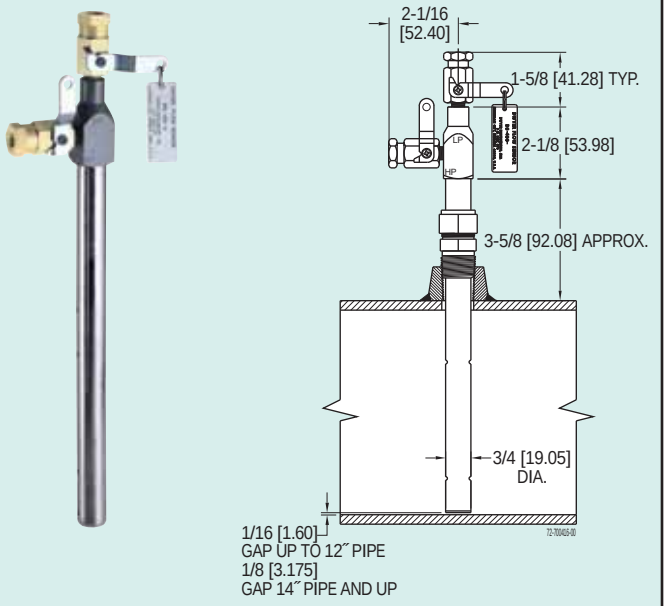
How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2˝ pipe would be a Model No. DS-300-2˝.

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS-400

GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1˝	1-1/4˝	1-1/2˝	2˝	2-1/2˝	3˝	4˝	6˝	8˝	10˝
2	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	4.8 19.0 50.0	8.3 33.0 90.5	11.5 42.0 120.0	20.5 65.0 210.0	30 113 325	49 183 510	86 330 920	205 760 2050	350 1340 3600	560 2130 6000
5	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	7.7 30.0 83.0	14.0 51.0 142.0	18.0 66.0 190.0	34.0 118.0 340.0	47 178 610	78 289 820	138 510 1600	320 1200 3300	560 2150 5700	890 3400 10000
10	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	11.0 41.0 120.0	19.0 72.0 205.0	25.5 93.0 275.0	45.5 163.0 470.0	67 250 740	110 410 1100	195 725 2000	450 1690 4600	800 3040 8100	1260 4860 15000
25	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	18.0 63.0 185.0	32.0 112.0 325.0	40.5 155.0 430.0	72.0 255.0 760.0	108 390 1200	173 640 1800	310 1130 3300	720 2630 7200	1250 4860 13000	2000 7700 22000
50	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	25.0 90.0 260.0	44.0 161.0 460.0	57.5 205.0 620.0	100.0 360.0 1050.0	152 560 1700	247 900 2600	435 1600 4600	1000 3700 10000	1800 6400 18500	
100	Water (GPM) Air @ 14.7 PSIA (SCFM) Air @ 100 PSIG (SCFM)	36.5 135.0 370.0	62.0 230.0 660.0	82.0 300.0 870.0	142.0 505.0 1500.0	220 800 2300	350 1290 3600	620 2290 6500	1500 5000 15000		

Model A-471 Portable Kit

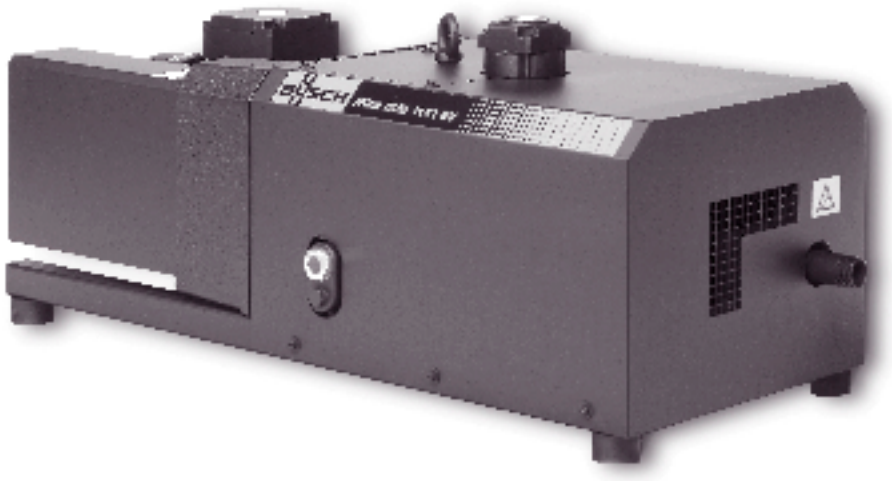
The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5˝ w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32 to 200°F (0 to 93.3°C). Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic® gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1-1/4˝ - 2˝ horizontal or vertical pipe.

For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 8 and 9 for complete information on the Capsuhelic® gage.

CAPSUHELIC® GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

Klauen-Vakuumpumpen
Rotary claw vacuum pumps
Pompes à vide à becs rotatifs

Mink MM 1104 - 1142 BV
Mink MM 1324 - 1322 AV



MM 1142 BV

Mink MM sind Klauen-Vakuumpumpen, die speziell für industrielle Anwendungen entwickelt wurden, bei denen konstantes Vakuum, hohes Saugvermögen und gleichzeitig eine völlig Öl freie Verdichtung gefordert werden.
Diese Vakuumpumpen arbeiten berührungsfrei: Es werden keine Betriebsmittel, wie Öl oder Wasser für den Verdichtungsvorgang benötigt.

Mink MM rotary claw vacuum pumps were developed especially for use in industrial applications where constant vacuum, high suction capacity and totally oil-free compression are required.
These vacuum pumps operate contact-free: neither oil nor water is needed for the compression process.

Les Mink MM sont des pompes à vide à becs rotatifs spécialement développées pour des applications industrielles. Elles procurent un vide constant, une capacité de pompage élevée au travers d'une compression sèche totalement exempte d'huile. Ces pompes à vide fonctionnent sans entretien particulier: la compression est réalisée sans aucun fluide d'étanchéité interne tel que de l'huile ou de l'eau.

Wartungsfrei
Durch die berührungsfreie Verdichtung entsteht keine Reibung und somit kein Verschleiß. Es müssen keine Verschleißteile kontrolliert oder ausgetauscht werden. So entfällt zum Beispiel der Kohleschieberwechsel.

Maintenance-free
Because of the non-touching operation of the pump no wear takes place.
No maintenance work such as checking or replacing wearing parts. For example, no replacement of carbon vanes necessary.

Sans entretien
La compression sans contact, donc sans frottement, n'induit aucune usure. Il n'est pas nécessaire de contrôler ou d'échanger des pièces d'usure, comme par exemple des palettes en graphite.

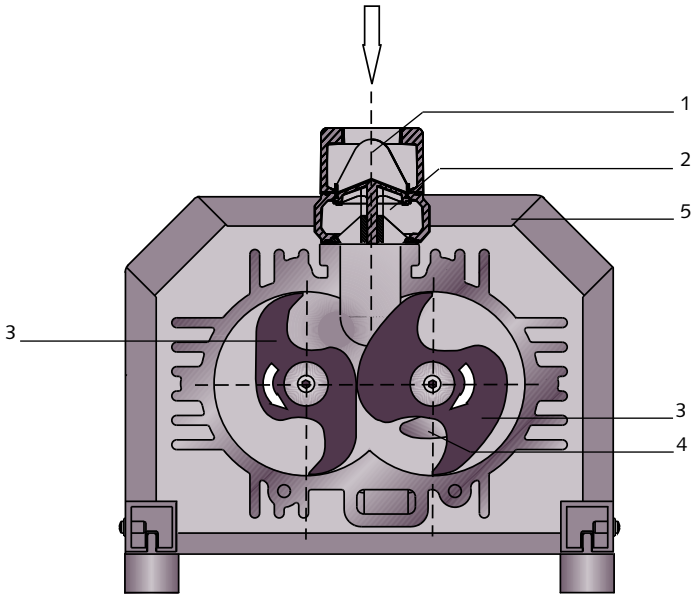
Wirtschaftlich
Durch den guten Wirkungsgrad im Vergleich zu anderen Vakuumprinzipien ist eine hohe Energieeinsparung möglich. Durch die Reduzierung von Wartungsarbeiten entfallen Stillstandszeiten und Kosten für Verschleißteile und Betriebsmittel.

Economical
The very high efficiency of the vacuum pumps compared with conventional pumps results in considerable energy savings.
Costs are further decreased through reduced down time and savings on wearing parts and operating fluids.

Economique
Un rendement élevé par rapport aux autres systèmes de vide permet des économies d'énergie substantielles. Un entretien minimal réduit les temps d'arrêt et ainsi les coûts pour pièces d'usure et fluide d'étanchéité.

Klauen-Vakuumpumpen
Rotary claw vacuum pumps
Pompes à vide à becs rotatifs

Funktionsprinzip
Principle of operation
Principe de fonctionnement



1 Saugflansch
2 Rückschlagventil
3 Klauen
4 Gasaustritt
5 Schalldämmhaube

1 Inlet flange
2 Non-return valve
3 Claws
4 Gas outlet
5 Acoustic enclosure

1 Bride d'aspiration
2 Clapet anti-retour
3 Becs
4 Refoulement
5 Capot d'insonorisation

Funktionsprinzip und Arbeitsweise

Zwei Klauen drehen sich gegenläufig in einem Gehäuse. Durch die spezielle geometrische Form der Klauen wird angesaugte Luft im Inneren der Vakuumpumpe verdichtet. Die Luft wird über den Saugflansch (1) angesaugt, im Verdichtungsraum verdichtet und auf der Druckseite anschließend wieder ausgestoßen.

Serienmäßig ist ein Rückschlagventil (2) im Saugkopf integriert. Dies verhindert beim Abschalten der Pumpe das Belüften des Rezipienten durch die Pumpe.
Angetrieben wird die Mink MM Klauen-Vakuumpumpe durch einen Normmotor. Ein Synchronisationsgetriebe sorgt für den exakten Gleichlauf der beiden Klauen.

Durch das komplette Zubehörprogramm lassen sich diese Vakuumpumpen optimal für jeden Einsatzfall ausrüsten.

Principle of operation

Two rotary claws rotate in opposite directions within a housing. The special geometrical shape of the claws allows the ingested air to be compressed within the vacuum pump. As the claws rotate constantly, air is sucked in (1), compressed in the compression chamber and discharged under pressure.

The non-return valve (2) incorporated into the inlet flange prevents air from back flowing into the vacuum chamber when the pump is switched off.
Mink MM rotary claw vacuum pumps are directly driven by a flanged motor; the two claws are synchronized by a gear.

A large variety of accessories ensures an optimum adaptation to every application.

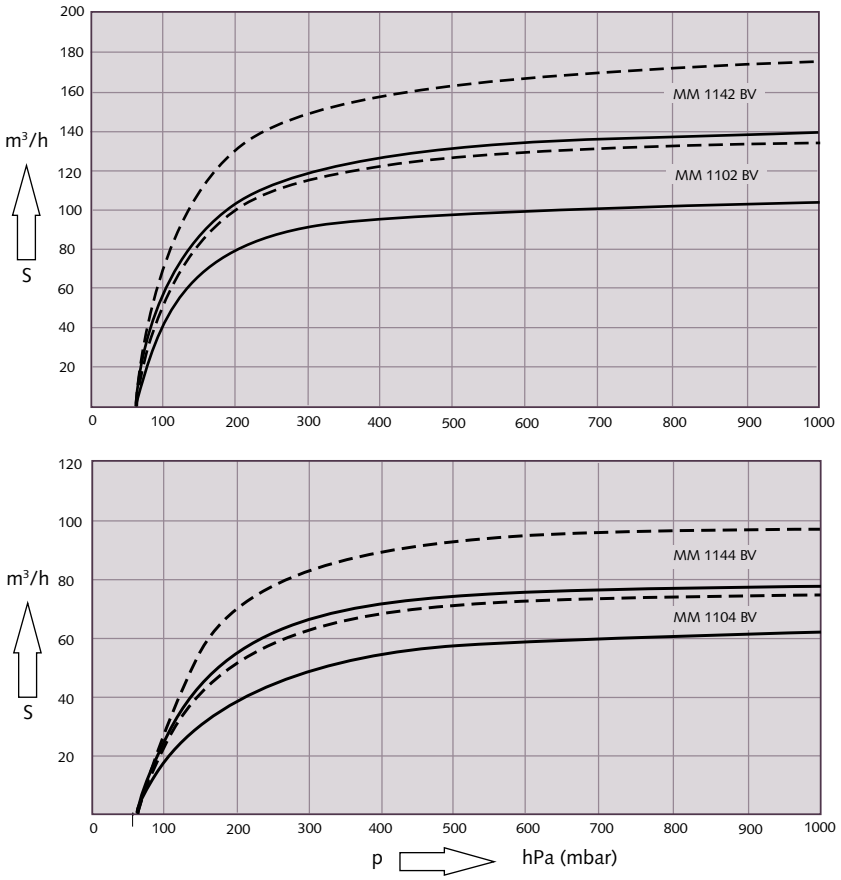
Principe de fonctionnement

Deux becs tournent en sens contraire dans le corps de pompe. Une géométrie particulière des becs crée l'aspiration de l'air et sa compression dans la pompe à vide. L'air pénètre par la bride d'aspiration (1) de la pompe, puis il est comprimé et ensuite rejeté par la bride d'échappement.

Un clapet anti-retour (2) est monté de série dans la bride d'aspiration. Ceci évite une remise à l'air accidentelle du volume pompé par l'intermédiaire de la pompe en cas d'arrêt.
La pompe Mink MM est entraînée par un moteur normalisé. Des pignons de synchronisation assurent un entraînement précis des deux becs.

Vaste programme d'accessoires permet de configurer les pompes pour chaque besoin spécifique.

Technische Daten MM 1104 BV/1144 BV/1102 BV/1142 BV
Technical data
Spécifications techniques



50 Hz
60 Hz

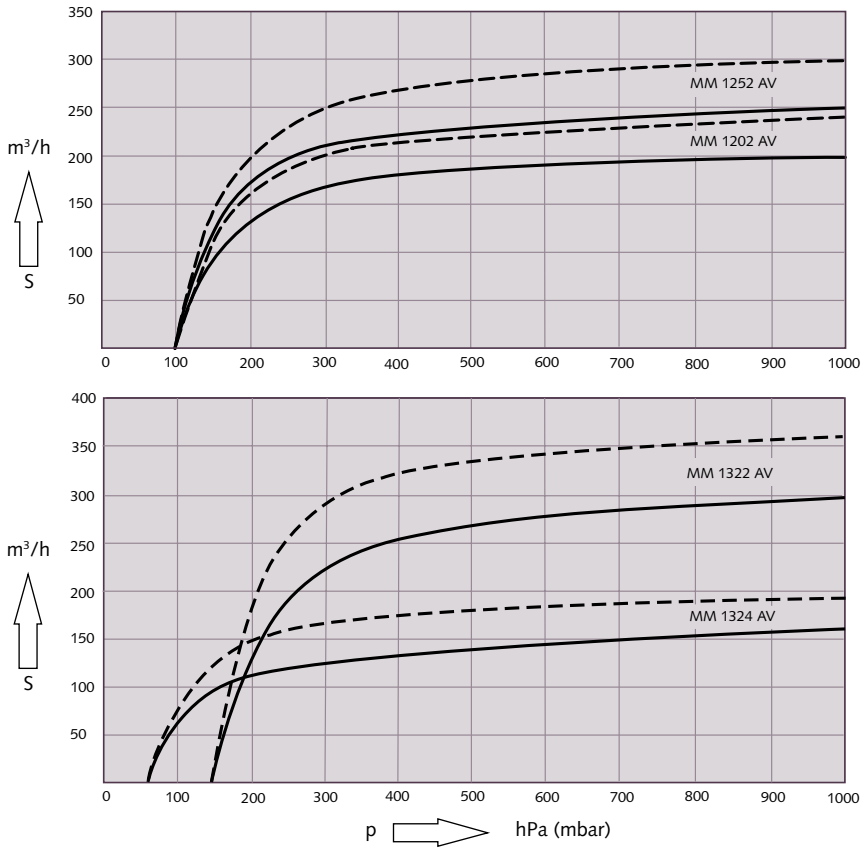
Die Kennlinien gelten für Luft von 20 °C. Toleranz: ± 10%
The displacement curves are valid for air at 20 °C. Tolerance: ± 10%
Les courbes sont données pour de l'air à 20 °C. Tolérance: ± 10%

Technische Daten Technical data Spécifications techniques			MM 1104 BV	MM 1144 BV	MM 1102 BV	MM 1142 BV
Nennsaugvermögen Nominal displacement Débit nominal	50 Hz 60 Hz	m³/h m³/h	62 75	78 96	105 135	140 175
Enddruck Ultimate pressure Pression finale		hPa (mbar)	60	60	60	60
Motornennleistung Nominal motor rating Puissance nominale du moteur	50 Hz 60 Hz	kW kW	1,1 1,5	1,5 2,2	2,2 3,0	3,0 4,0
Motornenndrehzahl Nominal motor speed Vitesse de rotation nominale	50 Hz 60 Hz	min^{-1} min^{-1}	1500 1800	1500 1800	3000 3600	3000 3600
Schalldruckpegel (DIN EN ISO 2151)* Sound level (DIN EN ISO 2151)* Niveau sonore (DIN EN ISO 2151)*	50 Hz 60 Hz	dB(A) dB(A)	66 70	66 70	75 79	75 79
Gewicht ca. Weight approx. Poids approx.	50 Hz 60 Hz	kg kg	166 172	172 180	168 174	179 187

*) bei 400 hPa Ansaugdruck *) at 400 hPa inlet pressure *) pression d'aspiration 400 hPa

Klauen-Vakuumpumpen
Rotary claw vacuum pumps
Pompes à vide à becs rotatifs

Technische Daten MM 1324 AV/1202 AV/1252 AV/1322 AV
Technical data
Spécifications techniques



Die Kennlinien gelten für Luft von 20 °C. Toleranz: ± 10%
The displacement curves are valid for air at 20 °C. Tolerance: ± 10%
Les courbes sont données pour de l'air à 20 °C. Tolérance: ± 10%

Technische Daten Technical data Spécifications techniques			MM 1324 AV	MM 1202 AV	MM 1252 AV	MM 1322 AV
Nennsaugvermögen Nominal displacement Débit nominal	50 Hz 60 Hz	m³/h m³/h	160 192	200 240	250 300	300 360
Enddruck Ultimate pressure Pression finale		hPa (mbar)	60	100	100	150
Motornennleistung Nominal motor rating Puissance nominale du moteur	50 Hz 60 Hz	kW kW	3,0 3,6	4,0 4,8	4,5 5,5	5,5 6,5
Motornenndrehzahl Nominal motor speed Vitesse de rotation nominale	50 Hz 60 Hz	min^{-1} min^{-1}	1500 1800	3000 3600	3000 3600	3000 3600
Schalldruckpegel (DIN EN ISO 2151)* Sound level (DIN EN ISO 2151)* Niveau sonore (DIN EN ISO 2151)*	50 Hz 60 Hz	dB(A) dB(A)	70 74	75 79	75 79	77 82
Gewicht ca. Weight approx. Poids approx.	50 Hz 60 Hz	kg kg	225 233	234 236	238 238	240 242

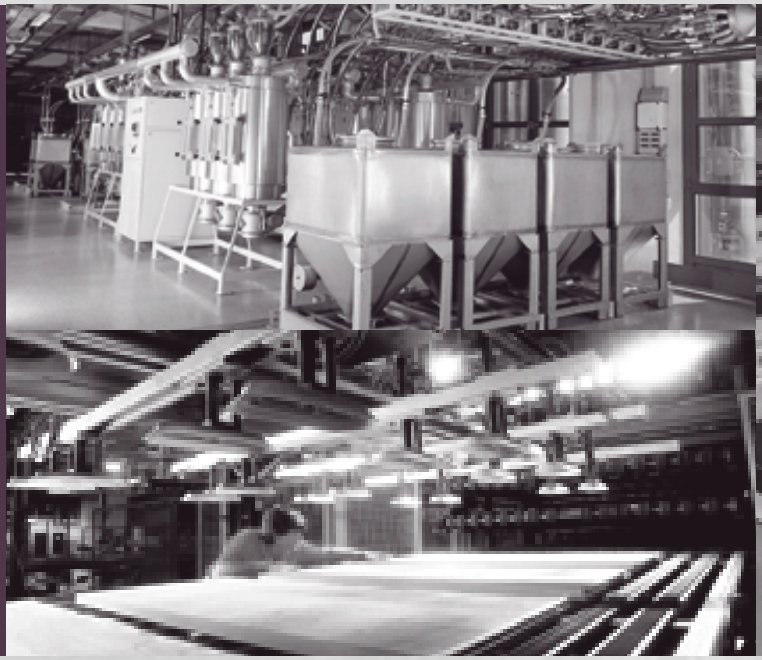
*) bei 400 hPa Ansaugdruck *) at 400 hPa inlet pressure *) pression d'aspiration 400 hPa

Anwendungen
Applications
Applications




Anwendungen	Applications	Applications
• Holzindustrie	• Wood industry	• Industrie du bois
• Pneumatische Saugförderung	• Pneumatic conveying	• Transport pneumatique
• Transport- und Hebeeinrichtungen	• Transport and lifting systems	• Systèmes de manutention et de transport
• Medizintechnik	• Medical technology	• Technique médicale
• Zentrale Vakuumversorgung	• Central vacuum systems	• Groupes de vide centralisés
• Verpackungsindustrie	• Packaging industry	• Industrie de l'emballage
• Kunststoffindustrie	• Plastics industry	• Industrie des plastiques
• Lebensmitteltechnik	• Food industry	• Industrie agro-alimentaire
• Druckindustrie	• Printing industry	• Arts graphiques
• Keramik- und Ziegelindustrie	• Ceramics and brick industry	• Industrie des céramiques et tuiles
• Umwelttechnik	• Environmental technology	• Technologie de l'environemment
• Vakuumkanalisation	• Vacuum sewage	• Canalisation sous vide
• Textilindustrie	• Textile industry	• Industrie du textile
• Papierindustrie	• Paper industry	• Industrie papetière
• Getränkeindustrie	• Beverage industry	• Industrie des boissons

Klauen-Vakuumpumpen
Rotary claw vacuum pumps
Pompes à vide à becs rotatifs



Betriebssicher
Die Klauentechnik hat sich seit Jahren in der Industrie bewährt.
Die robuste Konstruktion und der hohe Qualitätsstandard garantieren eine hohe Betriebssicherheit und Lebensdauer.

Reliable operation
The rotary claw principle has already been used successfully for many years in industry. Robust design and high quality guarantee high operating reliability and long life span.

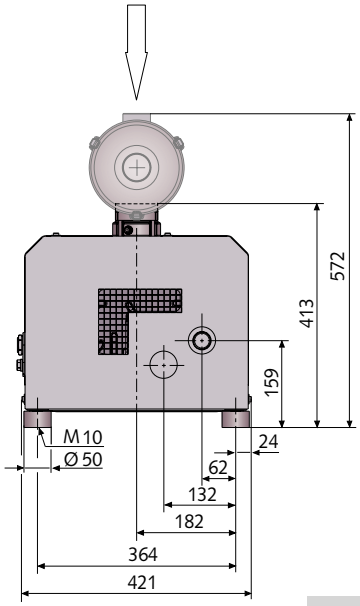
Fiable
La technologie des pompes à becs rotatifs à fait ses preuves dans l'industrie depuis de nombreuses années. Une conception robuste alliée à des critères de qualité élevés confèrent à ces pompes une grande fiabilité et une grande durée de vie.

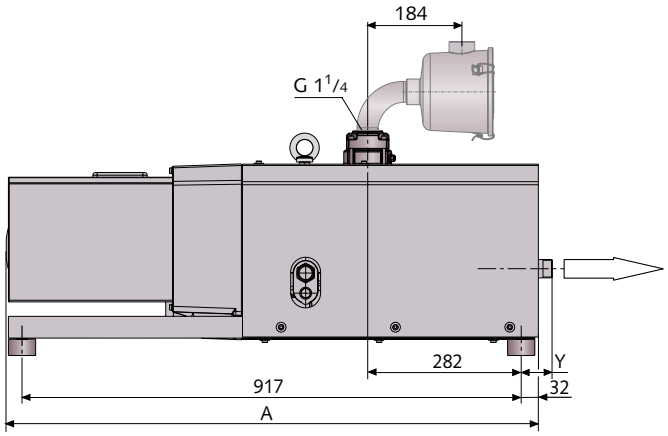
Kompakt
Durch die kompakte Konstruktion der Mink MM werden kleine äußere Abmessungen erreicht.
Ein wirkungsvoller Schalldämpfer, sowie eine effiziente Luftkühlung sind in die Vakuumpumpe integriert.

Compact
The compact design of Mink MM vacuum pumps results in small external pump dimensions.
These vacuum pumps are equipped with both an efficient silencer and an air cooling.

Compacte
Les dimensions très réduites sont le fruit d'une attention particulière lors de la conception des pompes Mink MM. Un silencieux efficace et un dispositif de ventilation à haut rendement sont intégrés dans les pompes à vide.

Abmessungen
Dimensions
Dimensions

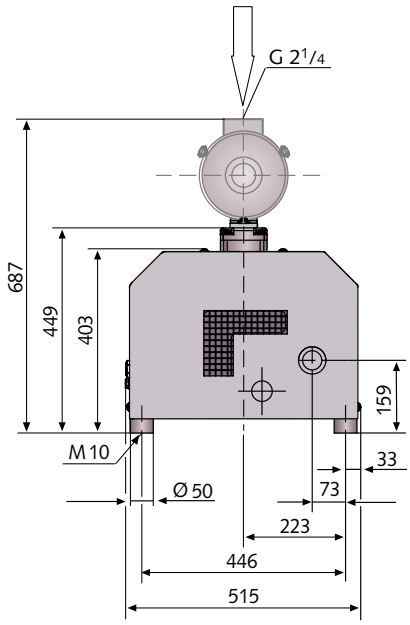


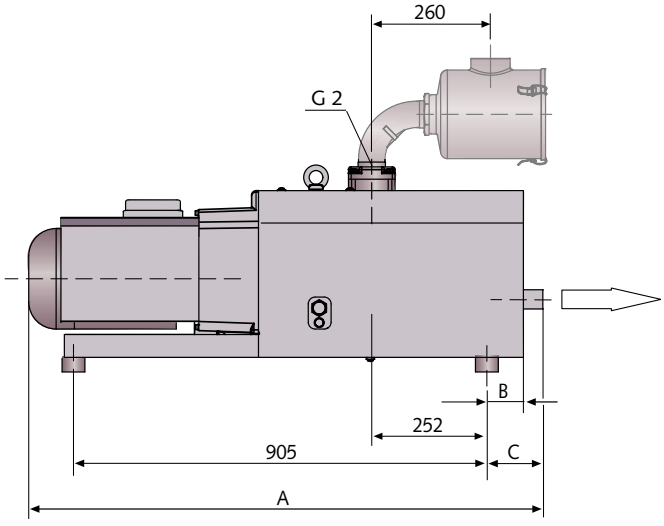


MM 1104 BV, 1144 BV, 1102 BV, 1142 BV

Abmessungen Dimensions mm Dimensions	A	Y
MM 1104 BV 50 Hz	978	–
MM 1104 BV 60 Hz	982	–
MM 1144 BV 50 Hz	978	–
MM 1144 BV 60 Hz	982	–

Abmessungen Dimensions mm Dimensions	A	Y
MM 1102 BV 50 Hz	978	42
MM 1102 BV 60 Hz	982	42
MM 1142 BV 50 Hz	978	57
MM 1142 BV 60 Hz	1003	57





MM 1324 AV, 1202 AV, 1252 AV, 1322 AV

Abmessungen Dimensions mm Dimensions	A	B	C
MM 1324 AV	1068	80	106
MM 1202 AV	1080	46	79
MM 1252 AV	1090	46	89
MM 1322 AV	1124	80	123

Klauen-Vakuumpumpen
Rotary claw vacuum pumps
Pompes à vide à becs rotatifs

Sonderausführungen Mink MM
Special executions Mink MM
Executions spéciales Mink MM

Mink MM, ATEX zertifiziert
Konform nach Richtlinie 94/9/EG (ATEX 95). Konzipiert für den industriellen Einsatz in explosionsgefährdeten Bereichen. Mink MM Klauen-Vakuumpumpen in ATEX-Ausführung sind zugelassen für Zone 2/22 (i), Zone 1/21 (o).

Mink MM, Drehzahl geregelt
Mit einem Drehzahl einstellbaren Antrieb wird das Saugvermögen dem tatsächlichen Bedarf angepasst. Hohe Energieeinsparungen sind möglich.

Mink MM Aqua für feuchte Anwendungen
Die Mink MM Aqua wurde zur Förderung großer Mengen Wasserdampf entwickelt. Mit einer speziellen Beschichtung ist sie korrosionsgeschützt und wird in feuchten Prozessen eingesetzt.

Mink MM, Sauerstoffausführung
Für alle Anwendungen mit Sauerstoffbegasung, bei denen Gasgemische mit mehr als 21% Sauerstoff (höher als Luft) angesaugt werden.

Mink MM, Antriebsvarianten
Ausführungen mit Keilriemen oder Hydraulikmotor kommen insbesondere auf mobilen Einheiten zum Einsatz.

Nähere Informationen und Leistungsdaten zu Mink MM Sonderausführungen erhalten Sie auf Anfrage.
Wir beraten Sie gerne.

Mink MM with ATEX certificate
Compliant with directive 94/9/EC (ATEX 95). Designed for the industrial use in potentially explosive atmospheres. Mink MM claw vacuum pumps in ATEX execution are certified for the use in zone 2/22(i), zone 1/21(o).

Mink MM with speed control
The suction capacity of the pump is adapted to the actual requirements by a speed control drive. This allows high energy savings.

Mink MM Aqua for humid applications
The Mink MM Aqua has been designed for the pumping of large quantities of water vapour. The pump is corrosion protected with a special coating and is suitable for humid processes.

Mink MM oxygen
For all applications with oxygen injection where gas mixtures with more than 21% oxygen (higher than air) are pumped.

Mink MM, drive executions
Executions with V-belt drive or hydraulic motor are specially designed for the use on mobile units.

More details on technical data for Mink MM special executions on request.
We would like to advise you.

Mink MM avec certificat ATEX
Conçues pour les applications industrielles en présence d'atmosphères explosibles conformément à la directive 94/9/CE (ATEX 95). Les pompes à vide à becs Mink MM en version ATEX sont certifiées pour la zone 2/22(i), zone 1/21 (o).

Mink MM avec variateur de vitesse
Le variateur de vitesse intégré dans le moteur permet d'adapter exactement le débit d'aspiration au besoin réel de l'application. Ceci permet de sensibles économies d'énergie.

Mink MM Aqua pour les applications humides
La Mink MM Aqua a été spécialement conçue pour pomper de grandes quantités de vapeur d'eau. Elle possède un revêtement spécial anti-corrosion et est utilisée pour des procédés humides.

Mink MM version oxygène
Pour toutes les applications impliquant l'injection d'oxygène et pour l'aspiration de mélanges gazeux comportant plus de 21% d'oxygène plus que l'air.

Mink MM, variantes de moteurs
Des exécutions avec poulie-courroie ou des moteurs hydrauliques ont été spécialement conçues pour pouvoir utiliser les pompes sur des unités mobiles.
N'hésitez pas à nous demander plus d'informations sur les spécifications techniques des exécutions spéciales disponibles pour les Mink MM.
Nous vous conseillons avec plaisir.

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Printed in Germany /BP 03/F - 0870 134 494

Water Technologies

Westates™ brand Vent-Scrub™ Vapor Phase Adsorbers

SIEMENS

APPLICATIONS

The Westates™ brand Vent-Scrub™ adsorbers have been proven to be the simplest and most cost effective way to treat malodorous and VOC emission problems. Sturdy steel construction and specially formulated corrosion resistant internal coating ensures long service life and low maintenance. Applications for Vent-Scrub™ adsorbers include:

- API separator vents
- VOC control from soil vapor extraction (SVE) systems and airstrippers
- Wastewater and product storage tank vents
- Process vents
- Refinery and chemical plant wastewater sewer vents
- Laboratory hood exhausts

INSTALLATION, STARTUP AND OPERATION

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our reactivation facilities, where the contaminants are thermally destroyed.

We provide instructions on sampling the spent carbon and completion of our spent carbon profile form. Spent carbon acceptance testing can be performed at our certified laboratory. When requested, a certificate of reactivation will be issued.

BENEFITS AND DESIGN FEATURES

- Durable, carbon steel construction.
- Abrasion and corrosion resistant baked epoxy lining; urethane exterior finish (Vent-Scrub™ 1000, 2000, 3000, 8000 adsorbers).
- Ready-to-use systems: simple installation and operation.
- Applications to 3000 SCFM.
- The Vent-Scrub™ 1000, 2000, 3000 and 8000 adsorbers have forklift channels for easy handling.
- The Vent-Scrub™ 200, 400, 1000 and 2000 adsorbers are UN/DOT approved transportation containers for RCRA hazardous spent carbon.
- Hose kit and pipe manifold options are available to simplify installation and operation.

PIPING MANIFOLD (OPTIONAL)

- 2"/3" sch 80 PVC piping and valves (optional carbon steel and stainless steel piping).
- Series or parallel operation.
- Sampling ports and pressure gauges.
- Flexible hoses with Kamlock fittings allow easy installation and removal during service exchange operations (Vent-Scrub™ 200, 400, 1000 and 2000 adsorbers).

SPECIFICATIONS					
Vent-Scrub™ Model No.	**200**	**400**	**1000/2000**	**3000**	**8000**
Dimensions, diameter x overall height	22" x 34"	30" x 43"	48" x 56"/48" x 8' 0"	60" x 9' 3"	96" x 11' 0"
Inlet Connection	2" FNPT	4" FNPT	4" FNPT	10" Flange	12" Flange
Outlet Connection	2" MPT	4" FNPT	4" FNPT	10" Flange	12" Flange
Manway	Top	Top	18" Top	16" Top	20" Top/Side
Internal Distribution(1)	PVC	PVC	PVC	FRP/PPL	FRP/PPL
Interior Coating	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Exterior Coating	Enamel	Enamel	Epoxy/Urethane	Epoxy/Urethane	Epoxy/Urethane
Carbon Fill Volume (Cu.ft.)	6.8	14	34/68	107	273
Cross Sectional Area (sq.ft.)	2.8	4.9	12.3	19.6	50.2
Approx. Carbon Weight (lbs)	200	400	1000/2000	3000	8000
Empty Vessel Weight (lbs)	250	480	890/1190	2500	4500
Flow, CFM (max.)	100	300	500	1500	3750
Pressure, psig (max.)	3	3	14.9	5	5
Temperature, deg. F (max)(4)	140	140	140	140	140
Vacuum, in. Hg (max.)	N/A	N/A	12/12(2)	6(3)	12(3)

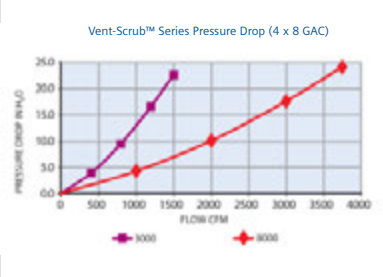
[1]*Carbon steel and stainless steel internals are also available.*
[2]*For vacuum greater than 12 in. Hg on Vent-Scrub™ 2000, contact your Siemens representative.*
[3]*For vacuum service on Vent-Scrub™ 3000 and Vent-Scrub™ 8000, contact your Siemens representative.*
[4]*For higher temperatures, stainless and carbon steel internals are available.*
For detailed dimensional information or drawings, contact your local Siemens sales representative.

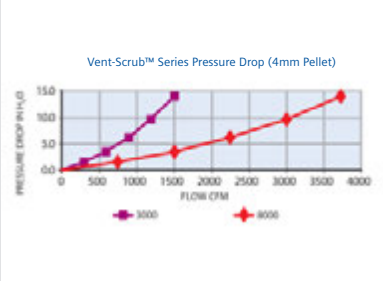
VENT-SCRUB™ ADSORBERS SAFETY CONSIDERATIONS

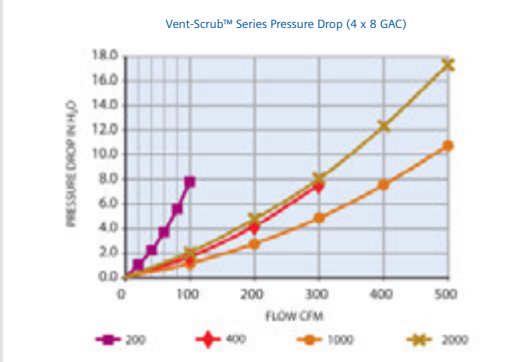
The adsorption of organic contaminants on activated carbon is an exothermic process, i.e. involves the release of heat.

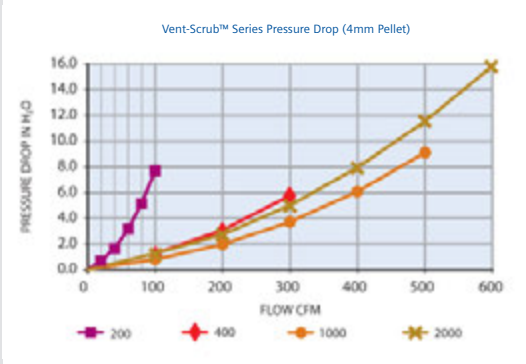
Certain chemical compounds such as ketones, aldehyes, organic acids and organic sulfur compounds may form reactive species on the carbon surface and under certain conditions may lead to a high temperature rise. If you are unaware or unsure of reactions that may occur, appropriate tests should be performed before installing the Vent-Scrub adsorbers.

At high VOC concentrations of organic compounds the heat of adsorption can lead to an increase in carbon bed temperature. The heat can be controlled by a number of techniques such a dilution of the inlet flow, nitrogen blanketing of the carbon system or prewetting of the carbon bed.









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WS-VSC-DS-0207

Appendix D
Ecology's Independent LUST Memo

DEPARTMENT OF ECOLOGY

November 20, 1995

TO: Interested Parties

FROM: Mike Llewelyn; Water Quality Program
Mary Burg; Toxics Cleanup Program

SUBJECT: Wastewater Discharges from Independent LUST sites

This is an update to the May 1992 "Recommendations to Joint Management Teams" of the Water Quality and Toxics Cleanup Programs regarding water discharges from independent leaking underground storage tank (LUST) cleanups where gasoline or diesel fuel are the pollutants of concern. Changes are only in the category of discharges to ground water and primarily affect permitting decisions within the Water Quality Program. Elements of the 1992 document which are still applicable and the updated policy are incorporated into chapter III of the Permit Writers Manual.

The purpose of this policy is to clarify for Ecology staff the decision points that result in a permit decision for a proposed discharge from an independent LUST cleanup site. The requirements that must be met in order for a company or entity to qualify for various degrees of permit actions are listed in a decision matrix in this document. Any proposed discharge unable to meet the requirements may be denied or issued an individual permit through normal Water Quality Program (WQP) permitting procedures.

At this time, LUST permitting decisions and actions are the responsibility of WQ staff except in SWRO, where the responsibility is shared with TCP regional staff, or where other specific regional cooperative efforts have been arranged.

ATTACHMENTS

Changes to 1992 Policy

1) Discharges to injection wells and dry wells, as well as infiltration trenches will be allowed. The requirements for use of a dry well or an injection well are more stringent when discharge is off-site or not hydraulically contained.

2) The term "hydraulically contained" is used to clarify the intent of the term "discharge to ground within site boundary". Hydraulically contained means that recharge rates are matched to local hydrogeologic conditions and pumping rates so the recharge fluid does not leave the site boundaries, but is recycled back to the pumping wells.

3) A more stringent set of limitations is introduced, labeled Level 2. Level 1 is the set of limitations referred to as "technical standards" in the 1992 policy document. Level 2 limitations are based on the groundwater standard or MTCA method A value, whichever is more stringent.

4) Long term discharges to ground (>60 days) with hydraulic containment need not obtain a permit if the water discharged meets new, more stringent limitations (Level 2). These more stringent limits define a discharge which is no longer a wastewater. If the discharger is unable to maintain Level 2, then a temporary permit is required as before.

5) Long term discharges to ground not hydraulically contained must meet the more stringent Level 2 limitations and obtain a temporary permit.

6) Short term discharges to ground (<60 days) not hydraulically contained have options. If the discharger can guarantee Level 2 limitations, no permit is required. When the discharge is not directly to ground water (not using a dry well or injection well), and Level 1 is the best that can be guaranteed, a temporary permit is required.

Underground Injection Control Program

The Department of Ecology is the lead agency for the EPA's Underground Injection Control (UIC) Program in Washington. The UIC program is authorized by the Safe Drinking Water Act (SDWA) to protect Underground Sources Drinking Water (USDW). The principal activity of the UIC program is an ongoing inventory and assessment of pollution potential from injection wells in the state. <u>All discharges to groundwater must be registered with the state UIC Coordinator</u>. If water quality problems or rule violations are discovered, the owner/operator will be required to take corrective actions which can vary from obtaining a UIC permit, modify the disposal operation, or closing the well.

INDEPENDENT LEAKING UNDERGROUND STORAGE TANK (LUST) CLEANUP SITES

Independent Leaking Underground Storage Tank (LUST) cleanup sites are allowed an exemption from permits for short term discharges that meet higher treatment standards.

- All discharges to ground water at LUST cleanup sites must register with the state Underground Injection Control (UIC) program. The UIC coordinator will evaluate the registration and will refer the owner/operator to the regional permit coordinator if a permit is required.

- All long term discharges (>60 days) to surface waters must contact the regional office.

- All **long term** dischargers to ground water must submit an engineering report which includes a hydrogeological investigation.

- The facility must notify the WQ permit manager when the discharge stops or effluent quality meets Level 2 and a permit is no longer required.

- For Independent LUST sites involving gasoline or diesel (only) go to Table A if there is a short term discharge (<60 days), otherwise go to Table B for discharges longer than 60 days.

Table A
Short Term <60 day Discharge

Discharge Location	Conditions	Permit Type
Surface Water	Meet Table C Level 1 treatment Local approval required if discharge is to municipal stormwater system	No permit required. These are typically tests of treatment methods.
POTW	Meet Table C Level 1 treatment Local approval required	No permit required
Ground Water, hydraulically contained* on-site	Meet Table C Level 1 treatment	UIC registration only No permit required
Ground Water, but not contained on-site	Option A: If meet Table C Level 2 treatment	UIC registration only No permit
	Option B: Meet Table C Level 1 treatment	Temporary permit Discharge to an injection well is not allowed

*Hydraulically contained means that recharge rates are matched to local hydrogeologic conditions and pumping rates so the recharge fluid does not leave the site boundaries, but is recycled back to the pumping wells.

Table B
Long Term ≥60 day Discharge

Discharge Location	Conditions	Permit Type
Surface Water	Meet Table C Level 1 treatment Local approval required if discharge is to municipal stormwater system	NPDES – Model Permit
POTW	Meet Table C Level 1 treatment Local approval required	State Industrial User (IU) Temporary Permit
Ground Water, hydraulically contained on-site	Option A: Meet Table C Level 2 treatment	UIC Registration – No permit
	Option B: Meet Table C Level 1 treatment	Temporary Permit
Ground Water, but not contained on-site	Meet Table C Level 2 treatment	Temporary Permit

A facility manager may require a permit in a situation that otherwise may be exempted if monitoring and reporting is required.

Table C
Discharge Quality Maximum Concentration Levels

Parameter	Level 1	Level 2
pH	6.0-9.0	6.5-8.5
TPH-G	800 ppb*	800 ppb*
TPH-D	500 ppb*	500 ppb*
Total Lead	5.0 ppb	5.0 ppb
BTEX	100 ppb	N/A
Benzene	5.0 ppb	1.0 ppb
Toluene	N/A (see BTEX)	40 ppb
Ethylbenzene	N/A (see BTEX)	30 ppb
Xylene	N/A (see BTEX)	20 ppb

Level 1 limitations are performance and technology based (MTCA method A for lead). Level 2 limitations are based on the ground water standards or MTCA method A value, whichever is more stringent.
*Updated to 2001 MTCA levels.