Les Gale
Sales Director
M: 207.322.3412

August 17, 2018

Project Name: Alabama A&M
2K18-24B
Location: Huntsville, Alabama

The following proposal has been developed after thorough review of the specifications and requirements of this project. We are pleased to offer the following proposal and hope that you will choose to partner with InterClean for your vehicle wash project.

Specifications
The proposed InterClean wash system meets or exceeds all specifications. The only clarification is our brush frames are hot dipped galvanized steel that will stand up much longer than the specified aluminum frames. Galvanized is the standard in the heavy duty vehicle wash industry.
Our spinners far exceed the specified model. Our spinners are individually adjustable for both speed and size of spray cone, the specified spinners do not have this feature. Our spinners also have a three year warranty.

Drawings and O&M Manual
We have included a set of drawings that we did for you previously that do not show the side brushes that are included in our proposal. We have also included a set of drawings from Coralville Transit that have them included as a reference. We have included a copy electronically on the thumb drives of the Coralville Transit O&M as a reference.

References
InterClean is a leading supplier of North American heavy duty vehicle wash equipment. We have provided a list of references in our proposal.

We thank you in advance for considering InterClean, please let us know if you have any questions or need more information.

Best regards,
INTERCLEAN EQUIPMENT

Les Gale
Director of Sales

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InterClean Company Introduction

InterClean Equipment, established in 1985, is headquartered in Ypsilanti, Michigan, approximately 35 miles southwest of Detroit. We are proud of our Midwestern heritage and continue to design and manufacture all equipment at our 45,000 ft^2 facility in southeastern Michigan.

InterClean has more than thirty years of history of designing, manufacturing, and commissioning heavy duty bus, truck and train washing systems for transit, municipal, and commercial fleet markets, as well as other, more specialized products for markets such as mining, aerospace, and military/defense.

InterClean is unique in the heavy-duty vehicle wash industry due to the wide variety of products available. The company offers systems for

- Touchless and friction (brush) drive thru cleaning
- Touchless and friction gantry (vehicle stationary) cleaning
- Chassis and wheel cleaning systems
- Manual washing with monitor nozzles and pressure wands
- Specialized systems such as aircraft rinses and mining haul truck washes
- Water recycling and treatment available for all systems

The InterClean engineering team is experienced in civil, mechanical, electrical and controls engineering disciplines. This broad range of capabilities allows us to control every facet of the design, build, and operation of our wash systems. Engineering maintains a database of all wash system designs providing ready access to a broad range of standard systems that can be customized and configured to meet the specific cleaning needs of individual customers.

InterClean has installed over 700 wash systems in North America. We continue to implement product improvement ideas generated from this installed base to ensure our designs achieve peak performance and operate with minimal maintenance requirements and expense.

Our customer service team supports this installed base offering technical support, on-site maintenance visits, and an inventory of service parts and chemicals to maximize our customers' uptime. In addition to our internal service team, InterClean has a large Distributor network comprised of InterClean-trained and certified Service Technicians. This ability to provide timely, on-site technical service is second to none in the heavy duty wash industry.

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InterClean is led by an experienced management team demonstrated in Figure 1.

Figure 1 – InterClean Management Team

Name / Title	Tenure		Skills / Experience
	ICE	Industry	
Greg Harvey VP and General Manager	1	9	• Substantial sales, engineering, and product development experience with large auto, aerospace, and heavy truck companies
Les Gale Sales Director	16	38	• A wash product expert with entire career in car and heavy duty wash sales • Leads InterClean sales team as well as global distribution network
Marianne Allen Project Management	9	9	• Proficient with MS Project and other PM best practices
Simon Luo Mechanical Eng. Manager	12	12	• Leads team of four mechanical engineers / designers • Responsible for several new product designs at InterClean
Bryan Hickson Electrical/Controls Eng. Manager	1	15	• Background in large automotive manufacturing plants and resulting experience with SCADA and other "Industry 4.0" methodologies • Expert in Allen Bradley PLC logic and other PLC brands
Dwayne Hamilton Production Manager	12	30	• Expert in metal fabrication and manufacturing execution • Previously owned and operated independent fabrication shop
Scott Hessling Purchasing & Service Manager	17	17	• An InterClean product expert leading service technician team • Experience in Assembly and Installations prior to management role
Jeff Shaw Customer Service Manager	13	13	• Entire career with InterClean installing and commissioning equipment • Prior experience with electrical panel build and technical troubleshooting
Kris Morris Director of Finance	1	5	• CPA with background in public accounting • Previously lead a team servicing automation companies

This management team is focused on our Project Execution Approach and overseeing the Stage Gate Process. Our regimented process is key to delivering projects on-time and on-budget.

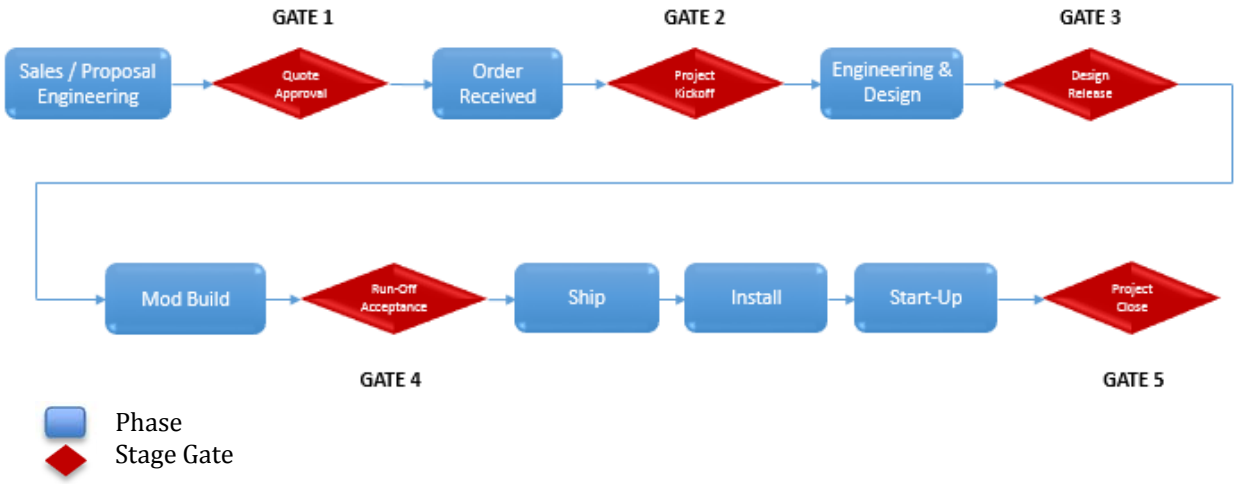
Figure 2 – InterClean Project Execution Approach

- Stage Gate Process defines required deliverables to move from one phase to next
- Dedicated Project Managers own execution of the Gate process

Pursuit of Best-in-Class Concept to Commissioning Execution

Les Gale
Sales Director
M: 207.322.3412

Figure 3 – InterClean Project Stage Gate Process



Our products, people, and processes are what differentiate InterClean as a best-in-class performing wash company. We look forward to the opportunity to prove our value by partnering with you on this upcoming project.

BID NO: 2K18-24B

InterClean Equipment **Reference List**

BC Transit
Multiple Locations
Wistler, BC - Vernon, BC - Kamloops, BC
Mr. Stephen Pugh
Steven_Pugh@BCTransit.com
Systems: Hybrid Bus Wash with Recycle
Install: 2009, 2012, 2012

LexTran
200 West Loudon
Lexington, KY 40508
Mr. James Reynolds
859-388-0691
System: XJ404 Recycle & RO
Install 2016

Edmonton Transit
15520 Ellerslie Road
Edmonton, Alberta T6W 1A5
Mr. Greg Sorenson
780-496-6446
greg.sorenson@edmonton.ca
System: Hybrid Bus Wash with Recycle
Two lanes drive through
Installed 2010

Greater Richmond Transit
301 East Belt Boulevard
Richmond, VA 23224
Contact: Gerald Brink
804-358-3871
Touchless Bus Wash two lanes
Installed 2009

Brampton Transit
120 Sandalwood Parkway
Brampton, ON L6T 5M8
Mr. Dale Morin
416-806-1643
2 Lanes, Wrap Style Bus Wash
Install 2008

Key West Transit
5701 College Road
Key West, FL 33040
Mr. Shane Harmon
305-809-3912
System: XJ402 Recycle
Install 2016

University of Michigan
1213 Kipke Drive
Ann Arbor, MI 48109
Ms. Rene Jordan
734-764-2485
Touchless Transit Bus Wash
Installed 1997

Duluth Transit
2402 W. Michigan St.
Duluth, MN 55806
Contact: Jim Caywood
218-722-4426
Hybrid Bus Wash
Installed 2010

Lethbridge Transit
614 4th Avenue
Lethbridge, Alberta T1H 0K3
Kevin Ponech
403-320-4737
Kevin.Ponech@lethbridge.ca
XJ404 brush wash Bus Wash
Install 2013

Calgary Transit Multiple locations
Calgary, AB Canada
Contact: Steve Samartino
403-268-1149
Steve.Sammartino@calgary.ca
Contact: Dave Leibel
403-537-7804
Dave.Leibel@calgary.ca
XJ404 Brush and Hybrid Bus Wash
Install 2013, 2014

BID NO: 2K18-24B

InterClean Equipment, Inc.

Coralville Transit Reclaim/FW Bus Wash System

Coralville, IA

LY09-070

2012

Released

04.10.12

INTERCLEAN

Table of Contents

General Table of Contents

1 GENERAL INFORMATION

Section 1 Table of Contents

List of Figures in Section 1

1.1 HOW TO USE THIS MANUAL

This Manual is divided into eight major Sections shown below. A Global Table of Contents at the front of the book gives the organization and page numbers of the major section divisions in the book. Each Section contains a more detailed local Table of Contents to easily locate information in that Section.

Section 1: General Information

How to Use This Manual; Copyright Notice; Who This Manual is For; Standard Equipment Warranty & Policies; Manufacturer's Contact Information; Safety Information; Glossary of Terms Used in This Manual.

Section 2: Wash System Description

A detailed description of the Wash System. The System is divided into functional subsystems and discussed with illustrations accompanying the text. The System Controller and Touch Screen are discussed in detail with screenshots of all the screens, navigation map through the Touch Screen system, etc.

Section 3: Using the Wash System

Describes how to start up and enable the Wash System, select a wash mode; select a wash type; authorize wash cycles.

Section 4: Preventive Maintenance

Presents regular and preventive maintenance procedures and schedules. A Preventive Maintenance Chart gives recommended service intervals.

Section 5: Troubleshooting

This section gives troubleshooting suggestions to locate and correct Wash System problems.

Section 6: Primary Repair

Describes system repair procedures, if applicable.

Section 7: Electrical and Plumbing Diagrams

The Wash System electrical and plumbing prints are included here.

Section 8: Appendix

Manufacturer's catalog information or operation/maintenance manuals on selected components.

1.2 COPYRIGHT NOTICE

Tammermatic InterClean Group

InterClean Equipment, Inc
Ypsilanti, MI, USA

Tammermatic Oy
Tampere, Finland

1.3 STANDARD EQUIPMENT WARRANTY AND POLICIES

InterClean Equipment, Incorporated (hereafter "InterClean") warrants its equipment, as follows:

What is Covered

InterClean warrants that all equipment manufactured by InterClean has been inspected and tested at the plant and is free from defects in material and workmanship.

InterClean will replace or repair, at its discretion, all parts covered by the terms of this Warranty, including all labor incurred at our shop.

The Warranty expressed herein is in lieu of all other warranties, expressed or implied or fitness for a particular purpose.

What is Not Covered

InterClean's Standard Warranty does not cover:

- Labor costs to replace defective parts at the Customer's site
- Freight charges or other incurred charges (i.e., insurance) for material returned to InterClean
- Losses, including loss of revenue, resulting from Wash System or component failure.
- Defective equipment or components resulting from, but not limited to, any of the following:
    - Improper use or abuse or lack of maintenance
    - Accidents to the Wash System
    - Use of chemicals not approved by InterClean
    - Normal wear (such as seals)

Except as expressively stated herein, InterClean is never liable for damages of any kind in connection with the purchase, maintenance, or use of its equipment.

InterClean does not authorize any person or entity to enter into any agreement or assume any obligations or liabilities in connection with this Warranty.

Warranty Period

All parts and systems manufactured by InterClean are covered under the terms of this Warranty for a period of one (1) year from date of purchase with the following exceptions:

- CentriSpinner® spinner assemblies are warranted for three (3) years from date of purchase
- Commercial parts and components purchased by InterClean and used in the manufacture of InterClean Wash Systems are covered by the warranty of their respective manufacturer.

This Warranty applies to the original InterClean equipment purchaser only ("Customer") and is non-transferable.

In the event of repair or replacement, the Warranty period is noncumulative and the original date of purchase applies.

Parts Purchased by InterClean

InterClean must return purchased parts to the original manufacturer for warranty evaluation (replacement, repair, or reject if out of warranty or not covered). During this evaluation period the customer will be billed for the replacement parts. If the part manufacturer issues InterClean a credit for the defective part, InterClean will credit the customer accordingly.

Warranty Expired Information

If the Standard Warranty has expired and field service is necessary, InterClean, at our discretion, will schedule a service call or will use qualified service professionals in your area to perform the necessary maintenance. The field service charges include field labor costs and traveling expenses.

Warranty Authorization

Parts cannot be returned to InterClean without first obtaining a Return Material Authorization number (RMA) from InterClean's End User Relations Department. After the RMA is issued, the suspected defective part(s) must be shipped pre-paid to InterClean within ten (10) days.

The shipping container and all accompanying paperwork must be clearly marked with the RMA number. All shipments not accompanied by the RMA number will be refused and returned to the sender at sender's expense.

RMA Numbers

Contact InterClean's End User Relations Department if your Wash System is having problems. The Service Person handling your call will issue a Return Merchandise Authorization (RMA) number for any component you need to return for service. Please do not ship back components for service without an RMA.

Mark the RMA number clearly on the package being returned and also on the Shipper documentation. The Shipper/Packing List should include:

- Customer Name
- Type of Wash System
- Description of the Problem
- Description of the Part(s) Being Returned

Purchase Orders

In addition to the RMA, InterClean must receive a Purchase Order Number or Credit Card number before any parts are sent back for service or replacement. We are unable to process repairs that do not have an RMA number and a Purchase Order or Credit Card number included.

Replacement or repair (InterClean's discretion) of the defective merchandise will be performed as soon as possible based on availability.

Service Information Required

Please have the following information available when calling for Technical Support:

- Company name, phone number, and name of the person placing the call
- Type of Wash System
- Start-up date of your equipment

Standard Work Days

Our standard work days are Monday through Friday, 8:00 a.m. to 5:00 p.m.

Warranty or Service Contact Information

Contact our End User Relations Department at:

Phone: 734.975.2967 or 1.800.INTERCLEAN

1.4 CONTACT US

1.4.1 Who We Are

InterClean was established in 1985 to specialize in heavy duty, automatic high pressure cleaning systems. Today, InterClean is known worldwide as the leader in innovative touchless cleaning technology. In the last 10 years, we have designed and completed over 500 custom engineered projects throughout the world.

Our customers include automobile plants where we have designed washing systems for vehicle manufacturing, US Military wash applications, mining industry, waste industry washing including biohazardous waste cleaning, radiation decontamination systems for vehicles, commercial truck washes, public works vehicles and bus washes, locomotive and light train wash systems and numerous other specialty applications around the globe.

InterClean understands the intricacies of vehicle cleaning and the art of effectively recycling wash water. This enables us to provide a standard range of systems to fit specific cleaning applications. We use a cost-effective approach in engineering our systems because our customers deserve a high-quality system at a reasonable price.

All of our engineering, fabrication, and facility layout drawings are designed using AutoCAD 3-D solid modeling. InterClean still remains the sole vehicle wash manufacturer in the world to use solid-model 3-D designs exclusively. Among our numerous patents on high-pressure washing, water recycling, and waste treatment technologies, the worldwide recognized CentriSpinner® patents and trademarks are both owned by InterClean Equipment, Inc.

1.4.2 How to Contact Us

InterClean Equipment, Incorporated

3939 Bestech Drive, Suite B

Ypsilanti, MI 48197-9628

U.S.A.

Telephone:

Main Telephone: 734.975.2967

1.800.468.3725 in the USA and Canada

FAX: 734.975.1646

Email:

Sales: sales@interclean.com

Service or Technical Issues: techsupp@interclean.com

Website:

www.interclean.com

1.5 SAFETY

Two of the most important factors for a safe working environment are knowledge and attitude. This manual can supply the knowledge needed to understand the operation of the Wash System and its components. This knowledge is ineffective if personnel's attitude is not geared to providing a safe working environment to protect both themselves and their coworkers.

All electrical and hydraulic service and maintenance should be performed only by licensed and qualified trades personnel. Follow all wash site safety rules and regulations.

1.5.1 Emergency Stop (E-Stop) Buttons

Two Emergency Stop (E-Stop) buttons provide emergency shutdown of the Wash System. One E-Stop button is located on the door of the Master Control Panel and the second button is located on the door of the Reclaim Slave Panel, both in the Equipment Area. Both E-Stop buttons perform the identical function.

The E-Stop button disables the Master Control Relay circuit and removes operating power from all System outputs. This generates a System Alarm and halts a wash in process while the E-Stop button is engaged. The System Controller is put into the OFF mode.

Press either E-Stop button to shut down the Wash System in case of emergency. The button remains pressed and until released manually to return the System to a working state. Correct the condition that caused the E-Stop button to be pressed before attempting to restart the system.

Access the CONTROL screen on the Touch Screen Terminal and press the AUTO button to return the Wash System to wash status. Refer to *Section 3.1 Starting Up the Wash* System *for System* start-up information.

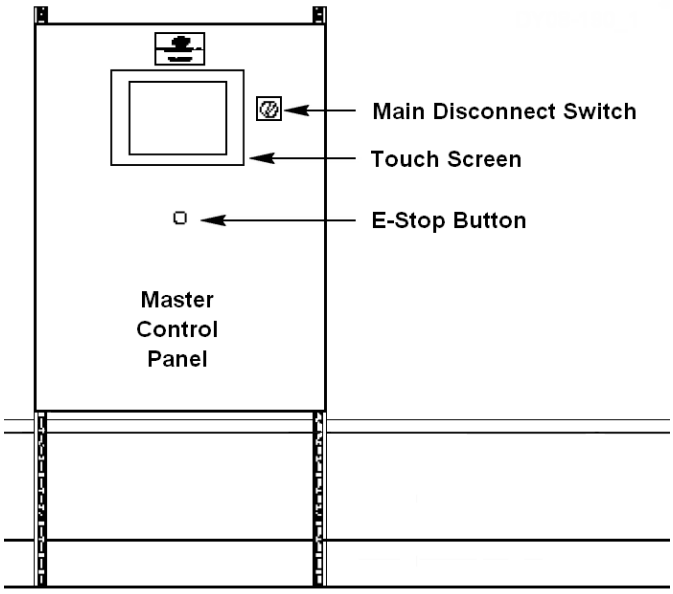


Figure 1- 1 E-Stop - Master Control Panel

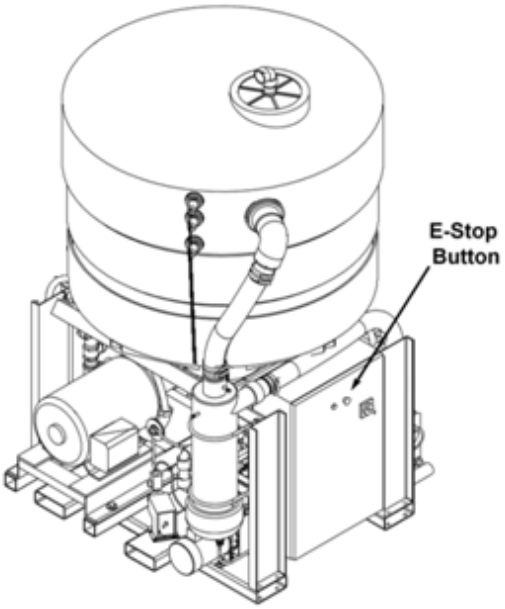


Figure 1- 2 E-Stop - Reclaim Slave Panel

1.5.2 Chemical Safety

When working with chemicals, follow these precautions:

- DO NOT dump chemicals down drains.
- DO wear eye protection, face protection, gloves, and protective clothing when working with or around the chemicals.
- DO immediately wash skin that has come in contact with chemicals.
- DO post MSDS (Material Safety Data Sheet) sheets for the chemicals you are using in a conspicuous area in the Equipment Area.
- Do follow applicable emergency medical procedures if chemicals are ingested in any way (oral, eyes, etc.).

1.5.3 Electrical Safety

Follow these precautions when working with electrical equipment:

- DO NOT open panel doors unless trained and authorized in electrical procedures.
- DO NOT work on energized equipment, if possible.
- DO wear eye protection around electrical panels.
- DO use proper lockout and tag-out procedures when servicing equipment.
- DO secure all electrical doors/covers when servicing is completed.

1.5.4 Wash Bay Safety

Follow these precautions when working in the Wash Bay:

- DO NOT sweep or discard debris into Wash Bay trench.
- DO wear proper-soled shoes (non-skid); the Wash Bay is slippery when wet.
- DO follow all applicable safety rules.

1.5.5 Pumps/Motors Safety

Follow these precautions when working with pumps and motors:

- DO NOT operate equipment without guards in place.
- DO NOT open or close manual valves in the Wash System without knowing what results these actions have to the system.
- DO consult the system schematic and this manual for correct valve states.
- DO perform preventive maintenance per schedule and procedure.
- DO keep hands, feet, and clothing clear of moving machinery – this is an automatic system.

1.5.6 Compressed Air Safety

When working with various pieces of equipment in the Equipment Area:

- DO wear eye protection when working around compressed air.

1.6 GLOSSARY OF TERMS USED IN THIS MANUAL

Communication Adaptor – a module that interfaces an Ethernet I/O Base to the System Control computer. The System Controller monitors and controls remote devices through the Communication Adaptor and the I/O Base.

E-Stop or Emergency Stop Buttons – two-state, maintained electrical switches that disable Wash System when pressed. Two E-Stop buttons are located in the Wash System. Pull the button to release or reset the switch.

Ethernet – the local area network (LAN) protocol the System Controller uses to interface with the input sensors and output devices in the Wash System.

Ethernet Base or I/O Base – the wiring interface for the electrical components in the Wash System; may contain discrete I/O points, analog I/O points, or both. The I/O Base is monitored and controlled by the Communication Adaptor.

IP Address – a number that uniquely identifies each Ethernet node or connection point in the System; i.e., 192.168.168.3.

Master Control Panel or MCP – the electrical panel that houses the System Controller and Ethernet I/O system. The Touch Screen is mounted on the MCP panel door. The MCP has a disconnect switch to remove AC power from the panel and an E-Stop Button to shut down the Wash System in an emergency.

Momentum – a trademark of Telemechanique Modicon; another name for the Ethernet I/O Bases.

pH – an indication of whether a solution is an acid or an alkaline (base). pH is rated on a scale of 0 (acid) to 14 (alkaline); the lower the pH number, the more acidic is the solution, and vice versa.

Photoeyes – visible light transmitter located on one side of the track with a corresponding receiver mounted on the opposite side of the track. An electrical signal output from the receiver is switched when the vehicle or other object blocks the red visible light beam emitted from the transmitter to the receiver.

Reclaim Slave Panel or RSP – the electrical panel that controls functions on the Reclaim Module. The MCP has a disconnect switch to remove AC power from the panel and an E-Stop Button to shut down the Wash System in an emergency.

Spray Arches – the mechanical structures that deliver water and chemicals to the vehicle in the Wash Bay. Arches are ∏-shaped and may contain spray nozzles or spinners to wash the vehicle. Nozzles are located on the vertical and/or horizontal pipes of the structure, as required, and their spray pattern adjusted to conform to the vehicle body requirements.

Spray Nozzles – individual ports (single or double) that spray water or soap solution over a fixed area of the vehicle body; arranged in Spray Bars and Spray Arches.

System Alarm – an abnormal condition in the Wash System. Alarm information is available on the Touch Screen ALARMS screen. See also Arches.

System Controller – the PC-based industrial computer that controls the wash operations - located in the Equipment Room in the Master Control Panel. The System Controller runs on the Windows 2000™ operating system. A flash memory card in the Controller holds both the operating system and the wash control program. A Touch Screen terminal on the front of the Controller is your interface to the computer allowing you to monitor processes and input configuration data.

Vehicle Sensors – see Photoeyes.

Spinners – CentriSpinner® rotating spray heads that deliver large volumes of high pressure water over large areas of the vehicle surface or under the chassis.

1.7 WASH SYSTEM SUMMARY

1.7.1 Overview

The Reclaim Water Vehicle Wash System is a drive-through design consisting of an Equipment Area, Wash Bay, and Drainage System. The Wash System uses chemicals, brushes, and high pressure sprays for vehicles of various sizes driving through the Wash Bay.

This is a reclaimed water Wash System with a fresh water option. This means the system can operate with water that has been reprocessed from previous wash cycles during the summer months to save money and water resources, or the system can use fresh water in the high pressure parts of the wash cycle during the winter months to avoid spraying the vehicles with water contaminated with road salt.

Fresh water is always used in the first part of the wash process, the 2-step chemical application. This water is softened and heated to optimize the effectiveness of the detergents and reduce detergent usage. Two types of concentrated detergent are automatically mixed with the hot water in correct proportions when the vehicle enters the Wash Bay and are applied to the vehicle through the two Chemical Arches.

The distance in the Wash Bay between the chemical application and the high-pressure wash section allows time for the chemicals to loosen and lift the dirt from the vehicle surfaces. Then high-pressure spray nozzles and/or spinners remove the dirt and rinse the vehicle clean. A floor-mounted Chassis Washer cleans the underside of the vehicle with high-pressure fixed spray nozzles.

The Wash System starts automatically when the vehicle enters the Wash Bay. Photoeye sensors throughout the Wash Bay detect the presence of the vehicle at each arch and control the wash process through the System Controller, an industrial PC running a custom wash program under the Microsoft Windows® operating system.

The Wash System can be divided into three functional systems: the Fresh Water System, Chemical Wash System, and the Reclaim Wash System. These are described briefly here and in detail in *Section 2: Wash System Description* of this manual.

1.7.2 Fresh Water System Summary

The Wash System receives fresh water from the municipal supply through a backflow preventer that allows water to flow only into the Wash System. This ensures that water cannot flow back out of the Wash System and into the municipal supply if the pressure in the main drops below the Wash System pressure. Do not bypass the backflow preventer.

The system uses fresh water to mix the detergent solutions applied to the vehicle at the start of the wash cycle. First, this water is softened to remove hard minerals, then heated to 105° F for more efficient washing.

Part of the fresh water is stored in a 925-gallon tank and is used for the high pressure wash parts of the cycle if the Wash System is in winter mode. Refer to *Section 2.1.3: Seasonal Wash Mode Configuration*. The tank also supplies fresh water to the Pickup Pit if the pit water level drops to a low level.

Finally, the Wash System uses the fresh water directly from the municipal supply to wet the brushes and to rinse the vehicle as it leaves the Wash Bay.

1.7.3 Chemical Wash System Summary

The Wash System uses a 2-step chemical application to loosen and lift dirt and oil from the vehicle body. The first chemical application is an acid-based detergent and the second is alkaline based.

The concentrated chemicals are mixed in correct proportion with hot, softened water and applied to the vehicle through fixed spray nozzles on two sets of chemical arches and spray bars. The timing for the chemical applications comes from four photoeyes and program timers. The soap solutions are sprayed onto the vehicle at approximately 50 psig developed by the Chemical Booster Pump.

The chemicals stay on the vehicle until it reaches the next part of the cycle, the high pressure wash. The distance between the chemical application and the high pressure wash gives the soap solutions time to work before being washed away. The speed of the vehicle through the Wash Bay is critical; too fast a speed and the chemicals do not have sufficient time to work and too slow a speed can lead to waste of water and chemicals. Drive the vehicle through the Wash Bay at 1-2 feet per second (fps).

1.7.4 Reclaim (High Pressure) Wash System Summary

The high pressure wash cycle sprays water onto the vehicle at pressures in the range of 300 to 320 psig. The water used depends on what mode (summer or winter) the Wash System is currently configured for. The system is configured using manually-operated ball valves and butterfly valves. Refer to *Section 2.1.3: Seasonal Wash Mode Configuration*.

All water used in the Wash Bay drains into an underground Settling Pit. In the inflow or primary side of the four-chambered concrete pit most of the debris and larger sediments settle out of the drain water which, when the level is high enough, overflows into the next chamber of the pit. This continues until the water fills the last part of the pit, referred to as the Pickup Pit, where it is pumped out and into the sediment separation system. The High Pressure Pump then pumps the water out to the high pressure spinners and arches during that part of the wash cycle (summer mode only).

Sediments are separated from the pit water through centrifugal action as the water is spun through a separator and then stored in a tank that continues the centrifugal action. This tank supplies water to the High Pressure Pump.

The Spinner Arch uses CentriSpinner® rotating spray heads that cover the vehicle with large volumes of water at a nominal 320 psig. The Spinner Arch takes care of the top and sides of all vehicles driving through the Wash Bay with 12 CentriSpinner® heads. The Chassis Washer is embedded in the floor of the drive lane and uses two CentriSpinner® heads to cover the bottom of the vehicle with high pressure reclaimed water.

The final high pressure wash arch, the Rear Wash Arch, uses 32 fixed spray nozzles focused on specific parts of the vehicle sides and top. These nozzles are also supplied by the High Pressure Pump at a nominal 320 psig. This arch is enabled only for larger vehicles that require an extended rear wash.

1.7.5 Wash Modes

The Wash System functions in one of four modes of operation. The modes are selected on the Control Screen on the Touch Screen terminal. The Touch Screen is the user interface to the System Controller. A detailed description of the Touch Screen and the wash modes follows in *Section* 2: *Wash System Description.*

The four operating modes are:

Auto Mode

This is the default or normal operational mode of the Wash System. All wash functions are enabled according to the current wash recipe (which can be viewed on the Touch Screen).

Standby

The Wash System is running but will not wash a vehicle in this mode; no Wash Bay functions operate. For example, none of the Aches spray water or detergent in Standby mode but the Booster Pump, Air Compressor, Water Heater, etc. continue to operate.

Manual

You cannot wash a vehicle in this mode but components/systems may be operated manually through functions on the Touch Screen Terminal. Some semi-automatic operations may occur in the back-

ground. For example, when a high-pressure arch is running, the fresh water storage tank will automatically refill.

Off

The entire Wash System is shut down. When power is first applied to the System or when a System Alarm occurs, the System reverts to OFF mode. You should manually set the System to this mode when making repairs to the Wash System.

1.7.6 Wash Authorization

The Wash System uses a radio-frequency identification system to authorize wash cycles. A vehicle must be tagged with a properly-encoded RFID tag to start a wash cycle when it drives into the Wash Bay. Vehicles without an RFID tag will not be washed.

All properly tagged vehicles entering the Wash Bay automatically receive the full vehicle wash; no further authorization is required and no other options are available. The wash cycle starts automatically when the tagged vehicle enters the Wash Bay and is detected by the first photoeye. The cycle proceeds automatically from that point as the vehicle travels through the Wash Bay.

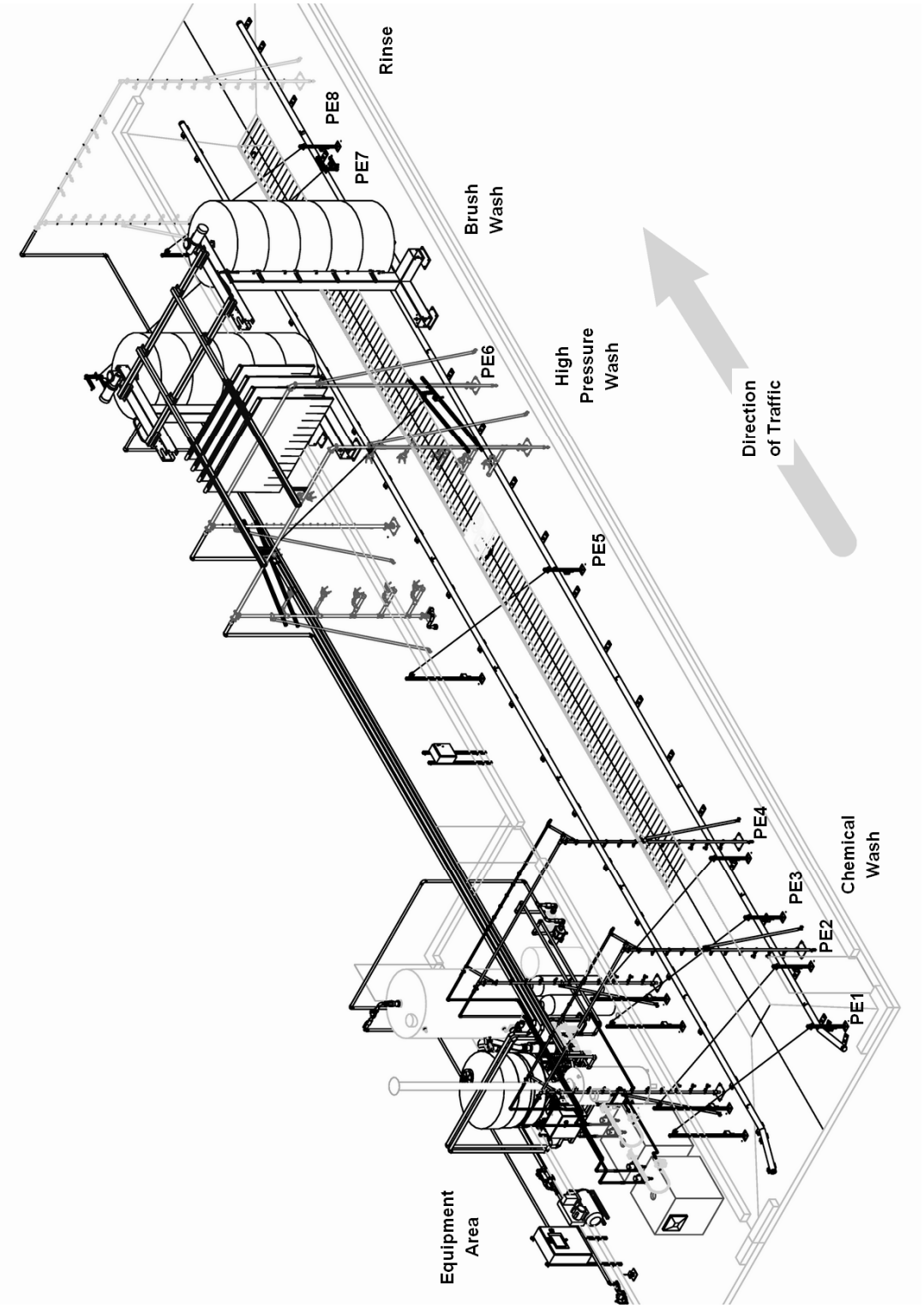


Figure 1- 3 Wash Site Layout – Plan View

2 WASH SYSTEM DESCRIPTION

Section 2 Table of Contents

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2.1 WASH SYSTEM OVERVIEW

2.1.1 Wash Cycle Overview

This Wash System is a drive-through design consisting of a Wash Bay, Equipment Area, and Drainage/Pit System. The system uses chemicals, high pressure sprays, and brushes to lift and remove dirt off the vehicle body. The system washes all parts of the vehicle body including under the chassis.

The system washes a variety of vehicles, basically whatever can safely fit through the arches. All the arches in the Wash Bay are used for every wash cycle and every vehicle receives the standard wash.

The wash cycles are automatic. Photoeyes throughout the Wash Bay track the progress of the vehicle and start and stop the different phases of the wash cycle automatically. The entire process is under the control of the System Controller, an industrial computer located in the Master Control Panel in the Equipment Area; also referred to as the wash computer.

The vehicle operator drives the vehicle through the Wash Bay during the cycle. The optimal speed through the Wash Bay is 1–2 fps (.68–1.36 mph). Driving through at a faster speed results in a degraded wash process because the detergents may not have sufficient time to work before the vehicle is rinsed. Too slow a speed through the Wash Bay may result in excessive chemical or water usage.

The Wash System has a seasonal option. During the summer months, the wash cycles use a combination of fresh water and water that has been reclaimed from the Settling Pit. This reclaimed water is used in the high pressure parts of the wash cycle. Because the Wash System is designed to wash salt trucks in the winter as well as other vehicles that may be heavily contaminated with road salt, the water draining into the Settling Pit can become very salty and reclaiming this water during the winter and spraying it onto vehicles can cause premature rusting of the vehicles.

The Wash System's fresh water option enables the wash site operator to switch the system over from using reclaimed water for the high pressure parts of the wash cycle to using fresh water during the winter months. This is a manual operation that involves opening and closing hand valves in the system and is described in *Section 3: Using the Wash System.*

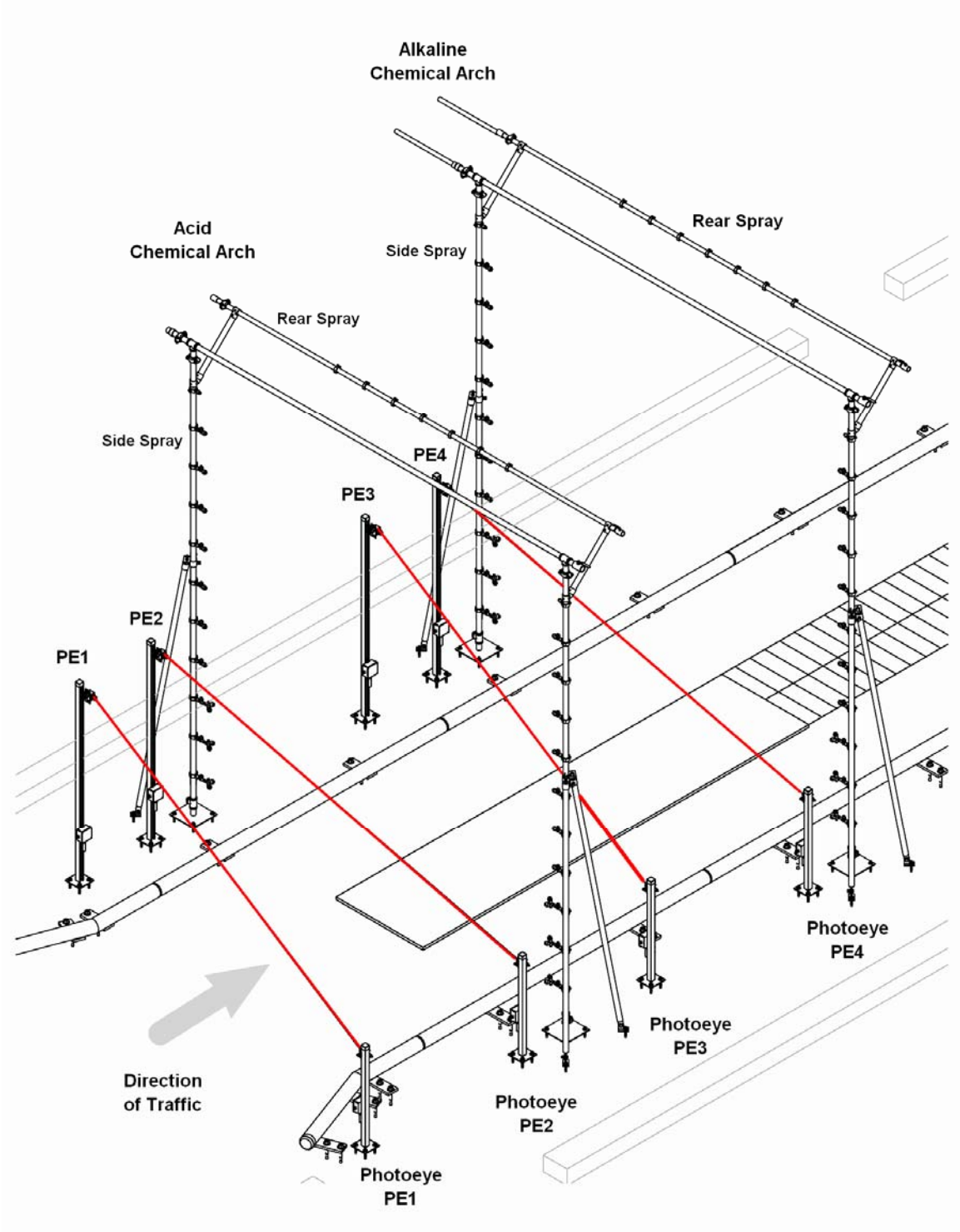


Figure 2- 1 Wash Bay Overview - Chemical Wash Section

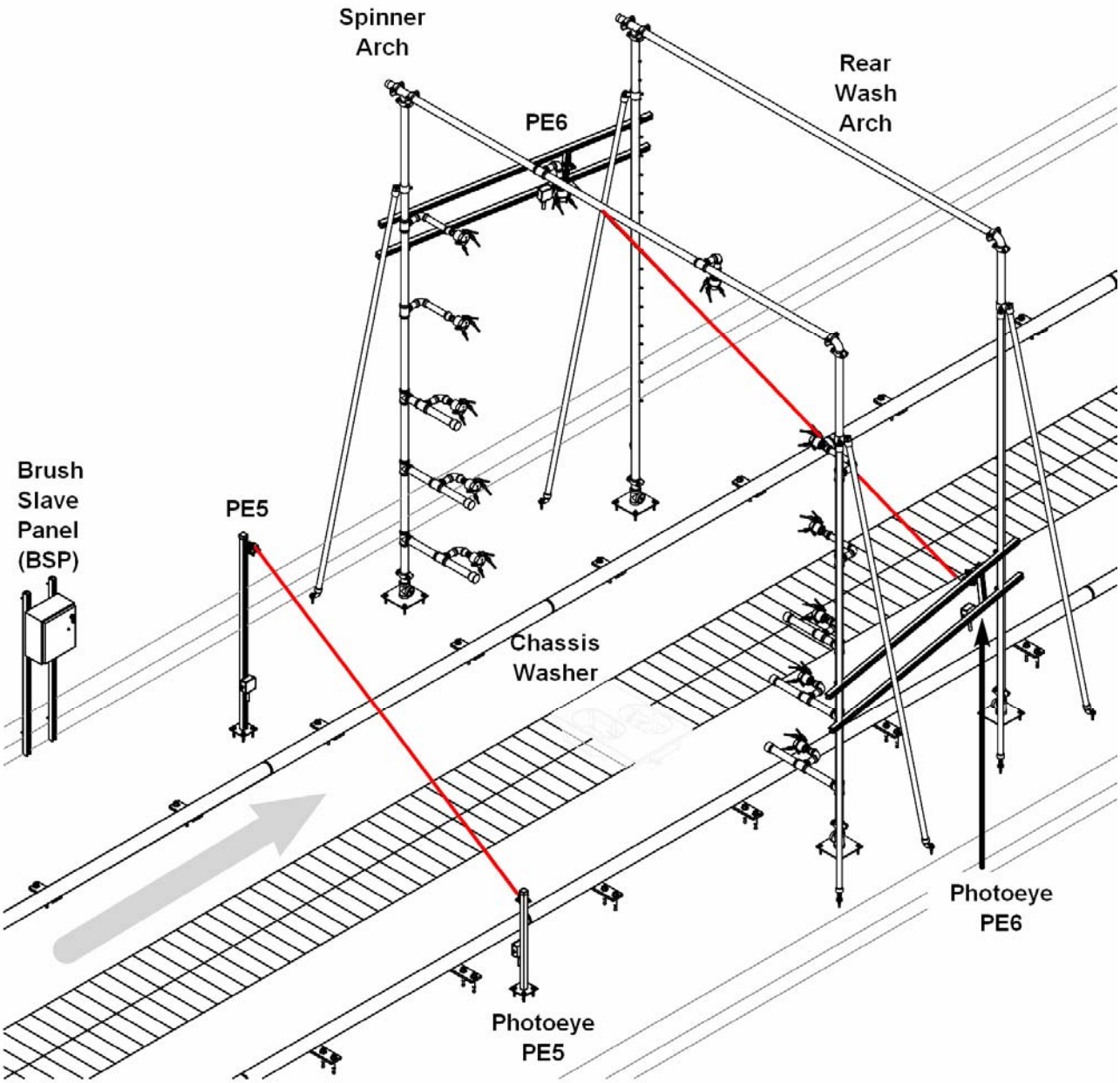


Figure 2- 2 Wash Bay Overview - High Pressure Wash Section

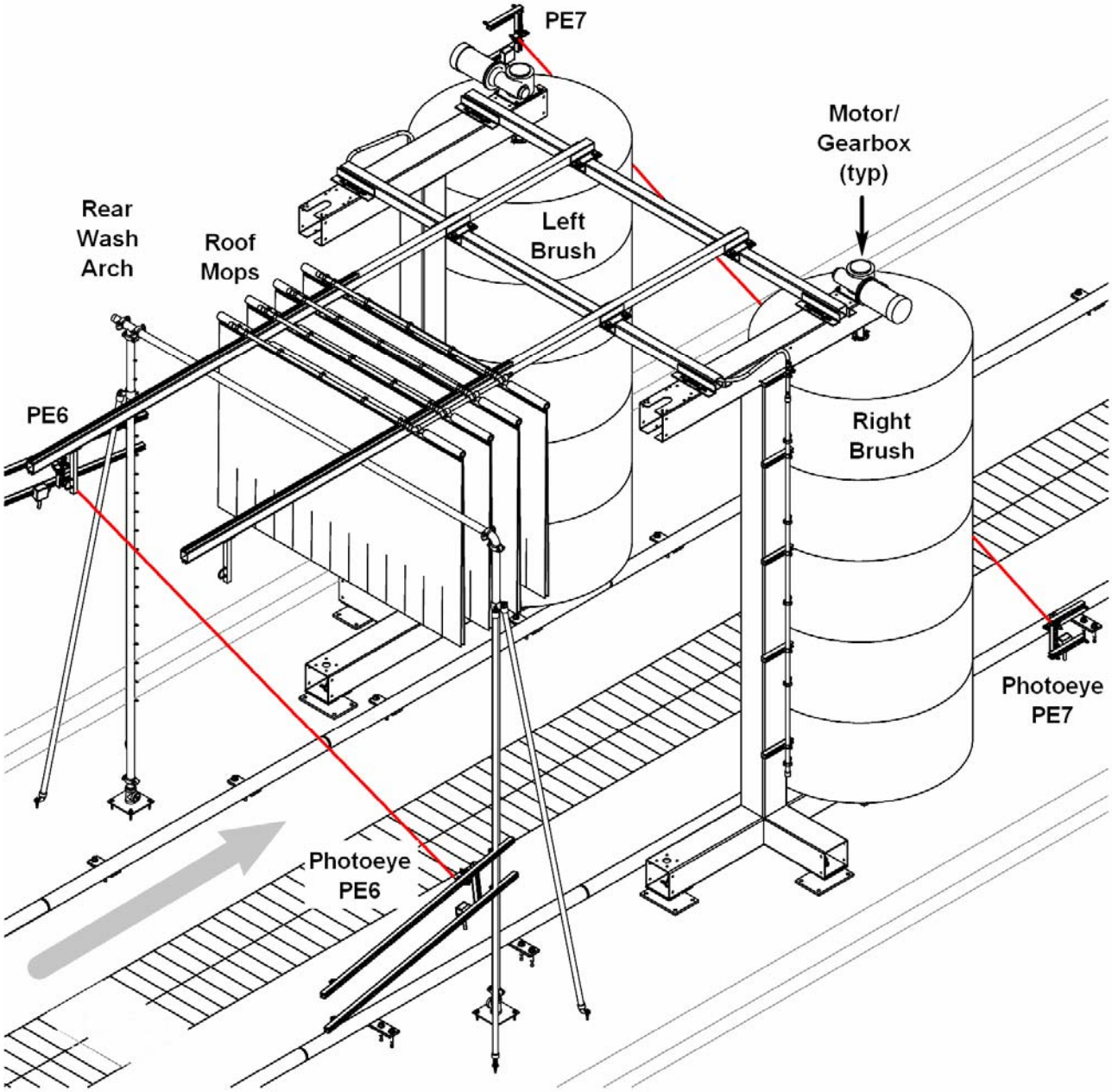


Figure 2- 3 Wash Bay Overview - Brush Section

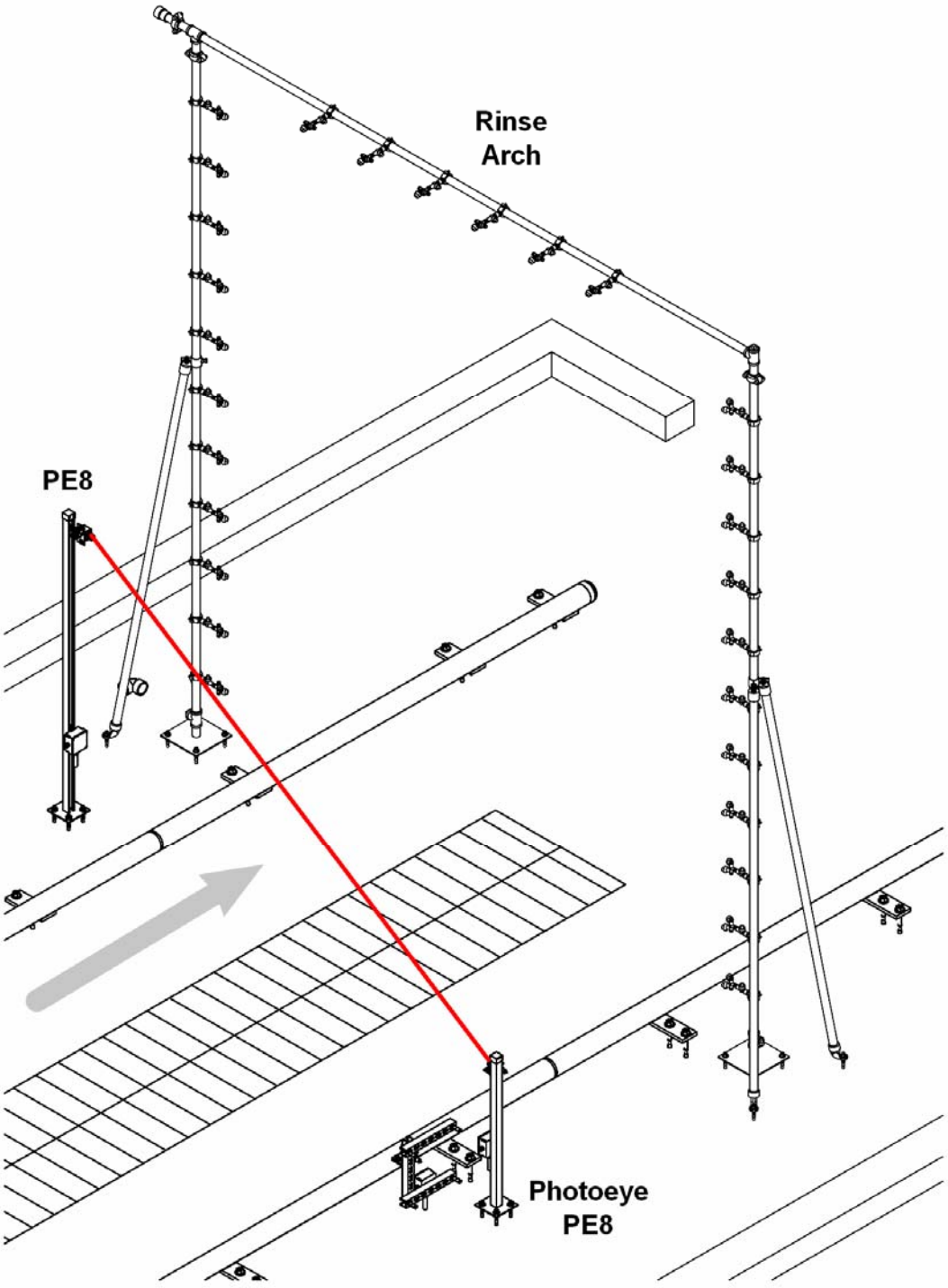


Figure 2- 4 Wash Bay Overview - Rinse Section

2.1.2 Wash Bay Description

The Wash Bay refers to the drive-through section of the wash site. It contains a number of what are referred to as 'wash arches' which may consist of an actual arch-shaped wash structure or floor-mounted wash devices; all are called arches in this manual. Each wash arch is described below in the order in which they are encountered in the Wash Bay.

2.1.2.1 RFID Reader – Detail 44 - DY07-099_1

The RFID tag reader is located at the entrance to the Wash Bay. The reader automatically detects a radio-frequency tag, if there is one installed on the vehicle, and authorizes the wash cycle. Once authorized, the vehicle just has to drive into the Wash Bay to start the cycle.

Any vehicle entering the Wash Bay without a properly encoded tag or a damaged tag will not start the wash cycle.

The RFID reader receives 24 VDC and 0 VDC from the Master Control Panel and communicates with the System Controller in that panel through a 13-conductor cable connected to the wash computer COM1 communication port.

2.1.2.2 Chemical Wash Arches – Detail 4 – DY00-210_1

Refer to *Figure 2- 5 Typical Chemical Wash* Arch and *Figure 2- 16 Chemical Wash Section Schematic.*

The two Chemical Arches each consists of two vertical side spray bars plumbed in common and a separately-plumbed horizontal rear spray bar. The arches sprays hot detergent solution onto the vehicle at the start of the wash cycle. All wash types receive the chemical application.

This Wash System uses a two-step chemical application. An acid-based detergent is applied first followed by an alkaline-based detergent. This combination, plus the dwell time before the vehicle reaches the next wash structure, loosen and lift dirt and oils from the vehicle surfaces. Refer to *Section 2.1.6: Chemical Wash System Description* for a description of the chemical mixing and application process.

The Acid Chemical Arch side spray bars are enabled when the vehicle blocks photoeye PE1 at the entrance to the Wash Bay. The photoeye consists of a sending unit on one side of the drive lane transmitting a light beam to a receiver on the opposite side. Blocking the beam changes an electrical signal and tells the System Controller the location of the vehicle.

This starts an on-delay timer in the wash program. The System Controller turns on the Acid Chemical Arch side spray bars when the timer times out. The spray bars remain on until the vehicle clears PE1 and an off-delay timer in the wash program times out.

Photoeye PE1 is wired into the system through input terminal P601 on I/O Base 1 located in the Master Control Panel (MCP).

As the vehicle drives forward it blocks the second photoeye sensor PE2. This starts an on-delay timer that signals the System Controller to turn on the Acid Chemical Arch rear spray bay when it times out. The spray bar remains on until the vehicle clears PE2 and an off-delay timer in the wash program times out.

Photoeye PE2 is wired into the system through input terminal P602 on I/O Base 1 located in the Master Control Panel (MCP).

The detergent solution applied to the vehicle here is mixed in the Acid Chemical Module (DY08-191_1) in the Equipment Area using hot fresh water and concentrated acid-based detergent. The process is described in detail in *Section 2.1.6: Chemical Wash System Description.*

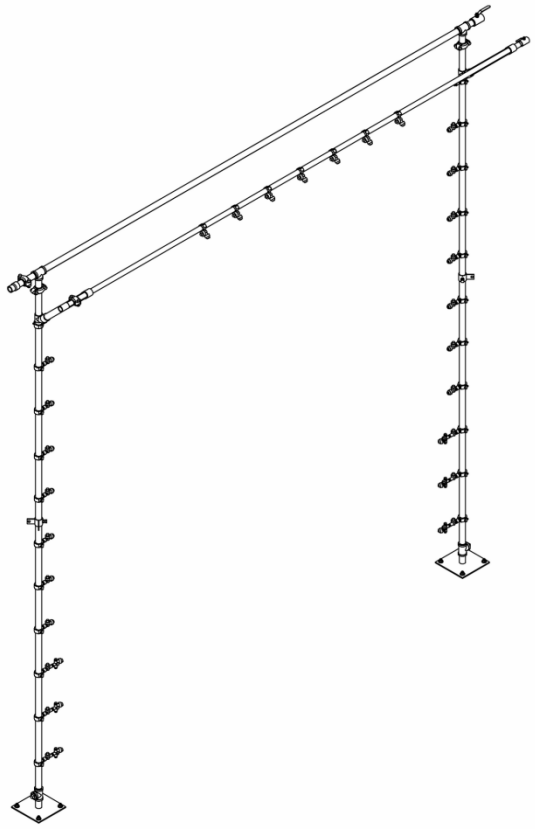


Figure 2- 5 Typical Chemical Wash Arch

Next, the Alkaline Chemical Arch side spray bars are enabled when the vehicle blocks photoeye PE3. The photoeye consists of a sending unit on one side of the drive lane transmitting a light beam to a receiver on the opposite side. Blocking the beam changes an electrical signal and tells the System Controller the location of the vehicle.

This starts an on-delay timer in the wash program. The System Controller turns on the Alkaline Chemical Arch side spray bars when the timer times out. The spray bars remain on until the vehicle clears PE3 and an off-delay timer in the wash program times out.

Photoeye PE3 is wired into the system through input terminal P603 on I/O Base 1 located in the Master Control Panel (MCP).

As the vehicle drives forward it blocks the second photoeye sensor PE4. This starts an on-delay timer that signals the System Controller to turn on the Alkaline Chemical Arch rear spray bay when it times out. The spray bar remains on until the vehicle clears PE4 and an off-delay timer in the wash program times out.

Photoeye PE4 is wired into the system through input terminal P604 on I/O Base 1 located in the Master Control Panel (MCP).

The detergent solution applied to the vehicle here is mixed in the Alkaline Chemical Module (DY08-190_1) in the Equipment Area using hot fresh water and concentrated alkaline-based detergent The process is described in detail in *Section 2.1.6: Chemical Wash System Description..* All vehicles receive the two-step chemical application.

2.1.2.3 Spinner Arch - Detail 2 – D99038_1

The Spinner Arch uses 12 CentriSpinners® to cover the vehicle with large volumes of water at a nominal 300-320 psig pressure. This water comes from the 75-hp High Pressure Pump on the EQ Module (DY05-001_1) located in the Equipment Area.

Each CentriSpinner® has four short spray arms set at an angle that rotate the spinner head at 80-160 rpm when the water flows through, enabling each CentriSpinner® to cover large areas of the vehicle. Refer to *Section 6: Primary Repair* for complete CentriSpinner® service and maintenance information.

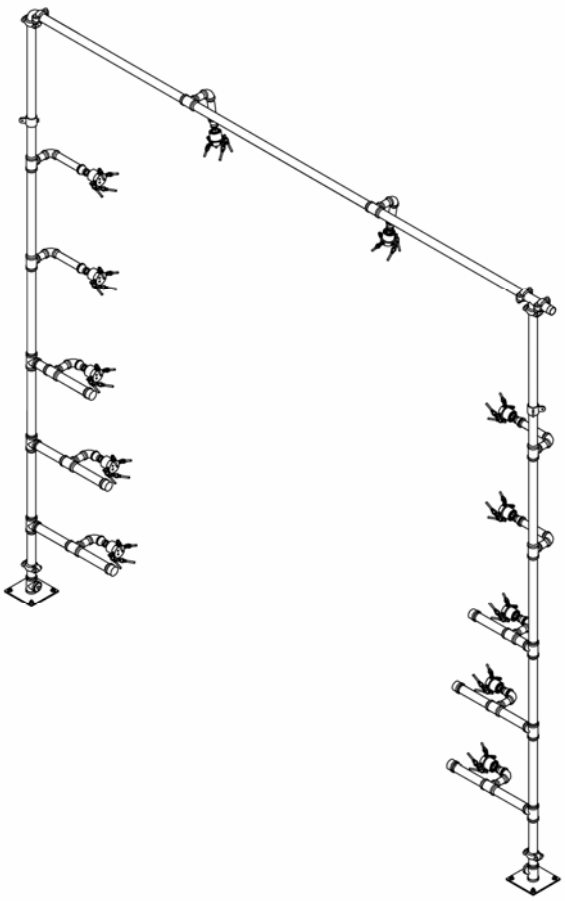


Figure 2- 6 Spinner Arch

If the Wash System is in winter mode (fresh water option) the arch is washing the vehicle with fresh water. In the summer mode, the spinners are spraying water reclaimed from the Settling Pit (reclaim water option). A complete description of how to change the seasonal wash configuration is in *Section 2.1.3*: *Seasonal Wash Mode Configuration* later in this manual. Refer to *Section 2.1.7: Reclaim Water System Description* for a detailed description of reclaiming waste water from the Settling Pit for reuse in wash cycles.

The Spinner Arch is controlled by photoeye PE5. When the System Controller senses PE5 is blocked (through input terminal P605 on I/O Base 1 in the Master Control Panel), the wash computer turns on the 75-hp High Pressure Pump on the EQ Module and turns on the 3-way Co-Ax solenoid valve SOV6 to direct the pump discharge to the Spinner Arch and Chassis Washer.

The arches remain on until the vehicle has cleared PE5 and an off-delay timer in the wash program has timed out. Following an off-delay time, the computer closes the two Co-Ax valves and turns off the High Pressure Pump.

2.1.2.4 Chassis Washer – Detail 47 – DY08-251_1

The Chassis Spinner is embedded in the floor of the Wash Bay by the spinner arches. It uses two CentriSpinners® to flood the underside of the vehicle with either reclaimed water (summer water option) or fresh water (winter water option).

Each CentriSpinner® has four short spray arms set at an angle that rotate the spinner head at 80-160 rpm when the water flows through, enabling each CentriSpinner® to cover large areas of the vehicle. Refer to *Section 6: Primary Repair* for complete CentriSpinner® service and maintenance information.

If the Wash System is in winter mode (fresh water option) the arch is washing the vehicle with fresh water. In the summer mode, the spinners are spraying water reclaimed from the Settling Pit (reclaim water option).

Refer to *Section 2.1.3: Seasonal Wash Mode Configuration* for a detailed description of the two options. Refer to *Section 2.1.7: Reclaim Water System Description* for a detailed description of reclaiming waste water from the Settling Pit for reuse in wash cycles.

The Chassis Washer is controlled by photoeye PE3 for all wash types. When the System Controller senses PE3 is blocked (through input terminal P603 on I/O Base 1 in the Master Control Panel), the computer turns on the 75-hp High Pressure Pump on the EQ Module, turns on the 3-way Co-Ax solenoid valve SOV6 to direct the pump discharge to the Chassis Washer through manual valve MV9.

The arch remains on until the vehicle has cleared PE3 and an off-delay timer in the wash program has timed out. At that time, the computer closes the Co-Ax valve and turns off the High Pressure Pump.

Adjust manual valve MV9 so the flow and pressure through the Chassis Washer does not flood the engine compartment with the upward spray of water discharged from the High Pressure Pump at a nominal 300-320 psig pressure.

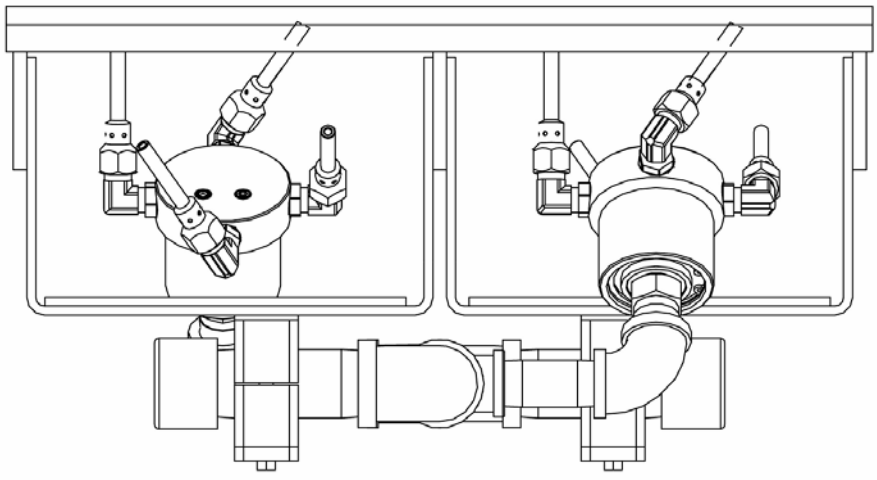


Figure 2- 7 Chassis Washer - Side View

2.1.2.5 Rear Wash Arch – Detail 3 – DY03-023_1

The Rear Wash Arch provides an extended high pressure wash of the rear of larger vehicles. This arch is enabled for all wash types if the vehicle is large enough to block the high-mounted photoeye PE6. If PE6

is not blocked when the vehicle drives through this part of the Wash Bay, the Rear Wash Arch is not active.

The System Controller monitors PE6 through input terminal P606 on I/O Base 1 located in the Master Control Panel. When the photoeye is blocked and an on-delay timer has timed out, the computer turns on the 75-hp High Pressure Pump on the EQ Module. The discharge from the pump flows to the Rear Wash Arch through the normally-open port on the 3-way Co-Ax solenoid valve SOV6 that is off at this time.

If the Wash System is in winter mode (fresh water option) the arch is washing the vehicle with fresh water. In the summer mode, the spinners are spraying water reclaimed from the Settling Pit (reclaim water option). A complete description of how to change the seasonal wash configuration is in *Section 2.1.3: Seasonal Wash Mode Configuration* later in this manual. Refer to *Section 2.1.7: Reclaim Water System Description* for a detailed description of reclaiming waste water from the Settling Pit for reuse in wash cycles.

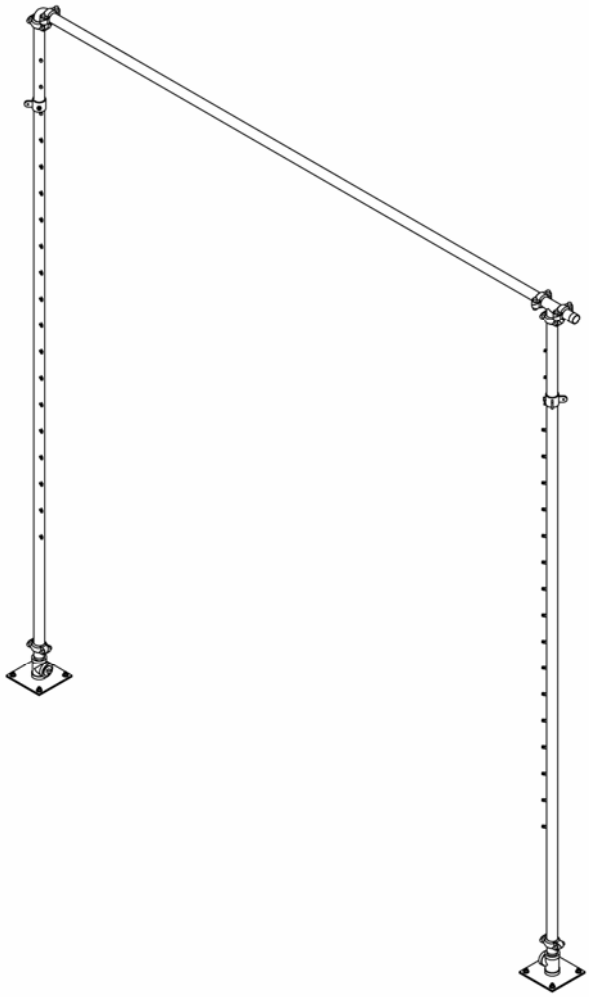


Figure 2- 8 Rear Wash Arch

2.1.2.6 Brush Module – Detail 9 – DY05-016_1

After the high pressure wash section, two vertical brushes scrub the sides of the vehicle as it passes through. Each brush is powered by a 5-hp, 480 VAC, 3-phase motor rotating at 1800 rpm. The motor torque is transferred to the brush shaft through an 18:1 reduction, 90-degree gearbox resulting in a brush rotational speed of approximately 100 rpm.

The brush motors are controlled by the wash computer through motor contactors located in the Brush Slave Panel (BSP) that is located in the Wash Bay.

The brushes rotate with the direction of travel of the vehicle to reduce the chance of brush damage to extensions such as mirrors. They are wetted by fresh water pumped to two vertical spray bars by the Rinse Booster Pump at approximately 50 psig. Five spray nozzles on each spray bar keep the brushes wet as they rotate.

Three stationary roof mops scrub against the tops of the vehicles as they pass through. The mops are wetted by three horizontal spray bars with fixed spray nozzles using fresh water supplied by the Rinse Booster Pump.

Photoeye PE5 turns on the Rinse Booster Pump through motor contactor 4M in the Master Control Panel when it is blocked by the vehicle. At the same time, both brush motors are turned on through motor contactor in the Brush Slave Panel located next to the Fresh Water Tank in the Equipment Area behind the splash wall.

The brushes continue to rotate until the vehicle has cleared photoeye PE7 and an off-delay timer in the control program has timed out. At that time, the brush motors and Rinse Booster pump are turned off.

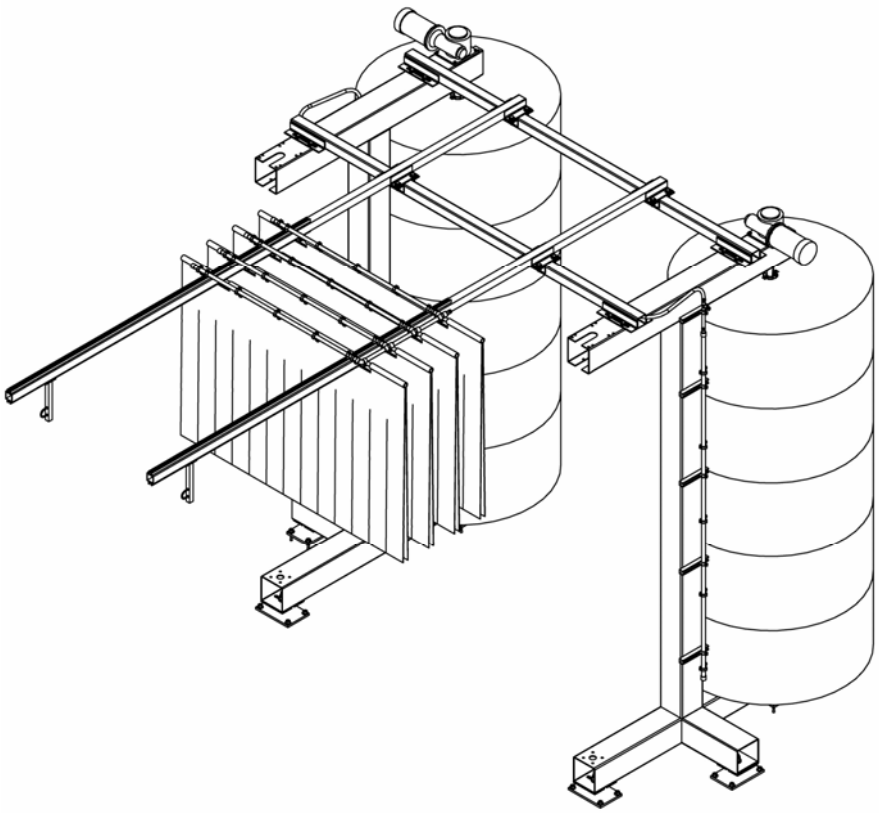


Figure 2- 9 Brush Module

2.1.2.7 Rinse Arch – Detail 5 – DY00-218_1

The Rinse Arch uses 28 double nozzles to rinse all vehicles with fresh water. The arch is enabled when the vehicle blocks photoeye PE5 and an on-delay timer times out. The System Controller turns on the 3-hp Rinse Booster Pump and 24 VDC solenoid valve SOV8 located in the Rinse Module (DY04-003_1) located in the Equipment Area.

The Rinse Booster Pump pulls fresh water from the municipal water supply through the backflow preventer. The 28 double nozzles on the arch give an effective 56 spray points to cover the vehicle.

The Booster Pump and arch remain on until the vehicle clears photoeye PE5 and an off-delay timer in the wash program times out. PE5 is wired to the system through input terminal P605 on I/O Base 1 located in the Master Control Panel (MCP).

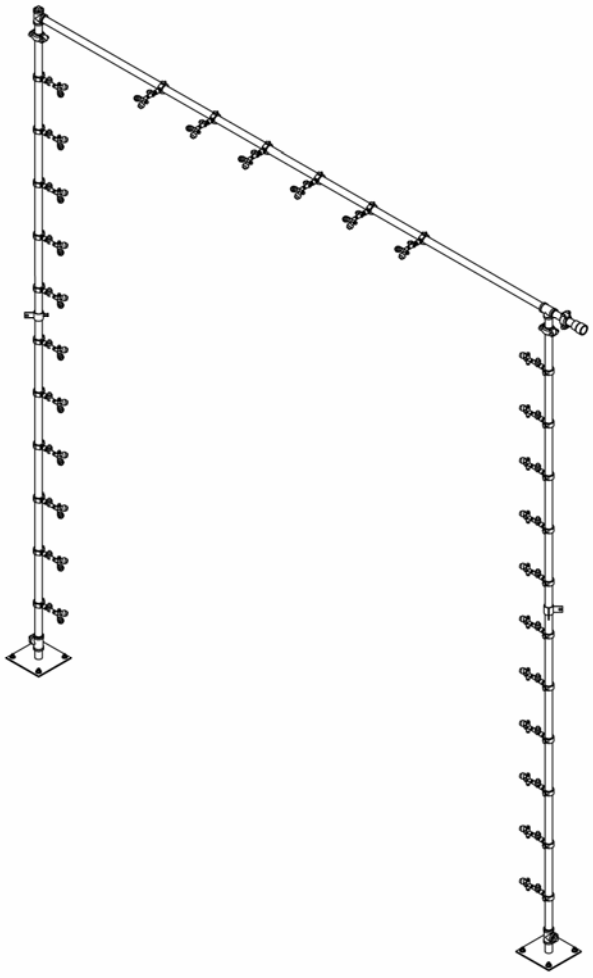


Figure 2- 10 Rinse Arch

2.1.3 Seasonal Wash Mode Configuration

The Wash System has two overall modes that enable it to offer the best wash depending on the season. This affects the high pressure parts of the wash cycle, allowing the system to use fresh water in the winter months and reclaimed water in the summer months for a saving in fresh water purchased from the local utility.

During the winter, the water in the Settling Pit contains a high percentage of salt that is washed off of salt trucks and other vehicles that pick up salt from the roads. Using this water for the high pressure washes will lead to early vehicle body rusting so it is best to use the fresh water option in the winter months.

Changing the system from one mode to the other involves opening and closing manual ball valves and butterfly valves in the system, as described in the following subsections. Refer to *Table 2- 1 Summer/Winter Modes Valve State Chart* for the location of the valves used in this process.

2.1.3.1 Summer Mode – Reclaim Water Option

The summer mode, or reclaim water option mode, enables the Wash System to use water that has been reclaimed from the Settling Pit. This is water that has drained off the vehicles and into the pit from previous wash cycles. Sediments are removed from the water, making it suitable for use in future washes. This affects only the high pressure parts of the wash cycle, not the chemical application or the rinse.

To use reclaimed water for the high pressure wash:

1. Close 4” butterfly valve BFV1 to isolate the High Pressure Pump from the Fresh Water Tank.
2. Open ½” manual valves MV12 and MV13 that connect the Cyclonic Separator sump area and the 500-gallon cone-bottomed EQ Tank sump area to the pit circulation water.
3. Open 4” butterfly valve BFV2 that connects the 7.5-hp Sump Pump on the EQ Module to the InterScreen filter in the Settling Pit.

Refer to *Section 2.1.7: Reclaim Water System Description* for a detailed description of the water reclamation process.

2.1.3.2 Winter Mode – Fresh Water Option

The winter mode, or fresh water option mode, enables the Wash System to use water from the municipal water supply for the high pressure parts of the wash cycle. This affects only the high pressure parts of the wash cycle, not the chemical application or the rinse.

To use fresh water for the high pressure wash:

1. Close 4” butterfly valve BFV2 to isolate the High Pressure Pump from the Settling Pit.
2. Close ½” manual valves MV12 and MV13 to disconnect the Cyclonic Separator sump area and the 500-gallon cone-bottomed EQ Tank sump area from the pit circulation water.
3. Open 4” butterfly valve BFV1 that connects the 7.5-hp Sump Pump on the EQ Module to the Fresh Water Tank.

Table 2- 1 Summer/Winter Modes Valve State Chart

Season	Water Source	BFV1	BFV2	MV12	MV13
Summer	Reclaimed	Closed	Open	Open	Open
Winter	Fresh	Open	Closed	Closed	Closed

2.1.4 Drain & Pit System

2.1.4.1 Wash Bay Drain

A central drain trench in the Wash Bay collects the waste water, soap, dirt, and sediments draining off vehicles during the wash cycle. The drain is sloped to gravity feed the water to the Settling Pit, a concrete structure located underground next to the Wash Bay. A steel grate covers the drain to prevent larger debris from falling into the system.

2.1.4.2 Settling Pit

The four-chambered Settling Pit collects the water in one end, the inflow section, and a series of pipes located at different heights in the walls separating the sections allows the water to gradually pass into the opposite end of the pit, the pickup section. Most of the heavier sediments and other debris settles out in the inflow section, then more in the next section, and so on until the water reaches the pickup section where it is free enough of sedimentary material to be used in future wash cycles.

Water is pumped from the pickup section by the 7.5-hp Sump Pump located on the EQ Module (DY05-001_1). This water is processed by components on the EQ Module and used during the high pressure parts of the wash cycle if the summer option configuration is in place. Refer to *Section 2.1.3: Seasonal Wash Mode Configuration.*

2.1.4.3 InterScreen Filter and Intake Pipe

The water pumped from the pit for reclamation is pulled through a drum-like filter called the InterScreen. The stainless filter has a finely-slotted outer wall the draws in the water when the Sump Pump is running, but blocks debris from enter the filter and, consequently, the pump.

To prevent the InterScreen from becoming clogged over time, the filter is automatically backflushed with compressed air every 5th wash cycle. Air from the system compressor is connected to the inside of the InterScreen through 24 VDC solenoid valve SOV5 located on the EQ Module. The short blast of air blows off any debris collected on the outer wall of the filter.

The intake pipe connects to the suction port of the 2-hp Circulation Pump located on the EQ Module. The Circulation pump pulls water from the pickup section of the Settling Pit, pumps it around a loop where air is injected to help prevent stagnation and pit odors, and then dumped into the inflow section of the pit. In the process, sediments collected from the sump sections of the Cyclonic Separator and cone-bottomed EQ Tank are also dumped into the inflow section of the pit. Refer to *Section 2.1.7: Reclaim Water System Description* for more information.

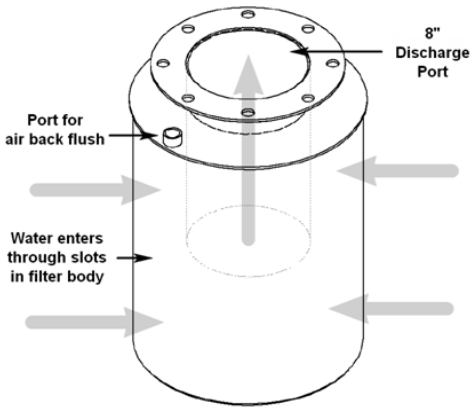


Figure 2- 12 InterScreen Filter - Suction Mode

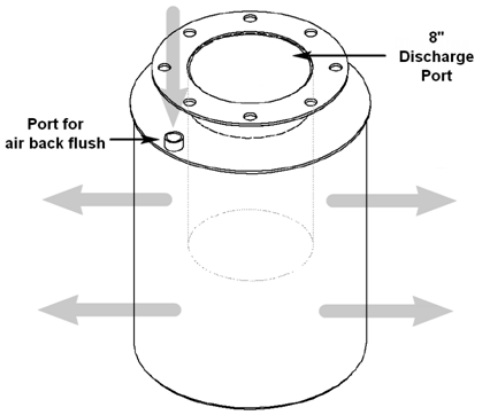


Figure 2- 11 InterScreen Filter - Backflush Mode

2.1.4.4 Float Switches

Two float switches in the pickup section of the Settling Pit monitor the pit water level. The pit must maintain at least a minimum water level to safely operate the Sump Pump that is part of the water reclamation process and the Circulation Pump that keeps the water agitated to prevent stagnation and prevent pit odors. The float switches have the following functions:

Upper float switch – Detail 25

This red normally-closed float switch controls the refilling of the pit when the water level drops. The switch is held open if there is sufficient water in the pit. If the switch closes due to falling water level, the System Controller turns on solenoid valve SOV8 that connects the pit to the municipal water supply.

There is a manual valve MV7 upstream of the solenoid valve that must be open to enable this automatic pit refilling if the valve is open. Closing MV7 disables automatic refilling. The pit receives water drained from the Wash Bay and this is usually sufficient to keep the pit at a safe level. Some water is lost from the wash process by vehicle carry out and from the Settling Pit due to evaporation. If frequent pit refilling is taking place you should investigate the possibility of a leak in the drainage system.

The pit may also be manually refilled at any time by opening manual valve MV8 that bypasses the SOV8/MV7 circuit.

CAUTION:	**Maintain visual contact with the Pickup Pit if you are refilling it manually by opening valve MV8. Failure to heed this caution can overfill the pit and flood the surrounding area with a resultant waste of water resources.**

Lower Float Switch – Detail 26

This yellow normally-open float switch monitors the pickup section of the Settling Pit for a safe water level. The switch is held closed by a safe water level and opens if the level drops too far. This signals the System Controller to issue an alarm, stop a wash cycle in progress, and shut down the pumps that rely on the pit for water to prevent pump damage due to cavitation if the pumps lose prime on their suction ports.

This should not happen if the pit is in automatic refill mode (MV7 is open and SOV8 is operating correctly). Troubleshoot the valves in this system if this alarm occurs. Refer to *Section 2.3.6: Main Screen – Alarms Screen* for more on recovering from an alarm condition.

2.1.4.5 Solenoid Valves

Three 24 VDC solenoid valves in this part of the system control fluid flow. The valves are controlled by the System Controller through the indicated I/O points.

- **SOV1** – controls the refilling of the Fresh Water Tank – controlled through output terminal P705 on I/O Base 1 in the Master Control Panel (MCP).
- **SOV8** – controls the automatic refilling of the Settling Pit with fresh water if manual valve MV7 is open – controlled through output terminal P702 on I/O Base 1 located in the Reclaim Slave Panel (RSP).
- **SOV9** – controls the flow of fresh water from the 3-hp Rinse Booster Pump to the Rinse Arch – located in the Rinse Module (DY05-031_1) – controlled through output terminal P715 on I/O Base 1 located in the Master Control Panel (MCP).
- **SOV10** - controls the flow of fresh water from the 3-hp Rinse Booster Pump to the Brush Module – located in the Rinse Module (DY05-031_1) – controlled through output terminal P716 on I/O Base 1 located in the Master Control Panel (MCP).

2.1.4.6 Manual Valves

A number of manual valves in the Wash System enable manual control over some fluid processes. The valves must be in the correct 'normal' state in order for the Wash System to operate correctly. Refer to *Table 4- 2 Manual Valve State Chart* located in *Section 4: Maintenance* for a brief explanation of each valve in the Wash System and its normal state.

2.1.5 Fresh Water System Description

2.1.5.1 Overview

Refer to *Figure 2- 13 Fresh Water System Schematic*.

The Fresh Water System receives water from the municipal supply through a backflow preventer (not supplied as part of the Wash System) that allows water to only flow into the Wash System. This ensures that no water can flow back out of the Wash System and into the municipal supply if the pressure in the main drops below the Wash System pressure. Do not bypass or remove the backflow preventer.

Fresh water is available directly from the municipal supply for mixing the detergent solutions applied to the vehicle through the Chemical Wash Arches. The water is first softened and heated to 105° F to make the detergents more effective in loosening and lifting dirt and grease from body panels.

Fresh water also fills the Fresh Water Tank that supplies water to the high pressure arches if the Wash System is in winter (fresh water option) mode. The tank is refilled automatically as required by the System Controller and a solenoid valve in the system.

2.1.5.2 Chemical Booster Pump – Detail 33 – Goulds HSC10B

This 1-hp centrifugal pump moves the fresh water from the outlet of the backflow preventer and manual valve MV2 to the water softener, then the water heater through check valve CV1. The pressure developed by this flow moves the water through the two Chemical Module (DY08-190_1 and DY08-191_1), where the soap solutions are mixed, and out to the Chemical Arches.

The pump is controlled by the wash computer through motor contactor 3M in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 in the MCP. When turned on, the contactor connects 480 VAC 3-phase power to the pump motor through an overload module that protects the wiring from fire if there is a short circuit to ground or the pump motor draws excessive current for a period of time. The overload module sends an auxiliary feedback signal to the computer through input terminal P614 on I/O Base 1 in the MCP.

CAUTION:	**Do not run the Booster Pump with manual valve MV2 closed or damage to the pump will occur from overheating.**

2.1.5.3 Rinse Booster Pump – Detail 34 – Goulds 3BF1H2A0H

This 3-hp centrifugal pump moves the fresh water from the outlet of the backflow preventer and manual valve MV2 to the Brush Module and the Rinse Arch through the Rinse Module (DY05-031_1).

The pump is controlled by the wash computer through motor contactor 4M in the Master Control Panel (MCP). The contactor is controlled through output terminal P712 on I/O Base 1 in the MCP. When turned on, the contactor connects 480 VAC 3-phase power to the pump motor through an overload module that protects the wiring from fire if there is a short circuit to ground or the pump motor draws excessive current for a period of time. The overload module sends an auxiliary feedback signal to the computer through input terminal P615 on I/O Base 1 in the MCP.

2.1.5.4 Water Softener – Detail 43 – Cuno OFDS5015S

The 39 GPM water softener receives water from the Chemical Booster Pump, removes magnesium and calcium ions from the water before supplying it to the Chemical Wash System through the water heater. Removing these minerals from the water enables the water to make better contact with whatever surface it covers and reduces the amount of detergents needed to produce high-quality soap solutions to apply to the vehicles being washed.

Water flows into and out of the softener through two normally-open manual valves, MV20 and MV21, respectively. These valves, and the water softener, can be bypassed by opening a normally-closed manual valve MV19 and closing the other two valves if offline service to the unit is required.

The softener has two resin tanks where the magnesium and calcium are removed and replaced with sodium ions. One tank is online at a time while the other tank is being backwashed or is waiting to go online. Backflushing of the resin tanks is performed automatically, with the online tank taken offline and the offline tank switched into service. This allows uninterrupted soft water for the wash processes.

The backwash solution is produced inside the brine tank which must be kept at least 50% filled with high-quality water softener salt. Do not use rock salt or a cheap grade of salt in the softener. The manufacturer's operation and maintenance manual for the water softener is included in *Section 8: Appendix*.

The water flows from the softener to the water heater where the temperature is raised to 105° F before it flows to the Chemical Wash System. Like the softener, two normally-open and one normally-closed manual valve control the flow of water into, out of, and around the water heater. The water heater was not supplied by InterClean Equipment Company as part of the Wash System and no other information regarding the heater is supplied in this manual.

2.1.5.5 Fresh Water Tank – Detail 44

This 925-gallon polyethylene tank holds fresh water received from the municipal supply until it is needed to supply the high pressure wash arches if the Wash System is in fresh water mode (winter mode).

The tank holds two float switches that monitor the water level. The tank is refilled automatically if the normally-closed upper float switch closes due to a falling water level and an on-delay timer in the wash program times out. The System Controller turns on solenoid valve SOV1 and the tank refills from the municipal water supply until the upper float switch closes and an off-delay timer times out.

The normally-open lower float switch in the tank, held closed with a safe water level, opens if the water level drops below a safe operating point. The switch signals the System Controller to disable future wash cycles to protect the pumps from cavitation damage if the pump suction port loses prime.

If the Wash System is in winter mode (fresh water option), water from the tank is used for all the high pressure phases of the wash cycle. Water is pulled from the tank by the 7.5-hp Sump Pump, part of the EQ Module (DY05-001_1), and pumped to the arches by the 75-hp High Pressure Pump, also part of the EQ Module. Refer to *Section 2.1.7: Reclaim Water System Description* for more information.

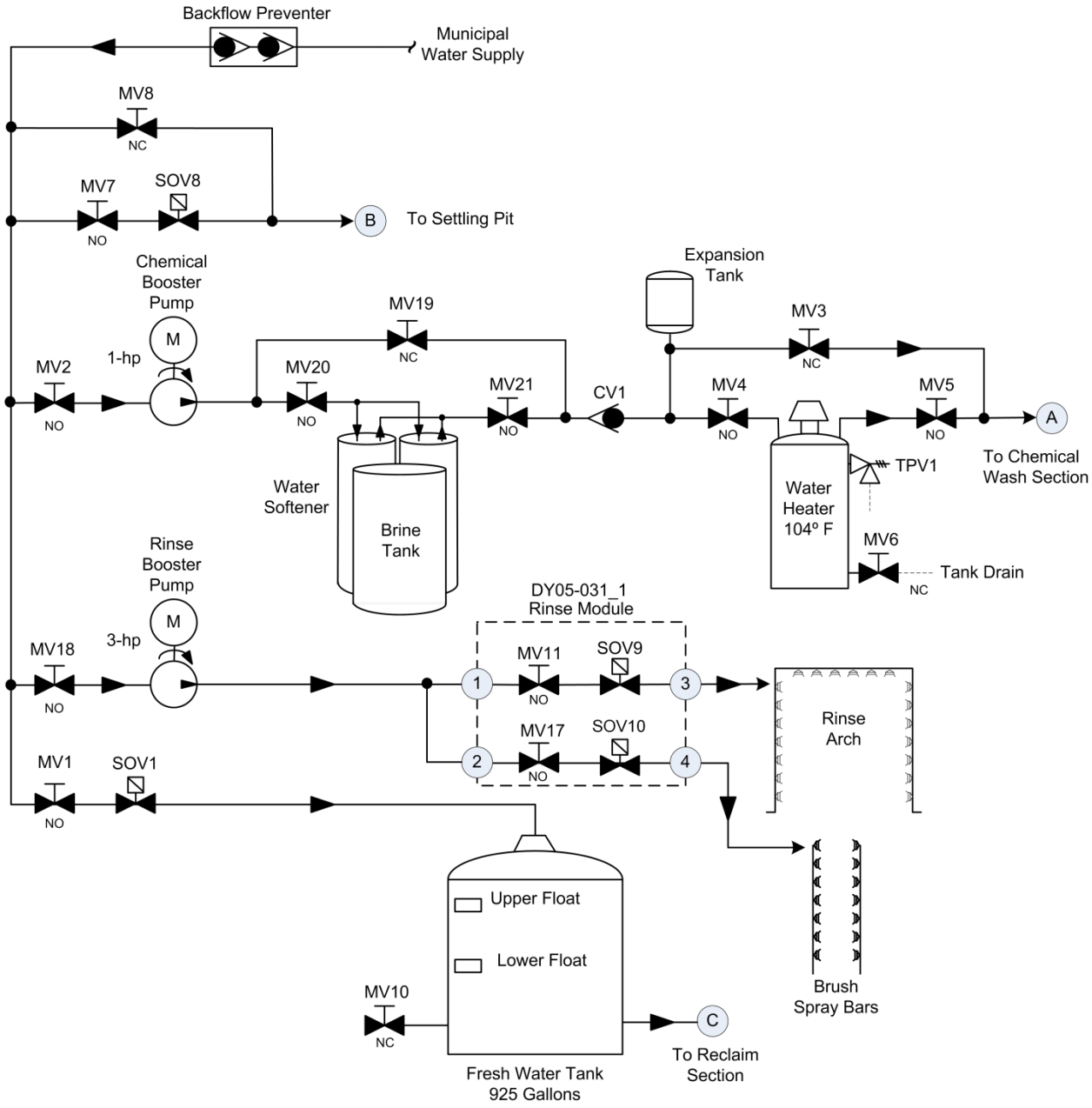


Figure 2- 13 Fresh Water System Schematic

2.1.6 Chemical Wash System Description

2.1.6.1 Overview

Refer to *Figure 2- 14 Acid Chemical Module Details* through *Figure 2- 16 Chemical Wash Section Schematic.*

The Wash System uses a 2-step chemical application to loosen and lift the dirt and oil from the vehicle body. The System first applies an acid-based detergent solution to the vehicle body followed by an alkaline-based detergent solution that remains the vehicle until it reaches the high pressure wash section.

At the start of the wash cycle, hot soft water is pumped into the Acid Chemical Module (DY08-191_1), an assembly of components that filter the water and regulate the pressure (F2 and PRV2). This is also where the water is mixed with the concentrated acid-based detergent to produce the soap solution initially applied to the vehicle. The two Chemical Modules are located in the Equipment Area.

The System Controller turns on 24 VDC solenoid valve SOV4 when the vehicle blocks photoeye PE1 and an on-delay timer in the wash program times out. The solenoid valve flows hot water to the side spray bars on the Acid Chemical Arch at approximately 50 psig pressure developed by the flow from the 1-hp Chemical Booster Pump.

In the Acid Chemical Module, the water flows through one of two Dosatron chemical injection pumps that pulls concentrated detergent from a supply tote or barrel and mixes it with the hot water in a precise ratio to form the first soap solution that sprays from the two vertical side spray bars on the arch. The concentration of the detergent solution is adjustable through the Dosatron pump. Refer to *Section 4.2.1: Adjusting the Dosatron Pumps* for more information.

Next, the vehicle blocks photoeye PE2 and starts another on-delay timer. When the timer times out, the System Controller turns on solenoid valve SOV5 that flows hot water out to the Acid Chemical Arch horizontal rear spray bar through the Acid Chemical Module. The other Dosatron chemical injection pump mixes concentrated detergent with the hot water to form the soap solution applied to the vehicle through the rear spray bar. The two injection pumps allow you to adjust the detergent solution strength individually for the side sprays and rear spray. Again, refer to *Section 4.2.1: Adjusting the Dosatron Pumps* for more information.

The Dosatron pumps do not require electricity to operate but are powered by the water flowing through them. Refer to the manufacturer's information included in *Section 8: Appendix* for complete adjustment and service information.

The spray bars on the Acid Chemical Wash Arch remain on until the vehicle clears photoeyes PE1 and PE2 and individual off-delay timers in the wash program time out. Each chemical spray bar incorporates a check valve that prevents the soap solutions from draining out between wash cycles. This enables the spray nozzles to begin applying chemicals to the vehicle as soon as their part of the cycle starts.

Next, the vehicle blocks photoeye PE3 and starts the alkaline-based detergent application. Hot soft water is pumped into the Alkaline Chemical Module (DY08-190_1), an assembly of components that filter the water and regulate the pressure (F1 and PRV1). This is also where the water is mixed with the concentrated alkaline-based detergent to produce the second soap solution applied to the vehicle.

The System Controller turns on 24 VDC solenoid valve SOV2 when the vehicle blocks photoeye PE3 and an on-delay timer in the wash program times out. The solenoid valve flows hot water to the side spray bars on the Alkaline Chemical Arch at approximately 50 psig pressure developed by the flow from the 1-hp Chemical Booster Pump.

In the Alkaline Chemical Module, the water flows through one of two Dosatron chemical injection pumps that pulls concentrated detergent from a supply tote or barrel and mixes it with the hot water in a precise ratio to form the first soap solution that sprays from the two vertical side spray bars on the arch. The con-

centration of the detergent solution is adjustable through the Dosatron pump. Refer to *Section 4.2.1: Adjusting the Dosatron Pumps* for more information.

Next, the vehicle blocks photoeye PE4 and starts another on-delay timer. When the timer times out, the System Controller turns on solenoid valve SOV3 that flows hot water out to the Alkaline Chemical Arch horizontal rear spray bar through the Alkaline Chemical Module. The other Dosatron chemical injection pump mixes concentrated detergent with the hot water to form the soap solution applied to the vehicle through the rear spray bar. The two injection pumps allow you to adjust the detergent solution strength individually for the side sprays and rear spray. Again, refer to *Section 4.2.1: Adjusting the Dosatron Pumps* for more information.

The spray bars on the Alkaline Chemical Wash Arch remain on until the vehicle clears photoeyes PE3 and PE4 and individual off-delay timers in the wash program time out. Each chemical spray bar incorporates a check valve that prevents the soap solutions from draining out between wash cycles. This enables the spray nozzles to begin applying chemicals to the vehicle as soon as their part of the cycle starts.

2.1.6.2 Filters F1, F2

Each Chemical Module contains one of these 200-mesh filters that protects downstream components, mainly the solenoid valves and Dosatron pumps, from contaminants that may be present in the water supply. The filters have internal screens that may be removed for cleaning or placed if badly contaminated.

2.1.6.3 Pressure Reducing Valves PRV1, PRV2

Each Chemical Modules contains one of these valve that are adjustable from 50 – 175 psig. The valve protects the downstream components, primarily the Dosatron pumps, from over-pressure; pressure should be set according to InterClean specifications. The downstream Dosatron pumps have a maximum inlet pressure specification of 80.0 psig. Exceeding this pressure may damage the pumps.

2.1.6.4 Solenoid Valves

Two 24 VDC solenoid valves in the Chemical Wash System control the flow of hot detergent solution to the spray bars on the Chemical Wash Arch, as follows:

- **SOV2** – controls the Alkaline Chemical Wash Arch side spray bars – controlled through output terminal P703 on I/O Base 1 located in the Master Control Panel.
- **SOV3** - controls the Alkaline Chemical Wash Arch rear spray bar – controlled through output terminal P704 on I/O Base 1 located in the Master Control Panel.
- **SOV4** – controls the Acid Chemical Wash Arch side spray bars – controlled through output terminal P701 on I/O Base 1 located in the Master Control Panel.
- **SOV5** - controls the Acid Chemical Wash Arch rear spray bar – controlled through output terminal P702 on I/O Base 1 located in the Master Control Panel.

2.1.6.5 Chemical Injection Pumps

Dosatron chemical injection pumps control the mixing of concentrated detergents with the hot soft water flowing to the two Chemical Arches under power from the 1-hp Booster Pump. One pump controls the solution mixing for the two vertical side spray bars on the arch and the other controls the solution mixing for the horizontal rear spray bar.

The pumps are not electrically powered and run automatically when water flows through them. Each is controlled by a separate solenoid valve that controls the flow of hot water to the spray bars. Each pump allows concentrations of soap solution to be set individually for each spray bar.

Refer to *Section 4.2.1: Adjusting the Dosatron Pumps* for chemical adjustment information.

The two Chemical Modules have Dosatron pumps that look identical but are not identical and care must be taken not to mix the two types of pumps. Each Chemical Module has two identical pumps that have internal seals designed to work with the type of detergent passing through the pump. Mixing pumps or parts of pumps from the two Chemical Modules may result in pump seal deterioration and pump failure if a pump with the wrong seals is flowing the wrong concentrated chemical.

The Dosatron pumps have the following part numbers:

- Acid Chemical Module – D25RE2VFPII (quantity 2)
- Alkaline Chemical Module – D25RE5AFPII (quantity 2)

Be sure to specify the correct pump or parts for the correct pump if you have to service the Dosatron pumps.

2.1.6.6 Foot Valves

Each Dosatron chemical injection pump pulls concentrated detergent out of a supply barrel or tote tank through a foot valve. The weighted valves, located inside the supply tank, allows detergent to be pulled out of the tank and prevents the backflow of detergent back into the tank when the pump is not running; in other words, this is a check valve.

The foot valve connects to its Dosatron pump through plastic tubing. Inspect both the tubing and the valves regularly for any damage or sticking valve conditions and service as required.

WARNING:	**Avoid direct contact with the concentrated chemicals used in the wash process. Wear protective clothing, gloves, and face shield when working with the chemicals.** **Follow all safety practices for handling such chemicals and keep copies of the MSDS information available on the wash site.** **Follow all wash site safety rules.**

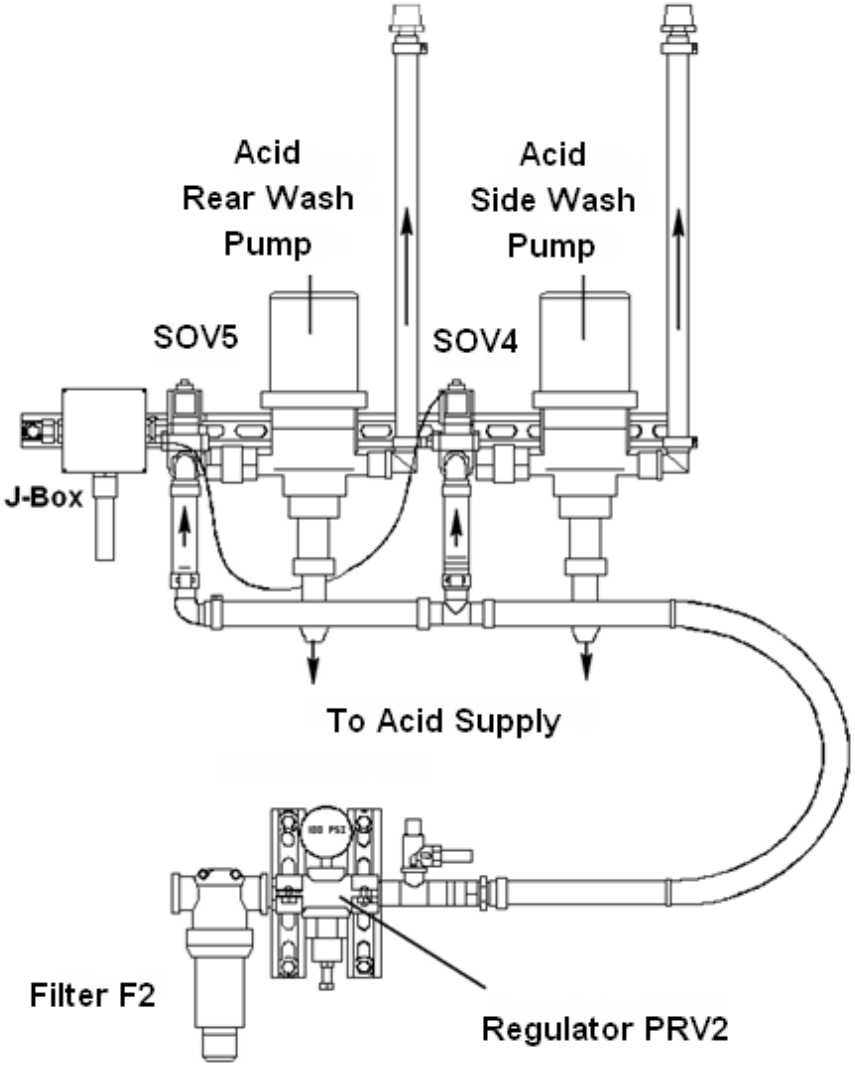


Figure 2- 14 Acid Chemical Module Details

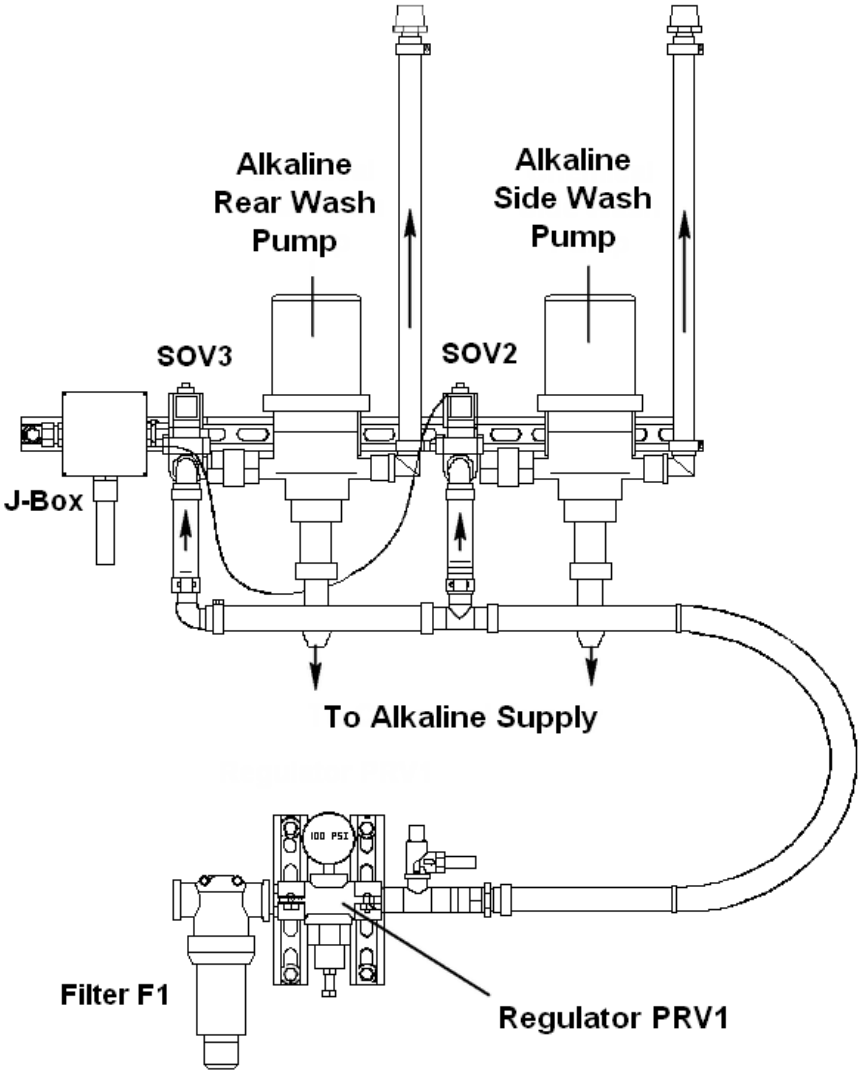


Figure 2- 15 Alkaline Chemical Module Details

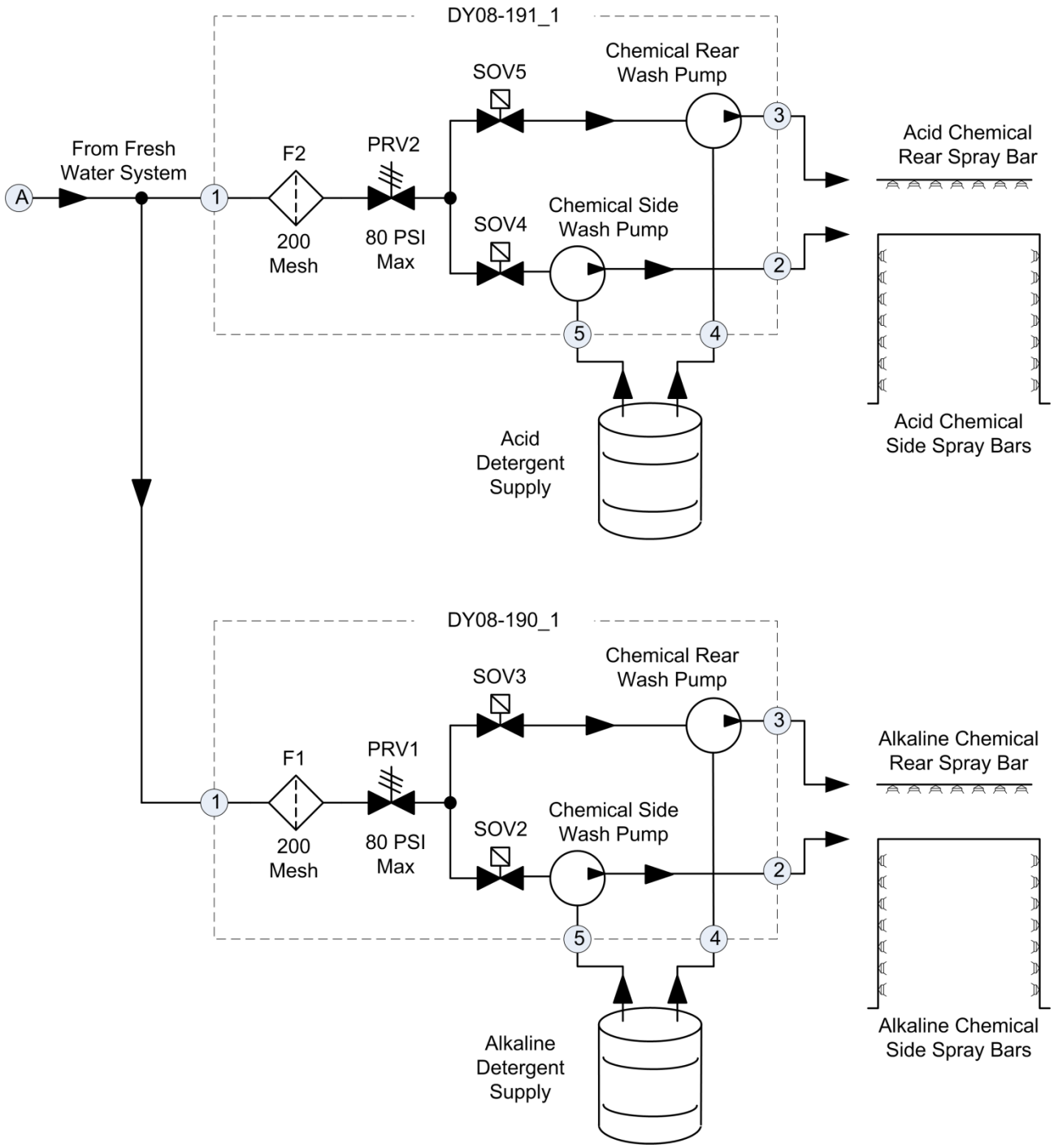


Figure 2- 16 Chemical Wash Section Schematic

2.1.7 Reclaim Water System Description

2.1.7.1 Overview

The high pressure phases of the wash cycle use water that has been reclaimed from the Settling Pit when the Wash System is in summer mode (reclaim water option). Refer to *Section 2.1.3: Seasonal Wash Mode Configuration* for an explanation of the winter/summer options and how to configure the system for each.

Refer to *Figure 2- 17 Typical Pickup Pit Section* through *Figure 2- 20 Reclaim (High Pressure) Section Schematic.*

Water is pumped from the Settling Pit and goes through a sediment removal process before it is pumped at high pressure (nominally 300-320 psig) to the high pressure spinners and arches. Most of the components responsible for reclaiming the pit water are mounted on the Reclaim Module.

Water draining off the vehicles during previous wash cycles flows into a drain trench in the center of the Wash Bay and from there into the underground Settling Pit. The Settling Pit is a 4-chambered concrete structure with the largest section (the inflow side) holding most of the debris and sediments that gravity settle out of the drain water. Pipes interconnect the pit chambers at various levels and allow water to flow from the inflow side to the last pickup side of the pit, leaving behind most sedimentary material and oils. The cleanest water in the Settling Pit is in the reclaim or pickup section.

2.1.7.2 Removing the Sediments

Water is drawn from the pickup section of the pit by the 7.5-hp Sump Pump through the InterScreen filter. The InterScreen is a back washable canister that pulls water in through slots in the outer wall. The slots prevent debris that may be present in the pit water from being sucked into the Sump Pump. Every fifth wash cycle the InterScreen is reverse flushed with compressed air that blows off any debris sucked up against the screen. The System Controller turns on a solenoid valve on the EQ Module for a time to connect the Wash System compressed air to the backwash pipe on the InterScreen.

Water discharged from the Sump Pump enters the Cyclonic Separator. This starts the final process of removing sediments from the water so it can be reused in the high pressure wash part of the cycle. The water enters the Separator tangentially and is spun around inside the Separator chamber. Sediments are forced to the outer part of the chamber by centrifugal force where they settle down in the Separator sump area. From here they are pulled out the bottom of the Separator and into the flow of the water circulated by the Circulation Pump and eventually dumped into the primary side of the Settling Pit.

The cleaner water is forced up a standpipe in the center of the Separator and is pulled into the EQ Tank, a 500-gallon cone-bottomed tank that stores the water until it is needed for the high pressure wash phase of the cycle. The water in the EQ Tank is also circulated around the inside the tank and the centrifugal separation of sediments from the water continues. These sediments also settle in the bottom of the Tank where they are pulled into the circulating water and dumped back into the primary side of the Pit.

Three water level sensors in the EQ Tank tell the System Controller when the tank needs water (middle level sensor), when to stop filling the tank (upper level sensor), and when the tank water level is too low (lower level sensor). The top two switches let the System Controller control the action of the Sump Pump to keep the tank filled to the proper level. The bottom level sensor tells the System Controller the water level is too low and that the High Pressure Pump, which gets its water from the tank, could lose prime if the water level continues to drop. This causes a System Alarm and the Controller shuts down the Wash System to prevent damage to the pump.

2.1.7.3 Pit Bacteria

Bacteria live in the Settling Pit; this is good and is encouraged. These helpful bacteria ingest and break down less desirable material present in the drain water that causes foul pit odors. For this reason, the pit

water is continuously circulated and air is injected into the water to provide oxygen to keep the bacteria alive.

The 2-hp Circulation Pump on the EQ Module pulls water from the reclaim section through a screened intake pipe. The water flows from the discharge side of this pump through an air injector that aerates the water to provide oxygen for the pit bacteria. This water is dumped back into the inflow side of the pit. The Circulation Pump runs continuously on an on/off duty cycle as long as there is sufficient water in the pit to prevent loss of prime of the pump. Loss of prime can lead to pump damage due to cavitation.

The bacteria have to live within a certain pH range and if Pit odors become a problem it may be because the bacteria are not surviving due to an over-acidic or over-alkalinic pit. If this happens, the Reclaim EQ Module contains a Bioremediation Pump to inject an appropriate chemical into the circulating water to balance the pit pH level and provide a friendlier environment for the pit bacteria. Normally, the Bioremediation system is not enabled when the Wash System is installed but can be turned on later if odors become a problem. Contact InterClean for more information.

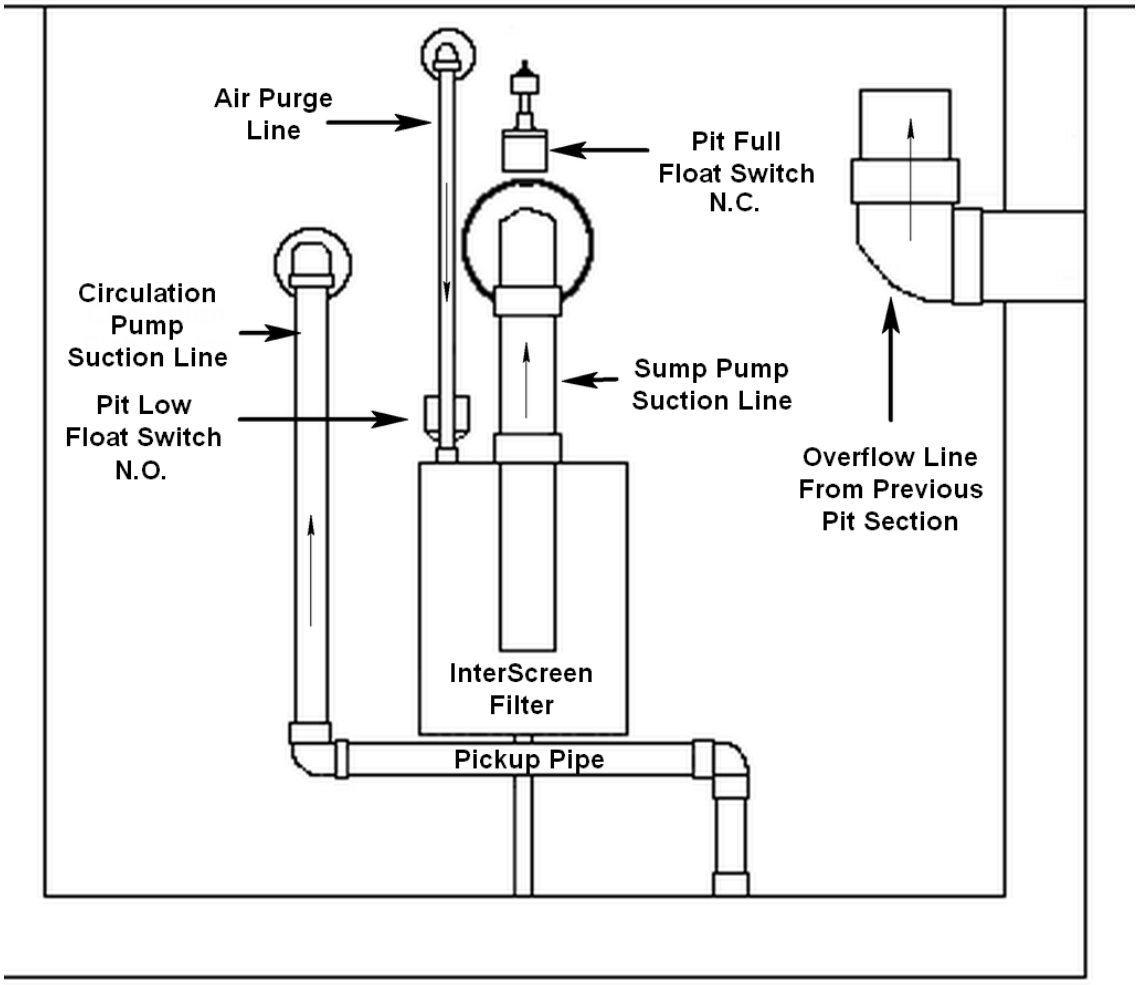


Figure 2- 17 Typical Pickup Pit Section

2.1.7.4 Pit Water Level

The pit water level must be maintained at a certain minimum level or several problems could occur, one of which is increased pit odors. More importantly, a too low pit water level can cause the Circulation Pump and the Sump Pump (and eventually the High Pressure Pump) to lose prime. This will cause pump damage due to cavitation, a condition where the pump is sucking in air as well as water. The low pressure on the suction side of the pump causes the air molecules to rapidly collapse, producing micro-explosions that pit the pump walls (the volute) and impeller.

Continued cavitation can produce a lot of noise and a lot of damage to the pumps. To prevent this, the pit water level is monitored by the lower pit level float switch that tells the System Controller when the water level drops below a safe level. This condition causes a System Alarm and the computer shuts down the pumps and the Wash System to prevent damage.

Pit water level is usually not a problem except at the start-up of the System, if there is a leak someplace in the pit system, there is a large water carry off by the washed vehicles, or there is a high level of evaporation from the pit. The pit can be filled/refilled manually by opening MV8 (see plumbing schematic) and connecting the pit directly to fresh water received from the municipal water supply. This is a completely manual operation that should be visually monitored at all times to prevent overflowing the pit.

A second provision provides an automatic refilling of the pit. A 24 VDC solenoid valve (SOV8) will be automatically turned on by the System Controller if the Pit water level drops below the setpoint of the upper pit float switch for a period of time. The valve remains on until the water level reaches the setpoint of the switch at which time the Controller turns the valve off.

You can disable the automatic refilling of the pit by closing manual valve MV7 upstream of SOV8. Frequent automatic pit refilling should be investigated to make sure the pit plumbing isn't leaking or for some other abnormal condition that will cause the pit to have to refill often.

CAUTION:	**If manual filling of the pit is necessary, open MV8 only long enough to fill the pit and then close completely. Visually monitor this operation at all times.**

2.1.7.5 Circulation Pump (AMT 2828-K5)

This 2-hp centrifugal pump continuously circulates the water from the reclaim side of the Settling Pit to the primary side. The water is drawn into the pump through the Pickup or Intake Pipe to protect the pump from debris. While the water is circulating, it picks up oxygen from the Air Injector and sediments that have separated from the water from the Cyclonic Separator and EQ Tank.

The pump is controlled by motor contactor 1M in the Reclaim Slave Panel (RSP). The contactor is controlled through output terminal P709 on I/O Base 1 located in the RSP. The contactor applies 3-phase power to the pump motor through an overload module that opens its contacts if there is a short circuit or the motor draws excessive current for a period of time. The overload sends an auxiliary feedback signal to the computer through input terminal P612 on I/O Base 1 in the same panel.

Complete information for this pump is included in *Section 8: Appendix*.

2.1.7.6 Sump Pump (AMT 2876-95)

This 7.5-hp centrifugal pump pulls water from the reclaim side of the Settling Pit through the InterScreen filter and discharges it into the Cyclonic Separator. The pump is controlled by motor starter 2M and the variable speed drive in the Reclaim Slave Panel. The VFD gives the System Controller control over the rate that the Sump Pump supplies water to the Separator. The pump turns on when the water level in the reclaim section of the Pit drops below the setpoint of the upper float switch. The pump is protected against loss of prime by turning off if the water level drops below the lower float switch setpoint.

The wash computer controls the pump contactor 2M through output terminal P710 on I/O Base 1 located in the Reclaim Slave Panel (RSP). The contactor applies 3-phase power to the pump motor through an overload module that opens its contacts if there is a short circuit or the motor draws excessive current for a period of time. The overload sends an auxiliary feedback signal to the computer through input terminal P613 on I/O Base 1 in the same panel.

The computer controls the VFD unit through a RUN signal from output terminal P712 on I/O Base 1 in the RSP. A FAULT signal from the VFD is wired to input terminal P615 on I/O Base 1 in the RSP.

Complete information for this pump is included in *Section 8: Appendix*.

2.1.7.7 High Pressure Pump (Goulds MP65.2/3-SB111)

This Goulds Model MP 75-hp centrifugal pump flows water to the Spinner Arch, the Chassis Washers, and the Rear Wash Arch. The pump is controlled by the System Controller through a motor contactor (3M) located in the Reclaim Slave Panel (RSP). The contactor is controlled by contact relay 6CR in the same panel. The relay is controlled by the computer through output terminal P711 on I/O Base 1 located in the RSP.

The complete information for the High Pressure Pump and soft start module are included in *Section 8: Appendix*.

2.1.7.8 Bioremediation Pump (Pulsatron LB02SA-KTC1-500)

The Pulsatron Bioremediation pump is included as part of the Reclaim Module. The pump injects enzymes into the circulating water stream to help balance the Pit pH and encourage the growth of helpful bacteria to reduce Pit odors. This system is not in place at the time of installation and is not generally required to keep down Pit odors but the pump is included as part of the Reclaim Module. The complete manufacturer's information on the Pulsatron pump is included in Section 8: Appendix. Contact InterClean if Pit odors become a problem.

2.1.7.9 Cyclonic Separator

The Rosedale Solid Liquid Separator uses centrifugal force to spin sediments out of the water being reclaimed for the high pressure wash parts of the cycle. The unit does not require any regular maintenance as the sump that collects the sediments is continuously purged out the bottom of the unit. The sediments are pulled into the circulating water and dumped back into the primary side of the Pit.

2.1.7.10 EQ Tank

This 500-gallon, cone-bottomed tank supplies reclaimed water to the high pressure section of the Wash Bay. Water from the Cyclonic Separator enters the tank tangentially and this centrifugal action continues the process of removing sediments from the water. Three water level sensors signal the Sump Pump to turn on and supply the tank with water (middle sensor), tell the Sump Pump the tank is full (upper sensor), and disable the High Pressure Pump if the water level drops too low (lower sensor). The sediments that are separated out of the water settle into the tank's sump area where they are pulled out and dumped back into the primary side of the pit by the water circulated by the Circulation Pump.

2.1.7.11 Manual Valves

A number of manual valves in the Wash System enable manual control over some fluid processes. The valves must be in the correct 'normal' state in order for the Wash System to operate correctly. Refer to *Table 4- 2 Manual Valve State Chart* located in *Section 4: Maintenance* for a brief explanation of each valve in the Wash System and its normal state.

2.1.7.12 Solenoid Valves

SOV8 – 24 VDC solenoid valve that connects the Settling Pit to the fresh water supply – can automatically fill the Pit if the water level drops if manual valve MV7 is open.

SOV7 – 24 VDC solenoid valve that connect the wash system compressed air supply to the back wash pipe on the InterScreen filter in the pickup section of the Settling Pit.

SOV6 – 24 VDC 3-way Co-Ax valve that connects the discharge side of the High Pressure Pump to the Spinner Arch and Chassis Washer (valve on) or the Rear Wash Arch (valve off).

2.1.7.13 InterScreen Filter

The InterScreen filter is a stainless-steel canister whose outer wall consists of a slotted screen. Water is drawn into the filter by the Sump Pump and pumped into the Cyclonic Separator. The slots prevent debris from being pulled into the pump. The filter is backwashed every fifth wash cycle by compressed being sent to the inside of the filter and blowing debris back off the outer screen.

2.1.7.14 Intake Pipe

The pickup or intake pipe is a length of 2" PVC with 100 ½" holes that allows the Circulation Pump to pull water from the reclaim side of the Settling Pit and circulate it back to the primary side without picking up debris that may be present in the Pit.

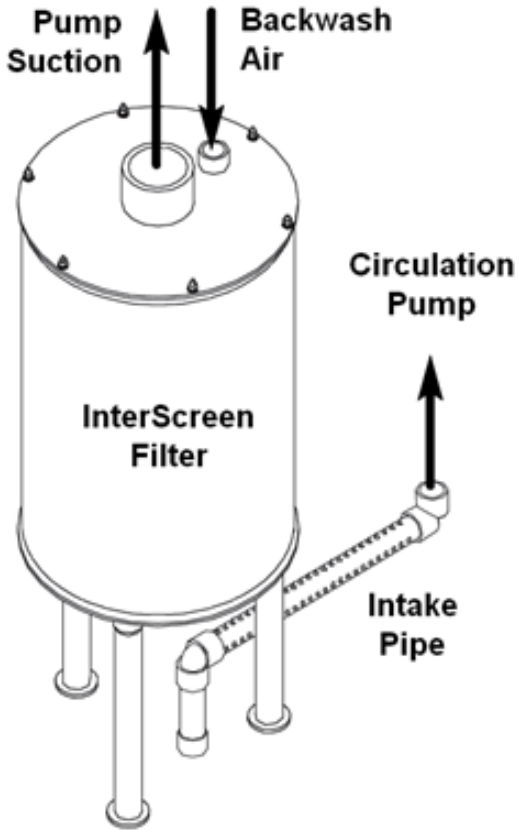


Figure 2- 18 InterScreen Filter and Intake Pipe (typical)

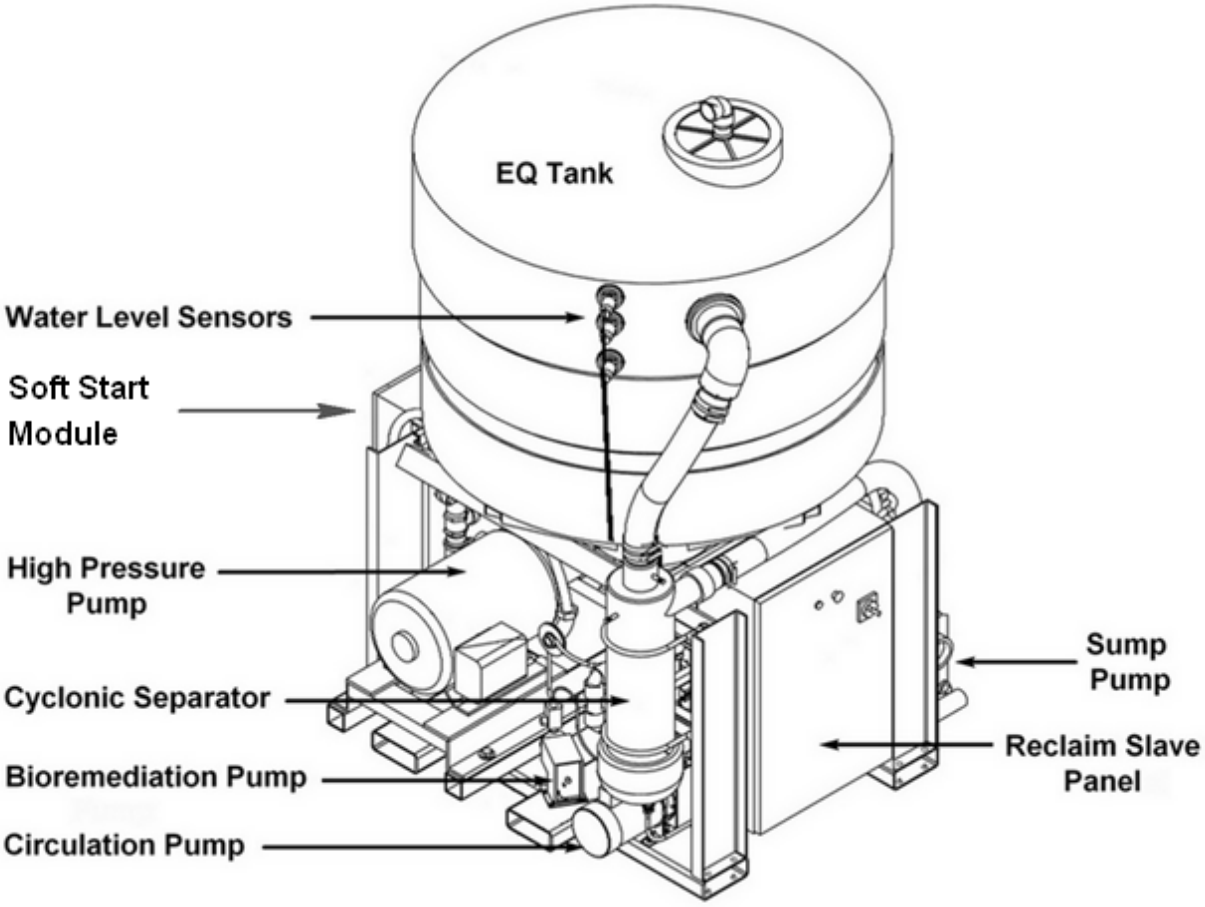


Figure 2- 19 Typical EQ Module

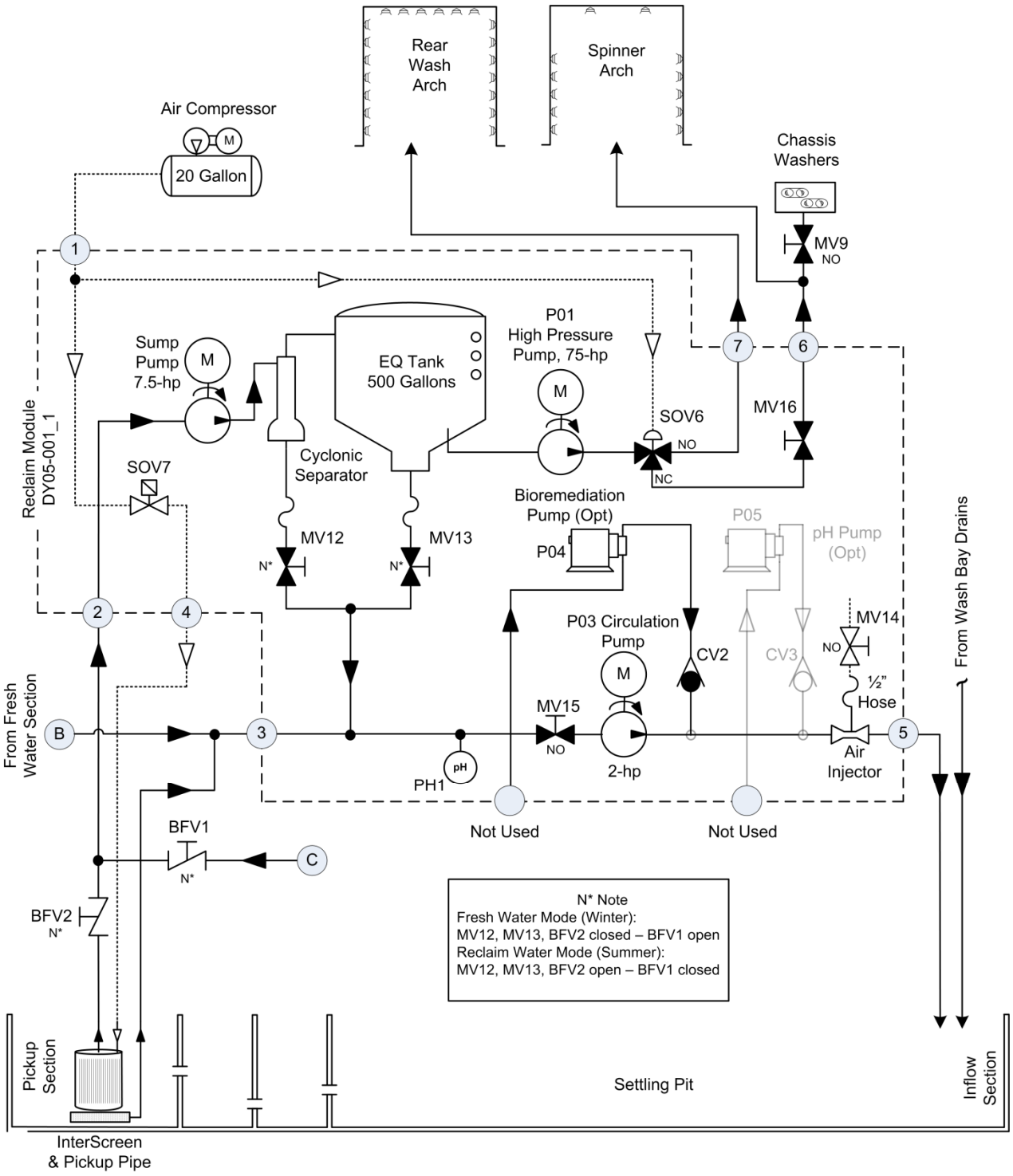


Figure 2- 20 Reclaim (High Pressure) Section Schematic

2.2 WASH SYSTEM CONTROLLER

2.2.1 Master Control Panel

Most of the Wash System controls are housed in the Master Control Panel (MCP) located inside the Equipment Area. The panel is Nema-4 rated to protect internal components. The remainder of the controls are in the Reclaim Slave Panel located on the Reclaim Module.

The MCP houses the System Controller, Touch Screen terminal, 24 VDC Power Supply, 480:120 VAC Stepdown Transformer, circuit breakers, relays, motor starters, and the Main Disconnect Switch.

The Master Control Panel receives 480 VAC, 60 Hz power from the Main Distribution Panel (MDP) on the site and is protected against fire from electrical overloads by circuit breakers in the MDP. The Main Disconnect Switch on the panel door removes 480 VAC electrical power from the MCP.

The 1 kVA transformer inside the MCP steps the 480 VAC power down to 120 VAC power for use in the Wash System. The transformer is also controlled by the Main Disconnect Switch and protected by two 3A fuses in the MCP.

An E-Stop button on the MCP door shuts down the Wash System in case of an emergency. Press the button to shut down the system. This also puts the Wash System in the OFF mode. The button remains engaged until it is manually reset.

2.2.2 System Controller

Overview

An industrial computer, located in the Master Control Panel in the Equipment Area, controls the Wash System. The computer runs the Microsoft Windows® operating system so it powers up and powers down much like a standard PC. Both the operating system and the wash control program are resident on a flash drive mounted on the computer.

The Wash System control program launches automatically after the computer finishes its boot cycle and loads the operating system. The Wash System initialization adds a few more minutes to the computer power-up sequence while the system initializes.

CAUTION:	**The flash drive card must be securely in place and connected before the computer is powered up or the computer operating system will not start.** **Do not connect or disconnect the flash card with power applied to the system.**

The prints for the Master Control Panel and all other controlled components of the Wash System are located in *Section 7: Electrical, Plumbing, and Layout Diagrams.*

The System Controller uses a distributed approach to controlling the Wash System. The System Controller resides in the Master Control Panel (MCP) in the Equipment Area but different components of the control architecture are spread throughout the Wash Bay. The Controller communicates with the remote devices through a local area network using the Ethernet protocol.

A Touch Screen provides your interface into the System Controller. The computer is programmed to show different screens that define the Wash System. Parts of some screens are programmed to act as buttons or switches that are actuated simply by touching that part of the screen.

Some screens are displays only, giving information about the Wash System or the wash cycle, while others allow changes to be made to the control program parameters by selecting options on the screen or entering data through on-screen keypads. Accessing most screens, especially for editing, requires you to

enter a password. This is done through a standard-looking keyboard that appears on the screen if you try to perform an action requiring a password. You enter the data by touching the on-screen 'keys'. Refer to *Section 2.3.3 Password Entry Screen.*

All the screens programmed into the computer for this Wash System are described in the following sections. Refer to *Section 2.3 Touch Screen* Terminal. A map showing how to navigate to each of the screens is shown in

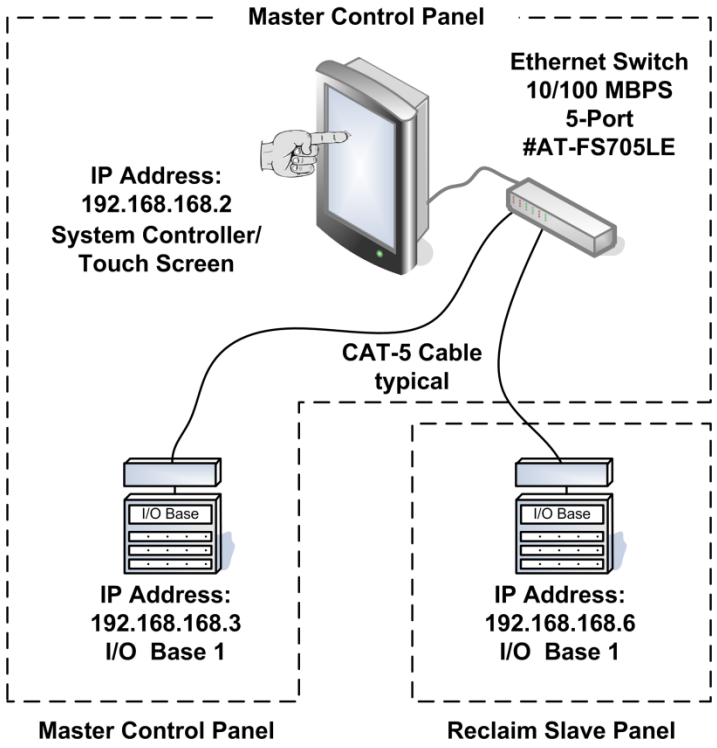


Figure 2- 21 Communication Layout

Ethernet

The control system is distributed over the length of the Wash Bay so the Controller uses a local area network to communicate with remotely-located devices. The communication protocol used is called Ethernet.

The remote devices and System Controller communicate over Category-5 communication cables. The cables terminate at the MCP end at an electronic switch (Ethernet Switch) that routes incoming signals from remote devices to the System Controller through a single Cat-5 cable. The packet of data the System Controller receives tells it what devices sent it and their current on/off status.

Likewise, the System Controller turns remote devices on and off by tagging its command message with the device's unique address and sending the packet to the Ethernet Switch which then directs it only to that remote device.

Ethernet requires that each node or communication point on the network has a unique identifying number called the IP address. The IP (Internet Protocol) address follows a specific format, sometimes called a dot-decimal or dotted-quad notation because it consists of four groups of decimal numbers separated by decimal points. The numbers have a range of 0 to 255 representing eight bits of binary data. In our Wash System, all controlled devices are identified on the local network by the number 192.168.168.nnn, where nnn represents the specific device's unique address.

Referring to Figure *2- 21 Communication Layout* you can see that I/O Base 1 in the MCP has the address 192.168.168.3. No other device in our control system can have this identifying address. Note, that if one of the quads of the IP address has leading zeros, such as in the example given (192.168.168.003), the leading zeros are understood and the address can be written without them as we have done here.

Some devices, like the System Controller computer, have the Ethernet interface built in. Most others devices, such as float switches or motor starters, do not have and must communicate with the Controller through interface hardware called I/O Bases or Momentums®. Momentum® is a registered trademark of Telemecanique, the device manufacturer.

Generally, I/O Bases have terminal strips for inputs and others for outputs where remote devices are connected. Just as each I/O Base has a unique address in the network, each terminal on each terminal strip is uniquely identified by its position on the strip, 1 through 16.

I/O Bases

I/O Bases provide the Ethernet connection for those devices, such as switches and motor starters, that don't have a built-in interface. They come in two parts, the wiring base where field wiring terminates and the communication adaptor that talks to the System Controller through the local network. These two units snap together to form the I/O Base. Refer to *Figure 2- 22 Wiring Base & Communication Adaptor.*

The I/O Base is located in the Master Control Panel (MCP). The base has an input wiring strip and an output wiring strip. Field devices that are controlled by the System Controller are wired to these strip.

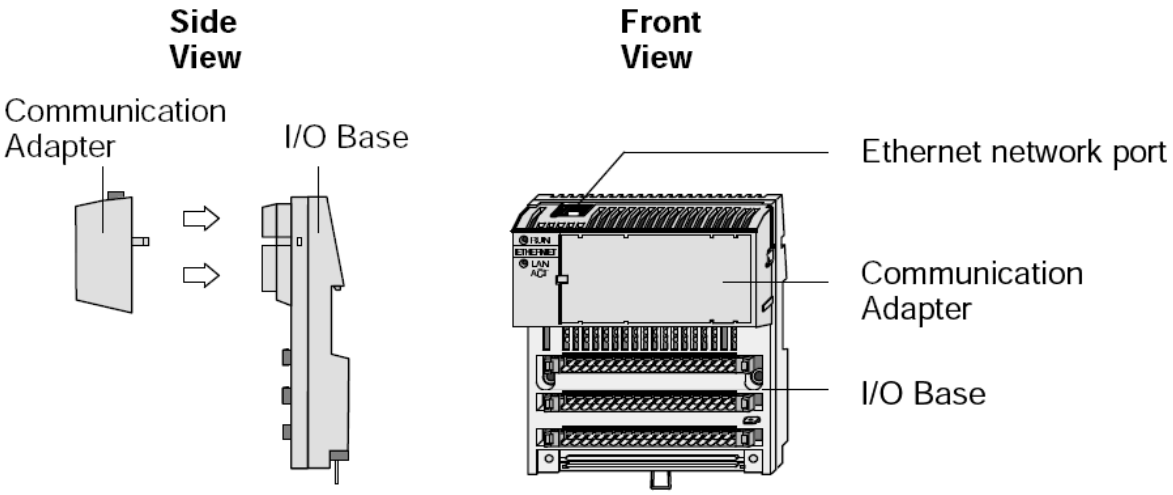
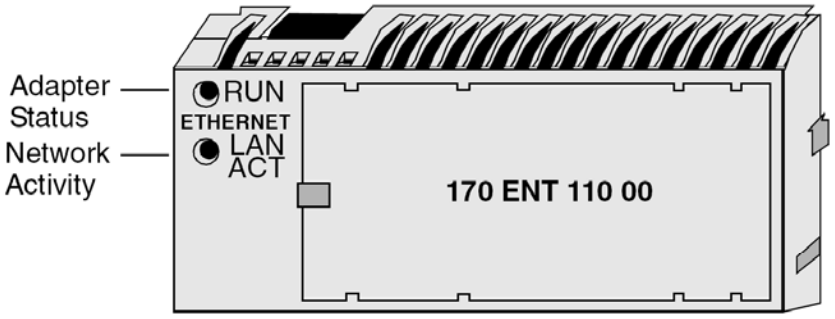


Figure 2- 22 Wiring Base & Communication Adaptor

The System Controller has a configuration map so that it knows, for example, that the first photoeye in the Wash Bay (PE1) is wired to terminal P601 on input terminal strip 1 of I/O Base 1 in the MCP.

LED indicators on the front of the communication adaptor indicate the status of that node on the network. The RUN and LAN ACT indicators should be ON for normal operation.

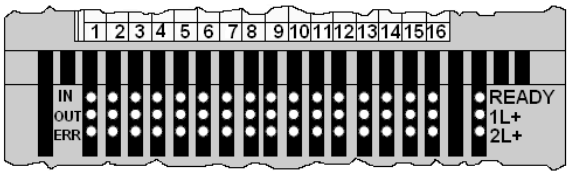


Indicators: Adaptor Status

LED RUN Indicator	LED STATUS Indicator	Description
ON (Steady)	ON (Steady)	Normal Operation
OFF	5 Flashes, long Off	No IP Address detected

Figure 2- 23 Communication Adaptor Status Lights

The inputs and outputs wired to the I/O Bases each have individual LED indicators that show the current status of each input and output. The row of status LEDs is located just above the top terminal strip on the I/O Base. These LEDs provide a lot of information when troubleshooting problems with the Wash System.



Indicator	Condition	Message
Ready	Green	Module is ready to communicate. Operating voltage for internal logic (5V) is present.
	Off	Module is not ready.
1L+	Green	Output voltage 1L+ for outputs 1 - 8 (goup 1) is present.
	Off	Output voltage for outputs 1 - 8 is not present.
2L+	Green	Output voltage 2L+ for outputs 9 - 16 (group 2) is present.
	Off	Output voltage for outputs 9 - 16 is not present.
Upper Row INputs 1 - 16	Green	Input status (an LED per input); Input point active, i.e., input carries a 1 signal (logically ON).
	Off	Input point inactive; Input carries a 0 signal (logically OFF).
Middle Row OUTputs 1 - 16	Green	Output status (an LED per output); Output point is active, i.e. output carries a 1 signal (logically ON).
	Off	Output point inactive;output carries a 0 signal (logically OFF)
Lower Row ERRor 1 - 16	Red	Output overload (an LED per output); Short circuit or overload on the corresponding output.
	Off	Outputs 1 - 16 operating normally.

Figure 2- 24 Input & Output Status LEDs

Generally, for each active input or output the corresponding LED will be green. For inputs, that means the input is seeing a nominal +24 VDC signal from a device such as a switch. For outputs, the green LED means that output point is supplying a nominal +24 VDC to some device such as a motor starter coil.

The bottom row of red LEDs should all be OFF for normal operation. Any red LED that is ON indicates that the corresponding output (1 thru 16) is in an overload condition. This could be a short circuit to ground on the wire or device connected to that point or a faulty device drawing excessive current.

The Figure above (*Figure 2- 24*) describes the input and output LED conditions.

The table on the following page shows the devices that are connected to the I/O Base in the Master Control Panel (MCP). There is one terminal strip for input devices and one for output devices. Each input and each output has a corresponding LED indicator that shows if that device is active.

Table 2- 2 Master Control Panel I/O Base 1 Terminal Assignments

Master Panel I/O Base 1 - IP Address: 192.168.168.3			
Row 1	**P6 - 16 DC Inputs**	**Row 2**	**P7 - 16 DC Outputs**
01	Photoeye PE1	**01**	Acid Chemical Arch Side Spray SOV4
02	Photoeye PE2	**02**	Acid Chemical Rear Spray SOV5
03	Photoeye PE3	**03**	Alkaline Chemical Side Spray SOV2
04	Photoeye PE4	**04**	Alkaline Chemical Rear Spray SOV3
05	Photoeye PE5	**05**	Fresh Water Tank Fill Solenoid SOV1
06	Photoeye PE6	**06**	
07	Photoeye PE7	**07**	Brush Slave Panel RUN Signal
08	Photoeye PE8	**08**	
09	Fresh Water Tank low level float	**09**	Motor Contactor (1M)
10	Fresh Water Tank high level float	**10**	Motor Contactor (2M)
11	Brush Slave Panel AUX signal	**11**	Motor Contactor (3M) Chemical Booster Pump
12	3CB+4CB+5CB auxiliary contacts	**12**	Control Relay (4M) Rinse Booster Pump
13	1M+2M auxiliary contacts	**13**	Control Relay (1CR)
14	3M auxiliary contact – Booster Pump	**14**	Control Relay (2CR)
15	4M auxiliary contact – Rinse Pump	**15**	Control Relay (3CR) Rinse Solenoid SOV9
16	1MCR-2 E-Stop circuit	**16**	Control Relay (4CR) Brush Solenoid SOv10
17	0 VDC	**17**	+24 VDC
18	+24 VDC	**18**	+24 VDC

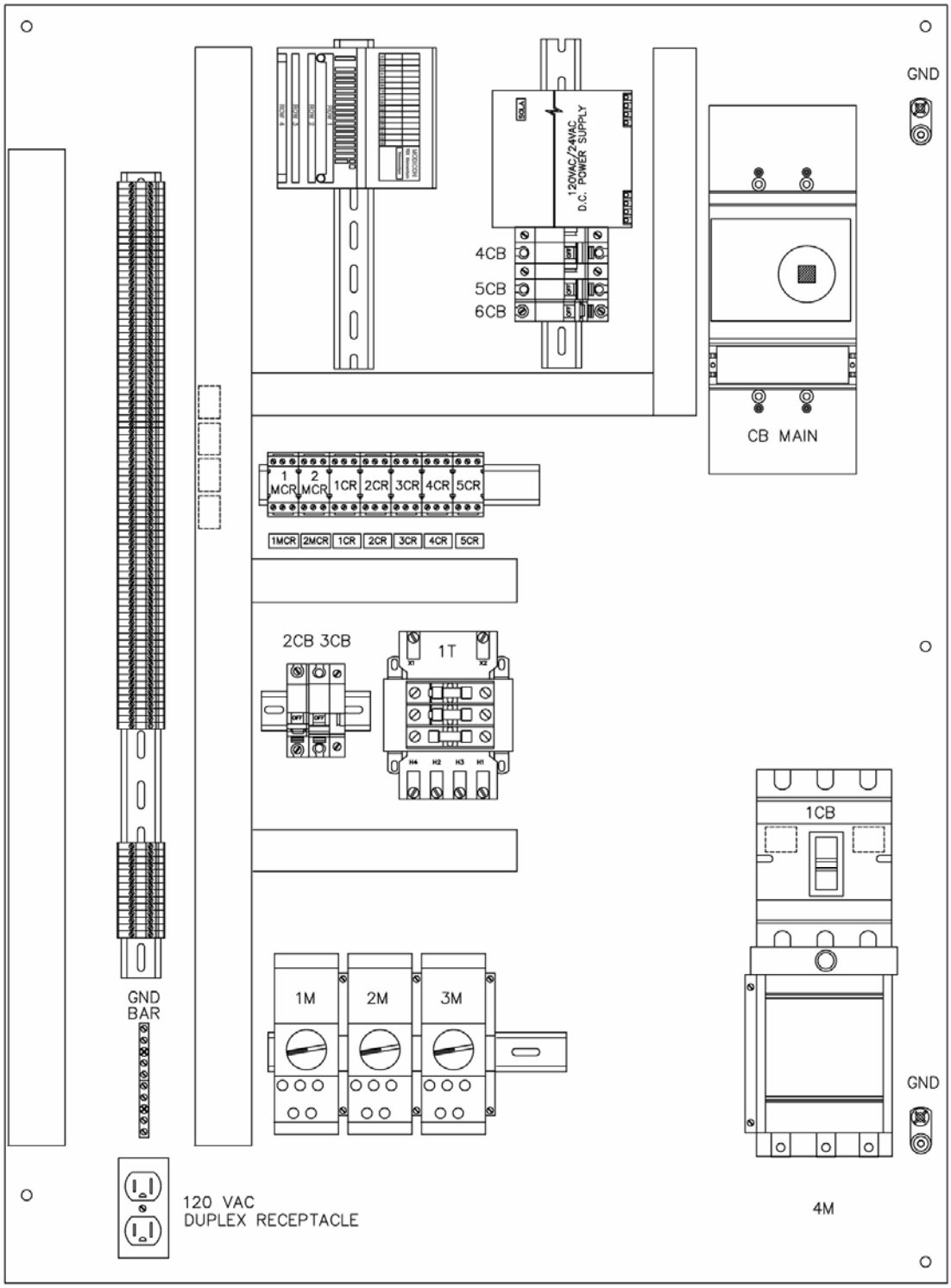


Figure 2- 25 Master Control Panel - Interior View

2.2.3 Reclaim Slave Panel (RSP)

The Reclaim Slave Panel holds the components that control the equipment mounted on the Reclaim Module; the equipment involved in reclaiming the water used in the high pressure wash section. Other components involved in the water reclamation but not mounted on the Reclaim Module, such as the Settling Pit float switches, also interface with the System Controller through the Reclaim Slave Panel.

The RSP houses a 24 VDC power supply, 480:120 VAC stepdown transformer, circuit breakers, relays, and motor starters. An Ethernet I/O Base interfaces discrete I/O devices to the System Controller in the Master Control Panel (MCP).

The door of the RSP holds a Disconnect Switch for the Panel, an E-Stop button, and a FAULT light. The light should normally be off and will turn on (red) if there is a fault in components associated with the water reclamation process.

The Master Control Panel receives 480 VAC, 60 Hz power from the Main Distribution Panel (MDP) on the site and is protected against fire from electrical overloads by circuit breakers in the MDP and the circuit breaker controlled by the Disconnect Switch. The Disconnect Switch on the panel door removes 480 VAC electrical power from the MCP.

The transformer inside the MCP steps the 480 VAC power down to 120 VAC power for use in the Wash System. The transformer is also controlled by the Disconnect Switch and is protected by two 3A fuses in the MCP.

The E-Stop button on the MCP door shuts down the Wash System in case of an emergency. Press the button to shut down the system. This also puts the Wash System in the OFF mode. The button remains engaged until it is manually reset.

Refer to *Section 2.2.2 System Controller* for information on the distributed control system and the I/O Base that interfaces the reclaim components with the System Controller.

Table 2- 3 Reclaim Slave Panel I/O Base 1 Terminal Assignments

Reclaim Slave Panel I/O Base 1 - IP Address: 192.168.168.6			
Row 1	**P6 - 16 DC Inputs**	**Row 2**	**P7 - 16 DC Outputs**
01	EQ Tank – top water level sensor	**01**	Air purge solenoid valve SOV7
02	EQ Tank – middle water level sensor	**02**	Pit fill solenoid valve SOV8
03	EQ Tank – lower water level sensor	**03**	Soft Start RUN Signal
04	Pickup Pit – low level float switch	**04**	
05		**05**	
06	Pickup Pit – pit fill float switch	**06**	
07	Soft Start FAULT Signal	**07**	
08		**08**	Fault light on door (red)
09		**09**	1M - Circulation Pump Motor Contactor
10		**10**	2M - Sump Pump Motor Contactor
11	3CB-4CB-5CB auxiliary contacts	**11**	6CR - High Pressure Pump Motor Contactor
12	1M – auxiliary contact	**12**	5CR - VFD Run
13	2M – auxiliary contact	**13**	1CR Control Relay
14	3M – auxiliary contact	**14**	2CR - Bioremediation Pump
15	VFD fault signal	**15**	3CR - Control Relay
16	1MCR-2 E-Stop circuit	**16**	4CR - Coax Valve SOV6 Spinner/Rear Wash Arch Select
17	0 VDC	**17**	+24 VDC
18	+24 VDC	**18**	+24 VDC

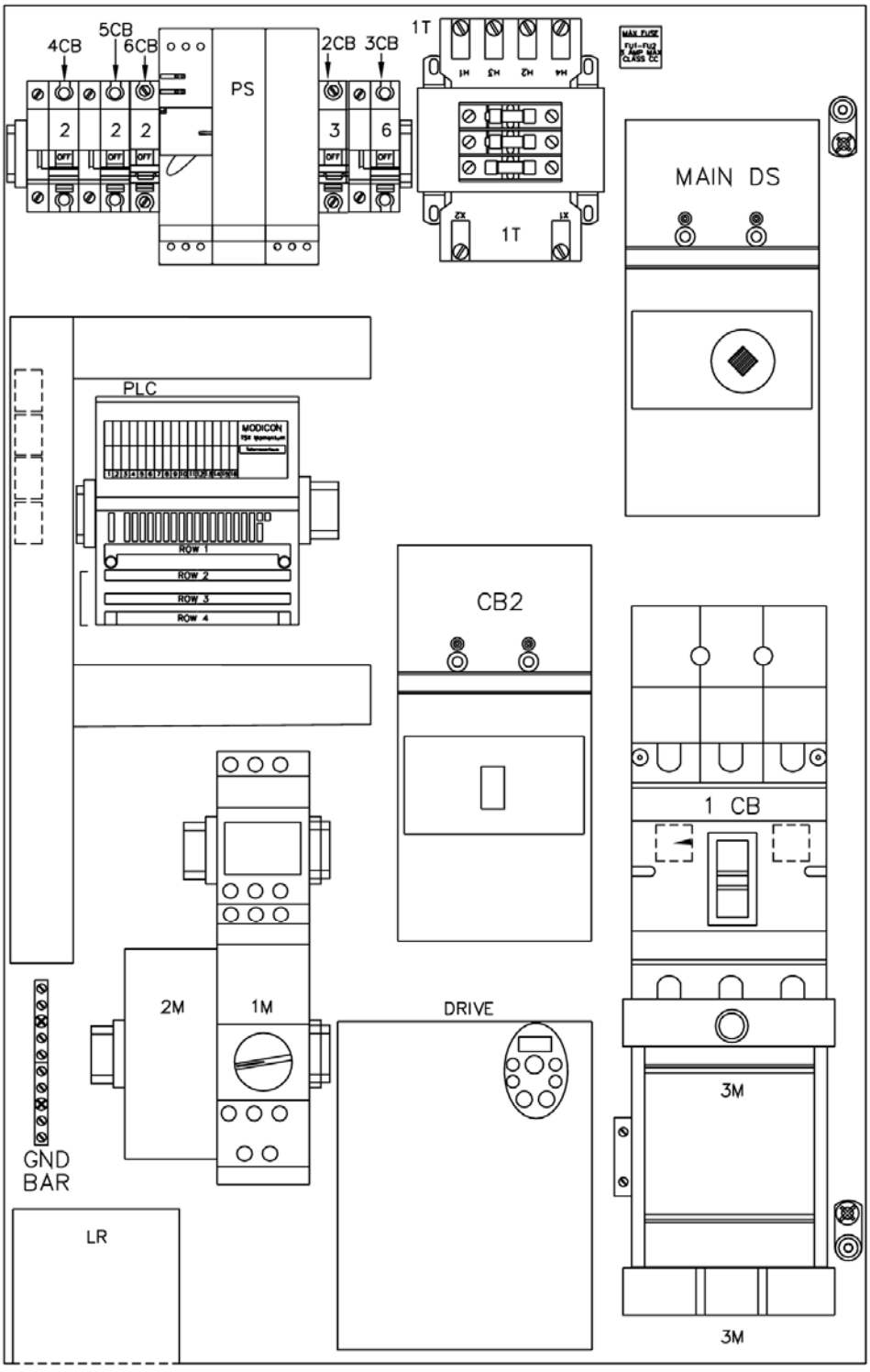


Figure 2- 26 Slave Panel Interior Details

2.3 TOUCH SCREEN TERMINAL

Overview

A flat screen display with touch screen technology interfaces the System Controller to personnel. The Touch Screen displays information about the wash cycle in progress and the Wash System itself. The Touch Screen is part of the System Control computer mounted on the front of the Master Control Panel.

Once the Wash System has been installed, the Touch Screen enables authorized personnel to view and change system operating parameters to adjust the Wash System for better performance. It also assists maintenance personnel in troubleshooting machine problems.

There are many different screens programmed into the Touch Screen organized in a tree-like structure. Refer to *Figure 2- 27 Touch Screen Map* for an overview of the screens, how the screens are organized, and how to navigate around the system.

Passwords

Most screens are password protected to guard against unauthorized personnel making changes to the Wash System. The computer pops up a password entry screen (keyboard) when you attempt to access a protected page. Refer to *Figure 2- 32 Password Entry Keyboard Screen.* Enter your password and press ENTER on the keyboard to access the screen. Refer to *Section 2.3.3* for more information.

Two levels of passwords are available to wash site personnel:

Level III: This higher-level password level is provided to site management, wash owner, etc. – includes all level IV functions plus access to additional functions not available to Level IV holders.

Level IV: This level is provided to trained wash operators, maintenance personnel - allows access to some timers, manual functions, and has the ability to force outputs, enable/disable wash authorization. The default Level IV password for the equipment is ICE.

CAUTION:	**Do not change system parameters without first communicating with the Wash System manufacturer. Abnormal performance may result from inadvertent changes to system-critical parameters. Call the manufacturer, InterClean Equipment Inc., in case of emergency or for further assistance with any Wash System issues.** **1-800-INTERCLEAN.**

Watchdog Timer

A watchdog timer starts whenever you enter a password-protected page. You have until the timer times out to make your edits, then you must re-enter your password to continue.

Main Screens

The Main Screens (Controls, Wash Selection, Alarm) are the three screens that display when the Wash System control program initializes. These are the top-level screens; all other screens in the Touch Screen system are accessed either through one of the Main Screens or from the Tools button on the Main Screen Menu Bar.

The following sections contain a map of the Touch Screen system and a description of each screen. Both the map and the individual screen pages show the keystrokes required to navigate to each screen from the Main Screens.

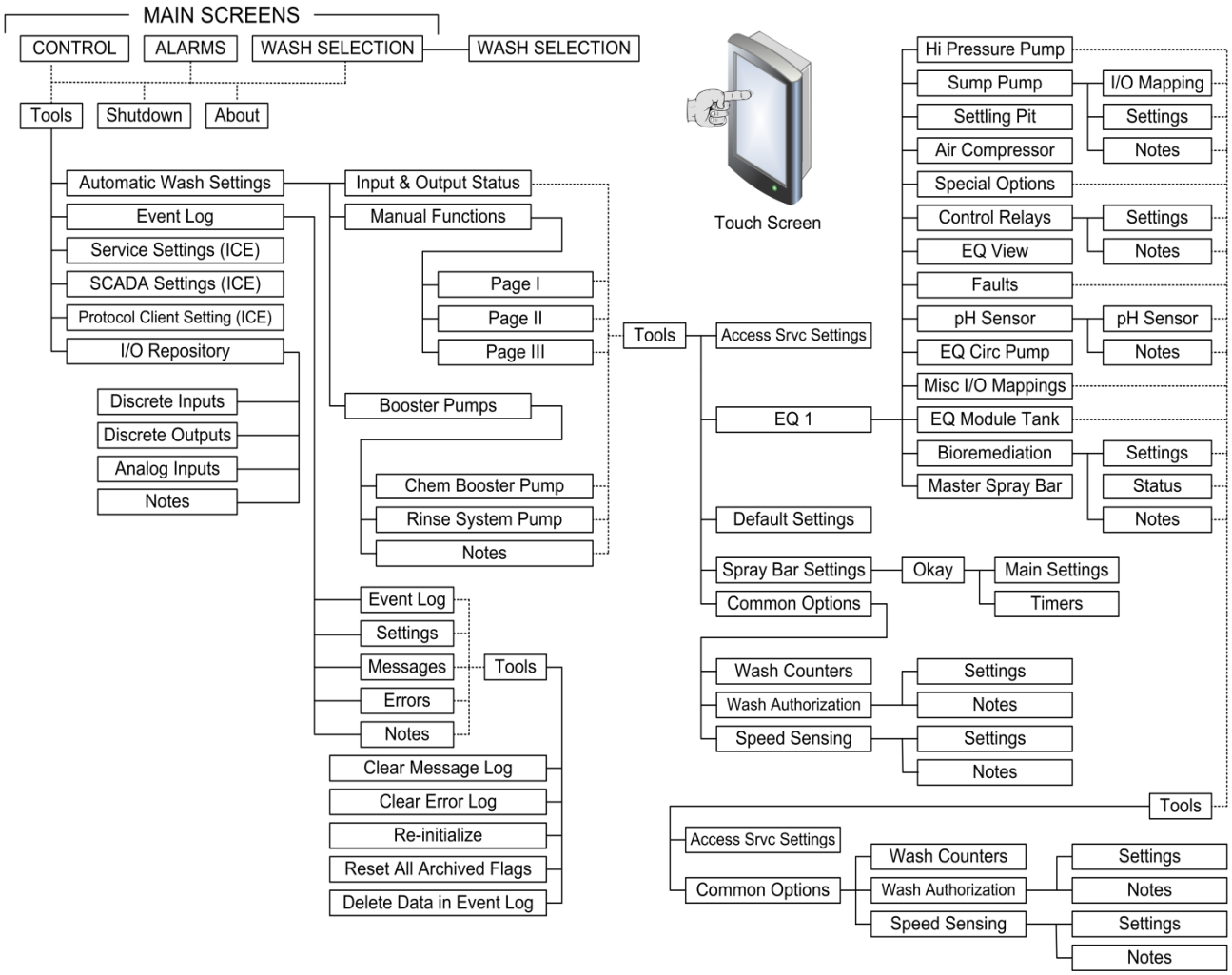


Figure 2- 27 Touch Screen Map

2.3.1 Initialization Screens

Figure 2- 28 Typical Initialization Screens

Screen Description

These screens show on the Touch Screen Terminal when the Wash System control program starts. The screens show the Wash System manufacturer's name and contact information plus the version number of the software. Note: the version number on your screen may be different from the image above.

The System may take several minutes to initialize the various software and hardware modules. The start-up progress is shown on your screen. The modules that have to be initialized (Tasks) are listed on the screen along with a check box for each item. Each Task is grayed out until that task becomes initialized, after which it appears in regular type and the check box is marked off. The Task remains grayed out if the initialization for that item could not be completed successfully.

At the end of the initialization phase, the ALARMS screen shows on the Touch Screen. If any of the Tasks shown on the initialization screen fails to initialize (is not checked off on the screen) then a message is shown on the ALARMS screen. Any other abnormal conditions detected during power-up will also be shown.

The ALARMS screen is one of the three screens referred to in this manual as a Main Screen; that is, those screens that are at the top of the hierarchy tree as shown in *Figure 2- 27 Touch Screen Map.* All other parts of the Touch Screen system are accessed, directly or indirectly, from these screens.

Refer to *Section 2.3.2 Touch Screen Layout* for an explanation of the Touch Screen terms.

CAUTION:	**The word "Press", as it relates to the Touch Screen system in this manual, simply means to touch the screen at that point. You do not have to, and should not, apply excessive force to the screen to actuate a function such as an on-screen button.** **Do not use sharp items, such as a screwdriver, to actuate on-screen functions.**

2.3.2 Touch Screen Layout

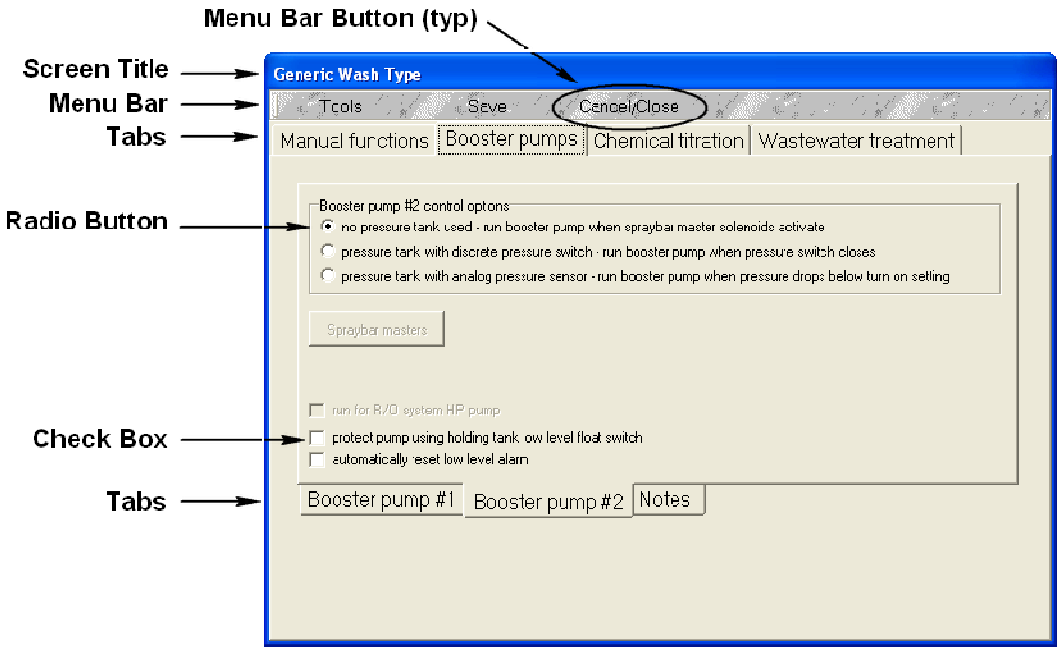


Figure 2- 29: Typical Touch Screen Layout

The Touch Screen Terminal screens are structured as shown in the typical screen above. Most of the screens incorporate some or all the features shown. The terms below are used throughout this manual.

Screen Title

This area at the top of the screen gives the screen title and an indication of the screen's function.

Menu Bar

The Menu Bar area just below the screen title gives one or more option buttons. Press a button to pop up another screen with options relating to the button or to change to another screen.

Menu Bar Buttons

The buttons show on the Menu Bar in the form of text blocks; i.e., Tools. Press a button to bring up screen options or navigate to another screen.

Tabs

Tabs are navigational features that change to the indicated screen when pressed. Tabs may be either on the top of the main screen area or below the main screen area. Some pages have both, some have neither. Press a tab to navigate to that screen.

Radio Buttons

Radio buttons allow you to select one and only one option from a list of options. Checking any button selects that option and deselects any button that may have been selected previously.

Check Boxes

Check Boxes allow you to select one (or more) options from a list of options.

Main Screen Area

This refers to the central part of the screen where the main function(s) of the screen are displayed. This area may contain some of the features described above or may contain just text or an image.

Pulldown Menus and Pop-up Windows

Pulldown menus appear on the screen as a result of pressing a button on the Menu Bar. The menus give options for that button, usually to navigate to some other screen related to that button. Some options may be listed but grayed out meaning that the current password level does not have access to those functions. Press an active menu item to select that item.

Pop-up windows are small screens that pop up over the current screen, usually as a response to a selection made on the current screen. Pop-ups give information (sometimes warnings) or ask for confirmation of something and usually require a response.

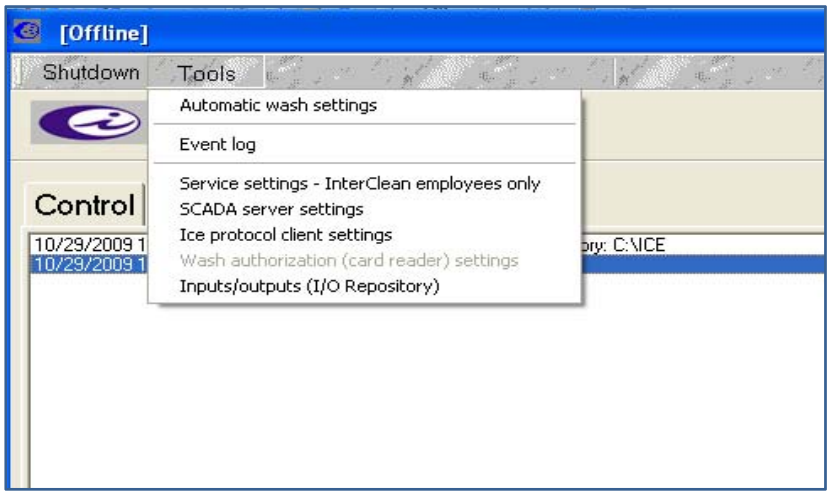


Figure 2- 30: Typical Pulldown Menu from the Tools Button

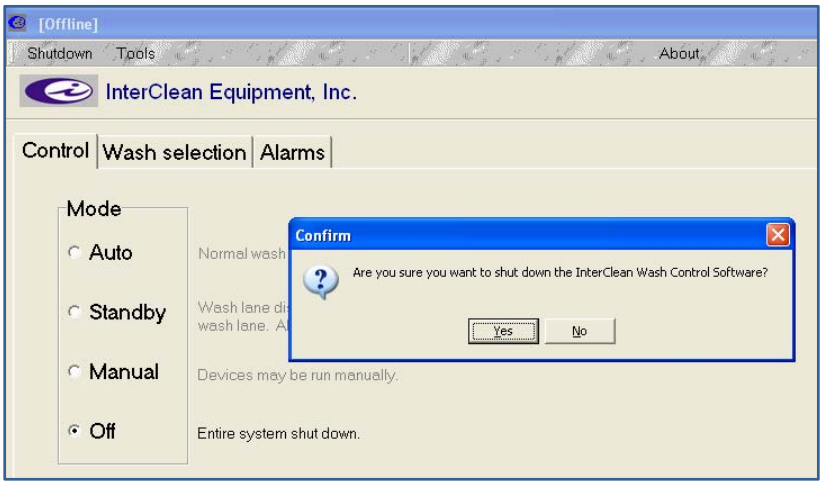


Figure 2- 31: Typical Pop-up Window

2.3.3 Password Entry Screen

After initialization, you may tab between any of the three Main Screens without a password. Passwords protect certain wash system parameters from alteration by unauthorized personnel. Anyone accessing the Touch Screen can call up some of the screens and even make some changes, such as changing the wash mode (Auto, Standby, Manual, Off). However, a password is required to access most other screens and to change actual System parameters, such as timer values.

Two levels of password are available to end-user personnel:

Level IV:

This password is provided to trained wash operators and maintenance personnel. Level IV passwords can change timer values, access manual functions, force outputs, etc. Level IV password holders may *view* more screens than they can actually interact with without a higher level (Level III) password. The current Level IV password: ICE.

Level III:

This level password is provided to site management, engineers, wash owner, etc. All level IV functions are available to Level III plus access to additional functions.

The keyboard (*Figure 2- 32*) pops up on the screen if you try to access a screen or option that is password protected. Enter a valid password by touching the keys on the on-screen keyboard, then press the ENTER. The System displays the selected screen or option if the password is accepted. Passwords are not case sensitive.

Figure 2- 32 Password Entry Keyboard Screen

The System Controller displays the following pop-up message if you enter an incorrect password:

Figure 2- 33 Password Reject Pop-up Window

Click the “OK” button to cancel the reject screen and the current password entry attempt. You may then retry to enter a correct password or make another screen selection.

Passwords are issued and maintained by the Wash System manufacturer. Contact InterClean Equipment, Inc. with any password issues at: 1-800-INTERCLEAN.

The watchdog timer provides protection to the Wash System in case an output or even a whole subsystem, such as a spray arch, is forced on and left on inadvertently.

NOTE:	**A watchdog timer monitors all password-protected screens. You have 10 minutes to complete your tasks after you enter a password. After that, the System turns off any functions that you may have actuated manually, such as turning on a pump. It then prompts you for a password if you try to select an option or change screens.** **Either abort the session or re-enter your password to continue.**

2.3.4 Main Screen - Control Screen

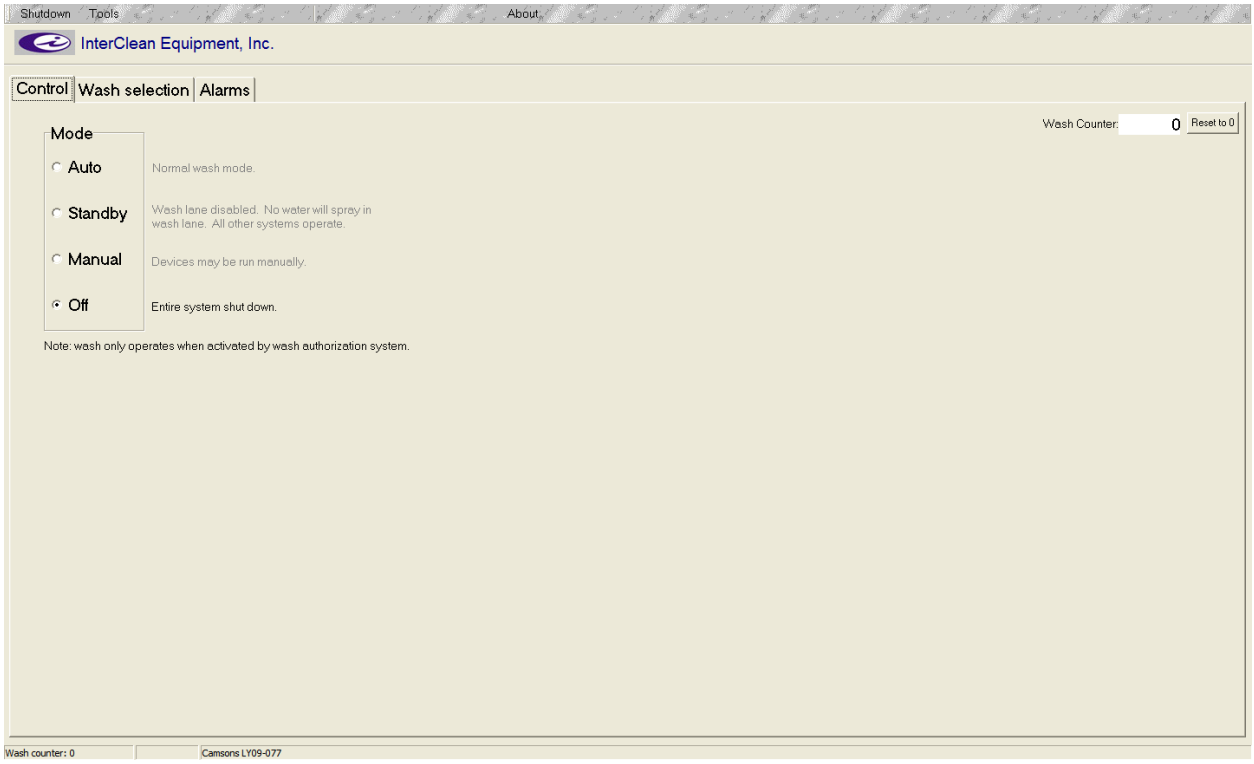


Figure 2- 34: Main Screen - Control Screen

Screen Description

Select the Wash System operating mode from this screen.

Mode

Auto - This is the mode for washing vehicles. The Wash System performs a wash according to the configuration selected on the Wash Selection Screen.

Standby - In this mode, all the Wash Bay functions are off; no chemicals or water will spray from the arches. All other components of the Wash System may be running.

Manual - Select this mode to run devices or subsections manually.

Off - All Wash System functions are shut down in this mode.

Wash Counter

This display in the upper right side of the screen shows the number of wash cycles performed since the counter was last reset. Each wash cycle increments the count by one.

Reset to Zero

Press this button to reset the Wash Counter display on this screen to zero.

2.3.5 Main Screen – Wash Selection Screen

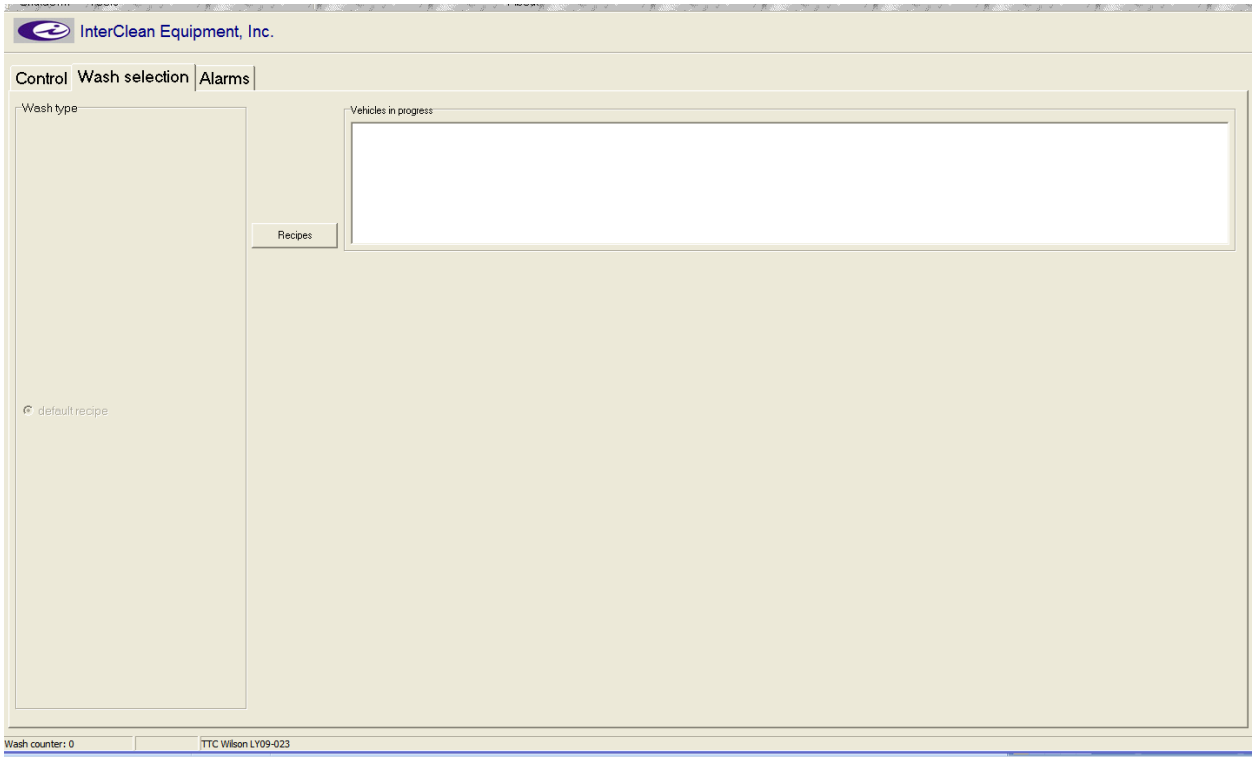


Figure 2- 35: Main Screen - Wash Selection Screen

Screen Description

Select the wash type from this screen and set up the wash quota (if used).

Wash Type

There aren't any wash type options selectable from this screen for this Wash System.

Recipes Button

Press to call up the Recipes screen. This screen shows the Wash System configurations that can be selected from this screen. The column labeled "Enabled" shows the true/false status of each configurable subsystem; systems marked 'True' are enabled for that wash type.

The 'Recipes' option is intended for use by ICE employees only.

CAUTION:	**A Level IV password allows you to open the 'Recipes' page where you can enable/disable spray arches and change timer values. These functions are intended for InterClean personnel only. Changing options on this page can cause your Wash System to not work or not work correctly and is not advised. Contact InterClean Equipment with any questions.**

2.3.6 Main Screen – Alarms Screen

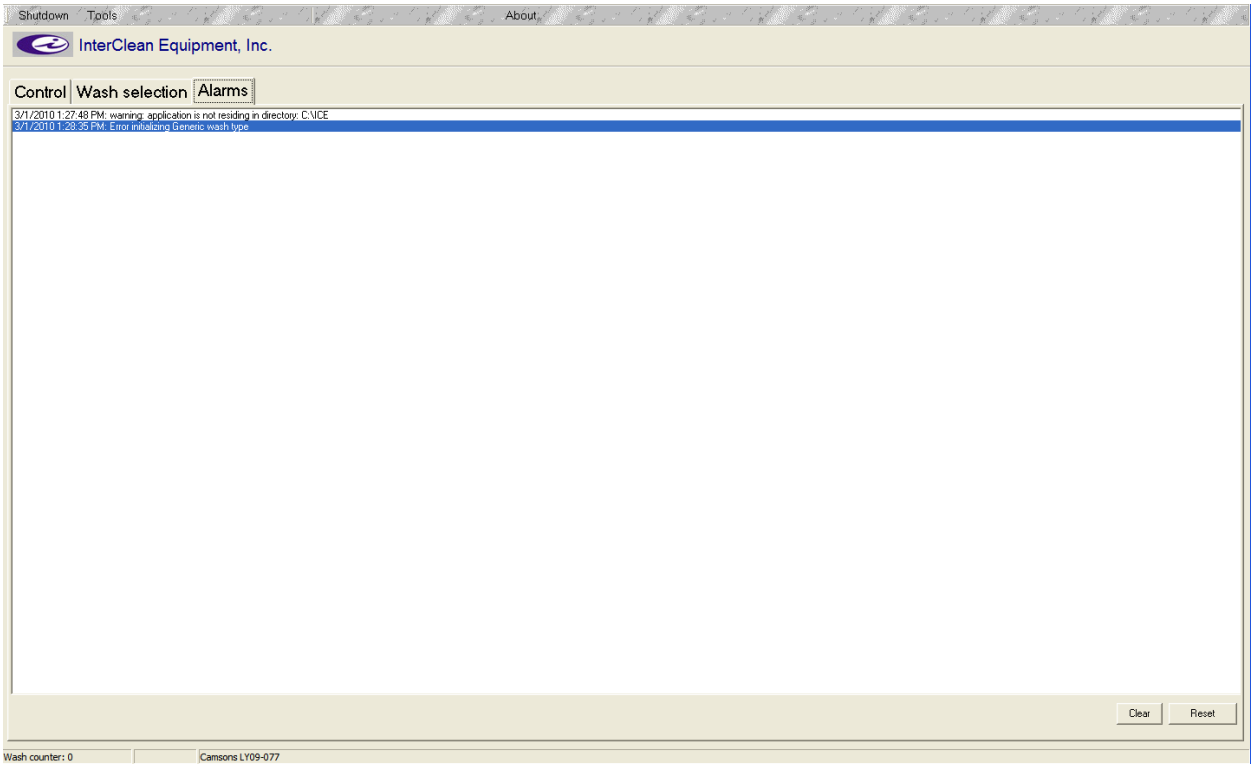


Figure 2- 36: Main Screen - Alarms Screen

Screen Description

The ALARMS screen displays a log of alarm conditions detected by the System Controller, including the date and time the alarm occurred. Each separate alarm event is displayed on a single line on the screen. The alarms are listed with the current or most recent alarm at the top of the list.

The System defaults to this screen when the Control System first powers up. You may also access this screen by pressing the ALARMS tab from the three other Main Screens.

System alarms are triggered in response to an abnormal condition in the Wash System. This ranges from hardware failures, such as a malfunctioning motor starter or a storage tank low on fluid, to an E-Stop pressed, to communication faults in an Ethernet base.

Clear Button:

Press to delete all previous alarms logged at in the System.

Reset Button:

Press to return the Wash System back to the previous wash state after an alarm has been corrected. All alarm conditions must be corrected before the System can be reset. You do not have to clear the screen to reset the alarm.

NOTE:	**You must correct the cause the alarm before resetting the alarm message.**

2.3.7 Main Screen – Tools Menu Bar Options

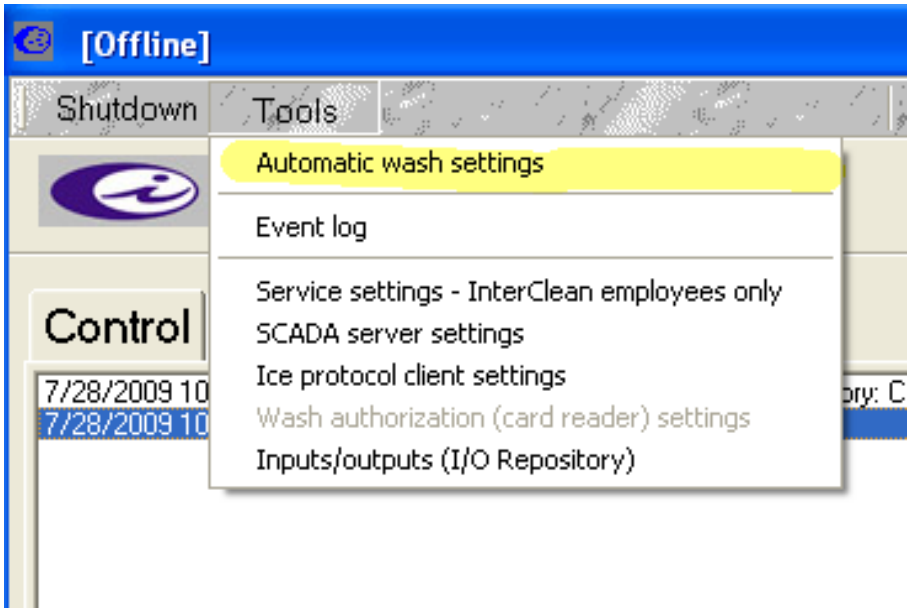


Figure 2- 37 Main Screen - Tools Pop-up Screen

Keystroke Sequence:

Wash Main Screens ⇨ Tools

Screen Description:

Press the 'Tools' menu bar button from any of the four Main screens to pop up the screen above. This screen gives the options described in the following sections.

- **Automatic Wash Settings** – Refer to *Page 2-71*.
- **Event Log** – Refer to *Page 2-111.*
- **Service Settings** – Used by ICE personnel only – not covered in this manual
- **SCADA Server Settings** – Used by ICE personnel only – not covered in this manual
- **ICE Protocol Client Settings** – Used by ICE personnel only – not covered in this manual
- **Inputs / Outputs (I/O Repository)** – Refer to *Page 2-119.*

2.3.8 Manual Functions – Page 1 Screen

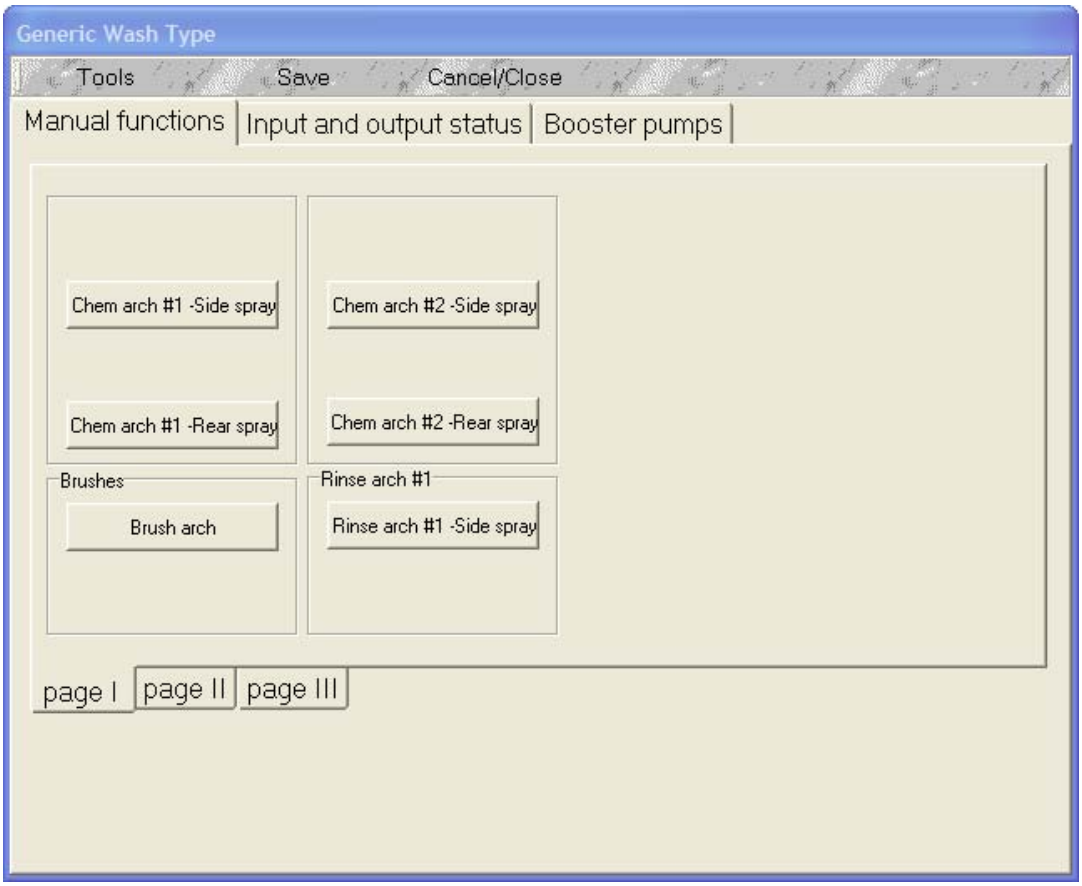


Figure 2- 38: Manual Functions - Page I Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Manual Functions ⇨ Page I

Screen Function:

Manually turn on or off selected Wash System subsystems. The subsystems include all the components required to turn on the function.

The Wash System must be in MANUAL mode to turn systems and components on or off manually.

CAUTION:	**The Wash System does make any safety evaluations when you turn on systems manually. You must make sure all personnel and equipment are out of danger in the Wash Bay before manually enabling a wash system.**

Screen Description:

All password users can manually turn on/off the following functions. Touch the onscreen button to toggle the selection on or off:

Chemical Arch #1 – Side Spray – Press to toggle on or off the 1-hp Chemical Booster Pump and solenoid valve SOV4 located in the Acid Chemical Module. This mixes hot water with concentrated detergent and flows it out to the Acid Chemical Arch side spray bars.

The pump is controlled through motor contactor 3M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P701 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Chemical Arch #1 – Rear Spray – Press to toggle on or off the 1-hp Chemical Booster Pump and solenoid valve SOV5 located in the Acid Chemical Module. This mixes hot water with concentrated detergent and flows it out to the Acid Chemical Arch rear spray bar.

The pump is controlled through motor contactor 3M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P702 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Chemical Arch #2 – Side Spray – Press to toggle on or off the 1-hp Chemical Booster Pump and solenoid valve SOV2 located in the Alkaline Chemical Module. This mixes hot water with concentrated detergent and flows it out to the Alkaline Chemical Arch side spray bars.

The pump is controlled through motor contactor 3M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P703 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Chemical Arch #2 – Rear Spray – Press to toggle on or off the 1-hp Chemical Booster Pump and solenoid valve SOV3 located in the Alkaline Chemical Module. This mixes hot water with concentrated detergent and flows it out to the Alkaline Chemical Arch rear spray bar.

The pump is controlled through motor contactor 3M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P704 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Brush Arch – Press to toggle on or off the 3-hp Rinse Booster Pump and solenoid valve SOV10 located in the Rinse Module. This pumps fresh water from the municipal water supply out to the vertical spray bars that keep the brushes wet through the solenoid valve in the Rinse Module.

The pump is controlled through motor contactor 4M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P712 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P716 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Rinse Arch #1 – Side Spray – Press to toggle on or off the 3-hp Rinse Booster Pump and solenoid valve SOV9 located in the Rinse Module. This flows fresh water from the municipal water supply out to the Rinse Arch.

The pump is controlled through motor contactor 4M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P712 on I/O Base 1 located in the MCP. The valve is controlled through output terminal P715 on I/O Base 1 located in the Master Control Panel (MCP).

When toggled on, the components remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

2.3.9 Manual Functions – Page II Screen

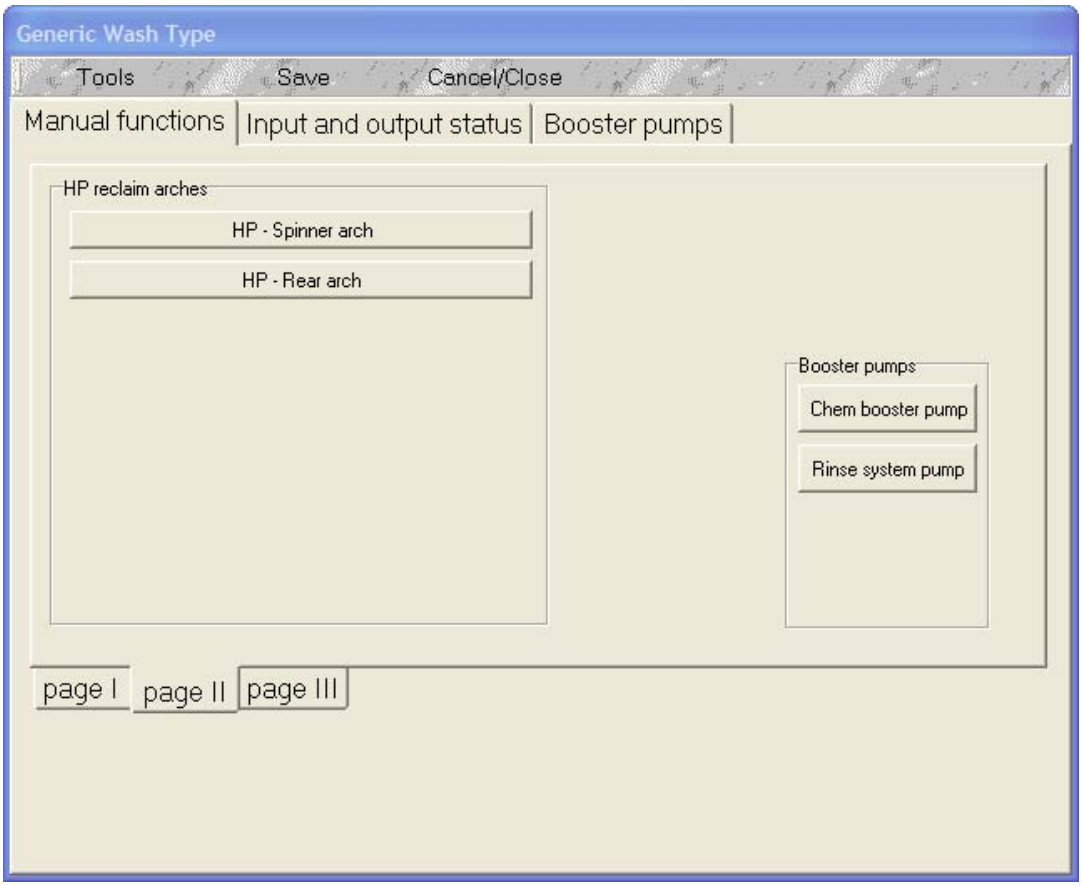


Figure 2- 39: Manual Functions - Page II Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Manual Functions ⇨ Page II

Screen Function:

Manually turn on or off selected Wash System subsystems. The Wash System must be in the MANUAL mode to turns systems and components on or off manually.

CAUTION:	**The Wash System does make any safety evaluations when you turn on systems manually.** **You must make sure all personnel and equipment are out of danger in the Wash Bay before manually enabling a wash system.**

Screen Description:

All password users can manually turn on/off the following functions. Touch the onscreen button to toggle the selection on or off:

HP Reclaim Arches:

HP - Spinner Arch – Press to toggle on or toggle off the 75-hp High Pressure Pump and Co-Ax valve SOV6. This 3-way valve connects the discharge side of the pump to the Spinner Arch and the Chassis Washer through the normally-closed port on valve SOV6.

The pump is controlled through motor contactor 3M located in the Reclaim Slave Panel (RSP). The contactor is controlled by contact relay 6CR that is controlled through output terminal P711 on I/O Base 1 located in the RSP. The wash computer also turns on the soft start module through output terminal P703 on I/O Base 1 located in the RSP. The soft start module connects the pump motor to 3-phase power gradually to reduce or eliminate electrical and mechanical shock to system components.

The Co-Ax valve is controlled through output terminal P716 on the same I/O Base.

When toggled on, the pump and valve remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

HP - Rear Arch – Press to toggle on or toggle off the 75-hp High Pressure Pump. This connects the discharge side of the pump to the Rear Wash Arch through the normally-open port on Co-Ax valve SOV6 which is off.

The pump is controlled through motor contactor 3M located in the Reclaim Slave Panel (RSP). The contactor is controlled by contact relay 6CR that is controlled through output terminal P711 on I/O Base 1 located in the RSP. The wash computer also turns on the soft start module through output terminal P703 on I/O Base 1 located in the RSP. The soft start module connects the pump motor to 3-phase power gradually to reduce or eliminate electrical and mechanical shock to system components.

When toggled on, the pump and valve remain on until you toggle them off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Booster Pumps:

Chem Booster Pump – Press to toggle on or toggle off the 1-hp pump that supplies fresh water to the Chemical Wash System.

The pump is controlled through motor contactor 3M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the MCP.

When toggled on, the pump remains on until you toggle it off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

Rinse System Pump – Press to toggle on or toggle off the 3-hp pump that supplies fresh water to the Rinse Arch and the Brush spray bars..

The pump is controlled through motor contactor 4M located in the Master Control Panel (MCP). The contactor is controlled through output terminal P712 on I/O Base 1 located in the MCP.

When toggled on, the pump remains on until you toggle it off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out.

2.3.10 Manual Functions – Page III Screen

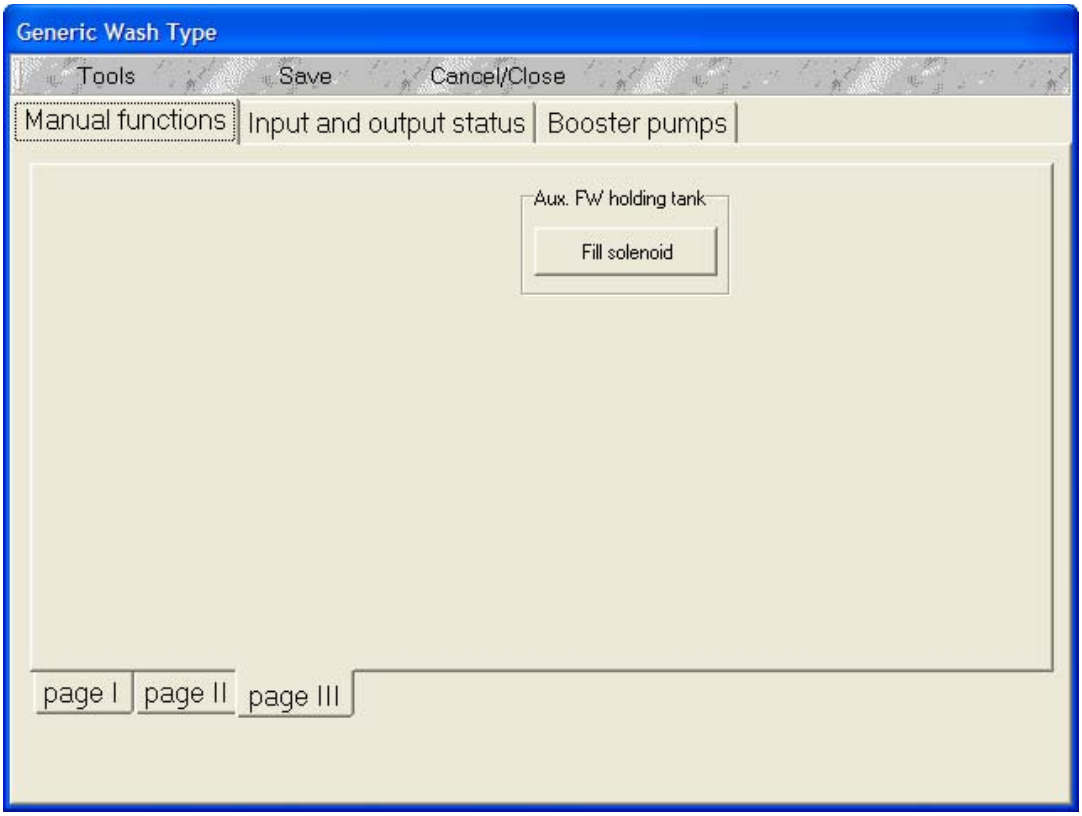


Figure 2- 40: Manual Functions - Page III Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Manual Functions ⇨ Page III

Screen Function:

Manually turn on or off selected Wash System subsystems. The Wash System must be in the MANUAL mode to turns systems and components on or off manually.

CAUTION:	**The Wash System does make any safety evaluations when you turn on systems manually. You must make sure all personnel and equipment are out of danger in the Wash Bay before manually enabling a wash system.**

Screen Description:

All password users can manually turn on/off the following functions. Touch the onscreen button to toggle the selection on or off:

Fill Solenoid – press this button to toggle on or off the valve that fills the Fresh Water Tank through output terminal P701 on I/O Base 1 in the Master Control Panel.

When toggled on, the valve remains on until you toggle it off, exit the MANUAL mode, the Touch Screen watchdog timer times out, or the maximum cycle timer times out

2.3.11 Input and Output Status Screen

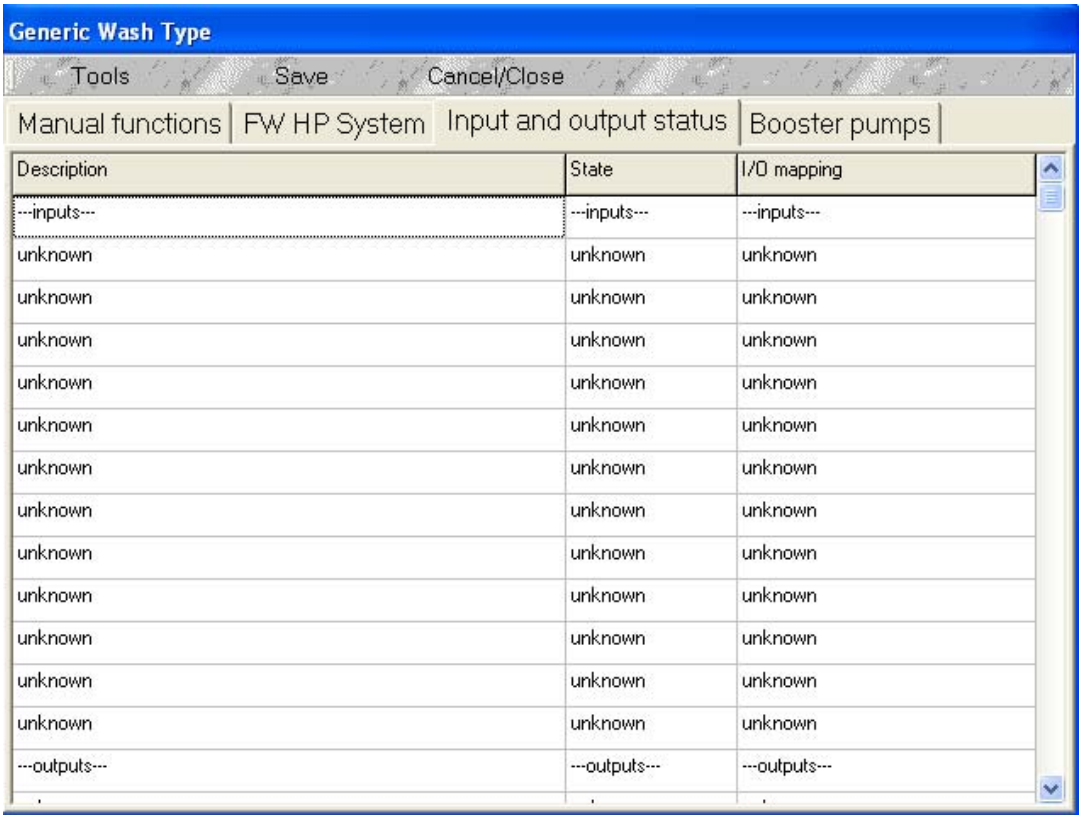


Figure 2- 41 Typical Inputs and Outputs Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Input and Output Status

Screen Function:

This screen lists inputs and output to the System Controller, how they are mapped into the system, and their current on/off status.

Screen Description:

All password users can access this screen.

2.3.12 Booster Pumps – Chem Booster Pump Screen

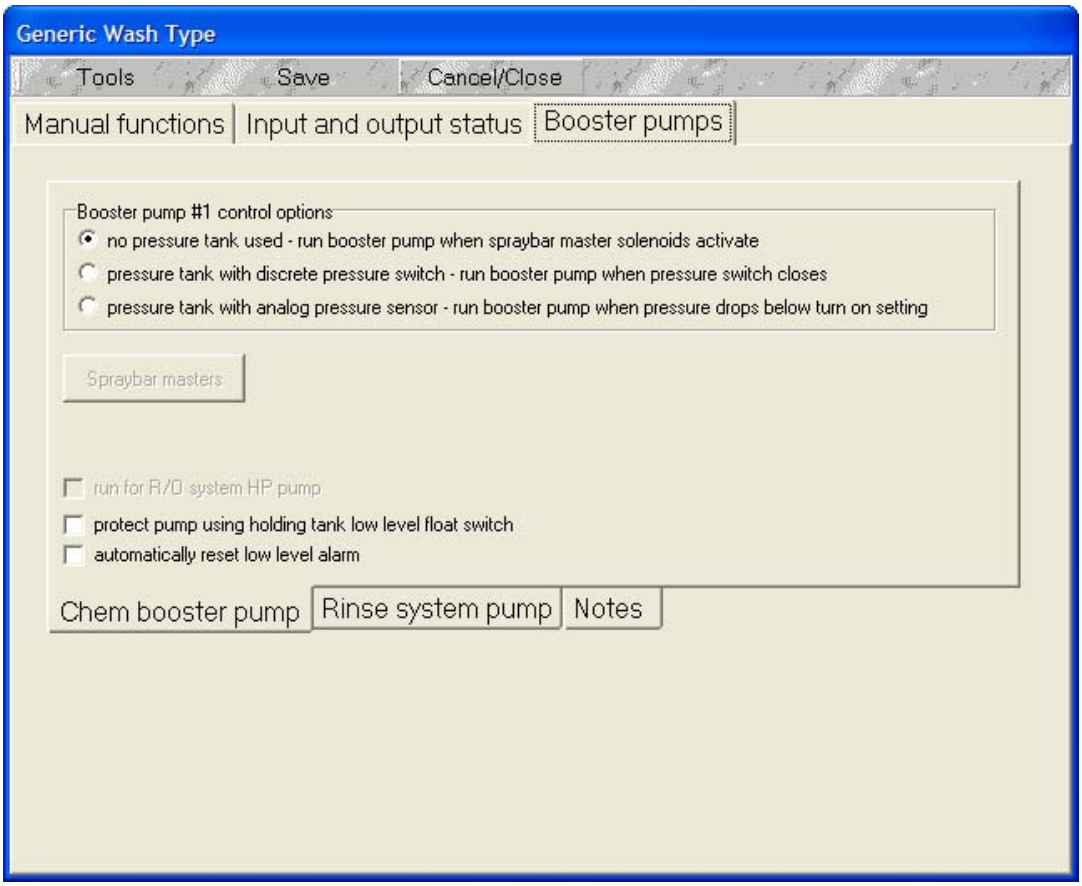


Figure 2- 42: Booster Pumps – Chem Booster Pump Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Booster Pumps ⇨ Chem Booster Pump

Screen Function:

Configure the Chemical Booster Pump during system design. The 1-hp Chemical Booster Pump supplies fresh water to the Chemical Wash System.

Screen Description:

Level IV passwords users can view the configuration of the Chemical Booster Pump but not make changes.

Level III password users can change the Chemical Booster Pump configuration by selecting the appropriate radio buttons on the screen. This should only be performed when the system is designed.

Booster Pump #1 Control Options:

- No pressure tank used – run booster pump when spray bar master solenoids activate (default)
- Pressure tank with discrete pressure switch – run booster pump when pressure switch closes

- Pressure tank with analog pressure sensor – run booster pump when pressure drops below turn on setting
- Protect Pump Using Holding Tank Low Level Float Switch
- Automatically reset low level alarm

2.3.13 Booster Pumps – Rinse System Pump Screen

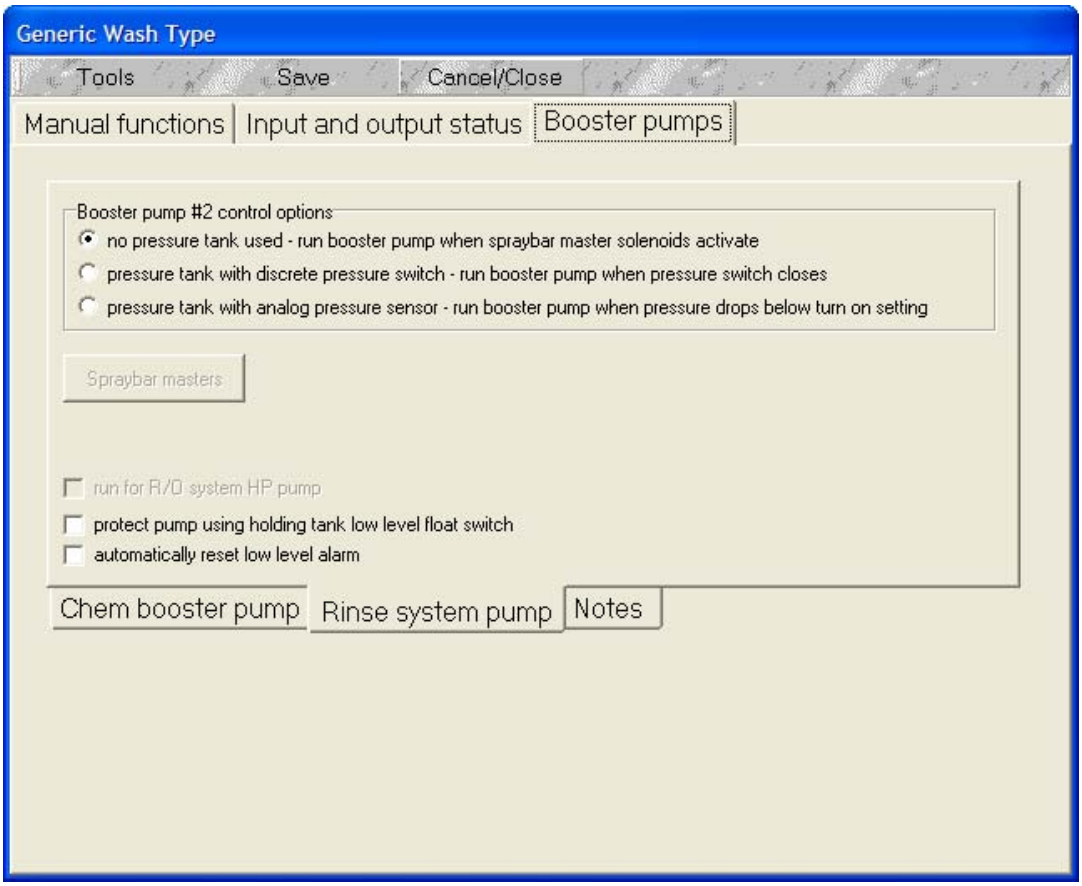


Figure 2- 43: Booster Pumps – Rinse System Pump Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Booster Pumps ⇨ Rinse System Pump

Screen Function:

Configure the Rinse Booster Pump during system design. The 3-hp Rinse Booster Pump supplies fresh water to the Brush Module vertical spray bars and the Rinse Arch.

Screen Description:

Level IV passwords users can view the configuration of the Rinse Booster Pump but not make changes.

Level III password users can change the Rinse Booster Pump configuration by selecting the appropriate radio buttons on the screen. This should only be performed when the system is designed.

Booster Pump #1 Control Options:

- No pressure tank used – run booster pump when spray bar master solenoids activate (default)
- Pressure tank with discrete pressure switch – run booster pump when pressure switch closes

- Pressure tank with analog pressure sensor – run booster pump when pressure drops below turn on setting
- Protect Pump Using Holding Tank Low Level Float Switch
- Automatically reset low level alarm

2.3.14 Booster Pump - Notes Screen

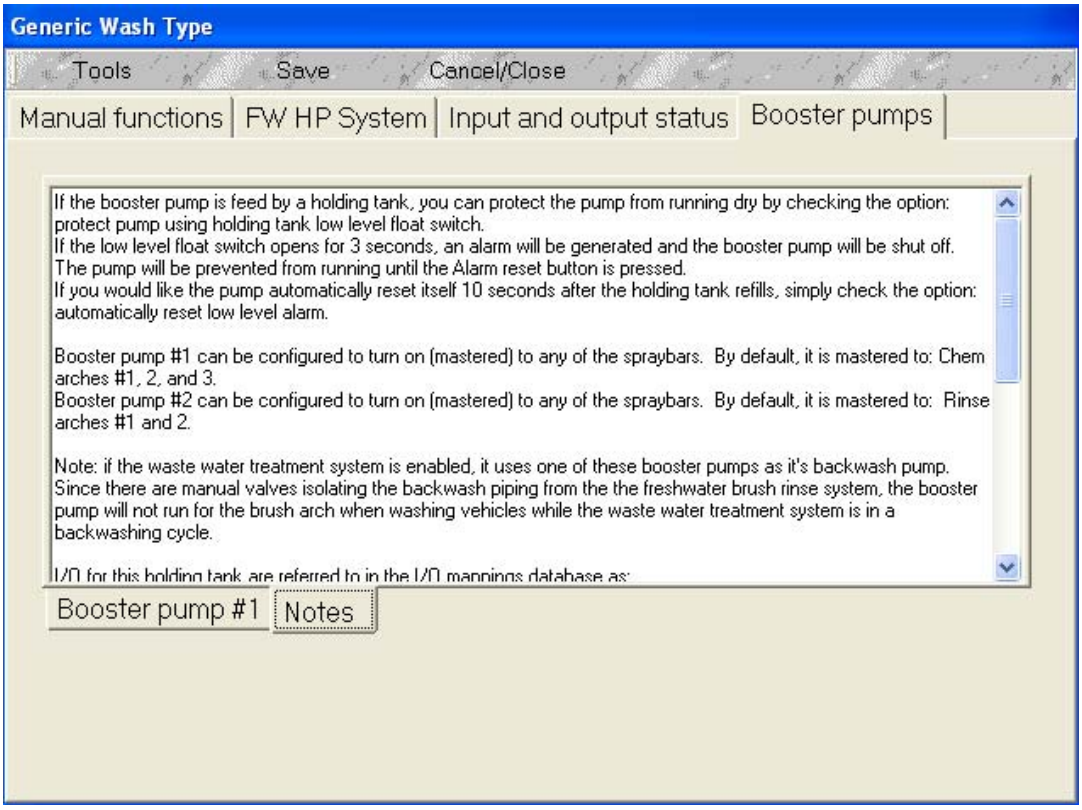


Figure 2- 44: Booster Pump – Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Booster Pumps ⇨ Notes

Screen Function:

Notes relating to the design of the Booster Pump system. Used mainly for designing and configuring the Wash System.

Screen Description:

All password users can access the design notes for the Booster Pumps.

2.3.15 Automatic Wash Settings Screen – Tools Menu Bar Options

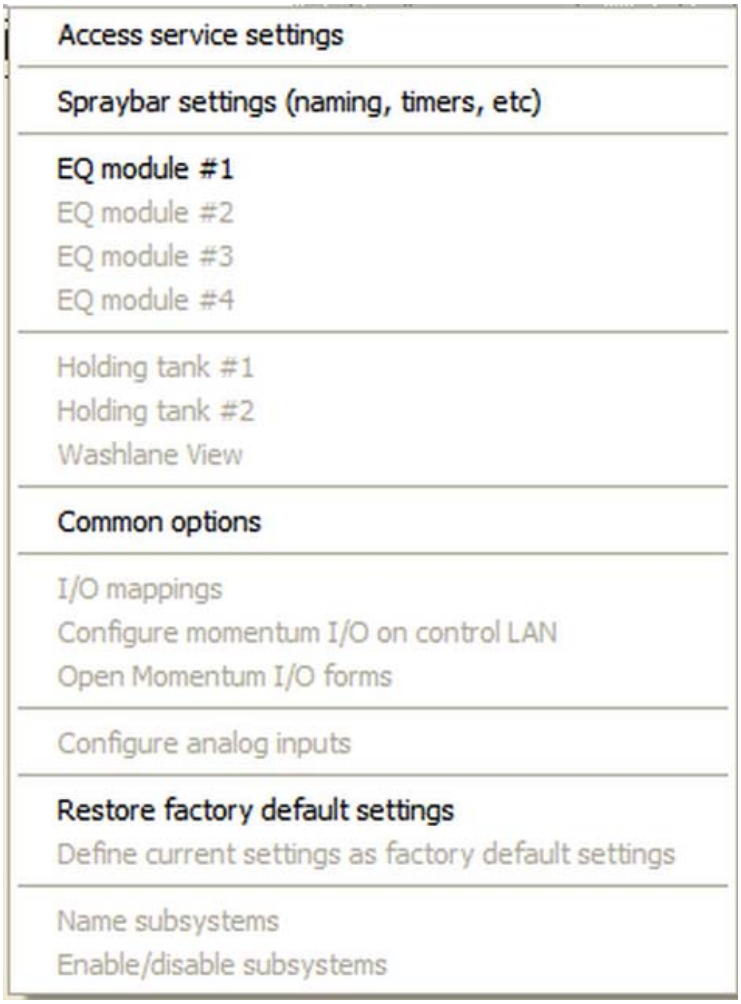


Figure 2- 45 Automatic Wash Settings - Tools Pop-up Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Setting screen) ⇨ Tools

Screen Description:

Press the 'Tools' menu bar button from any Automatic Wash Settings screen to pop up the screen above. This screen gives options described in the following sections. Options that are grayed out are not applicable to this Wash System.

2.3.16 Auto Wash Settings Screen – Tools – Access Service Settings Screen

Figure 2- 46 Password Entry Keyboard Popup

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Setting screen) ⇨ Tools ⇨ Access Service Settings ⇨ (enter password)

Screen Description:

Access higher level Touch Screen functions from this screen. The keyboard entry screen pops up when you access this screen. Enter a higher level password on the keyboard and press ENTER to access the higher level Touch Screen functions. Press CANCEL on the keyboard to exit the screen.

NOTE:	**'Higher level' means higher security level, not higher numerically. A Level III password in this system is a higher level than a Level IV password. Refer to Section *2.2.1 System Controller* for a description of the password levels.**

An error screen pops up if you enter an incorrect password. Enter a correct password or exit the function. Click the OK button to exit the error screen and the Access Service Settings screen. Re-enter the Access Service Settings screen and enter a valid higher level password.

Figure 2- 47: Invalid Password Message Popup

NOTE:	**You may access (with correct password) higher level functions from several 'Tools' menu bar buttons in the Touch Screen system and all function the same as above.**

2.3.17 Auto Wash Settings Screen – Tools - Spray Bar Settings Screen

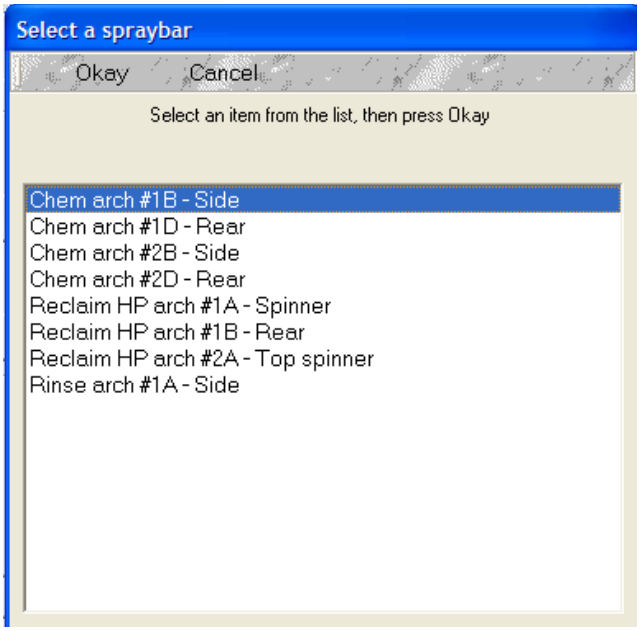


Figure 2- 48: Spray Bar Settings Screen

Keystroke Sequence:

Wash Main Screens ⇨ Tools ⇨ (any Automatic Wash Setting screen) ⇨ Tools ⇨ Spray Bar Settings

Screen Function:

This key sequence pops up the above screen showing the list of spray arches, spray bars, and spinners designed into this Wash System. Select the desired spray system for further options.

CAUTION:	**This screen and its subscreens are intended for use in the design process for the Wash System. Unauthorized changes to some of these functions may result in your Wash System not operating or operating incorrectly.** **Do not rename any of the spray bars after the Wash System has been installed.** **Contact InterClean Equipment (ICE) before making any changes to these functions.**

Screen Description:

This screen shows all the spray systems designed into this Wash System.

- Scroll to (highlight) the desired spray bar.
- Press the OKAY button while the spray bar is highlighted. The screen changes to the MAIN SETTINGS screen for the selected spray bar.

2.3.18 EQ Module #1 – Sump Pump - I/O Mappings Screen

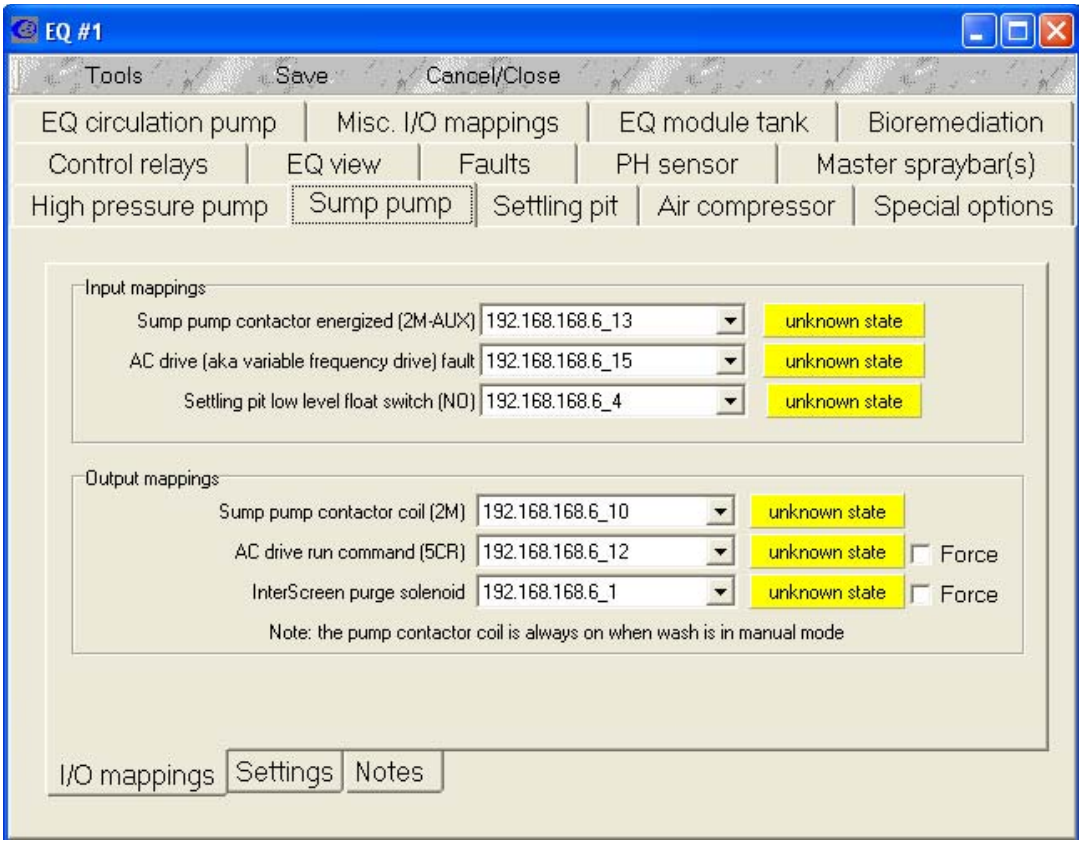


Figure 2- 49: EQ Module #1 – Sump Pump - I/O Mappings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Sump Pump ⇨ I/O Mappings

Screen Function:

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

Screen Description

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- Sump Pump Contactor Energized (2M-AUX)
- AC Drive (aka variable frequency drive) Fault

- Settling Pit Low Level Float Switch (NO)

Output Mappings – Click the down arrow (▼) next to the dropdown menu you want to open and select the IP address from the drop down list. The indicator next to the output shows the current state of that output when the program is running.

- Sump Pump Contactor Coil (2M)
- AC Drive Run Command (5CR)
- InterScreen Purge Solenoid

Level III Password:

Level III and higher password users can assign IP addresses to the I/O points on the screen. This is a design level function and should not be arbitrarily changed in the field. These password level users can also force an output on or off.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system.**

CAUTION:	**Do not change IP addresses after the Wash System has been installed or parts of your wash system will no longer work.**

2.3.19 EQ Module #1 – Sump Pump – Settings Screen

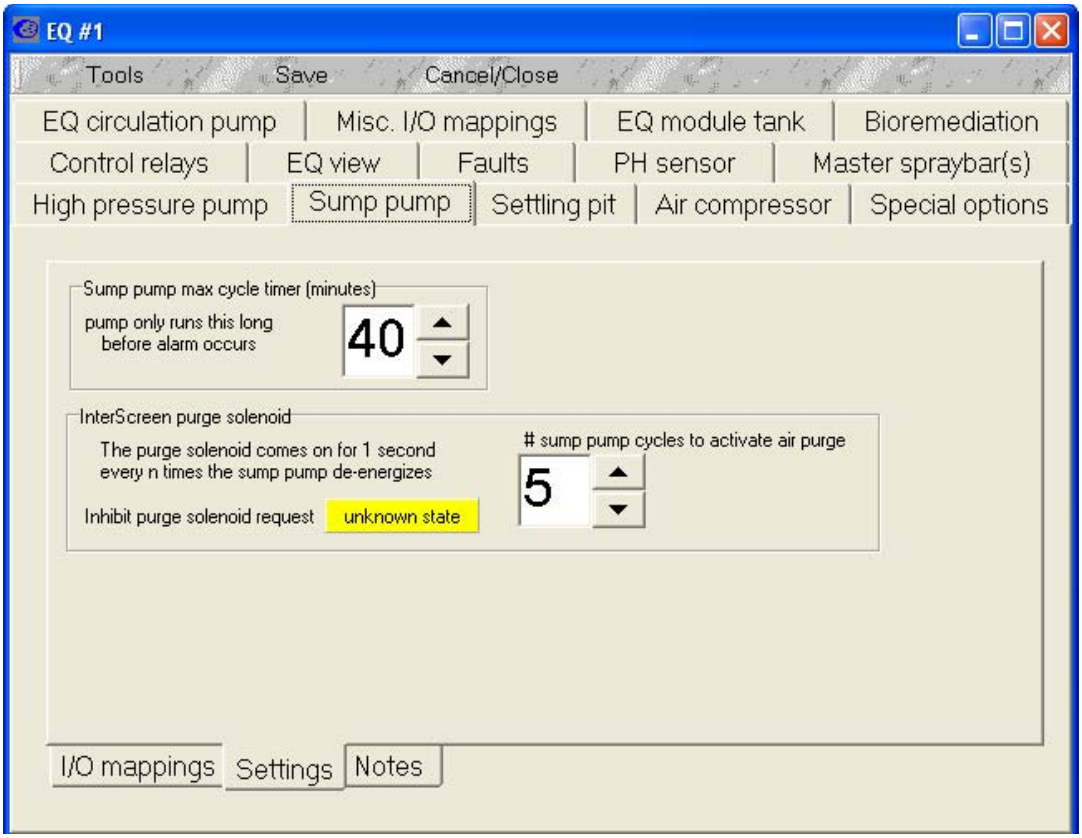


Figure 2- 50: EQ Module #1 - Sump Pump - Settings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Sump Pump ⇨ I/O Mappings

Screen Function

View or configure parameters relating to the Sump Pump for EQ1 Module.

Screen Description

Sump pump max cycle timer – set the maximum time the Sump Pump can run before a System Alarm occurs. Normally, logic conditions turn off the pump before this timer times out. Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to rapidly scroll up or down.

InterScreen purge solenoid – set the number of wash cycles that occur after which the System Controller turns on the air purge solenoid valves (SV7, SV8) that clear debris off the InterScreen filters. Click the up arrow (▲) to increase the count. Click the down arrow (▼) to decrease the count. Press and hold either arrow to rapidly scroll up or down.

2.3.20 EQ Module #1 – Sump Pump Notes Screen

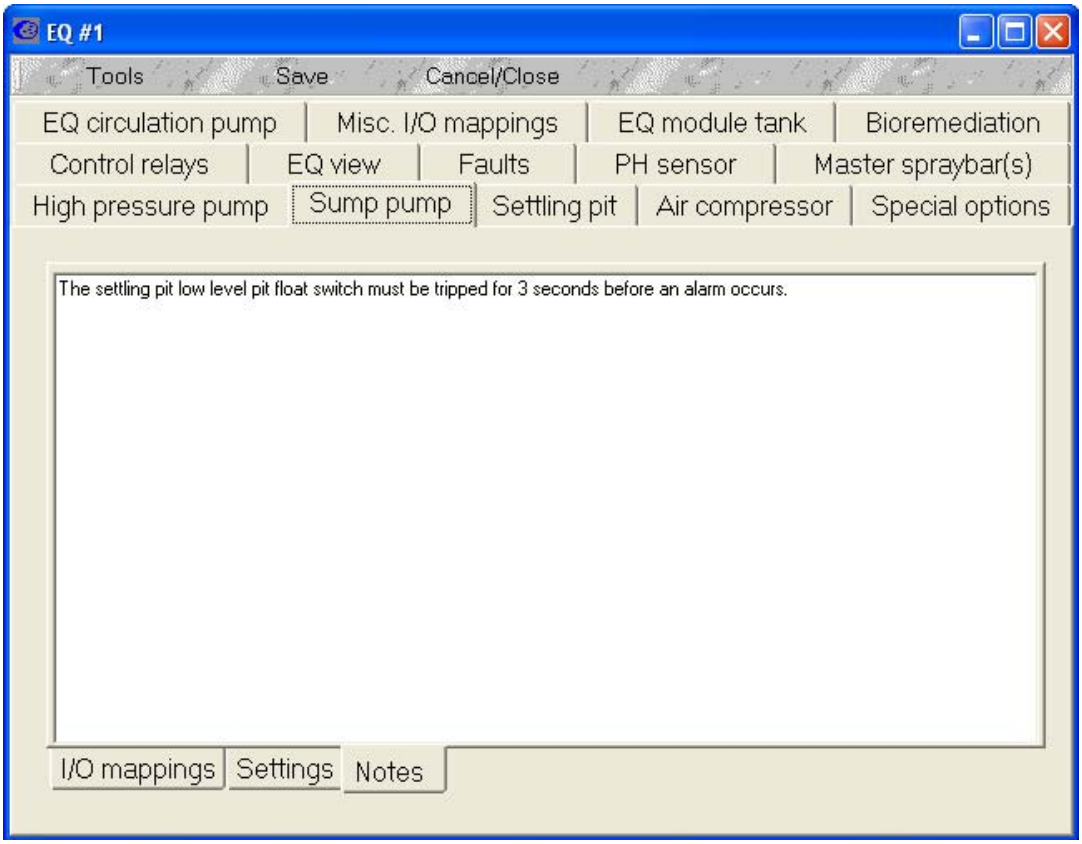


Figure 2- 51: EQ Module #1 – Sump Pump - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Sump Pump

Screen Function

View design notes relating to the Sump Pump circuit.

Screen Description

All password users can access the design notes for Sump Pump system.

2.3.21 EQ Module #1 - High Pressure Pump Screen

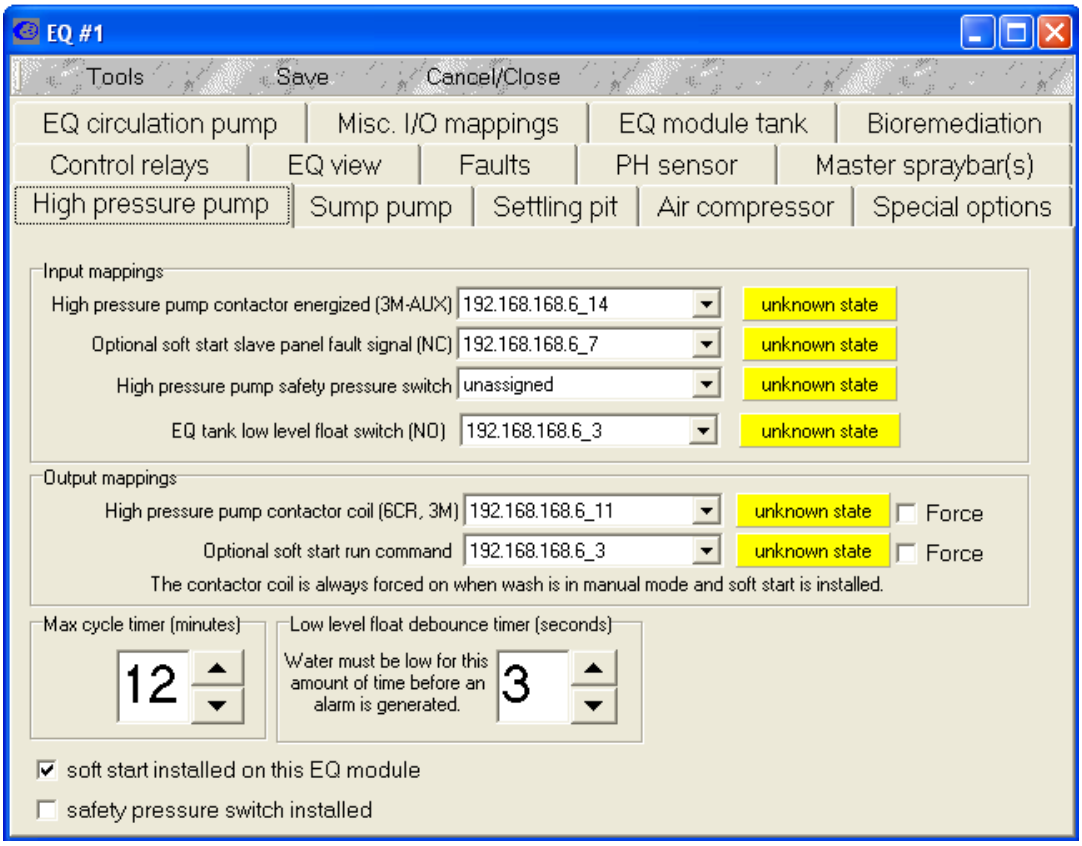


Figure 2- 52: EQ Module #1 - High Pressure Pump Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ High Pressure Pump

Screen Function:

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- High Pressure Pump Contactor Energized (3M-AUX)
- Optional Soft Start Slave Panel Fault Signal (NC)

- High Pressure Pump Safety Pressure Switch
- EQ Tank Low Level Float Switch (NO)

Output Mappings – Click the down arrow (▼) next to the dropdown menu you want to open and select the IP address from the drop down list. The indicator next to the output shows the current state of that output when the program is running.

- High Pressure Pump Contactor Coil (6CR, 3M)
- Optional Soft Start Run Command

Max Cycle Timer – Sets the maximum time the High-Pressure Pump can run before a System Alarm occurs. Normally, logic conditions turn off the pump before this timer times out. Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to rapidly scroll up or down.

Low Level Float Debounce Timer – Sets the time delay the System Controller waits before it turns off the High-Pressure Pump after it sees the low level float switch in the Settling Pit change state. Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to rapidly scroll up or down.

Level III Password:

Level III password users can force indicated outputs on through this screen. Put a checkmark (✓) in the box next to the output that you want to force.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system.**

CAUTION:	**Do not change IP addresses after the Wash System has been installed or parts of your wash system will no longer work.**

2.3.22 EQ Module #1 - Settling Pit Screen

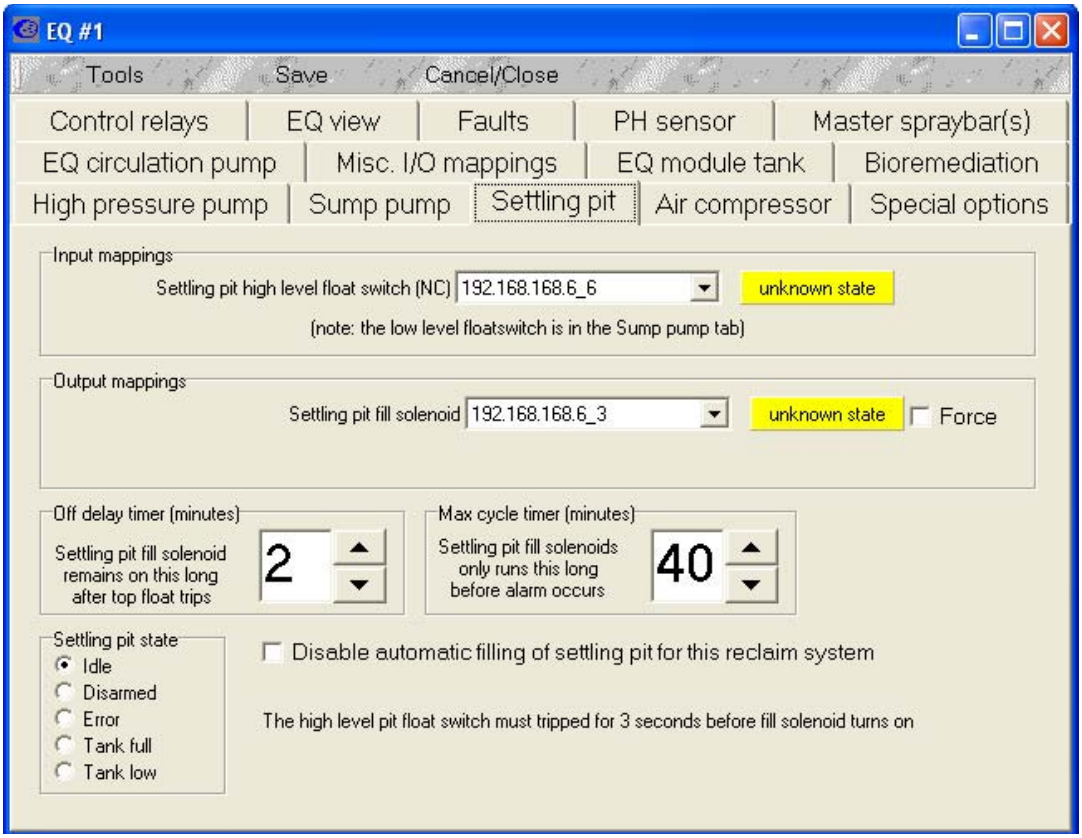


Figure 2- 53: EQ Module #1 - Settling Pit Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Settling Pit

Screen Function:

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- Settling Pit High Level Float Switch (NC)

Output Mappings – Click the down arrow (▼) next to the dropdown menu and select the IP address from the drop down list. The indicator next to the output shows the current state of that output when the program is running. Level III password users can force the output on or off.

- Settling Pit Fill Solenoid

Off-delay Timer – Sets the time the Setting Pit solenoid valves remain on after the top float switch in the Pit changes state (pit full). Click the down arrow (▼) to decrease the time or the up arrow (▲) to increase the timer value. Hold down either arrow to rapidly increase or decrease the time.

Max Cycle Timer – Sets the maximum time the two Settling Pit solenoid valve can run before a System Alarm occurs. Normally, logic conditions turn off the valves before this timer times out. Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to rapidly scroll up or down.

Settling Pit State – The System Controller indicates the current state of the Settling Pit by selecting the appropriate radio button. These buttons are controlled by the wash program and are not inputs to be selected by the operator.

Disable Automatic Refilling Of Settling Pit For This Reclaim System – Check this box to disable the System Controller from adding fresh water to the Pit to maintain a proper pit water level. Use of the automatic refilling feature could mask possible Pit or other plumbing leaks that could lead to a large increase in demand for fresh water and increased operating costs.

Level III Password:

Level III password users can force indicated outputs on through this screen. Put a checkmark (✓) in the box next to the output that you want to force.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system.**

CAUTION:	**Do not change IP addresses after the Wash System has been installed or parts of your wash system will no longer work.**

2.3.23 EQ Module #1 – Air Compressor Screen

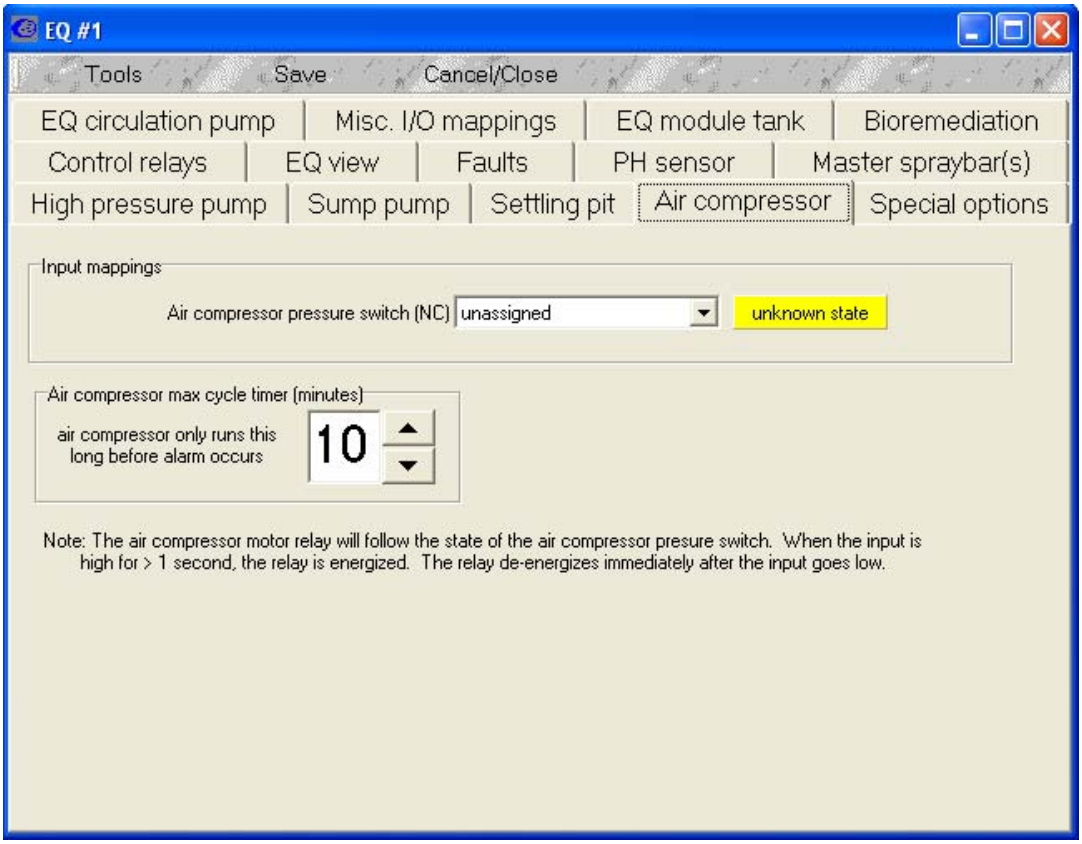


Figure 2- 54: EQ Module #1 - Air Compressor Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Air Compressor

Screen Function:

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- Air Compressor Pressure Switch (NC)

Air Compressor Max Cycle Timer – Sets the maximum time the air compressor can run before a System Alarm occurs. Normally, logic conditions turn off the valves before this timer times out.

Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to rapidly scroll up or down.

Press the SAVE button on the tool bar to save the new time setting or press CANCEL/CLOSE to exit the screen without saving the setting.

2.3.24 EQ Module #1 – Special Options

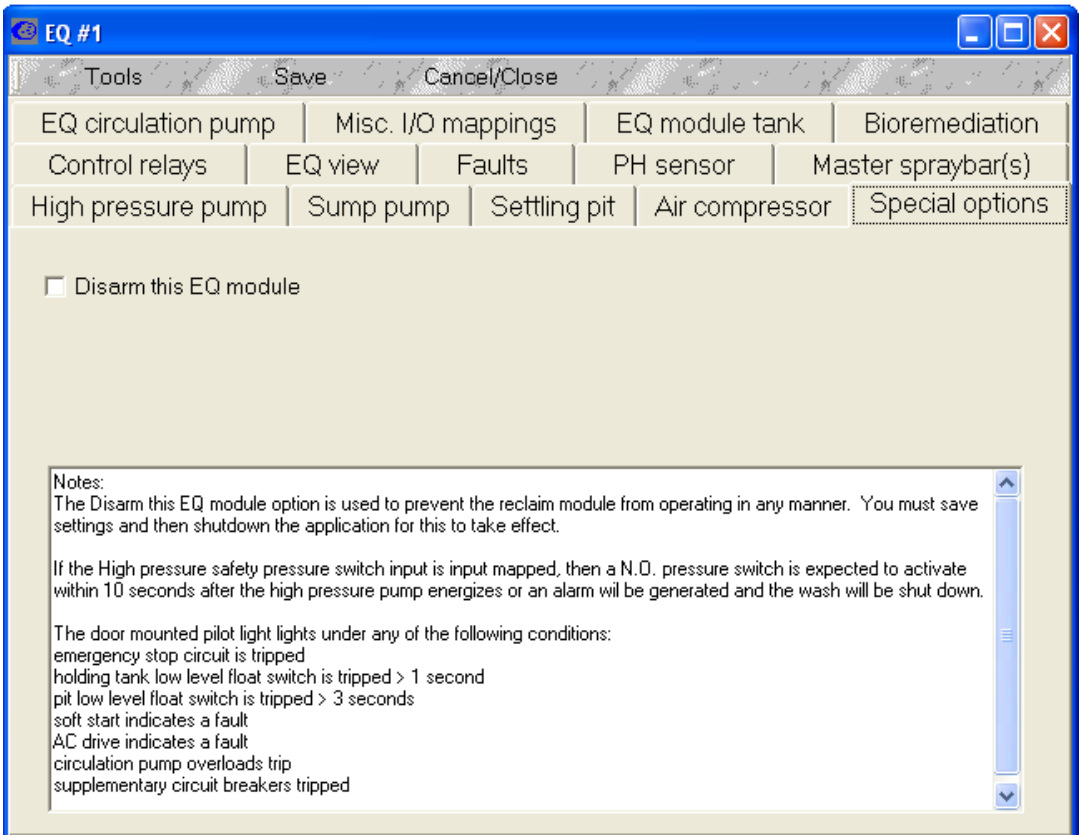


Figure 2- 55: EQ Module #1- Special Options Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Special Options

Screen Function:

Notes relating to the design of the EQ module (reclaim) system.

Screen Description:

All password users can access the design notes for EQ Module system.

Disarm this EQ module – Check this box to prevent the EQ module from operating. This box is available for troubleshooting purposes only. Leave the box unchecked for proper Wash System operation.

CAUTION:	**Checking the box on this screen disables the EQ module, which reclaims Settling Pit water, and the High-Pressure Spray Bars. Leave this box UNCHECKED for normal operation.**

2.3.25 EQ Module #1 – EQ Circulation Pump Screen

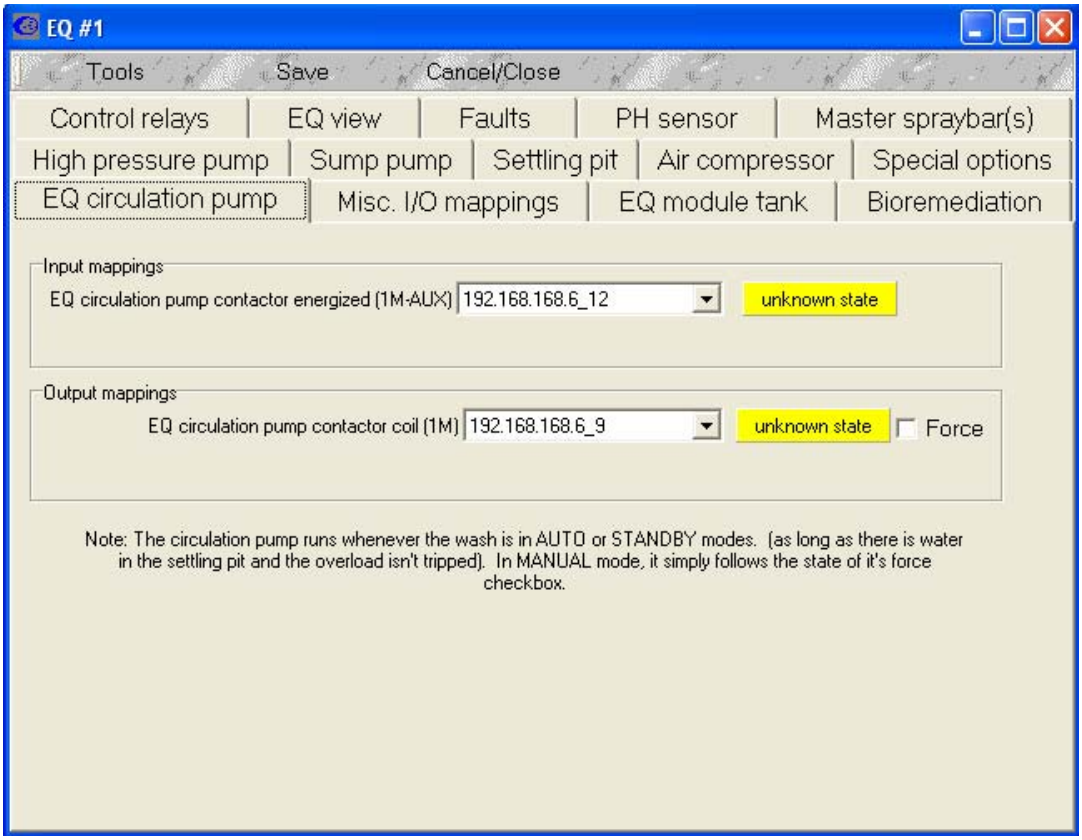


Figure 2- 56: EQ Module 31 - EQ Circulation Pump Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Tools ⇨ EQ Module #1 ⇨ EQ Circulation Pump

Screen Function:

View or configure options relating to the EQ Module Circulation Pump.

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- EQ Circulation Pump Contactor Energized (1M-AUX)

Output Mappings – Click the down arrow (▼) next to the dropdown menu and select the IP address from the drop down list. The indicator next to the output shows the current state of that output when the program is running. Level III password users can force the output (Circulation Pump) on or off.

- EQ Circulation Pump Contactor Coil (1M)

Level III password users can force indicated outputs on through this screen.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system.**

2.3.26 EQ Module #1 – Misc I/O Mappings

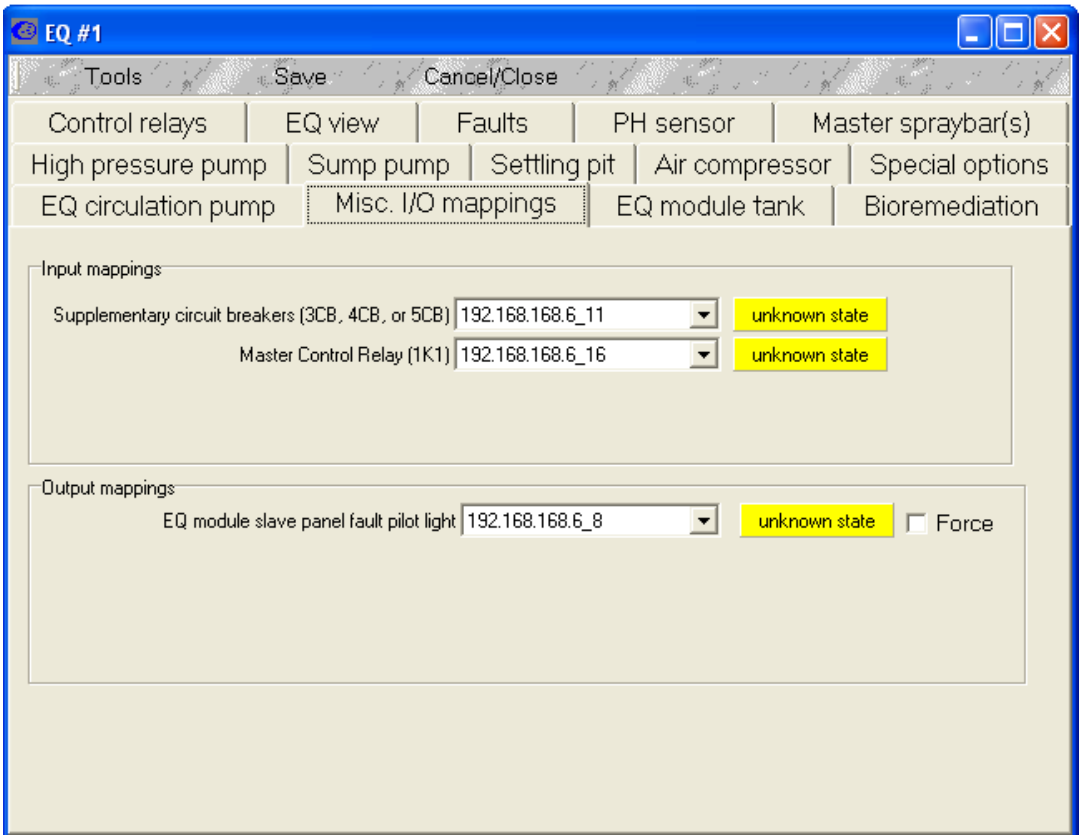


Figure 2- 57: EQ1 Module - Misc I/O Mappings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Tools ⇨ EQ Module #1 ⇨ Misc I/O Mappings

Screen Function:

View or configure options relating to the EQ Module Circulation Pump.

A Level IV password can access this screen for viewing only.

A Level III password allows configuration of the screen functions.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- Supplementary Circuit Breakers (3CB, 4CB, or 5CB)

Output Mappings – The indicator next to the output IP address shows the current state of that output point; i.e., ON (green), OFF (red), etc. when the wash program is running.

- EQ Module Slave Panel Fault Pilot Light

Level III Password:

Level III password users only can change the IP address of the output by clicking the down arrow (▼) next to the output address you want to assign and select the IP address from the drop down list.

Level III password users can also force that output on by checking the box next to the output. This will override logic conditions and turn on the output. If you exit the screen with the output forced on, the program will ask you if you want to keep the force in place or reset it.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system. Remember to reset all forces that you 'saved' or the Wash System will not operate correctly.**

Level III and higher password users can assign IP addresses to the I/O points on the screen. This is a design level function and should not be arbitrarily changed in the field. These password level users can also force an output on or off.

CAUTION:	**Do not change IP addresses after the Wash System has been installed or parts of your wash system will no longer work.**

2.3.27 EQ Module #1 – EQ Module Tank Screen

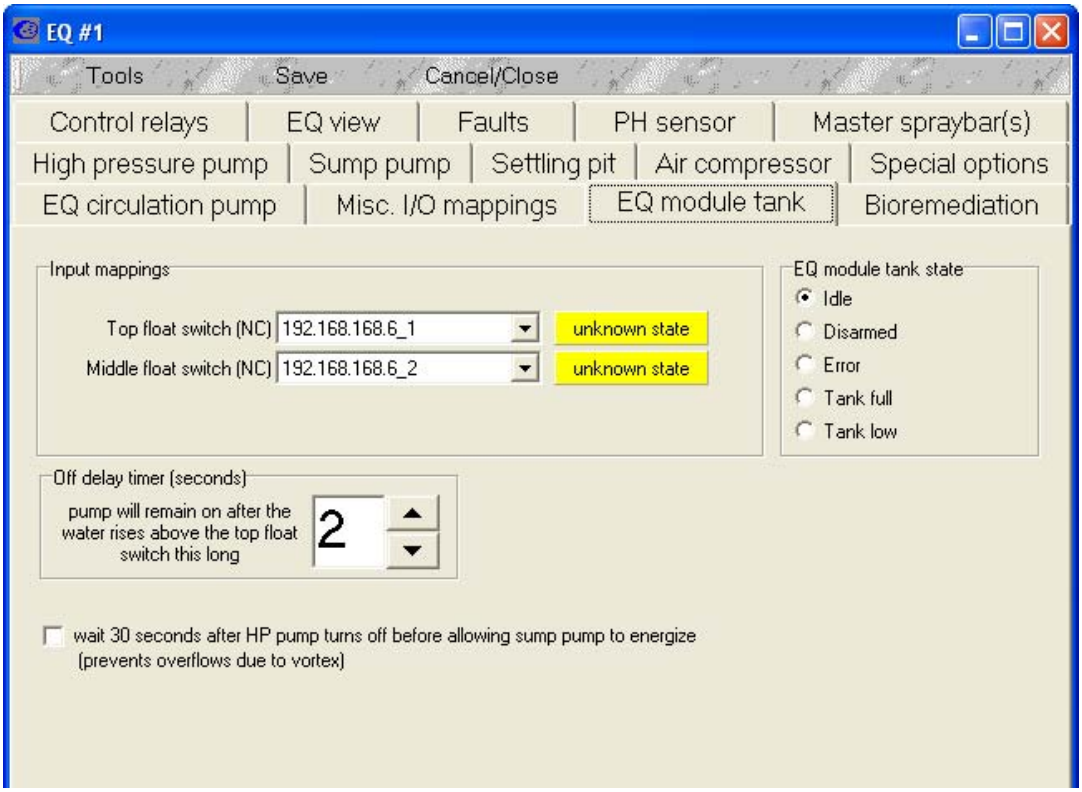


Figure 2- 58: EQ Module #1 - EQ Module Tank Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ EQ Module Tank

Screen Function:

Configure options relating to the EQ Tank.

This is a read-only screen for Level IV password users. Not all the options shown on the screen are enabled for this wash system. The screen is used by ICE personnel in the design stage or for troubleshooting the Wash System.

Screen Description:

Input Mappings – The indicator next to the input IP address shows the current state of that input point; i.e., ON (green), OFF (red), etc. when the wash program is running.

Level III password users only can change the IP address of the input by clicking the down arrow (▼) next to the input address you want to assign and select the IP address from the drop down list.

- Top Float Switch (NC)
- Middle Float Switch (NC)

Off Delay Timer (seconds) – Set the amount of time (in seconds) that the Sump Pump will remain on after the water level reaches the top float switch in the EQ Tank. Click the down arrow (▼) next to decrease the amount of time or click the up arrow (▲) to increase the time.

Press the SAVE button on the toolbar to keep the new time setting or press the CANCEL/CLOSE button to exit the screen without saving the new time setting.

Wait 30 seconds…energize – Check this box to force a 30 second delay before the System Controller turns on the Sump Pump after turning off the High-Pressure Pump.

EQ Module Tank State – The System Controller indicates the current state of the EQ tank by selecting the appropriate radio button. These buttons are controlled by the wash program and are not inputs to be selected by the operator.

2.3.28 EQ Module #1 – Bioremediation – Settings Screen

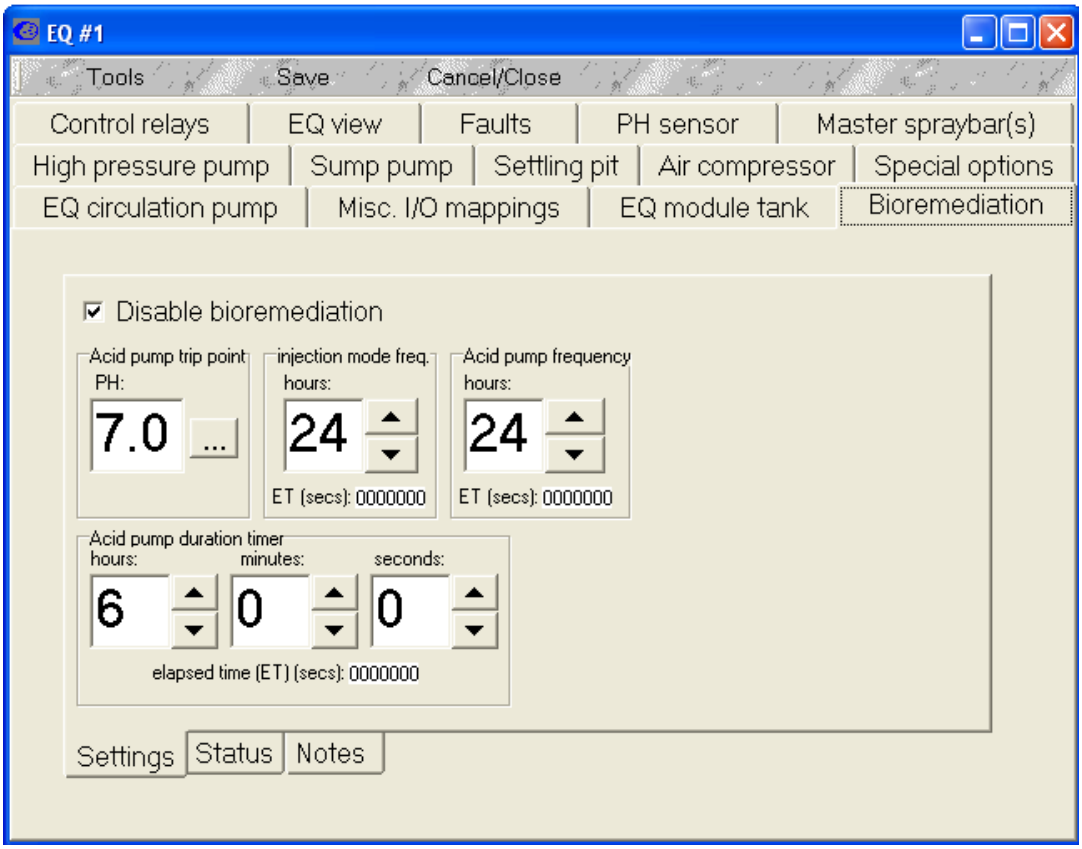


Figure 2- 59: EQ Module #1 – Bioremediation - Settings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Bio-remediation ⇨ Settings

Screen Function:

The functions on this screen are not applicable to this Wash System.

2.3.29 EQ Module #1 – Bioremediation – Status Screen

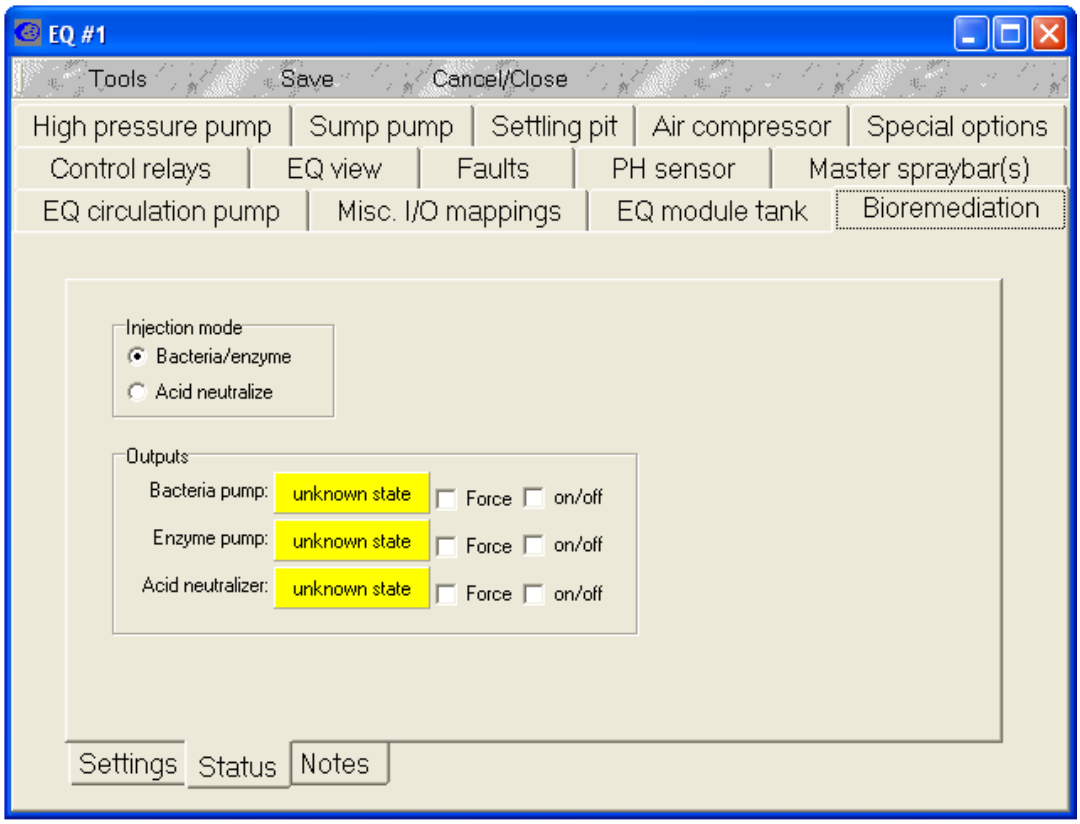


Figure 2- 60: EQ Module #1 - Bioremediation - Status Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Bio-remediation ⇨ Status

Screen Function:

The functions on this screen are not applicable to this Wash System.

2.3.30 EQ Module #1 – Bioremediation – Notes Screen

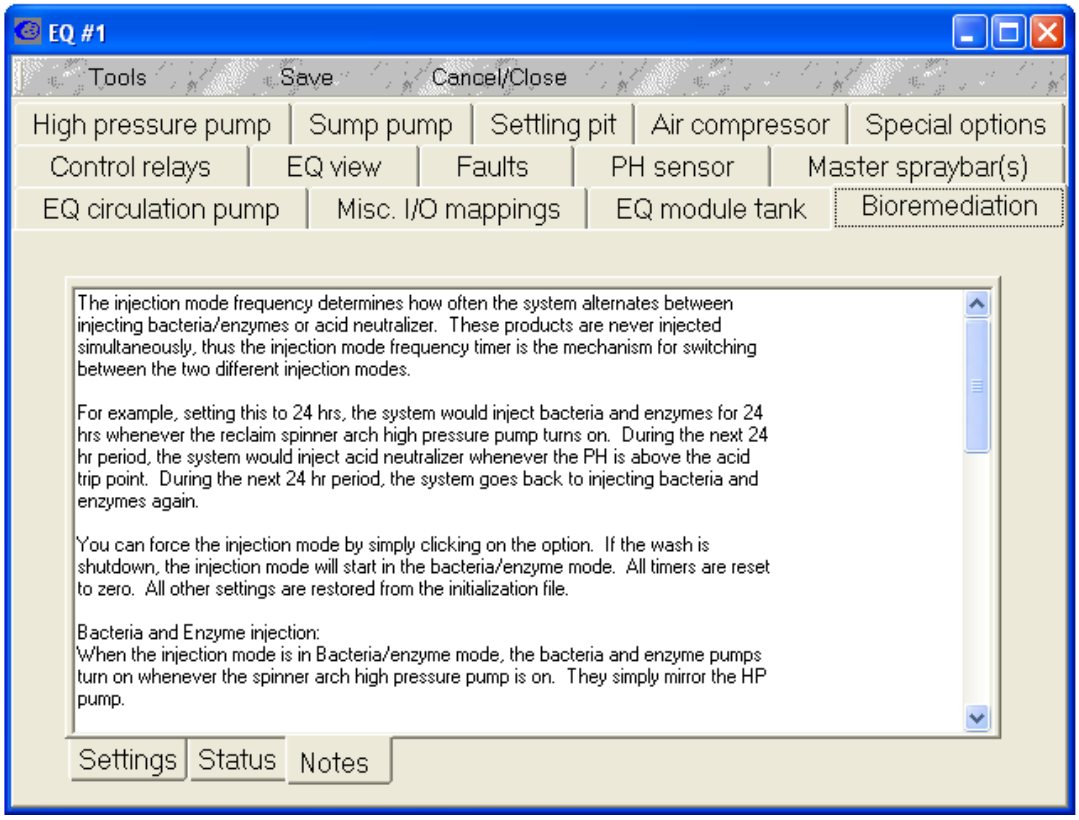


Figure 2- 61: EQ Module #1 - Bioremediation - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Tools ⇨ EQ Module #1 ⇨ Bioremediation ⇨ Notes

Screen Function:

The functions on this screen may not be applicable to this Wash System.

2.3.31 EQ Module #1 – EQ View Screen

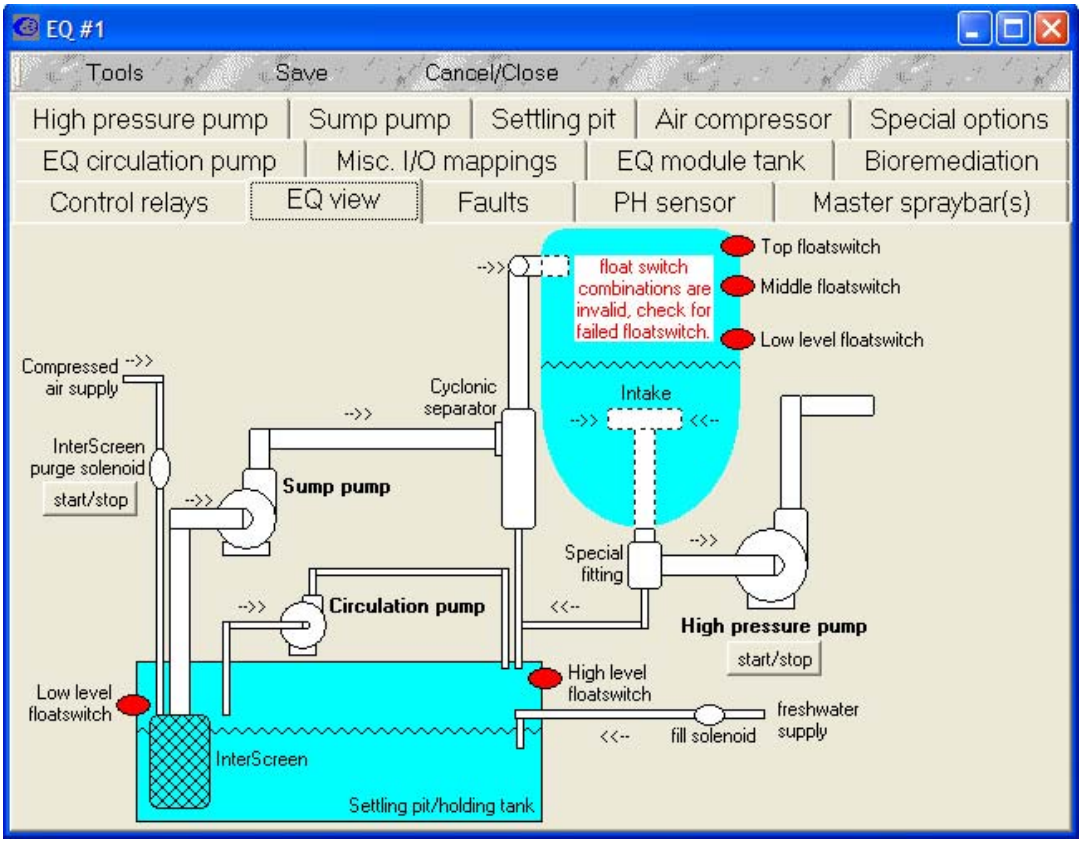


Figure 2- 62: EQ Module #1 – EQ View Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ EQ View

Screen Function

View or change some Water Reclaim System functions.

Screen Description

This screen shows a simplified (partial) schematic of the water reclaim system. Dynamic indicators on the screen show the on/off status of float switches or level sensors in the system. The text and color for each device changes as the device changes state.

Level IV and higher password users can turn on or off some components from this screen, as follows:

InterScreen Purge Solenoid Valve – press to toggle the solenoid valve (SOV7, SOV8) that connects compressed air to the InterScreen filter to blow off any debris accumulated on the filter screen. Press once to turn on, press again to turn off.

High Pressure Pump – press to turn on or off the High-Pressure Pump that feeds reclaim water to the High-Pressure Spray Bars. Press once to turn on, press again to turn the pump off.

2.3.32 EQ Module #1 - Controls Relay Settings Screen

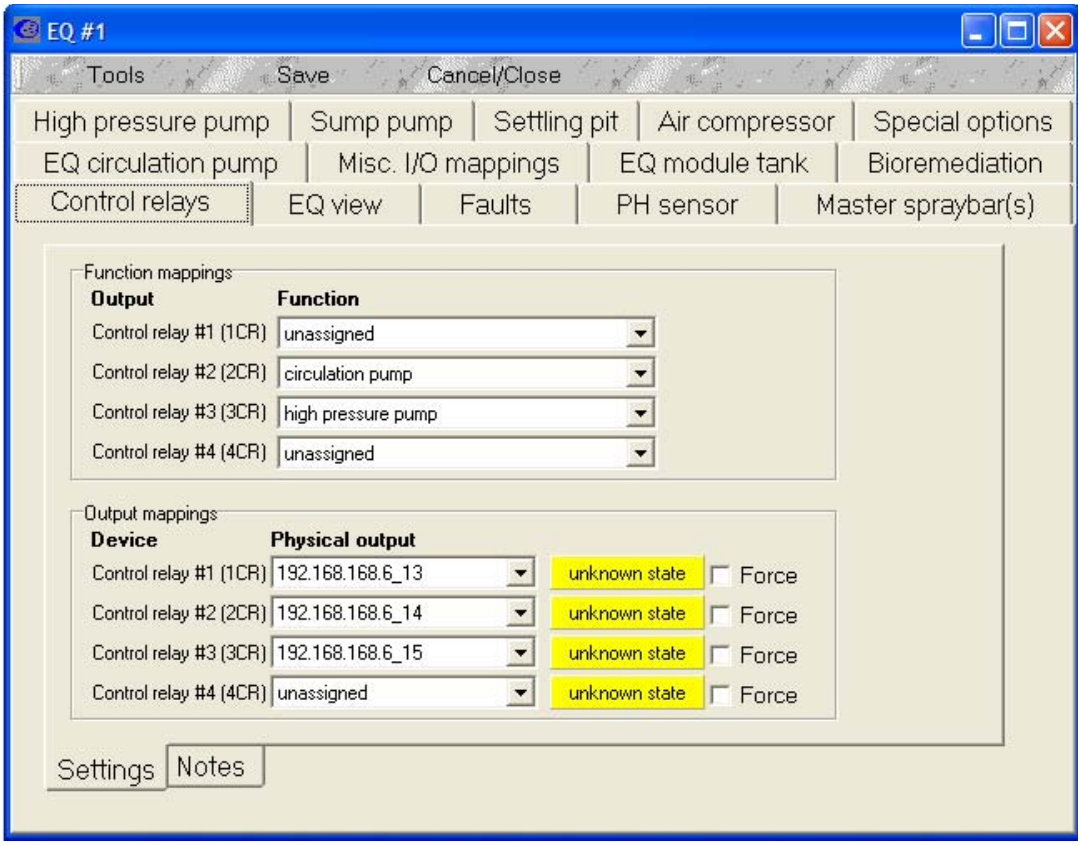


Figure 2- 63: EQ Modules #1 - Control Relay Settings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Control Relays - Settings

Screen Description:

Level IV Password: All password users can view the on/off status of any control relays configured in the Wash System.

Level III Password: Users can access the Tools menu from this screen, enter their password, and map a control relay to a function. Level III password users can also force an assigned relay on or off.

Level III password users can force indicated outputs on through this screen.

CAUTION:	**Do not force outputs without a thorough understanding of the consequences of forcing on a device or system.**

2.3.33 EQ Module #1 - Controls Relay Notes Screen

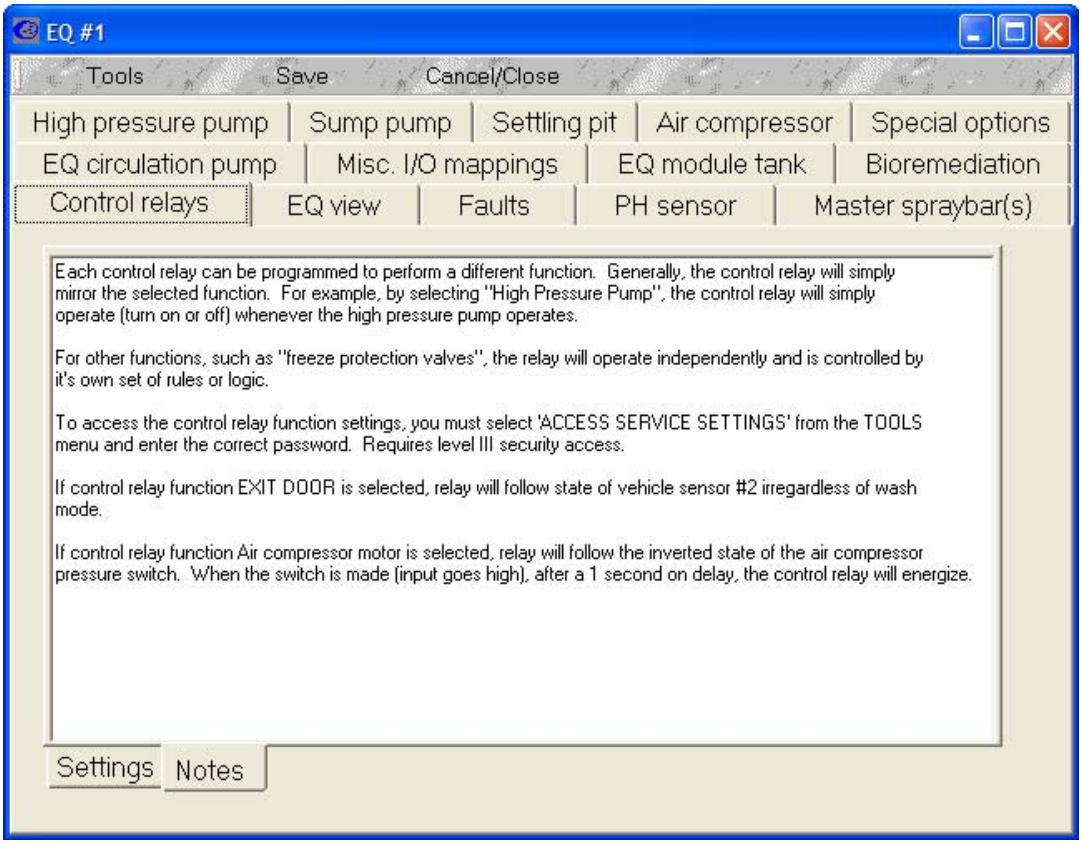


Figure 2- 64: EQ Modules #1 - Controls Relay Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Control Relays - Notes

Screen Function:

Notes relating to the design of the control relays in the system.

Screen Description:

All password users can access the design notes on this page; a Level III password is required to edit control relay functions

2.3.34 EQ Module #1 – Faults Screen

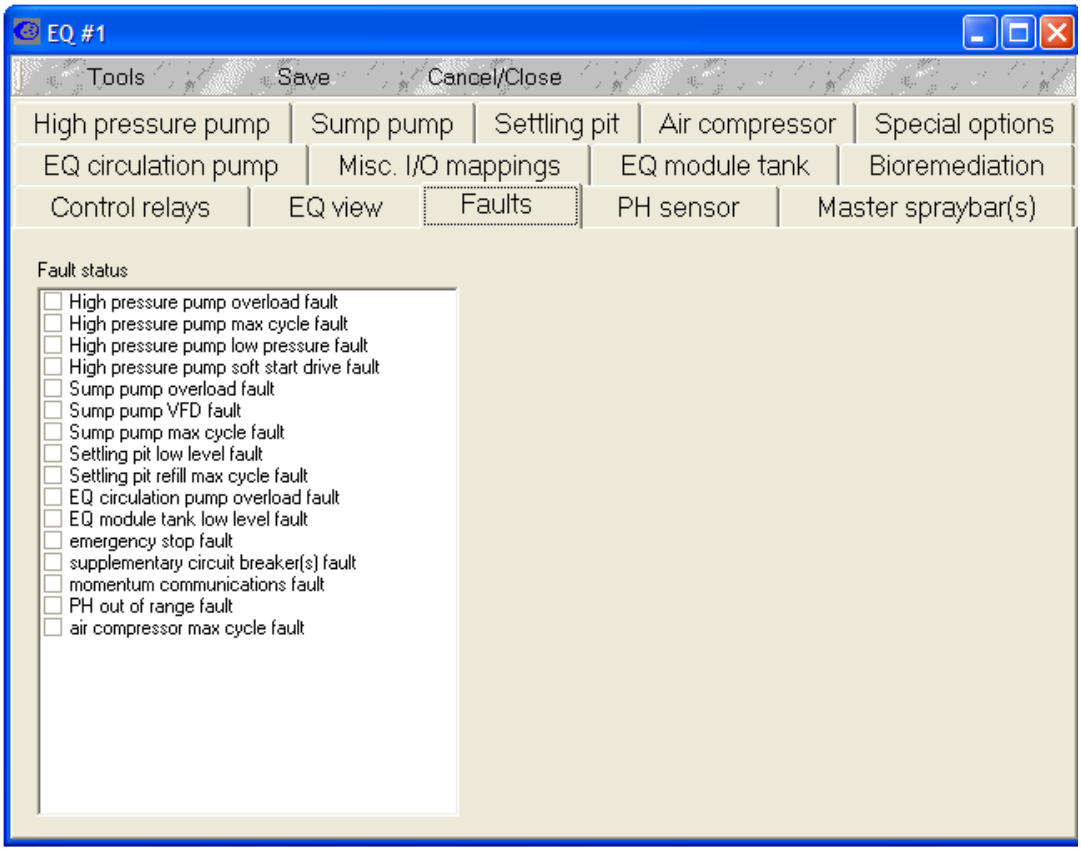


Figure 2- 65: EQ Module #1 - Faults Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Faults

Screen Description:

This screen displays a list of faults that can cause a System Alarm. The System Controller makes a check mark in the appropriate box ☑ when a fault occurs enabling you to narrow down problems for troubleshooting.

Any faults are displayed on the Alarms Main Screen and echoed on this screen.

2.3.35 EQ Module #1 – Master Spray Bars Screen

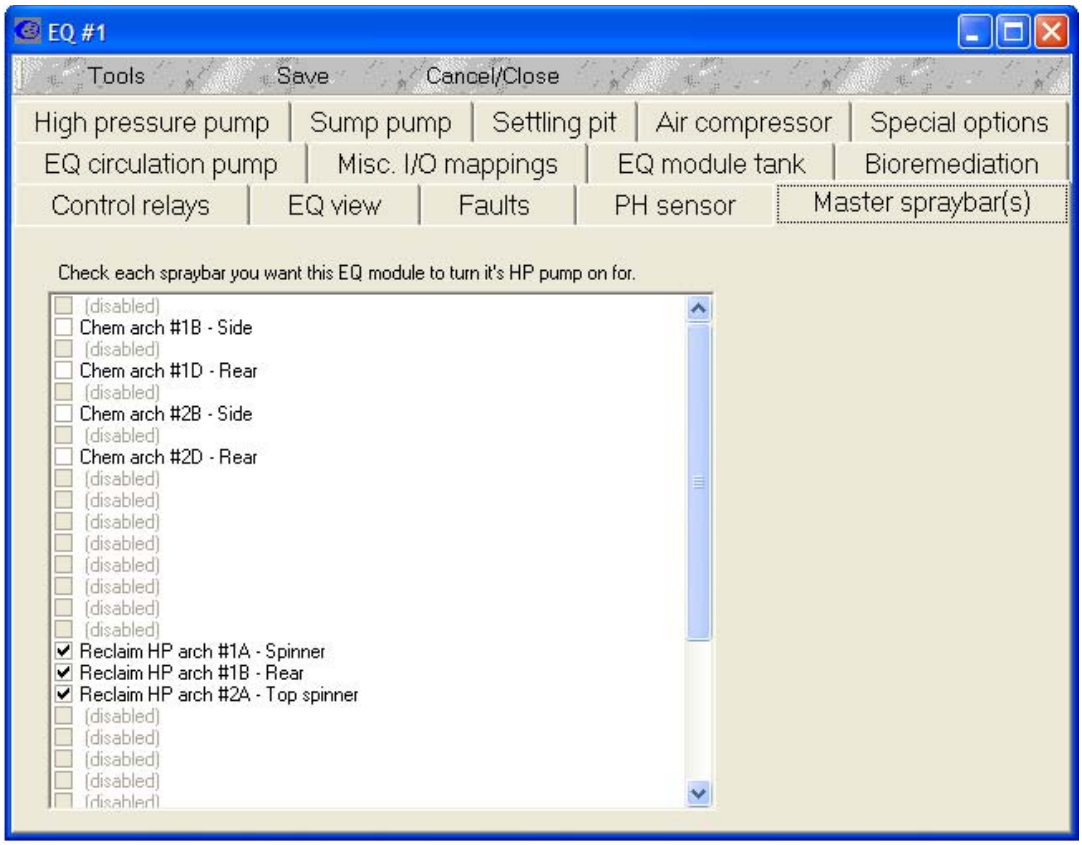


Figure 2- 66: EQ Module #1 - Master Spray Bar Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ Master Spray Bars

Screen Function:

Master or configure the spray bars that the output of the EQ module system (High-Pressure Pump) will pump to. This is a design level function and should not be changed by personnel in the field.

Screen Description:

Place a check in the box next to the spray bar to be enabled.

2.3.36 EQ Module #1 – pH Sensor – pH Sensor Screen

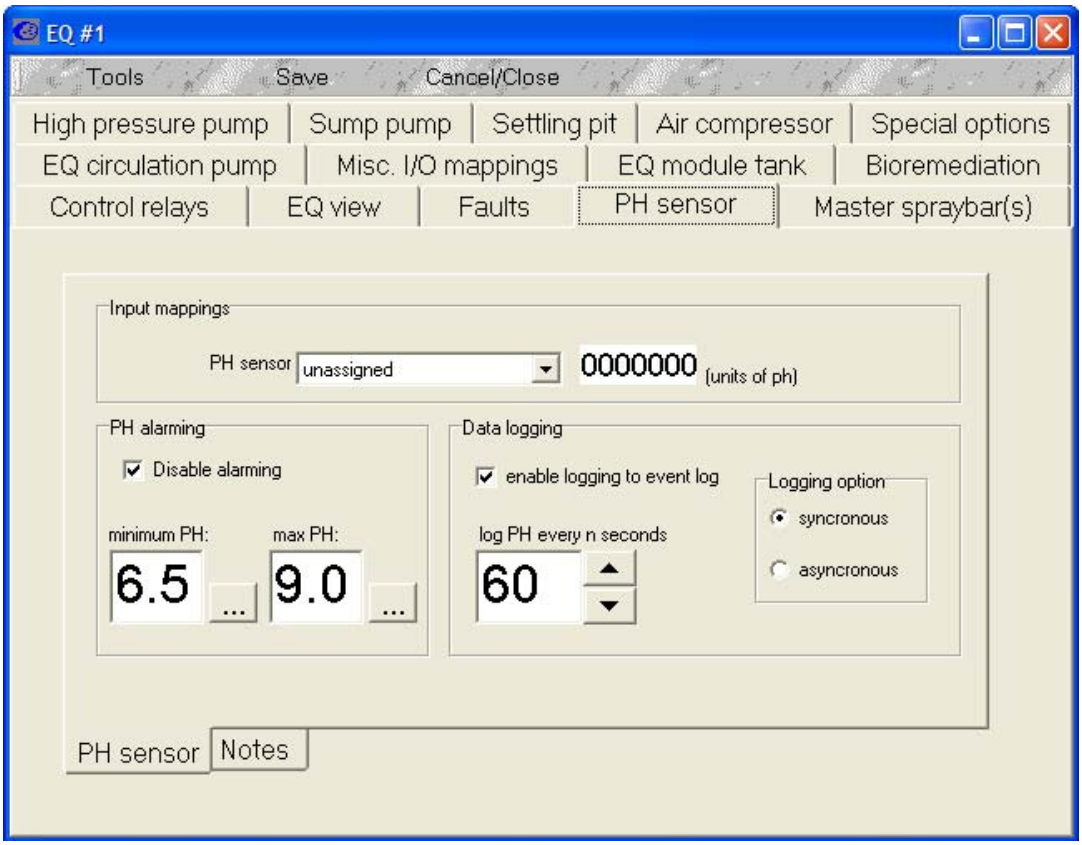


Figure 2- 67: EQ Module #1 - pH Sensor - pH Sensor Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ (any screen) ⇨ Tools ⇨ EQ Module #1 ⇨ pH Sensor

Screen Function:

This screen's functions are not used in this Wash System.

2.3.37 EQ Module #1 – pH Sensor – Notes Screen

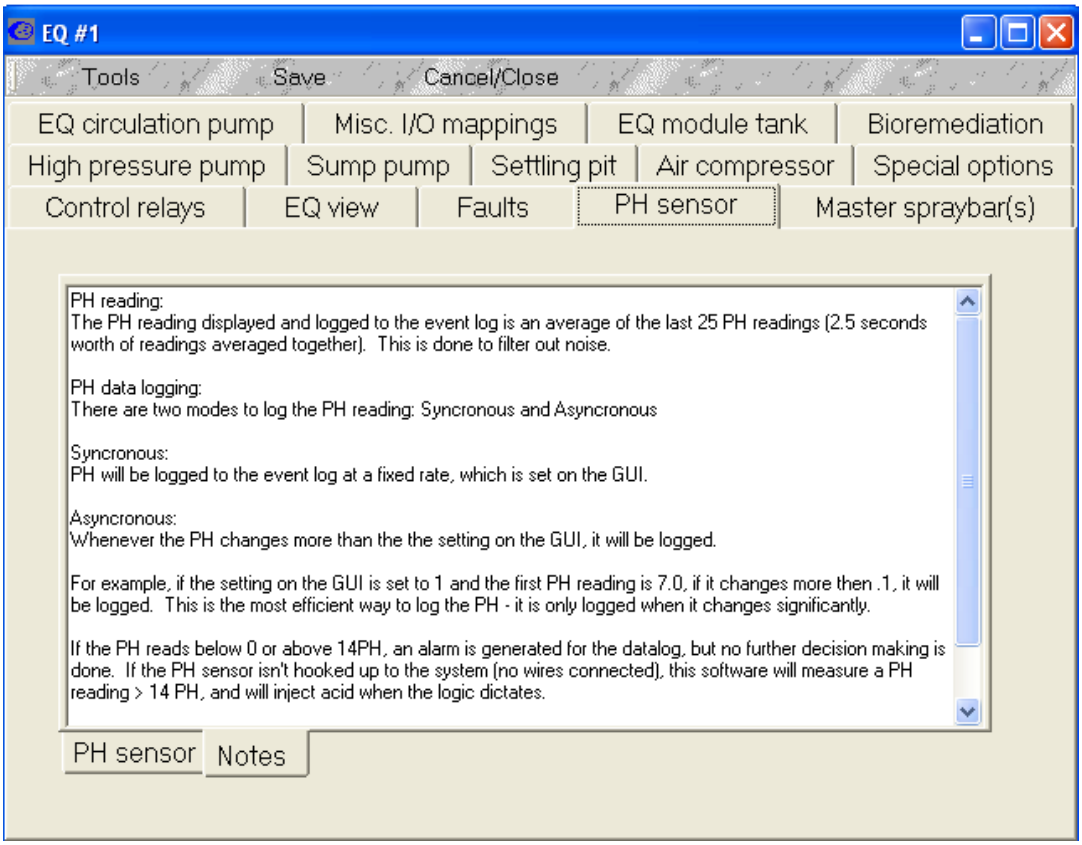


Figure 2- 68: EQ Module #1 - pH Sensor - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Automatic Wash Settings ⇨ Tools ⇨ EQ Module #1 ⇨ pH Sensor ⇨ Notes

Screen Function:

This screen's functions are not used in this Wash System.

2.3.38 Spray Bar Settings - Main Settings Screen

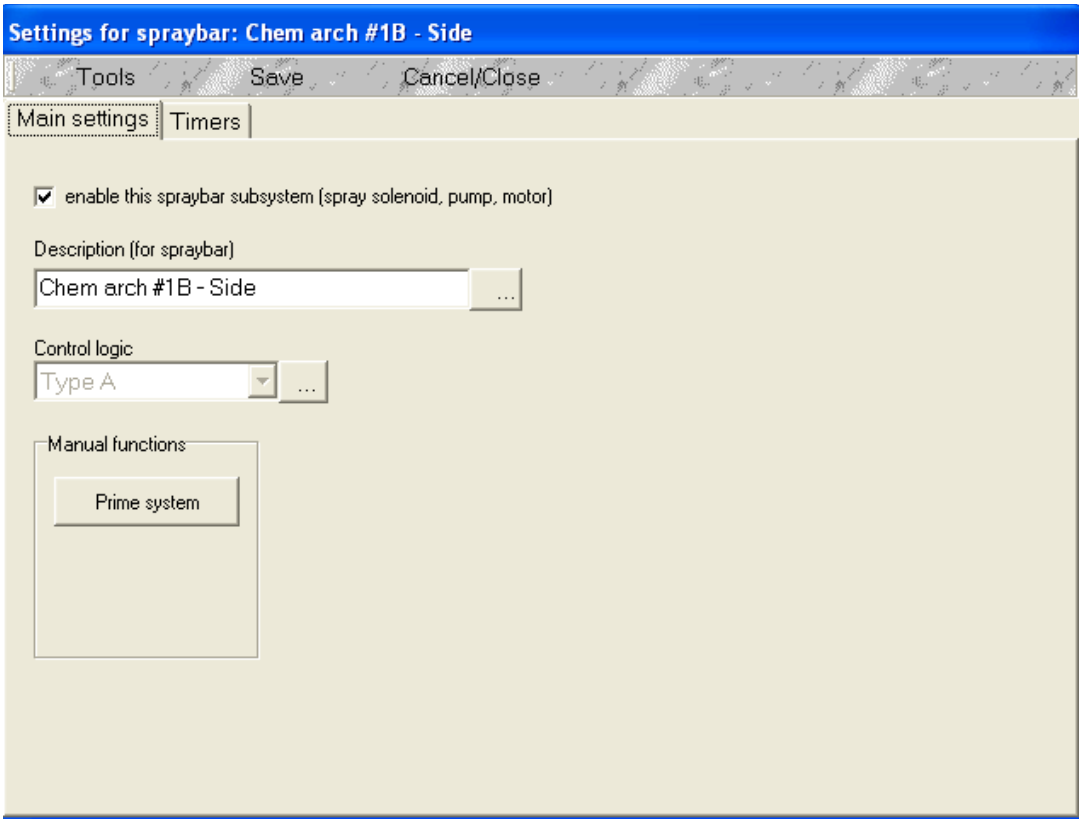


Figure 2- 69: Spray Bar Settings - Main Settings Screen (typical)

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Setting screen) ⇨ Tools ⇨ Spray Bar Settings ⇨ (select a spray bar) ⇨ Okay ⇨ Main Settings

Screen Description

This screen allows you to configure the Wash System spray bars main settings.

CAUTION:	**This screen is used in designing the Wash System. Unauthorized changes to some of these functions may result in your Wash System not operating or operating incorrectly. Do not rename any of the spray bars after the Wash System has been installed.** **Contact InterClean Equipment (ICE) before making any changes to these functions.**

Enable This Spraybar Subsystem (spray solenoid, pump, motor):

This checkbox must contain a check mark for all systems active in this Wash System. If you uncheck the box, the indicated wash subsystem (for example, Chem Arch #1B – Side) will not operate during a wash cycle.

Description (for Spraybar):

This box shows the wash subsystem that you have selected. It should read the same as the header on the pop-up screen. You can also change the description of the selected subsystem.

Press the ellipsis button ... next to the descriptor to change the description (see Caution above). The keyboard screen (below) pops up. Type in the new descriptor and press the ENTER key to make the change. Press the CANCEL key to exit that screen without changing the descriptor.

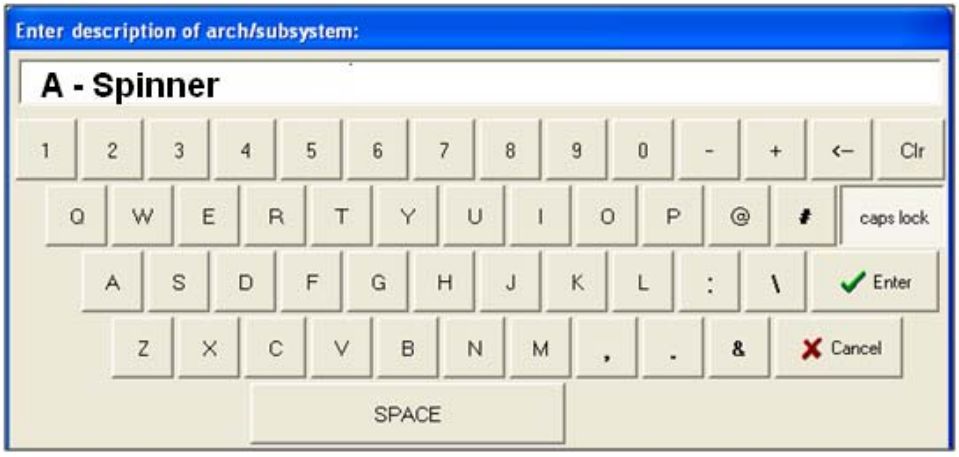


Figure 2- 70 Spray Bar Change Keyboard Pop-up Screen

Control Logic:

Shows a graphic representation of the spray bars available; below is a typical screen. Again, this information is used during the Wash System design.

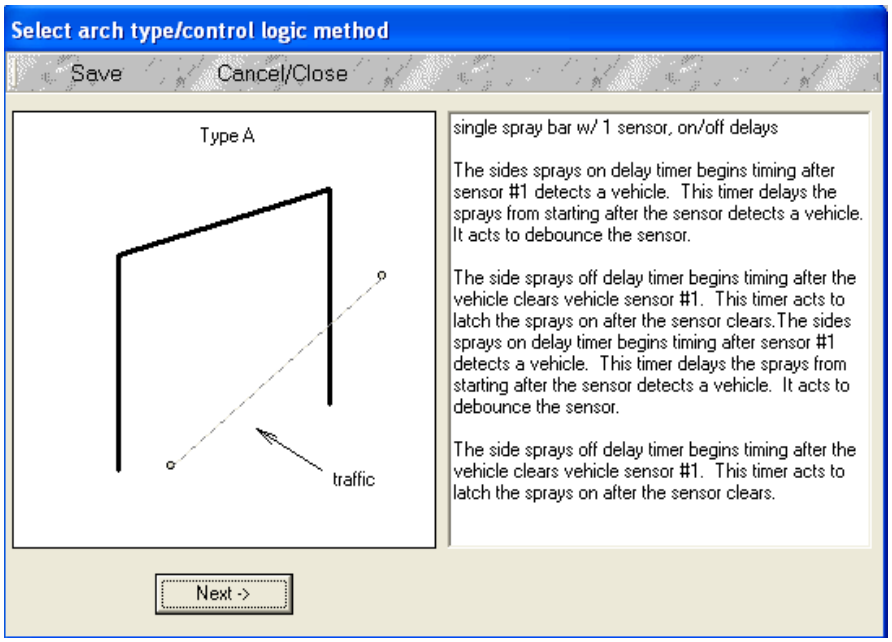


Figure 2- 71 Typical Spray Bar Configuration Graphic

Manual Functions:

Prime System – Press to turn on the wash subsystem shown in the DESCRIPTION box (*Figure 2-69: Spray Bar Settings - Main Settings Screen*) manually. All components required to actuate the selected spray bar (pumps, solenoid valves, etc.) will be turned on by the machine automatically. The button is detented when the system is actuated. Press again to turn the subsystem off. This button should be OFF for normal operation.

CAUTION:	**The Wash System does not make any safety checks when you operate the subsystems manually. Be sure the affected wash area is clear of personnel and/or equipment before manually actuating any subsystem function.**

Menu Bar:

Tools – This button attempts to access the Service Settings. You must have a higher than Level IV password to be able to alter the service settings.

Save – Press to save any changes you made and exit the current screen.

Cancel/Close – Press this button to exit the current screen without saving changes.

Screen Tabs:

Press a tab to navigate to the indicated screen:

Main Settings – The current screen.

Timers – Press this tab to select the Spray Bar timer adjustment screen.

2.3.39 Spray Bar Settings - Timers Screen

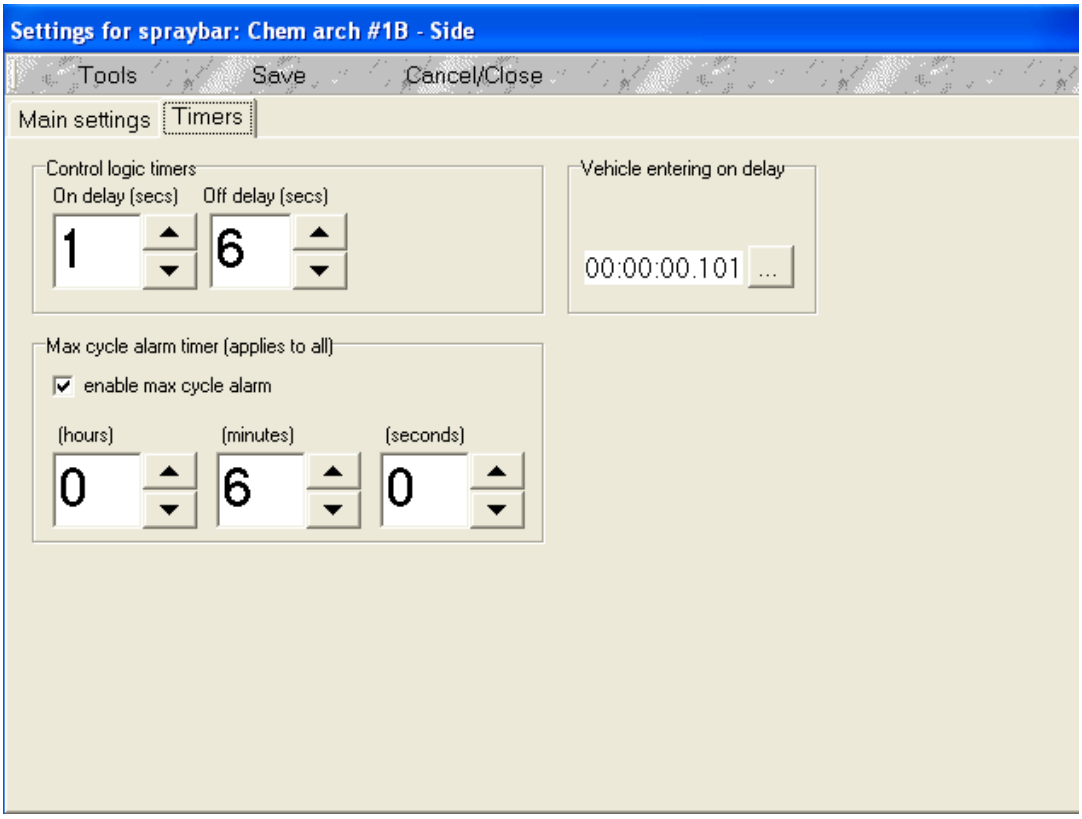


Figure 2- 72 Spray Bar Settings - Timers Screen (typical)

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Setting screen) ⇨ Tools ⇨ Spray Bar Settings ⇨ (select a spray bar) ⇨ Okay ⇨ Timers

Screen Function:

This screen allows you to configure the Wash System spray bars timer settings.

Control Logic Timers:

On Delay – Sets the delay (in seconds) between the time an event is triggered (such as a photoeye being blocked) and the time the System Controller performs the action (such as turning on a pump).

Off Delay – Sets the amount of time a subsystem remains on after the event that enables it is released (such as a photoeye being cleared).

Maximum Cycle Alarm Timer:

Enable Maximum Cycle Alarm Timer – Check this box to enable a System Alarm to be generated if the subsystem shown in the DESCRIPTION window on the MAIN SETTINGS screen is ON longer than the Maximum Cycle Alarm Timer value (below). An Alarm is not triggered if this box is unchecked.

Maximum Cycle Alarm Timer Settings – Sets the maximum amount of time the selected subsystem can run without triggering a System Alarm. Click the up arrow (▲) to increase the time setting. Click

the down arrow (▼) to decrease the time. Press and hold either arrow to scroll up or down rapidly. A System Alarm is generated if the subsystem runs for this amount of time if the box above the timers is checked.

Vehicle Entering On Delay Timer:

Provides a delay after the vehicle entering the Wash Bay trips the first photoeye (PE1), providing a debounce delay for the sensor.

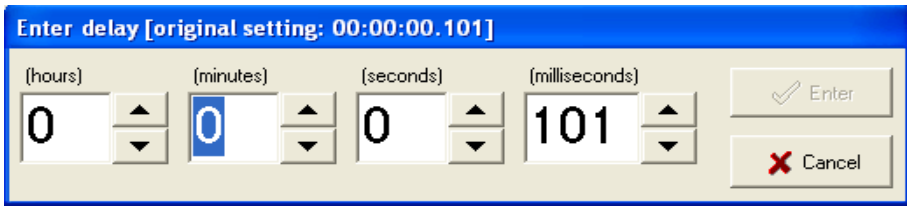


Figure 2- 73 Vehicle Entering ON Delay Timer Adjust Pop-up Screen

Click the up arrow (▲) to increase the time setting. Click the down arrow (▼) to decrease the time. Press and hold either arrow to scroll up or down rapidly.

2.3.40 Common Options – Wash Counters

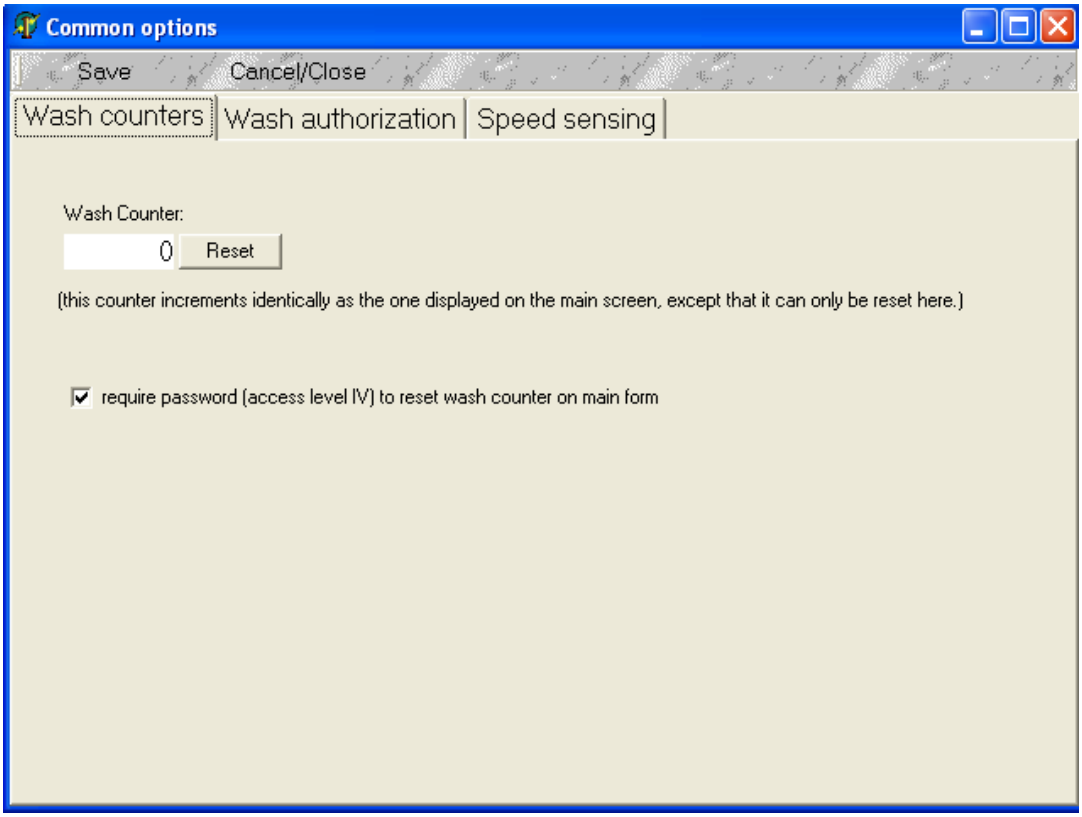


Figure 2- 74: Common Options - Wash Counters Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Settings screen) ⇨ Tools ⇨ Common Options ⇨ Wash Counters

Screen Function

Shows a counter that tallies the number of wash cycles since the counters were last reset. This mirrors the Wash Counter shown on the Controls Main Screen.

Press the **SAVE** button on the tool bar to save and exit this screen. Press **CANCEL/CLOSE** to exit this screen without saving any changes you made.

Screen Description

Wash Counter:

Displays the number of washes performed since the last time the counter was reset.

Reset - Press this button to reset the Wash Counter showing on this screen only; does not affect the Wash Counter shown on the Controls Main Screen.

Require password – check this box to require the operator to enter a password to reset the Wash Counter on the Controls Main Screen. Anyone can reset the main screen Wash Counter to zero if this box is unchecked.

2.3.41 Common Options – Wash Authorization – Settings Screen

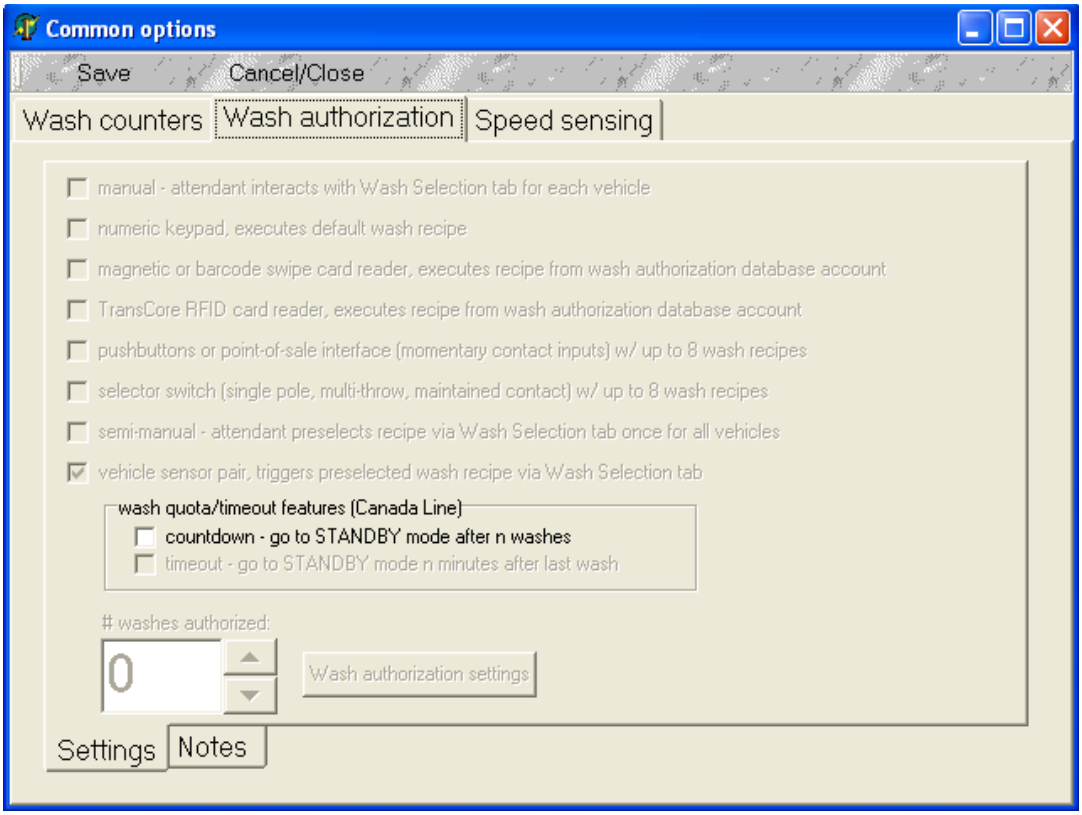


Figure 2- 75: Common Options - Wash Authorization - Settings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Settings screen) ⇨ Tools ⇨ Common Options ⇨ Wash Authorization ⇨ Settings

Screen Function

Configure the type of wash authorization to be used with the Wash System. Grayed areas of the screen are not applicable to this Wash System.

This screen's functions are not accessible for Level IV password users and not applicable for this Wash System

Screen Description

The functions on this screen require a Level III password or higher to modify.

Authorization type - Check a box next to the type of wash authorization that meets the system design and customer requirements. These inputs are not exclusive; more than one box may be checked so make your selection carefully

2.3.42 Common Options – Wash Authorization – Notes Screen

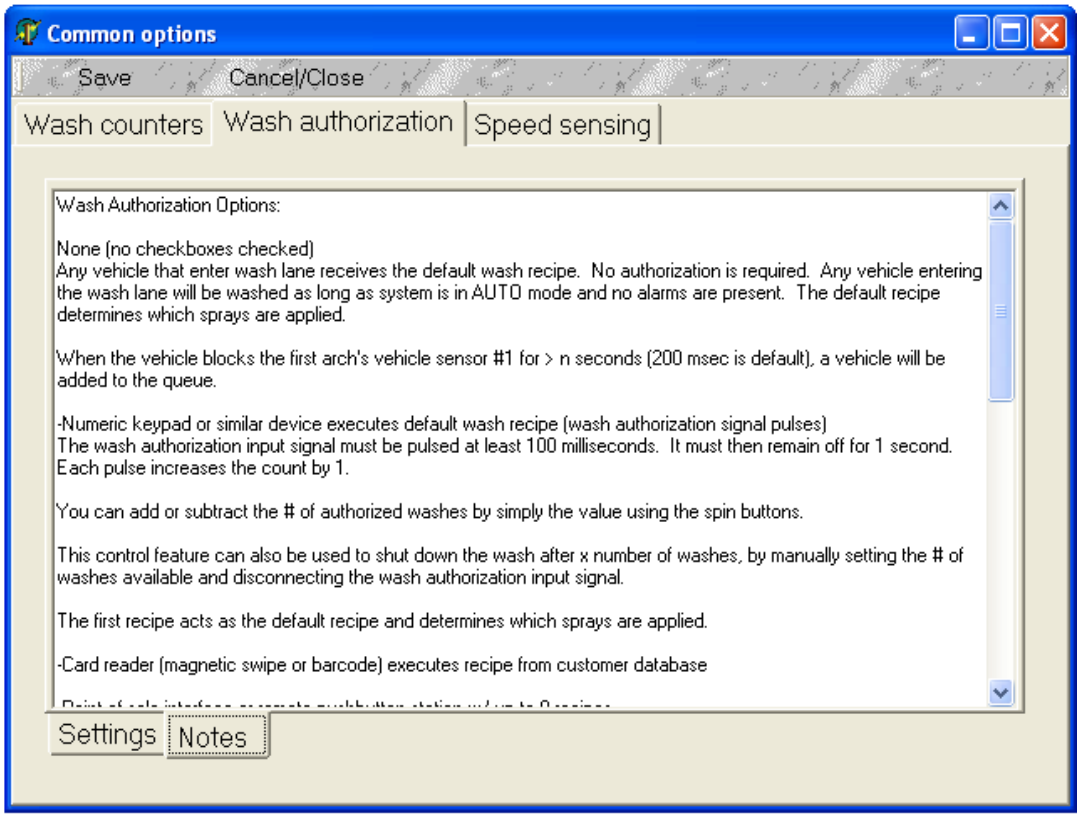


Figure 2- 76: Common Options - Wash Authorization - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Settings screen) ⇨ Tools ⇨ Common Options ⇨ Wash Authorization ⇨ Notes

Screen Function

Notes relating to the design of the wash authorization function.

Screen Description

All password users can access this Notes screen.

2.3.43 Common Options – Speed Sensing - Settings Screen

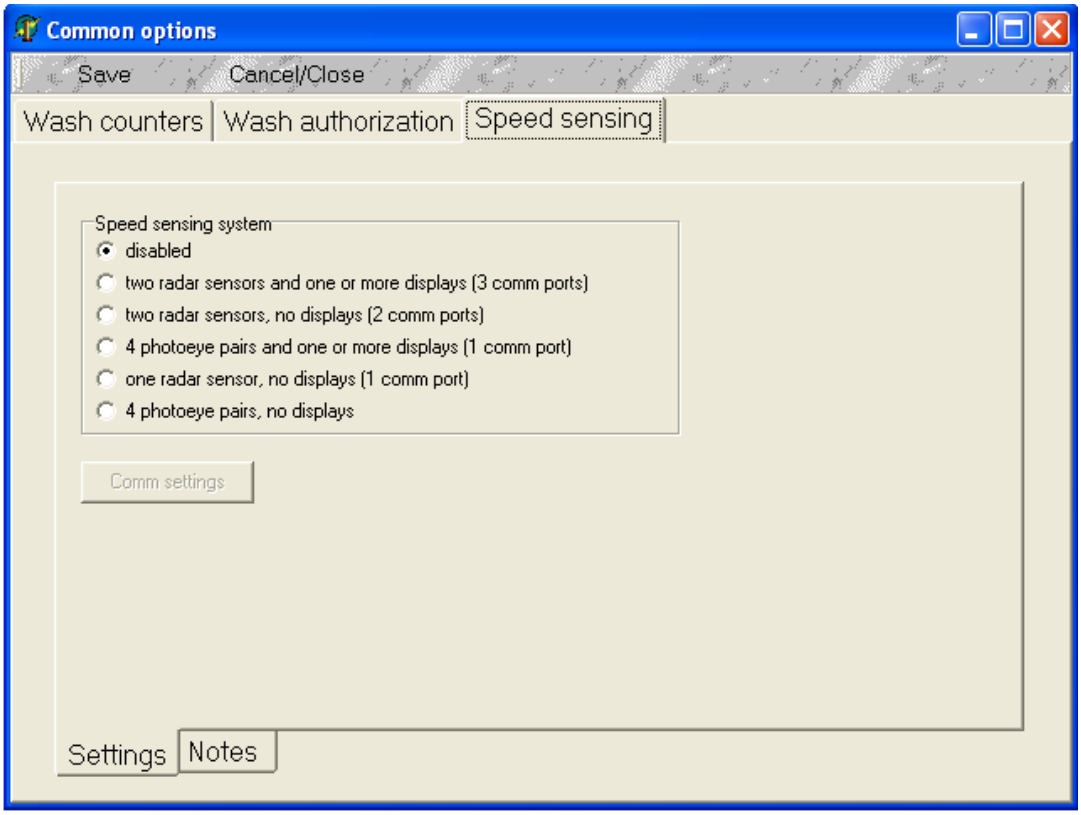


Figure 2- 77: Common Options - Speed Sensing - Settings Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Settings screen) ⇨ Tools ⇨ Common Options ⇨ Speed Settings ⇨ Settings

Screen Function

Configure the speed sensing options for the Wash System. This requires a Level III or higher password.

Screen Description

Press the appropriate radio button to select the type of speed sensor used in the system; only one button can be active at a time.

Select the “disabled’ button for this wash system.

Comm Settings

Used by ICE personnel only.

2.3.44 Common Options – Speed Sensing - Notes Screen

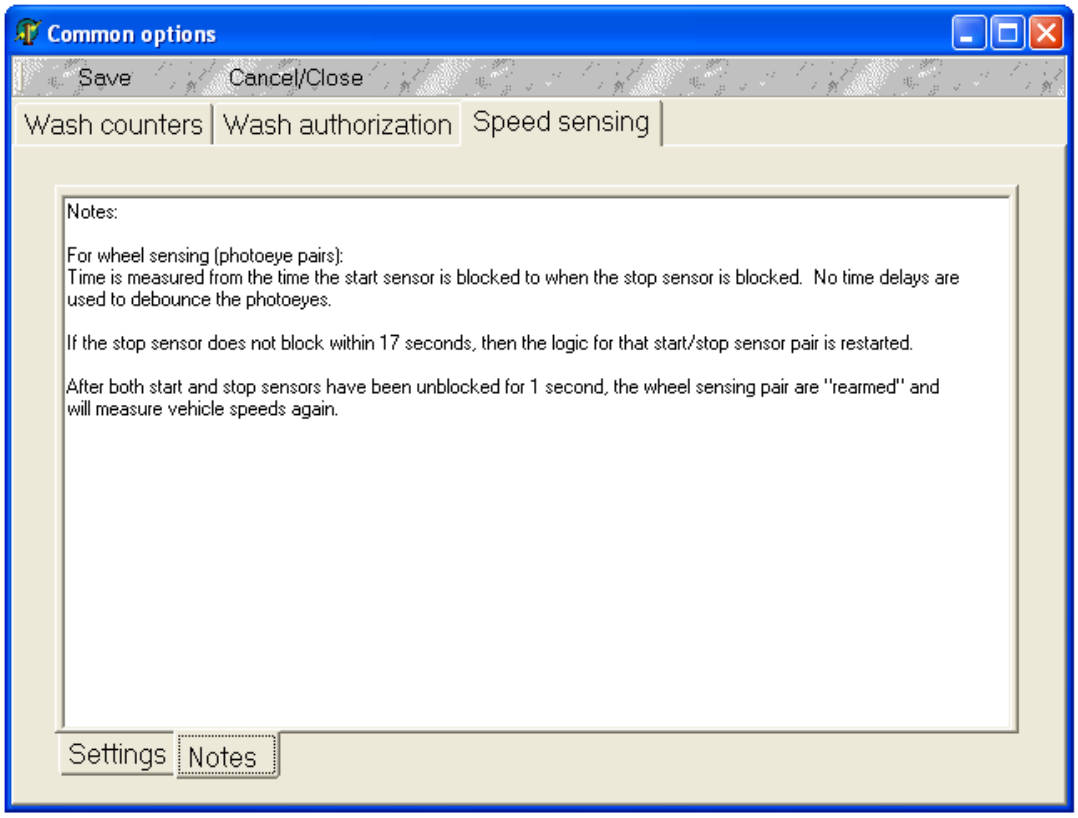


Figure 2- 78: Common Options - Speed Sensing - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ (any Automatic Wash Settings screen) ⇨ Tools ⇨ Common Options ⇨ Speed Sensing ⇨ Notes

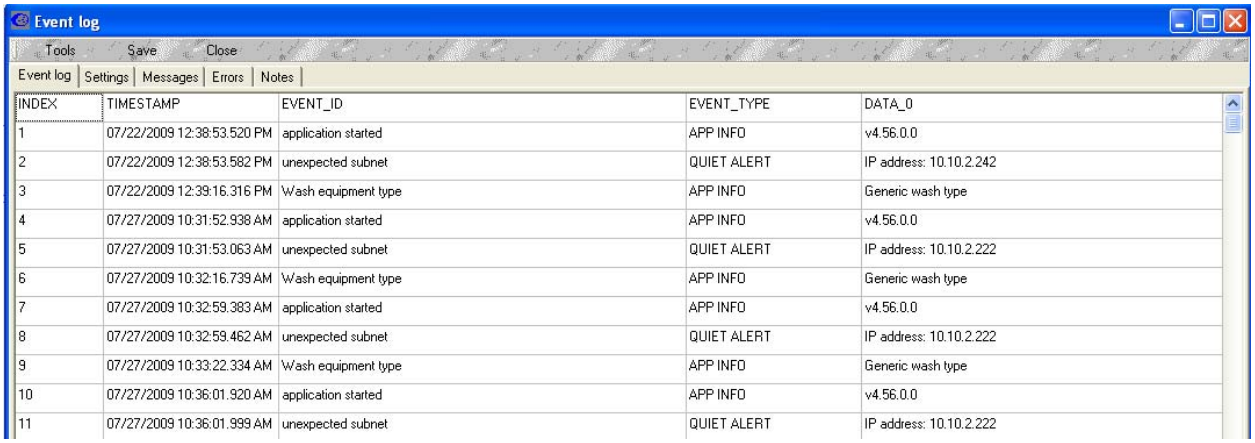
Screen Function

Notes relating to the speed sensing options.

Screen Description

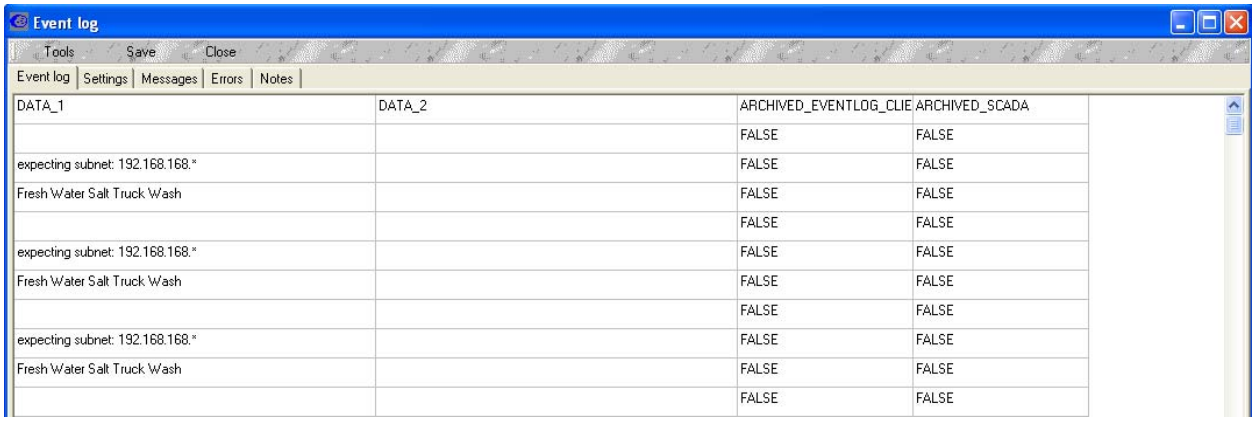
All password users can access this Notes screen.

2.3.45 Event Log – Event Log Screen



INDEX	TIMESTAMP	EVENT_ID	EVENT_TYPE	DATA_0
1	07/22/2009 12:38:53.520 PM	application started	APP INFO	v4.56.0.0
2	07/22/2009 12:38:53.582 PM	unexpected subnet	QUIET ALERT	IP address: 10.10.2.242
3	07/22/2009 12:39:16.316 PM	Wash equipment type	APP INFO	Generic wash type
4	07/27/2009 10:31:52.938 AM	application started	APP INFO	v4.56.0.0
5	07/27/2009 10:31:53.063 AM	unexpected subnet	QUIET ALERT	IP address: 10.10.2.222
6	07/27/2009 10:32:16.739 AM	Wash equipment type	APP INFO	Generic wash type
7	07/27/2009 10:32:59.383 AM	application started	APP INFO	v4.56.0.0
8	07/27/2009 10:32:59.462 AM	unexpected subnet	QUIET ALERT	IP address: 10.10.2.222
9	07/27/2009 10:33:22.334 AM	Wash equipment type	APP INFO	Generic wash type
10	07/27/2009 10:36:01.920 AM	application started	APP INFO	v4.56.0.0
11	07/27/2009 10:36:01.999 AM	unexpected subnet	QUIET ALERT	IP address: 10.10.2.222

Figure 2- 79: Event Log - Event Log Screen - Left Side (typical)



DATA_1	DATA_2	ARCHIVED_EVENTLOG_CLIE	ARCHIVED_SCADA
		FALSE	FALSE
expecting subnet: 192.168.168.*		FALSE	FALSE
Fresh Water Salt Truck Wash		FALSE	FALSE
		FALSE	FALSE
expecting subnet: 192.168.168.*		FALSE	FALSE
Fresh Water Salt Truck Wash		FALSE	FALSE
		FALSE	FALSE
expecting subnet: 192.168.168.*		FALSE	FALSE
Fresh Water Salt Truck Wash		FALSE	FALSE
		FALSE	FALSE

Figure 2- 80: Event Log - Event Log Screen - Right Side (typical)

Keystroke Sequence:

Wash Main Screens ⇨ Tools ⇨ Event Log ⇨ Event Log

Screen Function

Log of events recorded by the System Controller. All password users can access this Notes screen.

Screen Description

The Event Log screen displays a record of System Controller actions. The log shows the time and date the system was last started, any Wash System actions performed by the Controller, any user access to the system, screen changes, timer changes, etc.

The actions are logged with the oldest event first, progressing toward higher numbers. The highest event number shows the latest event.

Note: your screen details may differ from the figures above.

2.3.46 Event Log – Settings Screen

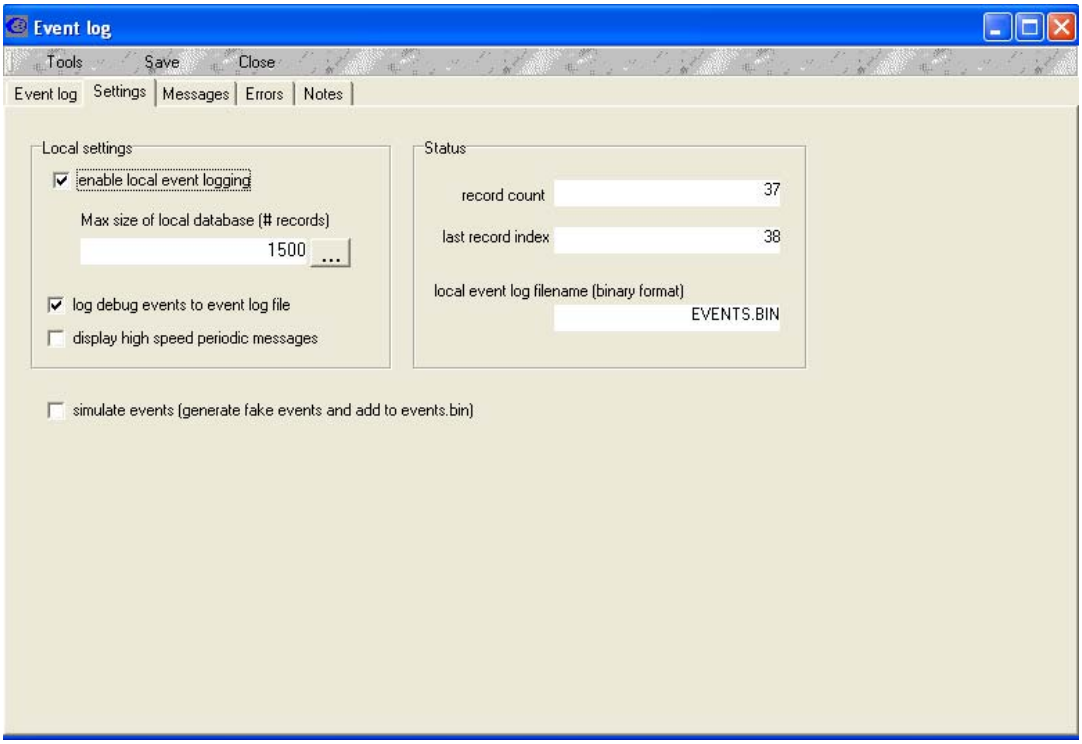


Figure 2- 81: Event Log - Settings Screen (typical)

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Event Log ⇨ Settings

Screen Function

This screen allows you to set up some of the event logging functions and view some log file status information. All users may access these screen functions.

Screen Description

Local Settings:

Enable Local Event Logging – Check this box to enable the System Controller to record the events in the log file. Event logging will not take place if this box is unchecked.

Max Size Of Local Database - This allows you to set the number of records the event database will hold before overflowing. The database is a first in, first out construct. If the number of records being logged exceeds the maximum size of the database, the earliest records will be recorded over and lost.

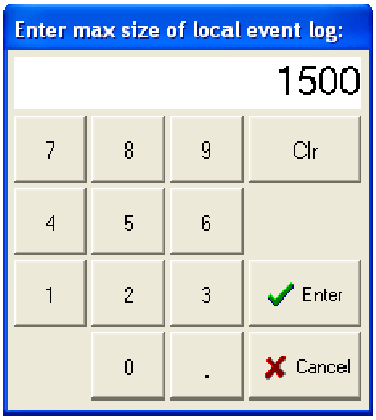


Figure 2- 82 Event Log Size Numerical Keypad

Press the ellipsis button ... next to this display to pop up the numerical keypad shown to the right. Press the CLEAR key and then enter the number of records you want the database to hold. Press the ENTER key to store the value or press the CANCEL key to abort the change.

The Wash System Controller does not have unlimited record storage so this value should be left as set by the manufacturer. The information recorded by the event logger may be helpful for trouble-shooting purposes.

Log Debug Events To Event Log File - Check this box to enable the System to record debugging events to the event log file. If unchecked, these events will not be logged.

Display High Speed Period Messages - Leave unchecked; does not apply to this wash system.

Simulate Events - Check this box to enable the System to generate random 'events' that will be recorded in the event log database. This is used mainly by InterClean personnel for troubleshooting and should be left unchecked.

Status:

Record Count – this shows the number of records currently logged into the database.

Last Record Index – This is the index number of the last record in the database; that is, the one most recently recorded.

Each database entry is given a unique record index number to identify it. If the database overflows, the index numbers keep incrementing even though the earlier indexed records are lost.

For example, if your database size is set to 1500 and is full, the next event to be recorded would be given index number 1501, then 1502, and so on, even though the database was still holding 1500 records. In this example, record index #1 and record index #2 would be lost.

Local Event Log Filename (binary) – This is the name of the binary file that is the event log database.

2.3.47 Event Log – Messages Screen

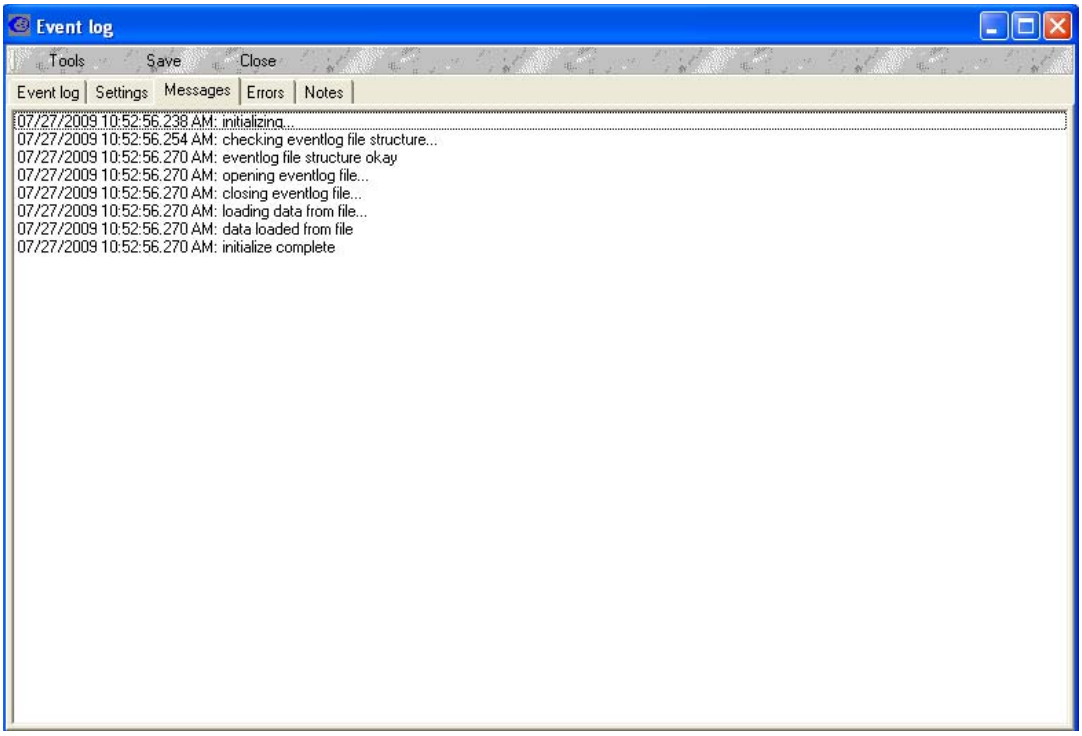


Figure 2- 83: Event Log - Messages Screen (typical)

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Event Log ⇨ Messages

Screen Description

This read-only screen shows messages relating to all interactions with the Event Log. These messages are helpful for troubleshooting and are distinct from error messages in that they consist of normal activities, such as when a remote server connects or disconnects. The screen also acts as a communications terminal window where you can watch packets of information being exchanged.

2.3.48 Event Log – Errors Screen

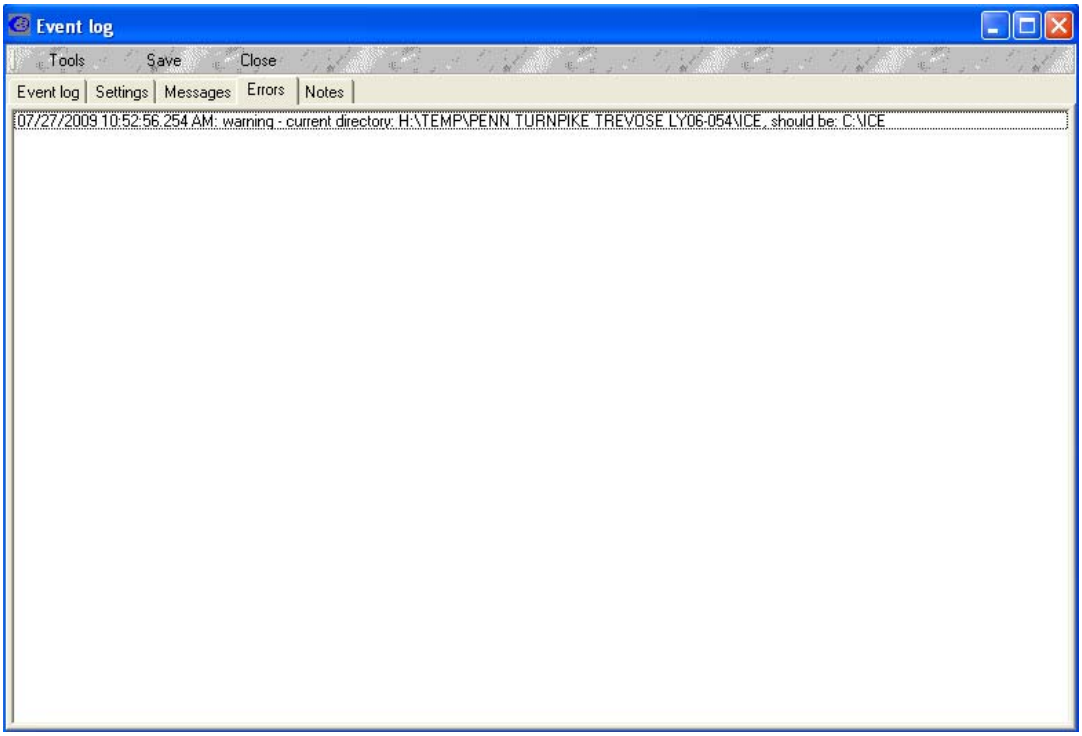


Figure 2- 84: Event Log - Errors Screen (typical)

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Event Log ⇨ Errors

Screen Description

This read-only screen shows detailed information related exclusively to Event Log binary file errors. If the file becomes corrupted, several pieces of information may be displayed here to help in troubleshooting the error.

2.3.49 Event Log – Notes Screen

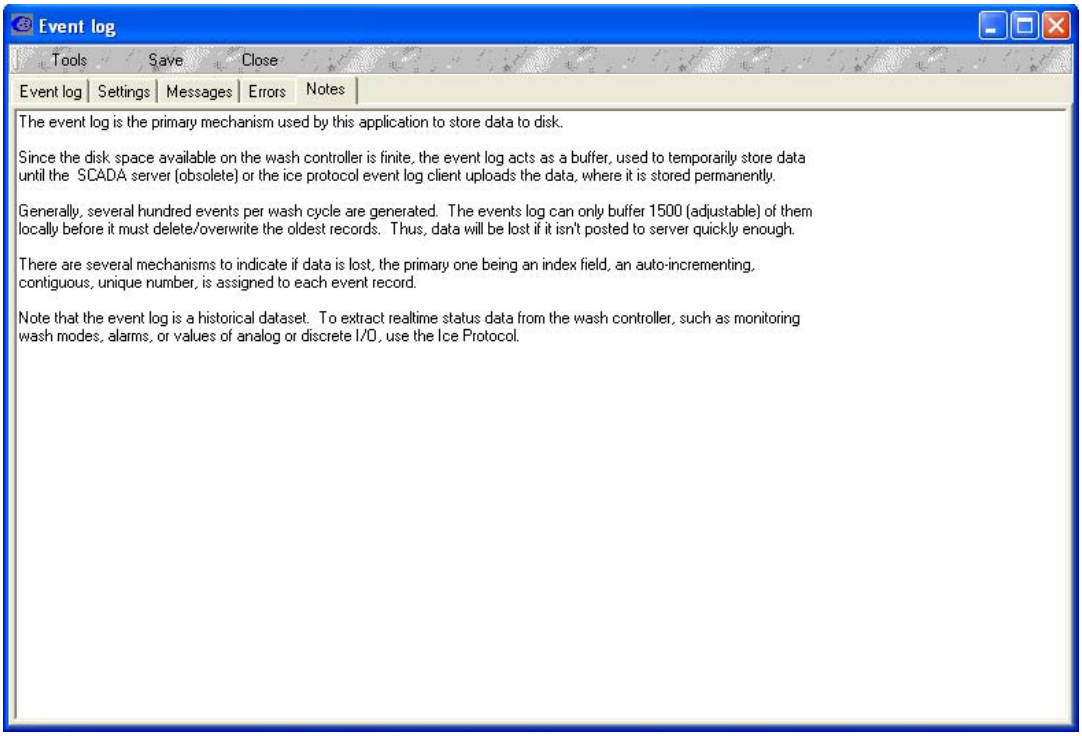


Figure 2- 85: Event Log - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Event Log ⇨ Notes

Screen Description

This read-only screen presents information relevant to the event log. The Notes screen is used primarily for System design purposes.

2.3.50 Event Log \ Tools Menu Bar Buttons

Press the TOOLS button on the menu bar of any of the Event Log screens to bring up this list of options relating to the Event Log file. The screen that pops up is shown below.

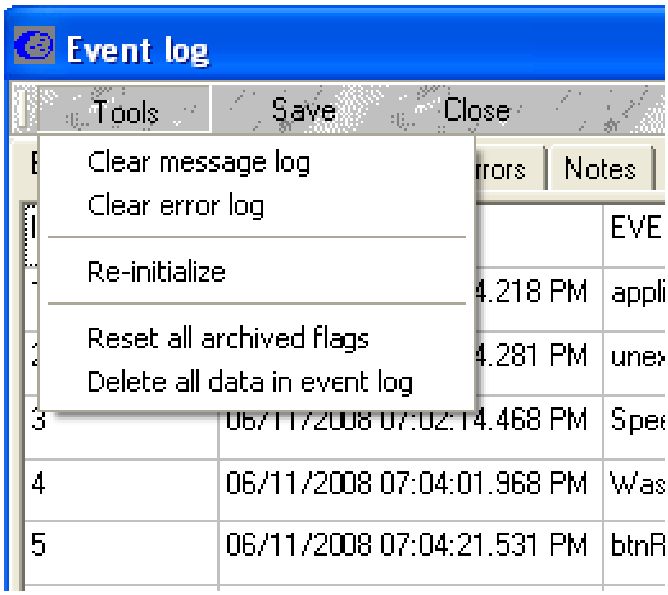


Figure 2- 86 Event Log Tools Screen Details

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Event Log ⇨ Tools

Screen Description

Tools:

Clear Message Log – Press to delete all messages from the MESSAGE LOG file.

Clear Error Log – Press to delete all messages from the ERROR LOG file.

Re-Initialize – Press this button to initialize the event logging system manually. This executes the same algorithms performed during System startup: closes all open files, does data integrity checks on the event log, reads that data in memory and displays it on the screen, and finally displays a pass/fail message to the operator.

Reset All Archived Flags – Press to reset the archived flags. When event log data is transmitted to a server, an ARCHIVED field is updated in the event log database to prevent that record being transmitted more than once. Pressing this button causes the Controller to resend all event log records to the remote server. This should be used only when the server lost data due to some failure.

Delete All Data in Event Log – Press to delete all data from the Controller's original copy of the event log database file.

Save:

Press this button to save any changes made and exit the screen.

Close:

Press to exit the screen without saving any changes made.

2.3.51 Main Menu Bar \ Tools \Service Settings

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Service Settings

Screen Description

This option is available only to InterClean employees. Selecting this option pops up the password entry keyboard. An incorrect entry pops up the message in *Figure 2- 87: Access Denied Pop-up Message*.

2.3.52 Main Menu Bar \ Tools \SCADA Server Settings

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ SCADA Server Settings

Screen Description

This option is available only to InterClean employees. Selecting this option pops up the password entry keyboard. An incorrect entry pops up the message in *Figure 2- 87: Access Denied Pop-up Message*.

2.3.53 Main Menu Bar \ Tools \ ICE Protocol Client Settings

Keystroke Sequence:

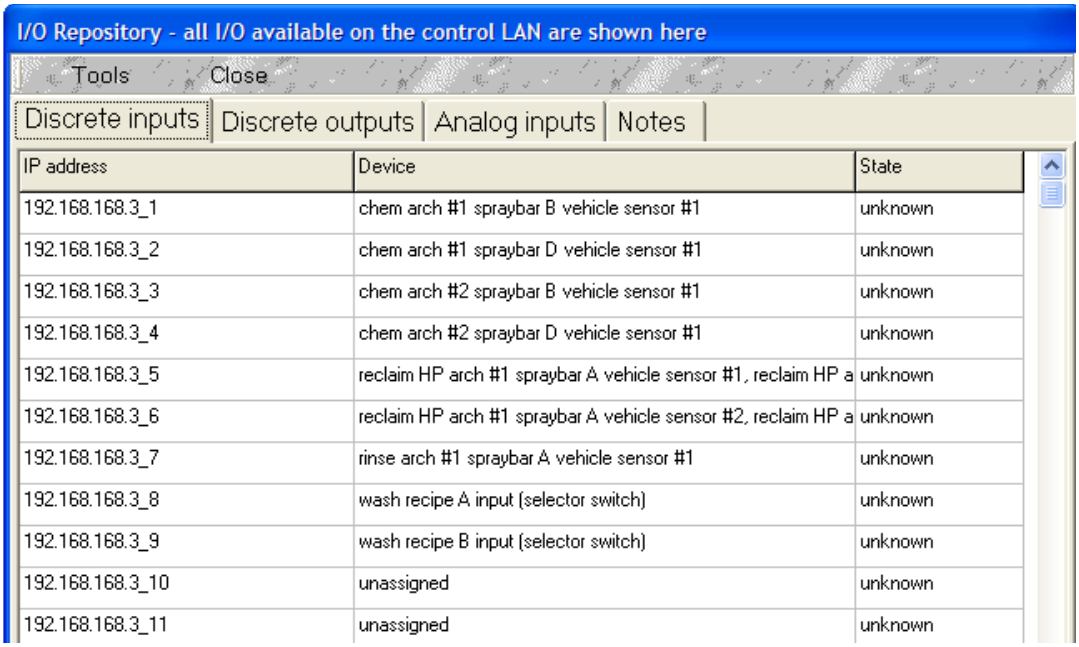
Main Screens ⇨ Tools ⇨ ICE Protocol Client Settings

Screen Description

This option is available only to InterClean employees. Selecting this option pops up the password entry keyboard. An incorrect entry pops up the message in *Figure 2- 87: Access Denied Pop-up Message*.

Figure 2- 87: Access Denied Pop-up Message

2.3.54 Inputs/Outputs (I/O Repository) – Discrete Inputs Screen



IP address	Device	State
192.168.168.3_1	chem arch #1 spraybar B vehicle sensor #1	unknown
192.168.168.3_2	chem arch #1 spraybar D vehicle sensor #1	unknown
192.168.168.3_3	chem arch #2 spraybar B vehicle sensor #1	unknown
192.168.168.3_4	chem arch #2 spraybar D vehicle sensor #1	unknown
192.168.168.3_5	reclaim HP arch #1 spraybar A vehicle sensor #1, reclaim HP a	unknown
192.168.168.3_6	reclaim HP arch #1 spraybar A vehicle sensor #2, reclaim HP a	unknown
192.168.168.3_7	rinse arch #1 spraybar A vehicle sensor #1	unknown
192.168.168.3_8	wash recipe A input (selector switch)	unknown
192.168.168.3_9	wash recipe B input (selector switch)	unknown
192.168.168.3_10	unassigned	unknown
192.168.168.3_11	unassigned	unknown

Figure 2- 88: Inputs/Outputs (I/O Repository) - Discrete Inputs Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Inputs/Outputs (I/O Repository) ⇨ Discrete Inputs

Screen Description

This screen shows the discrete inputs wired to the Ethernet I/O system. Note, the screen above is a generic screen – the information on your screen may vary from above. Discrete inputs points are wired to devices that have two active states; that is, they are either ON or OFF. An example would be a float switch.

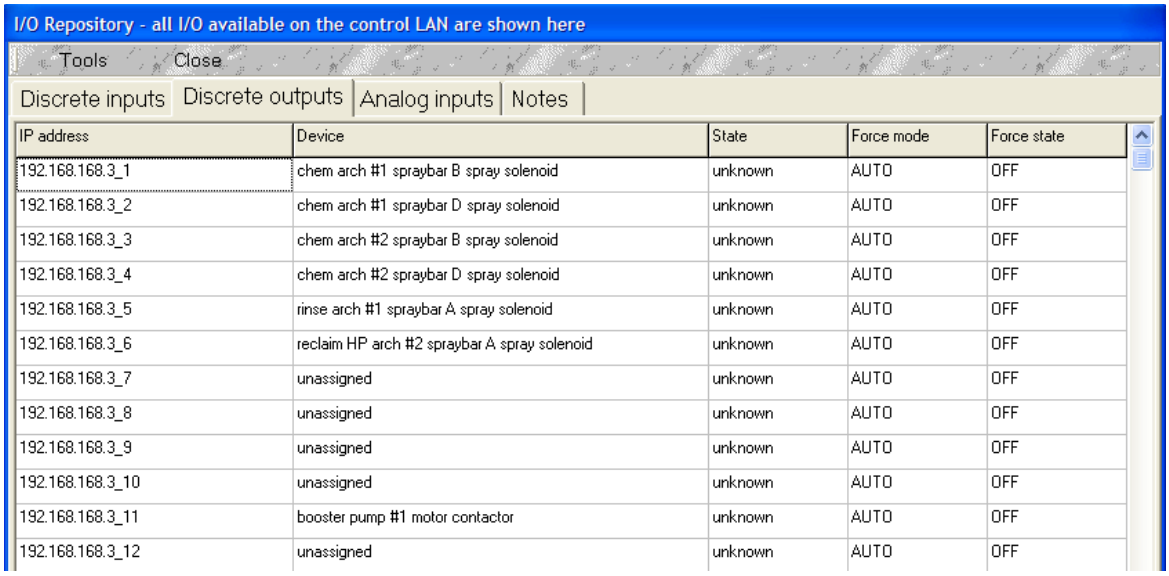
The screen shows three columns of information:

IP Address – This is the Ethernet address of the input point. Using IP Address 192.168.168.3_1 as an example, the first part of the address (192.168.168.3) shows which Ethernet base the switch is wired to (refer to *Figure 2- 88: Inputs/Outputs (I/O Repository) - Discrete Inputs Screen*), in this example, I/O Base 1. The last part of the address (in this example "_1) gives the terminal strip point (P6-01) where the wire from the device is attached to the I/O base.

Device – This gives the name of the input device wired to the Ethernet base. Using the IP Address above as an example, the device name that would show up on this screen is "Chem Arch #1 spraybar A vehicle sensor #1", indicating the first photoeye PE1. Note: this information is available on the control prints included in this manual.

State – This column shows the current state of the input device. If no device is wired to the input point the screen shows UNKNOWN and that block is yellow. A green block and message indicates the device is active or actuated; in this example, a vehicle is blocking the photoeye. A red block indicates the device is not actuated.

2.3.55 Inputs/Outputs (I/O Repository) - Discrete Outputs Screen



IP address	Device	State	Force mode	Force state
192.168.168.3_1	chem arch #1 spraybar B spray solenoid	unknown	AUTO	OFF
192.168.168.3_2	chem arch #1 spraybar D spray solenoid	unknown	AUTO	OFF
192.168.168.3_3	chem arch #2 spraybar B spray solenoid	unknown	AUTO	OFF
192.168.168.3_4	chem arch #2 spraybar D spray solenoid	unknown	AUTO	OFF
192.168.168.3_5	rinse arch #1 spraybar A spray solenoid	unknown	AUTO	OFF
192.168.168.3_6	reclaim HP arch #2 spraybar A spray solenoid	unknown	AUTO	OFF
192.168.168.3_7	unassigned	unknown	AUTO	OFF
192.168.168.3_8	unassigned	unknown	AUTO	OFF
192.168.168.3_9	unassigned	unknown	AUTO	OFF
192.168.168.3_10	unassigned	unknown	AUTO	OFF
192.168.168.3_11	booster pump #1 motor contactor	unknown	AUTO	OFF
192.168.168.3_12	unassigned	unknown	AUTO	OFF

Figure 2- 89: Inputs/Outputs (I/O Repository) - Discrete Outputs Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Inputs/Outputs (I/O Repository) ⇨ Discrete Outputs

Screen Description

This screen shows the discrete outputs wired to the Ethernet I/O system. Note, the screen above is a generic screen – the information on your screen may vary from above. Discrete outputs points are wired to devices that have two active states; that is, they are either ON or OFF. An example would be a pump motor starter.

This screen also allows forcing an output. Forcing an output means turning that output point on or off manually, overriding any logical conditions that would turn that output point on or off in the control pro-gram. For example, if a pump normally turned on based on the fluid level in a tank being low, this screen allows you to force the pump (motor starter) on regardless of the fluid level in that tank.

Forcing an output is a two-step process. First, you must change the force mode from AUTO to MA-NUAL and then you must force the output ON or OFF. Forces override the logical operation of the Wash System control program and should be used with caution and knowledge of what conse-quences may occur by forcing any particular output on or off. You could, for example, overfill a tank by forcing on a pump that ignores the state of the float switches that would normally turn the pump off when the tank became full.

CAUTION:	**Use caution when forcing outputs on or off. Refer to the control prints to see what consequences forcing an output will have to the System.**

Forces are active only while this screen is displayed on the Touch Screen. Changing to any other screen removes any forces, returns all the outputs to AUTO mode, and displays the following screen popup message:

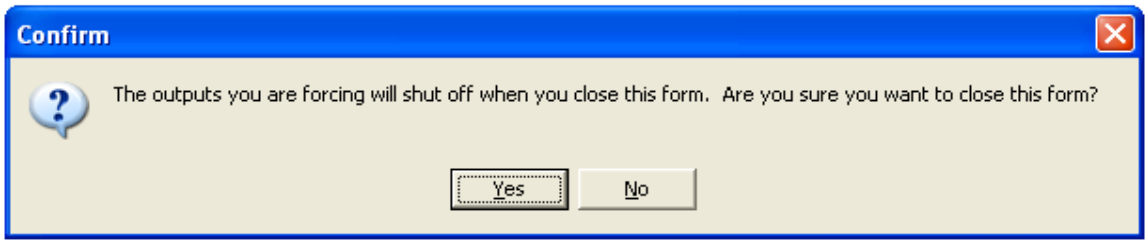


Figure 2- 90: Forced Outputs Exit Screen

The screen shows five columns of information:

IP Address – This is the Ethernet address of the output point. Using IP Address 192.168.168.3_3 as an example, the first part of the address (192.168.168.3) shows which Ethernet base the switch is wired to (refer to *Figure 2- 89: Inputs/Outputs (I/O Repository) - Discrete Outputs Screen)*, in this example, I/O Base 1. The last part of the address (in this example "_3) gives the terminal strip point where the wire is attached to the I/O base. In this example, the output device is wired to terminal P7-03 on I/O Base 1.

Device – This gives the name of the output device wired to the Ethernet base. For example, using the IP Address above as an example, the device name is "chem arch 2 spray bar A spray solenoid" would show on the screen. Note: I/O assignments are available on the control prints included in this manual.

State – This column shows the current state of the output device. If no device is wired to the output point the screen shows UNKNOWN and that block is yellow. A green block and message indicates the device is actuated by the Controller; a red block indicates the device is not actuated.

Force Mode – Shows the current state of that output. AUTO means the output is controlled by program logic and is not being forced. MANUAL indicates the output may be force on or off.

Force State – Shows the current state of that output, either ON or OFF.

2.3.56 Inputs/Outputs (I/O Repository) - Analog Inputs Screen

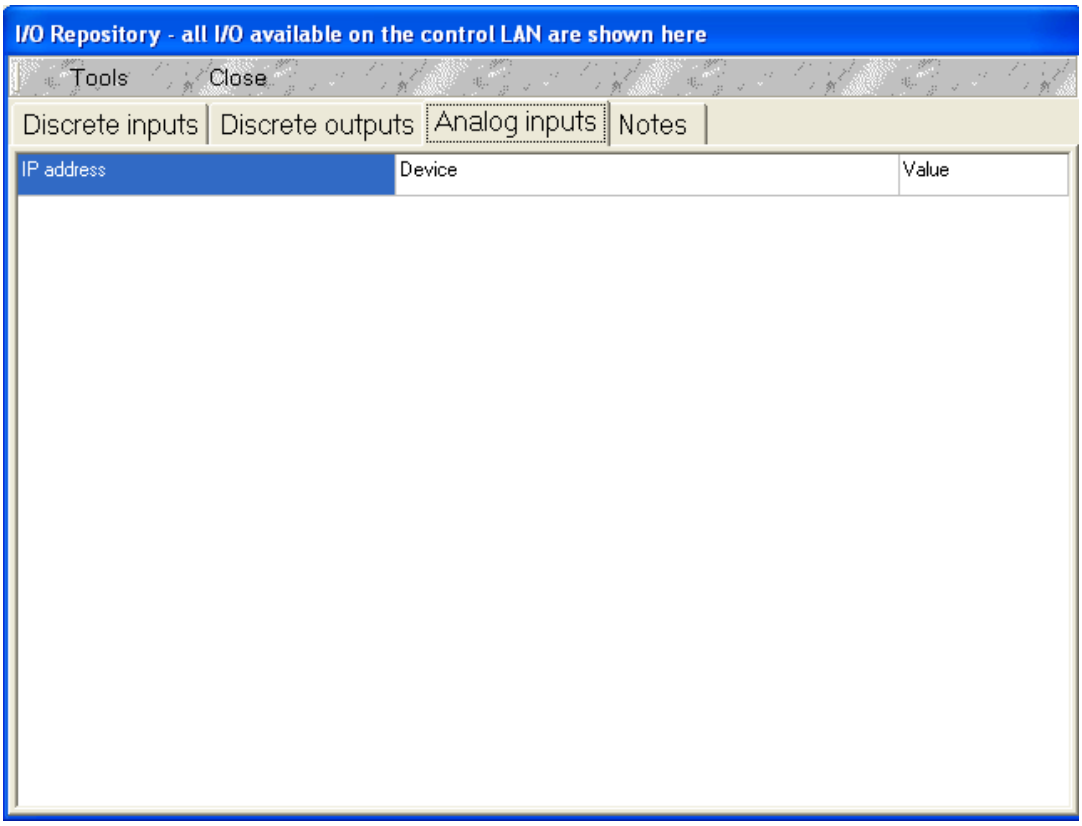


Figure 2- 91: Inputs/Outputs (I/O Repository) - Analog Inputs Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Inputs/Outputs (I/O Repository) ⇨ Analog Inputs

Screen Description

This screen shows the analog inputs wired to the Ethernet I/O system. Note that there are no analog inputs used in this Wash System.

I

2.3.57 Inputs/Outputs (I/O Repository) – Notes Screen

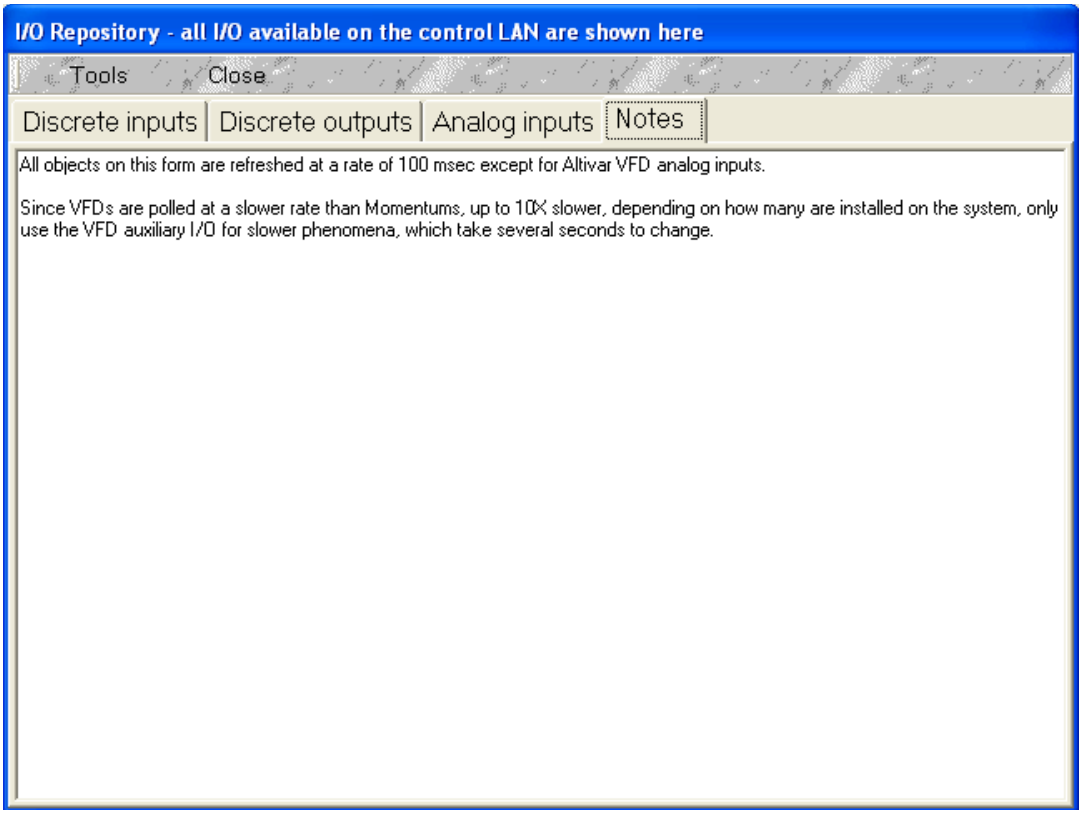


Figure 2- 92: Inputs/Outputs (I/O Repository) - Notes Screen

Keystroke Sequence:

Main Screens ⇨ Tools ⇨ Inputs/Outputs (I/O Repository) ⇨ Notes

Screen Description

This screen gives information pertaining to the I/O Repository screens. This is used mainly for troubleshooting by ICE personnel.

2.4 SENSORS AND CONTROLS

Several types of sensors and manual controls provide the System Controller with information to control the wash process.

2.4.1 Emergency Stop Buttons

Two E-Stop buttons in the Wash System shut down the System in case of an emergency. The pressed E-Stop button disables the Master Control Relay circuit and removes operating power from the System outputs. Any device controlled by the I/O Base(es) is shut down. This triggers a System Alarm and the wash mode reverts to the OFF mode.

The push-pull switch remains in the pressed state until released manually to its reset state by pulling the knob. All E-Stops in the System must be released to the reset state in order to run the Wash System.

Both E-Stop buttons are located in the Equipment Area, one on the front panel of the Master Control Panel and the other on the front panel of the Reclaim Slave Panel. Press either E-Stop button in case of an emergency shutdown condition.

You must manually reset any alarm condition on the Touch Screen terminal after the E-Stop buttons have been reset. Refer to *Section 2.3.6 Main Screen – Alarms Screen*.

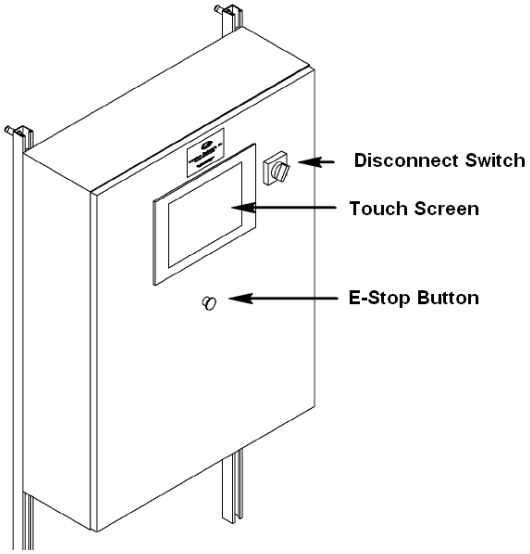


Figure 2- 93 MCP E-Stop Location

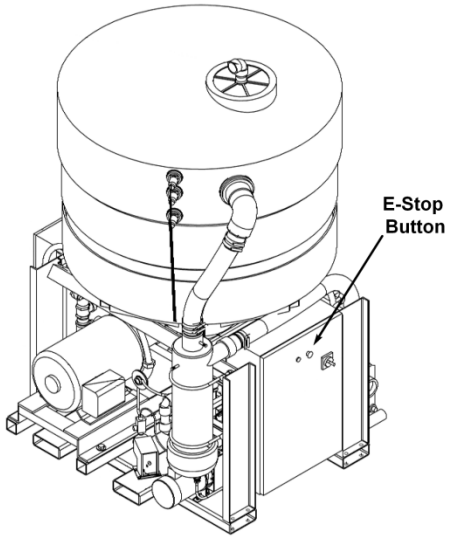


Figure 2- 94 Reclaim Slave Panel E-Stop Location

2.4.2 Float Switches

Float switches in the Settling Pit and EQ Tank inform the System Controller of the water levels, as follows:

- **Pit Lower Float Switch** – normally-open – held closed with sufficient water in the reclaim section of the Pit – triggers a System Alarm if the switch opens for more than 3 seconds to protect the reclaim pumps from loss of prime.
- **Pit Upper Float Switch** – normally-closed – tells the System Controller the Settling Pit is full – used for automatic Pit refilling (not recommended).
- **EQ Tank Upper Float Switch** – tells the System Controller the EQ Tank is full and disables the Sump Pump from pulling water from the Settling Pit.
- **EQ Tank Middle Float Switch** – tells the System Controller the EQ Tank requires filling and enables the Sump Pump to pull water from the Settling Pit.
- **EQ Tank Lower Float Switch** – tells the System Controller the water level in the EQ Tank is too low and triggers a System Alarm to protect the High Pressure Pump from loss of prime.

2.4.3 Photoeyes

Eight sets of photoeyes in the Wash Bay tell the System Controller when to start the wash cycle and when to start and stop the different spray arches, spray bars, and spinners in the System. Each photoeye consists of a visible light transmitter on one side of the Wash Bay focused on a corresponding receiver unit mounted on the opposite side of the Bay.

The output of the receiver changes state when a vehicle or other object blocks the light beam. The normally-closed optical receivers transmit 0-24 volt DC signals to the System Controller through the I/O Base located in the Master Control Panel. A zero volt signal means the beam blocked (vehicle present).

- **PE1** – Controls the Acid Chemical Arch Side Spray Bars
- **PE2** – Controls the Acid Chemical Arch Rear Spray Bar
- **PE3** – Controls the Alkaline Chemical Arch Side Spray Bars
- **PE4** – Controls the Alkaline Chemical Arch Rear Spray Bar
- **PE5** – Controls the Spinner Arch, Chassis Washer and Brush Module (start)
- **PE6** – Controls the Rear Wash Arch
- **PE7** – Controls the Brush Module (stop)
- **PE8** – Controls the Rinse Arch

Refer to *Figure 2- 1 Wash Bay Overview - Chemical Wash Section, Figure 2- 2 Wash Bay Overview - High Pressure Wash Section,* and *Figure 2- 4 Wash Bay Overview - Rinse Section* for the locations of the vehicle sensors in the Wash Bay.

2.5 ALARMS AND INDICATORS

Whenever a System Alarm is generated, the Wash System shuts down all motors and valves associated with that alarm to protect the equipment and prevent vehicle and equipment damage. All System Alarms are logged with a time stamp and displayed on the ALARMS screen on the Touch Screen terminal. Alarms are stored in permanent memory on the System Controller's flash card.

All alarms must be acknowledged and reset using the button on the screen before the Wash System can return to a normal operating condition. The cause of the alarm must be corrected before the alarm can be reset.

2.5.1 Low Level Alarms

If a low level float is activated for longer than three seconds a low level alarm is shown on the Touch Screen terminal Alarm screen. The three-second delay is to filter out float switch fluctuations which may be caused by turbulence in the tank.

2.5.2 Motor Overloads Alarms

An alarm is triggered if one of the motor overloads or circuit breakers trips. The alarm entry on the Alarm Touch Screen indicates which overload or circuit breaker has tripped. The motor cannot be restarted until the cause of the overload is corrected and the alarm has been reset.

2.5.3 Maximum Cycle Timer Alarms

Activation of a spray bar will start its maximum cycle timer. The maximum cycle timer is a safety feature that shuts down a wash cycle in the event a vehicle stalls in the wash bay and is keeping any of the sensors blocked for longer than the set time or if a sensor has failed.

Maximum cycle timers are adjustable (via touch screen) and allow you to increase or decrease the maximum time need to wash a vehicle, which typically depends on the length of your vehicles and wash bay.

If the maximum cycle timer expires during a wash, that system will shut down.

The maximum cycle expiring will cause an alarm and will not allow that system to activate until the alarm has been reset.

2.5.4 Communication Error

In the event that the industrial PC is unable to communicate to any of the I/O bases a fatal communication alarm is generated. This alarm will deactivate the entire system and place it into OFF mode. This may indicate that the link between the System Controller computer and the I/O bases has been lost.

2.5.5 Emergency Stop Activations

If the emergency stop button is pressed all wash function will stop. This triggers a System Alarm and disables the Wash System until the alarm has been reset. This Alarm will deactivate the entire system and place it into OFF mode.

2.5.6 Reclaim Panel Fault Light

The red light on the Reclaim Slave Panel door is normally off. The light illuminates when a fault occurs that involves components or processes involved in the water reclaim process. Check the Alarms screen on the Touch Screen terminal to determine the cause of the fault. Correct the fault and reset the Wash System using the RESET button on the Alarms screen.

3 USING THE WASH SYSTEM

Section 3 Table Of Contents

List of Figures in Section 3

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3.1 STARTING UP THE WASH SYSTEM

3.1.1 Overview

This section tells how to start up the Wash System Control Computer from a powered-off condition. It further describes the selections that have to be made at system start-up and how to access the Touch Screen Terminal screen for those selections.

Before starting the Wash System it is a good idea to visually

A summary of the start-up procedures:

- Apply power to the Wash System
- Start the System Control Computer
- Select the Wash Mode (if applicable)
- Verify the Manual Valve States

3.1.2 Apply Power to the Wash System

The Wash System is powered by 480 VAC power from the local utility company. Their power is typically wired into a Main Distribution Panel (MDP) where it is distributed to the Wash System through circuit breakers. The circuit breakers trip and remove power from the components connected to their LOAD side if that part of the system draws current in excess of the breaker's rating such as would happen with a short circuit to ground.

1. Move the MDP Wash System's circuit breaker(s) to the ON position; the breakers should remain engaged. If a circuit breaker trips, an overload or short exists in the load circuit. You must correct any electrical problems before putting the Wash System into service.

CAUTION:	**All electrical troubleshooting and service work should be performed by a certified electrician.**

2. Turn the Main Disconnect Switch on the Master Control Panel (MCP) to the ON position.
3. Turn the main circuit breaker on the Reclaim Slave Panel (RSP) to the ON position.

3.1.3 Start the System Controller computer

Turn on power to the computer. The computer boots up, loads the Windows® operating system, and then automatically starts up the wash program. The wash program takes a few minutes to load as it initializes various hardware systems.

CAUTION:	The flash memory card holding the operating system and wash control program must be resident in the computer before starting the computer. The card should not be inserted or removed from the computer while the computer's power is turned on or damage to the card may result.

During this time a screen similar to *Figure 3- 1: Typical System Controller Startup* Screen show the progress as the computer initializes the software modules in the system.

3.1.4 Configure the Winter / Summer Mode

The Wash System has two overall modes that enable it to offer the best wash depending on the season. This affects the high pressure parts of the wash cycle, allowing the system to use fresh water in the winter months and reclaimed water in the summer months for a saving in fresh water purchased from the local utility.

During the winter, the water in the Settling Pit contains a high percentage of salt that is washed off of salt trucks and other vehicle that pick up salt from the roads. Using this water for the high pressure washes will lead to early vehicle body rusting so it is best to use the fresh water option in the winter months.

Changing the system from one mode to the other involves opening and closing manual ball valves and butterfly valves in the system, as described in the following subsections. Refer to *Table 3- 1 Summer/Winter Modes Valve State Chart* for the location of the valves used in this process.

3.1.4.1 Summer Mode – Reclaim Water Option

The summer mode, or reclaim water option mode, enables the Wash System to use water that has been reclaimed from the Settling Pit. This is water that has drained off the vehicles and into the pit from previous wash cycles. Sediments are removed from the water, making it suitable for use in future washes. This affects only the high pressure parts of the wash cycle, not the chemical application or the rinse.

To use reclaimed water for the high pressure wash:

4. Close 4” butterfly valve BFV1 to isolate the High Pressure Pump from the Fresh Water Tank.
5. Open ½” manual valves MV12 and MV13 that connect the Cyclonic Separator sump area and the 500-gallon cone-bottomed EQ Tank sump area to the pit circulation water.
6. Open 4” butterfly valve BFV2 that connects the 7.5-hp Sump Pump on the EQ Module to the InterScreen filter in the Settling Pit.

Refer to *Section 2.1.7: Reclaim Water System Description* for a detailed description of the water reclamation process.

3.1.4.2 Winter Mode – Fresh Water Option

The winter mode, or fresh water option mode, enables the Wash System to use water from the municipal water supply for the high pressure parts of the wash cycle. This affects only the high pressure parts of the wash cycle, not the chemical application or the rinse.

To use fresh water for the high pressure wash:

4. Close 4” butterfly valve BFV2 to isolate the High Pressure Pump from the Settling Pit.
5. Close ½” manual valves MV12 and MV13 to disconnect the Cyclonic Separator sump area and the 500-gallon cone-bottomed EQ Tank sump area from the pit circulation water.
6. Open 4” butterfly valve BFV1 that connects the 7.5-hp Sump Pump on the EQ Module to the Fresh Water Tank.

Table 3- 1 Summer/Winter Modes Valve State Chart

Season	Water Source	BFV1	BFV2	MV12	MV13
Summer	Reclaimed	Closed	Open	Open	Open
Winter	Fresh	Open	Closed	Closed	Closed

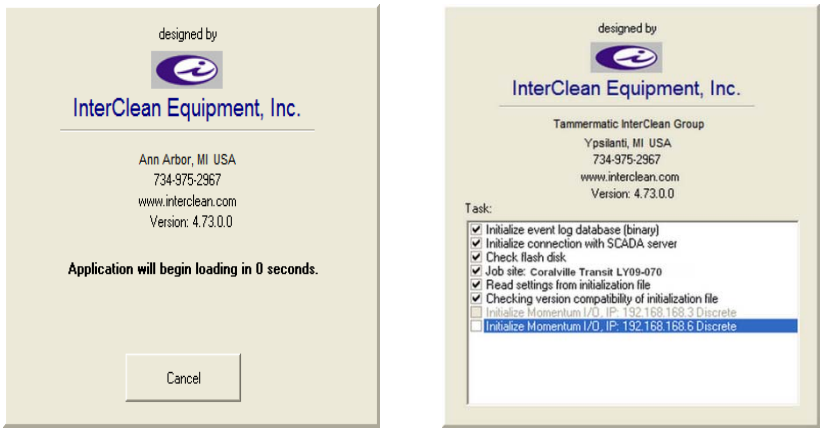

Figure 3- 1: Typical System Controller Startup Screens

3.1.5 Alarm Screen

The Wash System is in OFF mode when the System powers up; all wash components controlled by the System Controller are turned off. The Touch Screen Terminal shows the Alarms screen and any system alarms that may have occurred during initialization are listed. Check this screen for any problems that need to be corrected before putting the Wash System into service.

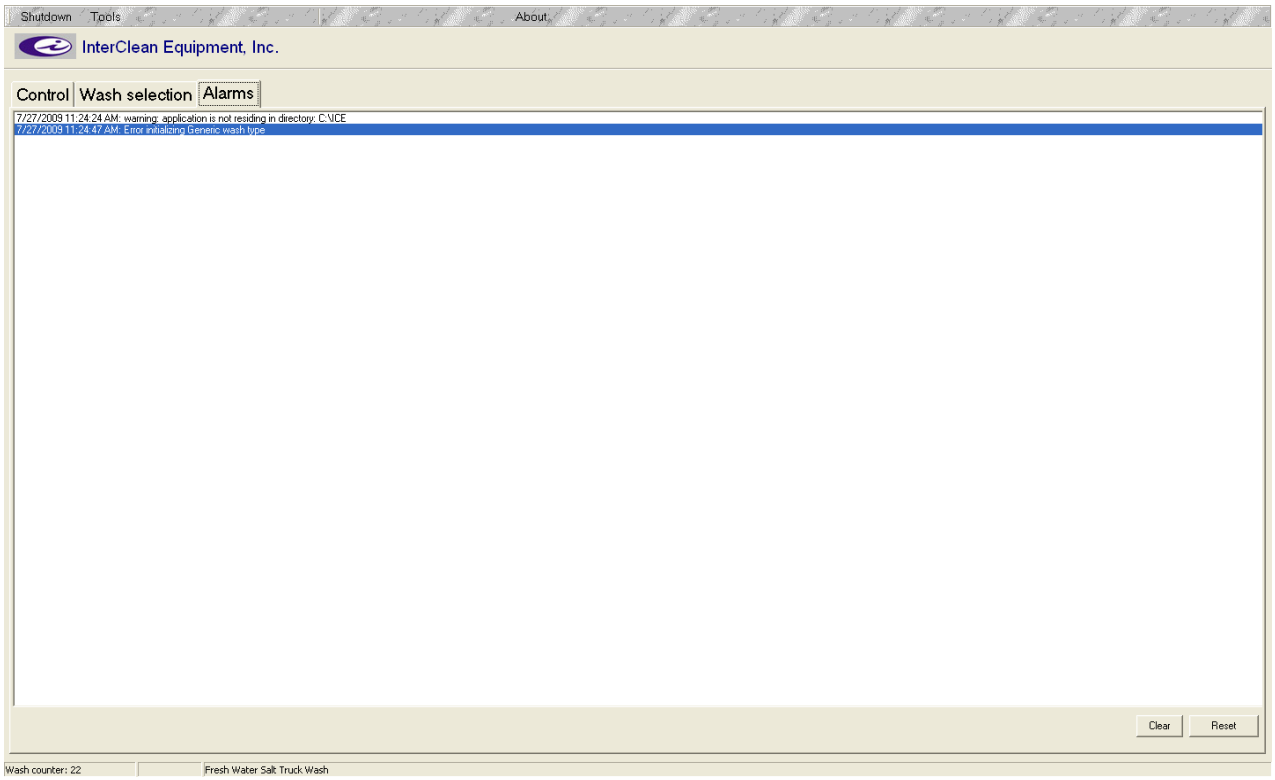

Figure 3- 2: Alarms Screen (typical)

3.1.6 Select the Wash Mode

Next, change the Touch Screen to the Control screen and select either Auto mode or Standby mode. The Auto mode is the normal wash mode. Select this if you are ready to wash vehicles. All the Wash System components controlled by the computer are operating (if all other conditions are normal).

In the Standby mode the Wash System is running but none of the Wash Bay systems will function. You cannot wash a vehicle in Standby mode. Other parts of the System may be functioning, such as the Water Softener, Hot Water Heater, etc., but the Wash Bay components will not function in this mode.

At this point, the Wash System is ready to wash vehicles.

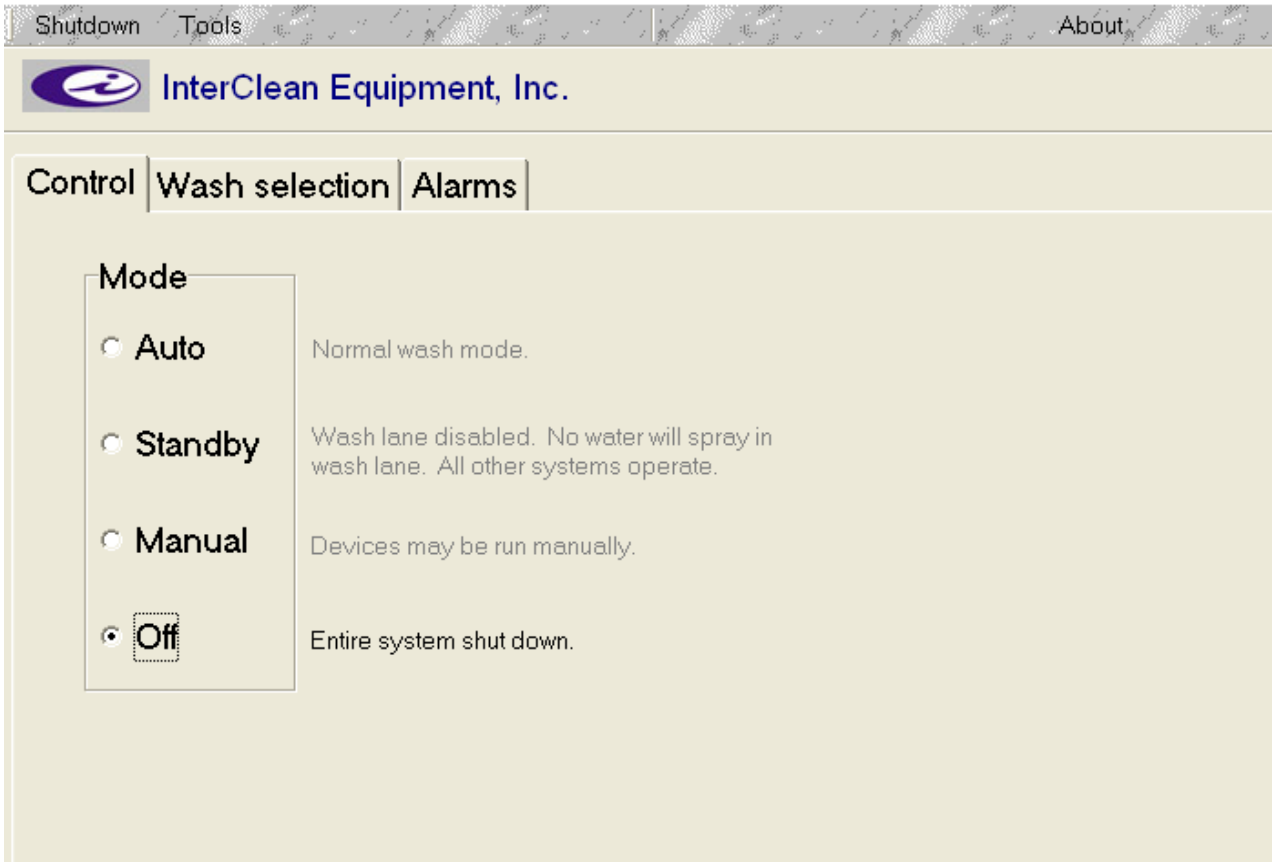

Figure 3- 3 A Portion of the Control Screen

3.1.7 Select The Wash Type

In this Wash System, all vehicles receive the standard wash using all the arches in the Wash Bay.

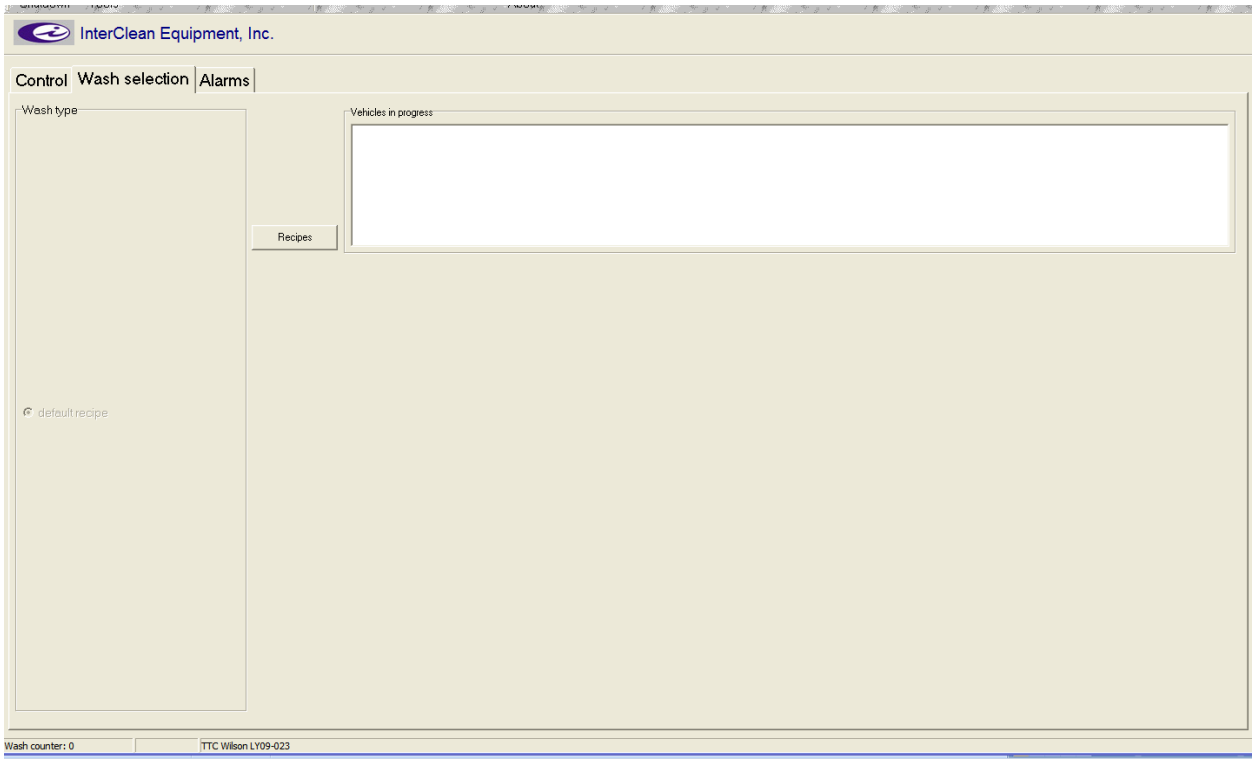

Figure 3- 4 Wash Selection Screen

3.1.7.1 Vehicles in Progress Display

The Vehicles in Progress display on the Wash Selection screen shows the queue of vehicle washes that are enabled. Generally, this will show just one wash cycle.

Recipes: Press the Recipes button on the Touch Screen to see how the Wash System is configured and what subsystems are activated for this Wash System. A Level IV password is required to see the Recipes screen or make changes. The screen also shows maximum timer durations for the various wash subsystems.

Each wash subsystem offers a TRUE or FALSE selection choice. It is possible to enable or disable wash subsystems from this screen. This feature enables you to turn off discrete parts of the Wash System; for example, a certain spray bar that is normally enabled as part of the Wash System design can be disabled by setting it to FALSE. If this setting is saved, that spray bar will not function on subsequent wash cycles.

Note that not all the subsystems listed on the Recipes screen are part of this Wash System design and are set to FALSE by default. Setting these systems to TRUE has no effect on the Wash System or wash cycles. If the subsystem was not part of the original design of your Wash System, changing its status to TRUE has no effect. However, if you do set to TRUE one of the subsystems not part of your System design, an error message appears on the Alarms screen.

To turn off part of your Wash System, click on the TRUE/FALSE option next to the subsystem descriptor. The program toggles that subsystem to the opposite state. Press the SAVE button on the Tool Bar if you wish to keep this setting or exit the Recipes screen without saving by pressing the CANCEL/CLOSE button on the Tool Bar. All subsequent wash cycles will be affected by the choice you make here.

Tools Save Cancel/Close

Wash recipe database

Standard wash
No top wash

Subsystem	Enabled	Max spray duration hrs	Max spray duration mins	Max spray duration secs	Max spray duration msecs
(disabled)	False	23	59	59	999
Chem arch #1B - Side	True	0	2	59	999
(disabled)	False	23	59	59	999
Chem arch #1D - Rear	True	0	2	59	999
(disabled)	False	23	59	59	999
Chem arch #2B - Side	True	0	2	59	999
(disabled)	False	23	59	59	999
Chem arch #2D - Rear	True	0	2	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
Reclaim HP arch #1A - Spinner	True	0	3	59	999
Reclaim HP arch #1B - Rear	True	0	3	59	999
Reclaim HP arch #2A - Top spinner	True	0	3	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
Rinse arch #1A - Side	True	0	2	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
(disabled)	False	23	59	59	999
tractor only option	False	23	59	59	999
XJ404 - brush front of vehicle	False	23	59	59	999

Figure 3- 5 Typical Wash Recipes Screen

Each subsystem also incorporates a Maximum Duration Timer setting shown in hours, minutes, seconds, and milliseconds values. These Maximum Duration Timers disable the affected subsystem if they time out during any one wash cycle. The elapsed time of the max timers is reset at the start of the next cycle. Note that the subsystem event itself is controlled by other logic and also by a different set of Maximum Cycle Timers.

The Maximum Cycle Timers, not the same as above and embedded in the control program, are generally not accessible to Level IV password holders. The Maximum Duration Timers on the Recipes page give these personnel some level of control over the subsystem cycle time without consulting the Wash System manufacturer, InterClean Equipment, Inc.

If you set the Maximum Duration Timer on this page to a lower value than the program Maximum Cycle Timer value it will cause the subsystem to turn off if the set time value is exceeded but will not generate an alarm. On the other hand, if the embedded Maximum Cycle Timer value is exceeded, an alarm is generated.

Obviously, misuse or misinformed use of the options on the Recipes page can lead to Wash System problems. There is no ‘reset to default’ button to press to undue changes to the Wash System from this page so use these options with discretion.

3.2 WASHING A VEHICLE

The wash cycles are automatically enabled once the Wash System is powered on and placed in AUTO mode. The wash cycle starts as soon as a vehicle that is tagged with a properly formatted RFID tag blocks the first photoeye (PE1) at the start of the Wash Bay. The RFID tag on the vehicle automatically authorizes the wash cycle. Vehicles not properly tagged will not start the wash cycle.

Drive the vehicle through the Wash Bay at a steady speed of 1 – 2 feet per second. Maintain this speed until the vehicle exits the end of the Wash Bay.

A faster speed may result in a degraded wash cycle because the chemicals may not have time to loosen and lift dirt and oils from the vehicle surfaces. Too slow a speed may result in excess water and chemical usage because the different parts of the wash cycle are controlled by the vehicle blocking and clearing photoeyes located throughout the Wash Bay.

Very slow speed or stopping the vehicle inside the Wash Bay may cause maximum cycle timers to time out and generate an alarm.

3.3 SHUTTING DOWN THE WASH SYSTEM

System shutdowns can be characterized as emergency or non-emergency. Execute an emergency shutdown whenever necessary.

Emergency Shutdown

Press the E-Stop button on the Master Control Panel to shut down the Wash System in an emergency. This removes power from the System Controller outputs and stops all wash operations. The System Controller puts the Wash System in OFF mode.

Wash System Shutdown

Press the OFF selection on the Touch Screen CONTROL screen to disable all Wash System functions but leave the System Control software application running. Alternately, use the Touch Screen to put the Wash System in STANDBY mode to disable all Wash Bay functions but leave the support systems (such as the Pit circulation) running.

Total System Shutdown

Perform the following steps for a complete Wash System shutdown:

Electrical

1. Press the SHUTDOWN button on the menu bar of the CONTROL, WASH SELECTION, or ALARMS screens to disable all Wash System functions and shut down the System Control software. The Touch Screen asks for a confirmation of the shutdown. Select YES to shut down the Wash System application and return to the Windows® operating system. Select NO to abort the Wash System software shutdown.
2. Perform a normal Windows® shutdown procedure to shut down the operating system and turn off the computer. Click the START button, then click the SHUT DOWN (or TURN OFF) option and verify your selection when the computer prompts.
3. To remove ALL electrical power from the Wash System, turn OFF the main circuit breaker inside the site Main Distribution Panel (MDP) where electrical power enters the Wash Site from the power utility company. **Follow all safety procedures for working inside or around the 480 volt AC Main Distribution Panel.**
4. To remove electrical power from the Master Control Panel only, turn the circuit breaker in the Main Distribution Panel (MDP) feeding the Master Control Panel (MCP) to the OFF position. Alternately, turn OFF the Main Disconnect Switch on the MCP door and lock it out. This

second option disconnects power inside the MCP but 480 VAC power is still supplied to the LINE side of the Disconnect Switch so some areas inside the MCP may still be 'hot'.

Hydraulic

1. Close manual valves MV1, MV2, MV7, and MV8 to disconnect the Wash System hydraulics from the municipal water supply. Caution: some parts of the hydraulic and pneumatic may retain residual pressure. Refer to the plumbing schematic before servicing the system.

4 MAINTENANCE

Section 4 Table of Contents

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List of Tables in Section 4

4.1 PREVENTIVE MAINTENANCE

Regular preventive maintenance can eliminate the need for costly repairs and lost revenue due to Wash System downtime while maintaining the System in best operating order.

WARNING:	**Do not enter the Wash Bay until the area has been secured to prevent vehicles entering the Wash Bay while service is being performed. Failure to heed this warning may result in severe or fatal personal injury.**

4.1.1 Preventive Maintenance Schedule

Table 4- 1 Preventive Maintenance Schedule

Maintenance Task	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually
Fresh Water System						
Check all piping for leaks or loose mounting brackets	X	X	X	X	X	X
Verify the state of all manual valves. Refer to *Table 4- 2 Manual Valve State Chart*	X	X	X	X	X	X
Drain sediments from hot water tank					X	X
Verify hot water tank gas pilot is lit (if applicable)	X	X	X	X	X	X
Verify hot water heater burner flame when heater is running	X	X	X	X	X	X
Verify water temperature setting is 104° F	X	X	X	X	X	X
Chemical Wash System						
Check all piping for leaks or loose mounting brackets	X	X	X	X	X	X
Remove and clean Filter F1, F2 screen				X	X	X
Verify setting on pressure reducing valves PRV1, PRV2 – 80 psig max		X	X	X	X	X
Verify operation of solenoid valves SOV2, SOV3, SOV4, SOV5			X	X	X	X
Verify chemical tank levels	X	X	X	X	X	X
Check that all spray nozzles on the Chemical Arches are intact and correctly oriented	X	X	X	X	X	X

Maintenance Task	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually
Check Chemical Arch nozzles for abnormal spray pattern that indicates a clogged nozzle	X	X	X	X	X	X
High Pressure Wash System Checks						
Check all piping for leaks or loose mounting brackets	X	X	X	X	X	X
Lubricate the High Pressure Pump – follow manufacturer's recommendations – See Appendix in Section 8	Follow the manufacturer's instructions in *Section 8: Appendix* for all pump maintenance and service information					
Verify stuffing box shaft seal packing allows a slow drip of water from around the shaft (2-3 drops per minute) of the High Pressure Pump – See manufacturer's recommendations in Section 8: Appendix	Follow the manufacturer's instructions in *Section 8: Appendix* for all pump maintenance and service information					
Check that all spray nozzles on all high-pressure arches are intact and correctly oriented	X	X	X	X	X	X
Check all high-pressure spray nozzles for abnormal spray pattern that indicates a clogged nozzle	X	X	X	X	X	X
Miscellaneous:						
Check the oil in the air compressor (if applicable); top off with 10W-30 Mobile 1 or equivalent		X	X	X	X	X
Inspect settling pit for excessive sludge buildup		X	X	X	X	X
Inspect tire guides and grating for physical damage		X	X	X	X	X
Inspect all photoeyes for damage, misalignment, etc		X	X	X	X	X

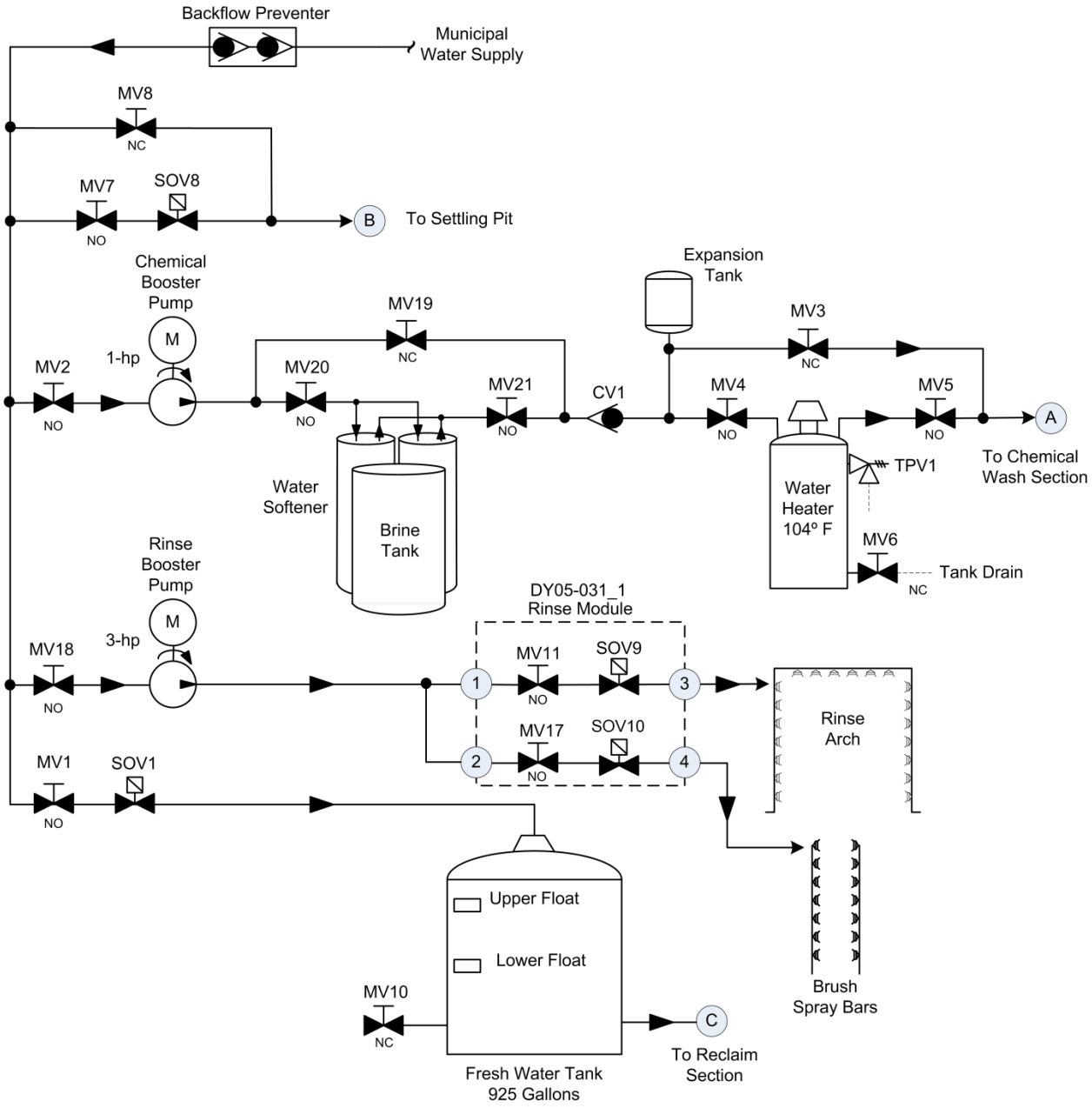


Figure 4- 1 Fresh Water System

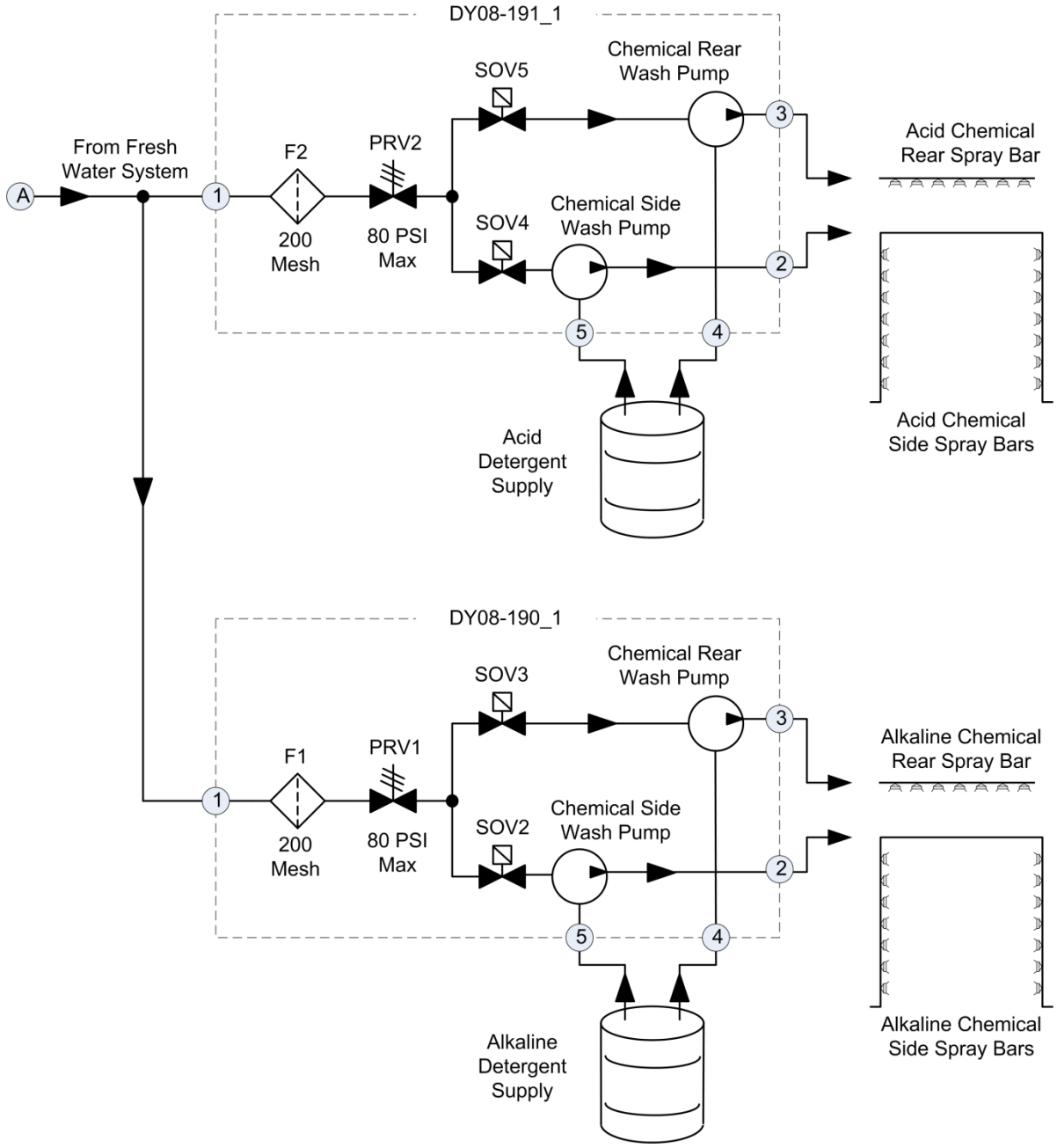


Figure 4- 2 Chemical Wash System

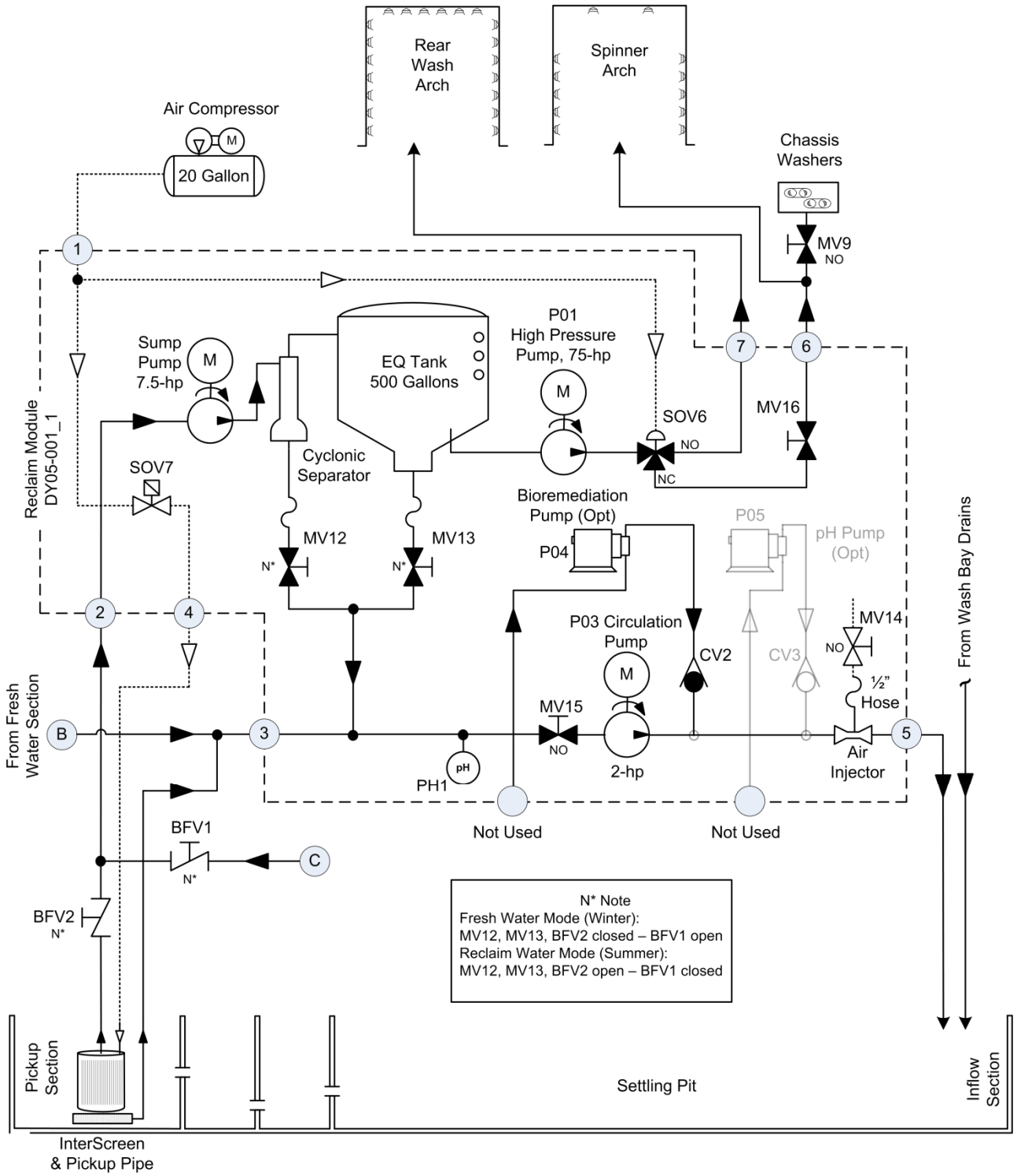


Figure 4- 3 Water Reclaim and High Pressure Wash System

4.1.2 Manual Valve State Chart

For normal operation, the manual valves in the Wash System should be in the following states. Refer to the schematic diagrams in *Section 5: Troubleshooting* to see how the valves are connected in the system.

Table 4- 2 Manual Valve State Chart

Valve	Normal State	Notes
MV1	Open	Connects the Fresh Water Tank to the municipal water supply
MV2	Open	Connects the Chemical Booster Pump to the municipal water supply
MV3	Closed	Open to bypass the water heater (MV4 and MV5 must be closed)
MV4	Open	Connects the water softener output to the water heater
MV5	Open	Connects the water heater output to the Chemical Wash System
MV6	Closed	Provides a drain for the water heater tank
MV7	Open	Open to enable automatic Settling Pit refilling; close to disable auto fill
MV8	Closed	Open to manually refill the Settling Pit; visually monitor this process
MV9	Open	Adjust the opening to suit Chassis Washer pressure and flow without flooding the vehicle engine compartment
MV10	Closed	Provides a drain for the Fresh Water Tank
MV11	Open	Connects the Rinse Booster Pump to the Rinse Arch thru SOV8
MV12	See Notes	Closed for fresh water option (winter); open for reclaim water option (summer)
MV13	See Notes	Closed for fresh water option (winter); open for reclaim water option (summer)
MV14	Open	Provides air flow into the circulation water through the venturi on the EQ Module
MV15	Open	Circulation Pump suction port; close to service the pump
MV16	Open	Adjust the opening to suit pressure and flow to the Spinner Arch from the High Pressure Pump discharge

MV17	Open	Connects the Rinse Booster Pump to the Brush Spray Bars thru SOV9
MV18	Open	Connects the Rinse Booster Pump to the municipal water supply
MV19	Closed	Open to bypass the water softener (MV20 and MV21 must be closed)
MV20	Open	Connects the Chemical Booster Pump to the water softener
MV21	Open	Connects the water softener output to the water heater

4.1.3 High Pressure Pump Service

Note: refer to the manufacturer's information included in Section 8: Appendix for all pump maintenance and service information.

Stuffing Box Packing Adjustment

The high-pressure pump leaks water down its shaft; this is normal. Each end of the shaft is sealed by packing rings held in place by a packing gland. This section of the pump is referred to as the 'stuffing box' and requires regular attention for successful pump service.

The packing rings are held in place by the packing gland. Refer to *Figure 4- 4 High Pressure Pump Cutaway View (typical*). The gland also applies force to the packing rings that determines how effectively they seal around the shaft. The packing should not seal the shaft completely but must be adjusted to allow a few drops per minute of water to escape from the pump. This small amount of water escaping down the pump shaft provides the shaft lubrication and cooling required to keep the shaft temperature in a safe operating range.

Adjust the nuts holding the packing gland against the packing. The farther the nut is rotated in the more the packing rings are compressed, making a tighter seal against the pump shaft. Adjust the gland to allow 2-3 drops of water per minute to escape down the shaft while the pump is running. **Do not allow the pump to run with a dry shaft or pump damage will eventually occur.**

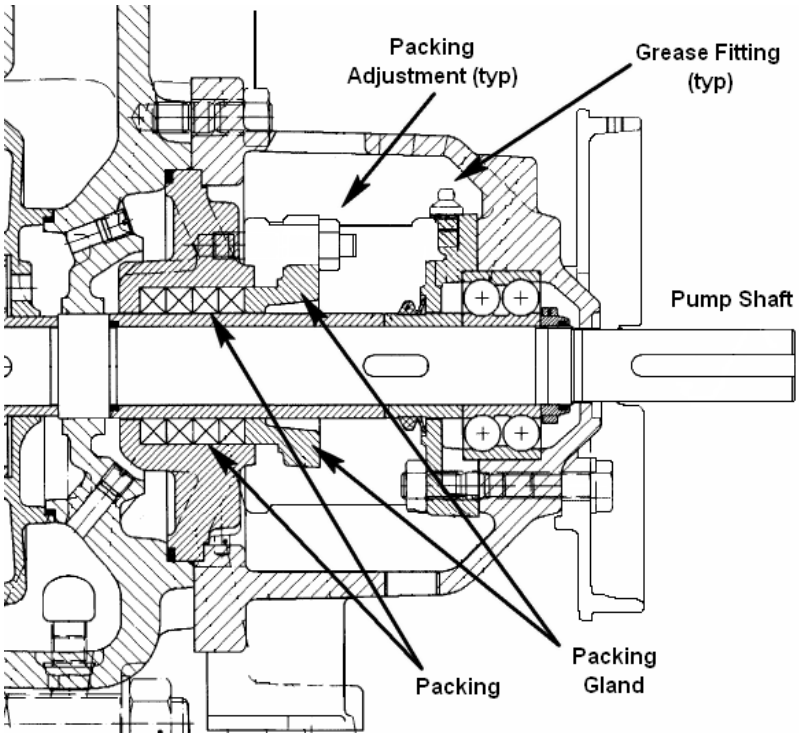


Figure 4- 4 High Pressure Pump Cutaway View (typical)

Bearing Lubrication

Each end of the pump shaft is retained by bearings that require a constant supply of clean, high-quality grease. Refer to *Figure 4- 4 High Pressure Pump Cutaway View (typical)*. Each pump has four grease fittings that require service: two fittings on the motor shaft (front and rear bearing housings) and two fittings on the pump shaft (front and rear bearing housings). Refer to *Figure 4- 4, Figure 4- 8, and Figure 4- 9* for grease fitting locations.

The charts below (*Figure 4- 6 and Figure 4- 7*) give the frequency and quantity of lubrication for the bearings. The pump manufacturer provides the following specification (*Figure 4- 5 Pump Grease Specification*) for the type of grease to use. You should stay with one type of grease once you start lubricating the pumps. If you do change grease, make sure it is compatible with lithium soap grease.

... K2K-20, KP2K-20, etc. as per DIN 51825:
- Lithium soap grease
- NLGI GRADE 2
- Temperature range -20 to 120°C
- Dripping point > 175°C
- Base oil viscosity 70 to 150 mm²/s at 40°C

Figure 4- 5 Pump Grease Specification

Pump Size	Relubrication Intervals in Operating Hours				
	3550 [min^{-1}]	2950 [min^{-1}]	2200 [min^{-1}]	1750 [min^{-1}]	1450 [min^{-1}]
MP/MPA/MPAI 40.2	3800	4300	5500	6000	6500
MP/MPA/MPAI 40.3	3800	4300	5500	6000	6500
MP/MPA/MPAI 65.1	3500	4000	5000	5500	6000
MP/MPA/MPAI 65.2	3500	4000	5000	5500	6000
MP/MPA/MPAI 100.1	3300	3800	4500	5000	5500
MP/MPA/MPAI 100.2	3300	3800	4500	5000	5500
MP/MPA/MPAI 125.1	2500	3300	4300	4800	5000
MP/MPA/MPAI 125.2	2500	3300	4300	4800	5000

Figure 4- 6 High Pressure Pump Lubrication Interval

Pump Size	Grease Quantity	
	Suction Side [cm^3]	Pressure Side [cm^3]
MP/MPA/MPAI 40.2	7,6	12,1
MP/MPA/MPAI 40.3	7,6	12,1
MP/MPA/MPAI 65.1	9,3	15,5
MP/MPA/MPAI 65.2	9,3	15,5
MP/MPA/MPAI 100.1	11,5	23,0
MP/MPA/MPAI 100.2	11,5	23,0
MP/MPA/MPAI 125.1	16,5	33,0
MP/MPA/MPAI 125.2	16,5	33,0

Figure 4- 7 High Pressure Pump Lubrication Quantity

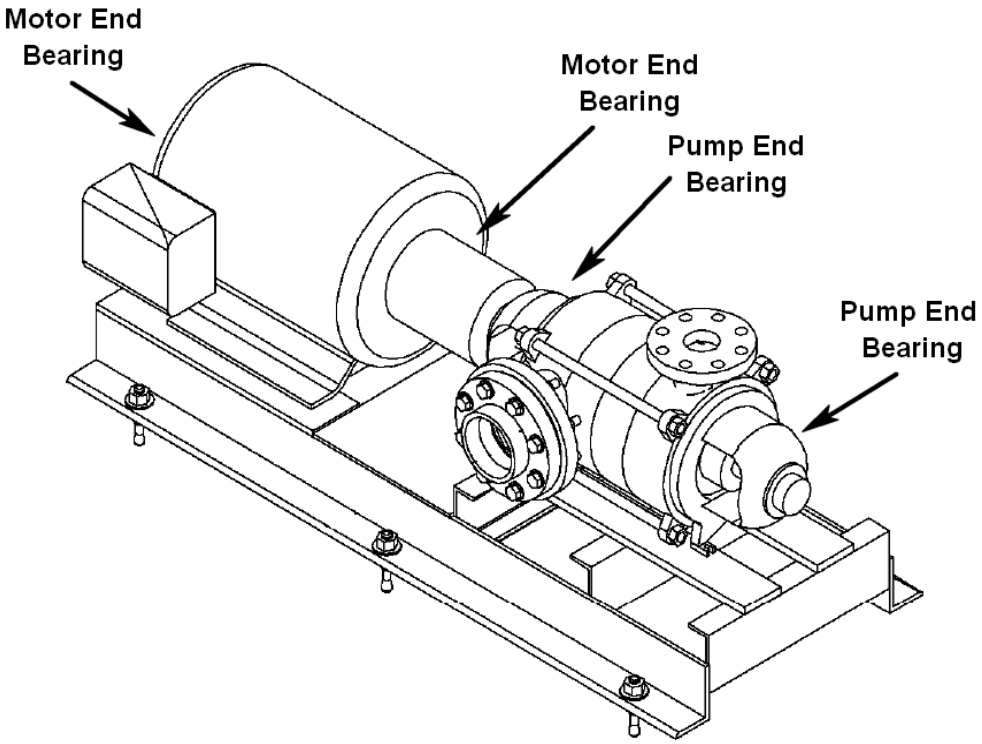


Figure 4- 8 High Pressure Pump Lubrication Points (4)

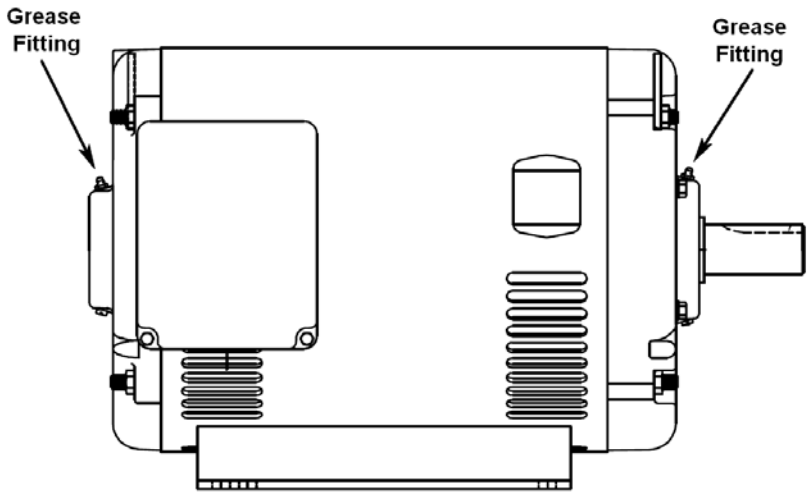


Figure 4- 9 Pump Motor Lube Point Details

4.1.4 Photoeye Service

Overview

The photoeye consists of a transmitter that sends an visible red light beam across the wash lane and a receiver that is actuated by the beam. The receiver electrically changes state (on to off) when the beam is blocked by the vehicle (or any object). The LED indicator on the receiver is ON when the receiver is actuated by the light beam.

The beam from the transmitter spreads into a cone-shaped field, the degree of spread increasing with the distance from the transmitter, the condition of the lens, and the quality of the air between transmitter and receiver. For this reason, the beam should be focused as closely on the center of the receiver as possible. Only the part of the light beam focused from center of transmitter to center of receiver can actuate the receiver electronics. Stray or incident beams do not influence the receiver action.

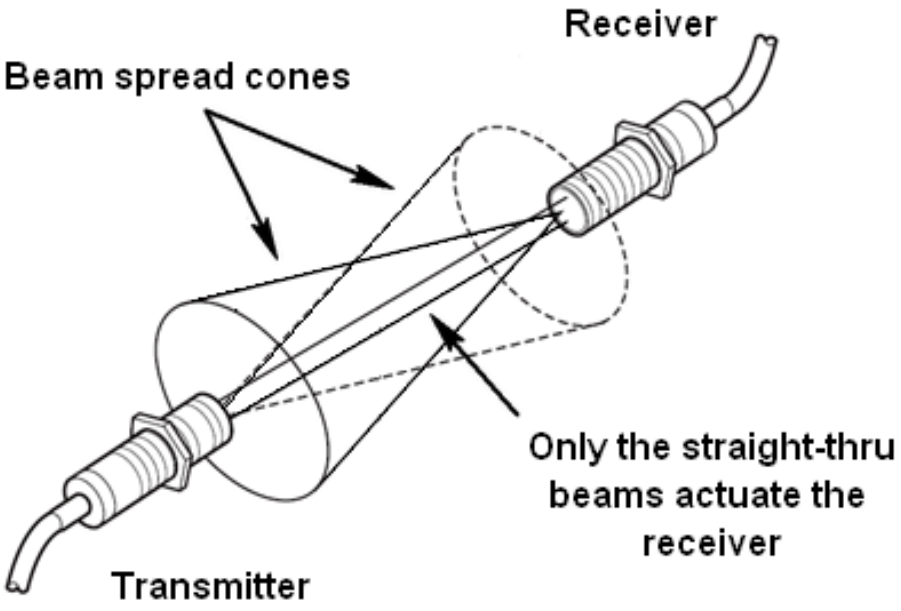


Figure 4- 10 Photoeye Beam Details

Photoeye Lens Cleaning

The lens on each transmitter and receiver pair must be kept clean. Dirty or grease smeared or fogged lens have the effect of diffusing the beam from the transmitter more than usual, reducing the straight-thru beam effectiveness.

1. Clean the lens with a soft, non-linting cloth and a non-streaking glass cleaner. A dirty or streaked lens can disperse the visible light beam.

Photoeye Beam Alignment

The photoeye transmitter/receiver pair must be aligned correctly to control the wash process as the vehicle drives through the Wash Bay. Both the photoeye transmitters and receivers are mounted to enable 3-axis adjustment. Referring to the Figure below, the vertical adjustment is set at the time of equipment installation and should not usually require adjustment.

If the photoeye mounting structure is bumped or otherwise damaged, the beam may become misaligned to where adjustment is necessary. Perform the following steps.

1. Place the Wash System in Standby mode through the Touch Screen Terminal.
2. Secure the Wash Bay against accidental vehicle entry.
3. Loosen the horizontal adjustment hardware and the tilt adjustment hardware on the transmitter to where both may be moved but are not sloppy.
4. Adjust the two axes until the visible red beam is focused on the center of the receiver lens. Slightly tighten both adjustment bolts and verify the alignment, then carefully tighten the hardware fully to secure.
5. Check the alignment by verifying the LED on the receiver is ON with the beam unblocked and turns OFF when the beam is blocked.
6. Clean the transmitter and receiver lens before returning the Wash Bay to service.

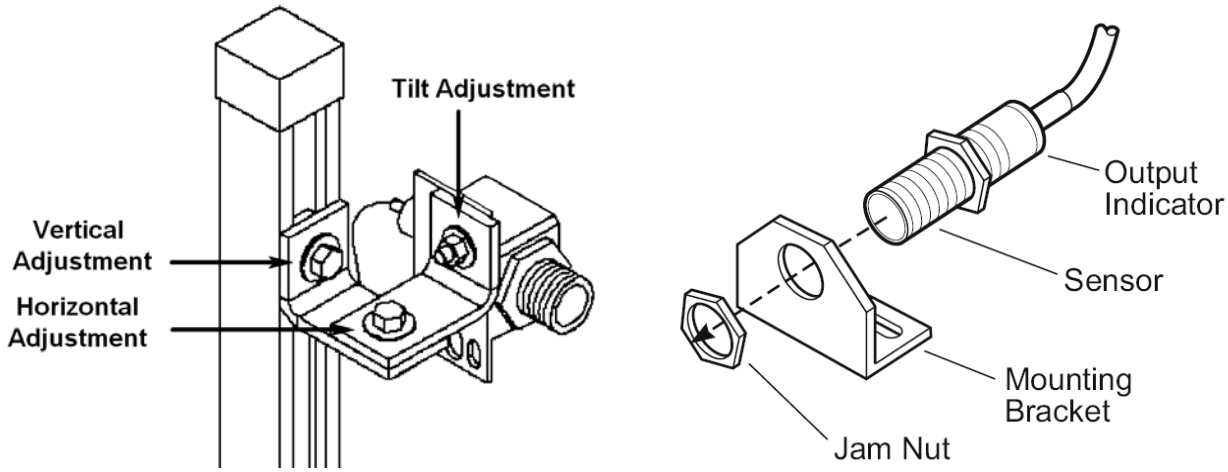


Figure 4- 11 Photoeye Mounting Details

4.1.5 Chemical Supply Check

Overview

Check the chemical supply containers used in the wash process. Fluid level monitoring in these containers is by visual check only. Failure to monitor detergent level may result in compromised Wash System performance or Wash System downtime if the supply container runs out of chemical.

Replace or refill low chemical drums. Refill low chemical containers with approved chemicals of the same type before the drum is empty to avoid Wash System downtime and prevent system performance issues.

Contact InterClean Equipment Company, Inc. for any assistance with purchasing or maintaining chemical supplies. Refer to *Section 1.4.2 How to Contact Us.*

WARNING:	**Follow all safety precautions when working around chemicals used in the Wash System. Refer to *Section 1.1 Safety* for safety information.** **Do not mix different types of chemicals together if you are resupplying an existing chemical drum. Be sure to resupply the drum with the same type of chemical that the drum held originally or replace the entire drum with a new supply (preferred).**

4.1.6 Drain the Water Heater Tank

Over time, sediment may collect in the bottom of the water heater tank. This can be carried in on the unfiltered water from the municipal supply. Shortly after the Wash System installation it is a good idea to drain the water heater tank. Afterwards, drain the tank semi-annually to prevent sediment buildup but this may be adjusted to once a year depending on the quality of your water supply.

1. Connect a hose from manual drain valve MV6 near the bottom of the tank to the nearest floor drain or the drain trench in the Wash Bay.
2. Close the cold water supply valve MV2; leave hot water discharge valve MV5 open to relieve internal pressure.
3. Carefully open the temperature and pressure (T/P) relief valve near the top of the heater tank. Use caution; if there is still pressure inside the tank it may spray water out the T/P valve discharge port. **Hot water may scald**.
4. Slowly open drain valve MV6 and allow the tank to drain until the water runs clear. **Caution: the water draining from the tank will be hot and may scald. Avoid contact with the hot water.**
5. If no or very little sediment was flushed from the tank you may want to adjust the frequency of this preventive maintenance task. The draining frequency depends on the water quality in your area.
6. Close the drain valve MV6 when the water runs clear and remove the drain hose.

4.2 ROUTINE MAINTENANCE

4.2.1 Adjusting the Dosatron Pumps

The Dosatron pumps mix concentrated detergent with hot water to produce the soap solution used in the wash process. The ratio of concentrated detergent to water is adjusted on the pumps and is critical for a quality wash job. The procedure below explains how to make these adjustments.

The Dosatron has a lockable sleeve that rotates around a scale that indicates the percent of chemical solution at the pump discharge port. Water flows into the pump inlet and is mixed with concentrated detergent pulled from the supply barrel. The setting on the pump delivers a consistent concentration (titration) of solution as long as the flow through the pump remains consistent. Changes in fluid pressure will not affect the titration.

The dial on the pump reads in percent but this can be converted into a ratio of chemical to water. Refer to the conversion chart in *Figure 4- 13 Dosatron Concentration Conversion Chart*.

1. **All adjustments must be done by hand only**. Do not use tools on the Dosatron pump adjustment components.
2. Adjustments must be made with no pressure present at the pump.
3. Unscrew the blocking ring ("B" in *Figure 4- 12 Dosatron Pump Adjustment Details*).
4. Rotate the adjusting sleeve either in or out to bring the pointers in the sleeve into line with the desired setting. Refer to *Figure 4- 12 Dosatron Pump Adjustment Details.*
5. Tighten the blocking ring; hand tighten only.

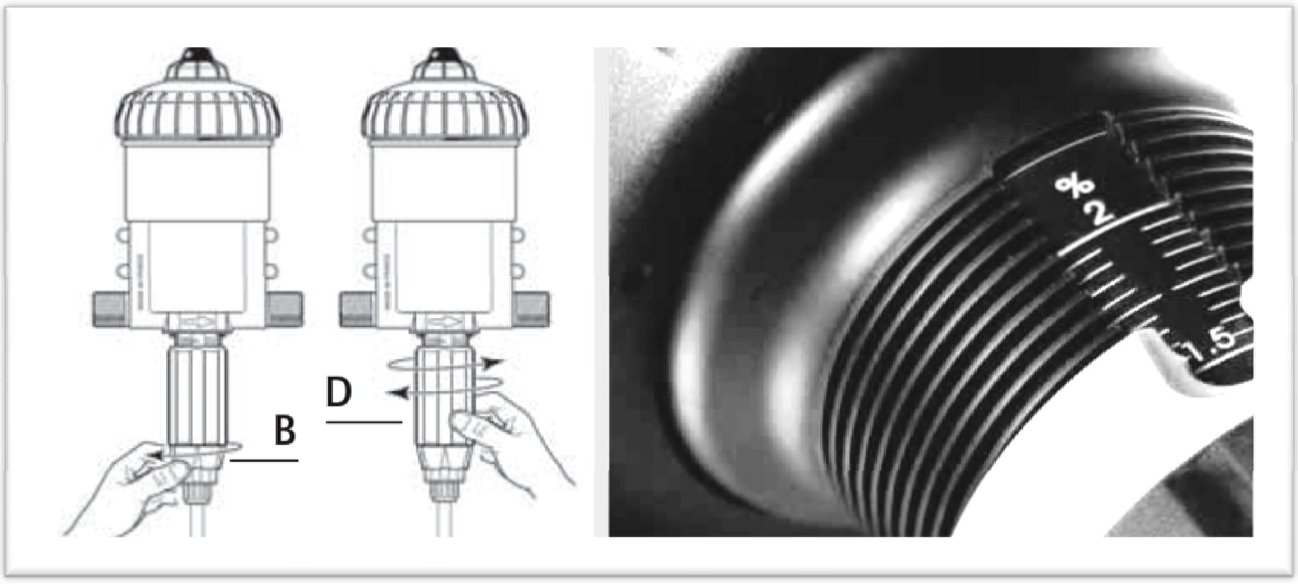
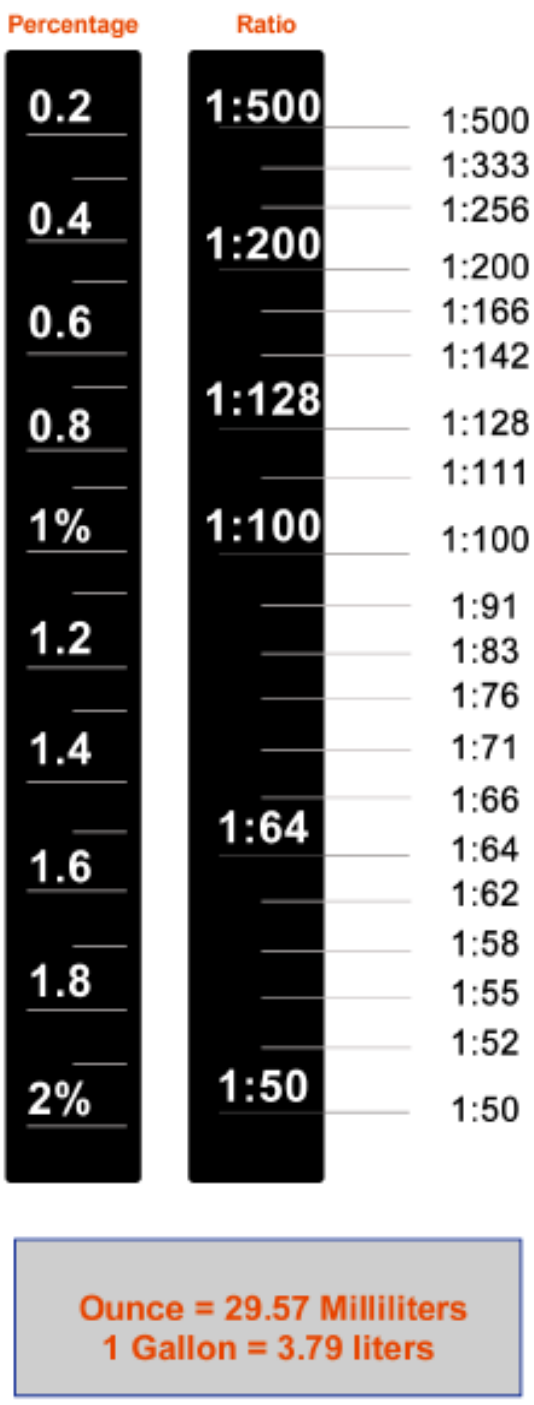


Figure 4- 12 Dosatron Pump Adjustment Details



Percentage	Ratio	Ounces per gallon
10.000 %	1: 10	12.800 oz/gal
5.000 %	1: 20	6.400 oz/gal
4.000 %	1: 25	5.120 oz/gal
3.333 %	1: 30	4.267 oz/gal
3.125 %	1: 32	4.000 oz/gal
3.030 %	1: 33	3.879 oz/gal
2.500 %	1: 40	3.200 oz/gal
2.000 %	1: 50	2.560 oz/gal
1.667 %	1: 60	2.133 oz/gal
1.429 %	1: 70	1.829 oz/gal
1.250 %	1: 80	1.600 oz/gal
1.111 %	1: 90	1.422 oz/gal
1.000 %	1: 100	1.280 oz/gal
0.781 %	1: 128	1.000 oz/gal
0.667 %	1: 150	0.853 oz/gal
0.571 %	1: 175	0.731 oz/gal
0.526 %	1: 190	0.674 oz/gal
0.500 %	1: 200	0.640 oz/gal
0.391 %	1: 256	0.500 oz/gal
0.333 %	1: 300	0.427 oz/gal
0.313 %	1: 320	0.400 oz/gal
0.286 %	1: 350	0.366 oz/gal
0.250 %	1: 400	0.320 oz/gal
0.200 %	1: 500	0.256 oz/gal
0.195 %	1: 512	0.250 oz/gal
0.167 %	1: 600	0.213 oz/gal
0.156 %	1: 640	0.200 oz/gal
0.143 %	1: 700	0.183 oz/gal
0.133 %	1: 750	0.171 oz/gal
0.125 %	1: 800	0.160 oz/gal
0.111 %	1: 900	0.142 oz/gal
0.100 %	1: 1000	0.128 oz/gal
0.080 %	1: 1250	0.102 oz/gal
0.067 %	1: 1500	0.085 oz/gal
0.050 %	1: 2000	0.064 oz/gal
0.033 %	1: 3000	0.043 oz/gal

Figure 4- 13 Dosatron Concentration Conversion Chart

4.2.2 Resetting / Adjusting the Motor Overloads

The pump motors in this Wash System are protected against fire due to excessive current draw by current-interrupting overload relays. The overloads will open the 3-phase circuit if an over-current condition is present for a period of time (or if the three phases become significantly unbalanced). If this happens, the motor is inoperative but the motor and equipment are protected.

The overload relay should normally be ON. In this state, the 3-phase power is connected through the overload module to the pump motor and the relay continually monitors the amount of current the motor is drawing. Excessive current, that is current above the setpoint of the module, TRIPS the overload and shuts down the motor. A TRIPPED LED indicator on the overload module (Detail 5) indicates this condition.

The Wash System uses auxiliary contacts on the relay to monitor the status of each pump motor. One or more of the contacts are wired back to an input on an I/O Base and monitored by the Controller. The Controller shuts down the Wash System if an overload condition occurs.

The TRIP setpoint on the relay is adjustable (Detail 1 in the Figure below) and is set for normal operation when the Wash System is installed. If a motor repeatedly trips the overload it indicates an abnormal condition that needs to be corrected. You should not arbitrarily increase the TRIP setpoint to mask an recurring over-current condition or you may be defeating the purpose of the protective device. Occasional tripping is not unusual and slightly increasing the TRIP setpoint should end nuisance tripping. Rotate the adjustment dial (Detail 1) slightly clockwise to increase the setting.

To return a TRIPPED overload relay to service press the RESET button (Detail 4). Press the STOP button (Detail 2) to turn the overload OFF and disconnect the motor from power. The TEST button lets you test the overload relay's ability to TRIP on an overcurrent condition. Press and hold the TEST button until the relay trips.

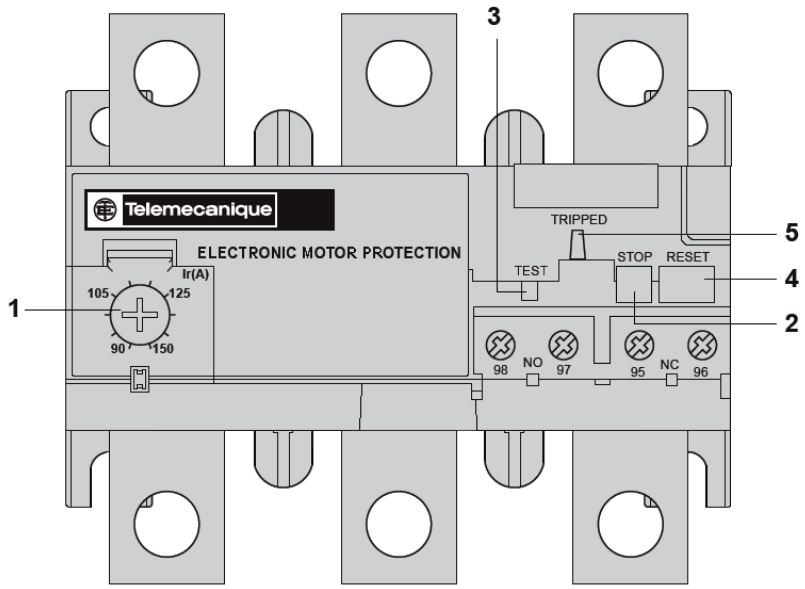


Figure 2- 95 Pump Motor Overload Relay (typical)

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5 TROUBLESHOOTING

Section 5 Table of Contents

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5.1 OVERVIEW

This section is a guide to troubleshooting problems that may occur with the Wash System. These guidelines offer a starting point for locating and fixing problems. Use the electrical and hydraulic control prints along with the information in this section if problems occur. The prints are included in *Section 7: Electrical and Plumbing Diagrams* in this manual.

Your most valuable help for troubleshooting problems with the Wash System will be to contact InterClean Equipment, Inc. Draw upon our years of experience for a quick resolution to Wash System problems. Our contact information is below.

Be sure to follow all safety rules when working on the Wash System to protect yourself, your co-workers, and the equipment. Refer to *Section 1.1 Safety* for general guidelines concerning workplace safety.

WARNINGS:	**Do not enter the Wash Bay until the area has been secured to prevent vehicles entering the Wash Bay while service is being performed. Failure to heed this warning may result in severe or fatal personal injury.** **All electrical troubleshooting and repair should be performed by trained and qualified electricians. Lethal voltages are present around the Wash System.**

Call or email the Wash System manufacturer, InterClean Equipment, Inc., regarding any service or repair related information you may require. We advise you to contact our trained personnel before starting any repairs or making any Wash System adjustments through the Touch Screen Terminal.

Contact Information

InterClean Equipment, Inc.	3939 Bestech Drive	Ypsilanti, MI, USA 48197
Phone 734.975.2967	FAX: 734.975.1646	Hours: 8:00 AM to 5:00 PM
techsupp@interclean.com	www.interclean.com	sales@interclean.com

5.2 SYSTEM HYDRAULIC TROUBLESHOOTING SCHEMATICS

5.2.1 Fresh Water Section Hydraulic Schematic

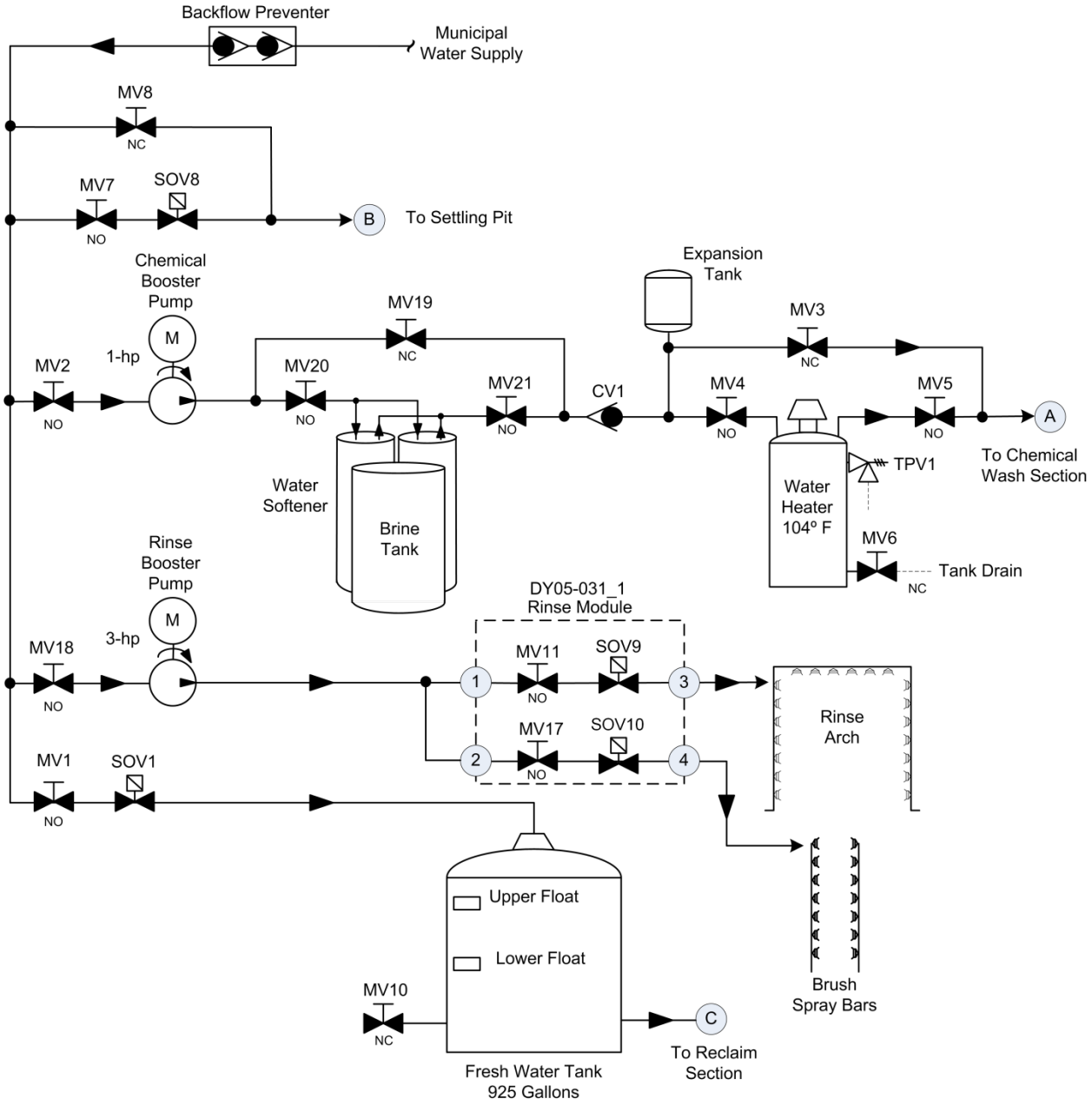

Figure 5- 1 Fresh Water Section Hydraulic Schematic

5.2.2 Chemical Wash Section Hydraulic Schematic

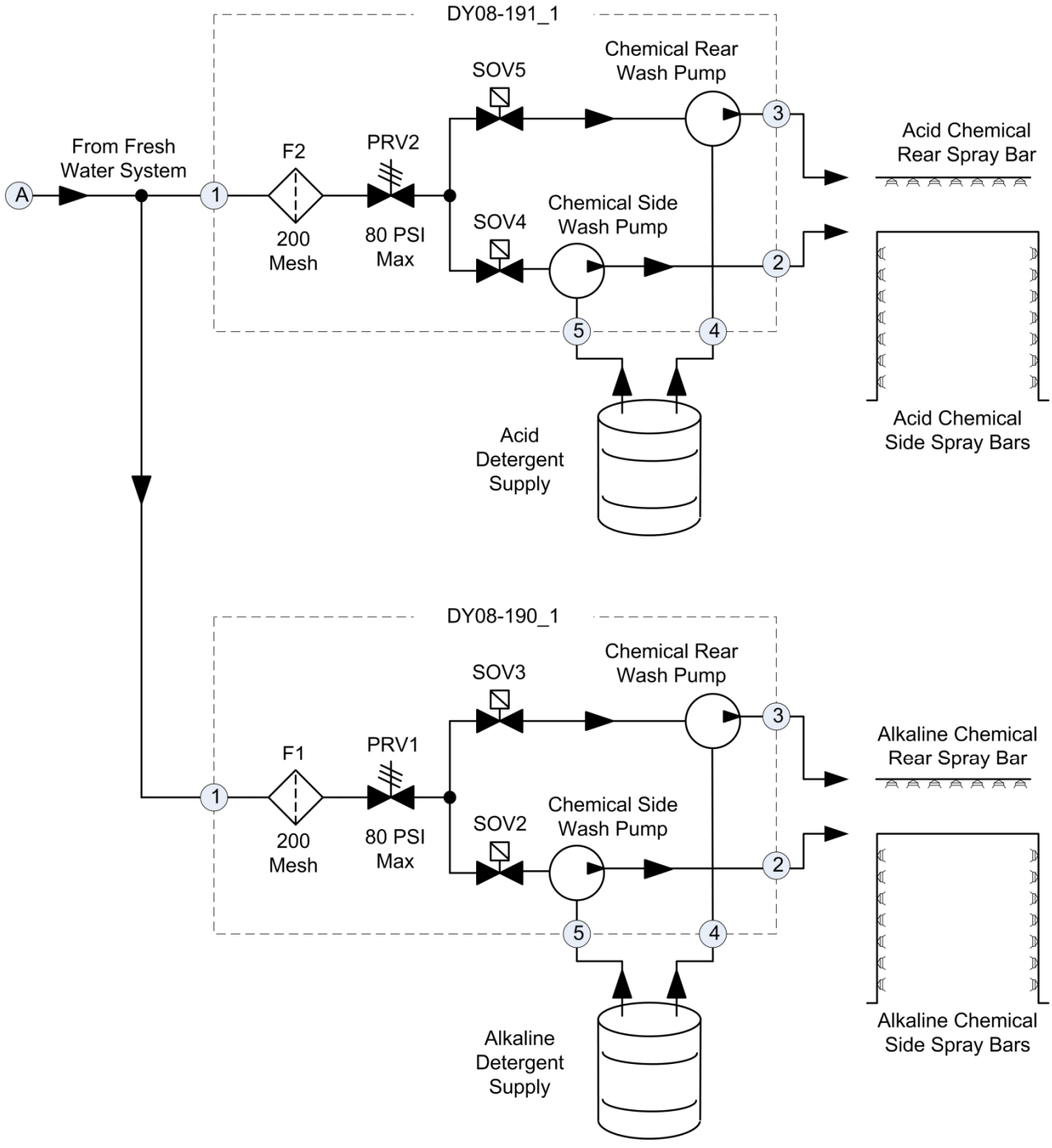

Figure 5- 2 Chemical Wash Section Hydraulic Schematic

5.2.3 Water Reclaim and High Pressure Section Hydraulic Schematic

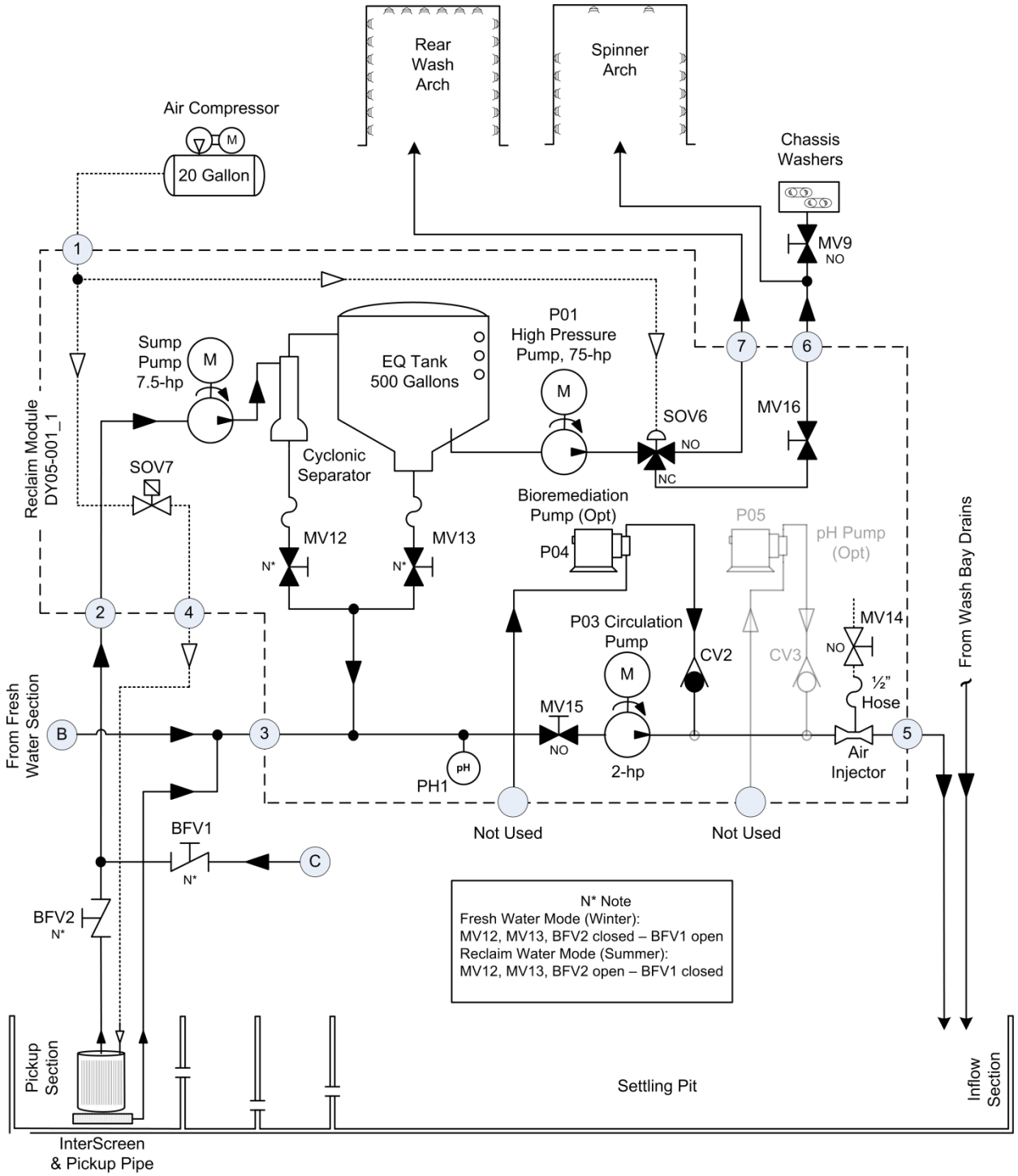

Figure 5- 3 Water Reclaim and High Pressure Section Hydraulic Schematic

5.3 PUMP ELECTRICAL TROUBLESHOOTING SCHEMATICS

Refer to the following electrical schematics when reading the troubleshooting sections below. These figures break down the electrical system according to their functional sections.

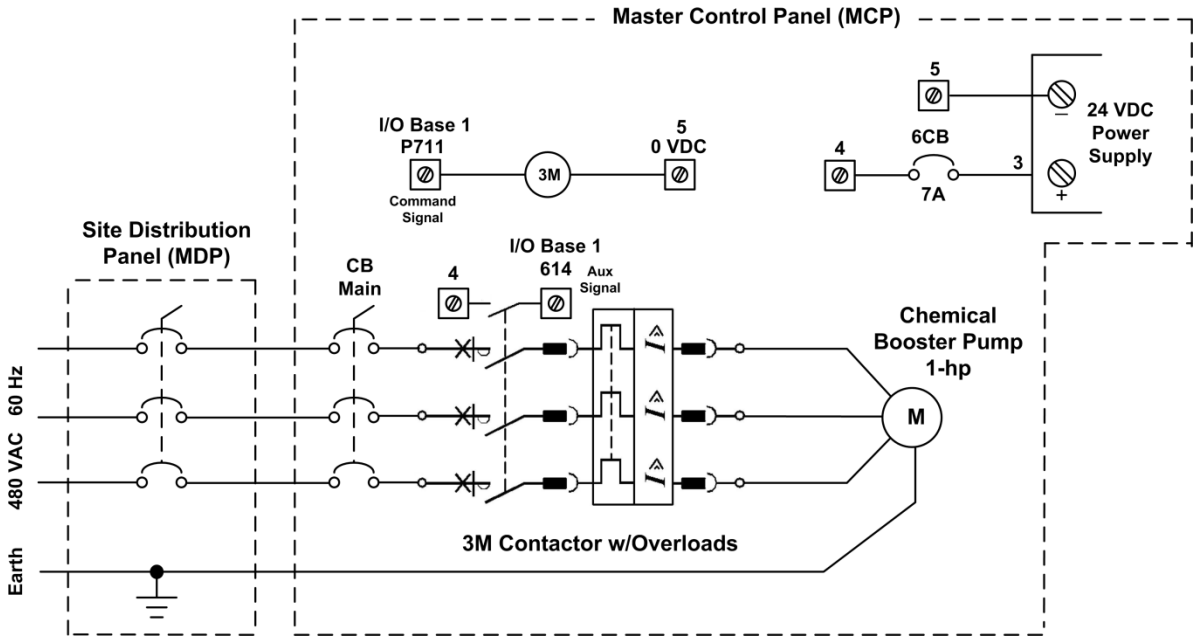

Figure 5- 4 Chemical Booster Pump Circuit Electrical Schematic

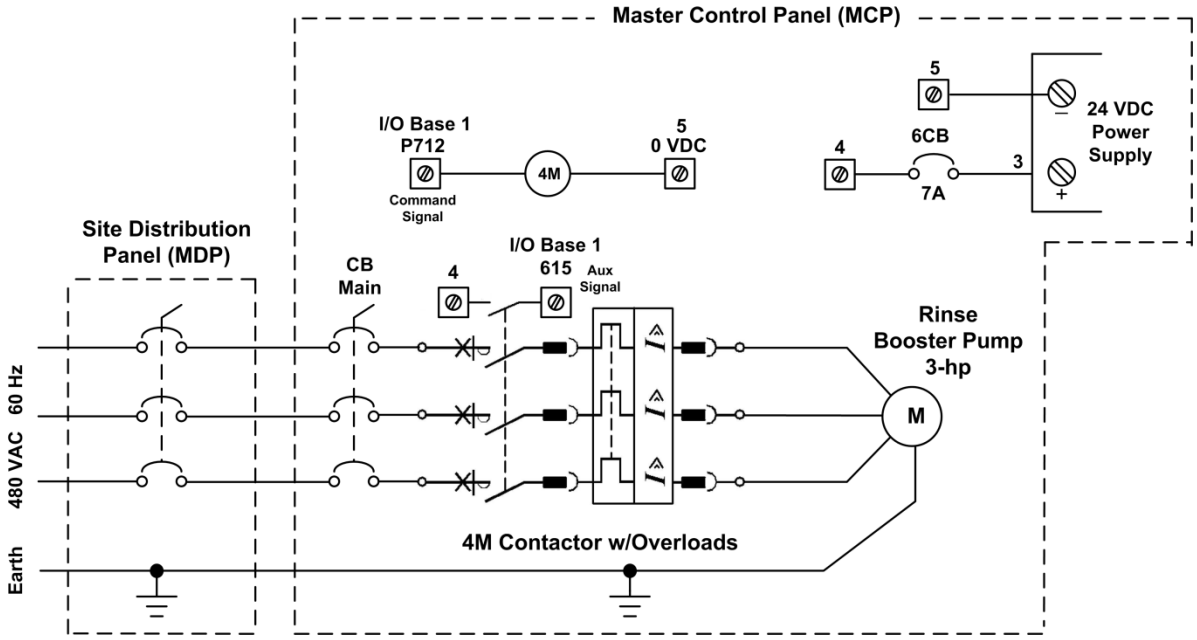

Figure 5- 5 Rinse Booster Pump Circuit Electrical Schematic

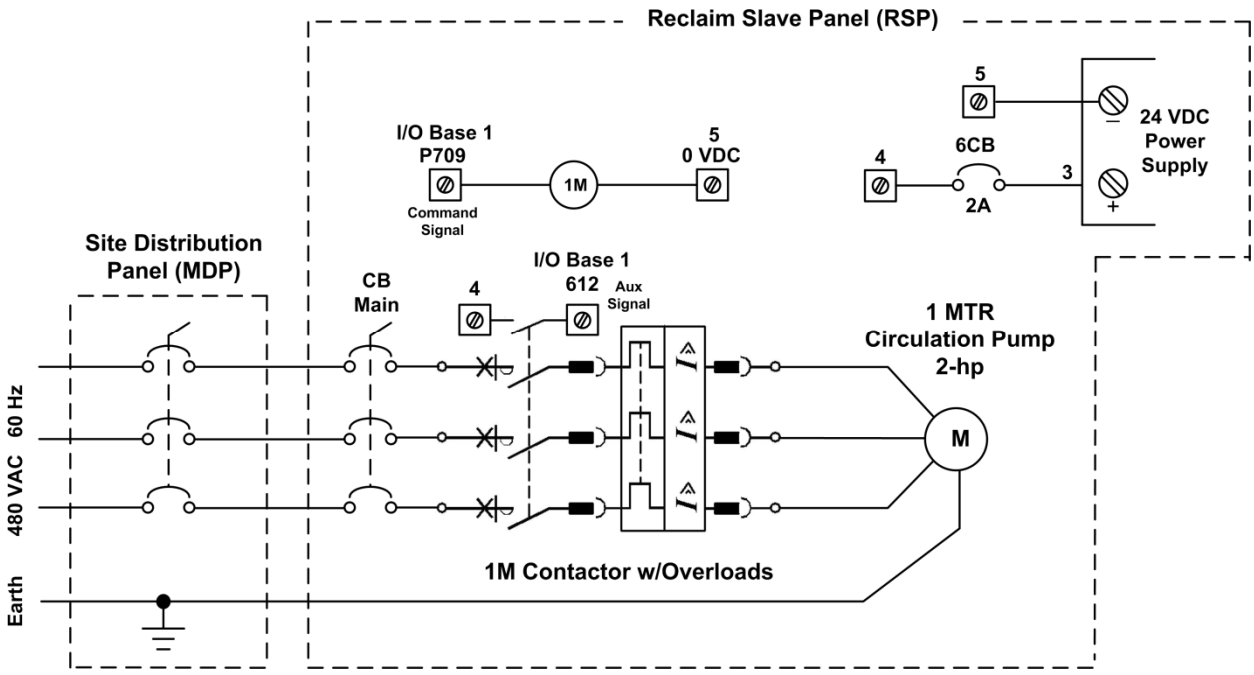

Figure 5- 6 Circulation Pump Circuit Electrical Schematic

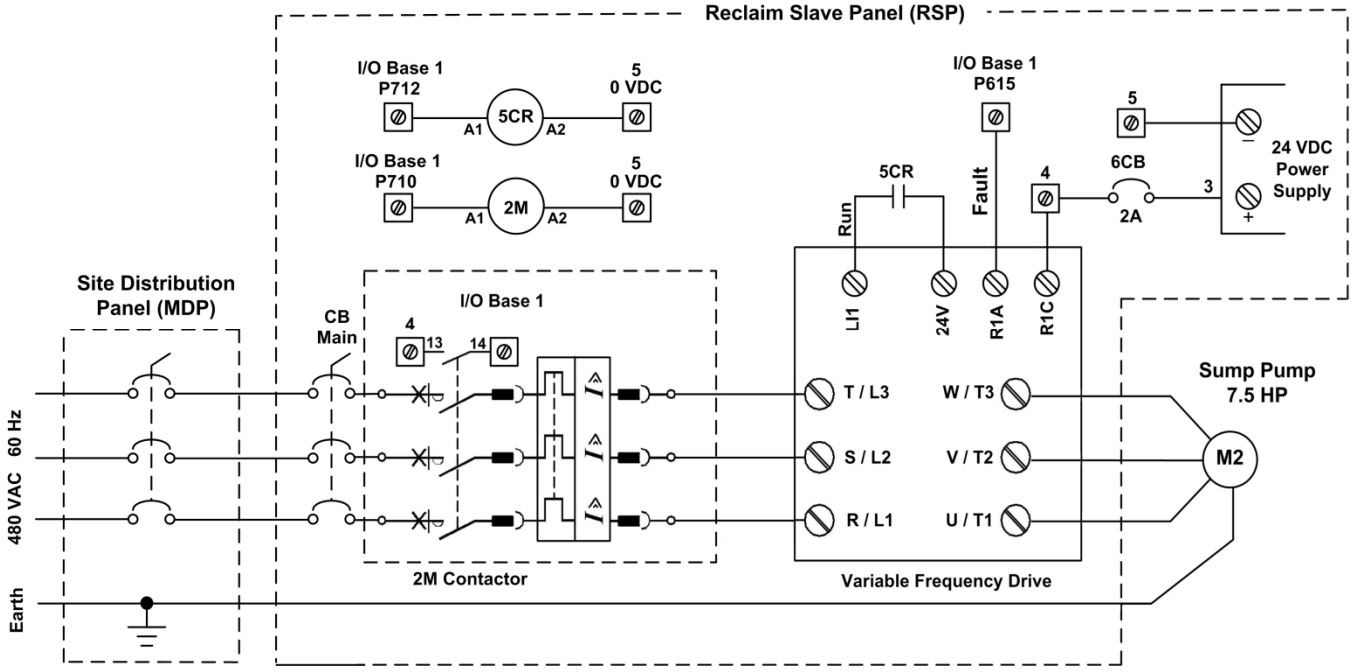

Figure 5- 7 Sump Pump Circuit Electrical Schematic

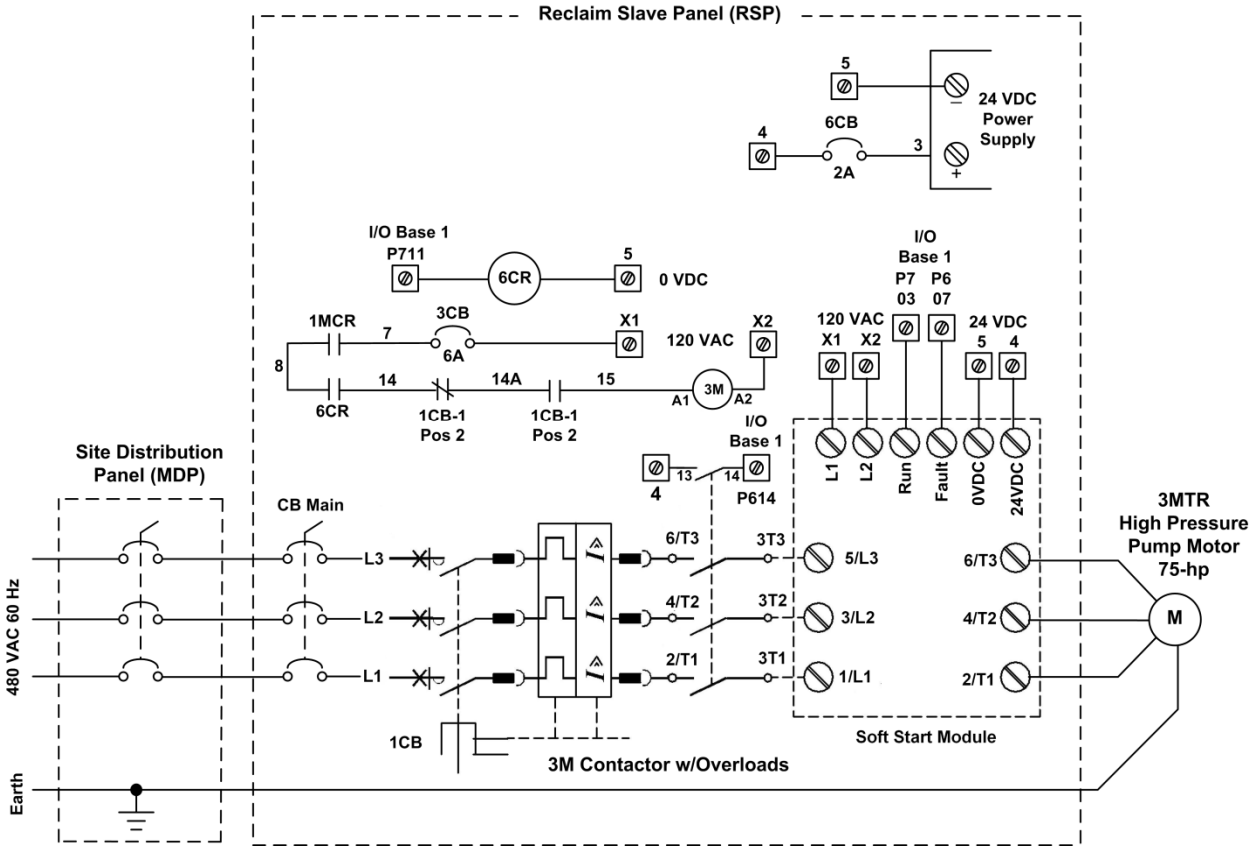

Figure 5- 8 High Pressure Pump Circuit Electrical Schematic

5.4 PUMP TROUBLESHOOTING

5.4.1 Chemical Booster Pump Troubleshooting (Goulds HSC10B)

Overview: This 1-hp pump supplies fresh water directly to the water softener, water heater, and on to the Chemical Wash System.

The System Controller turns on the pump with terminal P711 on I/O Base 1 in the MCP. This turns on motor contactor 3M that connects the pump to 3-phase power.

The 3-phase power is applied to the motor through overload contacts that open if the motor draws excessive current for a time or if there is a short to ground. An auxiliary feedback signal from the overload module is wired to input terminal P614 on I/O Base 1 in the MCP.

Refer to *Figure 5- 1 Fresh Water Section Hydraulic Schematic* and *Figure 5- 4 Chemical Booster Pump Circuit Electrical* Schematic.

Table 5- 1: Chemical Booster Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Motor starter 3M in the Master Control Panel is OFF.	Turn the motor starter switch to ON.
	Motor starter 3M overload module in the Master Control Panel is TRIPPED.	Investigate and correct the cause of a tripped overload; reset the overload.
	Power wiring damaged.	Verify the wiring and connections between the MCP and the pump motor.
Pump loses prime.	Manual valve MV2 closed.	Open the hand valve completely.

5.4.2 Rinse Booster Pump Troubleshooting (Goulds 3BF1H2A0H)

Overview: This 3-hp pump supplies fresh water directly to the Rinse Arch and to the Chemical Wash Section through the water softener and water heater.

The System Controller turns on the pump with terminal P712 on I/O Base 1 in the MCP. This turns on motor contactor 4M that connects the pump to 3-phase power.

The 3-phase power is applied to the motor through overload contacts that open if the motor draws excessive current for a time or if there is a short to ground. An auxiliary feedback signal from the overload module is wired to input terminal P615 on I/O Base 1 in the MCP.

Refer to *Figure 5- 1 Fresh Water Section Hydraulic Schematic* and *Figure 5- 5 Rinse Booster Pump Circuit Electrical Schematic.*

Table 5- 2: Rinse Booster Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Motor starter 4M in the Master Control Panel is OFF.	Turn the motor starter switch to ON.
	Motor starter 4M overload module in the Master Control Panel is TRIPPED.	Investigate and correct the cause of a tripped overload; reset the overload.
	Power wiring damaged.	Verify the wiring and connections between the MCP and the pump motor.
Pump loses prime.	Manual valve MV2 closed.	Open the hand valve completely.

5.4.3 Acid Chemical Side Wash Pump Troubleshooting (Dosatron D25RE2VFPII)

Overview: This chemical pump injects concentrated acid-based detergent into the hot water pumped out to Acid Chemical Wash Arch side spray bars. The pump operates from the water flowing through it; there is no electrical power to the Dosatron pump.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 3 Acid Chemical Side Wash Injection Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Solenoid valve SOV4 not operating.	Check all electrical wiring and connections; replace defective solenoid or entire valve.
	Pressure relief valve adjustment.	Verify PRV2 is adjusted correctly; maximum input pressure to the Acid chemical injection pump (Dosatron) is 80 PSI; do not exceed.
	Filter F2 clogged.	Troubleshoot/clean the filter screen.
No suction of concentrate; loss of prime.	No suction in the detergent suction tube.	Troubleshoot the tube; check for air leaks in the tube and fittings; check for blocked tube; check for damaged foot valve in the supply tank.
	Detergent supply low or empty.	Replace detergent supply.
Refer to the manufacture's information included in *Appendix* of this manual for complete troubleshooting and repair information for the Dosatron pump.		

CAUTION:	**Refer to *Section 1.5 Safety* for chemical safety information. Be sure to wear protective gloves, face shield, and suitable clothing when working with the chemicals.**

5.4.4 Acid Chemical Rear Wash Pump Troubleshooting (Dosatron D25RE2VFPII)

Overview: This pump injects concentrated acid-based detergent into the hot water pumped out to Acid Chemical Wash Arch rear spray bar. The pump operates from the water flowing through it; there is no electrical power to this Dosatron pump.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 4 Acid Chemical Rear Wash Injection Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Solenoid valve SOV5 not operating.	Check all electrical wiring and connections; replace defective solenoid or entire valve.
	Pressure relief valve adjustment.	Verify PRV2 is adjusted correctly; maximum input pressure to the Acid chemical injection pump (Dosatron) is 80 PSI; do not exceed.
	Filter F2 clogged.	Troubleshoot/clean the filter screen.
No suction of concentrate; loss of prime.	No suction in the detergent suction tube.	Troubleshoot the tube; check for air leaks in the tube and fittings; check for blocked tube; check for damaged foot valve in the supply tank.
	Detergent supply low or empty.	Replace detergent supply.
Refer to the manufacture's information included in *Appendix* of this manual for complete troubleshooting and repair information for the Dosatron pump.		

CAUTION:	**Refer to *Section 1.5 Safety* for chemical safety information. Be sure to wear protective gloves, face shield, and suitable clothing when working with the chemicals.**

5.4.5 Alkaline Chemical Side Wash Pump Troubleshooting (Dosatron D25RE5AFPII)

Overview: This chemical pump injects concentrated alkaline-based detergent into the hot water pumped out to Alkaline Chemical Wash Arch side spray bars. The pump operates from the water flowing through it; there is no electrical power to the Dosatron pump.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 5 Alkaline Chemical Side Wash Injection Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Solenoid valve SOV2 not operating.	Check all electrical wiring and connections; replace defective solenoid or entire valve.
	Pressure relief valve adjustment.	Verify PRV1 is adjusted correctly; maximum input pressure to the Alkaline chemical injection pump (Dosatron) is 80 PSI; do not exceed.
	Filter F1 clogged.	Troubleshoot/clean the filter screen.
No suction of concentrate; loss of prime.	No suction in the detergent suction tube.	Troubleshoot the tube; check for air leaks in the tube and fittings; check for blocked tube; check for damaged foot valve in the supply tank.
	Detergent supply low or empty.	Replace detergent supply.
Refer to the manufacture's information included in *Appendix* of this manual for complete troubleshooting and repair information for the Dosatron pump.		

CAUTION:	**Refer to *Section 1.5 Safety* for chemical safety information. Be sure to wear protective gloves, face shield, and suitable clothing when working with the chemicals.**

5.4.6 Alkaline Chemical Rear Wash Pump Troubleshooting (Dosatron D25RE4AFPII)

Overview: This pump injects concentrated alkaline-based detergent into the hot water pumped out to Alkaline Chemical Wash Arch rear spray bar. The pump operates from the water flowing through it; there is no electrical power to this Dosatron pump.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 6 Alkaline Chemical Rear Wash Injection Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Solenoid valve SOV3 not operating.	Check all electrical wiring and connections; replace defective solenoid or entire valve.
	Pressure relief valve adjustment.	Verify PRV1 is adjusted correctly; maximum input pressure to the Alkaline chemical injection pump (Dosatron) is 80 PSI; do not exceed.
	Filter F1 clogged.	Troubleshoot/clean the filter screen.
No suction of concentrate; loss of prime.	No suction in the detergent suction tube.	Troubleshoot the tube; check for air leaks in the tube and fittings; check for blocked tube; check for damaged foot valve in the supply tank.
	Detergent supply low or empty.	Replace detergent supply.
Refer to the manufacture's information included in *Appendix* of this manual for complete troubleshooting and repair information for the Dosatron pump.		

CAUTION:	**Refer to *Section 1.5 Safety* for chemical safety information. Be sure to wear protective gloves, face shield, and suitable clothing when working with the chemicals.**

5.4.7 Circulation Pump Troubleshooting (AMT 282B-95)

Overview: This pump circulates the water from the Pickup Pit back to the primary side to keep the Pit water agitated and aerated. This circulation process also removes sediments from the sumps of the Cyclonic Separator and 500-gallon cone-bottom Tank. Refer to the pump manufacturer's information included in *Section 8: Appendix*.

The pump is controlled by the System Controller through motor contactor 1M located in Reclaim Slave Panel (RSP). The contactor is controlled through output terminal P709 on I/O Base 1 located in the same panel. The 3-phase power is applied through an overload module that interrupts power to the motor if there is a short circuit or the motor draws excessive current for a period of time. The overload module sends an auxiliary feedback signal to the System Controller through input terminal P612 on I/O Base 1 located in the RSP.

Refer to *Figure 5- 6 Circulation Pump Circuit Electrical Schematic.*

Table 5- 7 Circulation Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Motor contactor 1M in the Reclaim Slave Panel (RSP) is OFF.	Turn the motor contactor switch to ON.
	Motor contactor 1M overload module in the Reclaim Slave Panel is TRIPPED.	Investigate and correct the cause of a tripped overload; reset the overload.
	Power wiring damaged.	Verify the wiring and connections between the RSP and the pump motor.
	Communication wiring damage or disconnected.	Verify the communication wiring between the Master Control Panel and the Reclaim Slave Panel.
Pump loses prime.	Low water level in the Pickup Pit.	Troubleshoot the low water condition. The Pickup Pit is supplied from the Settling Pits and also through two solenoid valves that flow fresh water into the Settling Pits when they are low.
		Verify the operation of the lower Pickup Pit float switch.
	Intake pipe in the Pickup Pit is clogged.	Clear all debris from the intake pipe and the InterScreen filter.

5.4.8 Sump Pump Troubleshooting (AMT 2876-K5)

Overview: The Sump Pump pulls water from the Pickup Pit through an InterScreen filter and pumps it through the Cyclonic Separator where sediments are moved and into the 500-gallon cone-bottom tank.

The pump is controlled by the System Controller through motor contactor 2M located in Reclaim Slave Panel (RSP). The contactor is controlled through output terminal P710 on I/O Base 1 located in the same panel. The 3-phase power is applied through an overload module that interrupts power to the motor if there is a short circuit or the motor draws excessive current for a period of time.

The 3-phase power from the overload module is controlled by a Altivar 31® variable-frequency drive (VFD). The drive controls the speed of the Sump Pump motor according to parameters programmed into its controls. Programming and operation information on the VFD is included in *Section 8: Appendix.*

The System Controller turns on the VFD through a RUN signal from output terminal P712 on I/O Base 1 and contact relay 5CR located in the Reclaim Slave Panel (RSP). The VFD sends a DRIVE OK signal back to the computer through input terminal P615 on the same I/O Base.

Both the pump and variable speed drive manuals are included in *Section 8: Appendix.*

Refer to *Figure 5- 7 Sump Pump Circuit Electrical Schematic.*

Table 5- 8 Sump Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Motor contactor 2M in the Reclaim Slave Panel (RSP) is OFF.	Turn the motor contactor switch to ON.
	Motor starter 2M overload module in Reclaim Slave Panel is TRIPPED.	Investigate and correct the cause of a tripped overload; reset the overload.
	Power wiring damaged.	Verify the wiring and connections between the RSP and the pump motor and the variable speed drive.
	Communication wiring damage or disconnected.	Verify the communication wiring between the Master Control Panel and the Reclaim Slave Panel.
	Variable Frequency Drive (VFD) not running. Refer to the manufacturer's information in *Section 8: Appendix* for additional troubleshooting information.	Check the operation of relay 5CR in the Reclaim Slave Panel. This provides the RUN signal for the VFD when energized.

Pump loses prime.	Low water level in the Pickup Pit.	Troubleshoot the low water condition. The Pickup Pit is supplied from the two Settling Pits and also through two solenoid valves that flow fresh water into the Settling Pits when they are low.
		Verify the operation of the lower Pickup Pit float switch.
	InterScreen filter in the Pickup Pit is clogged.	Clear all debris from the InterScreen.
		Verify the InterScreen is being blasted with compressed air every 5th wash cycle.
		Verify the operation of solenoid valve SOV7 that connects the InterScreen to compressed air in the Reclaim Module.
		Verify the operation and settings on the Wash System's air compressors.

5.4.9 High Pressure Pump Troubleshooting (Goulds MP65.2/3-SB111-75HP)

Overview: This 75-hp pump moves reclaimed water from the 500-gallon cone-bottom Tank to the Rear Wash Arch, Spinner Arch, and Chassis Washer. Refer to the pump manufacturer's information included in *Section 8: Appendix* for complete pump operation and maintenance information.

The pump is controlled by the System Controller through motor contactor 3M located in Reclaim Slave Panel (RSP). The contactor is controlled through output terminal P711 on I/O Base 1 located in the same panel. The 3-phase power is applied through an overload module that interrupts power to the motor if there is a short circuit or the motor draws excessive current for a period of time. The 3-phase power is then applied to the pump motor through a Soft Start Module that applies reduced power to the motor for several line cycles, then gradually ramps up to full line power. Information on troubleshooting the Soft Start module is located in the manufacturer's information in *Section 8: Appendix.*

The System Controller supplies a RUN signal to the Soft Start module through output terminal P703 on I/O Base 1 located in Reclaim Slave Panel (RSP). The module sends a FAULT signal back to the wash computer through input terminal P607 if it detects a short circuit, overcurrent, or other problem with the power applied to the pump motor.

Refer to *Figure 5- 8 High Pressure Pump Circuit Electrical Schematic.*

Table 5- 9: High Pressure Pump Troubleshooting

Problem	Check This	Do This
Pump does not run.	Motor starter 3M in Reclaim Slave Panel 1 is turned OFF.	Turn the motor starter switch to ON.
	Motor overloads 3M in Reclaim Slave Panel are OFF or TRIPPED.	Reset the overloads and investigate the cause of the overcurrent condition.
	The CB Main or 1CB circuit breaker in the RSP is OFF or TRIPPED.	Investigate and correct the cause of a tripped circuit breaker; reset the circuit breakers. CB Main is used as the Reclaim Slave Panel disconnect switch. Make sure it is ON.
	EQ Tank Low Level float switch defective.	The high-pressure pump will not run if the EQ1 Tank Low Level float switch indicates a low water level. Verify the switch operation and replace defective switch or wiring. The switch is wired to input terminal P603 on I/O Base 1 in the RSP.

	Power wiring damaged.	Verify all power wiring connections from the Main Distribution Panel to the pump motor.
	Communication wiring damaged.	Verify all communication wiring between the Master Control Panel and the Reclaim Slave Panel.
Pump loses prime, cavitates.	Low water level in the 500-gallon EQ tank.	Check the low level float switch in the EQ Tank – it should prevent the High Pressure Pump from running if the water level is low. Replace a defective switch or wiring. Check for plumbing leaks between the EQ Tank and the High Pressure Pump.

5.5 TANK TROUBLESHOOTING

5.5.1 Fresh Water Tank Troubleshooting

Overview: This tank supplies fresh water to the Overhead Rinse Arch and also to all the high pressure arches when the Wash System is configured for winter mode (fresh water mode). The tank is refilled automatically by the wash computer when the tank upper float switch closes. The computer turns on solenoid valve SOV1 to fill the tank from the municipal water supply.

Refer to *Figure 5- 1 Fresh Water Section Hydraulic Schematic*.

Table 5- 10 Fresh Water Tank Troubleshooting

Problem	Check This	Do This
Low water level in the tank.	Manual valve MV1 closed.	Open MV1 completely.
	Solenoid valve SOV1 not operating.	Replace a defective solenoid valve or wiring. The valve is wired to output terminal P701 in I/O Base 1 located in the Master Control Panel.
	Tank upper float switch is not operating.	Verify the operation of the Tank High Level float switch. The switch is closed when the water level is low and open when the water level reaches the float switch setpoint. The switch is wired to input terminal P610 on I/O Base 1 in the Master Control Panel.
	Defective backflow preventer (if on site).	Clean or replace defective backflow preventer.
	Municipal or site water pressure.	Verify the water flow and pressure from the fresh water supply.

5.5.2 EQ Tank Troubleshooting

Overview: This 500-gallon cone-bottomed tank stores reclaimed water for use in the High Pressure Wash System. The tank is supplied water from the Cyclonic Separator and itself supplies the High Pressure Pump.

Refer to *Figure 5- 3 Water Reclaim and High Pressure Section Hydraulic Schematic.*

Table 5- 11 EQ Tank Troubleshooting

Problem	Check This	Do This
Tank not filling.	Sump Pump problems.	Troubleshoot the Sump Pump. Refer to *Table 5- 8 Sump Pump Troubleshooting.*
	Middle float switch problems.	Verify the middle float normally-closed switch closes when the water level drops. The switch is wired to input terminal P602 on I/O Base 1 located in the Reclaim Slave Panel (RSP).

5.6 AIR COMPRESSOR TROUBLESHOOTING

Overview: The air compressor has two basic functions. First, it provides a back-flush capability for the InterScreen filter inside the Settling Pit to blow debris off the screen so the Sump Pump can draw water out of the Pit. This happens automatically every 5th wash cycle. Second, the compressed air is used to shift the pilot section of the solenoid-actuated Co-Ax valves. The compressor receives its power from any suitable 120 VAC outlet in the Wash System.

Table 5- 12 Air Compressor Troubleshooting

Problem	Check This	Do This
Air compressor not running.	No electrical power to the unit.	Verify the air compressor is plugged into a working 120 VAC outlet sized to handle the motor load.
		Verify 3 amp fuses FU1 and FU2 on the control transformer primary (MCP) are not blown. Replace defective fuse with identical part.

Problem	Check This	Do This
	Unit control is OFF.	Move the compressor control to the AUTO position. The compressor runs automatically when the tank air pressure drops to the factory-set cut-in pressure point and stops at the factory-set cut-out point.
Discharge air pressure too high or too low.	The compressor discharge regulator requires adjustment.	Pull the pressure regulator knob out and rotate clockwise to increase discharge pressure; turn counter-clockwise to decrease discharge pressure. Check the pressure on the compressor gauge.

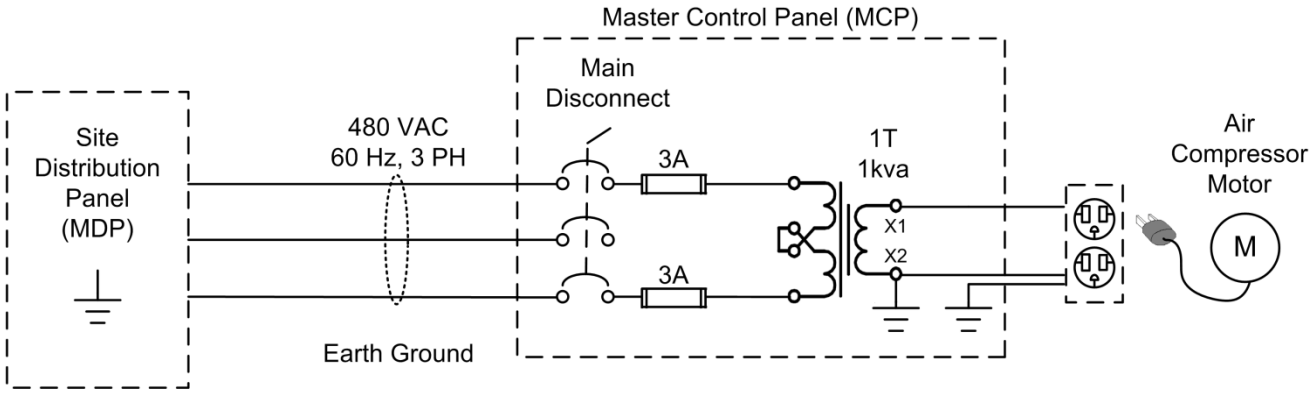

Figure 5- 9 Typical Air Compressor Electrical Circuit

5.7 CHEMICAL ARCH TROUBLESHOOTING

5.7.1 Acid Chemical Wash Arch Troubleshooting

Overview: The Acid Chemical Wash Arch sprays detergent/water solution onto the vehicle body at the start of the wash cycle.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 13 Acid Chemical Wash Arch Troubleshooting

Problem	Check This	Do This
Wash cycle does not start when the vehicle enters the Wash Bay. **No spray from either the Chemical Wash Arch side spray bars or the rear spray bar.**	Photoeye PE1 is not operating.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver. PE1 is wired to input terminal P601 on I/O Base 1 in the Master Control Panel.
	Chemical Booster Pump not operating.	Troubleshoot the Chemical Booster Pump. Refer to *Table 5- 1: Chemical Booster Pump Troubleshooting*.
	Filter F2 in the Chemical Module clogged.	Service the filter.

Problem	Check This	Do This
No spray from Chemical Wash Arch side spray bars. The rear spray bar is okay.	Solenoid valve SOV4 not operating.	Service the 24 VDC solenoid valve. Check all wiring and connections from the valve back to the MCP. Replace defective valve. SOV4 is wired to output terminal P701 on I/O Base 1 located in the MCP.
	Photoeye PE1 not functioning.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver. PE1 is wired to input terminal P601 on I/O Base 1 in the Master Control Panel.
No spray from Chemical Wash Arch rear spray bar. The side spray bars are okay.	Solenoid valve SOV5 not operating.	Service the 24 VDC solenoid valve. Check all wiring and connections from the valve back to the MCP. Replace defective valve. SOV5 is wired to output terminal P702 on I/O Base 1 located in the MCP.
	Photoeye PE2 not operating.	Refer to the PE1 photoeye troubleshooting section above. Photoeye PE2 is wired to input terminal P602 on I/O Base 1 in the MCP.
Weak spray from spray nozzle(s); any Arch or Spray Bar.	Nozzle(s) clogged or worn.	Remove and clean or replace defective spray nozzle. Refer to *Section 6.1* for complete nozzle maintenance information.

5.7.2 Alkaline Chemical Wash Arch Troubleshooting

Overview: The Alkaline Chemical Wash Arch sprays detergent/water solution onto the vehicle body at the start of the wash cycle.

Refer to *Figure 5- 2 Chemical Wash Section Hydraulic Schematic.*

Table 5- 14 Alkaline Chemical Wash Arch Troubleshooting

Problem	Check This	Do This
No spray from Chemical Wash Arch side spray bars. The rear spray bar is okay.	Solenoid valve SOV2 not operating.	Service the 24 VDC solenoid valve. Check all wiring and connections from the valve back to the MCP. Replace defective valve. SOV2 is wired to output terminal P703 on I/O Base 1 located in the MCP.
	Photoeye PE3 not functioning.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver. PE3 is wired to input terminal P603 on I/O Base 1 in the Master Control Panel.
No spray from Chemical Wash Arch rear spray bar. The side spray bars are okay.	Solenoid valve SOV3 not operating.	Service the 24 VDC solenoid valve. Check all wiring and connections from the valve back to the MCP. Replace defective valve. SOV3 is wired to output terminal P704 on I/O Base 1 located in the MCP.
	Photoeye PE4 not operating.	Refer to the PE3photoeye troubleshooting section above. Photoeye PE4 is wired to input terminal P604 on I/O Base 1 in the MCP.

Problem	Check This	Do This
Weak spray from spray nozzle(s); any Arch or Spray Bar.	Nozzle(s) clogged or worn.	Remove and clean or replace defective spray nozzle. Refer to *Section 6.1* for complete nozzle maintenance information.

5.8 HIGH PRESSURE SPRAY ARCHES TROUBLESHOOTING

5.8.1 Spinner Arch and Chassis Washer Troubleshooting

Overview: The Spinner Arch and Chassis Washer are controlled by photoeye PE5. The arches use fresh water if the Wash System is in winter mode and reclaimed water if in summer mode.

Refer to *Figure 5- 3 Water Reclaim and High Pressure Section Hydraulic Schematic.*

Table 5- 15 Spinner Arch and Chassis Washer Troubleshooting

Problem	Check This	Do This
The arches do not operate when the vehicle enters this section of the Wash Bay.	High Pressure Pump not operating.	Troubleshoot the pump. Refer to *Table 5- 9: High Pressure Pump Troubleshooting.*
	Vehicle sensor PE5 is not operating.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver. PE5 is wired to input terminal P605 on I/O Base 1 located in the Master Control Panel.
	Manual valve MV16.	Verify manual valve MV16 on the EQ Module is open.
	3-way Co-Ax valve SOV6.	Verify the operation of the valve. SOV6 is controlled through output terminal P716 on I/O Base 1 and relay 4CR located in the Reclaim Slave Panel (RSP).

Problem	Check This	Do This
The Chassis Washer does not spray; the other arches work.	Manual valve MV9.	Open and adjust manual valve MV9 to suit flow and pressure requirements to prevent engine compartment flooding.
Not all CentriSpinner® heads are spinning or spinning too slow.	Spinner screens are clogged or spinners are damaged.	Refer to *Section 6: Primary Repair* for information about servicing the CentriSpinner® spinners.

5.8.2 Rear Wash Arch Troubleshooting

Overview: The Rear Wash Arch is enabled for larger vehicles only that can break the high-mounted photoeye beam of PE4.

Refer to *Figure 5- 3 Water Reclaim and High Pressure Section Hydraulic Schematic.*

Table 5- 16 Rear Wash Arch Troubleshooting

Problem	Check This	Do This
The Rear Wash Arch does not operate when the vehicle enters this section of the Wash Bay.	High Pressure Pump not operating.	Troubleshoot the pump. Refer to *Table 5- 9: High Pressure Pump Troubleshooting.*
	Vehicle sensor PE6 is not operating.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver. PE6 is wired to input terminal P606 on I/O Base 1 located in the Master Control Panel.
	Co-Ax solenoid valve SOV6 in the EQ Module.	Verify that the valve is not stuck in the energized state that will direct water to the spinner arches and not the Rear Wash Arch.
Weak spray from spray nozzle(s); any Arch or Spray Bar.	Nozzle(s) clogged or worn.	Remove and clean or replace defective spray nozzle. Refer to *Section 6.1* for complete nozzle maintenance information.

5.8.3 Rinse Arch Troubleshooting

Overview: The Rinse Arch is the final stage of the wash cycle, using fresh water supplied to the Arch at low pressure from the Rinse Booster Pump. The Rinse Booster Pump is controlled through motor contactor 4M in the Master Control Panel.

Refer to *Figure 5- 1 Fresh Water Section Hydraulic Schematic* and *Figure 5- 5 Rinse Booster Pump Circuit Electrical Schematic.*

Table 5- 17 Rinse Arch Troubleshooting

Problem	Check This	Do This
The Rinse Arch does not operate when the vehicle enters this section of the Wash Bay.	Rinse Booster Pump not operating.	Troubleshoot the pump. Refer to *Table 5- 2: Rinse Booster Pump Troubleshooting.*
	Vehicle sensor PE8 is not operating.	Clean the photoeye transmitter and receiver.
		Verify photoeye transmitter aligned correctly to the receiver. Refer to Refer to *Section 4.1.4: Photoeye Service.*
		Photoeye LED should be ON when light beam is NOT blocked. Replace defective photoeye transmitter or receiver.
		Check all electrical wiring and connections from the MCP to the photoeye transmitter and receiver.
Weak spray from spray nozzle(s); any Arch or Spray Bar.	Nozzle(s) clogged or worn.	Remove and clean or replace defective spray nozzle. Refer to *Section 6.1* for complete nozzle maintenance information.

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6 PRIMARY REPAIR

Section 6 Table of Contents

List of Figures in Section 6

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6.1 PRIMARY REPAIRS

6.1.1 Cleaning or Replacing Fixed Spray Nozzles

Fixed position flat spray nozzles on the arches and spray bars in the system produce a specific spray pattern and spray angle and are focused to cover a specific area of the vehicle.

You should check the action of spray nozzles on a regular basis to ensure the integrity of the spray pattern. Nozzles can become unaligned due to mechanical contact with objects in the Wash Bay or clogged due to contaminants in the water supply.

Additionally, all nozzles will wear with use over time and should be replaced for the best quality wash. Worn nozzles will show an altered spray pattern and possibly a larger drop size.

The flat-spray nozzles have a slotted tip (see figure). The alignment of the nozzle tip slot is important for a correct spray pattern onto the vehicle. Note the originally installed nozzle slot orientation before replacing a nozzle tip or disassembling the nozzle for cleaning.

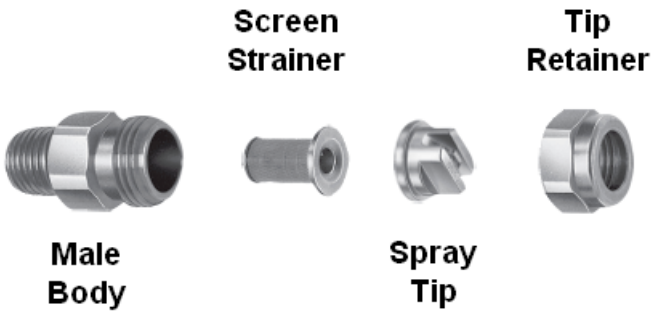

Figure 6- 1 Typical Spray Nozzle Assembly

To clean or replace a spray nozzle:

1. Place the Wash System in OFF mode and secure the Wash Bay against accidental vehicle entry before working on the system.
2. Note the orientation of the slot in the spray tip of the nozzle to be disassembled.
3. Hold the body of the nozzle with a wrench and loosen and remove the tip retainer with a second wrench.
4. Remove the spray tip and inspect for wear of the orifice or other damage. Replace worn or damaged tips. Be sure to replace with the correct nozzle or the wash quality will be degraded. Contact InterClean Equipment Company for help with nozzle replacement.
5. Remove and clean the strainer screen. Replace any damaged screen or one that cannot be unclogged.
6. Reassemble in reverse order being careful to orient the nozzle spray tip in its original direction.
7. Using the two wrench method as above, carefully tighten the tip retainer being careful not to overtorque the retainer.
8. Restore the Wash System to AUTO or STANDBY mode and check the nozzle for leaks.

6.1.2 Cleaning the Spinner Head Nozzles

Slowing down or stopping of the spinner head rotation is most likely caused by dirt inside the nozzles. To Detect plugged nozzles, turn on High Pressure Pump HP1 manually for a few seconds, then turn it off and observe the separate sprays as the water drains out. Note any nozzles that do not flow very well and clean the nozzles according to the following procedure.

The spinner heads incorporate internal strainers in each nozzle. Perform the following steps to clear a clogged spinner head.

1. Secure the entrance to the Wash Bay to prevent an accidental drive through while working the area.
2. Put the Wash System in STANDBY mode through the Touch Screen. This prevents a wash cycle from being accidentally.
3. Loosen the clogged nozzle with a wrench and remove from the spinner head assembly (Step 1 in *Figure 6- 2*).
4. Remove the internal strainer from the nozzle assembly (Step 2 in *Figure 6- 3*)
5. Clean off any debris clogging the strainer mesh (Step 3 in *Figure 6- 4*).
6. Replace the strainer into the nozzle assembly and hand tighten the nozzle onto the spinner head (Step 4 in *Figure 6- 5*).
7. Use a wrench to tighten the nozzle to the spinner; do not over-torque (Step 5 in *Figure 6- 6*).

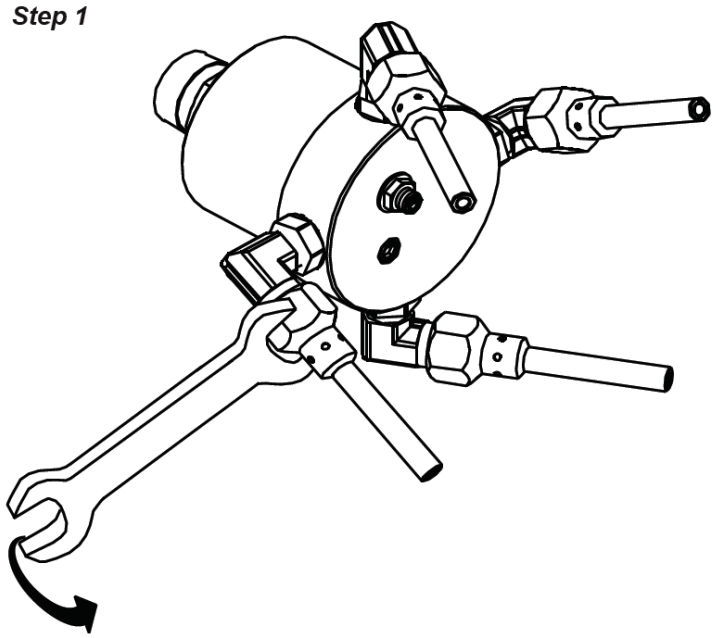

Figure 6- 2 Loosen the Spinner Nozzle

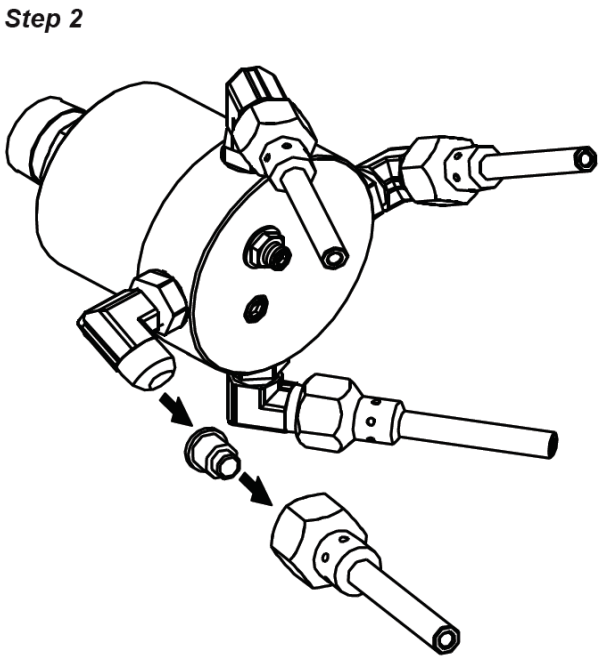

Figure 6- 3 Remove the Nozzle and Strainer

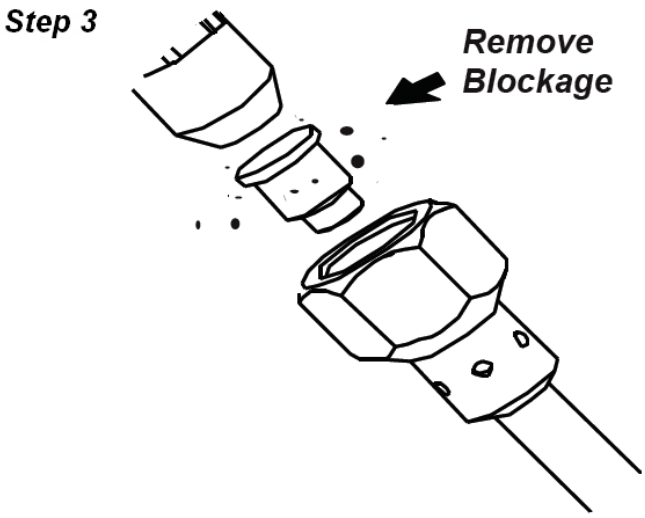

Figure 6- 4 Clean all Debris from the Strainer

Step 4

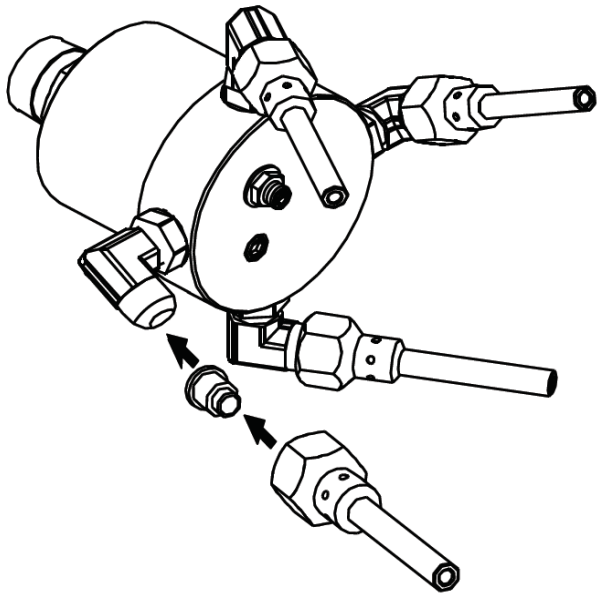

Figure 6- 5 Replace the Strainer and Nozzle

Step 5

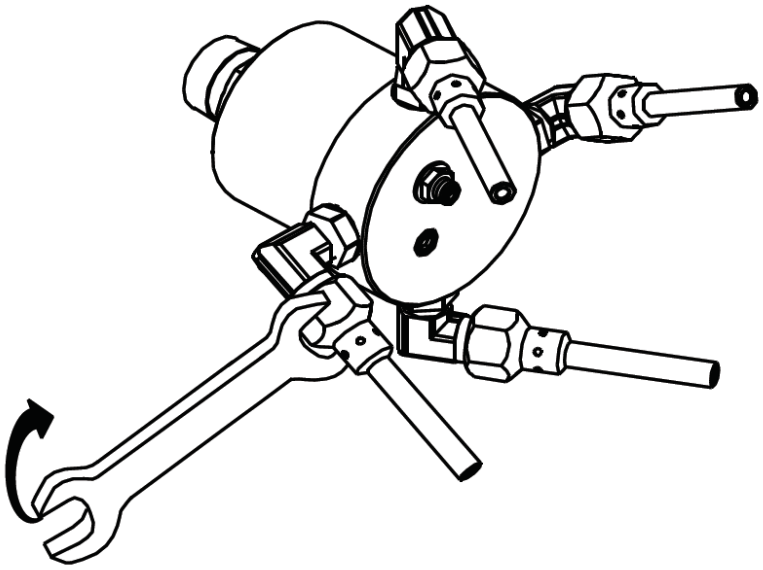

Figure 6- 6 Carefully Tighten Nozzle to Spinner Head

6.1.3 Spinner Nozzle Adjustment

Spinner nozzle adjustment must be performed prior to installation of a new spinner head or after the disassembly of a spinner for cleaning or repair. Nozzle adjustment requires the use of InterClean Spinner Adjustment. Contact InterClean Equipment, Inc. for more information.

Perform the steps below to adjust the spinner head nozzles using the adjustment tool:

1. Loosen all the nozzle on the head to be realigned. (*Figure 6- 7*)
2. Rotate the nozzle assemblies down (clockwise). (*Figure 6- 7*)
3. Install the Spinner Adjustment Tool. (*Figure 6- 8*)
4. Hook the Tool support rods to the bottom of the spinner housing. (*Figure 6- 9*)
5. Tighten the Spinner Tool to the top by the wing nuts. (*Figure 6- 10*)
6. Push the spinner nozzle assemblies counterclockwise against the Spinner Adjustment Tool top plate. (*Figure 6- 11*)
7. Tighten the nozzle assemblies and remove the Spinner Adjustment Tool. (*Figure 6- 12*)
8. Reverse Steps 3 thru 5 to remove the Spinner Adjustment Tool. (*Figure 6- 12*)

NOTE:	**The spinner head is designed to turn CLOCKWISE only (viewed from the nozzle side.**

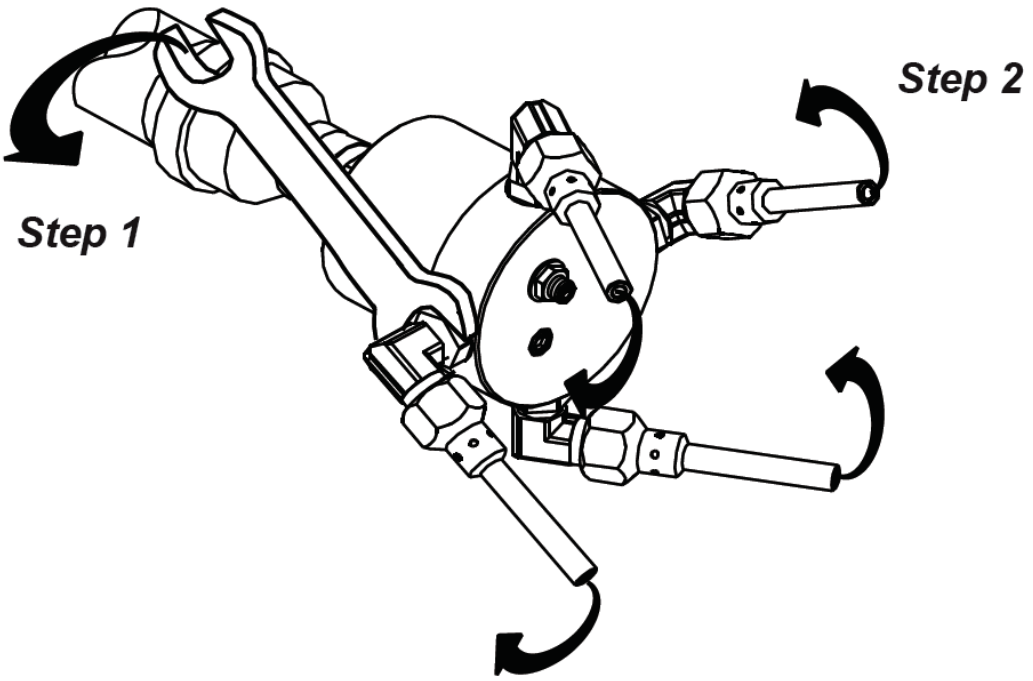

Figure 6- 7 Spinner Nozzle Adjustment Steps 1 & 2

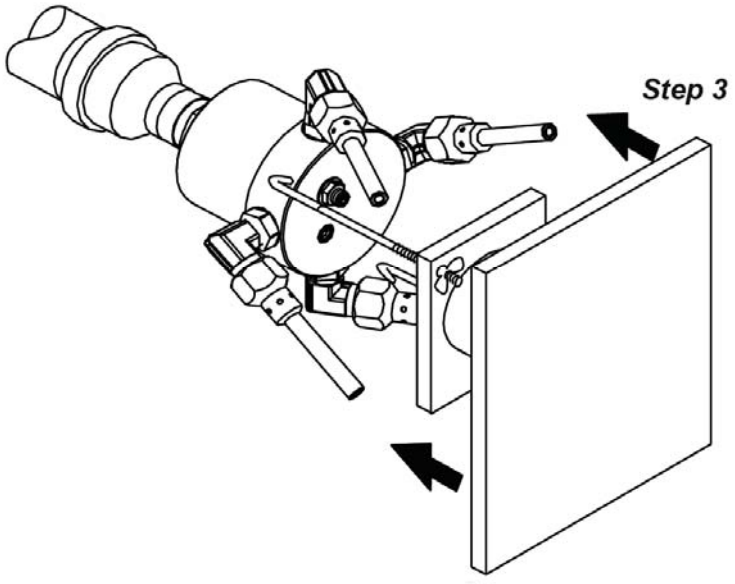

Figure 6- 8 Spinner Nozzle Adjustment Step 3

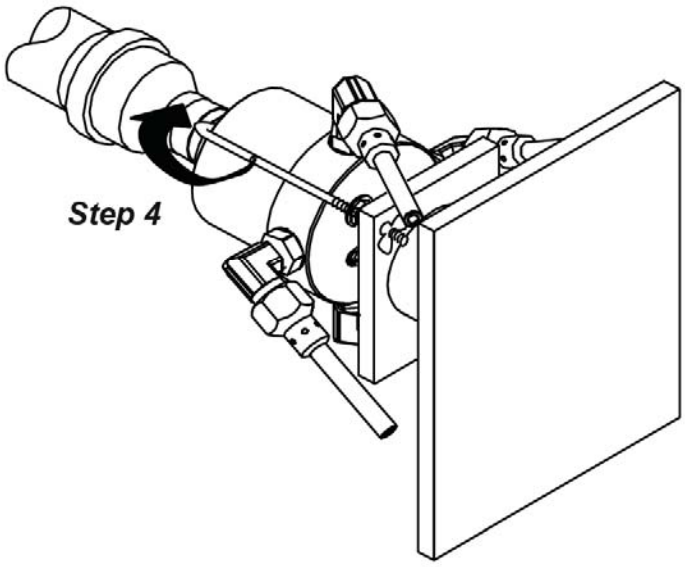

Figure 6- 9 Spinner Nozzle Adjustment Step 4

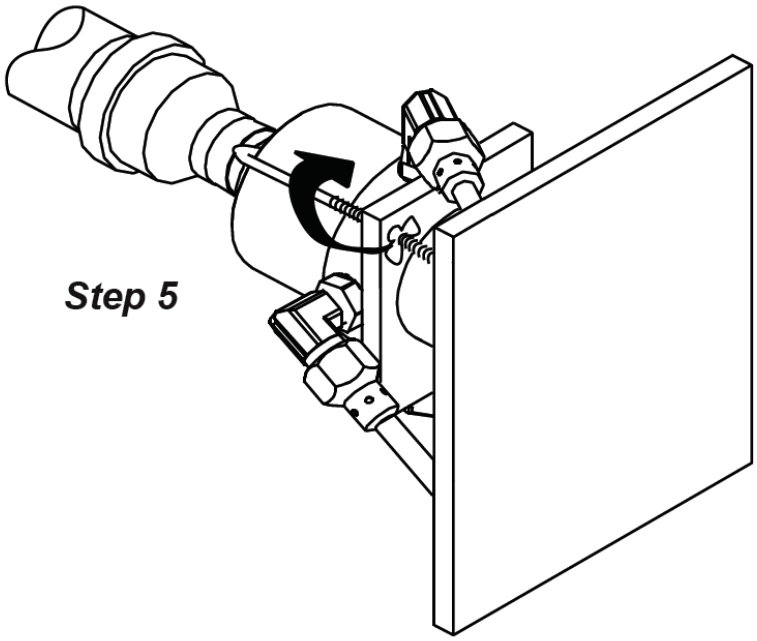

Figure 6- 10 Spinner Nozzle Adjustment Step 5

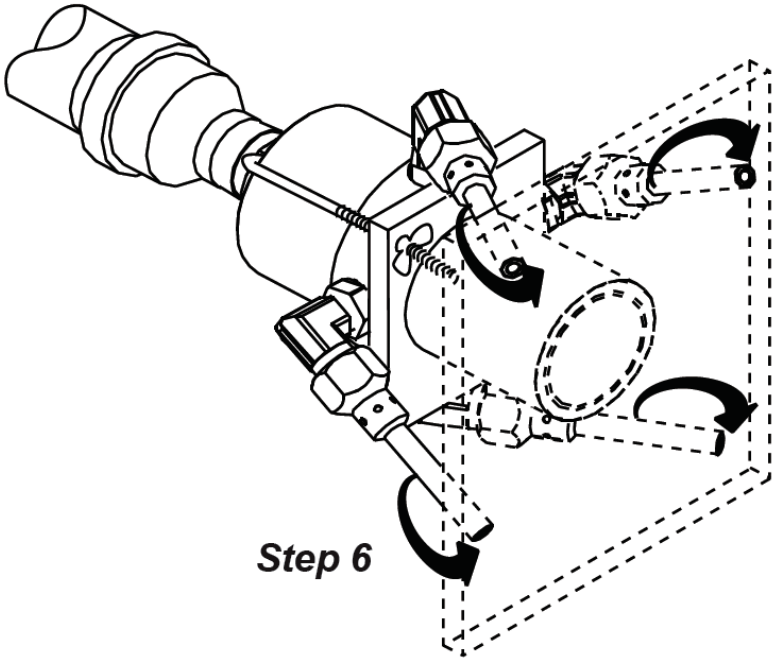

Figure 6- 11 Spinner Nozzle Adjustment Step 6

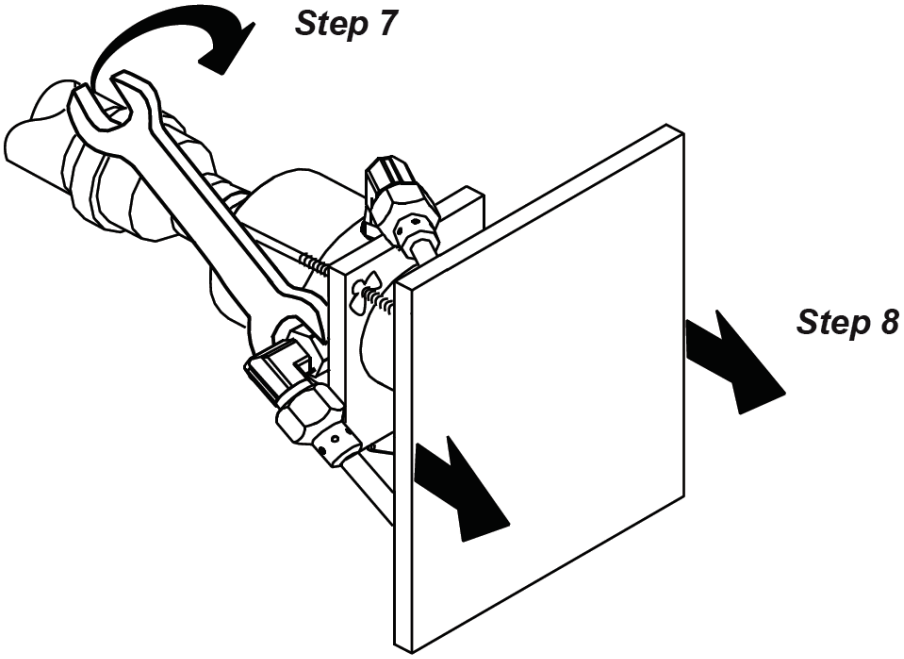

Figure 6- 12 Spinner Nozzle Adjustment Steps 7 & 8

6.1.4 Replacing Spinner Heads

Perform the following steps to remove and replace a spinner head:

8. Secure the entrance to the Wash Bay to prevent an accidental drive through while working the area.
9. Put the Wash System in STANDBY mode through the Touch Screen. This prevents a wash cycle from being accidentally.
10. Use a 1 3/8” wrench on the old spinner head to loosen and remove the spinner from the 1” NPT connection. Hold the pipe side of the connection with a wrench while loosening the spinner head to prevent damage to the plumbing.
11. Use Teflon® tape or Teflon® pipe dope to seal the male threads on the replacement spinner head.
12. Tighten the spinner head to the 1” NPT plumbing connection with the 1 3/8” wrench using a pipe wrench on the plumbing side of the connection to prevent damage.
13. Return the Wash System to the AUTOMATIC mode through the Touch Screen.

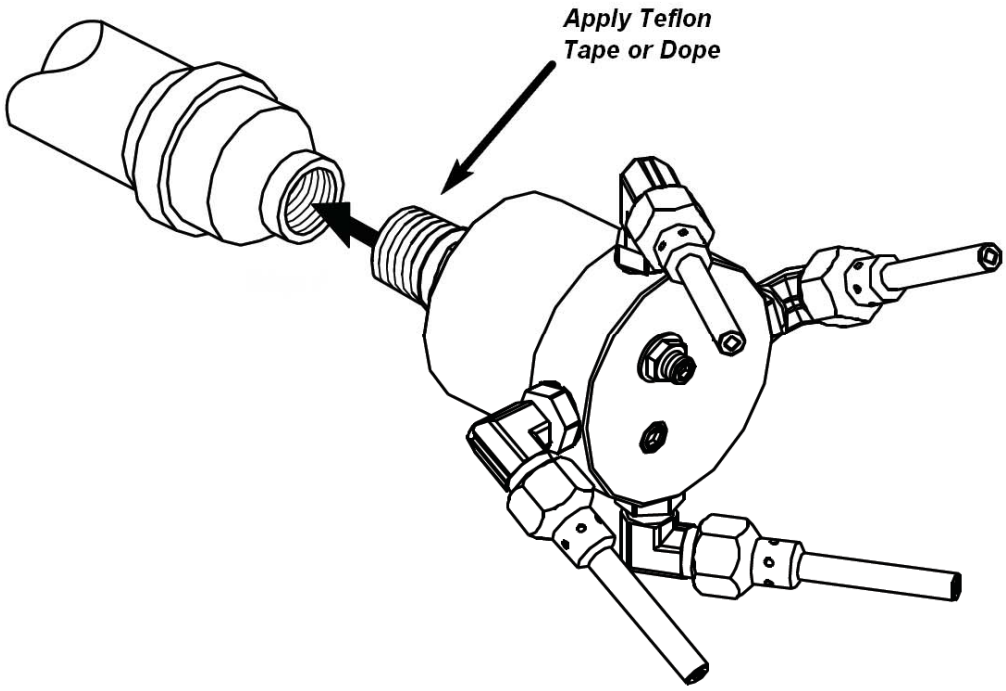

Figure 6- 13 Remount the Spinner Head 1

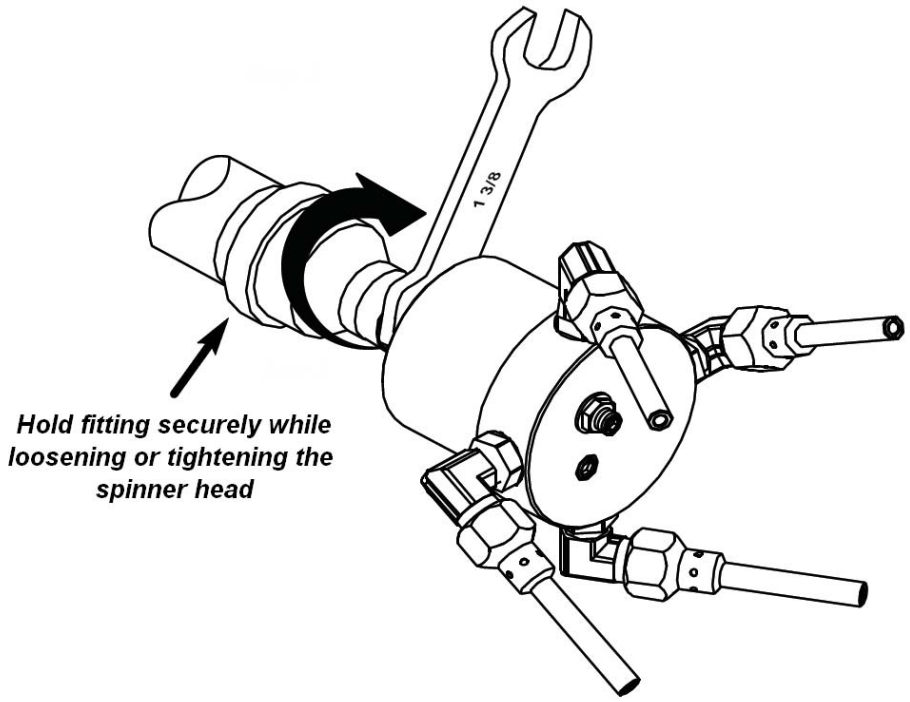

Figure 6- 14 Remount the Spinner Head 2

6.1.5 Spinner Head Rotational Speed Adjustment

The ideal rotational speeds of the spinner heads are from 80 rpm to 160 rpm. If the surface being washed comes out striped, the spinner is rotating too slowly and the speed should be increased just enough to eliminate the striping. Conversely, excess rotational speed results in reduced cleaning.

The spinner rotational speed very seldom requires adjustment. If a spinner head is rotating too slowly, the most common causes are:

- Nozzles are clogged. Refer to *Section 6.1.1 Cleaning the Spinner Head Nozzles.*
- Nozzles need to be adjusted. Refer to *Section 6.1.3 Spinner Nozzle Adjustment.*
- Do **not** adjust the rotational speed until the nozzles are cleared and adjusted.

Perform the steps below to adjust the spinner head nozzles using the adjustment tool:

1. Loosen the adjustment locknut with a wrench. (*Figure 6- 15*)
2. Rotate the adjustment set screw slightly clockwise to decrease speed or counterclockwise to increase speed, as required. (*Figure 6- 16*)
3. Tighten the locknut to secure the adjustment. (*Figure 6- 17*)
4. Check the rotation speed; repeat Steps 1 thru 3 until the required speed is obtained.

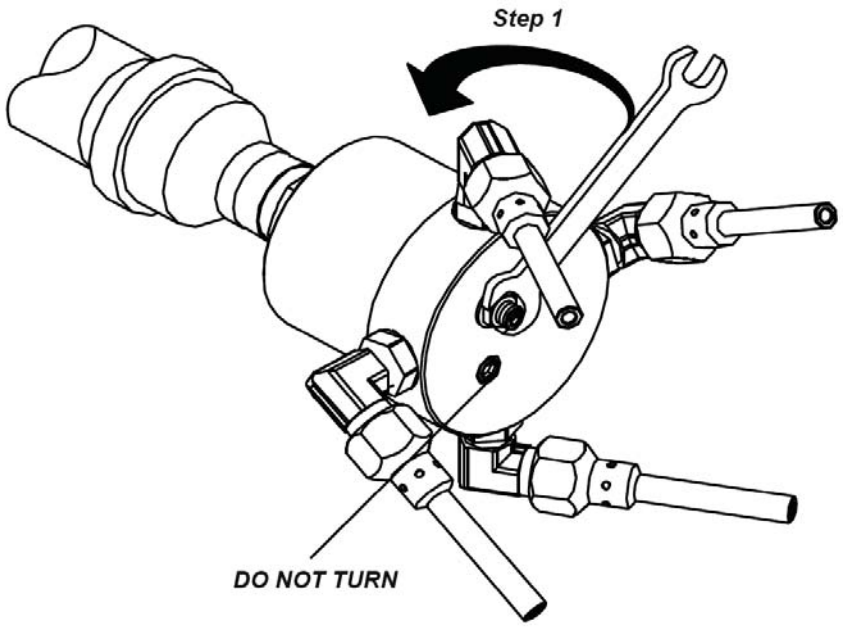

Figure 6- 15 Spinner Head Rotational Speed Adjustment Step 1

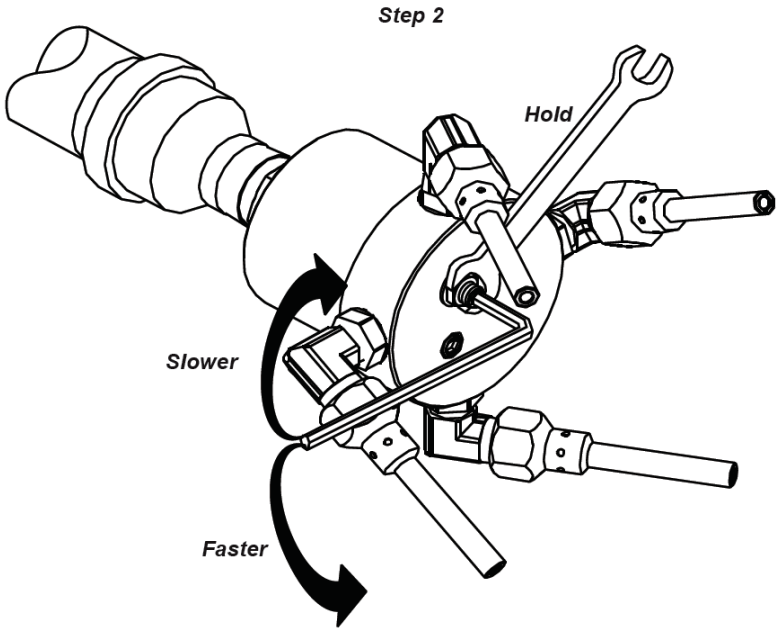

Figure 6- 16 Spinner Head Rotational Speed Adjustment Step 2

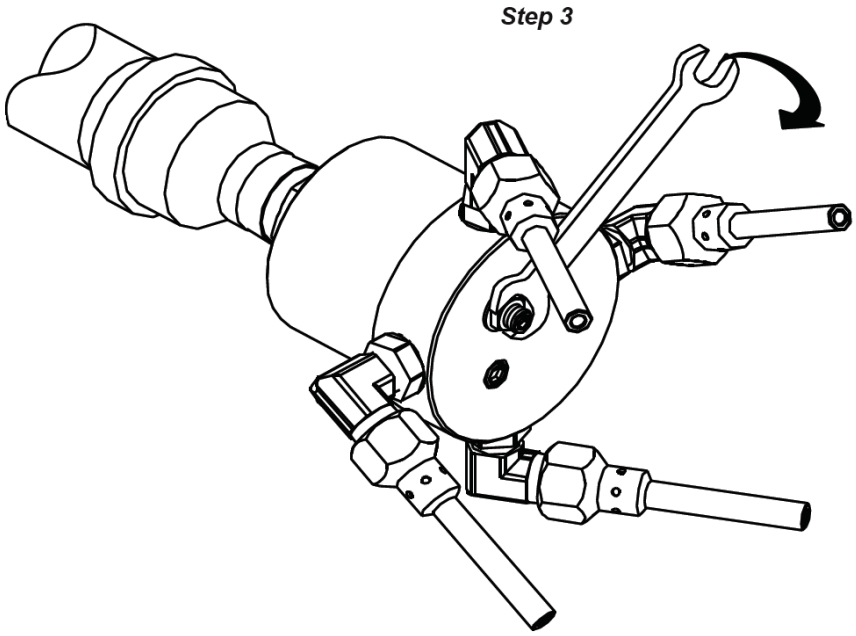

Figure 6- 17 Spinner Head Rotational Speed Adjustment Step 3

7 ELECTRICAL AND PLUMBING DIAGRAMS

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DRAWING INDEX

DRAWING NUMBER	DESCRIPTION
#LY09-070-00	DRAWING INDEX
#LY09-070-01	3D VIEW
#LY09-070-02	PLAN VIEW
#LY09-070-03	SIDE VIEW
#LY09-070-04	END VIEW
#LY09-070-05	PLUMBING SCHEMATIC
#LY09-070-06	ELECTRICAL LAYOUT
#LY09-070-07	EQUIPMENT LAYOUT
#LY09-070-08	PIPING 3D
#LY09-070-09	CONCRETE LAYOUT
#LY09-070-10	PIT DETAIL
#LY09-070-11	UNDERGROUND PIPES
#LY09-070-12	UNDERGROUND CONDUITS

Interclean Equipment, Inc.
3939 Bestech Dr
Ypsilanti, MI 48197

Web Site: www.interclean.com
E-mail: sales@interclean.com
Phone: (734) 975-2967
(800) 468-3725
Fax: (734) 975-1646

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN
CHECK: PK | APPR: ####
SCALE: NO SCALE

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
DRAWING INDEX

DATE: 07/21/09
PART NO: #LY09-070-00
WEIGHT:

D:\PROJECTS\USA\IA\Coralville\CoralvilleTransit\LY09-070.dwg, 00_Index, 5/11/2011 3:42:53 PM, Susan, HPDJ1055CM.pc3

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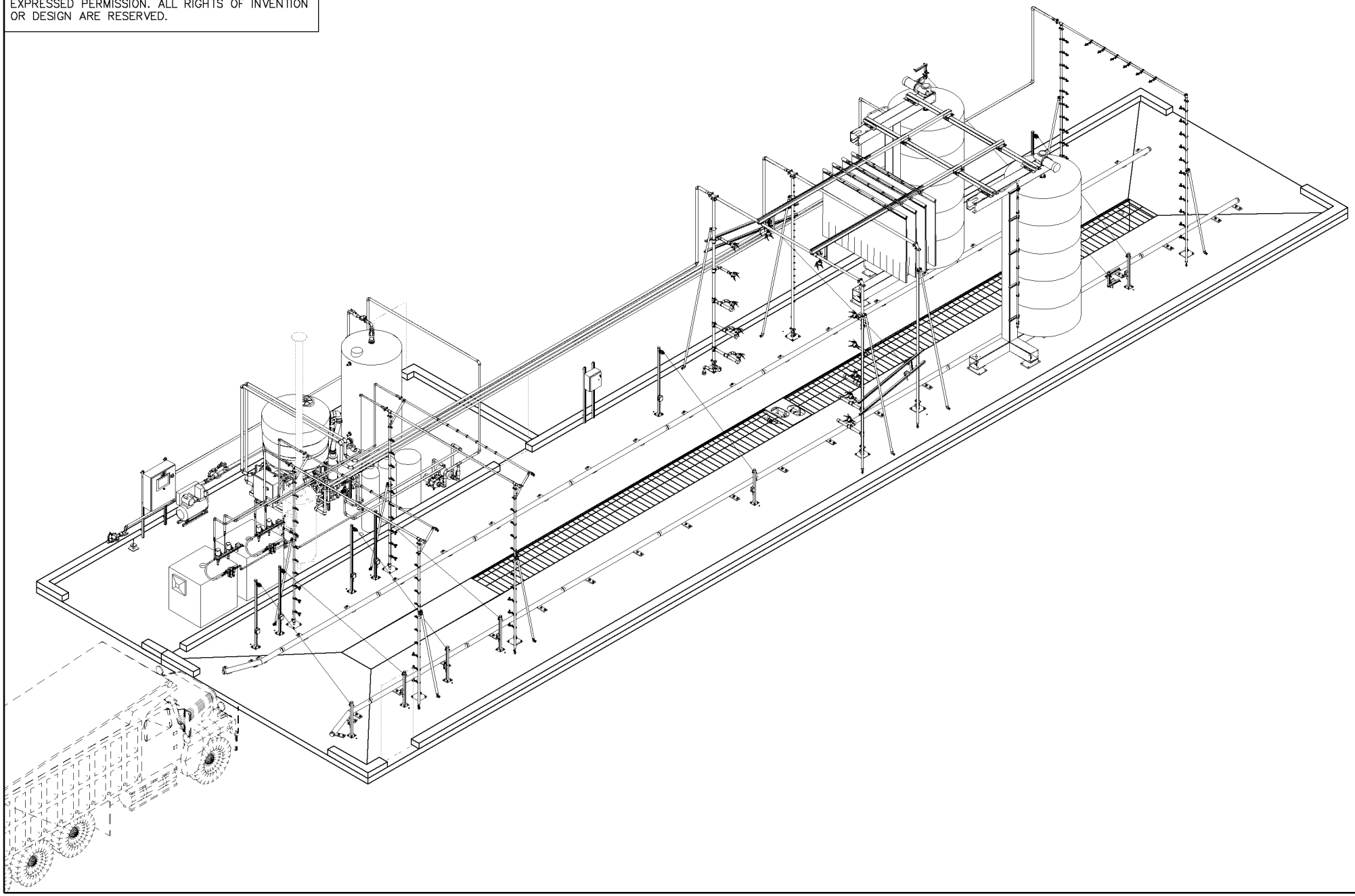

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C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: NO SCALE	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
3-D VIEW

DATE: 07/21/09
PART NO: #LY09-070-01
WEIGHT:

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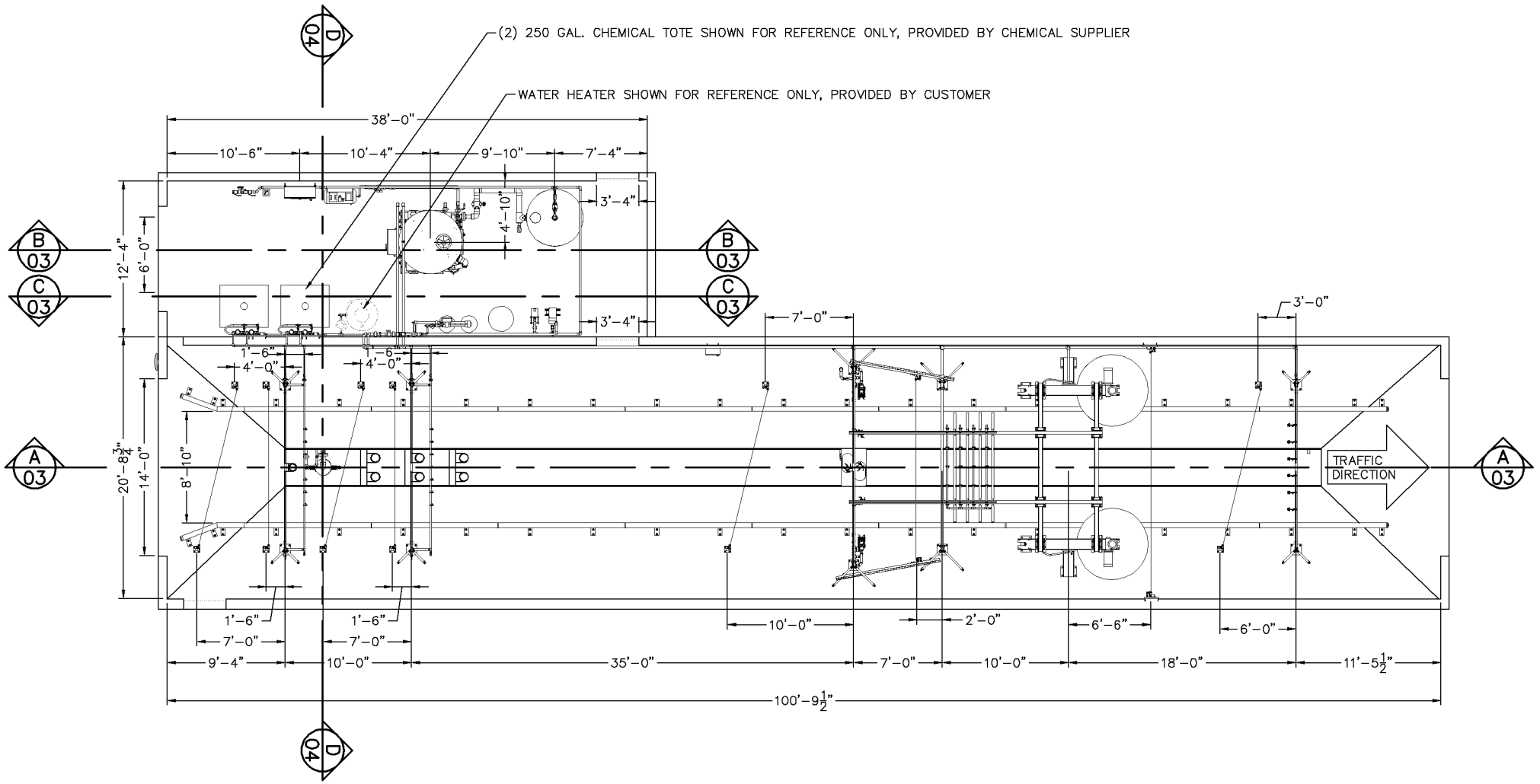


NOTE:
DURING INSTALLATION, MAKE SURE THE TIRE GUIDE AND ARCHES DO NOT INTERFERE WITH ENTRANCE OR EXIT OVERHEAD DOORS

NOTE:
THE CONCRETE MUST CURE FOR 27 DAYS BEFORE INSTALLING TIRE GUIDES

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

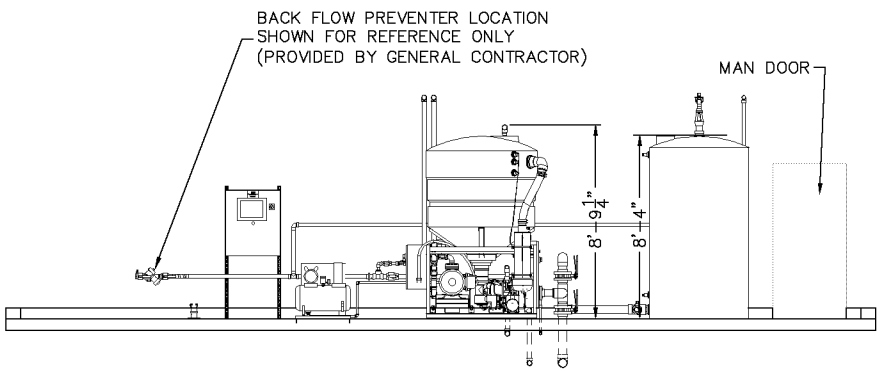
InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE:	
3/16"=1'	

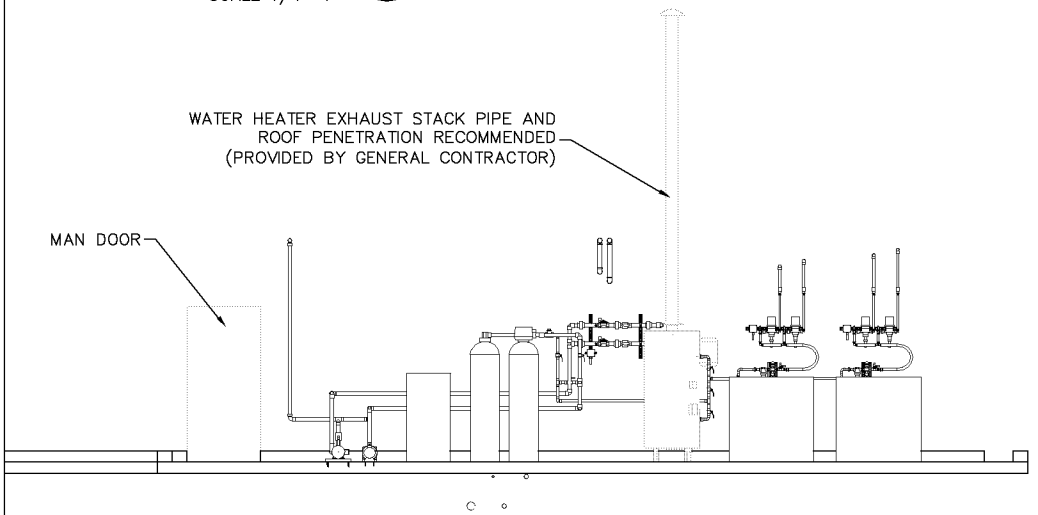
CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PLAN VIEW

DATE: 07/21/09
PART NO: #LY09-070-02
WEIGHT:

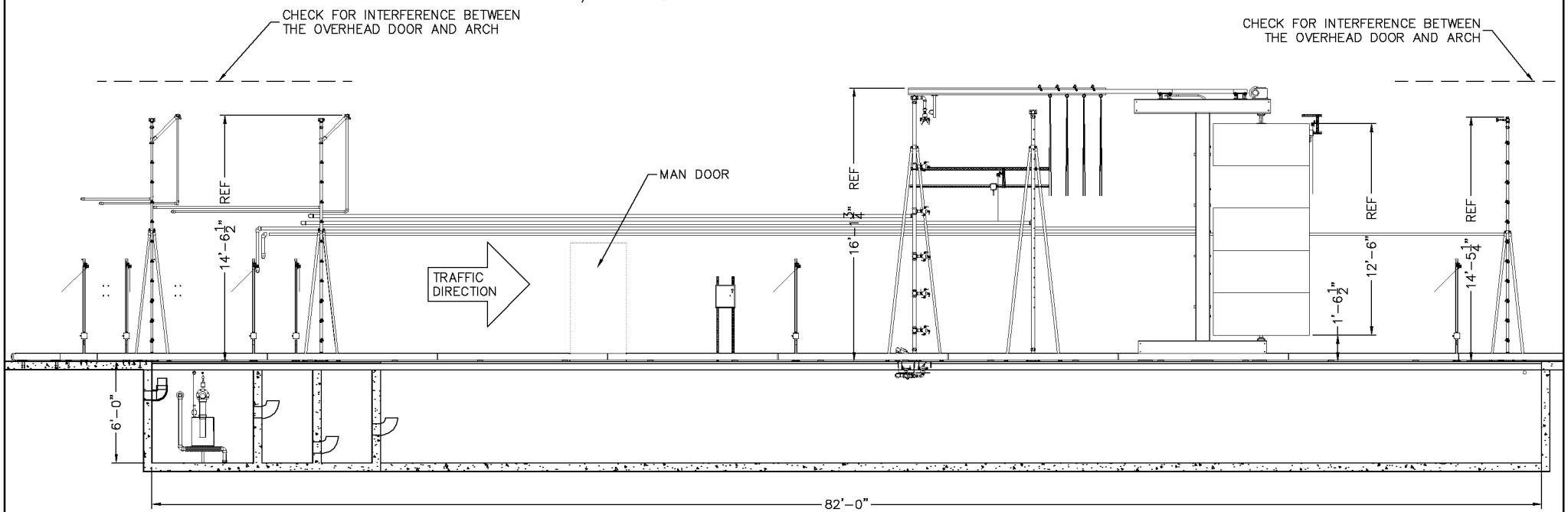
SECTION B/03
SCALE 1/4"=1'



SECTION C/03
SCALE 1/4"=1'



SECTION A/03
SCALE 1/4"=1'



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
SIDE VIEW

DATE: 07/21/09
PART NO: #LY09-070-03
WEIGHT:

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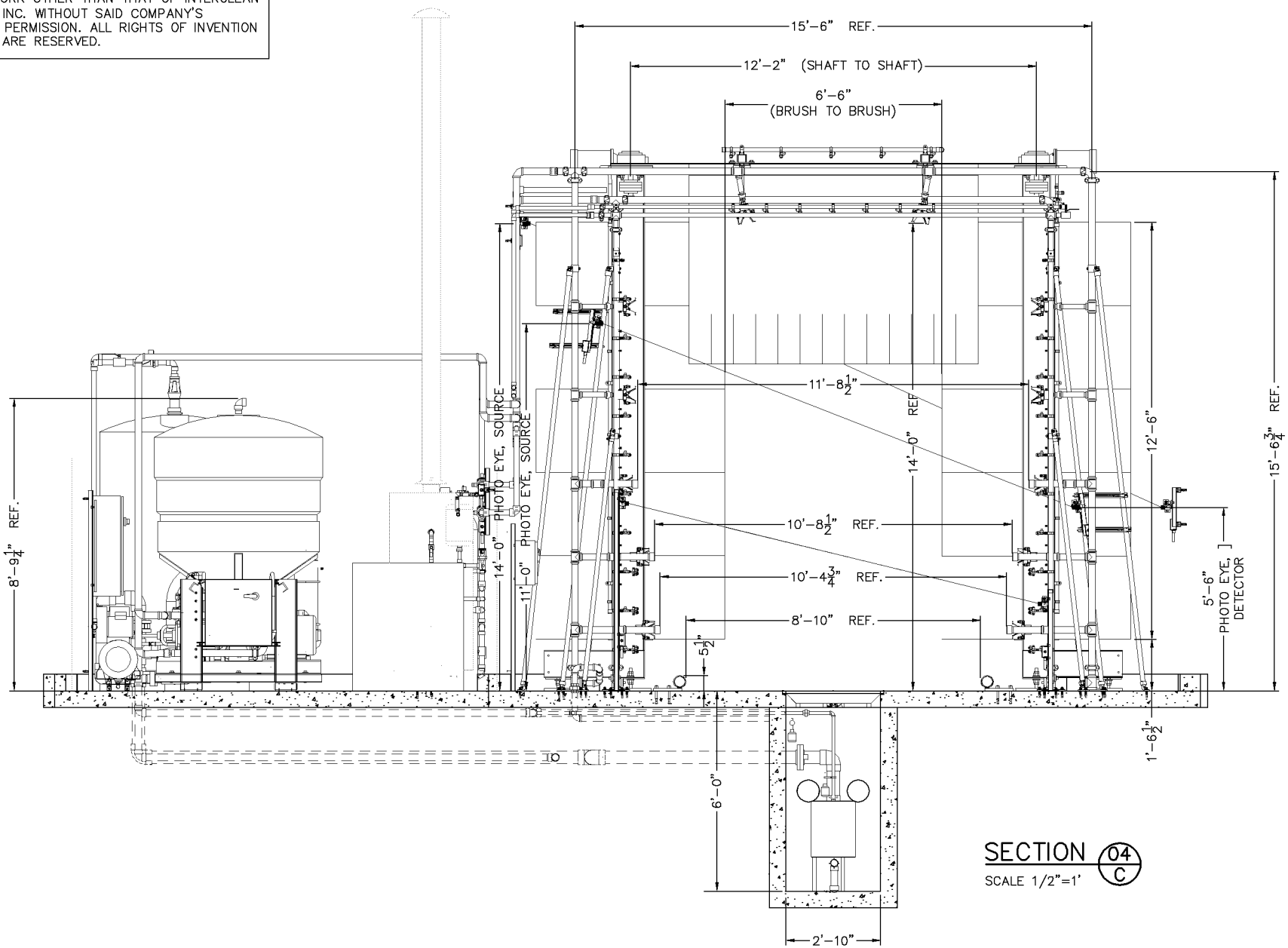


SECTION 04/C
SCALE 1/2"=1'

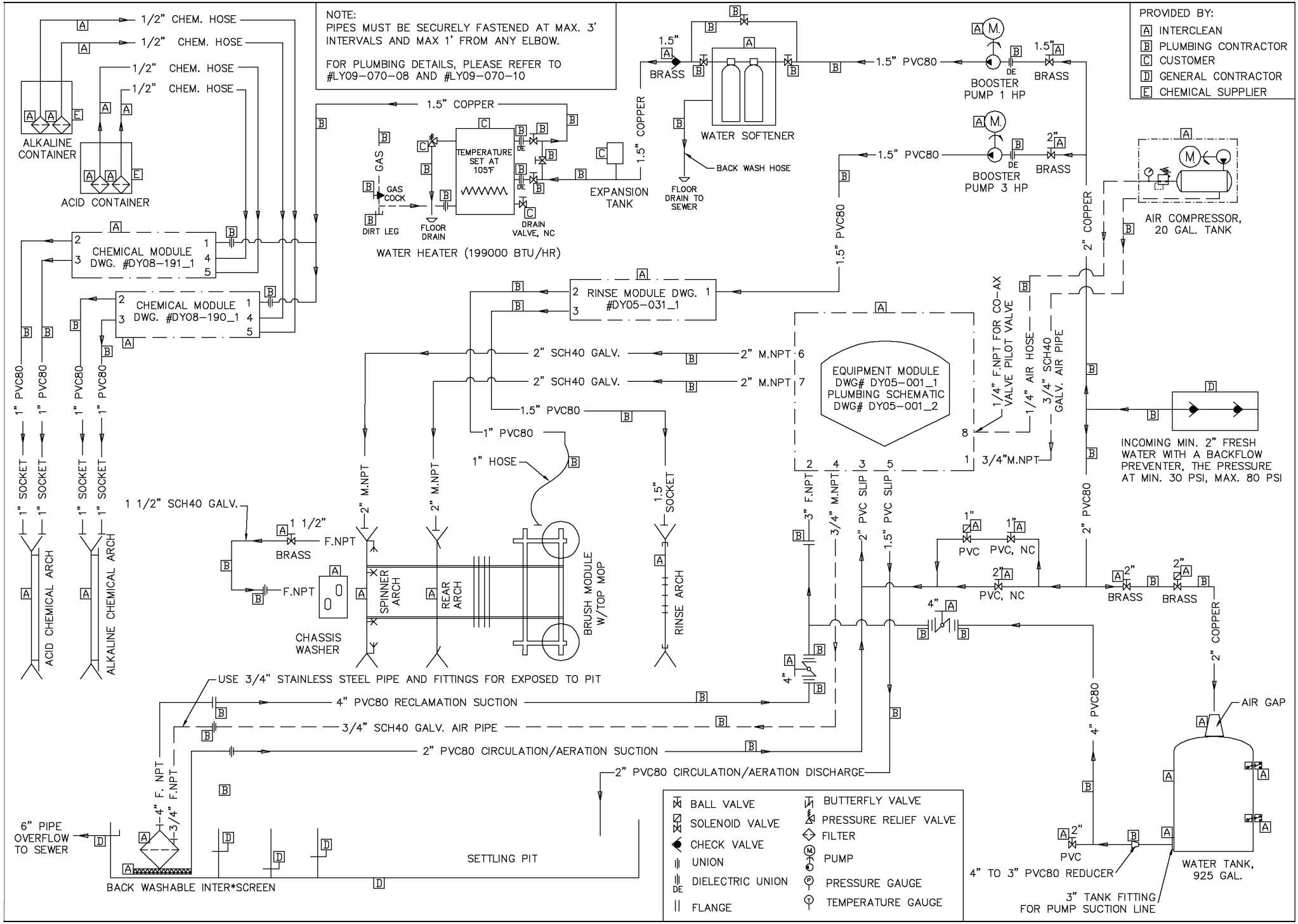
R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
END VIEW

DATE: 07/21/09
PART NO: #LY09-070-04
WEIGHT:



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: NO SCALE	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PLUMBING SCHEMATIC

DATE: 07/21/09
PART NO: #LY09-070-05
WEIGHT:

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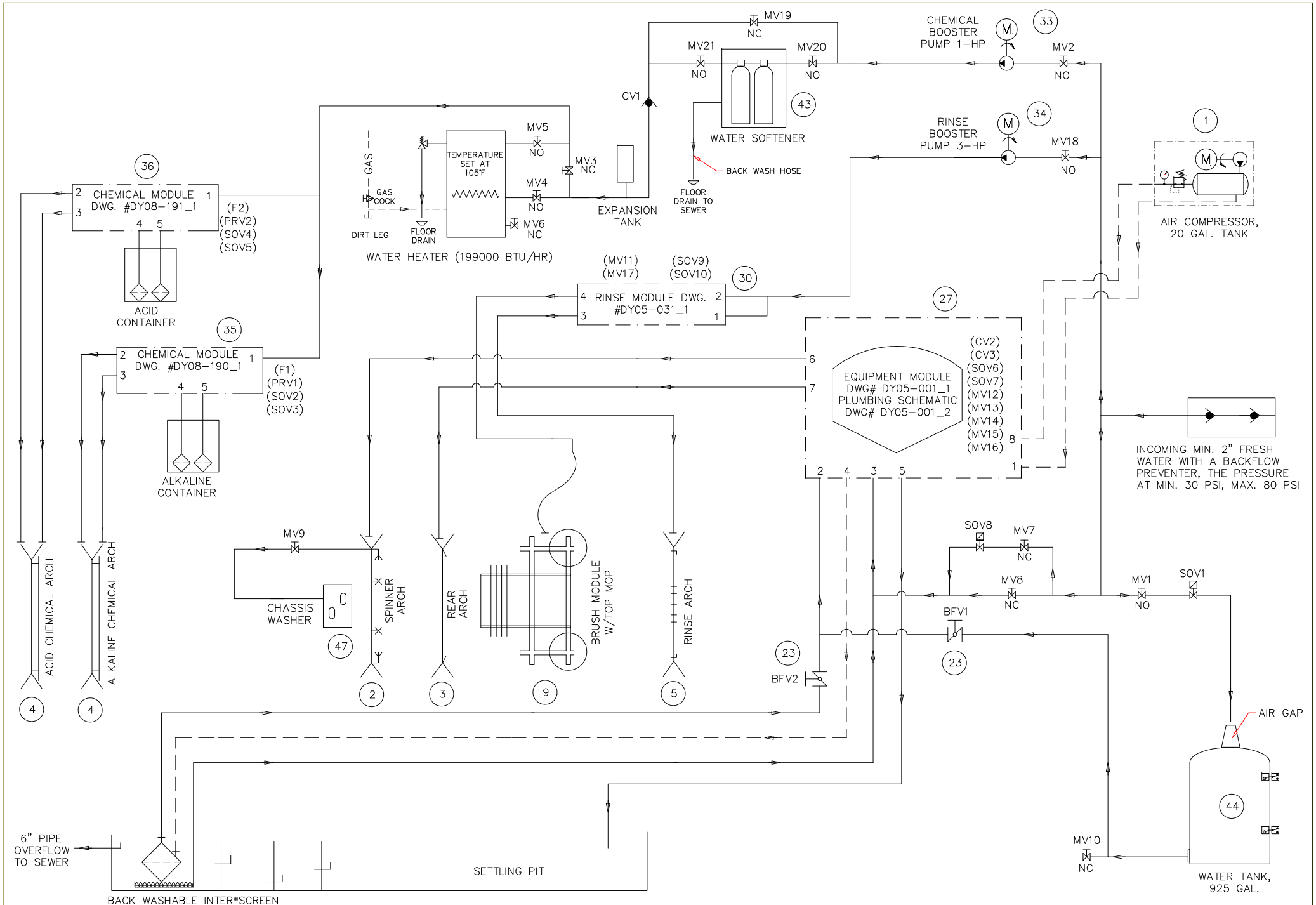


R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

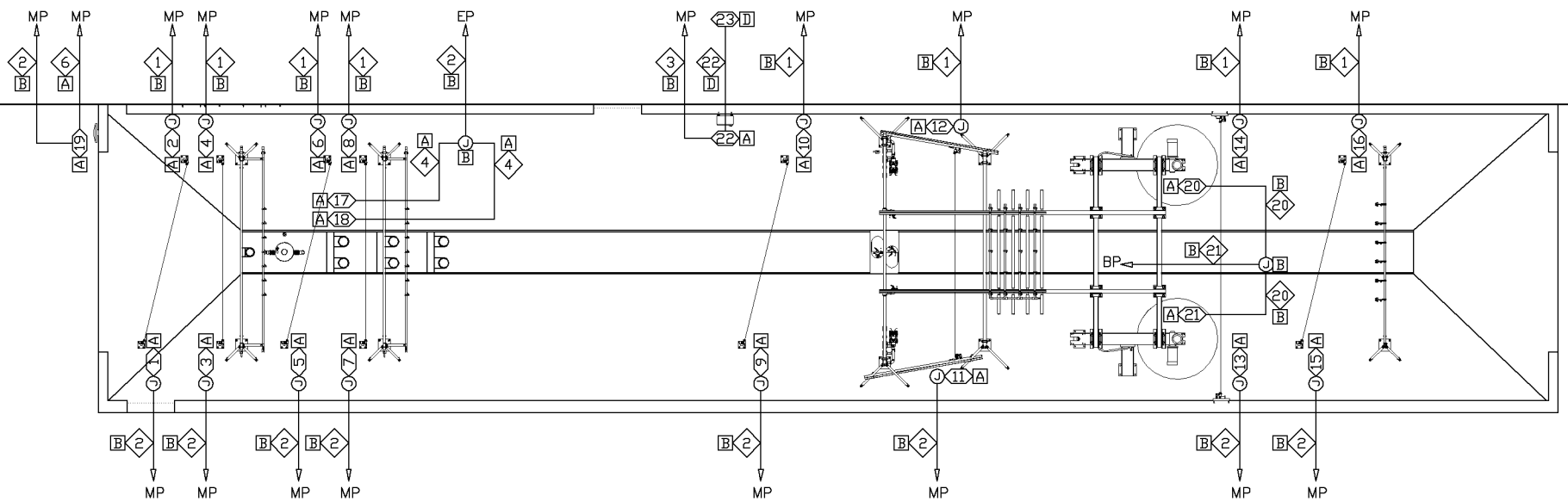
DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE:	
NO SCALE	

CORALVILLE TRANSIT, CORALVILLE, IA TRUCK WASH, RECLAIM WATER SYSTEM PLUMBING SCHEMATIC

DATE: 07/21/09
PART NO: #LY09-070-05
WEIGHT:

1. PHOTO EYE, DETECTOR, 24 VDC
2. PHOTO EYE, SOURCE, 24 VDC
3. PHOTO EYE, DETECTOR, 24 VDC
4. PHOTO EYE, SOURCE, 24 VDC
5. PHOTO EYE, DETECTOR, 24 VDC
6. PHOTO EYE, SOURCE, 24 VDC
7. PHOTO EYE, DETECTOR, 24 VDC
8. PHOTO EYE, SOURCE, 24 VDC
9. PHOTO EYE, DETECTOR, 24 VDC
10. PHOTO EYE, SOURCE, 24 VDC
11. PHOTO EYE, DETECTOR, 24 VDC
12. PHOTO EYE, SOURCE, 24 VDC
13. PHOTO EYE, DETECTOR, 24 VDC
14. PHOTO EYE, SOURCE, 24 VDC
15. PHOTO EYE, DETECTOR, 24 VDC
16. PHOTO EYE, SOURCE, 24 VDC
17. PIT LOW LEVEL FLOAT SWITCH, 24 VDC, NO, 3" ABOVE INTERSCREEN COVER
18. PIT FILL LEVEL FLOAT SWITCH, 24 VDC, NC, AT MAX. WATER LEVEL
19. ENCOMPASS encompass READER, 18 VAC
20. MOTOR, 5HP, BRUSH MODULE, 460V, 60HZ
21. MOTOR, 5HP, BRUSH MODULE, 460V, 60HZ
22. SLAVE PANEL (SP), 2x5HP, BRUSH MODULE, 460V, 60HZ, FLA 18
23. FEEDER AND DISCONNECT FOR BRUSH MODULE SLAVE CONTROL PANEL, 460 V, 3 PH.

1. 2-#16, 24 VDC, 1/2" CONDUIT
2. 3-#16, 24 VDC, 1/2" CONDUIT
3. 4-#16, 24 VDC, 1/2" CONDUIT
4. 2-#18, 2 CONDUCTOR FLEXIBLE CORD, COMES W/SENSOR
5. 4-#16, 24 VDC AND 1-ETHERNET CATEGORY 5E CABLE W/RJ-45 CONNECTORS, 1/2" CONDUIT
6. SERIAL CABLE, COMES W/EQUIPMENT
10. FLEXIBLE CORD WITH PLUG, COMES W/EQUIPMENT
11. 3-#14, 120 VAC, 1/2" CONDUIT
20. 3-#12, 460 VAC, 1/2" CONDUIT
21. 6-#12, 460 VAC, 1/2" CONDUIT
22. 3-#10, 460 VAC, 3/4" CONDUIT
22. 3-#10, 460 VAC, 3/4" CONDUIT
23. 3-#8, 460 VAC, 3/4" CONDUIT
24. 3-#4, 460 VAC, 1" CONDUIT
25. 3-#1/0, 460 VAC, 1 1/2" CONDUIT



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

LEGEND:
- DEVICE
- RECEPTACLE, 120V, 20A
- JUNCTION BOX
- BRANCH CIRCUIT/FEEDER
- MP CONNECTED TO MASTER CONTROL PANEL
- EP CONNECTED TO EQ-MODULE SLAVE PANEL
- BP CONNECTED TO BRUSH MODULE SLAVE PANEL

PROVIDED BY:
- [A] INTERCLEAN
- [B] ELECTRICAL CONTRACTOR
- [C] CUSTOMER
- [D] GENERAL CONTRACTOR

NOTE:
1. ALL ELECTRICAL METHODS AND MATERIALS SHALL BE SUITABLE FOR USE IN WET LOCATION PER NEC 310-8, 370-15A, 410-4A, AND ALL APPLICABLE CODES.
2. ALL CONDUCTORS SHALL BE THHN AND HAVE TEMPERATURE RATING OF 90 °C (194 F°).
3. CONDUITS MAY BE COMBINED TO MINIMIZE RUNS, BUT DO NOT COMBINE AC AND DC CIRCUITS.
4. BRANCH CIRCUITS ARE SIZED FOR 500' MAX. RUNS.
5. ELECTRICAL CONDUIT AND CONDUCTORS SIZES ARE MINIMUMS REQUIRED BY INTERCLEAN. SIZES MAY BE SUBJECT TO CHANGE PER CODES AND REGULATIONS.
6. MINIMUM SIZE FEEDER AMPACITY PER NEC 215-2(b)(C)

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	KM
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN
CHECK: KM | APPR: &&&
SCALE: 3/16"=1'

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
ELECTRICAL LAYOUT - WASH BAY

DATE: 07/21/09
PART NO: #LY09-070-06A
WEIGHT:

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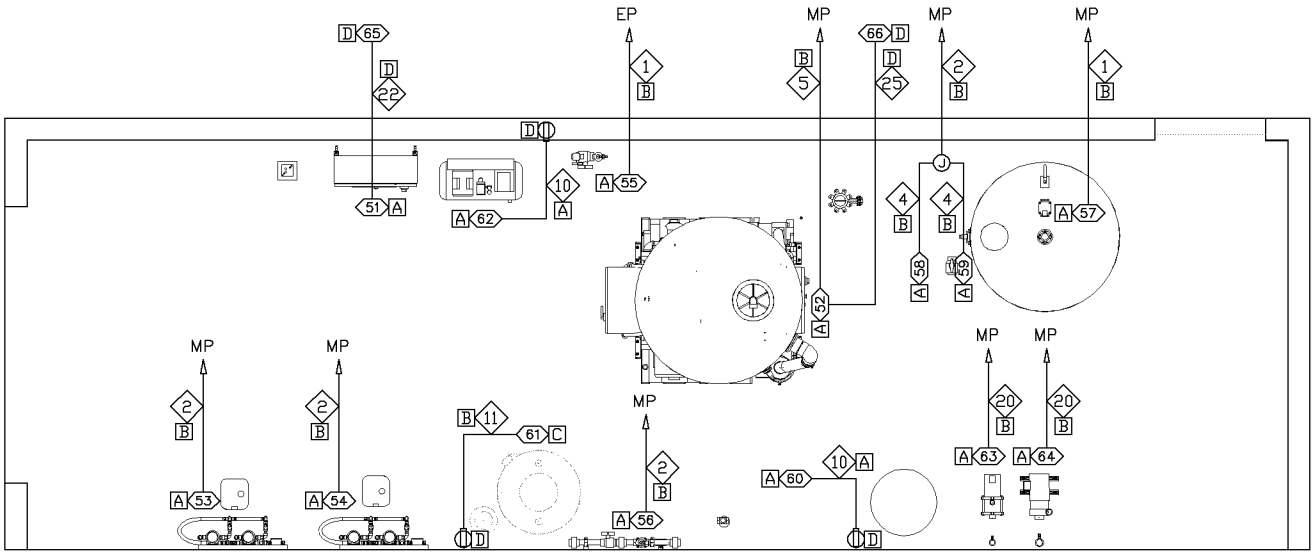
51 MASTER PANEL (MP), W/PC, 460VAC, 3PH, FLA 9
52 EQ–MODULE SLAVE PANEL (EQP), 460VAC, 3PH, FLA 113
53 2 SOLENOID VALVE (3/4") FOR CHMEICAL MODULE, 24 VDC
54 2 SOLENOID VALVE (3/4") FOR CHMEICAL MODULE, 24 VDC
55 SOLENOID VALVE, 1", 24 VDC, FOR PIT FILL
56 2 SOLENOID VALVE (1 1/2"), 24 VDC, FOR WALL MODULE
57 SOLENOID VALVE, 2", 24 VDC, FOR TANK FILL
58 HI–LEVLE FLOAT SWITCH, 24 VDC, FRESH WATER TANK
59 LOW–LEVLE FLOAT SWITCH, 24 VDC, FRESH WATER TANK
60 WATER SOFTENER, 120V/60HZ
61 WATER HEATER, NATURE GAS, 120V/60HZ
62 AIR COMPRESSOR, 20 GAL TANK, 120V, 11 AMPS
63 BOOSTER PUMP, CHEMCIAL ARCHES, 1 HP, 460V, 3M
64 BOOSTER PUMP, RINSE ARCH & BRUSH SPRAY BAR, 3 HP, 460V, 4M
65 FEEDER & DISCONNECT FOR MASTER PANEL, 460 V, 3 PH.
66 FEEDER & DISCONNECT FOR EQ–MODULE SLAVE PANEL, 460 V, 3 PH.

1 2–#16, 24 VDC, 1/2" CONDUIT
2 3–#16, 24 VDC, 1/2" CONDUIT
3 4–#16, 24 VDC, 1/2" CONDUIT
4 2–#18, 2 CONDUCTOR FLEXIBLE CORD, COMES W/SENSOR
5 4–#16, 24 VDC AND 1–ETHERNET CATEGORY 5E CABLE W/RJ–45 CONNECTORS, 1/2" CONDUIT
6 SERIAL CABLE, COMES W/EQUIPMENT
10 FLEXIBLE CORD WITH PLUG, COMES W/EQUIPMENT
11 3–#12, 120 VAC, 1/2" CONDUIT
20 3–#12, 460 VAC, 1/2" CONDUIT
21 6–#12, 460 VAC, 1/2" CONDUIT
22 3–#10, 460 VAC, 3/4" CONDUIT
22 3–#10, 460 VAC, 3/4" CONDUIT
23 3–#8, 460 VAC, 3/4" CONDUIT
24 3–#4, 460 VAC, 1" CONDUIT
25 3–#1/0, 460 VAC, 1 1/2" CONDUIT



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

LEGEND:
- DEVICE
- RECEPTACLE, 120V, 20A
- JUNCTION BOX
- BRANCH CIRCUIT/FEEDER
- MP CONNECTED TO MASTER CONTROL PANEL
- EP CONNECTED TO EQ–MODULE SLAVE PANEL
- BP CONNECTED TO BRUSH MODULE SLAVE PANEL

PROVIDED BY:
- A INTERCLEAN
- B ELECTRICAL CONTRACTOR
- C CUSTOMER
- D GENERAL CONTRACTOR

NOTE:
1 ALL ELECTRICAL METHODS AND MATERIALS SHALL BE SUITABLE FOR USE IN WET LOCATION PER NEC 310–8, 370–15A, 410–4A, AND ALL APPLICABLE CODES.
2 ALL CONDUCTORS SHALL BE THHN AND HAVE TEMPERATURE RATING OF 90 °C (194 F°).
3 CONDUITS MAY BE COMBINED TO MINIMIZE RUNS, BUT DO NOT COMBINE AC AND DC CIRCUITS.
4 BRANCH CIRCUITS ARE SIZED FOR 500' MAX. RUNS.
5 ELECTRICAL CONDUIT AND CONDUCTORS SIZES ARE MINIMUMS REQUIRED BY INTERCLEAN. SIZES MAY BE SUBJECT TO CHANGE PER CODES AND REGULATIONS.
6 MINIMUM SIZE FEEDER AMPACITY PER NEC 215–2(b)(C)

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	KM
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN | CHECK: KM | APPR: &&& | SCALE: 3/8"=1'

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
ELECTRICAL LAYOUT - EQUIPMENT ROOM

DATE: 07/21/09
PART NO: #LY09-070-06B
WEIGHT:

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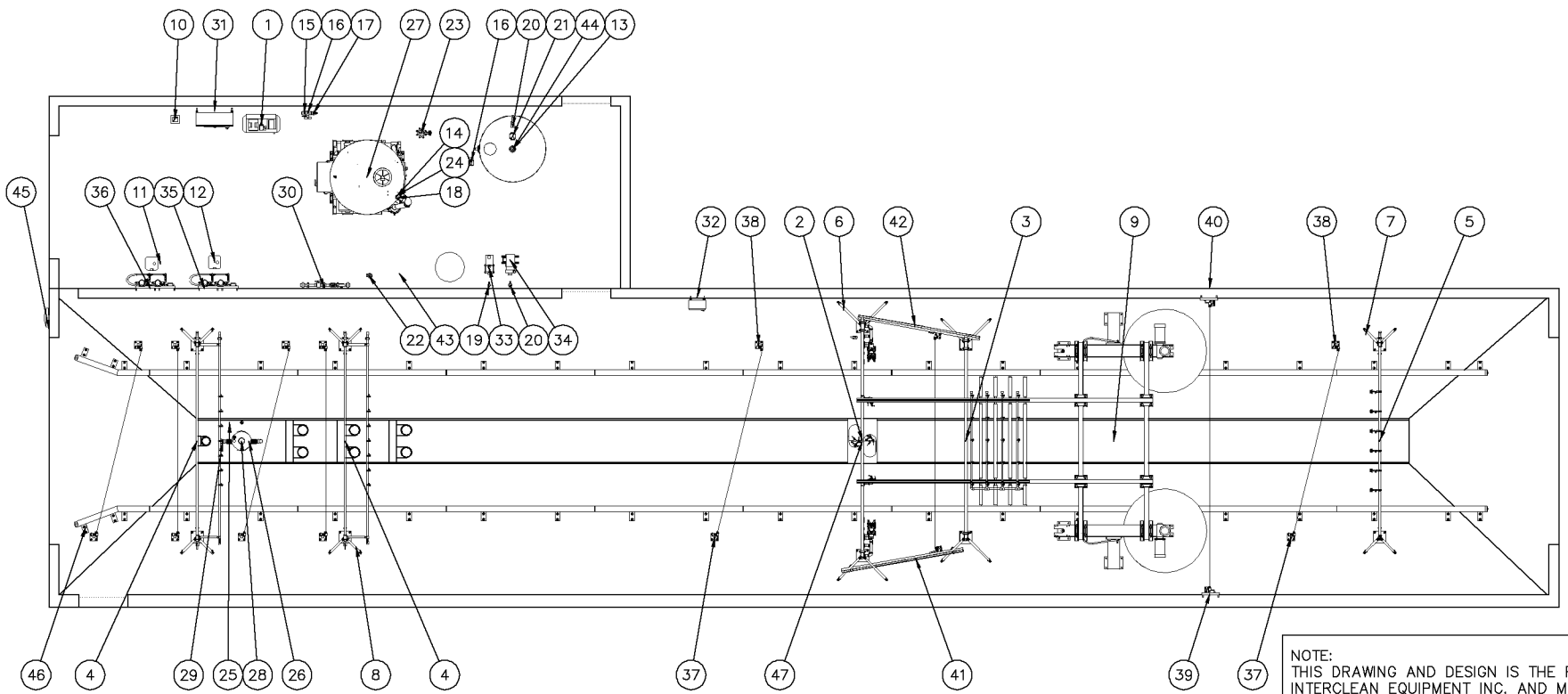
BILL OF MATERIALS FOR LY09-070

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#DY08-334_1	Air Compressor, Floor Mnt, 20 Gal., 120V/60Hz, w/3/4" Outlet	AC112121-00
2	1	#D99038_1	Spinner Arch Assembly, 12 Spinners, Galvanized	AR311c-00
3	1	#DY03-023_1	Arch Ass'y, Rear Wash, w/32x0530 Nozzles, W=13', H=14'-8"	AR31292-01
4	2	#DY00-210_1	Arch Ass'y, Chem., S.S., for Truck Wash, Side & Rear	AR322252-00
5	1	#DY00-218_1	Arch, Rinse, S.S., for Truck Wash	AR322352-00
6	8	#D97437_1	Arch Leg Ass'y, Floor Mount, H=12' 8 1/2", Galv.	AR3611-00
7	4	#D96096_1	Arch Leg Ass'y, Floor Mount, H=7'-8 1/4", Galv.	AR3611-01
8	8	#DY02-326_1	Arch Leg Assembly, Floor Mount, H=7'-8", SS 304	AR36121-01
9	1	#DY05-016_1	Brush Module Ass'y, Galv. Frame, 2-Hi Brushes, 460V, 60Hz	BM83111-02
10	1	#D99016_1	Spinner Nozzle Adjusting Tool Assembly	C61813-00
11	1	#DY07-624_1	Chemical w/Test Kit Ass'y, ICE-Citric, 5 Gallons	CH1121-5
12	1	#DY07-625_1	Chemical w/Test Kit Ass'y, InterGreen, 5 Gallons	CH1211-5
13	1	C0161e-00	Fixed Air Gap, Inlet 2", Outlet Threaded 3", Cast Iron	C0161e-00
14	4	C01b71-05Mnpt	Hose Barb, 1/2" M npt x 1/2" Hose End, Nylon	C01b71-05Mnpt
15	1	C02111-1	Valve, Ball, 1", Compact, Socket, EPDM O-Ring Seals	C02111-1
16	2	C02111-2	Valve, Ball, 2", Compact, Socket, EPDM O-Ring Seals	C02111-2
17	1	C02122-16	Valve, Solenoid, 1", npt x npt, 24 VDC, GF Nylon, w/Dim Coil	C02122-16
18	2	C02211-05	Ball Valve, 1/2", Brass, for Low Pressure Gas	C02211-05
19	2	C02211-15	Valve, Ball, 1 1/2", NPT, Bronze, Webstone #41706	C02211-15
20	2	C02211-2	Valve, Ball, 2", NPT, Brass, Webstone #41707	C02211-2
21	1	C02221-32	Valve, Sol.Op. 2", NPT x NPT, Brass, 24VDC	C02221-32
22	1	C02231-15	Valve, Swing Check, 1 1/2" F.NPT, Bronze	C02231-15
23	2	#DY05-320_1	Butterfly Valve Ass'y, 4", w/Manual Actuator (Lever)	C0235a1-4a
24	4	C084-05	Hose Clamp, 1/2", worm drive, S.S, #HSS6 (7/16"-25/32")	C084-05
25	1	C0b121-02	Float Level Switch, Pit fill, red, NC, 25', #2901-B1-S1-C1-25	C0b121-02
26	1	C0b122-01	Float Level Switch, Pit low, yellow, NO, 25', #2900-B1-S1-C1-25	C0b122-01
27	1	#DY05-001_1	EQ-Module Ass'y, 75Hp,460V,w/3-way Valve, Bio-Re.&Soft Start	EM12211-02
28	1	#DY06-130_1	InterScreen, SS, Weld, H=2'-11", 4" NPT Outlet, 0.015" Slot	IS232-00
29	1	#DY00-133_1	Intake Pipe, Field Ass'y, 2" SCH 80 PVC, 100 Holes	IS42-00
30	1	#DY05-031_1	Wall Module Ass'y, Rinse, 2 Inlets and 2 Outlet	MW3122-02
31	1	#DY01-278_1	Master Panel, Field Ass'y, Reclaim Water, Type A, 460V	PA111213-00
32	1	#DY01-286_1	Slave Panel, Field Ass'y, 2x5Hp, 460V, 60Hz	PA23212-00
33	1	#DY11-160_1	Pump, Booster, Floor Mnt, 1Hp, 460V, 60Hz, tefc, Gould.	PU22112321-00
34	1	#DY00-180_1	Pump, Booster, Floor Mounted, 3Hp, 230/460V, odp, Gould	PU22122311-00
35	1	#DY08-190_1	Dosatron Pump (Aflas 1:20) Ass'y, 2 Pumps, Wall Mnt	PU23432-00
36	1	#DY08-191_1	Dosatron Pump (Viton 1:50) Ass'y, 2 Pumps, Wall Mnt	PU23432-01
37	6	#DY08-433_1	Photo Eye Ass'y, Receiver, H=3', SS 304, Floor Mnt	SE3211211-00
38	6	#DY08-342_1	Photo Eye Ass'y, Sender, H=6', SS 304, Floor Mnt	SE3212212-00
39	1	#D98151_1	Photo Eye Assy, Cutler-Hammer, Receiver, Wall Mount	SE32231-01
40	1	#D98150_1	Photo Eye Ass'y, Cutler-Hammer, Sender, Wall Mount	SE32232-01
41	1	#DY00-101_1	Photo Eye Ass'y, Receiver, Cutler-Hammer, Arch Leg Mount	SE323311-00
42	1	#DY00-102_1	Photo Eye Ass'y, Sender, Culter-Hammer, Arch Leg Mount	SE323321-00
43	1	#DY07-628_1	Softener Ass'y, w/Salt & Test Kit, 110V, 60Hz, 18-39 GPM	SO3212-00
44	1	#D97258_1	Tank, 925 gallon, Field Ass'y, w/2 Float Level Switches	TA2112-00
45	1	#DY07-099_1	Encompass Reader Ass'y, Wall Mnt, w/200 Tag & 20' Cable	TC3611-00
46	1	#D98045_1	Tire Guides, CTW, Galv., L=96', OD=4.5", H= 5.5"	TGa141-95
47	1	#DY08-251_1	Underchassis Module Ass'y, Galv., 2 Spinners, L=2', W=3', H=1'	UC131111-00



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN | CHECK: PK | APPR: #### | SCALE: 3/16"=1'

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
EQUIPMENT LAYOUT

DATE: 07/21/09
PART NO: #LY09-070-07
WEIGHT:

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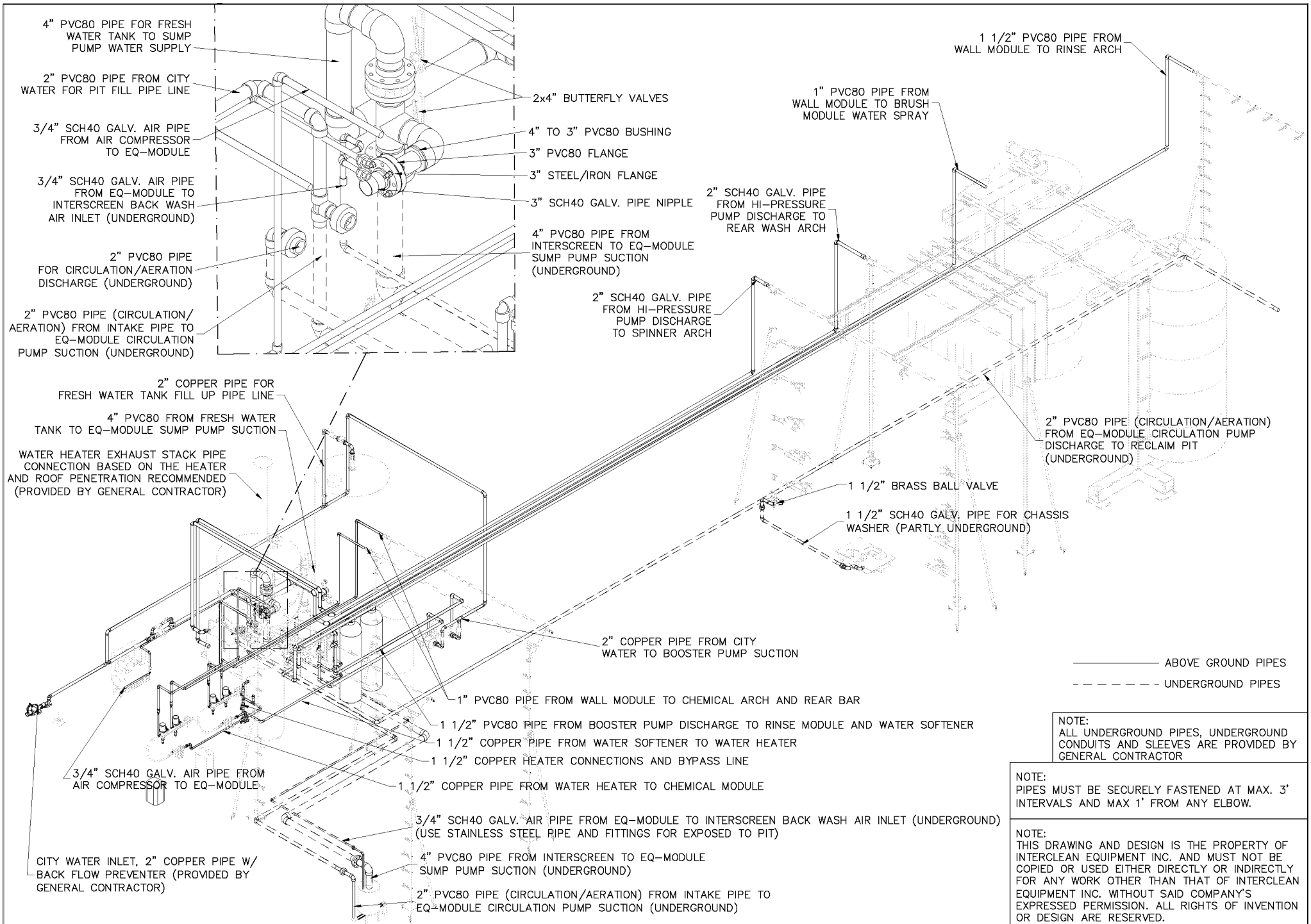

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

NOTE:
PIPES MUST BE SECURELY FASTENED AT MAX. 3' INTERVALS AND MAX 1' FROM ANY ELBOW.

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####

SCALE: NO SCALE

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PIPING 3D

DATE: 07/21/09
PART NO: #LY09-070-08
WEIGHT:

NOTE:
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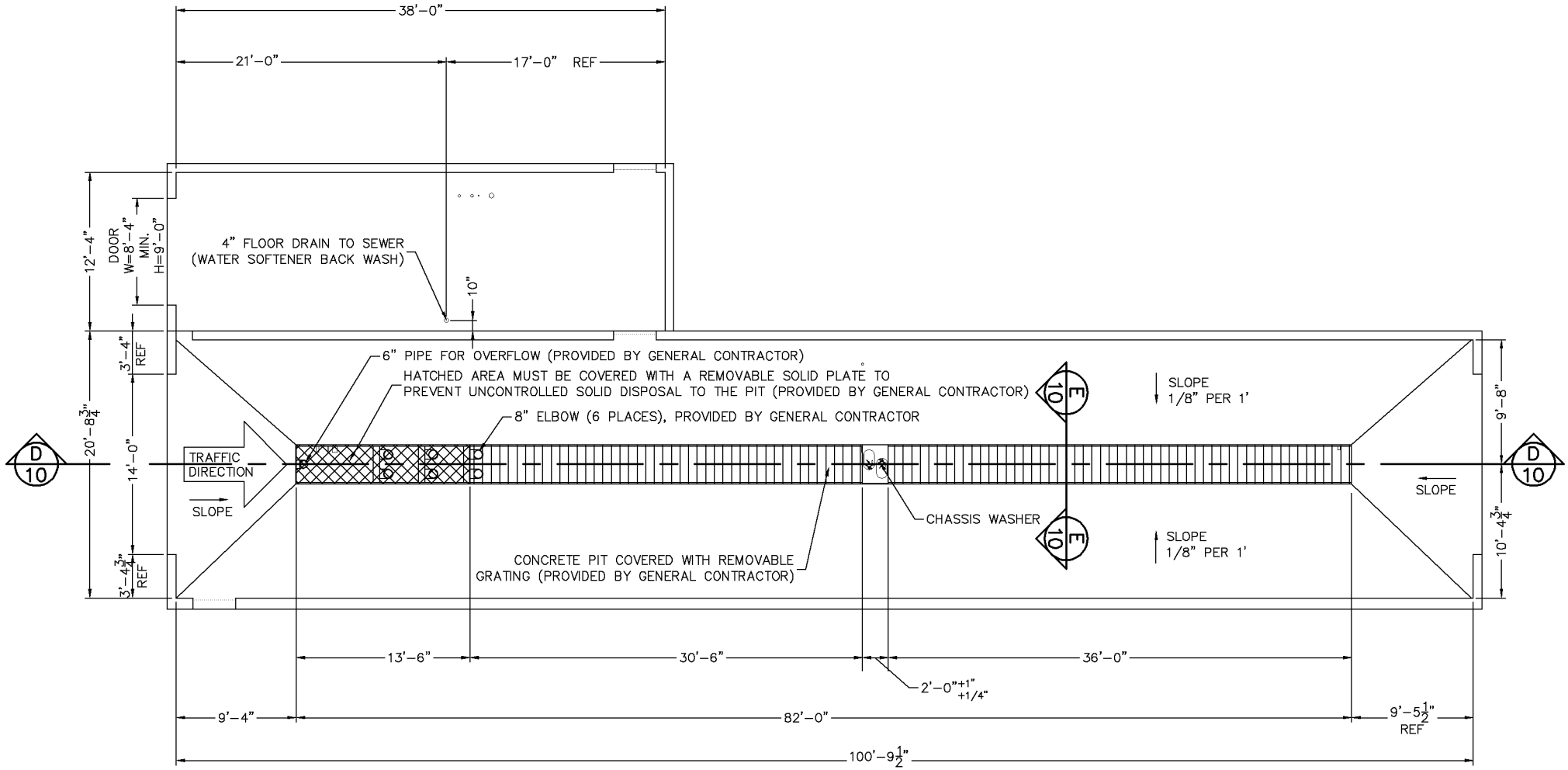
NOTE:
THE WASH SYSTEM TEMPERATURE REQUIRED:
WASH BAY: MIN. 33°F
EQUIPMENT ROOM: MIN. 33°F, MAX. 90°F

NOTE:
THE CONCRETE MUST CURE FOR 27 DAYS BEFORE INSTALLING TIRE GUIDES



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
CONCRETE LAYOUT

DATE: 07/21/09
PART NO: #LY09-070-09
WEIGHT:

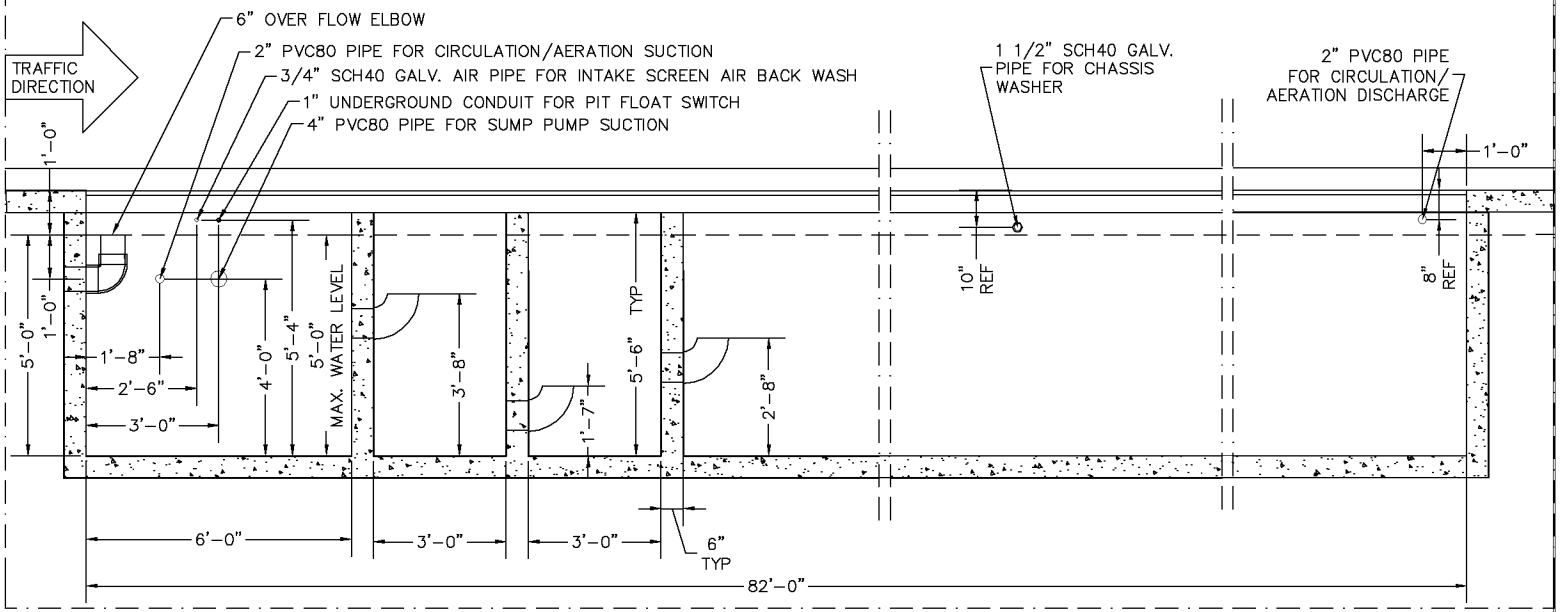
O:\ECTS\USA\IA\Coralville\CoralvilleTransit\LY08-070.dwg, 09_Concrete, 5/11/2011 3:45:41 PM, Susan, HPDJ1055CM.pc3

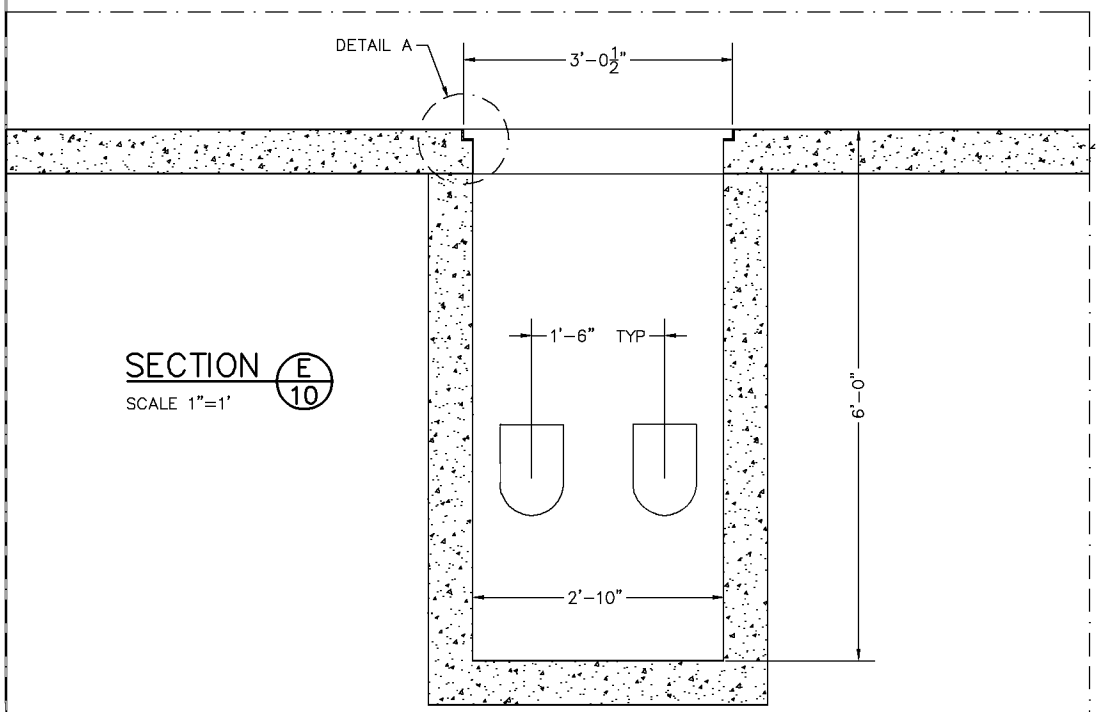
NOTE:
THE SUMP PUMP AND CIRCULATION /AERATION SUCTION PIPELINES TO BE LOCATED UNDER THE PIT WATER LEVEL FOR FULL LENGTH

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

SECTION D/10

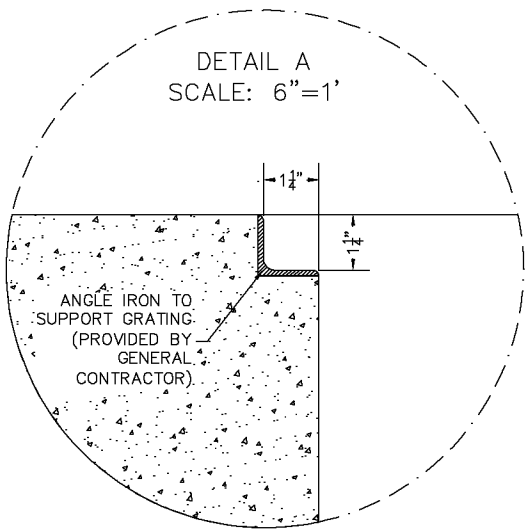
SCALE 1/2"=1'





SECTION E/10

SCALE 1"=1'



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PIT DETAIL

DATE: 07/21/09
PART NO: #LY09-070-10
WEIGHT:

O:\JECTS\USA\IA\Coralville\CoralvilleTransit\LY09-070.dwg, 10_PitDetail, 5/11/2011 3:45:45 PM, Susan, HPDJ1055CM.pc3

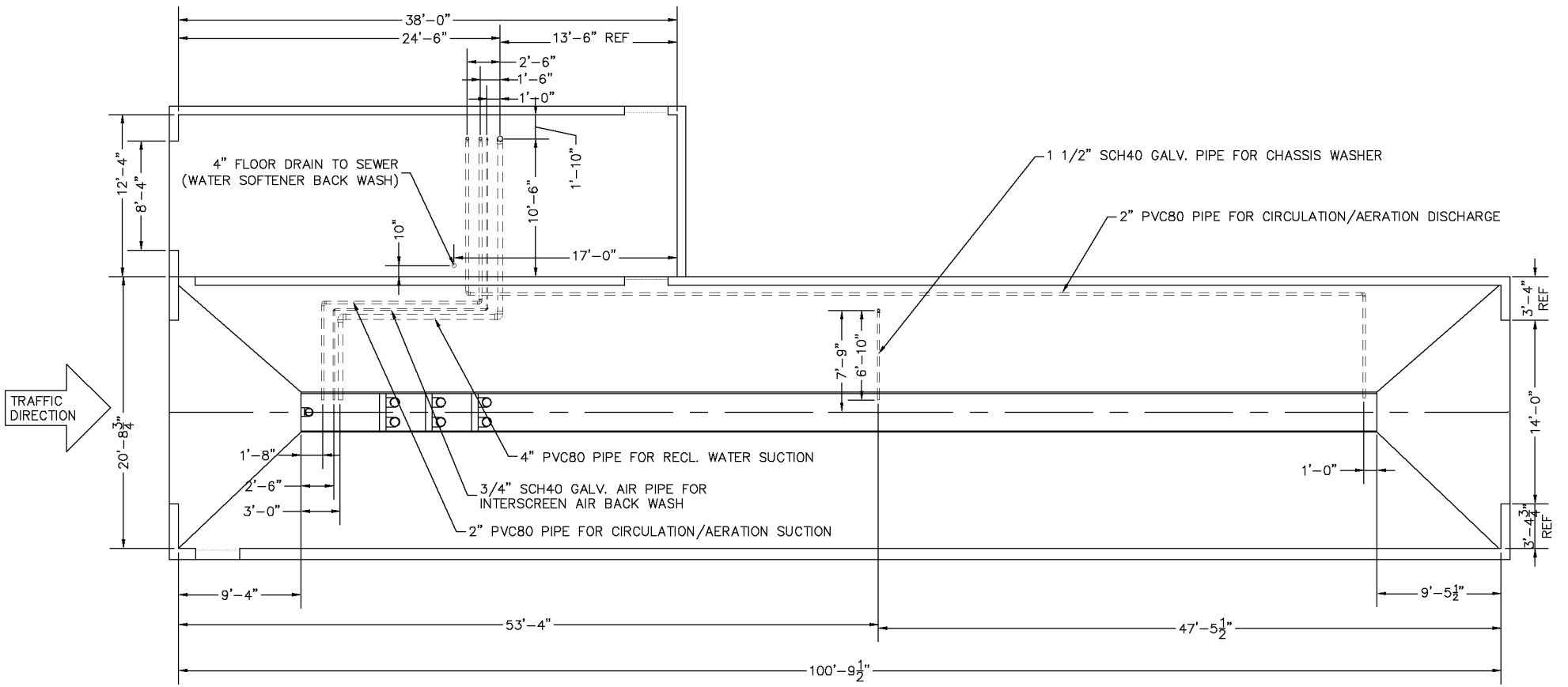
NOTE:
THE SUMP PUMP AND CIRCULATION /AERATION SUCTION PIPELINES TO BE LOCATED UNDER THE PIT WATER LEVEL FOR FULL LENGTH

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

ABOVE GROUND PIPES

UNDERGROUND PIPES

NOTE:
UNDERGROUND PIPELINES:
1. STANDARD PIPE THREADS AT BOTH ENDS OF GALVANIZED PIPE
2. LEAVE MIN. 6" STUB ABOVE FINISHED SURFACES
3. LEAVE MIN. 6" STUB OUT IN RECLAIM PIT
4. LOCATE UNDERGROUND PIPELINES FROM 8" TO 14" DEPTH UNLESS OTHERWISE STATED



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
UNDERGROUND PIPES

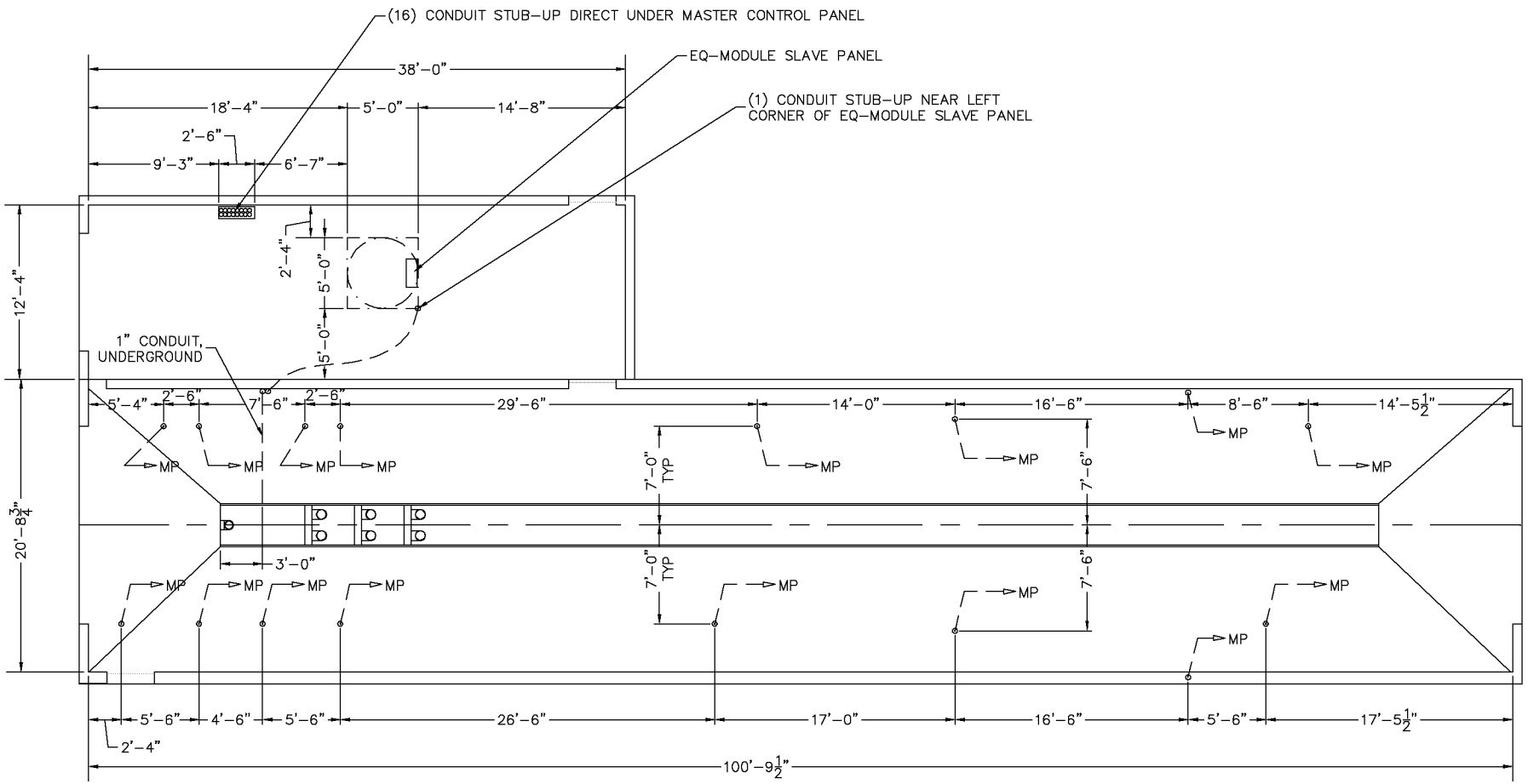
DATE: 07/21/09
PART NO: #LY09-070-11
WEIGHT:

PROJECTSUSA\IA\CoralMle\CoralMleTransit\LY09-070.dwg, 11_UGPipes, 5/11/2011 3:45:48 PM, Susan, HPDJ1055CM.pc3

CONDUIT STUB–UP, 6" ABOVE FLOOR

1/2" UNDERGROUND CONDUIT
UNLESS OTHERWISE NOTED

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

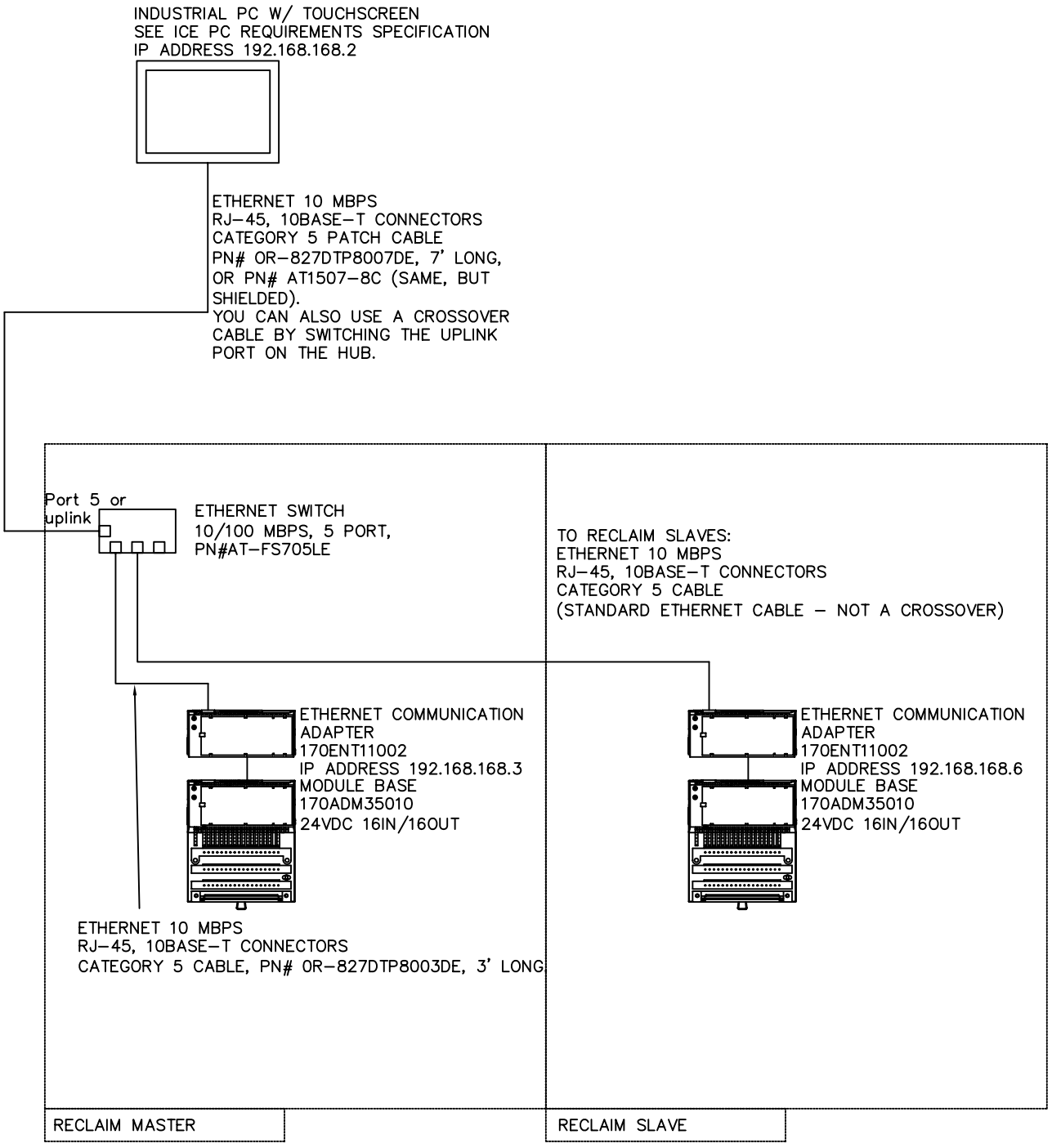
InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	@@@
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
UNDERGROUND CONDUITS

DATE: 07/21/09
PART NO: #LY09-070-12
WEIGHT:

O:\ECTS\SUA\Coralville\Coralville Transit\LY08-070.dwg, 12_Conduits, 5/11/2011 3:45:51 PM, Susan, HPDJ1055CM.pc3



REV	DATE	DESCRIPTION	APP.
D	04/14/08	ETHERNET COMM. ADPT. PART #UPDATE	KM
C	05/08/07	5 PORT SWITCH ADDED	KM
B	10/08/00	ADDED CABLING PN'S	DJL
A	12/15/99	ORIGINAL	DJL

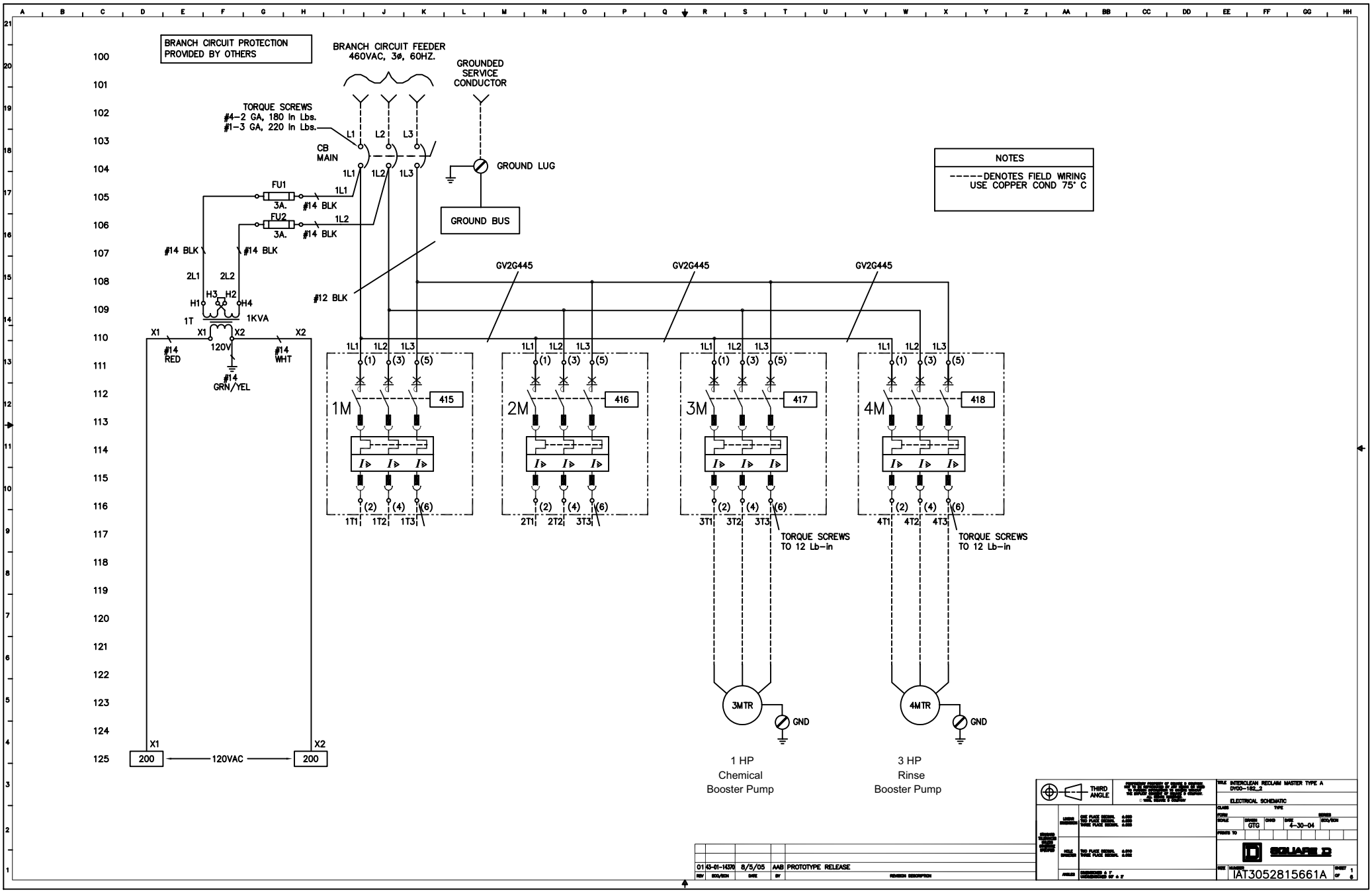
InterClean Equipment, Inc.

UNSPEC'D TOLERANCES: .X: ±1/16, .XX: ±1/64, .XXX: ±.005, .XXXX: ±.0005, ANGLE: ±1°

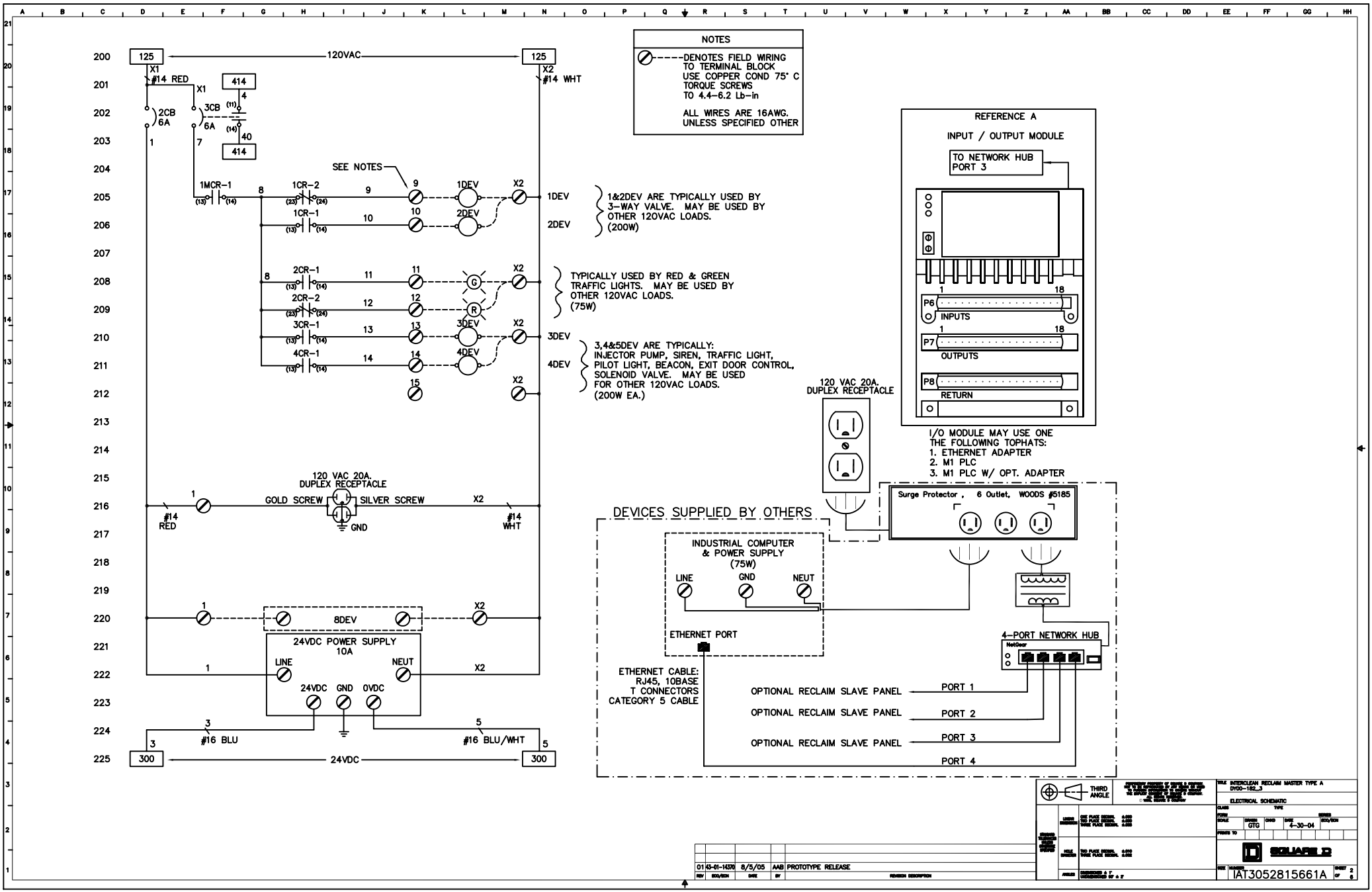
DRAWN BY: KM | CHECKED: KM | APPROVED: KM | SCALE: NA

STANDARD RECLAIM WASH
PC BASED SYSTEM
COMMUNICATION LAYOUT

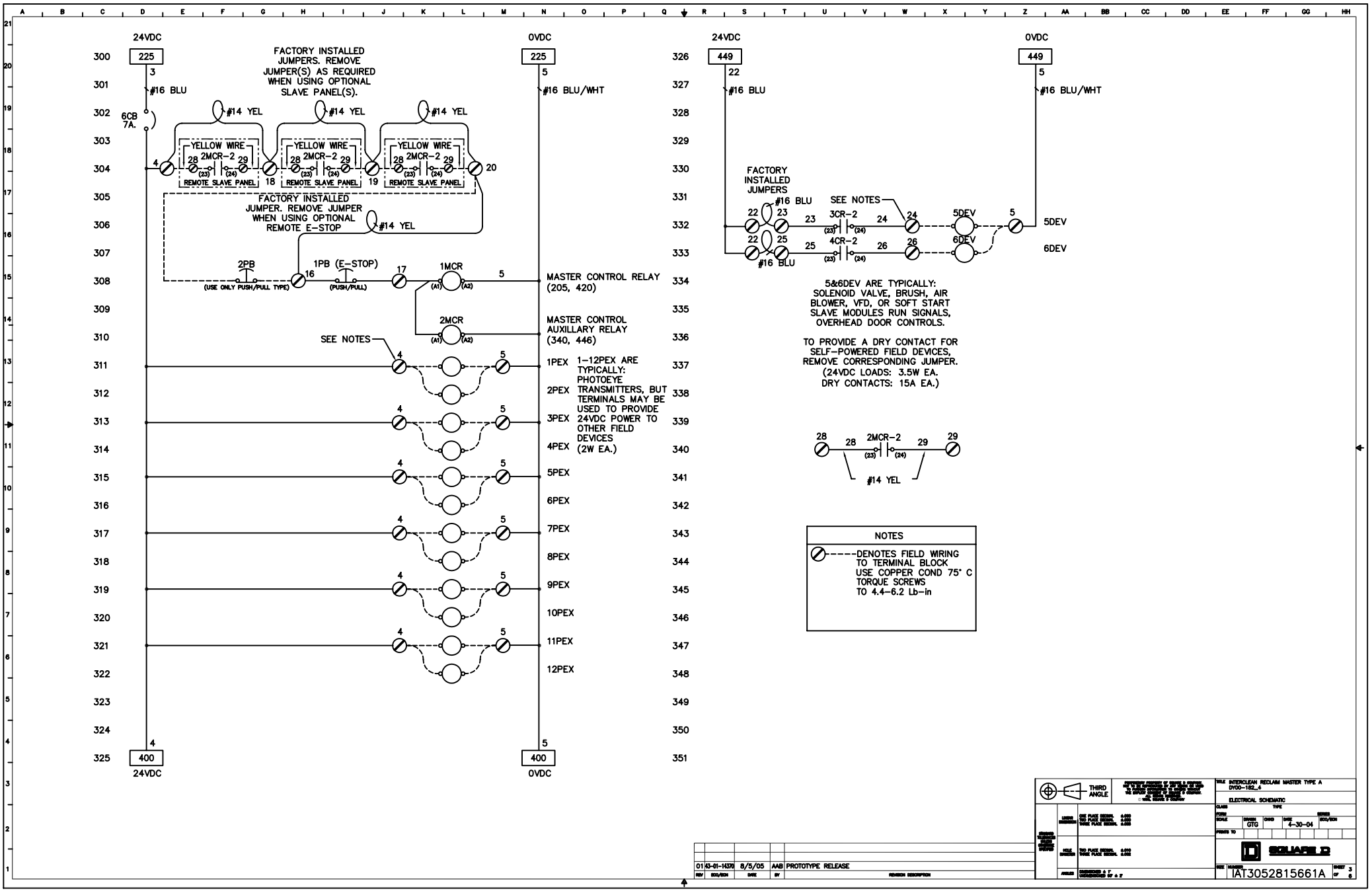
DATE: 09/25/01
D NO:



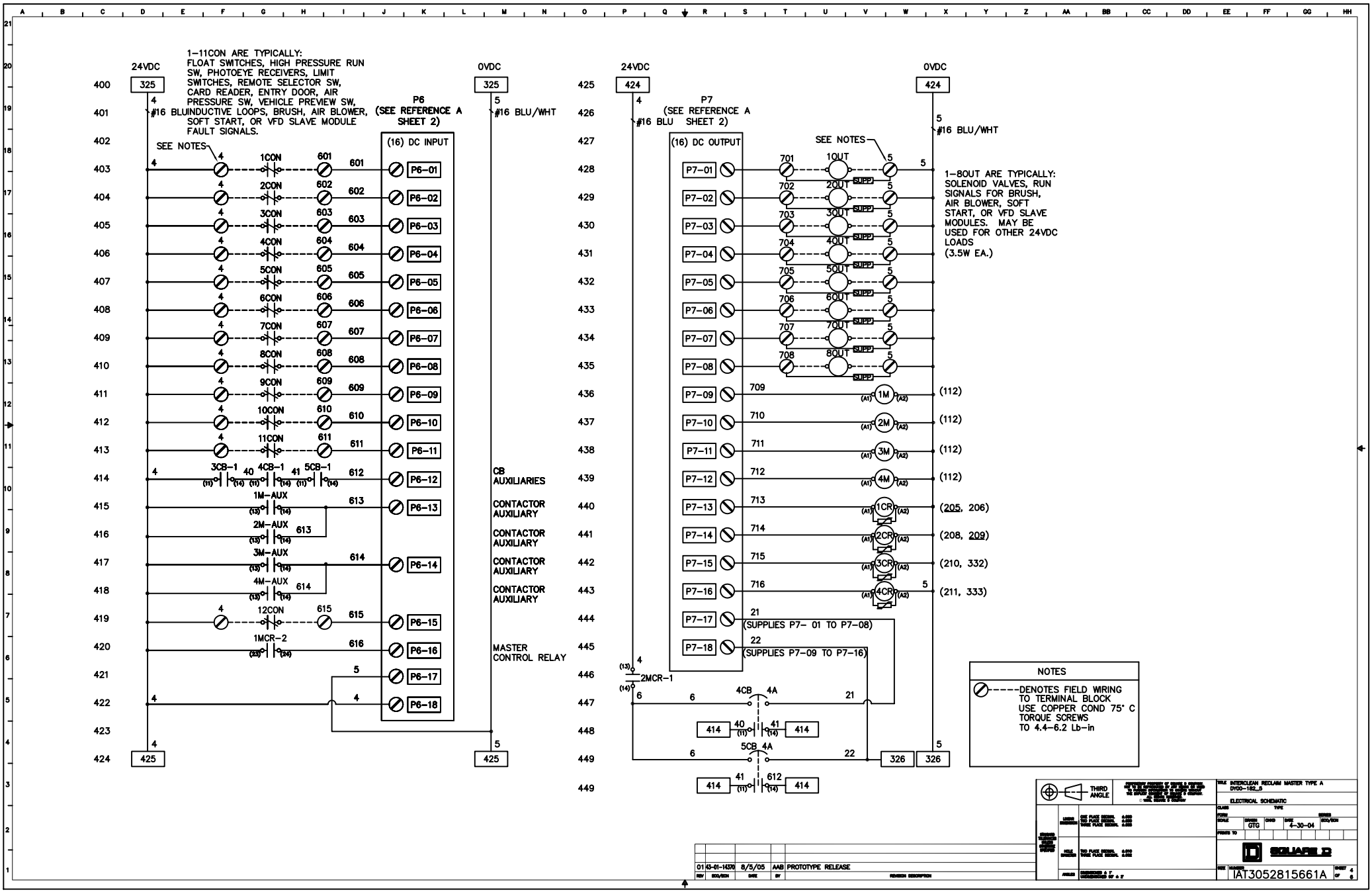
Master Control Panel



Master Control Panel

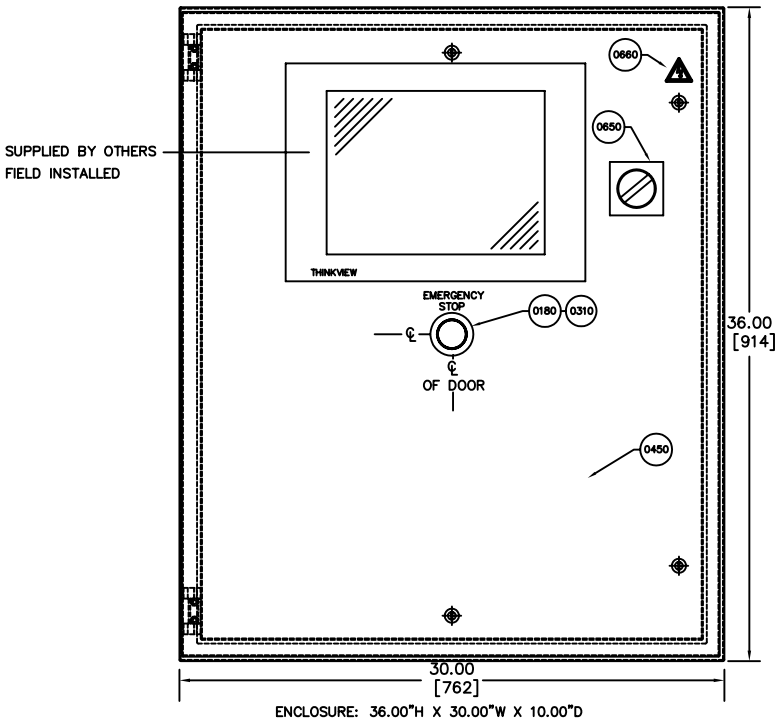


Master Control Panel



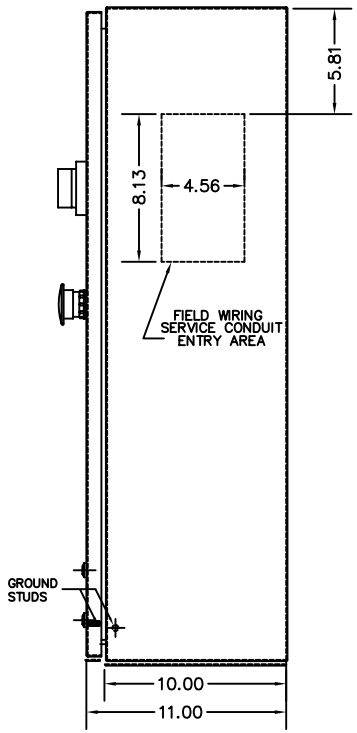
Master Control Panel

FRONT VIEW OF ENCLOSURE

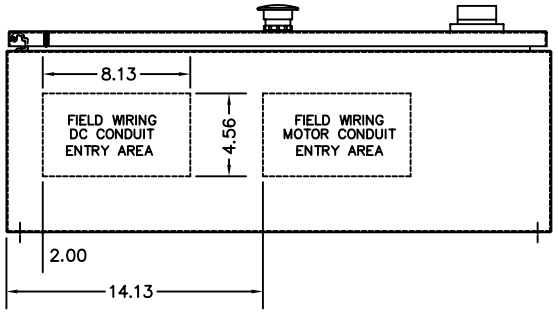


ENCLOSURE: 36.00"H X 30.00"W X 10.00"D

RIGHT SIDE VIEW OF ENCLOSURE



BOTTOM VIEW OF ENCLOSURE



REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
01	43-01-14370	8/5/05	AAB	PROTOTYPE RELEASE

THIRD ANGLE

TITLE: INTERCLEAN RECLAIM MASTER TYPE A
ENCLOSURE LAYOUT
ASSEMBLY DRAWING

CLASS	TYPE

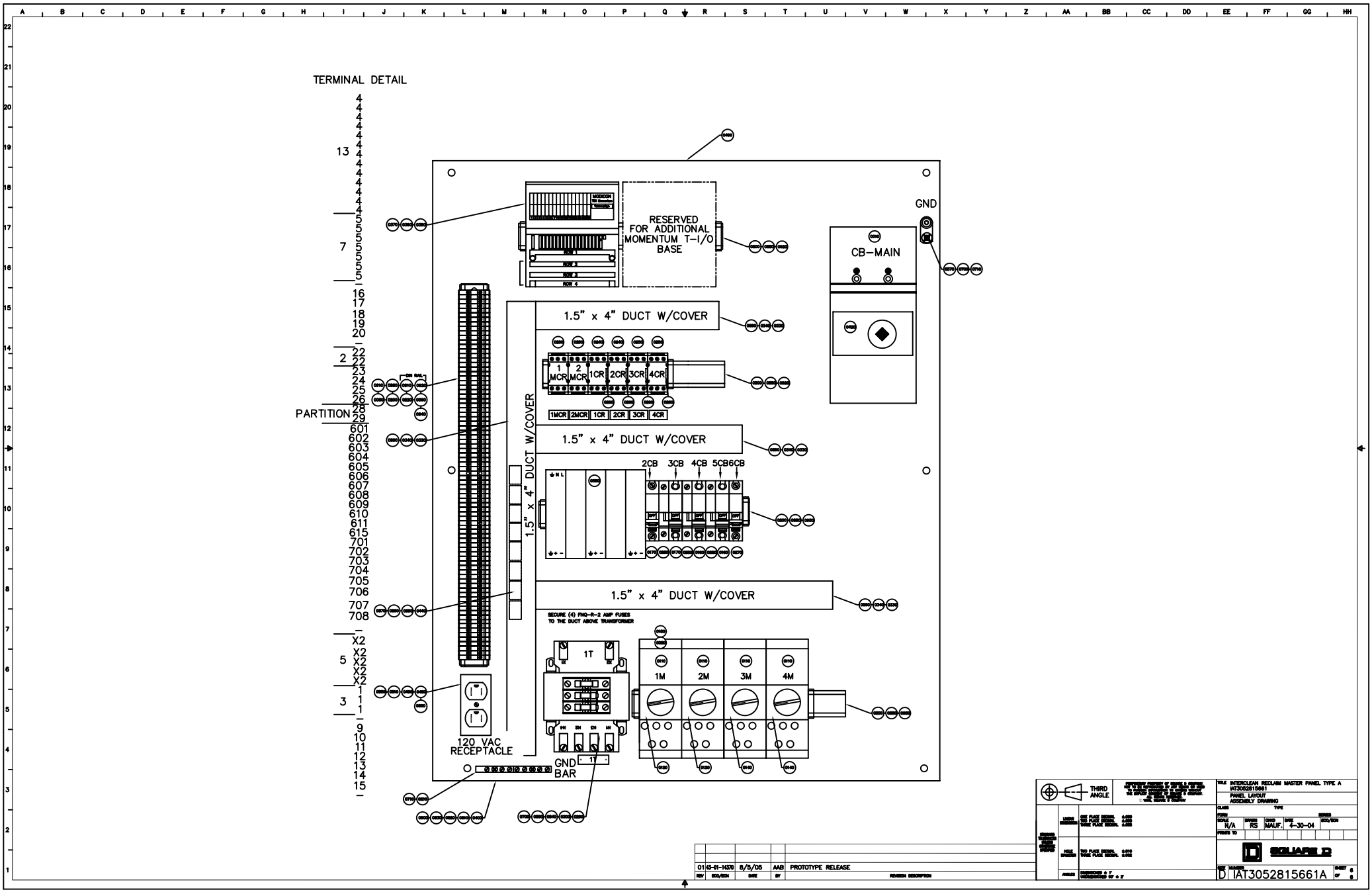
FORM	SCALE	DRAWN	CHKD	DATE	ECO/ECN
	N/A	RS	MAUF	4-30-04	

PRINTS TO

SQUARED

SIZE: D | NUMBER: IAT3052815661A | SHEET 1 OF 1

Master Control Panel



Master Control Panel

ITEM	Description	Qty.	Part Number	Reference	Manufacture
1	Enclosure, N4/12 36x30x10	1	MPINCAAM05	Main Enclosure	Saginaw Control
2	Mounting Plate 33 x 21	1	MPINCAAM06	Main Enclosure	Saginaw Control
3	Molded Case Switch, 150A	1	HGL36000S15	CB Main	Square D
4	Extension CB Mechanism	1	S29343	CB Main	Square D
5	Handle, Disconnect Red/Yellow	1	S29340	CB Main	Square D
6					
7					
8					
9					
10	Base Pussance 12A VIS conect.visE	4	LBU12	1m-2m-3m-4m	Telemecanique
11					
12	4 POS. Busbar WITH 45MM space	3	GV2G445	1m-2m-3m-4m	Telemecanique
13	Terminal Block 3P	1	GV1G09	1m	Telemecanique
14	Overload Unit 0.35A-1.0A 24VDC	2	LUCB1XBL	1m-2m	Telemecanique
15	Overload Unit 3.0A-12.0A 24VDC	2	LUCB12BL	3m-4m	Telemecanique
16					
17					
18					
19					
20	Relay, 1NO/1NC 24vdc coil	2	CA3SK11BD	1cr-2cr	Telemecanique
21	Relay 2NO 24vdc coil	4	CA3SK20BD	1&2mcr-3cr-4cr	Telemecanique
22					
23	Pushbutton, MushHd 40mm 1NC	1	XB4BT42	1pb	Telemecanique
24	Legend Plate, E-Stop Rnd 90mm	1	ZBY9330	1pb	Telemecanique
25					
26					
27					
28	CB UL489 4A 1Pole C Curve	2	60105IAT	4cb-5cb	Square D
29	CB 6A, 1Pole, C Curve, Box/Box	2	60107IAT	2cb-3cb	Square D
30	CB 7A, 1Pole, C Curve, Box/Box	1	60108IAT	6cb	Square D
31	Switch, Auxiliary for CB	3	MG26925	3cb-4cb-5cb	Square D
32	Lug, 1/0-#14 6061 ALU	1	KA25U	Ground	ILSCO
33	Ground Bar ALU 24 Circuit	1	PK15GTA	Ground	Square D
34	Transformer 1000VA w/3P FuBlk	1	9070TF1000D1	1t	Square D
35	Cover Transformer Pri/Sec Kit	1	9070FSC2	1t	Square D
36	Ethernet Communication Mod.	1	170ENT11002	plc	Schneider Automation
37	I/O Base	1	170ADM35010	plc	Schneider Automation
38	Terminals for Momentum	1	170XTS00100	plc	Schneider Automation
39	24VDC Pwr. Sup., 10A	1	SDN-10-24-100	p/s	Sola
40	Grey Terminal Block 22-10AWG	73	AB1VW435U	tb1	Telemecanique
41	Gray End Barrier	1	AB1AS24	tb1	Telemecanique
42	End Anchor Term Block 35mm	11	AB1AB8M35	tb1	Telemecanique
43				tb1	Telemecanique
44				tb1	Telemecanique
45	Terminal Block Markers	1	AB1BV6	tb1	Telemecanique
46	70 Pole Jumper	1	AB1AL4	tb1	Telemecanique
47					
48					
49					
50					

ITEM	Description	Qty.	Part Number	Reference	Manufacture
51					
52					
53	Suppressor (for CA Relays)	4	LA4SKE1E	1cr-2cr-3cr-4cr	Square D
54	Grommet for .875 Hole	1	752IAT		KEYSTONE
55	Fuse 3A (2 req'd. + 4 spares)	6	FNQ-R-3	1t	Bussman
56	Suppressor (for Field Solenoids)	8	199-MSMD1	1OUT thru 8OUT	Allen Bradley
57					
58					
59					
60					
61	Decal, Shock Risk	1	WL32		Panduit
62	1.5" x 4" Wire Duct Black	6'	SL-1.5"X4"W		Panduit
63	1.5" Wire Duct Cover Black	6'	C1.5WL6		Panduit
64		3			
65		1			
66		1			
67	2"x4" Metal Handy Box	1	58371-1/2	Duplex	Appleton
68	Metal Duplex Receptacle Cover	1	58-C-7	Duplex	Appleton
69	20A, Duplex Receptacle	1	5362-I	Duplex	Leviton
70					
71					
72					
73					
74					
75					
76					
77					
78					
79					
80	Decal, Ground	2	PESSERES		Pandiut
81	Fuse Puller	3	9070FP1	1t	Square D
82					
83					
84	Din Rail , High 9.84" long	1	3119117509		Square D
85	Din Rail, HIGH 10.84" long	3	3119117510		Square D
86	Din Rail, High 11.81" long	2	3119117511		Square D
87					
88					
89					
90	Ty-Rap Mounting Base	3	2590149417		Telemecanique

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
01	43-01-14370	8/5/05	AAB	PROTOTYPE RELEASE

THIRD ANGLE

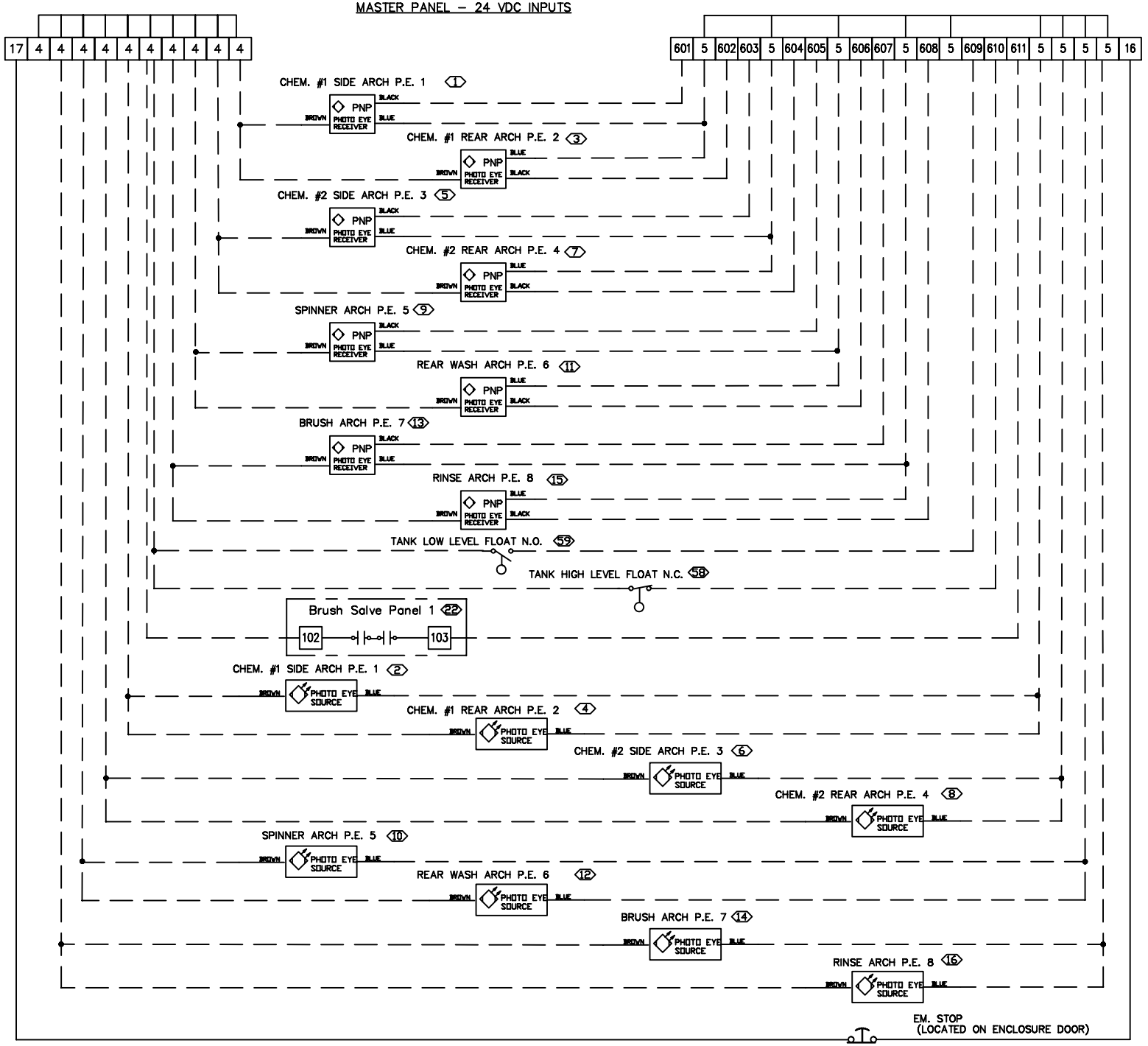
TITLE: INTERCLEAN RECLAIM MASTER PANEL TYPE A
IAT3052815661
MATERIAL LIST
ASSEMBLY DRAWING

CLASS: TYPE:
FORM: N/A | DRAWN: RS | CHKD: MAUF. | DATE: 4-30-04 | ECO/ECN:
FINISH TO:

SQUARE D

SIZE: D | NUMBER: IAT3052815661A | SHEET 7 OF 7

Master Control Panel



Master Control Panel

LEGEND
— — FIELD WIRING
⟨xx⟩ FIELD DEVICE Refer Drawing LY##-###-06
TERMINAL BLOCK

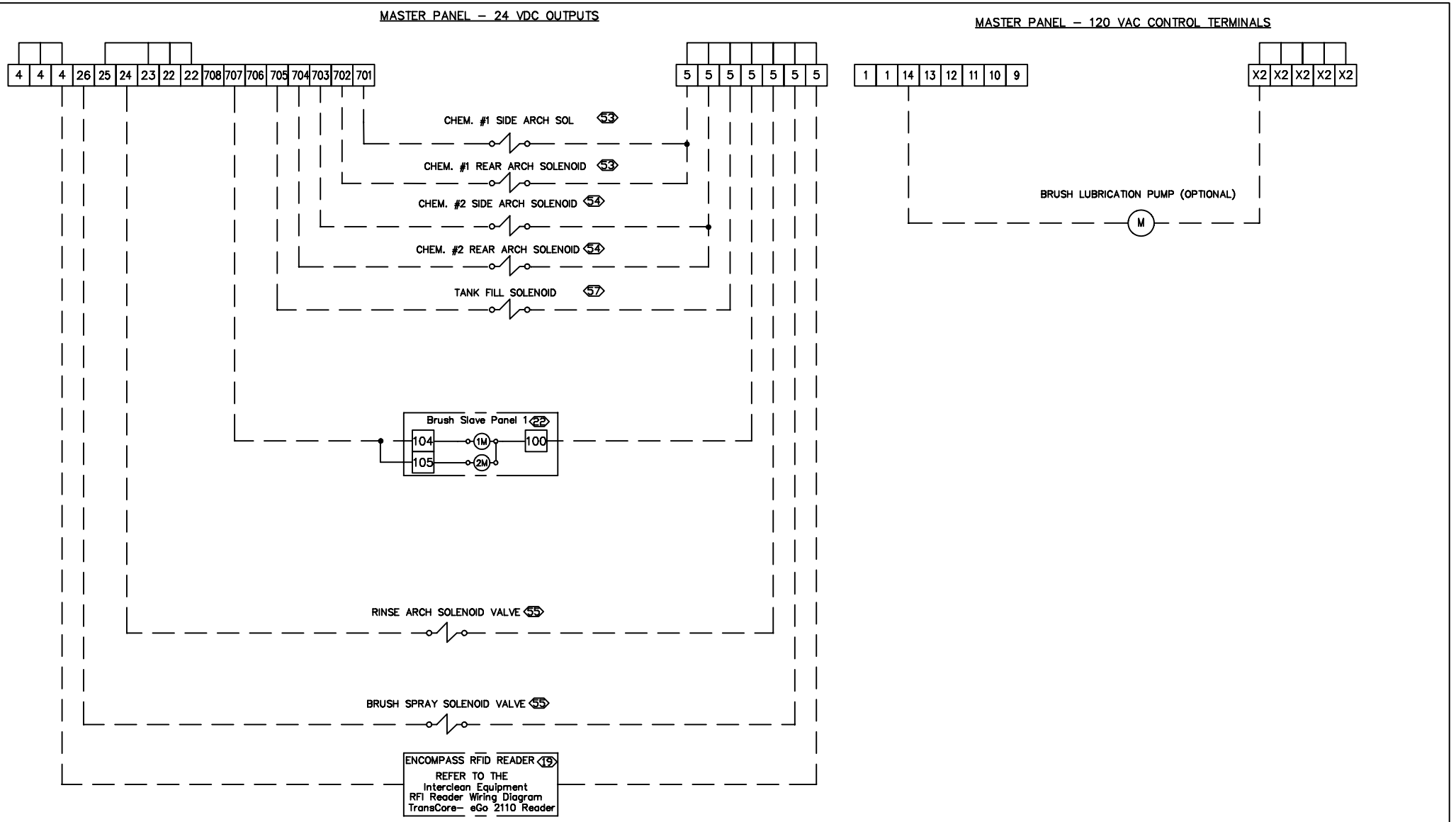
R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment, Inc.

DESIGN:	DRAWN:
KM	KM
CHECK:	APPR:
CHECK	APPR
SCALE:	
NONE	

CoralVille Transit, CoralVille, IA
Truck Wash, Reclaim Water System
Master Panel Input Riser Diagram

DATE:	04/02/12
PART NO:	LY09-070_RDI
WEIGHT:	



LEGEND
— — FIELD WIRING
⟨xx⟩ FIELD DEVICE Refer Drawing LY##–###–06
TERMINAL BLOCK

Master Control Panel

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment, Inc.

DESIGN:	DRAWN:
KM	KM
CHECK:	APPR:
CHECK	APPR
SCALE:	
NONE	

CoralVille Transit, CoralVille, IA
Truck Wash, Reclaim Water System
Master Panel Output Riser Diagram

DATE: 04/02/12
PART NO: LY09-070_RD2
WEIGHT:

BRANCH CIRCUIT PROTECTION
PROVIDED BY OTHERS
TOTAL FLA – 15.2

30A MAIN
DISCONNECT

460 VOLTS
3 PHASE
60 HERTZ

L1
L2
L3

GROUNDED
SERVICE
CONDUCTOR

GND. LUG

1M/1M O/L

TORQUE SCREWS
TO 15 Lb–in

1L1 (1) (2) 1T1
1L2 (3) (4) 1T2
1L3 (5) (6) 1T3

1MTR

5 HP
460VAC, 7.6FLA

2M/2M O/L

TORQUE SCREWS
TO 15 Lb–in

1L1 (1) (2) 2T1
1L2 (3) (4) 2T2
1L3 (5) (6) 2T1

2MTR

5 HP
460VAC, 7.6FLA

– 0VDC 100

+ 24VDC 101

AUX. OUTPUT 102 — 1M AUX 13 14 — 101

AUX. OUTPUT 103 — 2M AUX 13 14 — 101

RUN SIGNAL
+ 24VDC 104 — A1 1M A2

RUN SIGNAL
+ 24VDC 105 — A1 2M A2

⊘-----DENOTES FIELD WIRING
TO TERMINAL BLOCK
USE COPPER COND 75° C
TORQUE SCREWS
TO 4.4–6.2 Lb–in

EXTERNAL WIRING – ----------
INTERNAL WIRING – ——————
DC WIRING – #16 BLUE
DC COMON – #16 WHITE/BLUE STRIPE
460VAC – #12 BLACK

Brush Slave Panel

REV	DATE	DESCRIPTION	APP.
A	10/08/07	ULINE MOTOR STARTERS REPLACE INTEGRAL STARTER	KM

InterClean Equipment, Inc.

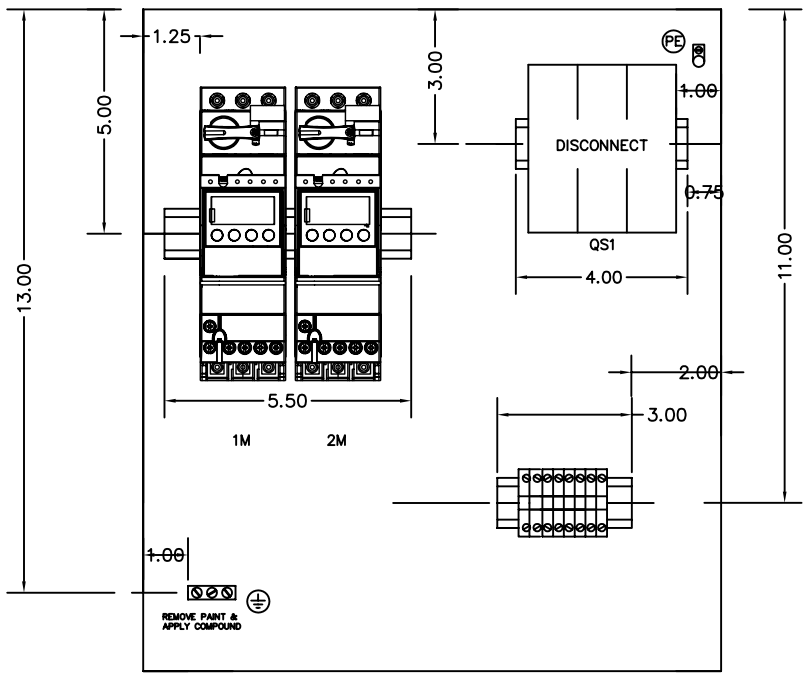
UNSPEC'D TOLERANCES: .X: ±1/16 .XX: ±1/64 .XXX: ±.005 .XXXX: ±.0005 ANGLE: ±1°

DRAWN BY: KM
CHECKED: KM
APPROVED: KM
SCALE: NONE

2 X 5HP SLAVE PANEL
TYPE A
ELECTRICAL SCHEMATIC

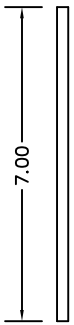
DATE: 5 - 1 - 01
D NO: DY00 - 167_2

PANEL LAYOUT

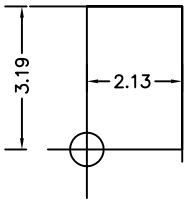


ITEM	QTY	MFG	DESCRIPTION (PART NUMBER)
1	1	HOFFMAN	ENCLOSURE B-LINE #16148CHQRFG
2	1	HOFFMAN	SUBPLATE #A16P14
3	1	TELEMECANQUE	30AMP NON-FUSIBLE DISCONNECT #LK3DU3
4	1	TELEMECANQUE	DISC. SHAFT 5X5X320mm SHAFT #GS1AE8
5	1	TELEMECANQUE	DISCONNECT OPERATING HANDLE #GS1AH420
6	2	TELEMECANQUE	U-LINE STARTER POWER BASE - #LUB12
7	2	TELEMECANQUE	U-LINE CONTROL UNIT- 3.0-12AMP #LUCB12BL
8			
9			
10	6	TELEMECANQUE	TERMINAL BLOCKS #AB1VV435U
11	1	TELEMECANQUE	END BARRIER #AB1AC24
12	2	TELEMECANQUE	END CLAMPS #AB1B8P35
13	1	TELEMECANQUE	TERMINAL MARKER 10 POSITION #AB1BV6
14			
15			
16	1	SQUARE D	DIN RAIL #AM1DE
17	1	SQUARE D	3-POSITION GROUND BAR #PK3GTA1
18			
19			
20			
21	1	BURNDY	UNIVERSAL TERMINAL LUG #KA6U
22	1	A1 ENGRAVING	STICK-ON MARKERS FOR GROUND AND PE
23	A/R	A1 ENGRAVING	STICK-ON WIRNING SIGNS AND LABELS

DISCONNECT SHAFT LENGTH



CENTERLINE DISCONNECT



Brush Slave Panel

REV	DATE	DESCRIPTION	APP.
A	10/08/07	ULINE MOTOR STARTERS REPLACE INTEGRAL STARTER	KM

InterClean Equipment, Inc.

UNSPEC'D TOLERANCES: .XX: ±1/64 .XXX: ±.005 .XXXX: ±.0005 ANGLE: ±1° | DRAWN BY: KM | CHECKED: KM | APPROVED: KM | SCALE: NONE

2 X 5HP SLAVE PANEL
TYPE A
ELECTRICAL SCHEMATIC

DATE: 5 - 1 - 01
D NO: DY00 - 167_3

BRANCH CIRCUIT PROTECTION PROVIDED BY OTHERS

BRANCH CIRCUIT FEEDER
460VAC, 3ø, 50/60 HZ.

GROUNDED SERVICE CONDUCTOR

NOTES
-----DENOTES FIELD WIRING USE COPPER COND 75° C

TORQUE SCREWS TO XX In Lbs.
L1 L2 L3
CB MAIN
1L1 1L2 1L3

GROUND LUG
#6 GR/YL
GROUND BUS
#2 AWG BLACK
BUS BAR

2L1 FU1 2A. 1L1
2L2 FU2 2A. 1L2

2L1 2L2
H3 H2
H1 H4
1T 750VA
X1 X1 X2 X2
#14 RED 120V #14 WHT
#14 GRN/YEL

1L1 1L2 1L3 (1) (3) (5)
1M 414
(2) (4) (6)
1T1 1T2 1T3
TORQUE SCREWS TO 12 Lb-in

1L1 1L2 1L3 (1) (3) (5)
2M 415
(2) (4) (6)
2T1 2T2 2T3

1/L1 3/L2 5/L3
1CB
213 POSITION #2
213 POSITION #4
2/T1 4/T2 6/T3
3M 416
3T1 3T2 3T3
TORQUE SCREWS TO 100 Lb-in

R/L1 S/L2 T/L3 START LI1
27 #16 BLU (13) (14) 5CR-1
AC VARIABLE SPEED DRIVE UNIT
24V 3 #16 BLU 225
TO PLC INPUT
U/T1 V/T2 W/T3
DRIVE O.K.
R1A 615 #16 BLU 417
R1C 4 #16 BLU 24V 417
TORQUE SCREWS TO 4.0-4.5 Lb-in

1/L1 3/L2 5/L3
OPT. SOFT START SLAVE MODULE (IN SEPARATE ENCLOSURE) 1SS
2/T1 4/T2 6/T3

L1	1	216	120VAC
L2	X2	216	
RUN	703	430	24VDC
FAULT	607	409	
OVDC	5	430	
24VDC	4	309	

NOTE: IF SOFT START IS PROVIDED, PROPER BRANCH CIRCUIT PROTECTION MUST ALSO BE PROVIDED PER MANUFACTURERS INSTALLATION INSTRUTIONS.

1MTR GND
2 HP

2MTR GND
7.5 HP

3MTR GND
60, OR 75 HP

SUPPLIED BY OTHERS

X1 200 ← 120VAC → X2 200

Reclaim Slave Panel

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES ROM MBR
D	43-04-16514	7/08/08	GH	SWITCH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	UPDATES FROM MBR

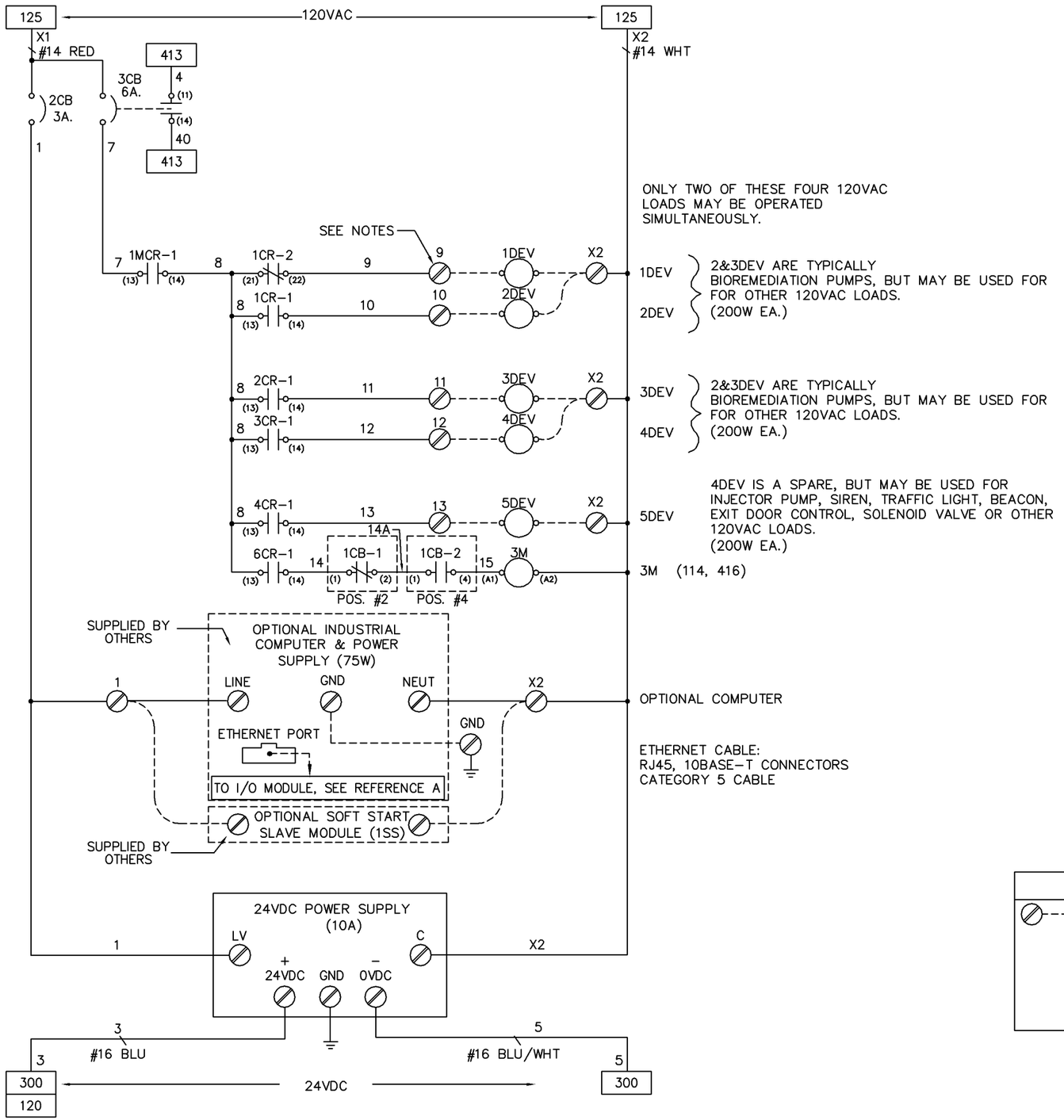
THIRD ANGLE

STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSION: ONE PLACE DECIMAL ±.060; TWO PLACE DECIMAL ±.030; THREE PLACE DECIMAL ±.005
HOLE DIAMETER: TWO PLACE DECIMAL ±.010; THREE PLACE DECIMAL ±.002
ANGLES: DIMENSIONED ± 1°; UNDIMENSIONED 90° ± 2°

TITLE: INTERCLEAN RECLAIM SLAVE PANEL TYPE A DY99-152_2
ELECTRICAL SCHEMATIC
CLASS: TYPE
FORM: SERIES
SCALE: DRAWN RS; CHKD; DATE 4-16-04; ECO/ECN
PRINTS TO

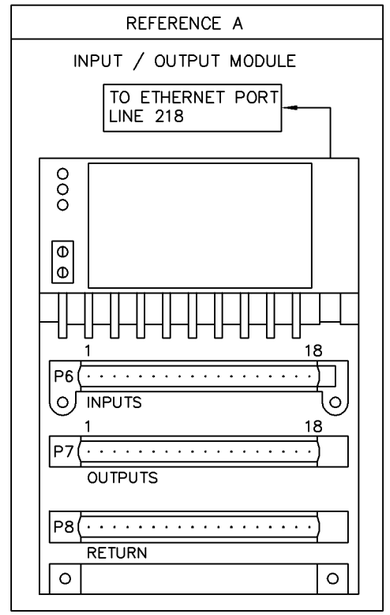
SQUARE D

SIZE: D | NUMBER: IAT3052815660A | SHEET 1 OF 6



REFERENCE A

INPUT / OUTPUT MODULE



I/O MODULE MAY USE THE
FOLLOWING TOPHATS:
1. ETHERNET ADAPTER
2. M1 PLC
3. M1 PLC W/ OPT. ADAPTER

NOTES

⊘-----DENOTES FIELD WIRING
TO TERMINAL BLOCK
USE COPPER COND 75° C
TORQUE SCREWS
TO 4.4–6.2 in.–lbs.

Reclaim Slave Panel

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES FROM MBR
D	43-04-16514	7/08/08	GH	SWITCH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	UPDATES FROM MBR

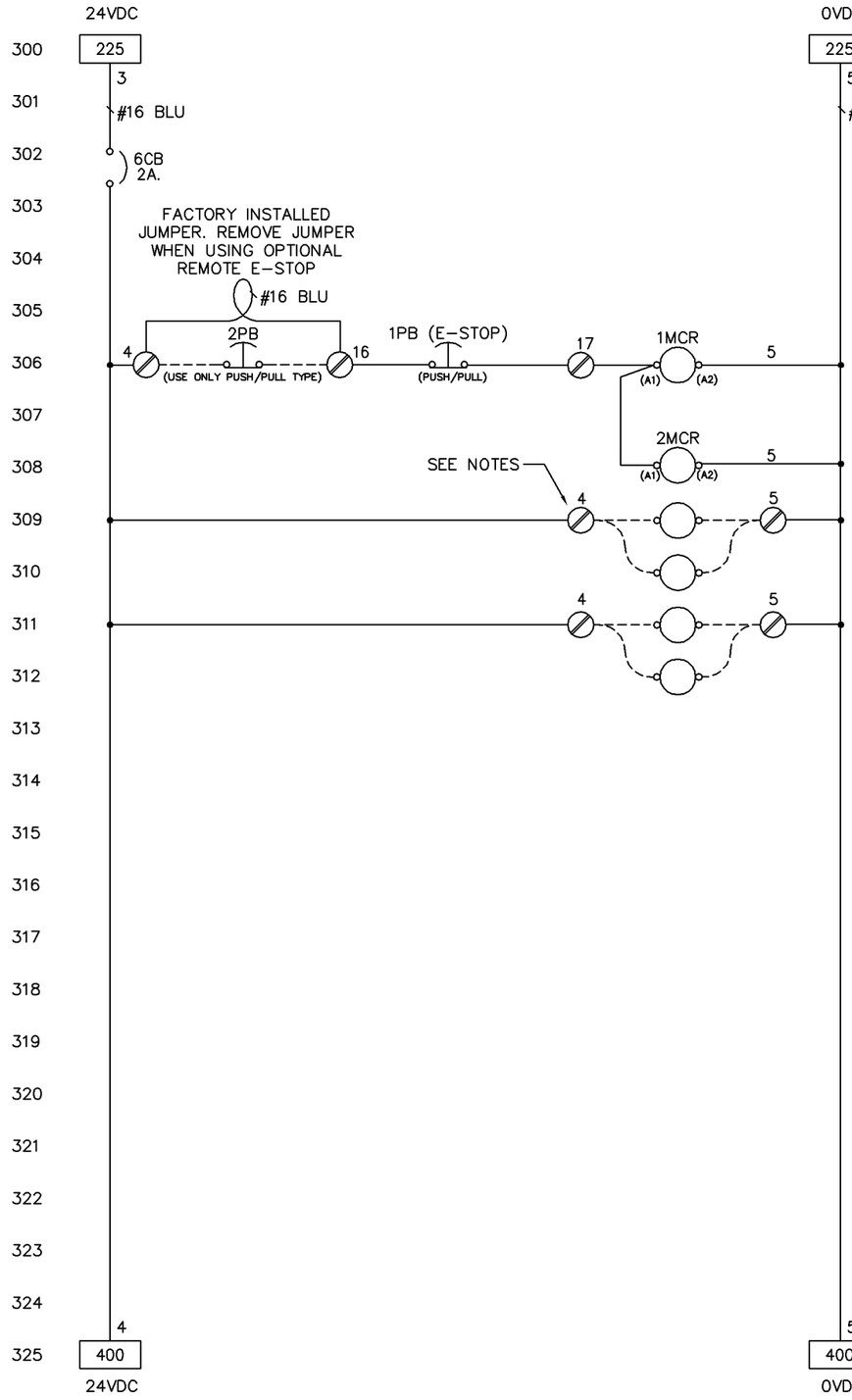
THIRD ANGLE

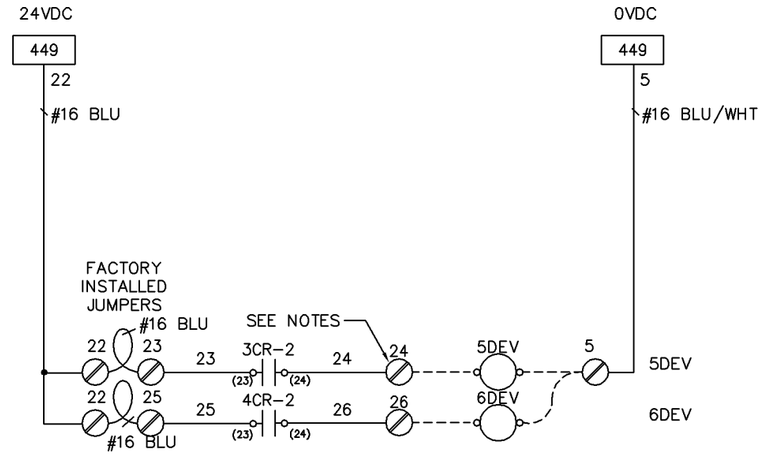
STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSION: ONE PLACE DECIMAL ±.060; TWO PLACE DECIMAL ±.030; THREE PLACE DECIMAL ±.005
HOLE DIAMETER: TWO PLACE DECIMAL ±.010; THREE PLACE DECIMAL ±.002
ANGLES: DIMENSIONED ± 1°; UNDIMENSIONED 90° ± 2°

TITLE: INTERCLEAN RECLAIM SLAVE PANEL TYPE A DY99-152_3
ELECTRICAL SCHEMATIC
CLASS | TYPE
FORM | SERIES
SCALE | DRAWN: RS | CHKD | DATE: 4-16-04 | ECO/ECN
PRINTS TO

SQUARE D

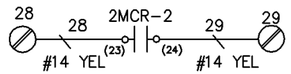
SIZE D | NUMBER IAT3052815660A | SHEET 2 OF 6





5&6DEV ARE TYPICALLY:
SOLENOID VALVE, BRUSH, AIR BLOWER, VFD, OR SOFT START SLAVE MODULES RUN SIGNALS, OVERHEAD DOOR CONTROLS.

TO PROVIDE A DRY CONTACT FOR SELF-POWERED FIELD DEVICES, REMOVE CORRESPONDING JUMPER.
(24VDC LOADS: 3.5W EA.
DRY CONTACTS: 15A EA.)



NOTES

⊘-----DENOTES FIELD WIRING TO TERMINAL BLOCK
USE COPPER COND 75° C
TORQUE SCREWS
TO 4.4-6.2 in.-lbs.

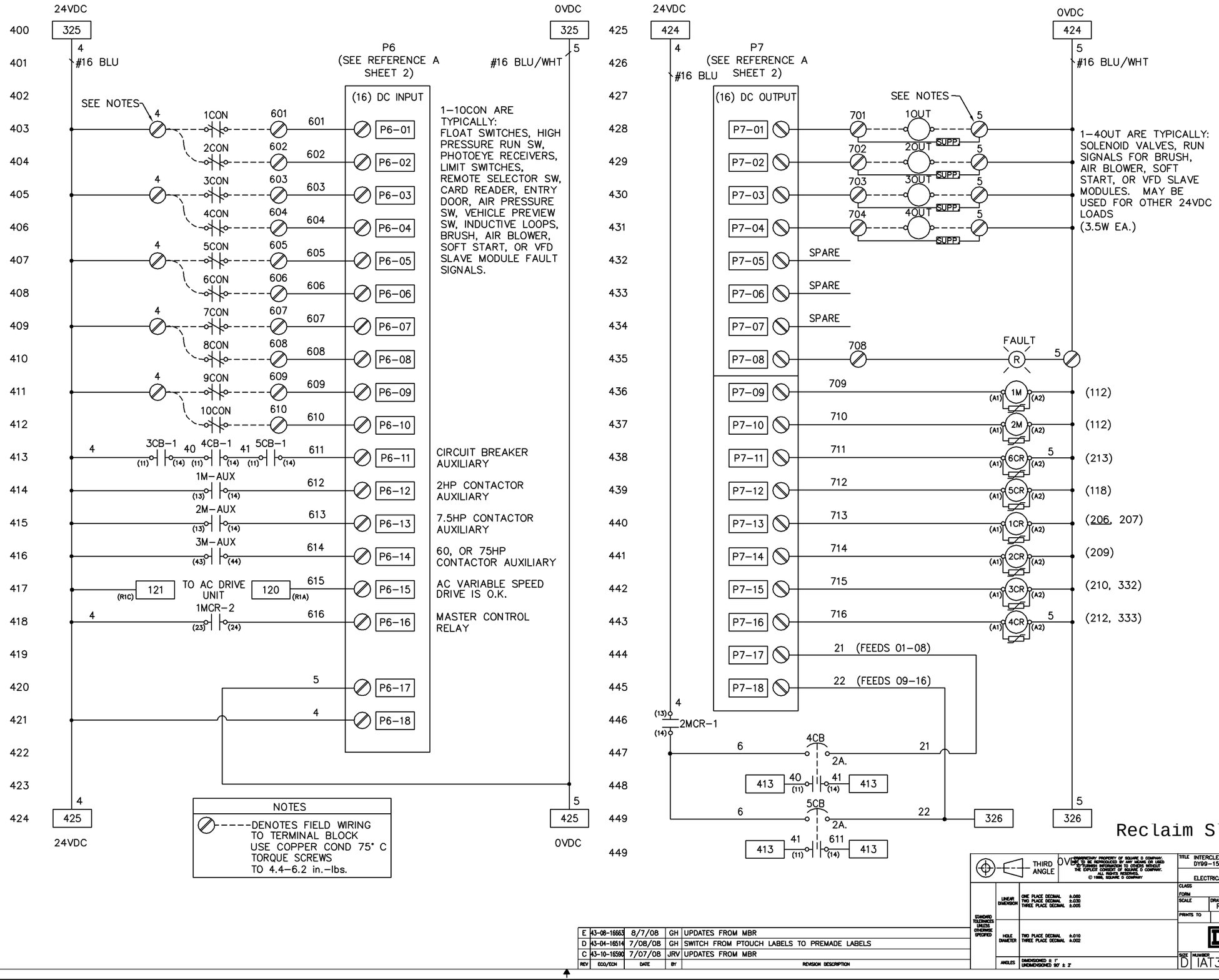
Reclaim Slave Panel

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES FROM MBR
D	43-04-16514	7/08/08	GH	SWITCH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	UPDATES FROM MBR

THIRD ANGLE

STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSION: ONE PLACE DECIMAL ±.060; TWO PLACE DECIMAL ±.030; THREE PLACE DECIMAL ±.005
HOLE DIAMETER: TWO PLACE DECIMAL ±.010; THREE PLACE DECIMAL ±.002
ANGLES: DIMENSIONED ± 1°; UNDIMENSIONED 90° ± 2°

TITLE: INTERCLEAN RECLAIM SLAVE PANEL TYPE A DY99-152_4
ELECTRICAL SCHEMATIC
CLASS TYPE
FORM SERIES
SCALE DRAWN RS CHK'D DATE 4-16-04 ECO/ECN
PRINTS TO
SQUARE D
SIZE D NUMBER IAT3052815660A SHEET 3 OF 6



Reclaim Slave Panel

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES FROM MBR
D	43-04-16514	7/08/08	GH	SWITCH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	UPDATES FROM MBR

THIRD ANGLE

STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED

LINEAR DIMENSION	ONE PLACE DECIMAL ±.060 TWO PLACE DECIMAL ±.030 THREE PLACE DECIMAL ±.005
HOLE DIAMETER	TWO PLACE DECIMAL ±.010 THREE PLACE DECIMAL ±.002
ANGLES	DIMENSIONED ± 1° UNDIMENSIONED 90° ± 2°

TITLE: INTERCLEAN RECLAIM SLAVE PANEL TYPE A DY99–152_5

ELECTRICAL SCHEMATIC

CLASS | TYPE | FORM | SERIES

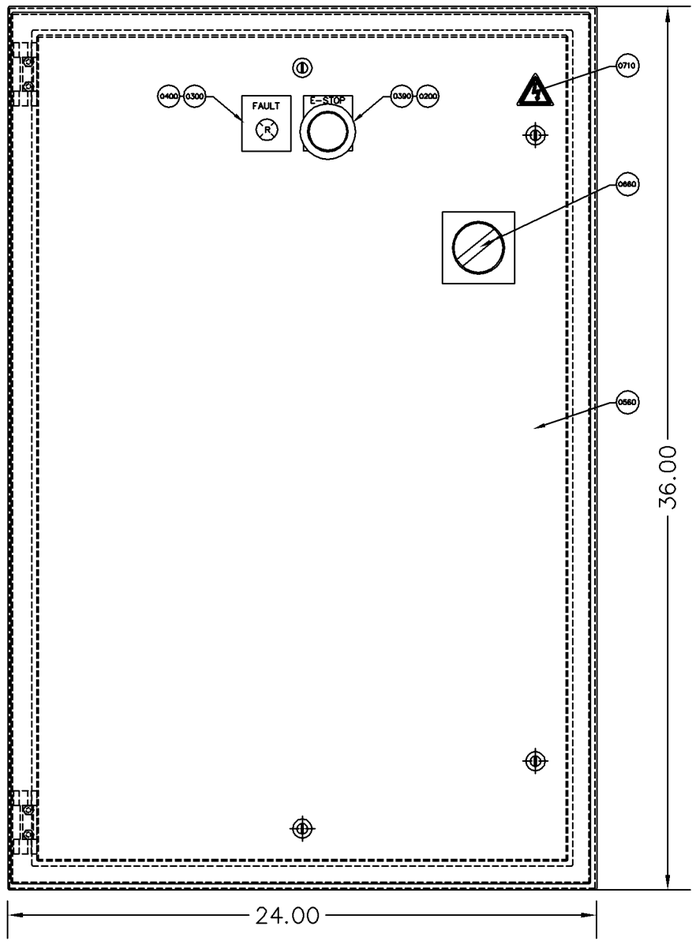
SCALE | DRAWN: RS | CHKD | DATE: 4–16–04 | ECO/ECN

PRINTS TO

SQUARE D

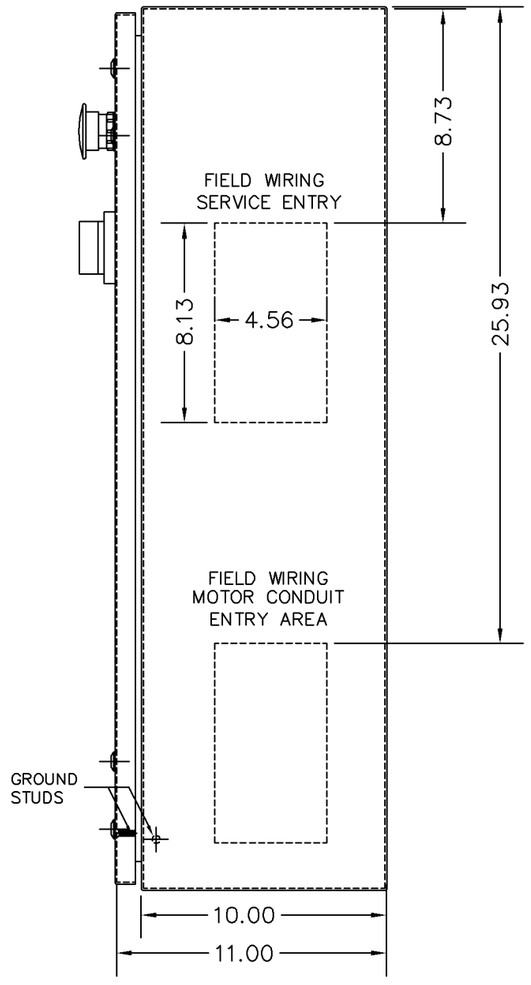
SIZE: D | NUMBER: IAT3052815660A | SHEET 4 OF 6

FRONT VIEW OF ENCLOSURE

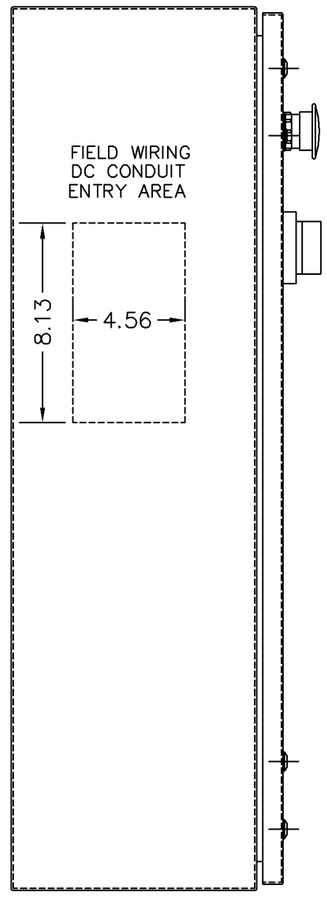


ENCLOSURE: 36.00"H X 24.00"W X 10.00"D

RIGHT SIDE VIEW OF ENCLOSURE



LEFT SIDE VIEW OF ENCLOSURE



NOTE:
CUT ROD LENGTH TO 6"

Reclaim Slave Panel

NOTE: THIS CALCULATION MUST BE REVIEWED IF ANY OF THE EVALUATED COMPONENTS CHANGE OR IF THE WIRING DIAGRAM CHANGES.

SQUARE D Schneider Electric — Telemecanique

VOLTAGE 460	SERIAL NUMBER _____
PHASES 3	Q2C NUMBER
AMP 135	PART NUMBER IAT3052815660A
Hz 50/60	
HP 75,7.5,2	ENCLOSURE NEMA RATING 4
	WIRING 90 DEG C
WIRING DIAGRAM	YEAR OF CONSTRUCTION _____

SHORT CIRCUIT CURRENT: 10KA RMS SYMMETRICAL, 460V MAXIMUM

ASSEMBLED IN U.S.A. PLANT 20 SPECIAL PANEL

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES FROM MBR
D	43-04-16514	7/08/08	GH	SWITCH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	ADDED NOTE
B	43-10-16174	12/11/07	GH	ADDED PACKING FOAM COVER
A	43-10-15656	4/10/07	GH	UPDATES FROM MBR

THIRD ANGLE

STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED

LINEAR DIMENSION	ONE PLACE DECIMAL	±.060
	TWO PLACE DECIMAL	±.030
	THREE PLACE DECIMAL	±.005
HOLE DIAMETER	TWO PLACE DECIMAL	±.010
	THREE PLACE DECIMAL	±.002
ANGLES	DIMENSIONED ± 1°	
	UNDIMENSIONED 90° ± 2'	

TITLE INTERCLEAN RECLAIM SLAVE PANEL TYPE A DY99-152_6
ENCLOSURE LAYOUT ASSEMBLY DRAWING

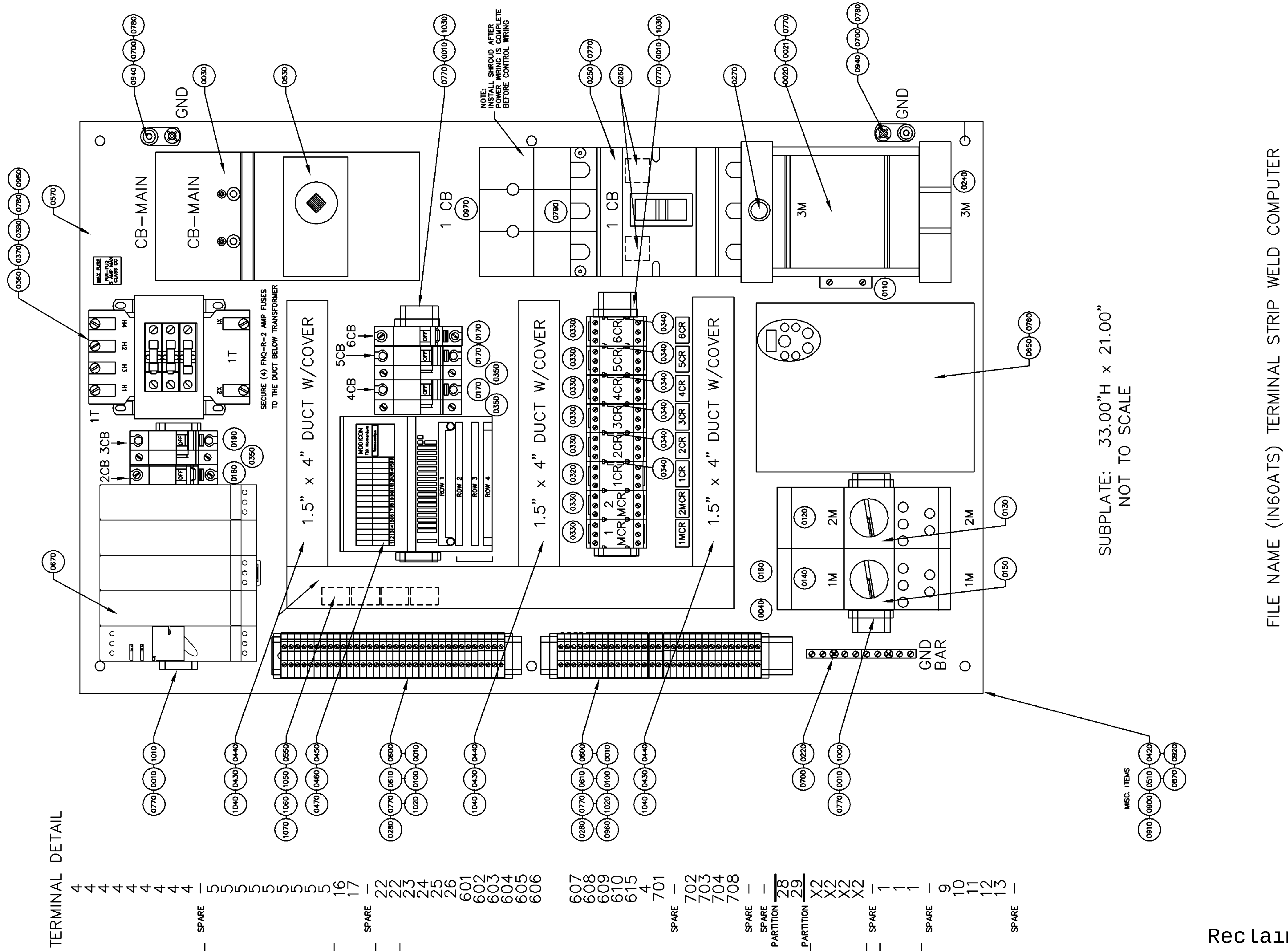
CLASS TYPE FORM SERIES

SCALE	DRAWN	CHKD	DATE	ECO/ECN
	RS		4-16-04	

PRINTS TO

SQUARE D

SIZE D NUMBER IAT3052815660A SHEET 5 OF 6



Reclaim Slave Panel

REV	ECO/ECN	DATE	BY	REVISION DESCRIPTION
E	43-08-16663	8/7/08	GH	UPDATES FROM MBR
D	43-04-16514	7/08/08	GH	SWITH FROM PTOUCH LABELS TO PREMADE LABELS
C	43-10-16590	7/07/08	JRV	UPDATES FROM MBR

THIRD ANGLE

STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR DIMENSION	ONE PLACE DECIMAL ±.060 TWO PLACE DECIMAL ±.030 THREE PLACE DECIMAL ±.005
	HOLE DIAMETER	TWO PLACE DECIMAL ±.010 THREE PLACE DECIMAL ±.002
	ANGLES	DIMENSIONED ± 1° UNDIMENSIONED 90° ± 2°

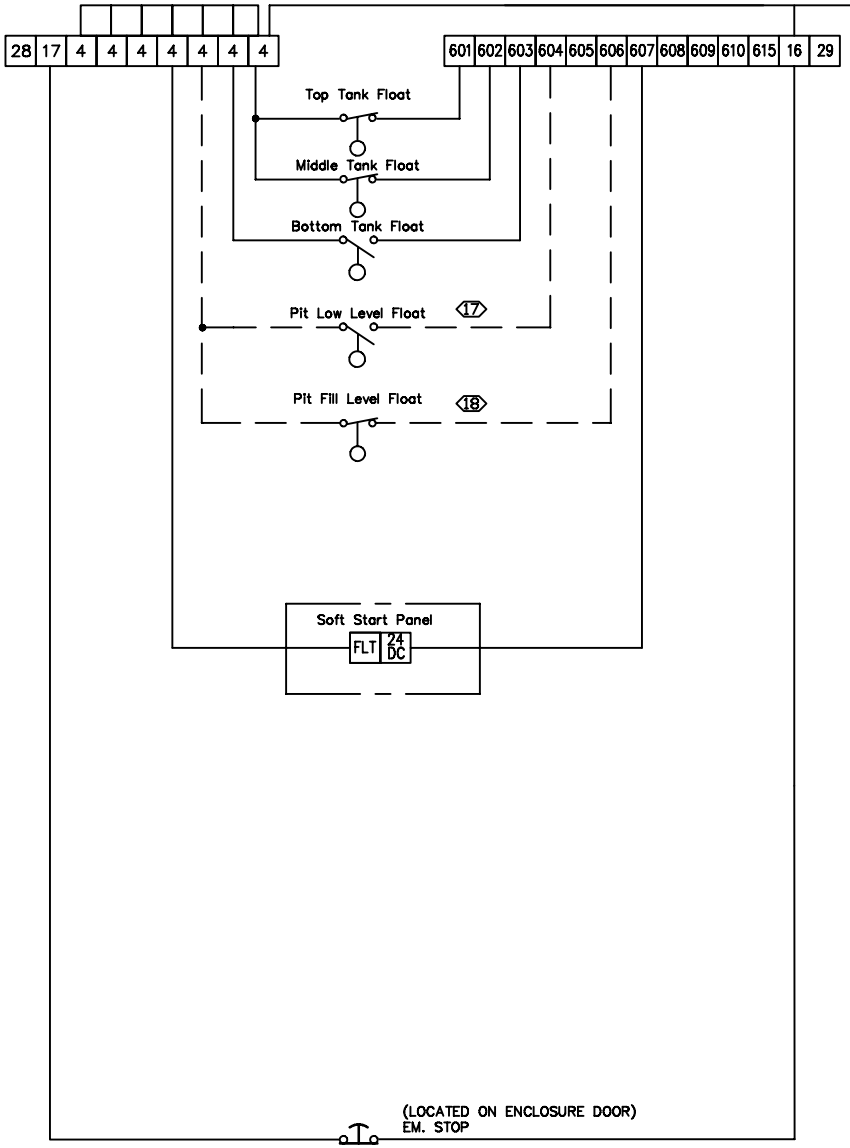
TITLE INTERCLEAN RECLAIM SLAVE PANEL TYPE A
DY99-152_7
PANEL LAYOUT
ASSEMBLY DRAWING

CLASS | TYPE | FORM | SERIES
SCALE | DRAWN RS | CHKD | DATE 4-16-04 | ECO/ECN
PRINTS TO

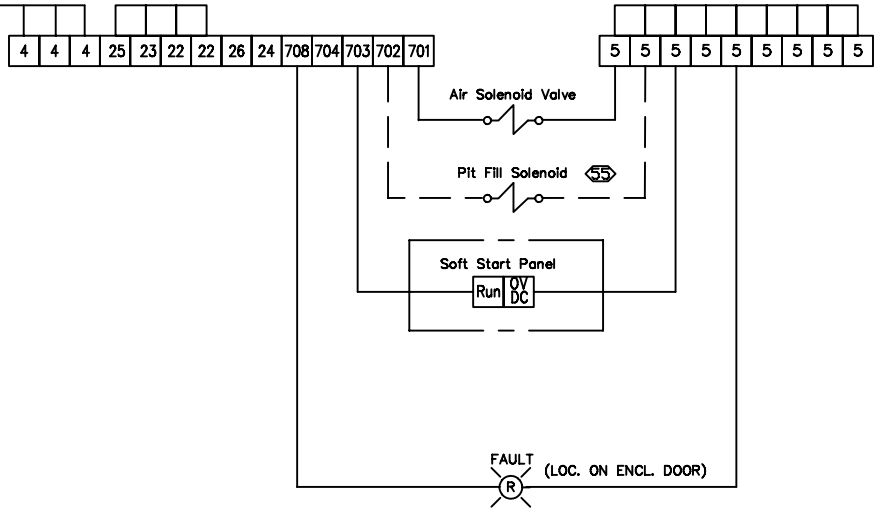
SQUARE D

SIZE D | NUMBER IAT3052815660A | SHEET 6 OF 6

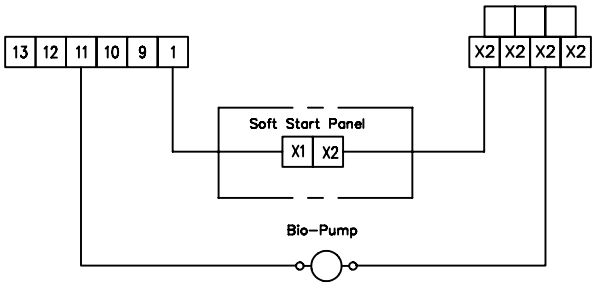
RECLAIM PANEL 24 VDC INPUTS



RECLAIM PANEL 24 VDC OUTPUTS



RECLAIM PANEL 120 VAC CONTROL TERMINALS



LEGEND

— — FIELD WIRING
⟨xx⟩ FIELD DEVICE Refer Drawing LY##-###-06
TERMINAL BLOCK

Reclaim Slave Panel

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment, Inc.

DESIGN: KM	DRAWN: KM
CHECK: CHECK	APPR: APPR
SCALE: NONE	

CoralVille Transit, CoralVille, IA
Truck Wash, Reclaim Water System
Reclaim Slave Panel Riser Diagram

DATE: 04/02/12
PART NO: LY09-070_RD3
WEIGHT:

NOTES:

1) USE SOFT SET PIPE COMPOUND AT PIPE THREAD CONNECTIONS.

2) ALL FLOW PATH FITTINGS MUST BE 150# CLASS MIN.

3) ALL CONNECTIONS MUST BE LEAK FREE.

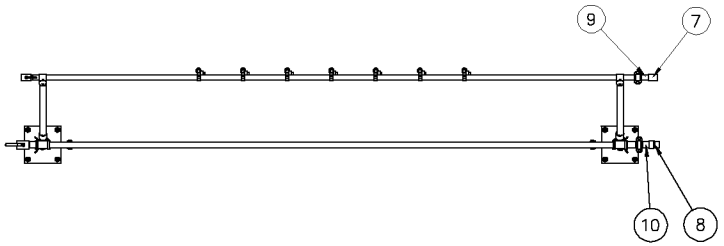
4) CLEAN ALL EXCESS PIPE JOINT COMPOUND RESIDUES FROM THREADS.

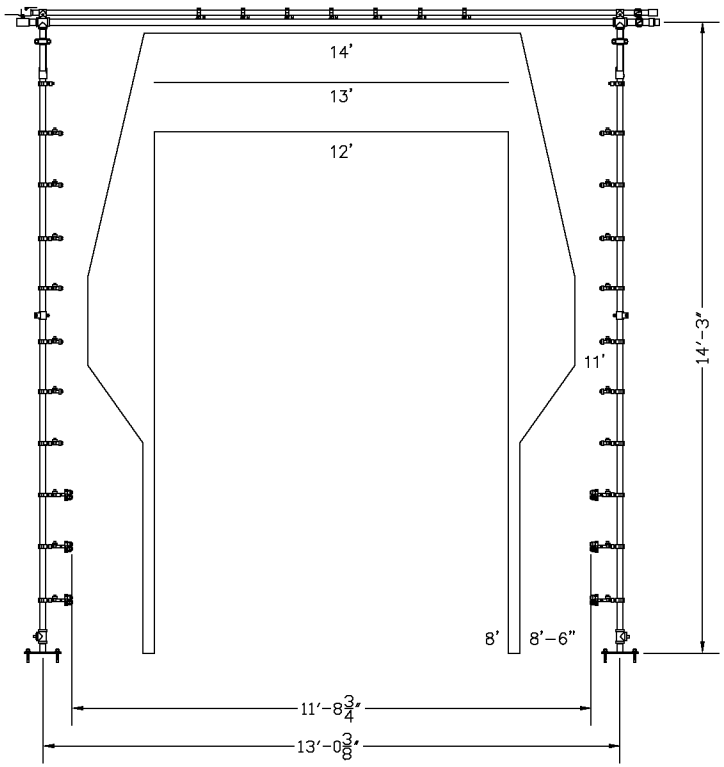
5) ASSURE ALL NOZZLE OUTLETS ARE ALIGNED WITHIN 1/4" AT A 24" EXTENSION.

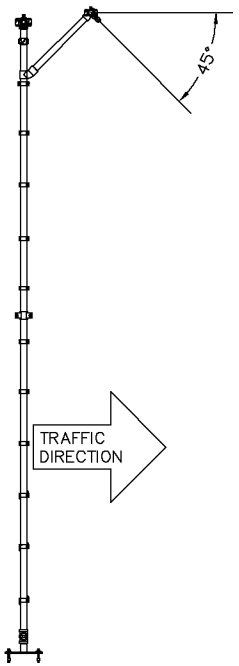
6) ASSURE VERTICAL ALIGNMENT, WHEN MOUNTING AND SUPPORTING THE ARCH.

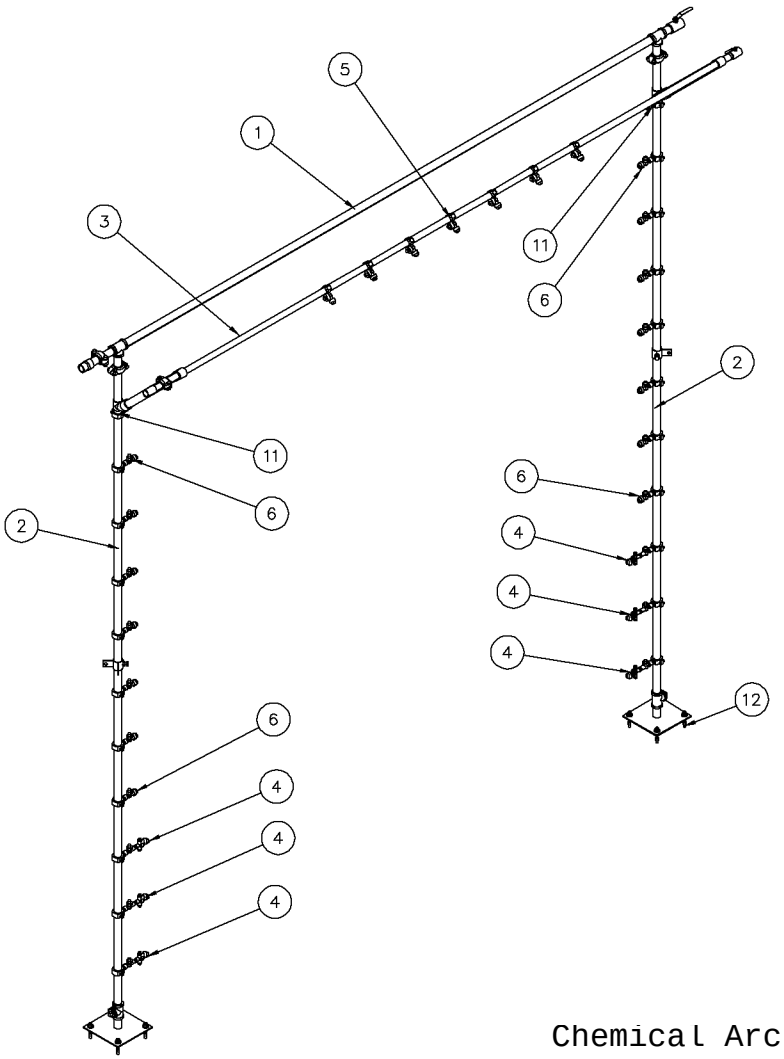
BILL OF MATERIALS FOR AR322252-00

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#D96335_1	Horizontal Bar Assembly, 1 1/4" S.S. Low Pressure	AR21121-02
2	2	#D96331_1	Vertical Bar Assembly, Low Pressure, S.S., H=13'-10"	AR21221-00
3	1	#D96338_1	Rear Bar with Support Ass'y, Low Pressure, 1" SS, W=13'	AR21321-00
4	6	#D98157_1	Nozzle Ass'y, w/Standard Seals, 1 1/4" Eyelet, Double Swiv. 4003	C6221128-03
5	7	#DY09-203_1	Nozzle Ass'y, w/Standard Seals, 1" Eyelet, Single No Swivel, 2515	C6222113-15
6	14	#DY02-473_1	Nozzle Ass'y, w/Standard Seals, 1 1/4" Eyele, Single 2503	C6222123-03
7	1	C011212-1	Coupling, 1", Soc. x Soc., PVC, SCH. 80, Spears	C011212-1
8	1	C011272-125-1	Reducer, 1.25" soc. to 1" soc.. PVC, SCH. 80, Spears	C011272-125-1
9	1	#DY02-471_1	Pipe nipple, 1" x 4", Slip to VIC, PVC, SCH. 80	C0412414-4
10	1	C0412415-4	Pipe nipple, 1-1/4" x 4", Slip to VIC, PVC SCH 80	C0412415-4
11	2	#D99107_1	Split Eyelet with Plug Ass'y, 1 1/4", w/Standard Seals	C0622212c-01
12	8	C0858151-375	Bolt, Anchor, 1/2" X 3-3/4"Lg, AISI 304 SS	C0858151-375









Chemical Arches

R.	DATE	DESCRIPTION	BY	APPR
B	03/12/09	The Spray Nozzles Updated	SL	PK
A	01/19/06	Zinc Plated Anchor Bolts Been Replaced with S.S.	SIL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
MK	PK
SCALE:	
1/2"=1'	

ARCH ASS'Y, CHEMICAL, S.S.
FOR TRUCK WASH, SIDE AND REAR
AR322252-00

DATE: 08/24/00
PART NO: DY00-210_1
WEIGHT:

FABRVARCH13FIELD\2Stainless\2No-Spinner\2Chemical\5Truck\2Public_works\AR322252-00.dwg, Layout1, 4/23/2009 11:24:08 AM, Susan, HPDJ1055CM.pc3, Custom 1: 8.5 x 11 in. (landscape), 1:1

BILL OF MATERIALS FOR AR311C–00

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#D96082_1	Horizontal Spinner Arch Ass'y, Right, Shop Assembly	AR221–01
2	1	#D97407_1	Arch – Spinner, Vertical Bar, Left, Shop Ass'y	AR222–20
3	1	#D97406_1	Arch – Spinner, Vertical Bar, Right, Shop Assembly	AR222–21
4	6	#D96085_1	Spinner Guard Assembly, Shop Assembly	AR223–02
5	4	#D99069_1	Mount, Spinner, Elbow Assembly	AR223–16
6	2	CO421117–11	Pipe nipple, 2" x 11" , NPT to NPT, Galv., SCH. 40	CO421117–11
7	2	CO421117–5	Pipe Nipple, 2" x 5" , NPT to NPT, Galv. , SCH. 40	CO421117–5
8	2	CO421127–13	Pipe nipple, 2" x 13" , NPT to NPT, Galv., SCH. 40	CO421127–13
9	12	#D–V–C061–25	Centri@Spinner	CO61–25
10	8	CO85835–375	Bolt, Anchor, 1/2" x 3 3/4", Zinc Plated, Grade 5	CO85835–375

NOTES:

1) USE HARD SET PIPE COMPOUND AT PIPE THREAD CONNECTIONS, USE TEFLON TAPE FOR SPINNERS.

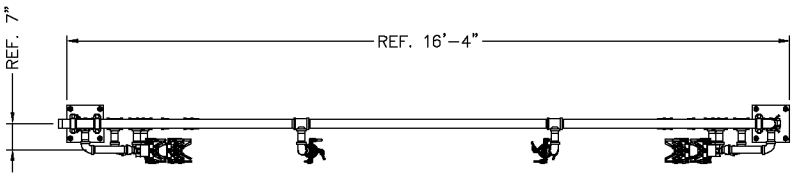
2) ALL FLOW PATH FITTINGS MUST BE 150# CLASS MIN.

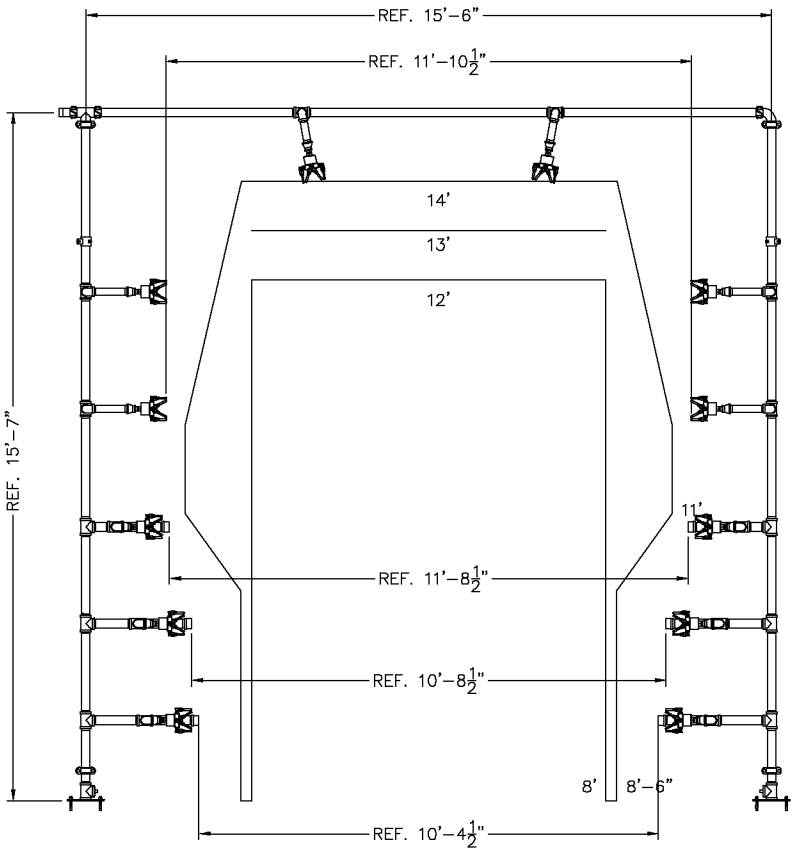
3) ALL CONNECTIONS MUST BE LEAK FREE.

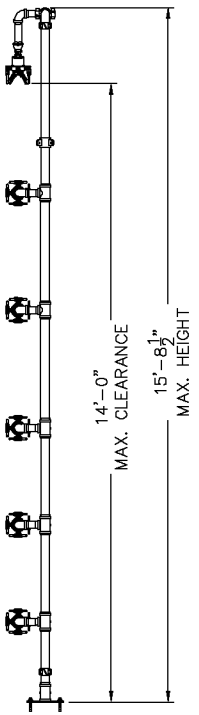
4) CLEAN ALL EXCESS PIPE JOINT COMPOUND RESIDUES FROM THREADS AND COLD–GALVANIZE ALL BARE METAL SURFACES.

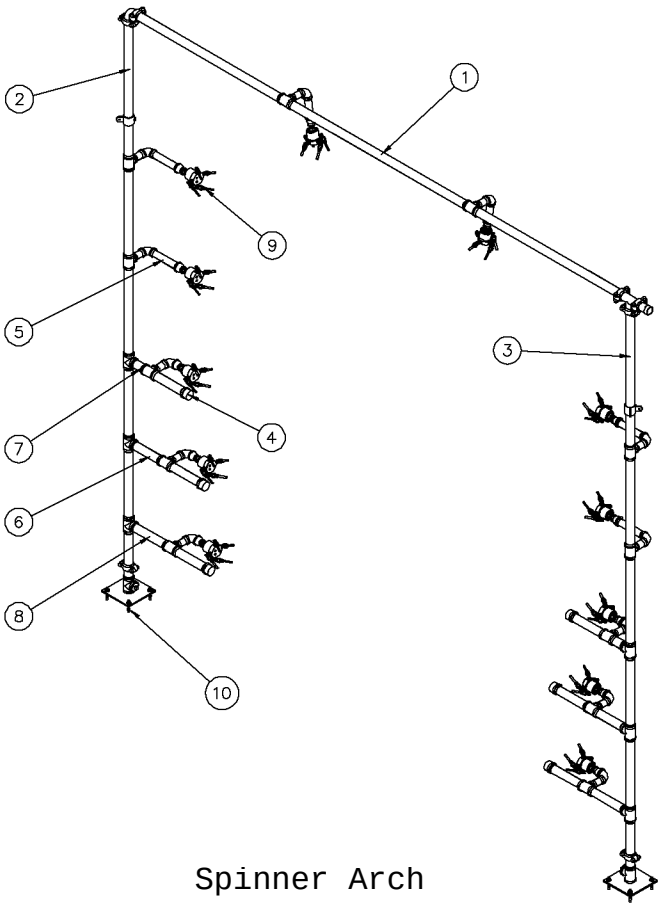
5) ASSURE ALL NOZZLE OUTLETS ARE ALIGNED WITHIN 1/4" AT A 24" EXTENSION.

6) ASSURE VERTICAL ALIGNMENT, WHEN MOUNTING AND SUPPORTING THE ARCH









Spinner Arch

REV.	DATE	DESCRIPTION	APP.
B	08/24/99	ANCHOR BOLTS CHANGED BY SUSAN	MK
A	05/07/99	DRAWING UPDATED BY SUSAN	MK

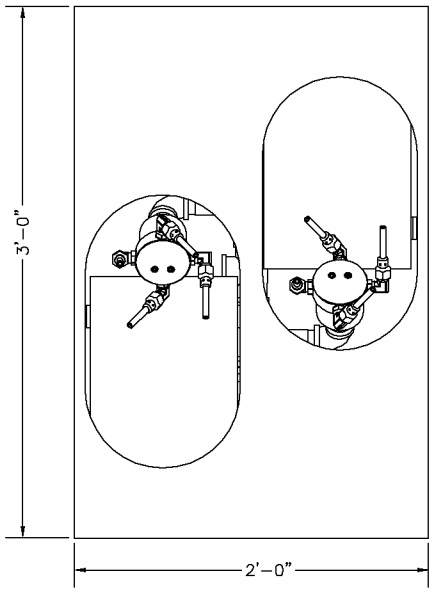
InterClean Equipment,Inc

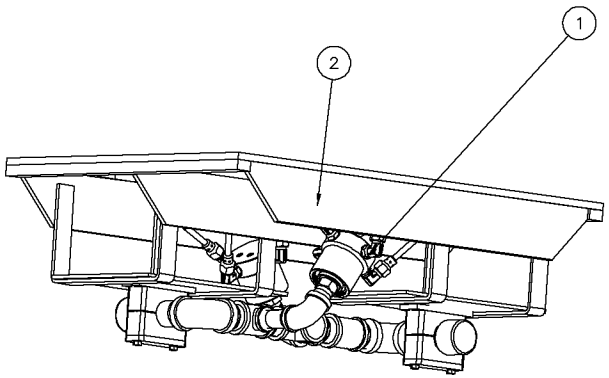
DRAWN BY: P.K.
CHECKED BY: JL
APPROVED BY: PK

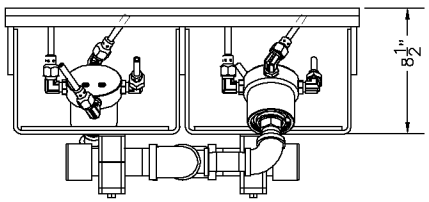
SPINNER ARCH ASSEMBLY
12 SPINNERS
AR311C-00

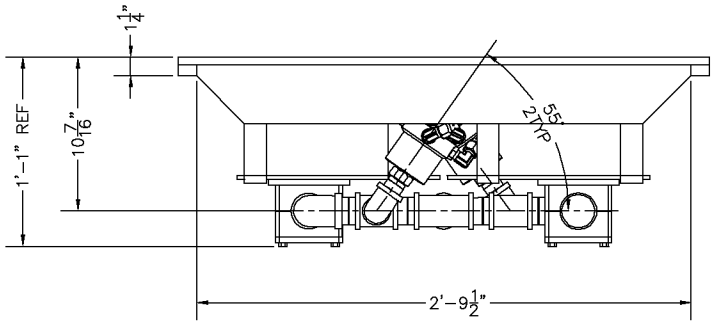
DATE: 04/08/96
DWG: D99038_1
SCALE: 1/2" = 1'

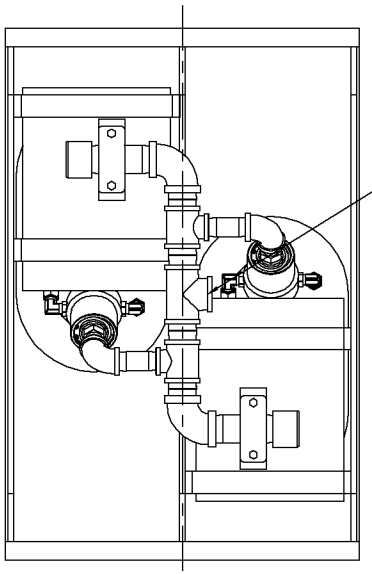
BILL OF MATERIALS FOR UC131111-00				
ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	2	#D-V-C061-25	Centri@Spinner	C061-25
2	1	#DY08-252_1	Underchassis Module Ass'y, Galv. L=2', W=3', H=1', for 2 Spinners	UC231111-00











Chassis Washer

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SIMON	SIMON
CHECK:	APPR:
PK	PK
SCALE: 2"=1'	

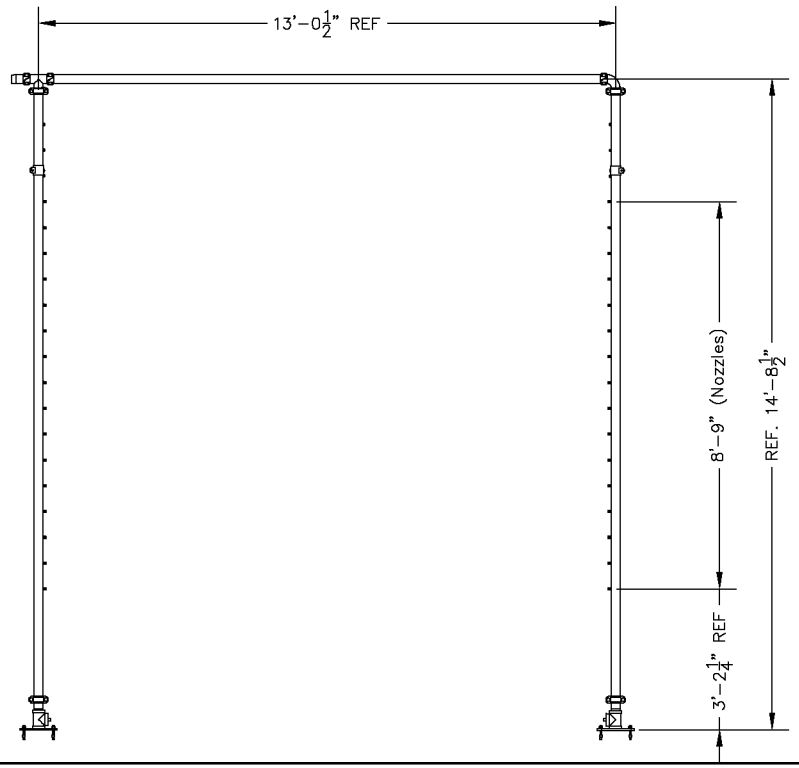
UNDERCHASSIS MODULE ASS'Y
2 SPINNERS, L=2', W=3', H=1', GALV.
UC131111-00

DATE: 04/21/08
PART NO: DY08-251_1
WEIGHT:

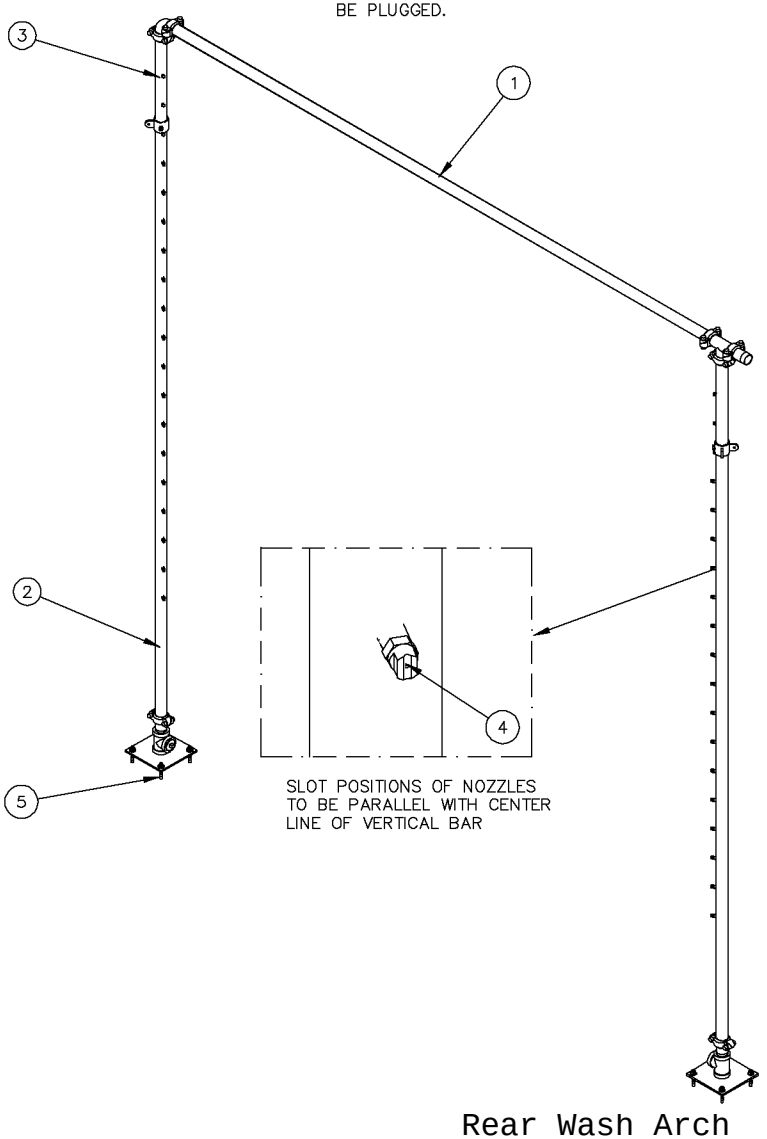
FABR\UnderChassis\1_Field\3_SpinnerModule\1_2Spinner\1_SteelFrame\1_StandardSize\1_Galvanized\UC131111-00.dwg, Layout1, 4/28/2008 1:23:08 PM, Simon, HPDJ1055CM.pc3

BILL OF MATERIALS FOR AR31292-01

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#DY05-059_1	Horizontal Bar Ass'y, 2" SCH 40 Galv.	AR22112-05
2	2	#D96399_1	Vertical Bar, Shop Assembly	AR222-10
3	6	C0121b-025	Pipe Plug (Hex), 1/4" NPT, Zinc Plated, Class 150	C0121b-025
4	32	C06201112-0530	WashJet Nozzle, 1/4" NPT, SS, 1/4 MEG-0530	C06201112-0530
5	8	C085835-375	Bolt, Anchor, 1/2" x 3 3/4", Zinc Plated, Grade 5	C085835-375



NOTE:
TOTAL NUMBER OF NOZZLES IS 32. THREE HIGHEST HOLES ON BOTH VERTICAL BARS ARE TO BE PLUGGED.



SLOT POSITIONS OF NOZZLES TO BE PARALLEL WITH CENTER LINE OF VERTICAL BAR

Rear Wash Arch

R.	DATE	DESCRIPTION	BY	APPR
A	10/11/05	The Spray Nozzles Updated	SL	PK

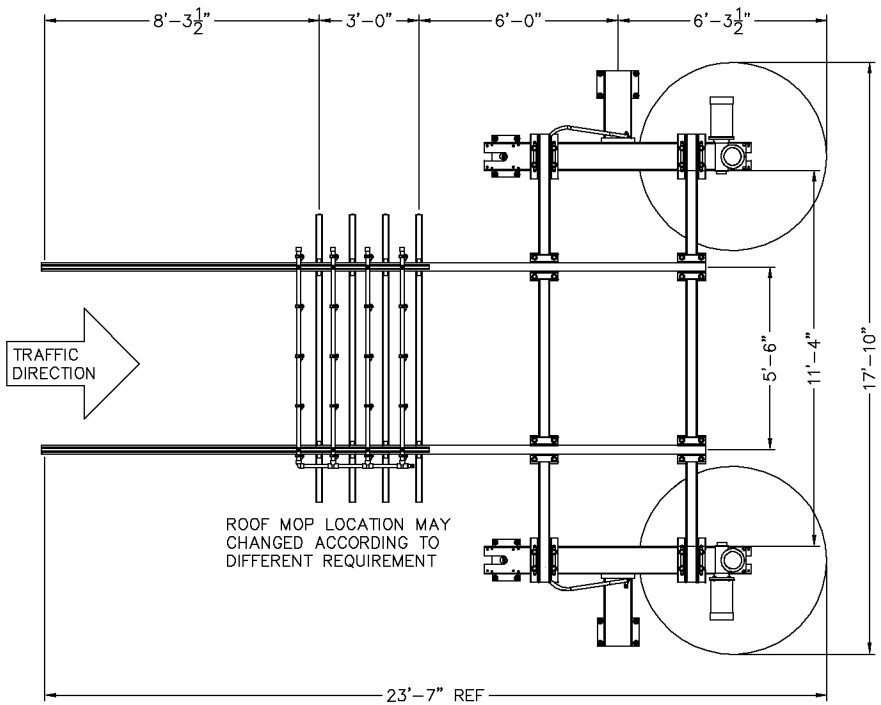
InterClean Equipment, Inc.

DESIGN:	DRAWN:
Susan	Susan
CHECK:	APPR:
PK	PK
SCALE: 1/2"=1'	

ARCH ASS'Y, REAR WASH
W/32x0530 NOZZLES, W=13', H=14'8"
AR31292-01

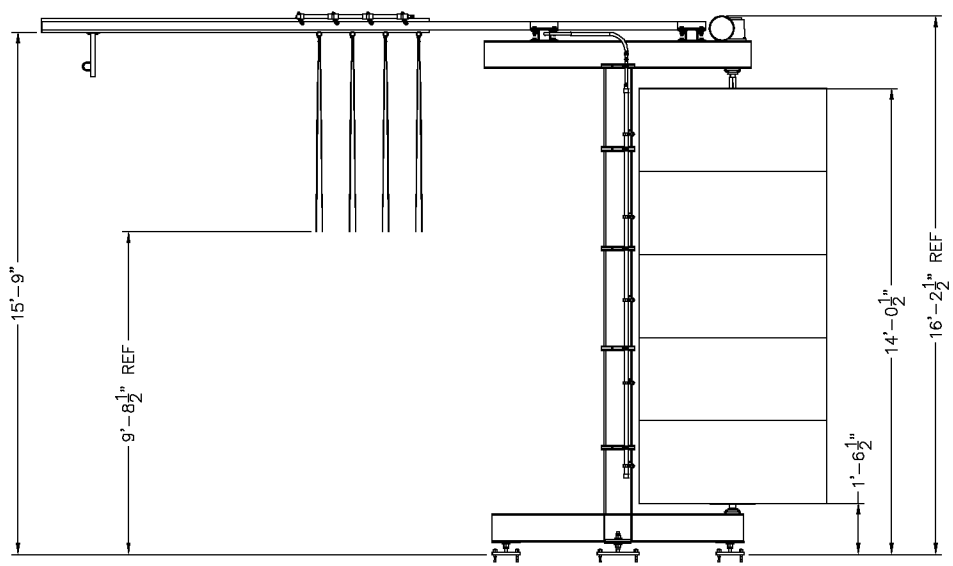
DATE: 03/24/05
PART NO: DY03-023_1
WEIGHT:

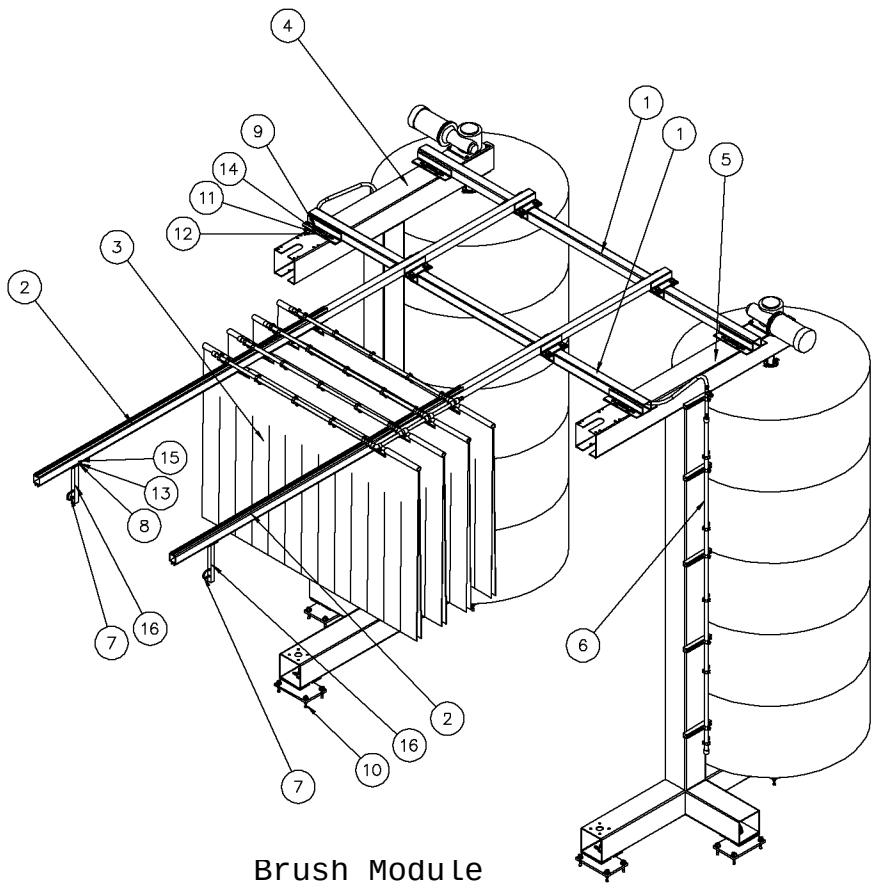
B:\ARCH13\FIELD\1Galv2No-Spinner\91Truck\2PublicWorks\AR31292-01.dwg, Layout1, 3/8/2006 3:22:36 PM, Susan, HPDJ1055CM.pc3



BILL OF MATERIALS FOR BM83111-02

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	2	#DY06-392_1	Crossing Frame, for Brush Module, Weld, L=13'-6"	BM2212-00
2	2	#DY06-387_1	Square Tubing, 3"x3"x3/16", L=20', Tooling	BM2212-02
3	1	#DY03-346_1	Roof Mop Plumbing Ass'y, for Brush Module	BM42231-00
4	1	#D99040_1	One Hi-Brush & Frame, Left, w/Low Density Brushes	BM5913-01
5	1	#D99039_1	One Hi-Brush & Frame, Right, w/Low Density Brushes	BM5923-01
6	1	#DY03-344_1	Brush Module Plumbing Ass'y, 2 High Brushes	BM6133-00
7	2	C08311-2	U-Bolt, for 2" Pipe, Zinc-plated Steel (3/8"-16)	C08311-2
8	4	C085133-1	Bolt, Hexagonal, 3/8"-16 x 1", Zinc Plated, Grade 5	C085133-1
9	32	C085138-250	Bolt, Hexagonal 3/4"-10 x 2 1/2", Zinc Plated, Grade 5	C085138-250
10	24	C085838-43-4	Bolt, Anchor, 3/4"-10 x 4 3/4", Zinc Plated, Grade 5	C085838-43-4
11	32	C086138-00	Nut, Hexagonal, 3/4"-10, Zinc Plated, Grade 5	C086138-00
12	32	C086338-00	Nut, Hexagonal, Jam, 3/4"-10, Zinc Plated, Grade 5	C086338-00
13	4	C087133-00	Washer, Flat, 3/8", Zinc Plated, Grade 5	C087133-00
14	64	C087138-00	Flat Washer, 3/4", USS, Zinc Plated, Grade 5	C087138-00
15	4	Cd3122-N228WO	Nut, Without Spring, N228-WO, 3/8"-16, Channel Nut	Cd3122-N228WO
16	2	Cd612ab-16	Single Channel Bracket, B409-16, Plated	Cd612ab-16





Brush Module

R.	DATE	DESCRIPTION	BY	APPR
A	01/29/07	Cross Frame Updated	SL	PK

InterClean Equipment, Inc.

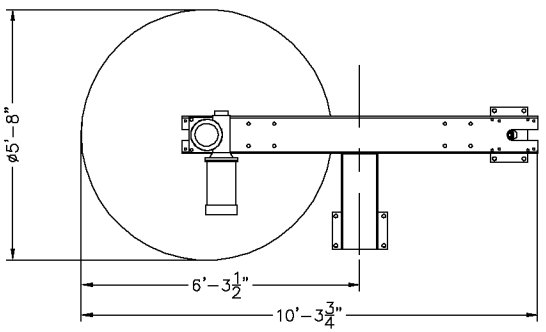
DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK: PK	APPR:
SCALE: 3/8"=1'	

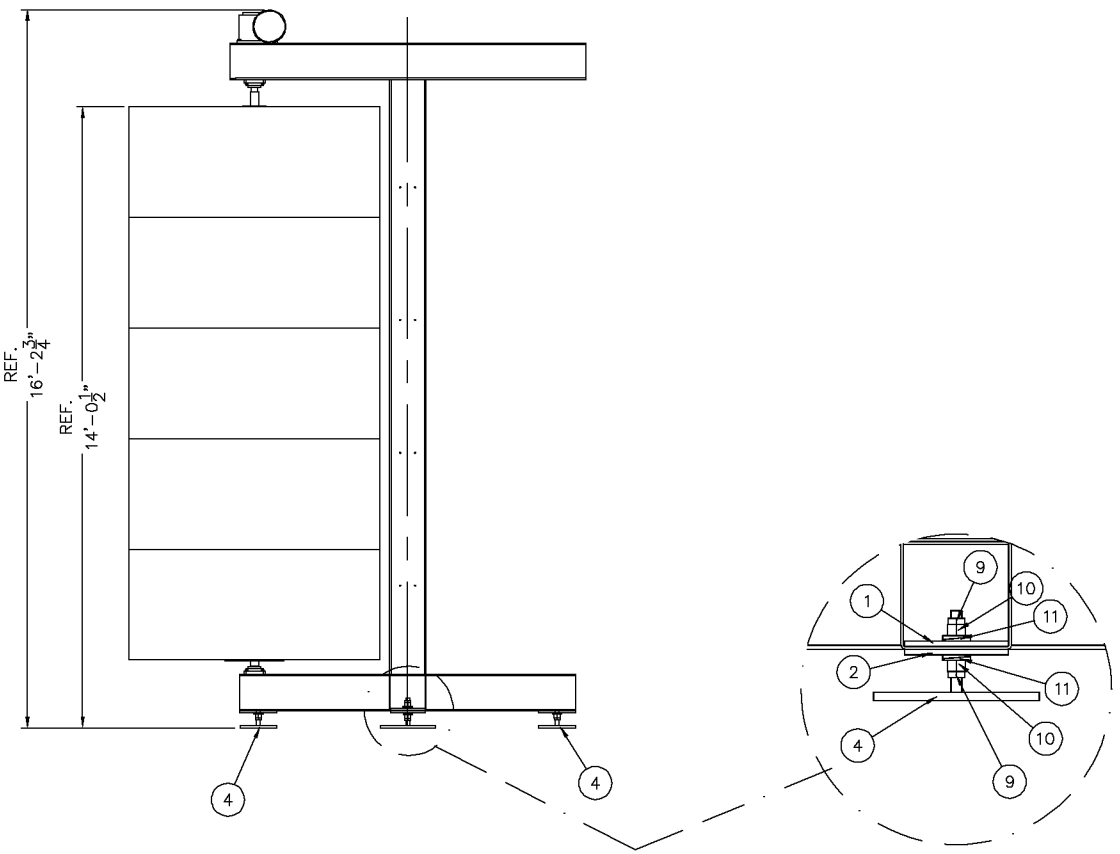
Brush Module Ass'y, Galv. Frame
2-Hi Brushes, 460V. 60Hz
BM83111-02

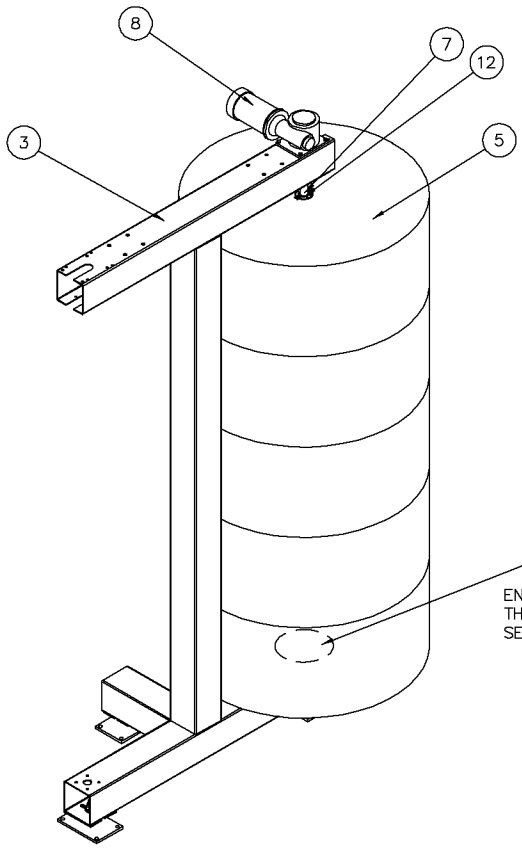
DATE: 01/19/05
PART NO: DY05-016_1
WEIGHT:

BILL OF MATERIALS FOR BM5913-01

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#D97078_1	Low Side Column Upper Stiffener for InterClean Brush Module	BM1115-01
2	1	#D97077_1	Low Side Column Lower Stiffener for InterClean Brush Module	BM1115-02
3	1	#D96487_1	Brush Module Frame, Side, Weld, for 72" Brush	BM121-00
4	3	#D96488_1	Leg Assembly for InterClean Brush Module	BM122-00
5	5	#DY04-259_1	Brush Segment, D=68" Brush, Trailer Brush, Low Density, 40 Tips	BM512-04
6	1	BM513-16	End Disc, 16" Dia., w/2 1/4" Dia. Shaft Adapter	BM513-16
7	9	BM52-00	Adapter for Brush Segment, 2.25", Al, Universal Brush	BM52-00
8	1	#D97022_1	Motor & Shaft Ass'y, 5hp, 460V, 18:1, Right, for 5 Segments	BM5822-01
9	6	C08633A-00	Nut, Hexagonal, Jam, 1"-8, Zinc Plated, M-C #91078A251	C08633A-00
10	6	C08643A-00	Nut, Hexagonal, Jam, Heavy, 1"-8, Zinc Plated, M-C #91015A038	C08643A-00
11	6	C08733A-00	Washer Set, Spherical, 1", McMaster-Carr #91131A110	C08733A-00
12	10	C08815-263	Pin, Dowel, 1/2"x2-5/8", ASTM A1045, (Comes in shafts)	C08815-263







NOTE:
ALL HARDWARE SUPPLIED HAS TO BE AT LEAST GRADE 5.

R.	DATE	DESCRIPTION	BY	APPR
A	03/02/05	QTY OF ADAPTER CHANGED TO 9	SL	PK

InterClean Equipment, Inc.

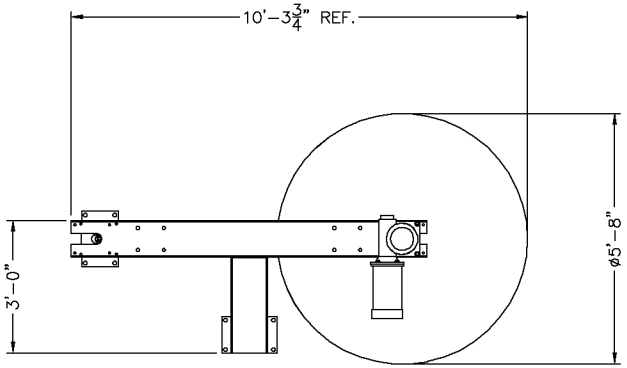
DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	APPR
SCALE:	
1/2"=1'	

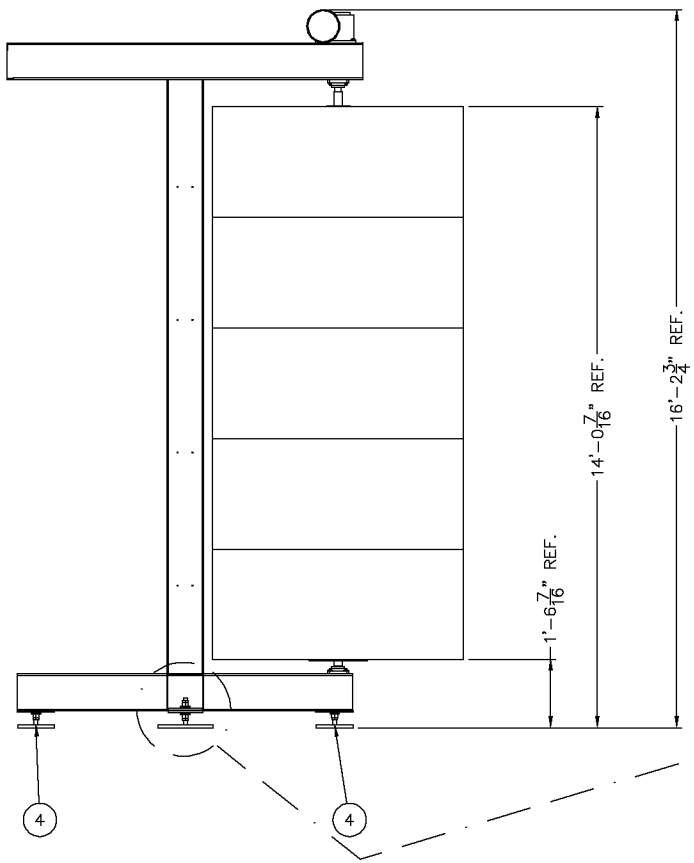
ONE HI-BRUSH & FRAME
LEFT, W/LOW DENSITY BRUSHES
BM5913-01

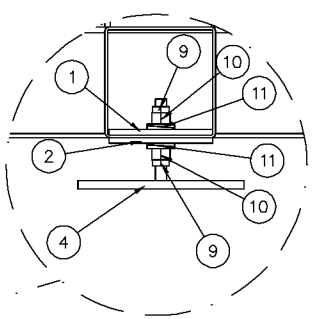
DATE: 01/17/05
PART NO: D99040_1
WEIGHT:

BILL OF MATERIALS FOR BM5923-01

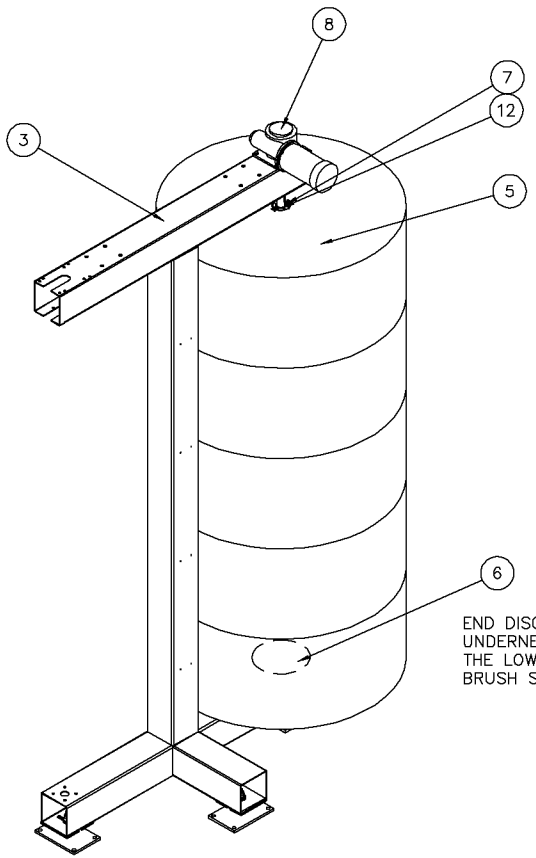
ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#D97078_1	Low Side Column Upper Stiffener for InterClean Brush Module	BM1115-01
2	1	#D97077_1	Low Side Column Lower Stiffener for InterClean Brush Module	BM1115-02
3	1	#D96487_1	Brush Module Frame, Side, Weld, for 72" Brush	BM121-00
4	3	#D96488_1	Leg Assembly for InterClean Brush Module	BM122-00
5	5	#DY04-259_1	Brush Segment, D=68" Brush, Trailer Brush, Low Density, 40 Tips	BM512-04
6	1	BM513-16	End Disc, 16" Dia., w/2 1/4" Dia. Shaft Adapter	BM513-16
7	9	BM52-00	Adapter for Brush Segment, 2.25", Al, Universal Brush	BM52-00
8	1	#D97005_1	Motor & Shaft Ass'y, 5Hp, 460V, 18:1, Left, for 5 Segments	BM5821-01
9	6	C08633A-00	Nut, Hexagonal, Jam, 1"-8, Zinc Plated, M-C #91078A251	C08633A-00
10	6	C08643A-00	Nut, Hexagonal, Jam, Heavy, 1"-8, Zinc Plated, M-C #91015A038	C08643A-00
11	6	C08733A-00	Washer Set, Spherical, 1", McMaster-Carr #91131A110	C08733A-00
12	10	C08815-263	Pin, Dowel, 1/2"x2-5/8", ASTM A1045, (Comes in shafts)	C08815-263







NOTE:
ALL HARDWARE SUPPLIED HAS TO BE AT LEAST GRADE 5.



R.	DATE	DESCRIPTION	BY	APPR
A	03/02/05	QTY OF ADAPTER CHANGED TO 9	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
CHECK	APPR
SCALE:	
1/2"=1'	

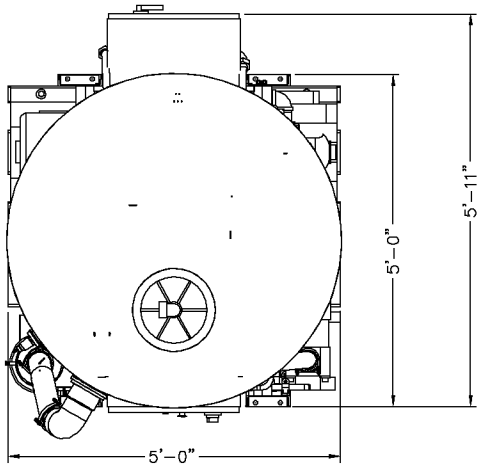
ONE HI-BRUSH & FRAME
RIGHT, W/LOW DENSITY BRUSHES
BM5923-01

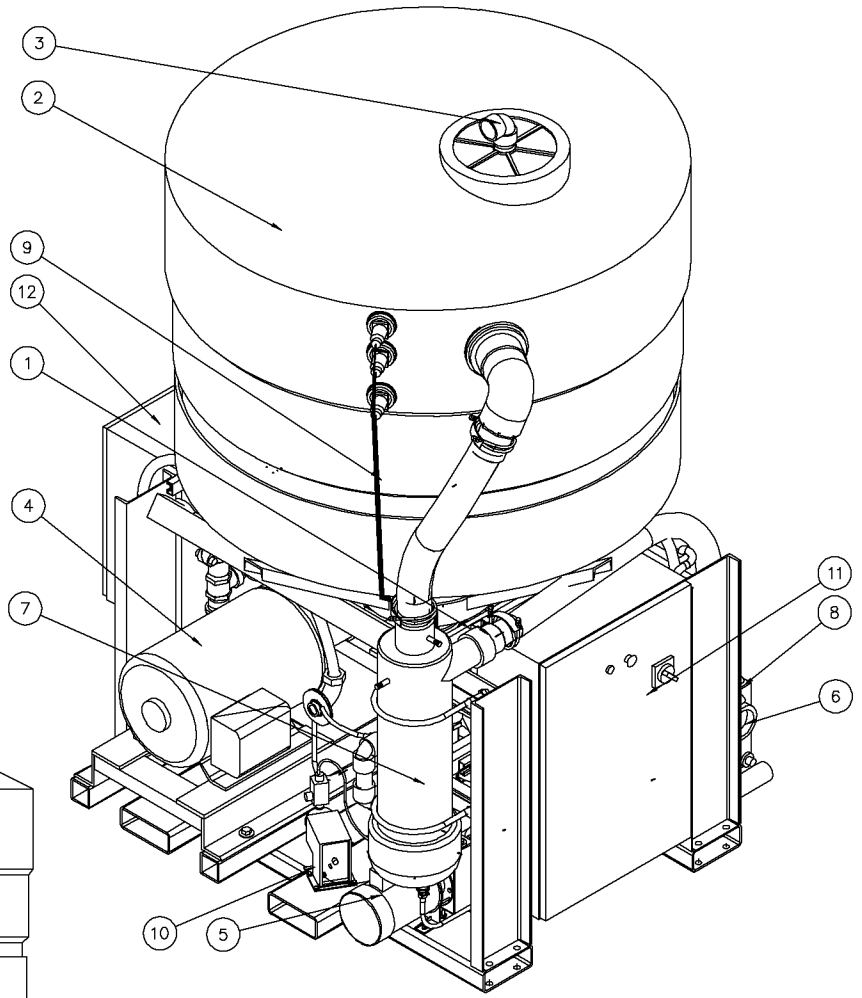
DATE: 01/19/05
PART NO: D99039_1
WEIGHT:

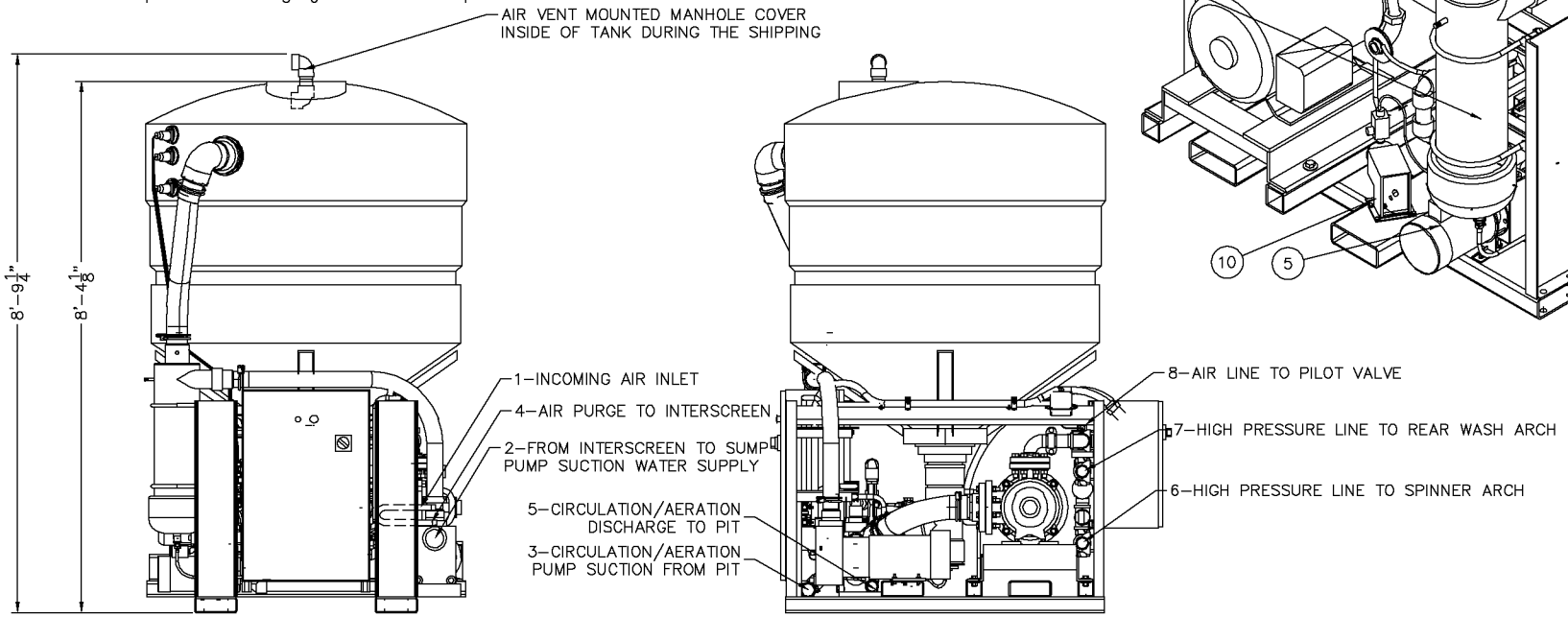
F:\FABR\Brush-Modul\5Brush-assy\9Shop Assembly\2Right\3No_Br-H\BM5923-01.dwg, Layout1, 4/3/2007 1:37:54 PM, Susan, HPDJ1055CM.pc3

BILL OF MATERIALS FOR EM12211-02

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#DY01-305_1	Panel Support Ass'y, EQ-Frame Mnt, Panel Size: H36"xL24"xW10"	EM221-00
2	1	#DY03-001_1	Tank w/Base Frame, 500 Gal. Cone Bottom Tank	EM311-00
3	1	#DY03-193_1	Air Vent Assembly, 2" PVC 80	EM332-01
4	1	#DY03-036_1	Pump, High Press., Base Frame Mnt, 75Hp,460V, w/CO-Ax Valve&Fittings	EM4112211-00
5	1	#DY03-004_1	Pump, Circ., Base Frame Mnt, 2Hp, 460, w/Pipes & Fittings	EM421121-00
6	1	#DY03-003_1	Pump, Sump, Base Frame Mounted, 7.5 Hp, 460V, 60Hz	EM431121-00
7	1	#DY03-039_1	Cyclonic Separator Assembly, w/Suction and Discharge Lines	EM51-00
8	1	#D97432_1	Air Purge Line Ass'y, 3/4" Galv. Pipe w/a Solenoid Valve	EM6111-00
9	1	#DY05-002_1	EQ-Module Elec. Ass'y, w/3-Way Valve, Bio-Re. & Soft Start	EM71-06
10	1	#DY04-036_1	Bioremediation System, One Pump, EQ-Module Frame Mount	EM82-00
11	1	#D99152_1	Slave Panel, Reclaim, Type A, 460V, SQD# 30528-156-60,	PA2111211-00
12	1	#DY01-492_1	Soft Start, 75Hp, 460v, EQ-Module Mounting	PA27212-00







R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK: PK	APPR:
SCALE: 3/4"=1'	

EQ-MODULE ASS'Y, 75HP, 460V
W/3-WAY VALVE, BIO-RE. & SOFT START
EM12211-02

DATE: 01/04/05
PART NO: DY05-001_1
WEIGHT:

8 APPENDIX

Section 8 Table of Contents

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Coralville Transit, Coralville, IA
Project # LY09-070
Truck Wash, Reclaim Water System
Master Panel Pre-start-up and Input Checklist

General:

1. Check all plumbing connections.
2. Check High-pressure pump alignment.
3. Check for correct amp settings on overloads in control panels. (Refer to motor nameplate for FLA and SFA.) Make sure all circuit breakers and overloads are in the on position.
4. Install Flash disk (program) into slot on upper right side on rear of Industrial PC (touch screen). Verify that Ethernet cables are connected from Industrial PC (touch screen) to ether hub and from hub to TSX Momentum Communication Adapters. Apply power to reclaim slave panels then master control panel. Wait a few moments, verify that wash program has started and is [**Online]**. This is indicated in the upper left hand corner of screen.
5. Check inputs. Tank floats, pit floats, limit switches, photo eye sensors. Verify sensors status at touch screen. (Refer to controls section in manual and use riser diagrams to correct if necessary.)
6. Check outputs. Test solenoids. (For Manual functions refer to controls section in manual)
7. Startup air compressor. ((Refer to air compressor manual.)
8. Startup softener. (Refer to softener service manual.) Use hardness test kit to confirm operation.
9. Startup water heater (Refer to Heater service manual).
10. Secure pit floats to the correct levels. Pit Low-level float (N.O.) should activate if water level should drop to 3" above interscreen. Pit Fill-level float (N.C.) should activate if water level drop 12" below overflow line. When water level in pit 2" below overflow line Pit Fill-level float (N.C.) should de-activate. (be up right)
11. Fill settling pit to operating level by opening manual pit fill ball valve. (Ensure that pit floats are fasten at correct heights before filling)
12. Remove plug on top of 7.5Hp sump pump and 2Hp circulation pump on reclaim module and prime with water. (Placing system in Standby mode will activate tank fill sequence.)
13. Place system in manual mode.
14. Refer Reclaim Slave Panel Pre-Startup and Input check List.
15. Place system into standby mode. This will start automatic tank fill operations
16. Check all pump/ motor rotations.
17. Remove plugs on arches or some nozzles and spinners. So lines can be flushed. Replaced when lines are flushed.
18. Run high-pressure arches. Check amps on high pressure pump to name plate. Check that pressure is at 300 to 320 psi. (For Manual functions refer to controls section in manual, placing system in Standby mode will activate tank fill sequence.)
19. Prime chemical pump. (For Manual functions refer to controls section in manual)
20. Test all other manual functions.
21. Re-check plumbing connections for leaks.
22. Put system in Auto mode and test operations. (For wash mode functions refer to controls section in manual.)
23. Make adjustment to on and off delay timers as necessary. (For timer settings refer to controls section in manual.)
24. Make sure that both 2" manual and 1" automatic pit fill ball valves are in the off position. (1" automatic pit fill ball valve should only be open special circumstances, like excessive carry of by vehicles.)

Coralville Transit, Coralville, IA
Project # LY09-070
Truck Wash, Reclaim Water System
Master Panel Pre-start-up and Input Checklist

The input devices wired to the I/O base must be checked to verify that the proper signals are being sent. The input signal checklist below will aid in checking the type of signal required from the various input devices. Note that if the incoming signals are not correct the automatic wash functions will not operate correctly.

Input Checklist for Reclaim Master Panel Type A- TSX MOMENTUM:

Input address	Description	Sensor Blocked	Sensor Cleared
6.01	Chemical arch #1 sensor 1	LED off	LED on
6.02	Chemical arch #1 rear sensor 2	LED off	LED on
6.03	Chemical arch #2 sensor 3	LED off	LED on
6.04	Chemical arch #2 rear sensor 4	LED off	LED on
6.05	Spinner arch sensor 5	LED off	LED on
6.06	Rear wash arch sensor 6	LED off	LED on
6.07	Brush arch sensor 7	LED off	LED on
6.08	Rinse arch sensor 8	LED off	LED on

Input address	Description	Tank empty	Tank full
6.09	Tank low level float switch	LED off	LED on
6.10	Tank high level float switch	LED on	LED off

Input address	Description	Energized	De-Energized
6.11	Brush slave panel auxiliary contact signal	LED on	Bit off

Input address	Description	Off position	On position
6.12	Circuit Breaker Auxiliary 3CB,4CB,5CB	LED off	LED on

Input address	Description	Energized	De-Energized
6.13	(1M/2M) Motor Contactors	LED on	LED off
6.14	(3M/4M) 3HP Motor Contactors	LED on	LED off

Input address	Description	Engaged	Disengaged
6.16	Master panel emergency stop button	LED off	LED on

Coralville Transit, Coralville, IA
Project # LY09-070
Truck Wash, Reclaim Water System
Reclaim Slave Panel Pre-start-up and Input Checklist

General:

1. Remove vent cap from top of EQ module 500-gal cone bottom tank.
2. Correct Amperes setting must be set on all overloads. Refer to Motor nameplates to find actual Amp. Ratings
3. Insure all circuit breakers are turned on and apply power to the electrical control panel.
4. The input devices wired to the programmable controller must be checked to verify that the proper signals are being sent. The input signal checklist below will aid in checking the type of signal required from the various input devices. Note that if the incoming signals are not correct the automatic wash functions will not operate correctly.
5. Altivar 31 adjustable speed drive controller must have acceleration Time setting (**ACC)** change to **2 Seconds. Refer to page 30-31 of the Altivar start-up guide for instructions.** Configuring the VFD in reclaim slave panel, For the Altivar 31 drive under the Drive Control Menu (drC) enter motor nameplate information for the following settings (bFr), (UnS), (FrS), (nCr), (nSP),(COS) and change (Uft) to **P**:
6. Under Settings Menu (Set) change (LSP) to **60Hz** and (ItH) to FLA on motor nameplate. Under the I/O menu (I-O) change the (tCt) setting to **LEL**: **Refer to pages 30-35 of the Altivar start-up guide for instructions.**

7. Remove plug on top of 7.5Hp sump pump and 2Hp circulation pump on reclaim module and prime with water. (Placing system in Standby mode will activate tank fill sequence.)
8. Configure soft start settings. Altistart 48: Under Settings Menu (SEt) change (In) to FLA on motor nameplate. under the Drive Control Menu (drC) change (CLP) to OFF, (ULn) to panels line voltage, change (FrC) to 60hz. Adjust (ACC) Acceleration as needed.
9. Check all Motors for proper rotations.

Input Checklist for Reclaim Slave Panel Type A TSX MOMENTUM:

Input address	Description	Tank empty	Tank full
6.01	Holding tank fill senor(1FS) *Top level setting*	LED on	LED off
6.02	Holding tank fill sensor (2FS) *Mid. level setting*	LED on	LED off
6.03	Holding tank low sensor(3FS) *Low level setting*	LED off	LED on

Input address	Description	Pit empty	Pit full
6.04	Reclaim pit low level float (4FS)	LED off	LED on
6.06	Reclaim pit fill level float (5FS)	LED on	LED off

Input address	Description	Fault	OK
6.07	Soft Start Fault	LED off	LED on

Input address	Description	Off position	On position
6.11	Circuit Breaker Auxiliary 3CB,4CB,5CB	LED off	LED on

Input address	Description	Energized	De-Energized
6.12	(1M) 2HP Motor Contactor	LED on	LED off
6.13	(2M) 7.5HP Motor Contactor	LED on	LED off
6.14	(3M) 75HP Motor Contactor	LED on	LED off
6.15	VFD Unit	LED on	LED off

Input address	Description	Engaged	Disengaged
6.16	Master panel emergency stop button	LED off	LED on

FDS & OFDS SERIES

OFDS5015S

TWIN ALTERNATING COMMERCIAL Water Softeners

Actual product may vary from image shown

SYSTEM SPECIFICATIONS:

Flow Rate:	* 8 - 45 gpm (30 – 170 lpm)
Capacity:	* 63 – 300 K grains (4.1 – 19.4 Kg)
Regeneration:	* Meter Initated Alternating Standby
Pipe Size:	1 & 1-1/2 inch NPT (Std.) or BSP
Pressure:	100 psi Max. (689 kPa)
Vacuum:	None
Temperature:	40 – 100F (4 – 40C)
Electrical:	* 120V/60HZ (Std.), or 220V/50HZ
Turbidity:	5 NTU Max.
Chlorine:	1 mg/L Max.
Iron:	** 3 mg/L Max.

STANDARD FEATURES (FDS & OFDS Models):

- Single, rugged, solid brass, programmable, 6-cycle motorized piston valve; meter initiation with manual initiation capability
- Single, heavy duty composite mineral tank; will not rust or corrode, less weight to ship and less susceptible to damage than FRP
- High capacity HDPE brine tank with non-degradable salt platform allows use of any type of salt, reduces maintenance
- Single point distributor system with quartz gravel under-drainage eliminates channeling of resin bed and is less susceptible to damage during shipping or installation
- High capacity cation exchange resin in cubic foot bags for ease of installation and reduction of waste materials at job site
- 24 hour soft water availability
- Soft water regeneration for maximum softening capacity
- Timed brine refill provides accurate and efficient salt dosing
- Safety Brine Valve on 5 Cu Ft and smaller
- Complete installation and operating documentation provided with system
- Toll-free technical support by telephone (within US) or by e-mail

OPTIONS:

☐ **Meter Range** (check only one)
- ☐ Standard Range (FDS "S" SUFFIX)
  310 – 5,270 gal (1,173 – 19,949 liters)
- ☐ Standard Range (OFDS "S" SUFFIX)
  625 – 10,625 gal (2,366 – 40,220 liters)
- ☐ Extended Range (FDS "E" SUFFIX)
  1,150 – 26,350 gal (4,353 – 99,745 liters)
- ☐ Extended Range (OFDS "E" SUFFIX)
  3,125 – 53,125 gal (11,829 – 201,100 liters)

☐ **220V/50HZ** (check only one)
- ☐ European two prong power cord (-EUR)
- ☐ Australian power cord (-AUS)
  BSP pipe connections Std. for –EUR and –AUS configurations

☐ **Electronic Control**

☐ **Safety Brine Valve** (7 Cu Ft & Larger)

☐ **Custom Engineering** Additional specifications attached

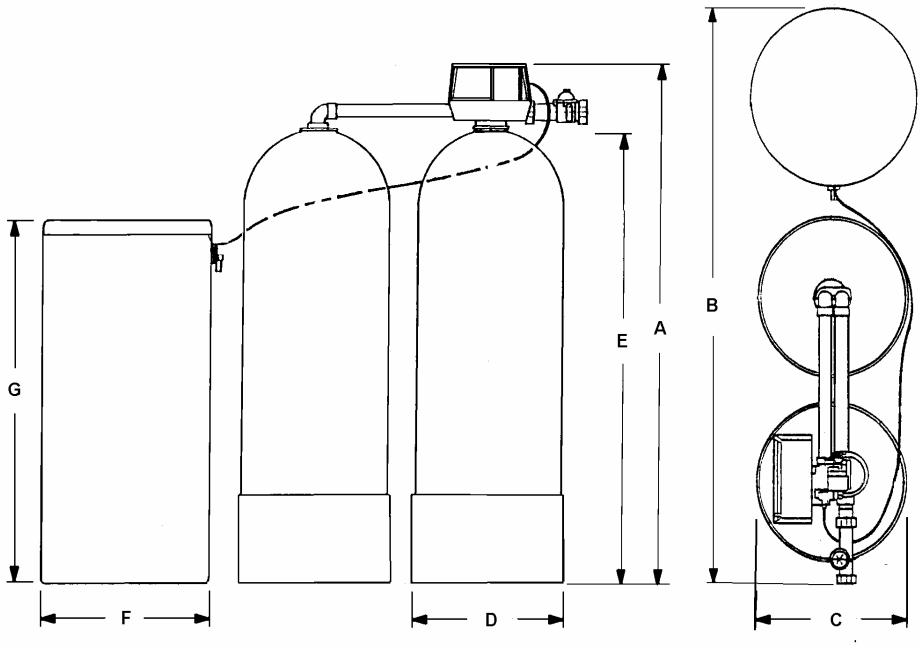
This Space for Architect / Engineer Approval

Cuno Tech. Services, Toll Free: (866)693-2543
Web: www.cuno.com E-mail: cwttech@cuno.com

* Dependant upon system configuration selected

** See back for details

FDS & OFDS SERIES
TWIN ALTERNATING COMMERCIAL Water Softeners



A – Overall system height
(Including all tanks if multi-tank)

B – Overall system width
(Including all tanks if multi-tank)

C – Overall system depth
(Including all tanks if multi-tank)

D – Resin tank diameter

E – Resin tank height

F – Brine tank diameter

G – Brine tank height

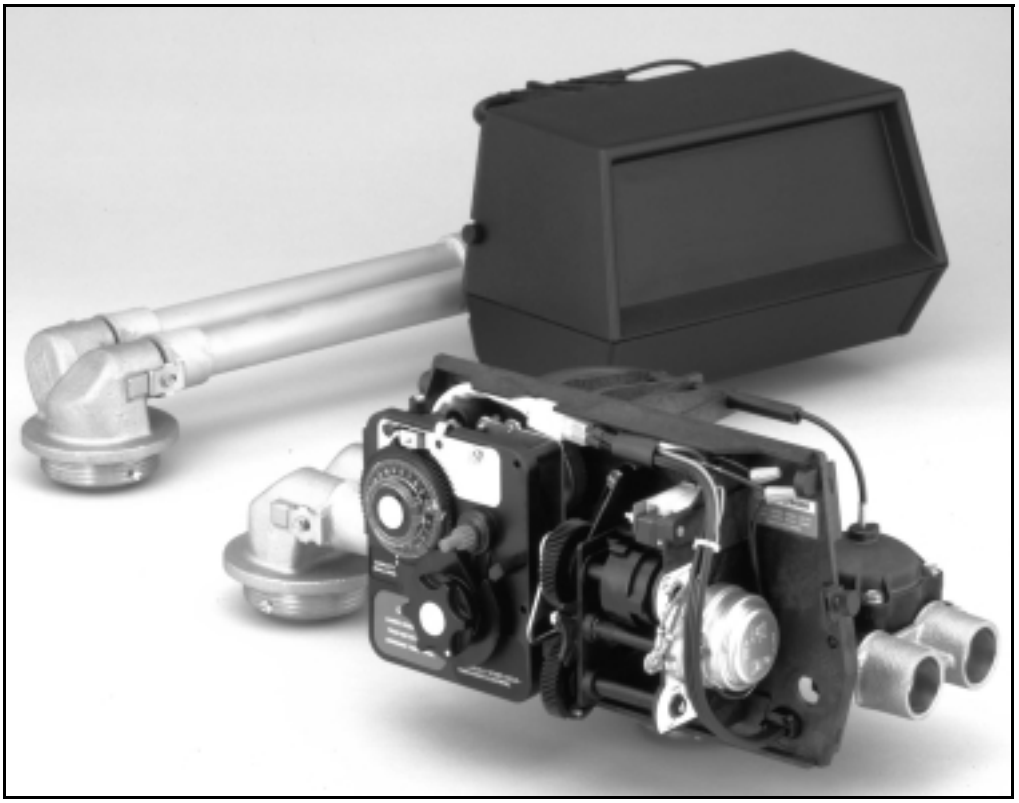
NOTE: All measurements in inches
1 in. = 2.54 cm

Model	Resin Volume Cu. Ft. (Liters)	Exchange Capacity K grains (Kilograms)		Flow Rates GPM (LPM)				Salt Capacity Lbs (Kg)	Overall Dim.'s AxBxC	Resin Tank Size DxE	Brine Tank Size FxG	Approx Ship Wt Lbs (Kg)
		@Max. salt per Cu. Ft.	@Factory salt per Cu. Ft.	Peak @25psi drop	Service @15psi drop	Cont. @ 8psi drop	Back Wash					
1" IN / OUT												
FDS3011S FDS3011E	3 (85)	90 (5.8)	63 (4.1)	18 (68)	12 (45)	8 (30)	5 (19)	800 (363)	73x65x30	14x65	24x50	571 (259)
FDS4011S FDS4011E	4 (113)	120 (7.8)	84 (5.4)	19 (72)	16 (61)	10 (38)	7 (26)	800 (363)	73x68x30	16x65	24x50	671 (304)
FDS5011S FDS5011E	5 (142)	150 (9.7)	105 (6.8)	20 (76)	18 (68)	13 (49)	7 (26)	800 (363)	73x68x30	16x65	24x50	781 (354)
1-1/2" IN / OUT												
OFDS3015S OFDS3015E	3 (85)	90 (5.8)	63 (4.1)	35 (132)	24 (91)	12 (45)	5 (19)	800 (363)	73x65x30	14x65	24x50	840 (381)
OFDS4015S OFDS4015E	4 (113)	120 (7.8)	84 (5.4)	37 (140)	27 (102)	16 (61)	7 (26)	800 (363)	73x68x30	16x65	24x50	940 (426)
OFDS5015S OFDS5015E	5 (142)	150 (9.7)	105 (6.8)	39 (148)	28 (106)	18 (68)	7 (26)	800 (363)	73x68x30	16x65	24x50	1,050 (476)
OFDS7015S OFDS7015E	7 (198)	210 (13.6)	147 (9.5)	43 (163)	32 (121)	22 (83)	10 (38)	800 (363)	70x77x30	21x62	24x50	1,390 (630)
OFDS10015S OFDS10015E	10 (283)	300 (19.4)	210 (13.6)	45 (170)	34 (129)	25 (95)	15 (57)	1,200 (544)	79x88x36	24x72	30x50	1,825 (828)

** All softeners are capable of removing limited amounts of "clear-water" iron although they are neither designed nor warranted to do so. An iron filter should be installed before the softener if iron levels exceed 2 mg/L, iron is "red-water" iron or if iron bacteria is present.
should be installed before the softener if iron levels exceed 3 mg/L, iron is "red-water" iron or if iron bacteria is present.

MODEL 9000

Service Manual



IMPORTANT: Fill in pertinent information on page 2 for future reference.

MODEL 9000 ECONOMINDER®

Job Specification Sheet

* JOB NO. _____

* MODEL NO. _____

* WATER TEST _____

* CAPACITY PER UNIT_____MAX. _____PER REGENERATION

* MINERAL TANK SIZE DIA._____HEIGHT_____

* BRINE TANK SIZE &
SALT SETTING PER REGENERATION _____

* 9000 CONTROL VALVE SPECIFICATIONS

1. Type of Timer
   - A) 82 minute available regeneration time, 1/15 RPM
   - B) 164 minute available regeneration time, 1/30 RPM
2. Type of Meter (see page 23)
   - A) 3/4″ meter *Std. range 125 to 2,100 gal. setting
*Ext. range 625 to 10,625 gal. setting
   - B) 1″ meter *Std. range 310 to 5,270 gal. setting
*Ext. range 1,550 to 26,350 gal. setting
3. Meter Gallon Setting _____ gal. (see pages 6 & 7)
4. Regeneration Program Settings (see page 5)
   - A) Backwash _____ min.
   - B) Brine & Slow Rinse _____ min.
   - C) Rapid Rinse _____ min.
   - D) Brine Tank Refill _____ min.
5. Drain Line Flow Control _____ gpm
6. Brine Refill Rate_____ gpm
7. Injector Size _____

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MODEL 9000 ECONOMINDER®

General, Residential & Commercial Installation Check List

WATER PRESSURE: A minimum of 25 pounds of water pressure is required for regeneration valve to operate effectively.

ELECTRICAL FACILITIES: A continuous 110 volt, 60 Hertz current supply is required. Make certain the current supply is always hot and cannot be turned off with another switch.

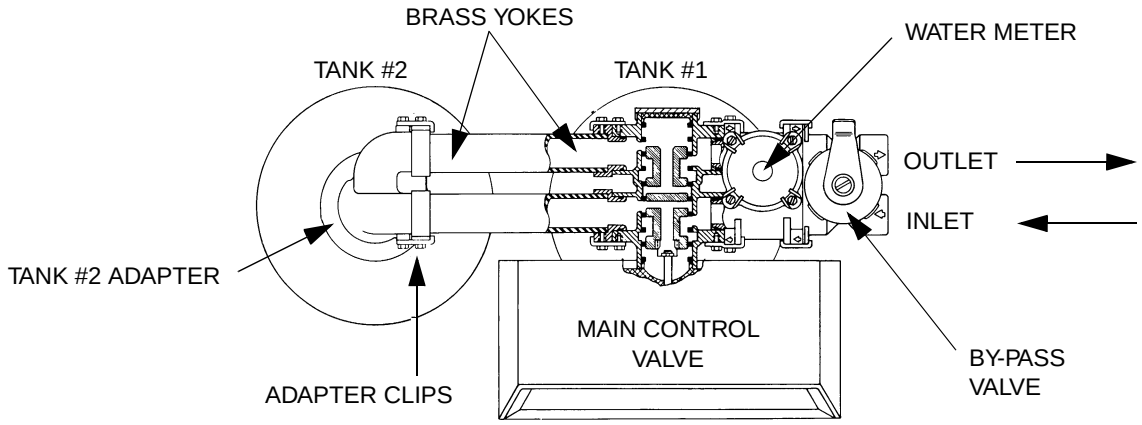
EXISTING PLUMBING: Condition of existing plumbing should be free from lime and iron buildup. Piping that is built up heavily with lime and/or iron should be replaced. If piping is clogged with iron, a separate iron filter unit should be installed ahead of the water softener.

LOCATION OF SOFTENER AND DRAIN: The softener should be located close to a drain.

BY-PASS VALVES: Always provide for the installation of a by-pass valve.

CAUTION: Water pressure is not to exceed 120 p.s.i., water temperature is not to exceed 110° F, and the unit cannot be subjected to freezing conditions.

Installation and Start-Up Instructions



1. Place the softener tank where you want to install the unit, making sure the tanks are level and on a firm base.
2. All plumbing should be done in accordance with local plumbing codes. The pipe size for the drain line should be minimum 1/2″. Overhead drains exceeding 4′ above unit require 3/4″ drain line.
3. Both tanks must be the same height and diameter and filled with equal amounts of media. The 1″ distributor tube (1.050 O.D.) should be cut flush with top of each tank.
4. Lubricate the distributor O-Ring seal and tank O-Ring seal with silicone lubricant. Place the main control valve on one tank and the tank adapter on the second tank.
5. NOTE: The 1″ copper tubing to interconnect the tanks must be soldered prior to assembly on the main control valve and tank adapter. There should be a minimum of 1″ distance between tanks on final assembly.
6. Solder joints near the drain must be done prior to connecting the Drain Line Flow Control fitting. Leave at least 6″ between the DLFC and solder joints when soldering. Failure to do this could cause damage to the drain module.
7. Teflon tape is the only sealant to be used on the drain fitting.
8. Make sure that the floor is clean beneath the salt storage tank and that it is level.
9. Place approximately 1″ of water above the grid plate (if used) in your salt tank. Salt may be placed in the unit at this time.
10. On units with a by-pass, place in by-pass position. Turn on the main water supply. Open a cold soft water tap nearby and let run a few minutes or until the system is free from foreign material (usually solder) that may have resulted from the installation.
11. Place the by-pass in service position and let water flow into the mineral tanks. When water flow stops, open a cold water tap nearby and let run until air pressure is relieved.
12. Electrical: All electrical connections must be connected according to codes. Plug unit into electrical outlet. **Do not insert meter cable** into the meter yet.

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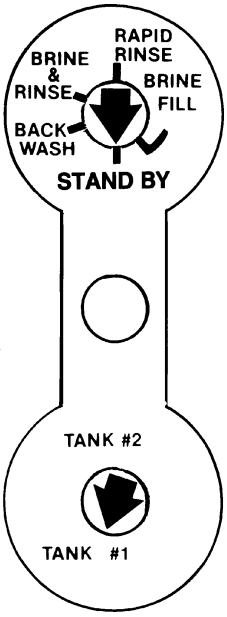
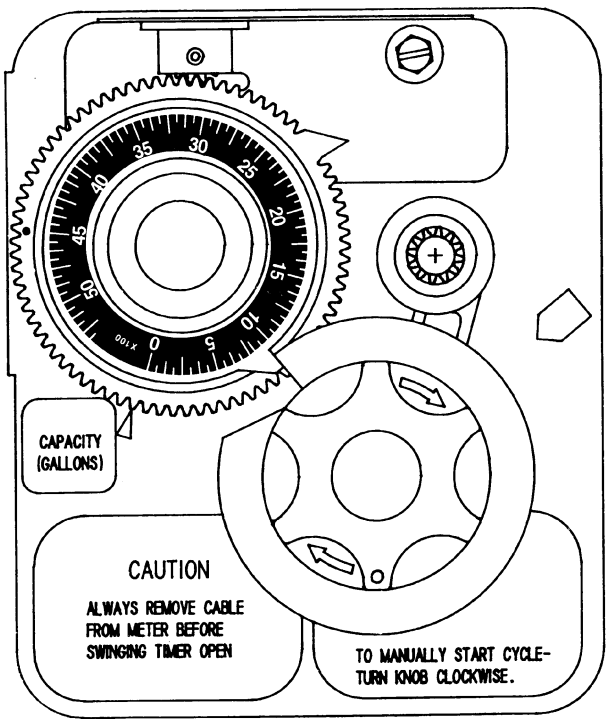
13. Tank #1 has control valve.

    Tank #2 has the adapter.

    Look on the right side of the control valve, it has indicators which tells you which position the control valve is in during regeneration and which tank is *IN SERVICE.* Photo on the right indicates the valve is in the service position and tank #1 is supplying conditioned water. Tank #2 is on standby.





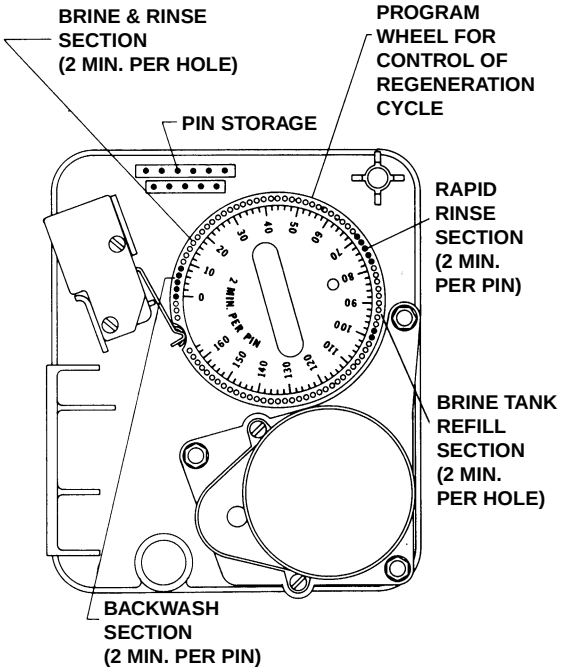
NOTE: *Make sure the meter cable is not* inserted in the meter dome. Swing the timer out to expose the program wheel *Figure 2* (to swing timer out) grab onto the lower right corner of timer face *Figure 1* and pull outward.

14. Cycle timer into backwash position. Turn manual knob (figure 1) so that the micro switch is riding on the 1st set of pins (figure 2). In this position the tanks will switch (lower piston) and the control valve will move to the backwash position (upper piston). *You must* wait until the positioning of upper and lower pistons has stopped before advancing the timer further. *If advanced too fast* the control will not *home* into the service position (it will not advance to any other position). To correct this, rotate the manual knob back to service and start again into backwash. **Note:** once valve has positioned itself into the backwash cycle, the homing circuit is locked in.

    With all the air backwashed out, slowly cycle the timer to the brine position; rapid rinse; and brine tank refill. You must wait for the control drive motor to position itself in each cycle and stop, before advancing on to the next position.

    Once back in the service position, cycle the control valve again into the backwash position. The tanks will switch again, and you will backwash the air head out of the other tank. Cycle the control back to the service position. Leave the timer in the open position.

DO NOT INSERT METER CABLE YET.



NOTE: 2 motors are available, 1/15 RPM will have a 82 min. reg. time available.

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MODEL 9000 ECONOMINDER®

Regeneration Cycle Program Setting Procedure

(Brine Tank Refill Separate From Rapid Rinse)

How To Set The Regeneration Cycle Program:

The regeneration cycle program on your water conditioner has been factory preset, however, portions of the cycle or program may be lengthened or shortened in time to suit local conditions.

To expose cycle program wheel, grasp timer in lower right hand corner and pull, releasing snap retainer and swinging timer to the left. Meter cable *must* be removed from meter dome before opening timer.

To change the regeneration cycle program, the program wheel must be removed. Grasp program wheel and squeeze protruding lugs towards center, lift program wheel off timer. (Switch arms may require movement to facilitate removal.)

Return timer to closed position engaging snap retainer in back plate. Make certain all electrical wires locate above snap retainer post.

How To Change The Length Of The Backwash Time:

The program wheel as shown in the drawing is in the service position. As you look at the numbered side of the program wheel, the group of pins starting at zero determines the length of time your unit will backwash.

FOR EXAMPLE: If there are six pins in this section, the time of backwash will be 12 min. (2 min. per pin). To change the length of backwash time, add or remove pins as required. The number of pins times two equals the backwash time in minutes.

How To Change The Length Of Brine And Rinse Time:

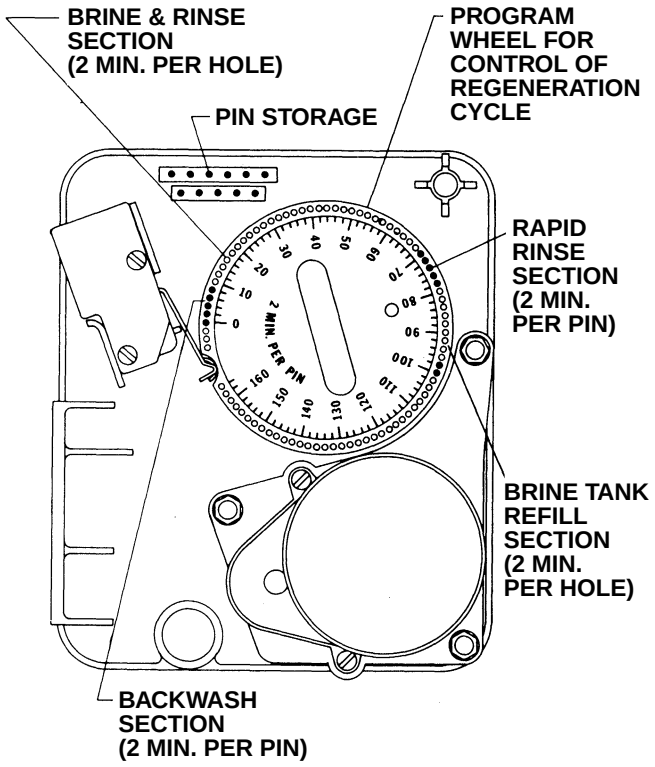
The group of holes between the last pin in the backwash section and the second group of pins determines the length of time that your unit will brine and rinse. (2 min. per hole.)

To change the length of brine and rinse time, move the rapid rinse group of pins to give more or fewer holes in the brine and rinse section. Number of holes times two equals brine and rinse time in minutes.

How To Change The Length Of Rapid Rinse:

The second group of pins on the program wheel determines the length of time that your water conditioner will rapid rinse. (2 min. per pin.)

To change the length of rapid rinse time, add or remove pins at the higher numbered end of this section as required. The number of pins times two equals the rapid rinse time in minutes.



NOTE: Program wheels having 0 to 82 min. cycle times, use “1” min. per pin or hole to set regeneration times. The layout of pins and holes on the program wheel follow the same procedure as on this page.

How To Change The Length Of Brine Tank Refill Time:

The second group of holes on the program wheel determines the length of time that your water conditioner will refill the brine tank (2 min. per hole.)

To change the length of refill time, move the two pins at the end of the second group of holes as required.

The regeneration cycle is complete when the outer micro-switch is tripped by the two pin set at end of the brine tank refill section. The program wheel, however, will continue to rotate until the inner micro-switch drops into the notch on the program wheel. See page 6 for salt setting calculations, and page 24 for general timer settings.

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MODEL 9000 ECONOMINDER®

Time Brine Refill & Meter Setting Procedure

PROGRAMMING

1. Your control valve has been factory set for backwash; brine and slow rinse; rapid rinse and brine tank fill times. See the control valve specification sheet (pg. 24). Any of these times can be changed by repositioning the pins and holes or adding more pins (see pg. 5). Note that two different speed timer motors are used, one allows for an 82 minute maximum regeneration time (each pin or hole = 1 min.). The other allows for 164 minute maximum regeneration time (each pin or hole = 2 min.).

2. The 9000 Control has a separate brine tank fill cycle. Your desired salt setting must be calculated, using the blue (.25 gpm) or black (.5 gpm) or red (1.0 gpm) rate of refill (in gpm) times your timer setting. Then using one gallon of fresh water dissolving approximately 3 lbs. salt, calculate your refill time.

   ie: A desired 9 lb. salt setting: The unit has a .5 gpm refill rate, we will need a 3 gallon fill. (3 gal. x 3 lb./gal. = 9 lb. salt). The timer refill section would have to be set at 6 minutes. (6 min x .5 gpm = 3 gal. fill)

   Note: There always must be 2 pins at the end of your refill time. This is to stop the fill cycle. With your regeneration times now set, place timer back to its original position, making sure the lower right hand corner snaps back into the backplate and the meter cable slides through the backplate and does not bind.

3. **Setting the gallon wheel**

   Knowing the amount of resin you have in each tank and your salt setting per regeneration, calculate the gallons available, using the following capacities as a guide:

One Cubic Foot of Resin

Salt Setting at	Capacity per Regeneration
15 lb	30,000 grains
10 lb	27,000 grains
8 lb	24,000 grains
6 lb	20,000 grains

Gallons available = **Capacity per Regeneration.**
Compensated Hardness of H_2O

ie: 24 grain water; each tank having 1 cubic foot of resin and salted at 8 lb. of salt, yielding a usable 24,000 grain capacity: 1,000 gallons available = 24,000 gr. capacity / 24 gr. water

DO NOT SET THIS FIGURE - GO TO STEP 4

3. Since the 9000 Valve regenerates with soft water from the other tank, you must subtract the water used for regeneration. Take each of your regeneration cycles and calculate the water used. (Use the injector Slow Rinse rate chart supplied, see pg. 24.)

   ie: Unit is set up for a 10 tank having 2.4 gpm backwash, #1 injector, .5 gpm refill, timer set up for *8 min. backwash, 54 min. brine and rinse, 6 min. rapid rinse, 6 min. brine tank fill.*

   A. Backwash - 8 mins. x 2.4 gpm = 19.2 gallons

   B. Brine and Rinse - 54 mins. x .33 gpm = 17.8 gallons
   (See injector chart slow rinse flow, pg. 23)

   C. Rapid Rinse - 6 mins. x 2.4 gpm = 14.4 gallons

   D. Brine Tank Fill - 6 mins. x .5 gpm = 3.0 gallons

   Total Regeneration Water = 54.4 gallons

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If we have 1000 gallons available from Step 3, we want to subtract the regeneration water used from the total water available.

1000 gallons available - 55. gallons used = 945 gallons setting (in regeneration)

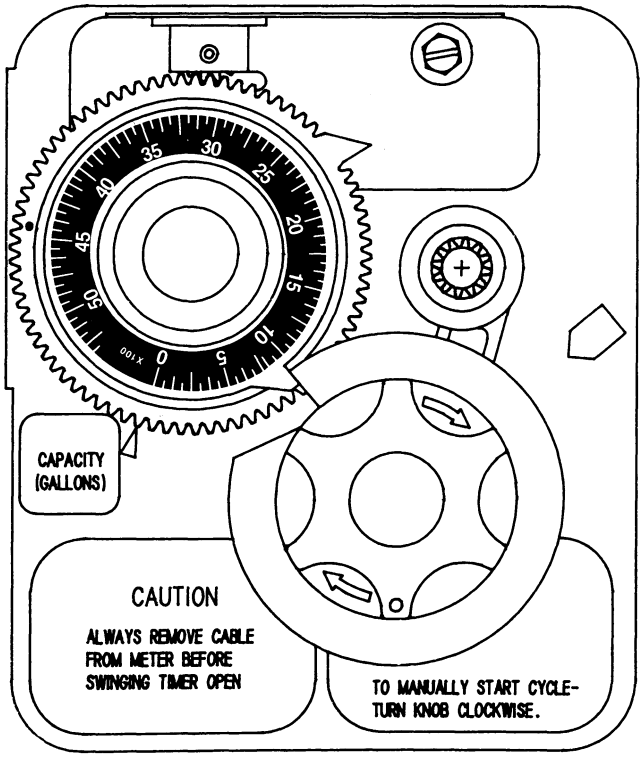
4. **NOW** set Meter wheel at approximately 950 gallons. Lift the inner dial of the meter program wheel so that you can rotate it freely. Position the white dot opposite the 950 gallon setting (see diag. below).

NOTE: There is a slight delay time from the time the meter zero's out and when the cycle starts. Units using the 1/15 rpm motor, 82 minute regeneration time available (tanks 6″ thru 12″) have a *9 minute delay.* Units using the 1/30 rpm motor, 180 minute regeneration time available (tanks 13″ and larger) have an *18 minute delay.* Typically on residential equipment this delay period is not critical. On commercial applications, this must be taken into consideration and continuous flows for 9 minutes or 18 minutes should be subtracted from water available.

NOW 1. Insert Meter cable into Meter.

2. Check Bypass.

3. Plug unit in.



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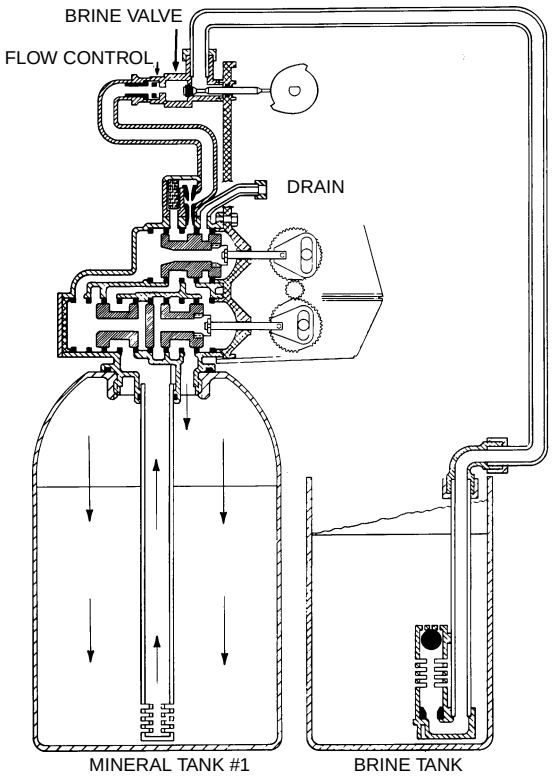
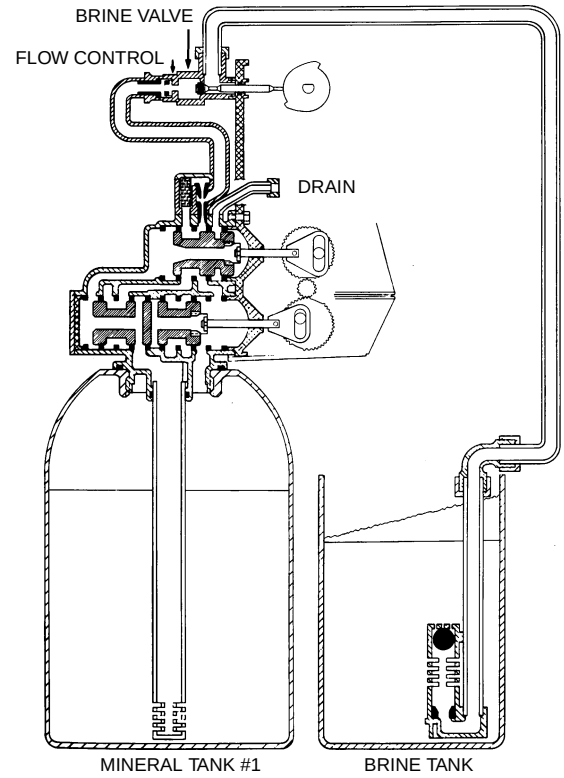


1 - SERVICE POSITION

Hard water enters the unit at the valve inlet, flows around the lower piston, and down through the mineral in the first tank. Conditioned water enters the center tube through the bottom distributor, flows up through the center tube, around the lower piston, through the meter, and out the valve outlet. The second mineral tank is regenerated and on standby.



2 - TANKS SWITCHING
(the meter has initiated a regeneration)

Hard water enters the unit at the valve inlet, flows around the lower piston, through the pipe leading to the second mineral tank, and down through the mineral in the second tank. Conditioned water enters the center tube of the second tank through the bottom distributor, flows up through the center tube, through the pipe leading back to the main valve, around the lower piston, through the meter, and out the valve outlet. The depleted first mineral tank is out of the flow path, and ready for regeneration.

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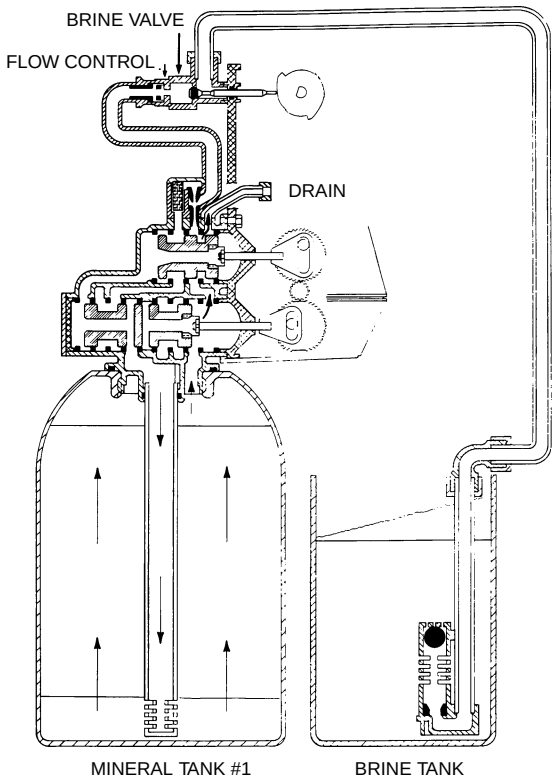
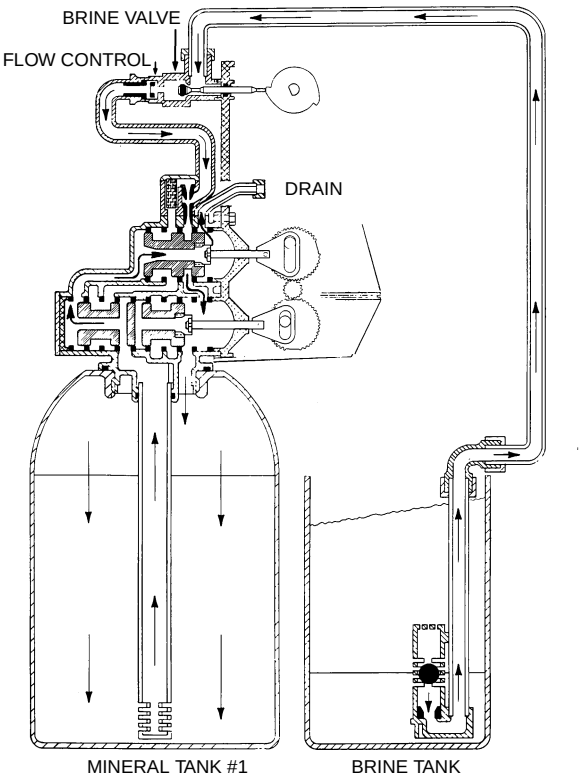


3 - BACKWASH

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, through the center of the lower piston, down the center tube, up through the mineral, around the upper piston, and out the drain line.



4 - BRINE DRAW

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, and down through the nozzle and throat to draw brine from the brine tank. Brine flows around the upper piston, down through the mineral, into the center tube through the bottom distributor, up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.

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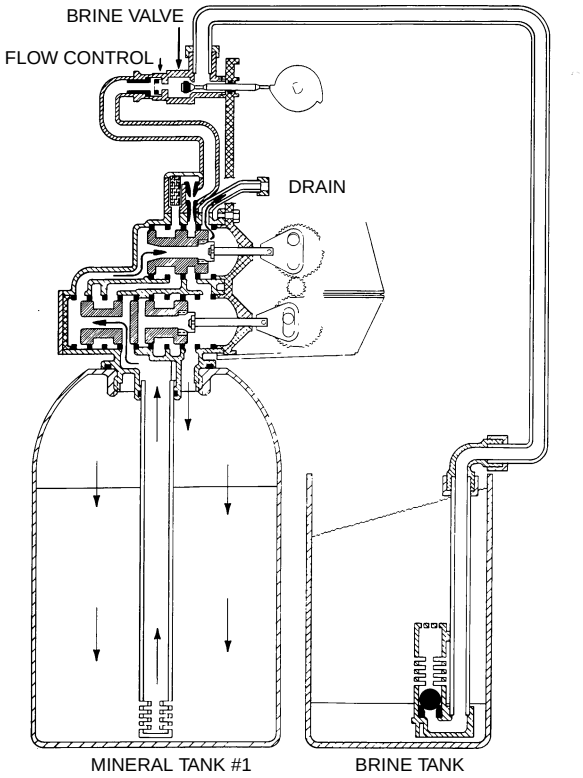
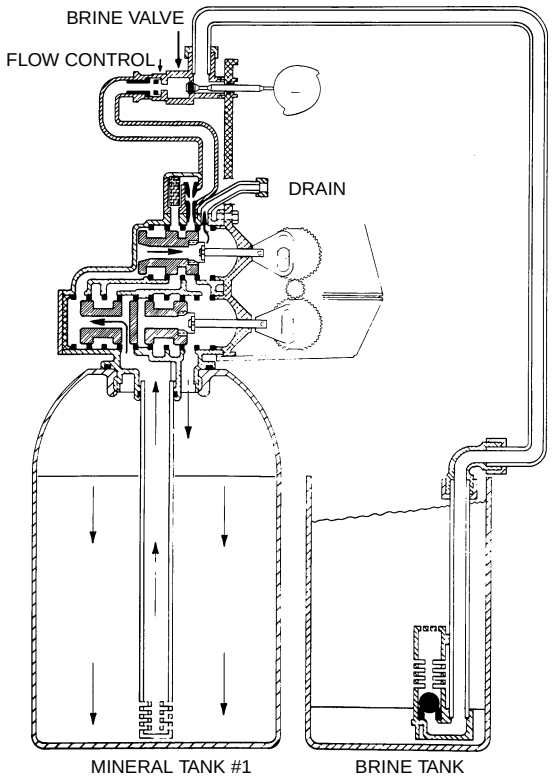


5 - SLOW RINSE

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, down through the nozzle and throat, around the upper piston, down through the mineral, into the center tube through the bottom distributor, up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.



6 - RAPID RINSE

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, and down through the mineral in the first tank. Rinse water from the mineral bed enters the center tube through the bottom distributor, flows up the center tube, through the center of the lower piston, through the center of the upper piston, and out through the drain line.

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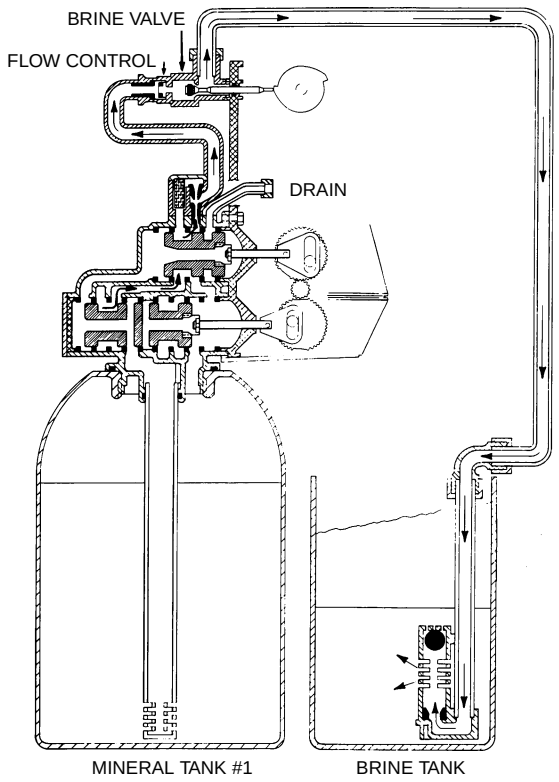
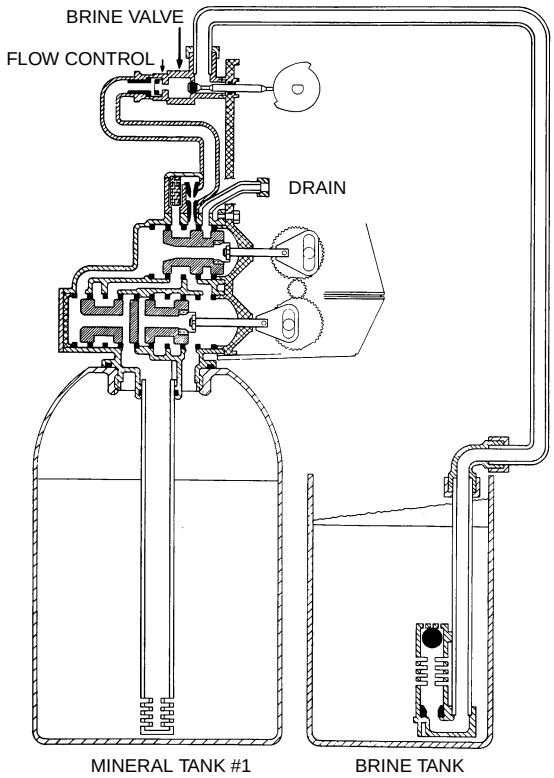


7 - BRINE TANK FILL POSITION

Conditioned water from the second mineral tank flows around the lower piston, around the upper piston, into the injector housing, through the brine line flow control, through the brine valve, and into to brine tank. No water flows through the first mineral tank.



8 - SERVICE (TANKS SWITCHED)

Hard water enters the unit at the valve inlet, flows around the lower piston, through the pipe leading to the second mineral tank, and down through the mineral in the second tank. Conditioned water enters the center tube of the second tank through the bottom distributor, flows up through the center tube, through the pipe leading back to the main valve, around the lower piston, through the meter, and out the valve outlet. The regenerated first mineral tank is out of the flow path, and ready for use when the second mineral tank becomes depleted.

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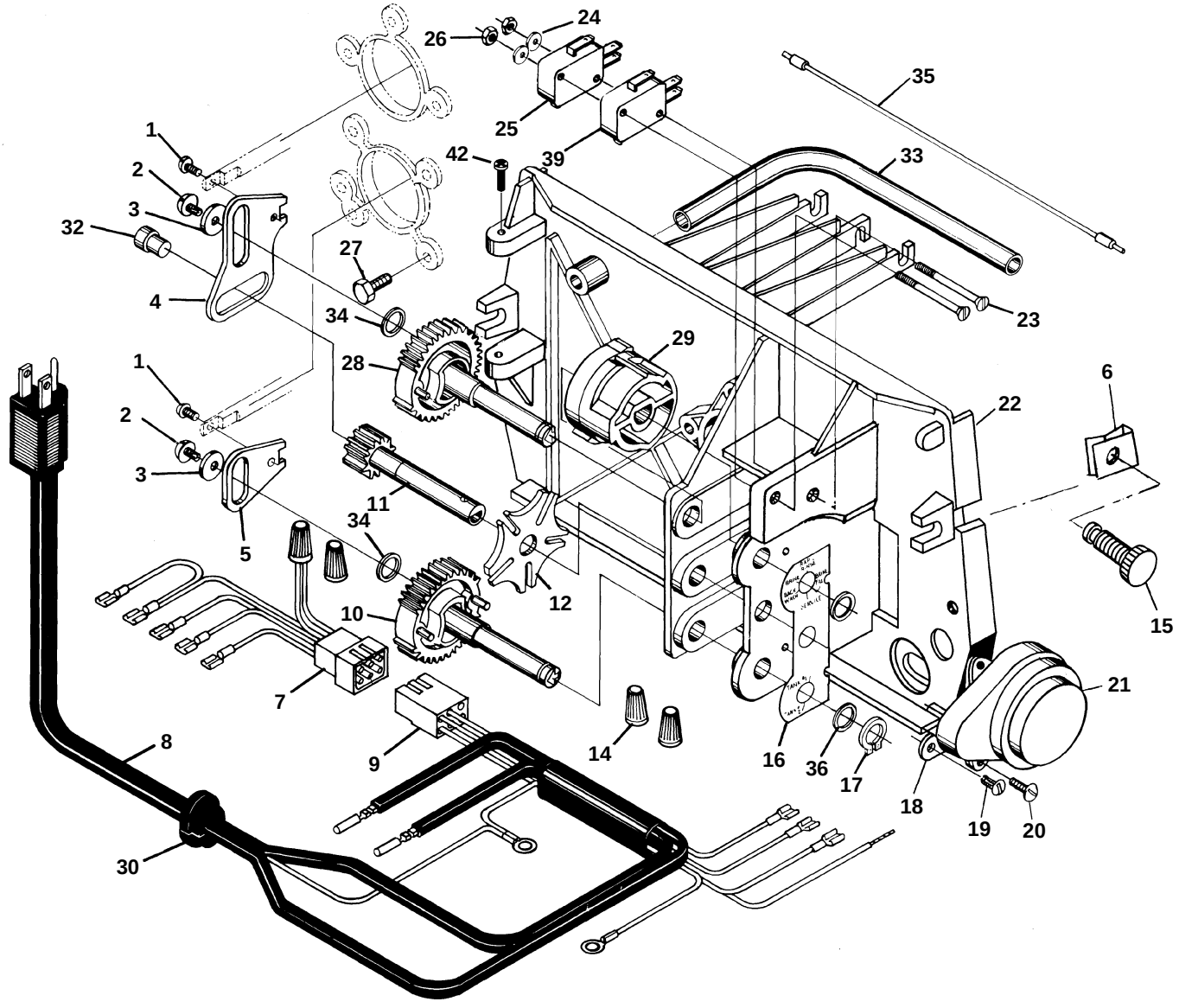
MODEL 9000 ECONOMINDER®

Drive Assembly

(See opposite page for parts list)



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MODEL 9000 ECONOMINDER®

Drive Assembly

Parts List

Item No.	Quantity	Part No.	Description
1	2	11335	Screw, #4-40
2	2	18564	Screw, Hex Washer #6-20
3	2	13363	Washer
4	1	14921	Piston Rod Link, Upper
5	1	15019	Piston Rod Link, Lower
6	2	18728	Nut, Clip, #8-32
7	1	15203	Wiring Harness - Timer
8	1	11838	Power Cord
9	1	15202	Wiring Harness - Drive
10	1	15134	Drive Gear, Assembly, Lower
11	1	15135	Drive Gear
12	1	14896	Geneva Wheel
14	4	12681	Wire Connector
15	2	19367	Cover Screw Assembly
16	1	15175	Position Decal
17	2	14917	Retaining Ring
18	1	15199	Ground Plate
19	1	14430	Screw, Hex Washer #6
20	2	13602	Screw, Round Hd #6-32
21	1	18739	Drive Motor - 220V., 50 Hz
	1	18738	Drive Motor - 120V., 60 Hz
	1	18737	Drive Motor 24V., 50-60 Hz
22	1	15131	Control Panel
23	2	15172	Screw, Flat Hd #4-40
24	2	10340	Washer, Lock #4
25	1	10218	Micro Switch
26	2	10339	Nut, Hex #4-40
27	7	15331	Screw, Hex Washer #10-24
28	1	15133	Drive Gear, Assembly, Upper
29	1	15132	Triple Cam
30	1	13547	Strain Relief
31	1	15810	Retaining Ring, Drive Gear (not shown)
32	1	15323	Guide Pin Upper Piston Rod Link
33	1	15368	Cable Guide
34	2	15372	Washer, Thrust
35	1	15216	Meter Cable Assy. - 1″ Meter
	1	15425	Meter Cable Assy. - 3/4″ Meter
36	2	15692	Spacer
37	1	10302	Insulator (not shown)
38			Not Assigned
39	1	16433	Micro Switch, Program
40	1	18699-XX	Cover, Top (Now Shown)
41	1	14779-XX	Cover, Bottom (Not Shown)
	1	19291-020	Cover, 1 Piece, Black
42	2	15173	Screw

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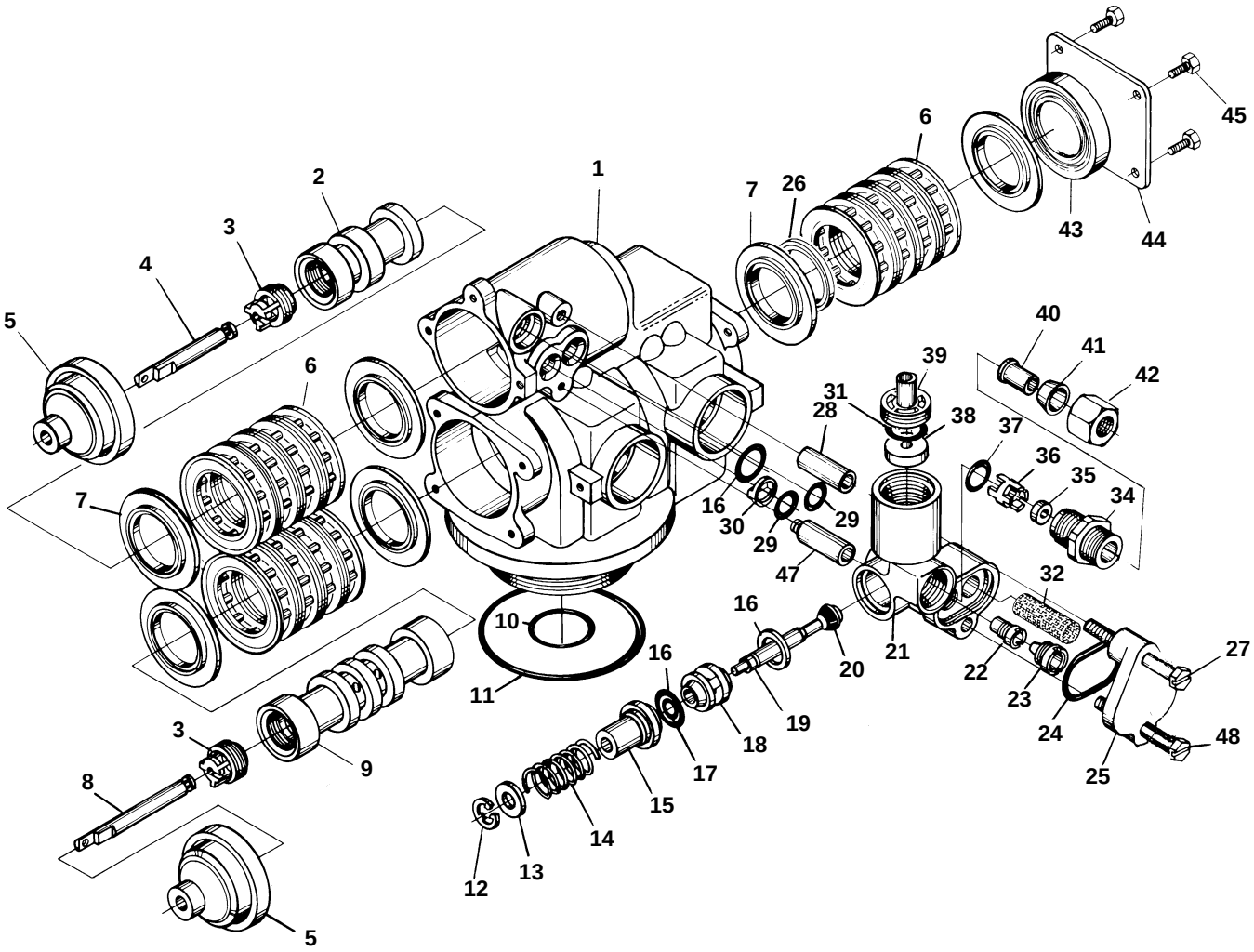
MODEL 9000 ECONOMINDER®

Control Valve Assembly

(See opposite page for parts list)



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MODEL 9000 ECONOMINDER®

Control Valve Assembly

Parts List

Item No.	Quantity	Part No.	Description
1	1	14861-01	Valve Body
2	1	14914	Piston, Upper
3	2	14309	Piston Rod Retainer
	2	16590	Piston Rod Retainer, HW
4	1	14919	Piston Rod, Upper
5	2	13446	End Plug Assy.
	2	13446-01	End Plug Assy., HW
6	12	14241	Spacer
	12	14241-01	Spacer, HW
7	16	13242	Seal
	16	18759	Seal, HW
8	1	14920	Piston Rod, Lower
9	1	14905	Piston, Lower
10	1	11710	O-Ring, -215
11	1	12281	O-Ring, -338
12	1	11981-01	Retaining Ring
13	1	16098	Washer, Brine Valve (Nylon)
14	1	11973	Spring, Brine Valve
15	1	13165	Brine Valve Cap
16	3	13302	O-Ring, -014
17	1	12550	Quad Ring, -009
18	1	13167	Brine Valve Spacer
19	1	14925	Brine Valve Stem
20	1	12626	Brine Valve Seat
21	1	15215	Injector Body
22	1	10914	Injector Throat - Specify Size pg. 24
		10226	Injector Throat, SS
23	1	10913	Injector Nozzle, Specify Size pg. 24
		10225	Injector Nozzle, SS
24	1	13303	O-Ring, -021
25	1	13166	Injector Cover
26	1	16595	Spacer
27	1	13387	Screw, Hex Hd #10-24
28	1	13361	Spacer, Injector
29	2	13301	O-Ring, -011
30	1	13497	Air Disperser
31	1	15348	O-Ring, -563
32	1	10227	Injector Screen
33			Not Assigned
34	1	13244	B.L.F.C. Fitting
37	1	16173	B.L.F.C. Fitting - Bored*
35	1		B.L.FC. Button - Specify Size pg. 24
36	1	13245	B.L.F.C. Button Retainer
	1	12977	O-Ring, -015
38	1		D.L.F.C. Button - Specify Size pg. 24
39	1	13173	D.L.F.C. Button Retainer
40	1	10332	Tube Insert - 3/8″
	1	15415	Tube Insert - 1/2″*
41	1	10330	Ferrule - 3/8″
	1	16124	Ferrule - 1/2″*
42	1	10329	Tube Nut - 3/8″
	1	16123	Tube Nut - 1/2″*
43	1	14928	Stub End Plug
44	1	14906	End Plate
45	4	15137	Screw, Hex Washer, #10-24
46	1	16140	Adapter, 1/2″ T to 1/4″ P (not shown)*
47	1	15471	Brine Valve Stand Off
48	1	13315	Screw, Hex Washer, #10-24

Note: For Hot Water Delete Items 41 & 42 and use

18698 . . Nut & Sleeve Assy. 3/8″

15414 . . Nut & Sleeve Assy. 1/2″

* These parts are used with #4 Injector and 2 GPM or larger Brine Line Flow Control (B.L.F.C.). Items 34, 35 and 36 are not used.

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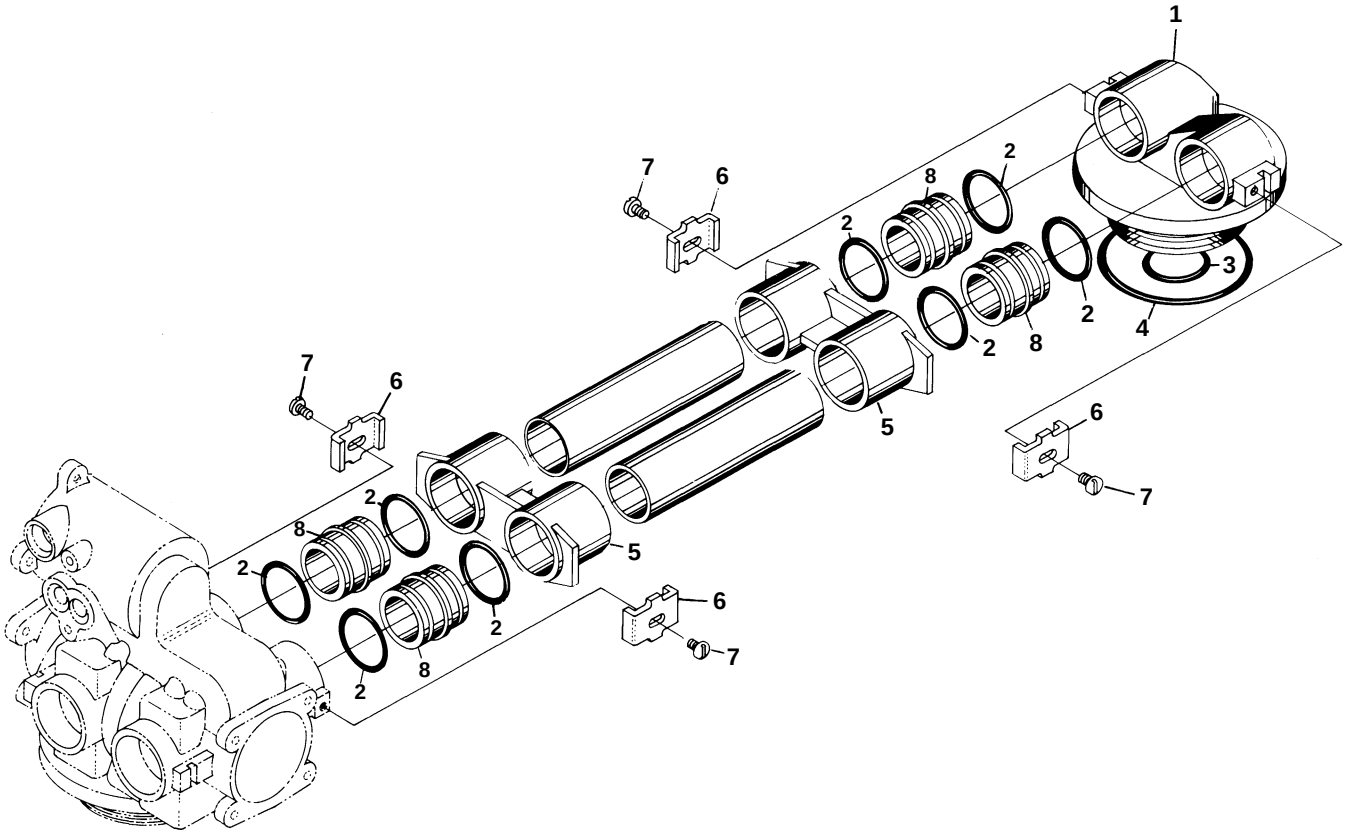
Second Tank Adapter Assembly



PARTS LIST

Item No.	Quantity	Part No.	Description
1	1	14864-01	2nd Tank Adapter
2	8	13305	O-Ring, -119
3	1	11710	O-Ring, -215
4	1	12281	O-Ring, -338
5	2	13708-40	Yoke
	1	15823-XX	Yoke Assy. Specify Tank Size
6	4	13255	Hold-Down Clip
7	4	14202	Screw, Hex Hd #8-32
8	4	15078	Coupling
9	2		Pipe - 1″ Copper Cut to Length

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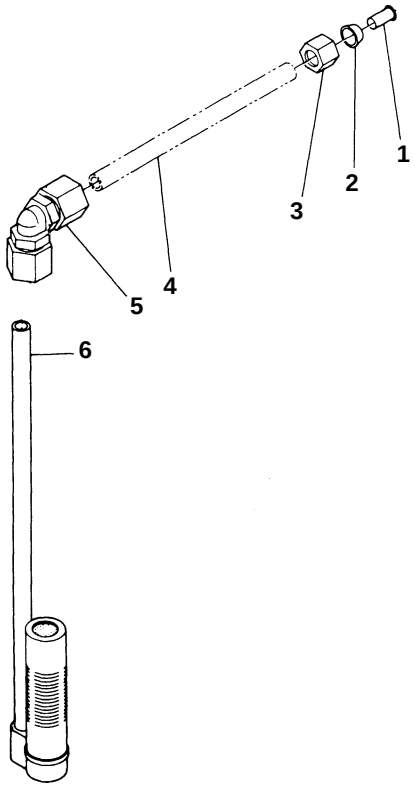
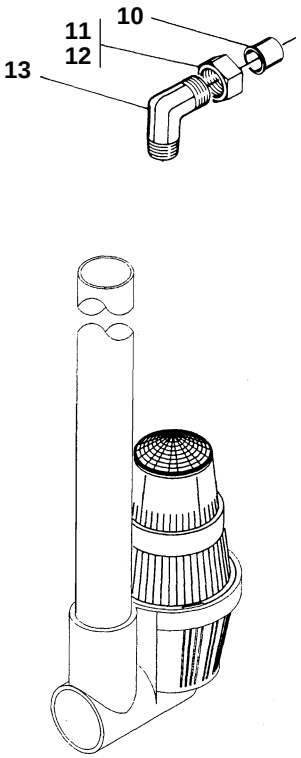
Air Check





PARTS LIST

Item No.	Quantity	Part No.	Description
1	1	10332	Tube Insert 3/8″
2	1	10330	Ferrule 3/8″
3	1	10329	Tube Nut 3/8″
4	1	Not Supplied	Brine Line Tube (3/8 Flexible Tube)
5	1	12794	90° Elbow - 3/8″ T to 3/8″ T
	1	13555	90° Elbow - 3/8″ T to 3/8″ T, HW
6	1	60002	#500 Air Check Assembly
	1	60003	#500 Air Check Assembly, HW
		For Use With 2 GPM Flow Control	
10		15415	Tube Insert 1/2″
11		16123	Ferrule 1/2″
12		16124	Tube Nut 1/2″
13		15413	Elbow
14		60009	#900 Air Check Assembly
		60009-01	#900 Air Check Assembly, HW

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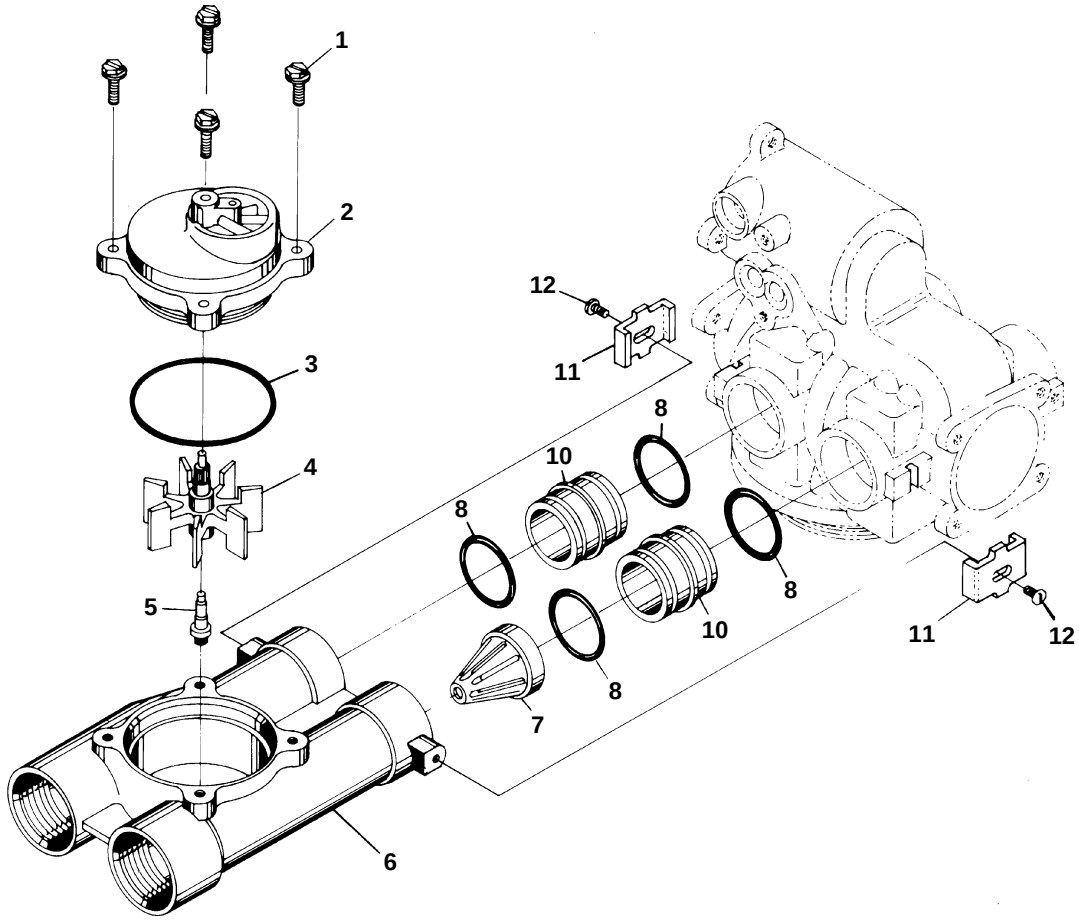
MODEL 9000 ECONOMINDER®

1″ Meter Assembly



PARTS LIST

Item No.	Quantity	Part No.	Description
1	4	12112	Screw, Hex Hd #10-24
2	1	15218	Meter Cover Assy.
		15237	Meter Cover Assy. (Ext. range)
3	1	13847	O-Ring, -137
4	1	13509	Impeller
	1	13509-01	Impeller, HW
5	1	13882	Impeller Post
6	1	15043	Meter Body 1″ - 11-1/2 N.P.T.
	1	15043-10	Meter Body 1″ - 11 B.S.P.
7	1	14960	Flow Straightener
8	4	13305	O-Ring, -119
9			Not Assigned
10	2	15078	Coupling
11	2	13255	Adapter Clip
12	2	14202	Screw, Hex Hd #8-32

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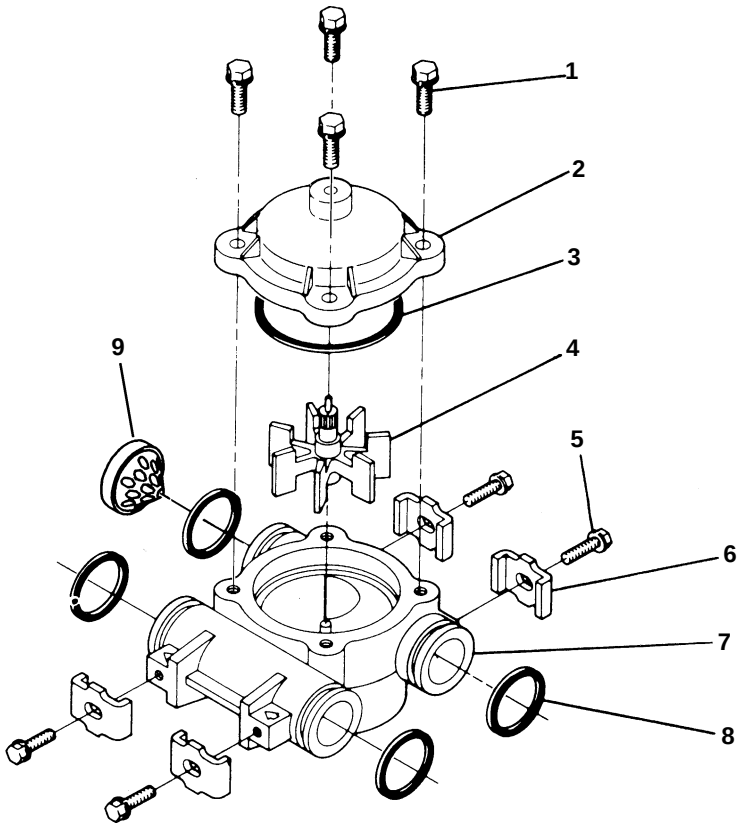
3/4″ Meter Assembly



PARTS LIST

Item No.	Quantity	Part No.	Description
1	4	12473	Screw, Hex Washer #10-24
2	1	14038	Meter Cover Assembly - Standard
		15150	Meter Cover Assembly - Extended Range
3	1	13847	O-Ring, -137
4	1	13509	Impeller
5	4	13314	Screw, Hex Washer #8-18
6	4	13255	Adapter Clip
7	1	13821	Meter Body
8	4	13305	O-Ring, -119
9	1	14613	Flow Straightener

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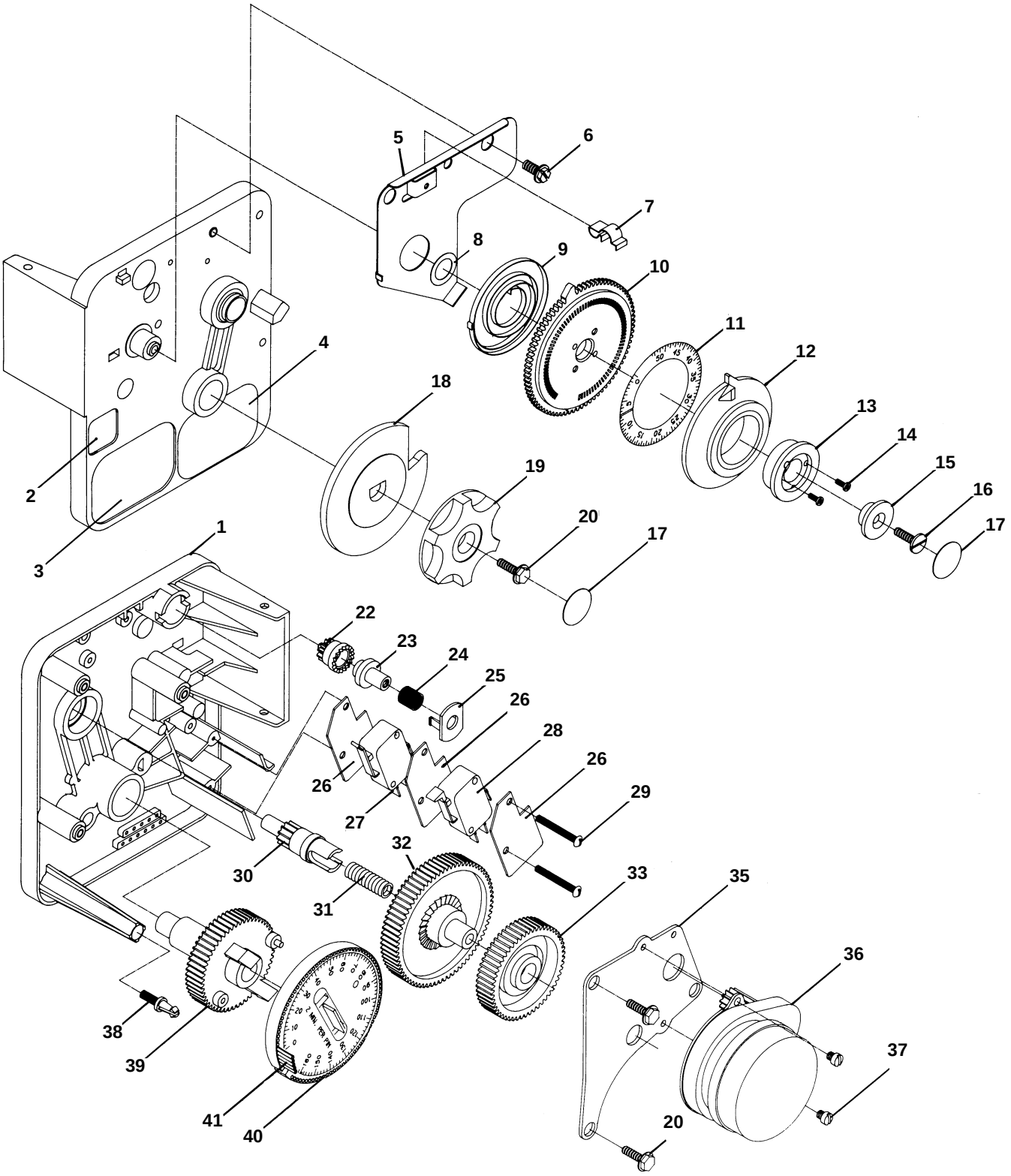
MODEL 9000 ECONOMINDER®

Timer Assembly

(See opposite page for parts list)



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MODEL 9000 ECONOMINDER®

Timer Assembly

Parts List

Item No.	Quantity	Part No.	Description
1	1	13870-03	Timer Housing Assy.
2	1	17870	Label - Capacity Gallons
3	1	15465	Label - Caution
4	1	16930	Label - Instruction
5	1	15227	Actuator Plate
6	1	10300	Screw, Hex Washer #8
7	1	17513	Spring Clip
8	1	15407	Washer, Plain #4
9	1	15228	Spring
10	1	15224-01	Drive Gear - Program Wheel
11	1	15967	Gallon Label 3/4″ Meter
		15968	Gallon Label 3/4″ Meter - Ext. Range
		15969	Gallon Label 1″ Meter
		15970	Gallon Label 1″ Meter - Ext. Range
12	1	15956	Adjusting Disc
13	1	16218	Program Wheel Cover
14	2	17054	Screw, #4-40
15	1	13806	Program Wheel Retainer
16	1	13748	Screw, Flat Hd #6-20
17	2	11999	Button Decal
18	1	15223	Cycle Actuator Gear
19	1	13886-01	Knob
20	4	13296	Screw, Hex Washer #6-20
22	1	17724	Drive Pinion
23	1	17723	Drive Pinion Clutch
24	1	14276	Spring - Meter Clutch
25	1	14253	Retainer
26	3	14087	Insulator
27	1	15314	Switch
28	1	15320	Switch
29	2	11413	Screw, Pan Hd #4-40
30	1	13018	Idler Shaft
31	1	18563	Spring - Idler Shaft
32	1	13017	Idler Gear
33	1	13164	Drive Gear
35	1	13887	Motor Mtg. Plate
36	1	18743	Motor - 120V 60 Hz. - 1/30 RPM
		18824	Motor - 220V 50 Hz. - 1/30 RPM
		19170	Motor - 120V 60 Hz. - 1/15 RPM
		18825	Motor - 220V 50 Hz. - 1/15 RPM
		19169	Motor - 24V 60Hz - 1/15 RPM
		19168	Motor - 24V 50Hz - 1/15 RPM
37	2	13278	Screw, #6-32
38	1	14265	Spring Clip
39	1	15055	Main Drive Gear
40	1	19210-05	Program Wheel Assembly - 180 min.
	1	19210-02	Program Wheel Assembly - 90 min.
41	23	15493	Roll Pin
42			Not Assigned
43	1	14430	Screw, Hex Washer, #6 (Ground, Nut Shown)
		15203	Harness
		12681	Wire Nuts

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PROBLEM	CAUSE	CORRECTION
1. Softener Fails To Regenerate.	A. Electrical Service To Unit Has Been Interrupted.	A. Assure Permanent Electrical Service (Check Fuse, Plug, Pull Chain or Switch).
	B. Timer Is Defective.	B. Replace Timer.
2. Hard Water.	A. By-Pass Valve is Open.	A. Close By-Pass Valve.
	B. No Salt in Brine Tank.	B. Add Salt To Brine Tank and Maintain Salt Level Above Water Level.
	C. Injector Screen Plugged.	C. Clean Injector Screen.
	D. Insufficient Water Flowing Into Brine Tank	D. Check Brine Tank Fill Time And Clean Brine Line Flow Control If Plugged.
	E. Hot Water Tank Hardness.	E. Repeated Flushings Of The Hot Water Tank is Required.
	F. Leak At Distributor Tube.	F. Make Sure Distributor Tube Is Not Cracked. Check O-Ring And Tube Pilot.
	G. Internal Valve Leak.	G. Replace Seals and Spacers And/Or Piston.
3. Unit Used Too Much Salt.	A. Improper Salt Setting.	A. Check Salt Usage and Salt Setting.
	B. Excessive Water in Brine Tank.	B. See Problem No. 7.
4. Loss Of Water Pressure.	A. Iron Buildup In Line To Water Conditioner.	A. Clean Line To Water Conditioner.
	B. Iron Buildup In Water Conditioner.	B. Clean Control and Add Mineral Cleaner to Mineral Bed. Increase Frequency of Regeneration and/or Backwash Time.
	C. Inlet of Control Plugged Due to Foreign Material Broken Loose From Pipes By Recent Work Done On Plumbing System.	C. Remove Pistons and Clean Control.
5. Loss of Mineral Through Drain Line.	A. Air In Water System.	A. Assure That Well System Has Proper Air Eliminator Control. Check For Dry Well Condition.
6. Iron In Conditioned Water.	A. Fouled Mineral Bed.	A. Check Backwash, Brine Draw And Brine Tank Fill. Increase Frequency Of Regeneration.
7. Excessive Water In Brine Tank.	A. Plugged Drain Line Flow Control.	A. Clean Flow Control.
	B. Plugged Injector System.	B. Clean Injector and Screen.
	C. Timer Not Cycling.	C. Replace Timer.

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PROBLEM	CAUSE	CORRECTION
	D. Foreign Material In Brine Valve.	D. Replace Brine Valve Seat And Clean Valve.
	E. Foreign Material In Brine Line Flow Control.	E. Clean Brine Line Flow Control.
	F. Power Loss During Brine Fill.	F. Check Power Source.
8. Softener Fails To Draw Brine.	A. Drain Line Flow Control Is Plugged.	A. Clean Drain Line Flow Control.
	B. Injector Is Plugged.	B. Clean Injector.
	C. Injector Screen Plugged.	C. Clean Screen.
	D. Line Pressure Is Too Low.	D. Increase Line Pressure To 25 P.S.I. Min.
	E. Internal Control Leak.	E. Change Seals, Spacers and Piston Assembly.
9. Control Cycles Continuously.	A. Broken or Shorted Switch.	A. Determine If Switch or Timer Is Faulty and Replace it or Replace Complete Power Head.
10. Drain Flows Continuously.	A. Valve Is Not Programming Correctly.	A. Check Timer Program and Positioning of Control. Replace Power Head Assembly If not Positioning Properly.
	B. Foreign Material In Control.	B. Remove Power Head Assembly And Inspect Bore, Remove Foreign Material and Check Control In Various Regeneration Positions.
	C. Internal Control Leak.	C. Replace Seals and Piston Assembly.

General Service Hints

Problem: Softener Delivers Hard Water.

Cause could be that . . . Reserve Capacity Has Been Exceeded.

Correction: Check salt dosage requirements and reset program wheel to provide additional reserve.

Cause could be that . . . Program Wheel Is Not Rotating With Meter Output.

Correction: Pull cable out of meter cover and rotate manually. Program wheel must move without binding and cycle actuator must start the cycle before the clutch releases.

Cause could be that . . . Meter Is Not Measuring Flow.

Correction: Check output by observing rotation of small gear on front of timer (Note — program wheel must not be against regeneration stop for this check). Each tooth is approximately 75 gallons on 1″ installations. If not performing properly, replace meter.

Cause could be that . . . Trip Dog On Program Wheel Is Beyond Cycle Actuator Arm.

Correction:
1. If power failed during regeneration; reset program wheel and cycle manually.
2. If exceeding system capacity before regeneration was completed; either a) increase system capacity, b) restrict flow rates, or c) change timer from 164 min./cycle to 82 min./cycle.
3. If defective timer; replace timer.

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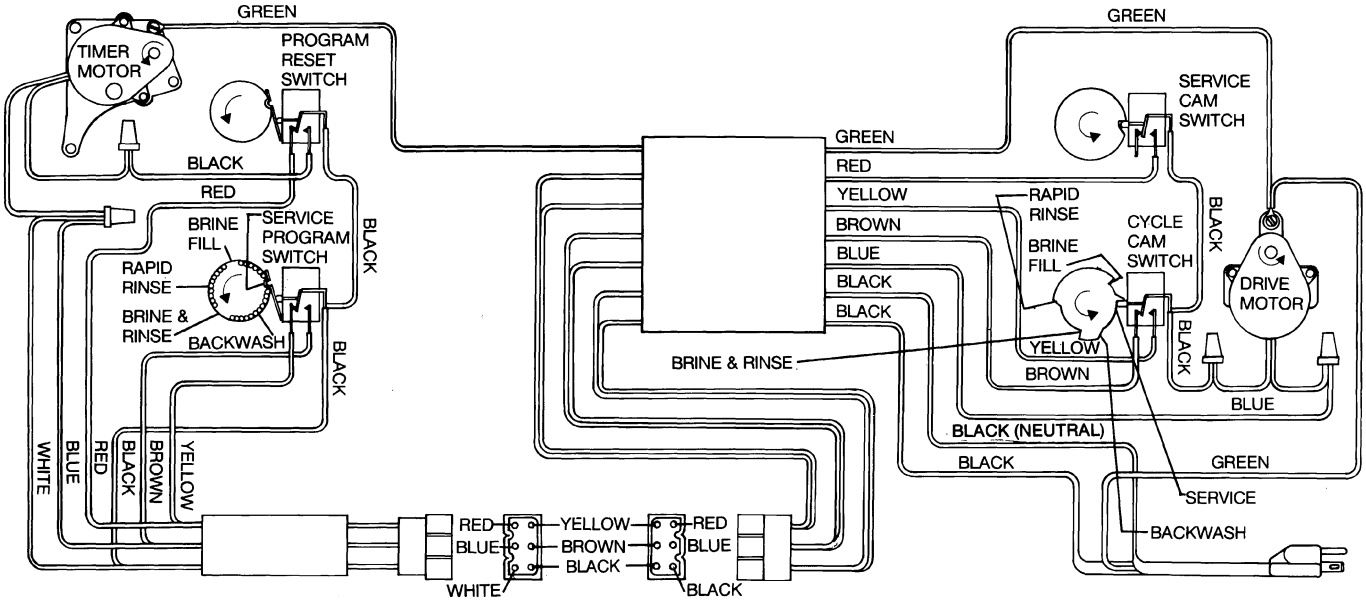
MODEL 9000 ECONOMINDER®

2 Tank Wiring & Control Information

9000 WIRING DIAGRAM



CONTROL INFORMATION

Tank Size Dia.	Injector	Slow Rinse Rate (gpm)	B.L.F.C.[1]	D.L.F.C.[2]	Timer Motor	Timer Setting[3]
6″ 7″	#0 Red #0 Red	.26 gpm .26 gpm	.5 gpm .5 gpm	1.2 gpm 1.2 gpm	1/15 rpm 1/15 rpm	8-54-6-6 8-54-6-6
8″ 9″ 10″	#1 White #1 White #1 White	.33 gpm .33 gpm .33 gpm	.5 gpm .5 gpm .5 gpm	1.5 gpm 2.0 gpm 2.4 gpm	1/15 rpm 1/15 rpm 1/15 rpm	8-54-6-6 8-54-6-6 8-54-6-6
12″ 13″	#2 Blue #2 Blue	.64 gpm .64 gpm	1.0 gpm 1.0 gpm	3.5 gpm 4.0 gpm	1/15 rpm 1/30 rpm	8-54-6-6 8-60-6-6
14″ 16″	#3 Yellow #3 Yellow	.89 gpm .89 gpm	1.0 gpm 1.0 gpm	5.0 gpm 7.0 gpm	1/30 rpm 1/30 rpm	8-60-6-6 8-70-6-6

[1] B.L.F.C. (Brine Line Flow Control). Refill Rate for Filling Brine Tank.

[2] D.L.F.C. (Drain Line Flow Control). Backwash and Rapid Rinse Flow Rates.

[3] 8-54-6-6 Refer to -8 min. Backwash; 54 min. Brine and Slow Rinse; 6 min. Rapid Rinse; 6 min. Brine Tank Refill.

Note: Due to varying water conditions, tank sizes and water pressures, the above settings should be used only as a guideline.

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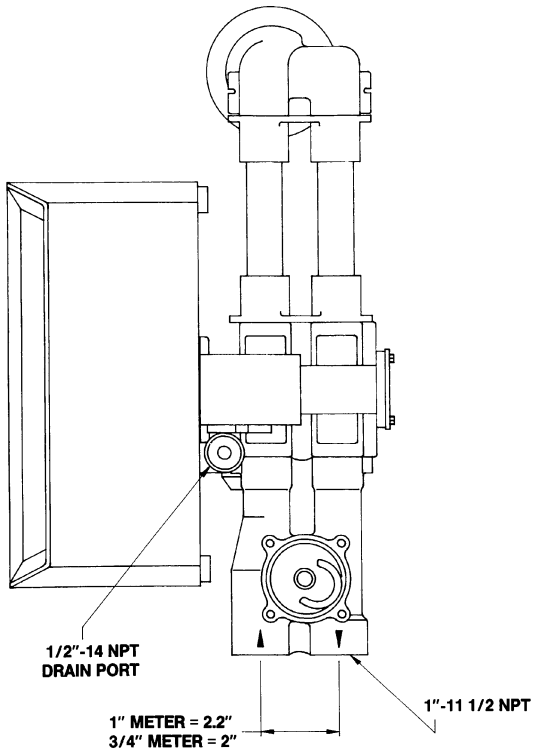
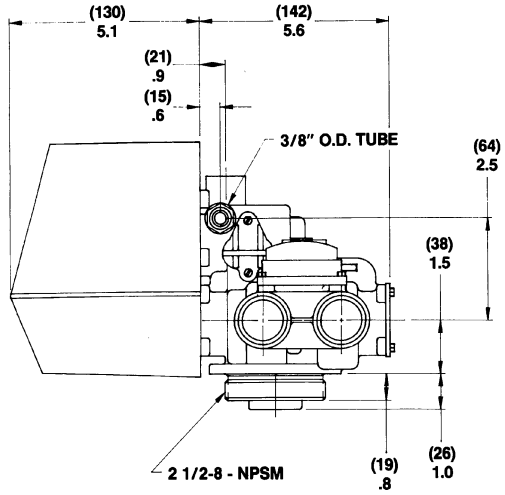
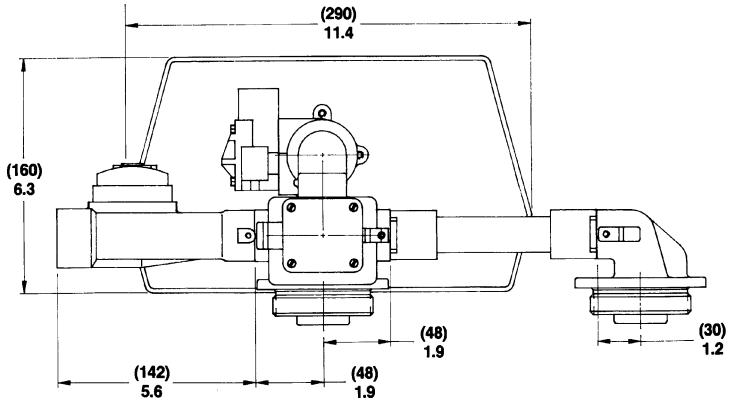
Controlled Dimensions







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60022-25 . . . . . BLFC .25 GPM

60022-50 . . . . . BLFC .50 GPM

60022-100 . . . . BLFC 1.0 GPM

For Illustration, See Page 14

1 . . . . . 12094 . . . . . Flow Washer .25 GPM
12095 . . . . . Flow Washer .50 GPM
12097 . . . . . Flow Washer 1.0 GPM
1 . . . . . 12977 . . . . . O-Ring - 015
1 . . . . . 13244 . . . . . Adapter, BLFC
1 . . . . . 13245 . . . . . Retainer, BLFC Button

60350 . . . . . Brine Valve Assy, 9000

For Illustration, See Page 14

1 . . . . . 11973 . . . . . Spring, Brine Valve
1 . . . . . 11981 . . . . . Retaining Ring
1 . . . . . 16095 . . . . . Washer, Plain #10 Nylon
1 . . . . . 12550 . . . . . Quad Ring, -009
1 . . . . . 12626 . . . . . Seat, Brine Valve
1 . . . . . 13165 . . . . . Cap, Brine Valve
1 . . . . . 13167 . . . . . Spacer, Brine Valve
2 . . . . . 13302 . . . . . O-Ring, -014
1 . . . . . 14925 . . . . . Brine Valve Stem, 9000

60385-XXXX. . . Injector/Drain Assy

See “Parts Price List”

60086 . . . . . 3/4″ Meter, Standard Range

60087 . . . . . 3/4″ Meter, Extended Range

For Illustration and Parts
See Page 19

6O389. . . . . 1″ Meter, Standard Range

60390 . . . . . 1″ Meter, Extended Range

For Illustration and Parts
See Page 18

60401 . . . . . Piston Assy, 9000 Lower

For Illustration and Parts
See Page 14

1 . . . . . 11335 . . . . . Screw, Fil Hd
Mach 4-40 x 3/16
1 . . . . . 13446 . . . . . End Plug Assy White
1 . . . . . 14309 . . . . . Retainer, Piston Rod
1 . . . . . 14905 . . . . . Piston, Lower 9000
1 . . . . . 14920 . . . . . Piston Rod, Lower
1 . . . . . 15019 . . . . . Link, Piston Rod

60400 . . . . . Piston Assy, 9000 Upper

For Illustration, See Page 14

1 . . . . . 11335 . . . . . Screw, Fil Hd
Mach 4-40 X 3/16
1 . . . . . 13446 . . . . . End Plug, White Assy
1 . . . . . 14309 . . . . . Retainer, Piston Rod
1 . . . . . 14914 . . . . . Piston, Upper 9000
1 . . . . . 14919 . . . . . Piston Rod, Upper
1 . . . . . 14921 . . . . . Link, Piston Rod

60125 . . . . . Seal & Spacer Kit, 9000 - Upper

For Illustration, See Page 14

5 . . . . . 13242 . . . . . Seal
4 . . . . . 14241 . . . . . Spacer

60421 . . . . . Seal & Spacer Kit, 9000 - Lower

For Illustration, See Page 14

11 . . . . . 13242 . . . . . Seal
8 . . . . . 14241 . . . . . Spacer
1 . . . . . 16595 . . . . . Spacer, 9000

60412 . . . . . 9000 Powerhead Assembly

See “Parts Price List”

60375-XX . . . . 9000, Timer 1/15 RPM

60376-XX . . . . 9000, Timer 1/30 RPM

See “Parts Price List”

60136-9000 . . . 9000 Service Repair Kit

See “Parts Price List”

DLFC, Flow Washers

12085 . . . . . Flow Washer, 1.2 GPM
12086 . . . . . Flow Washer, 1.5 GPM
12087 . . . . . Flow Washer, 2.0 GPM
12088 . . . . . Flow Washer, 2.4 GPM
12089 . . . . . Flow Washer, 3.0 GPM
12090 . . . . . Flow Washer, 3.5 GPM
12091 . . . . . Flow Washer, 4.0 GPM
12092 . . . . . Flow Washer, 5.0 GPM
12408 . . . . . Flow Washer, 7.0 GPM

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60612. . . . . 1″ Meter, Standard Range, HW

60632. . . . . 1″ Meter, Ext. Range

60401-01 . . . . . Piston Assy, 9000 Lower, HW
For Illustration and Parts List
See Page 14

1. . . . . 11335. . . . . Screw, Fil Hd Mach 4-40 x 3/16
1. . . . . 13446-01 . . . . . End Plug Assy White
1. . . . . 16590. . . . . Retainer, Piston Rod, HW
1. . . . . 14905. . . . . Piston, Lower 9000
1. . . . . 14920. . . . . Piston Rod, Lower
1. . . . . 15019. . . . . Link, Piston Rod

60400-01 . . . . . Piston Assy, 9000 Upper, HW
For Illustration, See Page 14

1. . . . . 11335. . . . . Screw, Fit Hd Mach 4-40 x 3/16
1. . . . . 13446-01 . . . . . End Plug, White Assy
1. . . . . 16590. . . . . Retainer, Piston Rod
1. . . . . 14914. . . . . Piston, Upper 9000
1. . . . . 14919. . . . . Piston Rod, Upper
1. . . . . 14921. . . . . Link, Piston Rod

60125 HW . . . . Seal & Spacer Kit, 9000 - Upper, HW
For Illustration, See Page 14

5. . . . . 18759. . . . . Seal
4. . . . . 14241-01 . . . . . Spacer

60421 HW . . . . Seal & Spacer Kit, 9000 - Lower, HW
For Illustration, See Page 14

11. . . . . 18759. . . . . Seal
8. . . . . 14241-01 . . . . . Spacer
1. . . . . 16595. . . . . Spacer, 9000

Yoke Assy.
15823-06 . . . . . 6″ Tank & 6″ Tube
15823-08 . . . . . 8″ Tank & 4.26″ Tube
15823-12 . . . . . 6″-12″ Tank & 8-1/2″ Tube
15823-14 . . . . . 14″ Tank & 10-1/2″ Tube
15823-16 . . . . . 16″ Tank & 12-1/2″ Tube

Printed in U.S.A.

ITT

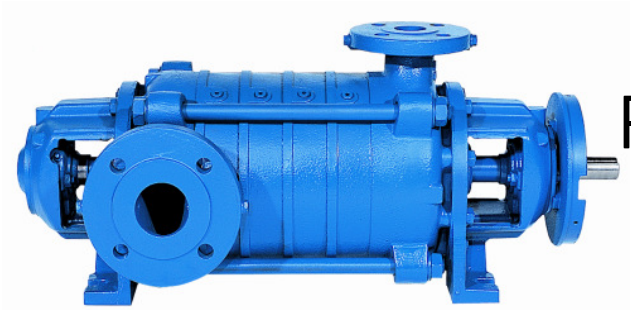
High Pressure Pump
MP65.2/3-SB111

Vogel Pumpen

Einbau-, Betriebs- und Wartungsanleitung

Instructions de montage, de service et de maintenance

Installation, Operation and Maintenance Instruction



Mehrstufenpumpen
Pompes multicellulaires
Multistage Pumps

Baureihe - Série - Model: **MP, MPA, MPAI**

Für künftige Verwendung aufbewahren !

Diese Betriebsanleitung vor dem Transport, dem Einbau, der Inbetriebnahme usw. genau beachten!

Conserver soigneusement ces instructions pour consultations ultérieures !

Lire attentivement ces instructions de service avant le transport, le montage, la mise en service etc. !

Keep for further use !

Pay attention to this operating instruction before the delivery, installation, start-up a.s.o.!

Engineered for life

MP - german/french/english
Artikel Nr. 771074011

Revision 02
Ausgabe 01/2007

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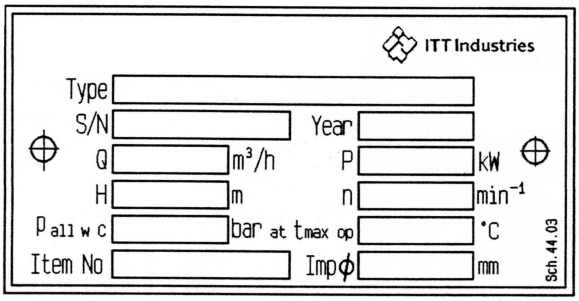
Pump Name Plate



Type *)	Type of pump
S/N *)	Serial number
Year	Year of construction
Q	Rated capacity at the operating point
P	Rated power at the operating point
H	Head (Energy head) at the operating point
n	Speed
$p_{all\ w\ C}$	Max. permitted casing-operation-pressure (=highest discharge pressure at the rated operating temperature to which the pump casing can be used).
$t_{max\ op}$	Maximum permitted operating temperature of pumped liquid
Item No	Customer related order number
Imp∅	Outer diameter of the impeller

*) All details of design and materials are defined with this information. They must be stated on all inquiries to the manufacturer resp. orders of spare.

1. General

This product corresponds with the requirements of the Machine directive 98/37/EG (former 89/392/EWG).

The staff employed on installation, operation, inspection and maintenance must be able to prove that they know about the relevant accident prevention regulations and that they are suitably qualified for this work. If the staff does not have the relevant knowledge, they should be provided with suitable instruction.

The operation safety of the delivered pump resp. unit (= pump with motor) can only be guaranteed on designated use according to the attached data sheet and / or order confirmation resp. chapter 6 "Start-up, Operation, Shut down".
The operator is responsible for following the instructions and complying with the safety requirements given in these Operating Instructions.
Smooth operation of the pump or pump unit can only be achieved if installation and maintenance are carried out carefully in accordance with the rules generally applied in the field of engineering and electrical engineering.
If not all the information can be found in these Operating Instructions, please contact us.
The manufacturer takes no responsibility for the pump or pump unit if the Operating Instructions are not followed.
These Operating Instructions should be kept in a safe place for future use.
If this pump or pump unit is handed on to any third party, it is essential that these Operating Instructions and the operating conditions and working limits given in the Confirmation of Order are also passed on in full.
These Operating Instructions do not take into account all design details and variants nor all the possible chance occurrences and events which might happen during installation, operation and maintenance.

1.1 Guarantee

The guarantee is given in accordance with our Conditions of Delivery and/or the confirmation of order.
Repair work during the guarantee period may only be carried out by us, or subject to our written approval. Otherwise the guarantee ceases to apply.
Longer-term guarantees basically only cover correct handling and use of the specified material. The guarantee shall not cover natural wear and tear and all parts subject to wear, such as impellers, shaft sealings, shafts, shaft sleeves, bearings, wear rings etc. or damage caused by transport or improper handling.
In order for the guarantee to apply, it is essential that the pump or pump unit is used in accordance with the operating conditions given on the name plate, confirmation of order and in the data sheet. This applies particularly for the endurance of the materials and smooth running of the pump and shaft sealing.
If one or more aspects of the actual operating conditions are different, we should be asked to confirm in writing that the pump is suitable.

2. Safety Regulations

These Operating Instructions contain important instructions which must be followed when the pump is assembled and commissioned and during operating and maintenance. For this reason, these Operating Instructions must be read by the skilled staff responsible and/or by the operator of the plant before it is installed and commissioned, and they must be left permanently available at the place where the pump or pump unit is in use.
These Operating Instructions do not refer to the General Regulations on Accident Prevention or local safety and/or operating regulations. The operator is responsible for complying with these (if necessary by calling in additional installation staff).
Equally, instructions and safety devices regarding handling and disposal of the pumped media and/or auxiliary media for flushing, lubrication a.s.o., especially if they are explosive, toxical, hot a.s.o., are not part of this operating instruction.
For the competent and prescribed handling only the operator is responsible.

2.1 Marking of References in the Operating Instructions

The safety regulations contained in these Operating Instructions are specially marked with safety signs acc. to nach DIN 4844:

Safety reference!
Non-observance can impair the pump and its function.

EC-Ex Marking
Products intended for use in explosive atmospheres must be marked.

General Symbol for Danger!
Persons can be endangered.

Warning of electric voltage!

Safety instructions attached directly to the pump resp. unit must be followed under any circumstances. Further they must be kept in good readable condition.

In the same way, as these Operating Instructions of the pump, all possibly attached Operating Instructions of accessories (e.g. motor) must be noticed and kept available.

2.2 Dangers of non-observance of the Safety Instructions

Non-observance of the Safety Instructions can lead to loss of any claim for damages.
Further, non-observance can lead to following risks:

- Failure of important functions of the machine or facility.
- Failure of electronic appliances and measuring instruments by magnetic fields.
- Endangering of persons and their personal property by magnetic fields.
- Endangering of persons by electric, mechanic and chemical influences.
- Endangering of environment through leakage of dangerous substances.


On application of the unit in areas endangered to explosion special attention must be paid to sections marked with Ex.

2.3 Safety Instructions for the Operator / Worker

- Depending on the operating conditions, wear and tear, corrosion or age will limit the working life of the pump/pump unit, and its specified characteristics. The operator must ensure that regular inspection and maintenance are carried out so that all parts are replaced in good time, which would otherwise endanger the safe operation of the system. If abnormal operation or any damage is observed, the pump must cease operation immediately.
- If the breakdown or failure of any system or unit could lead to people being hurt or property being damaged, such system or unit must be provided with alarm devices and/or spare modules, and they should be tested regularly to ensure that they function properly.
- If there is any risk of injury from hot or cold machine parts, these parts must be protected against contact by the user, or suitable warning signs must be affixed.
- Contact protection on moving parts (e.g. coupling guards) must not be removed from systems that are in operation.
- If the sound level of a pump or pump unit is above 85 dB(A) an ear protection has to be used when staying near the pump for some time.
- If dangerous media (e.g. explosive, toxic, hot) leak out (e.g. from shaft seals), these must be directed away so that there is no danger to people or the environment. The provisions of the law must be observed.
- Measures should be taken to exclude any danger from electricity (e.g. by complying with the local regulations on electrical equipment). If work is carried out on live electrical components, they should be unplugged from the mains or the main switch turned off and fuse unscrewed. A motor protection switch is to be provided.

2.4 Safety Instructions for Maintenance, Inspections and Mounting Work

- The operator is responsible that any maintenance, inspections and mounting work is made by authorized competent personnel, which must be informed by having read the Operating Instructions.
- Basically, all work on the pump or pump unit should only be carried out when the pump is stationary and not under pressure. All parts must be allowed to return to ambient temperature. Make sure that no-one can start the motor during such work. It is essential that the procedure for stopping the system described in the Operating Instructions is observed. Pumps or pump systems that carry media that are dangerous to health must be decontaminated before being taken apart. Safety Data Sheets for the various liquids handled. Immediately after finishing work, all safety and protective devices must be replaced or restarted.

2.5 Unauthorized Alteration and Spare Parts Production

Alteration or changes of the machine are permitted after agreement with the manufacturer.
Original spare parts and accessory authorized by the manufacturer are serving the safety.
The use of other parts can lead to loss of liability for there from resulting consequences.

2.6 Undue Operation

The operating safety of the delivered machine can only be guaranteed by designated use acc. to the following chapters of the Operating Instructions. The limits stated in the data sheet and / or order confirmation must not be exceeded under any circumstances.

2.7 Explosion Protection

On application of units in areas endangered to explosion measures and references in the chapters 2.7.1 to 2.7.6 must be observed, so that explosion protection is guaranteed.

2.7.1 Filling of unit


During operation of the pump the system of the suction and pressure pipe and the pump itself must permanently be filled with the pumped liquid. Thus, no explosive atmosphere can develop and the danger of dry-run is avoided.


If the operator can´t guarantee that, according monitoring measures must be provided.

Equally all seal casings, auxiliary systems of the shaft sealing, as well as heating and cooling systems must be filled carefully.

2.7.2 Marking

The marking of the pump refers to the pump itself. For coupling and motor resp. further additions a separate Declaration of Conformity, as well as a corresponding marking must be available.

Example of of marking at pump:

CE Ex II 2 G c T... .

The marking shows the theoretically applicable range of temperature classes. The different temperatures, permitted acc. to pump design, result as shown in chapter 2.7.5. The same is valid for the drive.
For a whole unit (pump, coupling, motor) with different temperature classes the lowest is valid.

2.7.3 Rotation Control

Carry out rotation control with separated coupling halves only! Refer to chapter 5.5 and 6.1 as well.

If danger of explosion is also existing during installation, the rotation control must not be carried out by short start-up of the empty pump, to avoid undue temperature increase in case of contact of rotating and stationary parts.

2.7.4 Operation of pump

The pump must only be started up with fully opened suction side and slightly opened pressure side valve. The start-up against closed non-return valve, however, is possible. Immediately after the start-up the discharge side valve must be adjusted to the operating point.
Refer to chapter 6.2, as well.
Operation with closed valve in suction and / or discharge pipe is not permitted!

There´s a danger, that high surface temperatures are developing at the pump casing after relatively short time, through fast heating of the liquid inside the pump.

Fast pressure increase inside the pump can lead to overload and, thus, the pump can burst.

In chapter 6.4.1 the minimum flow is stated. Longer operating phases with these flows and the named liquids don´t cause additional increase of surface temperature at the pump.
Furthermore the references in chapter 6 of these operating Instructions must be taken into consideration.

On pumps with mech. seals the permitted temperature limits can be exceeded due to dry-run. Dry run not only can occur on insufficiently filled seal casing, but also because of too much gas in the medium.
Operation of the pump out of the permitted operating range can lead to dry-run, as well.

2.7.5 Temperature Limits

Under normal operating conditions the highest temperatures must be expected at the surface of the pump casing and in the area of the bearings.

The surface temperature occurring at pump casing corresponds with the temperature of the pumped liquid.

If the pump is heated (e. g. heating jacket), care must be taken, that the temperature classes, prescribed for the plant are observed.

In the area of the bearing bracket free contact from surface to surrounding must be given.

During operation of the pump it must be secured that an overabundant sedimentation of dust is avoided (regular cleaning), to prevent heating of pump surface over the permitted temperature.

The operator of the plant must secure that the defined operating temperature is observed. The max. allowed temperature of the pumped liquid at suction depends on the particular temperature class.
The following table shows the theoretical temperature limits of the pumped liquid in consideration of the temperature classes acc. to EN 13463-1.

Temperature class acc. EN 13463-1	Temperature limit of pumped liquid
T4 (135°C)	135°C
T3 (200°C)	140°C
T2 (300°C)	140°C
T1 (450°C)	140°C

The particular allowed operating temperature of the pump is shown in the data sheet and / or the order confirmation resp. the type plate at the pump.

In the area of the bearings the temperature class T4 is guaranteed, provided that the ambient temperature is 40°C and the appliance is duly operated and maintained.

2.7.6 Maintenance

For a secure and reliable operation it must be secured by regular inspections, that the unit is maintained competently and is kept in good technical condition.

Example: Function of bearings. Operation and application conditions are essentially responsible for their achievable life cycle.

By regular control of the lubricant and the running sound the danger of occurring over temperatures by bearings running hot or defect bearing seals is avoided. Refer to chapter 6.6 and 7.4.
The function of the shaft sealing must be secured by regular control.
If auxiliary systems (e.g. external flushing, cooling, heating) are installiert, it must be checked, if monitoring devices are necessary to secure the function.

2.7.7 Electric switches and control device, Instrumentation and accessories

Electric switches and control devices, instrumentation and accessories like e.g. flush tanks, a.s.o., must correspond with the valid safety requirements and regulations for explosion protection.

2.8 Use acc. to Regulations

2.8.1 Speed, Pressure, Temperature

Suitable safety measures must be taken at the plant to ensure that the speed, pressure and temperature of the pump and the shaft sealing do not exceed the limit values given in the data sheet and / or order confirmation. The given admission pressures (system pressures) must also be sufficiently high.

Further, pressure shocks, as can occur on too fast shut down of the facility, must be kept away from the pump (e.g. by non-return valve at pressure side, fly wheel, air tanks). Quick temperature changes must be avoided. They could cause a temperature shock and lead to damage or impair the function of single components.

2.8.2 Permitted Nozzle Loads and Torques

Basically the suction and discharge piping must be designed in such way, that as little forces as possible are effective to the pump. If that is not possible, the values shown in chapter 3.5 must not be exceeded under any circumstances. This is valid for the operation as well as for the standstill of the pump and therefore for all possible pressures and temperatures of the unit.

2.8.3 NPSH

The pumped liquid must have a min. pressure NPSH at the impeller inlet, so that cavitation free work is secured resp. a "break off" of the pump flow is prevented. This condition is fulfilled, when NPSH-value of the system (NPSHA) lies above NPSH-value of the pump (NPSHR) under all operating conditions.

Attentention must especially be paid to the NPSH-value on pumping liquids near the vapour pressure. If the NPSH-value of the pump remains under, this can lead from damage of the material due to cavitation to destruction by overheating.
The NPSH-value of the pump (NPSHR) is shown in the curves of every pump type.

2.8.4 Sealing, Flushing, Cooling

Suitable provisions for the regulation and monitoring of sealing, flushing or cooling are to be provided.
When handling dangerous liquids or if temperatures are high, care should be taken to ensure that the pump ceases operating if the sealing, flushing or cooling system fails.
Sealing, flushing and cooling systems must always be operational before the pump is started up. They should not be taken out of operation until the pump has stopped, provided that the nature of the operation allows this at all.

2.8.5 Minimum flows

If the pump is started against a closed pressure line valve, it should be noted that the power taken up by the pump is transmitted to the liquid handled in the form of heat. This can cause the liquid to heat up excessively within a relatively short time, which will then cause damage to the pump's internal fittings. After the pump has reached operating speed, the discharge valve should therefore be opened as quickly as possible. If operating conditions mean that Q = 0 is unavoidable, or if hot water is circulating, a free flow non-return valve, or, on smaller systems, a by-pass pipe, should be provided. We should be pleased to advise on determining the minimum flow or designing the by-pass line.

2.8.6 Protection against running dry

The pumps may under no circumstances be operated without containing a pumped medium because the heating can lead to a destruction of pump parts (e.g. the mechanical seal).

2.8.7 Back Flow

In systems where pumps are operating in closed circuits under pressure (gas cushions, steam pressure), the pressure of the gas cushion must not be reduced via the pump, since the back flow speed may be much higher than the operating speed, which would destroy the unit.

3. Description

3.1 Models

Design MP: Horizontal shaft with bearings at both ends, drive end at discharge side (standard), rotation clockwise with suction branch left and discharge branch radially upwards. Grease lubrication.
Optional: Suction branch right or radially upwards, discharge branch left or right, drive-end at suction side (rotation anti-clockwise).

Design MPA: Endsuction type, discharge branch radially upwards. Drive end at discharge side. Thrust bearing at drive side, grease lubrication, medium lubricated slide bearing between first and second stage.
Optional: Discharge branch left or right.

MPAI Design: As the MPA design, but also with an inducer.

The pumps are designed as modular systems and can, therefore, be delivered in many variants (e.g. different materials, shaft sealings, different kinds of lubrication, cooling / heating, a.s.o.).
The permitted application conditions and design details of the delivered pump are shown in the attached data sheet and / or order confirmation.

3.2 Shaft Sealing

Basically there are two kinds of shaft sealing: the packing and the mechanical seal, whereas, there again are many variants of both kinds. At the data sheet and / or the order confirmation the shaft sealing type of your pump is shown.
Instructions for packing a gland can be found in Section 7.3 and instructions for installation and operation of mechanical seals in Section 8 "Disassembly of the Pump and Repair".

Further details about packing and mech. seals, as well as the therewith connected accidental dangers, you can find in chapter 6.6 and in chapters 7.2 and 7.3.

In areas endangered to explosion the use of pumps with packing is forbidden!

3.3 Bearings

Design MP: Bearings at both ends; thrust bearing at discharge side, ball bearing at suction side. Lubrication: Grease lubrication (standard design) with relubricating mechanism (lubricating nipple).

Design MPA, MPAI: Thrust bearing at discharge side, medium lubricated slide bearing between first and second stage at suction side.
Lubrication: Grease lubrication (standard design) with relubricating mechanism (lubricating nipple).

Bearing types

Pump size	Grease lubrication Bearing type	
	Suction side (only MP)	Discharge side (MP, MPA, MPAI)
MP/MPA/MPAI 40.2	6306-C3	3306-C3
MP/MPA/MPAI 40.3	6306-C3	3306-C3
MP/MPA/MPAI 65.1	6307-C3	3307-C3
MP/MPA/MPAI 65.2	6307-C3	3307-C3
MP/MPA/MPAI 100.1	6308-C3	2x 7308 (X-arrangement)
MP/MPA/MPAI 100.2	6308-C3	2x 7308 (X-arrangement)
MP/MPA/MPAI 125.1	6310-C3	2x 7310 (X-arrangement)
MP/MPA/MPAI 125.2	6310-C3	2x 7310 (X-arrangement)

3.4 Approximate Value for Sound Pressure Level

Nominal power P_N in kW	Sound pressure level L_{pA} in dB(A) Pump alone 2950 min^{-1}	Pump alone 1450 min^{-1}	Pump alone 975 min^{-1}	Pump + Motor 2950 min^{-1}	Pump + Motor 1450 min^{-1}	Pump + Motor 975 min^{-1}
1,5	66,7	65,8	65,3	68,2	66,0	65,5
2,2	68	67	66,5	69,2	67,2	66,7
3	69	68,1	67,6	71,5	68,3	68,5
4	69,9	69	68,5	72,1	69,2	69,2
5,5	71	70	69,5	73,1	70,4	70,1
7,5	71,9	71	70,5	73,7	71,3	71,8
11	73,3	72,3	71,8	75,0	73,2	72,8
15	74,2	73,3	72,8	75,6	74,0	74,0
18,5	74,9	74	73,5	76,1	74,6	76,3
22	75,5	74,5	74	77,1	75,1	76,5
30	76,5	75,6	75,1	77,8	76,1	75,7
37	77,1	76,2	75,7	78,3	76,8	76,4
45	77,9	76,9	76,4	79,4	77,4	76,8
55	78,5	77,5	77	80,1	78,0	77,3
75	79,4	78,5	78	81,4	78,9	78,4
90	80,1	79,1	78,6	81,8	79,4	79,0
110	80,8	79,8		83,4	80,2	
132	81,3	80,4		83,7	80,8	
160	81,9	81		84,1	81,3	
200	82,7			84,6		
250	83,4			86,2		
315	84,1			86,6		
355	84,6			86,9		
400	84,9			87,1		
450	85,4			87,4		
500	85,6			88,3		

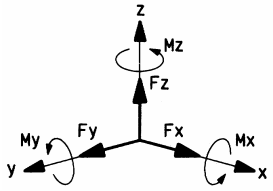
Sound pressure level L_{pA} measured in 1 m distance from pump surface acc. to DIN 45635, part 1 and 24. Room and foundation influences are not considered. The tolerance for these values is ±3 dB(A).
Addition with 60 Hz-operation:
Pump alone: –
Pump with motor: +4 dB(A)

3.5 Permitted Nozzle Loads and Torques at the Pump Nozzles ...

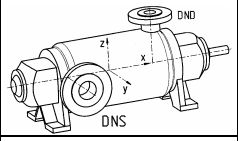
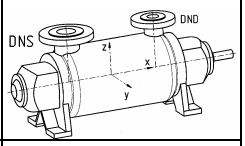
... following the Europump-Recommendation for pump acc. to ISO 5199.
The individual forces and individual torques as well as collective forces and collective torques given in the table may not be exceeded.

$$\sum F = \sqrt{(Fx^2 + Fy^2 + Fz^2)} \quad [N]$$

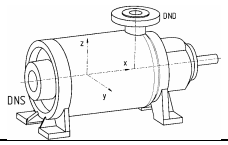
$$\sum M = \sqrt{(Mx^2 + My^2 + Mz^2)} \quad [Nm]$$



MP Design
Permissible Forces / Torques on the DNS Suction Joints

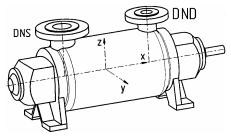
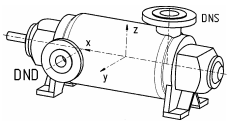
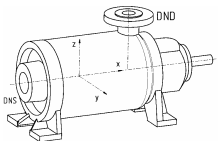
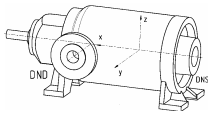
Dimension			
		Horizontal Suction Joints, Left or Right	**Vertical Suction Joints**
MP40.2 **MP40.3** DNS 65	Fx	560	560
	Fy	620	510
	Fz	510	620
	∑F	980	980
	Mx	350	350
	My	200	200
	Mz	260	260
	∑M	480	480
MP65.1 **MP65.2** DNS 100	Fx	900	900
	Fy	1010	810
	Fz	810	1010
	∑F	1580	1580
	Mx	440	440
	My	260	260
	Mz	330	330
	∑M	610	610
MP100.1 **MP100.2** DNS 125	Fx	1130	1130
	Fy	1250	1010
	Fz	1010	1250
	∑F	1970	1970
	Mx	570	570
	My	350	350
	Mz	440	440
	∑M	800	800
MP125.1 **MP125.2** DNS 150	Fx	1350	1350
	Fy	1500	1220
	Fz	1220	1500
	∑F	2360	2360
	Mx	700	700
	My	440	440
	Mz	540	540
	∑M	990	990

MPA, MPAI Design
Permissible Forces / Torques on the DNS Suction Joints

Dimension			
		Vertical Suction Joints	
MPA40.2 **MPAI40.2** **MPA40.3** **MPAI40.3** DNS 65	Fx	620	
	Fy	560	
	Fz	510	
	∑F	980	
	Mx	350	
	My	200	
	Mz	260	
	∑M	480	
MPA65.1 **MPAI65.1** **MPA65.2** **MPAI65.2** DNS 100	Fx	1010	
	Fy	900	
	Fz	810	
	∑F	1850	
	Mx	440	
	My	260	
	Mz	330	
	∑M	610	
MPA100.1 **MPAI100.1** **MPA100.2** **MPAI100.2** DNS 125	Fx	1250	
	Fy	1130	
	Fz	1010	
	∑F	1970	
	Mx	570	
	My	350	
	Mz	440	
	∑M	800	
MPA125.1 **MPAI125.1** **MPA125.2** **MPAI125.2** DNS 150	Fx	1500	
	Fy	1350	
	Fz	1220	
	∑F	2360	
	Mx	700	
	My	440	
	Mz	540	
	∑M	990	

General Instructions:
Direction of the forces and torques:

Fx ...Force in direction of the x-axis (pump shaft)
Fy ...Force in direction of the y-axis (perpendicular to the x-axis)
Fz ...Force in direction of the z-axis (perpendicular to the x-axis)
Mx ...Torque around the x-axis
My ...Torque around the y-axis
Mz ...Torque around the z-axis

MP, MPA, MPAI Design Permissible Forces / Torques on the DND Pressure Joints			
			
Dimension			
		Vertical Pressure Joints	**Horizontal Pressure Joints, Right or Left**
MP40.2 MP40.3 MPA40.2 MPAI40.2 MPA40.3 MPAI40.3 DND 40	Fx	330	330
	Fy	300	380
	Fz	380	300
	∑F	590	590
	Mx	280	280
	My	140	140
	Mz	190	190
	∑M	370	370
MP65.1 MP65.2 MPA65.1 MPAI65.1 MPA65.2 MPAI65.2 DND 65	Fx	560	560
	Fy	510	620
	Fz	620	510
	∑F	980	980
	Mx	350	350
	My	200	200
	Mz	260	260
	∑M	480	480
MP100.1 MP100.2 MPA100.1 MPAI100.1 MPA100.2 MPAI100.2 DND 100	Fx	900	900
	Fy	810	1010
	Fz	1010	810
	∑F	1580	1580
	Mx	440	440
	My	260	260
	Mz	330	330
	∑M	610	610
MP125.1 MP125.2 MPA125.1 MPAI125.1 MPA125.2 MPAI125.2 DND 125	Fx	1130	1130
	Fy	1010	1250
	Fz	1250	1010
	∑F	1970	1970
	Mx	570	570
	My	350	350
	Mz	440	440
	∑M	800	800

The suction and pressure joints must be considered separately.

If not all loads in effect reach the value limits, one of these loads may exceed the usual value limit by 1.4 times. The following requirement must be observed here:

$$((\sum F_{berechnet} / \sum F_{\max .zul.})^2 + (\sum M_{berechnet} / \sum M_{\max .zul.})^2) \leq 2$$

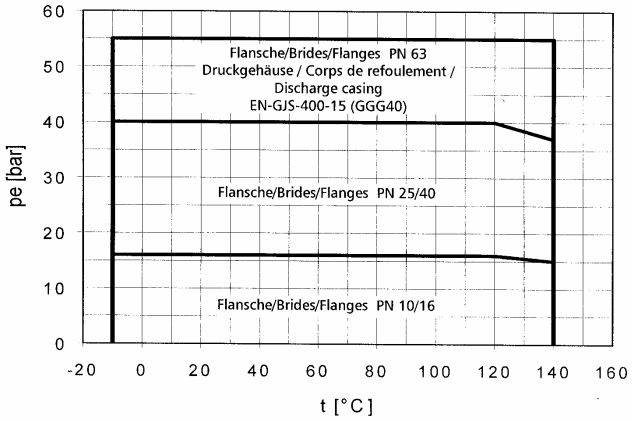
3.6 Permitted Pressures and Temperatures

In principle, the pressure and temperature values given in the datasheet and/or order confirmation as well as the performance label apply. Values (for pressure and temperature) exceeding these values or falling below them (for temperature) are not permitted. If no pressures and/or temperatures are specified in the data sheet and/or the order confirmation, the following limits apply for supply pressure and room temperature:

Supply pressure (system pressure) = Pressure at the pump intake:
MP design: max. 40 bar
MPA, MPAI design: max. 10 bar
Room temperature: max. 40°C

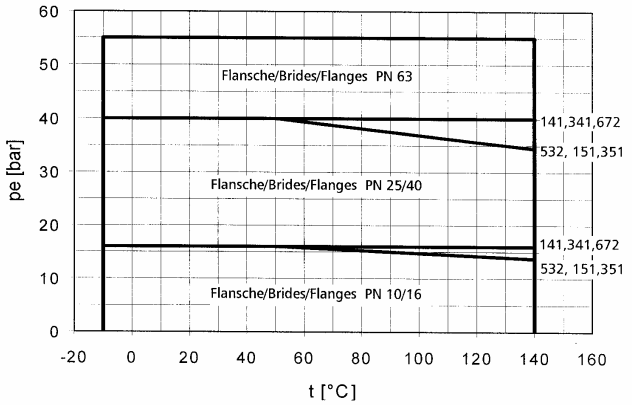
Also obey the applicable laws and regulations when using the pump (e.g. DIN 4747 or DIN 4752, Section 4.5).

Curve acc. EN 1092



Max. permissible operating pressure (casing and flange) applies for the material codes:
111, 211, 311, 262, 411, 462

Curve acc. EN 1092



Max. permissible operating pressure (casing and flange) applies for the material codes:
532, 141, 341, 151, 351, 672
For the material code used, see the data sheet and/or the order confirmation.
The specified pressure and temperature limits apply for standard materials.
The usage limits for other materials are available upon request.

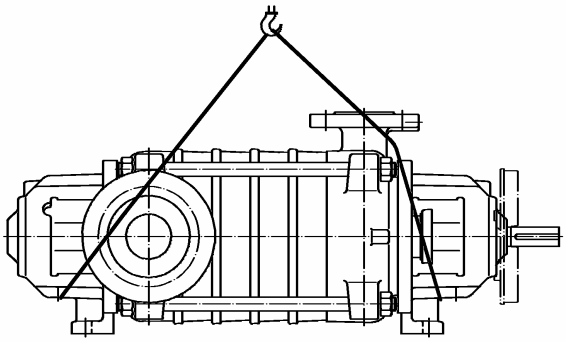
4. Transport, Handling, Storage

4.1 Transport, Handling

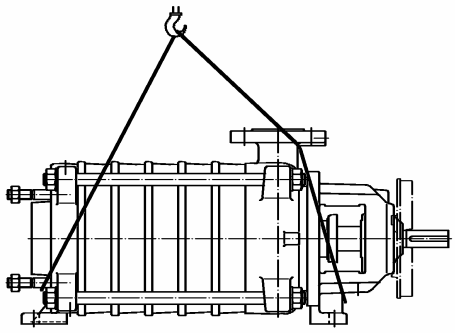
- Check the pump / pump unit immediately upon delivery / receipt of despatch for damage or missing parts.
- The pump / pump unit must be transported carefully and by competent personnel. Avoid serious impacts.
- Keep the pump/pump unit in the same position in which it was supplied from the factory. Take note of the instructions on the packaging.
- The suction and discharge side of the pump must be closed with plugs during transport and storage.

Dispose of all packing materials in accordance with local regulations.

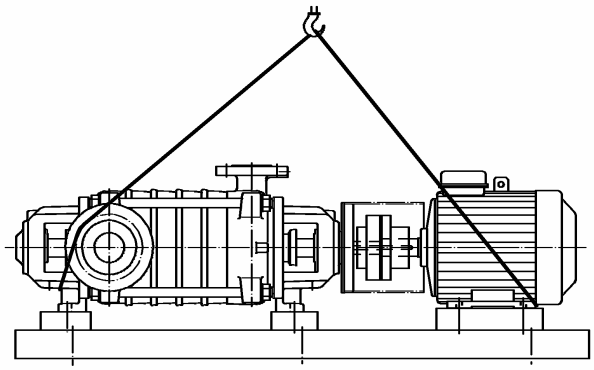
- Lifting devices (e.g. fork-lift truck, crane, crane device, pulleys, sling ropes, etc.) must be sufficiently strong and must only be used by authorized persons.
- Lifting of the pump / unit may only be performed at stabile suspension points such as the casing, bearing supports or frame. Figures 1a, 1b and 2 show the correct handling during transport by crane.



pic 1a



pic 1b



pic 2

Do not stand underneath suspended loads.
Take note of the general regulations on prevention of accidents.
The pump / pump unit must be secured against tipping over and slipping until it has been fixed in its final location.

Sling ropes must not be fixed to ends of shafts or the ring loops of the motor.

Slipping out of the pump / pump unit of the transport lifting device can cause damages to persons and things.

4.2 Storage / Preservation

Pumps or units, which are stored over a longer period before start-up (max. 6 months), must be protected from moisture, vibrations and dirt (e.g. by wrapping in oil paper or plastic). Pumps must basically be stored in a place where they are protected from the weather, e.g. under dry cover. During this time, all suction and discharge branches and all other intakes and outlets must be closed with dummy flanges or plugs.
For longer periods of storage conservation measurements at machined surfaces and packing with moisture protection can be necessary!

Preservation

On storing the pump longer than 3 month (depends on order; also see adhesive plate on the pump):
A special preservation has been made ex works. The product used for that must be flushed away from the unit before the first normal operation.

5. Mounting / Installation

5.1 Mounting of Pump / Unit

5.1.1 Mounting of pump on a base frame

The pump and motor (= pump unit) must be provided with a base frame made of steel or cast iron or a fabricated (welded) frame, where this does not exist already or if it is not included in the delivery. This base frame must be placed on a foundation which can withstand all loads that arise during operation (refer to chapter 5.1.2).

When mounting the pump onto the base frame the following must to be noticed:

- The base frame must be solid, so that there won't occur any twists or vibrations during the operation.
- The mounting surfaces of the pump feet and motor on the base frame must be flat (machining is recommended). Bracing of the pump leads to premature breakdown of the pump and to a loss of warranty.
- The drillings for the pump mounting must be in such a way, that safe fastening is guaranteed.
- Between pump and motor shaft an adequate space must be left depending on the used coupling, refer to chapter 5.3.
- Between pump and base frame there must be an adequate shimming, so that in the case of replacement of the pump the equal height between bottom and centerline can be adjusted (recommended vertical adjustment 4 to 6 mm).
- Align pump and motor, refer to chapter 5.3, as well.

5.1.2. Mounting the unit to a foundation

The place, where the pump is mounted must be prepared acc. to the dimensions of the dimensional drawings. The concrete foundations should have sufficient firmness acc. to DIN 1045 or equal standard (min. BN 15), to ensure a secure, functional mounting. The concrete foundation must have set, before the unit is errected. Ist surface must be horizontal and even.

Sufficient space must be provided for maintenance and repair work, especially for replacing the drive motor or the complete pump unit. The motor fan must be able to take in enough cool air, and the intake grille must therefore be at least 10 cm away from any wall, etc.

- For the set of anchor bolts according recesses must be provided. If that is not the case, concrete expansion bolts resp. epoxy capsule anchor bolts can be used.
- When mounting the pump on the foundation it must be adjusted at the discharge nozzle by means of a spirit-level (at discharge nozzle). The permitted deviation is 0,5 mm/m. After inserting the foundation bolts they must be cast in the foundation with concrete. After setting of the grout the coupling alignment must be checked according chapter 5.3.1 and possible misalignments must be corrected by adjusting foundation frame in the area of the drive motor. The smoothness of the base frame must be 0,5 mm/m before it is filled up resp. fastened. For adjustment levelling shims or levelling screws (optional, not delivered standard wise) can be used. Levelling shims must be inserted next to the foundation anchors and must lie plainly. After that fasten foundation bolts symmetrically but only slightly. Fill in base frame with non shrinking grout.

Notice:

- Avoid air bubbles (e.g. by vibrating).
- Check that the grout has properly set and hardened.
- Take care for the after-treatment of the concrete acc. to DIN 1045.

After setting, tighten the foundation anchor evenly and firmly. Check alignment of coupling acc. to chapter 5.3.1 and re-adjust, if necessary. Further, check that all screws between pump / motor and the base frame fit snugly.
Although the original MP-base frames are designed solidly, the filling in of the adjusted base frame up to the rim is recommended.

- If vibrations are transmitted to the foundation from adjoining components, it must be guarded through adequate vibration damping padding (vibrations from outside can impair the bearing).
- To prevent vibrations being transmitted to adjoining components, the foundation should be laid on a suitable insulating base.

The size of these insulating pads will vary, depending on circumstances, and should therefore be determined by an experienced specialist.

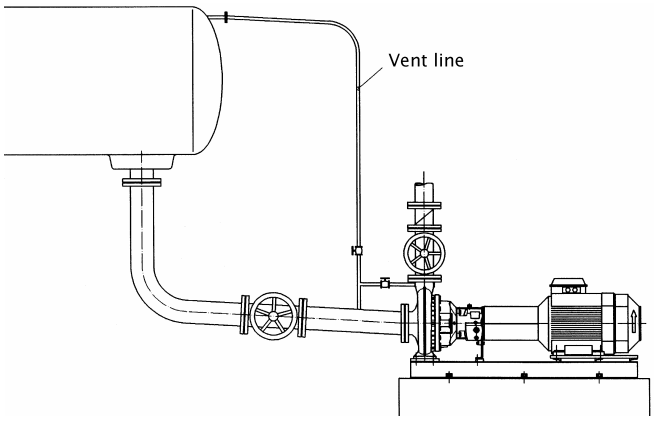
5.2 Connection of Pipings to the Pump

The pump must not be used as fixed point for the piping. The permitted piping loads must not be exceeded, refer to chapter 3.5.

5.2.1 Suction and discharge pipe

- The pipes must be of a size and design that liquid can flow freely into the pump and that the pump functions without problems. Particular attention is to be paid to ensuring that suction pipes are airtight and that the NPSH values are observed. Under suction lift condition laid the suction pipe in the horizontal section towards the pump so that it is slightly inclined upwards so that no air traps occur. Under positive suction head condition install the suction pipe work slightly declined towards the pump. Do not install fittings or elbows right before the suction nozzle.
- If the suction supply is under vacuum and entrained gas may be present in the liquid, it is recommended that a vent line be considered

upstream of the pump suction with return to the suction supply, above the max liquid level.
- An additional flushed piping - discharge branch-vent line - makes it easier to de-aerate the pump before start-up (pic 3).



pic 3

- When laying the pipes, make sure that the pump is accessible for maintenance, installation and disassembly.
- Notice "Permitted Forces on Flanges" (chapter 3.5).
- If expansion joints are used in the pipes, they have to be supported in such a way that the pump is not loaded unduly high because of the pressure in the pipes.
- Before connecting up to pump: remove protective coverings from suction and discharge branches.
- Before starting up, the pipe system, fittings and equipment must be cleaned to remove weld spatter, scale etc. Any pollutants are to be completely removed from pump units that are directly or indirectly connected to drinking water systems before being installed and taken into use.
- To protect the shaft sealing (especially mechanical seals) against foreign impurities, it is recommended that a sieve, 800 micron, is installed in the suction/intake pipe when the motor is being started up.
- If the pipe system is tested with the pump installed, do not exceed the maximum permitted casing pressure of the pump and/or shaft sealing.
- When emptying the pipe after the pressure test, make sure that the pump is treated properly (danger of rust and problems when starting up).
- In the case of pumps with stuffing boxes, replace packing after pressure test (packing may be over-compressed and thus no longer suitable for use).

5.2.2 Additional connections

Any required sealing, flushing or cooling pipe connections must be installed. Please consult the data sheet and/or the confirmation of order to see which pipes, pressures and amounts are necessary. The position and size of connections to the pump are given in the appendix, "Connections".

These connections are essential for the function!

It is recommended that a pipeline is installed to take off any leakage from the shaft seal. For connection, see appendix, "Connections".

5.3 Coupling

Make sure that nobody can start the motor during work on the coupling.
According to Accident Prevention Regulations, the pump unit may only be operated when the coupling guard is mounted.

On operation in zone 1 and 2 a coupling with valid Atex-certification must be used.

The Operating Instructions of the manufacturer must be followed.

5.3.1 Installation of Coupling

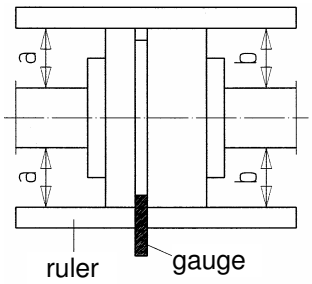
If the pump unit is not completely assembled until it reaches its place of use and no separate operating instructions have been supplied by the manufacturer, you should proceed according to the following points:
- Before starting installation, carefully clean shaft ends and coupling components.
- Pull coupling onto shaft end, do not hit. The coupling may be heated beforehand in an oil bath to approx. 100°C (pulling on is then easier). Remove rubber packs from coupling section first.
- The coupling sections must be flush with the shaft end surfaces.
- Secure coupling hubs against axial sliding using a pin screw.

5.3.2 Alignment of coupling

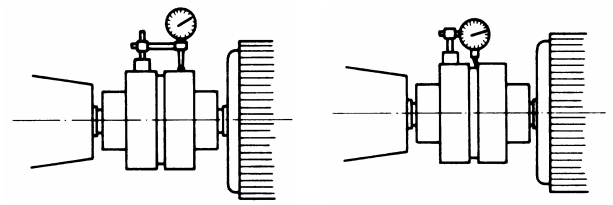
The alignment of the coupling must be carried out with the utmost care and attention, so that the unit will operate without failure. If you do not pay attention to this hint you will lose your warranty!

After mounting onto the foundation and the connection of the pipings the coupling must be adjusted again, even, if the unit was delivered completely mounted on the frame.

- Before starting installation, carefully clean shaft ends and coupling components.
- The unit is properly aligned, when a ruler, which is laid axially over both coupling halves, has the same distance to the particular shaft everywhere on the circumference. Further, both coupling halves must have the same distance to one another on every of the circumference. This must be checked by means of a tracer, gauge or dial gage; refer to pic. 4 and 5.
- The permitted tolerances for your coupling are shown in the operating instructions of the coupling. For the exact characterization of your coupling refer to data sheet and / or order confirmation.



pic 4 - Alignment of coupling with gauge and ruler



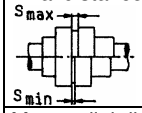
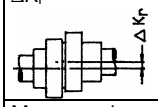
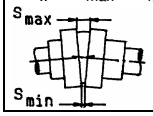
pic 5 - Adjustment using dial gauge

Control alignment of coupling again in operation warm condition and on system pressure (if available) and correct, if necessary. Pay attention to chapter 6 beforehand! It must be possible to turn the unit easily and harmoniously by hand.

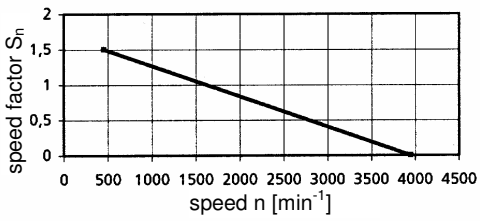
Improper alignment of the unit can lead to damages at coupling and unit!

Mount coupling guard after alignment and before start-up.

5.3.3 Permitted displacement for flexible couplings

Coupling size		H80FK	H95FK	H110FK	B125KF	H125FK	B140FK	H140FK	B160FK	H160FK	B180FK	H180FK	B200FK	H200FK	B225FK	H225FK
Outer diameter of coupling [mm]		80	95	110	125	140	160	180	200	225						
Axial distance S 	S_{max}	3									6					
	S_{min}	2														
Max. radial displacement ΔK_r 		0,1									0,2					
Max. angular displacement S_{max} . S_{min} $\Delta K_w = S_{max} - S_{min}$ 		0,1					0,2								0,3	

The given values ΔK_r and ΔK_w apply for 1500 min^{-1}.
For all other speeds the following applies:
ΔK_w . S_n bzw. ΔK_r . S_n

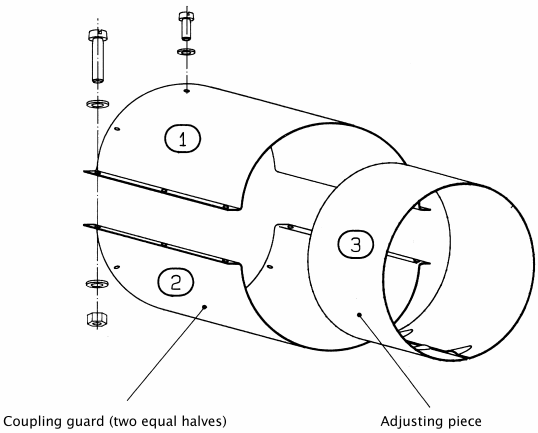


5.3.4 Coupling Guard

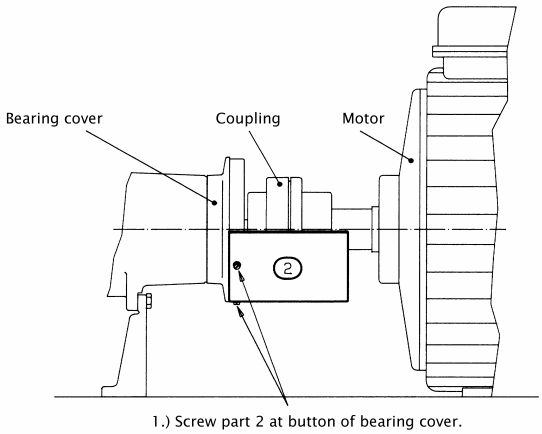
Acc. to accident prevention regulations the pump must only be operated with coupling guard.

Care has to be taken, that the used coupling guard consists of non-sparking material.

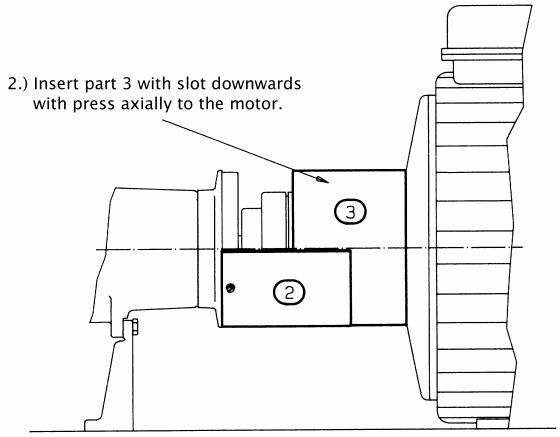
Parts:

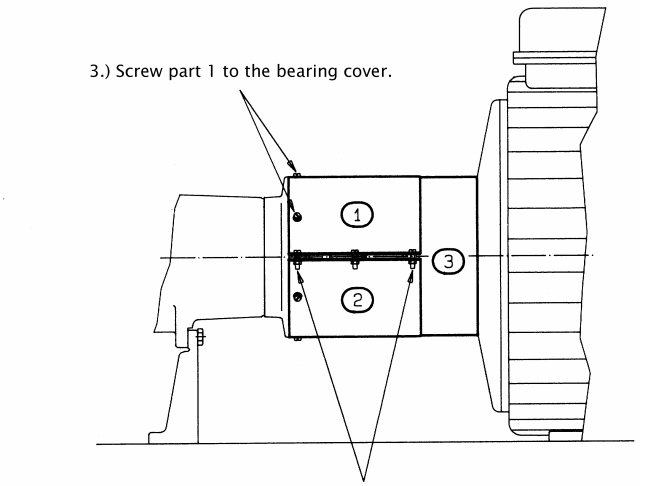


Assembly:



1.) Screw part 2 at button of bearing cover.





4.) Screw part 1 and part 2 together, which fixes the adjusting piece.

5.4 Drive

On selecting the motor size care has to be taken, that the requirements acc. to ISO 5199 are fulfilled. **Note the Operating Instructions of the motor manufacturer.**

On application in zone 1 and 2 a motor with valid Atex-certification must be used.

5.5 Electric Connection

Electrical connection work may only be carried out by an authorised professional. The rules and regulations valid for electrical technology, especially those concerned with safety measures, must be observed. The regulations of the national power supply companies operating in that area must also be observed.

Before starting work, check that the information on the motor name plate is the same as the local mains network. The power supply cable of the coupled drive motor must be connected up in accordance with the wiring diagram produced by the motor manufacturer. A protective motor switch must be provided.

In areas endangered to explosion IEC 60079-14 must additionally be noticed for the electric installation.

Care must be taken that the base frame (2x M10-thread available for earthing screws) is earthed by means of corresponding measures.

The direction of rotation must only be checked when the pump is full. Dry running will cause damage to the pump.

5.6 Final Control

Check alignment of coupling acc. to chapter 5.3.1 again. It must be possible to turn the unit easily by hand at the coupling.

6. Start-up, Operation, Shut down

The plant may only be started up by people who are familiar with the local safety regulations and with these Operating Instructions (especially with the safety regulations and safety instructions given here).

Hints for the use as boiler feed pump

Limits for cast iron when used in boiler feed or condensate applications: pH-value ≥ 9,0 (optimum ≥ 9,3), short term: pH-value ≥ 8,5.
The above stated values must be guarantied at the suction side of the pump in any case.
The water treatment must be in acc. with the specifications for water treatment of boiler feed water in steam plants up to 64 bar.
Air traps in the system must be avoided in any case.

6.1 Initial start-up

Before starting up the pump, check, if the following points were controlled and carried out:

- The bearings are already filled with grease and therefore ready for operation.
- Pump and suction pipe must be filled completely with liquid when starting up. Open the screwed plugs "PM1" resp. "M2" when filling the pump. Close them when water is flowing out.
- Turn pump unit once again by hand and check that it moves smoothly and evenly.
- Check that coupling guard is installed and that all safety devices are operational.
- Switch on any sealing, flushing or cooling devices that are provided. See Data Sheet for quantity and pressure.
- Open valve in suction /intake pipe.
- Set the pressure-side slider to approx. 25% of the pump rate for which the system was designed. For pumps with a drive output lower than 30 kW, the slider may also remain closed briefly upon startup.
- Secure, that unit is electrically connected acc. to all regulations and with all safety devices.
- Check direction of rotation by switching on and off briefly. It must be the same as the directional arrow on the bearing frame.

6.2 Switch on drive

- Immediately (max. 10 seconds on 50 Hz resp. max. 7 seconds on 60 Hz currency feed) after reaching normal operating speed open discharge valve adjust the required operating point. The pumping data shown at the type plate resp. in the data sheet and / or the order confirmation must be met. Every change is only permitted after talking with the manufacturer!

Operation with closed valve in the suction and / or discharge piping is not permitted.

On starting-up without back-pressure, the back-pressure must be produced through throttling at the discharge side. After reaching full back-pressure open valve

In order that the shaft sealing can be monitored and maintained unhindered, no protection cover is provided in this area. Therefore special attention is required when pump is working (no long hair, loose clothes, a.s.o.).

- Packing: Packing need leakage for trouble free function (drop wise outlet of pumped medium). Adjust ample leakage in the beginning. Reduce that slowly during the first operating hours by continuously fastening of gland (see position "69" and "M3" in sectional drawing) when pump is running. Assume 60-100 drops / minute as approx. value.
  The leakage must flow out liquid in any case (not vaporous).

Packing that run dry will harden and then destroy the shaft sleeve and/or the shaft.

- Mechanical seals: Mech. seals don't need to be maintained and are almost free of leakage.

If pump does not reach attended head or if atypical sounds or vibrations do occur:
Switch off pump (see chapter 6.7) and seek for causes (see chapter 10).

6.3 Restarting

Basically, the same procedure should be followed as for starting up for the first time. However, there is no need to check the direction of rotation and the accessibility of the pump unit.
The pump should only be automatically restarted if it has been made sure that the pump has remained filled whilst stand by.

Be particularly careful not to touch hot machine parts and when working in the unprotected shaft seal area. Remember that automatically controlled systems may switch themselves on suddenly at any time. Suitable warning signs should be affixed.

6.4 Limits of Operation

The operating limits of the pump / unit regarding pressure, temperature, performance and speed are shown in the data sheet and / or order confirmation and must be observed under any circumstances!

- Do not exceed the output given on the motor name plate.
- Avoid sudden changes in temperature (temperature shocks).
- The pump and motor should run evenly and without vibrations; check at least once a week.

6.4.1 Flow min. / max.

If no other data are given in the curves or data sheets, the following is valid:

Q_{min} = 0,1 x Q_{BEP} for for short time operation
Q_{min} = 0,3 x Q_{BEP} for continuous operation
Q_{max} = 1,2 x Q_{BEP} for continuous operation *)

Q_{BEP} = Flow in efficiency optimum
*) on condition that $NPSH_{facility}$ > ($NPSH_{pump}$ + 0,5 m)

6.4.2 Abrasive Media

On pumping liquids with abrasive components an increased wear at hydraulic and shaft sealing must be expected. The intervals of inspection should be reduced compared to the usual times.

6.4.3 Permitted number of starts

With electric motors, the permitted number of starts is given in the attached motor operating instructions.
If no values for the switching frequency are given in the motor operating manual, the values according to Diagram 7 apply.

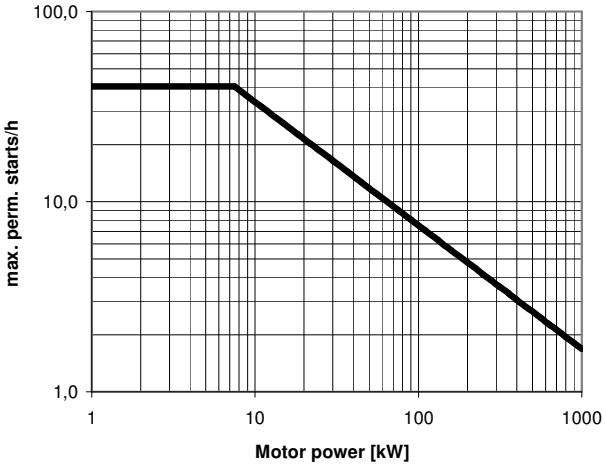


Diagram 7

If two different figures are given, the lower figure is valid.

6.5 Lubrication of Bearings

Grease lubrication

For quality of grease refer to chapter 7.4.
For quantity of grease refer to chapter 7.4.

- The bearings are already filled with lithium based grease at the factory and are thus ready for use.
- The grease provided is suitable for a temperature range from -30° to +90°C (measured at surface of bearing bracket).
- Re-lubrication via the two grease nipples (G).
- Bearing temperature (measured at bearing bracket) should lie max. 50°C over ambient temperature and must not exceed 90°C, control weekly at least. On grease lubrication the bearing temperature can temporarily be higher by 5-10°C after regreasing, till a possible surplus of grease in the bearings is cut.

6.6 Monitoring

In areas endangered to explosion it is recommended to monitor the temperature of the bearings and the vibrations of the bearing bracket.

Regular monitoring and maintenance will extend the life of your pump or pump system.

- Check pump for leaks at least once a week.
- On packing, check quantity of leakage at least once a week (see chapter 6.2 section "Packing").
- Check the regulating and monitoring devices of any sealing, flushing or cooling systems once a week to ensure that they function properly. Outgoing cooling water should be hand warm.
- With double mechanical seals, monitor pressure and flow rate in mechanical seal area; check at least once a week.
- Pumps which are exposed to corrosive chemicals or to wear through abrasion must be inspected periodically for corrosion or wear and tear. The first inspection should be carried out after six months. All further inspection intervals should be determined on the basis of the state of the pump.

6.7 Shutting down

- Close the valve in discharge pipe right before (max. 10 seconds) switching off the motor. This is not necessary if there is a spring-loaded check valve.
- Switch off motor (make sure it runs down quietly).
- Close the valve on suction side.
- Close auxiliary systems. Do not shut down cooling system until pump has cooled down.
- If there is any risk of freezing, empty pump, cooling areas and pipes completely.
- If the pump also remains under operating conditions (pressure and temperature) when stationary, leave all sealing, flushing and cooling systems switched on.
- The shaft sealing must remain sealed if there is a risk of air being sucked in (in the event of supply from vacuum systems or parallel operation with shared suction pipe).

6.8 Storage / longer periods of non-operation

6.8.1 Storage of new pumps

If the putting into operation shall happen a longer period after the delivery, we recommend the following measures for the storage of the pump:

- Store pump at a dry place.
- Rotate pump by hand at least once a month.

6.8.2 Measures for longer putting out of operation

Pump remains installed and in ready for operation:

- Test runs of 5 min. duration must be made in regular intervals. The span between the test runs is depending on the plant. However, it should be made once a week, at least.

6.8.3 Longer periods of non-operation

After long stationary periods, packing may have hardened; these must be replaced before start-up.
When starting up, follow the instructions for starting up for the first time (see chapter 6)!

a) Filled pumps

- Switch stand-by pumps on and immediately off again once a week. Possibly use as main pump.
- If the stand-by pump is at operating pressure and temperature, leave all sealing, flushing and cooling systems switched on.
- Replace the grease in the bearings after 2 years.
- Stuffing box must be adjusted to maintain lubrication of the packing (e.g. do not over tighten).

b) Drained pumps

- Turn shaft at least 1x week (do not switch on because of dry running).
- Replace the grease in the bearings after 2 years.
- If the pump jams, it can be loosened with moderate pounding on the coupling in the axial direction. Use a plastic hammer for this.

7. Servicing, Maintenance

7.1 General remarks

Maintenance and servicing work must only be carried out by trained, experienced staff who are familiar with the contents of these Operating Instructions, or by the Manufacturer's own service staff.

Work should only be carried out on the pump or pump unit when it is not in operation. You must observe chapter 2.

7.2 Mechanical seals

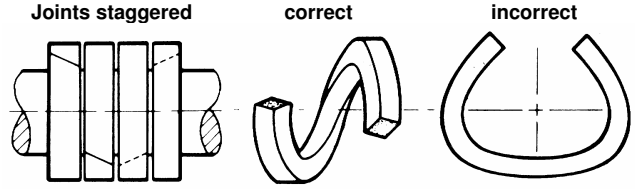
Before opening the pump, it is essential that you note chapter 2 and chapter 8.

If the liquid being handled leaks out at the mechanical seal, it is damaged and must be replaced.
Replace the mechanical seal according to Section 8.6 "Replacing the Shaft Seal".
Mech. seals do not need to be maintained and are completely free of leakage. Pumps with mech. seals must only be operated when completely filled and vented. The mechanical seal chamber must always remain filled with liquid during operation of the pump. If the liquid being handled drips out at the mechanical seal, it is damaged and must be replaced.
When installing the mechanical seal make sure that the seal casing is absolutely clean, particular care has to be paid to the surface of the seal rings. To facilitate the slip-on of the rotating components of the seal onto the shaft lubricate all moving components and sliding areas by means of water, soapy water or soft soap. Use mineral oils only in case all elastomers are oil resistant. Do not lubricate the surface of the seal rings. Do not force elastomeric elements over sharp edges, if necessary use assembling aiding sleeves.

7.3 Stuffing boxes

Stuffing boxes require constant maintenance, see chapter 6.2 section "Stuffing box". If the leakage rate can no longer be set correctly, the packing is worn out and must be replaced in good time (increased wear on shaft sleeve). Replace the packing gland according to Section 8.7 "Replacing the Shaft Seal".
If employing new packing tight at the beginning the gland only gentle (heavy leakage). Arrange ends of packing rings at opposite positions (refer to drawing). After a while tighten the gland smoothly until leakage is reduced to only a few drops per minute. Avoid dry run.

Method of opening packing rings to fit over shaft



Because of the risk of accidents, addition of packing to pumps during operation or at operating pressure or temperature is strictly forbidden!

7.4 Lubrication and Change of Lubricant

Re-greasing

- Grease lubricated bearings with the possibility of re-greasing must be re-lubricated all 4000 operating hours, but at least 1x year. Clean lubricating nipples (G) first.

Lubricating grease quality ...

... K2K-20, KP2K-20, etc. as per DIN 51825:

- Lithium soap grease
- NLGI GRADE 2
- Temperature range -20 to 120°C
- Dripping point > 175°C
- Base oil viscosity 70 to 150 mm²/s at 40°C

When changing the grease type, ensure compatibility with the residual grease.

Quantity of re-greasing (approx. value)

Pump Size	Grease Quantity	
	Suction Side	Pressure Side
	[cm³]	[cm³]
MP/MPA/MPAI 40.2	7,6	12,1
MP/MPA/MPAI 40.3	7,6	12,1
MP/MPA/MPAI 65.1	9,3	15,5
MP/MPA/MPAI 65.2	9,3	15,5
MP/MPA/MPAI 100.1	11,5	23,0
MP/MPA/MPAI 100.2	11,5	23,0
MP/MPA/MPAI 125.1	16,5	33,0
MP/MPA/MPAI 125.2	16,5	33,0

Pump Size	Relubrication Intervals in Operating Hours				
	3550	2950	2200	1750	1450
	[min⁻¹]	[min⁻¹]	[min⁻¹]	[min⁻¹]	[min⁻¹]
MP/MPA/MPAI 40.2	3800	4300	5500	6000	6500
MP/MPA/MPAI 40.3	3800	4300	5500	6000	6500
MP/MPA/MPAI 65.1	3500	4000	5000	5500	6000
MP/MPA/MPAI 65.2	3500	4000	5000	5500	6000
MP/MPA/MPAI 100.1	3300	3800	4500	5000	5500
MP/MPA/MPAI 100.2	3300	3800	4500	5000	5500
MP/MPA/MPAI 125.1	2500	3300	4300	4800	5000
MP/MPA/MPAI 125.2	2500	3300	4300	4800	5000

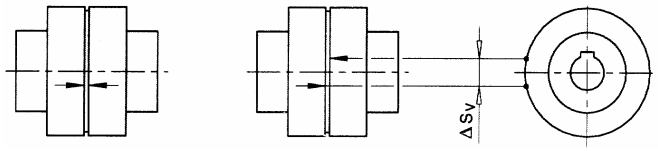
Relubrication intervals with activation durations of approx. 50% (cycle duration 1 hour).
For activation durations of approx. 100%, halve the relubrication intervals.

- If the pump is left non-operational for a longer time, the grease in the bearings should be changed after 2 years.

7.5 Coupling

Check the clearance in the coupling components regularly approx. every 1000 operating hours, but at least 1x year, the radial clearance in the coupling parts must be checked.

For couplings with rubber pads the following applies:
Unless a clearance in the couplings is necessary, the coupling pads may wear out to approximately ¼ of their usual thickness, before they have to be changed. To measure the clearance in the coupling place a mark on the O.D. of each coupling hub (see following pic). Then fixing one hub, turn the opposite hub as far as possible. Then measure the distance (ΔS_V) between the marks of the coupling. If this measure exceeds the value given in the chart, the packing must be replaced. They must be replaced in sets.



Size	80	95	110	125	140	160	180	200	225
ΔS_V [mm]	5,0	6,0	7,0	8,0	8,5	8,0	8,0	8,5	9,0

If wear is heavy, it must be assumed that the motor is not properly aligned with the pump or that the distance between the coupling sections has changed. Replace worn elements and re-install or adjust coupling, as described in chapter 5.3.

7.6 Cleaning of pump

The pump must not be cleaned with pressurised water - water will get into the bearings.

Dirt on the outside of the pump has an adverse effect on transmission of heat. The pump should therefore be cleaned with water at regular intervals (depending on the degree of dirt).

8. Dismantling and repair of pump

8.1 General remarks

Repair to the pump or pump system may only be carried out by authorised skilled personnel or by the manufacturer's specialist staff.

When disassembling the pump pay attention to chapter 2 and chapter 4.1.

For mounting and repair you can order specialized personnel if you want.

If dangerous liquids are pumped the appropriate disposal of the handled liquid is necessary before the disassembly of the pump. Pay attention to the fact, that even in drained pumps there are remainders of the handled liquid. If necessary the pump must be flushed or decontaminated. Laws must be observed, otherwise danger to health is existing!

- Before the disassembly the pump has to be secured in such a way, that it can't be started.
- The pump casing must be drained and without pressure.
- All locking devices in the suction- and discharge-pipe must be closed.
- All parts must have taken on the temperature of the environment.

While disassembling the pump use of an open flame (blowlamp, etc.) only, when there is no danger of setting fire, cause an explosion or cause injurious vapours.
Never apply heat to remove the impeller nut. Use of heat may result in severe physical injury and property damage.

Secure disassembled pumps, units or single parts against tipping over or rolling off.

Use original spare parts only. Pay attention to the right materials and the matching design.

8.2 General

Works, which require shocks (hammer), must only be performed outside the explosive atmosphere or only non-sparking tools must be used.

The schematic sectional drawing with part designations that matches the delivered pump and the design of the shaft seal can be found in the enclosed data sheet and/or the order confirmation and the enclosures.

All work carried out on the pump must be performed in compliance with the rules of machine construction.

- Never use force (never hit too hard with a hammer and always use a suitable base (hard wood or copper)).
- Obey safety instructions, secure components so that they cannot fall over or roll away
- Only use suitable products in a perfect technical condition, (e.g. properties of lubricating agent must be known)
- Always clean parts before installation (dust, rust, particles, old grease etc.).
- All specified values must be complied with (e.g. torque etc.)
- Fitting surfaces and centering should only be lubricated shortly before assembly.

8.3 Tools and Equipment

In normal cases no special tools are required.
The following tools simplify assembly work:

Warm-up equipment for roller bearings
Two-armed withdrawing screw
Sickle spanner for shaft nuts

Cleaning and degreasing agents (e.g. Acetone).
Lubricating agent for roller bearings (see Operating Instructions for appropriate products).
Lubricating agent for assembly work (e.g. beef dripping, Molikote, silicon grease and soap water).

For drinking water pumps only lubricants should be used that are guaranteed to contain no harmful substances.

8.4 Dismantling the Pump

Work may only be carried out while the pump is at a standstill.
The pump must be shut down in accordance with the Operating Instructions. For pumps with automatic pump control appropriate measures must be taken to prevent the pump from starting up accidentally (e.g. cutting off the power supply).

- Empty pump.

In the case of sizes MP, MPA 40 and 65, emptying the pump over the drain holes (D) provided will not completely empty the pump cover. The pump can only be emptied completely by turning it.

The operator's or manufacturer's fitters must be informed about the nature of the pumping medium. In the case of pumps that are operated with hazardous materials, the pumping medium must be disposed of in an environmentally friendly manner before the pump is dismantled. Please note that residues of pumping medium are present even in pumps that have been drained. If necessary the pump must be rinsed or decontaminated.

- Unscrew the pump from the pipe system and base.
- Disconnect pumps with standard couplings by pulling apart the engagement.
- Separate screwed coupling halves by unscrewing the connector screws (see Coupling Operating Instructions).
- Transport to the workplace (see Transport, Handling in the Operating Instructions).

8.5 Replacing Roller Bearings

This section describes how to replace roller bearings. Clean and check condition of all parts that have been removed. In case of doubt, components should be replaced. Wearing parts and seals must always be replaced.
If parts or half-open pumps are to be stored for any length of time, they must be protected from dirt and corrosion.

8.5.1 Intake Side Roller Bearings (K2), (Suction Side) – MP only

See the "Appendix" in the Operating Instructions for relevant sectional drawing.

Dismantling

- Place the pump in a horizontal position, raise the suction casing (3) with wooden blocks so that the feet of the bearing flange (10) are exposed by approx. 10 to 20 mm.
- Move back the splash ring (73)
- Unscrew nuts (M2) and nuts (M5); pull the bearing cap (12) off the bearing flange (10).
- Remove bearing flange (10) (tapping the bearing flange lightly in an axial direction (10) facilitates removal)
- Unscrew shaft nut (50) (sickle spanner). The shaft nut has a securing device to prevent it coming loose.
- If this securing device is no longer adequate, the nut must be replaced.
- Remove roller bearings (K2) with the withdrawing screw.
- Check the surface of the shaft for damage, grind away any furrows.

Assembly

- Clean and lubricate the fitting surfaces between the bearing flange (10) and suction casing (3).
- Preheat new bearing (K2) (max. 80°C) and slide onto the shaft (24).
- Tighten the shaft nut (50) while the bearing is still hot, then turn back a ¼ turn.
- Fill approximately 60% of the space in the roller bearing (K2) with grease (when the bearing has cooled down).
- Fit bearing flange (10) and screw on lightly for the time being.
- Screw the bearing cap (12) to the bearing flange (10).
- Grease the counter contact surface of the splash ring packing washer on the bearing cap (12).
- Bring the splash ring (73) into position (nut in the spacer sleeve (72).
- Align the bearing surface of the pump feet (place pump on an even surface).
- Tighten nuts (M2) firmly (see Supplementary Sheet for torque)
- Rotate shaft (24) to see that it runs smoothly.

8.5.2 Discharge Side Roller Bearing (K1), (delivery side)

See the "Appendix" in the Operating Instructions for relevant sectional drawing.

Dismantling

- Remove coupling halves with withdrawing screw.
- Place the pump in a horizontal position, raise the suction casing (4) with wooden blocks so that the feet of the bearing flange are exposed by approximately 10 to 20 mm.
- Move back the splash ring (73)
- Unscrew nuts (M2) and nuts (M5), pull the bearing cap (12) off the bearing flange (10).

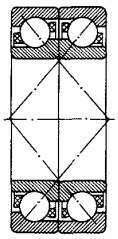
- Remove bearing flange (10) (lightly tapping the bearing flange (10) facilitates removal).

After the bearing flange (10) has been removed the shaft can be moved freely in an axial direction (approx. 3 – 4 mm). Standard shaft seals can absorb this adjustment without their function being impaired. In the case of special shaft seals (e.g. cartridge seals) please follow the Operating Instructions of the seal.

- Unscrew shaft nuts (50) (sickle spanner). The shaft nut has a securing device to prevent it coming loose.
- If this securing device is no longer adequate, the nut must be replaced.
- Remove roller bearings (K1) with the withdrawing screw.
- Check the surface of the shaft for damage, grind away any furrows.

Assembly

- Clean and lubricate the fitting surfaces between the bearing flange (10) and suction casing (3).
- Preheat the new bearing (K1) (max. 80°C) and slide onto the shaft (24).
  (Variants): MP, MPA 40 and 65 .....roller bearing (K1) – double row angular ball bearings (single bearing)
  MP, MPA 100 and 125 ....roller bearing (K1) – paired angular ball bearings in X arrangement



Paired angular ball bearings in X arrangement

- Tighten shaft nut (50) while the bearing is still hot.
- Fill approximately 60% of the space in the roller bearing (K1) with grease (when the bearing has cooled down).
- Mount bearing flange (10) and screw on lightly for the time being.
- Screw the bearing cap (12) to the bearing flange (10).
- Grease the counter contact surface of the splash ring packing washer on the bearing cap (12).
- Bring the splash ring into position (73) (groove in the spacer sleeve (72)).
- Align the bearing surface of the pump feet (place pump on an even surface).
- Tighten nuts (M2) firmly (see Supplementary Sheet for torque).
- Rotate shaft (24) to see that it runs smoothly.
- Mount coupling half (maybe preheat to approx. 80°C).

8.6 Replacement of the slide bearing

This section describes the replacement of the slide bearing in the inner bearing casing (54 – MPA, MPAI design).
If the whole pump is to be dismantled for maintenance work, the pump should be placed in a vertical position (intake pipe facing upwards). A workbench with a hole (approx. 10 mm larger than the shaft) is very helpful in such cases.
MPA 40 and MPA 65 can be placed on the coupling protection adapter (95). Stand MPA 100 and MPA 125 vertically with an additional support.
A hoist or a second person is required for dismantling type MPA 100 and MPA 125 pumps.
See the "Appendix" in the Operating Instructions for relevant sectional drawing.

Secure the pump so that it cannot fall over.

This description does not include dismantling the mechanical seal. Read the instructions for "Replacing the Shaft Seal" before dismantling the pump in order to carry out any necessary preparations in good time.

Dismantling

- Loosen nuts (M1) and remove casing anchor (25).
- Remove suction casing (3) and take out O-ring (OR1).

Model MP:

- Loosen impeller nuts (28), remove washer (29).

Model MPAI (Sizes 40.1 and 40.2)

- Screw off the inducer (101), thereby fix the shaft on the coupling against twist.

Model MPAI (Sizes.1, 65.2, 100.1, 100.2, 125.1 and 125.2)

- Loosen impeller nuts (28), remove washer (29).
- Remove the inducer (101) and take out the key (PF5).
- Dismantle impeller (1) and diffuser (2), take out key (PF1).
- Remove inside bearing housing (54) and bearing sleeve (23).
- Inspect the shaft for surface damage, grind off any remaining furrows.
- Remove the bearing bush (21) from the suction casing (3) (screw off).

Assembly

- Press the new bearing bush (21) into the inner bearing casing (54).
- Clean the fitting surfaces between the inner bearing casing (54) and the suction casing (3) and coat them with lubricant.
- Slide the new bearing sleeve (23) onto the shaft (24).
- Insert the key (PF1), install the diffuser (2) and impeller (1).

Model MP:

- Slide on the impeller (1) with washer (29).
- Tighten the first impeller nut (28), then turn it back approx. ¼ turn, secure with the locknut.

Model MPAI (Baugrößen 40.1 und 40.2)

- Screw on the inducer (101), thereby fix the shaft on the coupling against twist.

Model MPAI (Sizes 65.1, 65.2, 100.1, 100.2, 125.1 and 125.2)

- Insert the key (PF5) and put the inducer (101) off.
- Insert the washer (29).
- Tighten the first nut (28), then turn it back approx. ¼ turn, secure with the locknut.
- Put the suction casing (3) in place, screw in the tie bolts (25) and tighten the nut (M1) (see the appendix for the tightening torque).
- Turn the shaft (24) and check for easy motion.

8.7 Replacement of the shaft sleeve with a packing gland / Replacement of the mechanical seal

This section describes the replacement of the shaft sleeve for designs with a packing gland or the replacement of the mechanical seal.
Clean and check condition of all parts that have been removed. In case of doubt, components should be replaced. Wearing parts (roller bearings) and seals must always be replaced.
If parts or half-open pumps are to be stored for any length of time, they must be protected from dirt and corrosion.

8.7.1 Model with Packing Gland (Code "P")

See the "Appendix" in the Operating Instructions for relevant sectional drawing.

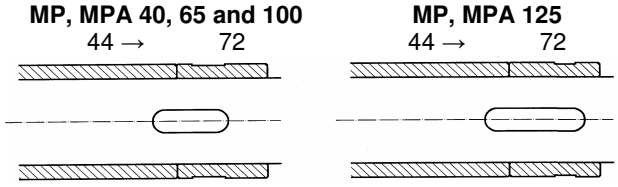
Instructions are valid for shaft seals on the intake side (MP) and discharge side (MP, MPA, MPAI).

Dismantling

- Dismantle pump on the appropriate side as described in Point 3 (Replacing Roller Bearings)
- Remove bearing cap (12), spacer sleeve (72) and splash ring (73).
- Remove feather key (PF3).
- Unscrew nuts (M3) and remove packing box gland (69).
- Pull out worn packing rings (P).
- Pull off shaft protective sleeve (44), draw out O-Ring (OR4).
- Depending on how worn the bearing surface is (less than 0.5mm diameter) the shaft protective sleeve (44) can be levelled (take finishing cut and polish or grind). If the shaft protective sleeve (44) is very worn it must be replaced.
- Remove rest of packing rings (P) from the packing chamber and clean all other parts. Degrease shaft (24) but do not lubricate yet.

Assembly

- Slide on O-Ring (OR4) and apply lubricant with a brush (e.g. silicon grease).
- Lubricate the shaft protective sleeve (44) in the borehole) so that the O-ring groove remains clean (start approx. 10-15mm inside). Standard O-rings made of EP rubber are not resistant to oil emulsive lubricants and must not come into contact with them. Once resistance has been ensured (e.g. beef dripping as lubricating agent or oil resistant O-rings) the entire shaft (24) may be lubricated.
- Slide on the shaft protective sleeve (44), insert new packing rings (P) (see Operating Instructions) and fix loosely with the packing box gland (69) (nuts (M3). When sliding on the shaft protective sleeve (44) take care that the O-ring can slide easily into the groove.
- Insert the feather key (PF3) and slide on the spacer sleeve (72). Pump must be assembled in the following direction.)



- Slide on splash ring (73) and bearing cap (12)
- For further assembly work see Point 3 (Replacing Roller Bearings) "Assembly".

8.7.2 Model with Standard Rotating Mechanical Seal (Code "SA, SB, SC, SD, SE and SF")

See the "Appendix" in the Operating Instructions for relevant sectional drawing.

Instructions are valid for shaft seals on the intake side (MP) and discharge side (MP, MPA, MPAI).
Shaft protective sleeves (44) and the mechanical seals (GLRD) are different. The parts must be marked so that they can be mounted in the same position.

Dismantling

- Dismantle pump on the appropriate side as described in Point 3 (replacing roller bearings)
- Remove bearing cap (12), spacer sleeve (72) and splash ring (73).
- Remove feather key (PF3).
- Remove seal cap (18). Pre-treat fitting surface between the seal cap and the casing with branded penetrating agent.
- Slide off shaft protective sleeve (44U and 44B), pull out O-ring (OR4).
- Press out the countering of the mechanical seal (GLRD) from the seal cap (18) using even pressure. Attention: The seal has very sharp edges if it breaks → danger of injury
- Slide the rotating unit of the mechanical seal off the shaft protective sleeve (44). If the mechanical seal has securing screws these must be loosened earlier.
- Clean and check all parts for wear. Mechanical seals must always be replaced. Repairing mechanical seals is only to be recommended with specialist training.

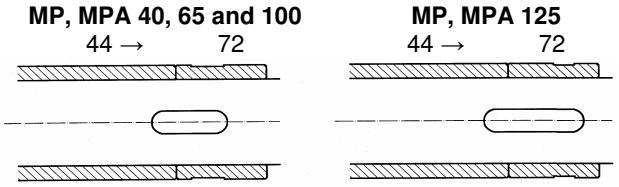
Assembly

Placing the pump in a vertical position is advantageous for assembly).

- Always use a lubricant when mounting mechanical seals. We recommend lubricating the O-ring or

rubber bellows with soap water shortly before it is mounted. Do not use any mineral grease or oil if you are not absolutely certain that the O-ring is resistant to it.

- Insert the countering of the mechanical seal (GLRD) in the seal cap (18). Slide the rotating unit of the mechanical seal (GLRD) onto the shaft protective sleeve (44) and secure (if possible).
- Work on mechanical seals with a rubber bellows must now proceed quickly. This is the only way to guarantee that the rotating mechanical seal element can still be moved during assembly and can be brought into the correct position.
- Slide on the O-ring (OR4) and apply lubricating agent (e.g. silicon grease) using a brush.
- Lubricate the shaft protective sleeve (44) in the borehole so that the O-ring groove remains clean (start approx. 10-15mm inside). Standard O-rings made of EP rubber are not resistant to mineral oil or greases and must not come into contact with them. Once resistance has been ascertained (e.g. beef dripping as lubricant or oil-resistant O-rings) the entire shaft may be lubricated.
- Slide on the shaft protective sleeve (44). When sliding on the shaft protective sleeve take care that the O-ring can slide easily into the groove.
- Insert the O-ring (OR3) in the casing and secure with silicon grease. If possible, the O-ring should lie touching the outer diameter (the O-ring can be enlarged slightly by pulling).
- Carefully mount the sealing cap (18), taking care that the pin is in the correct direction (S4), (groove in bearing flange).
- Insert feather key (PF3) and slide on the spacer sleeve (72). Pump must be assembled in the following direction.



- Slide on splash ring (73) and bearing cap (12)
- For further assembly work see Point 3 (replacing roller bearings) "Assembly".

8.7.3 Model with Cartridge Mechanical Seal (Code "CS, CQ, CD")

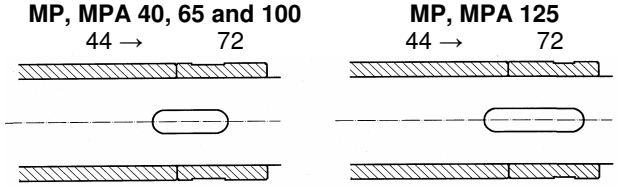
See "Appendix" in the Operating Instructions for sectional drawing

Description is valid for shaft seals on the intake (MP) and discharge sides (MP,MPA, MPAI).
Normally the pump is fitted with two identical cartridge mechanical seals.
In certain cases there may, however, be differences. We recommend that parts are always marked before dismantling.
The Appendix in the Operating Instructions contains a detailed description of the cartridge mechanical seal.

- Fix the rotating part of the cartridge mechanical seal (GLRD) axially with the stationary part. For this purpose, a fixing clamp (FB) (or similar construction) is provided on the stationary part (see sectional drawing).
- Loosen nuts (M3) and screws (S9), cartridge mechanical seal (GLRD) should move freely
- Dismantle pump as described in Point 3 (replacing roller bearings).
- Remove bearing cap (12), spacer sleeve (72) and splash ring (73).
- Slide off cartridge seal (without shaft protective sleeve) (44).
- Take out feather key (PF3) and slide off shaft protective sleeve (44). Remove O-ring (OR4).
- Clean all parts and check for wear. Mechanical seals must always be replaced. Repairing mechanical seals is only recommended with specialist training. Worn cartridge seal parts can be replaced or repaired by the manufacturer.

Assembly

- Always use a lubricant when mounting the mechanical seal (e.g. silicon grease). Do not use mineral grease or oil if you are not absolutely certain that the O-ring is resistant to it.
- Slide on the O-ring (OR4) and apply lubricant (e.g. Silicon grease) with a brush.
- Lubricate the shaft protective sleeve (44) in the borehole so that the O-ring groove remains clean (start approx. 10-15mm inside). Standard O-rings made of EP rubber are not resistant to mineral oils or greases and must not come into contact with them. Once resistance has been ascertained (e.g. beef dripping as lubricating agent or oil resistant O-rings) the entire shaft may be lubricated (24)
- Slide on the shaft protective sleeve (44). When sliding on the shaft protective sleeve take care that the O-ring can slide easily into the groove.
- Slide on cartridge mechanical seal (GLRD) but do not screw on tightly (M3 and S9 remain loose).
- Insert feather key (PF3) and slide on the spacer sleeve (72). Pump must be assembled in the following direction.



- Slide on splash ring (73) and bearing cap (12)
- For further assembly work see Point 3 (Replacing Roller Bearings) "Assembly".
- Finally tighten the nuts (M3) and then the screws (S9) (must be done in this order). Bring fixing clamp (FB) in its original position.
- Rotate shaft (24) to see that it runs smoothly.

8.8 Dismantling

8.8.1 Model MPA, MPAI (axial intake pipe)

See "Appendix" in Operating Instructions for sectional drawing

If the whole pump is to be dismantled for maintenance work, the pump should be placed in a vertical position (intake pipe facing upwards). A workbench with a hole (approx. 10 mm larger than the shaft) is very helpful in such cases.
MPA 40, MPAI 40, MPA 65 and MPAI 65 can be placed on the coupling protection adapter (95). Stand MPA 100, MPAI 100 and MPA 125, MPAI 125 vertically with an additional support.
A hoist or a second person is required for dismantling type MPA 100, MPAI 100 and MPA 125, MPAI 125 pumps.


Secure the pump so that it cannot fall over.


This description does not include dismantling the mechanical seal. Read the instructions for "Replacing the Shaft Seal" before dismantling the pump in order to carry out any necessary preparations in good time.

- Loosen nuts (M1) and remove casing anchor (25).
- Remove suction casing (3) and take out O-ring (OR1).

Model MP:
- Loosen impeller nuts (28), remove washer (29).

Model MPAI (Sizes 40.1 and 40.2)
- Screw off the inducer (101), thereby fix the shaft on the coupling against twist.

Model MPAI (Sizes 65.1, 65.2, 100.1, 100.2, 125.1 and 125.2)
- Loosen impeller nuts (28), remove washer (29).
- Remove the inducer (101) and take out the key (PF5).
- Dismantle impeller (1) and diffuser (2), take out feather key (PF1). Mark all parts for assembly.
- Remove inside bearing housing (54) and bearing sleeve (23).
- Dismantle pump in stages down to the pump casing
- Turn over the remaining part of the pump (bearing flange (10) faces upward), axially secure shaft (24) (use a support so that it cannot slip).)
- Move back splash ring (73)
- Unscrew nuts (M2) and nuts (M5), pull the bearing cap (12) off the bearing flange (10).
- Remove bearing flange (10) (lightly tapping the bearing flange (10) facilitates removal)
- Unscrew shaft nut (50) (sickle spanner), the shaft nut has a securing device to prevent it from coming loose.
- If this securing device is no longer adequate, the nut must be replaced.
- Remove roller bearing (K1) with withdrawing screw.
- Remove spacer sleeve (72), bearing cap (12) and splash ring (73), pull out feather key (PF3).
- Removing the shaft seal: See "Replacing the Shaft Seal".
- Clean all parts. If the pump is to be reassembled at a later date, carefully store all parts and protect from corrosion.

8.8.2 Model MP (bearings on both sides)

See "Appendix" in Operating Instructions for sectional drawing.

If the whole pump is to be dismantled for maintenance work, the pump should be placed in a vertical position (intake pipe facing upwards). A workbench with a hole (approx. 10 mm larger than the shaft) is very helpful in such cases.
MPA 40 and MP65 can be placed on the coupling protection adapter (95). Stand MPA 100 and MPA 125 vertically with an additional support.
A hoist or a second person is required for dismantling type MPA 100 and MPA 125 pumps.


Secure the pump so that it cannot fall over.


This description does not include dismantling the mechanical seal. Read the instructions for "Replacing the Shaft Seal" before dismantling the pump in order to carry out any necessary preparations in good time.

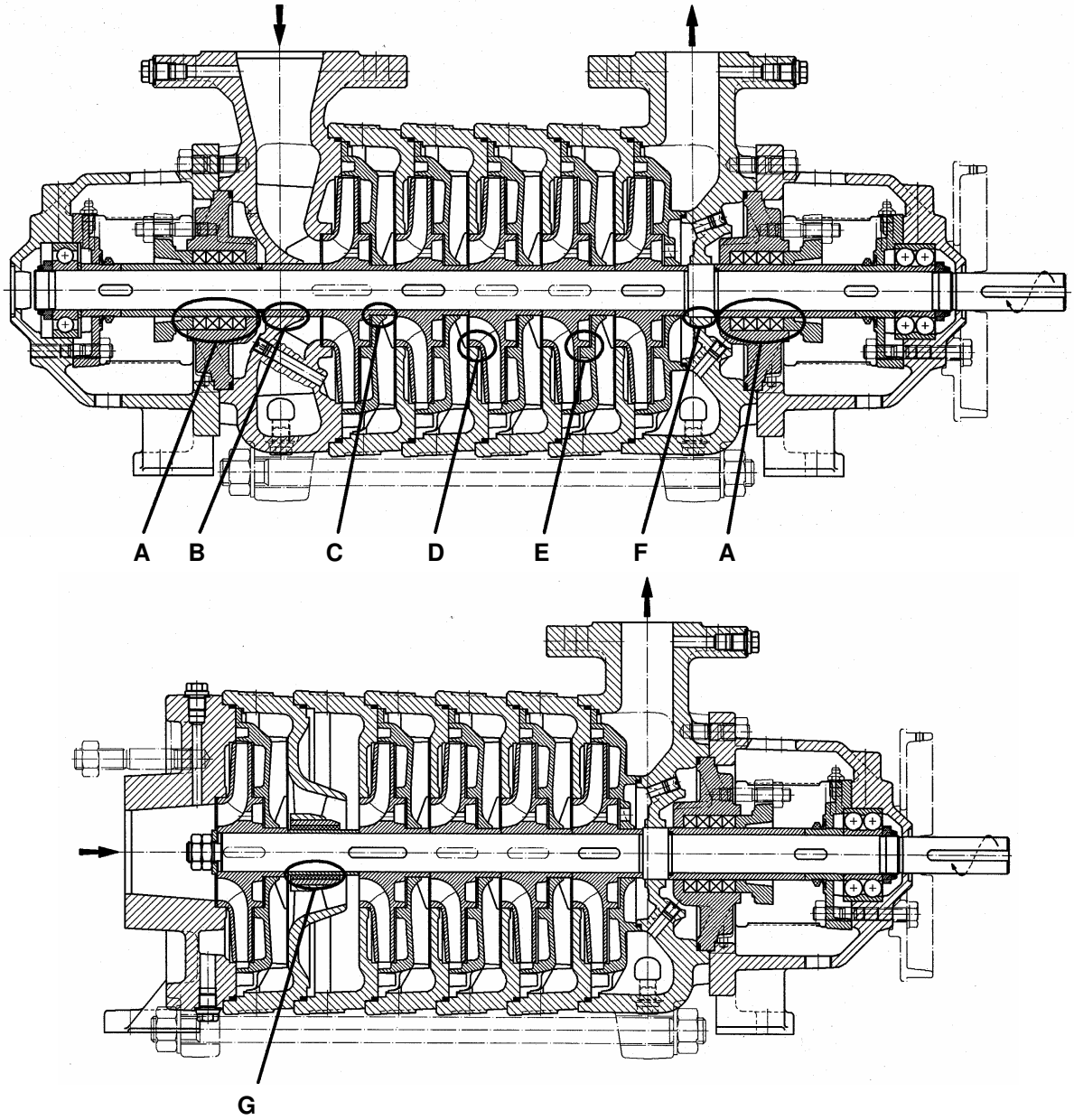
- Move back the splash ring (73).
- Unscrew nuts (M2) and nuts (M5), pull the bearing cap (12) off the bearing flange (10).
- Remove bearing flange (10) (tapping the bearing flange lightly in an axial direction (10) facilitates removal).
- Unscrew shaft nut (50) (sickle spanner). The shaft nut has a securing device to prevent it coming loose. If this securing device is no longer adequate, the nut must be replaced.
- Remove roller bearing (K2) with withdrawing screw.
- Remove spacing washer (SS) and spacer sleeve (72)
- For removal of the shaft seal see: "Replacing Shaft Seal".
- Loosen nuts (M1) and remove casing anchor (25).
- Remove suction casing (3) and take out O-ring (OR1). Remove sleeve (38).
- Remove impeller (1) and diffuser (2), take out feather key. Mark all parts for assembly.
- Remove stage casing (60).
- Dismantle pump in stages down to the pump casing
- Turn over the remaining part of the pump (bearing flange (10) faces upward), axially secure shaft (24) (use a support so that it cannot slip).
- Move back splash ring (73)
- Unscrew nuts (M2) and nuts (M5), pull the bearing cap (12) off the bearing flange (10).
- Remove bearing flange (10) (lightly tapping the bearing flange (10) facilitates removal)
- Unscrew shaft nut (50) (sickle spanner). The shaft nut has a securing device to prevent it from coming loose.
- If this securing device is no longer adequate, the nut must be replaced.
- Remove roller bearing (K1) with withdrawing screw.
- Remove spacer sleeve (72), bearing cap (12) and splash ring (73), pull out feather key (PF3).

- Removing the shaft seal: See "Replacing the Shaft Seal".
- Clean all parts. If the pump is to be reassembled at a later date, carefully store all parts and protect from corrosion.

8.9 Repairs

Clean all parts and check for wear. In case of excessive wear, parts must be replaced. This is a practical opportunity to renew parts such as seals (O-rings), roller bearings and shaft seals.

Wearing parts and dimensions:



Models		Area A				Area B				Area C				Area D				Area E				Area F				Area G			
		Gap between shaft protective shaft sleeve (44) and packing box gland (69)				Gap between sleeve (38) and suction casing				Gap between impeller hub (1) and peeler (2, 2E)				Gap between impeller (1) and casing (3) and stage casing (60)				Gap between impeller (1) and peeler (2, 2E)				Gap between pump shaft (24) and pressure casing (4)				Gap between bearing sleeve (23) and bearing bush (21)			
	Code	all models				111, 211, 311, 411, 141, 341, 151, 351, 262, 462				111, 211, 311, 141, 341, 151, 351, 262				111, 211, 311, 411, 141, 341, 151, 351, 262, 462				111, 211, 311, 411, 141, 341, 151, 351, 262, 462				111, 211, 311, 411, 141, 341, 151, 351, 262, 462				all models			
	Pump size	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap
			min.	max			min.	max			min.	max			min.	max			min.	max			min.	max			min.	max	
MP , MPA	40	40	0,20	0,25	0,80	40	0,10	0,15	0,50	38	0,15	0,20	0,50	85	0,15	0,20	0,50	85	0,15	0,20	0,50	40	0,10	0,15	0,50	35	0,050	0,08	0,125
	65	45	0,20	0,25	0,80	47	0,15	0,20	0,55	45	0,15	0,20	0,50	105	0,15	0,20	0,50	105	0,15	0,20	0,50	45	0,10	0,15	0,55	40	0,050	0,08	0,125
	100	55	0,20	0,25	0,80	55	0,15	0,20	0,55	52	0,15	0,20	0,50	135	0,15	0,20	0,50	135	0,15	0,20	0,50	52	0,15	0,20	0,55	45	0,050	0,08	0,125
	125	65	0,20	0,25	0,80	65	0,20	0,25	0,60	65	0,15	0,20	0,50	170	0,15	0,20	0,50	170	0,15	0,20	0,50	62	0,20	0,25	0,60	60	0,075	0,100	0,150
	Code					532				411, 462, 532				532				411, 462, 532				532							
	Pump size					Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap	Nominal diameter	Gap "new"		Max. permissible gap				
							min.	max			min.	max			min.	max			min.	max			min.	max					
	40					40	0,25	0,30	0,50	38	0,30	0,35	0,50	85	0,3	0,35	0,5	85	0,3	0,35	0,5	40	0,25	0,30	0,50				
	65					47	0,30	0,35	0,55	45	0,30	0,35	0,50	105	0,3	0,35	0,5	105	0,3	0,35	0,5	45	0,25	0,30	0,55				
	100					55	0,30	0,35	0,55	52	0,30	0,35	0,50	135	0,3	0,35	0,5	135	0,3	0,35	0,5	52	0,30	0,35	0,55				
	125					65	0,35	0,40	0,60	65	0,30	0,35	0,50	170	0,3	0,35	0,5	170	0,3	0,35	0,5	62	0,30	0,35	0,60				

A number of methods can be used for repair work. Depending on the area (A to G) the following methods can be used. In certain cases, it is better to use new parts.

"A": Reworking the outer diameter (levelling), the gap width should not exceed the value stated in the table. The new surface should be as fine as possible (grind). Polish the surface using a grinding belt.

"B": New Part (only use original parts)

"C": .) ..... Replace impeller (only use original parts)
.) ..... Turn away impeller hub and make an appropriate spacer sleeve (take care with material selection)
It might be necessary to rework the bore in the diffuser

"D": .) ..... Replace impeller (only use original parts)
.) ..... Rework seal (level), hollow out casing and insert ring (split ring).

"E": .) ..... Replace impeller (only use original parts)
.) ..... Rework seal (level), hollow out casing and insert ring (split ring).

"F": The precise gap width in this area is only necessary in special cases (shaft seal with discharge line). In normal cases, the gap width is unimportant. The value specified in the table may be exceeded.

"G": New parts (only use original parts)
Bearing play has a direct influence on the smooth running of the pipe. If pump oscillation rises perceptibly this can indicate that the bearing is worn.
When carrying out repairs always replace the bearing bush (23) and bearing sleeve (21).

9.Reassembly

9.1 Preliminary work

Assembling a pump consisting of new parts requires preliminary work. Therefore some of the following points might already have been carried out when the pump is reassembled. Always use the sectional drawing contained in the Appendix of the Operating Instructions.

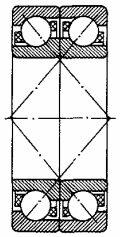
- Clean all components and remove any rust.
- Suction housing (3) (only for MP): Screw in and secure throttle part (DR).
- A bore with approx. 4mm diameter must be provided to ventilate the sealing chamber. Depending on the location of the lines of the suction casing, the bore must always be in the top position (use one of the three depressions cast)
- Screw in stud bolts (S2)
- Pressure casing (4): Code "P" Screw in and secure screw plugs (V2)
- Code "SA,SB etc." Screw in and secure throttle part (DR) (use correct bore)
- Screw in stud bolts (S2)
- Stuffing box casing (19): Hammer in pin (S4)
- Screw in stud bolts (S3)
- Sealing cap (18): Hammer in pin (S4) and pin (S7) (if present)
- Bearing flange (10): Screw in stud bolts (S5)
- Bearing cap (12): Screw in lubricating nipple (G)
- Inside bearing casing (54): Press in bearing bush (21)

9.2 Model MPA, MPAI (axial intake lines)

See "Appendix" in Operating Instructions for sectional drawing.

All parts must be cleaned, free of grease and prepared in accordance with Point 9.1.

- Clamp the shaft in a vertical position (24) (use soft protective wedges), with coupling stub pointing upwards.
- Other assembly work depends on the type of shaft seal, see Points 4.1 to 4.3, Section Assembly.
- Attention: In contrast to the description in Points 4.1 to 4.3, the casing of the shaft seal is exposed.
- Proceed carefully in order to avoid damage to the mechanical seal (GLRD).
- Preheat bearing (K1) (max. 80°C) and slide onto the shaft (24).
  Variants: MP, MPA, MPAI 40 and 65 .....roller bearing (K1) – double row angular ball bearings (single bearings)
  MP, MPA, MPAI 100 and 125 ....roller bearing (K1) – paired angular ball bearings in X arrangement



Paired angular ball bearings in X arrangement

- Tighten shaft nut (50) while the bearing is still hot.
- Fill approx. 60% of the space in the roller bearing (K1) with grease (when the bearing has cooled down)
- Mount bearing flange (10), at the same time insert shaft seal casing (18 and 19).
- Screw bearing cap (12) to bearing flange (10).
- Grease the counter contact surface of the splash ring packing on the bearing cap (12).
- Bring the splash ring (73) into position (groove in the spacer sleeve) (72).
- Lay pressure casing (4) horizontally so that the shaft can be inserted (24) (mounting plate with borehole or assembling trestle)
- Place pre-mounted unit on the pressure casing (4) and tighten nuts (M2) (see Supplementary Sheet for torque)
- Rotate shaft (24) to see that it runs smoothly.
- The pump must be turned around for further assembly work (free shaft pointing upwards vertically)
- Assembly as for dismantling.
- Lubricate shaft (24)
- Check position of the impeller: Insert diffuser (2/E), slide impeller (1) until impact.
- The impeller is in the correct position when the impeller outlet channel lies within the diffuser intake channel
- (avoids impact losses). Corrections can be carried out by adding compensation disks or by turning off the impeller hub on the rear side. This check must be carried out at every stage.
- If a pump is assembled with new impellers, care must be taken that the first and last stage is always provided with an impeller with the full blade diameter. If only one impeller is available with the full blade diameter it must be used as the first stage.

Please note that assembly work always starts with the final stage.

- Remove impeller and diffuser once more, insert O-ring (OR2), re-insert diffuser (2/E).
- Insert feather key (PF1 or PF2) for the impeller that is to be mounted.
- Mount impeller (1) (as the O-ring (OR2) presses on the diffuser (2/E) the setting will not be correct at first).
- Generously grease O-ring (OR1) with silicon grease and stage casing (60). Do not twist O-ring.
- Place stage casing (60) on level and force down sharply. Hit with a plastic hammer until it impacts.
- Assemble pump down to the inside bearing casing (54).
- Slide on bearing sleeve (23), lubricate bearing surface.
- Mount inside bearing casing (54) with bearing bushing (21) as for stage casing.
- Mount first stage of the pump, secure impeller (1) with washer (29) and nuts (28).
- Tighten first nut (28) securely, then turn back by ¼ turn and secure with counter nut.
- Mount suction casing (3) with O-ring (OR1), pull pump with casing armature (25) and nuts (M1) together slightly.
- Align bearing surface of pump feet (place pump on a flat surface).
- Tighten nuts (M1), see table in Appendix for torque.
- Rotate shaft (24) to see that it runs smoothly.

Model MP:

- Put off the impeller (1) with washer (29).
- Tighten first nut (28) securely, then turn back by ¼ turn and secure with counter nut.

Model MPAI (Sizes 40.1 and 40.2)

- Screw on the inducer (101), thereby fix the shaft on the coupling against twist.

Model MPAI (Sizes 65.1, 65.2, 100.1, 100.2, 125.1 and 125.2)

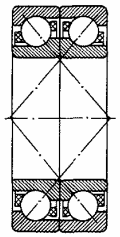
- Insert the key (PF5) and put the inducer (101) off.
- Insert the washer (29).
- Tighten first nut (28) securely, then turn back by ¼ turn and secure with counter nut.
- Mount suction casing (3) with O-ring (OR1), pull pump with casing armature (25) and nuts (M1) together slightly.
- Align bearing surface of pump feet (place pump on a flat surface).
- Tighten nuts (M1), see table in Appendix for torque.
- Rotate shaft (24) to see that it runs smoothly.

9.3 Model MP (bearings on both sides)

See "Appendix" in Operating Instructions for sectional drawing.

All parts must be cleaned, free of grease and prepared in accordance with Point 9.1.

- Clamp the shaft in a vertical position (24) (use soft protective wedges), with coupling stub pointing upwards.
- Other assembly work depends on the type of shaft seal, see Points 4.1 to 4.3, Section Assembly.
- Attention: In contrast to the description in Points 4.1 to 4.3, the casing of the shaft seal is exposed.
- Proceed carefully in order to avoid damage to the mechanical seal (GLRD).
- Preheat bearing (K1) (max. 80°C) and slide onto the shaft (24).
  Variants: MP, MPA 40 and 65 .....roller bearing (K1) – double row angular ball bearings (single bearings)
  MP, MPA 100 and 125 ....roller bearing (K1) – paired angular ball bearings in X arrangement



Paired angular ball bearings in X arrangement

- Tighten shaft nut (50) while the bearing is still hot.
- Fill approx. 60% of the space in the roller bearing (K1) with grease (when the bearing has cooled down)
- Mount bearing flange (10), at the same time insert shaft seal casing (18 and 19).
- Screw bearing cap (12) to bearing flange (10).
- Grease the counter contact surface of the splash ring packing on the bearing cap (12).
- Bring the splash ring (73) into position (groove in the spacer sleeve) (72).
- Lay pressure casing (4) horizontally so that the shaft can be inserted (24) (mounting plate with borehole or assembling trestle)
- Place pre-mounted unit on the pressure casing (4) and tighten nuts (M2) (see Supplementary Sheet for torque)
- Rotate shaft (24) to see that it runs smoothly.
- The pump must be turned around for further assembly work (free shaft pointing upwards vertically)
- Assembly as for dismantling.
- Lubricate shaft (24)
- Check position of the impeller: Insert diffuser (2/E), slide impeller (1) until impact.
- The impeller is in the correct position when the impeller outlet channel lies within the diffuser intake channel
- (avoids impact losses). Corrections can be carried out by adding compensation disks or by turning off the impeller hub on the rear side. This check must be carried out at every stage.
- If a pump is assembled with new impellers, care must be taken that the first and last stage is always provided with an impeller with the full blade diameter. If only one impeller is available with the full blade diameter it must be used as the first stage.

Please note that assembly work always starts with the final stage.

- Remove impeller and diffuser once more, insert O-ring (OR2), re-insert diffuser (2/E).
- Insert feather key (PF1 or PF2) for the impeller that is to be mounted.
- Mount impeller (1) (as the O-ring (OR2) presses on the diffuser (2/E) the setting will not be correct at first.
- Generously grease O-ring (OR1) with silicon grease and stage casing (60). Do not twist O-ring.
- Place stage casing (60) on level and force down sharply. Hit with a plastic hammer until it impacts.
- Assemble pump down to the suction casing (3)
- Slide on sleeve (38), mount suction casing (3) with O-ring (OR1), take care that the lines are in the correct position.
- Further assembly work depends on the type of the shaft seal. See Point 4.1 to 4.3 Section Assembly

"Assemble" bearings according to Point 3 (Replacing Roller Bearings).

10. Spare Parts, Spare Pumps

10.1 Spare Parts

Spare parts should be selected to last for two-years continuous operation. If no other guidelines are applicable, we recommend that you stock the number of parts listed below (in accordance with DIN 24296).

To ensure optimum availability, we recommend that suitable quantities of spare parts are held in stock, especially if these are made from special materials and in the case of mechanical seals, because of the longer delivery times.

	Number of pumps (incl. stand-by pumps)						
	2	3	4	5	6/7	8/9	10/+
Spare Parts	Number of spare parts						
Impeller	i	i	i	2i	2i	3i	30%
Diffuser	i/2	i/2	i/2	i	i	3i/2	15%
Wear ring-casing	2i	2i	2i	4i	4i	6i	30%
Shaft with key and shaft screws/nuts	1	1	2	2	2	3	30%
Bearing (roller bearing)	1	1	2	2	2	3	30%
Shaft sleeve	2	2	2	3	3	4	50%
Packing rings	16	16	24	24	24	32	40%
Joints for pump casing sets	4	6	8	8	9	12	150%
other joints sets	4	6	8	8	9	10	100%
Mechanical seal	2	3	4	5	6	7	90%

i = number of stages

Ordering Spare Parts

When ordering spare parts, please supply the following information:

- Type: _____
- S/N (Order No.): _____
- Part name: _____
- Sectional Drawing _____

All the information is given in the data sheet or the confirmation of order and the relevant sectional drawing.

Store spare parts in dry and clean rooms!

10.2 Stand-by pumps

It is essential that a sufficient number of stand-by pumps are kept ready for use in plants where failure of a pump could endanger human life or cause damage to property or high costs. Regular checks should be carried out to ensure that such pumps are always ready for use (see chapter 6.8).

Store stand-by pumps according to chapter 6.8.

11. Faults - Causes and Solutions

The following notes on causes of faults and how to repair them are intended as an aid to recognising the problem. The manufacturer's Customer Service Department is available to help repair faults that the operator cannot or does not want to repair. If the operator repairs or changes the pump, the design data on the Confirmation of Order / Data Sheet and chapter 2 of these Operating Instructions should be particularly taken into account. If necessary, the written agreement of the manufacturer must be obtained.

Discharge too low	Discharge stops after a time	Head too low	Head too high	Drive mechanism overloaded	Pump not running quietly	Temperature in pump too high	Temperature in shaft sealing too high	Temperature at the bearing too high	Pump leaking	Leakage rate at shaft sealing too high	Cause	Solution
■											Back-pressure too high	check facility for pollution, open discharge valve reduce resistance in discharge pipe (e.g. clean filter if necessary) use larger impeller (note available motor power)
		■		■				■			Back-pressure too low, discharge too low	throttle discharge valve
			■	■							Speed too high	reduce speed compare speed of motor with specified pump speed (rating plate) when adjusting speed (frequency transformer) check reference value setting
■		■									Speed too low	increase speed (check available motor power) compare speed of motor with specified pump speed (rating plate) when adjusting speed (frequency transformer) check reference value settings
	■	■			■	■					Flow too little	increase min. flow (open discharge valve, bypass)
								■			Flow too big	reduce flow (throttle discharge valve)
			■	■							Impeller diameter too big	use smaller impeller
■		■									Impeller diameter too small	use larger impeller (check available motor power)
■		■			■	■					Pump and/or pipes not completely filled with liquid	fill vent
■	■	■									Pump or suction/intake pipe blocked	clean
■		■									Air pocket in pipeline	vent improve course of pipe
■	■	■			■	■					Suction height too big / NPSH of system too small	increase liquid level and admission pressure reduce resistance in the intake/suction pipe (change course and rated width, open shut-off valves, clean filters)
■	■	■									Air being sucked in	increase liquid level check if suction pipe is vacuum-tight
■	■	■									Air being sucked in through shaft sealing	clean sealing pipe increase sealing pressure replace shaft sealing
■		■									Direction of rotation is wrong	swap over two phases of power supply (to be done by an electrician)
■		■			■			■			Inner components suffering from wear	replace worn parts
■		■		■							Density and/or viscosity of liquid handled is too high	seek assistance
				■						■	Stuffing box not straight	tighten evenly
							■				Stuffing box is fastened too tight resp. shaft sealing is worn	loosen stuffing box replace packing and/or mechanical seal check sealing, flushing and cooling pipes (pressure) avoid dry running
							■			■	Lines and roughness on shaft or shaft sleeve	replace parts
							■			■	Unsuitable packing material	use suitable material (check shaft or shaft sleeve for damage beforehand)
							■			■	Deposits on mechanical seal	clean replace mechanical seal if necessary if necessary provide additional rinsing or quench
					■					■	Impeller out of balance	remove blocks/deposits replace impeller if broken or unevenly worn check shafts to ensure that they are running true
					■			■		■	Coupling not aligned	align pump unit better
					■			■			Coupling distance too small	change
				■	■			■	■	■	Forces in pipeline too high (pump unit under strain)	change (support pipes, use compensators, etc.) is foundation plate/frame properly cast in place?
								■			Too much, too little or the wrong type of lubricant	change
				■							Electricity supply not right (2-phase running)	check voltage of all phases check cable connections and fuses
									■		Sealing insufficient	tighten screws replace sealing
					■			■			Bearing damaged	replace check lubricant and bearing space for pollutants (rinse oil area)
								■			Relief fittings insufficient	clean relief openings in impeller replace worn parts (impeller, split rings) adjust in line with the system pressure/intake pressure given on ordering
					■						System-related vibrations (resonance)	seek assistance

12. Motor Operating Instructions Type DPIG, 2DPIG, DPIH, SEE

The following instructions must be followed exactly, to guarantee the safety at the installation, at the operation and at the maintenance of the motor. All persons should be directed to the present manual which are performing these tasks. The neglect of the instructions can cause the loss of the guarantee.

12.1 Validity

This operation manual is valid for the following motors:

Model DPIG, 2DPIG, DPIH, SEE
IEC-Sizes 56 - 355.

(Additional information may be required for some machine types due to special application and/or design considerations).

The exact designation of the motor are shown on the motor name plate and/or on the order confirmation.
For all other sizes or other makes look to the additional added operation manual of the motor supplier.

12.2 Preparatory inspection

12.2.1 Reception check

Check all rating plate data, especially voltage and winding connection (star or delta).

12.2.2 Insulation resistance check

Measure insulation resistance before commissioning and when winding dampness is suspected.
Resistance, measured at 25°C, shall exceed the reference value, i.e.

$Ri\ [M\Omega] \geq (20 \times U) / (1000 + 2P)$

where U = voltage [V]
P = output power [kW]

Windings should be discharged immediately after measurement to avoid risk of electric shock.

Insulation resistance reference value is halved for each 20°C rise in ambient temperature.
If the reference resistance value is not attained, VOGEL should be informed immediately.
In case there is too much dampness in the winding it needs to be dried.
When drying, the heating temperature should be 90°C for 12 - 16 hours; followed by a final drying process lasting 6 - 8 hours at 105°C.
Drain hole plugs, if fitted, must be removed during heating. Windings drenched in sea water normally need to be rewound.

12.3 Scope and limits of operation

12.3.1 Operating conditions

The machines are intended for use in industrial drive applications.
Normal ambient temperature limits -25°C to +40°C.
Maximum altitude 1000 m above sea level.

12.3.2 Safety considerations

The machine is intended to be installed and used by qualified persons only who are familiar with relevant safety requirements.
Safety equipment necessary for the prevention of accidents at the mounting and operating site shall be provided in accordance with the regulations prevailing in the local country.

The motors are not qualified for the use in dangerous rooms with gas or explosion hazardous materials.

Small motors with supply current directly switched by thermally sensitive switches can start automatically.

Points to observe

- the machine shall not be stepped on.
- the temperature of the outer casing of the machine may be hot to the touch during normal operation.
- some special machine applications require special instructions (e.g. using frequency converter).

12.3.3 Maximum number of starts per hour

The diagram in chapter 6.4.3 is valid for motors with more than 7,5 kW power of the models DPIG, 2DPIG, DPIH, SEE.

12.4 Starting up for the first time

12.4.1 Condensate drain holes ...

Standardized motors in the frame size 90-112 do not have drain holes. If necessary they have to be made facing downwards according to the frame size before mounting.

Be cautious not to damage the motor winding when drilling the drain holes.

Motors in the frame size 56-80 and 132-315 do have drain holes, which have to be opened from time to time depending on their conditions of use. If they are not facing downwards leave them closed and drill new ones.

12.4.2 Electric supply

For the connection to the electric circuit use a switch, which guarantees the complete separation of all phases from the circuit.

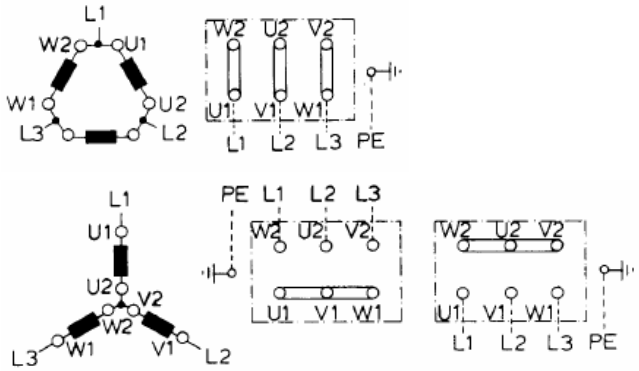
Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

All unused openings of the terminal box must get closed.
Connection diagrams for auxiliary elements are found inside the terminal box cover.
In frequency converter applications motor frame external grounding must be used for equalizing the potential between the motor frame and the driven machine, if the two machines are not mounted on the same metallic base. Use a flat conductor rather than round wire.

Direct-on-line or star/delta starting
The terminal box on standard single speed machines normally contains 6 winding terminals and at least one earth terminal.
Grounding shall be carried out according to local regulations before the machine is connected to the electric power supply.
The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL)
Y or Δ winding connections may be used.
e.g. 690 VY, 400 V Δ indicates Y-connection for 690 V and Δ-connection for 400V.

Star/Delta starting (Y/Δ)
The supply voltage must be equal to the rated voltage of the machine in Δ-connection.
Remove all connection links from the terminal block. For two-speed, single phase and special machines, supply connection must follow the instructions inside the terminal box.



Terminals and direction of rotation
Direction of rotation is counter-clockwise when viewing the shaft face at the machine drive end, when the line phase sequence L1, L2, L3 is connected to the terminals as shown on the connection diagram in the terminal box.
To alter the direction of rotation, interchange the connection of any two line cables.

The terminal box is located on top for the DPIG motors of the frame sizes 56-180 and the SEE motors of the frame size 315 and 355, while the terminal box location is on the right side looking to the shaft end for the DPIG motors of the frame sizes 200-355 creating easy cable entry possibilities.

Unused cable entries openings must be closed.
Besides the main winding and earthing terminals the terminal box can also contain connections for thermistors, standstill heating elements or bimetallic switches.

12.5 Assembly and dismantling

12.5.1 General
Dismantling and assembly of machines must be carried out by qualified persons using only suitable tools and working methods.

12.5.2 Bearings
Special care shall be taken with the bearings. Bearing shall be removed using pullers and fitted by heating or the use of specialized tools for the purpose.

12.6 Maintenance and lubrication

12.6.1 General inspection
- Inspect the machine at regular intervals.
- Keep the machine clean and ensure free ventilation air flow.
- Check the condition of shaft seals (e.g. V-ring) and replace if necessary.
- Check the condition of connections and mounting and assembly bolts.
- Check the bearing condition by listening for unusual noise, vibration measurement, bearing temperature, inspection of spent grease.

12.6.2 Lubrication
Machines with permanently greased bearings
Machines up to frame size 280 are normally fitted with permanently greased bearings of either 2Z or 2RS types.

Machines fitted with grease nipples for frame sizes 315 and above
Lubricate the machine while running.
If a grease outlet plug is fitted, remove temporarily when lubricating, or permanently with automatic lubrication.
If the machine is fitted with a lubrication information plate, follow the values given, otherwise use values as follows.

Speed [rpm]	lubrication interval [h]	time [months]
max. 1800	1500	6
above 1800	750	3

Speed [rpm]	lubrication interval [h]	time [months]
max. 1800	10000	24
above 1800	5000	12

The maintenance intervals are based on standard ambient conditions.

Life time of roller bearings:
approx. 20.000 hours for the frame size 56-180.

12.6.3 Bearing dimensions of the motors

frame size	bearing type
DPIG 56	6201 ZZ
DPIG 63	6202 2RS
DPIH 71	6203 2RS
DPIH 80	6204 2RS
DPIH 90 IMB3	6205 ZZ C3
DPIH 90 IMV1	6205 ZZ C3 6305 ZZ C3
DPIG 100 IMB3	6206 ZZ C3
DPIG 100 IMV1	6206 ZZ C3 6306 ZZ C3
DPIG 112	6306 ZZ C3
DPIG 132	6308 ZZ C3
DPIG 160	6309 ZZ C3
DPIG 180	6311 ZZ C3
DPIG 200	6212 ZZ C3
DPIG 225	6213 ZZ C3
2DPIG 225	6313 ZZ C3
DPIG 250	6215 ZZ C3
2DPIG 250	6315 ZZ C3
DPIG 280	6215 ZZ C3
2DPIG 280	6315 ZZ C3

12.6.4 Quantity of lubrication (g) according table

Frame size	Bearing type	Regreasing	Change of grease	Remarks
DPIG 315	6315 C3	30	170	2 polig
DPIG 315	6318 C3	40	260	4 - 8 polig
SEE 315	6315 C3	30	170	2 polig
SEE 315	6320 C3 6318 C3	50 40	300 260	4 - 8 polig
DPIG 355	6317 C3	30	300	2 polig
DPIG 355	6322 C3	65	585	4 - 8 polig
SEE 355	6217 C3	21	460	2 polig
SEE 355	6222 C3	38	460	4 - 8 polig

Regreasing with grease nipples - while the machine is running.

The table is prepared for horizontally mounted machines. Lubrication intervals for vertical machines are half of the above values.

The grease amount in the table given is used if small quantities of fresh grease are replaced at regular intervals as above.

As an alternative, when the machine is fitted with grease escape valves, fresh grease may be pressed into the bearings until the old grease is totally replaced.
The table values are based on 80°C bearing temperature. The values should be halved for every 15°C increase in bearing temperature.
If the maximum bearing temperature is 70°C, the table values may be doubled.

The maximum operating temperature of the grease and bearings must not be exceeded.

Higher speed operation, e.g. frequency converter applications, or slower speed with heavy load will require shortened lubrication intervals.
Typically a doubling of speed will require a reduction of lubrication intervals to approx. 40% of values tabulated above.
Suitability of bearings for high speed operation must also be checked.

Lubricants:
When regreasing, use only special ball bearing grease with the following properties:

- good quality lithium base or lithium complex grease
- base oil viscosity 100-140 cST at 40°C
- consistency NLGI grade 2 or 3
- temperature range -30°C - +120°C, continuously.

Greases with the correct properties are available from all the major lubricant manufacturers.
If the make of grease is changed and compatibility is uncertain, lubricate several times at short intervals in order to displace the old grease.
Highly loaded and/or slowly rotating bearings require EPgrease.
If lubrication intervals are short due to bearing temperatures of 80°C or above, use high temperature greases which normally permit approximately 15 K higher bearing temperatures.
If the ambient temperature is below -25°C consult the manufacturer regarding the possible use of low temperature grease.

NOTE
For high speed machines (e.g. larger 2-pole machines), check that the fn factor of the grease is sufficiently high.

fn = Dm x n

Dm = average bearing diameter (mm)
n = rotational speed (r/min)

Many greases can cause skin irritation and eye inflammation.
Follow all safety precautions specified by the manufacturer.

12.6.5 Spare parts

When ordering spare parts, the full type designation and product code as stated on the rating plate must be specified.
If the machine is stamped with a serial manufacturing number, this should also be given.

12.6.6 Noise levels

Smaller machines have a sound pressure level which does not exceed 70 dB(A).
The following table indicates the sound pressure level of all motor types of the frame sizes 56 - 355, 2 / 4 / 6 / 8 pole.

Guidline sound pressure level, dB(A)

Frame size	2 pole	4 pole	6 pole	8 pole
DPIG 56	60	49	50	-
DPIG 63	60	51	50	50
DPIH 71	60	56	52	50
DPIH 80	65	59	52	52
DPIH 90	65	58	58	53
DPIG 100	65	60	60	56
DPIG 112	67	65	60	56
DPIG 132	72	65	64	59
DPIG 160	72	65	65	61
DPIG 180	85	73	65	64
DPIG 200	78	69	65	63
DPIG 225	79	73	67	63
DPIG 250	81	75	68	66
DPIG 280	82	78	70	67
DPIG 315	82	82	70	70
SEE 415	90	90	84	87
DPIG 355	84	84	78	76
SEE 355	84	78	75	74

Values for specific machines can be found in the relevant product catalogues.
The table values refer to 50 Hz frequency of electric power supply.
For 60 Hz frequency of electric power supply, add 4 dB(A) to the above values.

12.6.7 Rewinding

Rewinding should always be carried out by qualified repair shops.

12.7 Faults - Causes and Solutions

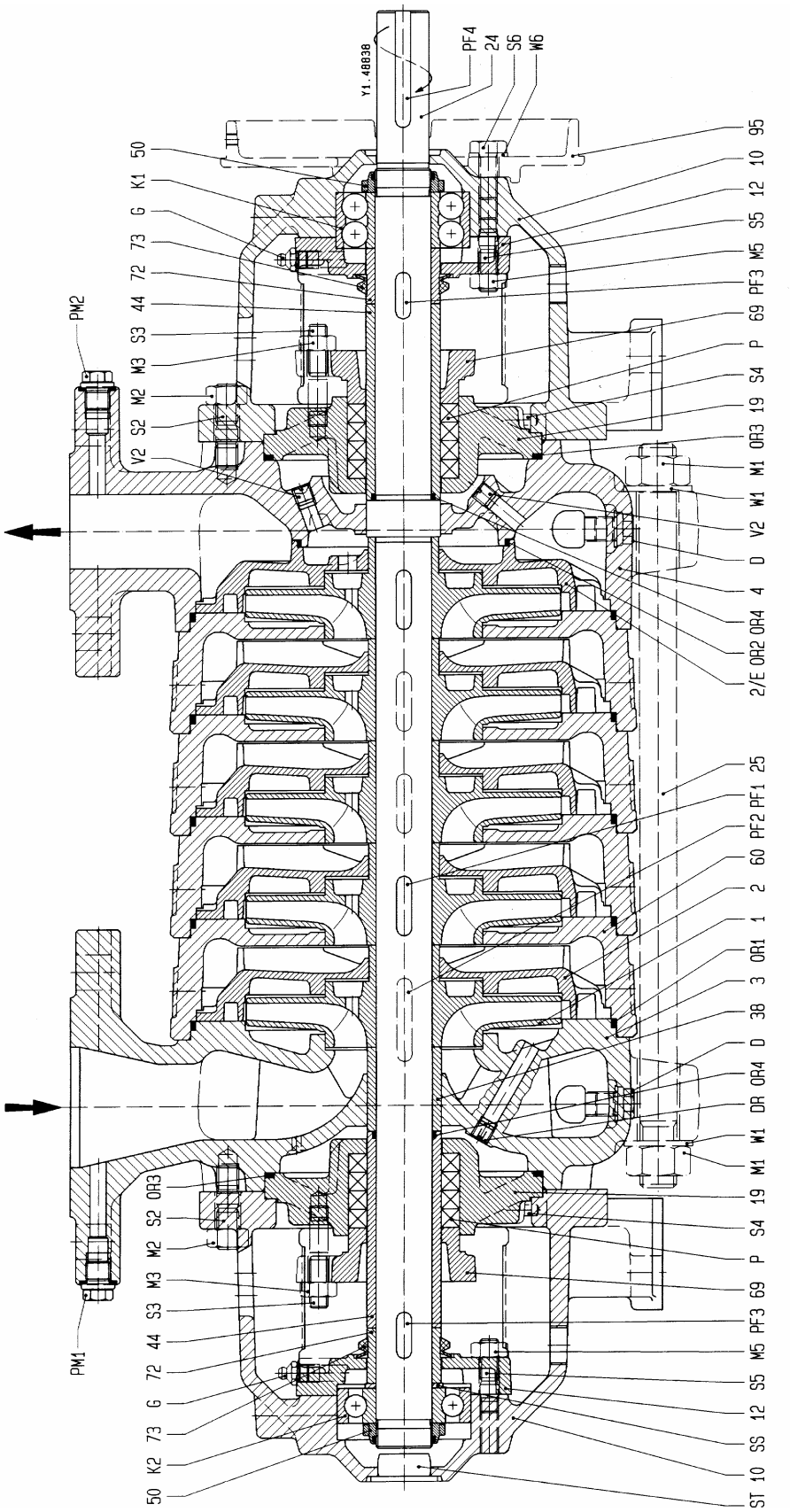
The following procedure cannot list all technical details or differences between the different motor models or all possible happening situations at the installation, the operation or at the maintenance.

Maintenance and elimination of errors on the motor must be performed by qualified persons and with qualified tools/instruments and resources.

Motor fails to start	Motor stalls	Motor runs and then dies down	Motor does not come up to speed	Motor takes too long to accelerate and/or draws high amp	Wrong rotation	Motor overheats while running underloaded	Motor vibrates	Scraping noise	Noisy operation	Hot bearings	Cause	What to do
■											Blown fuses	Replace fuses with proper type and rating.
■											Overload trips	Check and reset overload in starter.
■											Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
■											Improper line connections	Check connections with diagram supplied with motor.
■											Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also, ensure that all control contacts are closed.
■											Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
■											Short circuited stator	Indicated by blown fuses. Motor must be rewound.
■											Poor stator coil connection	Remove end bells, locate with test lamp.
■											Rotor defective	Look for broken bars or end rings.
■	■			■		■					Motor may be overloaded	Reduce load.
	■										One phase may be open	Check lines for open phase.
	■										Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	■										Open circuit	Fuses blown, check overload relay, stator and push buttons.
		■									Power failure	Check for loose connections to line, fuses and control.
			■								Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
			■								Starting load too high	Check load motor is supposes to carry at start.
			■								Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
			■								Open primary circuit	Locate fault with testing device and repair.
				■							Low voltage during start	Check for high resistance. Adequate wire size.
				■							Defective squirrel cage rotor	Replace with new rotor.
				■							Applied voltage too low	Get power company to increase power tap.
					■						Wrong sequence of phases	Reverse connections at motor or at switchboard.
						■					Frame or bracket vents may be clogged with dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor.
						■					Motor may have one phase open	Check to make sure that all leads are well connected.
						■					Grounded coil	Locate and repair.
						■					Unbalanced terminal voltage	Check for faulty leads, connections and transformers.
							■				Defective bearings	Replace bearings.
							■				Balancing weights shifted	Rebalance motor.
							■				Contradiction between balancing of rotor and coupling (half key - full key)	Rebalance motor.
							■				Polyphase motor running single phase	Check for open circuit.
							■				Excessive end play	Adjust bearing or add shim.
								■			Fan rubbing fan cover	Remove interference.
								■			Fan striking insulation	Clear fan.
									■		Airgap not uniform	Check and correct bracket fits or bearing.
									■		Rotor unbalance	Rebalance.
										■	Bent or sprung shaft	Straighten or replace shaft.
										■	Insufficient grease	Maintain proper quality of grease in bearing.
										■	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease.
										■	Excess lubricant	Reduce quantity of grease, bearing should not be more than 1/2 filled.
										■	Overloaded bearing	Check alignment, side and end thrust.
										■	Broken ball or rough races	Replace bearing, first clean housing thoroughly.

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

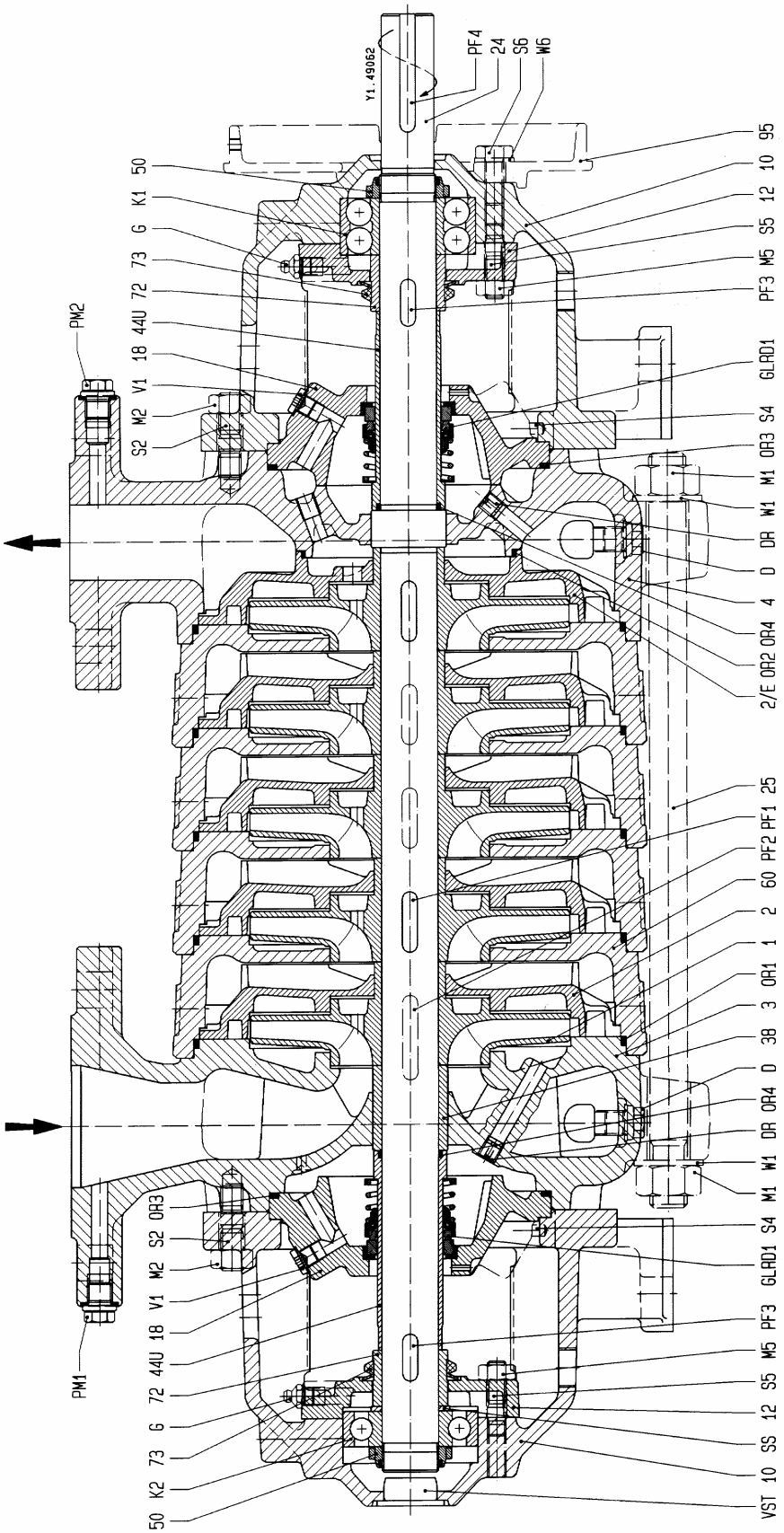
Wellenabdichtung:	Packungsstopfbuchse	Code...P
Etanchéité d'arbre:	presse-ètoupe	Code...P
Shaft seal:	stuffing box	Code...P



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
19	Stopfbuchsgehäuse	boîtier de presse-étoupe	stuffing box housing
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
69	Stopfbuchsbrille	fouloir	gland
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	raisseur	grease nipple
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M3	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
P	Stopfbuchspackung	garniture de presse-étoupe	gland packing
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S3	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V2	Verschlußschraube	bouchon filete	screwed plug
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

Wellenabdichtung:	Gleitringdichtung	Code...SA
Etanchéité d'arbre:	garniture mécanique	Code...SA
Shaft seal:	mechanical seal	Code...SA



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18	Dichtungsdeckel	couvercle d'etancheite	seal cover
24	Welle	arbre	shaft
25	Hülse	chemise d'arbre	sleeve
44U	Wellenschutzhülse	chemise d'arbre sous garniture	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD1	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
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OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
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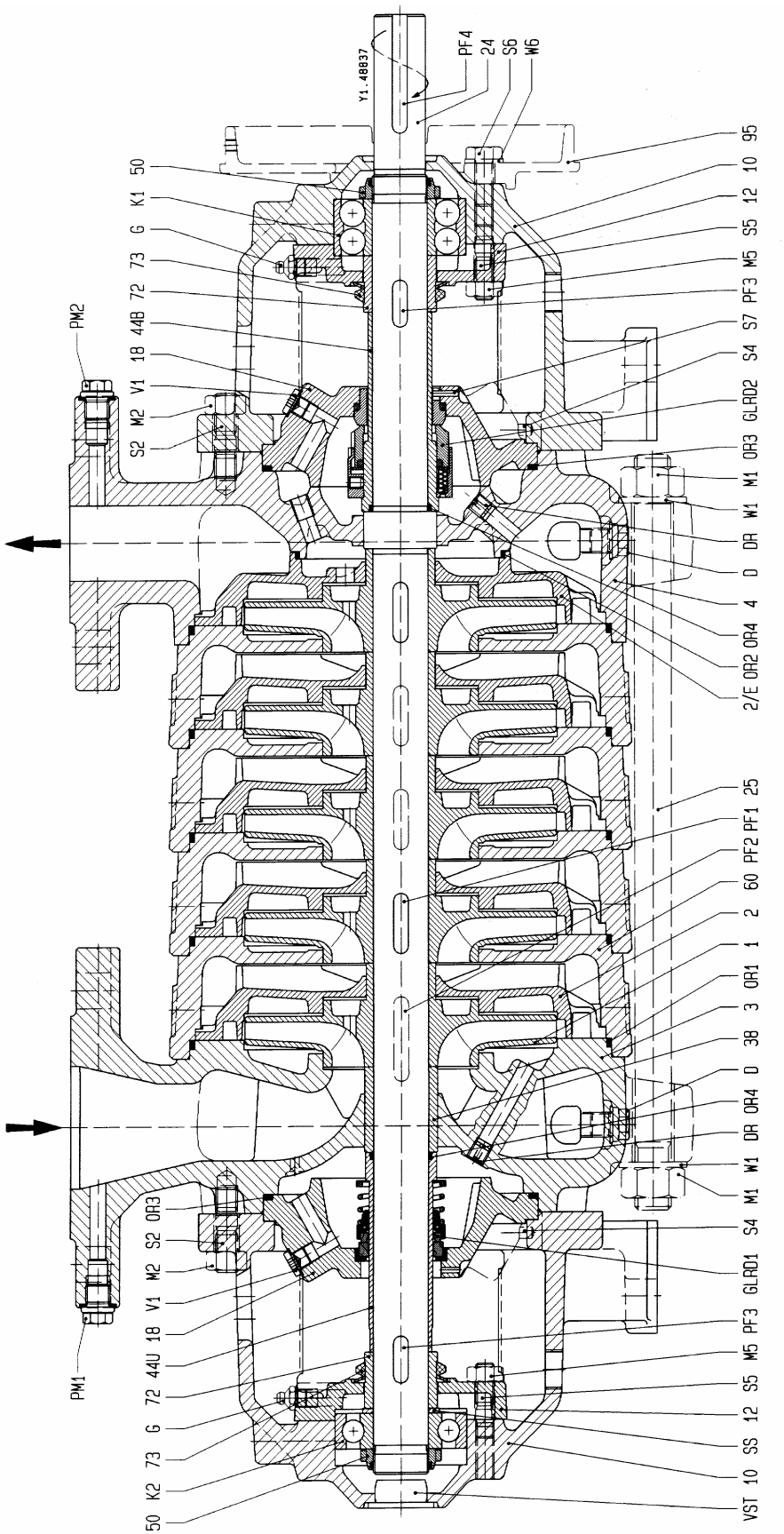
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V1	Verschlußschraube	bouchon filete	plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

Wellenabdichtung:	Gleitringdichtung	Code...SB, SD
Etanchéité d'arbre:	garniture mécanique	Code...SB, SD
Shaft seal:	mechanical seal	Code...SB, SD



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24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44B	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
44U	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
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OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
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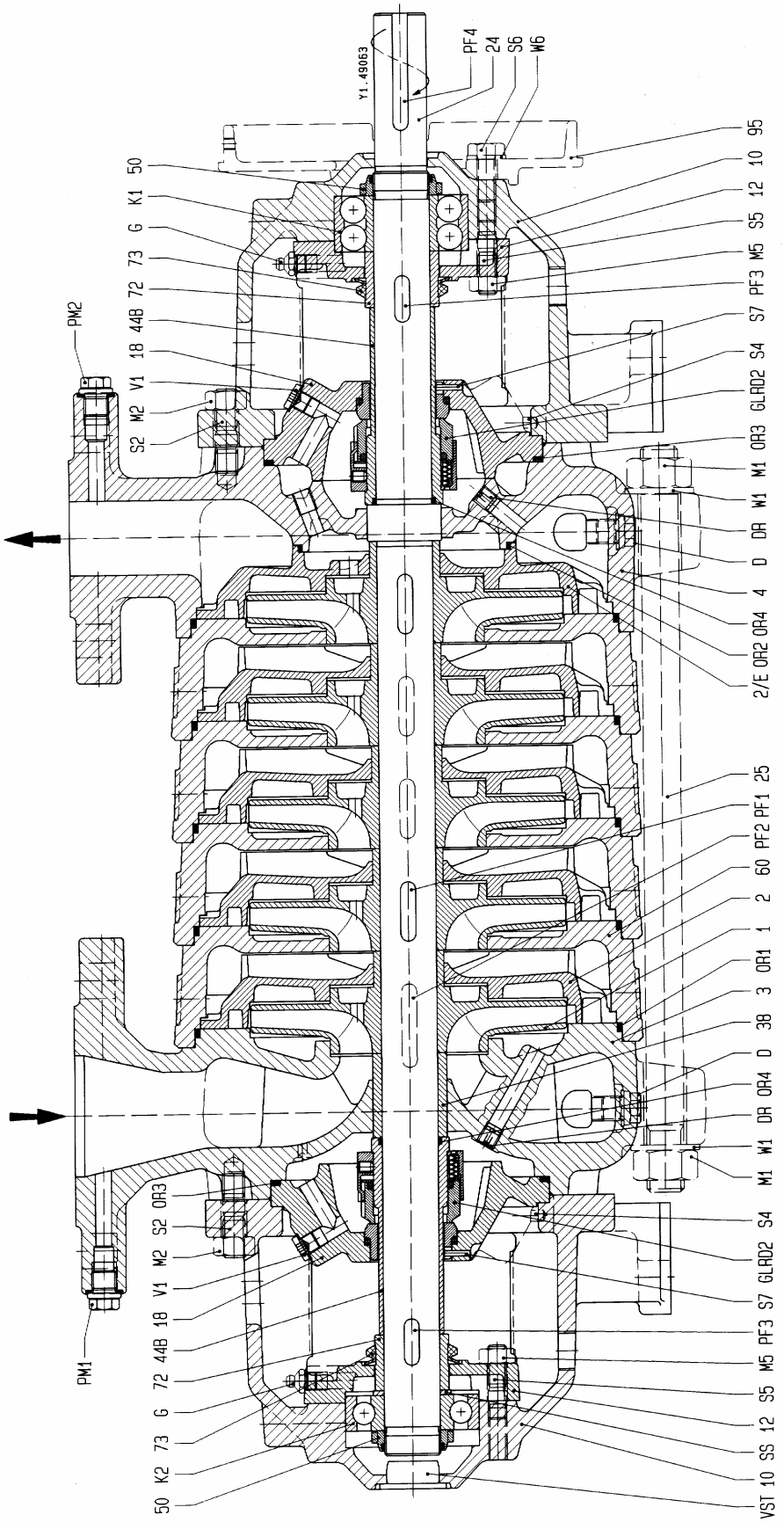
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V1	Verschlußschraube	bouchon filete	screwed plug
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

Wellenabdichtung:	Gleitringdichtung	Code...SC, SE, SF
Etanchéité d'arbre:	garniture mécanique	Code...SC, SE, SF
Shaft seal:	mechanical seal	Code...SC, SE, SF



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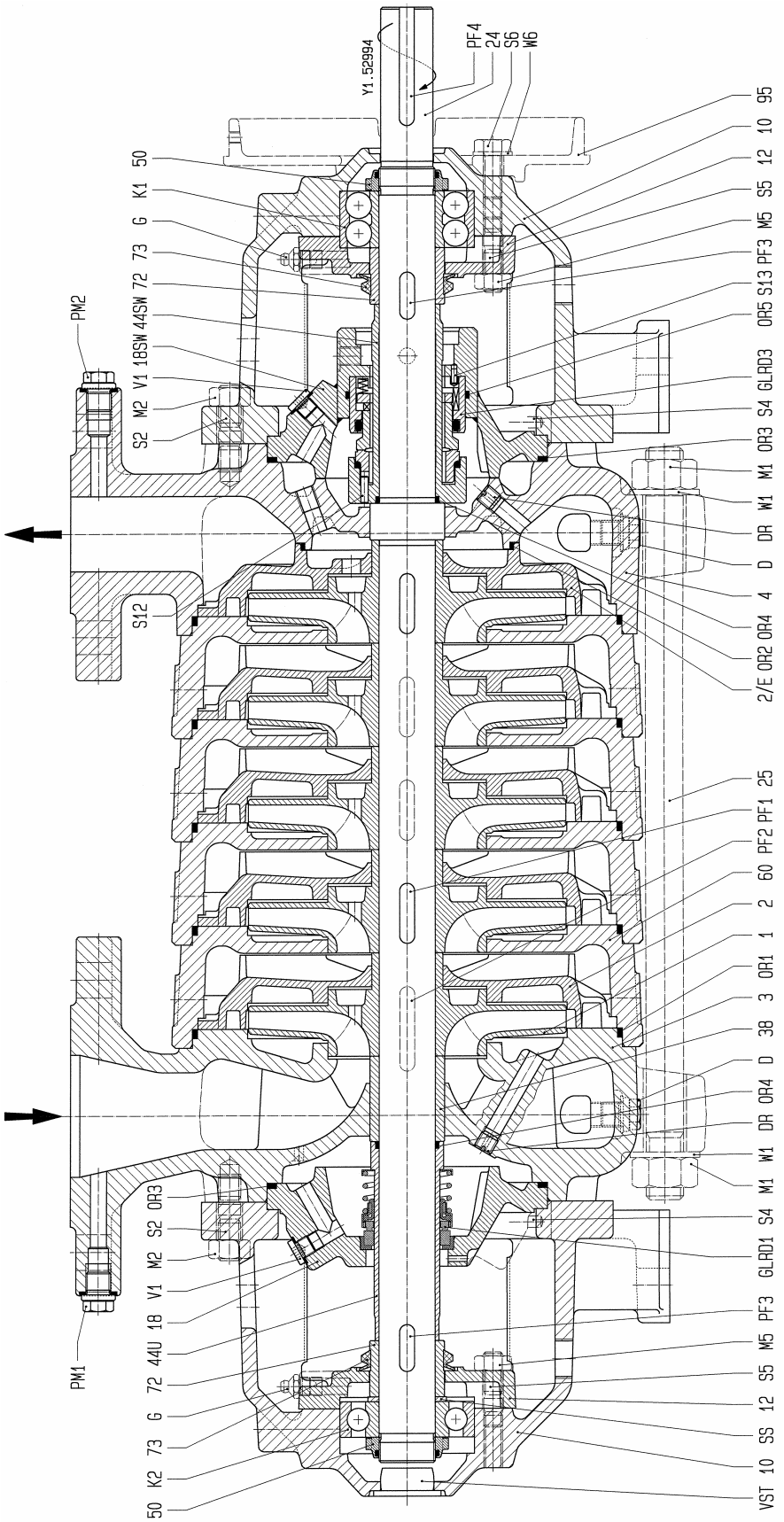
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD2	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V1	Verschlußschraube	bouchon filete	screwd plug
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

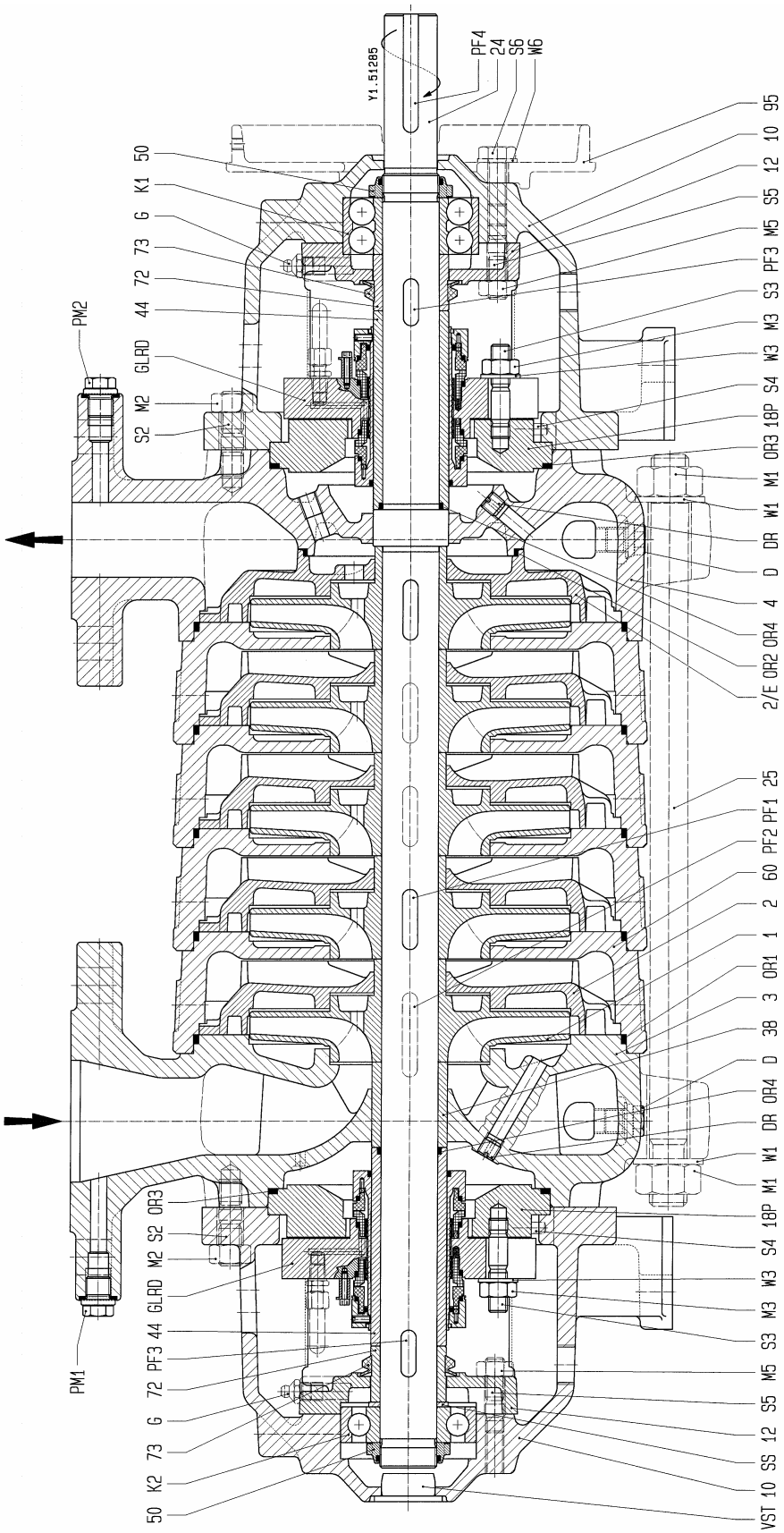
Wellenabdichtung:	Gleitringdichtung	Code...SW
Etanchéité d'arbre:	garniture mécanique	Code...SW
Shaft seal:	mechanical seal	Code...SW



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18	Dichtungsdeckel	couvercle d'etancheite	seal cover
18SW	Dichtungsdeckel	couvercle d'etancheite	seal cover
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44SW	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
44U	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	oupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD1	Gleitringdichtung	garniture mecanique	mechanical seal
GLRD3	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
OR5	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
S12	Stift	pointe	pin
S13	Stift	pointe	pin
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V1	Verschlußschraube	bouchon filete	screwd plug
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

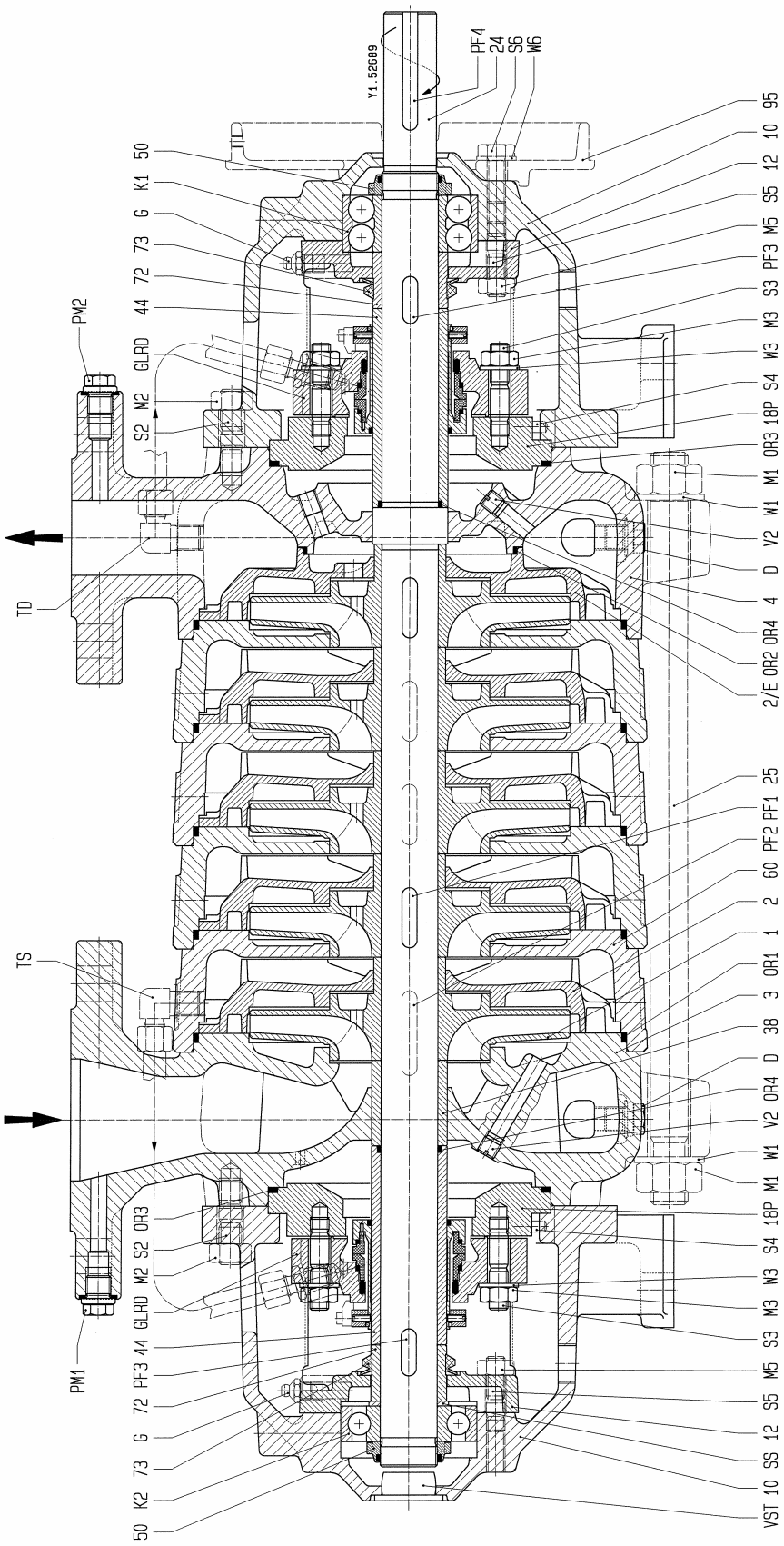
Wellenabdichtung:	Gleitringdichtung	Code...CD
Etanchéité d'arbre:	garniture mécanique	Code...CD
Shaft seal:	mechanical seal	Code...CD



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18P	Gehäusedeckel	couvercle de corps	casing cover
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	raisseur	grease nipple
GLRD	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M3	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S3	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
SS	Abstandscheibe	rondelle-entretoise	disc spacer
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W3	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

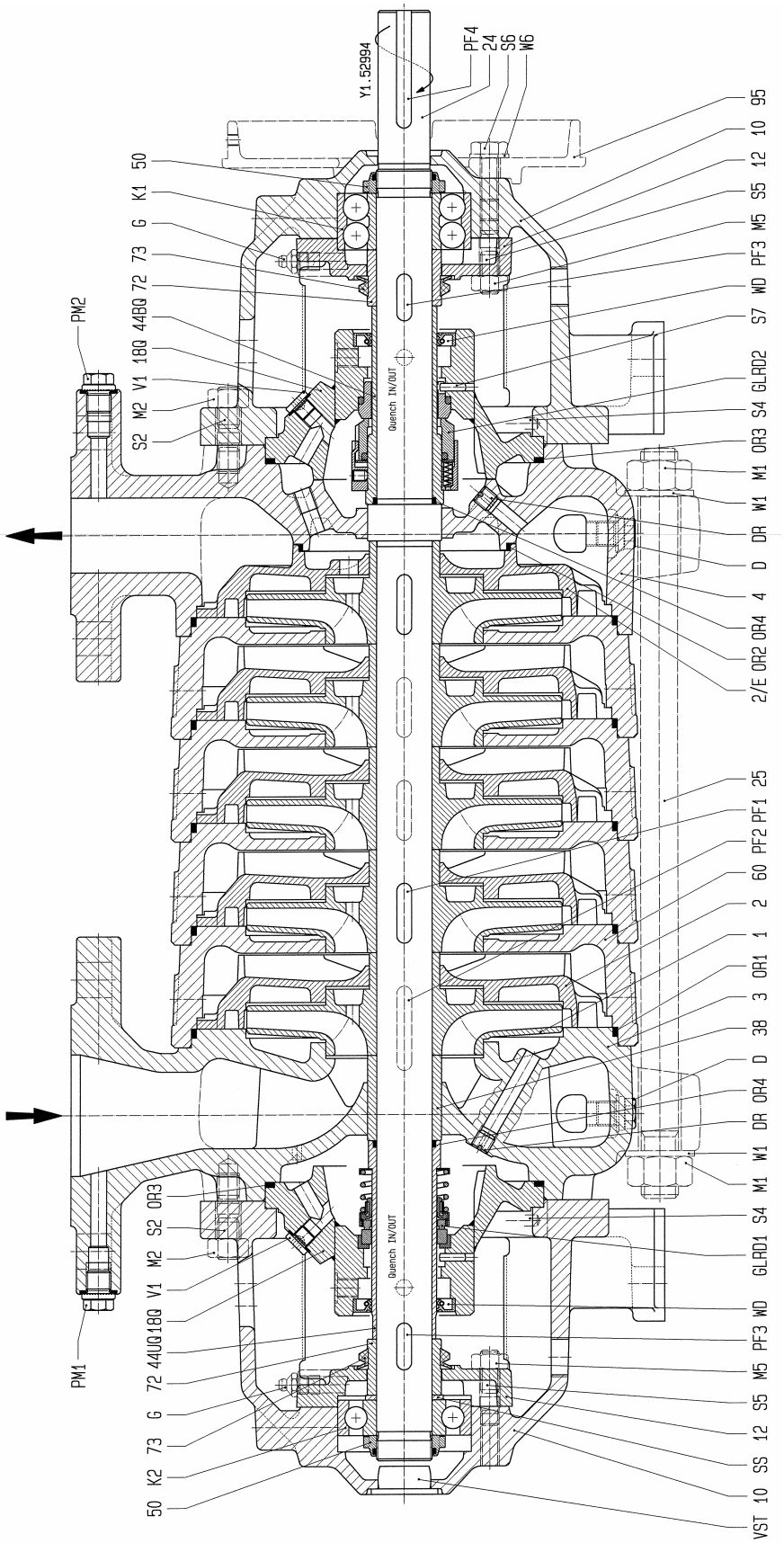
Wellenabdichtung:	Gleitringdichtung	Code...CS
Etanchéité d'arbre:	garniture mécanique	Code...CS
Shaft seal:	mechanical seal	Code...CS



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18P	Gehäusedeckel	couvercle de corps	casing cover
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
G	Schmiernippel	raisseur	grease nipple
GLRD	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M3	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S3	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
SS	Abstandscheibe	rondelle-entretoise	disc spacer
TS	Rohrleitung	tuyauterie	tubing
TD	Rohrleitung	tuyauterie	tubing
V2	Verschlußschraube	bouchon filete	screwed plug
VST	Verschlußstopfen	bouchon	plug
W1	Scheibe	rondelle	washer
W3	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

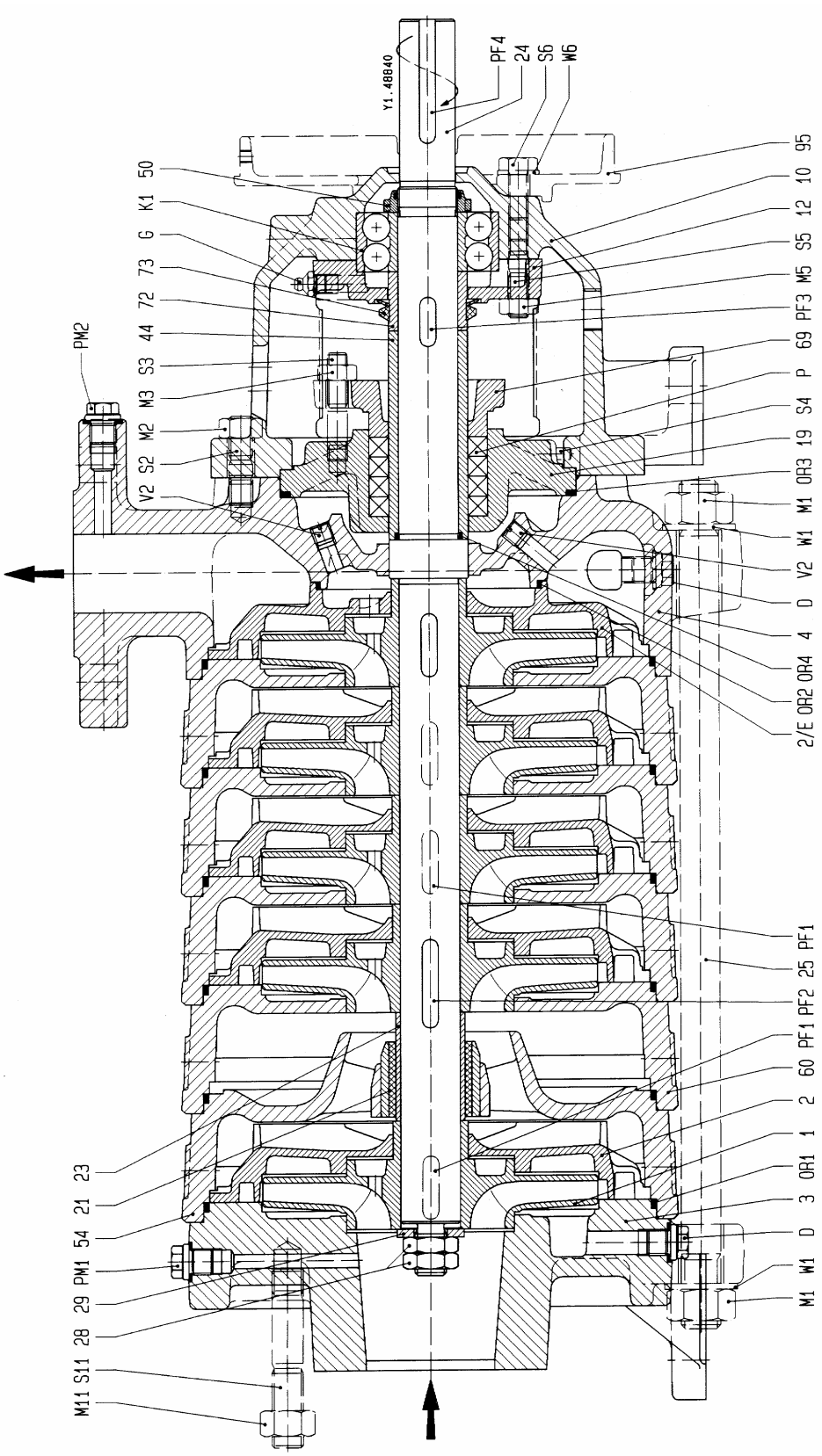
Wellenabdichtung:	Gleitringdichtung	Code...SBQ, SDQ
Etanchéité d'arbre:	garniture mécanique	Code...SBQ, SDQ
Shaft seal:	mechanical seal	Code...SBQ, SDQ



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18Q	Dichtungsdeckel	couvercle d'etancheite	seal cover
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
38	Hülse	chemise d'arbre	sleeve
44BQ	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
44UQ	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD1	Gleitringdichtung	garniture mecanique	mechanical seal
GLRD2	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
K2	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M5	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
SS	Abstandscheibe	rondelle-entretoise	disc spacer
V1	Verschlußschraube	bouchon filete	screwed plug
VST	Verschlußstopfen	bouchon	plug
WD	Wellendichtring	bague d'etanchéité d'arbre	Shaft seal ring
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MPA40.2, MPA40.3, MPA65.1, MPA65.2, MPA100.1, MPA100.2, MPA125.1, MPA125.2
Taille:
Size:

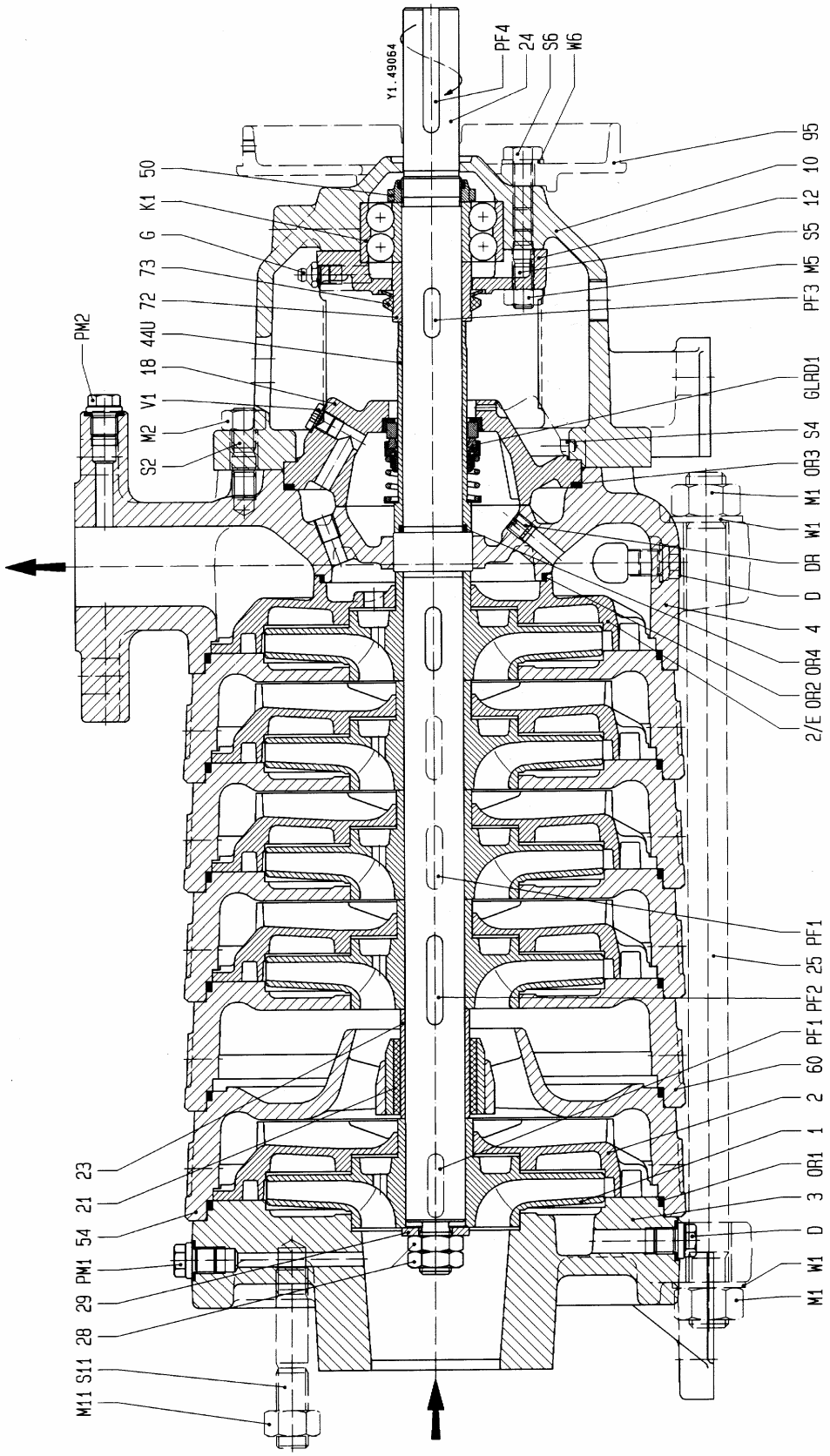
Wellenabdichtung:	Packungsstopfbuchse	Code...P
Etanchéité d'arbre:	presse-ètoupe	Code...P
Shaft seal:	stuffing box	Code...P



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
19	Stopfbuchsgehäuse	boîtier de presse-étoupe	stuffing box housing
21	Lagerbuchse	coussinet	bearing bush
23	Lagerhülse	chemise d'arbre du palier	bearing sleeve
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
28	Laufradmutter	écrou de blocage de roue	impeller nut
29	Scheibe	rondelle	washer
44	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
54	Innenlagergehäuse	corps de palier intermédiaire	intermediate bearing housing
60	Stufengehäuse	corps d'étage	stage casing
69	Stopfbuchsbrille	fouloir	gland
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
G	Schmiernippel	graisseur	grease nipple
K1	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M3	Mutter	écrou	nut
M5	Mutter	écrou	nut
M11	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
P	Stopfbuchspackung	garniture de presse-étoupe	gland packing
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S3	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S11	Stiftschraube	goujon	stud
V2	Verschlußschraube	bouchon filete	screwed plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MPA40.2, MPA40.3, MPA65.1, MPA65.2, MPA100.1, MPA100.2, MPA125.1, MPA125.2
Taille:
Size:

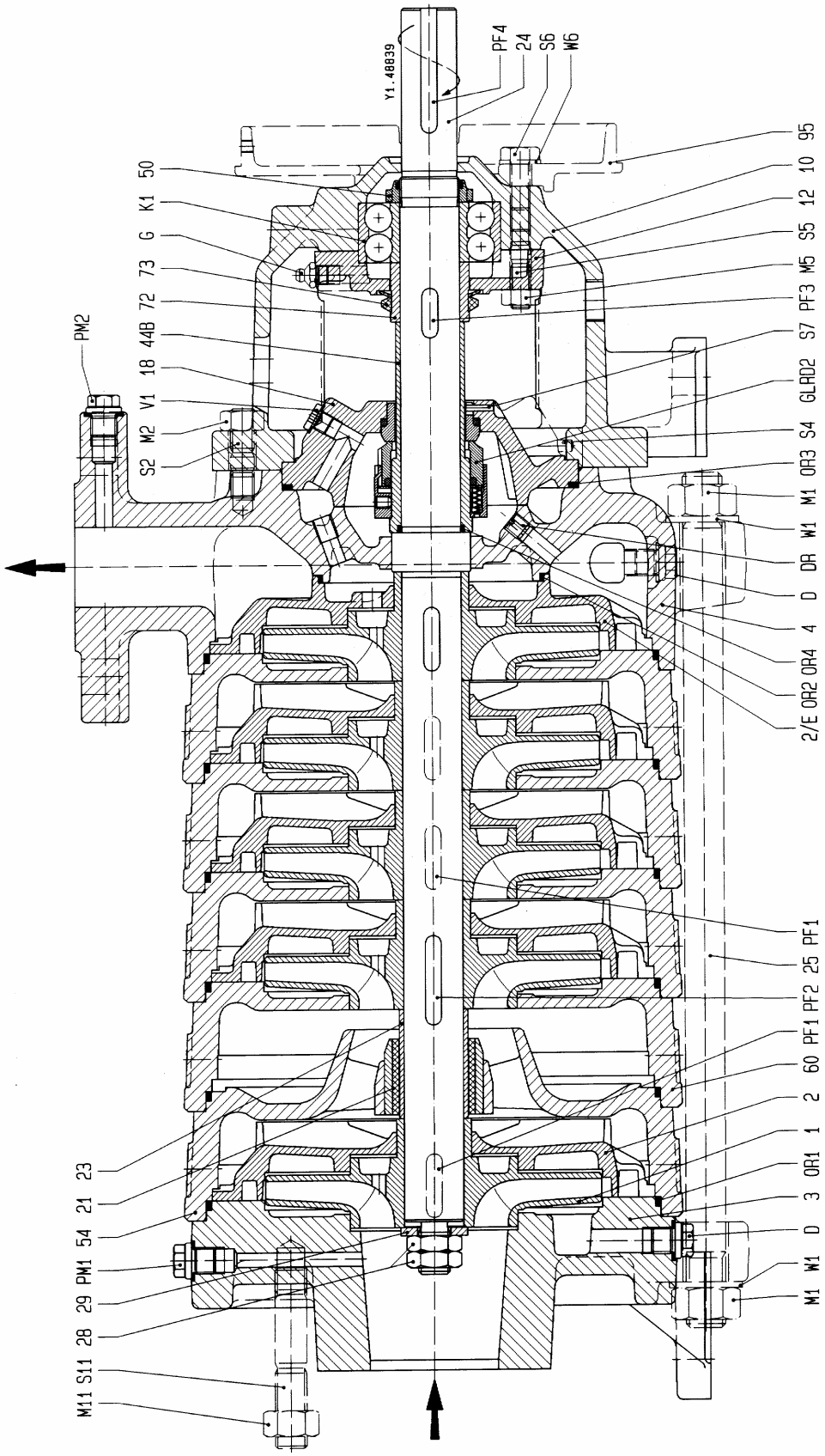
Wellenabdichtung:	Gleitringdichtung	Code...SA
Etanchéité d'arbre:	garniture mécanique	Code...SA
Shaft seal:	mechanical seal	Code...SA



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18	Dichtungsdeckel	couvercle d'etancheite	seal cover
21	Lagerbuchse	coussinet	bearing bush
23	Lagerhülse	chemise d'arbre du palier	bearing sleeve
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
28	Laufradmutter	écrou de blocage de roue	impeller nut
29	Scheibe	rondelle	washer
44U	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
54	Innenlagergehäuse	corps de palier intermédiaire	intermediate bearing housing
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD1	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M5	Mutter	écrou	nut
M11	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S11	Stiftschraube	goujon	stud
V1	Verschlußschraube	bouchon filete	screwed plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MPA40.2, MPA40.3, MPA65.1, MPA65.2, MPA100.1, MPA100.2, MPA125.1, MPA125.2
Taille:
Size:

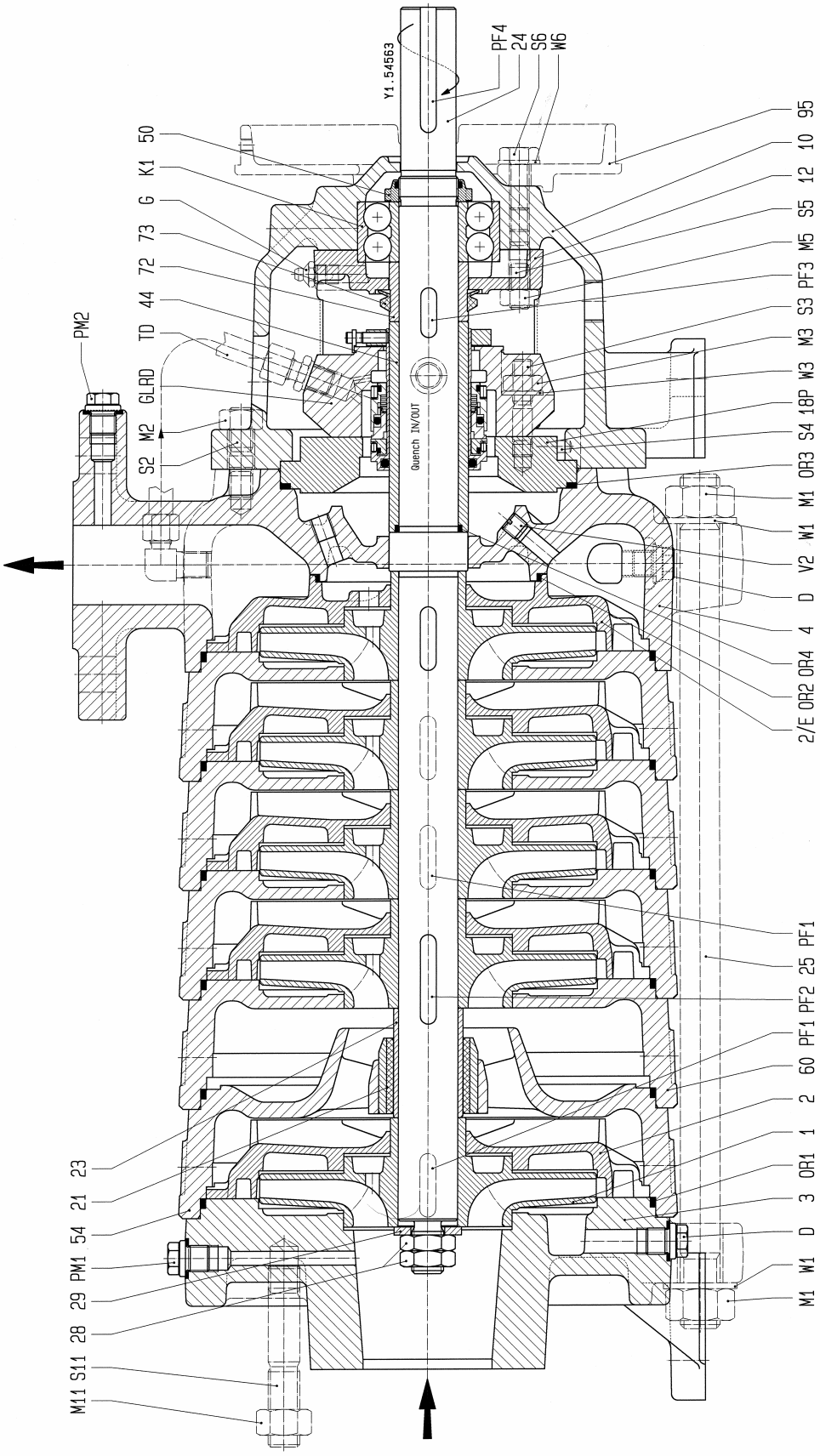
Wellenabdichtung:	Gleitringdichtung	Code...SB, SD
Etanchéité d'arbre:	garniture mécanique	Code...SB, SD
Shaft seal:	mechanical seal	Code...SB, SD



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18	Dichtungsdeckel	couvercle d'etancheite	seal cover
21	Lagerbuchse	coussinet	bearing bush
23	Lagerhülse	chemise d'arbre du palier	bearing sleeve
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
28	Laufradmutter	écrou de blocage de roue	impeller nut
29	Scheibe	rondelle	washer
44B	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
54	Innenlagergehäuse	corps de palier intermédiaire	intermediate bearing housing
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
DR	Drosselstück	organe d'étranglement	throttling element
G	Schmiernippel	graisseur	grease nipple
GLRD2	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M5	Mutter	écrou	nut
M11	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
S11	Stiftschraube	goujon	stud
V1	Verschlußschraube	bouchon filete	screwed plug
W1	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MPA40.2, MPA40.3, MPA65.1, MPA65.2, MPA100.1, MPA100.2, MPA125.1, MPA125.2
Taille:
Size:

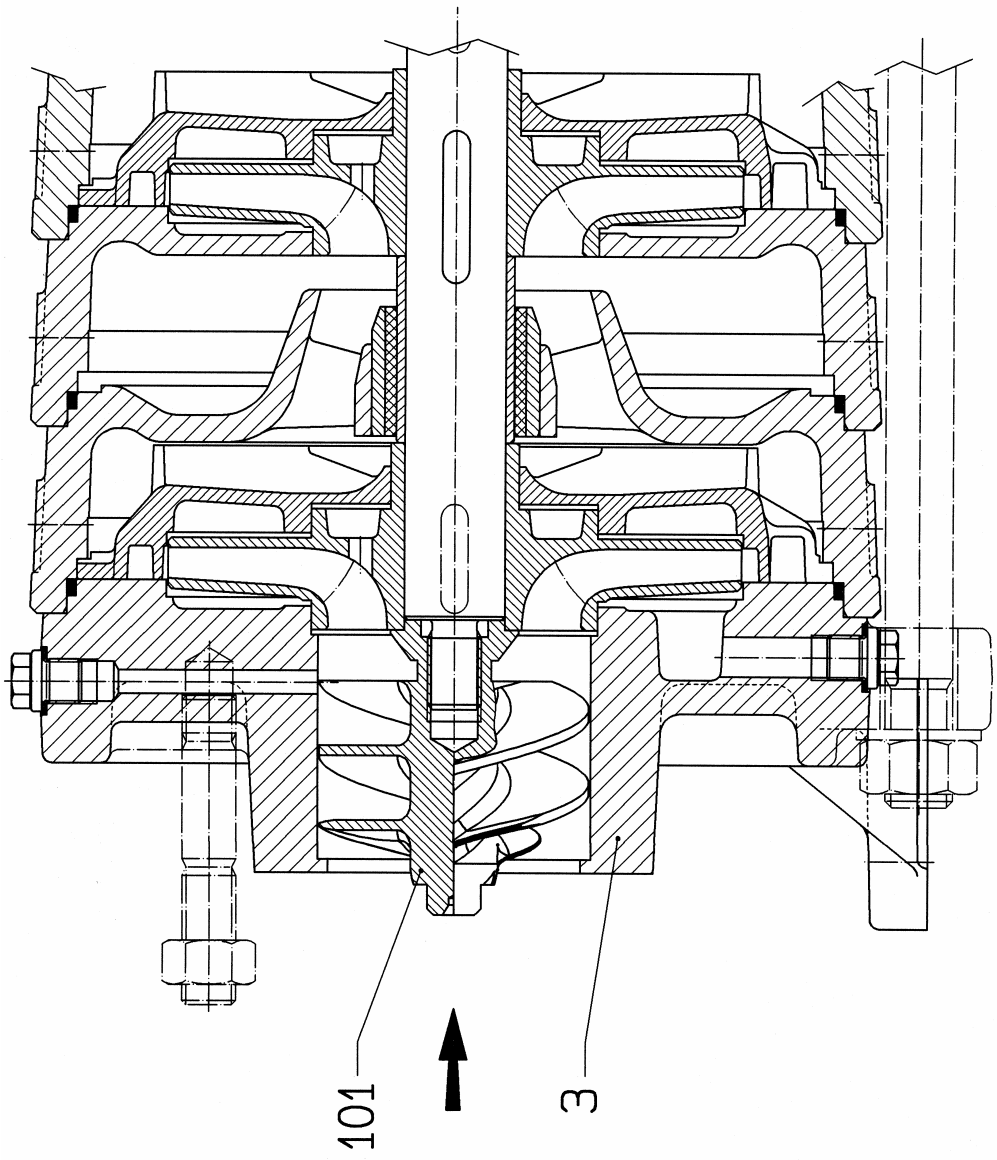
Wellenabdichtung:	Gleitringdichtung	Code...CS, CQ
Etanchéité d'arbre:	garniture mécanique	Code...CS, CQ
Shaft seal:	mechanical seal	Code...CS, CQ



Nr.	Teilebezeichnung	Nomenclature	Index of Parts
1	Laufrad	roue	impeller
2	Leitrad	diffuseur	diffuser
2/E	Leitrad, letzte Stufe	diffuseur, dernier êtage	diffuser, last stage
3	Sauggehäuse	corps d'aspiration	suction casing
4	Druckgehäuse	corps de refoulement	discharge casing
10	Lagerträger	corps de palier	bearing bracket
12	Lagerdeckel	couvercle de palier	bearing cover
18P	Dichtungsdeckel	couvercle d'etancheite	seal cover
21	Lagerbuchse	coussinet	bearing bush
23	Lagerhülse	chemise d'arbre du palier	bearing sleeve
24	Welle	arbre	shaft
25	Gehäuseschraube	tirant d'assemblage	tie bolt
28	Laufradmutter	écrou de blocage de roue	impeller nut
29	Scheibe	rondelle	washer
44	Wellenschutzhülse	chemise d'arbre sous garniture	shaft wearing sleeve
50	Lagermutter	écrou de roulement	bearing nut
54	Innenlagergehäuse	corps de palier intermédiaire	intermediate bearing housing
60	Stufengehäuse	corps d'étage	stage casing
72	Distanzhülse	entretoise	spacer sleeve
73	Spritzring	déflecteur	thrower
95	Kupplungsschutzadapter (nur auf Wunsch)	protetion d'accouplement raccord (sur demande)	Coupling guard adapter (by request)
D	Entleerungsstopfen	bouchon de vidange	drain plug
G	Schmiernippel	graisseur	grease nipple
GLRD	Gleitringdichtung	garniture mecanique	mechanical seal
K1	Radialkugellager	roulement a billes	radial ball bearing
M1	Mutter	écrou	nut
M2	Mutter	écrou	nut
M3	Mutter	écrou	nut
M5	Mutter	écrou	nut
M11	Mutter	écrou	nut
OR1	Runddichtring	joint torique	O-ring
OR2	Runddichtring	joint torique	O-ring
OR3	Runddichtring	joint torique	O-ring
OR4	Runddichtring	joint torique	O-ring
PM1	Druckmesser	mesureur de pression	pressure gauge
PM2	Druckmesser	mesureur de pression	pressure gauge
PF1	Paßfeder	clavette	key
PF2	Paßfeder	clavette	key
PF3	Paßfeder	clavette	key
PF4	Paßfeder	clavette	key
S2	Stiftschraube	goujon	stud
S3	Stiftschraube	goujon	stud
S4	Stift	pointe	pin
S5	Stiftschraube	goujon	stud
S6	Sechskantschraube	vis a tete hexagonale	hexagon head screw
S7	Stift	pointe	pin
S11	Stiftschraube	goujon	stud
TD	Rohrleitung	conduite	tubing
V2	Verschlußschraube	bouchon filete	screwed plug
W1	Scheibe	rondelle	washer
W3	Scheibe	rondelle	washer
W6	Scheibe	rondelle	washer

Baugrößen: MPAI40.2, MPAI40.3
Taille:
Size:

Detailzeichnung mit Inducer
Dessin en détail avec inducer
Detail drawing with inducer

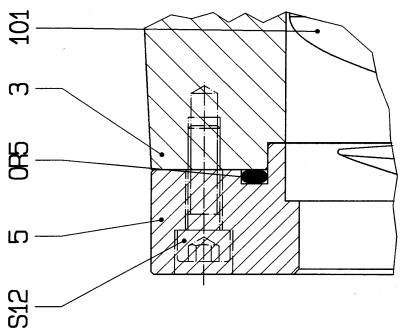


Nr.	Teilebezeichnung	Nomenclature	Index of Parts
101	Inducer	inducer	inducer
3	Sauggehäuse	corps d'aspiration	suction casing

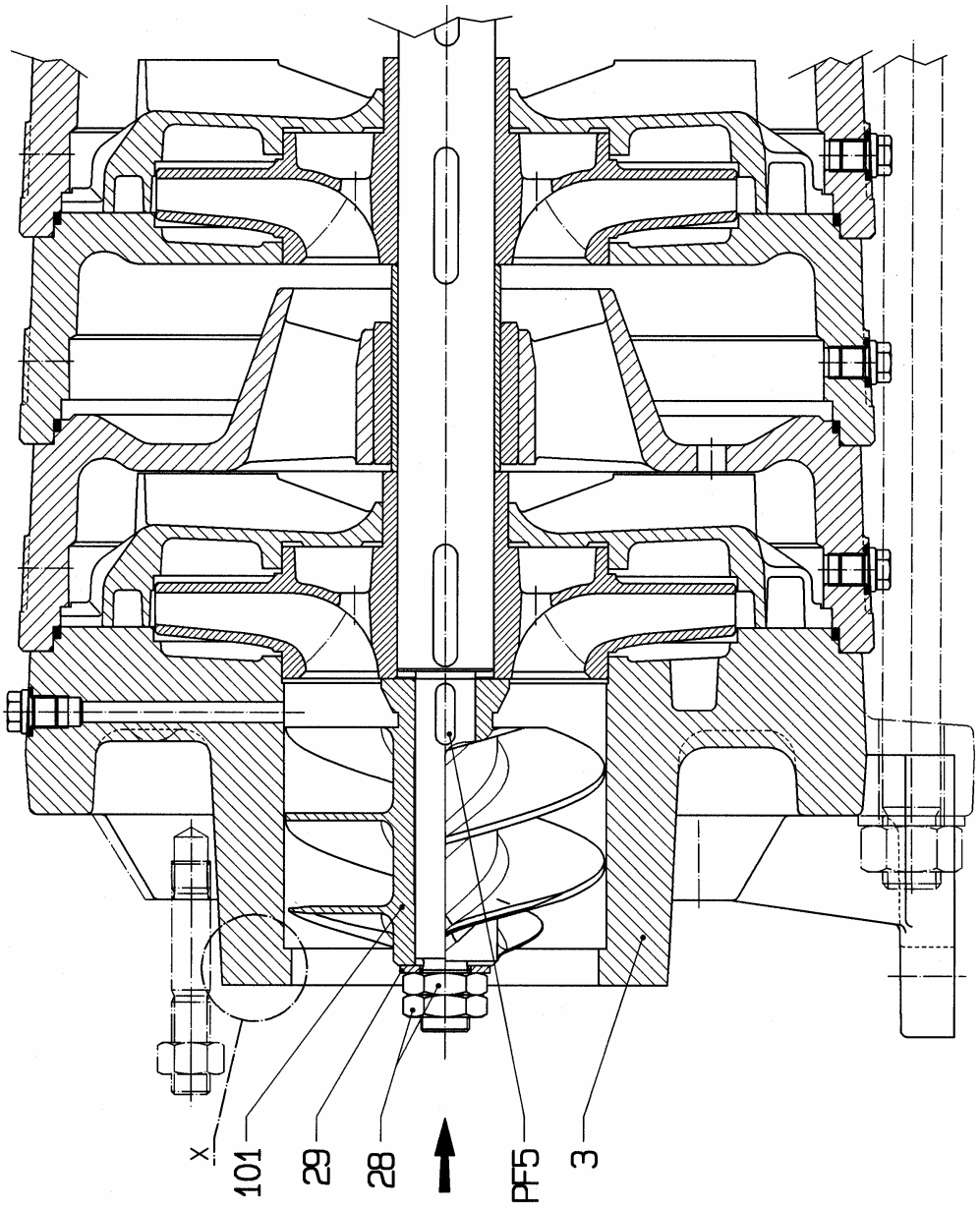
Baugrößen: MPAI65.1, MPAI65.2, MPAI100.1, MPAI100.2, MPAI125.1, MPAI125.2
Taille:
Size:

Detailzeichnung mit Inducer
Dessin en détail avec inducer
Detail drawing with inducer

Detail „X"
Baugröße: MPAI65.1, MPAI65.2
Taille:
Size:



Baugröße: MPAI100.1 , MPAI100.2 , MPAI125.1 , MPAI125.2
Taille:
Size:

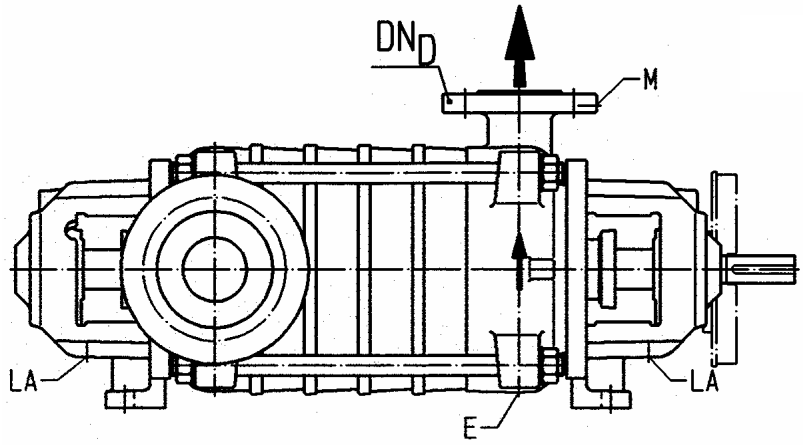


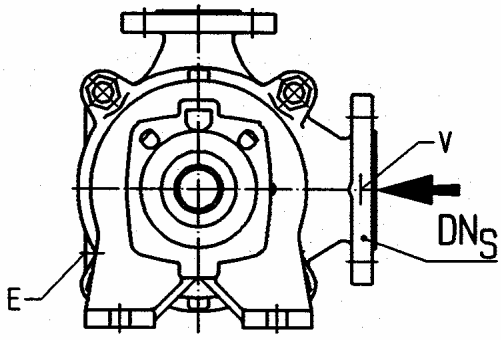
Nr.	Teilebezeichnung	Nomenclature	Index of Parts
101	Inducer	inducer	inducer
3	Sauggehäuse	corps d'aspiration	suction casing
5	Saugstutzen	tubulure d'aspiration	suction nozzle
28	Laufradmutter	écrou de blocage de roue	impeller nut
29	Scheibe	rondelle	washer
PF5	Paßfeder	clavette	key
OR5	Runddichtring	joint torique	O-ring
S12	Zylinderschraube	vis â tête cylindrique	head cap screw

Anschlüsse - Raccordements - Connections

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

Standardausführung: LO
Construction standard: LO
Standard construction: LO





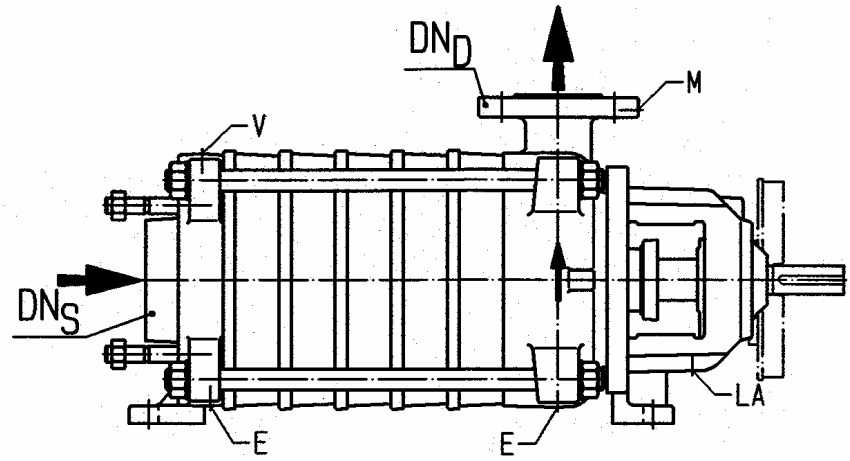
L	O	R	Stutzenrichtungen Position des tubulures Position of branches					
DNS	DND	Code	DNS	DND	Code	DNS	DND	Code
L	O	LO	L	L	LL	L	R	LR
O	O	OO	O	L	OL	O	R	OR
R	O	RO	R	L	RL	R	R	RR

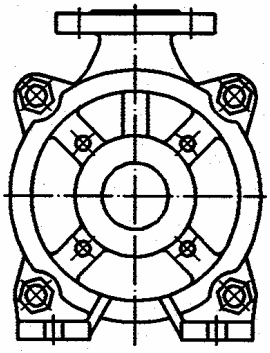
PM1..Vakuumeter G1/4
Vacuometre
Vacuum gauge
PM2..Manometer
Manometre
Pressure gauge
D.....Entleerung G1/4
Purge
Drain

L.....Leckflüssigkeit G1/2
Récupération des fuites
Leakage
G....Schmiernippel DIN 71412
Graisseur
Grease nipple

Baugrößen: MPA / MPAI40.2, MPA / MPAI40.3, MPA / MPAI65.1, MPA / MPAI65.2
Taille:
Size:

Standardausführung: AO
Construction standard: AO
Standard construction: AO





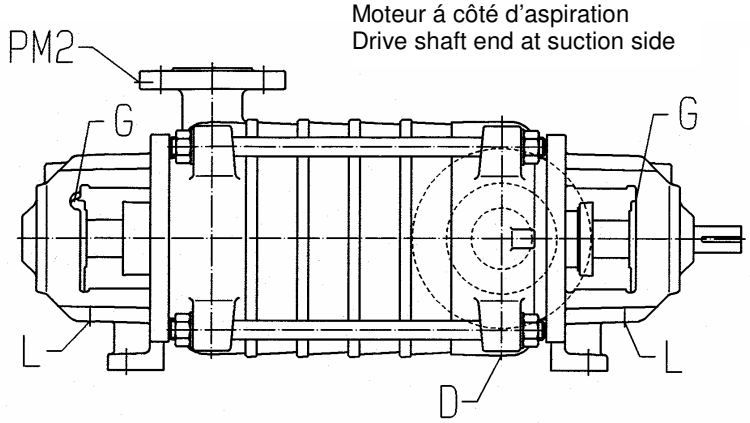
L	O	R	Stutzenrichtungen Position des tubulures Position of branches					
DNS	DND	Code	DNS	DND	Code	DNS	DND	Code
L	O	LO	-	-	-	-	-	-
O	O	OO	-	-	-	-	-	-
R	O	RO	-	-	-	-	-	-

PM1..Vakuumeter G1/4
Vacuometre
Vacuum gauge
PM2..Manometer
Manometre
Pressure gauge
D.....Entleerung G1/4
Purge
Drain

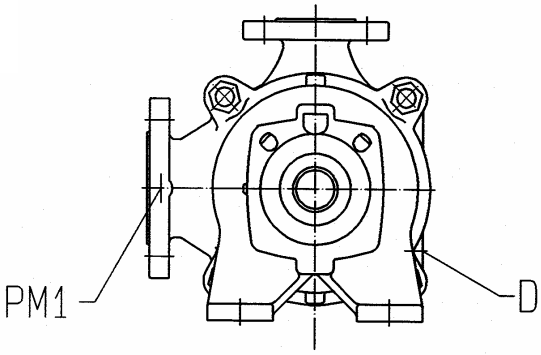
L.....Leckflüssigkeit G1/2
Récupération des fuites
Leakage
G....Schmiernippel DIN 71412
Graisseur
Grease nipple

Baugrößen: MP40.2, MP40.3, MP65.1, MP65.2, MP100.1, MP100.2, MP125.1, MP125.2
Taille:
Size:

Saugseitiger Antrieb
Moteur á côté d'aspiration
Drive shaft end at suction side



Standardausführung: RO/S
Construction standard: RO/S
Standard construction: RO/S



L	0	R	Stutzenrichtungen Position des tubulures Position of branches					
DNS	DND	Code	DNS	DND	Code	DNS	DND	Code
L	O	LO/S	L	L	LL/S	L	R	LR/S
O	O	OO/S	O	L	OL/S	O	R	OR/S
R	O	RO/S	R	L	RL/S	R	R	RR/S

PM1..Vakuumeter G1/4
Vacuometre
Vacuum gauge
PM2..Manometer
Manometre
Pressure gauge
D.....Entleerung G1/4
Purge
Drain

L.....Leckflüssigkeit G1/2
Récupération des fuites
Leakage
G....Schmiernippel DIN 71412
Graisseur
Grease nipple

Anzugsmomente - Couples de serrage - Tightening Torques

				Pumpengröße											
				MP, MPA, MPAI 40			MP, MPA, MPAI 65			MP, MPA, MPAI 100			MP, MPA, MPAI 125		
	Schraube	Mutter	Qualität	Größe	Anzugsmoment in Nm (kgm)		Größe	Anzugsmoment in Nm (kgm)		Größe	Anzugsmoment in Nm (kgm)		Größe	Anzugsmoment in Nm (kgm)	
	Pos	Pos	min.		Gewinde			Gewinde			Gewinde			Gewinde	
Verschraubung					trocken	geölt		trocken	geölt		trocken	geölt		trocken	geölt
Gehäuseanker	25	M1	8.8	4 x M20	**264 (26,9)**	**236 (24,1)**	4 x M24	**417 (42,5)**	**379 (38,6)**	8 x M24	**314 (32)**	**285 (29,1)**	8 x M24	**452 (46,1)**	**411 (41,9)**
Lagerträger (10) mit Sauggehäuse (3) bzw. Druckgehäuse (4)	S2	M2	8.8	8 x M12	**42 (4,3)**	**38 (3,9)**	8 x M12	**57 (5,8)**	**52 (5,3)**	8 x M16	**97 (9,9)**	**87 (8,9)**	8 x M20	**152 (15,5)**	**135 (13,8)**
Lagerträger (10) mit Lagerdeckel (12)	S5	M5	4.6	2 x M10	**22 (2,2)**	**20 (2,0)**	2 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**

Hinweis: Stiftschrauben müssen bis zum Gewindeende eingeschraubt werden.

				Taille de la pompe											
				MP, MPA, MPAI 40			MP, MPA, MPAI 65			MP, MPA, MPAI 100			MP, MPA, MPAI 125		
	Vis	Ecrou	Qualité	Taille	Couple de serrage en Nm (kgm)		Taille	Couple de serrage en Nm (kgm)		Taille	Couple de serrage en Nm (kgm)		Taille	Couple de serrage en in Nm (kgm)	
	Pos	Pos	min.		Filetage			Filetage			Filetage			Filetage	
Raccord					sec	huilé		sec	huilé		sec	huilé		sec	huilé
Ancrages du corps	25	M1	8.8	4 x M20	**264 (26,9)**	**236 (24,1)**	4 x M24	**417 (42,5)**	**379 (38,6)**	8 x M24	**314 (32)**	**285 (29,1)**	8 x M24	**452 (46,1)**	**411 (41,9)**
Corps de palier (10) avec corps d'aspiration (3) ou de refoulement (4)	S2	M2	8.8	8 x M12	**42 (4,3)**	**38 (3,9)**	8 x M12	**57 (5,8)**	**52 (5,3)**	8 x M16	**97 (9,9)**	**87 (8,9)**	8 x M20	**152 (15,5)**	**135 (13,8)**
Corps de palier (10) avec couvercle de palier (12)	S5	M5	4.6	2 x M10	**22 (2,2)**	**20 (2,0)**	2 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**

Remarque : les goujons filetés doivent toujours être vissés jusqu'à la fin du filetage.

				Pump Size											
				MP, MPA, MPAI 40			MP, MPA, MPAI 65			MP, MPA, MPAI 100			MP, MPA, MPAI 125		
	Screw	Nut	Quality	Size	Tightening Torque in Nm (kgm)		Size	Tightening Torque in Nm (kgm)		Size	Tightening Torque in Nm (kgm)		Size	Tightening Torque in Nm (kgm)	
	Item	Item	Min.		Thread			Thread			Thread			Thread	
Screw Connection					Dry	Oiled		Dry	Oiled		Dry	Oiled		Dry	Oiled
Casing anchor	25	M1	8.8	4 x M20	**264 (26,9)**	**236 (24,1)**	4 x M24	**417 (42,5)**	**379 (38,6)**	8 x M24	**314 (32)**	**285 (29,1)**	8 x M24	**452 (46,1)**	**411 (41,9)**
Bearing support (10) with suction casing (3) and pressure casing (4)	S2	M2	8.8	8 x M12	**42 (4,3)**	**38 (3,9)**	8 x M12	**57 (5,8)**	**52 (5,3)**	8 x M16	**97 (9,9)**	**87 (8,9)**	8 x M20	**152 (15,5)**	**135 (13,8)**
Bearing support (10) with bearing cover (12)	S5	M5	4.6	2 x M10	**22 (2,2)**	**20 (2,0)**	2 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**	4 x M10	**22 (2,2)**	**20 (2,0)**

Note: Studs must be screwed in to the end of the thread.

Pumpenfabrik ERNST VOGEL GmbH
Ernst Vogel-Straße 2
A-2000 Stockerau
Telefon: (+43) 2266 / 604
Fax: (+43) 2266 / 65311
E-Mail: vogelau.info@itt.com
Internet: www.vogel-pumpen.com

Altistart 48
Panel-Mount Soft Starts

Catalog

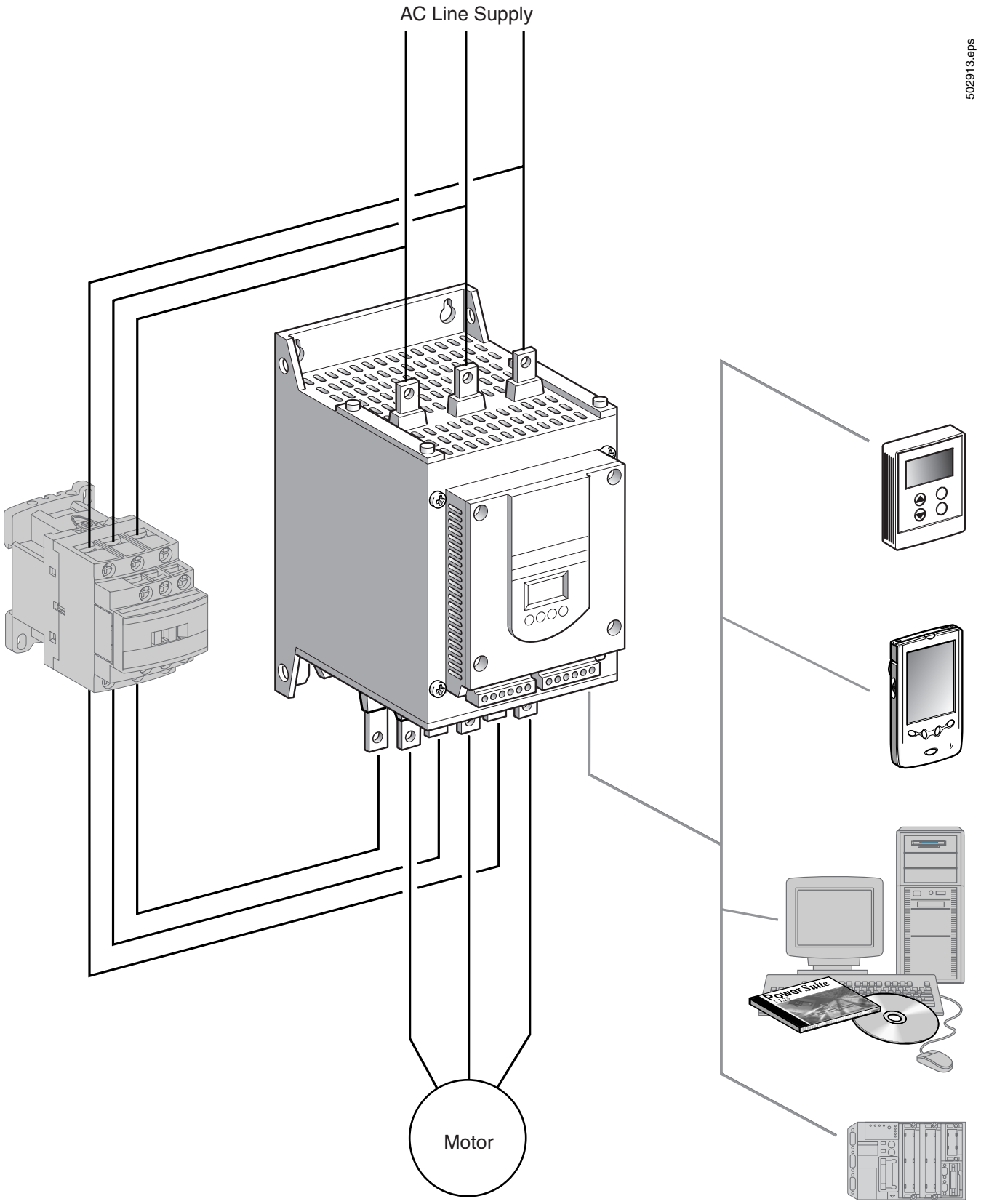
04

File 8636

CONTENTS

a brand of Schneider Electric

Telemecanique



Applications

The ATS48 soft start is a controller with 6 thyristors. It is used for torque-controlled soft starting and stopping of three-phase asynchronous squirrel cage motors with power ranges between 3 and 1200 hp.

ATS48 soft starts offer soft starting and deceleration functions, machine and motor protection functions, and functions for communicating with control systems. These functions are designed for use in state-of-the-art centrifugal machines, pumps, fans, compressors, and conveyors in the construction, food and beverage, and chemical industries. The high-performance algorithms of the ATS48 soft start contribute significantly to its robustness and ease of setup.

The ATS48 soft start is a cost-effective solution which can:

- Reduce machine operating costs by reducing mechanical stress and improving machine availability
- Reduce the stress placed on the electrical distribution system by reducing line current peaks and voltage drops during motor starts

The ATS48 soft start is rated for three-phase voltages 208 to 690 V, 50/60 Hz, and for standard and severe duty applications.

Functions

The ATS48 soft start is supplied ready for use in a standard duty application with Class 10 motor thermal overload protection. All devices include a built-in keypad display which can be used to modify the configuration to adapt it to the application and individual customer requirements.

Soft Start performance functions:

- Exclusive torque control system (TCS) patented by Schneider Electric
- Constant control of the torque supplied to the motor during acceleration and deceleration periods (significantly reducing pressure surges)
- Adjustments for ramp and the starting torque
- The soft start can be bypassed using a contactor at the end of the starting period while maintaining electronic overload protection (bypass function)
- Wider frequency tolerance for generator set (source) power supplies

Machine and motor protection functions:

- Built-in motor thermal overload protection
- Processing of information from PTC thermal probes
- Monitoring of the starting time
- Protection against underloads and overcurrents during continuous operation

Extended I/O functions for integration into control systems:

- 4 logic inputs, 2 logic outputs, 3 relay outputs, and 1 analog output
- Pull-apart terminal connectors
- Function for configuring a second set of motor parameters and easy-to-adapt settings
- Display of electrical values, running conditions, and operating time
- RS-485 serial link for connection to a Modbus® system

Options

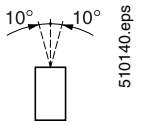
A remote keypad display can be mounted on the door of a wall-mounted or floor-standing enclosure.

PowerSuite advanced dialog solutions:

- PowerSuite Pocket PC with PPC type terminal.
- PowerSuite software workshop. (Version 1.30, build 5 or higher)
- A range of wiring accessories for connecting the soft start to PLCs via a Modbus® Systems connection.
- Ethernet, Fipio®, DeviceNet™ and Profibus® DP network communication options

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

Altistart 48 Panel-Mount Soft Starts
Technical Characteristics

Environment			
Conformity to standards			The ATS48 soft starts have been developed and performance tested in accordance with international standards, in particular with the starter product standard EN/IEC 60947-4-2.
CE marking			CE marking in accordance with the harmonized standard EN/IEC 60947-4-2.
Product approvals			UL, CSA DNV, C-Tick, Ghost, CCIB
Pollution degree	Soft starts ATS48D17Y to 48C11Y		IP 20 (IP 00 in the absence of connections)
	Soft starts ATS48C14Y to 48M12Y (1)		IP 00
Vibration resistance	Conforming to IEC 60068-2-6		1.5 mm from 2 to 13 Hz 1 gn from 13 to 200 Hz
Shock resistance	Conforming to IEC 60068-2-27		15 g for 11 ms
Soft start noise level (2)	Soft starts ATS48D32Y to D47Y	dBA	52
	Soft starts ATS48D62Y to C11Y	dBA	58
	Soft starts ATS48C14Y to C17Y	dBA	50
	Soft starts ATS48C21Y to C32Y	dBA	54
	Soft starts ATS48C41Y to C66Y	dBA	55
	Soft starts ATS48C79Y to M12Y	dBA	60
Fans	Soft starts ATS48D17Y and D22Y		Natural convection
	Soft starts ATS48D32Y to M12Y		Forced convection. The fans are activated automatically when a temperature threshold is reached. For flow rate, see page 19.
Ambient temperature around the unit	Operation		14 to 104 °F (-10 to 40 °C) without derating Up to 140 °F (60 °C), derate the current by 2% for each °C above 40 °C (104 °F) 14 to 122 °F (-10 to 50 °C) with user supplied shorting/bypass contactor
	Storage, conforming to IEC 60947-4-2		-13 to 158 °F (- 25 to 70 °C)
Maximum relative humidity	Conforming to IEC 60068-2-3		95% without condensation or dripping water
Maximum ambient pollution	Conforming to IEC 60664-1		Level 3
Maximum operating altitude		ft (m)	3300 ft (1000 m) without derating. Above this, derate the nominal current of the soft start by 2.2% for each additional 330 ft (100 m) to a maximum of 6600 ft (2000 m).
Operating position Maximum permanent angle in relation to the normal vertical mounting position			

Electrical characteristics			
Operating category	Conforming to IEC 60947-4-2		AC-53a
Three-phase supply voltage	Soft starts ATS48●●●Y (3)	V	208 - 15% to 690 + 10%
Frequency		Hz	50/60 ± 5% (automatic) 50 or 60 ± 20% (must be set)
Nominal soft start current	Soft starts ATS48●●●Y	A	17 to 1200
SCRs	Soft starts ATS48●●●Y	PIV	1800
Motor power	Soft starts ATS48●●●Y	kW HP	3 to 900 2 to 1200
Voltage indicated on the motor nameplate	Soft starts ATS48●●●Y	V	208 to 690
Soft start control circuit supply voltage	Soft starts ATS48●●●Y	V	110 - 15% to 230 + 10%, 50/60 Hz
Maximum control circuit consumption (with fans operating)	Soft starts ATS48D17Y to C17Y	W	30
	Soft starts ATS48C21Y to C32Y	W	50
	Soft starts ATS48C41Y to M12Y	W	80
Relay output (2 configurable outputs)	3 relay outputs (R1, R2, R3), normally open contacts 1 N.O. Minimum switching capacity: 10 mA for 6 Vdc. Maximum switching capacity on inductive load: 1.8 A for 230 Vac and 30 Vdc (power factor= 0.5 and L/R=20 ms). Maximum nominal operating voltage is 400 Vac. Factory setting: R1 assigned as the fault relay (configurable) R2 assigned as the end of starting relay to control the soft start bypass relay R3 assigned as motor powered (configurable)		

(1) Protective covers can be fitted to the power terminals of ATS48C14Y to C32Y soft starts. ATS48C41Y to 48M12Y soft starts have protection on the front panel and on the sides.

(2) Soft starts located 3 ft. (1 m) away. The noise levels may change depending on the characteristics of the fans.

(3) Throughout this catalog, the symbol "•" designates a portion of the catalog number that varies with controller rating.

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

Electrical characteristics (continued)

Logic inputs LI (2 configurable inputs)			4 logic inputs: Stop, Run, LI3, LI4; Impedance: 4.3 kΩ, isolated + 24 V input (maximum 30 V) I max. 8 mA State 0 if V < 5 V State 1 if V > 11 V
Internal source available			One 24 V output, isolated and protected against short-circuits and overloads. Accuracy ± 25%. Max. current 200 mA.
Logic outputs LO (configurable)			2 logic outputs LO1 and LO2 with 0 V common, compatible with level 1 PLC, according to standard IEC 65A-68. + 24 V input (minimum: +12 V, maximum: + 30 V) to LO+ Maximum LO output current: 200 mA if external 24 V power supply is used
Analog output AO (configurable)			Current output 0-20 mA or 4-20 mA Maximum load impedance: 500 Ω Accuracy ± 5% of the maximum value
Input for PTC probe			Total resistance of probe circuit 750 Ω at 25 °C (77 °F), according to IEC 60 738-A
Maximum I/O connection capacity			12 AWG (2.5 mm^2)
Communication			RS-485 multidrop serial link integrated in the starter, for Modbus® Systems, with RJ45 type connector Transmission speed 4800, 9600 or 19200 bps Maximum number of ATS48 soft starts connected: 18 Other uses: - connection to a remote keypad display or - connection to a PC or - connection to other buses and networks via communication options.
Protection	Thermal		Built-in, starter and motor (calculated and/or thermal protection with PTC probes)
	Line protection		Phase failure, indicated by output relay
Current settings			The nominal motor current, In, can be adjusted from 0.4 to 1.3 times the starter nominal current. Adjustment of the maximum starting current from 1.5 to 7 times the motor In, limited to 5 times the starter nominal current.
Starting mode			By torque control with starter current limited to 5 In maximum. Factory setting: 4 In for standard operation on 15 s torque ramp
Stopping mode	Freewheel stop		Freewheel stop (factory setting)
	Controlled stop on torque ramp		Programmable between 0.5 and 60 s (for pump applications)
	Braked stop		Controlled dynamically by the flux

Electromagnetic compatibility EMC (1)

	Standards	**Test levels**	**Examples (sources of interference)**
Summary of immunity tests carried out with the ATS48 soft start	IEC 61000-4-2 level 3 Electrostatic discharge: - by contact - in the air	 6 kV 8 kV	 Contact off an electrically charged individual
	IEC 61000-4-3 level 3 Radiated electromagnetic fields	10 V/m	Equipment transmitting radio frequencies
	IEC 61000-4-4 level 4 Rapid electrical transients: - power supply cables - control cables	 4 kV 2 kV	 Opening/closing of a contactor
	IEC 61000-4-5 level 3 Shock wave: - phase/phase - phase/ground	 1 kV 2 kV	 -
	IEC 61000-4-12 level 3 Damped oscillating waves	1 kV - 1 M Hz	Oscillating circuit on the line supply
Radiated and conducted emissions	According to IEC 60947-4-2, class A, on all starters		
	According to IEC 60947-4-2, class B, on starters up to 170 A: ATS48D17● to 48C17●. Must be bypassed at the end of starting		

(1) The soft starts conform to IEC 60947-4-2 (EMC). This standard ensures a level of immunity for products and a level of emitted interference. In steady state, the interference emitted is below that required by the standard.

NOTE:

- *Power factor correction capacitors can only be used upstream of the ATS48 soft start and only powered up at the end of starting.*
- *The soft start must be grounded to meet regulations concerning leakage currents (≤ 30 mA). If the installation involves several soft starts on the same supply line, each soft start must be grounded separately.*

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

TORQUE CHARACTERISTICS

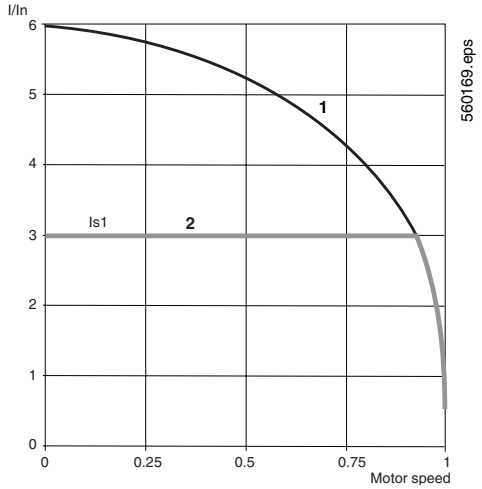
In the following diagrams, the curves indicate changes in the torque that depend on the starting current of a three-phase asynchronous motor.

Curve 1: full voltage starting
Curve 2: starting in current limiting mode

Torque curve, Ts1, indicates the total torque range available depending on the limiting current Is1. Limiting the starting current, Is, to a preset value, Is1, reduces the starting torque, Ts1, to a value which is almost equal to the square of currents Is1/Is.

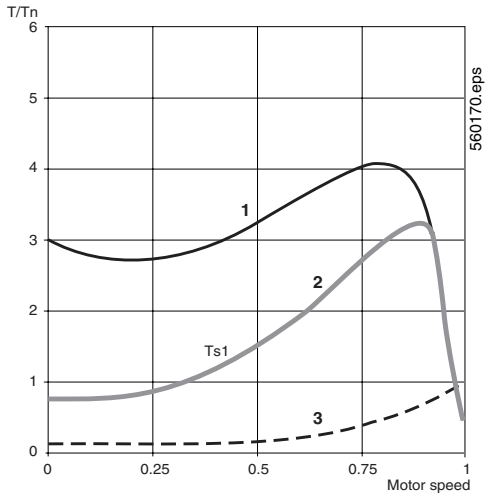
Example:
For motor characteristics: Ts = 3 Tn for Is = 6 In,
limit the current to Is1 = 3 In (0.5 Is)
resulting in a starting torque Ts1 = Ts x $(0.5)^2$ = 3 Tn x 0.25 = 0.75 Tn

STARTING CURRENT



1) Full voltage starting current
2) Starting current limited to Is1

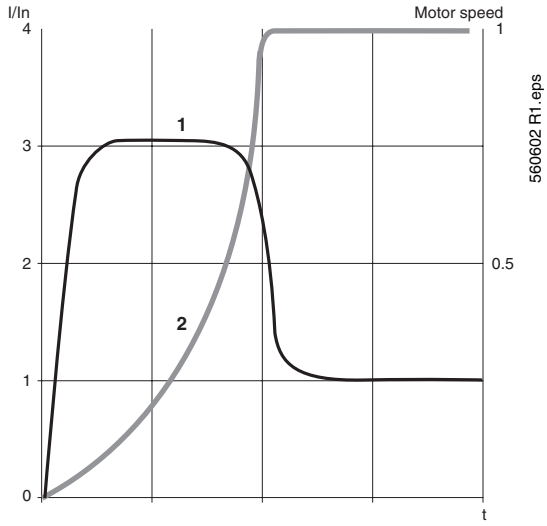
STARTING TORQUE



1) Full voltage starting torque
2) Starting torque with current limited to Is1
3) Load torque

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

CONVENTIONAL STARTING USING CURRENT LIMITATION OR VOLTAGE RAMP

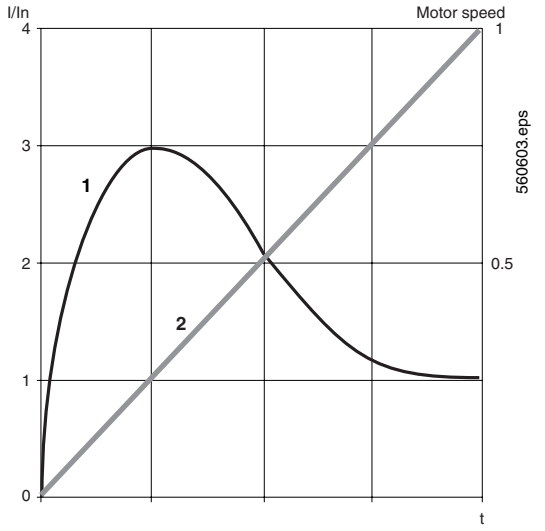


With current limitation Is1, the accelerating torque applied to the motor is equal to the motor torque Ts1 minus the resistive torque Tr. The accelerating torque increases in the starting range as the speed changes and is at its highest at the end of acceleration (curve 2). This characteristic means that the load is taken up very abruptly, which is not recommended for pump type applications.

Example of speed curve for starting with current limitation

1) Current applied to the motor (I/In)
2) Motor speed

STARTING WITH THE ATS48 SOFT START



Torque control on the ATS48 soft start applies the torque to the motor during the entire starting phase if the current required (curve 1) does not exceed the limiting current. The accelerating torque can be virtually constant over the entire speed range (curve 2). It is possible to set the ATS48 soft start so as to obtain a high torque on starting for a rapid motor speed rise, while limiting its temperature rise, and a lower torque at the end of starting for gradual loading. This control function is ideal for centrifugal pumps or for machines with high resistive torque on starting.

Example of speed curve for starting with torque control

1) Current applied to the motor (I/In)
2) Motor speed

STOPPING WITH THE ATS48 SOFT START

- Freewheel stop: the motor comes to a freewheel stop.
- Decelerated stop: this type of stop is ideal for pumps. It can be used to effectively reduce pressure surges. Torque control on the ATS48 soft start reduces the effect of hydraulic transients even if the load increases. This type of control makes adjustment easy.
- Braked stop: this type of stop is suitable for high inertia applications because it reduces the stopping time of the machine.

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

SELECTION CRITERIA FOR AN ATS48 SOFT START UNIT

Select the ATS48 soft start on the basis of three main criteria:

1. AC Mains voltage supply:
   — Three-phase AC voltage: 208–690 V
2. The power and the nominal current (motor FLA) indicated on the motor nameplate
3. The type of application and the operating cycle

To simplify selection, the applications are categorized as 2 types:

— Standard duty applications
— Severe duty applications

Standard or severe duty applications define the limiting values of the current and the duty cycle ratings.

Standard Duty Application

In standard duty applications, the ATS48 soft start is designed to provide:

- Starting at 4x In for 23 seconds or at 3x In for 46 seconds from a cold state
- Starting at 3x In for 23 seconds or at 4x In for 12 seconds with a load factor of 50% and with 10 starts per hour or an equivalent thermal cycling

The motor thermal protection conforms to Class 10 and 20 overload protection (see page 27).

Example: Centrifugal pump

Severe Duty Application

In severe duty applications, the ATS48 soft start is designed to provide:

- Starting at 4x In for 48 seconds or at 3x In for 90 seconds from a cold state
- Starting at 4x In for 25 seconds with a load factor of 50% and with 5 starts per hour or an equivalent thermal cycling

The motor thermal protection conforms to Class 10 and 20 overload protection (see page 27).

Example: Grinder

Selecting the Soft Start

First consult page 9 to identify the application type. Once the application type has been identified, select the soft start from pages 12 to 13 according to the supply voltage and the motor power.

Caution:

If the ATS48 soft start is installed inside an enclosure, observe the mounting and derating recommendations on pages 18 and 19.

APPLICATION TYPES

Depending on the type of machine, the applications are categorized as standard or severe duty based on the starting characteristics. Examples are given in the table below.

Type of machine	Application Type	Functions performed by the ATS48 Soft Start	Starting current (% In)	Starting time (s)
Centrifugal pump	Standard	Deceleration (reduction in pressure surges) Protection against underloads or inversion of the phase rotation direction	300	5 to 15
Piston pump	Standard	Control of running dry and direction of rotation of the pump	350	5 to 10
Fan	Standard Severe if > 30 s	Detection of overloads caused by clogging or underloads (motor fan transmission broken) Braking torque on stopping	300	10 to 40
Cold compressor	Standard	Protection, even for special motors	300	5 to 10
Screw compressor	Standard	Protection against inversion of direction of phase rotation Contact for automatic draining on stopping	300	3 to 20
Centrifugal compressor	Standard Severe if > 30 s	Protection against inversion of direction of phase rotation Contact for automatic emptying on stopping	350	10 to 40
Piston compressor	Standard	Protection against inversion of direction of phase rotation Contact for automatic emptying on stopping	350	5 to 10
Conveyor, transporter	Standard	Overload control for detecting faults or underload control for detecting breaks	300	3 to 10
Lifting screw	Standard	Overload control for detecting hard spots or underload control for detecting breaks	300	3 to 10
Drag lift	Standard	Overload control for detecting jamming or underload control for detecting breaks	400	2 to 10
Lift	Standard	Overload control for detecting jamming or underload control for detecting breaks Constant starting with variable load	350	5 to 10
Circular saw, band saw	Standard Severe if > 30 s	Braking for fast stop	300	10 to 60
Pulper, butchery knife	Severe	Torque control on starting	400	3 to 10
Agitator	Standard	The current display indicates the density of the product	350	5 to 20
Mixer	Standard	The current display indicates the density of the product	350	5 to 10
Grinder	Severe	Braking to limit vibrations during stopping, overload control to detect jamming	450	5 to 60
Crusher	Severe	Braking to limit vibrations during stopping, overload control to detect jamming	400	10 to 40
Refiner	Standard	Torque control on starting and stopping	300	5 to 30
Press	Severe	Braking to increase the number of cycles	400	20 to 60

SPECIAL USES

Other criteria can influence the selection of the ATS48 soft start:

Shorting/Bypass Contactor

Refer to the recommended wiring diagrams on pages 20 to 23.

The soft start can be bypassed by a contactor at the end of starting (to limit the heat dissipated by the soft start). The shorting/bypass contactor is controlled by the soft start and the current measurements. Thermal protection remains active when the soft start is bypassed.

Multi Motors

Motors may be connected in parallel provided that the power limit of the soft start is not exceeded (the sum of the motor currents must not exceed the nominal current of the soft start selected depending on the type of application). Individual thermal protection is required for each motor.

Brush Motor

The ATS48 soft start can operate with a bypassed stator resistance motor or with a resistance lug. The starting torque is modified in accordance with the rotor resistance. If necessary, maintain a low resistance in order to obtain the required torque to overcome the resistive torque on starting.

A bypassed brush motor has a very low starting torque. A high stator current is required to obtain the sufficient starting torque.

Oversize the soft start so that the value of the limiting current is 7 times that of the nominal current.

NOTE: Ensure that the starting torque of the motor, equal to 7 times the nominal current, is greater than the resistive torque.

NOTE: The ATS48 soft start torque control enables excellent soft starting despite the limiting current being 7 times the nominal current required to start the motor.

2-Speed Motor

The ATS48 soft start can operate with a 2-speed motor. A motor demagnetization period must elapse before changing from low speed to high speed in order to avoid antiphase between the line supply and the motor, which would generate very high currents.

Select the soft start using the three main criteria, see page 8.

Long Motor Cable Lengths

Very long motor cables cause voltage drops due to the resistance of the cable. If the voltage drop is significant, it could affect the current consumption and the available torque. This criteria must be taken into account when selecting the motor and the soft start.

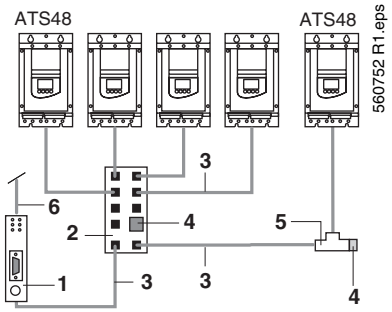
Miscellaneous Application Precautions

Do not use the ATS48 soft start upstream of loads other than motors (for example transformer and resistor type loads).

Do not connect power factor correction capacitors to the terminals of a motor controlled by an ATS48 soft start.

COMMUNICATION

The ATS48 soft start can be connected directly to a Modbus® system using an RJ45 connector. It communicates over the RS-485 serial link (2-wire) using the Modbus® system's RTU protocol. The communication function provides access to the configuration, adjustment, control, and signalling functions of the soft start.



1. Communication module
2. Modbus® Systems hub **LU9GC3**
3. Modbus® Systems drop cable **VW3A8306R●●**
4. Line terminator **VW3A8306RC**
5. Modbus® Systems splitter cable **VW3A8306TF●●**
6. To other buses or networks

The ATS48 soft start can be connected to other buses or networks using the communication modules and accessories below.

LUFP1

Item number	Communication modules	Catalog number
1	Ethernet Bridge	**174CEV30020**
	DeviceNet Gateway	**LUFP9**
	Profibus DP Gateway	**LUFP7**
	FIPIO Gateway	**LUFP1**
3	1/3 meter connection cable (RJ45 to RJ45)	**VW3A8306R03**
	1 meter connection cable (RJ45 to RJ45)	**VW3A8306R10**
	3 meter connection cable (RJ45 to RJ45)	**VW3A8306R30**
5	1/3 meter splitter cable (RJ45 daisy chain connection)	**VW3A8306TF03**
	1 meter splitter cable (RJ45 daisy chain connection)	**VW3A8306TF10**
4	RJ45 terminator (2 per package)	**VW3A8306RC**
2	Modbus hub (Eight RJ45 ports)	**LU9GC3**

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

Altistart 48 Panel-Mount Soft Starts
Selection


106762.tif

ATS48D17Y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ATS48C14Y


106758.tif

ATS48M12Y

Line Voltage 208 to 690 V, Motor Power in HP

For Standard Duty Applications

Motor				Soft Start 208 to 690 V - 50/60 Hz				
Motor power (1)				Soft start current rating (2)	Nominal motor current (4)	Power dissipated at nominal load	Catalog number	Weight
208 V	230 V	460 V	575 V					
HP	HP	HP	HP	A	A	W		lb (kg)
3	5	10	15	17	14	59	**ATS48D17Y**	10.8 (4.9)
5	7.5	15	20	22	21	74	**ATS48D22Y**	10.8 (4.9)
7.5	10	20	25	32	27	104	**ATS48D32Y**	10.8 (4.9)
10	–	25	30	38	34	116	**ATS48D38Y**	10.8 (4.9)
–	15	30	40	47	40	142	**ATS48D47Y**	10.8 (4.9)
15	20	40	50	62	52	201	**ATS48D62Y**	18.3 (8.3)
20	25	50	60	75	65	245	**ATS48D75Y**	18.3 (8.3)
25	30	60	75	88	77	290	**ATS48D88Y**	18.3 (8.3)
30	40	75	100	110	96	322	**ATS48C11Y**	18.3 (8.3)
40	50	100	125	140	124	391	**ATS48C14Y**	27.3 (12.4)
50	60	125	150	170	156	479	**ATS48C17Y**	27.3 (12.4)
60	75	150	200	210	180	580	**ATS48C21Y**	40.1 (18.2)
75	100	200	250	250	240	695	**ATS48C25Y**	40.1 (18.2)
100	125	250	300	320	302	902	**ATS48C32Y**	40.1 (18.2)
125	150	300	350	410	361	1339	**ATS48C41Y**	113.3 (51.4)
150	–	350	400	480	414	1386	**ATS48C48Y**	113.3 (51.4)
–	200	400	500	590	477	1731	**ATS48C59Y**	113.3 (51.4)
200	250	500	600	660	590	1958	**ATS48C66Y**	113.3 (51.4)
250	300	600	800	790	720	2537	**ATS48C79Y**	253.6 (115.0)
350	350	800	1000	1000	954	2865	**ATS48M10Y**	253.6 (115.0)
400	450	1000	1200	1200	1170	3497	**ATS48M12Y**	253.6 (115.0)

For Severe Duty Applications

Motor				Soft Start 208 to 690 V - 50/60 Hz				
Motor power (1)				Soft Start Current Rating (3)	Nominal motor current (4)	Power dissipated at nominal load	Catalog number	Weight
208 V	230 V	460 V	575 V					
HP	HP	HP	HP	A	A	W		lb (kg)
2	3	7.5	10	12	14	46	**ATS48D17Y**	10.8 (4.9)
3	5	10	15	17	21	59	**ATS48D22Y**	10.8 (4.9)
5	7.5	15	20	22	27	74	**ATS48D32Y**	10.8 (4.9)
7.5	10	20	25	32	34	99	**ATS48D38Y**	10.8 (4.9)
10	–	25	30	38	40	116	**ATS48D47Y**	10.8 (4.9)
–	15	30	40	47	52	153	**ATS48D62Y**	18.3 (8.3)
15	20	40	50	62	65	201	**ATS48D75Y**	18.3 (8.3)
20	25	50	60	75	77	245	**ATS48D88Y**	18.3 (8.3)
25	30	60	75	88	96	252	**ATS48C11Y**	18.3 (8.3)
30	40	75	100	110	124	306	**ATS48C14Y**	27.3 (12.4)
40	50	100	125	140	156	391	**ATS48C17Y**	27.3 (12.4)
50	60	125	150	170	180	468	**ATS48C21Y**	40.1 (18.2)
60	75	150	200	210	240	580	**ATS48C25Y**	40.1 (18.2)
75	100	200	250	250	302	695	**ATS48C32Y**	40.1 (18.2)
100	125	250	300	320	361	1017	**ATS48C41Y**	113.3 (51.4)
125	150	300	350	410	414	1172	**ATS48C48Y**	113.3 (51.4)
150	–	350	400	480	477	1386	**ATS48C59Y**	113.3 (51.4)
–	200	400	500	590	590	1731	**ATS48C66Y**	113.3 (51.4)
200	250	500	600	660	720	2073	**ATS48C79Y**	253.6 (115.0)
250	300	600	800	790	954	2225	**ATS48M10Y**	253.6 (115.0)
350	350	800	1000	1000	1170	2865	**ATS48M12Y**	253.6 (115.0)

(1) Value indicated on the motor nameplate.
(2) Corresponds to the soft start's continuous current rating with overload protection set to Class 10.
(3) Corresponds to the soft start's continuous current rating with overload protection set to Class 20.
(4) This factory setting corresponds to the value of the nominal current of a standard motor according to NEC, 460 V, Class 10 (standard application). Adjust the value of parameter In to match the motor's full load amperage rating.

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

Line Voltage 208 to 690 V, Motor Power in kW

For Standard Duty Applications

Motor							Soft Start 208 to 690 V - 50/60 Hz				
Motor power (1)							Soft start current rating (2)	Nominal motor current (4)	Power dissipated at nominal load	Catalog number	Weight
230 V	400 V	440 V	500 V	525 V	660 V	690 V					
kW	kW	kW	kW	kW	kW	kW	A	A	W		lb (kg)
4	7.5	7.5	9	9	11	15	17	14	59	**ATS48D17Y**	10.8 (4.9)
5.5	11	11	11	11	15	18.5	22	21	74	**ATS48D22Y**	10.8 (4.9)
7.5	15	15	18.5	18.5	22	22	32	27	104	**ATS48D32Y**	10.8 (4.9)
9	18.5	18.5	22	22	30	30	38	34	116	**ATS48D38Y**	10.8 (4.9)
11	22	22	30	30	37	37	47	40	142	**ATS48D47Y**	10.8 (4.9)
15	30	30	37	37	45	45	62	52	201	**ATS48D62Y**	18.3 (8.3)
18.5	37	37	45	45	55	55	75	65	245	**ATS48D75Y**	18.3 (8.3)
22	45	45	55	55	75	75	88	77	290	**ATS48D88Y**	18.3 (8.3)
30	55	55	75	75	90	90	110	96	322	**ATS48C11Y**	18.3 (8.3)
37	75	75	90	90	110	110	140	124	391	**ATS48C14Y**	27.3 (12.4)
45	90	90	110	110	132	160	170	156	479	**ATS48C17Y**	27.3 (12.4)
55	110	110	132	132	160	200	210	180	580	**ATS48C21Y**	40.1 (18.2)
75	132	132	160	160	220	250	250	240	695	**ATS48C25Y**	40.1 (18.2)
90	160	160	220	220	250	315	320	302	902	**ATS48C32Y**	40.1 (18.2)
110	220	220	250	250	355	400	410	361	1339	**ATS48C41Y**	113.3 (51.4)
132	250	250	315	315	400	500	480	414	1386	**ATS48C48Y**	113.3 (51.4)
160	315	355	400	400	560	560	590	477	1731	**ATS48C59Y**	113.3 (51.4)
–	355	400	–	–	630	630	660	590	1958	**ATS48C66Y**	113.3 (51.4)
220	400	500	500	500	710	710	790	720	2537	**ATS48C79Y**	253.6 (115.0)
250	500	630	630	630	900	900	1000	954	2865	**ATS48M10Y**	253.6 (115.0)
355	630	710	800	800	–	–	1200	1170	3497	**ATS48M12Y**	253.6 (115.0)

For Severe Duty Applications

Motor							Soft Start 208 to 690 V - 50/60 Hz				
Motor power (1)							Soft start current rating (3)	Nominal motor current (4)	Power dissipated at nominal load	Catalog number	Weight
230 V	400 V	440 V	500 V	525 V	660 V	690 V					
kW	kW	kW	kW	kW	kW	kW	A	A	W		lb (kg)
3	5.5	5.5	7.5	7.5	9	11	12	14	46	**ATS48D17Y**	10.8 (4.9)
4	7.5	7.5	9	9	11	15	17	21	59	**ATS48D22Y**	10.8 (4.9)
5.5	11	11	11	11	15	18.5	22	27	74	**ATS48D32Y**	10.8 (4.9)
7.5	15	15	18.5	18.5	22	22	32	34	99	**ATS48D38Y**	10.8 (4.9)
9	18.5	18.5	22	22	30	30	38	40	116	**ATS48D47Y**	10.8 (4.9)
11	22	22	30	30	37	37	47	52	153	**ATS48D62Y**	18.3 (8.3)
15	30	30	37	37	45	45	62	65	201	**ATS48D75Y**	18.3 (8.3)
18.5	37	37	45	45	55	55	75	77	245	**ATS48D88Y**	18.3 (8.3)
22	45	45	55	55	75	75	88	96	252	**ATS48C11Y**	18.3 (8.3)
30	55	55	75	75	90	90	110	124	306	**ATS48C14Y**	27.3 (12.4)
37	75	75	90	90	110	110	140	156	391	**ATS48C17Y**	27.3 (12.4)
45	90	90	110	110	132	160	170	180	468	**ATS48C21Y**	40.1 (18.2)
55	110	110	132	132	160	200	210	240	580	**ATS48C25Y**	40.1 (18.2)
75	132	132	160	160	220	250	250	302	695	**ATS48C32Y**	40.1 (18.2)
90	160	160	220	220	250	315	320	361	1017	**ATS48C41Y**	113.3 (51.4)
110	220	220	250	250	355	400	410	414	1172	**ATS48C48Y**	113.3 (51.4)
132	250	250	315	315	400	500	480	477	1386	**ATS48C59Y**	113.3 (51.4)
160	315	355	400	400	560	560	590	590	1731	**ATS48C66Y**	113.3 (51.4)
–	355	400	–	–	630	630	660	720	2073	**ATS48C79Y**	253.6 (115.0)
220	400	500	500	500	710	710	790	954	2225	**ATS48M10Y**	253.6 (115.0)
250	500	630	630	630	900	900	1000	1170	2865	**ATS48M12Y**	253.6 (115.0)

(1) Value indicated on the motor nameplate.
(2) Corresponds to the soft start's continuous current rating with overload protection set to Class 10.
(3) Corresponds to the soft start's continuous current rating with overload protection set to Class 20.
(4) This factory setting corresponds to the value of the nominal current of a standard motor according to NEC, 460 V, Class 10 (standard application). Adjust the value of parameter In to match the motor's full load amperage rating.

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

REMOTE KEYPAD DISPLAY

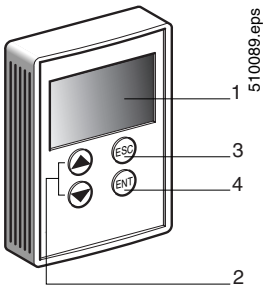

106770.tif

VW3G48101

The remote keypad display can be mounted on the door of a wall-mounted or floor-standing enclosure. It has the same signalling display and configuration buttons as the keypad display integrated in the soft start. A switch to lock access to the menus is located on the back of the keypad display.

The option includes:

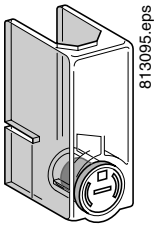
- The remote keypad display
- A mounting kit containing a cover, screws and an IP 65 seal on the front panel
- A 9.82 ft. (3 m) connecting cable with a 9-pin SUB-D connector for connecting to the keypad display and an RJ45 connector for connecting to the ATS48 soft start.



1. Information is displayed in the form of codes or values in three 7-segment displays
2. Buttons for scrolling through the menus or modifying values
3. ESC: Button for exiting the menus (cannot be used for validation purposes)
4. ENT: Validation button for entering a menu or confirming the new value selected

Description	Catalog number	Weight lb (kg)
Remote keypad display	**VW3G48101**	0.44 (0.20)

PROTECTIVE COVERS FOR POWER TERMINALS


813095.eps

LA9F702

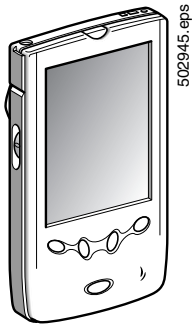
To be used with tags closed

For Soft Starts	Number of covers per set	Catalog number	Weight lb (kg)
ATS48C14Y and ATS48C17Y	6 *(1)*	**LA9F702**	0.6 (0.25)
ATS48C21Y, ATS48C25Y and ATS48C32Y	6 *(1)*	**LA9F703**	0.6 (0.25)

(1) The soft starts have 9 unprotected power terminals.

The PowerSuite advanced dialog solutions can be used for Telemecanique drives and soft starts. They enable communication with the product from a Pocket PC, Personal Computer, or a dedicated terminal. The PowerSuite dialog solutions, with a Pocket PC or PC, enable files to be prepared for uploading to the drives and the soft starts. The PowerSuite software creates its files ensuring consistency between the configuration/adjustment functions of the product.

PowerSuite Pocket PC



The Pocket PC can be used during preparation, programming, setup and maintenance. It comprises a Pocket PC terminal and corresponding connection accessories. The software is integrated into a Windows CE environment. The software incorporates all the functions of integrated and remote terminals (drive or soft start configuration and adjustment, control, signalling, etc).

The Pocket PC can be used:

- Alone to prepare and store configuration/adjustment files (integral battery or line supply).
- Connected to the drive or to the soft start for configuration, adjustment or control purposes or to upload a configuration/adjustment file from the Pocket PC to the product or download a configuration/adjustment file from the product to the Pocket PC.

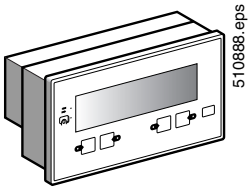
PowerSuite Software for PC

The PowerSuite software is used to set up a drive or a soft start from a PC in a Microsoft® Windows environment. The software incorporates all the functions of integrated and remote terminals (drive or soft start configuration and adjustment, control, signalling, etc.) in a Windows environment. It can be used:

- Alone to prepare and store drive or soft start configuration files. The drive or soft start configuration can be printed out on paper or can be exported to office automation software.
- Connected to the drive or soft start for configuration, adjustment or control purposes, or for uploading a configuration/adjustment file from the PC to the product or downloading from the product to the PC. Connection is via a link between the drive or soft start connector and the serial port on the PC.

POWERSUITE Products Available from Schneider Electric

Catalog number	Description	
VW3A8104	POWERSUITE commissioning software on CD	
VW3A8106	PC connection kit. Includes the following to connect a PC to an ATV11, ATV28, ATV58, ATS48, or TeSys U controller:	
	1 m (3.28 ft.) cable with RJ45 connectors	RJ45 to DB9 male adapter for use with an ATV58 controller
	RS-232 to RS-485 adapter with RJ45 and DB9 female connectors	Cable adapter for use with an ATV11 controller, VW3A11301
VW3A8110	Optional compact flash memory module loaded with POWERSUITE software, for use with JORNADA and iPAQ PPCs	
VW3A8111	Pocket PC connection kit. Includes the following to connect a JORNADA or iPAQ PPC to an ATV11, ATV28, ATV58, ATS48, or TeSys U controller:	
	0.5 m (1.64 ft.) cable with RJ45 connectors	RJ45 to DB9 male adapter for use with an ATV58 controller
	RS-232 to RS-485 adapter with RJ45 and DB9 male connectors	Cable adapter for use with an ATV11 controller, VW3A11301
VW3A11301	RS-485 to TTL cable adapter for use with the ATV11 controller	



For more information about PowerSuite software, obtain Data Bulletin 8806DB0001R_ available at www.us.SquareD.com.

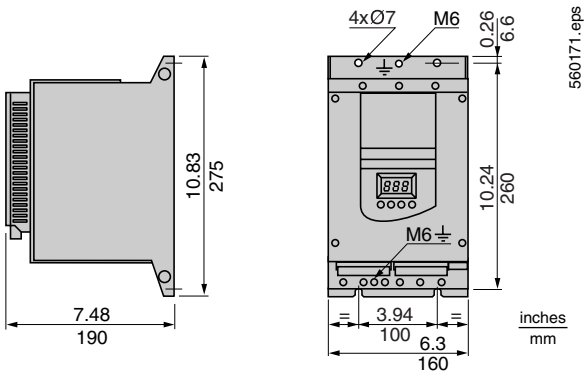
Magelis® Display Unit With Matrix Screen

The Magelis® display unit with matrix screen can be used to monitor, diagnose, and adjust up to 8 ATS48 soft starts in 5 languages (English, French, German, Spanish, Italian). It can display variables in alphanumeric format with European, Cyrillic, or Asian fonts in 4 sizes, or it can display icons or background images in black and white, as well as animations in barchart or gauge format. The terminal has a backlit LCD with 8 lines of 40 characters.

Description	Catalog number	Weight lb (kg)
Magelis® display unit with matrix screen	**XBTHM017010A8**	1.3 (0.60)

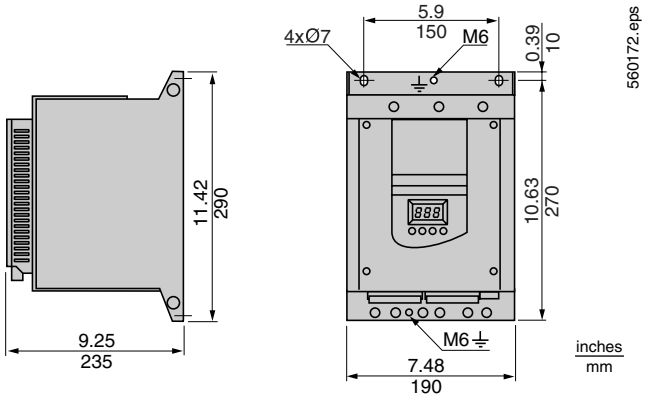
Altistart 48 Panel-Mount Soft Starts
Dimensions

ATS48D17Y to ATS48D47Y



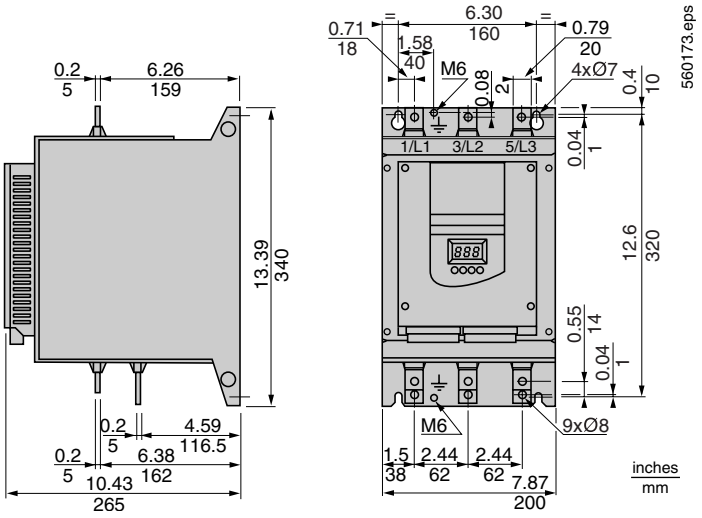
Maximum connection capacity:
Ground connections: 8 AWG (10 mm²)
Power terminals: 8 AWG (16 mm²)

ATS48D62Y to ATS48C11Y



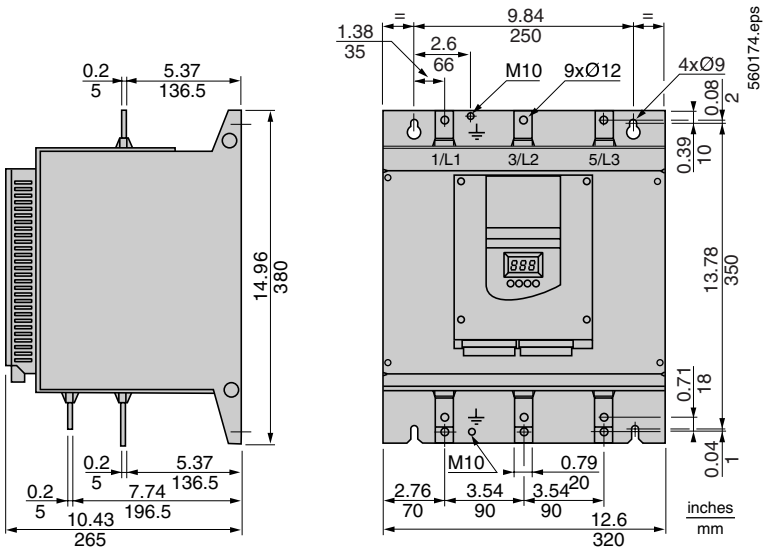
Maximum connection capacity:
Ground connections: 4 AWG (16 mm²)
Power terminals: 2/0 (50 mm²)

ATS48C14Y to ATS48C17Y



Maximum connection capacity:
Ground connections: Busbar (120 mm²)
Power terminals: 2/0 (95 mm²)

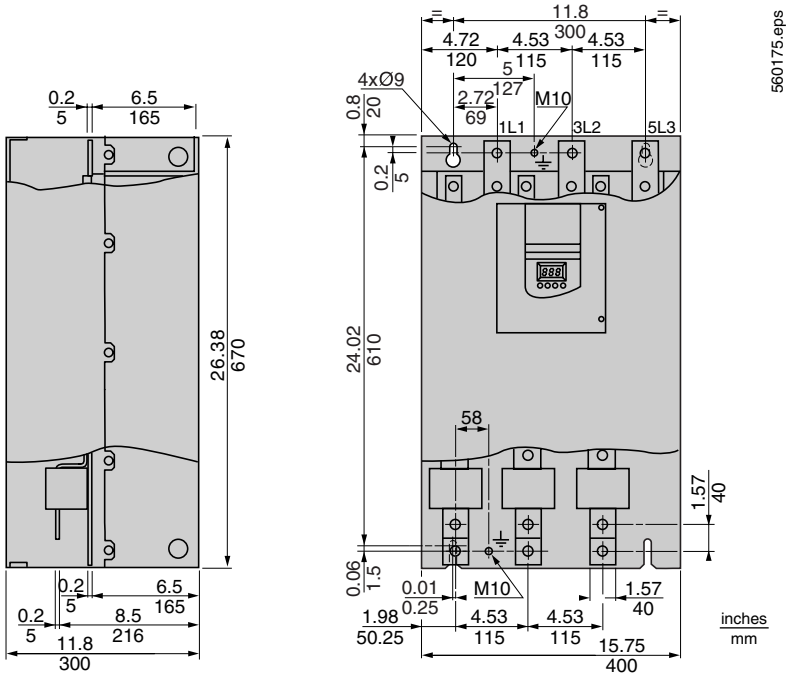
ATS48C21Y to ATS48C32Y



Maximum connection capacity:
Ground connections: Busbar (120 mm²)
Power terminals: Busbar (240 mm²)

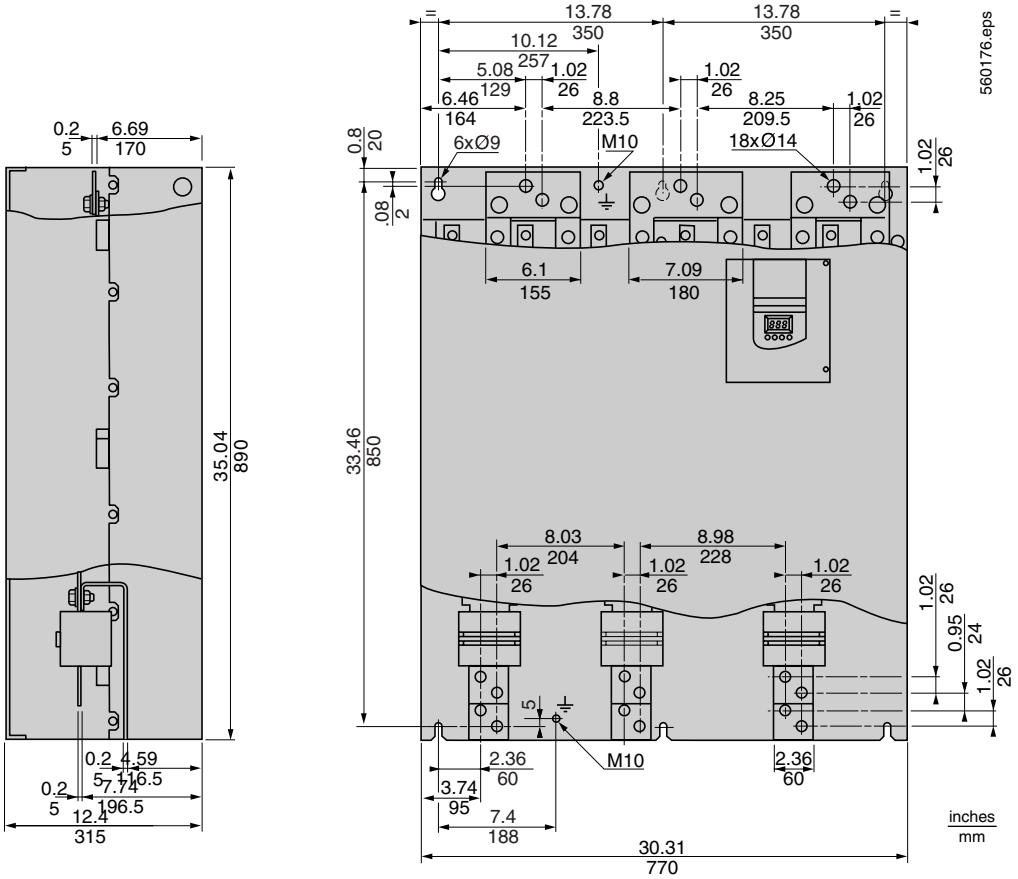
Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

ATS48C41Y to C66Y



Maximum connection capacity:
Ground connections: Busbar (240 mm²)
Power terminals: Busbar (2 x 240 mm²)

ATS48C79Y to M12Y

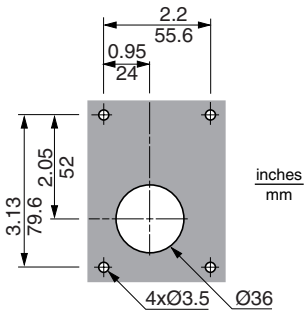


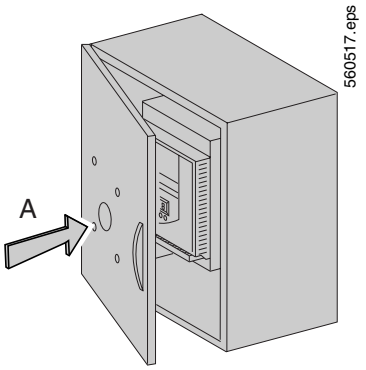
Maximum connection capacity:
Ground connections: Busbar (2 x 240 mm²)
Power terminals: Busbar (4 x 240 mm²)

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

MOUNTING THE REMOTE KEYPAD DISPLAY

VW3G48101

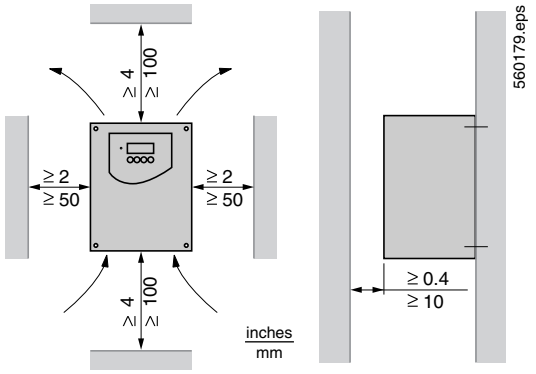




MOUNTING RECOMMENDATIONS

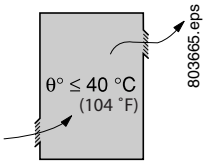
- Install the ATS48 soft start vertically, within ± 10°.
- Do not place the ATS48 soft start near sources of heat.
- Leave sufficient free space to ensure that the air required for cooling can circulate from the bottom to the top of the unit.

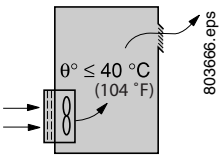
NOTE: The IP 00 version of the ATS48 soft start must be fitted with a protective cover to protect personnel against electrical contact. Protective covers are available for the ATS48C14Y to ATS48C32Y. They should be ordered separately. See page 14.



Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

MOUNTING IN A METAL WALL-MOUNTED OR FLOOR-STANDING ENCLOSURE WITH DEGREE OF PROTECTION TYPE 1 (IP 23) OR TYPE 12 (IP 54)





- Observe the mounting recommendations on page 18.
- To ensure proper air circulation in the soft start:
  - — Fit ventilation grilles
  - — Ensure that there is sufficient ventilation. If not, install forced ventilation with a filter. The openings and/or fans must provide a flow rate at least equal to that of the soft start fans (see the table below)
- Use special filters with Type 12 (IP 54) protection.

Fan Flow Rate Depending On The Soft Start Rating

ATS48 Soft Start	Flow rate CFM	Flow rate m^3/hour
ATS48D32Y and D38Y	24	14
ATS48D47Y	48	28
ATS48D62Y to C11Y	146	86
ATS48C14Y and C17Y	235	138
ATS48C21Y to C32Y	476	280
ATS48C41Y to C66Y	1020	600
ATS48C29Y to M12Y	2040	1200

For non-ventilated ATS48 soft starts (ATS48D17Y and 48D22Y) in metal wall-mounted or floor-standing enclosures with Type 12 (IP 54) degree of protection, install no more than 2" (50 mm) below the soft start to circulate the air inside the enclosure in order to avoid hot spots.

Calculating Enclosure Size

The maximum allowable thermal resistance of the enclosure, Rth (°C/W), is calculated as follows:

$$Rth = \frac{\theta - \theta e}{P}$$

θ = maximum temperature inside enclosure in °C
θe = maximum external temperature in °C
P = total power dissipated in the enclosure in W

- The soft start/motor combinations on pages 12 and 13 can be used in ambient temperatures ≤ 40 °C (104 °F).
- For temperatures between 40 °C and 60 °C (104 °F and 140 °F), derate the maximum permanent current of the soft start by 2% for every degree above 40 °C (104 °F).
- For the power dissipated by the soft starts at rated load: see pages 12 and 13.
- If the starts are infrequent, use a shorting/bypass contactor with the ATS48 soft start at the end of starting to minimize heat dissipation.

Calculate minimum useful heat exchange surface area requirement, S (in^2):

$$S = \frac{K}{Rth}$$

Rth = thermal resistance of the enclosure (calculated previously)
K = thermal resistance per square inch of the enclosure
K = 186 with enclosure fan
K = 233 without enclosure fan

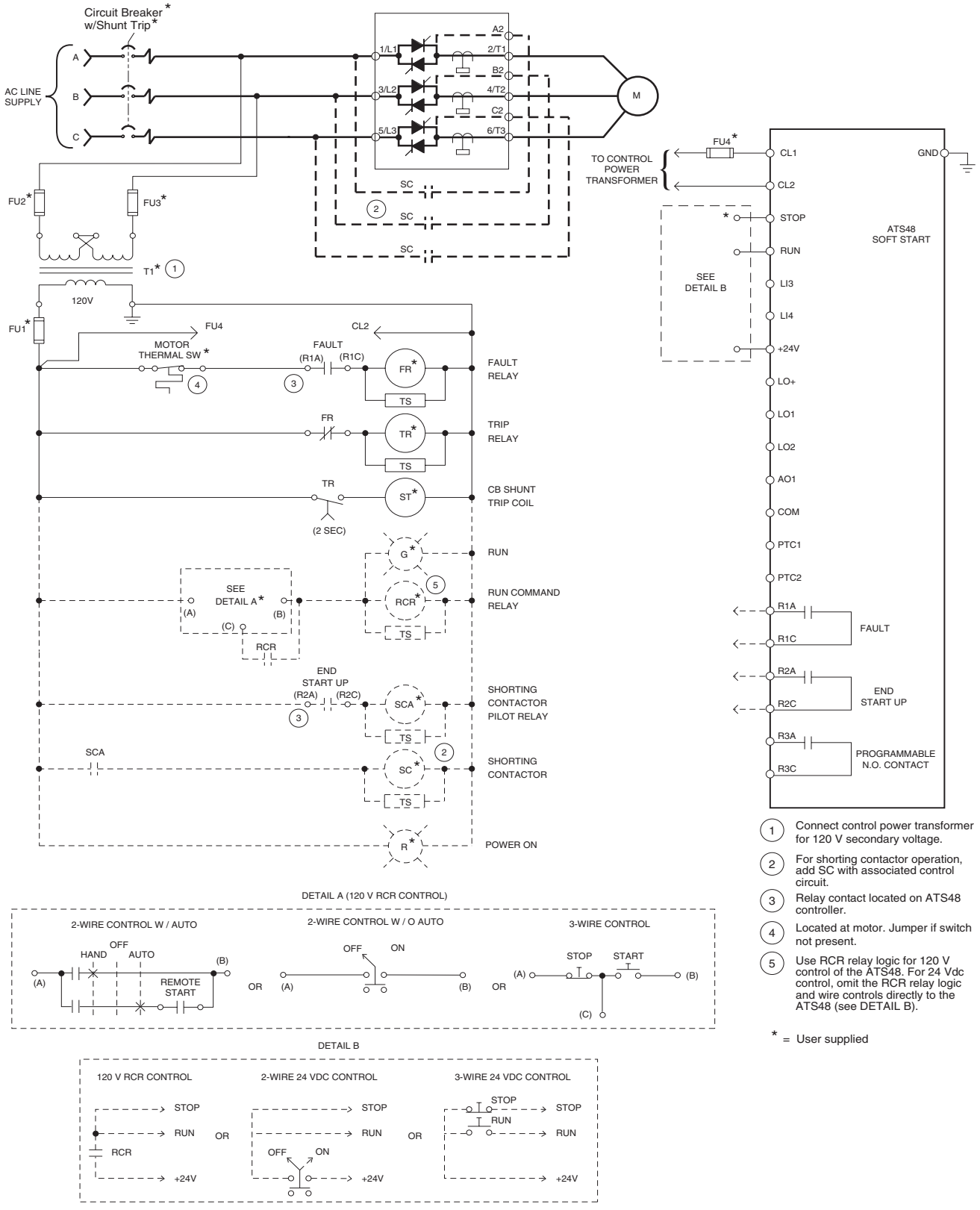
Compare the effective heat exchange surface area to the proposed wall mounted enclosure, S (in^2) which should be less than:

S = (Front area) + (Top area) + 2 (Side area)

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

Altistart 48 Panel-Mount Soft Starts
Recommended Wiring Diagrams

Nonreversing with Shunt Trip Fault Isolation

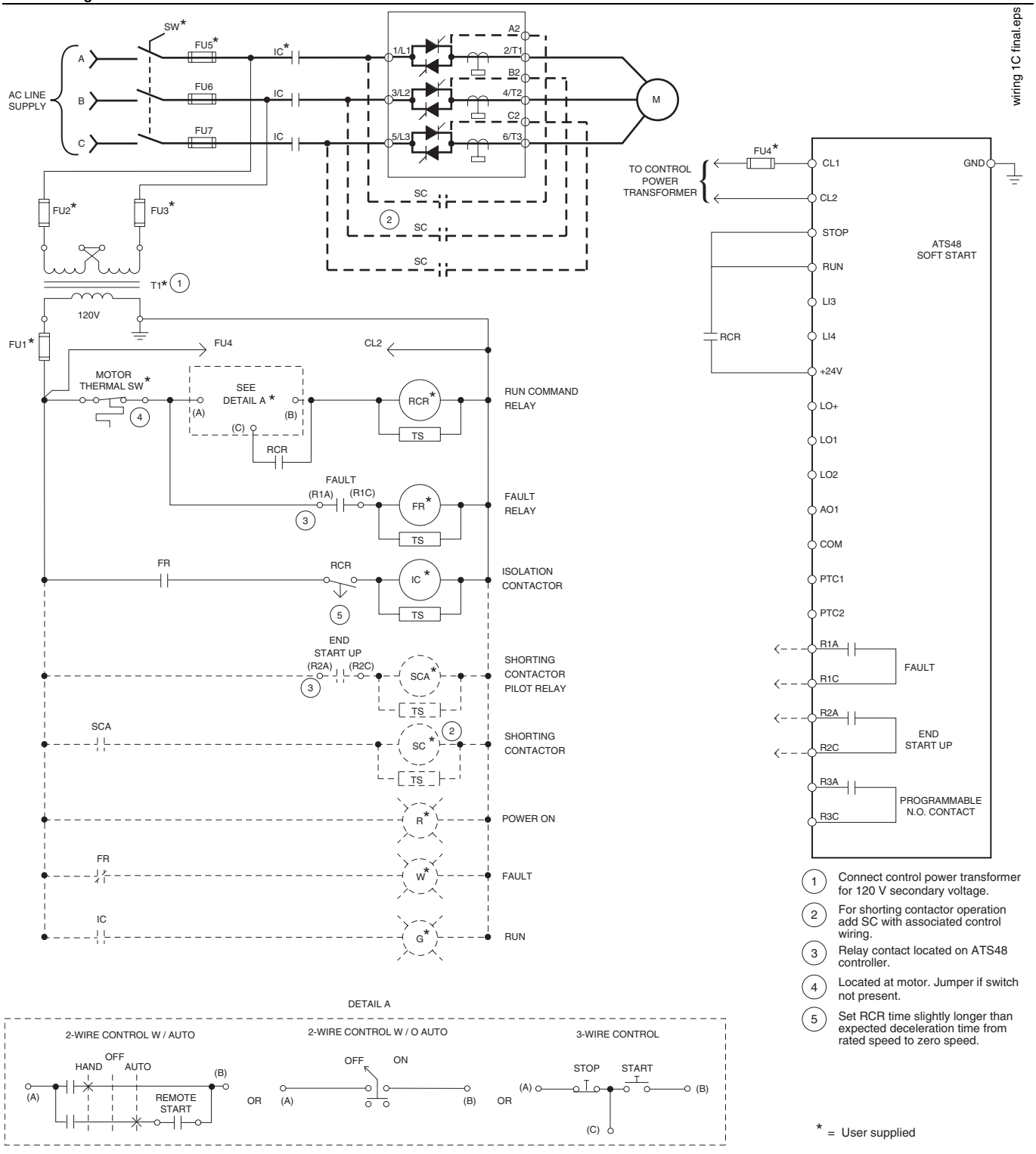


1. Connect control power transformer for 120 V secondary voltage.
2. For shorting contactor operation, add SC with associated control circuit.
3. Relay contact located on ATS48 controller.
4. Located at motor. Jumper if switch not present.
5. Use RCR relay logic for 120 V control of the ATS48. For 24 Vdc control, omit the RCR relay logic and wire controls directly to the ATS48 (see DETAIL B).

* = User supplied

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

Nonreversing with Isolation Contactor



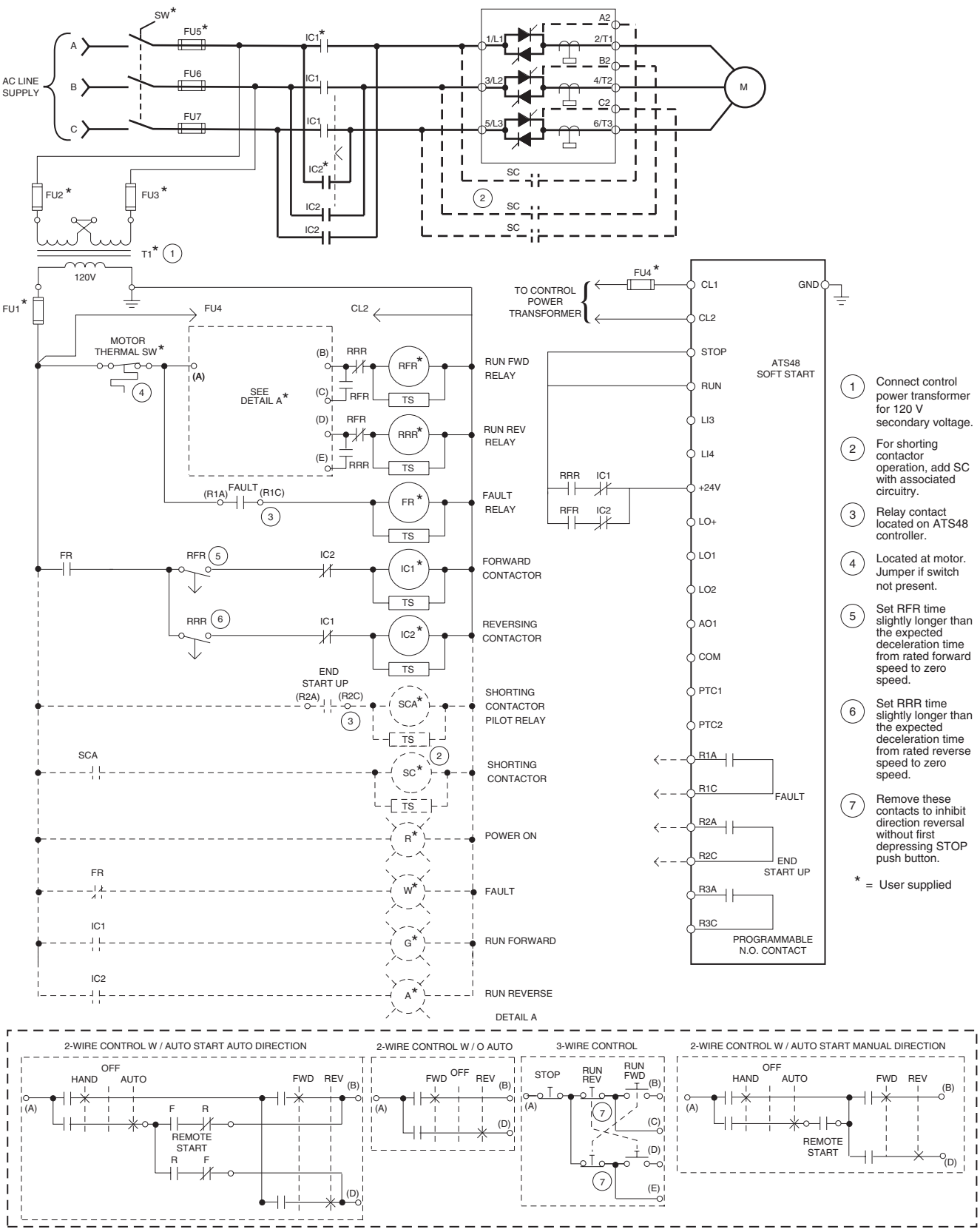
DETAIL A

1. Connect control power transformer for 120 V secondary voltage.
2. For shorting contactor operation add SC with associated control wiring.
3. Relay contact located on ATS48 controller.
4. Located at motor. Jumper if switch not present.
5. Set RCR time slightly longer than expected deceleration time from rated speed to zero speed.

* = User supplied

Characteristics: pages 4 to 7 | Dimensions: pages 16 to 17 | Wiring Diagrams: pages 20 to 23

Reversing with Isolation Contactors



Description of Logic for Recommended Wiring Diagrams

Item	Name	Description
IC1 IC1A	Isolation Contactor (Fwd)	The isolation contactor logic closes IC1 upon a start command and opens IC1 after the stop is complete. The RCR (or RFR and RRR for reversing) are timed contacts that must have a time delay greater than the deceleration ramp time or the braking time. When a coast stop is selected, the time delay must be set for a time that will allow a complete decay of the motor residual voltage. The isolation contactor will open immediately upon a fault. The pilot relay (IC1A) is required when the IC1 contactor coil exceeds the ATS48 relay output ratings.
IC2 IC2A	Isolation Contactor (Rev)	Used for reversing applications only, the IC2 must be mechanically interlocked to IC1. A reversing contactor may be used for the combination of IC1 and IC2. In general, the operation of IC2 is identical to IC1. The pilot relay (IC1A) is required when the IC1 contactor coil exceeds the ATS48 relay output ratings
SC SCA	Shorting Contactor & Pilot Relay	The shorting contactor is used to reduce the heat dissipated by the soft start when the motor is operating at full speed and voltage. The soft start provides proper sequencing of this contactor by the “end-start-up” relay. When the start is completed, the shorting contactor will be commanded to close. The soft start will continue to monitor the motor thermal state and provide motor overload protection. Upon a stop command, the SC contactor will open, transferring the motor current to the ATS48 soft start to allow for controlled deceleration if desired. The pilot relay (SCA) is required when the SC contactor coil exceeds the ATS48 relay output ratings.
TS	Transient Suppressors	Transient suppression of all relay and contactor coils (except ST) is recommended to minimize the possibility of electrical interference with the soft start electronics and to increase relay contact life.
RCR	Run Command Relay	Used in shunt trip fault isolation installations only if 120 V control of the ATS48 soft start is required. Used in non-reversing installations with a isolation contactor for proper sequencing of contactor logic. When energized, RCR initiates the start sequence. When de-energized, stopping is initiated. Operator controls can be either on/off selector switch, HOA selector switch or start/stop push buttons. RCR remains energized during a fault. Once the fault condition has been cleared, RCR must be de-energized by a “stop” command then re-energized to restart the soft start.
RFR	Run Forward Relay	Used for reversing applications only, this coil duplicates the functionality of RCR for the forward direction and is interlocked with the RFR relay.
RRR	Run Reverse Relay	Used for reversing applications only, this coil duplicates the functionality of RCR for the reverse direction and is interlocked with the RRR relay.
ST	Shunt Trip Coil	This coil is attached to the shunt trip coil on the disconnect and will energize 2 seconds after a soft start fault by the TR timer contact. The time delay is to prevent nuisance tripping of the circuit breaker during soft start power-up or during line undervoltage conditions.
TR	Trip Relay	Used in shunt trip circuit breaker logic only; coil energized upon a soft start fault.
FR	Fault Relay	The fault relay is energized during normal operation and deenergizes if the soft start fault contacts open or if the motor thermal switch (if supplied) opens. FR also provides additional contacts for the soft start fault output.

Suggested Components for Standard Duty Applications

Induction Motor				ATS48 Soft Start		FU4	
Rated hp (1)				ATS48 Soft Start	Device Rated Current	ATS Control	Class CC 600 V Time Delay
208 V	230 V	460 V	575 V	Model	@ 40 °C (104 °F)(2)	Power Burden (W)	@115 V
3	5	10	15	**ATS48D17Y**	17	25	0.5 A
5	7.5	15	20	**ATS48D22Y**	22	25	0.5 A
7.5	10	20	25	**ATS48D32Y**	32	30	0.6 A
10	—	25	30	**ATS48D38Y**	38	30	0.6 A
—	15	30	40	**ATS48D47Y**	47	30	0.6 A
15	20	40	50	**ATS48D62Y**	62	30	0.6 A
20	25	50	60	**ATS48D75Y**	75	30	0.6 A
25	30	60	75	**ATS48D88Y**	88	30	0.6 A
30	40	75	100	**ATS48C11Y**	110	30	0.6 A
40	50	100	125	**ATS48C14Y**	145	30	0.6 A
50	60	125	150	**ATS48C17Y**	170	30	0.6 A
60	75	150	200	**ATS48C21Y**	210	50	1 A
75	100	200	250	**ATS48C25Y**	250	50	1 A
100	125	250	300	**ATS48C32Y**	320	50	1 A
125	150	300	350	**ATS48C41Y**	410	80	1.5 A
150	—	350	400	**ATS48C48Y**	480	80	1.5 A
—	200	400	500	**ATS48C59Y**	590	80	1.5 A
200	250	500	600	**ATS48C66Y**	660	80	1.5 A
250	300	600	800	**ATS48C79Y**	790	80	1.5 A
350	350	800	1000	**ATS48M10Y**	1000	80	1.5 A
400	450	1000	1200	**ATS48M12Y**	1200	80	1.5 A

(1) Motor full load currents through 500 hp @ 460/575 V, 250 hp @ 230 V, and 200 hp @ 208 V are taken from the National Electric Code (NFPA 70-2002, Table 430.150). Above these ratings, motor full load currents are calculated based upon 1.2 A/hp for 460 V and 2.4 A/hp for 230 V. Motors listed are for standard duty applications. For severe duty applications, select the next larger soft start size.

(2) The ambient temperature indicated in the table represents the temperature of the air surrounding the ATS48 soft start. Any additional temperature factors associated with the enclosure system or actual installation ambient temperature must be considered when determining the actual rated current (I_{CL}) of the soft start. For operating ambient above 40 °C (104 °F) without a shorting/bypass contactor and 50 °C (122 °F) with a shorting/bypass contactor but not exceeding 60 °C (140 °F) , the rated current (I_{CL}) of the soft start must be de-rated by 2% per °C.

NOTE: To select control operators (push buttons, pilot lamps, and selector switches), control power transformers, and wire management devices (control and power terminal strips, wire terminations) indicated on the recommended wiring diagram configurations, visit www.us.squared.com.

Additional Suggested Components for Standard Duty Applications

ATS48 Soft Start	Contactors (1), (2), (3)				Disconnect (4)			
	IC1	IC2		SC	Fusible Disconnect			Circuit Breaker
ATS48 Model	Isolation Contactor	Reversing Contactor (5)	Mechanical Interlock	Shorting Contactor (AC1)	Power Fuses Class/Rating	Fuse Block (6)	Molded Case Switch (7)	Thermal Magnetic (7)
D17Y	LC1D09	LC1D09	**(8)**	LC1D09	J / 25	60308J	FHL36000M	FAL36030
D22Y	LC1D18	LC1D18	**(8)**	LC1D18	J / 30	60308J	FHL36000M	FAL36040
D32Y	LC1D25	LC1D25	**(8)**	LC1D25	J / 40	60608J	FHL36000M	FAL36050
D38Y	LC1D32	LC1D32	**(8)**	LC1D32	J / 50	60608J	FHL36000M	FAL36060
D47Y	LC1D40	LC1D40	**(8)**	LC1D40	J / 60	60608J	FHL36000M	FAL36080
D62Y	LC1D50	LC1D50	**(8)**	LC1D50	J / 80	61038J	FHL36000M	FAL36090
D75Y	LC1D80	LC1D80	**(8)**	LC1D80	J / 100	61038J	FHL36000M	FAL36100
D88Y	LC1D80	LC1D80	**(8)**	LC1D80	J / 120	62003J	KHL36000M	KAL36110
C11Y	LC1D115	LC1D115	**(8)**	LC1D115	J / 150	62003J	KHL36000M	KAL36150
C14Y	LC1D115	LC1D115	**(8)**	LC1D115	J / 200	62003J	KHL36000M	KAL36200
C17Y	LC1F150	LC1F150	LA9FF970	LC1F150	J / 225	64033J	LHL36000M	LAL36225
C21Y	LC1F185	LC1F185	LA9FG970	LC1F185	J / 300	64033J	LHL36000M	LAL36250
C25Y	LC1F225	LC1F225	LA9FJ970	LC1F225	J / 350	64033J	LHL36000M	LAL36350
C32Y	LC1F330	LC1F330	LA9FJ970	LC1F330	J / 400	64033J	LHL36000M	LAL36400
C41Y	LC1F400	LC1F400	LA9FJ970	LC1F400	J / 500	6633J	MHL36000M	MAL36500
C48Y	LC1F500	LC1F500	LA9FJ970	LC1F500	J / 600	6633J	MHL360006M	MAL36600
C59Y	LC1F500	LC1F500	LA9FJ970	LC1F500	L / 700	**(6)**	MHL360008M	MAL36800
C66Y	LC1F630	LC1F630	LA9FJ970	LC1F630	L / 900	**(6)**	MHL360008M	MAL36900
C79Y	LC1F630	LC1F630	LA9FL970	LC1F630	L / 1100	**(6)**	MHL36000M	**(9)**
M10Y	LC1F780	LC1F780	LA9FL970	LC1F780	L / 1350	**(6)**	MHL36000M	**(9)**
M12Y	LC1F780	LC1F780	LA9FX970	LC1F780	L / 1600	**(6)**	NCL3600012M	**(9)**

(1) All coils are selected for 120 V, 60 Hz operation. Refer to the *Digest* for additional coil voltages or auxiliary contact configurations. One block may be added to each contactor.

(2) Power terminals are not included with LC1-F contactors. For additional ordering information visit www.us.SquareD.com.

(3) The use of transient suppressors across all contactor coils is recommended. Refer to the latest editions of Schneider Electric's full line product catalogs for selection of transient suppressors.

(4) According to the National Electric Code, branch circuit overcurrent protection must be provided for each soft start. Short circuit protective devices recommended in this table are within NEC requirements for Type 1 coordination.

(5) Reversing contactors for C11 through M12 soft starts must be assembled from components. Parts quantities for a basic contactor assembly, minus the power connection links and terminals, are indicated before each part number. Refer to the latest editions of Schneider Electric's full line product catalogs for power connector link and terminal kits. Reversing contactor interlock units used for the C79 through M12 soft starts are designed for vertical interlocking of the individual contactors. Horizontally interlocked contactors are used for D17 through C59 soft starts.

(6) Fuse holder part number references are for Class J fuses only based on Ferraz Shawmut spring reinforced with box type connectors acceptable for Al/Cu wiring. Class L fuses require bolt-on connections to user-supplied power bus work.

(7) The molded case switches and circuit breakers selected require the addition of operator mechanisms to allow operation from the exterior of an enclosure. Refer to the latest editions of Schneider Electric's full line product catalogs for operator mechanism information. When using a shunt trip relay for SCR fault isolation, order a disconnect switch with suffix -1021 for addition of shunt trip coil.

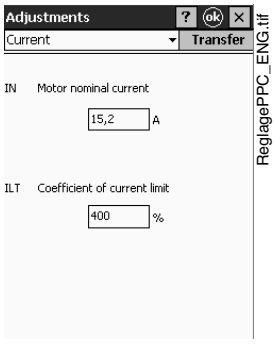
(8) The D Line contactor is available as a reversing configuration. For these applications, change the IC1 part number prefix from LC1- to LC2- to order the IC1 and IC2 combination complete with mechanical interlocks.

(9) Devices rated above 660 A have not been coordinated with circuit breakers. You must use a Class L fuse for overcurrent protection with ATS48 soft start models C79, M10, and M12.

Characteristics: pages 4 to 7 Dimensions: pages 16 to 17 Wiring Diagrams: pages 20 to 23

Summary of Functions

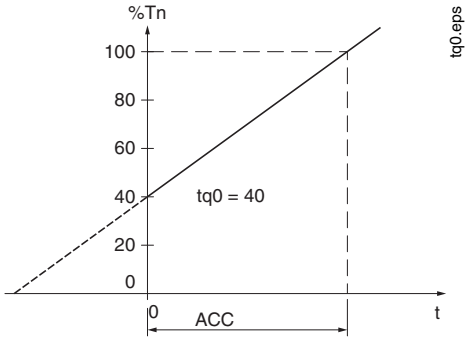
Soft Start Factory Setting



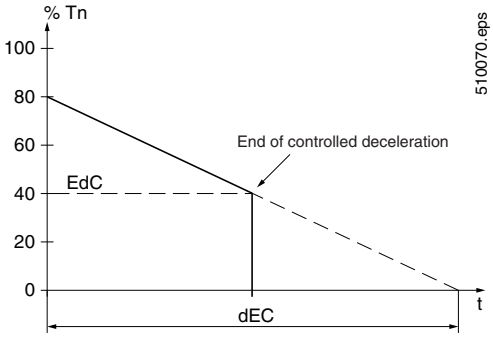
Current setting with PowerSuite on PPC

The soft start is supplied ready for use in most applications. The default settings of the primary functions are as follows:

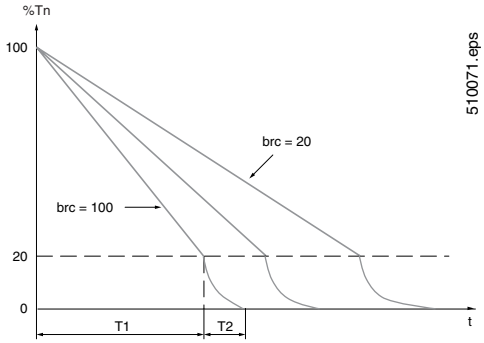
- Nominal motor current (depends on the soft start rating)
- Limiting current: 400%
- Acceleration ramp time: 15 s
- Initial starting torque: 20%
- Selection of the type of stop: freewheel stop
- Motor thermal protection: class 10
- Time before restarting: 2 s
- Motor phase loss threshold: 10%
- Line frequency: automatic
- RUN and STOP logic inputs: 2-wire or 3-wire control via wiring
- Logic input LI3: forced freewheel stop
- Logic input LI4: local mode control (serial link disabled)
- Logic output LO1: thermal motor alarm
- Logic output LO2: motor powered
- Relay output R1: fault relay
- Relay output R3: motor powered
- Analog output: motor current



Acceleration ramp during time ACC with initial starting torque tq0 = 40% of the nominal motor torque



Decelerated stop by torque control during time dEC with threshold EdC for changing to freewheel stop mode
EdC = 40% of nominal motor torque

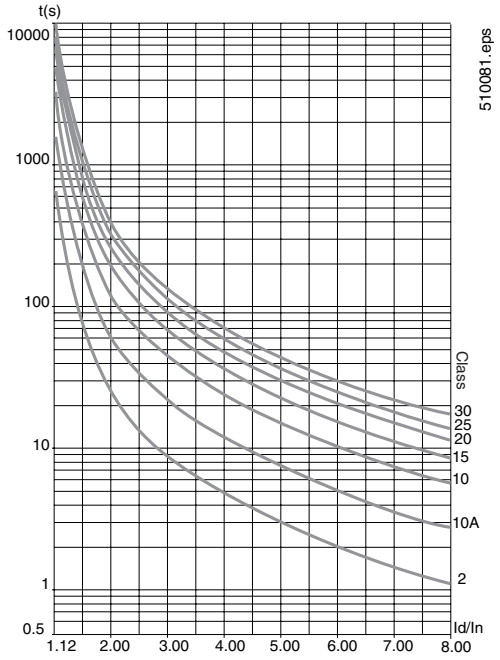


InTele™ braking stops for different braking torque levels brc

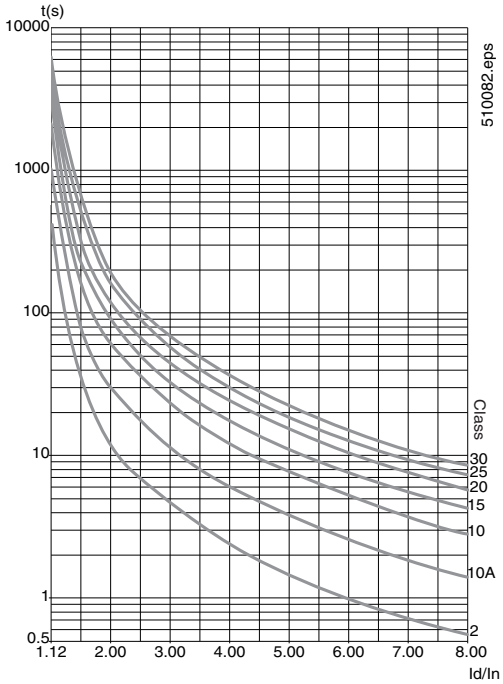
Adjustment Functions

- **Nominal motor current** (maximum continuous current)
  The nominal current of the soft start can be adapted to the nominal motor current indicated on the nameplate.
  Adjustment range: 0.4 to 1.3 times the soft start nominal current.
- **Limiting current**
  The maximum starting current can be adjusted.
  Adjustment range: 150% to 700% of the nominal motor current. Limited to 500% of the maximum permanent current defined for the soft start rating.
- **Acceleration ramp time**
  During the starting phase, the ATS48 soft start applies a torque ramp to the motor. The ramp time (ACC) corresponds to the time it takes the ramp to reach the nominal torque (starting at 0). Adjustment range: 1 to 60 s.
- **Initial starting torque**
  The initial torque tq0 applied to the motor can be used to instantly overcome any resistive starting torque. Adjustment range: 0 to 100% of the nominal motor torque.
- **Selection of the type of stop**
  Three types of stop are available:
  - **Freewheel motor stop**
  - **Motor stop by deceleration via torque control (pump application)**
    This type of stop enables a centrifugal pump to decelerate gradually on a ramp in order to avoid a sudden stop. It can be used to dampen the hydraulic transient in order to significantly reduce pressure surges. The deceleration ramp time (dEC) can be adjusted. During deceleration, the pump flow rate decreases and becomes negligible at a certain speed. To continue to decelerate would serve no purpose. A torque threshold (EdC) can be set at which the motor will change to freewheel stop mode, avoiding the unnecessary heating of the motor and the pump.
  - **InTele™ braking**
    The braking torque level (brc) can be adjusted. The dynamic braking time (T1) corresponds to the time taken to decelerate from 100% to 20% of the nominal motor speed. To improve braking at the end of deceleration, the soft start injects a DC current for an adjustable period of time (T2). It produces less motor heating than traditional DC injection braking.

    Consult the Schneider Electric Product Support Group (919-266-8600) for criteria to be met for this feature.



Motor thermal protection curves (cold)



Motor thermal protection curves (warm)

Protection Functions

The ATS48 soft start offers functions for protecting the motor and the machine.

- **Calculated motor thermal protection**
  The soft start continuously calculates the temperature rise of the motor based on the nominal current and the actual current absorbed. In order to adapt the ATS48 soft start to individual motors and applications, several protection classes are offered in accordance with standard IEC 60947-4-2: Class 30, Class 25, Class 20 (severe duty application), Class 15, Class 10 (standard duty application), Class 10 A, sub-class 2.
  Different protection classes are defined for the starting capacities of the motor
  — cold start without thermal fault (corresponding to a stabilized motor thermal state, motor switched off)
  — warm start without thermal fault (corresponding to a stabilized motor thermal state, at nominal power)

  The motor thermal protection function can be disabled.
  After the motor has stopped or the soft start has been switched off, the thermal state is calculated even if the control circuit is not energized.
  The ATS48 soft start's thermal control prevents the motor from restarting if the temperature rise is too high. If special motors are used which do not have thermal protection, provide external thermal protection via probes or thermal overload relays.
  The soft start is factory preset to Class 10.
  The tripping curves are based on the relationship between the starting current Is and the (adjustable) nominal motor current In.

Trip time (cold)

Trip time for a standard duty application (class 10)			Trip time for a severe duty application (class 20)		
Is = 3 In	Is = 4 In	Is = 5 In	Is = 3.5 In	Is = 4 In	Is = 5 In
46 s	23 s	15 s	63 s	48 s	29 s

Trip time (warm)

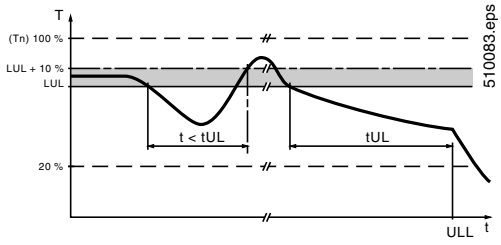
Trip time for a standard duty application (class 10)			Trip time for a severe duty application (class 20)		
Is = 3 In	Is = 4 In	Is = 5 In	Is = 3.5 In	Is = 4 In	Is = 5 In
23 s	12 s	7.5 s	32 s	25 s	15 s

- **Reset motor thermal state**
  Activating the function resets the motor thermal state calculated by the soft start to zero.
- **Motor thermal protection with PTC (1) probes**
  PTC probes are integrated into the soft start, thus avoiding the necessity of an external thermal protection device. The "PTC probe thermal overshoot" fault opr alarm can be indicated using a configurable logic output or displayed via the serial link. The function can be disabled.
  Note: The PTC probe protection and calculated motor thermal protection functions are independent and can be active simultaneously.
- **Soft start ventilation**
  The cooling fan on the soft start is switched on as soon as the heatsink temperature reaches 50 °C (122 °F). It is switched off when the temperature returns to 40 °C (104 °F).

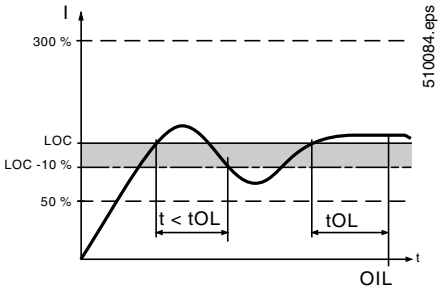
Soft Start Thermal Protection

The soft start is protected against thermal overloads by an analog thermal probe.

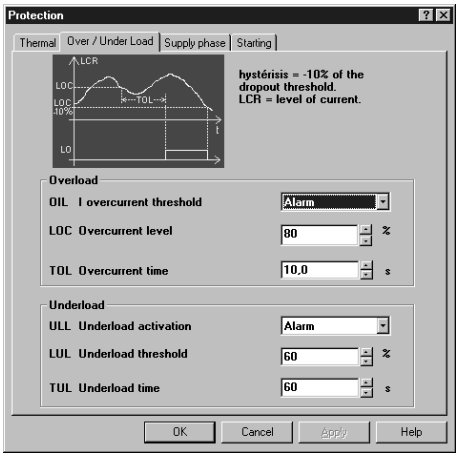
(1) PTC: Positive Temperature Coefficient



Motor underload detection (ULL)



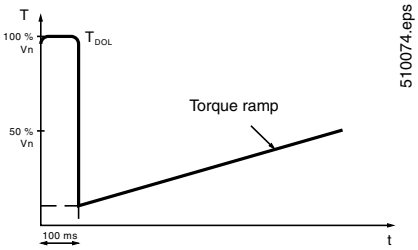
Motor overcurrent detection (OIL)



Configuring the starter overload and underload with PowerSuite on a PC

Protection Functions (continued)

- **Motor underload protection**
  The soft start detects a motor underload if the motor torque falls below a preset torque threshold (LUL) for a specific (adjustable) period of time (tUL).
  The motor underload threshold can be set between 20% and 100% of the nominal motor torque. The permissible underload duration can be set between 1 and 60 s. The detection function can trigger an alarm or a fault. The detection function can be disabled. The “motor underload detected” alarm can be indicated by a configurable logic output or displayed via the serial link. The “motor underload detected” fault (ULF) locks the soft start and can be displayed via the serial link.
- **Excessive acceleration time protection**
  This protection function can be used to detect a start which takes place in adverse conditions. Examples of such conditions include a locked rotor or a motor unable to reach its nominal rotation speed. If the start duration is longer than the set value (between 10 and 999 s), the soft start enters fault mode. The function can be disabled.
- **Current overload protection**
  The soft start detects a current overload if the motor current exceeds a preset overcurrent threshold (LOC) for a specific (adjustable) period of time (tOL). The overcurrent threshold can be set between 50% and 300% of the nominal motor current. The permissible overcurrent duration can be set between 0.1 and 60 s. This function is only active in steady state. The detection function can trigger an alarm or a fault. It can also be disabled. The “current overload detected” alarm can be indicated by a configurable logic output or displayed via the serial link. The “current overload detected” fault (OLC) locks the soft start and can be displayed via the serial link.
- **Protection against line phase inversion**
  This function can be used to detect the direction of rotation of the motor phases and, if it is enabled, to indicate a fault when the direction of rotation is reversed.
- **Time before restarting**
  This function can be used to avoid several consecutive starts which may cause
  — thermal overheating of the application
  — a thermal fault, which may require maintenance work
  — overcurrents (if the direction of rotation is reversed) or repeats (run/stop commands)
  After a stop command, the motor can only restart after the preset time delay has elapsed. The motor is restarted when the time delay has elapsed if a run command is still valid or if a new run command is sent.
  Adjustment range: 0 to 999 s.
- **Motor phase loss detection**
  The function is used to adjust the sensitivity of the protection function to detect a loss of current or a low current in one of the three motor phases for at least 0.5 s or in all three motor phases for at least 0.2 s. The value of the minimum current level can be set between 5% and 10% of the soft start nominal current.
- **Automatic restart**
  This function permits up to six restart attempts after locking on a fault at intervals of 60 s if the cause of the fault has been removed and if the run commands are still present. After the sixth attempt, the soft start remains locked and the fault must be reset before a restart is permitted.
  If the function is active, the fault relay remains activated if line phase loss, motor phase loss, or line frequency out of tolerance faults are detected. This function can only be used in 2-wire control.



Application of a voltage boost equal to 100% of the nominal motor voltage

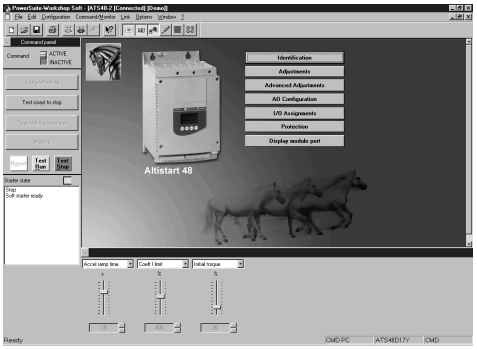
Advanced Adjustment Functions

- **Torque limit**
  Designed primarily for high inertia and constant torque conveyor applications, this function restricts the torque ramp reference to the preset value.
  For example, the function can be used to limit the torque to a constant value throughout the starting period.
  Adjustment range: 10% to 200% of the nominal motor torque.
- **Voltage boost level**
  This function can be used to avoid any “starting” torque (phenomenon caused by friction on stopping or by mechanical play). When a run command is sent, the soft start applies a fixed voltage to the motor for a limited period of time before starting. The function can be disabled. The voltage setting value varies between 50% and 100% of the nominal motor voltage.
- **Test on low power motor**
  This function can be used to test a starter on a motor whose power is much lower that of the soft start. It can be used, for example, to check the electrical wiring of a device. The function is automatically cancelled when the soft start is switched off. The next time the soft start is switched on, the soft start returns to its initial configuration.
- **Activation of the cascade function**
  This function can be used to start and decelerate several cascaded motors with a single soft start. In order to gain maximum benefit from torque control, it is advisable to use motors with powers between 0.5 and 1 times the power of the soft start.
- **Line frequency**
  The following frequencies can be selected for this function:
  — 50 Hz. The frequency fault monitoring tolerance is ± 20%.
  — 60 Hz. The frequency fault monitoring tolerance is ± 20%.
  — Automatic detection of the line frequency by the soft start. The frequency fault monitoring tolerance is ± 6%.
  — 50 Hz and 60 Hz are recommended if the power supply is provided by a emergency standby generator set, given their high tolerance.
- **Reset kWh or the operating time**
  Sets the value of the power in kW/h or the operating time value to 0. The calculation of the values is updated once the reset command has been sent.
- **Return to factory settings**
  This function can be used to reset each setting to its initial value (soft start factory setting, see page 25).

2nd Motor Adjustment Functions

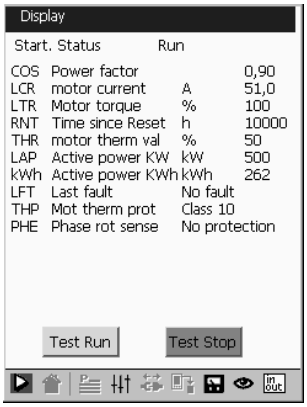
In order to access the 2nd motor adjustment functions, one logic input must be assigned to the second set of motor parameters function. The adjustment functions and ranges are identical for both sets of motor parameters.
The settings are as follows (see page 26):

— Nominal motor current
— Limiting current
— Acceleration ramp time
— Initial starting torque
— Deceleration ramp time
— Threshold for changing to freewheel stop mode at the end of deceleration
— Maximum torque limit



Commande_ENG.tif

Displaying the commands and settings with PowerSuite on PC



SurveillancePPC_ENG.tif

Monitoring the parameters with PowerSuite on PPC

Communication Functions

The ATS48 soft start is supplied with an RS-485 multidrop serial link with Modbus® systems protocol as standard. The serial link is configured in the Communication menu using:

- The address of the soft start (0 to 31)
- The communication speed (4800, 9600, or 19200 bps)
- The format of the communication data. The following formats can be selected:
  - 8 data bits, odd parity, 1 stop bit
  - 8 data bits, even parity, 1 stop bit
  - 8 data bits, no parity, 1 stop bit
  - 8 data bits, no parity, 2 stop bits
- The time-out (1 to 60 s)

PowerSuite Advanced Dialog Solutions

The PowerSuite advanced dialog solutions (see page 15) offer the following advantages:

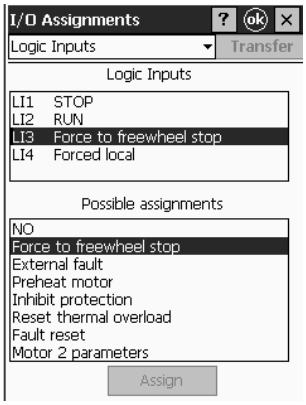
- Connection to the ATS48 soft start and access to the adjustment, monitoring, and control functions
- Display of messages in plain text in 5 languages (English, French, German, Spanish, and Italian)
- Preparation and saving of settings to hard disk
- Comparison and editing of settings using office automation tools
- Downloading of soft start settings to the PC and uploading from the PC to the soft start

Application Monitoring Functions

The monitoring functions provide the following information:

- Power factor, displayed between 0.00 and 1.00
- Motor thermal state: 100% corresponds to the thermal state of the motor consuming the set nominal current
- Motor current: displayed in amperes between 0 and 999 A and in kA between 1000 and 9999 A
- The operating time corresponding to the total number of soft start operating hours during heating, acceleration, steady state, deceleration, braking, and continuous bypass operation. It is displayed in hours between 0 and 999 hours and in kilo hours between 1000 and 65536 hours.The active power is displayed between 0 and 255%, where 100% corresponds to the power at the set nominal current and at full voltage.
- The motor torque is displayed between 0 and 255%, where 100% corresponds to the nominal torque.
- The active power consumed is displayed in kW. The line voltage value must be configured. The accuracy of this setting depends on the error between the voltage configured and the actual voltage.
- Energy in kWh displayed with PowerSuite

- The following soft start states are shown in the display of the current state:
  - — Soft start without a run command and with no power supplied
  - — Soft start without a run command and with power supplied
  - — Acceleration/deceleration in progress
  - — Steady state operation
  - — Braking in progress
  - — Soft start in current limiting mode
  - — Starting time delay not elapsed
- Last fault
- Phase rotation direction. Displays the direction of rotation (direct or indirect).
- **Keypad display locking code**
  - — An access code can be used to protect access to the soft start's adjustment and configuration parameters. Only the monitoring parameters are accessible when the adjustment and configuration parameters are locked out.



IOAssignPPC_ENG.tif

Logic input Application Functions

The soft start has 4 logic inputs:

- **2 logic inputs (RUN and STOP) are reserved for run/stop commands** which can be sent in the form of maintained contacts or as pulsed contacts.
  - — **2-wire control**: Starting and stopping are controlled by a single logic input. State 1 of the logic input controls starting and state 0 controls stopping.
  - — **3-wire control**: Starting and stopping are controlled by 2 separate logic inputs. A stop is obtained on opening (state 0) the STOP input. The pulse on the RUN input is stored until the stop input opens.
- **2 logic inputs (LI3 and LI4) can be configured with the following functions**:
  - — **Freewheel stop**: When combined with a braked stop or decelerated stop command, activating the logic input will stop the motor in freewheel mode.
  - — **External fault**: Enables the soft start to detect an external, customer-defined fault (such as level or pressure). When the contact is open, the soft start enters fault mode.
  - — **Force to local control mode**: When the soft start is connected to a serial link, this function can be used to change from line mode (control via serial link) to local mode (control via the keypad display).
  - — **Reset motor thermal fault**: Enables the motor thermal fault to be reset remotely.
  - — **Activation of the cascade function**: With this function active, motor thermal protection is disabled and relay R1 is configured as the fault isolation relay. This function can be used to start and decelerate several motors one after the other with a single soft start.
  - — **Reset all faults**: Enables all faults to be reset remotely.
  - — **Second set of motor parameters**: Enables a second set of parameters to be selected to start and decelerate two different motors with a single soft start.

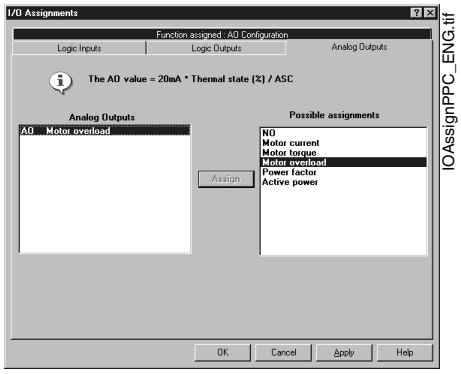
Logic Output Application Functions

The soft start has 2 logic outputs (LO1 and LO2) which, depending on their configuration, can be used for remote indication of the following states or events:

- Motor thermal alarm: The motor thermal state has exceeded the alarm threshold. This alarm can be used, for example, to avoid starting a motor if the thermal reserve is insufficient.
- Motor powered: Indicates that there may be current in the motor.
- Motor overcurrent alarm: The motor current is higher than the set threshold.
- Motor underload alarm: The motor torque is lower than the set threshold.
- Motor PTC probe alarm: The thermal state monitored by the PTC motor probe has been exceeded.
- Second set of motor parameters activated

Relay and Analog Output Application Functions

The soft start has 3 relays, 2 of which are configurable.



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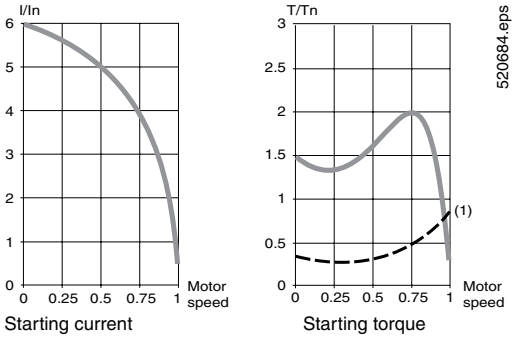
- **End of starting relay R2**: Cannot be configured. The end of starting relay controls the bypass contactor on the soft start. It is activated when the motor completes the starting phase. It is deactivated when a stop command is sent and in the event of a fault. The soft start regains control when a braking or deceleration command is sent.
- **Relay R1 application functions**
  Relay R1 can be configured as follows:
  - — **Fault relay**: Relay R1 is activated when the soft start is powered and there are no faults. It is deactivated when a fault occurs and the motor switches to freewheel mode.
  - — **Isolating relay**: The contact of relay R1 closes when a run command is sent and re-opens when a stop command is sent, at the end of deceleration on a decelerated stop or in the event of a fault. The line contactor is deactivated and the motor is isolated from the line supply.
- **Relay R3 application functions**
  Relay R3 is configured to indicate the same states or events as logic outputs LO1 or LO2 (see page 32).
- **Analog current output AO application function:**
  - — Analog output AO provides an image of the following values: motor current, motor torque, motor thermal state, power factor, active power.
  - — The following settings are associated with the analog output:
    - The type of signal supplied: 0-20 mA or 4-20 mA
    - The scale setting of the signal. The function associates the maximum amplitude of the analog output (20 mA) with a percentage of the nominal value of the parameter, which can be set between 50% and 500%.

Function Compatibility Table

Functions	Decelerating stop	INTELE™ braking stop	Forced freewheel stop	Thermal protection	Motor phase loss detection	Tests on low power motor	Cascaded motors
Decelerating stop	N/A	N	Y	Y	Y	Y	Y
INTELE™ braking stop	N	N/A	Y	Y	Y	Y	Y
Forced freewheel stop	Y	Y	N/A	Y	Y	Y	N
Thermal protection	Y	Y	Y	N/A	N/A	Y	N
Motor phase loss detection	Y	Y	Y	N/A	N/A	Y	N/A
Tests on low power motor	Y	Y	Y	Y	Y	N/A	N
Cascaded motors	Y	Y	N	N	N/A	N	N/A

Y - Compatible functions N - Incompatible functions N/A - Not applicable

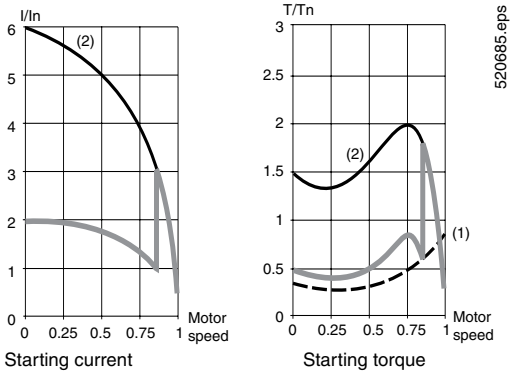
Direct starting



- Starting current: 4 to 8 times the nominal current
- Starting torque: 0.5 to 1.5 times the nominal torque
- Characteristics:
  - — Motor with 3 terminals, low and medium power
  - — On-load starting
  - — High current peak and voltage drop
  - — Simple device
  - — Sudden starting for the mechanism
- No parameter adjustment

(1) Load torque

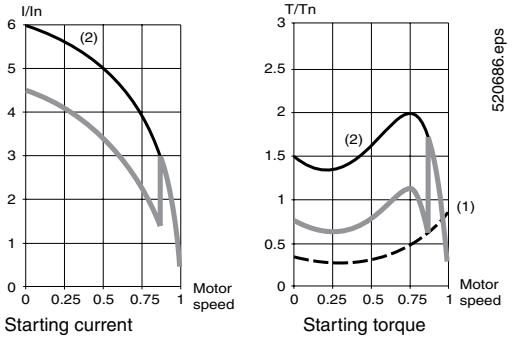
Wye Delta starting



- Starting current: 1.8 to 2.6 times the nominal current
- Starting torque: 0.5 times the nominal torque
- Characteristics:
  - — Motor with 6 terminals
  - — No-load or low resistive torque starting
  - — High current peaks and torque when changing to “Wye Delta” mode
  - — A device requiring maintenance
  - — Subject to mechanical stress when starting
- No parameter adjustment

(1) Load torque
(2) Direct Starting

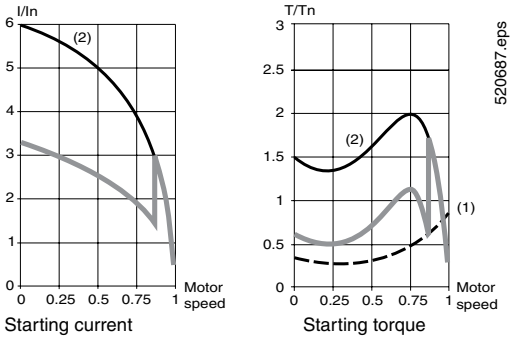
Primary resistor starting



- Starting current: 4.5 times the nominal current
- Starting torque: 0.5 to 0.75 times the nominal torque
- Characteristics:
  - — Motor with 3 terminals, high power
  - — Starting with increasing resistive torque
  - — High current peak
  - — A large, bulky device requiring maintenance
  - — Subject to mechanical stress when starting
- No parameter adjustment

(1) Load torque
(2) Direct Starting

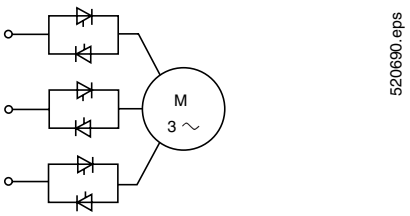
Autotransformer starting



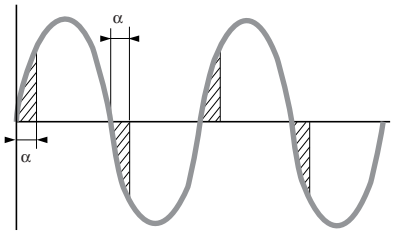
- Starting current: 1.7 to 4 times the nominal current
- Starting torque: 0.4 to 0.85 times the nominal torque
- Characteristics:
  - — Motor with 3 terminals, high power
  - — Large voltage drop and current peak when connected at full voltage
  - — A complex, bulky device requiring maintenance
  - — Subject to mechanical stress when starting
- No parameter adjustment

(1) Load torque
(2) Direct Starting

Conventional Electronic Starting With Voltage Ramp And Current Limit



Schematic diagram



Firing angle

- A soft start with 6 thyristors connected head-to-tail in each line phase is used to power the three-phase asynchronous motor by gradually increasing the voltage on start-up.
  - — Depending on the firing time and angle of the thyristors, it can be used to supply a voltage which will gradually increase at a fixed frequency.
  - — The gradual increase in the output voltage can either be controlled by the acceleration ramp, or by the value of the limiting current, or linked to both parameters.

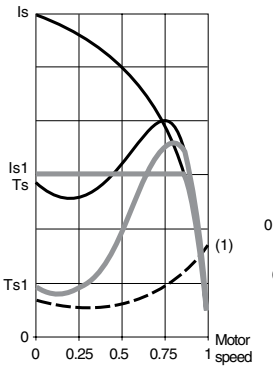


Figure 1

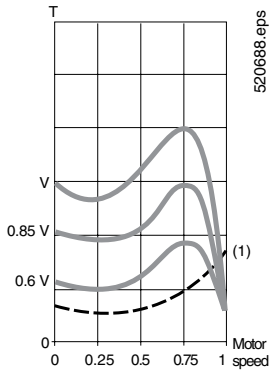


Figure 2

- Figure 1 shows the behavior of the torque in relation to the starting current. Limiting the starting current Is to a preset value Is1 will reduce the starting torque Ts1 to a value which is almost equal to the ratio of the square of currents Is and Is1.

Example

On a motor with the following characteristics: Ts = 2 Tn for Is = 6In, current limiting at Is1= 3 In or 0.5 Is results in a starting torque: Ts1 = Ts x (0.5)2 = 2 Tn x 0.25 = 0.5 Tn. (Tn is motor rated torque; In is motor rated current.)

- Figure 2 shows the torque/speed characteristic of a squirrel cage motor in relation to the supply voltage. The torque varies like the square of the voltage at a fixed frequency. The gradual increase in the voltage prevents the instantaneous current peak on power-up.

(1) Load torque

Advantages of Starting with the ATS48 Soft Start

- **Conventional electronic starting**
  To rectify problems caused by:
  - — Mechanical stress when starting
  - — Hydraulic transients during acceleration and deceleration in pump applications

  Conventional electronic starting requires the use of several current limits or the switching of several voltage ramps.
  The settings become complicated and must be modified every time the load changes.
- **Starting with the ATS48 Soft Start**
  The ATS48 soft start's torque control enables starting without mechanical stress and the smooth control of hydraulic transients with a single acceleration ramp. The settings are simple and effective, whatever the load.

Schneider Electric USA
8001 Highway 64 East
Knightdale, NC 27545
1-888-SquareD
(1-888-778-2733)
www.us.SquareD.com

Schneider Electric Canada
19 Waterman Avenue,
M4B 1 Y2
Toronto, Ontario
1-800-565-6699
www.schneider-electric.ca

Catalog No. 8636CT0201R3/04 March 2004
Replaces 8636CT0201 dated 06/02.

GOULDS PUMPS

Rinse Booster Pump
3BF1H2A0H

3656/ 3756 S-Group

Cast Iron Bronze Fitted Centrifugal Pumps

Bombas centrífugas en hierro fundido con accesorios de bronce

Goulds Pumps

ITT Industries

A Full Range of Product Features

The 3656 and 3756 S-Group pumps from Goulds have been designed with technical benefits to meet the needs of users in a variety of water supply, recirculation, and cooling applications.

- The model 3656 offers close coupled design for space saving and simplified maintenance.
- The model 3756 offers a bearing frame mounted design for flexibility of installation and drive arrangements.
- Back pull-out to reduce maintenance down time.
- Standard Type 21 mechanical seal for both reliability and availability. Carbon/ceramic/ BUNA standard, with other faces and elastomers available.
- 3656/3756 available in all iron, bronze fitted or all bronze construction for application versatility.
- Replaceable wearing components include stainless steel shaft sleeve and casing and hub wear rings to maintain peak efficiency.
- Packed box sealing is also available as an option.
- Enclosed impeller design, dynamic balancing and renewable wear rings reduce losses affecting performance and pump life.
- Suction and discharge pipe connections are NPT threaded, except 3 x 4 – 7 which has 125 lb. ANSI flat faced flanges.
- Rigid cast iron motor adapter provides support and registered fits maintain positive unit alignment.
- Standard NEMA motor frame, JM or JP shaft extension, C-face mounting, single phase or three phase, 3500 or 1750 RPM. Open drip proof and totally enclosed fan cooled.
- Optional explosion proof or high efficiency motors available.
- Optional rigid carbon steel bedplate, sheet metal coupling guard and T. B. Woods spacer coupling for 3756 models.

Una amplia gama de variadas características

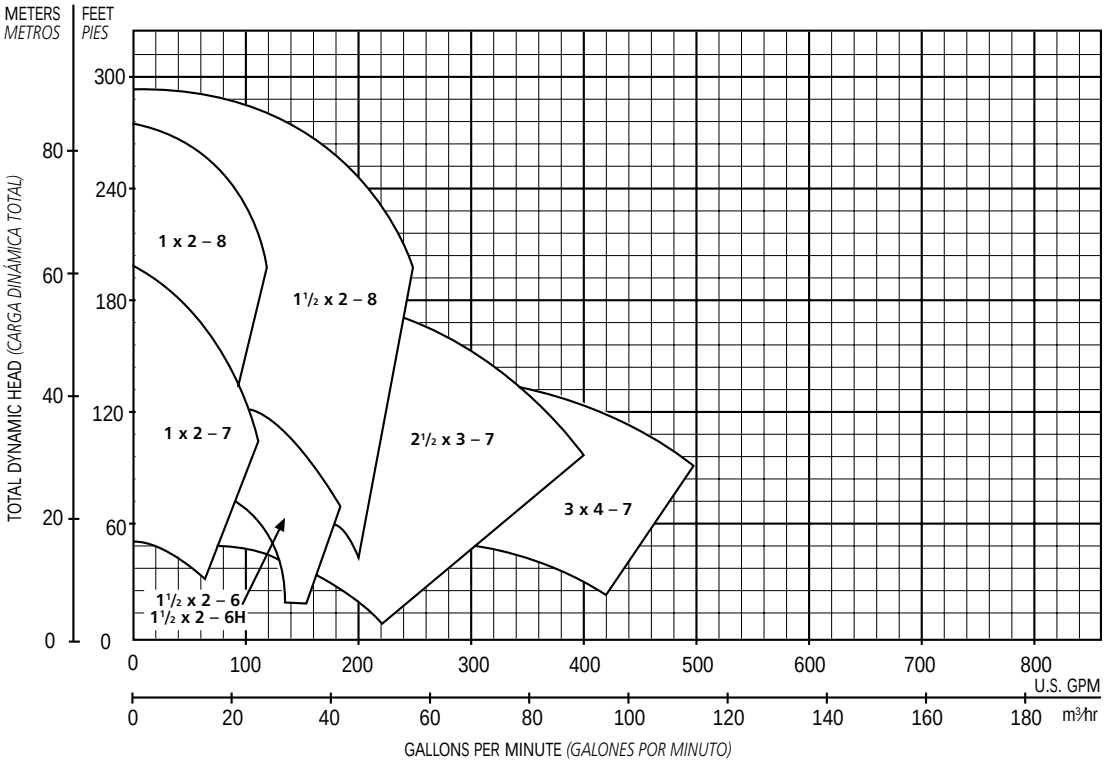
Las bombas 3656 y 3756 del Grupo S de Goulds han sido diseñadas con beneficios técnicos para satisfacer las necesidades de los usuarios en variadas aplicaciones de suministro y recirculación de agua y aplicaciones de refrigeración.

- *El modelo 3656 cuenta con diseño de acoplamiento corto para ahorrar espacio y simplificar el mantenimiento.*
- *El modelo 3756 cuenta con diseño de montaje sobre bastidor que ofrece gran flexibilidad en los arreglos de instalación y accionamiento.*
- *Desmontaje posterior que reduce el tiempo de inactividad por mantenimiento.*
- *Sello mecánico estándar Tipo 21, brinda gran confiabilidad y asegura la disponibilidad. Estándar de carbono/cerámica/ BUNA, también se encuentran disponibles con otras caras y elastómeros.*
- *Los modelos 3656 y 3756 se fabrican en todo hierro, con accesorios de bronce o en todo bronce, para una mayor versatilidad de aplicación.*
- *Los componentes de desgaste reemplazables incluyen los anillos de desgaste de la carcasa y del rodete y la camisa del eje, de acero inoxidable, para mantener la eficiencia pico.*
- *El diseño de impulsor encerrado, balanceo dinámico y anillos de desgaste reemplazables reducen las pérdidas que afectan el desempeño y la vida de la bomba.*
- *Las conexiones de succión y descarga son roscadas NPT, con excepción de la bomba de 3 x 4 – 7, que cuenta con bridas de cara lisa ANSI de 125 lbs.*
- *El adaptador rígido del motor, de hierro fundido, ofrece soporte y los montajes registrados mantienen el alineamiento positivo de la unidad.*
- *Motor con bastidor NEMA estándar, extensión de eje JM, montaje en cara C, monofásico o trifásico, 3500 ó 1750 RPM. Abierto a prueba de filtraciones o totalmente encerrado enfriado por ventilador.*
- *Motores a prueba de explosiones y de alta eficiencia disponibles como opción.*
- *Placa de asiento rígida de acero al carbono, protector de acoplamiento de chapa metálica y acoplamiento espaciador T. B. Woods disponibles como opción en los modelos 3756.*

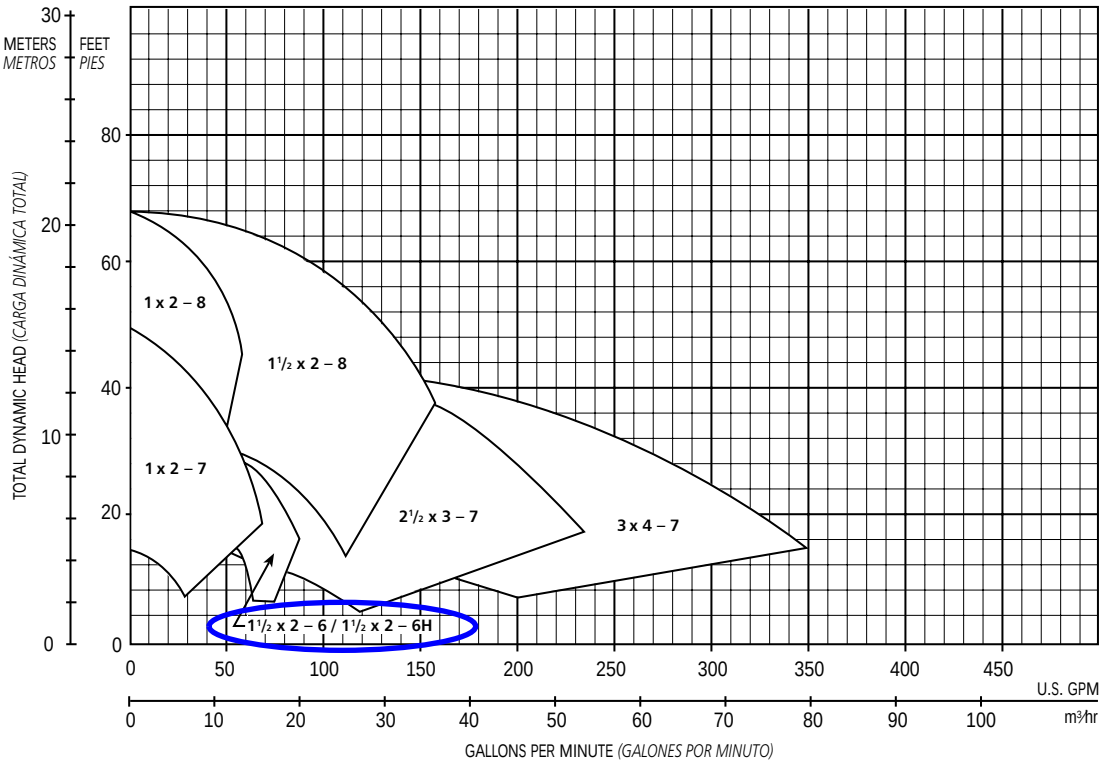
Goulds Pumps is ISO 9001 Registered.

Performance Coverage
Curvas de desempeño

3500 Coverage Curve, *Curva de alcance 3500*



1750 Coverage Curve, *Curva de alcance 1750*



3656/3756 S-Group Numbering System For All Units Built After June 1, 1998

Sistema de numeración del Grupo S, modelos 3656/3756, para todas las unidades fabricadas luego del 1° de junio de 1998

The various versions of the 3656 and 3756 S-Group are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown below.

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

Not recommended for operation beyond printed H-Q curve. For critical application conditions consult factory.

Las diferentes versiones de los modelos 3656 y 3756 del Grupo S se identifican con un número de código de producto en la etiqueta de la bomba. Este número es también el número de catálogo de la bomba. A continuación se ilustra el significado de cada dígito en el código del producto.

No todas las combinaciones de motor, impulsor y sellos están disponibles para cada modelo. Consulte a Goulds sobre números que no aparecen en el catálogo.

No se recomienda la operación más allá de la curva impresa de H-Q (carga-capacidad). Para aplicaciones bajo condiciones críticas, consulte con la fábrica.

Example Product Code, *Ejemplo del código de producto*

9 BF 1 H 2 G 0 H

High Head Impeller (1½ x 2 – 6H Only), *Impulsor de carga alta (1½ x 2 – 6H únicamente)*

Mechanical Seal and O-ring, *Sello mecánico y anillo en O*

Type 21 Mechanical Seal, *Tipo 21 sello mecánico*					
Seal Code, *Código del Sello*	**Rotary, *Rotativo***	**Stationary, *Estacionario***	**Elastomers, *Elastómeros***	**Metal Parts, *Partes Metálicas***	**Part No., *Pieza Número***
0	Carbon, *Carbón*	Ceramic, *Cerámica*	BUNA-N	316 SS, *316 Acero inoxidable*	10K13
1		Sil-Carbide, *Carburo de silicona*	EPR		10K19
3			Viton		10K27
5	Sil-Carbide				10K64
9	Packed Box Design with BUNA O-Ring, *Diseño de prensaestopas empacado con anillo en O de BUNA*				15K16

Note: 10K27 replaces obsolete 10K25, ***Nota:** La 10K27 reemplace la obsoleta 10K25.*

Impeller Option Code, *Código de opción de impulsor*

Impeller Code, *Código del impulsor*	22BF	9BF	3BF		5BF	4BF	6BF
	1 x 2 – 7	1 x 2 – 8	1½ x 2 – 6	1½ x 2 – 6H	1½ x 2 – 8	2½ x 3 – 7	3 x 4 – 7
	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.
A	6¾"	8 1/16"	5 15/16"	5 15/16"	8 1/16"	7 1/16"	7 1/16"
B	6 7/16	7 5/8	5 5/8	5 5/8	7 5/8	6¾	6⅜
C	6	7 5/16	5⅛		6¾	6⅜	5½
D	5¾	7	4¾		5¾	5⅞	4 11/16
E	5½	6½			7¾	5⅝	5⅛
F	5 1/16	6 3/16			7	5 7/16	6
G	4 13/16	5⅜			6¼	5¼	
H	4 9/16	5⅛			6⅛	4 15/16	
J	4⅜					4¾	
K	4 1/16					4⅛	
L	3 13/16						

Driver, *Elemento motor*

1 = 1 PH, *fase*, ODP 4 = 1PH, *fase*, TEFC 7 = 3 PH, *fases*, XP 0 = 1 PH, *fase*, XP
2 = 3 PH, *fases*, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
3 = 575 V, ODP 6 = 575 V, TEFC 9 = 3 PH, *fases*, TEFC, PREFF
1 PH, fase = Monofásiico; 3 PH, fases = Trifásico

HP Rating, *Potencia nominal, HP*

C = ½ HP F = 1½ HP J = 5 HP M = 15 HP
D = ¾ HP G = 2 HP K = 7½ HP N = 20 HP
E = 1 HP H = 3 HP L = 10 HP

Driver: Hertz/Pole/RPM, *Elemento motor: Hertz/Polos/RPM*

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

For frame mounted version, substitute the letters "FRM" in these positions.

Para las versiones de montaje en bastidor, reemplazar las letras en esta ubicación con "FRM".

Material, *Material*

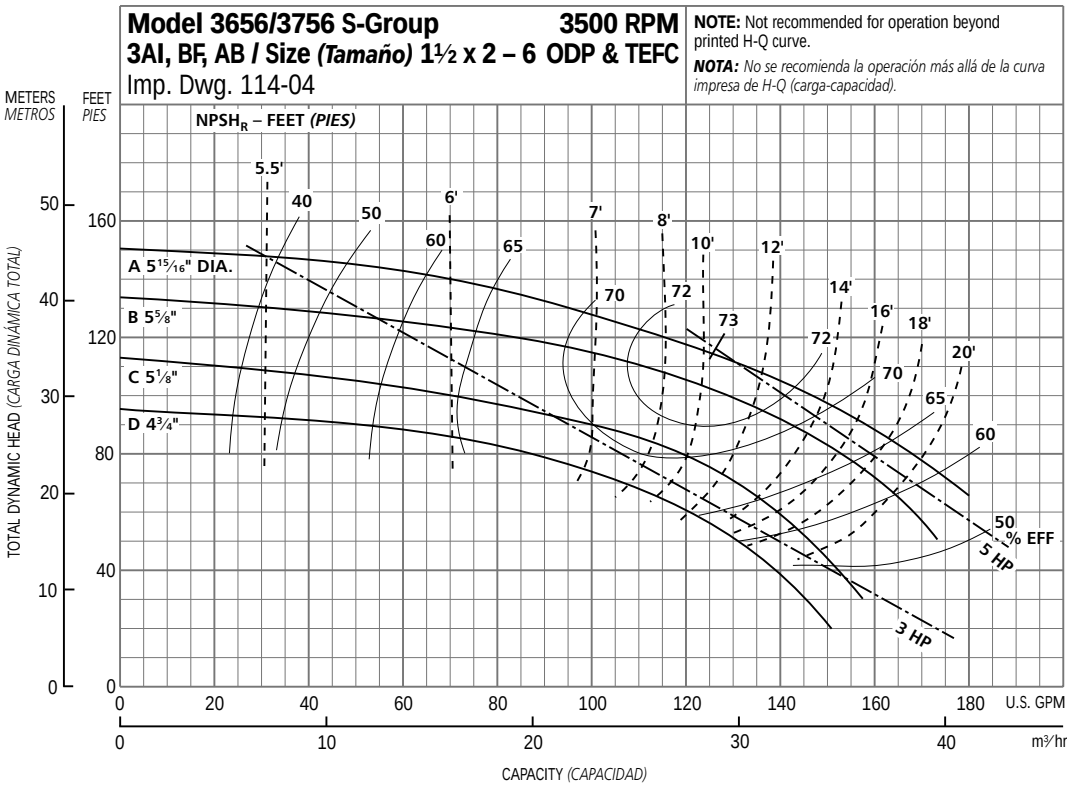
BF = Bronze fitted, *Accesorios de bronce* AI = All iron, *Todo hierro* AB = All bronze, *Todo bronce*

Pump Size, *Tamaño de bomba*

3 = 1½ x 2 – 6(H) 5 = 1½ x 2 – 8 9 = 1 x 2 – 8
4 = 2½ x 3 – 7 6 = 3 x 4 – 7 22 = 1 x 2 – 7

The 1 x 2 – 8 and 1 x 2 – 7 are only available in Bronze Fitted.
Los tamaños 1 x 2 – 8 y 1 x 2 – 7 están disponibles con accesorios de bronce únicamente.

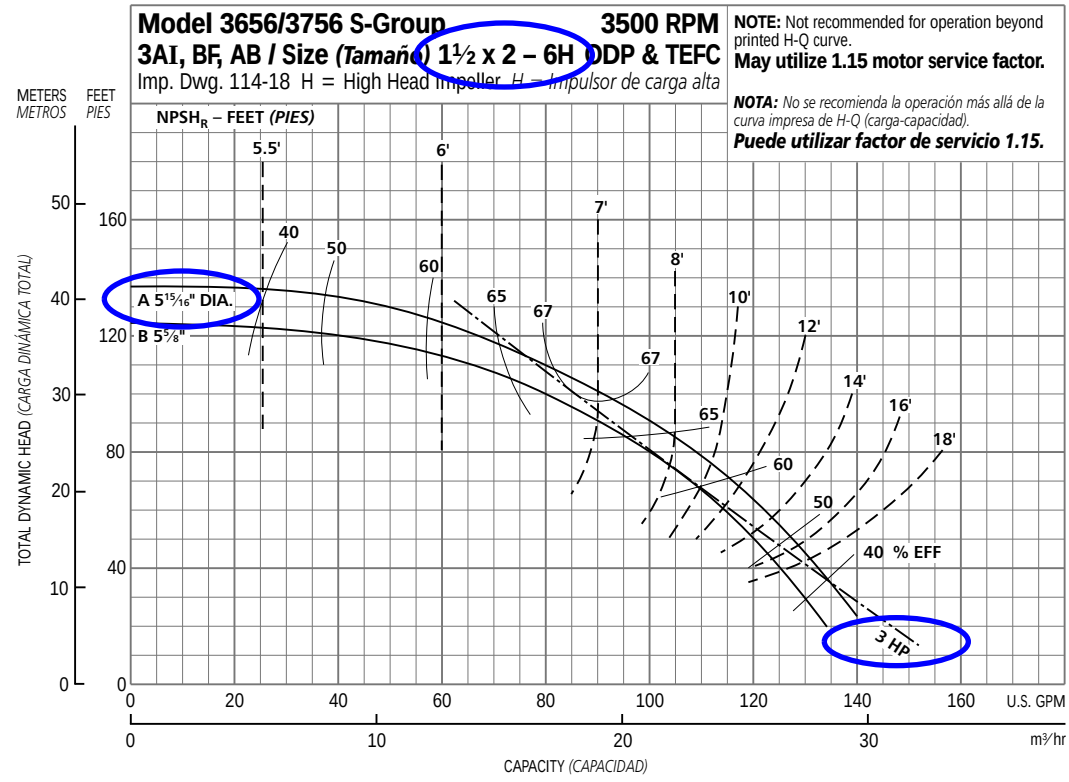
Performance Curves – 60 Hz, 3500 RPM
Curvas de desempeño – 60 Hz, 3500 RPM



Optional Impeller *Impulsor optativo*	
Ordering Code ***Código de pedido***	**Dia.** ***Diá.***
A	5 15/16"
B	5 5/8"
C	5 1/8
D	4 3/4

NOTE: Pump will pass a sphere to 5/16" diameter.

NOTA: *La bomba dejará pasar una esfera de hasta 5/16 de pulgada de diámetro.*

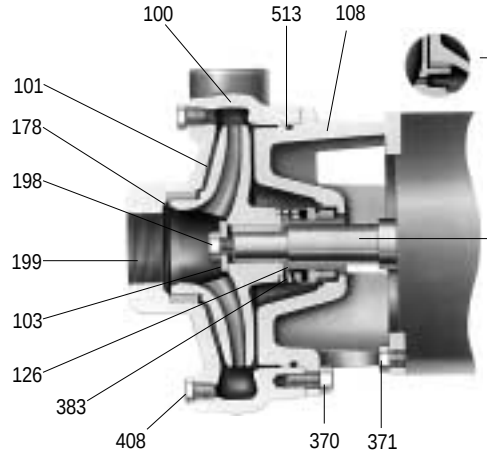


Optional Impeller *Impulsor optativo*	
Ordering Code ***Código de pedido***	**Dia.** ***Diá.***
A	5 15/16"
B	5 5/8"

NOTE: Pump will pass a sphere to 3/16" diameter.

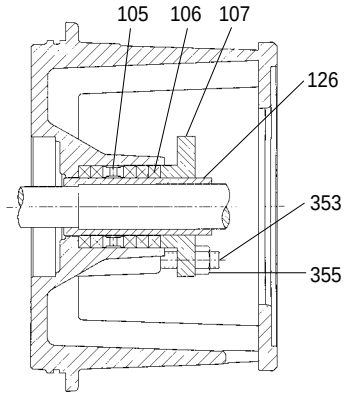
NOTA: *La bomba dejará pasar una esfera de hasta 3/16 de pulgada de diámetro.*

3656 S-Group Materials of Construction
Materiales de construcción - Grupo S, modelo 3756



Back wearing ring on S-Group (2½ x 3 – 7) only
Anillo de desgaste posterior en el Grupo S (2½ x 3 – 7) únicamente.

AISI 1045 steel motor shaft extension (typical)
Extensión del eje del motor de acero AISI 1045 (típico)



Packed Box Arrangement
Caja prensaestopas

Item No. *No. Ítem*	Description *Descripción*	Materials, *Materiales*		
		All Iron *Todo hierro*	Bronze Fitted *Accesorios de bronce*	All Bronze *Todo bronce*
100	Casing, *Carcasa*	1001	1001	1101
101	Impeller, *Impulsor*		1101	
103	Casing wear ring, *Anillo de desgaste de la carcasa*		1618	1618
108	Adapter, *Adaptador*		1001	1001
184	Seal housing, *Cubierta del sello* ①	One piece with adapter, *Una pieza con adaptador*		1101
126	Shaft sleeve, *Camisa del eje*	AISI Type 300 series stainless steel *Acero inoxidable serie AISI tipo 300*		
178	Impeller key, *Chaveta del impulsor*			
198	Impeller bolt, *Perno del impulsor*			
199	Impeller washer, *Arandela del impulsor*			
370	Hex head cap screw (adapter to case), *Tornillo de cabeza hexagonal (del adaptador a la cubierta)*	Steel SAE 1200 Grade 5 *Acero SAE 1200 grado 5*		
371	Hex head cap screw (adapter to motor), *Tornillo de cabeza hexagonal (del adaptador al motor)*			
383	Mechanical seal, *Sello mecánico*	See seal chart, *Ver tabla del sello*		
408	Pipe plug ¼" or ⅜", *Tapón de tubos de ¼ de pulgada ó ⅜ de pulgada*	Steel, *Acero*		Bronze, *Bronce*
513	O-ring, *Anillo en O*	BUNA-N, *BUNA-N*		

Material Code, *Código de material*	Engineering Standard, *Norma de ingeniería*
1101	Cast iron ASTM A48 CL20, *Hierro fundido ASTM A48 CL20*
1101	Silicon bronze ASTM B584, C87500, *Siliciuro de bronce ASTM B584, C87500*
1618	Bizmuth brass, *Latón al bismuto*

Packed Box Arrangement, *Caja prensaestopas*

Item No., *No. Ítem*	Description, *Descripción*	Materials, *Materiales*
105	Lantern ring, *Aro de linterna*	Teflon™
106	Packing, 5 rings; *Empaquetadura, 5 aros*	Teflon Impregnated, *Impregnado de Teflon*
107	Gland, *Casquillo*	AISI 316SS
126	Shaft sleeve, *Camisa del eje*	AISI Type 300 Series Stainless Steel *Acero inoxidable serie AISI tipo 300*
353	Gland stud, *Perno del casquillo*	
355	Gland nut, *Tuerca del casquillo*	

① For separate seal housing and adapter construction, all bronze material only, see repair parts page.

Para la construcción separada del compartimiento del sello y el adaptador, materiales de bronce únicamente, consulte la página de piezas de repuesto.

NOTE:
Pumps will be shipped with top-vertical discharge position as standard. For other orientations, remove casing bolts – rotate discharge to desired position – replace and tighten bolts to 25 ft./lbs. Note that discharge may extend below motor mounting surface in bottom-horizontal position; adequate clearance must be provided.

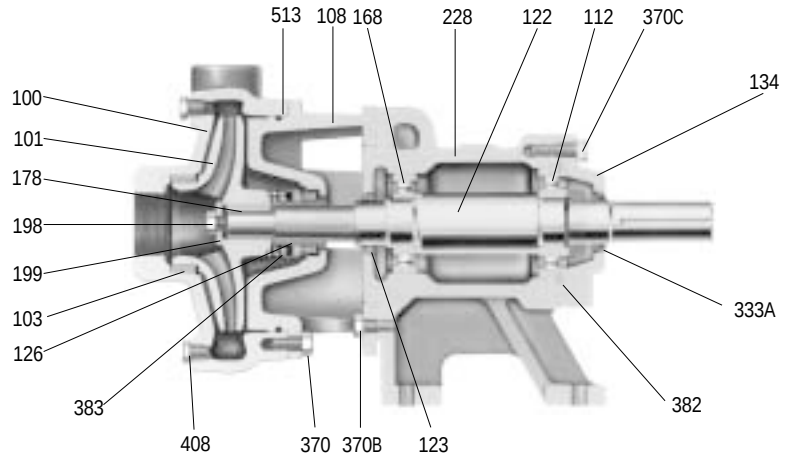
NOTA:
Las bombas salen de la fábrica con la descarga orientada en posición vertical superior de manera estándar. Para modificar la orientación, retirar los pernos de la carcasa, hacer girar la descarga hasta la posición deseada y volver a colocar los pernos, ajustándolos a una torsión de 25 pies/libras. Se ha de notar que la descarga se puede extender por debajo de la superficie de montaje del motor en la posición horizontal inferior; por lo tanto, debe proveerse suficiente espacio.

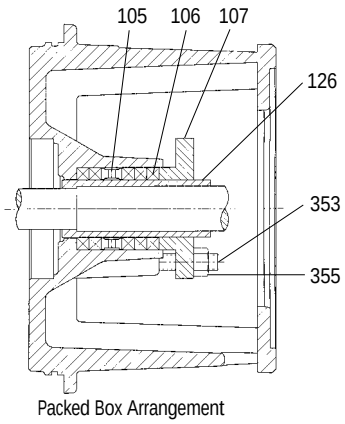
Type 21 Mechanical Seal, *Tipo 21 sello mecánico*

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
0	Carbon, *Carbón*	Ceramic, *Cerámica*	BUNA-N	316 SS, *316 Acero inoxidable*	10K13
1		Sil-Carbide, *Carburo de silicona*	EPR		10K19
3			Viton		10K27
5	Sil-Carbide				10K64
9	Packed Box Design with BUNA O-Ring, *Diseño de prensaestopas empacado con anillo en O de BUNA*				15K16

Note: 10K27 replaces obsolete 10K25, ***Nota:*** *La 10K27 reemplace la obsoleta 10K25.*

3756 S-Group Materials of Construction
Materiales de construcción - Grupo S, modelo 3756





Packed Box Arrangement
Caja prensaestopas

Item No. *No. Ítem*	Description *Descripción*	Materials, *Materiales*		
		All Iron *Todo hierro*	Bronze Fitted *Accesorios de bronce*	All Bronze *Todo bronce*
100	Casing, *Carcasa*	1001	1001	1101
101	Impeller, *Impulsor*		1101	
103	Casing wear ring, *Anillo de desgaste de la carcasa*		1618	1618
108	Adapter, *Adaptador*		1001	1001
184	Seal housing, *Cubierta del sello*	One piece with adapter, *Una pieza con adaptador*		1101
112	Ball bearing (outboard), *Cojinete de bolas (exterior)*	Steel, *Acero*		
122	Shaft, *Eje*	Carbon steel, *Acero al carbono*		
123	V-ring (Deflector), *Anillo en V (Deflector)*	BUNA-N		
126	Shaft sleeve, *Camisa del eje*	AISI Type 303 SS, *Acero inoxidable AISI tipo 303*		
134	Bearing cover, *Cubierta del cojinete*	1001		
168	Ball bearing (inboard), *Cojinete de bolas (interior)*	Steel, *Acero*		
178	Impeller key, *Chaveta del impulsor*	AISI Type 303 Series SS *Acero inoxidable serie AISI tipo 300*		
198	Impeller screw, *Tornillo del impulsor*			
199	Impeller washer, *Arandela del impulsor*			
228	Bearing frame, *Marco de cojinete*	1001		
333A	Lip seal, *Sello con reborde*			
370	Hex head cap screw (adapter to case), *Tornillo de cabeza hexagonal (del adaptador a la cubierta)*	Steel SAE 1200 Grade 5 *Acero SAE 1200 grado 5*		
370B	Hex head cap screw (adapter to bearing frame), *Tornillo de cabeza hexagonal (del adaptador al marco de cojinetes)*			
370C	Hex head cap screw (bearing cover to frame), *Tornillo de cabeza hexagonal (de la cubierta de cojinetes al marco)*			
382	Retaining ring, *Anillo de retención*			
383	Mechanical seal, *Sello mecánico*	See seal chart, *Ver tabla del sello*		
408	Pipe plug ¼" or ⅜", *Tapón de tubos de ¼ de pulgada ó ⅜ de pulgada*	Steel, *Acero*		Bronze, *Bronce*
513	O-ring, *Anillo en O*	BUNA-N, *BUNA-N*		

Material Code, *Código de material*	Engineering Standard, *Norma de ingeniería*
1101	Cast iron ASTM A48 CL20, *Hierro fundido ASTM A48 CL20*
1101	Silicon bronze ASTM B584, C87500, *Siliciuro de bronce ASTM B584, C87500*
1618	Bizmuth brass, *Latón al bismuto*

Packed Box Arrangement, *Caja prensaestopas*

Item No., *No. Ítem*	Description, *Descripción*	Materials, *Materiales*
105	Lantern ring, *Aro de linterna*	Teflon™
106	Packing, 5 rings; *Empaquetadura, 5 aros*	Teflon Impregnated, *Impregnado de Teflon*
107	Gland, *Casquillo*	AISI 316SS
126	Shaft sleeve, *Camisa del eje*	AISI Type 300 Series Stainless Steel *Acero inoxidable serie AISI tipo 300*
353	Gland stud, *Perno del casquillo*	
355	Gland nut, *Tuerca del casquillo*	

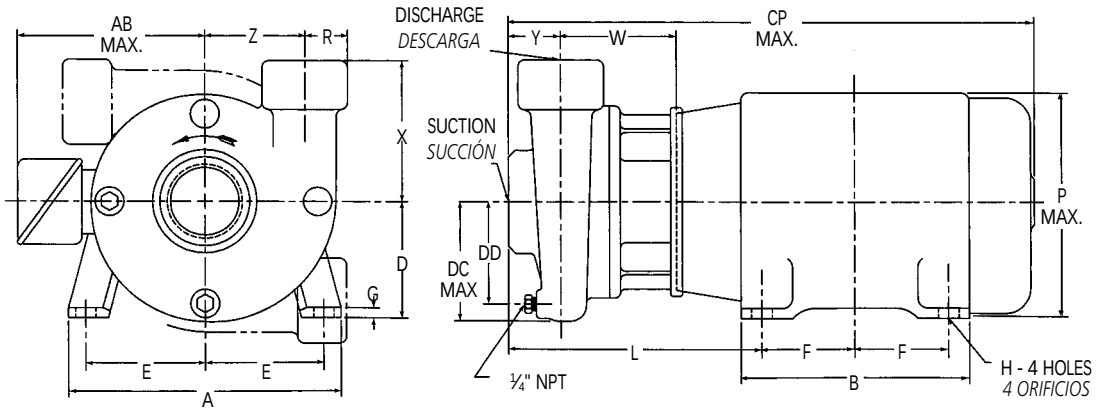
NOTE:
Above shows typical AI or BF construction. For separate seal housing adapter, all bronze construction, see repair parts.

Pumps will be shipped with top-vertical discharge position as standard. For other orientations, remove casing bolts – rotate discharge to desired position – replace and tighten bolts to 25 ft./lbs. Note that discharge may extend below motor mounting surface in bottom-horizontal position; adequate clearance must be provided.

NOTA:

Esta información corresponde a las construcciones típicas AI y BF. Para el adaptador separado del compartimiento de sellos y construcción en todo bronce, consulte las partes de repuesto.

Las bombas salen de la fábrica con la descarga orientada en posición vertical superior de manera estándar. Para modificar la orientación, retirar los pernos de la carcasa, hacer girar la descarga hasta la posición deseada y volver a colocar los pernos, ajustándolos a una torsión de 25 pies/libras. Se ha de notar que la descarga se puede extender por debajo de la superficie de montaje del motor en la posición horizontal inferior; por lo tanto, debe proveerse suficiente espacio.



Pump Dimensions and Weights (Dimension "L" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "L" está determinada por la bomba y el motor)*

Pump *Bomba*	Suction *Succión*	Discharge *Descarga*	CP Max.	DC Max.	DD	R	W	X	Y	Z	Wt. (lbs.) *Pesos (libras)*	Motor Frame Size, *Bastidor*			
												140	180	210	250
												L			
1 x 2 – 7	2	1	27	4¼	3½	1 1/16	4⅛	5½	3	4	52	10	10¾	—	—
1 x 2 – 8					4		3 15/16	5¾	3 3/16	4¼	52			—	—
1½ x 2 – 6		1½	23¾		3½	1¼	4¼	4½	2⅝	3½	34	9¾	10½	—	—
1½ x 2 – 8			27⅛	5⅜	4⅝			5		4¼	54			11⅜	11⅝
2½ x 3 – 7	3	2½	25⅝	5⅛	4½	1 13/16		6	3	4	49	10⅛	10¾	11¾	—
3 x 4 – 7	4*	3*	25¼	5¾	5⅛	3¾	4⅜		2½	4½	82	9¾	10⅜	11⅜	—

Motor Dimensions and Weights (may vary with manufacturer)*
Peso y dimensiones del motor *(pueden variar de acuerdo al fabricante) **

Frame Size JM *Tamaño del bastidor JM*	A	AB (Max.)	B	D	E	F	G	H	P (Max.)	Weight (lbs.) *Pesos (libras)*
143	6½	5¼	6	3½	2¾	2	1/8	11/32	6⅝	41
145						2½				57
182	8½	5⅞	6½	4½	3¾	2¼	3/16	13/32	7⅞	77
184						2¾				97
213	9½	7⅜	8	5¼	4¼	2¾	7/32	13/32	9⅝	122
215						3½				155
254 TCZ	11¼	9	9½	6¼	5	4⅛	¼	17/32	11½	265
256 TCZ			11¾			5				320

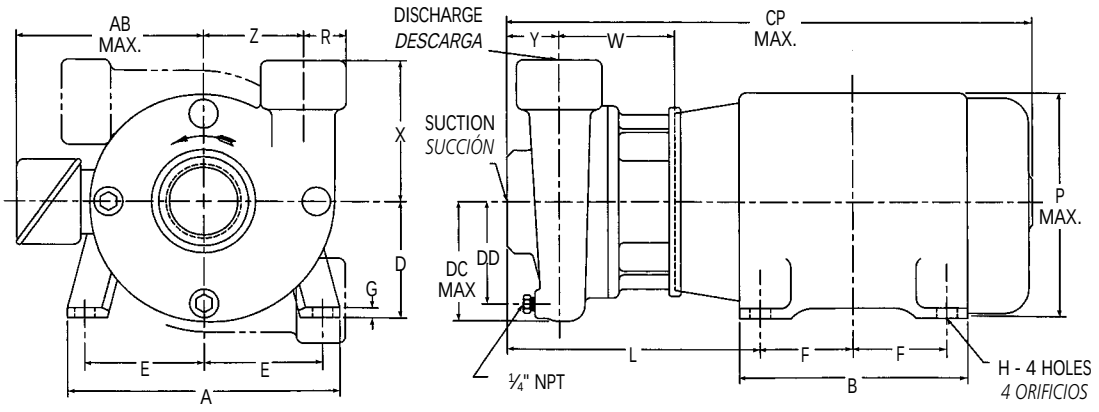
NOTE:
All pumps shipped in vertical discharge position. May be rotated in 90º increments. Tighten casing bolts to 25 ft./lbs. torque.

NOTA:
Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

Motor Frames and Horsepower
Bastidores del motor y potencia en HP

Motor Frame *Bastidor del motor*	3500 RPM				1750 RPM			
	1 Phase		3 Phase		1 Phase		3 Phase	
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC
143	—	¾,1,1½	¾,1,1½	¾,1,1½	—	½,¾	½,¾,1	½,¾,1
145	—	2	2,3	2,3	—	1,1½	1½,2	1½,2
182	3	3	5	3	3	2,3	3	3
184	5	3,5	7½	5	—	—	5	5
213	7½	—	10	7½	5	—	7½	7½
215	10	—	15	10,15	—	—	—	—
254TCZ	—	—	20	—	—	—	—	—
256TCZ	—	—	25	20,25	—	—	—	—

All dimensions in inches and weights in lbs. Do not use for construction purposes.
Todas las dimensiones están en pulgadas, el peso en libras. No utilizar para fines de construcción.



Pump Dimensions and Weights (Dimension "L" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "L" está determinada por la bomba y el motor)*

Pump Bomba	*Suction* Succión	*Discharge* Descarga	CP Max.	DC Max.	DD	R	W	X	Y	Z	Wt. (lbs.) *Pesos (libras)*	Motor Frame Size, *Bastidor* 140	180	210	250
												L			
1 x 2 – 7	2	1	30	4¼	3½	1¹⁄₁₆	7³⁄₁₆	5½	3	4	52	13¹⁄₁₆	13¹³⁄₁₆	—	—
1 x 2 – 8					4		7	5¾	3³⁄₁₆	4¼	52			—	—
1½ x 2 – 6		1½	26¾		3½	1¼	7⁵⁄₁₆	4½	2⅝	3½	34	12¹³⁄₁₆	13⁹⁄₁₆	—	—
1½ x 2 – 8			30⅛	5⅜	4⅝			5		4¼	54			14⁷⁄₁₆	11⅝
2½ x 3 – 7	3	2½	28⅝	5⅛	4½	1¹³⁄₁₆		6	3	4	49	13³⁄₁₆	13¹³⁄₁₆	14¹³⁄₁₆	—
3 x 4 – 7	4*	3*	28¼	5¾	5⅛	3¾	7⁷⁄₁₆		2½	4½	82	12¹³⁄₁₆	13⁷⁄₁₆	14⁷⁄₁₆	—

Motor Dimensions and Weights (may vary with manufacturer)*
Peso y dimensiones del motor *(pueden variar de acuerdo al fabricante) **

Frame Size JP *Tamaño del bastidor JP*	A	AB (Max.)	B	D	E	F	G	H	P (Max.)	Weight (lbs.) *Pesos (libras)*
143	6½	5¼	6	3½	2¾	2	⅛	¹¹⁄₃₂	6⅝	41
145						2½				57
182	8½	5⅞	6½	4½	3¾	2¼	³⁄₁₆	¹³⁄₃₂	7⅞	77
184						2¾				88
213 TCZ	9½	7⅜	8	5¼	4¼	2¾	⁷⁄₃₂	¹³⁄₃₂	9⅝	122
215 TCZ						3½				155
213 TCZ	11¼	9	9½	6¼	5	2¾	¼	¹⁷⁄₃₂	11½	265
215 TCZ			11¾			3½				320

TCZ indicates west coast fit.

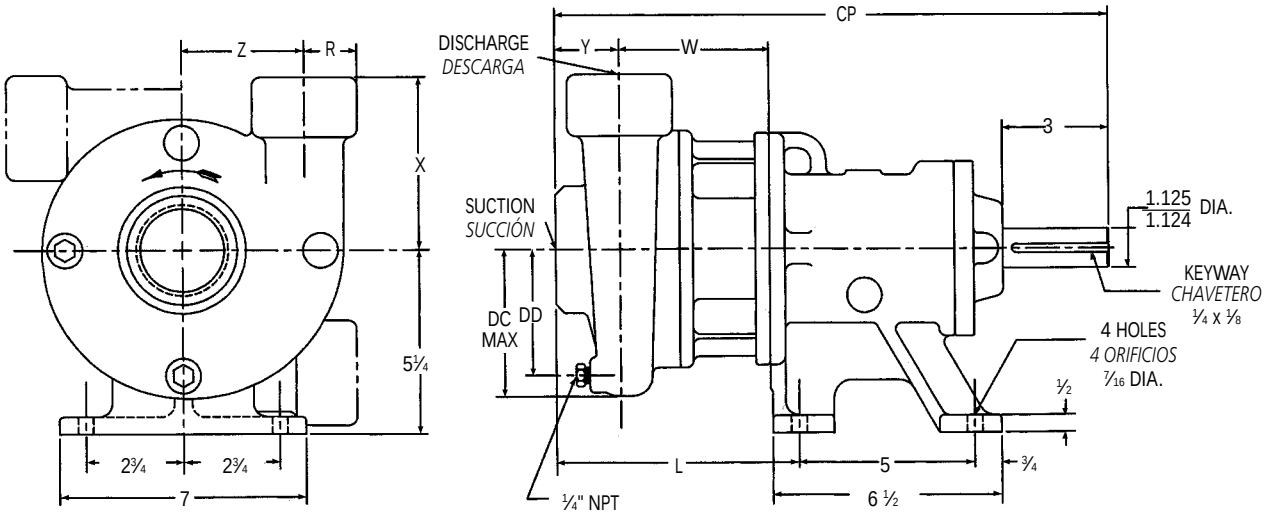
NOTE:
All pumps shipped in vertical discharge position. May be rotated in 90º increments. Tighten casing bolts to 25 ft./lbs. torque.

NOTA:
Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

Motor Frames and Horsepower
Bastidores del motor y potencia en HP

Motor Frame *Bastidor del motor*	3500 RPM				1750 RPM			
	1 Phase		3 Phase		1 Phase		3 Phase	
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC
143 JP	—	—	—	—	—	—	1	—
145 JP	—	—	3	2,3	—	—	1½,2	1½,2
182 JP	3	—	5	—	3	—	3	3
184 JP	5	—	7½	5	—	—	5	5
213 TCZ	7½	—	10	7½	5	—	—	—
215 TCZ	10	—	15	10,15	—	—	—	—
254 TCZ	—	—	20	—	—	—	—	—
256 TCZ	—	—	25	—	—	—	—	—

All dimensions in inches and weights in lbs. Do not use for construction purposes.
Todas las dimensiones están en pulgadas, el peso en libras. No utilizar para fines de construcción.
TCZ indicates west coast fit.



Pump Dimensions and Weights (Dimension "L" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "L" está determinada por la bomba y el motor)*

Pump *Bomba*	Suction *Succión*	Discharge *Descarga*	CP	DC Max.	DD	L	R	W	X	Y	Z	Wt.(lbs.) *Pesos (libras)*
1 x 2 –7	2	1	16⅜	4¼	3½	8	1 1/16	4⅛	5½	3	4	84
1 x 2 – 8					4			3 15/16	5¾	3 3/16	4¼	84
1½ x 2 – 6		1½	16½		3½	7¾	1¼	4¼	4½	2⅝	3½	66
1½ x 2 – 8				5⅜	4⅝				5		4¼	86
2½ x 3 – 7	3	2½	16⅞	5⅛	4½	8⅛	11 3/16		6	3	4	81
3 x 4 – 7	4*	3*	16½	5¾	5⅛	7¾	3¾	4⅜		2½	4½	114

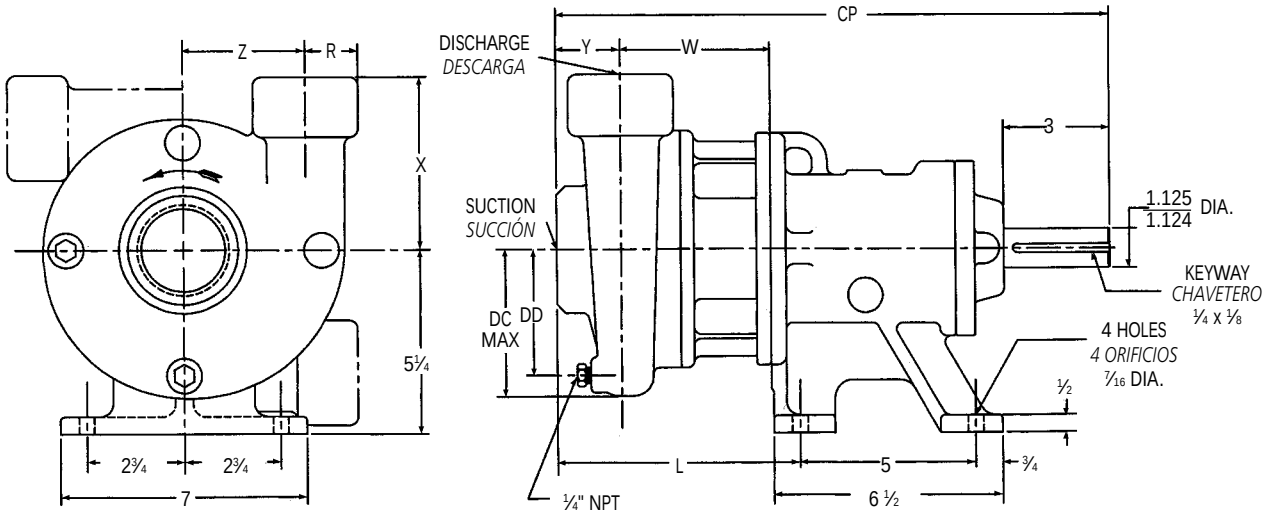
*For use with ANSI class 150 mating flange. All others are NPT connections.
** Para uso con brida de contacto ANSI clase 150. Todas las demás son conexiones NTP.*

NOTE:
All pumps shipped in vertical discharge position. May be rotated in 90º increments. Tighten casing bolts to 25 ft./lbs. torque.

Dimensions in inches, weights in lbs. Do not use for construction purposes.

NOTA:
Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

Dimensiones en pulgadas, peso en libras. No utilizar para fines de construcción.



Pump Dimensions and Weights (Dimension "L" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "L" está determinada por la bomba y el motor)*

Pump *Bomba*	Suction *Succión*	Discharge *Descarga*	CP	DC Max.	DD	L	R	W	X	Y	Z	Wt.(lbs.) *Pesos (libras)*
1 x 2 –7	2	1	19 7/16	4¼	3½	11 1/16	1 1/16	7 3/16	5½	3	4	84
1 x 2 – 8					4			7	5¾	3 3/16	4¼	84
1½ x 2 – 6		1½	19 9/16		3½	10 13/16	1¼	7 5/16	4½	2⅝	3½	66
1½ x 2 – 8				5⅜	4⅝				5		4¼	86
2½ x 3 – 7	3	2½	19 15/16	5⅛	4½	11 3/16	11 3/16		6	3	4	81
3 x 4 – 7	4*	3*	19 9/16	5¾	5⅛	10 13/16	3¾	7 1/16		2½	4½	114

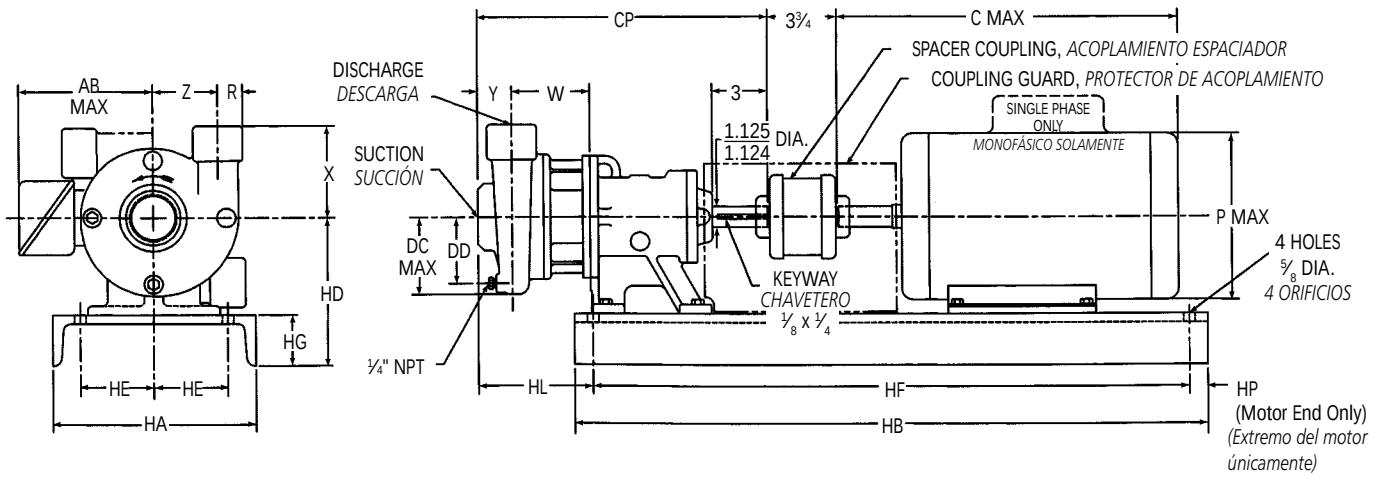
*For use with ANSI class 150 mating flange. All others are NPT connections.
** Para uso con brida de contacto ANSI clase 150. Todas las demás son conexiones NTP.*

NOTE:
All pumps shipped in vertical discharge position. May be rotated in 90º increments. Tighten casing bolts to 25 ft./lbs. torque.

Dimensions in inches, weights in lbs. Do not use for construction purposes.

NOTA:
Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

Dimensiones en pulgadas, peso en libras. No utilizar para fines de construcción.



Pump Dimensions and Weights (Dimension "HL" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "HL" está determinada por la bomba y el motor)*

Pump *Bomba*	Suction *Succión*	Discharge *Descarga*	CP Max.	DC Max.	DD	R	W	X	Y	Z	Wt.(lbs.) *Pesos (libras)*	Motor Frame Size, *Tamaño del bastidor*		
												140 / 180	210	250 / 280
												HL		
1 x 2 – 7	2	1	16⅜	4¼	3½	1 1/16	4⅛	5½	3	4	84	9¼	—	—
1 x 2 – 8					4		3 15/16	5¾	3 3/16	4¼	84		7¾	—
1½ x 2 – 6		1½	16½		3½	1¼	4¼	4½	2⅝	3½	66			—
1½ x 2 – 8					5⅜			5		4¼	86			—
2½ x 3 – 7	3	2½	16⅞	5⅛	4½	1 13/16		6	3	4	81	9⅝	8⅛	4⅜
3 x 4 – 7	4*	3*	16½	5¾	5⅛	3¾	4⅜		2½	4½	114	9¼	7¾	7

*For use with ANSI class 150 mating flange. All others are NPT connections.
** Para uso con brida de contacto ANSI clase 150. Todas las demás son conexiones NTP.*

Motor Dimensions and Weights, *Peso y dimensiones del motor*

Motor Frame *Bastidor del motor*	3500 RPM				1750 RPM				AB Max.	C Max.	P Max.	Wt. (lbs.) *Pesos (libras)*
	1 Phase		3 Phase		1 Phase		3 Phase					
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC				
143 T	½,1,1½	¾,1,1½	¾,1,1½	¾,1,1½	½,¾	½,¾	½,¾,1	½,¾,1	5¼	13⅜	5¼	45
145 T	2	2	2,3	2,3	1,1½	1,1½	1½,2	1½,2		14¼		53
182 T	3	3	5	3	2	2,3	3	3	5⅞	16⅝	5⅞	74
184 T	5	3,5	7½	5	3	—	5	5		18⅛		95
213 T	7½	—	10	7½	5	—	7½	7½	7⅜	18	7⅜	116
215 T	10	—	15	10,15	—	—	—	—		19⅛		136
254 T	—	—	20	—	—	—	—	—	10⅛	21⅝	10⅛	266
256 T	—	—	25	20,25	—	—	—	—		23⅜		264
284 TS/T	—	—	30	25	—	—	—	—	12⅝	24⅞	15	392

Bedplate Dimensions and Weights, *Pesos y dimensiones de la place de asiento*

Motor Frame *Bastidor del motor*	HA	HB	HD	HE	HF	HG	HP*	Motor *Shim Cuña*	Bearing Frame *Shim Cuña del marco de cojinetes*	Weight (lbs.) *Pesos (libras)*
143 T	10	28	8	3¾	24	2¾	¾	1¾	—	48
145 T										
182 T								¾	—	
184 T										
213 T	12	31	8¼	4¼	29	3	1	—	—	65
215 T										
213 TCZ	13	42	9¼	5¼	38½	4	1¾	—	1	110
215 TCZ										
284 TS/T	15	44	10½	5¾	40½	3½		—	1¾	124

* "HP" Dimension at Motor end only. ** Dimensión "HP" al extremo del motor únicamente.*

NOTE:

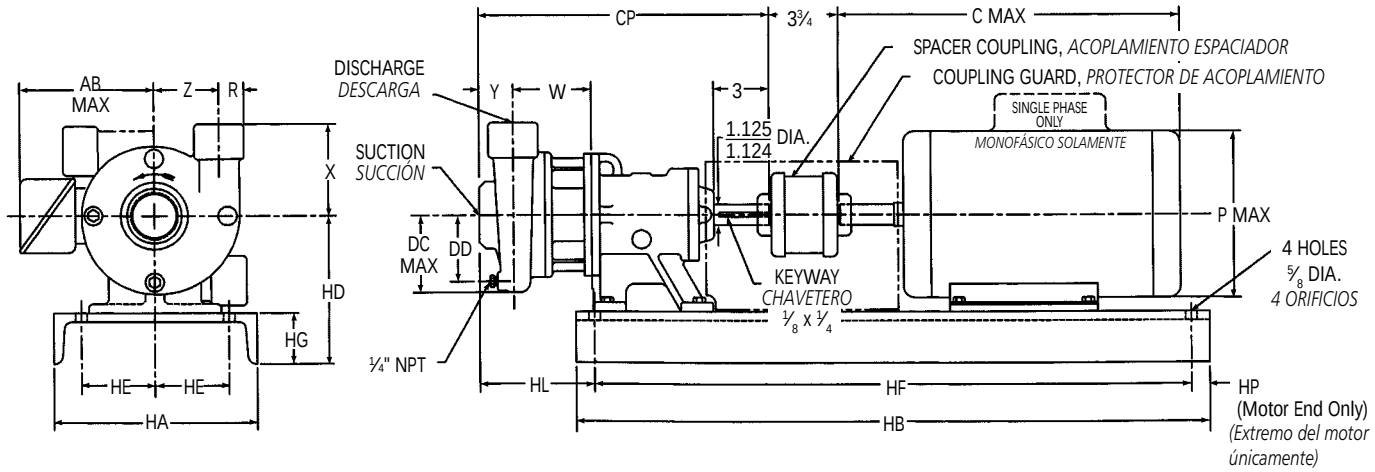
1. All pumps shipped in vertical discharge position. May be rotated in 90° increments. Tighten casing bolts to 25 ft./lbs. torque.
2. Dimensions in inches, weights in lbs. Do not use for construction purposes.
3. Motor dimensions and weights very with manufacturer.

NOTA:

1. Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

2. Dimensiones en pulgadas, peso en libras. No utilizar para fines de construcción.

3. Las dimensiones y el peso de los motores varían de acuerdo al fabricante.



Pump Dimensions and Weights (Dimension "HL" determined by Pump and Motor)
Peso y dimensiones de la bomba *(la dimensión "HL" está determinada por la bomba y el motor)*

Pump *Bomba*	Suction *Succión*	Discharge *Descarga*	CP Max.	DC Max.	DD	R	W	X	Y	Z	Wt.(lbs.) *Pesos (libras)*	Motor Frame Size, *Tamaño del bastidor*		
												140 / 180	210	250 / 280
												HL		
1 x 2 – 7	2	1	19 7/16	4¼	3½	1 1/16	7 3/16	5½	3	4	84	12 5/16	—	—
1 x 2 – 8					4		7	5¾	3 3/16	4¼	84			—
1½ x 2 – 6		1½	19 9/16		3½	1¼	7 5/16	4½	2⅝	3½	66		10 13/16	—
1½ x 2 – 8					5⅜			5		4¼	86			—
2½ x 3 – 7	3	2½	19 15/16	5⅛	4½	1 13/16		6	3	4	81	12 11/16	11 3/16	7 7/16
3 x 4 – 7	4*	3*	19 9/16	5¾	5⅛	3¾	7 7/16		2½	4½	114	12 5/16	10 13/16	10 1/16

*For use with ANSI class 150 mating flange. All others are NPT connections.
** Para uso con brida de contacto ANSI clase 150. Todas las demás son conexiones NTP.*

Motor Dimensions and Weights, *Peso y dimensiones del motor*

Motor Frame *Bastidor del motor*	3500 RPM				1750 RPM				AB Max.	C Max.	P Max.	Wt. (lbs.) *Pesos (libras)*
	1 Phase		3 Phase		1 Phase		3 Phase					
	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC				
143 T	½,1,1½	¾,1,1½	¾,1,1½	¾,1,1½	½,¾	½,¾	½,¾,1	½,¾,1	5¼	13⅜	5¼	45
145 T	2	2	2,3	2,3	1,1½	1,1½	1½,2	1½,2		14¼		53
182 T	3	3	5	3	2	2,3	3	3	5⅞	16⅝	5⅞	74
184 T	5	3,5	7½	5	3	—	5	5		18⅛		95
213 T	7½	—	10	7½	5	—	7½	7½	7⅜	18	7⅜	116
215 T	10	—	15	10,15	—	—	—	—		19⅛		136
254 T	—	—	20	—	—	—	—	—	10⅛	21⅝	10⅛	266
256 T	—	—	25	20,25	—	—	—	—		23⅜		264
284 TS/T	—	—	30	25	—	—	—	—	12⅝	24⅞	15	392

Bedplate Dimensions and Weights, *Pesos y dimensiones de la place de asiento*

Motor Frame *Bastidor del motor*	HA	HB	HD	HE	HF	HG	HP*	Motor *Shim Cuña*	Bearing Frame *Shim Cuña del marco de cojinetes*	Weight (lbs.) *Pesos (libras)*
143 T	10	28	8	3¾	24	2¾	¾	1¾	—	48
145 T										
182 T								¾	—	
184 T										
213 T	12	31	8¼	4¼	29	3	1	—	—	65
215 T										
213 TCZ	13	42	9¼	5¼	38½	4	1¾	—	1	110
215 TCZ										
284 TS/T	15	44	10½	5¾	40½	3½		—	1¾	124

* "HP" Dimension at Motor end only. ** Dimensión "HP" al extremo del motor únicamente.*

NOTE:

1. All pumps shipped in vertical discharge position. May be rotated in 90° increments. Tighten casing bolts to 25 ft./lbs. torque.
2. Dimensions in inches, weights in lbs. Do not use for construction purposes.
3. Motor dimensions and weights very with manufacturer.

NOTA:

1. Todas las bombas se embarcan con la descarga en posición vertical. Esta posición puede rotarse en incrementos de 90°. Ajustar los pernos de la carcasa a una torsión de 25 pies/libras.

2. Dimensiones en pulgadas, peso en libras. No utilizar para fines de construcción.

3. Las dimensiones y el peso de los motores varían de acuerdo al fabricante.

Specifications

Capacities to:
550 GPM (125 m^3/hr) at 3500 RPM
350 GPM (79 m^3/hr) at 1750 RPM

Heads to:
280 feet TDH (85 m) at 3500 RPM
67 feet TDH (20 m) at 1750 RPM

Working pressure to:
175 PSIG (12 bars)

Suction pressure to:
100 PSIG (7 bars)

Maximum temperature to:
212°F (100°C) with standard seal or 250°F (121°C) with optional seal.

Motor:
NEMA standard JM frame or JP frame for 3656 or T-frame for 3756. Open drip-proof, totally enclosed fan cooled and explosion proof enclosures available. Single phase (115/208 – 230 V), ½ to 3 HP (208 – 230 V) 5 HP and (230V only) on 7½, 10 HP. Three phase (208 – 230/460 V) standard note that 20 and 25 HP are (230/460 V).

Direction of Rotation:
Clockwise viewed from motor end.

Especificaciones

Capacidad hasta:
550 GPM (125 m^3/hr) a 3500 RPM
350 GPM (79 m^3/hr) a 1750 RPM

Cargas hasta:
280 pies (85 m) carga dinámica total a 3500 RPM
67 pies (20 m) carga dinámica total a 1750 RPM

Presión de operación hasta:
175 PSIG (12 bars)

Presión de succión hasta:
100 PSIG (7 bars)

Temperatura máxima:
212 °F (100 °C) con sello estándar o 250 °F (121 °C) con sello optativo.

Motor:
Bastidor NEMA JM estándar en el modelo 3656 y bastidor NEMA T estándar en el modelo 3756. Las cubiertas disponibles son: abierta a prueba de filtración, totalmente encerrada con enfriamiento por ventilador y a prueba de explosiones. Monofásico (115/208 – 230 V), ½ a 3 HP; (208 – 230 V) 5 HP y (230 V solamente) 7½ a 10 HP. Trifásico (208 – 230/460 V) estándar. Los motores de 20 a 25 HP son de 230/460 V.

Dirección de rotación:
Dextrorsa (sentido de las agujas del reloj) cuando se mira desde el extremo del motor.

Typical Applications

- Booster service
- Spraying systems
- Irrigation
- Water circulation
- Liquid transfer
- General purpose pumping

Aplicaciones típicas

- *Servicio de refuerzo*
- *Sistemas de rociado*
- *Sistemas de riego*
- *Circulación de agua*
- *Transferencia de líquidos*
- *Aplicaciones de bombeo en general*

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ITT Industries

BHSC

ITT

Commercial Water

Chemical Booster Pump
HSC10B

Goulds Pumps

HSC Multi-Stage Centrifugal Pump

FEATURES

- **Multi-stage Design:** Provides steady, quiet and vibration-free operation for years of trouble-free service.
- **Impellers:** 20% glass-filled thermoplastic precision molded for high efficiencies.
- **Compact Design:** Close-coupled, space saving design provides easy installation. Flexible coupling and bedplate not required.
- **Mounting:** Can be mounted in vertical or horizontal position.
- **Stainless Steel Pump Shaft:** Hex design provides positive drive for impellers and eliminates clearance adjustments.
- **Corrosion Resistant:** Stainless steel wear rings and coverplates. Electro-coated paint process applied inside and out and then baked on.
- **O-rings:** Throughout for positive sealing.
- **Easy to Service:** Can be taken apart for service by removing four bolts.
- **Motor:** Close coupled design. Ball bearings carry all radial/axial thrust loads. Designed for continuous operation. All ratings are within working limits of the motor. Available from ¾ – 3 HP.

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

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AGENCY LISTING

UL® Tested to UL778

APPLICATIONS

Specifically designed for the following uses:

- Water circulation
- Booster service
- Liquid transfer
- Spraying systems
- Jockey pump service
- General purpose pumping

SPECIFICATIONS

Pump

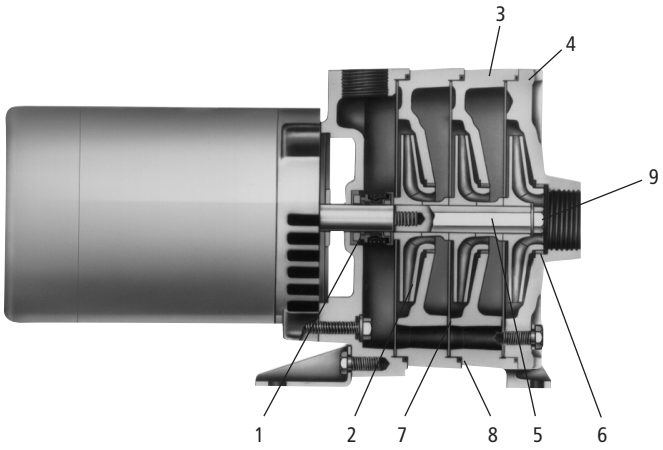
- Capacities: to 50 GPM
- Pressures: to 100 PSI (230 feet)
- Pipe connections: 1¼" suction, 1" discharge
- Temperatures: to 180°F (82°C) maximum
- Maximum working pressure: 125 PSI
- Rotation: right hand, ie; clockwise when viewed from motor end.

Motor

- NEMA standard
  ¾ – 1½ HP, 115/230 V;
  2 and 3 HP, 230 V, 60 Hz.
- Single phase ODP (standard)
- Three phase available
- 3500 RPM, ODP motors standard
- Built-in overload with automatic reset
- Capacitor type
- Stainless steel shaft
- TEFC and Explosion-proof motors available. See price book.

COMPONENTS

Item No.	Description
1	Mechanical seal
2	Impellers
3	Intermediate stage
4	Casing
5	Stainless steel hex shaft
6	Stainless steel wear rings
7	Stainless steel cover plates
8	O-ring seals
9	Impeller bolt and washer



Single and Three Phase Models

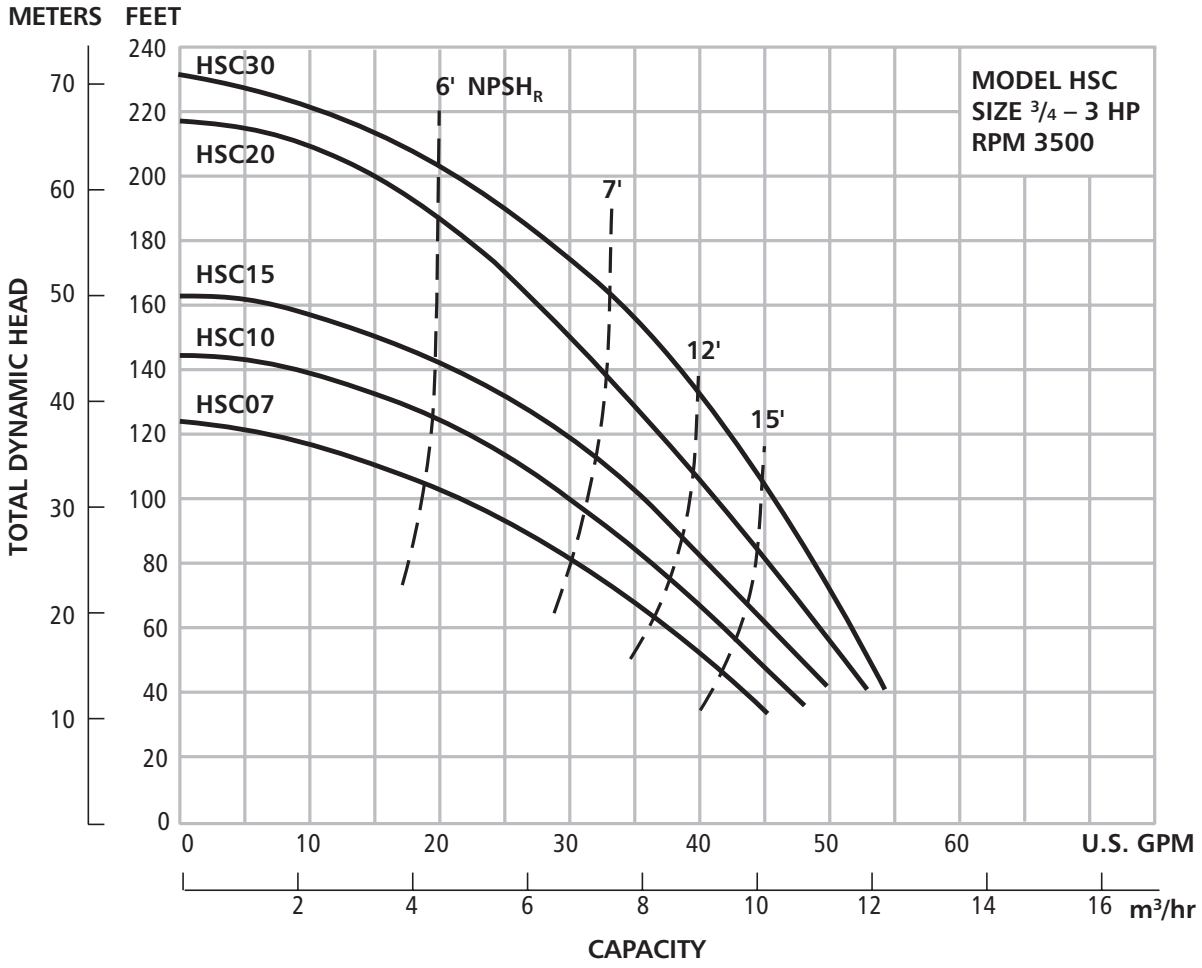
HP	Stages	Order Numbers — ODP Motor	
		1Ø Model	3Ø Model
¾	2	HSC07	HSC07B
1	2	HSC10	HSC10B
1½	2	HSC15	HSC15B
2	3	HSC20	HSC20B
3	3	HSC30	HSC30B

DIMENSIONS AND WEIGHTS

Model	HP	Length	Width	Height	Weight (lbs.)
HSC07	¾	15	8	9	53
HSC10	1	16	8	9	58
HSC15	1½	17	8	9	72
HSC20	2	19.7	8	9	75
HSC30	3	19.1	8	9	85

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

PERFORMANCE CURVE



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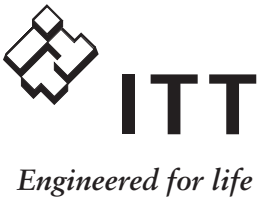


GOULDS PUMPS

Installation, Operation and Maintenance Instructions

page 2

Model HSC

Owner's Information

Model Number: _____

Serial Number: _____

Dealer: _____

Dealer Telephone: _____

Purchase Date: _____

Installation Date: _____

Instrucciones de instalación, operación y mantenimiento

página 3

Modelo HSC

Información para el propietario:

Número de modelo: _____

Número de serie: _____

Distribuidor: _____

Teléfono del distribuidor: _____

Fecha de compra: _____

Fecha de instalación: _____

Directives d'installation, d'utilisation et d'entretien

page 7

Modèle HSC

Informations pour le propriétaire

Numéro de modèle : _____

Numéro de série : _____

Détaillant : _____

Nº de tél. du détaillant : _____

Date d'achat : _____

Date d'installation : _____

Goulds Pumps

ITT Industries

IM008R02

DESCRIPTION and SPECIFICATIONS:

The Model HSC is a multi-stage, end-suction, centrifugal pump for general liquid transfer service, booster applications, etc. Liquid-end construction is cast iron, stainless steel and engineered composites.

All units have NEMA 48 Frame single-phase, 115/230 V, 60 Hz motors with C-face mounting and NEMA 56J threaded shaft extensions.

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., in compliance with 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.

1.6. Maximum Operating Limits:

Liquid Temperature: 180ºF (82ºC)
Working Pressure: 125 PSI
Starts per Hour: 20, evenly distributed.

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time.

2. Installation

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

2.2. Protect from freezing or flooding.

2.3. Allow adequate space for servicing and ventilation.

2.4. 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.

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

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

CAUTION

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

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

2.8. Tighten casing hold-down bolts before connecting piping to pump.

2.9. No field alignment of pump to motor is necessary as pumps are close-coupled.

3. Suction Piping

3.1. Low static suction lift and short, direct suction piping is desired. Consult pump performance curve for *Net Positive Suction Head Required (NPSHR)*, especially for lifts above 15'.

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 Figures 1 through 4.

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

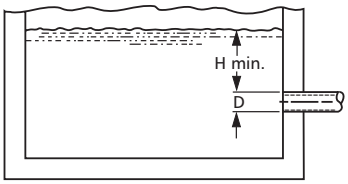


Figure 1

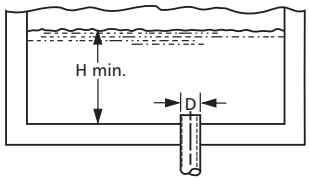


Figure 2

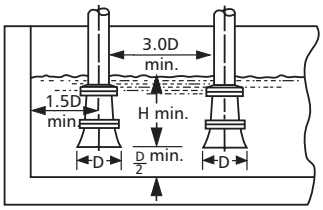


Figure 3

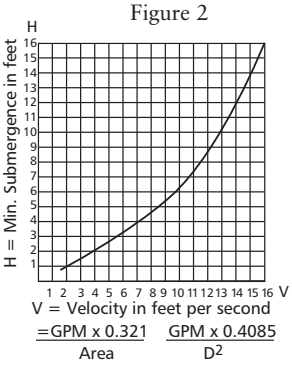


Figure 4

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 to 4 wraps of Teflon tape to seal threaded connections.

5. Rotation

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

5.1.1. Single-phase motor: Non-reversible
5.1.2. Three-phase motor: Not offered.

6. Operation

6.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open. Plugs are provided in the casing and valve so pump/suction piping can be filled and/or vented/drained in any pump orientation.

6.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping.

7. Maintenance

7.1. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

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.

8. Disassembly

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

8.1. Turn off power.

8.2. Drain system and flush if necessary.

8.3. Disassembly of Liquid-End:

8.3.1. Remove casing bolts.

8.3.2. Remove motor and remaining Liquid-End assembly from casing (still connected to piping) and position vertically for easier disassembly.

8.3.3. Remove impeller bolt and washer.

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.

8.3.4. Remove impeller by pulling axially.

8.3.5. Remove separator plate.

8.3.6. Remove shaft sleeve.

8.3.7. Remove intermediate stage.

8.3.8. Repeat steps 8.3.4 through 8.3.7 for three stage pumps.

8.3.9. Remove last impeller.

8.3.10. Remove last separator plate.

8.3.11. Remove seal retainer.

8.3.12. Remove shaft extension using a screwdriver in the slot or flats in the back of the motor to prevent rotation and a wrench to turn extension.

8.3.13. Pry off the rotating element of the mechanical seal from the motor shaft by using two (2) regular screw drivers 180° apart and using the motor adapter inner boss as a fulcrum point and then prying seal up.

8.3.14. Remove the motor adapter bolts, washers and o-rings.

8.3.15. Remove the motor adapter.

8.3.16. Remove the stationary element of the mechanical seal by pushing it out from the motor side with a blunt instrument.

9. Reassembly

9.1. All parts should be cleaned before assembly.

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

9.3. Reassembly is the reverse of disassembly.

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

9.4.1. 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.

9.4.2. Inspect the o-rings and replace if damaged. The o-rings may be lubricated with petroleum jelly to ease assembly.

9.4.3. Inspect impellers for wear, degradation or blockage. Clean or replace as necessary.

9.4.4. Inspect iron parts for excessive corrosion or degradation. Replace as necessary.

9.4.5. Inspect stainless steel components for excessive wear or degradation and replace as necessary.

9.4.6. Wear rings contained in the interstage(s) and casing would need to be pressed or pried out and pressed in should they need replacement.

9.5. Check reassembled unit for binding and correct as necessary.

9.6. Be sure to tighten casing bolts in a criss-cross manner to prevent o-ring binding and cracking of the casing ears. Secure to 35 ft-lbs.

10. Trouble Shooting Chart

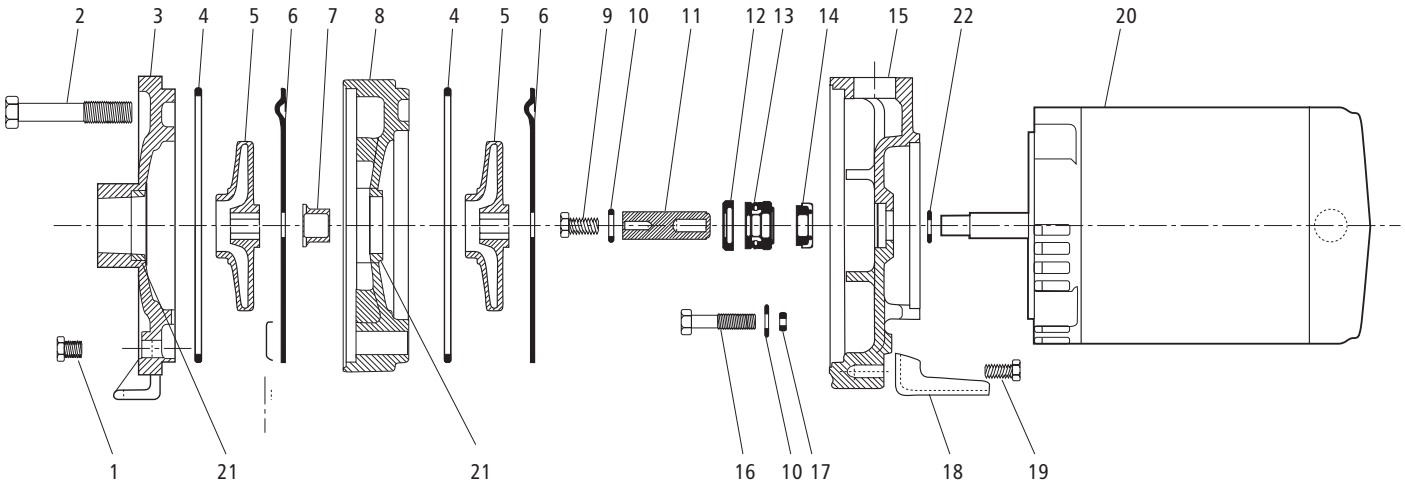
MOTOR NOT RUNNING (See causes 1 through 6)
LITTLE OR NO LIQUID DELIVERED
(See causes 7 through 16)
POWER CONSUMPTION TOO HIGH
(See causes 4, 16, 17, 18, 21)
EXCESSIVE NOISE AND VIBRATION
(See causes 4, 6, 9, 12, 14, 15, 17, 19, 20, 21)
PROBABLE CAUSE:

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. Air or gasses in liquid
13. System head too high
14. NPSHA too low: Suction lift too high or suction losses excessive. Check with vacuum gauge.
15. Impeller worn or plugged
16. Incorrect impeller diameter
17. Head too low, causing excessive flow rate
18. Viscosity or specific gravity too high
19. Worn bearings
20. Pump or piping loose
21. Pump and motor misaligned

Item	Part Name	Quantity
1	Pipe Plug ¼" NPT	3
2	Bolt – casing to adapter, 2 stage	4
2	Bolt – casing to adapter, 3 stage	4
3	Casing	1
4	O-Ring – casing and intermediate stage	1 per stage
5	Impeller – ¾, 1 and 1½ HP Impeller – 2 HP	2 3
6	Coverplate	(1 per impeller)
7	Sleeve	(1 – 2 stage) (2 – 3 stage)
8	Intermediate Stage	(1 – 2 stage) (2 – 3 stage)
9	Impeller Bolt	1
9, 10, 11, 12	Shaft Extension Assembly	1

Item	Part Name	Quantity
10	Washer – impeller (1) and adapter (4)	5
12	Seal Retainer	1
13, 14	Shaft Seal Assembly	1
15	Motor Adapter	1
16	Bolt – adapter to motor	4
17	O-Ring – motor adapter bolts	4
18	Foot	1
19	Bolt – foot to adapter	1
21	Wear Ring	1 per impeller
22	Deflector	1

Motor Codes			
Item	**HP**	**Model**	**Order No.**
20	¾	HSC07	J05853
	1	HSC10	J06853
	1½	HSC15	J07858
	2	HSC20	J08854



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.

Goulds Pumps

ITT Industries

Printed in U.S.A.
October, 2002

GOULDS PUMPS

Instrucciones de instalación, operación y mantenimiento

Modelo HSC

DESCRIPCIÓN y ESPECIFICACIONES:

El modelo HSC es una bomba centrífuga de etapas múltiples, de succión de extremo para el servicio general de transferencia de líquido, aplicaciones de unidades reforzadoras, etc. El extremo de líquido es de hierro fundido, acero inoxidable y compuestos diseñados.

Todas las unidades tienen motores de bastidor NEMA 48, monofásicos, de 115/230 V, de 60 Hz con montaje de cara en C y extensiones de eje roscadas NEMA 56J.

1. Importante

1.1. Inspeccione la unidad para determinar si está dañada. Notifique cualquier daño al transportista/agente de inmediato.

1.2. El suministro eléctrico debe ser un circuito derivado separado con fusibles o cortacircuitos, tamaños de alambre, etc. en cumplimiento con los códigos eléctricos nacionales y locales. Instale un desconectador de todos los circuitos, cerca de la bomba.

PRECAUCIÓN

Siempre desconecte el suministro eléctrico cuando maneje la bomba o los controles.

1.3. Los motores deben cablearse para la tensión apropiada. El diagrama de cableado del motor está en la placa del fabricante del motor. El tamaño del alambre debe limitar la caída máxima de tensión al 10% de la tensión de la placa del fabricante en los terminales del motor; de lo contrario se reducirá la vida útil del motor y disminuirá el rendimiento de la bomba.

1.4. Siempre utilice interruptores, contactadores y arrancadores de potencia nominal.

1.5. Protección del motor

1.5.1. Monofásico: A veces la protección térmica para unidades monofásicas está incorporada (consulte la placa del fabricante). Si no se proporciona protección incorporada, utilice un contactador con una sobrecarga apropiada. Se permite instalar fusibles.

1.6. Límites máximos de operación:
Temperatura del líquido: 180°F (82°C)
Presión de trabajo: 125 lbs./pulg. cuadrada
Arranques por hora: 20, distribuidos uniformemente.

1.7. La inspección y el mantenimiento regulares prolongarán la vida de servicio. Base la programación en el tiempo de operación.

Goulds Pumps

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2. Instalación

2.1. Sitúe la bomba lo más cerca posible de la fuente de líquido (por debajo del nivel de líquido para la operación automática).

2.2. Proteja la bomba contra la congelación o inundación.

2.3. Deje un espacio adecuado para el mantenimiento y la ventilación.

2.4. Todas las tuberías deben apoyarse independientemente de la bomba y deben "alinearse" naturalmente.

PRECAUCIÓN

Nunca instale la tubería en posición forzando las conexiones de succión y de descarga de la bomba.

2.5. Evite el uso de accesorios innecesarios. Seleccione los tamaños para mantener las pérdidas por fricción a un mínimo.

2.6. Las unidades pueden instalarse horizontales, inclinadas o verticales.

PRECAUCIÓN

No instalar con el motor debajo de la bomba. Cualquier fuga o condensación afectará el motor.

2.7. El cimiento debe ser plano y substancial para eliminar el esfuerzo cuando se aprieten los pernos. Utilice monturas de caucho para reducir al mínimo el ruido y la vibración.

2.8. Apriete los pernos de sujeción de la carcasa antes de conectar las tuberías a la bomba.

2.9. El alineamiento en el campo de la bomba al motor no es necesario ya que las bombas son de acoplamiento cerrado.

3. Tuberías de succión

3.1. Se desea una elevación de succión estática baja y una tubería de succión corta y directa. Consulte la curva de rendimiento de la bomba con respecto a la ***carga de succión positiva requerida (NPSHR)***, especialmente para levantamientos de más de 15 pies..

3.2. La tubería de succión debe ser al menos del mismo tamaño que la conexión de succión de la bomba. Un tamaño más pequeño degradará el rendimiento.

3.3. Si se requiere un tubo más grande, debe instalarse un reductor de tubo excéntrico (con el lado recto hacia arriba) en la bomba.

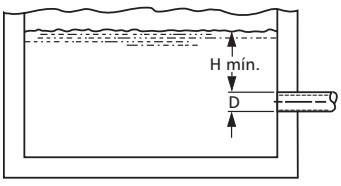


Figura 1

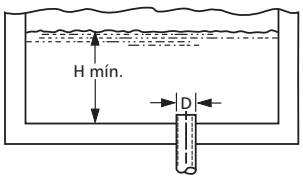


Figura 2

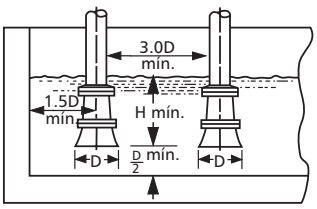


Figura 3

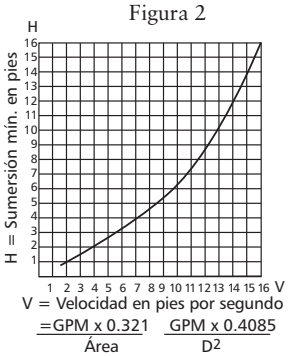


Figura 4

3.4. Instalación con la bomba debajo de la fuente de suministro:

3.4.1. Instale una válvula de aislamiento de flujo completo en la tubería para las operaciones de inspección y mantenimiento.

PRECAUCIÓN

No utilice la válvula de aislamiento de succión para regular la bomba.

3.5. Instalación con la bomba sobre la fuente de suministro:

3.5.1. Evite las bolsas de aire. Ninguna parte de la tubería debe estar más alta que la conexión de succión de la bomba. Incline la tubería hacia arriba de la fuente de líquido.

3.5.2. Todas las juntas deben ser herméticas.

3.5.3. Sólo debe usarse una válvula de aspiración si es necesario para el cebado o para retener el cebado en servicio intermitente.

3.5.4. El área abierta del colador de succión debe ser al menos el triple del área del tubo.

3.6. El tamaño de la entrada de la fuente de líquido y la sumersión mínima sobre la entrada deben ser suficientes para evitar la entrada de aire a través de un vórtice. Ver las Figuras 1 a 4.

3.7. Aplique tres o cuatro vueltas de cinta de Teflon para sellar las conexiones roscadas.

4. Tuberías de descarga

4.1. El dispositivo debe incluir una válvula de retención situada entre una válvula de compuerta y la bomba. La válvula de compuerta es para regular la capacidad o para inspeccionar la bomba o la válvula de retención.

4.2. Si se requiere un aumentador, colóquelo entre la válvula de retención y la bomba.

4.3. Aplique tres o cuatro vueltas de cinta de Teflon para sellar las conexiones roscadas.

5. Rotación

5.1. La rotación correcta es hacia la derecha (en el sentido de las agujas del reloj cuando se mira desde el extremo del motor). Encienda y apague el suministro eléctrico rápidamente. Observe la rotación del eje.

5.1.1. Motor monofásico: no reversible

5.1.2. Motor trifásico: No se ofrece.

6. Operación

6.1. Antes de arrancar, la bomba debe cebarse (sin aire y la tubería de succión debe estar llena de líquido) y la válvula de descarga debe estar parcialmente abierta. Se proporcionan tapones en la carcasa y válvula de manera que la bomba/tubería de succión pueda llenarse y/o ventearse / drenarse en cualquier orientación de la bomba.

6.2. Efectúe una revisión completa después de haber hecho funcionar la unidad en las condiciones de operación y después que se haya estabilizado la temperatura. Revise para determinar si se ha expandido la tuberìa.

7. Mantenimiento

7.1. Los rodamientos están situados en el motor y forman parte del mismo. Están permanentemente lubricados. No se requiere engrasar.

PRECAUCIÓN

El líquido bombeado proporciona lubricación. Si la bomba se hace funcionar seca, las partes giratorias se aferrarán y se dañará el sello mecánico. No haga funcionar la unidad con un flujo de cero o cerca de cero. La energía aplicada al líquido se convierte en calor. El líquido podría vaporizarse instantáneamente. Las partes giratorias requieren líquido para evitar las rayaduras o aferramiento.

8. Desarmado

Se describirá el desmontaje completo de la unidad. Desmonte sólo lo necesario para realizar el trabajo de mantenimiento requerido.

8.1. Apague el suministro eléctrico.

8.2. Drene el sistema y enjueáguelo si es necesario.

8.3. Desmontaje del extremo de líquido:

8.3.1. Quite los pernos de la carcasa.

8.3.2. Retire el motor y el conjunto restante del extremo de líquido de la carcasa (aún conectado a la tubería) y posiciónelos en sentido vertical para facilitar el desmontaje.

8.3.3. Retire la contratuerca y arandela del impulsor.

PRECAUCIÓN

No inserte un destornillador entre los álabes del impulsor para impedir la rotación de las unidades de acoplamiento cerrado. Retire la tapa del extremo opuesto del motor. Una ranura para destornillador o un par de áreas planas quedará al descubierto. Úselas para evitar dañar el impulsor.

8.3.4. Retire el impulsor halando en sentido axial.

8.3.5. Retire la placa de cubierta.

8.3.6. Retire la camisa del eje.

8.3.7. Retire el mecanismo entre etapas.

8.3.8. Repita los pasos 8.3.4 a 8.3.7 para las bombas de tres etapas.

8.3.9. Retire el último impulsor.

8.3.10. Retire la última placa de cubierta.

8.3.11. Retire el retén del sello.

8.3.12. Retire la extensión del eje con un destornillador en la ranura o en las áreas planas en la parte posterior del motor para impedir la rotación y con una llave para hacer girar la extensión.

8.3.13. Retire el elemento giratorio del sello mecánico del eje del motor con dos (2) destornilladores regulares separados 180°y utilizando el refuerzo interior del motor como punto de fulcro y luego empujando el sello hacia arriba.

8.3.14. Quite los pernos, arandelas y anillos en O del motor.

8.3.15. Retire el adaptador del motor.

8.3.16. Retire el elemento estacionario del sello mecánico empujándolo hacia afuera del lado del motor con un instrumento sin punta.

9. Rearmado

9.1. Deben limpiarse todas las partes antes del armado.

9.2. Consulte la lista de partes para identificar los artículos de reemplazo requeridos. Especifique el número de índice o de catálogo cuando ordene partes.

9.3. Reensamble en el orden inverso del desmontaje.

9.4. Observe lo siguiente cuando reensamble el extremo de líquido:

9.4.1. Todos los componentes del sello mecánico deben estar en buenas condiciones o podría producirse fuga. Es una buena práctica reemplazar el conjunto del sello completo cada vez que se haya retirado el sello. Se puede utilizar lubricante poco denso como la glicerina para facilitar el armado. No contamine las caras del sello mecánico con lubricante.

9.4.2. Inspeccione los anillos en O y reemplácelos si están dañados. Los anillos en O pueden lubricarse con gelatina de petróleo para facilitar su instalación.

9.4.3. Inspeccione los impulsores para verificar que no haya desgaste, degradación o bloqueo. Límpielos o reemplácelos, según sea necesario.

9.4.4. Inspeccione las partes de hierro para detectar corrosión o degradación excesiva. Reemplácelas según sea necesario.

9.4.5. Inspeccione los componentes de acero para detectar desgaste o degradación excesiva y reemplácelos según sea necesario.

9.4.6. Los anillos de desgaste contenidos entre las etapas y la carcasa tendrían que presionarse o levantarse hacia afuera y luego presionarse hacia adentro si necesitan reemplazo.

9.5. Inspeccione la unidad rearmada para verificar que no haya roce y corríjala según sea requerido.

9.6. Asegúrese de apretar los pernos de la carcasa en secuencia cruzada para evitar el atascamiento del anillo en O y el agrietamiento de la carcasa. Apriete los pernos a 35 pie-lbs.

10. Tabla de identificación de problemas

EL MOTOR NO ESTÁ FUNCIONANDO
(Ver las causas 1 a 6)

SE ENTREGA POCO O NADA DE LÍQUIDO
(Ver las causas 7 a 16)

EL CONSUMO DE ELECTRICIDAD ES DEMASIADO ALTO
(Ver las causas 4, 16, 17, 18, 21)

RUIDO Y VIBRACIÓN EXCESIVOS
(Ver las causas 4, 6, 9, 12, 14, 15, 17, 19, 20, 21)

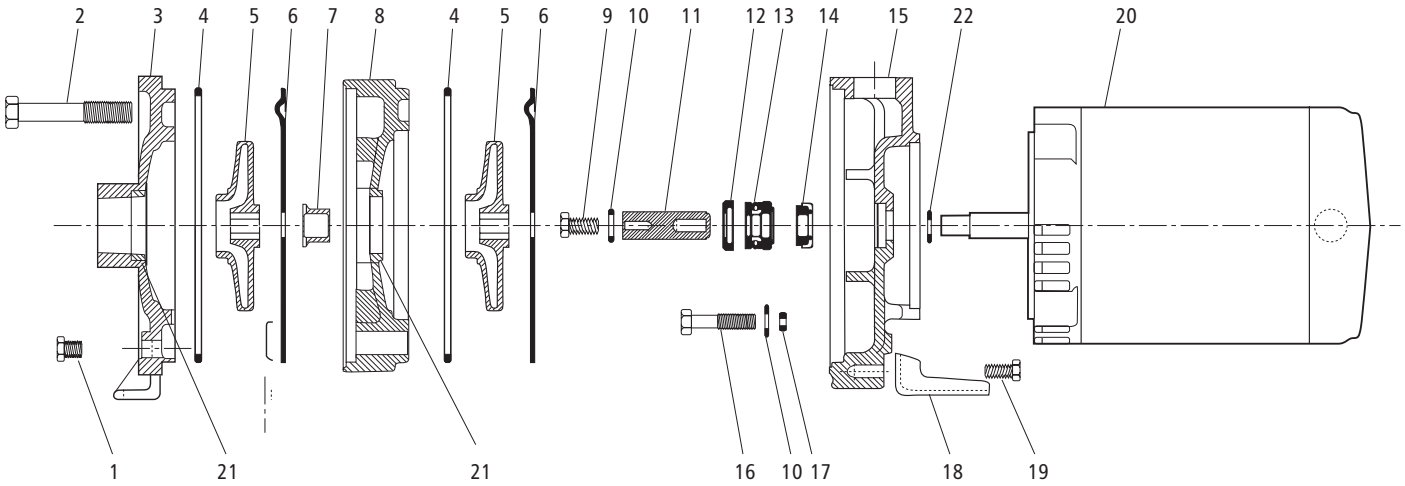
CAUSA PROBABLE:

1. Protector térmico disparado
2. Cortacircuitos abierto
3. Fusible quemado
4. Roce de las partes giratorias
5. Cableado incorrecto del motor
6. Motor defectuoso
7. Falta de cebado
8. Descarga bloqueada o válvula cerrada
9. Rotación incorrecta
10. Válvula de aspiración demasiado pequeña, la succión no está sumergida, el filtro de entrada está tapado.
11. Baja tensión
12. Aire o gases en el líquido
13. Carga del sistema demasiado alta
14. Carga de succión positiva neta disponible (NPSHA) demasiado baja: Elevación de succión demasiado alta o pérdidas de succión excesivas. Revise con un indicador de vacío.
15. Impulsor gastado o taponado
16. Diámetro incorrecto del impulsor
17. Carga demasiado baja, produciendo una velocidad de flujo excesiva
18. Viscosidad o peso específico del fluido demasiado alto
19. Cojinetes gastados
20. Bomba o tubería suelta
21. Bomba y motor desalineados

Artículo	Nombre de la parte	Cantidad
1	Tapón para tubo ¼ pulg. NPT 3	3
2	Perno – de la carcasa al adaptador, 2 etapas	4
2	Perno – de la carcasa al adaptador, 3 etapas	4
3	Carcasa	1
4	Anillo en O – carcasa y etapa intermedia	1 por etapa
5	Impulsor – ¾, 1, 1½ HP Impulsor – 2 HP	2 3
6	Placa de cubierta	(1 por impulsor)
7	Camisa	(Etapa 1 – 2) (Etapa 2 – 3)
8	Etapa intermedia	(Etapa 1 – 2) (Etapa 2 – 3)
9	Perno del impulsor	1
9, 10, 11, 12	Conjunto de extensión del eje – 2 etapas, ¾, 1 y 1½ HP Conjunto de extensión del eje – 3 etapas, 2 HP	1 1

Artículo	Nombre de la parte	Cantidad
10	Arandela – impulsor (1) y adaptador (4)	4
12	Retén del sello	1
13, 14	Conjunto de sello del eje – 1½ y 2 HP	1
15	Adaptador del motor	1
16	Perno – del adaptador al motor	4
17	Anillo en o – pernos del adaptador del motor	4
18	Soporte	1
19	Perno – del soporte al adaptador	1
21	Anillo de desgaste	1 por impulsor
22	Deflector	1

Códigos de motores			
Artículo	Caballos de fuerza	Modelo	N° de orden
20	¾	HSC07	J05853
	1	HSC10	J06853
	1½	HSC15	J07858
	2	HSC20	J08854



GARANTÍA LIMITADA DE GOULDS PUMPS

Esta garantía es aplicable a todas las bombas para sistemas de agua fabricadas por Goulds.

Toda parte o partes que resulten defectuosas dentro del período de garantía serán reemplazadas sin cargo para el comerciante durante dicho período de garantía. Tal período de garantía se extiende por doce (12) meses a partir de la fecha de instalación, o dieciocho (18) meses a partir de la fecha de fabricación, cualquiera se cumpla primero.

Todo comerciante que considere que existe lugar a un reclamo de garantía deberá ponerse en contacto con el distribuidor autorizado de Goulds del cual adquiriera la bomba, y ofrecer información detallada con respecto al reclamo. El distribuidor está autorizado a liquidar todos los reclamos por garantía a través del Departamento de Servicios a Clientes de Goulds.

La presente garantía excluye:

(a) La mano de obra, el transporte y los costos relacionados en los que incurra el comerciante;
(b) los costos de reinstalación del equipo reparado;
(c) los costos de reinstalación del equipo reemplazado;
(d) daños emergentes de cualquier naturaleza; y
(e) el reembolso de cualquier pérdida causada por la interrupción del servicio.

A los fines de esta garantía, los términos "Distribuidor", "Comerciante" y "Cliente" se definen como sigue:

(1) "Distribuidor" es aquel individuo, sociedad, corporación, asociación u otra entidad jurídica que opera entre Goulds y el comerciante para la compra, consignación o contratos de venta de las bombas en cuestión.
(2) "Comerciante" es todo individuo, sociedad, corporación, asociación u otra entidad jurídica que realiza negocios de venta o alquiler-venta (leasing) de bombas a clientes.
(3) "Cliente" es toda entidad que compra o que adquiere bajo la modalidad de leasing las bombas en cuestión de un comerciante. El término "cliente" puede significar un individuo, una sociedad, una corporación, una sociedad de responsabilidad limitada, una asociación o cualquier otra entidad jurídica con actividades en cualquier tipo de negocios.

LA PRESENTE GARANTÍA SE EXTIENDE AL COMERCIANTE ÚNICAMENTE.

Goulds Pumps

ITT Industries

Impreso en EE.UU
Octubre de 2002

GOULDS PUMPS

Directives d'installation, d'utilisation et d'entretien

Modèle HSC

Description et caractéristiques

La pompe modèle HSC est une pompe centrifuge multi-étagée à aspiration en bout, servant au transfert de liquides de nature générale, à l'augmentation de pression, etc. Les éléments de la tête de pompage sont en fonte, en inox et en composites ouvrés.

La pompe est montée sur un moteur à carcasse NEMA 48, à adaptateur en C et à arbre-rallonge fileté NEMA 56J, alimenté en monophasé de 115/230 V, 60 Hz.

1. Informations importantes

1.1. Inspecter l'appareil et signaler immédiatement tout dommage au transporteur ou au détaillant.

1.2. L'alimentation électrique doit être assurée par un circuit de dérivation distinct dont les fusibles ou les disjoncteurs, le calibre des fils, etc. sont conformes aux prescriptions du code provincial ou national de l'électricité. Poser un sectionneur tout conducteur près de la pompe.

ATTENTION !

On doit toujours couper le courant lorsque l'on effectue quelque travail que ce soit sur la pompe ou les commandes.

1.3. Le câblage d'alimentation du moteur doit convenir à la tension de fonctionnement. Le schéma de câblage se trouve sur la plaque signalétique du moteur. Les fils doivent avoir un calibre limitant la chute de tension maximale, aux bornes du moteur, à 10 % de la valeur de tension indiquée sur la plaque signalétique, sinon la durée de vie du moteur et les performances de la pompe diminueront.

1.4. Il faut toujours employer des contacteurs et des démarreurs de puissance nominale en horse-power (hp).

1.5. Protection du moteur
1.5.1. Les moteurs monophasés sont parfois munis d'une protection thermique intégrée (voir la plaque signalétique). Dans le cas contraire, utiliser un contacteur à protection appropriée contre les surcharges. Les dispositifs fusibles sont permis.

1.6. Limites d'utilisation maximales
Température du liquide : 82 °C (180 °F)
Pression : 125 lbf/po^2
Démarrages par heure : 20, répartis uniformément

1.7. Une inspection et un entretien réguliers augmenteront la durée de vie de l'appareil. Établir un programme d'entretien et d'inspection basé sur le temps de fonctionnement.

2. Installation

2.1. Placer la pompe aussi près de la source de liquide que possible (au-dessous du niveau du liquide pour qu'elle fonctionne automatiquement).

2.2. Protéger l'appareil contre les inondations et le gel.

2.3. Prévoir assez d'espace autour de la pompe pour l'entretien et l'aération.

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2.4. La tuyauterie doit posséder ses propres supports et « s'aligner » sans contraintes sur la pompe.

ATTENTION !

Poser la tuyauterie de façon à n'appliquer aucune contrainte sur les raccords d'aspiration et de refoulement de la pompe.

2.5. Ne poser aucun accessoire ni raccord de tuyauterie superflu. Choisir le calibre qui réduit les pertes de charge (par frottement) au minimum.

2.6. La pompe peut être installée à l'horizontale, à la verticale ou sur une surface inclinée.

ATTENTION !

Ne pas placer le moteur plus bas que la pompe afin de le protéger contre les fuites et l'eau de condensation.

2.7. La surface portante (dalle, massif, etc.) doit être plane et solide pour empêcher que le serrage des boulons d'ancrage ne cause de contraintes. Monter l'appareil sur caoutchouc pour réduire le bruit et les vibrations au minimum.

2.8. Serrer les boulons d'ancrage du corps de pompe avant de raccorder la tuyauterie à la pompe.

2.9. La pompe forme un groupe monobloc avec le moteur et ne requiert donc aucun alignement pompe-moteur sur place.

3. Tuyauterie d'aspiration

3.1. Une hauteur geométrique d'aspiration réduite et une tuyauterie directe et courte sont souhaitables. Consulter la courbe de performances de la pompe pour obtenir la *hauteur nette d'aspiration requise* (*NPSHR*), particulièrement pour les hauteurs dépassant 15 pi.

3.2. Le calibre du tuyau d'aspiration doit être au moins égal à celui du raccord d'aspiration de la pompe pour éviter une baisse des performances.

3.3. S'il faut un tuyau plus gros, on doit installer un raccord réducteur excentré (le côté non oblique en haut) à la pompe.

3.4. Pompe placée plus bas que la source de liquide :
3.4.1. Poser un robinet d'isolement à passage intégral sur le tuyau d'aspiration pour l'inspection et l'entretien.

ATTENTION !

Ne pas employer le robinet d'isolement pour réduire la section de passage vers la pompe.

3.5. Pompe placée plus haut que la source de liquide :
3.5.1. Afin de prévenir les poches d'air, aucun élément de la tuyauterie d'aspiration ne devrait être plus haut que le raccord d'aspiration de la pompe. Donner à la tuyauterie une inclinaison vers le haut à partir de la source de liquide.

3.5.2. Chaque joint doit être étanche.

3.5.3. N'employer un clapet de pied que s'il est requis pour amorcer la pompe ou la maintenir amorcée pendant les arrêts.

3.5.4. La section de passage de la crépine du tuyau d'aspiration doit être au moins le triple de celle du tuyau.

3.6. Le diamètre (*d*) et la hauteur d'immersion minimale (*h* min.) de l'entrée du tuyau d'aspiration doivent être suffisants pour empêcher l'aspiration d'air par vortex (v. fig. 1 à 4).

3.7. Enrouler les raccords filetés de 3 ou 4 couches de ruban de téflon pour les étancher.

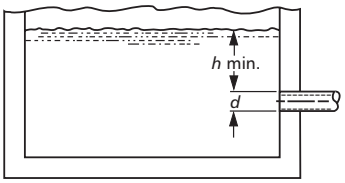


Figure 1

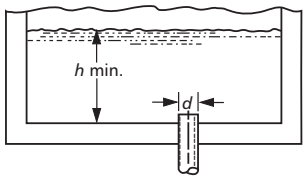


Figure 2

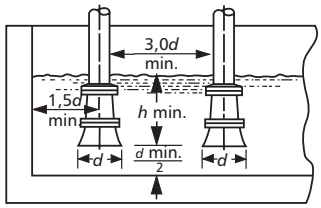


Figure 3

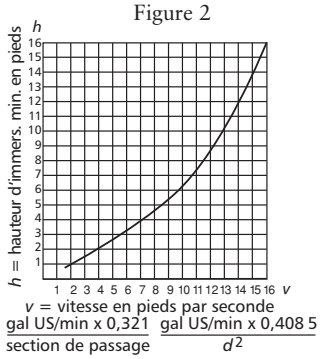


Figure 4

4. Tuyauterie de refoulement

4.1. L'installation doit comporter un robinet-vanne, ainsi qu'un clapet de non-retour placé entre le robinet-vanne et la pompe. Le robinet-vanne sert à la régularisation du débit et à l'inspection de la pompe et du clapet de non-retour.

4.2. Si un raccord agrandisseur est nécessaire, le poser entre le clapet de non-retour et la pompe.

4.3. Enrouler les raccords filetés de 3 ou 4 couches de ruban de téflon pour les étancher.

5. Sens de rotation

5.1. La pompe doit tourner en sens horaire (vers la droite, vue de l'extrémité du moteur). Démarrer et arrêter la pompe immédiatement tout en observant le sens de rotation de l'arbre.

5.1.1. Le sens de rotation des moteurs monophasés est irréversible.

5.1.2. Les moteurs triphasés, dont le sens de rotation peut être inversé, ne sont pas offerts avec la HSC.

6. Utilisation

6.1. Avant de mettre la pompe en service, on doit l'amorcer (pour en chasser l'air), ainsi que le tuyau d'aspiration, et entrouvrir le robinet de refoulement. Le corps de pompe et le robinet sont munis de bouchons de mise à l'air libre (d'amorçage) ou (et) de vidange permettant l'amorçage de la pompe, qu'elle soit horizontale, verticale ou inclinée.

6.2. Faire fonctionner l'appareil dans des conditions normales jusqu'à ce que sa température se soit stabilisée, puis vérifier tout le système. Vérifier également la dilatation de la tuyauterie.

7. Entretien

7.1. Les roulements à billes sont situés à l'intérieur du moteur et sont lubrifiés à vie. Aucun graissage n'est requis.

ATTENTION !

Le liquide pompé sert de lubrifiant. Si la pompe tournait à sec, les pièces mobiles gripperaient, et la garniture mécanique s'endommagerait. Il ne faut donc pas faire

marcher la pompe lorsque le débit est nul ou presque, car le liquide absorberait la chaleur produite par frottement et pourrait se changer rapidement en vapeur. Les pièces mobiles doivent être lubrifiées par le liquide pour ne pas s'endommager ni gripper.

8. Démontage

Le démontage complet de la pompe est décrit ci-dessous. Ne démonter que ce qui permet d'effectuer l'entretien nécessaire.

8.1. Couper le courant.

8.2. Vidanger le système. Le rincer au besoin.

8.3. Démontage de la tête de pompage :

8.3.1. Enlever les vis du corps de pompe.

8.3.2. Séparer l'ensemble d'entraînement des roues (moteur et organes de pompage) d'avec le corps de pompe (celui-ci reste fixé à la tuyauterie), et placer l'ensemble à la verticale pour en faciliter le démontage.

8.3.3. Déposer le vis et la rondelle de roues.

ATTENTION !

Ne pas insérer de tournevis entre les aubes des roues pour empêcher l'arbre de tourner : enlever le couvercle d'extrémité du moteur et utiliser la fente ou les méplats de blocage de l'arbre. On préviendra ainsi l'endommagement des roues.

8.3.4. Tirer sur la roue pour l'enlever de l'arbre.

8.3.5. Déposer la plaque séparatrice.

8.3.6. Retirer la chemise d'arbre.

8.3.7. Enlever le corps d'étage intermédiaire.

8.3.8. Répéter les étapes 8.3.4. à 8.3.7. pour les pompes à trois étages.

8.3.9. Enlever la dernière roue.

8.3.10. Déposer la dernière plaque séparatrice.

8.3.11. Retirer l'étrier de retenue de la garniture mécanique.

8.3.12. Avec un tournevis ou un autre outil approprié, bloquer l'arbre de moteur par la fente ou les méplats précités, puis dévisser l'arbre-rallonge avec une clé.

8.3.13. À l'aide de deux (2) tournevis plats utilisés comme leviers dans un angle de 180° entre le bossage interne (point d'appui) de l'adaptateur de moteur et l'élément mobile de la garniture, retirer l'élément mobile.

8.3.14. Déposer les vis de fixation de l'adaptateur de moteur, les rondelles et les joints toriques.

8.3.15. Enlever l'adaptateur de moteur.

8.3.16. Avec un outil de forme et de dimension appropriées, pousser l'élément fixe de la garniture hors de son siège par le côté moteur de l'adaptateur.

9. Remontage

9.1. Chaque pièce devrait être nettoyée avant le remontage.

9.2. Voir la liste de pièces de rechange pour déterminer celles qui sont requises. Préciser le numéro de pièce ou de catalogue de la pompe lorsque l'on commande des pièces.

9.3. Le remontage se fait dans l'ordre inverse du démontage.

9.4. Observer les directives ci-après pendant le remontage de la tête de pompage :

9.4.1. Tous les composants de la garniture mécanique doivent être en bon état pour empêcher les fuites. Le remplacement de la garniture en entier est une pratique courante appropriée chaque fois que la garniture est enlevée. On peut utiliser un lubrifiant léger tel que la glycérine pour faciliter l'assemblage. Ne pas contaminer les surfaces de la garniture mécanique avec le lubrifiant.

9.4.2. Inspecter les joints toriques et les remplacer s'ils sont endommagés. On peut employer du pétrolatum (vaseline) pour en faciliter la pose.

9.4.3. Vérifier si les roues sont engorgées, usées ou détériorées. Les nettoyer ou les remplacer au besoin.

9.4.4. Inspecter les pièces en fer et les remplacer si elles sont trop corrodées ou dégradées.

9.4.5. Vérifier si les pièces en inox sont trop usées ou détériorées. Les remplacer au besoin.

9.4.6. Pour remplacer la bague d'usure du corps de pompe ou du (des) corps d'étage intermédiaire(s), on devra probablement utiliser une presse.

9.5. Vérifier si les pièces mobiles de la tête de pompage grippent et, au besoin, apporter les correctifs appropriés.

9.6. Voir à serrer les vis du corps de pompe uniformément et en croix à 35 lbf·pi pour éviter le pinçage du joint torique et le bris des oreilles de jonction du corps de pompe.

10. Diagnostic des anomalies

ANOMALIE

NON-FONCTIONNEMENT DU MOTEUR
(V. causes probables 1 à 6)

DÉBIT DE LIQUIDE FAIBLE OU NUL
(V. causes probables 7 à 16)

CONSOMMATION D'ÉNERGIE EXESSIVE
(V. causes probables 4, 16, 17, 18 et 21)

VIBRATION ET BRUIT EXESSIFS
(V. causes probables 4, 6, 9, 12, 14, 15, 17, 19, 20 et 21)

CAUSE PROBABLE

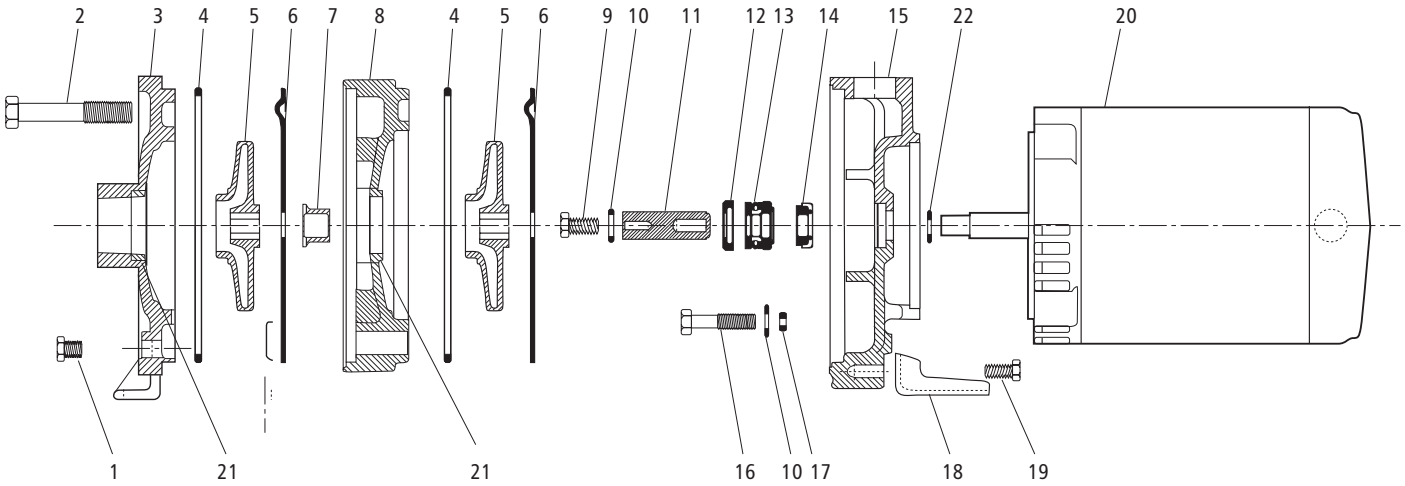
1. Protecteur thermique déclenché
2. Disjoncteur ouvert
3. Fusible sauté
4. Pièces mobiles grippées
5. Moteur mal connecté
6. Moteur défectueux
7. Pompe non amorcée
8. Tuyau de refoulement obstrué ou robinet fermé
9. Mauvais sens de rotation
10. Clapet de pied trop petit, entrée de tuyau d'aspiration non immergée, crépine de tuyau d'aspiration obstruée
11. Basse tension électrique
12. Présence d'air ou de gaz dans le liquide
13. Hauteur de charge trop élevée du système
14. Hauteur nette d'aspiration disponible (NPSHA) trop faible : hauteur ou perte d'aspiration excessives — à vérifier avec un vacuomètre
15. Roues usées ou engorgées
16. Diamètre de roue inapproprié
17. Hauteur de charge trop faible : débit excessif
18. Viscosité ou densité trop élevées
19. Roulements usés
20. Pompe ou tuyauterie mal assujetties
21. Pompe et moteur désalignés

Liste de pièces de rechange

Article	Nom de pièce	Quantité
1	Bouchon de tuyau, ¼ po, NPT	3
2	Vis (adaptateur-corps de pompe, 2 ou 3 étages)	4
3	Corps de pompe	1
4	Joint torique (corps de pompe-corps d'étage intermédiaire)	1 par étage
5	Roue (pompes de ¾, 1 et 1½ hp) Roue (pompes de 2 hp)	2 3
6	Plaque séparatrice	1 par roue
7	Chemise d'arbre	1 (2 étages) 2 (3 étages)
8	Corps d'étage intermédiaire	1 (2 étages) 2 (3 étages)
9	Vis de roues	1
9, 10, 11 et 12	Ensemble arbre-rallonge	1

Article	Nom de pièce	Quantité
10	Rondelle (de roues : 1, d'adaptateur : 4)	5
12	Étrier de retenue de la garniture mécanique	1
13 et 14	Garniture mécanique	1
15	Adaptateur de moteur	1
16	Vis (moteur-adaptateur de moteur)	4
17	Joint torique (vis de fixation moteur-adaptateur)	4
18	Patte	1
19	Vis (patte-adaptateur de moteur)	1
20	Moteur (v. table Codes de moteur)	1
21	Bague d'usure	1 par étage
22	Déflecteur	1

Codes de moteur			
Article	**hp**	**Modèle**	**N° de catalogue**
20	¾	HSC07	J05853
	1	HSC10	J06853
	1½	HSC15	J07858
	2	HSC20	J08854



GARANTIE LIMITÉE DE GOULDS PUMPS

La présente garantie s'applique à chaque pompe de système d'alimentation en eau fabriquée par Goulds Pumps.

Toute pièce se révélant défectueuse sera remplacée sans frais pour le détaillant durant la période de garantie suivante expirant la première : douze (12) mois à compter de la date d'installation ou dix-huit (18) mois à partir de la date de fabrication.

Le détaillant qui, aux termes de la présente garantie, désire effectuer une demande de règlement doit s'adresser au distributeur Goulds Pumps agréé chez lequel la pompe a été achetée et fournir tous les détails à l'appui de sa demande. Le distributeur est autorisé à régler toute demande par le biais du service à la clientèle de Goulds Pumps.

La garantie ne couvre pas :

a) les frais de main-d'œuvre ni de transport ni les frais connexes encourus par le détaillant ;
b) les frais de réinstallation de l'équipement réparé ;
c) les frais de réinstallation de l'équipement de remplacement ;
d) les dommages indirects de quelque nature que ce soit ;
e) ni les pertes découlant de la panne.

Aux fins de la garantie, les termes ci-dessous sont définis comme suit :

1) « Distributeur » signifie une personne, une société de personnes, une société de capitaux, une association ou autre entité juridique servant d'intermédiaire entre Goulds Pumps et le détaillant pour les achats, les consignations ou les contrats de vente des pompes en question.
2) « Détaillant » veut dire une personne, une société de personnes, une société de capitaux, une association ou autre entité juridique dont les activités commerciales sont la vente ou la location de pompes à des clients.
3) « Client » désigne une entité qui achète ou loue les pompes en question chez un détaillant. Le « client » peut être une personne, une société de personnes, une société de capitaux, une société à responsabilité limitée, une association ou autre entité juridique se livrant à quelque activité que ce soit.

LA PRÉSENTE GARANTIE SE RAPPORTE AU DÉTAILLANT SEULEMENT.

Goulds Pumps

ITT Industries

Imprimé aux É.-U.
Octobre 2002

AMT
A Subsidiary of The Gorman-Rupp Company

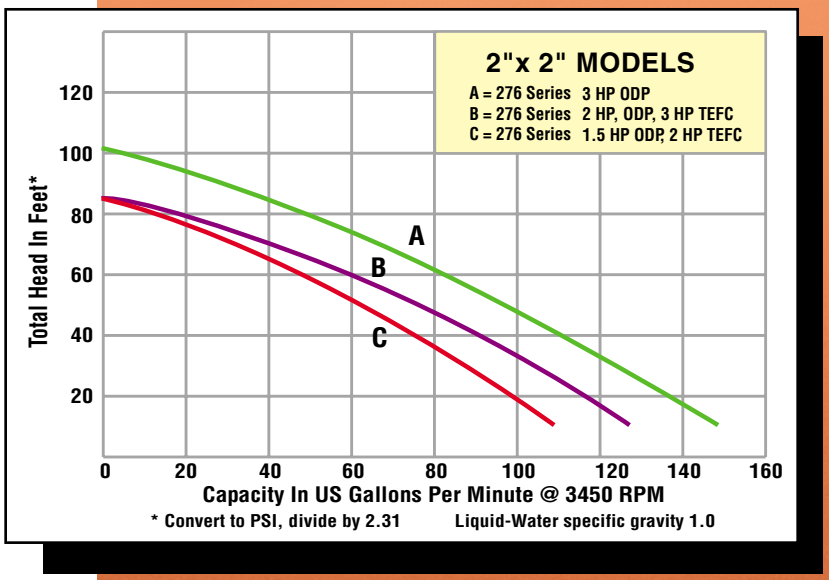
Circulation™ Pump 282B-95

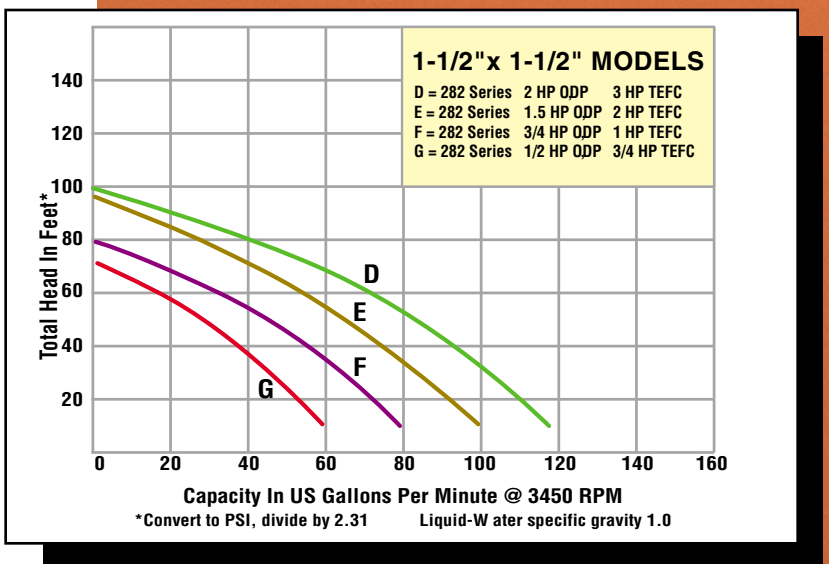
Self-Priming Centrifugal Pumps

INDUSTRIAL DUTY

Model 2761-95

- ***300 Series Investment Cast Stainless Steel Construction with Viton® Seals; Maximum Temperature 200° F***
- ***Cast Iron Construction with Buna-N Seals; Maximum Temperature 180° F***
- ***Optional Silicon Carbide Seals Available***
- ***1-1/2" and 2" NPT Port Sizes***
- ***Self-Priming up to 20 Ft.***
- ***Maximum Working Pressure 75 PSI***
- ***Maximum Flow 150 GPM***
- ***Maximum Head 102 Ft. (44 PSI)***
- ***Dual Volute Design***
- ***Self-cleaning, Clog Resistant Impeller***
- ***Built In Check Valve***
- ***Available with Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) Motors***
- ***1/2 to 3 HP 56J Single and Three Phase, 3450 RPM Motors***



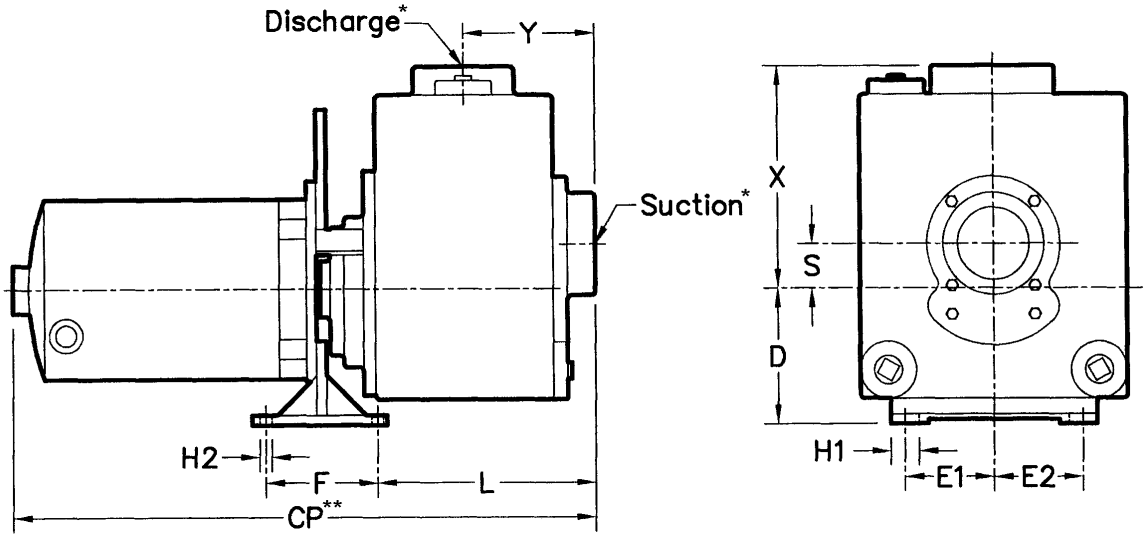


This line of AMT Self-priming Centrifugal pumps is designed for Industrial and Commercial applications requiring high volume liquid transfer, waste water drainage and processing. These pumps feature self-cleaning clog resistant impeller capable of handling up to 3/8" diameter semi-solids. Built in flapper/check valves enable consistent self-priming to 20 ft. Dual volute design reduces radial load on motor. Stainless Steel models are especially effective in applications where rust and/or corrosion can develop in systems and also are highly resistant to erosion and chemicals. Cast Iron models offer durability, high quality and value that continue to set the standard in the industry.

AMT Centrifugal pumps are reliable, cost effective and low maintenance. Many are readily available **"Off-the-Shelf"** for fast 24 hour shipment. For use with non-flammable liquids compatible with pump component materials.

Viton® is a registered trademark of E.I. DuPont

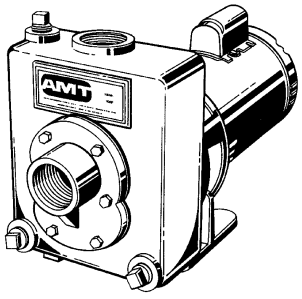
Self-Priming Centrifugal Pumps



Pump Dimensional & Specification Chart

Cast Iron Models	Curve	Stainless Models	HP	PH	ENC	Voltage @ 60 Hz+	Full Load Amps	SUC*	DIS*	CP**	D	E1	E2	F	H1	H2	L	S	X	Y	Cast Iron Ship Wt	Stainless Ship Wt
2827-95	G	2827-98	1/2	1	ODP	115/230	10/5	1-1/2"	1-1/2"	16.9	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	47 Lbs.	50 Lbs.
282J-95	G	282J-98	1/2	3	ODP	230/460	4/2	1-1/2"	1-1/2"	17.4	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	51 Lbs.	53 Lbs.
2825-95	F	2825-98	3/4	1	ODP	115/230	13/7	1-1/2"	1-1/2"	17.6	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	50 Lbs.	53 Lbs.
2826-95	F	2826-98	3/4	3	ODP	230/460	4/2	1-1/2"	1-1/2"	17.8	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	50 Lbs.	53 Lbs.
282D-95	G	282D-98	3/4	1	TEFC	115/230	9/5	1-1/2"	1-1/2"	19.0	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	52 Lbs.	55 Lbs.
282F-95	G	282F-98	3/4	3	TEFC	230/460	3/2	1-1/2"	1-1/2"	18.4	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	49 Lbs.	52 Lbs.
282C-95	F	282C-98	1	1	TEFC	115/230	12/6	1-1/2"	1-1/2"	19.4	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	55 Lbs.	58 Lbs.
282K-95	F	282K-98	1	3	TEFC	230/460	4/2	1-1/2"	1-1/2"	19.0	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	51 Lbs.	54 Lbs.
2821-95	E	2821-98	1-1/2	1	ODP	115/230	22/11	1-1/2"	1-1/2"	16.8	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	62 Lbs.	65 Lbs.
2822-95	E	2822-98	1-1/2	3	ODP	230/460	7/4	1-1/2"	1-1/2"	16.6	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	58 Lbs.	61 Lbs.
2828-95	D	2828-98	2	1	ODP	115/230	28/14	1-1/2"	1-1/2"	17.6	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	69 Lbs.	72 Lbs.
282L-95	D	282L-98	2	3	ODP	230/460	7/4	1-1/2"	1-1/2"	17.7	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	68 Lbs.	71 Lbs.
282A-95	E	282A-98	2	1	TEFC	115/230	22/11	1-1/2"	1-1/2"	19.2	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	74 Lbs.	77 Lbs.
282B-95	E	282B-98	2	3	TEFC	230/460	6/3	1-1/2"	1-1/2"	18.0	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	69 Lbs.	71 Lbs.
282E-95	D	282E-98	3	1	TEFC	230	16	1-1/2"	1-1/2"	20.0	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	80 Lbs.	83 Lbs.
282M-95	D	282M-98	3	3	TEFC	230/460	8/4	1-1/2"	1-1/2"	20.8	4.5	2.2	2.2	3.0	0.5	0.7	5.4	0.9	5.1	3.5	80 Lbs.	83 Lbs.
2762-95	C	2762-98	1-1/2	1	ODP	115/230	17/9	2"	2"	18.4	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	68 Lbs.	72 Lbs.
2764-95	C	2764-98	1-1/2	3	ODP	230/460	7/4	2"	2"	18.6	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	69 Lbs.	73 Lbs.
2761-95	B	2761-98	2	1	ODP	115/230	28/14	2"	2"	19.1	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	74 Lbs.	78 Lbs.
276B-95	C	276B-98	2	1	TEFC	115/230	22/11	2"	2"	20.7	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	79 Lbs.	83 Lbs.
2763-95	B	2763-98	2	3	ODP	230/460	7/4	2"	2"	19.1	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	67 Lbs.	71 Lbs.
276D-95	C	276D-98	2	3	TEFC	230/460	6/3	2"	2"	19.4	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	68 Lbs.	72 Lbs.
2767-95	A	2767-98	3	1	ODP	230	18	2"	2"	20.2	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	76 Lbs.	79 Lbs.
276A-95	B	276A-98	3	1	TEFC	230	16	2"	2"	21.4	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	79 Lbs.	83 Lbs.
2766-95	A	2766-98	3	3	ODP	230/460	9/5	2"	2"	19.9	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	74 Lbs.	78 Lbs.
276C-95	B	276C-98	3	3	TEFC	230/460	8/4	2"	2"	20.9	4.5	2.2	2.2	3.0	0.5	0.7	6.7	1.2	6.7	4.4	76 Lbs.	80 Lbs.

(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase motors can also operate on 50 Hz. (This will change Full Load Amps, Service Factor, RPM and Priming Capabilities)
NOTE: Dimensions have a tolerance of ±1/8".
NOTE: Electric supply for ALL motors must be within ±10% of nameplate voltage rating (Ex. 230V ±10%= 207 to 253)



Standard Features

- 300 Series Investment Cast Stainless Steel Construction with Viton® seals, Max. Temperature 200° F
- Cast Iron Construction with Buna-N seals, Max. Temperature 180° F
- Dual Volute Design
- Handles 3/8" Diameter Semi-solids
- Self-cleaning, Clog Resistant Impeller
- Built in Flapper/Check Valve
- Steel Base and Handle
- "**Off-the-Shelf**" Availability for Many Models
- Nema 56J Motors with Stainless Steel Shafts
- Available in ODP or TEFC, Single or Three Phase
- Self-primes to 20 Ft.

Viton® is a registered trademark of E.I. DuPont

See price book page 19

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

Self-Priming Centrifugal Pumps

High Volume Dewatering
Cast Iron Models

Refer to form 1808-634-00 for General Operating and Safety Instructions.

Description

These centrifugal pumps are self-priming (to 20 ft. lift) units designed for high volume liquid transfer - irrigation, de-watering, lawn sprinkling, etc. They can also accommodate semi-solids (up to 3/8" dia.), sediment laden liquids, and liquids with entrained air or gases. Units are equipped with flapper valves to shorten re-prime time. Handles liquids from 40° to 180° F (4° to 82° C). For use with non-flammable, non-abrasive liquids compatible with pump component materials.

Maintenance

⚠WARNING ***Make certain that unit is disconnected from power source before attempting to service or remove any component!***

NOTE: The pump casing should be removed and inspected periodically to insure that any foreign material is not clogging internal pump parts. This unit is equipped with a dual volute pump casing. One of the volutes runs 180°, all the way from the side opposite the discharge into the discharge through a completely enclosed passageway. If foreign material clogs this area, it can be dislodged by using a wire or long spring.

MECHANICAL SEAL REPLACEMENT

Refer to Figure 1

IMPORTANT: Always replace both seal seat (Ref. No. 8) and seal head (Ref. No. 9) to ensure proper mating of components!

1. Unthread fasteners (Ref. No. 6) and remove pump casing (Ref. No. 14) and casing seal (Ref. No. 7) from adapter (Ref. No. 5).
2. Unscrew impeller fastener (Ref. No. 13), (where applicable), and impeller (Ref. No. 11) separately by turning each counterclockwise.

NOTE: Most motors use an open end 7/16" wrench across flats on rear of motor shaft (remove bearing cap for access) to prevent shaft from turning. Other motor shafts have a screwdriver slot instead of flats.

3. Unscrew fasteners (Ref. Nos. 4 & 18) and remove adapter, foot (Ref. No. 19), and handle (Ref. No. 3) from motor (Ref. No.1) mounting face. Seal head will come loose at this time.
4. Push seal seat from adapter recess with a screwdriver.
5. Clean adapter recess before inserting a new seal seat.
6. Carefully wipe polished surface of new seal seat with a clean cloth.
7. Wet rubber portion of seal seat with a light coating of soapy water.
8. Press new seal seat squarely into cavity in adapter. If seal seat does not press squarely into cavity, it can be adjusted in place by pushing on it with a piece of pipe. Always use a piece of cardboard between pipe and seal seat to avoid scratching seal seat. (This is a lapped surface and must be handled very carefully.)
9. After seal seat is in place, insure that it is clean and has not been marred.
10. Using a clean cloth, wipe shaft and make certain that it is perfectly clean.

NOTE: If removed, slide slinger washer (Ref. No. 2) onto shaft until it is located approximately 1/8" from face of motor bearing hub.

11. Secure adapter, foot, and handle on motor mounting face. Carefully guide motor shaft through seal seat.
12. Apply a light coating of soapy water to inside rubber portion of seal head and slide onto shaft (with sealing face first) so that rubber portion is

Performance

Model	GPM of Water at Total Head in Feet									Max. Head*
	10'	20'	30'	40'	50'	60'	70'	80'	90'	
2827, 282J, 282D, 282F	58	51	44	37	28	18	7	—	—	74 ft.
2825, 2826, 282C, 282K	78	72	64	56	46	35	20	—	—	78
2821, 2822, 282A, 282B	99	92	84	75	65	54	43	31	15	93
2828, 282L, 282E, 282M	117	112	102	92	82	70	56	42	24	95
2762, 2764, 276B, 276D	111	96	85	75	60	48	30	15	—	86
2761, 2763, 276A, 276C	127	115	103	90	76	60	40	20	—	93
2767, 2766	148	136	123	110	95	82	68	49	30	101

(*) Shut-off; To convert to psi, multiply by SG (specific gravity of liquid), then dived by 2.31.

Self-Priming Centrifugal Pumps

High Volume Dewatering
Cast Iron Models

Specifications

Model	DRIVER HP	Enclosure	Power Supply @60 Hz	PUMP Suction x Discharge*	Weight (lbs.)
2827-95	1/2	ODP	115/230VAC, 1 Phase	1½" x 1½"	47
282J-95	1/2	ODP	230/460VAC, 3 Phase	1½ x 1½	50
282D-95	3/4	TEFC	115/230VAC, 1 Phase	1½ x 1½	52
282F-95	3/4	TEFC	230/460VAC, 3 Phase	1½ x 1½	49
2825-95	3/4	ODP	115/230VAC, 1 Phase	1½ x 1½	50
2826-95	3/4	ODP	230/460VAC, 3 Phase	1½ x 1½	49
282C-95	1	TEFC	115/230VAC, 1 Phase	1½ x 1½	54
282K-95	1	TEFC	230/460VAC, 3 Phase	1½ x 1½	50
2821-95	1½	ODP	115/230VAC, 1 Phase	1½ x 1½	62
2822-95	1½	ODP	230/460VAC, 3 Phase	1½ x 1½	58
282A-95	2	TEFC	115/230VAC, 1 Phase	1½ x 1½	74
282B-95	2	TEFC	230/460VAC, 3 Phase	1½ x 1½	68
2828-95	2	ODP	115/230VAC, 1 Phase	1½ x 1½	69
282L-95	2	ODP	230/460VAC, 3 Phase	1½ x 1½	68
282E-95	3	TEFC	230VAC, 1 Phase	1½ x 1½	79
282M-95	3	TEFC	230/460VAC, 3 Phase	1½ x 1½	79
2762-95	1½	ODP	115/230VAC, 1 Phase	2 x 2	68
2764-95	1½	ODP	230/460VAC, 3 Phase	2 x 2	69
276B-95	2	TEFC	115/230VAC, 1 Phase	2 x 2	79
276D-95	2	TEFC	230/460VAC, 3 Phase	2 x 2	68
2761-95	2	ODP	115/230VAC, 1 Phase	2 x 2	74
2763-95	2	ODP	230/460VAC, 3 Phase	2 x 2	67
276A-95	3	TEFC	230VAC, 1 Phase	2 x 2	78
276C-95	3	TEFC	230/460VAC, 3 Phase	2 x 2	76
2767-95	3	ODP	230VAC, 1 Phase	2 x 2	75
2766-95	3	ODP	230/460VAC, 3 Phase	2 x 2	74

(ODP) Open Drip Proof; (TEFC) Totally Enclosed Fan Cooled
(*) Standard NPT (female) pipe thread.
NOTE: Driver data is subject to change without notice, see label on driver for actual specifications.

Maintenance (Continued)

just up over shaft shoulder.

⚠ CAUTION ***Do not touch or wipe polished face of seal head.***

13. Replace any impeller shims (Ref. No. 10) which may have been removed in disassembly. (See "Shim Adjustment" below.)
14. Screw impeller back into place, tightening until it is against shaft shoulder.
15. Replace impeller nut (where applicable), and tighten until snug.
16. Remount casing seal and pump casing on adapter.

IMPORTANT: Always use a new casing gasket whenever unit is disassembled.

SHIM ADJUSTMENT

When installing a replacement impeller (Ref. No. 11) or motor (Ref. No. 1), it may be necessary to adjust number of shims (Ref. No. 10) to insure proper running clearance between impeller and casing. Proceed as follows:

NOTE: A proper running clearance is less than 0.010".

1. For impeller replacement, add one 0.010"shim in addition to those removed originally.
2. For motor replacement, add two 0.010" shims in addition to those removed during disassembly.
3. Reassemble the pump as described in steps 15, 16 & 17.

IMPORTANT: Ensure that the casing is snugly in place and check shaft to make sure it is turning freely (use screwdriver slot in motor to turn shaft). If it turns freely, check to insure that adapter and casing are fitted tight together. If they are not, tighten fasteners (Ref. Nos. 4, 6 and 18) and recheck shaft for free turning. Tighten carefully, turning shaft while tightening so that motor bearings are not damaged in the event that too many shims were installed. If shaft seizes before fasteners are completely tight, disassemble pump and remove one shim and repeat reassembly.

For Repair Parts, contact dealer where pump was purchased.

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

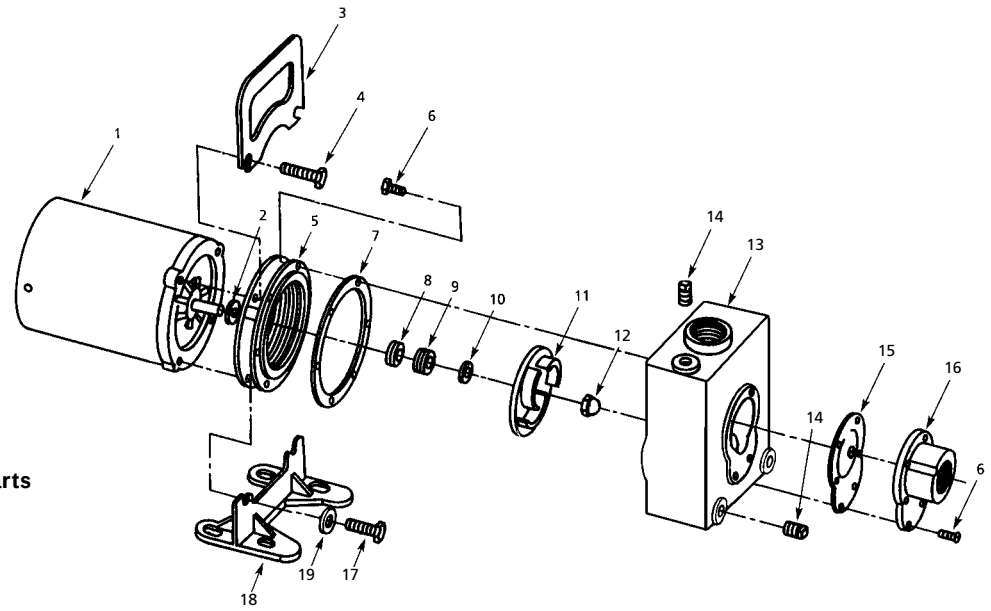


Figure 1 – Repair Parts Illustration

Repair Parts List

Ref. No.	Description		Part Number for Models: **2827-95** *(1/2HP)* **282J-95** *(1/2HP)* **282D-95** *(3/4HP)* **282F-95** *(3/4HP)*	**2825-95** *(3/4HP)* **2826-95** *(3/4HP)* **282C-95** *(1HP)* **282K-95** *(1HP)*	**2821-95** *(1 1/2HP)* **2822-95** *(1 1/2HP)* **282A-95** *(2HP)* **282B-95** *(2HP)*	**2828-95** *(2HP)* **282L-95** *(2HP)* **282E-95** *(3HP)* **282M-95** *(3HP)*	Qty.
1	Motor	-1 Phase ODP	1626-009-00	1626-010-00	1626-012-00	1626-024-00	1
		-3 Phase ODP	1626-013-00	1626-014-00	1626-016-00	1626-025-00	
		-1 Phase TEFC	1626-051-00	1626-069-00	1626-070-00	1626-071-00	
		-3 Phase TEFC	1626-052-00	1626-077-00	1626-054-00	1626-072-00	
2	Slinger washer		1534-000-00	1534-000-00	1534-000-00	1534-000-00	1
3	Handle		1515-000-00	1515-000-00	1515-000-00	1515-000-00	1
4	Fastener		*	*	*	*	2
5	Adapter		1499-000-01	1499-000-01	1499-000-01	1499-000-01	1
6	Fastener		*	*	*	*	12
7	Casing seal		1478-000-00	1478-000-00	1478-000-00	1478-000-00	1
8&9	† Shaft seal assembly	-Buna N	1640-161-90	1640-161-90	1640-161-90	1640-161-90	1
		-Viton	1640-161-91	1640-161-91	1640-161-91	1640-161-91	
10	Impeller shim set		1657-000-90	1657-000-90	1657-000-90	1657-000-90	1
11	Impeller	-1 Phase	1510-001-01	1514-001-02	1512-000-01	1513-001-01	1
		-3 Phase	1510-001-02	1514-001-03	1510-000-01	1513-001-02	
12	Impeller fastener		1784-001-00	1784-001-00	1784-001-00	1784-001-00	1
13	Casing		1497-000-01	1497-000-01	1497-000-02	1497-000-02	1
14	Pipe plug		*	*	*	*	3
15	Flapper valve assembly	-Buna N	1674-000-90	1674-000-90	1674-000-90	1674-000-90	1
		-Viton	1674-000-91	1674-000-91	1674-000-91	1674-000-91	
16	Suction plate		1501-000-01	1501-000-01	1501-000-01	1501-000-01	1
17	Fastener		*	*	*	*	2
18	Foot		1506-000-00	1506-000-00	1506-000-00	1506-000-00	1
19	Washer		*	*	*	*	2

(*) Standard hardware item, available locally; (†) Seal head and seat available as set only.

For Repair Parts, contact dealer where pump was purchased.

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

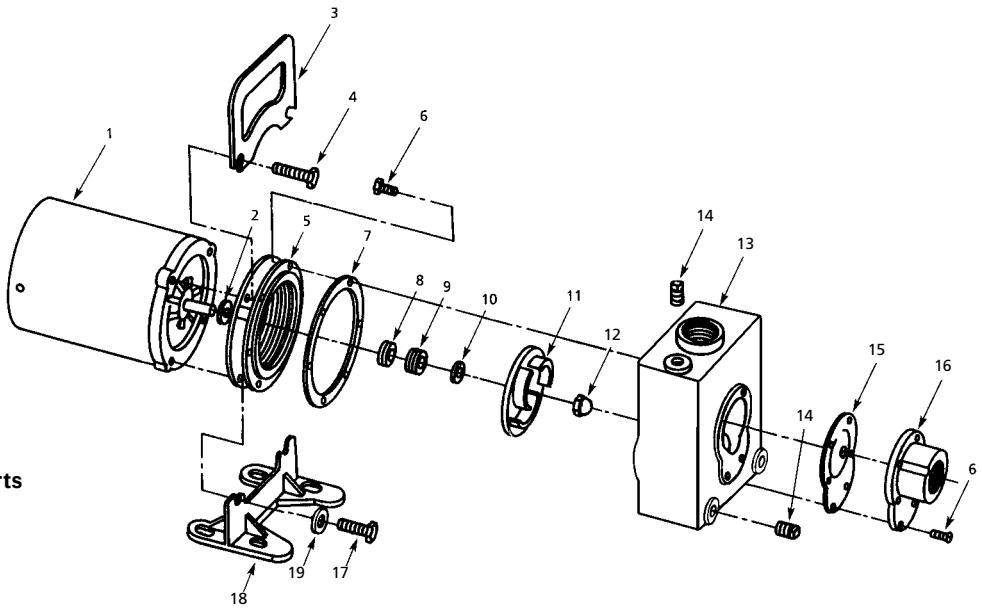


Figure 2 – Repair Parts Illustration

Repair Parts List

Ref. No.	Description		Part Number for Models: **2762-95** *(1½HP)* **2764-95** *(1½HP)* **276B-95** *(2HP)* **276D-95** *(2HP)*	**2761-95** *(2HP)* **2763-95** *(2HP)* **276A-95** *(3HP)* **276C-95** *(3HP)*	**2767-95** *(3HP)* **2766-95** *(3HP)*	Qty.
1	Motor	-1 Phase ODP	1626-012-00	1626-024-00	1626-026-00	1
		-3 Phase ODP	1626-016-00	1626-025-00	1626-027-00	
		-1 Phase TEFC	1626-070-00	1626-071-00	—	
		-3 Phase TEFC	1626-054-00	1626-072-00	—	
2	Slinger washer		1534-000-00	1534-000-00	1534-000-00	1
3	Handle		1515-000-00	1515-000-00	1515-000-00	1
4	Fastener		*	*	*	2
5	Adapter		1499-000-01	1499-000-01	1499-000-01	1
6	Fastener		*	*	*	12
7	Casing seal		1478-000-00	1478-000-00	1478-000-00	1
8&9	† Shaft seal assembly	-Buna N	1640-161-90	1640-161-90	1640-161-90	1
		-Viton	1640-161-91	1640-161-91	1640-161-91	
10	Impeller shim set		1657-000-90	1657-000-90	1657-000-90	1
11	Impeller	-1 Phase	1512-000-03	1493-010-09	1496-002-02	1
		-3 Phase	1510-000-03	1491-000-01	1496-002-02	
12	Impeller fastener		1784-001-00	1784-001-00	1784-001-00	1
13	Casing		1484-000-01	1484-000-01	1484-000-01	1
14	Pipe plug		*	*	*	3
15	Flapper valve assembly	-Buna N	1683-000-90	1683-000-90	1683-000-90	1
		-Viton	1683-000-91	1683-000-91	1683-000-91	
16	Suction plate		1487-000-01	1487-000-01	1487-000-01	1
17	Fastener		*	*	*	2
18	Foot		1506-000-00	1506-000-00	1506-000-00	1
19	Washer		*	*	*	2

(*) Standard hardware item, available locally; (†) Seal head and seat available as set only.

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Electric Motor-Driven Pumps

Refer to Specifications Information and Repair Parts Manual for product specific information

Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

⚠ DANGER ***Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.***

⚠WARNING ***Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.***

⚠ CAUTION ***Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.***

NOTE: ***indicates important information that, if not followed, may cause damage to equipment.***

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts. (See pump exploded view and Repair Parts List.) **Do not attempt to assemble or operate pump if any parts are missing or damaged. Determine that all parts are properly installed.**

General Safety Information

1. Know the pump application, limitations, and potential hazards.

⚠WARNING ***Pump should only be used with liquids compatible with pump component materials.***

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres.

When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

2. Make certain that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing. If the power disconnect is out of sight, lock in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pressure within the system before servicing any component.
6. Drain liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use. Make certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (See Maintenance section).
10. Provide a means of pressure relief for pumps whose discharge line can be shut off or obstructed.
11. **Personal Safety:**
    a. Wear safety glasses at all times when working with pumps.
    b. Wear a face shield and proper apparel when pumping hazardous chemicals.
    c. Keep work area clean,

Electric Motor-Driven Pumps

General Safety Information (Cont.)

uncluttered, and properly lighted; replace all unused tools and equipment.

d. Keep visitors at a safe distance from the work area.

e. Make workshop childproof - with padlocks, master switches, and by removing starter keys.

12. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water.

13. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

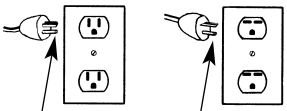
⚠WARNING ***Risk of electric shock!***

14. **THREE-PHASE MOTORS:** These units are for permanent installation using a power supply with a ground. To reduce the risk of electric shock, electric motor must be adequately grounded to a metal raceway system, or by using a separate grounding wire connected to bare metal on the motor frame, or to the grounding screw located inside motor terminal box, or by other suitable means. Refer to the most recent National Electrical Code (NEC) Article 250 (Grounding) for additional information. ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN.

    On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

⚠WARNING ***Risk of electric shock! Never connect the green (or green and yellow) wire to a live terminal!***

15. **SINGLE PHASE MOTORS:** These units can be wired for either portability, with flexible 3-wire cord, or permanent installation using a supply with a ground. To reduce the risk of electric shock, the motor must be securely and adequately grounded! This can be accomplished by either 1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding type receptacle (as shown in Figure A for 110-120 volt, or Figure B for 220-240 volt); 2) permanently wiring the unit with a grounded, metal raceway system; 3) Using a separate ground wire connected to the bare metal of the motor frame; 4) Other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.



Grounding blade Figure A

Grounding blade Figure B

Figure 1 - Grounding Methods

Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle installed in accordance with the National Electrical Code, local codes and ordinances. To ensure a proper ground, the grounding means must be tested by a quali-

Electric Motor-Driven Pumps

General Safety Information (Cont.)

fied electrician.

16. Use only 3-wire extension cords that have 3-prong grounding type plugs an d 3-pole receptacles that accept the equipment plug.
17. All wiring should be performed by a qualified electrician.
18. Protect electrical cord from sharp objects, hot surfaces, oil, and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
19. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
20. Use wire of adequate size to minimize voltage drop at the motor.
21. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.
22. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

⚠WARNING ***Do not handle a pump or pump motor with wet hands or when standing on a wet or damp surface, or in water.***

⚠WARNING ***All single phase pump motors are equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage, inadequate wiring, incorrect motor connections, or a defective motor or pump.***

Installation

⚠WARNING ***The pumps should not be used in flammable or explosive atmospheres. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids.***

For installations where property damage might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) should be used.

Failure to follow any warning can result in personal injury and/or property damage.

LOCATION

— **Open, Dripproof Motor -** Clean dry locations with access to an adequate supply of cooling air.

— **Totally Enclosed Motor -** Harsher environments where damp and dirty conditions may exist. Totally enclosed motors are not water proof.

— Use only UL listed **Hazardous Location** motors for service in **Hazardous Locations** as defined in Article 500 of the NEC.

— Temperature around the motor should not exceeed 104°F (40°C). Minimum temperature is -20°F (29°C).

— If the motor nameplate indicates "Air-Over, Cont. A.O.," etc., the motor must be mounted in the air stream of an air moving device.

1. Locate pump as close to the fluid source as possible, thus making the suction line short and direct as possible.

⚠ CAUTION ***The unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.***

2. Attach piping suction line to suction inlet and piping discharge line to discharge outlet. Avoid using looped section of pipe or fittings which might permit air to insure airtight pipe connections.

IMPORTANT: If plastic or fabric hose is used for the

Electric Motor-Driven Pumps

Installation (Cont.)

suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be one size larger than the discharge piping.

3. Support the piping independently of the pump to avoid universal or excessive stresses on the pump casing, which would cause impeller misalignment and possible pump failure.
4. Install both a union and a gate valve (not furnished) on the discharge side of the pump for service convenience.

⚠ CAUTION ***Do not use a globe or other restricting type of valve at the discharge. Globe valves seriously restrict the capacity of the pump; however, restricting the discharge of a centrifugal pump will not overload the drive motor.***

5. **SELF-PRIMING PUMPS:** It is recommended that a foot-valve be used on the suction line to assure quick priming and that a suitable suction strainer be attached to the suction line so that large pieces of foreign material are not drawn into the pump.
6. **WIRING:** For proper electrical connections, refer to the diagram located on the nameplate or inside the terminal of the motor. Make sure the connections are correct for the voltage being supplied to the motor. Connections should be made with flexible conduit to minimize vibration transmission.

   Whenever possible, the pump should be powered from a separate branch circuit of adequate capacity to keep voltage drop to a minimum during starting and running.

   Select the voltage to be used, either

   a. Single phase - 115V or 230V

   b. Three-phase - 230V or 460V

   Check motor wiring to verify which voltage the motor is currently wired for. If the wiring must be changed to conform to a specific voltage requirement, then the motor should be wired according to recommend-ations of wiring diagrams located on motor nameplate or wiring compartment cover. Make sure unit is properly grounded. A motor to be used with single-phase power cannot be used with three-phase power and vice versa. If unsure about the above information or the wiring diagrams, consult an electrician familiar with motor wiring.

⚠WARNING ***A wrong connection can burn out the pump motor, cause an electrical short, or produce an electrical shock. Failure to follow the above warning can result in property damage and/or personal injury. Always wire the motor with a three-wire system, ensuring that a ground wire runs to a good electrical ground such as a grounded water system or conduit. Also, ensure that a good electrical ground is provided at the supply end of the line. Connections should be made with flexible conduit to minimize vibration transmission.***

7. Do not operate pump dry. Mechanical seal damage will result.
8. Install any auxiliary components (e.g. pressure switch, time).

Operation

SELF-PRIMING PUMPS

It is necessary to prime the pump before initial start up. Prime the pump by filling the casing with liquid through the top fill plug, the discharge port, or by installing a pipe tee at the discharge of the pump. (When installing a tee, use the horizontal leg of the tee as the pump discharge and place a pipe plug in the vertical leg. This procedure will help facilitate priming later.)

NON-PRIMING PUMPS

1. The casing and suction piping must be filled with liquid before the unit can begin pumping. In order to completely fill casing

Electric Motor-Driven Pumps

Operation (Cont.)

with liquid, entrapped air in casing must be vented. This is accomplished by momentarily loosening or removing the top drain plug located on the casing.

⚠ CAUTION ***Do not run pump dry as permanent damage to the mechanical seal will result.***

2. Activate the unit.

IMPORTANT: Proper Rotation- Power supply should be applied momentarily to the pump at first and the direction of rotation checked. When viewing the front of the pump, the motor shaft (impeller) should be rotating counterclockwise. If it is not, disconnect power and re-check wiring to motor. (See "Installation" section.)

To change rotation on three-phase models, interchange any two incoming line (power) leads. Other models, consult driver information that came with driver.

NOTE: Never shut off discharge or restrict suction flow while the pump is operating. It may take up to 5 minutes for a **SELF-PRIMING** pump to prime if long horizontal/vertical lines are used. If pump has not picked up prime in 2 minutes, re-prime piping and casing after letting unit cool down for 5 minutes. Re-check all suction connections making sure pipe compound has sealed all connections. Initial priming may take 2 to 3 tries to prime successfully.

⚠ CAUTION ***The proper impeller (motor) rotation is CCW facing the front of the pump. Wrong rotation will give low performance, low head, and could damage unit and/or injure personnel.***

3. On initial start-up (after 15 minutes running time), check power consumption to be sure motor is not overloaded.
4. If motor is overloaded, install a valve on discharge to increase back pressure. Close the valve until pump motor is below full nameplate, or within Service Factor (SF) amps.

Maintenance

⚠WARNING ***Make certain that the unit is disconnected from the power source before attempting to service or remove any components!***

NOTE: Always flush pump thoroughly after use or if unit is not going to be used for any prolonged length of time to prevent crystallization and/or damage to seal and pump.

ROUTINE

1. Pump should be drained when subjected to freezing temperatures.
   A drain plug is provided on the pump casing.
2. Clean the suction line strainer at regular intervals.
3. Properly selected and installed electric motors are capable of operating for years with minimal maintenance. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings).
4. Periodically check to see if electrical connections are tight.
5. Pump should be checked daily, weekly, monthly, etc. for proper operation. If anything has changed since unit was new, unit should be removed and repaired or replaced. Only qualified electricians or service personnel should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.

Electric Motor-Driven Pumps

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Motor will not start or run	1. Improperly wired	1. Check wiring diagram on motor
	2. Blown fuse or open circuit breaker	2. Replace fuse or close circuit breaker after reason for overload has been determined and corrected
	3. Loose or broken wiring	3. Tighten connections, replace broken wiring
	4. Stone or foreign object lodged in impeller	4. Disassemble pump and remove foreign object
	5. Motor shorted out	5. Replace
	6. Thermal overload has opened circuit	6. Allow unit to cool. Restart after reason for overload has been determined
	7. Voltage too low at motor terminals due to line drop	7. Consult local power company. Increase wire size. Check for poor connections
Motor runs slowly; will not get up to speed	1. Motor wired improperly	1. Check and recheck wiring diagram on motor. Make internal wiring changes in wiring compartment
	2. Capacitor burned out (single-phase units only)	2. Replace capacitor
	3. Voltage too low at motor terminals	3. Increase wire size. Check for poor connections. Check for voltage unbalance (3-phase)
Motor overheats while running under load	1. Dirt blocking ventilation openings	1. Clean motor
	2. Unbalanced supply voltage	2. Check for faulty connections. Voltage on all three lines should be balanced within 1%. Excessive single phase loads
	3. Faulty connection	3. Clean, tighten, or replace
	4. High or low voltage	4. Check voltage at motor, should not be more than 10% above or below rated
Pump will not prime	1. No priming water in casing	1. Fill pump casing
	2. Mechanical seal is leaking	2. Replace (See Maintenance)
	3. Leak in suction line	3. Use thread sealant on piping, tighten, repair or replace
	4. Discharge line is closed and priming air has nowhere to go	4. Open
	5. Suction line (or valve) is closed	5. Open

Electric Motor-Driven Pumps

Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump will not prime (cont.)	6. Pipe union was used on suction side instead of discharge	6. Remove union from suction side. Replace with single section of pipe
	7. Pump is worn	7. Replace worn parts
Little or no discharge	1. Casing not filled with water	1. Fill pump casing with liquid
	2. Total head too high	2. Shorten suction lift and/or discharge head
	3. Suction head too high	3. Lower suction head, install foot valve and prime
	4. Impeller plugged	4. Disassemble pump and clean impeller
	5. Rotation incorrect	5. Correct (See wiring diagram on motor)
	6. Hole or air leak in suction line	6. Repair or replace suction line
	7. Foot valve was too small	7. Match foot valve to piping or install one size larger foot valve
	8. Impeller damaged	8. Replace
	9. Foot valve or suction line not submerged deep enough in water	9. Submerge lower in water
	10. Suction piping too small	10. Increase to pump inlet size or one size larger
	11. Discharge piping too small	11. Match to discharge outlet size on pump
	12. Motor wired incorrectly	12. Check wiring diagram
	13. Casing gasket leaking	13. Replace
	14. Suction or discharge line valve closed	14. Open
	15. Single-phase, new installation. Motor wired for 230V, etc. but supply is 115V, etc.	15. Check voltage of incoming power supply. Rewire as necessary
	16. Mechanical seal is leaking	16. Replace (See Maintenance)
Loss of suction	1. Air leak in suction line	1. Use thread sealant on piping, tighten, repair or replace
	2. Suction lift too high	2. Lower suction lift, install foot valve and prime
	3. Clogged foot valve or strainer	3. Clean

Electric Motor-Driven Pumps

Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump vibrates and/or makes excessive noise	1. Mounting plate or foundation not rigid enough	1. Reinforce
	2. Foreign material in pump	2. Disassemble pump and clean
	3. Impeller damaged	3. Replace
	4. Worn motor bearings	4. Replace
	5. Suction lift too high	5. Decrease suction lift
	6. Cavitation present	6. Check suction line for proper size and be sure valve is open. Remove excessive loops in suction line. Install gate valve on discharge side of pump and reduce flow as necessary to match suction conditions available
Pump leaks at shaft	1. Damaged or worn mechanical seal	1. Replace (See Maintenance)
	2. Corrosion due to character of liquid pumped	2. Discontinue pumping liquid and consult factory
	3. Abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them	3. Pump not designed for abrasives. Discontinue use
	4. Liquid not compatible with seal	4. Consult factory. Operational seal may be available
	5. Temperature too high	5. Lower liquid temperature below temperature rating of pump, See Specifications
Pinholes in casting, drips around seal area	Cavitation caused by insufficient inlet pressure or suction head (NPSH)	Increase inlet pressure by adding a higher liquid level of fluid to source, increasing inlet pressure, or remove piping restrictions (valves, loops, etc.) in suction line

AMT
A Subsidiary of The Gorman-Rupp Company

Sump Pump
2876-95
™

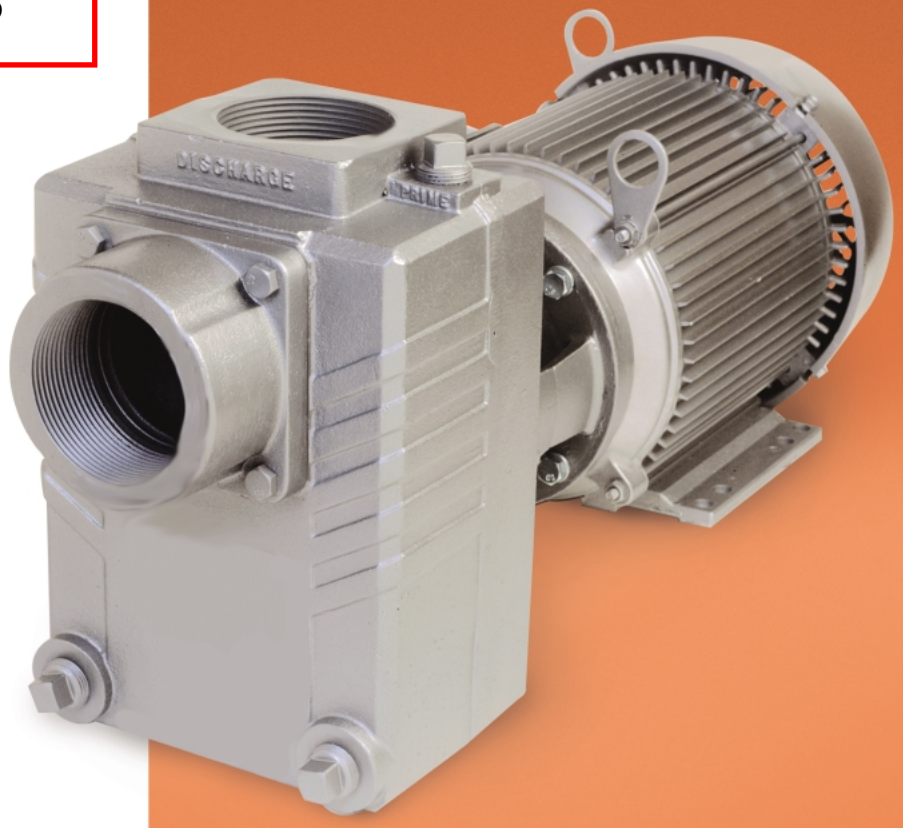
3" Self-Priming Centrifugal Pumps

- ***Cast Iron** Construction with Bronze Impeller*
- ***Buna-N** Mechanical Seal, Flapper/Check Valve and O-Ring*
- ***Optional Viton® Mechanical Seal, Flapper/Check Valve and O-Ring Available***
- ***Optional Silicon Carbide Seal Available***
- ***3" NPT Suction and Discharge Ports***
- ***Solids Handling up to 3/8" Diameter***
- ***Optional Mounting Base Available***
- ***Maximum Working Pressure 125 PSI***
- ***Maximum Temperature 180° F***
- ***Maximum Flow 375 GPM***
- ***Maximum Head 110 ft.***
- ***Self-priming to 20 ft.***
- ***Self-cleaning, Semi-open Impeller***
- ***3 to 7-1/2 HP Three Phase TEFC Motors, 3 & 5 HP Single Phase TEFC Motors***

AMT Self-Priming Cast Iron Centrifugal pumps are designed for a broad range of high capacity applications, including dewatering, liquid transfer, circulation, drainage and irrigation. Dual volute design reduces radial load on motor. The centerline discharge feature is specifically designed to prevent vapor binding and makes for convenient piping connections. All models are fitted with self-cleaning, semi-open bronze impellers which can handle 3/8" diameter semi-solids. Built-in check valves for fast priming are standard on all units. Self-priming to 20 Ft. Fill and drain plugs for easy installation and servicing.

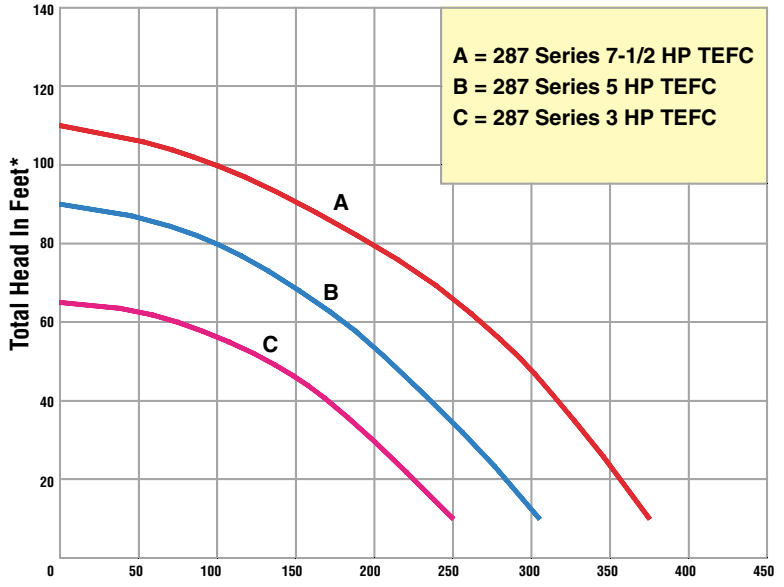
AMT Self-Priming Cast Iron Centrifugal pumps are reliable, cost effective and low maintenance. Many are readily available **"Off-the-Shelf"** for fast 24 hour shipment. For use with non-flammable liquids compatible with pump component materials.

Viton® is a registered trademark of E.I. DuPont



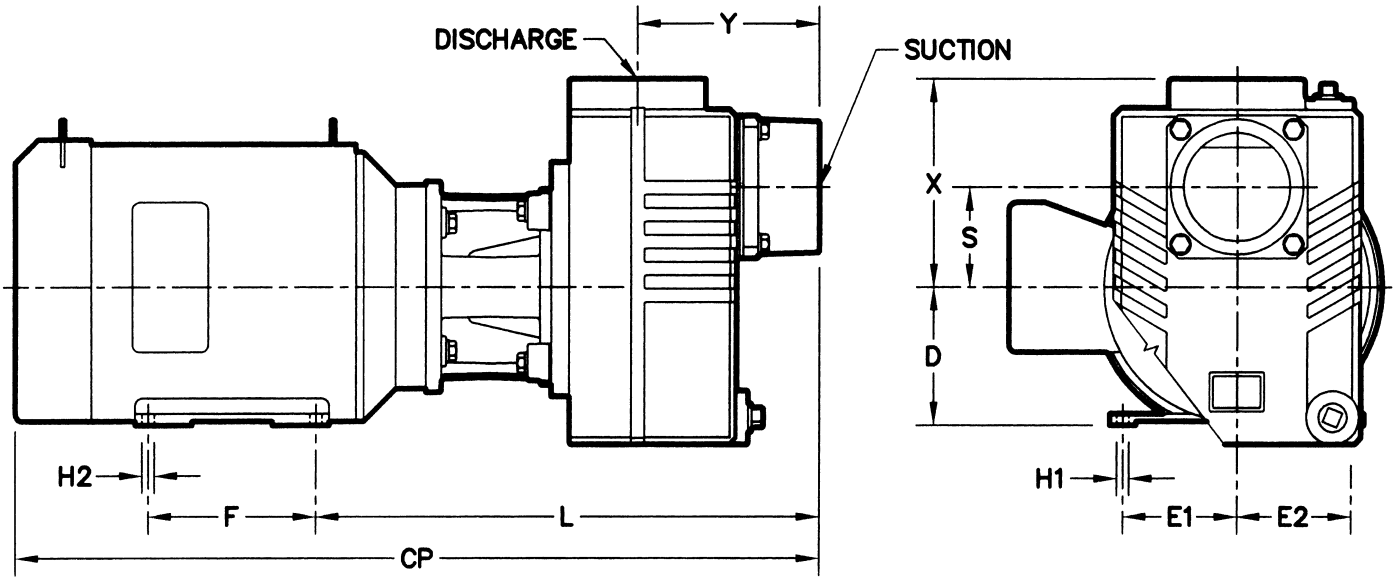
3" Self-Priming Pump

Performance of Self-Priming Centrifugal Pumps



*Convert to PSI, divide by 2.31 Liquid-Water specific gravity 1.0

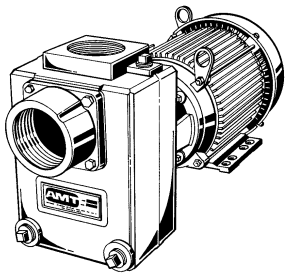
3" Self-Priming Cast Iron Centrifugal Pumps

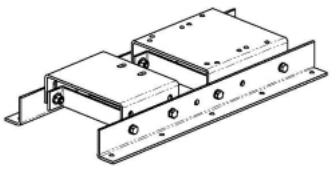


Pump Dimensional & Specification Data

Model	CURVE	SUC.*	DIS.*	CP**	D	E1	E2	F	H1	H2	L	S	X	Y	Motor	Frame
2877-95	C	3"	3"	26.04	4.50	3.75	3.75	5.50	0.41	0.41	16.56	3.25	6.75	5.97	3HP, 1PH	184JM
2874-95	C	3"	3"	26.04	4.50	3.75	3.75	4.50	0.41	0.41	16.56	3.25	6.75	5.97	3HP, 3PH	182JM
2878-95	B	3"	3"	28.97	4.50	3.75	3.75	5.50	0.41	0.41	16.56	3.25	6.75	5.97	5HP, 1PH	184JM
2875-95	B	3"	3"	25.04	4.50	3.75	3.75	5.50	0.41	0.41	16.56	3.25	6.75	5.97	5HP, 3PH	184JM
2876-95	A	3"	3"	28.04	4.50	3.75	3.75	5.50	0.41	0.41	16.56	3.25	6.75	5.97	7.50HP, 3PH	184JM

(*) Standard NPT (female) pipe thread.
(**) This dimension may vary due to motor manufacturer's specifications.
(+) 3-Phase models can also operate on 50 Hz (This will change Full Load Amps and Service Factor, RPM and Priming Capabilities).
NOTE: Dimensions have a tolerance of ± 1/8".
NOTE: Electric supply for **ALL** motors must be within ±10% of nameplate voltage rating (e.g. 230V ±10%= 207 to 253).





Optional Mounting Base
Model # A200-90

Standard Features

- Cast Iron construction with Bronze Impeller
- Buna-N Mechanical Seal and O-Ring
- Optional Viton® Mechanical Seal and Flapper Valve Available
- Optional Silicon Carbide Seal Available
- 3" NPT Suction and Discharge Ports
- Stainless Steel Shaft Sleeve
- Dual Volute Design Reduces Radial Load on Motor
- Fill and Drain Plug for Easy Servicing
- Maximum Working Pressure 125 PSI
- Maximum Temperature 180° F
- Maximum Flow 375 GPM
- Maximum Head 110 ft.
- Self-cleaning, Semi-open Impellers
- 3 to 7-1/2 HP Three Phase, 184JM, Totally Enclosed Fan Cooled (TEFC) Motors
- 3 & 5 HP Single Phase, 184JM, Totally Enclosed Fan Cooled (TEFC) Motors
- **"Off-the-Shelf"** Availability on Many Models
- Optional Mounting Base Available on All Above Models (Reference pgs. 41-42)

OFF THE SHELF PUMPS

Viton® is a registered trademark of E.I. DuPont

See price book page 21

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

3 Inch Self-Priming Centrifugal Pumps

Refer to form 1808-634-00 for General Operating and Safety Instructions.

Description

These centrifugal pumps are self-priming (to 20 ft. lift) units designed for high volume liquid transfer – irrigation, de-watering, lawn sprinkling, etc. They can also accommodate semi-solids (up to 1/2" dia.), sediment laden liquids, and liquids with entrained air or gases. Casing working pressure to 100 psi (689 kPa).

The units are equipped with a cast iron pump casing designed with a full dual volute, clog resistant semi-open bronze impeller, and a cast iron adapter. Units are equipped with flapper valves to assure a positive prime. A mechanical seal isolates the motor from the liquid in the pump casing. The units are coupled to 3600 RPM, totally enclosed fan cooled motors. All units are manual models, no controls are supplied.
For use with nonflammable, non-abrasive liquids compatible with pump component materials.

Maintenance

⚠WARNING Make certain that unit is disconnected from power source before attempting to service or remove any component.

NOTE: Pump casing should be removed and inspected periodically to insure that any foreign material or rust is not clogging internal pump parts. This unit is equipped with a dual volute pump casing. One of the volutes runs 180˚, all the way from side opposite discharge into discharge through a completely enclosed passageway. If foreign material clogs this area, it can be dislodged by using a wire or long spring.

REMOVAL OF OLD SEAL

Refer to Figure 1

IMPORTANT: Always replace both seal seat (Ref. No. 10) and seal head (Ref. No. 11) to insure proper mating of components! Also, impeller seal washer (Ref. No. 14) should be replaced anytime impeller lock bolt (Ref. No. 15) has been removed.

1. Remove four bolts (Ref. No. 4) that connect adapter (Ref. No. 7) to casing (Ref. No. 16).
2. Remove casing and casing seal (Ref. No. 8).

⚠CAUTION Care should be taken not to "pinch" or "shave" the o-ring gasket (Ref. No. 8) between adapter and casing.

3. Using an Allen wrench, remove impeller lock bolt, impeller seal washer, and impeller (Ref. No. 13).
   IMPORTANT: Care should be taken to insure that same number of shim washers (Ref. No. 12) are replaced behind impeller as were removed. These shim washers are located directly behind impeller. These washers as well as impeller key (Ref. No. 2) become loose as impeller is removed.
4. Seal head and shaft sleeve can now be pulled from shaft.
5. Pry seal seat from adapter.
6. Push seal head from shaft sleeve.

INSTALLATION OF NEW SEAL

⚠CAUTION The precision lapped faces on mechanical seal are easily damaged. Handle your replacement seal carefully.

1. Thoroughly clean all surfaces of seal seat cavity.
2. Using a clean cloth, wipe shaft and shaft sleeve and make certain that they are perfectly clean.
3. Wet the rubber portion of new seal seat with a light coating of soapy water. While wearing clean gloves or using a clean light rag, press seal seat squarely into adapter recess. Avoid scratching polished surface. If seal will not position properly, place a cardboard washer over polished surface and use a piece of pipe to press in, firmly but gently.

Specifications

Suction inlet	3" NPT
Discharge outlet	3" NPT
Motor (TEFC)	3 HP(Model 2874 & 2877)
	5 HP (Model 2875 & 2878)
	7.5 HP (Model 2876)
Power Supply:	
Model 2874, 2875, 2876:	230/460 VAC, 60 Hz, 3 Phase
Models 2877 and 2878:	230 VAC, 60 Hz, 1 Phase
RPM	3600
Pump construction	Cast Iron
Impeller material	Bronze
STD Mechanical Seal	Carbon/ceramic
Buna-N, S.S. springs and parts	
Liquid temp	40˚ to 180˚ F (4˚ to 82˚ C)

NOTE: Data is subject to change without notice.

4. Dispose of cardboard washer. Check again to see that polished surface is free of dirt and all other foreign particles and that it has not been scratched or damaged.
5. Wet the inside of rubber portion of new seal head with a light coating of soapy water. Slide head onto shaft sleeve. Slide shaft sleeve with seal head onto motor shaft. Seal head and seal seat will meet. Reinstall any shims which have been removed. (See SHIM ADJUSTMENT section.)
6. Replace impeller key and impeller. Replace impeller seal washer before screwing impeller lock bolt in place.
7. Reassemble pump.
8. A short "run-in" period may be necessary to provide completely leak free seal operation.

SHIM ADJUSTMENT

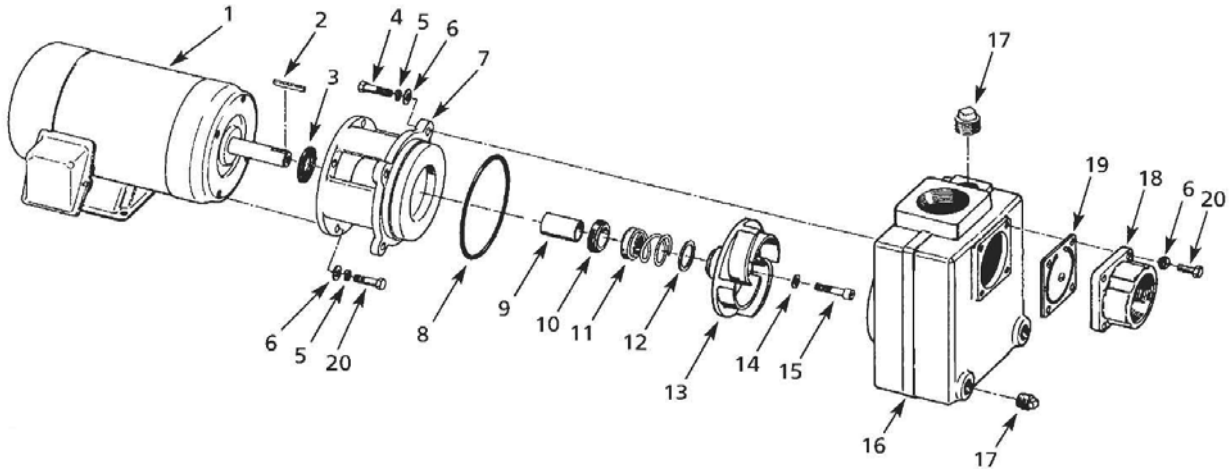
When installing a replacement impeller (Ref. No. 13) or motor (Ref. No. 1), it may be necessary to adjust the number of shims (Ref. No. 12) to insure proper running clearance between impeller and casing (Ref. No. 16). Proceed as follows:

NOTE: A proper running clearance is less than 0.010".

1. For impeller replacement, add one (1) shim in addition to those removed originally.
2. For motor replacement, add two (2) shims in addition to shims removed during disassembly.

3. Reassemble pump as described in steps 6 and 7. (See INSTALLATION OF NEW SEAL section.)
IMPORTANT; Insure that casing is snugly in place and check shaft to make sure it is turning freely (use screwdriver slot in the motor to turn shaft). If it turns freely, check to insure that adapter (Ref. No. 7) and casing are fitted "metal to metal" where they meet on outside. If they are not "metal to metal", tighten fasteners (Ref. No. 4) and recheck shaft for free turning. Tighten carefully, turning shaft while tightening so that motor bearings are not damaged in the event that too many shims were installed. If shaft seizes before fasteners are completely tight, disassembly pump and remove one (1) shim and repeat reassembly.

For Repair Parts, contact dealer where pump was purchased.



Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

Figure 1 – Repair Parts Illustration

Repair Parts List

Reference Number	Description	Part Number	Quantity
1	Motor: Model 2874-95 – 3 HP	1626-043-00	1
	Model 2875-95 – 5 HP	1626-044-00	1
	Model 2876-95 – 7.5 HP	1626-045-00	1
	Model 2877-95 – 3 HP	1626-082-00	1
	Model 2878-95 – 5 HP	1626-078-00	1
2	Impeller Key	1471-030-00	1
3	Slinger Washer	1470-093-00	1
4	3/8"-16 UNC x 1-1/4" Grade 5 Hex Hd Cap Screw	*	4
5	3/8" Split Lock Washer	*	8
6	3/8" Flat Washer	*	12
7	Adapter	1470-001-02	1
8	O-Ring Buna N	1470-010-00	1
9	Shaft Sleeve S.S.	1472-000-00	1
10 & 11	†Seal Assembly Buna (standard)	1640-163-90	1
10 & 11	†Seal Assembly Viton (optional)	1640-163-91	1
12	Impeller Shim Set (one each 0.010", 0.020", 0.030")	1664-000-90	1
13	Impeller: Model 2874-95 & 2877-95, 3 HP	1550-004-01	1
	Model 2875-95 & 2878-95, 5 HP	1550-002-01	1
	Model 2876-95, 7.5 HP	1550-003-01	1
14	Impeller Seal Washer	1471-020-00	1
15	3/8"-16 UNC x 1-1/4" Socket Hd Cap Screw S.S.	1757-010-00	1
16	Casing	1543-003-01	1
17	3/4" NPT Pipe Plug	*	3
18	Suction Plate	1589-000-01	1
19	Flapper Valve Assembly - Buna N	1694-000-90	1
20	3/8"-16 UNC x 1-1/4" Hex Hd Cap Screw	*	8

(*) Standard hardware available locally.
(†) Ref. No. 10 is seal seat. Ref No. 11 is seal head

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Electric Motor-Driven Pumps

Refer to Specifications Information and Repair Parts Manual for product specific information

Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

⚠ DANGER ***Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.***

⚠WARNING ***Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.***

⚠ CAUTION ***Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.***

NOTE: ***indicates important information that, if not followed, may cause damage to equipment.***

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts. (See pump exploded view and Repair Parts List.) **Do not attempt to assemble or operate pump if any parts are missing or damaged. Determine that all parts are properly installed.**

General Safety Information

1. Know the pump application, limitations, and potential hazards.

⚠WARNING ***Pump should only be used with liquids compatible with pump component materials.***

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres.

When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

2. Make certain that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing. If the power disconnect is out of sight, lock in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pressure within the system before servicing any component.
6. Drain liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use. Make certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (See Maintenance section).
10. Provide a means of pressure relief for pumps whose discharge line can be shut off or obstructed.
11. **Personal Safety:**
    a. Wear safety glasses at all times when working with pumps.
    b. Wear a face shield and proper apparel when pumping hazardous chemicals.
    c. Keep work area clean,

Electric Motor-Driven Pumps

General Safety Information (Cont.)

uncluttered, and properly lighted; replace all unused tools and equipment.

d. Keep visitors at a safe distance from the work area.

e. Make workshop childproof - with padlocks, master switches, and by removing starter keys.

12. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water.

13. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

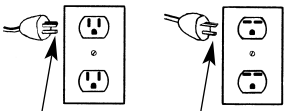
⚠WARNING ***Risk of electric shock!***

14. **THREE-PHASE MOTORS:** These units are for permanent installation using a power supply with a ground. To reduce the risk of electric shock, electric motor must be adequately grounded to a metal raceway system, or by using a separate grounding wire connected to bare metal on the motor frame, or to the grounding screw located inside motor terminal box, or by other suitable means. Refer to the most recent National Electrical Code (NEC) Article 250 (Grounding) for additional information. ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN.

    On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

⚠WARNING ***Risk of electric shock! Never connect the green (or green and yellow) wire to a live terminal!***

15. **SINGLE PHASE MOTORS:** These units can be wired for either portability, with flexible 3-wire cord, or permanent installation using a supply with a ground. To reduce the risk of electric shock, the motor must be securely and adequately grounded! This can be accomplished by either 1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding type receptacle (as shown in Figure A for 110-120 volt, or Figure B for 220-240 volt); 2) permanently wiring the unit with a grounded, metal raceway system; 3) Using a separate ground wire connected to the bare metal of the motor frame; 4) Other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.



Grounding blade Figure A

Grounding blade Figure B

Figure 1 - Grounding Methods

Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle installed in accordance with the National Electrical Code, local codes and ordinances. To ensure a proper ground, the grounding means must be tested by a quali-

Electric Motor-Driven Pumps

General Safety Information (Cont.)

fied electrician.

16. Use only 3-wire extension cords that have 3-prong grounding type plugs an d 3-pole receptacles that accept the equipment plug.
17. All wiring should be performed by a qualified electrician.
18. Protect electrical cord from sharp objects, hot surfaces, oil, and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
19. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
20. Use wire of adequate size to minimize voltage drop at the motor.
21. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.
22. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

⚠WARNING ***Do not handle a pump or pump motor with wet hands or when standing on a wet or damp surface, or in water.***

⚠WARNING ***All single phase pump motors are equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage, inadequate wiring, incorrect motor connections, or a defective motor or pump.***

Installation

⚠WARNING ***The pumps should not be used in flammable or explosive atmospheres. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids.***

For installations where property damage might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) should be used.

Failure to follow any warning can result in personal injury and/or property damage.

LOCATION

— **Open, Dripproof Motor -** Clean dry locations with access to an adequate supply of cooling air.

— **Totally Enclosed Motor -** Harsher environments where damp and dirty conditions may exist. Totally enclosed motors are not water proof.

— Use only UL listed **Hazardous Location** motors for service in **Hazardous Locations** as defined in Article 500 of the NEC.

— Temperature around the motor should not exceeed 104°F (40°C). Minimum temperature is -20°F (29°C).

— If the motor nameplate indicates "Air-Over, Cont. A.O.," etc., the motor must be mounted in the air stream of an air moving device.

1. Locate pump as close to the fluid source as possible, thus making the suction line short and direct as possible.

⚠ CAUTION ***The unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.***

2. Attach piping suction line to suction inlet and piping discharge line to discharge outlet. Avoid using looped section of pipe or fittings which might permit air to insure airtight pipe connections.

IMPORTANT: If plastic or fabric hose is used for the

Electric Motor-Driven Pumps

Installation (Cont.)

suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be one size larger than the discharge piping.

3. Support the piping independently of the pump to avoid universal or excessive stresses on the pump casing, which would cause impeller misalignment and possible pump failure.
4. Install both a union and a gate valve (not furnished) on the discharge side of the pump for service convenience.

⚠ CAUTION ***Do not use a globe or other restricting type of valve at the discharge. Globe valves seriously restrict the capacity of the pump; however, restricting the discharge of a centrifugal pump will not overload the drive motor.***

5. **SELF-PRIMING PUMPS:** It is recommended that a foot-valve be used on the suction line to assure quick priming and that a suitable suction strainer be attached to the suction line so that large pieces of foreign material are not drawn into the pump.
6. **WIRING:** For proper electrical connections, refer to the diagram located on the nameplate or inside the terminal of the motor. Make sure the connections are correct for the voltage being supplied to the motor. Connections should be made with flexible conduit to minimize vibration transmission.

   Whenever possible, the pump should be powered from a separate branch circuit of adequate capacity to keep voltage drop to a minimum during starting and running.

   Select the voltage to be used, either

   a. Single phase - 115V or 230V

   b. Three-phase - 230V or 460V

   Check motor wiring to verify which voltage the motor is currently wired for. If the wiring must be changed to conform to a specific voltage requirement, then the motor should be wired according to recommend-ations of wiring diagrams located on motor nameplate or wiring compartment cover. Make sure unit is properly grounded. A motor to be used with single-phase power cannot be used with three-phase power and vice versa. If unsure about the above information or the wiring diagrams, consult an electrician familiar with motor wiring.

⚠WARNING ***A wrong connection can burn out the pump motor, cause an electrical short, or produce an electrical shock. Failure to follow the above warning can result in property damage and/or personal injury. Always wire the motor with a three-wire system, ensuring that a ground wire runs to a good electrical ground such as a grounded water system or conduit. Also, ensure that a good electrical ground is provided at the supply end of the line. Connections should be made with flexible conduit to minimize vibration transmission.***

7. Do not operate pump dry. Mechanical seal damage will result.
8. Install any auxiliary components (e.g. pressure switch, time).

Operation

SELF-PRIMING PUMPS

It is necessary to prime the pump before initial start up. Prime the pump by filling the casing with liquid through the top fill plug, the discharge port, or by installing a pipe tee at the discharge of the pump. (When installing a tee, use the horizontal leg of the tee as the pump discharge and place a pipe plug in the vertical leg. This procedure will help facilitate priming later.)

NON-PRIMING PUMPS

1. The casing and suction piping must be filled with liquid before the unit can begin pumping. In order to completely fill casing

Electric Motor-Driven Pumps

Operation (Cont.)

with liquid, entrapped air in casing must be vented. This is accomplished by momentarily loosening or removing the top drain plug located on the casing.

⚠ CAUTION ***Do not run pump dry as permanent damage to the mechanical seal will result.***

2. Activate the unit.

IMPORTANT: Proper Rotation- Power supply should be applied momentarily to the pump at first and the direction of rotation checked. When viewing the front of the pump, the motor shaft (impeller) should be rotating counterclockwise. If it is not, disconnect power and re-check wiring to motor. (See "Installation" section.)

To change rotation on three-phase models, interchange any two incoming line (power) leads. Other models, consult driver information that came with driver.

NOTE: Never shut off discharge or restrict suction flow while the pump is operating. It may take up to 5 minutes for a **SELF-PRIMING** pump to prime if long horizontal/vertical lines are used. If pump has not picked up prime in 2 minutes, re-prime piping and casing after letting unit cool down for 5 minutes. Re-check all suction connections making sure pipe compound has sealed all connections. Initial priming may take 2 to 3 tries to prime successfully.

⚠ CAUTION ***The proper impeller (motor) rotation is CCW facing the front of the pump. Wrong rotation will give low performance, low head, and could damage unit and/or injure personnel.***

3. On initial start-up (after 15 minutes running time), check power consumption to be sure motor is not overloaded.
4. If motor is overloaded, install a valve on discharge to increase back pressure. Close the valve until pump motor is below full nameplate, or within Service Factor (SF) amps.

Maintenance

⚠WARNING ***Make certain that the unit is disconnected from the power source before attempting to service or remove any components!***

NOTE: Always flush pump thoroughly after use or if unit is not going to be used for any prolonged length of time to prevent crystallization and/or damage to seal and pump.

ROUTINE

1. Pump should be drained when subjected to freezing temperatures.
   A drain plug is provided on the pump casing.
2. Clean the suction line strainer at regular intervals.
3. Properly selected and installed electric motors are capable of operating for years with minimal maintenance. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings).
4. Periodically check to see if electrical connections are tight.
5. Pump should be checked daily, weekly, monthly, etc. for proper operation. If anything has changed since unit was new, unit should be removed and repaired or replaced. Only qualified electricians or service personnel should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.

Electric Motor-Driven Pumps

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Motor will not start or run	1. Improperly wired	1. Check wiring diagram on motor
	2. Blown fuse or open circuit breaker	2. Replace fuse or close circuit breaker after reason for overload has been determined and corrected
	3. Loose or broken wiring	3. Tighten connections, replace broken wiring
	4. Stone or foreign object lodged in impeller	4. Disassemble pump and remove foreign object
	5. Motor shorted out	5. Replace
	6. Thermal overload has opened circuit	6. Allow unit to cool. Restart after reason for overload has been determined
	7. Voltage too low at motor terminals due to line drop	7. Consult local power company. Increase wire size. Check for poor connections
Motor runs slowly; will not get up to speed	1. Motor wired improperly	1. Check and recheck wiring diagram on motor. Make internal wiring changes in wiring compartment
	2. Capacitor burned out (single-phase units only)	2. Replace capacitor
	3. Voltage too low at motor terminals	3. Increase wire size. Check for poor connections. Check for voltage unbalance (3-phase)
Motor overheats while running under load	1. Dirt blocking ventilation openings	1. Clean motor
	2. Unbalanced supply voltage	2. Check for faulty connections. Voltage on all three lines should be balanced within 1%. Excessive single phase loads
	3. Faulty connection	3. Clean, tighten, or replace
	4. High or low voltage	4. Check voltage at motor, should not be more than 10% above or below rated
Pump will not prime	1. No priming water in casing	1. Fill pump casing
	2. Mechanical seal is leaking	2. Replace (See Maintenance)
	3. Leak in suction line	3. Use thread sealant on piping, tighten, repair or replace
	4. Discharge line is closed and priming air has nowhere to go	4. Open
	5. Suction line (or valve) is closed	5. Open

Electric Motor-Driven Pumps

Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump will not prime (cont.)	6. Pipe union was used on suction side instead of discharge	6. Remove union from suction side. Replace with single section of pipe
	7. Pump is worn	7. Replace worn parts
Little or no discharge	1. Casing not filled with water	1. Fill pump casing with liquid
	2. Total head too high	2. Shorten suction lift and/or discharge head
	3. Suction head too high	3. Lower suction head, install foot valve and prime
	4. Impeller plugged	4. Disassemble pump and clean impeller
	5. Rotation incorrect	5. Correct (See wiring diagram on motor)
	6. Hole or air leak in suction line	6. Repair or replace suction line
	7. Foot valve was too small	7. Match foot valve to piping or install one size larger foot valve
	8. Impeller damaged	8. Replace
	9. Foot valve or suction line not submerged deep enough in water	9. Submerge lower in water
	10. Suction piping too small	10. Increase to pump inlet size or one size larger
	11. Discharge piping too small	11. Match to discharge outlet size on pump
	12. Motor wired incorrectly	12. Check wiring diagram
	13. Casing gasket leaking	13. Replace
	14. Suction or discharge line valve closed	14. Open
	15. Single-phase, new installation. Motor wired for 230V, etc. but supply is 115V, etc.	15. Check voltage of incoming power supply. Rewire as necessary
	16. Mechanical seal is leaking	16. Replace (See Maintenance)
Loss of suction	1. Air leak in suction line	1. Use thread sealant on piping, tighten, repair or replace
	2. Suction lift too high	2. Lower suction lift, install foot valve and prime
	3. Clogged foot valve or strainer	3. Clean

Electric Motor-Driven Pumps

Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump vibrates and/or makes excessive noise	1. Mounting plate or foundation not rigid enough	1. Reinforce
	2. Foreign material in pump	2. Disassemble pump and clean
	3. Impeller damaged	3. Replace
	4. Worn motor bearings	4. Replace
	5. Suction lift too high	5. Decrease suction lift
	6. Cavitation present	6. Check suction line for proper size and be sure valve is open. Remove excessive loops in suction line. Install gate valve on discharge side of pump and reduce flow as necessary to match suction conditions available
Pump leaks at shaft	1. Damaged or worn mechanical seal	1. Replace (See Maintenance)
	2. Corrosion due to character of liquid pumped	2. Discontinue pumping liquid and consult factory
	3. Abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them	3. Pump not designed for abrasives. Discontinue use
	4. Liquid not compatible with seal	4. Consult factory. Operational seal may be available
	5. Temperature too high	5. Lower liquid temperature below temperature rating of pump, See Specifications
Pinholes in casting, drips around seal area	Cavitation caused by insufficient inlet pressure or suction head (NPSH)	Increase inlet pressure by adding a higher liquid level of fluid to source, increasing inlet pressure, or remove piping restrictions (valves, loops, etc.) in suction line

Altivar® 31

Adjustable Speed Drive Controllers
Variadores de velocidad ajustable
Variateurs de vitesse

Start-Up Guide
Guía de puesta en marcha
Guide de mise en service

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Conservar para uso futuro.
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Altivar® 31 Adjustable Speed Drive Controllers
Start-Up Guide

ESPAÑOL

Variadores de velocidad ajustable Altivar® 31
Guía de puesta en marcha

FRANÇAIS

Variateurs de vitesse Altivar® 31
Guide de mise en service

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BEFORE YOU BEGIN

Read and follow these instructions before beginning any procedure with this drive controller.

⚠ DANGER

HAZARDOUS VOLTAGE

- Read and understand this start-up guide before installing or operating the Altivar 31 drive controller. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- For more information on Altivar 31 drive controllers, see the *Altivar 31 Installation Manual*, VVDED303041US, and the *Altivar 31 Programming Manual*, VVDED303042US. Both manuals are provided on the CD-ROM shipped with the drive controller. They are also available from www.us.SquareD.com or from your Schneider Electric representative.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA and PC or across the DC capacitors.
- Install and close all covers before applying power or starting and stopping the drive controller.
- Before servicing the drive controller:
  - — Disconnect all power.
  - — Place a “DO NOT TURN ON” label on the drive controller disconnect.
  - — Lock the disconnect in the open position.
- Disconnect all power including external control power that may be present before servicing the drive controller. WAIT 3 MINUTES for the DC bus capacitors to discharge. Then follow the DC bus voltage measurement procedure on page 19 to verify that the DC voltage is less than 45 Vdc. The drive controller LEDs are not accurate indicators of the absence of DC bus voltage.

Electric shock will result in death or serious injury.

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> **⚠ CAUTION**
>
> **DAMAGED EQUIPMENT**
>
> Do not operate or install any drive controller that appears damaged.
>
> **Failure to follow this instruction can result in injury or equipment damage.**

About this Document

This Start-Up Guide describes the minimum steps necessary for bringing an Altivar 31 (ATV31) drive controller into service. The CD-ROM supplied with the drive controller contains the following additional documentation:

- *Altivar 31 Installation Manual*, VVDED303041US
- *Altivar 31 Programming Manual*, VVDED303042US

The operations, parameters, and faults described in this guide assume factory configuration in the CtL-, FUn-, FLt-, and CON- menus. The drive controller may behave differently if modifications are made to the factory settings in these menus.

Consult the *ATV31 Programming Manual* for the CtL-, FUn-, FLt-, and CON- menus and for complete programming information. Consult the *ATV31 Installation Manual* for complete installation instructions.

NOTE: Throughout this guide, a dash appears after menu codes to differentiate them from parameter codes. For example, SEt- is a menu, but ACC is a parameter.

PRELIMINARY RECOMMENDATIONS

Precautions

Before powering up and configuring the drive controller, read and observe the following precautions.

CAUTION

INCOMPATIBLE LINE VOLTAGE

Before powering up and configuring the drive controller, ensure that the line voltage is compatible with the supply voltage range of the drive controller. The drive controller may become damaged if the line voltage is not compatible.

Failure to follow this instruction can result in equipment damage.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Before powering up and configuring the drive controller, ensure that the logic inputs are switched off (State 0) to prevent unintended starting.
- An input assigned to the run command may cause the motor to start immediately on exiting the configuration menus.

Failure to follow these instructions will result in death or serious injury.

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Adjustment and Extension of Functions

⚠DANGER

UNINTENDED EQUIPMENT OPERATION

- Ensure that changes to the current operating settings do not present any danger.
- It is recommended that changes to the current operating settings be made with the drive controller stopped.

Failure to follow these instructions will result in death or serious injury.

The following menus are covered in this start-up guide:

- SEt- Settings Menu (page 31)
- drC- Drive Control Menu (page 35)
- I-O- I/O Menu (page 39)
- SUP- Display Menu (page 41)

If necessary, use the display to modify the drive configuration and extend the functions. It is always possible to **return to the factory settings** by setting the FCS parameter to “InI” in the drC- menu. See page 38.

Power Up After a Manual Fault Reset or Stop Command

With the factory configuration, when the drive controller is powered up after a manual fault reset or a stop command, the forward and reverse commands must be reset for the drive controller to start. If they have not been reset, the drive controller will display “nSt” and will not start.

Test on a Low Power Motor or Without a Motor

With the factory configuration, motor phase loss detection is active. To check the drive controller in a test or maintenance environment without having to switch to a motor with the same rating as the drive controller, disable motor phase loss detection and configure the voltage/frequency ratio (UFt) to L, constant torque (see page 36). Refer to the *ATV31 Programming Manual* for more information.

Operation on an Impedance Grounded System

When using the drive controller on a system with an isolated or impedance grounded neutral, use a permanent insulation monitor compatible with non-linear loads.

ATV31•••M2 and N4 drive controllers feature built-in radio frequency interference (RFI) filters which have capacitors to ground. These filters can be disconnected from ground when using the drive controller on an impedance grounded system to increase the operating life of their capacitors. Refer to the *ATV31 Installation Manual* for more information.

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START-UP

1. Mount the drive controller (pages 15–18).
2. Make the following connections to the drive controller (pages 19–26):
   - Connect the grounding conductors.
   - Connect the line supply. Ensure that it is within the voltage range of the drive controller.
   - Connect the motor. Ensure that its rating corresponds to the drive controller's voltage.
3. Power up the drive controller, but do not give a run command.
4. Configure the following parameters in the SEt- menu (pages 31–34):
   - bFr (motor nominal frequency), if it is other than 50 Hz. bFr appears on the display the first time the drive controller is powered up. It can be accessed in the drC- menu (page 35) anytime.
   - ACC (acceleration) and dEC (deceleration)
   - LSP (low speed when the reference is zero) and HSP (high speed when the reference is at its maximum)
   - ItH (motor thermal protection)
   - SP2, SP3, SP4 (preset speeds 2, 3, and 4)
5. If the factory configuration is not suitable for the application, configure the parameters and I/O assignments in the drC- (page 35) and I-O- (page 39) menus.
6. Remove power from the drive controller, follow the bus voltage measurement procedure on page 19, then connect the control wiring to the logic and analog inputs.
7. Power up the drive controller, then issue a run command via the logic input (see page 26).
8. Adjust the speed reference.

DIMENSIONS

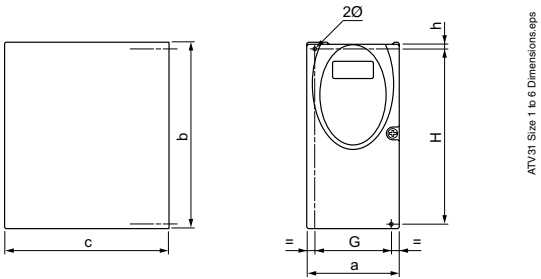

Table 1: Frame Sizes 1–6

ATV31•••••• [1]	Frame Size	a mm (in.)	b mm (in.)	c [2] mm (in.)	G [3] mm (in.)	h mm (in.)	H [3] mm (in.)	Ø mm (in.)	Weight kg (lb.)
H018M3X, H037M3X	1	72 (2.83)	145 (5.71)	120 (4.72)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	0.9 (1.99)
H055M3X, H075M3X	2	72 (2.83)	145 (5.71)	130 (5.12)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	0.9 (1.99)
H018M2, H037M2	3	72 (2.83)	145 (5.71)	130 (5.12)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.05 (2.32)
H055M2, H075M2	4	72 (2.83)	145 (5.71)	140 (5.51)	60 (2.36)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.05 (2.32)
HU11M3X, HU15M3X	5	105 (4.13)	143 (5.63)	130 (5.12)	93 (3.66)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.25 (2.76)
HU11M2, HU15M2, HU22M3X, H037N4, H055N4, H075N4, HU11N4,HU15N4, H075S6X, HU15S6X	6	105 (4.13)	143 (5.63)	150 (5.91)	93 (3.66)	5 (0.20)	121.5 (4.78)	2 x 5 (0.20)	1.35 (2.92)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

[2] For controllers with a potentiometer and Run/Stop button, add 8 mm (0.31 in.) for the potentiometer.

[3] The values for this dimension are ±1 mm (0.04 in.).

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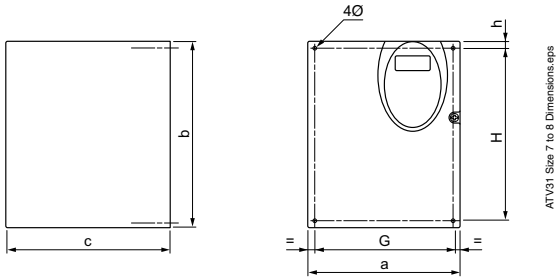

Table 2: Frame Sizes 7–9

ATV31•••••••[1]	Frame Size	a mm (in.)	b mm (in.)	c [2] mm (in.)	G [3] mm (in.)	h mm (in.)	H [3] mm (in.)	Ø mm (in.)	Weight kg (lb.)
HU22M2, HU30M3X, HU40M3X, HU22N4, HU30N4, HU40N4, HU22S6X, HU40S6X	7	140 (5.51)	184 (7.24)	150 (5.91)	126 (4.96)	6.5 (0.26)	157 (6.18)	4 x 5 (0.20)	2.35 (5.19)
HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X	8	180 (7.09)	232 (9.13)	170 (6.69)	160 (6.30)	5 (0.20)	210 (8.27)	4 x 5 (0.20)	4.70 (10.39)
HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X	9	245 (9.65)	330 (13.0)	190 (7.48)	225 (8.86)	7 (1.93)	295 (11.61)	4 x 6 (0.24)	9.0 (19.89)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

[2] For controllers with a potentiometer and Run/Stop button, add 8 mm (0.31 in.) for the potentiometer.

[3] The values for this dimension are ±1 mm (0.04 in.).

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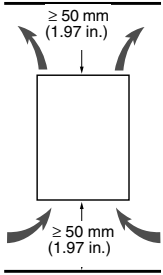
MOUNTING

Clearances



ATV31 Clearances.eps

Install the drive controller vertically, ± 10°.

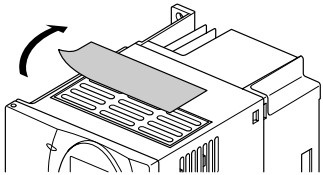
Do not place the drive controller close to heating sources.

Leave sufficient free space around the drive controller to ensure that air can circulate from the bottom to the top of the unit.

Leave a minimum of 10 mm (0.4 in.) of free space in front of the drive controller.

Removing the Protective Cover

When IP20 protection is adequate, remove the protective cover on top of the drive controller as shown below. Consult pages 16–18 to determine the type of mounting appropriate for your application before removing the protective cover from the drive controller.



ATV31Protective Cover.eps

Example: ATV31HU11M3X

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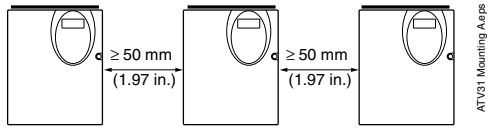
Mounting Methods

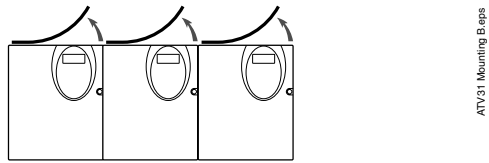
Type A Mounting

Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover in place.



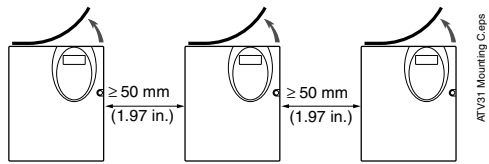
Type B Mounting

Drive controllers mounted side-by-side, with the protective cover removed (degree of protection becomes IP20).



Type C Mounting

Free space ≥ 50 mm (1.97 in.) on each side, with the protective cover removed (degree of protection becomes IP20).



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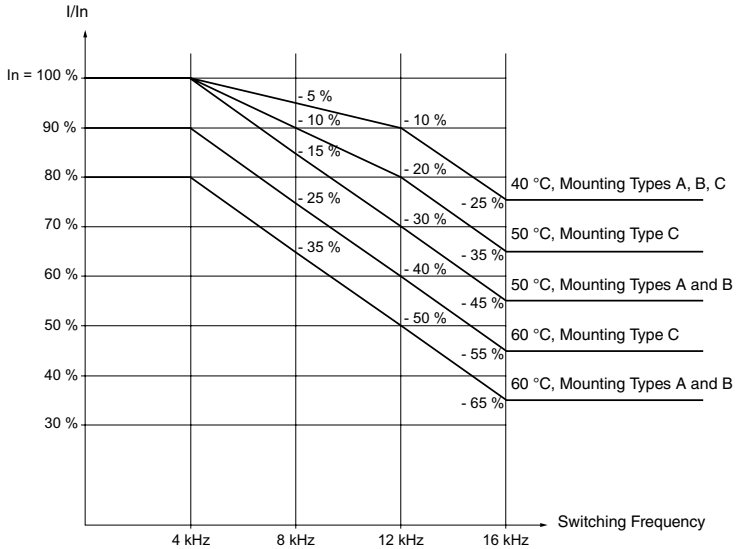
Derating Curves

The figure below illustrates derating curves for the drive current (In) as a function of temperature, switching frequency, and type of mounting. For intermediate temperatures, such as 55 °C, interpolate between two curves.

ATV31 drive controllers can be used at altitudes up to 3,300 ft. (1000 m) without derating. Derate by 1% for each additional 330 ft (100 m).



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Minimum Air Flow Rates

If you are installing the drive controller in an enclosure, provide an air flow at least equal to the value listed in Table 3 for your drive controller.

Table 3: Minimum Air Flow Rates

ATV31••••••• [1]	Flow Rate	
	m^3/hour	CFM
H018M2, H037M2, H055M2, H018M3X, H037M3X, H055M3X, H037N4, H055N4, H075N4, HU11N4 H075S6X, HU15S6X	18	10.6
H075M2, HU11M2, HU15M2 H075M3X, HU11M3X, HU15M3X HU15N4, HU22N4 HU22S6X, HU40S6X	33	19.4
HU22M2, HU22M3X, HU30M3X, HU40M3X HU30N4, HU40N4 HU55S6X, HU75S6X	93	54.8
HU55M3X HU55N4, HU75N4 HD11S6X	102	60.1
HU75M3X, HD11M3X, HD11N4, HD15N4 HD15S6X	168	99.0
HD15M3X	216	127.2

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

BUS VOLTAGE MEASUREMENT PROCEDURE

⚠DANGER

HAZARDOUS VOLTAGE

Read and understand the precautions on page 7 before performing this procedure.

Failure to follow these instructions will result in death or serious injury.

The bus voltage can exceed 1000 Vdc. Use appropriately rated measuring equipment when performing this procedure. To measure the bus capacitor voltage:

1. Disconnect all power from the drive controller.
2. Wait 3 minutes to allow the DC bus to discharge.
3. Measure the DC bus voltage between the PA (+) and PC (–) terminals to verify that the DC voltage is less than 45 Vdc. Refer to the *ATV31 Installation Manual* for the power terminal locations. **It may take up to 15 minutes for the DC bus voltage to discharge.**
4. If the bus capacitors are not fully discharged, contact your local Schneider Electric representative—do not service or operate the drive controller.

ELECTRICAL INSTALLATION

Ensure that the electrical installation of this drive controller conforms to the appropriate national and local codes.

- Verify that the voltage and frequency of the input supply line and the voltage, frequency, and current of the motor match the rating on the drive controller nameplate.

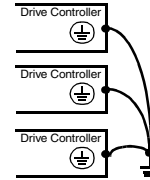
⚠DANGER

HAZARDOUS VOLTAGE

Ground equipment using the provided ground connecting point as shown in the figure on page 20. The drive controller panel must be properly grounded before power is applied.

Electric shock will result in death or serious injury.

- Verify that resistance to ground is one ohm or less. Ground multiple controllers as shown to the right. Do not loop the ground cables or connect them in series.



- Provide overcurrent protection. To achieve the short-circuit current rating listed on the drive controller nameplate, install the line power fuses recommended on the drive controller nameplate.

⚠ WARNING

INADEQUATE OVERCURRENT PROTECTION

- Overcurrent protective devices must be properly coordinated.
- The National Electrical Code requires branch circuit protection. Use the fuses recommended on the drive controller nameplate to achieve published short-circuit current ratings.
- Do not connect the drive controller to a power feeder whose short-circuit capacity exceeds the drive controller short-circuit current rating listed on the drive controller nameplate.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

- Do not use mineral-impregnated cables. Select motor cabling with low phase-to-phase and phase-to-ground capacitance.
- Motor cables must be at least 0.5 m (20 in.) long.
- Do not run control, power, or motor wiring in the same conduit. Do not run motor wiring from different drive controllers in the same conduit. Separate metallic conduit carrying power wiring from metallic conduit carrying control wiring by at least 8 cm (3 in.). Separate non-metallic conduits or cable trays used to carry power wiring from metallic conduit carrying control wiring by at least 31 cm (12 in.). Always cross power and control wiring at right angles.

⚠ WARNING

IMPROPER WIRING CONNECTIONS

- The drive controller will be damaged if input line voltage is applied to the output terminals (U, V, W).
- Check the power connections before energizing the drive controller.
- If replacing another drive controller, verify that all wiring connections to the ATV31 drive controller comply with all wiring instructions in this manual.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

- Do not immerse motor cables in water.
- Do not use lightning arrestors or power factor correction capacitors on the output of the drive controller.
- Equip all inductive circuits near the drive controller (such as relays, contactors, and solenoid valves) with electrical noise suppressors, or connect them to a separate circuit.

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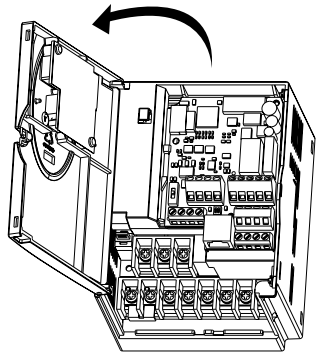
WIRING

Access to Terminals

To access the terminals, open the cover as shown below.



ATV31 Terminals.eps

Example ATV31HU11M2

Power Terminals

Connect the power terminals before connecting the control terminals.

Table 4: Power Terminal Characteristics

ATV31•••••••[1]	Maximum Connection Capacity		Tightening Torque in N•m (lb-in)
	AWG	mm^2	
H018M2, H037M2, H055M2, H075M2, H018M3X, H037M3X, H055M3X, H075M3X, HU11M3X, HU15M3X	14	2.5	0.8 (7.08)
HU11M2, HU15M2, HU22M2, HU22M3X, HU30M3X, HU40M3X, H037N4, H055N4, H075N4, HU11N4,HU15N4, HU22N4, HU30N4, HU40N4 H075S6X, HU15S6X, HU22S6X, HU40S6X	10	5	1.2 (10.62)

Table 4: Power Terminal Characteristics (Continued)

ATV31•••••••[1]	Maximum Connection Capacity		Tightening Torque in N•m (lb-in)
	AWG	mm^2	
HU55M3X, HU75M3X, HU55N4, HU75N4, HU55S6X, HU75S6X	6	16	2.2 (19.47)
HD11M3X, HD15M3X, HD11N4, HD15N4, HD11S6X, HD15S6X	3	25	4 (35.40)

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

Table 5: Power Terminal Functions

Terminal	Function	On ATV31 Drive Controllers
⏚	Ground terminal	All ratings
R/L1 S/L2	Power supply	ATV31••••M2 [1]
R/L1 S/L2 T/L3		ATV31••••M3X [1] ATV31••••N4 [1] ATV31••••S6X [1]
PO	DC bus + polarity	All ratings
PA/+	Output to braking resistor (+ polarity)	All ratings
PB	Output to braking resistor	All ratings
PC/-	DC bus - polarity	All ratings
U/T1 V/T2 W/T3	Outputs to the motor	All ratings

[1] Throughout this guide, the symbol "•" in a catalog number indicates the part of the number that varies with controller size or rating.

NOTE: Never remove the common link between PO and PA/+.

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Control Terminals

Table 6: Control Terminal Characteristics

Terminal	Function	Electrical characteristics
R1A R1B R1C	R1A is a N.O. contact. R1B is a N.C. contact. R1C is common. R1 is a programmable relay, factory set as a fault relay. As a fault relay, R1A is closed and R1B is open when the controller is powered with no fault.	• Min. switching capacity: 10 mA for 5 V c • Max. switching capacity on a resistive load (power factor = 1 and L/R time constant = 0 ms): 5 A for 250 V a and 30 V c • Max. switching capacity on an inductive load (power factor = 0.4 and L/R time constant = 7 ms): 1.5 A for 250 V a and 30 V c • Sampling time: 8 ms • Service life: 100,000 operations at max. switching power 1,000,000 operations at min. switching power
R2A R2C	N.O. contact of programmable relay R2	
COM	Analog I/O common	0 V
AI1	Analog voltage input	Analog input 0 to +10 V (max. safe voltage is 30 V) • Impedance: 30 kΩ • Resolution: 0.01 V, 10-bit converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms • Operation with a shielded cable: 100 m max.
10 V	Power supply for setpoint potentiometer 1 to 10 kΩ	+10 V (+ 8%, - 0%), 10 mA max, protected against short circuits and overloads
AI2	Analog voltage input	Bipolar analog input 0 to ±10 V (max. safe voltage is ±30 V) **The + or - polarity of the voltage on AI2 affects the direction of the setpoint and therefore the direction of operation.** • Impedance: 30 kΩ • Resolution: 0.01 V, 10-bit + sign converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms • Operation with shielded cable: 100 m max.

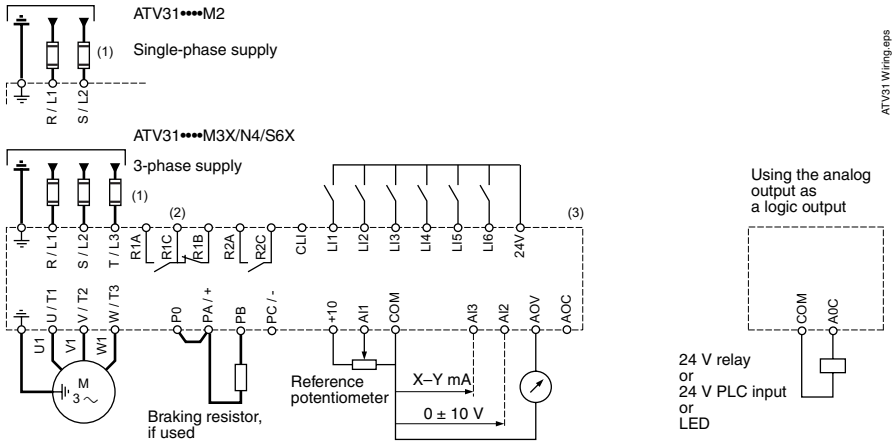
Table 6: Control Terminal Characteristics (Continued)

Terminal	Function	Electrical characteristics
AI3	Analog current input	Analog input X to Y mA; X and Y are programmable from 0–20 mA • Impedance: 250 Ω • Resolution: 0.02 mA, 10-bit converter • Precision: ± 4.3% of max. value • Linearity: ± 0.2% of max. value • Sampling time: 8 ms
COM	Analog I/O common	0 V
AOV AOC	Analog voltage output AOV or Analog current output AOC or Logic voltage output on AOC Either AOV or AOC can be assigned, but not both.	Analog output 0 to 10 V with a min. load impedance of 470 Ω or Analog output X to Y mA, with X and Y programmable from 0 –20 mA and with a max. load impedance of 800 Ω: • Resolution: 8 bits [1] • Precision: ± 1% [1] • Linearity: ± 0.2% [1] • Sampling time: 8 ms or AOC can be configured as a 24 V logic output with a min. load impedance of 1.2 kΩ.
24 V	Logic input power supply	+ 24 V protected against short circuits and overloads, min. 19 V, max. 30 V Max. available current is 100 mA.
LI1 LI2 LI3 LI4 LI5 LI6	Logic inputs	Programmable logic inputs • + 24 V power supply (max. 30 V) • Impedance: 3.5 kΩ • State 0 if the voltage difference between LI and CLI is < 5 V, State 1 if the voltage difference between LI and CLI is > 11 V • Sampling time: 4 ms
CLI	Logic input common	Refer to the *ATV31 Installation Manual* for the logic input switch.

[1] Characteristics of the digital/analog converter.

ENGLISH

Wiring Diagram for Factory Settings



NOTE: The line supply terminals are shown at the top and the motor terminals are shown at the bottom. Connect the power terminals before connecting the control terminals. Install surge suppressors on all inductive circuits located near the drive controller or coupled to the same circuit.

(1) Refer to the drive controller nameplate for recommended fuses. Fast acting or time delay Class J fuses can be used.
(2) Fault relay contacts for remote indication of drive controller status.
(3) Internal +24 V. If an external source is used (30 V max.), connect the 0 V of the source to the COM terminal, and do not use the +24 V terminal on the drive controller.

Logic Input Switch

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The logic input switch is factory set for source logic. Do not change the position of the logic input switch without consulting the *ATV31 Installation Manual*.

Failure to follow this instruction can result in injury or equipment damage.

This switch assigns the logic input common link to 0 V, 24 V, or floating. Refer to the *ATV31 Installation Manual*, VVDED303041US, for more information.

ENGLISH

PROGRAMMING

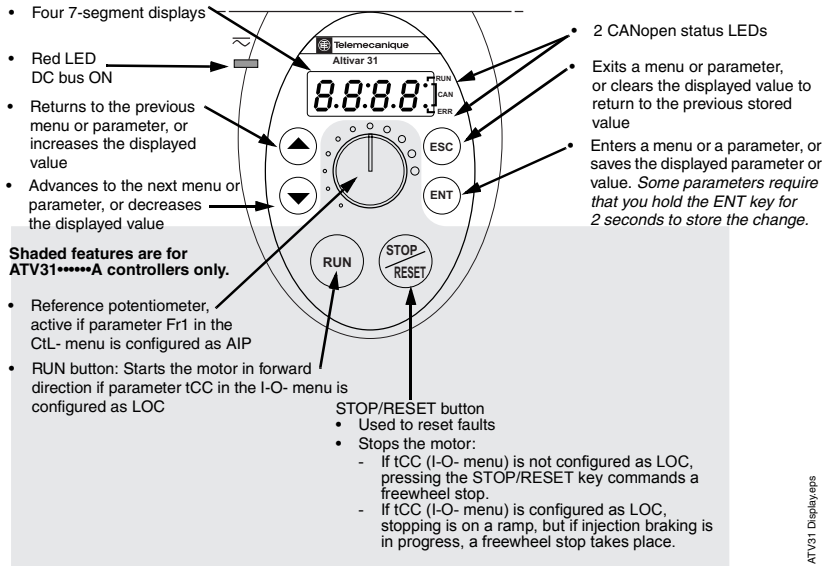
⚠DANGER

UNQUALIFIED USER

- This equipment must be installed, programmed, and serviced only by qualified personnel.
- Qualified personnel performing diagnostics or troubleshooting that requires electrical conductors to be energized must comply with NFPA 70 E - Standard for Electrical Safety Requirements for Employee Workplaces and OSHA Standards - 29 CFR Part 1910 Subpart S Electrical.

Failure to follow these instructions will result in death or serious injury.

Display Functions



- Press and hold down (longer than 2 seconds) the ▲ or ▼ keys to scroll through the data quickly.
- Pressing ▲ or ▼ does not store the selection.
- To store the selection, press the ENT key.The display flashes when a value is stored.

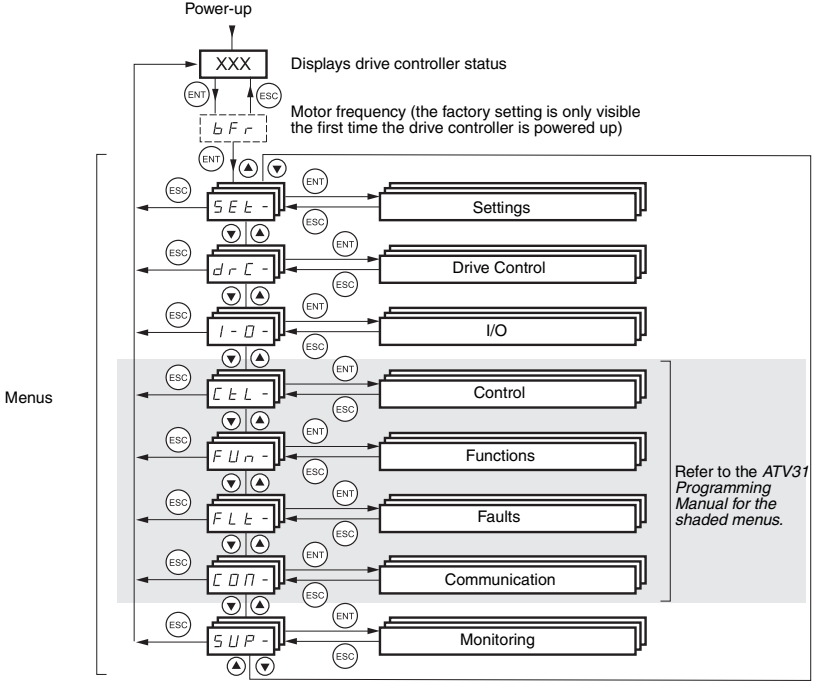
A normal display with no fault present and no run command shows:

- The value of one of the monitoring parameters (see page 41). The default display is motor frequency, for example 43.0. In current limiting mode, the display flashes.
- init: Initialization sequence
- rdY: Drive ready
- dcb: DC injection braking in progress
- nSt: Freewheel stop
- FSt: Fast stop
- tUn: Auto-tuning in progress

If a fault is present, the display flashes.

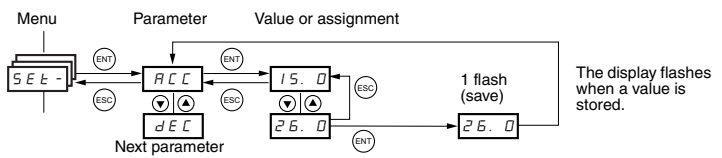
ENGLISH

Access to Menus



A dash appears after menu codes to differentiate them from parameter codes. For example, SEt- is a menu, but ACC is a parameter.

- To store the selection, press the ENT key.



bFr Parameter

Code	Description	Adjustment Range	Factory Setting
bFr	Motor frequency	50 or 60 Hz	50 Hz
	This is the first parameter displayed when the drive controller is powered up or after a factory reset. bFr can be modified at any time in the drC- menu. This parameter modifies the preset values of the following parameters: HSP (page 32), Ftd (page 34), FrS (page 35), and tFr (page 37).		

Settings Menu SEt-

⚠DANGER

UNINTENDED EQUIPMENT OPERATION

- Ensure that changes to the current operating settings do not present any danger.
- It is recommended that changes be made with the drive controller stopped.

Failure to follow these instructions will result in death or serious injury.

CAUTION

MOTOR OVERHEATING

- This drive controller does not provide direct thermal protection for the motor.
- Use of a thermal sensor in the motor may be required for protection at all speeds or loading conditions.
- Consult the motor manufacturer for the thermal capability of the motor when operated over the desired speed range.

Failure to follow these instructions can result in equipment damage.

ENGLISH

Settings Menu SEt-

Code	Assignment	Adjustment Range	Factory Setting
ACC dEC	Acceleration ramp time for the motor to go from 0 Hz to FrS (nominal frequency, see page 35). Deceleration ramp time for the motor to go from FrS to 0 Hz. Ensure that dEC is not set too low for the load.	0.0 to 999.9 s 0.0 to 999.9 s	3 s 3 s
LSP	Low speed (minimum reference)	0 to HSP	0 Hz
HSP	High speed (maximum reference). Ensure that this setting is appropriate for the motor and the application.	LSP to tFr	bFr
ItH	Current used for motor thermal protection. Set ItH to the nominal current indicated on the motor nameplate. To disable thermal protection, refer to the *ATV31 Programming Guide*.	0 to 1.15 In [1]	According to the controller rating
UFr	IR compensation/voltage boost Used to optimize torque at low speeds. Increase UFr if the torque is insufficient. To avoid operating instability, ensure that the value of UFr is not too high for a warm motor. *NOTE: Modifying UFt (page 36) will cause UFr to return to the factory setting (20%).*	0 to 100%	20%
FLG	Frequency loop gain Used only in n and nLd ratios (see page 36). This parameter adjusts the speed ramp based on the inertia of the driven load. If the value is too low, the response time is longer. If the value is too high, overspeed or operating instability can result.	0 to 100%	20%
StA	Frequency loop stability Used only in n and nLd ratios (see page 36). If the value is too low, overspeed or operating instability can result. If the value is too high, the response time is longer.	1 to 100%	20%

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Settings Menu SEt- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
SLP	Slip compensation Used only in n and nLd ratios (see page 36). Adjusts slip compensation for fine tuning of speed regulation. If slip setting < actual slip, the motor is not rotating at the correct speed in steady state. If the slip setting > actual slip, the motor is overcompensated and the speed is unstable.	0 to 150%	100
tdC	Automatic DC injection time	0.1 to 30 s	0.5 s
SdC	Level of automatic DC injection current **⚠ WARNING** **NO HOLDING TORQUE** • DC injection braking does not provide holding torque at zero speed. • DC injection braking does not function during a loss of power or during a drive controller fault. • When required, use a separate brake for holding torque. **EXCESSIVE DC INJECTION BRAKING** • Application of DC injection braking for long periods of time can cause motor overheating and damage. • Protect the motor from extended periods of DC injection braking. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**	0 to 1.2 In [1]	0.7 In [1]
tdC2	Second automatic DC injection time Refer to the *ATV31 Programming Manual* for more information.	0 to 30 s	0 s
SdC2	Second level of DC injection current Refer to the *ATV31 Programming Manual* for more information.	0 to 1.2 In [1]	0.5 In [1]
JPF	Skip frequency Skip frequency prevents prolonged operation at a frequency range of ± 1 Hz around JPF. This function avoids a critical speed which leads to resonance. Setting the function to 0 renders it inactive.	0 to 500 Hz	0 Hz

[1] In is the nominal drive controller current shown on the drive controller nameplate.

ENGLISH

Settings Menu SEt- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
JF2	Second skip frequency Prevents prolonged operation at a frequency range of ± 1 Hz around JF2. This function avoids a critical speed which leads to resonance. Setting the function to 0 renders it inactive.	0 to 500 Hz	0 Hz
SP2	Second preset speed	0 to 500 Hz	10 Hz
SP3	Third preset speed	0 to 500 Hz	15 Hz
SP4	Fourth preset speed	0 to 500 Hz	20 Hz
CLI	Current limiting	0.25 to 1.5 In [1]	1.5 In [1]
tLS	Low speed operating time This parameter defines a period for operation at LSP (see page 32). After the programmed time has elapsed, the motor is stopped automatically. When the frequency reference is greater than LSP and a run command is still present, the motor will restart. Setting the function to 0 renders it inactive.	0 to 999.9 s	0 (no limit)
Ftd	Refer to the *ATV31 Programming Manual*.		
ttd	Refer to the *ATV31 Programming Manual*.		
Ctd	Refer to the *ATV31 Programming Manual*.		
SdS	Refer to the *ATV31 Programming Manual*.		
SFr	Switching frequency This parameter can also be accessed in the drC- menu. See page 37.	2.0 to 16 kHz	4 kHz

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC-

With the exception of tUn, which can power up the motor, drive control parameters can only be modified when the drive controller is stopped and no run command is present. Drive controller performance can be optimized by:

- Setting the drive control parameters to the values on the motor nameplate
- Performing an auto-tune operation (on a standard asynchronous motor)

Drive Control Menu drC-

Code	Assignment	Adjustment Range	Factory Setting
bFr	Motor frequency This parameter modifies the presets of the following parameters: HSP (page 32), Ftd (page 34), FrS (page 35), and tFr (page 37)	50 or 60 Hz	50 Hz
UnS	Nominal motor voltage indicated on the nameplate	According to the drive controller rating	According to the drive controller rating
FrS	Nominal motor frequency indicated on the nameplate. The factory setting is 50 Hz, or 60 Hz if bFr is set to 60 Hz.	10 to 500 Hz	50 Hz
nCr	Nominal motor current indicated on the nameplate	0.25 to 1.5 In [1]	According to the drive controller rating
nSP	Nominal motor speed indicated on the nameplate. 0 to 9999 rpm, then 10.00 to 32.76 krpm. If nominal speed is not listed on the nameplate, refer to the *ATV31 Programming Manual*.	0 to 32760 rpm	According to the drive controller rating
COS	Motor power factor indicated on the nameplate	0.5 to 1	According to the drive controller rating

[1] In is the nominal drive controller current shown on the drive controller nameplate.

ENGLISH

Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
tUn	Auto-tuning Before performing an auto-tune, ensure that all of the drive control parameters (UnS, FrS, nCr, nSP, COS) are configured correctly. nO: auto-tune not performed YES: Auto-tuning is performed as soon as possible, then the parameter automatically switches to dOnE or, in the event of a fault, to nO. The tnF fault is displayed. dOnE: Auto-tuning is completed and the measured stator resistance will be used to control the motor. rUn: Auto-tuning is performed each time a run command is sent. POn: Auto-tuning is performed each time the controller is powered up. LI1 to LI5: Auto-tuning is performed when the logic input assigned to this function transitions from 0 to 1. *Note: Auto-tuning will only be performed if no run or braking command has been activated. Auto-tuning may last for 1 to 2 seconds.* ***Do not interrupt the auto-tune! Wait for the display to change to dOnE or nO.*** *During auto-tune, the motor operates at nominal current.*		nO
tUS	Auto-tuning status tAb: The default stator resistance value is used to control the motor. PEnd: Auto-tuning has been requested, but not yet performed. PrOG: Auto-tuning in progress. FAIL: Auto-tuning has failed. dOnE: The stator resistance measured by the auto-tuning function will be used to control the motor.		tAb
UFt	Selection of the voltage/frequency ratio L: Constant torque (for motors connected in parallel or special motors) P: Variable torque (pump and fan applications) n: Sensorless flux vector control (for constant torque applications) nLd: Energy savings (for variable torque applications not requiring high dynamics. This behaves in a way similar to the P ratio at no-load and the n ratio with load.) Modifying UFt will cause UFr to return to the factory setting of 20%.		n

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
nrd	Random switching frequency This function randomly modulates the switching frequency to reduce motor noise. YES: Function active nO: Function inactive		YES
SFr	Switching frequency Adjust the setting to reduce audible motor noise. If the switching frequency is set to a value higher than 4 kHz, in the event of excessive temperature rise the drive controller will automatically reduce the switching frequency. It will increase it again when the temperature returns to normal. Refer to page 17 for derating curves. SFr can also be accessed in the SEt- menu. See page 34.	2 to 16 kHz	4.0 kHz
tFr	Maximum output frequency The factory setting is 60 Hz, or 72 Hz if bFr is set to 60 Hz.	10 to 500 Hz	60 Hz
SSL	Suppression of the speed loop filter nO: The speed loop filter is active (prevents the reference from being exceeded). YES: The speed loop filter is suppressed (in position control applications, this reduces the response time but the reference may be exceeded.)		nO
SCS	Saving the parameter configurations nO: Function inactive Str1: Saves the current configuration (but not the result of auto-tuning) to EEPROM. SCS automatically switches to nO as soon as the save has been performed. Use this function to keep a backup configuration in addition to the current configuration. The drive controller ships with both the current configuration and the backup configuration initialized to the factory settings.		nO

[1] In is the nominal drive controller current shown on the drive controller nameplate.

Drive Control Menu drC- (Continued)

Code	Assignment	Adjustment Range	Factory Setting
FCS	Return to factory settings/Restore the configuration nO: Function inactive rECI: Replaces the current configuration with the backup configuration previously saved by SCS. rECI is visible only if the backup has been carried out. FCS automatically switches to nO as soon as this action has been performed. InI: Replaces the current configuration with the factory settings. FCS automatically switches to nO as soon as this action has been performed. *Note: For rECI and InI to be taken into account, the ENT key must be held down for 2 seconds.*		nO

[1] In is the nominal drive controller current shown on the drive controller nameplate.

I/O Menu I-O-

These parameters can only be modified when the drive controller is stopped and no run command is present.

I/O Menu I-O-

Code	Assignment	Factory Setting
tCC	Configuration of terminal block control: 2C: 2-wire control 3C: 3-wire control LOC: Local control 2-wire control (maintained contact): The state of the input (open or closed) controls running or stopping. 3-wire control (momentary contact): A forward or reverse pulse is needed to control start-up. A stop pulse is sufficient to control stopping. See the *ATV31 Programming Manual* for more information. On ATV31••••••A controllers, reconfiguring tCC to 2C reassigns the LI1 (forward) and LI2 (reverse) inputs. Although this renders the RUN button on the drive controller inactive, the potentiometer still provides the speed reference. The potentiometer can be deactivated and the speed reference assigned to analog input AI1 by configuring parameter Fr1 to AI1 in the CTL- menu. Refer to the *ATV31 Programming Manual* for more information. *Note: To change the assignment of tCC, press the ENT key for 2 seconds. This causes rrS, tCt, and all functions affecting logic inputs to return to their factory setting.*	2C ATV31••••••A: LOC
tCt	Type of 2-wire control (parameter only accessible if tCC is set to 2C) LEL: If the forward or reverse input is high when the drive controller is powered up, the drive controller will start the motor. If both inputs are high on power up, the controller will run forward. trn: The forward or reverse input must transition from low to high before the drive controller will start the motor. If the forward or reverse input is high when the drive controller is powered up, the input must be cycled before the drive controller will start the motor. PFO: Same as LEL, but the forward input has priority over the reverse input. If forward is activated while the controller is running in reverse, the controller will run forward.	trn

ENGLISH

I/O Menu I-O- (Continued)

Code	Assignment	Factory Setting
rrS	Reverse operation via logic input nO: Not assigned to a logic input. Reverse operation may still be commanded by another means, such as negative voltage on AI2 or a serial link command. LI2: Logic input LI2 can be accessed if tCC is set to 2C LI3: Logic input LI3 LI4: Logic input LI4 LI5: Logic input LI5 LI6: Logic input LI6	
CrL3 CrH3 AOt dO r1 r2	Refer to the *ATV31 Programming Manual.*	
SCS FCS	Identical to the drC- menu, see pages 37 and 38.	

Display Menu SUP-

Display parameters can be accessed with the drive controller running or stopped. Some functions have numerous associated parameters. To clarify programming and keep parameter lists short, these functions have been grouped together in sub-menus. Like menus, sub-menus are identified by a dash after their code, for example LIF-.

When the drive controller is running, the value of one of the monitoring parameters is displayed. The factory setting is output frequency (rFr).

To change the parameter displayed, scroll to the desired monitoring parameter and press the ENT key. To retain your selection as the new default, press and hold the ENT key again for 2 seconds. The value of this parameter will be displayed during operation, even after power to the drive controller has been cycled. If the new choice is not confirmed by pressing the ENT key a second time, the drive controller will return to the previous parameter after power is cycled.

Display Menu SUP-

Code	Description	Range
	Shaded parameters only appear if the function has been enabled.	
LFr	Frequency reference for control via integrated terminal or remote terminal.	0 to 500 Hz
rPI	Internal PI reference	0 to 100%
FrH	Frequency reference (absolute value)	0 to 500 Hz
rFr	Output frequency applied to the motor	- 500 Hz to + 500 Hz
SPd	Output value in customer units Refer to the *ATV31 Programming Manual.*	
LCr	Motor current (A)	
OPr	Motor power 100% = Nominal motor power	
ULn	Line voltage calculated from the measured voltage on the DC bus (Vac).	

ENGLISH

Display Menu SUP- (Continued)

Code	Description	Range
tHr	Motor thermal state 100% = Nominal thermal state 118% = OLF threshold (motor overload, see page 45)	
tHd	Drive thermal state 100% = Nominal thermal state 118% = OHF threshold (drive overload, see page 45)	
LFt	Last fault See “Troubleshooting” on page 43	
Otr	Motor torque 100% = Nominal motor torque	
rtH	Operating time Total time the motor has been powered up: 0 to 9999 (hours), then 10.00 to 65.53 (khours). Can be reset to zero by the rPr parameter in the FLt- menu (refer to the *ATV31 Programming Manual*.)	0 to 65530 hours
COd	Terminal locking code Please refer to the *ATV31 Programming Manual*.	
tUS	Auto-tuning status (refer to page 36 for auto-tuning parameters.) tAb: The default stator resistance value is used to control the motor. PEnd: Auto-tuning has been requested but not yet performed. PrOG: Auto-tuning in progress. FAIL: Auto-tuning has failed. dOnE: The stator resistance measured by the auto-tuning function will be used to control the motor.	
UdP	Indicates the ATV31 software version For example, 1102 = V 1.1IE02	
LIF-	Logic input functions Refer to the *ATV31 Programming Manual*.	
AIF-	Analog input functions Refer to the *ATV31 Programming Manual*.	

TROUBLESHOOTING

Fault Display

If a problem occurs during setup or operation, ensure that all ambient environment, mounting, and connection recommendations have been followed.

The first fault detected is stored and displayed, flashing, on the screen. The drive controller locks and the fault relay (R1A-R1C or R2A-R2C) contact opens.

Drive Controller Does Not Start, No Display

If the drive controller will not start and there is no display indication, check the power supply to the drive controller. Refer to the *ATV31 Programming Manual* for more troubleshooting information.

Faults Which Cannot be Automatically Reset

Faults which cannot be automatically reset are listed in the table beginning on page 44. To clear these faults:

1. Remove power from the drive controller.
2. Wait for the display to go off completely.
3. Determine the cause of the fault and correct it.
4. Reapply power.

CrF, SOF, tnF, bLF, and OPF can also be reset remotely via a logic input (rSF parameter in the FLt- menu, see the *ATV31 Programming Manual*).

Faults Which Cannot be Automatically Reset

Fault	Probable Cause	Remedy
bLF Brake sequence	Brake release current not reached	• Check the drive controller and motor connections. • Check the motor windings. • Check the Ibr setting in the FUn-menu. Refer to the *ATV31 Programming Manual*.
CrF Precharge circuit fault	Precharge circuit damaged	• Reset the drive controller. • Replace the drive controller.
InF Internal fault	• Internal fault • Internal connection fault	• Remove sources of electromagnetic interference. • Replace the drive controller.
OCF Overcurrent	• Incorrect parameter settings in the SEt- and drC- menus • Acceleration too rapid • Drive controller and/or motor undersized for load • Mechanical blockage	• Check the SEt- and drC- parameters. • Ensure that the size of the motor and drive controller is sufficient for the load. • Clear the mechanical blockage.
SCF Motor short circuit	• Short circuit or grounding at the drive controller output • Significant ground leakage current at the drive controller output if several motors are connected in parallel	• Check the cables connecting the drive controller to the motor, and check the motor insulation. • Reduce the switching frequency. • Connect output filters in series with the motor.
SOF Overspeed	• Instability • Overhauling load	• Check the motor, gain, and stability parameters. • Add a braking resistor. • Check the size of the motor, drive controller, and load.
tnF Auto-tuning fault	• Motor or motor power not suitable for the drive controller • Motor not connected to the drive controller	• Use the L or the P ratio (see UFt on page 36). • Check the presence of the motor during auto-tuning. • If a downstream contactor is being used, close it during auto-tuning.

Faults Which Can be Reset With the Automatic Restart Function

After the cause of the fault has been removed, the following faults can be reset:

- With the automatic restart function (Atr parameter in the FLt- menu, see the *ATV31 Programming Manual*),
- Via a logic input (rSF parameter in the FLt- menu, see the *ATV31 Programming Manual*),
- By cycling power to the drive controller.

Faults Which Can be Reset With Automatic Restart

Fault	Probable Cause	Remedy
CnF Serial link failure CANopen	Loss of communication between drive controller and communication device or remote keypad.	• Check the communication bus. • Refer to the product-specific documentation.
EPF External fault	User defined	User defined
LFF Loss of 4-20 mA follower	Loss of the 4-20 mA reference on input AI3	Check the connection on input AI3.
ObF Overvoltage during deceleration	• Braking too rapidly • Overhauling load	• Increase the deceleration time. • Install a braking resistor if necessary. • Activate the brA function if it is compatible with the application. Refer to the *ATV31 Programming Manual*.
OHF Drive overload	• Drive controller or ambient temperature are too high. • Continuous motor current load is too high.	Check the motor load, the drive controller ventilation, and the environment. Wait for the drive controller to cool before restarting.
OLF Motor overload	• Thermal trip due to prolonged motor overload • Motor power rating too low for the application	Check the ItH setting (motor thermal protection, page 32), check the motor load. Allow the motor to cool before restarting.

ENGLISH

Faults Which Can be Reset With Automatic Restart (Continued)

Fault	Probable Cause	Remedy
OPF Motor phase failure	• Loss of phase at drive controller output • Downstream contactor open • Motor not connected • Instability in the motor current • Drive controller oversized for motor	• Check the connections from the drive controller to the motor. • If a downstream contactor is being used, set OPL to OAC. Refer to the *ATV31 Programming Manual*, FLt- menu. • Test the drive controller on a low power motor or without a motor: set OPL to nO. Refer to the *ATV31 Programming Manual*, FLt- menu. • Check and optimize the UFr (page 32), UnS (page 35), and nCr (page 35) parameters and perform auto-tuning (page 36).
OSF Overvoltage during steady state operation or during acceleration	• Line voltage too high • Line supply transients	• Check the line voltage. Compare with the drive controller nameplate rating. • Reset the drive controller.
PHF Input phase failure	• Input phase loss, blown fuse • 3-phase drive controller used on a single phase line supply • Input phase imbalance • Transient phase fault *Note: This protection only operates with the drive controller running under load.*	• Check the connections and the fuses. • Disable the fault by setting IPL to nO. Refer to the *ATV31 Programming Manual*. • Verify that the input power is correct. • Supply 3-phase power if needed.
SLF Serial link failure Modbus	Loss of connection between drive controller and communication device or remote keypad.	• Check the communication connection. • Refer to the product-specific documentation.

Faults That Will Be Reset As Soon As the Fault is Cleared

Fault	Probable Cause	Remedy
CFF Configuration fault	The parameter configurations are not suited to the application.	Restore the factory settings or load the backup configuration, if it is valid. See parameter FCS in the drC- menu, page 38.
CFI Configuration fault via serial link	The parameter configurations loaded in the drive controller via the serial link are not suited to the application.	• Check the configuration loaded previously. • Load a compatible configuration.
USF Undervoltage	• Line supply too low • Transient voltage dip • Damaged precharge resistor	• Check the line voltage. • Check the setting of the UNS parameter (see page 35). • Replace the drive controller.

DOSATRON®

WATER POWERED DOSING TECHNOLOGY

2.5 m³/h - 11 GPM

D 25 F
D 25 F 1
D 25 F 0.2
D 25 F 2
D 25 RE 1500
D 25 RE 09
D 25 RE 2
D 25 RE 5
D 25 RE 10
D 25 RE 2 IE
D 25 RE 5 IE
D 25 RE 10 IE

Acid Pump
D25RE2VFPII

Alkaline Pump
D25REAFPII

manuel d'utilisation
owner's manual
gebrauchsanweisung
manuale d'uso
manual de utilización
gebruiksaanwijzing

You have just become the owner of one of the latest in the line of DOSATRON proportional dosing pumps and we congratulate you on your choice.
The development of this model is the result of over 30 years experience. Our engineers have placed the DOSATRON series at the forefront of technical development in the field of non-electric proportional dosing pumps.
The choice of materials used in manufacture was most meticulous in order to resist chemical attack from the great majority of injectable products on the market. This DOSATRON will, as time goes by, prove itself to be a most faithful ally.
A little care and attention, regularly spent, will guarantee you an operation in which the word breakdown has no place.

THEREFORE, PLEASE, READ THIS MANUAL CAREFULLY BEFORE PUTTING THE DOSATRON INTO OPERATION.

Important !
The complete model reference and the serial number of your DOSATRON is stamped **on the pump body.**
Please record this number in the space below and refer to it when you call your distributor for information, parts, and service.

Ref. # .....

Serial # .....

Purchase Date .....

....

English Summary

EN

SPECIFICATIONS

	D 25 F / D 25 F 1	D 25 F 0.2	D 25 F 2	D 25 RE 1500	D 25 RE 09	D 25 RE 2 D 25 RE 2 IE	D 25 RE 5 D 25 RE 5 IE	D 25 RE 10* D 25 RE 10 IE
Practical operating **flow range**:	**10 l/h mini - 2.5 m³ maxi** [1/3 US Pint/min - 11 US GPM]							*2 m³/h limit [8.8 GPM]
Operating **pressure**:								
bar	**0.30 - 6**	**0.30 - 6**	**0.30 - 6**	**0.30 - 6**	**0.30 - 6**	**0.30 - 6**	**0.30 - 6**	**0.3 - 4**
PSI	4.3 - 85	4.3 - 85	4.3 - 85	4.3 - 85	4.3 - 85	4.3 - 85	4.3 - 85	4.3 - 58
Externally adjustable or fixed injection rate:								
%	**0.8 / 1**	**0.2**	**2**	**0.07 - 0.2**	**0.1 - 0.9**	**0.2 - 2**	**1 - 5**	**3 - 10**
ratio mini	1:128 / 1:100	1: 500	1:50	1:1500	1:1000	1:500	1:100	1:33
ratio maxi				1:500	1:112	1:50	1:20	1:10
Concentrated additive injection:								
Mini l/h	**0.08 / 0.10**	**0.2**	**0.2**	**0.007**	**0.01**	**0.02**	**0.1**	**0.3**
Maxi l/h	**20 / 25**	**5**	**50**	**5**	**22.5**	**50**	**125**	**200**
US Fl. oz/min	0.045 / 0.06	0.011	0.11	0.004	0.0056	0.011	0.056	0.17
US GPM/max	0.088 / 0.11	0.022	0.22	0.022	0.099	0.22	0.55	0.88
Maximum operating **temperature**: **40 °C** [104 ° F]								
Connections (NPT/BSP): **Ø 20x27 mm** [3/4"]								
Hydraulic motor capacity (for every 2 clicks of the piston) :	about **0.45 l** [0.118 US Gallons]							
NOTE: The Dosatron is not preset,	**see chapter ADJUSTING THE INJECTING RATE**							
UNIT SIZE								
Diameter: **cm**	**12.7**	**12.7**	**12.7**	**12.7**	**12.7**	**12.7**	**12.7**	**12.7**
["]	5	5	5	5	5	5	5	5
Total height: **cm**	**33.9**	**31.9**	**33.9**	**39.8**	**39.8**	**39.9**	**44**	**44**
["]	13 3/8	12 9/16	13 3/8	15 11/16	15 11/16	15 11/16	17 5/16	17 5/16
Width: **cm**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**
["]	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16
Weight: ± **kg**	**1.0**	**1.0**	**1.0**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
[lbs]	2.2	2.2	2.2	2.7	2.7	2.7	2.7	2.7

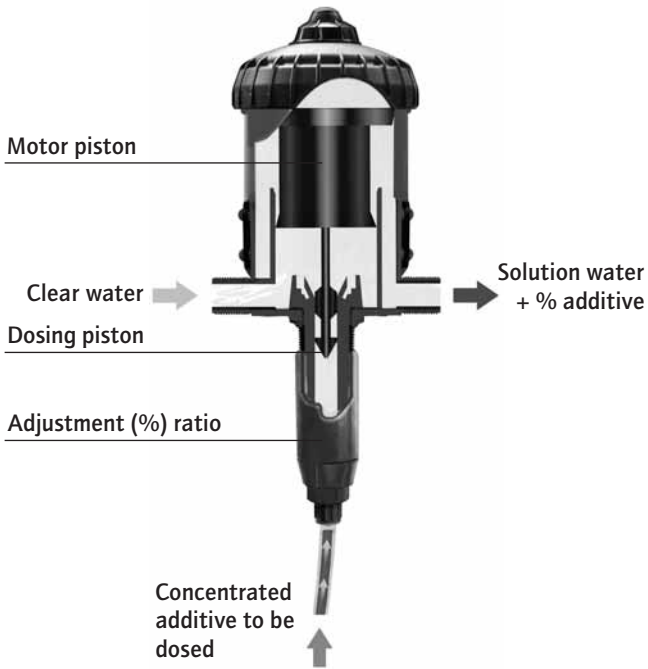
SHIPPING CONTENTS: 1 DOSATRON / 1 mounting bracket for DOSATRON / 1 suction tube of concentrated additive / 1 strainer / 1 injection suction tube for "IE" model / 1 owner's manual

PACKAGE SIZE : 52 x 16.8 x 17.5 cm [20 1/2" x 6 5/8" x 6 7/8"]
PACKAGE WEIGHT : 1.7 kg environ [~ 3.7 US lbs]

EN

Precise, simple and reliable

Installed directly in the water supply line, the DOSATRON operates by using water pressure as the power source. Water activates the DOSATRON, which takes up the required percentage of concentrate. Inside the DOSATRON, concentrate is mixed with water. Water pressure forces the solution downstream. The dose of concentrate will be directly proportional to the volume of water entering the DOSATRON, regardless of variations in flow or pressure which may occur in the main line.



Installation

PRECAUTIONS

1 - GENERAL REMARKS

- When connecting a DOSATRON either to the public water supply or to its own water source, you must respect the regulations in force concerning protection of the source i.e. backflow prevention, etc.

- In a case where the downstream water installation is higher than the DOSATRON itself, there is a possible risk of water and concentrate flowing back through the DOSATRON. In this case, installing a check valve downstream is recommended.
- Do not install the DOSATRON just above an acid container, (risk of acid fumes attacking the DOSATRON) and protect it from possible contact with corrosive products.
- Protect the DOSATRON from freezing temperatures by draining it and store it away from sources of excessive heat.
- Do not install the DOSATRON on the suction side of the supply pump (risk of siphoning).
- During any intervention the operator must stay in front of the DOSATRON and wear protective eyewear and gloves.
- It is the responsibility of the owner/operator to replace the injection seals annually to ensure precise injection.
- The setting of the Dosatron's dosing rate is the sole responsibility of the user. The user has to respect the recommendations given by the manufacturer of the chemical product.
- It is the responsibility of the owner/operator to check that the flow and pressure of the installation do not exceed the DOSATRON characteristics.
- It is the responsibility of the owner/operator of the DOSATRON, to determine the correct amount of solution and injection ratio to obtain the desired result.
- An air inlet, an impurity or a chemical attack on a seal can interrupt the dosing function. It is recommended to periodically check that the solution is being correctly drawn up into the DOSATRON.
- Change the suction tube as soon as it seems damaged by the chemical.
- Relieve the pressure after use (advised).
- Rinsing of the DOSATRON is required :

. when changing chemicals,

. before handling the DOSATRON, to avoid any contact with the chemical.

PRECAUTIONS (cont...)

1 - GENERAL REMARKS (cont...)

- Before applying any aggressive chemicals, please consult your distributor to confirm compatibility with the dosing pump.

- All assembly should be done without tools, hand tighten only.

2 - WATER WITH HIGH PARTICLE CONTENT

- A (ex.: 300 mesh - 60 microns depending on your water quality) water filter must be installed upstream from the DOSATRON (see accessories), if a filter is not installed abrasive substances will cause the DOSATRON to deteriorate prematurely.

3 - WATER-HAMMER / EXCESSIVE FLOW

- For installations subject to water hammer a protection device such as a check valve or union ball check must be fitted (pressure/flow control system).
- For automatic installations, slow opening and closing solenoid valves are preferable.
- In an installation where a DOSATRON serves several sectors, the closing of one sector and the opening of another sector must be done at the same time (simultaneous operation of the solenoid valves).

4 - INSTALLATION LOCATION

- The location of the DOSATRON and concentrate container should be accessible, but should never present a risk of pollution or contamination.
- It is recommended to label all water lines with a warning about the injected solution i.e. Not For Human Consumption.

5 - MAINTENANCE

- Rinse the injection areas after using the DOSATRON. To do this, insert suction tube into a container of clean water and inject about 1/4 liter [8 1/2 US Fl.oz].
- Routine maintenance once a year will add to the life of your DOSATRON. Replace the injection seals as well as the suction hose annually to ensure proper injection.

6 - SERVICE

- This DOSATRON was tested prior to packaging.
- Complete maintenance and seal kits are available.
- Call your DOSATRON distributor for service or parts.

ASSEMBLING THE DOSATRON

ASSEMBLY SHOULD BE CARRIED OUT WITHOUT THE USE OF TOOLS

The DOSATRON is delivered with :
- a mounting bracket,
- a suction tube with a strainer.

The bracket enables the DOSATRON to be fixed to a wall.

Snap the DOSATRON into the bracket by fitting the two lugs on one side of the body **(Fig. 1-A)** into the corresponding holes in the bracket **(Fig. 1-B)**, and springing the bracket arms apart until the other 2 lugs click into place.

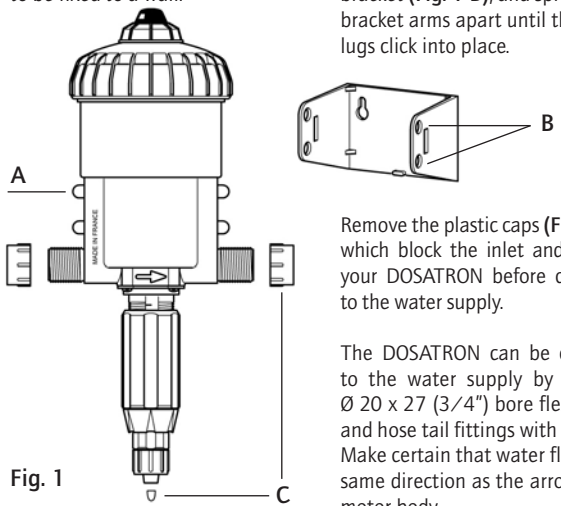


Fig. 1

Remove the plastic caps **(Fig. 1/2-C)** which block the inlet and outlet of your DOSATRON before connecting to the water supply.

The DOSATRON can be connected to the water supply by means of Ø 20 x 27 (3/4") bore flexible hose and hose tail fittings with hose clips. Make certain that water flows in the same direction as the arrows on the motor body.

EXTERNAL INJECTION (IE) MODELS

In order to use corrosive concentrates, the external injection model DOSATRON is also delivered with an external injection hose **(Fig. 2-D)**.

CAUTION screw in the components carefully !

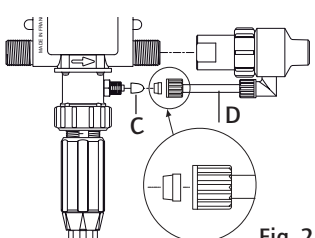


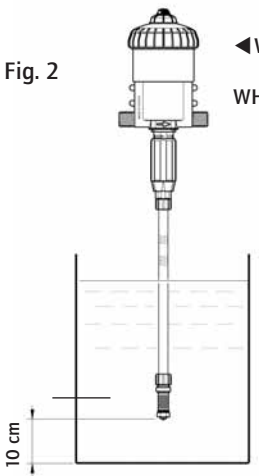
Fig. 2

ASSEMBLING THE DOSATRON (cont...)

The DOSATRON is delivered with a suction tube (cut it to the needed length) enabling its use with a large capacity concentrate container.
The tube must be fitted with its strainer and weights.
The instructions for fitting the tube are to be found in the specific chapter.
NOTE : The maximum suction height is 4 meters (13 vertical feet).
Fit the tube, equipped with its strainer and its weight, and immerse it in the solution to be injected.

IMPORTANT ! - Do not put the suction tube strainer on the bottom of the stock solution container. The strainer must be suspended at least 10 cm [4"] above the bottom of the tank to avoid sucking up the insoluble particles that may damage the injection assembly (Fig.2).
- Do not put the strainer on the ground.

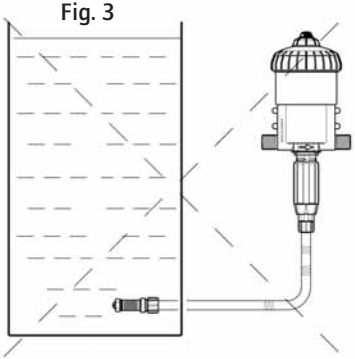
Fig. 2



◀WHAT YOU SHOULD DO

WHAT YOU MUST NOT DO▼

Fig. 3



Under no circumstance should the solution level be above the water inlet of the DOSATRON (to avoid siphoning situations).

INSTALLATION HINTS

The DOSATRON can be connected to the main water line **directly (Fig. 4)** ; on a **by-pass (Fig. 5)**, recommended.
If your flow rate is above the operating limits of the DOSATRON, see EXCESSIVE FLOW.

To prolong the working life of the DOSATRON it is advisable to install a filter (ex.: 300 mesh - 60 microns depending on your water quality) upstream.
This is imperative if the water contains impurities or particles, especially if the water comes from a well.

A filter is recommended and required for the warranty to be valid.

Installing the DOSATRON on a bypass enables clean water to be supplied without operating the DOSATRON and the DOSATRON to be easily dismantled.

When connecting an installation to the public water supply, you must respect the rules and regulations in force in the country.

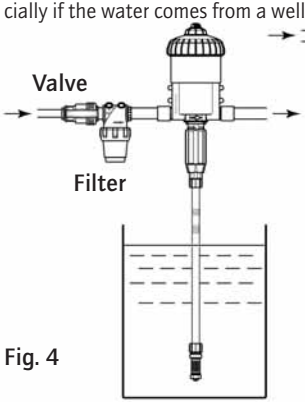


Fig. 4

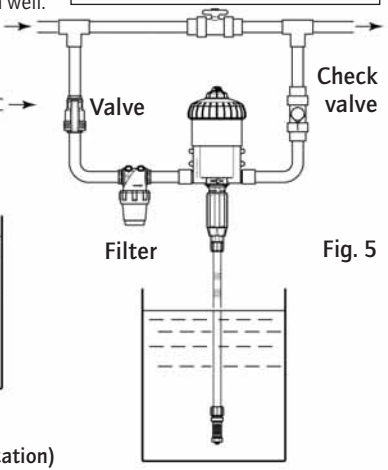
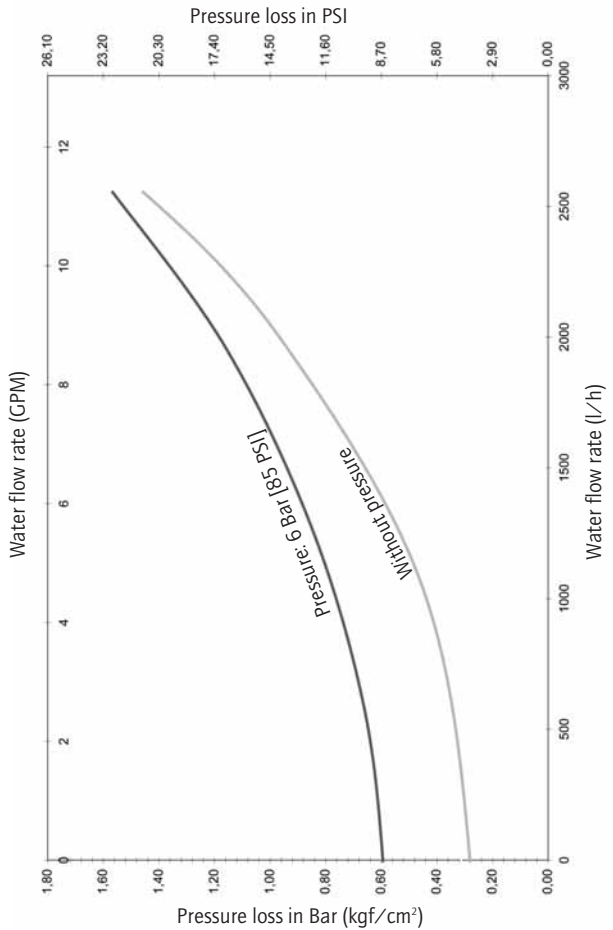


Fig. 5

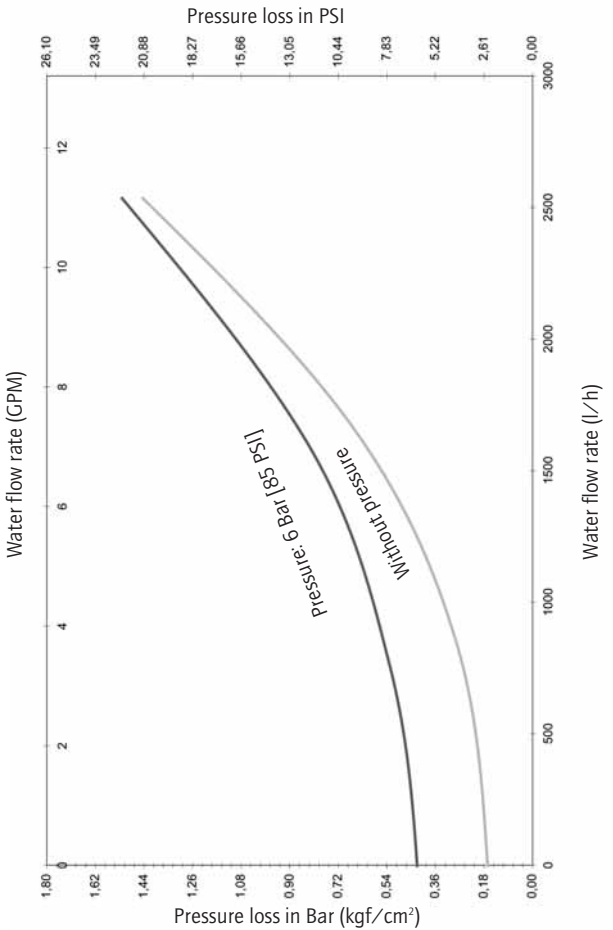
EXCESSIVE FLOW (as an indication)
If your DOSATRON clicks more than **40 times,** that is **20 cycles in 15 seconds***, you are close to the maximum flow limit. If you need more flow, you must install a DOSATRON with a higher capacity of flow.
*D 25 RE 10 = 30 times, 15 cycles

EN

PRESSURE LOSS CURVES D 25 F



PRESSURE LOSS CURVES D 25 RE 2



EN

Putting the Dosatron into order

USING FOR THE FIRST TIME

- Partially open the water inlet valve.
- Press the bleed button on the top of the DOSATRON **(Fig. 6)**.
- When a constant flow of water is seen coming from around the bleed button (no more "spitting" of air), release the button.
- Open the water inlet valve slowly, the DOSATRON is self-priming.
- Operate the DOSATRON until the product to be injected is drawn up into the doser body (the product is visible through the plastic tube).
- The DOSATRON makes a characteristic "click-clack" noise when working.

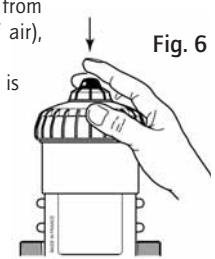
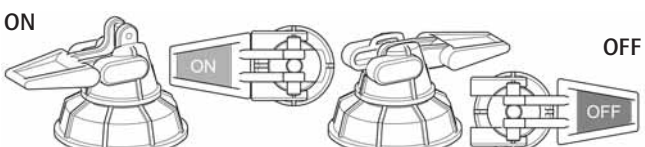


Fig. 6

NOTE: The time required to prime the suction tube depends on water flow-rate, ratio setting and length of the suction tube. To bleed air from the suction tube and accelerate priming, set injection rate at maximum. Once the DOSATRON is primed, adjust to the required injection rate (see § ADJUSTING THE INJECTION RATE).

The DOSATRON may be fitted in its upper part with the function by-pass (optional equipment) :
- By-pass in **ON**, the DOSATRON works and the concentrate is drawn up.
- By-pass in **OFF**, the DOSATRON is stopped and does not draw up the product.

ON **OFF**



Maintenance

RECOMMENDATIONS

1 - When using soluble products to be made up into solutions, we recommend the periodic dismantling of the entire dosing part (see : § CLEANING AND REFITTING THE SUCTION VALVE § CHANGING SEALS IN THE INJECTION ASSEMBLY). Thoroughly rinsing all the elements of the dosing part with water and re-assembling them after having previously lubricated the seal **(Fig. 7)** with a silicone lubricant, in the case of difficulty in re-fitting.

2 - Before putting the DOSATRON into operation after a non-use period, remove the motor piston and soak it into lukewarm water < 40° C [104°F] overnight. This helps to dissolve any deposits which may have dried onto the piston motor.

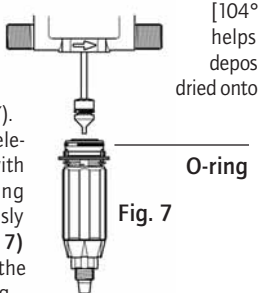


Fig. 7

HOW TO DRAIN THE DOSATRON
(in case of freezing temperature)

- Turn off the water supply.
- Remove the injection assembly, see § CHANGING THE MOTOR PISTON.
- Remove the screw-top and the motor piston.
- Disconnect the water inlet and outlet fittings.
- Remove the pump body from the mounting bracket, unscrew the screw-top and empty any remaining water.
- The DOSATRON can now be reassembled, having first cleaned the seal **(Fig. 8-N)**.

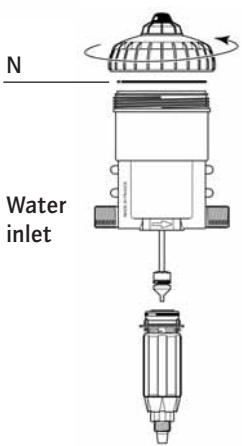


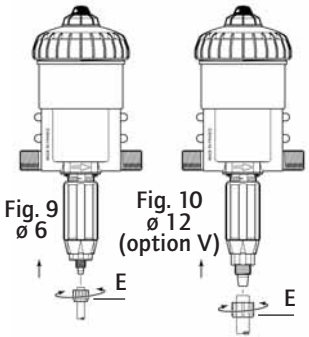
Fig. 8

FITTING THE SUCTION TUBE

If the DOSATRON has already been used, please **imperatively refer to: PRECAUTIONS.**

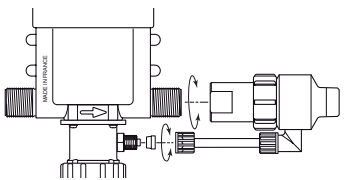
- Unscrew the nut **(Fig. 9-E)** at the bottom of the injection assembly and put it over the hose.
- Push the tube onto the dip tube insert **as far as it will go** and screw up the nut **by hand**.
- Identical process for viscous products option **(Fig. 10-E)**.

Model in the drawing: D 25 RE 2



CONNECTING THE EXTERNAL INJECTION (IE)

If the DOSATRON has already been used, please imperatively refer to chapter **PRECAUTIONS.**

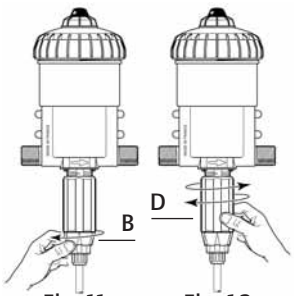


ADJUSTING THE INJECTION RATE (with pressure off)

IMPORTANT ! Use no tools
ADJUSTMENT MUST BE MADE WHEN THERE IS NO PRESSURE IN THE DOSATRON

- Turn off the water supply and allow the pressure to drop to zero.
- Unscrew the blocking ring **(Fig. 11-B)**.
- Screw or unscrew the adjusting sleeve **(Fig. 12-D)** so as to bring the top of the sleeve into line with the desired injection rate.
- Tighten the blocking ring **(Fig. 11-B).**

Model in the drawing: D 25 RE 2



INTERNATIONAL CONVERSIONS

Principle : Setting at 1% ⇒ 1/100 = 1 part of concentrate for 100 parts of water.

Ex. : Setting at 2% ⇒ 2/100 = 2 parts of concentrate for 100 parts of water.
Ratio ⇒ 1:50.

EN

CHANGING SEALS IN THE INJECTION ASSEMBLY (with pressure off)

Frequency : Once per year.

IMPORTANT ! Use no tool or metallic utensils

ADVICE: Before dismantling any part of the injection assembly it is advisable to operate the DOSATRON, injecting clean water so as to rinse through the injection system. In this way, risks of contact with concentrated solutions in the injection assembly are minimized.
During any such intervention, wear protective eyewear and gloves !

METHOD OF REMOVING SEAL

Fig. 13 : Between finger and thumb, pinch the component and the seal ; push towards one side to deform the seal.

Fig. 14 : Increase the deformation to grip the part of the seal thus exposed and pull it out of its groove.

Clean the seal seating without any tools.
Refitting is done by hand.
It is very important that the seal is not twisted once in place as this would impair its efficiency.

Fig. 13

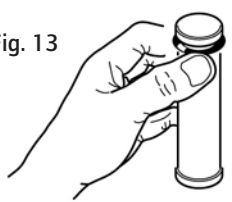


Fig. 14

CHANGING SEALS IN THE INJECTION ASSEMBLY (cont...)

CLEANING AND REFITTING THE SUCTION VALVE

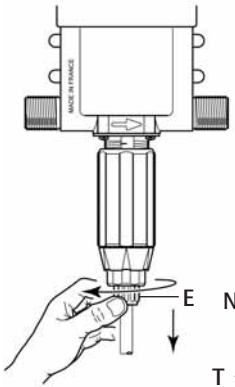


Fig. 15

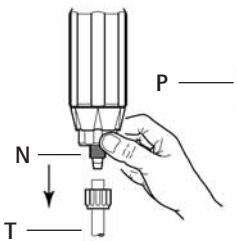


Fig. 16

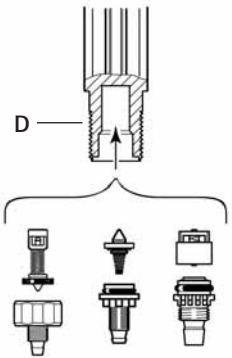


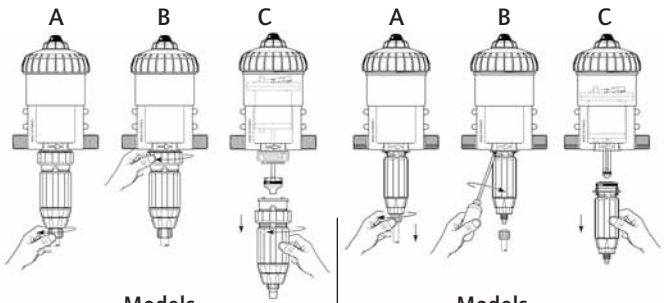
Fig. 17

- Turn off the water supply and allow the pressure to drop to zero.
- Unscrew the nut **(Fig. 15-E)** and pull downwards to remove the suction tube **(Fig. 16-T)**.
- Unscrew and remove the nut **(Fig. 16-N)**.
- Pull downwards to remove the suction valve assembly **(Fig. 17)**.
- Rinse copiously the different parts with clean water, re-assemble them **(Fig. 17)**.
- Put the valve back **(Fig. 17-P)** in the doser body **(Fig. 17-D)**, push it in the back.
- Check that the return spring is working.
- Re-assemble in the reverse order to the above **by hand**.

CHANGING THE MOTOR PISTON (with pressure off)

- Turn off the water supply and allow the pressure to drop to zero.
- Take off the suction tube of product **(Fig. 18 A)**.
- Unscrew the injection part by hand or by means of a long cruciform screwdriver, according to the dispenser type **(Fig. 18 A)**.
- Pull downwards to remove the dosing part **(Fig. 18 C)**.

Fig. 18



- Unscrew the screw-top by hand **(Fig. 19-C)** and remove it.
- Remove the motor piston **(Fig. 20-M)** by pulling it up.
- Change and reassemble in the reverse order to the above.
- Refit the screw-top (take care not to damage its seal) and tighten **by hand**.

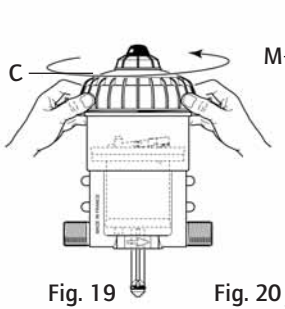


Fig. 19

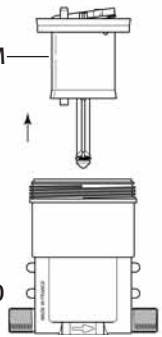


Fig. 20

CHANGING THE DOSING SEALS

- Change the seals, the suction valve and the barbed fitting.
- To do this, please refer to the drawings of the different models at the end of this manual
- **Change the seals once a year.**
- Turn off the water supply and allow the pressure to drop to zero.
- Take off the suction tube of product, remove the injection assembly as described in the previous chapter.
- Pull downwards to remove the injection assembly.
- Re-assemble in the reverse order to the above.

Reference Designation

REF:..... Serial #: .....

EXAMPLE	D 25...	IE	BP	V	AO	AF	P	ii

- Type of DOSATRON
- IE : External Injection
- BP : integrated by-pass
- V : Viscous Products (200-400 cSt)
- AO : Organic Acid
- Dosing Seals:
  AF = Advised for alkalines concentrates PH 7-14
  VF = Advised for acides concentrates PH 1-7
- Couleur : - = Blue
  P = White
  R = Red
  V = Green
  J = Yellow
  O = Orange
- Others extensions (consult us)

Troubleshooting

SYMPTOM	CAUSE	SOLUTION
Motor piston		
DOSATRON does not start or stops	Piston stalled	Reset piston, by hand
	Air has not been bled from unit	Bleed air from unit, by bleed button
	Maximum flow exceeded.	1. Reduce flow, restart unit 2. Unscrew the top cap. Take off the piston and check piston valves seals to ensure correct position
	Motor piston is damaged	Return unit to your service center for repair
Injection		
Water flowing back into concentrate container	Contaminated, worn, or missing check valve parts	Clean or replace it
No suction of concentrate	The piston motor has stopped	See **Motor piston** section
	Air leak (inlet) in the suction tube	Check the tightness between nut and suction hose
	Blocked suction tube or clogged strainer	Clean or replace it
	Missing or worn suction check valve seal	Clean or replace it
	Missing or worn plunger seal	Clean or replace it
	Worn injection stem	Replace it

EN

SYMPTOM	CAUSE	SOLUTION
Injection		
Under injection	Suction of air	1. Check the tightness of the nuts in the injection area 2. Check suction tube
	Dirty or worn check valve seal.	Clean or replace it.
	Maximum flow exceeded (cavitation)	Reduce flow
	Worn plunger seal	Replace it
	Worn injection stem	Replace it
Leaks		
Leaks in the vicinity of the fixing ring under the body housing	Injector sleeve seal is damaged or positioned incorrectly	Replace it
Leaks between the setting sleeve and the blocking ring	Injector stem seal damaged, positioned incorrectly or missing	Replace it
Leaks between the body and screw-top	Screw-top seal is damaged, positioned incorrectly or missing	Unscrew the screw-top, clean the seal seating, replace or change the seal. Position correctly the screw-top.

THE MANUFACTURER DECLINES ALL RESPONSIBILITY IF THE DOSATRON IS USED IN CONDITIONS THAT DO NOT CORRESPOND TO THE OPERATING INSTRUCTIONS AS INDICATED IN THIS MANUAL..

Limited warranty

DOSATRON INTERNATIONAL S.A. will provide for replacement of all parts shown to be defective in material or workmanship during a period of twelve months from the date of purchase by the original purchaser. To obtain warranty replacement of a part, the DOSATRON must be returned with original proof of purchase receipt to the manufacturer or authorized distributor and thereafter recognized as defective after examination by the technical services of the manufacturer or distributor.

The DOSATRON must be flushed of any chemical and sent to the manufacturer or distributor prepaid, but will be returned free of charge once repairs are made if found to be covered by the warranty.

Any repairs made under warranty will not extend the initial warranty period. This warranty only covers circumstances where the part has failed due to defects caused by the manufacturing process.

This warranty is invalid if the defects are found to be due to the product's misuse, inappropriate use of tools, lack of maintenance or defective installation or environmental accidents or corrosion by foreign bodies and liquids found within or in proximity to the DOSATRON.

Before using any aggressive chemicals, please consult your distributor to confirm compatibility with the dosing pump. The seals and "o-rings" are not covered under warranty, nor is damage to the DOSATRON caused by water impurities such as sand.

A filter (ex.: 300 mesh - 60 microns depending on your water quality) must be used in front of the DOSATRON for the warranty to be valid.

DOSATRON INTERNATIONAL S.A. declines any responsibility if the DOSATRON is not used in compliance with the operating instructions and tolerances as indicated in this owner's manual.

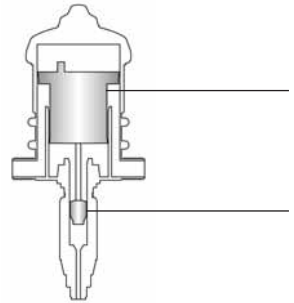
This warranty gives you specific legal rights and you may also have other rights which vary from state to state. But any implied warranty or merchantability or fitness for a particular purpose applicable to this product is limited in duration to the time period of this written warranty or any implied warranty.

The manufacturer or authorized distributor shall not be liable for incidental or consequential damage, such as any economic loss, resulting from breach of this written warranty or any implied warranty. There are no warranties, express or implied, which extend beyond those described above, relating in any way to products used in conjunction with DOSATRON INTERNATIONAL S.A. products.

Don't hesitate to call your distributor or Dosatron for any after sales service.

A SIMPLE METHOD

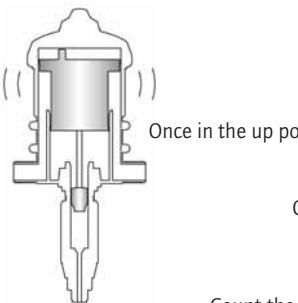
THE DOSATRON IS COMPOSED OF:



A driving volumetric hydraulic piston motor connected to:

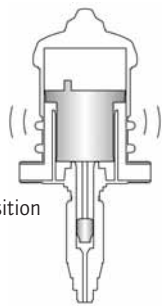
An injector plunger.

The speed of the motor is proportional to the flow of water passing through the system.
The greater the flow the faster it goes.
In its up and down movement, you can hear the piston motor "click" :



Once in the up position

Once in the down position



Count the number of clicks
in **90** seconds x 10 = **Flow of water in litres/hour**
[in **45** seconds ÷ 10 = **Flow of water in GPM**]

NOTE: This method of calculation cannot replace a flow meter.
It is given only as an approximate guide.

8.3 RETURNS

The Customer Service Department will issue a Return Authorization (RA) number for all returns. The following information will be required:

1. Billing and a ship-to address.
2. Model and serial number.
3. Contact name and phone number.
4. Reason for return.
5. Purchase order (where applicable).
6. RA number on outside of the carton.

All material must be returned freight prepaid. All merchandise must be properly packaged and free of any corrosive, toxic or otherwise hazardous chemical. All items returned must reference Return Authorization.

8.4 CREDITS

No equipment will be accepted beyond six months after date of shipment from the factory. Only unused and undamaged equipment will be accepted for return to stock. All credits are based on acceptance of materials as new and unused by our inspection personnel. A restocking fee will apply. All equipment returned for credit must have a RA number and be returned freight prepaid.

Electronic Metering Pumps

Series C, C PLUS, A PLUS, E, E-DC and E PLUS

Installation
Operation
Maintenance
Instruction

Bioremediation Pump
LB02SA-KTC1-500

READ ALL WARNINGS CAREFULLY BEFORE INSTALLING

TABLE OF CONTENTS

8.0 POLICIES AND PROCEDURES

8.1 MANUFACTURERS PRODUCT WARRANTY

The manufacturer warrants its equipment of its manufacture to be free of defects in material or workmanship Liability under this policy extends for eighteen (18) months from the date of purchase or one (1) year from date of installation or whichever comes first. The manufacturer's liability is limited to repair or replacement of any device or part, which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through use of its products.

The above warranty is in lieu of any other warranty, either expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to make any warranty other than the above.

For warranty and service matters within the European Union, contact the seller first or:

Fagotpad 2
3822 CN Amersfoort
The Netherlands

8.2 EUROPEAN TECHNICAL FILE LOCATION

P.O. Box 91
Washington
NE371YH
United Kingdom

7.0 TROUBLESHOOTING cont'd.

PROBLEM	PROBABLE CAUSE	REMEDY
PUMP LOSES PRIME	1. Dirty check valve.	1. Remove and replace or clean off any scale or sediment.
	2. Ball checks not seating or not sealing properly.	2. Check seat and ball checks for chips, clean gently. If deformity or deterioration is noted, replace part with proper material. Resulting crystals can hold check valves open, therefore, the valves must be disassembled and cleaned.
	3. Solution container allowed to run dry.	3. Refill the tank with solution and prime. See 5.0 (Start-Up and Operation Section).
	4. Chemical Outgassing.	4. Bleed gas, use flooded suction and maintain chemical at room temperature (approx. 20°F) to minimize outgassing.
PUMP WILL NOT PRIME	1. Too much pressure at discharge.	1. Turn off all pressure valves, relieve system pressure then loosen outlet tubing connection at discharge point. Remove discharge valve cartridge. Dampen ball check and valve seats with a few drops of solution. Set pump dial to maximum rate. When pump is primed, reconnect all tubing connectors.
	2. Check valves not sealing.	2. Disassemble, clean & check for deterioration, damage or swelling. Reassemble and wet the valve assembly, then prime. See 5.0 (Start-Up & Operting Section).
	3. Output dials not set at maximum.	3. Always prime pump with output dial set at maximum rated capacity.
	4. Suction lift height too much. Maximum 5 ft (1.5 m)	4. Decrease suction lift or pull vacuum on pump discharge until pump is primed.
	5. Pump equipped with spring loaded high viscosity valves.	5. Loosen discharge valve to aid in priming, take necessary safety precautions for spills, or apply vacuum to pump discharge.

1.0 SAFETY INSTRUCTIONS

WARNING

When using chemical feed pumps, basic safety precautions should always be followed to reduce risk of fire, electric shock, and personal injury. Failure to follow these instructions could result in death or serious injury.

READ ALL INSTRUCTIONS

1.1 GENERAL SAFETY CONSIDERATIONS

- Always wear protective clothing including gloves and safety goggles when working on or near chemical metering pumps.
- Inspect tubing regularly when replenishing chemical solution for cracking or deterioration and replace as necessary. **(Always wear protective clothing and safety glasses when inspecting tubing.)**
- When pump is exposed to direct sunlight use U.V. resistant tubing.
- Follow directions and warnings provided with the chemicals from the chemical manufacturer. User is responsible for determining chemical compatibility with chemical feed pump.
- Secure chemicals and metering pumps, making them inaccessible to children and pets.
- Make sure the voltage on the chemical metering pump matches the voltage at the installation site.
- Do not cut plug or the ground lug off of the electrical cord – consult a licensed electrician for proper installation.
- Pump is **NOT** to be used to handle flammable liquids.

1.2 SAFETY OPERATING PROCEDURES

Each Electronic Metering Pump has been tested to meet prescribed specifications and safety standards.

Proper care in handling, installation and operation will help in ensuring a trouble free installation.

Please read all these cautionary notes prior to installation and start-up of your metering pump.

Important: Pump must be installed and used with supplied back pressure/injection valve. Failure to do so could result in excessive pump output.

- Handle the pump with care. Dropping or heavy impact causes not only external damage to the pump, but also to electrical parts inside.

- Install the pump in a place where the ambient temperature does not exceed 104°F (40°C). The pump is water resistant and dust proof by construction and can be use outdoors, however **do not operate the pump submerged.** To avoid high internal pump temperatures, do not operate in direct sunlight.

  ⚠CAUTION Solenoid housing, head and pump housing may be hot to touch 160°F(70°C).

- Install the pump in a place convenient for its future maintenance and inspection, and then secure it to prevent vibration.

- Protective caps must be removed prior to installing tubing onto valve assemblies. Use tubing of specified size. Connect the tubing to the suction side securely to prevent the entrance of outside air. Make sure that there is no liquid leakage on the discharge side.

- Be careful to check that the voltage of the installation matches voltage indicated on the pump data label. Most pump models are equipped with a three-prong plug. Always be sure the pump is grounded. To disconnect, do not pull wire but grip the plug with fingers and pull out. Do not use the receptacle in common with heavy electrical equipment, which generates surge voltage. It can cause failure of the electronic circuit inside the pump.

- Tampering with electrical devices can be potentially hazardous. Always place chemicals and pump installation well out of the reach of children.

- Never repair or move the metering pump while operating. Always disconnect electrical power. **For safety, always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps.**

- An air bleed valve is available for most models with tubing connections. Air purges should be performed when the pump-chamber contains no fluid at the time of start-up. As a safety measure, connect the return tubing to the air bleed valve and bypass fluid back to storage tank or a suitable drain.

- For accurate volume output, the pump must be calibrated under typical operating conditions.

7.0 TROUBLESHOOTING cont'd.

PROBLEM	PROBABLE CAUSE	REMEDY
LOSS OF CHEMICAL RESIDUAL	1. Pump setting too low.	1. Adjust to higher setting (pump must be operting to adjust stroke length knob).
	2. Scale at injection point.	2. Clean injection parts with 8% muriatic acid or undiluted vinegar. (Also, see Maintenance Section).
	3. Solution container allowed to run dry	3. Refill the tank with solution and prime. (See Start-up and Operation Section).
TOO MUCH CHEMICAL	1. Pump setting too high.	1. Lower pump setting (pump must be operting to adjust stroke length knob).
	2. Chemical in solution tank too rich.	2. Dilute chemical solution. NOTE: For chemical that reacts with water, it may be necessary to purchase a more dilute grade of chemical direct from chemical supplier.
	3. Siphoning of chemical into well or main line.	3. Test for suction or vacuum at the injection point. If suction exists, install an anti-siphon valve.
LEAKAGE AT TUBING CONNECTIONS	1. Worn tube ends.	1. Cut off end of tubing (about 1 in/2.5 cm) and then reconnect as before.
	2. Chemical attack.	2. Consult your seller for alternate material.
LEAKAGE AT FITTING	1. Loose fittings.	1. Tighten hand tight. Replace gasket if hand tightening does not stop leakage.
	2. Broken or twisted gasket.	2. Check gaskets and replace if broken or damaged.
	3. Chemical attack.	3. Consult your pump supplier for alternate material.

7.0 TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
FAILURE TO PUMP	1. Leak in suction side of pump.	1. Examine suction tubing. If worn at the end , cut approximately one inch (2.5 cm) off and reconnect.
	2. Valve seats not sealing.	2. Clean valve seats if dirty or replace with alternate material if deterioration is noted.
	3. Low setting on pump.	3. When pumping against pressure, the dial should be set above 20% capacity for a reliable feed rate.
	4. Low suction level.	4. Solution must be above foot valve strainer.
	5. Diaphragm ruptured.	5. Replace diaphragm as shown in 6.0 "Maintenance Section". Check for pressure above rated maximum at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head.
	6. Pump head cracked or broken.	6. Replace pump head as shown in 6.0 "Maintenance Section". Make sure fittings are hand tight only. Using pliers and wrench can crack pump head. Also, chemical incompatibility can cause cracking and subsequent leakage.
	7. Pump head contains air or chlorine gas.	7. Bleed pump head, see 5.0 "Start-up and Operation".
	8. Breakdown or disconnection of wiring.	8. Connect wiring properly. Check fuse or circuit breaker.
	9. Voltage drop.	9. Take measures after investigation of cause.
	10. Malfunction of electronic control board.	10. Contact supplier.

- Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children and others. We cannot be responsible for the misuse of chemicals being fed by the pump. Always have the material safety data sheet (MSDS) available for any fluid being pumped.

- All pumps are pretested with water before shipment. Remove head and dry thoroughly if you are pumping a material that will react with water, (i.e. sulfuric acid, polymers). Valve seats, ball checks, gaskets, and diaphragm should also be dried. Before placing pump into service, extreme care should be taken to follow this procedure.

- Valve cartridges are stamped to indicate fluid flow direction. Always install so that markings read from top to bottom, with the arrow pointing in the direction of flow.

- When metering hazardous material **DO NOT** use plastic tubing, strictly use proper rigid pipe. Consult supplier for special adapters or valve assemblies.

- **Pump is NOT to be used to handle or meter flammable liquids or materials.**

- Standard white discharge tubing is not recommended for installations exposed to direct sunlight. Consult supplier for special black tubing.

- Factory will not be held responsible for improper installation of pump, or plumbing. All cautions are to be read thoroughly prior to hookup and plumbing. For all installations a professional plumber should be consulted. Always adhere to local plumbing codes and requirements.

- When using pump with pressurized systems, make sure the pressure of the system does not exceed the maximum pressure rating on the pump data label. Be sure to depressurize system prior to hook up or disconnecting a metering pump.

- Electronic power modules are equipped with automatic reset thermal overload devices and may reset unexpectedly.

2.0 UNPACKING THE PUMP

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages or damages should be reported immediately to the carrier and to the seller of the equipment.

The carton should Contain:

- -Metering Pump
- -Clear Flexible Suction Tubing*
- -Stiff White Discharge Tubing*
- -Foot valve/Strainer Assembly
- -Backpressure Injection Valve Assembly
- -Manual
- -Bleed Valve Assembly*
- -Strainer Weight*

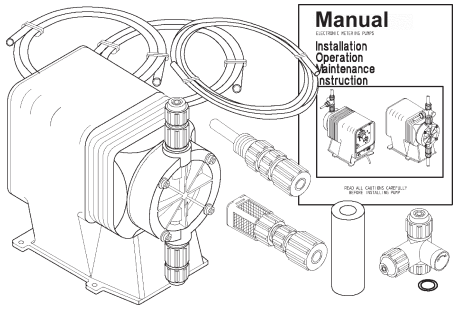


FIGURE 1

*Items may or may not be included depending on model.

Make sure that all items have been removed from the shipping carton before it is discarded.

3.0 INTRODUCTION

These installation, operation and maintenance instructions cover your electronic metering pump. Refer to the pump data label to determine the actual model.

3.1 PRINCIPLE OF OPERATION

Diaphragm metering pumps are used to dispense chemicals or fluids. This is achieved by an electromagnetic drive mechanism (solenoid), which is connected to a diaphragm. When the solenoid is pulsed by the control circuit it displaces the diaphragm, which, through the use of check valves, moves the fluid out the discharge under pressure. When the solenoid is de-energized it returns the diaphragm and pulls more fluid into the pump head and the cycle repeats.

The pump stroke rate is controlled by an internal circuit and is changed by turning the rate knob. The mechanical stroke length is controlled by the stroke length knob. Some models do not allow stroke rate control and do not have the stroke rate knob.

3.2 MATERIALS OF CONSTRUCTION

The wetted materials (those parts that contact the solution being pumped) available for construction are FPP (glass filled polypropylene), PVC, SAN, Hypalon, Viton, PTFE or FTF, 316 Stainless Steel, PVDF, Ceramic and Alloy C. These materials are very resistant to most chemicals. However, there are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as the diaphragm, valve seats, or head.

6.3 DIAPHRAGM REPLACEMENT cont'd.

- Apply grease to areas of the diaphragm that contact the deflection plate.
- Slide the diaphragm deflection plate onto the back of the diaphragm stud, radius side towards the diaphragm. Next slide two shims onto the diaphragm threaded stud and screw the diaphragm into the EPM unit. Refer to Figure 14. Turn diaphragm clockwise until deflection plate and shims are tight against solenoid shaft and the diaphragm stops turning. If there is a gap between the adaptor and diaphragm, repeat the procedure removing one shim each time until the diaphragm just touches the adaptor or is slightly recessed.
- If not already done, adjust stroke length to 50%. Place the pump head onto the adaptor with valve flow arrows pointing up and install and tighten pump head screws. Tighten screws until pump head pulls up against adaptor.

  NOTE: Adjust stroke length only when pump is running!
- Adjust stroke length back to 100% for easier priming and place pump back into service.

6.4 VALVE REPLACEMENT

- Flush pump to clean any chemical from pump head.
- Unplug pump, release system pressure, and disconnect tubing or piping.
- Unscrew valve cartridges and discard. Also remove o-rings down inside the pump head.
- Install new valve cartridges with stamped letters reading from top to bottom, and the arrow pointing in the direction of flow. Hand tighten only, do not use wrenches or pliers. This is especially important when the pump head is made of SAN material.
- Reconnect tubing or piping and reinstall the pump.
- Check for leaks around newly installed fittings.

- If the pump has been out of service for a month or longer, clear the pump head valve assemblies by pumping fresh water for approximately 30 minutes. If the pump does not operate normally after this "purging run", replace cartridge valve assemblies.

6.2 DISASSEMBLY AND ASSEMBLY DIAPHRAGM REMOVAL

Flush pump head and valve assemblies out by running pump with water or other suitable neutralizing solution. Wash outside of pump if chemical has dripped on pump. Set stroke length knob of pump to 0% and unplug pump.

Depressurize the system and disconnect tubing or piping from the pump. Remove the four pump head screws and then remove the pump head assembly.

Remove the diaphragm by grasping it at the outer edge and turning it counter clockwise until it unscrews from the electronic power module (EPM). Don't lose the deflector plate or diaphragm shims which are behind the diaphragm, they are needed for re-assembly. Note shim quantity may be from 0 to 2.

Inspect diaphragm, if it is intended to be used again look for indications of the PTFE face being overstretched, (localized white areas) or the elastomer on the back of the diaphragm being worn. Excessive amounts of either condition require diaphragm replacement.

6.3 DIAPHRAGM REPLACEMENT

- When replacing the diaphragm, it is always a good idea to replace the valve cartridges and other worn parts. A kit is available from your supplier with all parts necessary to completely rebuild your pump's wet end. All your supplier needs to know is the "KOPkit No." on your pump's data label to supply this kit.

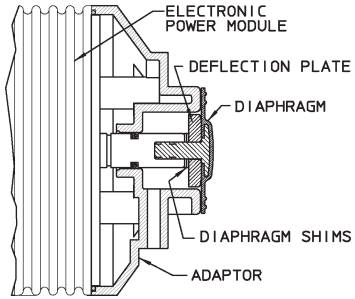


FIGURE 14

- Set pump stroke length at 50% and unplug the pump.

- If you kept the shims from the original diaphragm or know the original quantity you can avoid the next step for shimming the diaphragm.

3.2 MATERIALS OF CONSTRUCTION cont'd.

Consult a Chemical Resistance Guide or Supplier for information on chemical compatibility.

Various manufacturers of plastics, elastomers and pumping equipment publish guidelines that aid in the selection of wetted materials for pumping commercially available chemicals and chemical compounds. Two factors must always be considered when using an elastomer or plastic part to pump chemicals. They are:

- The temperature of service: Higher temperatures increase the effect of chemicals on wetted materials. The increase varies with the material and the chemical being used. A material quite stable at room temperature might be affected at higher temperatures.

- Material choice: Materials with similar properties may differ greatly from one another in performance when exposed to certain chemicals.

4.0 INSTALLATION

The metering pump should be located in an area that allows convenient connections to both the chemical storage tank and the point of injection. The pump is water resistant and dust proof by construction and can be used outdoors, however, **do not operate submerged.** Avoid continuous temperatures in excess of 104°F (40°C). To do otherwise could result in damage to the pump.

4.1 MOUNTING

Typical mounting arrangements are shown in Figures 3, 4, and 5.

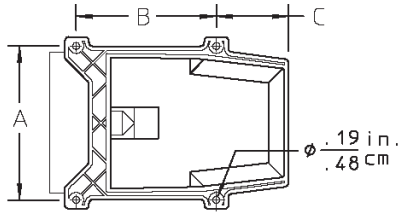
Important: Injection point must be higher than the top of the solution supply tank to prohibit gravity feeding, unless suitable backpressure is always present at the injection point. Installation of an antisiphon valve will prohibit gravity feeding.

- For wall or shelf mounting refer to Figure 3. Connect suction tubing to suction valve of chemical pump. Suction valve is the lower valve. Tubing should be long enough so that the foot valve/strainer assembly hangs about 1-2 inches (2-5 cm) above the bottom of chemical tank. To keep chemical from being contaminated, the tank should have a cover.

- Flooded suction mounting (installing the pump at the base of the chemical storage tank, Figure 4) is the most trouble free type of installation and is recommended for very low output requirements. Since the suction tubing is filled with chemical, priming is accomplished quickly and the chance of losing prime is reduced.

To mount pump, drill four holes of .25" (6 mm) diameter in the shelf as shown in the dimension drawing (Figure 2). Attach pump securely using four #10 (M5) bolts and nuts.

- The pump can be mounted on top of a solution tank as shown in Figure 5. Install chemical pump on the cover. Insert suction tubing through the center hole and cut tubing so foot valve/strainer hangs about 1 or 2 inches (2-5 cm) above the bottom of the tank. Mount the chemical pump rigidly by drilling four .25" (6 mm) holes and using four #10 (M5) screws and nuts.



MOUNTING HOLE DIMENSIONS

HOUSING SIZE	DIMENSIONS (in./cm.) A	B	C
HSG.#1	4.50/11.4	3.00/ 7.6	1.75/4.4
HSG.#2	4.81/12.2	4.38/11.1	2.19/5.6
HSG.#3	5.56/14.1	4.38/11.1	2.19/5.6

FIGURE 2

- USE AN ANTI-SIPHON VALVE IN THE DISCHARGE LINE whenever the fluid pressure in the discharge line is below atmospheric pressure. This can occur if the injection point is on the suction side of a water pump or against a "negative" head such as when feeding down into a well.

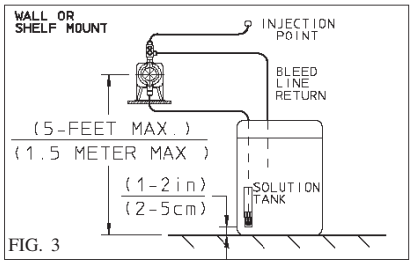


FIG. 3

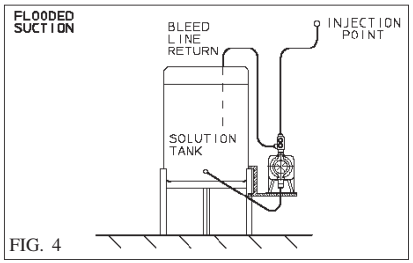


FIG. 4

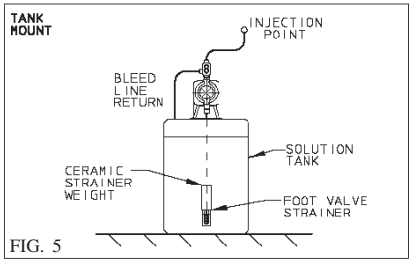


FIG. 5

5.5.3 4-20mA DC INPUT FUNCTION cont'd.

- The signal cord polarity is:
  Black = Common
  White = Positive
  Wrong polarity can result in excess flow.

- Signal input impedance is 124 ohms.

- Remove cap from pump socket labeled 4-20 mA, use polarized cord supplied with pump to connect control circuit to pump. Plug cord into pump socket labeled 4-20 mA.

6.0 MAINTENANCE

⚠CAUTION **Before performing any maintenance or repairs on chemical metering pumps, be sure to disconnect all electrical connections, insure that all pressure valves are shut off and pressure in the pump and lines has been bled off.**

Always wear protective clothing, gloves and safety glasses when performing any maintenance or repairs on chemical metering pumps.

6.1 ROUTINE MAINTENANCE

- Routinely check the physical operating condition of the pump. Look for the presence of any abnormal noise, excessive vibration, low flow and pressure output or high temperatures [when running constantly at maximum stroke rate, the pump housing temperature can be up to 160°F (70°C)].

- For optimum performance, cartridge valves should be changed every 6-12 months. Depending on the application, more frequent changes may be required. Actual operating experience is the best guide in this situation.

- Repeated short-term deterioration of valve seats and balls usually indicates a need to review the suitability of wetted materials selected for the application. Contact the supplier for guidance.

- Check for leaks around fitting or as a result of deteriorating tubing e.g. when standard white translucent discharge tubing is exposed to direct sunlight. Take appropriate action to correct leak by tightening fittings or replacing components.

- Keep the pump free of dirt and debris as this provides insulation and can lead to excessive pump temperatures.

- When the "ON" signal pulse is input, the pump operates one stroke and the fluid is discharged. In addition, the pump can be operated continuously at a rate of up to 125 strokes/min. by repeated input of "ON" and "OFF" signals.
- After receiving an input signal, the pump generates the necessary power pulse to actuate the solenoid. The external signal input is debounced by the pump circuit. The pump will not stroke in response to a spurious or erratic input signal that follows at a rate greater than 125 spm. If the external signal rate exceeds 125 spm, the pump will stroke at half the external signal rate to prevent overdosing and to protect the pump from overheating.
- The input signal must be in the form of closure of a mechanical relay, other mechanical switching device, or of a solid-state switching device. Voltage signals are prohibited. The switching resistance of either mechanical or solid-state devices must be 100 ohms or below when ON and 1 megohm or above when OFF. If any type of solid-state device is employed, it must be installed with proper polarity, if required for the device; and leakage current must not exceed 200 microamperes to prevent false triggering in the OFF state.
- Cycle rate of the input signal should not exceed 125 times per minute.
- Typical wiring is shown at right for use with switch closure flowmeters. (Figure 12)
- 10 millisecond contact time required for each "ON" input signal.

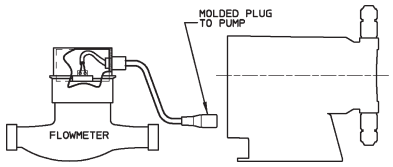


FIGURE 12

5.5.3 4-20mA DC INPUT FUNCTION (E Plus only)

The pump's stroke rate can also be controlled by a 4-20 mA DC signal to the terminal marked [4-20 mA].

- For the 4-20 mA input to have any effect on the pump output rate, the AUTO/OFF/MANUAL switch must be in the AUTO position.
- The 4-20 mA input signal affects the pump's outputs as per the graph below:

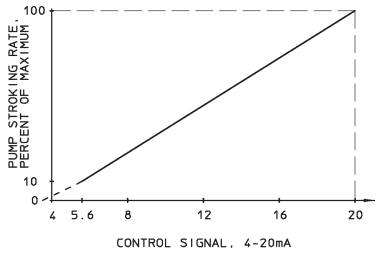


FIGURE 13

4.2 PIPING

- Use provided tubing of specified size for connection. Connect tubing securely to prevent leakage of chemical and the entrance of air. Since plastic nuts are used for fittings, they should not be tightened excessively (i.e. hand tighten only). NPT suction and discharge valves must **NOT** be over tightened. Hold fitting in place while adding piping and fittings. NPT suction and discharge valves should only be tightened 25 to 35 in. lbs. (4.5-6.3 kg/cm).
- If the air bleed valve assembly is being used, a return line (tubing) should be securely connected and routed back to the storage tank. **To avoid possible injury from chemicals do not attempt to prime using a bleed valve without installing a return line.**
- When pump is shelf mounted or top mounted on tank, suction tubing should be kept as short as possible.
- To maintain metering performance, a backpressure/injection valve is provided. The spring in the standard injection valve typically adds 17 - 20 PSI (1.17 - 1.38 BAR) to the line pressure, with the exception of the H8 pump, which adds 8 - 10 PSI (.55 - .69 BAR). The injection valve must be installed in the discharge line. Best practice is to install the injection valve at the point of chemical injection.
- If the discharge tubing is going to be exposed to direct sunlight, black tubing should be used instead of the standard white translucent tubing supplied with each pump. To obtain, contact supplier.
- To prevent clogging or check valve malfunction always install a strainer assembly to the end of the suction tubing (Figure 5). This foot valve/strainer assembly should always be installed 1 to 2 inches (2-5 cm) above the bottom of the chemical tank. This will help prevent clogging the strainer with any solids that may settle on the tank bottom. The chemical tank and foot valve/strainer should be cleaned regularly, to ensure continuous trouble free operation. If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (e.g. calcium hydroxide), a mixer should be used in the chemical tank. These are readily available in many motor configurations and mounting. To obtain, contact supplier.
- A flooded suction (tank liquid level always at a higher elevation than the pump) is recommended when pumping solutions such as sodium hypochlorite (NaOCl), hydrogen peroxide (H_2O_2), etc., which are likely to produce air bubbles. Maintaining a low liquid temperature will also help eliminate this problem.
- Pipe corrosion can result if dilution at the injection point does not occur rapidly. This problem is easily prevented by observing this simple rule: install injection fitting so that the end is in the center of the flow stream of the line being treated. Trim injector tip as required. See Figure 6. Note: Extended injection assemblies are available for large water lines. Consult your supplier for more information.

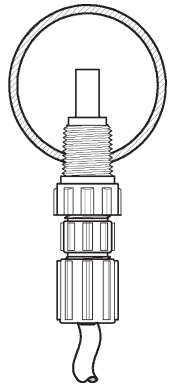


FIGURE 6

4.3 WIRING

- **⚠ WARNING—Risk of electrical shock. This pump is supplied with a three-prong grounding type power plug. To reduce risk of electric shock, connect only to a properly grounded, grounding type receptacle.**

- The metering pump should be wired to an electrical source, which conforms to those on the pump data label. Applying higher voltage than the pump is rated for will damage the internal circuit.

- In the electronic circuit of the control unit, measures for surge voltage are made by means of surge absorbing elements and high voltage semiconductors. Nevertheless, excessive surge voltage may cause failure in some areas. Therefore, the receptacle should not be used in common with heavy electrical equipment, which generates high voltage. If this is unavoidable however, measures should be taken by (a) the installation of a surge-absorbing element (varistor of min. surge resistance 2000A) to the power supply connection of the pump, or (b) the installation of a noise suppression transformer.

- Signal input to the external pulse signal input terminals ([EXTERNAL], [STOP]) must be a no-voltage signal from relay-contacts etc. and the input of other signals is prohibited. (In the case of relay contacts, 100 ohms or below when ON and 1-meg ohms or above when OFF). The pulse duration of the input signal must be 10 milliseconds or over and the frequency of the input signal must not exceed 125 times per minute. Signal cord is provided with the pump.

4.4 WELL PUMP SYSTEM INSTALLATION

Ensure that the metering pump voltage matches the voltage of the well pump. Typical well pump electrical circuits are shown in Figure 8. All electric wiring should be installed in accordance to local codes by a licensed electrician.

Install the backpressure/injection (Figure 7) on the discharge side of the metering pump into a tee which is installed into the water line going to the pressure tank.

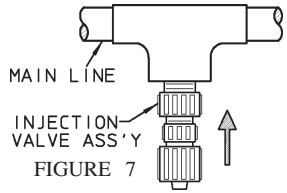


FIGURE 7

Pumps carrying the or "ETL Sanitation" (tested to NSF Standard-50) marks are listed for swimming pools, spas and hot tubs, and when proper materials are selected, are capable of handling but not linited to the following chemical solutions:

12% ALUMINUM SULPHATE,	5% SODIUM CARBONATE,
2% CALCIUM HYPOCHLORITE,	10% SODIUM HYDROXIDE,
12.5% SODIUM HYPOCHLORITE,	10% HYDROCHLORIC ACID

5.5 OPERATION BY EXTERNAL INPUT SIGNALS (Options):

The pump can be controlled by three types of input signals. All are fully isolated from AC input and from earth ground. The input socket connections are located at the bottom of the control panel face and the signal cords are provided with the pump. Remove rubber plugs to access plug sockets.

5.5.1 STOP FUNCTION (E Plus, A Plus, C Plus & C only)

Operation of the pump can be stopped by an external signal input. When the external signal is input to the terminal marked Ⓢ which is provided at the bottom of the control panel, the Ⓢ lamp (red) lights up and operation of the pump is stopped. The stop function overrides both manual settings and external input.

⚠ CAUTION Operation of more than one pump from the same contact closure will damage the pump circuits. When such operation is required, the pump circuits must be electrically isolated from one another by means of a multicontact control relay or similar means.

- The input signal must be in the form of closure of a mechanical relay or other mechanical switching device, or solid-state relay or other solid-state switching device. Voltage signals are prohibited. The switching resistance of either mechanical or solid-state devices must be 100 ohms or below when ON and 1 megohm or above when OFF. If any type of solid-state device is employed, it must be installed with the proper polarity, if required for the device; and leakage current must not exceed 200 microamperes to prevent false triggering in the OFF state.

The stop function is commonly used in conjunction with a tank float switch. The float switch contacts are normally open but when the tank level falls past a certain point the contacts close and the pump stops.

5.5.2 EXTERNAL PACING FUNCTION (E Plus, A Plus, C Plus & C only)

The pump's stroke rate can be controlled by an external signal input. When the input signal line is connected and the EXTERNAL /OFF /MANUAL switch is in the external position and a contact signal is input to the terminal marked ⏎, the pump makes one discharge stroke.

⚠ CAUTION Operation of more than one pump from the same contact closure will damage the pump circuits. When such operation is required, the pump circuits must be electrically isolated from one another by means of a multicontact control relay or similar means.

5.3.3 Controlling Procedure cont'd.

Example	Selected Model	=	LPD4
	Set Stroke Length	=	100%
	Set Stroke Rate	=	100%
	Output Capacity (Rated Pressure)	=	21 gallons per day (GPD)*
	Desired Flow	=	15 GPD
	Adjust Stroke Rate to 80%		
	Output Capacity	=	0.80 x 21 = 16.8 GPD*
	Stroke Length Setting	=	15 / 16.8 x 100 = 90% approximate

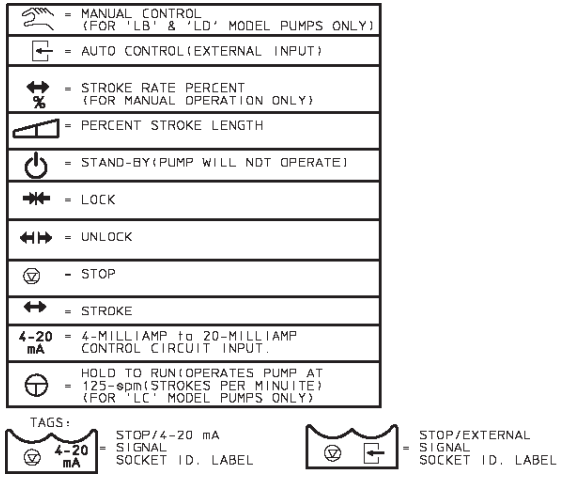
Thus to obtain the desired flow, stroke length is set at 90% and stroke rate is set at 80% i.e. output capacity = 0.90 x 0.80 x 21 = 15.12 GPD*

***IMPORTANT!**

Check these values by measurement. Output capacity is higher when feeding against less than rated pressure

5.4 CONTROL PANEL SYMBOLS

The pumps come with universally accepted symbols, the following is provided for your convenience.



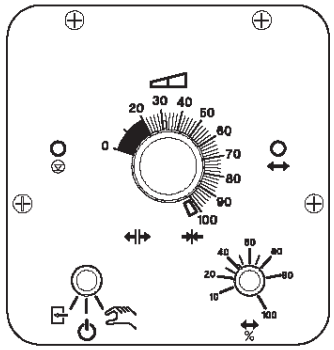


FIGURE 11

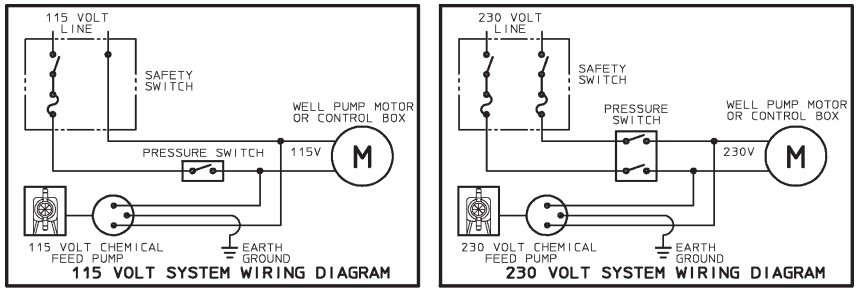


FIGURE 8

5.0 START UP AND OPERATION

5.1 POWER

All metering pumps are available in 115 and 230 volts at 50/60 Hertz, single phase. In addition, certain models are available in 12 volt DC. Prior to start-up always check to insure that the pump voltage/frequency/phase matches that of the power supply.

CAUTION If pump is fitted with a PVC pump head (7th position of model number is "V" or "W". Note: PVC is gray, not black), uniformly hand tighten the four head screws before use, 18-22 in. lbs. (3.2 -3.9 kg/cm). Periodically tighten after installation.

5.2 PRIMING

CAUTION **When working on or around a chemical metering pump installation, protective clothing and gloves and safety glasses should be worn at all times.**

All pumps are tested with water. If the chemical to be pumped reacts when mixed with water (e.g. sulfuric acid, polymer) the pump head should be removed and dried thoroughly along with the diaphragm and valve seats.

- Turn on the power to the pump. The green LED (not available on all models) will light up and flash off each time the pump strokes.

- Adjust the stroke rate knob to the 100% setting mark (for more information see Section 5.3, Capacity Control).

- Adjust the stroke length knob to the 100% setting mark if applicable (for more information see Section 5.3, Capacity Controls).

- If the discharge line is connected directly to a pressurized system it should be temporarily bypassed during priming of the pump. A bleed valve will simplify this operation by allowing easy bypass of the discharge fluid. Air must be purged from the pumphead before the pump will operate against pressure. (See Figure 9)

  Air Bleed Operation:
  - While pump is running, turn adjustment knob counterclockwise.
  - Run with valve open until a solid stream of fluid comes out of the bypass tubing with no air bubbles.
  - Close air bleed valve by turning adjustment screw clockwise.

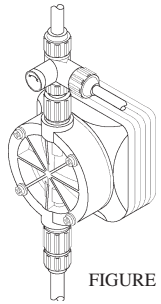


FIGURE 9

- Chemical should reach the pump head after a few minutes of operation. If not, remove the discharge fitting and moisten the discharge valve area (ball check and valve seats) with a few drops of ***chemical being fed to the metering pump.*** For safety, always use protective clothing and gloves, wear safety glasses and use a proper container to hold the chemical.

- If the pump continues not to prime, refer to Section 7.0, Troubleshooting, of these instructions.

- Once the pump has been primed and is pumping the chemical through the head, turn off the power, reconnect the discharge tubing (if it had been removed) and immediately clean any spilled chemical that is on the pump housing or head.

- Turn the power on once more and adjust the pump flow to the desired rate (see Section 5.3.3, Controlling Procedure).

- Always check the calibration of the pump after start-up. It's best to calibrate the pump under your typical use conditions.

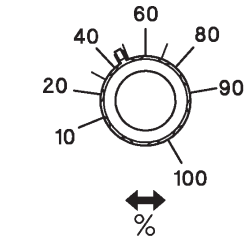
5.3 CAPACITY CONTROL

Capacity can be controlled by means of the stroke length adjusting knob and/or stroke rate adjusting knob (except model C pumps). Control knobs provide coarse adjustment; use a calibration column for accurate calibration. Contact your pump supplier for proper calibration equipment.

5.3.1 Stroke Frequency Adjustment (E, E-DC, E Plus, A Plus & C Plus only)

- Stroke frequency can be controlled from 10 to 100% (12 to 125 strokes per minute) by means of the electronic circuit.

- Stroke frequency can be set by means of the stroke rate adjusting knob even while the pump is in operation. (See Figure 10)



5.3.2 Stroke Length Adjustment

- Stroke length can be controlled within 0 to 100% of the diaphragm displacement. It should be controlled within 20 to 100% for practical use.

- Stroke length can be set by means of the stroke length adjusting knob while the pump is in operation. **Do not turn the knob while the pump is stopped.**

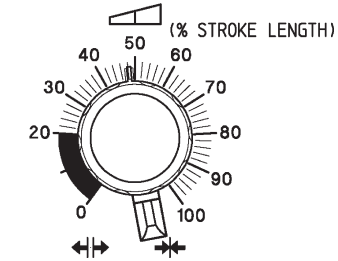


FIGURE 10

5.3.3 Controlling Procedure

Proper set points for stoke length and stroke frequency should be determined after consideration of the pump and characteristics of the fluid. The following procedure is recommended from the viewpoint of pump performance. **Note: The closer the stroke length is to 100%, the better the pump performance will be.**

- Set the stroke length to 100% then adjust the stroke frequency for coarse capacity control.
- Measure the capacity.
- When the measured capacity is less than the required value, increase the stroke frequency and measure the capacity again.
- Then, adjust the stroke length for fine capacity control.
- Finally, measure the capacity and make sure that the required value is obtained.

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Speedaire® Portable Air Compressors

For Warranty & Service call 1-888-606-5587
Do Not Return To Branch

Description

Air compressor units are intended to provide compressed air to power pneumatic tools and to operate spray guns. The pumps supplied are oil lubricated. A small amount of oil carryover is present in the compressed air stream. Applications requiring air free of oil or water should have the appropriate filter installed. The air compressor unit must be mounted on a solid floor or solid ground. Any other use of these units will void the warranty and the manufacturer will not be responsible for problems or damages resulting from such misuse.

Unpacking

After unpacking the unit, inspect carefully for any damage that may have occurred during transit. Make sure to tighten fittings, bolts, etc., before putting unit into service.

⚠CAUTION ***Do not operate unit if damaged during shipping, handling or use. Damage may result in bursting and cause injury or property damage.***

General Safety Information

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols.

⚠DANGER ***Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.***

⚠WARNING ***Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.***

⚠CAUTION ***Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.***

NOTICE ***Notice indicates important information, that if not followed, may cause damage to equipment.***

CALIFORNIA PROPOSITION 65

⚠WARNING

This product or its power cord may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

⚠DANGER

Breathable Air Warning

This compressor/pump is NOT equipped and should NOT be used "as is" to supply breathing quality air. For any application of air for human consumption, you must fit the air compressor/pump with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in Compressed Gas Association Commodity Specification G 7.1 - 1966, OSHA 29 CFR 1910. 134, and/or Canadian Standards Associations (CSA).

DISCLAIMER OF WARRANTIES

IN THE EVENT THE COMPRESSOR IS USED FOR THE PURPOSE OF BREATHING AIR APPLICATION AND PROPER IN-LINE SAFETY AND ALARM EQUIPMENT IS NOT SIMULTANEOUSLY USED, EXISTING WARRANTIES ARE VOID, AND DAYTON ELECTRIC MFG. CO. DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY LOSS, PERSONAL INJURY OR DAMAGE.

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SPEEDAIRE®

Speedaire® Portable Air Compressors

ENGLISH

General Safety Information (Continued)

GENERAL

Since the air compressor and other components (material pump, spray guns, filters, lubricators, hoses, etc.) used, make up a high pressure pumping system, the following safety precautions must be observed at all times:

1. Read all manuals included with this product carefully. Be thoroughly familiar with the controls and the proper use of the equipment.
2. Follow all local electrical and safety codes as well as in the United States, the National Electrical Codes (NEC) and Occupational Safety and Health Act (OSHA).
3. Only persons well acquainted with these rules of safe operation should be allowed to use the compressor.
4. Keep visitors away and NEVER allow children in the work area.

5. Wear safety glasses and use hearing protection when operating the unit.
6. Do not stand on or use the unit as a handhold.
7. Before each use, inspect compressed air system and electrical components for signs of damage, deterioration, weakness or leakage. Repair or replace defective items before using.
8. Check all fasteners at frequent intervals for proper tightness.

⚠WARNING

Motors, electrical equipment and controls can cause electrical arcs that will ignite a flammable gas or vapor. Never operate or repair in or near a flammable gas or vapor. Never store flammable liquids or gases in the vicinity of the compressor.

⚠WARNING

Never operate compressor without a beltguard. This unit can start automatically without warning. Personal injury or property damage could occur from contact with moving parts.

9. Do not wear loose clothing or jewelry that will get caught in the moving parts of the unit.

⚠CAUTION

Compressor parts may be hot even if the unit is stopped.

10. Keep fingers away from a running compressor; fast moving and hot parts will cause injury and/or burns.
11. If the equipment should start to vibrate abnormally, STOP the engine/motor and check immediately for the cause. Vibration is generally a warning of trouble.
12. To reduce fire hazard, keep engine/motor exterior free of oil, solvent, or excessive grease.

⚠WARNING

An ASME code safety relief valve (included) with a setting no higher than 150 psi MUST be installed in the tank for this compressor. The ASME safety valve must have sufficient flow and pressure ratings to protect the pressurized components from bursting.

⚠CAUTION

See compressor specification decal for maximum operating pressure. Do not operate with pressure switch or pilot valves set higher than the maximum operating pressure.

13. Never attempt to adjust ASME safety valve. Keep safety valve free from paint and other accumulations.

NOTICE ***Drain liquid from tank daily.***

⚠DANGER

Never attempt to repair or modify a tank! Welding, drilling or any other modification will weaken the tank resulting in damage from rupture or explosion. Always replace worn, cracked or damaged tanks.

14. Tanks rust from moisture build-up, which weakens the tank. Make sure to drain tank regularly and inspect periodically for unsafe conditions such as rust formation and corrosion.
15. Fast moving air will stir up dust and debris which may be harmful. Release air slowly when draining moisture or depressurizing the compressor system.

SPRAYING PRECAUTIONS

⚠WARNING

Do not spray flammable materials in vicinity of open flame or near ignition sources including the compressor unit.

1. Do not smoke when spraying paint, insecticides, or other flammable substances.
2. Use a face mask/respirator when spraying and spray in a well ventilated area to prevent health and fire hazards.

3. Do not direct paint or other sprayed material at the compressor. Locate compressor as far away from the spraying area as possible to minimize overspray accumulation on the compressor.
4. When spraying or cleaning with solvents or toxic chemicals, follow the instructions provided by the chemical manufacturer.

⚠WARNING

Disconnect, tag and lock out power source, then release all pressure from the system before attempting to install, service, relocate or perform any maintenance.

Models 1NNF4, 1NNF6, 1NNF7

Introduction

Refer to Figure 1 to locate the following items.

Pressure switch - Auto/Off Switch - In the "**AUTO**" position, the compressor shuts off automatically when tank pressure reaches the maximum preset pressure. In the "off" position, the compressor will not operate. This switch should be in the "**OFF**" position when connecting or disconnecting the power cord from the electrical outlet or when changing air tools. (See Figure 5.)

When the pressure switch turns the motor off you will hear air leaking out of the Pressure Switch Unloader Valve for a short time. This releases the air pressure from the discharge tube and allows the compressor to restart easier.

Regulator - The regulator controls the amount of air pressure in the air hose. The air hose is attached at the outlet of the regulator.

ASME Safety Valve - This valve automatically releases air if the tank pressure exceeds the preset maximum.

Discharge tube - This tube carries compressed air from the pump to the check valve. This tube becomes very hot during use.

⚠WARNING ***To avoid the risk of severe burns, never touch the discharge tube.***

Check valve - One-way valve that allows air to enter the tank, but prevents air in the tank from flowing back into the compressor pump.

Handle - Designed to move the compressor.

⚠WARNING ***Never use the handle to lift the unit completely off the ground. Handle is intended for pushing or pulling product only.***

Belt Guard - Covers the belt, motor pulley and flywheel.

⚠WARNING

Never operate compressor without a beltguard. This unit can start automatically without warning. Personal injury or property damage could occur from contact with moving parts.

Tank Drain Valve - This valve is located on the bottom of the tank. Use this valve to drain moisture from the tank daily to reduce the risk of corrosion.

Reduce tank pressure below 10 psi, then drain moisture from tank daily to avoid tank corrosion. Drain moisture from tank(s) by opening the drain valve located underneath the tank.

Tank Pressure Gauge - Indicates amount of air pressure stored in tank.

Hose Pressure Gauge - Indicates amount of air pressure in hose used to operate tools. This pressure is increased or decreased by the regulator.

ENGLISH

Assembly

REGULATOR ASSEMBLY

1. Remove plug(s) from plastic bag. Apply thread sealant tape to threads.
2. The assembly is designed to be attached only to the pressure switch outlet (see Figure 1) by inserting the pipe nipple (see Figure 2) and turning the assembly clockwise. Tighten until snug or 75 in.-lb. Gauge should be oriented the same as the gauge already on the pressure switch (see Figure 1). Attach hose and tire chuck. Check for leaks with soapy water.

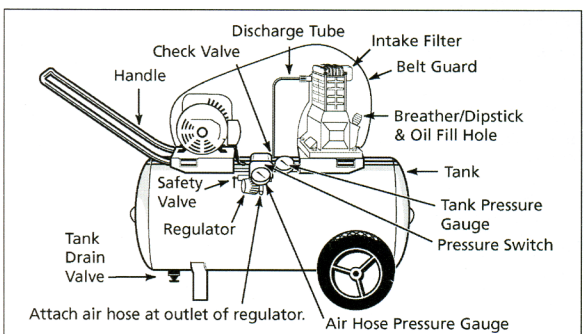

Figure 1

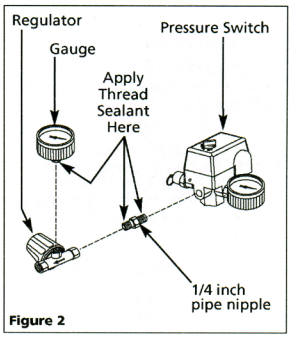

Figure 2

SPEEDAIRE®

Speedaire® Portable Air Compressors

ENGLISH

Assembly (Continued)

HANDLE

1. Remove the handle screw from the tank baseplate, if preinstalled.
2. Insert handle into both sides of tank baseplate. Squeeze handle to fit into special openings in baseplate (See Figure 3).

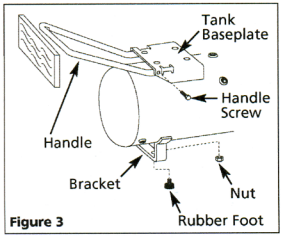

Figure 3

3. Place a short piece of wood against end of handle and tap with a mallet or hammer until the hole in the handle lines up with the hole in the baseplate.
4. Insert and tighten the handle screw into the hole in the baseplate and through the handle. Make sure the screw goes through the handle.

WHEEL ASSEMBLY

The items marked with an asterisk (*) in Figure 3 were shipped loose with the unit. Assemble as follows:

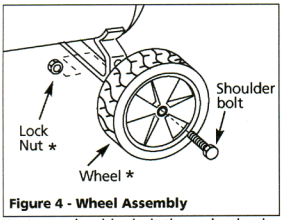

Figure 4 - Wheel Assembly

1. Insert shoulder bolt through wheel hub with the bolt head on the opposite side of the protruding hub section.
2. For the 8 inch diameter wheels, insert the shoulder bolt in the lowest hole of the tank axle iron and tightly secure with locknut.
3. For the 10 inch diameter wheels, insert the shoulder bolt in the upper hole in the tank axle iron and tightly secure with the locknut. Repeat this step on the opposite side.

When assembled, the tank must sit level or slope slightly towards the tank drain valve to allow tank to drain properly.

BREATHER INSTALLATION

Remove cap from oil fill opening. Install breather (found in parts bag with this manual). See Figure 5.

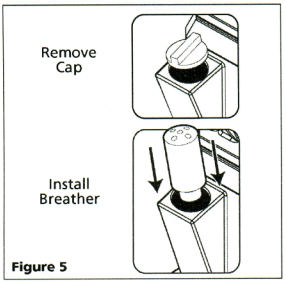

Figure 5

OIL DRAIN EXTENSION

Some models include an oil drain extension and cap (found with the owner's manual). Install the oil drain extension and cap **before adding oil to the pump**. To avoid oil leaks, it is highly recommended to apply Teflon® tape or plumber's putty to the threads on each end of the oil drain extension. Screw the cap onto one end of the extension. Remove the oil drain plug from the base of the pump and install the oil drain extension (See Figure 6).

NOTE: If your model is equipped with an oil sight glass, add oil to the fill line (See Figure 6).

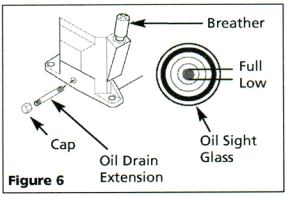

Figure 6

LUBRICATION

⚠CAUTION ***THIS UNIT CONTAINS NO OIL! Follow lubrication instructions before operating compressor.***

Oil capacity is approximately 8.5 ounces. Synthetic oil has proven to provide superior lubrication and is recommended. Use 10W30 100% synthetic oil such as Mobil1 (Stock No. 5XB58) . Single viscosity, ISO100 (SAE30) non-detergent compressor oil such as Mobil Rarus® (Stock No. 4ZF21), can also be used. Both are available at your local Grainger branch.

NOTICE ***Do not use petroleum based automotive oil which has shown to increase carbon deposits on the valves, resulting in more frequent service and reduced life.***

Models 1NNF4, 1NNF6, 1NNF7

Assembly (Continued)

ELECTRICAL DATA

⚠CAUTION

Overheating, short-circuiting and fire damage will result from inadequate wiring.

The 120 volt, 15 amp units can be operated on a 120 volt 15 amp circuit under the following conditions:

1. No other electrical appliances or lights are connected to the same branch circuit.
2. Voltage supply is normal.
3. Circuit is equipped with a 15 amp circuit breaker or a 15 amp slow blow fuse type T (For Canada use Type D).

If the above conditions cannot be met or if nuisance tripping of the current protection device occurs, it may be necessary to operate the compressor from a 120 volt 20 amp circuit. See Figure 7A.

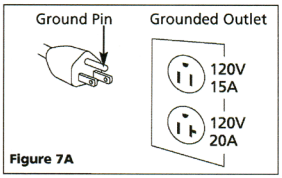

Figure 7A

The 240 volt unit must be operated on a 240 volt circuit. The cord provided will only plug into a 240 volt grounded outlet. See Figure 7B.

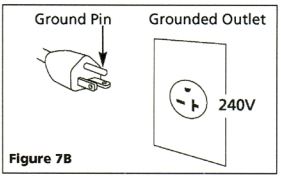

Figure 7B

GROUNDING INSTRUCTIONS

This product must be grounded. In the event of an electric short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the electric current. Unit is equipped with a cord that has a grounding prong.

⚠DANGER

Improper use of grounding plug can result in a risk of electrical shock.

NOTE: Do not use grounding adapter.

Operation

START-UP

NOTICE

This compressor pump must be filled with oil before startup. See lubrication section.

⚠CAUTION ***Do not attach air tools to open end of the hose until start-up is completed and the unit checks OK.***

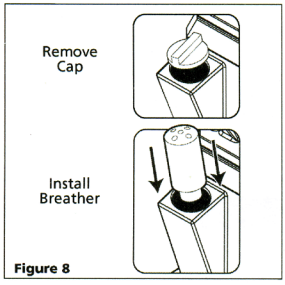

Figure 8

1. Check for proper oil level. See Lubrication Section.
2. Turn regulator knob clockwise to open air flow.
3. Turn pressure switch lever or knob to **OFF** position and plug in power cord.

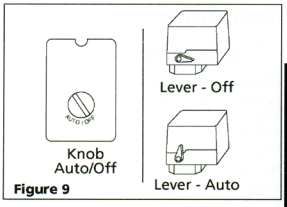

Figure 9

4. Turn pressure switch lever or knob to **AUTO** position and run unit for 30 minutes to break in the pump parts (See Figure 9).
5. Turn regulator knob fully counterclockwise. Compressor will build to maximum preset pressure and shut off.
6. Turn regulator knob clockwise to cause air to bleed off. Compressor will restart at preset pressure.
7. Turn pressure switch lever or knob to **OFF** position and unplug power cord. Slowly turn regulator knob clockwise to allow all air pressure to be released. Do not proceed to the next step until the tank pressure reaches zero (0).
8. Attach hose, then add chuck or other tool to open end of hose. Plug in power cord. Turn pressure switch lever to **AUTO** position. When full pressure is reached turn regulator knob clockwise until desired outlet pressure is achieved.
9. After use, turn pressure switch lever or knob to the **OFF** position.
10. If compressor is not used for a long time period, bleed air from line and use drain valve to drain water from the tank. Then, follow the maintenance schedule.

NOTE: Electric models are equipped with a pressure switch that automatically turns the motor OFF when the tank pressure reaches a preset level. After air is used from the tank and drops to a preset low level, the pressure switch automatically turns the motor back on.

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SPEEDAIRE®

Speedaire® Portable Air Compressors

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Maintenance

⚠WARNING

Disconnect, tag and lock out power source, then release all pressure from the system before attempting to install, service, relocate or perform any maintenance.

All repairs should be performed by an authorized service representative.

FOR EFFICIENT OPERATION:

Perform the following test to verify free operation of the safety valve weekly and follow maintenance schedule below.

1. Pull ring on safety valve and allow the ring to snap back to normal position (See Figure 10). This valve automatically releases air if the tank pressure exceeds the preset maximum.

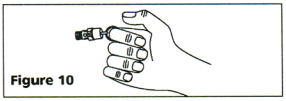

Figure 10

⚠CAUTION ***A large amount of fast moving air will be release if the safety valve is actuated with air pressure in the tank.***

⚠DANGER ***Do not attempt to tamper with this valve. This valve should be checked occasionally. If air leaks after the ring has been released, or the valve is stuck and cannot be actuated by the ring, the safety valve must be replaced.***

2. With motor OFF and unplugged, clean debris from motor, flywheel, tank, air lines and pump cooling fins.

DRIVE BELT

Belts will stretch in normal use. Properly adjusted, a 5-pound pressure applied to the belt between the motor pulley and the pump will deflect the belt about 1/2 inch (See Figure 11).

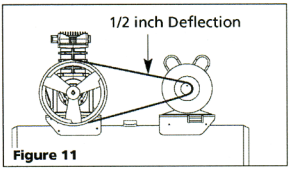

Figure 11

STORAGE

1. When not in use, hose and compressor should be stored in a cool dry place.
2. Tanks should be drained of moisture and hose should be disconnected and hung with open ends down to allow any moisture to drain.
3. Protect the electrical cord from possible damage by winding the cord loosely around the handle of the unit or coiling the cord up.

MOISTURE IN COMPRESSED AIR

Moisture in compressed air will form into droplets as it comes from an air compressor pump. When humidity is high or when a compressor is in continuous use for an extended period of time, this moisture will collect in the tank. When using a paint spray or sandblast gun, this water will be carried from the tank through the hose, and out of the gun as droplets mixed with the spray material.

IMPORTANT: This condensation will cause water spots in a paint job, especially when spraying other than water based paints. If sandblasting, it will cause the sand to cake and clog the gun, rendering it ineffective.

A filter or air dryer in the air line, located as near to the gun as possible, will help eliminate moisture.

TORQUE REQUIREMENTS	
Compressor Head Bolts	250 in-lbs
Bearing Cap Bolts	50-120

MAINTENANCE SCHEDULE

Operation	Daily	Weekly	Monthly	3 Months
Check Oil Level	●			
Drain Tank	●			
Check Air Filter		●		
Check Safety Valve		●		
Blow Dirt From Inside Motor			●	
Check Belt Tightness			●	
Change Oil				●

Speedaire® Portable Air Compressors

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Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Low discharge pressure	1. Air demand exceeds pump capacity	1. Reduce air demand or use a compressor with more capacity
	2. Air leaks	2. Listen for escaping air. Apply soap solution to all fittings and connections. Bubbles will appear at points of leakage. Tighten or replace leaking fittings or connections
	3. Restricted air intake	3. Clean the air filter element
	4. Blown gaskets	4. Replace any gaskets proven faulty on inspection
	5. Leaking or damaged valves	5. Remove head and inspect for valve breakage, misaligned valves, damaged valve seats, etc. Replace defective parts and reassemble **⚠CAUTION** ***Install a new head gasket each time head is removed.***
Pump overheating causes air filter to melt	1. Insulating gasket between filter and head is missing	1. Install gasket
	2. Broken valves/blown gasket	2. Replace valves or install new gasket
Excessive noise (knocking)	1. Loose motor or compressor pulley	1. Loose motor or compressor pulleys are a very common cause of compressors knocking. Tighten pulley clamp bolts and set-screws
	2. Lack of oil in crankcase	2. Check for proper oil level; if low, check for possible damage to bearings. Dirty oil can cause excessive wear
	3. Worn connecting rod	3. Replace connecting rod. Maintain oil level and change oil more frequently
	4. Worn piston pin bores	4. Remove piston assemblies from the compressor and inspect for excess wear. Replace excessively worn piston pin or pistons, as required. Maintain oil level and change oil more frequently
	5. Piston hitting the valve plate	5. Remove the compressor head and valve plate and inspect for carbon deposits or other foreign matter on top of piston. Replace head and valve plate using new gasket. See Lubrication section for recommended oil
	6. Noisy check valve in compressor system	6. Replace **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
Large quantity of oil in the discharge air **NOTE:** In an oil lubricated compressor there will always be a small amount of oil in the air stream.	1. Worn piston rings	1. Replace with new rings. Maintain oil level and change oil more frequently
	2. Compressor air intake restricted	2. Clean filter. Check for other restrictions in the intake system
	3. Excessive oil in compressor	3. Drain down to full level
	4. Wrong oil viscosity	4. Use Mobil 1® 10W-30
Water in discharge air/tank	Normal operation. The amount of water increases with humid weather	A. Drain tank more often. At least daily B. Add a filter to reduce the amount of water in the air line

Models 1NNF4, 1NNF6, 1NNF7

Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Motor hums and runs slowly or not at all	1. Use of extension cord	1. Do not use an extension cord. Use longer air hose with larger diameter
	2. Malfunctioning check valve or unloader valve	2. Replace check valve, unloader valve or pressure switch **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
	3. Low voltage	3. Check with voltmeter, check reset switch on motor. If reset switch trips repeatedly, find and correct the cause. See next item
	4. Malfunctioning pressure switch - contacts will not close	4. Repair or replace pressure switch
Reset mechanism cuts out repeatedly or fuses blow repeatedly	1. Too many devices on same circuit	1. Limit the circuit to the use of only the air compressor
	2. Incorrect fuse size or circuit breaker	2. Be sure that fuses or circuit breakers are rated properly
	3. Malfunctioning check valve	3. Replace check valve **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
	4. Pressure switch set too high	4. Adjust or replace
	5. Loose wiring	5. Check all electrical connections
	6. Malfunctioning motor	6. Replace motor
Tank does not hold pressure when compressor off and the shut off valve is closed	1. Worn check valve	1. Replace check valve **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
	2. Check all connections and fittings for leaks	2. Tighten
	3. Check tank for cracks or pin holes	3. Replace tank. Never repair a damaged tank
Pressure switch continuously blows air out the unloader valve	Malfunctioning check valve	Replace the check valve if the unloader valve bleeds off constantly **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
Pressure switch does not release air when the unit shuts off	Malfunctioning unloader valve on pressure switch	Replace the pressure switch if it does not release the pressure for a short period of time when the unit shuts off **⚠DANGER** ***Do not disassemble check valve with air pressure in tank***
Excessive vibration	1. Loose fasteners	1. Tighten
	2. Belt needs to be replaced	2. Replace with correct size
	3. Belt alignment	3. Align flywheel and pulley

encompass 4

Quick Start Guide

TransCore

March 2011

412109-007

Driving inefficiencies out of surface transportation through innovative solutions

Table of Contents

FCC Site Licensing

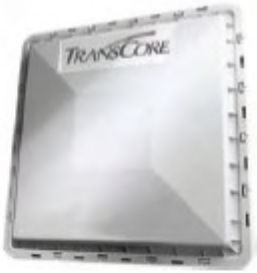
Because Encompass® 4 Readers radiate more than 3 milliwatts of RF power; their use requires licensing under Federal Communications Commission (FCC) Section 90.239.

An FCC license provides the user with the legal authorization to operate the Encompass 4 Reader on the licensed frequencies at the site specified in the license. The FCC license also provides the user with protection and authorization to maintain the system should any other RFID product be used in the licensed area after the Encompass 4 Reader equipment is installed.

The site owner must complete and file form 601, FCC Application for Wireless Telecommunications Bureau Radio Service Authorization. Forms are available online at the FCC internet site *http://www.fcc.gov/formpage.html*.

The authorized frequency band for this product in the United States is 911.75 to 919.75 MHz. Only an authorized installer or service technician should set the RF frequency of the Encompass 4 Reader to the frequency specified in the FCC site license.

Only authorized TransCore Encompass 4 Reader dealers, installers, or service personnel should attempt to install Encompass 4 Readers. Once the system is set up and tested by the authorized installer, Encompass 4 Reader operation requires no end-user intervention.



Start with Site Design

You should develop your site plan BEFORE applying for FCC approval, ordering equipment, and installing the Encompass 4 Reader. Factors to be considered include tag type, reader and tag alignment, reader mounting requirements, site layout and traffic flow, and electrical and communications requirements. If your site configuration differs significantly from the recommendations below, contact your TransCore sales representative. Reader/tag choice and site planning is discussed in detail in the *Encompass® 4 Reader System Guide*.

Determining Right Reader and Tag Combination

What type of tags are you going to read? If eGo® Plus, eGo, ATA, Interagency Group (IAG), or combinations of two protocols, then the Encompass 4 is the correct reader to use.

How are the tags formatted? Are they ASCII (full or half-frame) or Wiegand tag format? If Wiegand, then is it 26, 37, 54, or other bit configuration? This will determine the tag read mode for your reader.

If an external antenna is required for increased signal strength, you should use the Encompass 4.

Encompass 4 Reader Features

Reader Model	Protocol(s)	Wiegand	Antenna		Communication	
			Internal	External	RS-232	RS-422
10-40xy-008	ATA	✓	✓	✓	✓	✓
10-40xy-001	SeGo	✓	✓	✓	✓	✓
10-40xy-019	IAG	✓	✓	✓	✓	✓
10-40xy-002	ATA/SeGo	✓	✓	✓	✓	✓
10-40xy-010	ATA/IAG	✓	✓	✓	✓	✓
10-40xy-004	SeGo/IAG	✓	✓	✓	✓	✓
10-40xy-009	eGo/ATA	✓	✓	✓	✓	✓
10-40xy-003	eGo/SeGo	✓	✓	✓	✓	✓

Where x = 0 (internal antenna), x = 1 (external antenna)
y = 2 (RS–232), y = 4 (RS–422)

Reader Placement

Encompass 4 Readers may be mounted on a pole at the side of the lane (side fire) or mounted on a gantry or surface extending over the center of the lane (overhead). You must position the Encompass 4 Reader, which contains an internal antenna, or the antenna for the Encompass 4, so that the RF signal can travel to and return from the tags within the desired read area or "footprint." Locate

the reader where it is not likely to be bumped out of alignment. Encompass 4 Readers should not directly face each other or be positioned back-to-back.

For a pole mount installation, install the reader as high as possible so that you can point the reader down to control the read zone and minimize interference in the adjacent lane.

Tag Placement

Reader location determines tag placement in the windshield. Overhead readers require a center-mounted tag; readers on the side of the lane require that tags are placed on the nearest side of the windshield.

Site Layout, Lane Type, and Traffic Flow

It is important to know the configuration of the site and its proximity to other sites in order to develop a correct site plan as well as a workable frequency plan. Will the lanes be AVI only, or will the lanes also have ticket machines, proximity readers, or other in-lane equipment?

The number of lanes at the site, how they are grouped, and number of total entry and exit points determine the number of readers required and the distance between readers. You must determine the lane widths and the distance between adjacent lanes, taking into account any island/barrier width. TransCore recommends that, for the Encompass 4, the lane width with barrier be at least 12 feet.

Interfaces to External Loops, Gates or Converters

For the best lane layout and transaction framing, the distance from the entry loop to the reader should normally be no more than about 8 feet with the distance from the reader to the gate arm not exceeding an additional 3 to 4 feet. In most cases, the reader will be positioned before the gate.

With this defined read area (frame), it is very difficult for a non-tagged vehicle to sit in front of the gate and be admitted by a following car (the following car won't be read). As well, if the first vehicle is valid, then subsequent vehicles will not be able to follow.

If the read zone is much larger than the distance referenced above, then a following car may be read and allow a non-tagged vehicle to enter the facility. Bigger isn't always better; in RFID systems, long range can create a problem.

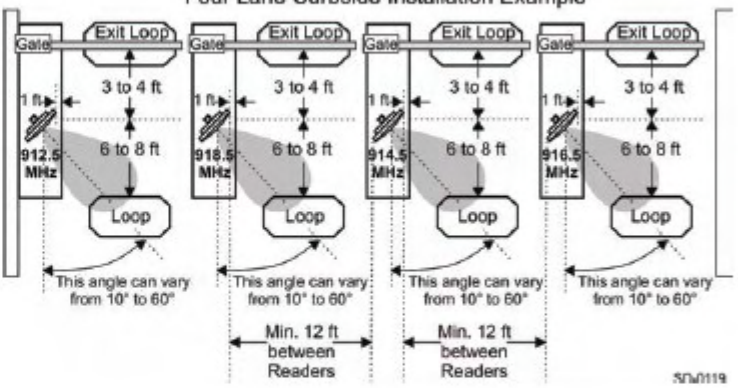
The readers are typically configured to be loop activated (on by presence) but may be set to have RF on continuously. The choice depends on traffic volume and possible interaction with the other in-lane components.

Frequency Plan

The Encompass 4 Reader FCC-approved frequency band is 911.75 to 919.75 MHz. Because of this relatively narrow frequency band, it requires careful planning to maintain the desired 2 MHz frequency separation between adjacent readers.

If readers are spread out within a facility (readers ½ mile or so apart), and loops are used, then frequencies may be reused. Special circumstances may necessitate use of multiplexers, especially in installations exceeding 20 readers. The illustration below shows frequency separation for 4 lanes.

Four Lane Curbside Installation Example



Reader Frequencies Staggered for 14 Lanes

Lane Number	Reader Frequency	Lane Number	Reader Frequency
1	912.5	2	915
3	917.5	4	913.5
5	916	6	918.5
7	914.5	8	917
9	913	10	915.5
11	918	12	914
13	916.5	14	919

Causes of RF Interference or Poor Performance

When designing your site plan, you must consider permanent structures and transient factors in the vicinity that may affect RF signals. Metal objects, walls, and even wet pavement or ice can reflect RF signals, degrading system performance.

Interference from RF and electrical sources also can degrade system performance. Fluorescent lights, neon signs, nearby radio stations, or power lines can interfere with the optimal operation of the system. The magnetic impulse noise from relays that control gate opening and closing can also disrupt the RF signal.

Existing interference at the site should be shielded, removed, or positioned farther from the Encompass 4 Reader.

Possible Sources of RF Interference or Poor Performance

- Metal fences, gates, posts, signs, grates
- Wet or icy slopes
- Walls, buildings
- Curve at entrance
- Gate relays
- Reader incorrectly located

Electrical and Communications Requirements

Measured voltage at the Encompass 4 Reader MUST be at least 16V for proper operation. It is important to use TransCore approved transformers and cable lengths. TransCore does not endorse or support RF cable lengths greater than 35 feet. See the *Encompass 4 Reader System Guide* for detailed information.

The reader is available as an RS–232 or RS–422 model. The proper configuration depends on the distance between the reader and the computer room. Maximum distance for the RS–232 (3-wire serial) is 50 feet, while RS–422 (4-wire differential signal) maximum distance is up to 4000 feet. You may adjust the baud rate to accommodate noisy environments.

If you wish to use Wiegand format tags, you must first:

- Connect the Encompass 4 Reader using the RS–232 or RS–422 interface,
- Set all necessary operating parameters in the reader,
- Set the Encompass 4 Reader's configuration to Wiegand,
- Then connect the Encompass 4 Reader to the Wiegand interface.

Pre-Installation Testing

Once you have developed the site plan and frequency plan, you are ready to install the reader and perform pre-installation testing of Encompass 4 Reader output power and tag read capability. The **Encompass® 4 Reader System Guide** discusses pre-installation testing in detail.

Bench Testing the Reader

To bench test your reader you need an **audible circuit tester**, a compatible **power/communications cable**, and a **PC**. A laptop using a terminal emulation program such as Microsoft HyperTerminal can be used for most diagnostic test and reader command entry.

The Encompass 4 Reader uses a single 26-pin (13 twisted pair) round Souriau connector to interface to all external components. Power, I/O interface, and communications signals are transmitted through this cable. The reader cable is directly connected to external devices or may be routed to other components via an external junction box.

1. Connect all hardware as directed below.

A. Connect the power wires from the cable to the transformer using the color coding as described below. (Do not apply power to transformer at this time.)

Power Connections

Colored-Wire Pair	Use These Colors	Connect to Transformer Terminal Strip
Brown/Red	Orange and Brown	L1 (16 to 20V AC)
Orange/Red	Red and Red	L2 (16 to 20V AC)

The Encompass 4 Reader system is powered by an 18V AC transformer. Normally, one 10 amp circuit will be sufficient for powering the reader and all associated electronics.

B. For the Encompass 4 that requires an external antenna, you must next connect the external antenna using an N-type connector. THE EXTERNAL ANTENNA MUST BE CONNECTED before powering up the external antenna-series readers.

C. Connect the red and white leads from the audible tester to the red and white pair of wires from the power/communications cable.

D. Connect the appropriate communications wires from the cable to an appropriate connector.

Refer to Correct Reader Grounding on page 9 when connecting power and communications.

RS–232 Interface

Colored Wire Pair	User This Color	Connect to Host DB9 Pin	Connect to Host DB25 Pin
Red/Black	Black	Pin 2	Pin 3
	Red	Pin 3	Pin 2
Yellow/Black	Yellow or Black	Pin 5	Pin 7

RS–422 Interface

(Your host must have an RS–422 interface with either an internal or external converter)

Colored Wire Pair	Use This Color	Connect to Host Signal
Yellow/Red	Yellow	Receive (+)
	Red	Receive (-)
Red/Black	Black	Transmit (+)
	Red	Transmit (-)

2. **Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories> Communications>HyperTerminal and pressing ENTER.**

   In the dialog boxes choose the com port to which the communications interface is attached and set the properties as follows:

   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

3. **Power up the reader by plugging the transformer into an approved outlet. Verify reader sign-on message appears on laptop/computer display**

   Once the reader has been wired up and turned on (with the laptop connected), a sign-on message will appear signifying that the reader is talking to the laptop. If startup is successful, the sign-on message appears as follows:

   Model E4 Series [software version] SNYYYYYY
   [Copyright notice]

   where YYYYYY is the serial number of the Encompass 4 Reader unit being used.

   At this point, you can enter commands into the reader for testing, set up, and tuning.

4. **Input proper commands in order to test the reader. Commands will include those to set the tag read mode and turn RF ON.**

Testing Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#481	#Done <CR/LF>	Sets operational mode to read ATA tags.
#40	#Done <CR/LF>	Transmits all tag IDs without regard for uniqueness.
#8401	#Done <CR/LF>	Turns RF ON.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

NOTE: Encompass 4 Reader will have tag modes specific to your model only

5. **If not using Wiegand tags, skip to Step 6. If using Wiegand tags, configure the reader for Wiegand operation and connect the Wiegand interface.**

Wiegand Testing Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#489	#Done <CR/LF>	Sets operational mode to read eATA data from eGo Plus or eGo tags.
#451	#Done <CR/LF>	Switches reader to Wiegand mode.
#8401	#Done <CR/LF>	Turns RF ON.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

Wiegand Interface

Colored Wire Pair	Use This Color	Connect to data wire of Wiegand device
Blue/Red	Blue	Data0
	Red	Data1
Yellow/Black	Yellow or Black	Ground

6. **Hold a tag in front of the reader and make sure its data is read out on the computer screen or on the Wiegand interface.**

7. **If desired, input the following commands to return reader to factory defaults.**

Return to Factory Default Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#86F	#Done <CR/LF>	Loads all factory default operating parameters except operating frequency.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

Installation at the Site

After pre-installation testing, using the site plan and frequency plan previously developed, you are ready to install the reader on site.

1. **Confirm the following:**

   - All construction is complete and electrical and communications cables of the appropriate length are in place.
   - A watertight junction box with terminal strip is present.
   - A dedicated power supply of the appropriate voltage is present.
   - The placement of the readers follows the site plan.
   - The readers are the correct distance apart, side fire or overhead.

   Normally readers (or antennas) are installed either on the side of the lane, pointing into the lane (side fire) or directly over the lane, pointed downward (center fire or overhead).

   Overhead installations normally are used within parking garages and other areas where a mounting surface already exists.

   Side-fire installations normally are used where the lanes are out in the open and the installation of a pole is sufficient to mount a reader.

   For side-fire reader placement, optimum tag placement is on the side of the windshield nearest the reader; for overhead reader placement, the optimum tag placement is in the upper center of the windshield.

2. **Mount the reader on a round pole or flat surface.**

   Proper reader angle may require both up-down and right-left adjustment. Ensure that the correct wall-mount or pole-mount bracket is used in the reader installation.

For reliable reader operation, ensure that the reader is connected to Earth Ground. Do this by connecting the cable shield of the communications cable to Earth Ground. TransCore strongly recommends that you follow the National Electric Code for lightning protection for the locale where you are installing the Encompass 4 Reader.

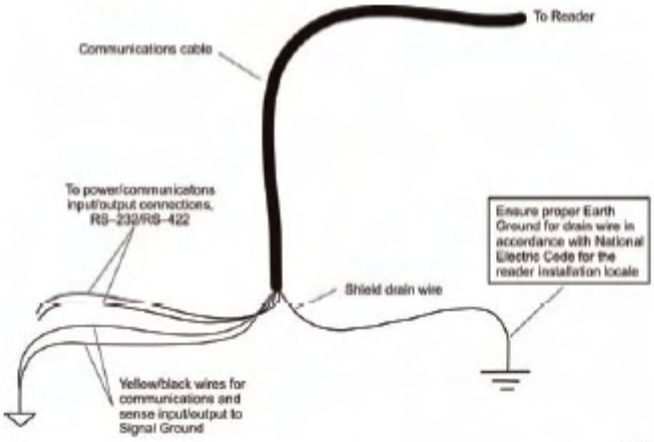
3. **Connect all wiring as described in Pre-Installation Testing Step 1 on page 5 using the appropriate RS–232 or RS–422 Wiring Diagram on pages 10 and 11 as a guide.**

   Also connect sense input and sense output circuits using the Sense Input/Output Cabling Assignments table on page 12 as a guide.

4. **Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories> Communications>HyperTerminal and press ENTER as described in Pre-Installation Testing Step 2 on page 6.**

Correct Reader Grounding

Ground the reader following the recommended grounding shown here.



CAUTION

Do not ground the input power supply.

5. **Apply power and verify reader sign-on message appears on laptop/computer display as described in Pre-Installation Testing Step 3 on page 6.**

6. **Use reader commands to query status and set up the system to ensure the following:**

   - If multiple readers are used, ensure that the frequency separation between readers is sufficient and make sure that each reader is set up to the proper settings
   - Adjust reader angle/power to optimize read zone for each reader.
   - Check for interference by each reader (or by the environment).

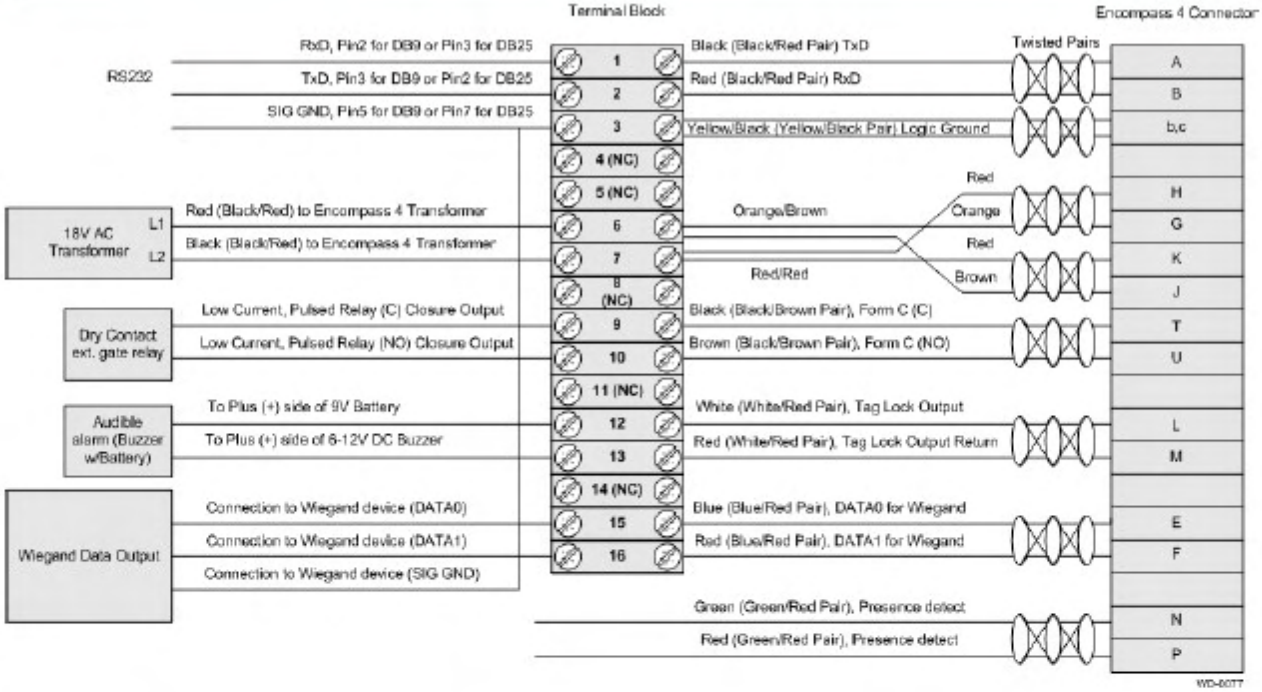
7. **If using Wiegand tags configure the reader for Wiegand operation and connect the Wiegand interface. See Step 5 on page 7.**

8. **Disconnect the laptop and connect reader to back end devices and recheck read zone and for interference between readers.**

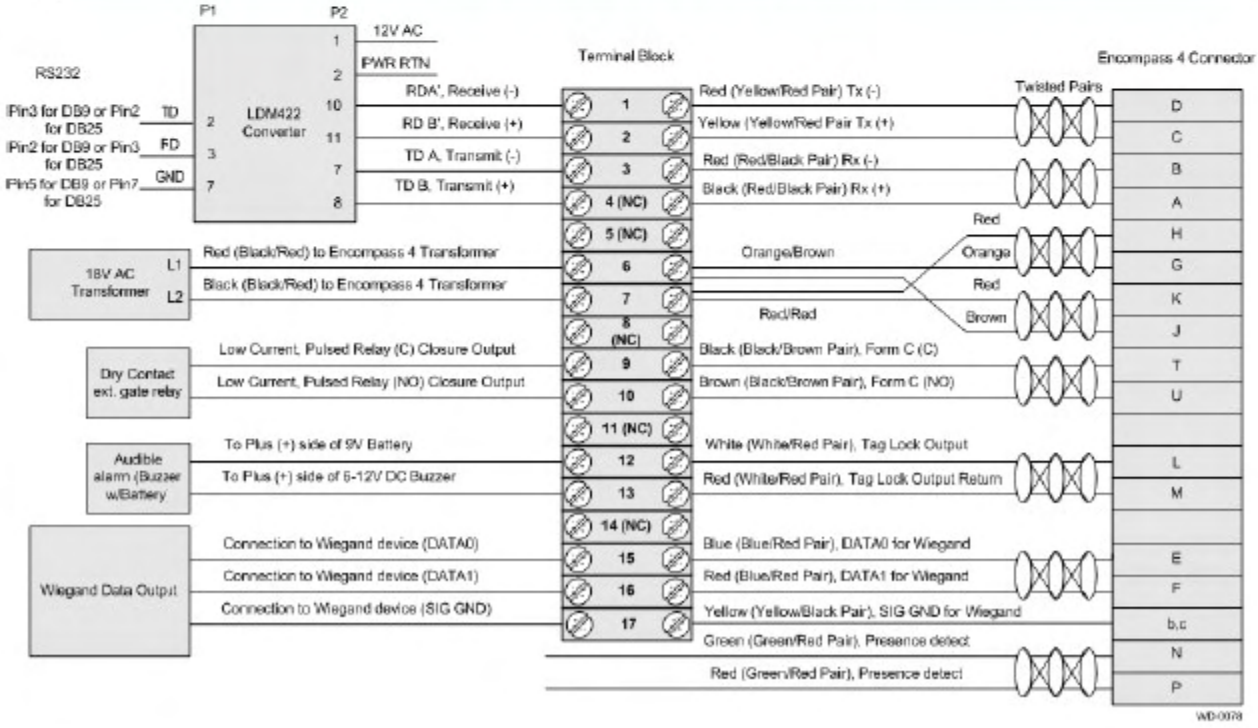
9. **System-test the reader.**

   Once all in lane testing is complete, perform a system test using tagged vehicles passing through numerous lanes. The tag reads are sent to the back end system and evaluated for validity.

Wiring Diagram for an Encompass® 4 (RS232) Unit



Wiring Diagram for an Encompass® 4 (RS422) Unit



Sense Input/Output Cabling Assignments

Pair	Pin	Color	Signal	Description	Typical Function
Blue/ Red	E	Blue	WGND0	Wiegand data0	Parking/access control
	F	Red	WGND1	Wiegand data1	Parking/access control
White/ Red	L	White	Lock	Tag lock output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Green/ Red	N	Green	Sense Input0	Sense Input0 (loop)	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Blue/ Black	R	Blue	Sense Input1	Sense Input1	General-purpose sense input, not used for detecting presence
	S	Black	Sense Input1_RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used for detecting presence
Brown/ Black	T	Black	Sense Output0_COM	Sense Output0 (tag detect), common terminal	Switched output to control gate
	U	Brown	Sense Output0_NO	Sense Output0 normally open terminal	Switched output to control gate
Orange/ Black	V	Black	Sense Output0_COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
	W	Orange	Sense Output0_NC	Sense Output0 normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Sense Output1_ COM	Sense Output1, common terminal	Switched sense output
	Y	Green	Sense Output1_NO	Sense Output1 normally open terminal	Switched sense output
White/ Black	Z	Black	Sense Output1_ COM	Sense Output1, common terminal	Switched sense output
	a	White	Sense Output1_NC	Sense Output1 normally closed terminal	Switched sense output
Yellow/ Black	b	Yellow	GND	Logic ground	Signal ground used with RS–232 and Wiegand
	c	Black	GND	Logic ground	Signal ground used with RS–232 and Wiegand

Reader Commands

The following table provides the commands frequently used in testing, setting up, and tuning the Encompass 4 Reader. For a complete list of commands see the *Encompass® 4 Reader System Guide*.

NOTE: *An "Error" reader response indicates that the command was entered incorrectly.*

Frequently Used Reader Commands

Enter	Reader Response	What It Does
#00	Done	Returns reader to data mode.
#01	Done	Switches to command mode.
#1005	Done	Set baud rate = 9600
#1010	Done	Use one stop bit
#1020	Done	Disable parity
#40	Done	Transmits all tag IDs without regard for uniqueness
#450	Done	Disable Wiegand mode
#451	Done	Enable Wiegand mode
#454	Done	Disable multi-tag sort
#455	Done	Enable multi-tag sort
#46NN	Done	Set Wiegand retransmit interval NN = 01–FF seconds
#48N	Done	Select tag mode N = 0–9 0 = disable ATA 1 = enable ATA 2 = disable eGo 3 = enable eGo 4 = disable SeGo 5 = enable SeGo 6 = disable IAG 7 = enable IAG 8 = disable eATA 9 = enable eATA **NOTE**: *Encompass 4 Reader will have tag modes specific to your model only*
#505	Model [model] Ver [version no.] SN [serial no.]	Display version

Enter	Reader Response	What It Does
#520	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred	Display power fail bit
#521	RDID xx xx = 00–FF	Display reader ID number
#527	RFST Cx Ox T1 Fxx Rxx Gxx Axx C0 = RF controlled by host C1 = RF-by-input control O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min Fxx = RF output frequency, 00 to 34 Rxx = ATA RF output range, 00 to 1F Gxx = eATA RF output range, 00 to 1F Axx = RF power attenuation, 00 to 0A	Display RF status
#532	TOF <0 to 1> 0 = Wiegand disabled 1 = Wiegand enabled	Display Wiegand mode status
#533	WTI <01 to FF> seconds (1-255) in hex	Display Wiegand retransmit interval
#570	ATA:_ eGo: _ SeGo: _ IAG: _ SORT: _ I = IT500 ID (64 bits) E = enabled F = full transaction D = disabled	Display tag mode status
#610	Done	Select basic protocol
#6140	Done	Disable flow control
#621	Done	Select predefined output mode
#63	Model [model] Ver [version no.] SN [serial no.] Copyright [date] TransCore	Reset reader
#6400	Done	Turn RF off
#6401	Done	Turn RF on
#641	Done	Select RF-by-input control
#642NN (00 – FF)	Done	Set RF operating frequency. Backward compatible with Encompass 2 and AI1620 readers.
#643NN	Done	Set operating range for ATA protocol (distance); 00 = shortest

Enter	Reader Response	What It Does
#644NN (00 – 0A)	Done	Set attenuation in 1.0 dB increments; 0 to 10 dB
#645NN	Done	Set operating range for eGo and SeGo protocols
#647XXX (000 – 118)	Done	Set frequency from 860 to 930 MHz in new 0.25-MHz steps. The FCC approved range is from 0CF = 911.75 MHz to 0EF = 919.75 MHz
#66F	Done	Load default operating parameters (except RF operating frequency)
#693F	Done	Set RF timeout = infinite

Modulated Frequencies Approved for Use in the U.S.

Command	Frequency (MHz)
6470CF	911.75
6470D0	912
6470D1	912.25
6470D2	912.50
6470D3	912.75
6470D4	913
.	.
.	.
.	.
6470E8	918
6470E9	918.25
6470EA	918.50
6470EB	918.75
6470EC	919
6470ED	919.25
6470EE	919.50
6470EF	919.75

If using ATA-only version (10-40xy-008) of the Encompass 4 Reader, use continuous wave frequencies. These are 902.25 – 903.75 MHz and 910.00 – 921.50 MHz.

NOTE: *The Encompass 4 Reader's #642NN command, Set RF Operating Frequency can be used where backward compatibility with Encompass 2 or AI1620 Readers is necessary. The #642NN command sets RF in 0.5 MHz steps.*

Common Problems – Potential "Gotchas"

Frequency interference between readers
Frequency interference may be caused by incorrect spacing and angle of readers, incorrect frequency assignment, objects or changes in the environment, incorrect RF power settings, etc. See pages 2, 3, and 4.

Communications problems between the reader and backend host
These problems may be caused by incorrectly wiring the communications cable, using the wrong cable, having a too-long cable run, or incorrectly setting communications parameters between host and reader. See pages 5, 6, and 7.

Cable run for RS–232 exceeds 50 feet in length
Fifty feet exceeds the maximum length for RS–232 interface. The interface should be converted to RS–422, wireless modem, fiber optic, or Wiegand. If in a noisy environment or running long cable lengths, you may need to reduce the baud rate.

Long RF cable runs to antennas
For the external antenna-series Encompass 4 Readers, long RF cable runs between the reader and the antenna may cause signal degradation or loss. This scenario may be site-specific, but TransCore recommends limiting antenna cable runs to 35 feet.

RF is not on
The technician must verify that RF is on by presence or on continuously. Command #527 may be used to verify RF status. See page 14.

Improper grounding
Cable shielding should be connected to Earth Ground to prevent damage from lightning or power surges.

Mixed tag population
In a mixed tag population, multiple tags in the same vehicle must be separated by at least 2 inches, preferably a greater distance.

Reader not programmed correctly
The technician must verify that all parameters are set appropriately for the reader location. Command #527 may be used to verify reader parameters. If tags are Wiegand, the technician can use commands #532 and #533 to verify Wiegand status.

Readers pointed toward each other
Readers must not be "aimed" directly facing each other or be in close proximity back-to-back. See pages 1 through 4.

Tag presentation
Tags must be properly mounted in a location determined by the reader placement. See page 2.

Tag-to-reader polarization
Tag polarization must match reader polarization. Tag and reader must be installed horizontally polarized.

More Troubleshooting

When performing a quick test of the Encompass 4 Reader, the buzz box does not buzz.
Check all your wiring connections, and ensure that your buzz box is functioning. You could find more than one red wire, more than one black wire, and so on. You must connect the correct red and white wire pair to the leads from the battery. Verify that RF is on (#6401). Verify that tag uniqueness is NOT on (#40).

When testing the Encompass 4 Reader, all the wires are connected correctly but the unit does not respond.
Check that the Encompass 4 Reader communication cable is connected to the correct COM port. Verify that the reader is in the correct tag read mode (#48N). Contact Technical Support.

Strange signal responses come from the Encompass 4 Reader when tested with the PC.
Ensure that the reader is in the correct interface mode for the test tag, that is, Wiegand mode for a Wiegand tag.

Nothing happens when the test tag is passed in front of the Encompass 4 Reader.
Ensure that the Encompass 4 Reader is powered on and is in predefined output mode. (#821). Verify that the reader is in the correct tag read mode (#48N). Verify that the reader is set to RF ON (#6401).

The Encompass 4 Reader came from another site and does not work the way the factory defaults indicate that it should.
Different commands were probably used to support the other site. You can restore the defaults by issuing command #66F. The factory defaults will be restored except for RF operating frequency.

Two easy ways to contact us:

- Call Dealer Technical Support at 214 461 6449
- Visit us on the Web at www.transcore.com

TransCore

8600 Jefferson Street NE
Albuquerque, NM 87113

INTERCLEAN
THE WASH THAT WORKS

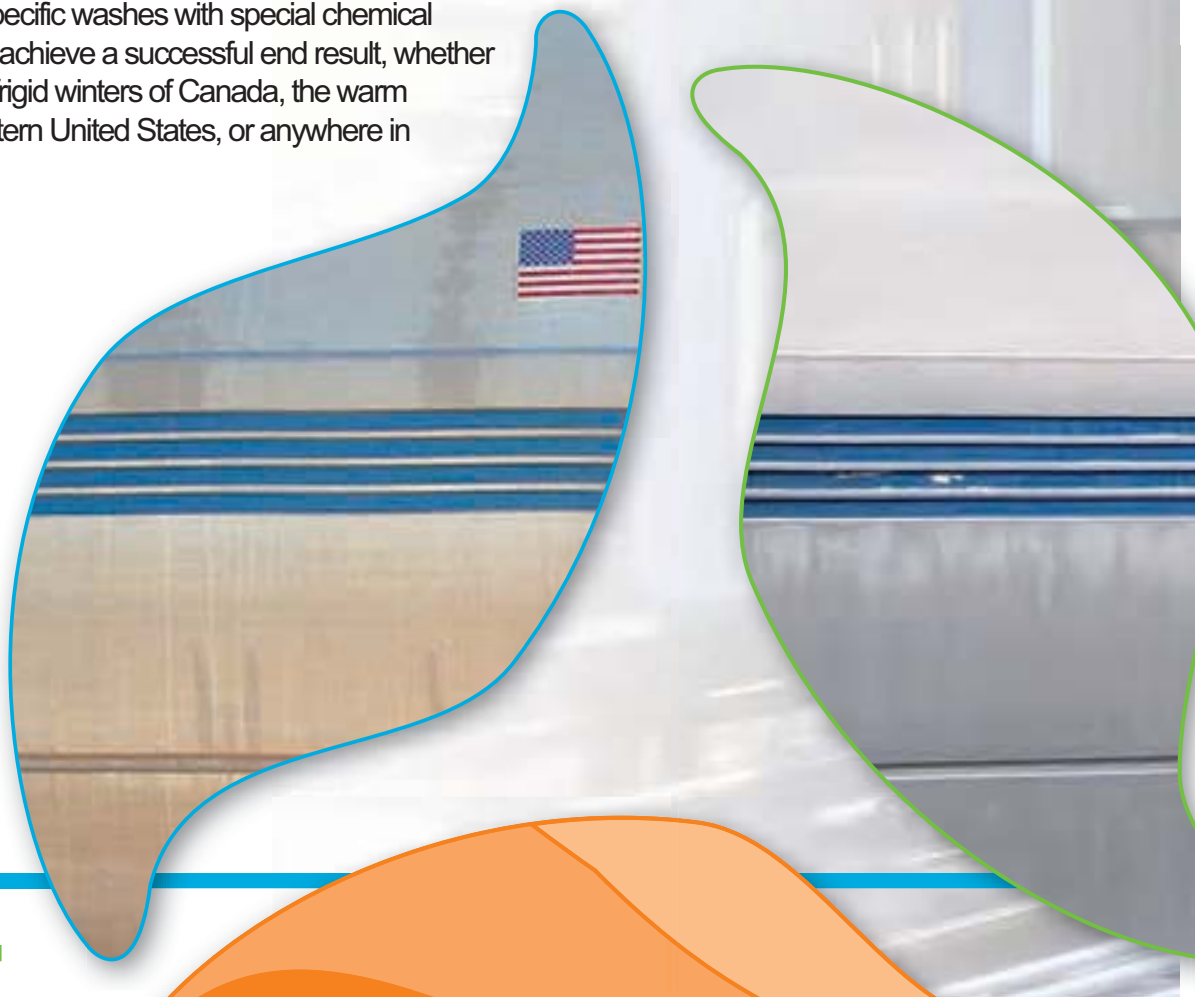
Heavy Duty Vehicle Wash Systems

www.interclean.com

Transit Rail

InterClean Equipment's approach to Transit Rail wash systems is as innovative as the company itself. With our global installations for Transit Rail, we have become a leader in cleaning this type of vehicle. Whether catenary, third rail, diesel, or hybrid electric, we have the experience and knowledge to create the appropriate wash solution for the trains of today and tomorrow.

InterClean creates site-specific washes with special chemical formulations designed to achieve a successful end result, whether the train is located in the frigid winters of Canada, the warm humidity of the Southeastern United States, or anywhere in between.




BART

Transit Bus

InterClean Equipment has multiple solutions for cleaning transit buses. Whether the customer is looking for completely touchless, or a brush wash system, we have the equipment and experience to assist in designing the appropriate wash system for the application.

InterClean has designed and developed our Hybrid Bus Wash, which combines the best of the brush and touchless technologies. With high pressure front, rear, top and wheel sprays, combined with side brushes the result is a clean vehicle with no potential for damage to the bus or the wash system.

School Bus

School busses present a particular challenge for conventional brush wash systems, which is why InterClean's touchless wash units are so popular in school bus garages across the country. The InterClean Centri*Spinner system will never damage cross-over mirrors, safety side signs or rear light covers.

Our systems can clean the under carriage of the bus, dramatically reducing chassis and side panel corrosion, and making maintenance access easier. At a working rate of up to 40 vehicles an hour, driver productivity is high and downtime is not a factor.


SCHOOL BUS
BLUE BIRD
53

Public Works

The first ever InterClean Public Works vehicle wash installation is still going strong, even after 20 years of operation. For washing municipal fleets from police cars to garbage trucks and waste haulers, there is no more effective or efficient system. It takes just 60 to 90 seconds for our units to clean a garbage truck, and the wash is unattended.

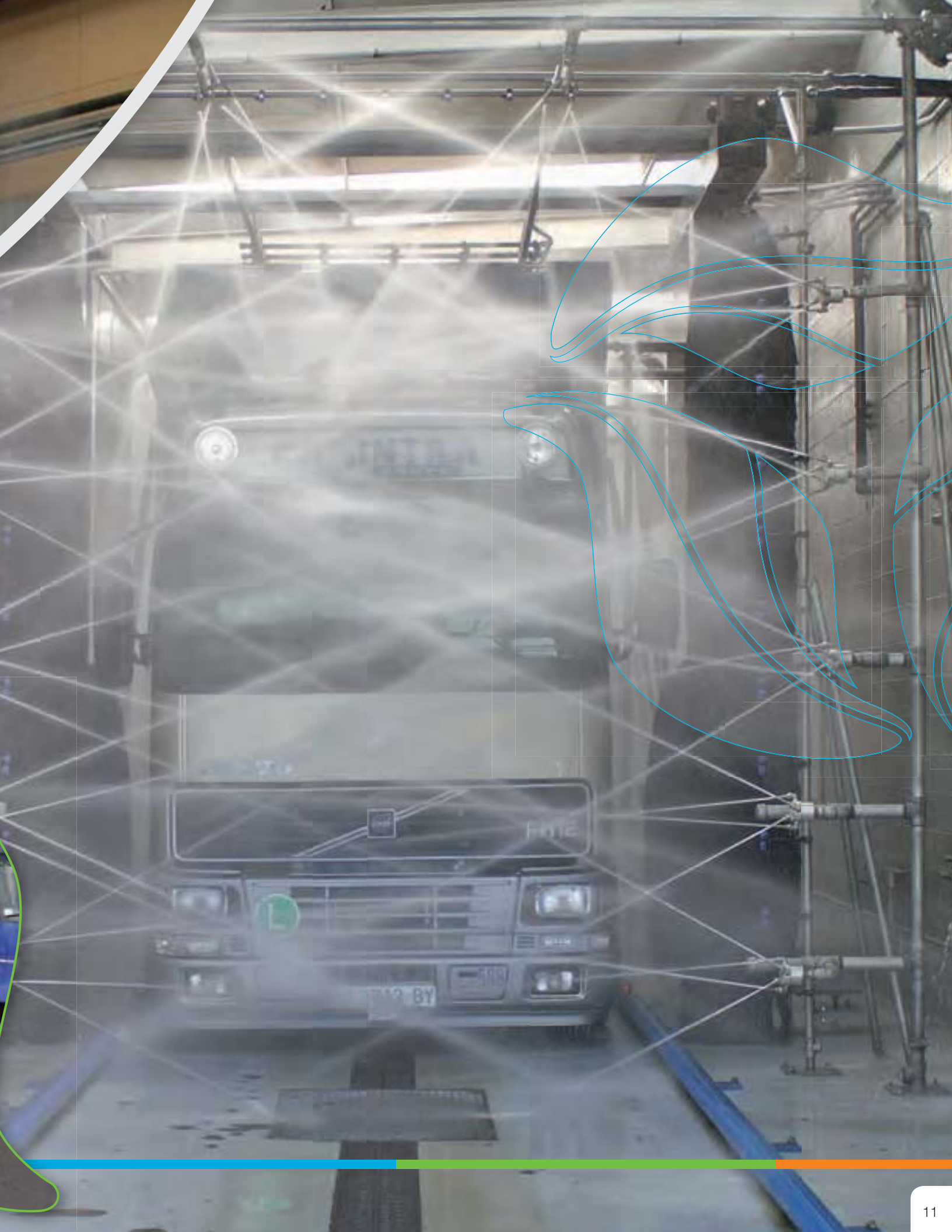
Not only do the cleaner vehicles present a better visual impression, but corrosion is reduced, and maintenance access is notably improved. This combined with the low maintenance requirements of our systems makes it easy to see why we have a dominant U.S. market share in this sector.


SANITATION

Fleet Wash

Simplicity. Efficiency. Results. The same things an operator would want from a fleet of trucks, InterClean delivers in its fleet wash systems. Automated systems remove the need for attendants, are low-maintenance, and require no detailing. Our fleet washes can handle over 7,000 trucks in a month, ensuring that your fleet presents a clean impression of the company over the road.

A cleaner vehicle is easier to maintain and suffers less maintenance issues that arise from dirty trucks, such as corrosion. InterClean fleet wash systems can utilize recycled or fresh water, and can be fitted with one or two-step chemical applicators in order to meet your specific needs.



Oil & Gas Field

Oil & Gas field support vehicles have to perform their duties in extreme conditions and in remote locations. This generally means poor or non-existent roadways to travel from site to site. Often these support vehicles travel for miles on unpaved surfaces where they build up large amount of soil. This soil can weight between 200 to 2000 pounds depending on the size of the vehicle. If this issue is ignored, it leads to extreme wear on the vehicle driveline and braking systems as well as reduced efficiency as the vehicle has to carry the additional weight. Using conventional methods, removing this amount of buildup can take hours.

InterClean has designed a heavy duty system using recycled water to address the issue of heavy mud buildup. Spraying water at relatively low pressures with high volumes we can remove this heavy buildup in a matter of minutes.

Military

The United States Army operates the largest, more sophisticated wash installation ever designed and installed, and only one company could provide it - InterClean. By utilizing state-of-the-art virtual prototyping software to predict the dynamic behavior of the robotic gantry and analyze all critical parameters, we were able to meet the challenge of washing military tanks automatically.

Our systems utilizes a laser-guided outline recognition and control system, ensuring that all areas of the tank are throroughly cleaned. InterClean is currently under contract to provide systems to meet the specific needs of military depots in Georgia and Alaska, cementing our place as a leader in the military market.

Mining

Mining vehicles work in extreme conditions and require routine maintenance to operate properly and safely. The task of cleaning these vehicles before the maintenance can be done is a difficult one. Depending on the size of the vehicle and conditions at the mine site, it can take between 8-15 hours to clean each piece of equipment. InterClean's approach to cleaning these vehicles uses relatively low pressure, under 300 PSI, at high volumes to remove the soiling buildup. This is a much safer method than the ultra high pressure wands operating at 10,000 -20,000 PSI. We have seen substantial reductions in the time required to clean these vehicles, which reduces equipment downtime. This allows the vehicles to be maintained and placed back into service faster than other cleaning methods.

InterClean was the first company to install an automated, drive through wash system for mine haul trucks. These vehicles have capacities up to 440 tons. Our drive through wash can remove most exterior soiling in less than 10 minutes. This allows the haul trucks to be cleaned after each work shift, rather than waiting to clean them for preventive maintenance tasks.


CATERPILLAR
7858
7858

Wheel & Under Chassis

Landfills, mines, quarries, power plants, and agricultural facilities all generate dirt and waste. To keep these potentially harmful by-products in their designated areas - away from the public and off of vehicles - a fast, effective means of washing the tires and chassis of vehicles becomes necessary. At InterClean, we have produced the ideal system, balancing intense cleaning power, reliable and safe water recycling, and the convenient and economical removal of accumulated dirt and waste. By simply driving vehicles through your on-site InterClean system, you can easily comply with the standards of public safety and environmental responsibility.


NO
ENTRY

Car Wash

Simplicity and reliability are the hallmarks of any InterClean wash system, and our car washes are no different. Simple to install and maintain, our touchless Centri*Spinner wash systems provide unmatched performance for you and your clients. The InterClean car wash system is one designed to meet the needs of today and tomorrow by leaving behind the over-complicated, ineffective, high-maintenance car washes of the past. In addition, the water-recycling knowledge of our larger systems applies to our car wash system as well, resulting in a reusable water rate of 90% to satisfy the needs of an increasingly "green" society while also lowering your bottom line. Cost-effective, responsible, reliable cleaning and a sound financial investment - our promises to you.

InterClean Components

The heart of the InterClean system is the patented anti-turbulent recycling and high pressure equipment module. The same module is used for all InterClean applications, from automated military tank washing to manual hand gun applications.

Each module is capable of producing up to 300 GPM recycled water continuously. The system is designed to recycle and aerate the wash water automatically, without changing filters or manual supervision.

The InterClean module facilitates the inexpensive and reliable use of high volumes of recycled wash water. The system is capable of operating under the most demanding vehicle wash conditions such as recycling water used to wash garbage trucks. The system uses no chemical or additives and is totally environmentally sound.

By using this effective yet inexpensive recycling system, InterClean Equipment is able to employ the full force of huge volumes of pressurized wash water, which create a cleaning impact that is simply not possible with other automatic vehicle washing systems.

To achieve recycled water volumes in excess of 300 gpm (1,250 l/m), multiple modules can be utilized in parallel. The 1200 gpm (500 l/m), necessary in washing military tanks, is achieved by the use of four parallel InterClean modules.

The module is pre-wired, pre-plumbed and mounted on a skid. The overall dimensions of the unit are such that it can be shipped in standard road trailers, or in high cube 40 feet ocean freight containers.

The system has its own electrical panel, which includes a slave PLC that controls all system internal functions, such as liquid level monitoring and adjustments. The system allows modem hook-up for remote control and trouble shooting.

Dimensions: 60” (150 cm) wide, 60” (150 cm) long, 102” (260 cm) high
Recycling capacity: 300 gpm (1250 l/m) continuously
High pressure capacity: 50 - 300 gpm (200-1250 l/m) continuously

The patented Centri*Spinner® is approved for both fresh and recycled water applications. Please contact InterClean for system performance approval before using with recycled water applications not engineered and supplied by InterClean.

Centri*Spinner® Specifications:

- Power Venturi Assisted Zero Degree Nozzles
- Hydrodynamic Rotational Speed Control
- Mechanical High Pressure Seal
- 1” NPT Connection
- 270-300 psi Operational Pressure Range

Established in 1984, InterClean Equipment Inc. is an engineering, innovation, and technology pioneer in the field of large vehicle cleaning applications. InterClean builds wash systems for vehicles ranging from standard automobiles up to 440-ton mining haul trucks. We have the knowledge and experience to handle the toughest applications in the most demanding environments.

InterClean is first and foremost an engineering company. We strive to understand the intricacies of each application in order to design the best wash solution. By taking the time to fully understand our customer's specific needs, we can create the best cleaning solution possible. Although most cleaning applications may appear similar, we at InterClean take the necessary steps to ensure the best solution is provided to the customer.

AutoCAD 3-D solid modeling is used to construct all of our engineering, fabrication and facility layout drawings. Custom designed equipment packages can be placed into architectural drawings in either 2-D or 3-D views.

Interchange owns numerous patents on high pressure washing, water recycling and waste water treatment technologies. The worldwide recognized Centri*Spinner® patents and trademarks are both owned by InterClean.

If you want to know more about Interclean Equipment, Inc., please do not hesitate to contact us.

TAMMERMATIC group

NORTH AMERICA

INTERCLEAN

InterClean Equipment, Inc.
709 James L. Hart Parkway | Ypsilanti, MI 48197 | USA

Phone: +1 (734) 961-3300
or, in the U.S. and Canada,
1-800-INTERCLEAN (1-800-468-3725)

Fax: +1 (734) 961-0092

sales@interclean.com
techsupp@interclean.com
www.interclean.com

EUROPE AND RUSSIA

TAMMERMATIC

Tammermatic Oy
Tesoman valtatie 28 | FI-33300 Tampere, Finland

Customer service: +358 201 373 400
Procurement & logistics: +358 201 373 401
Finance & administration: +358 201 373 402

Fax: +358 201 373 409

sales@tammermatic.com
service@tammermatic.com
www.tammermatic.com

INTERCLEAN
THE WASH THAT WORKS

HEAVY-DUTY TRANSIT VEHICLE WASH SYSTEMS

Wash Systems Engineered With Decades of Global Experience and Made in the U.S.A.

InterClean is an engineering, innovation and technology pioneer in the field of large vehicle cleaning applications. The fast changing transit market requires us to evolve and quickly react to application requirements and market standards. InterClean's wash systems: Transit Rail, Ultima, XJ Series and Hybrid deliver wash solutions that achieve maximum results in the transit bus, transit rail and paratransit bus industry.

HYBRID Bus Wash

The Hybrid Wash System is a drive through wash system designed to use a combination of touchless cleaning for the front, top, wheel, under chassis and rear of a transit vehicle and foam brushes for the sides. The brushes are in a fixed position and typically use a foam material to prevent scratching and damage to the bus. As the vehicle passes through the wash, the wash detects it's position and activates the proper high pressure touchless cleaning component and activates and de-activates the brushes. Since the brushes are in a fixed position, they do not interfere with bus traffic and will prevent accidental damage to the bus and the wash equipment.
This system is available using fresh water or recycled water and the following options:

- Blowers
- Polyethylene Brush Material
- RO Rinse

RAINBOW ULTIMA Wash System

Ultimate Cleaning Power for Large Vehicle Fleets
The Rainbow Ultima wash delivers state-of-the-art technology to the transit vehicle cleaning industry and is available in three models; the single wash unit, twin wash unit or drive through unit, the premium models combine advanced touchless and brush wash methods for the best cleaning combination for transit bus, rail and paratransit vehicles.

Touchless Cleaning
The RAINBOW ULTIMA can be equipped for only touchless cleaning, using the Centri-Spinner and equipped with the optional EQ100 water recycling module. This provides effective cleaning for odd shaped vehicles or vehicles with hard to clean areas that are beyond the reach of a brush.

Brush Cleaning
The RAINBOW ULTIMA can also be configured for using brushes for cleaning. There are 2 or 3 brush units which can be configured with a vertical front contour to match the profile of modern vehicles.

Combination
The best cleaning solution may include a combination of the Touchless and Brush Cleaning, this will enable the machine to safely and effectively clean different types of vehicles within the same fleet.

Wheel Wash
Wheel Washing and Under Chassis systems can be provided to clean the insides of the wheels, the lower portion of the bus and the under chassis.

XJ Series

The XJ Series wash systems are drive through systems designed to use brushes to clean the front, sides and back of the transit vehicle. In addition to the basic design, the system can be customized to include touchless cleaning for the front of the bus to prevent damage to the bike racks, mirrors or other accessories mounted on the outside of the bus. The Touchless Cleaning Modules are available with 30, 60 or 75HP motors. This system is available using fresh water or recycled water and the following options:

- Blowers
- Foam Brushes
- RO Final Rinse
- Touchless Cleaning Modules with 30, 60 or 75HP motors

InterClean Equipment's Approach to Transit Rail Wash Systems is as Innovative as the Company Itself

With our global installations for Transit Rail, we have become a leader in cleaning these types of vehicles. Whether catenary, third rail, diesel, hybrid electric or locomotive, we have the experience and knowledge to create the wash solution for the trains of today and tomorrow. InterClean creates site specific washes with special chemical formulations designed to achieve a successful end result, whether the train is located in the frigid winters of Canada, the warm humidity of the Southeastern United States, or anywhere in between.

Our expertise in touchless cleaning allows us to design and manufacture complex systems that not only clean effectively, but also provide efficient water recycling, pH control, and multiple combinations of touchless and friction cleaning.

INTRODUCING: New Automatic Brushing Options for Train Washing

- Automatic Brush Washing for the front and back of the train
- Automatically adjusting side brushes that move in to provide consistent brush pressure on the sides of train cars - even if the train cars are different sizes

Recycling Module Delivers Continuous Supply of Recycled Water

The heart of the InterClean system is the patented anti-turbulent recycling and high pressure equipment module.

Each module is capable of producing up to 300 gpm recycled water continuously. The system is designed to recycle and aerate the wash water automatically without changing filters or manual supervision. The InterClean module facilitates the inexpensive and reliable use of high volumes of recycled wash water. The system is capable of operating under the most demanding vehicle wash conditions. The system uses no chemicals or additives and is totally environmentally sound.

To achieve recycled water volumes in excess of 300 gpm (1,250 l/min), multiple modules can be utilized in parallel. The module is pre-wired, pre-plumbed and mounted on a skid. The units are designed to fit in standard road trailers, or in high cube 40 feet ocean freight containers. The system has its own electrical panel that controls all system functions, such as liquid level monitoring and adjustments. The system is configured for modem hook-up that allows remote control and trouble-shooting.

Dimensions: 60 in (150 cm) wide, 60 in (150 cm) long, 102 in (260 cm) high
Recycling Capacity: 300gpm (1250 l/m) continuously
High Pressure Capacity: 50-300 gpm (200-1250 l/m) continuously

Touchless CENTRI* SPINNER Provides Unmatched Performance

Bus, train car and locomotive shapes, configurations and exterior components present a particular challenge for conventional brush wash systems. Transportation vehicles have a larger number of areas beyond the reach of brushes. And, unlike rotating brushes, the Centri*Spinner® system will not damage mirrors, safety side signs, bike racks or rear light covers. The Centri*Spinner is designed to provide the best available touchless cleaning power. The patented Centri*Spinner is approved for both fresh and recycled water applications.

Centri*Spinner Specifications:

- Power Venturi Assisted Zero Degree Nozzles
- Hydrodynamic Rotational Speed Control
- Rotational Speed Range 60-200 RPM
- Mechanical High Pressure Seal
- 1” NPT Connection
- 270-330 psi Operational Pressure Range

CENTRI SPINNER®

Dramatically reduced corrosion, improved accessibility to the maintenance areas of the vehicle, and improved general appearance are direct advantages of using a Centri*Spinner Wash System.

INTERCLEAN

InterClean Equipment, Inc.
709 James L. Hart Parkway | Ypsilanti, MI 48197 | USA

Phone: +1 (734) 961 3300 or, in the U.S. and Canada, 1-800-INTERCLEAN (1-800-468-3725)

Fax: +1 (734) 961 0092

sales@interclean.com
techsupp@interclean.com
www.interclean.com

DRAWING INDEX

DRAWING NUMBER	DESCRIPTION
#LY09-070-00	DRAWING INDEX
#LY09-070-01	3D VIEW
#LY09-070-02	PLAN VIEW
#LY09-070-03	SIDE VIEW
#LY09-070-04	END VIEW
#LY09-070-05	PLUMBING SCHEMATIC
#LY09-070-06	ELECTRICAL LAYOUT
#LY09-070-07	EQUIPMENT LAYOUT
#LY09-070-08	PIPING 3D
#LY09-070-09	CONCRETE LAYOUT
#LY09-070-10	PIT DETAIL
#LY09-070-11	UNDERGROUND PIPES
#LY09-070-12	UNDERGROUND CONDUITS

Interclean Equipment, Inc.
3939 Bestech Dr
Ypsilanti, MI 48197

Web Site: www.interclean.com
E-mail: sales@interclean.com
Phone: (734) 975-2967
(800) 468-3725
Fax: (734) 975-1646

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN
CHECK: PK | APPR: ####
SCALE: NO SCALE

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
DRAWING INDEX

DATE: 07/21/09
PART NO: #LY09-070-00
WEIGHT:

D:\PROJECTS\USA\IA\Coralville\CoralvilleTransit\LY09-070.dwg, 00_Index, 5/11/2011 3:42:53 PM, Susan, HPDJ1055CM.pc3

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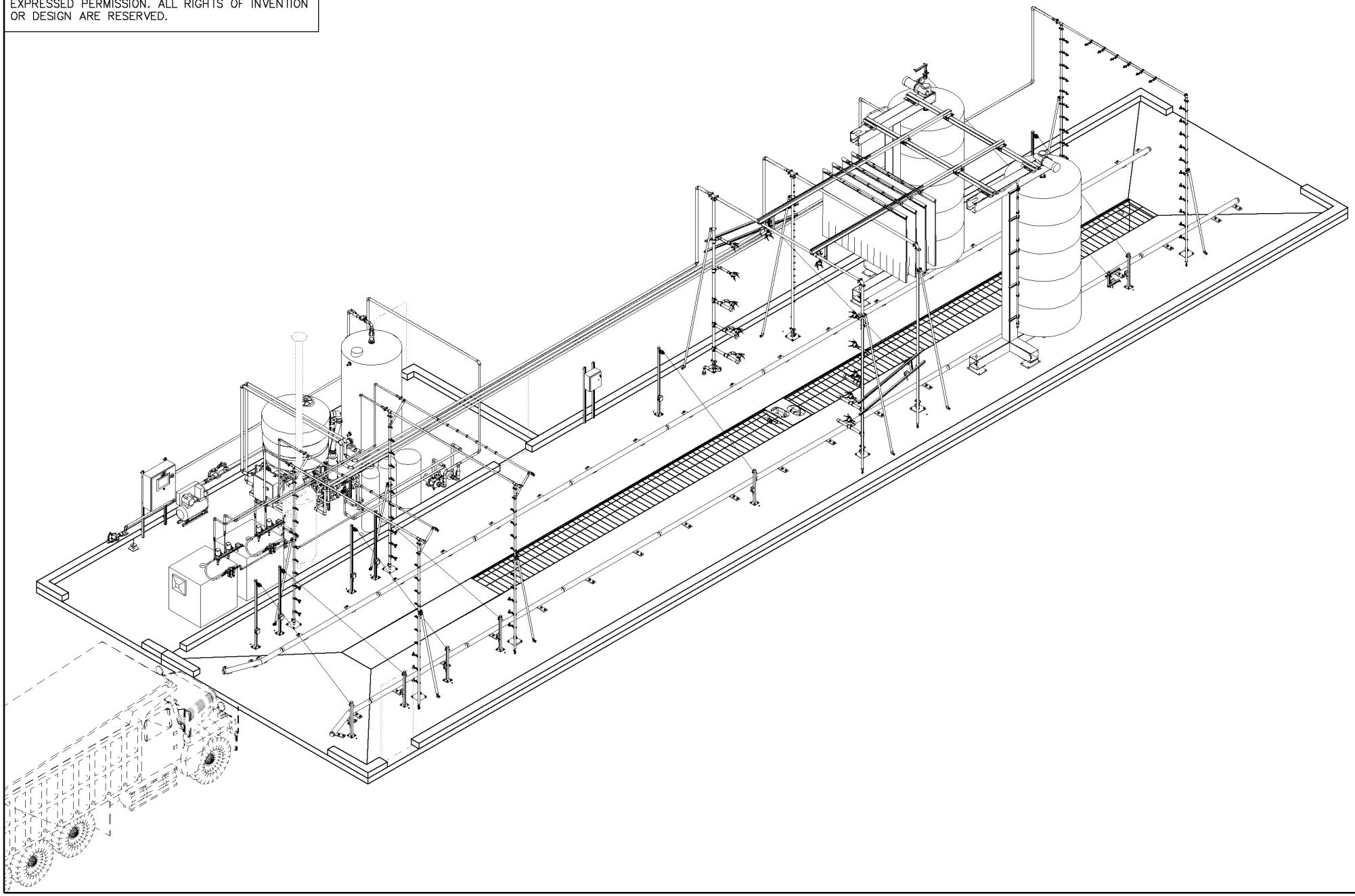


R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

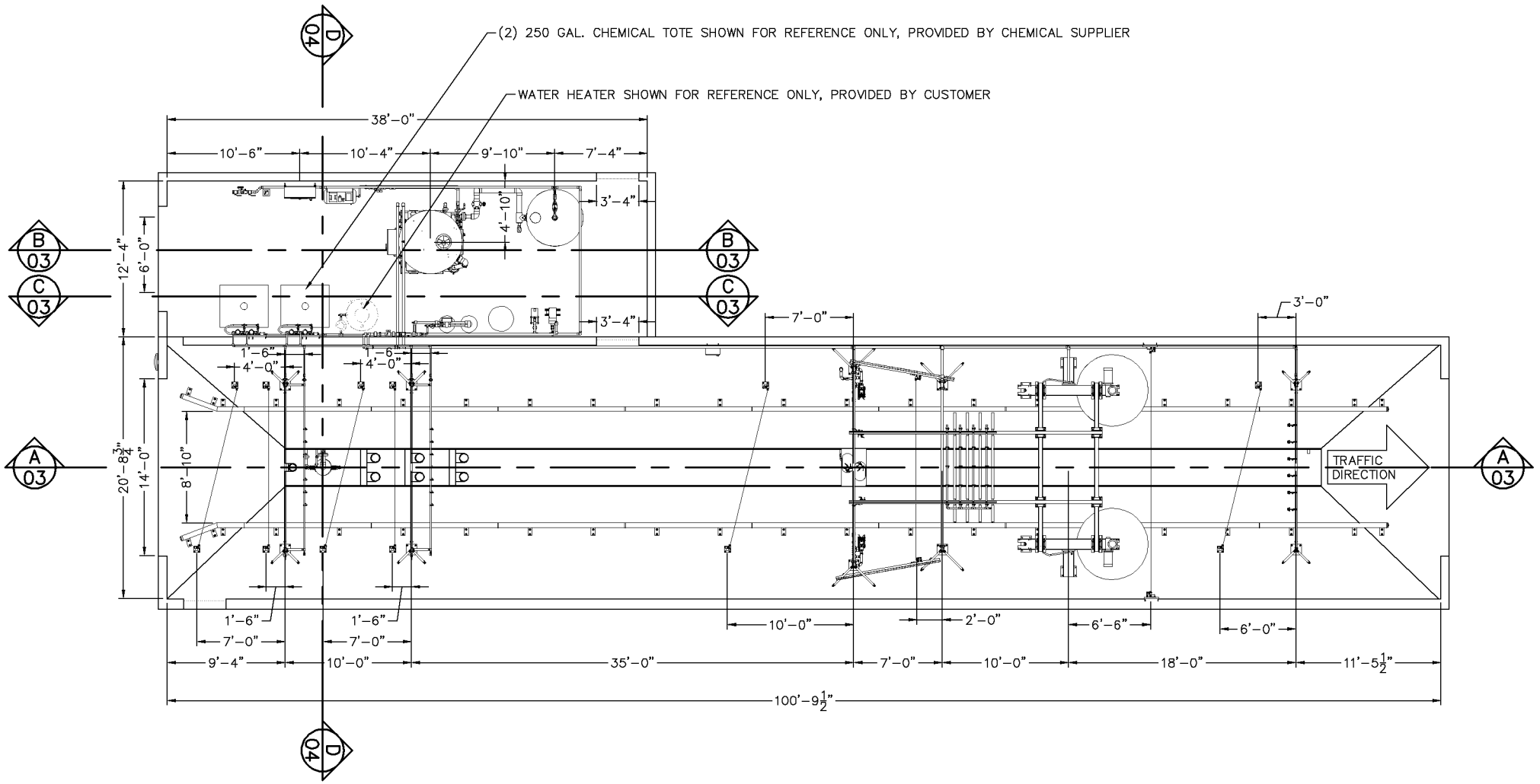
InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: NO SCALE	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
3-D VIEW

DATE: 07/21/09
PART NO: #LY09-070-01
WEIGHT:

PROJECTSUSAI\Coralville\Coralville Transit\LY09-070.dwg, 01_3D, 5/11/2011 3:42:57 PM, Susan, HPDJ1055CM.pc3



NOTE:
DURING INSTALLATION, MAKE SURE THE TIRE GUIDE AND ARCHES DO NOT INTERFERE WITH ENTRANCE OR EXIT OVERHEAD DOORS

NOTE:
THE CONCRETE MUST CURE FOR 27 DAYS BEFORE INSTALLING TIRE GUIDES

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

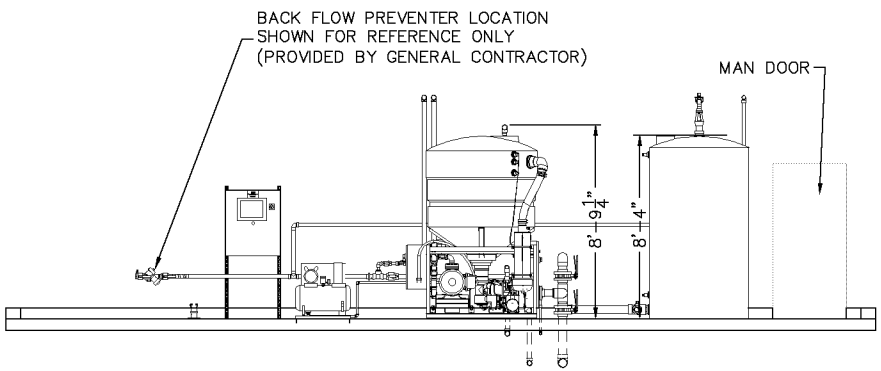
InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE:	
3/16"=1'	

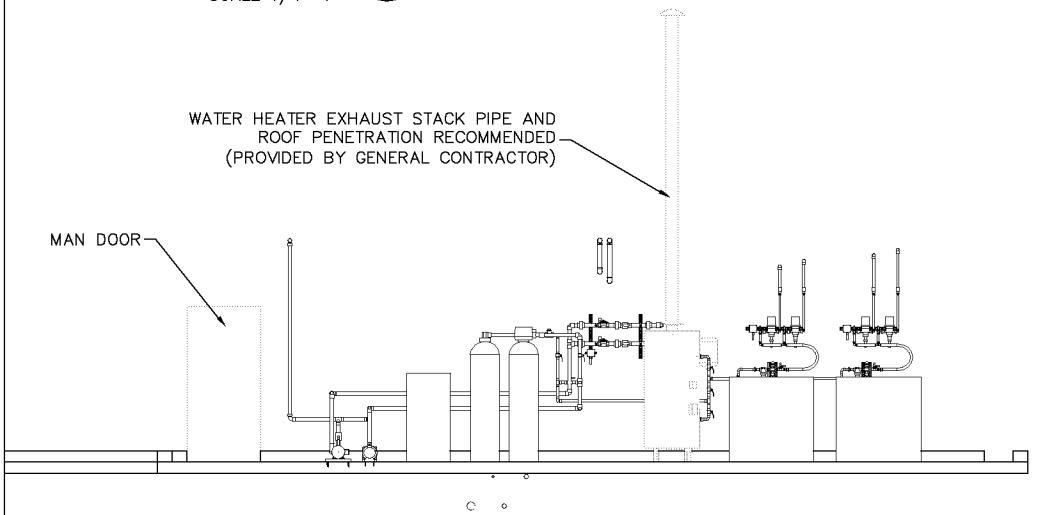
CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PLAN VIEW

DATE: 07/21/09
PART NO: #LY09-070-02
WEIGHT:

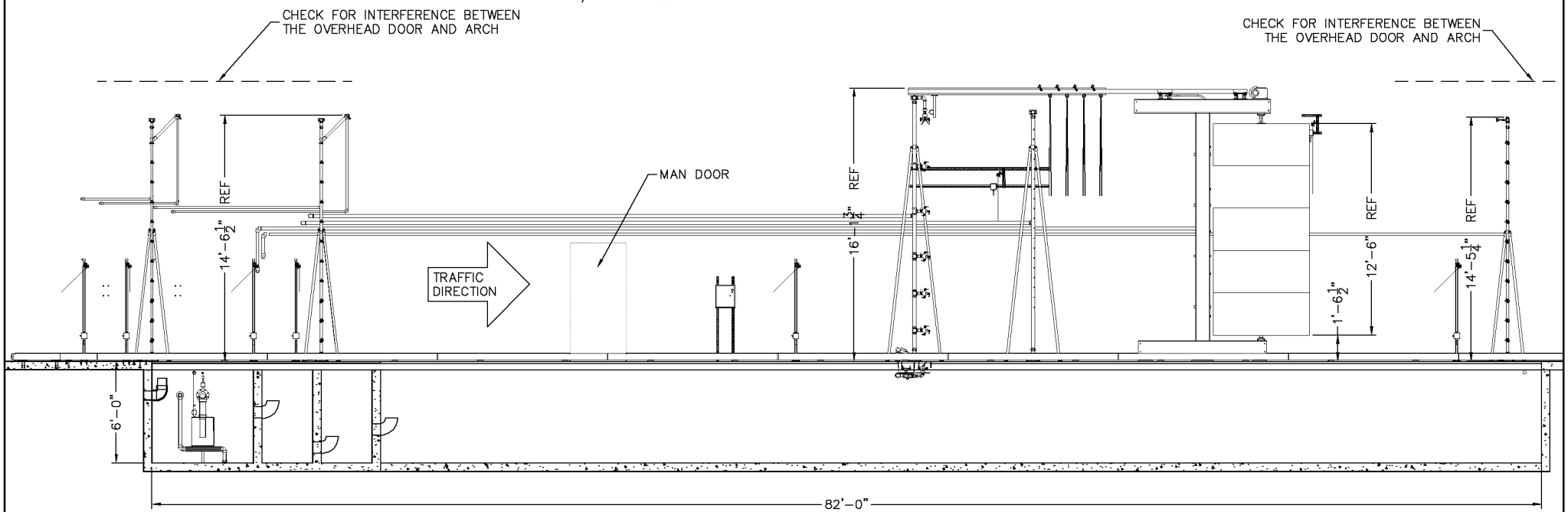
SECTION B/03
SCALE 1/4"=1'



SECTION C/03
SCALE 1/4"=1'



SECTION A/03
SCALE 1/4"=1'



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
SIDE VIEW

DATE: 07/21/09
PART NO: #LY09-070-03
WEIGHT:

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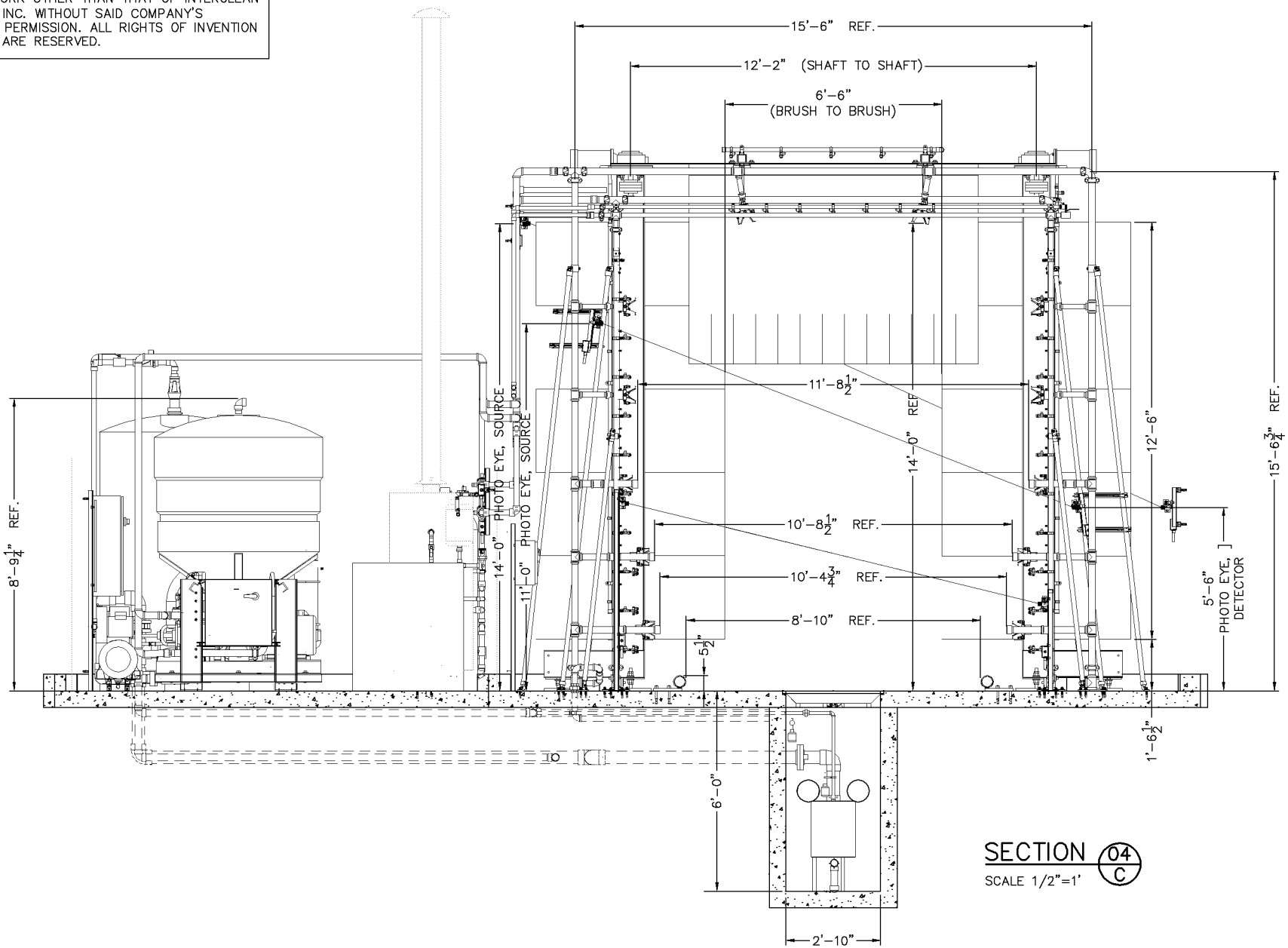


SECTION 04/C
SCALE 1/2"=1'

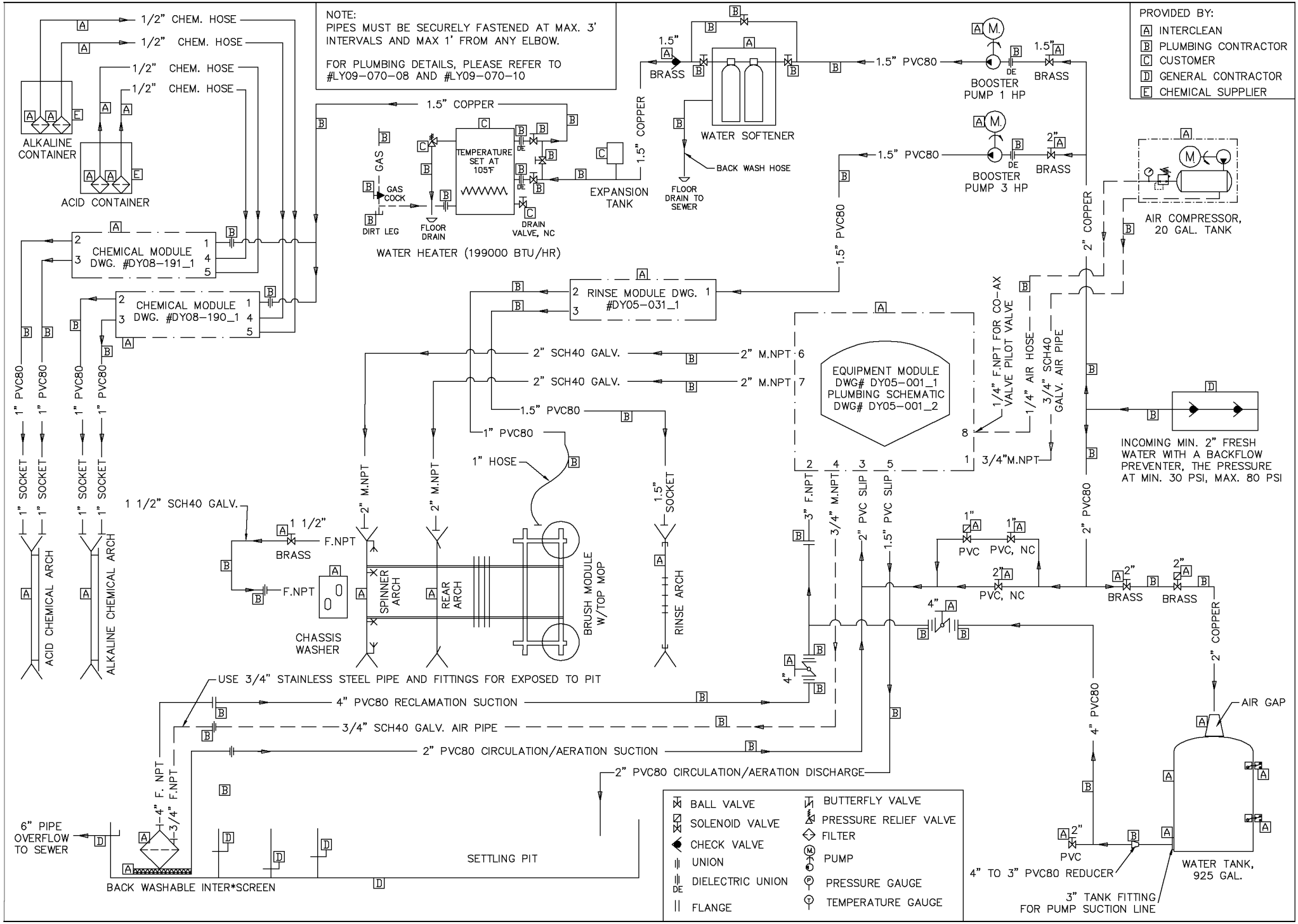
R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
END VIEW

DATE: 07/21/09
PART NO: #LY09-070-04
WEIGHT:



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: NO SCALE	

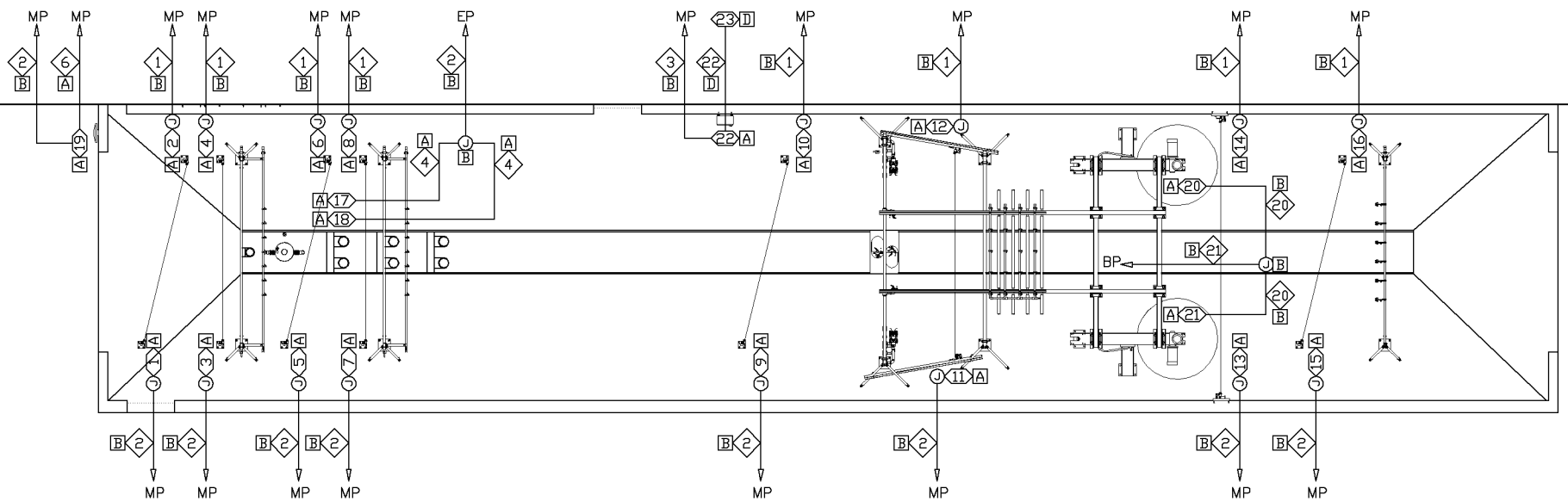
CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PLUMBING SCHEMATIC

DATE: 07/21/09
PART NO: #LY09-070-05
WEIGHT:

C:\ECTS\USA\IA\Coralville\Coralville Transit\LY09-070.dwg, 05_Schematic, 5/11/2011 3:44:27 PM, Susan, HPDJ1055CM.pc3

1. PHOTO EYE, DETECTOR, 24 VDC
2. PHOTO EYE, SOURCE, 24 VDC
3. PHOTO EYE, DETECTOR, 24 VDC
4. PHOTO EYE, SOURCE, 24 VDC
5. PHOTO EYE, DETECTOR, 24 VDC
6. PHOTO EYE, SOURCE, 24 VDC
7. PHOTO EYE, DETECTOR, 24 VDC
8. PHOTO EYE, SOURCE, 24 VDC
9. PHOTO EYE, DETECTOR, 24 VDC
10. PHOTO EYE, SOURCE, 24 VDC
11. PHOTO EYE, DETECTOR, 24 VDC
12. PHOTO EYE, SOURCE, 24 VDC
13. PHOTO EYE, DETECTOR, 24 VDC
14. PHOTO EYE, SOURCE, 24 VDC
15. PHOTO EYE, DETECTOR, 24 VDC
16. PHOTO EYE, SOURCE, 24 VDC
17. PIT LOW LEVEL FLOAT SWITCH, 24 VDC, NO, 3" ABOVE INTERSCREEN COVER
18. PIT FILL LEVEL FLOAT SWITCH, 24 VDC, NC, AT MAX. WATER LEVEL
19. ENCOMPASS encompass READER, 18 VAC
20. MOTOR, 5HP, BRUSH MODULE, 460V, 60HZ
21. MOTOR, 5HP, BRUSH MODULE, 460V, 60HZ
22. SLAVE PANEL (SP), 2x5HP, BRUSH MODULE, 460V, 60HZ, FLA 18
23. FEEDER AND DISCONNECT FOR BRUSH MODULE SLAVE CONTROL PANEL, 460 V, 3 PH.

1. 2-#16, 24 VDC, 1/2" CONDUIT
2. 3-#16, 24 VDC, 1/2" CONDUIT
3. 4-#16, 24 VDC, 1/2" CONDUIT
4. 2-#18, 2 CONDUCTOR FLEXIBLE CORD, COMES W/SENSOR
5. 4-#16, 24 VDC AND 1-ETHERNET CATEGORY 5E CABLE W/RJ-45 CONNECTORS, 1/2" CONDUIT
6. SERIAL CABLE, COMES W/EQUIPMENT
10. FLEXIBLE CORD WITH PLUG, COMES W/EQUIPMENT
11. 3-#14, 120 VAC, 1/2" CONDUIT
20. 3-#12, 460 VAC, 1/2" CONDUIT
21. 6-#12, 460 VAC, 1/2" CONDUIT
22. 3-#10, 460 VAC, 3/4" CONDUIT
22. 3-#10, 460 VAC, 3/4" CONDUIT
23. 3-#8, 460 VAC, 3/4" CONDUIT
24. 3-#4, 460 VAC, 1" CONDUIT
25. 3-#1/0, 460 VAC, 1 1/2" CONDUIT



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

LEGEND:
- DEVICE
- RECEPTACLE, 120V, 20A
- JUNCTION BOX
- BRANCH CIRCUIT/FEEDER
- MP CONNECTED TO MASTER CONTROL PANEL
- EP CONNECTED TO EQ-MODULE SLAVE PANEL
- BP CONNECTED TO BRUSH MODULE SLAVE PANEL

PROVIDED BY:
- [A] INTERCLEAN
- [B] ELECTRICAL CONTRACTOR
- [C] CUSTOMER
- [D] GENERAL CONTRACTOR

NOTE:
1. ALL ELECTRICAL METHODS AND MATERIALS SHALL BE SUITABLE FOR USE IN WET LOCATION PER NEC 310-8, 370-15A, 410-4A, AND ALL APPLICABLE CODES.
2. ALL CONDUCTORS SHALL BE THHN AND HAVE TEMPERATURE RATING OF 90 °C (194 F°).
3. CONDUITS MAY BE COMBINED TO MINIMIZE RUNS, BUT DO NOT COMBINE AC AND DC CIRCUITS.
4. BRANCH CIRCUITS ARE SIZED FOR 500' MAX. RUNS.
5. ELECTRICAL CONDUIT AND CONDUCTORS SIZES ARE MINIMUMS REQUIRED BY INTERCLEAN. SIZES MAY BE SUBJECT TO CHANGE PER CODES AND REGULATIONS.
6. MINIMUM SIZE FEEDER AMPACITY PER NEC 215-2(b)(C)

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	KM
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN
CHECK: KM | APPR: &&&
SCALE: 3/16"=1'

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
ELECTRICAL LAYOUT - WASH BAY

DATE: 07/21/09
PART NO: #LY09-070-06A
WEIGHT:

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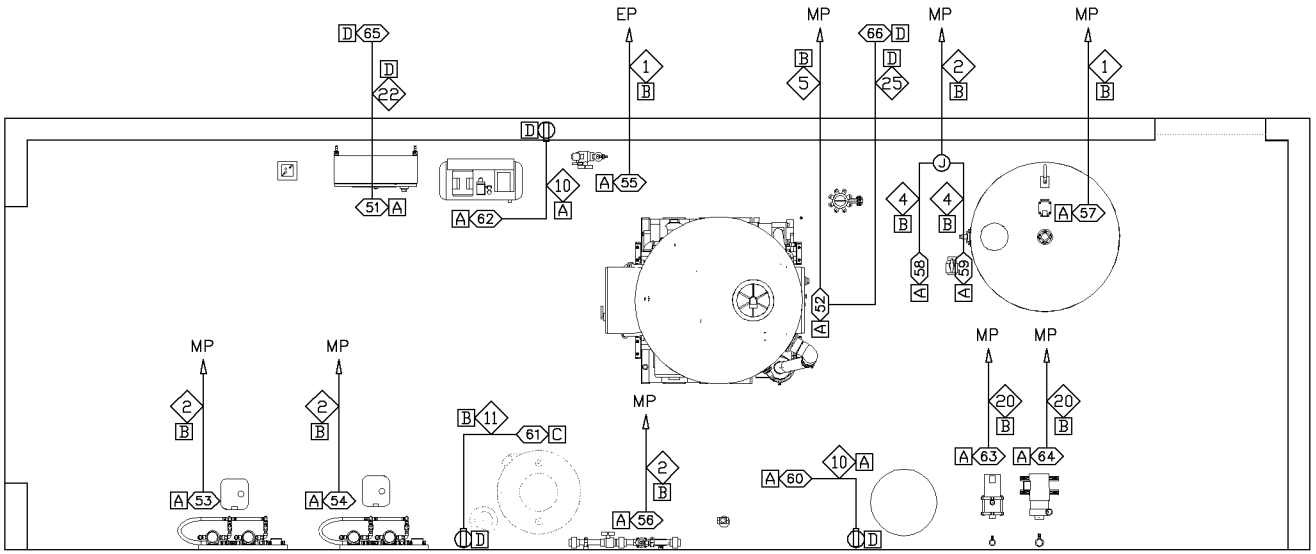
51 MASTER PANEL (MP), W/PC, 460VAC, 3PH, FLA 9
52 EQ–MODULE SLAVE PANEL (EQP), 460VAC, 3PH, FLA 113
53 2 SOLENOID VALVE (3/4") FOR CHMEICAL MODULE, 24 VDC
54 2 SOLENOID VALVE (3/4") FOR CHMEICAL MODULE, 24 VDC
55 SOLENOID VALVE, 1", 24 VDC, FOR PIT FILL
56 2 SOLENOID VALVE (1 1/2"), 24 VDC, FOR WALL MODULE
57 SOLENOID VALVE, 2", 24 VDC, FOR TANK FILL
58 HI–LEVLE FLOAT SWITCH, 24 VDC, FRESH WATER TANK
59 LOW–LEVLE FLOAT SWITCH, 24 VDC, FRESH WATER TANK
60 WATER SOFTENER, 120V/60HZ
61 WATER HEATER, NATURE GAS, 120V/60HZ
62 AIR COMPRESSOR, 20 GAL TANK, 120V, 11 AMPS
63 BOOSTER PUMP, CHEMCIAL ARCHES, 1 HP, 460V, 3M
64 BOOSTER PUMP, RINSE ARCH & BRUSH SPRAY BAR, 3 HP, 460V, 4M
65 FEEDER & DISCONNECT FOR MASTER PANEL, 460 V, 3 PH.
66 FEEDER & DISCONNECT FOR EQ–MODULE SLAVE PANEL, 460 V, 3 PH.

1 2–#16, 24 VDC, 1/2" CONDUIT
2 3–#16, 24 VDC, 1/2" CONDUIT
3 4–#16, 24 VDC, 1/2" CONDUIT
4 2–#18, 2 CONDUCTOR FLEXIBLE CORD, COMES W/SENSOR
5 4–#16, 24 VDC AND 1–ETHERNET CATEGORY 5E CABLE W/RJ–45 CONNECTORS, 1/2" CONDUIT
6 SERIAL CABLE, COMES W/EQUIPMENT
10 FLEXIBLE CORD WITH PLUG, COMES W/EQUIPMENT
11 3–#12, 120 VAC, 1/2" CONDUIT
20 3–#12, 460 VAC, 1/2" CONDUIT
21 6–#12, 460 VAC, 1/2" CONDUIT
22 3–#10, 460 VAC, 3/4" CONDUIT
22 3–#10, 460 VAC, 3/4" CONDUIT
23 3–#8, 460 VAC, 3/4" CONDUIT
24 3–#4, 460 VAC, 1" CONDUIT
25 3–#1/0, 460 VAC, 1 1/2" CONDUIT



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

LEGEND:
- DEVICE
- RECEPTACLE, 120V, 20A
- JUNCTION BOX
- BRANCH CIRCUIT/FEEDER
- MP CONNECTED TO MASTER CONTROL PANEL
- EP CONNECTED TO EQ–MODULE SLAVE PANEL
- BP CONNECTED TO BRUSH MODULE SLAVE PANEL

PROVIDED BY:
- A INTERCLEAN
- B ELECTRICAL CONTRACTOR
- C CUSTOMER
- D GENERAL CONTRACTOR

NOTE:
1 ALL ELECTRICAL METHODS AND MATERIALS SHALL BE SUITABLE FOR USE IN WET LOCATION PER NEC 310–8, 370–15A, 410–4A, AND ALL APPLICABLE CODES.
2 ALL CONDUCTORS SHALL BE THHN AND HAVE TEMPERATURE RATING OF 90 °C (194 F°).
3 CONDUITS MAY BE COMBINED TO MINIMIZE RUNS, BUT DO NOT COMBINE AC AND DC CIRCUITS.
4 BRANCH CIRCUITS ARE SIZED FOR 500' MAX. RUNS.
5 ELECTRICAL CONDUIT AND CONDUCTORS SIZES ARE MINIMUMS REQUIRED BY INTERCLEAN. SIZES MAY BE SUBJECT TO CHANGE PER CODES AND REGULATIONS.
6 MINIMUM SIZE FEEDER AMPACITY PER NEC 215–2(b)(C)

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	KM
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN | CHECK: KM | APPR: &&& | SCALE: 3/8"=1'

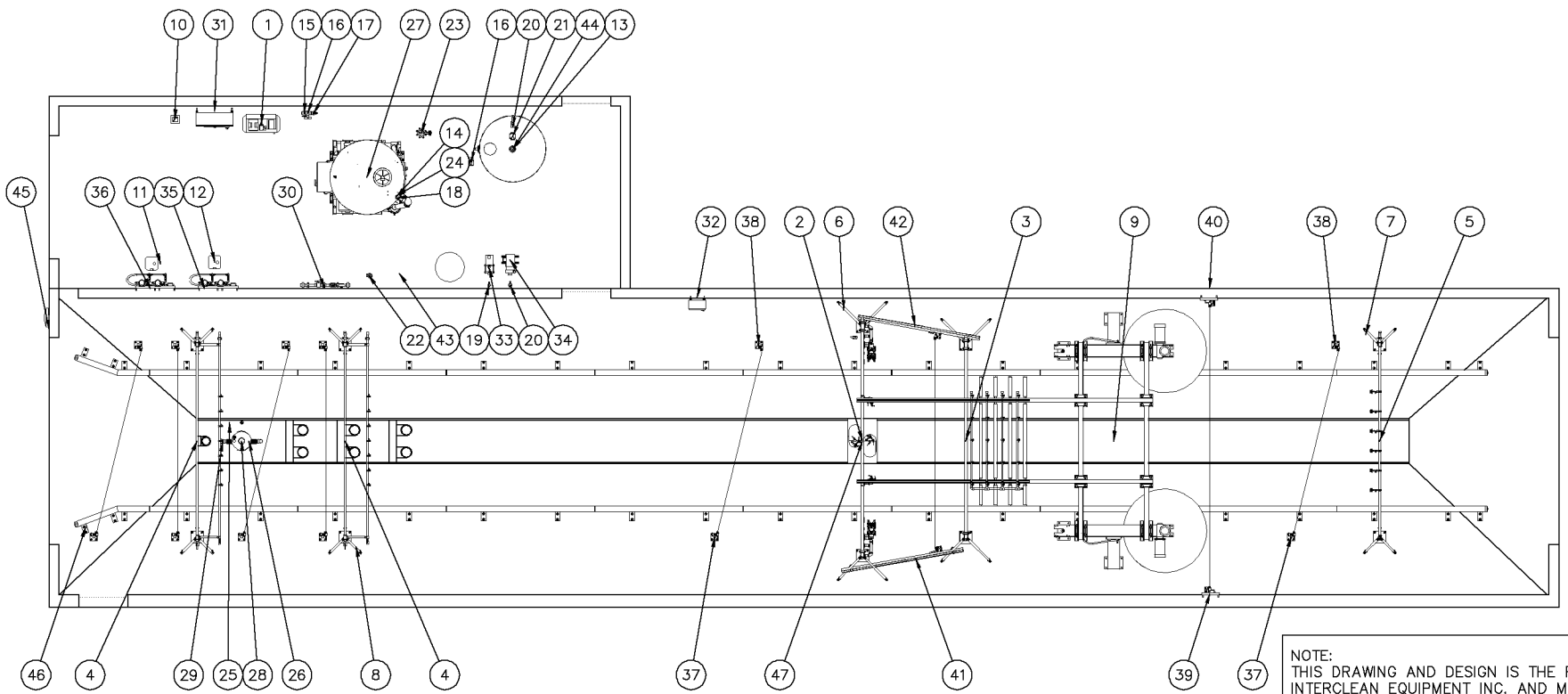
CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
ELECTRICAL LAYOUT - EQUIPMENT ROOM

DATE: 07/21/09
PART NO: #LY09-070-06B
WEIGHT:

PROJECTS\SUSAN\Coralville\Coralville Transit\LY09-070.dwg, 06_Elec2, 5/11/2011 3:44:46 PM, Susan, HPDJ1055CM.pc3

BILL OF MATERIALS FOR LY09-070

ITEM NO.	QTY REQD.	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#DY08-334_1	Air Compressor, Floor Mnt, 20 Gal., 120V/60Hz, w/3/4" Outlet	AC112121-00
2	1	#D99038_1	Spinner Arch Assembly, 12 Spinners, Galvanized	AR311c-00
3	1	#DY03-023_1	Arch Ass'y, Rear Wash, w/32x0530 Nozzles, W=13', H=14'-8"	AR31292-01
4	2	#DY00-210_1	Arch Ass'y, Chem., S.S., for Truck Wash, Side & Rear	AR322252-00
5	1	#DY00-218_1	Arch, Rinse, S.S., for Truck Wash	AR322352-00
6	8	#D97437_1	Arch Leg Ass'y, Floor Mount, H=12' 8 1/2", Galv.	AR3611-00
7	4	#D96096_1	Arch Leg Ass'y, Floor Mount, H=7'-8 1/4", Galv.	AR3611-01
8	8	#DY02-326_1	Arch Leg Assembly, Floor Mount, H=7'-8", SS 304	AR36121-01
9	1	#DY05-016_1	Brush Module Ass'y, Galv. Frame, 2-Hi Brushes, 460V, 60Hz	BM83111-02
10	1	#D99016_1	Spinner Nozzle Adjusting Tool Assembly	C61813-00
11	1	#DY07-624_1	Chemical w/Test Kit Ass'y, ICE-Citric, 5 Gallons	CH1121-5
12	1	#DY07-625_1	Chemical w/Test Kit Ass'y, InterGreen, 5 Gallons	CH1211-5
13	1	C0161e-00	Fixed Air Gap, Inlet 2", Outlet Threaded 3", Cast Iron	C0161e-00
14	4	C01b71-05Mnpt	Hose Barb, 1/2" M npt x 1/2" Hose End, Nylon	C01b71-05Mnpt
15	1	C02111-1	Valve, Ball, 1", Compact, Socket, EPDM O-Ring Seals	C02111-1
16	2	C02111-2	Valve, Ball, 2", Compact, Socket, EPDM O-Ring Seals	C02111-2
17	1	C02122-16	Valve, Solenoid, 1", npt x npt, 24 VDC, GF Nylon, w/Dim Coil	C02122-16
18	2	C02211-05	Ball Valve, 1/2", Brass, for Low Pressure Gas	C02211-05
19	2	C02211-15	Valve, Ball, 1 1/2", NPT, Bronze, Webstone #41706	C02211-15
20	2	C02211-2	Valve, Ball, 2", NPT, Brass, Webstone #41707	C02211-2
21	1	C02221-32	Valve, Sol.Op. 2", NPT x NPT, Brass, 24VDC	C02221-32
22	1	C02231-15	Valve, Swing Check, 1 1/2" F.NPT, Bronze	C02231-15
23	2	#DY05-320_1	Butterfly Valve Ass'y, 4", w/Manual Actuator (Lever)	C0235a1-4a
24	4	C084-05	Hose Clamp, 1/2", worm drive, S.S, #HSS6 (7/16"-25/32")	C084-05
25	1	C0b121-02	Float Level Switch, Pit fill, red, NC, 25', #2901-B1-S1-C1-25	C0b121-02
26	1	C0b122-01	Float Level Switch, Pit low, yellow, NO, 25', #2900-B1-S1-C1-25	C0b122-01
27	1	#DY05-001_1	EQ-Module Ass'y, 75Hp,460V,w/3-way Valve, Bio-Re.&Soft Start	EM12211-02
28	1	#DY06-130_1	InterScreen, SS, Weld, H=2'-11", 4" NPT Outlet, 0.015" Slot	IS232-00
29	1	#DY00-133_1	Intake Pipe, Field Ass'y, 2" SCH 80 PVC, 100 Holes	IS42-00
30	1	#DY05-031_1	Wall Module Ass'y, Rinse, 2 Inlets and 2 Outlet	MW3122-02
31	1	#DY01-278_1	Master Panel, Field Ass'y, Reclaim Water, Type A, 460V	PA111213-00
32	1	#DY01-286_1	Slave Panel, Field Ass'y, 2x5Hp, 460V, 60Hz	PA23212-00
33	1	#DY11-160_1	Pump, Booster, Floor Mnt, 1Hp, 460V, 60Hz, tefc, Gould.	PU22112321-00
34	1	#DY00-180_1	Pump, Booster, Floor Mounted, 3Hp, 230/460V, odp, Gould	PU22122311-00
35	1	#DY08-190_1	Dosatron Pump (Aflas 1:20) Ass'y, 2 Pumps, Wall Mnt	PU23432-00
36	1	#DY08-191_1	Dosatron Pump (Viton 1:50) Ass'y, 2 Pumps, Wall Mnt	PU23432-01
37	6	#DY08-433_1	Photo Eye Ass'y, Receiver, H=3', SS 304, Floor Mnt	SE3211211-00
38	6	#DY08-342_1	Photo Eye Ass'y, Sender, H=6', SS 304, Floor Mnt	SE3212212-00
39	1	#D98151_1	Photo Eye Assy, Cutler-Hammer, Receiver, Wall Mount	SE32231-01
40	1	#D98150_1	Photo Eye Ass'y, Cutler-Hammer, Sender, Wall Mount	SE32232-01
41	1	#DY00-101_1	Photo Eye Ass'y, Receiver, Cutler-Hammer, Arch Leg Mount	SE323311-00
42	1	#DY00-102_1	Photo Eye Ass'y, Sender, Culter-Hammer, Arch Leg Mount	SE323321-00
43	1	#DY07-628_1	Softener Ass'y, w/Salt & Test Kit, 110V, 60Hz, 18-39 GPM	SO3212-00
44	1	#D97258_1	Tank, 925 gallon, Field Ass'y, w/2 Float Level Switches	TA2112-00
45	1	#DY07-099_1	Encompass Reader Ass'y, Wall Mnt, w/200 Tag & 20' Cable	TC3611-00
46	1	#D98045_1	Tire Guides, CTW, Galv., L=96', OD=4.5", H= 5.5"	TGa141-95
47	1	#DY08-251_1	Underchassis Module Ass'y, Galv., 2 Spinners, L=2', W=3', H=1'	UC131111-00



NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN: SUSAN | DRAWN: SUSAN | CHECK: PK | APPR: #### | SCALE: 3/16"=1'

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
EQUIPMENT LAYOUT

DATE: 07/21/09
PART NO: #LY09-070-07
WEIGHT:

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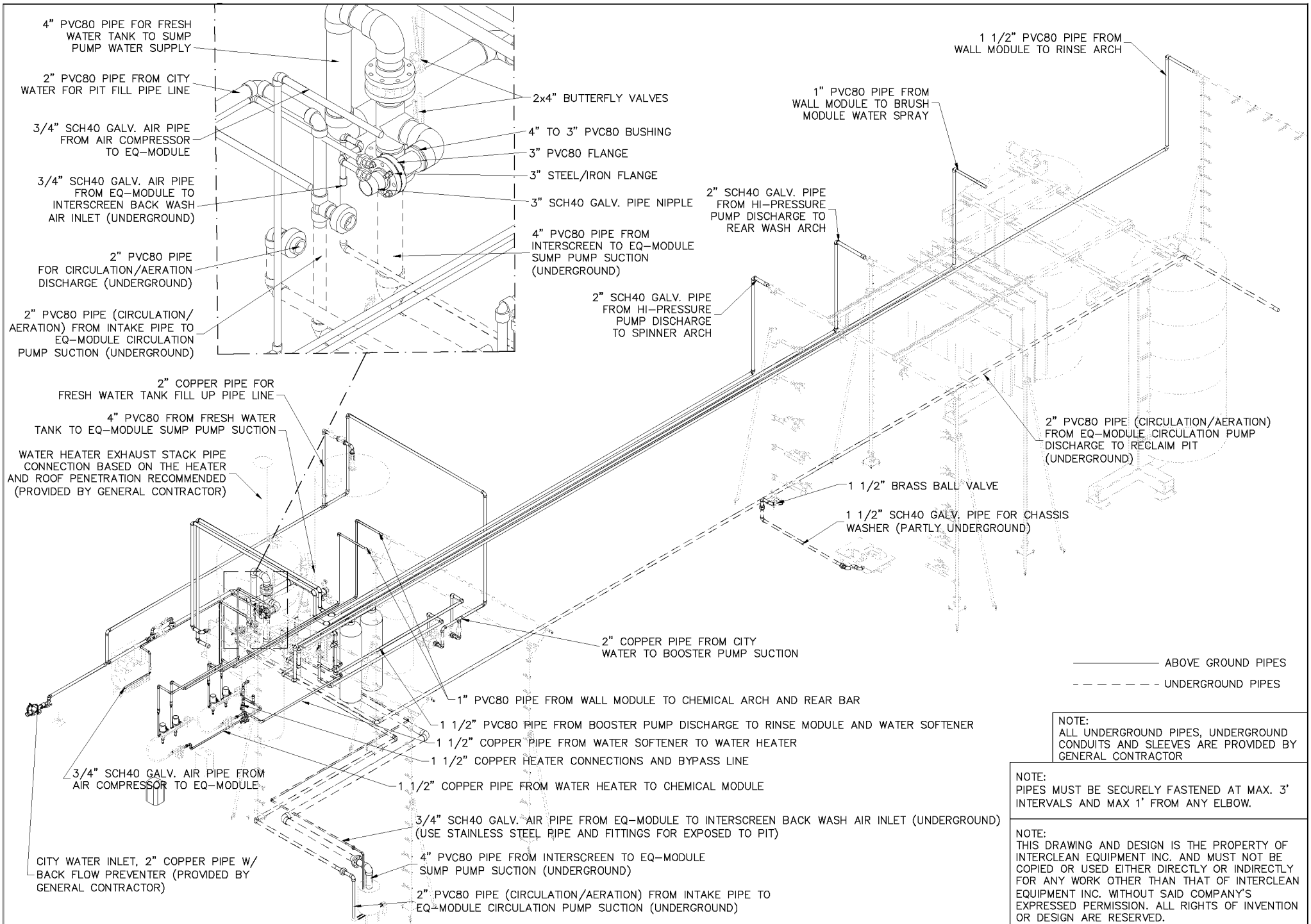

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

NOTE:
PIPES MUST BE SECURELY FASTENED AT MAX. 3' INTERVALS AND MAX 1' FROM ANY ELBOW.

R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####

SCALE: NO SCALE

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PIPING 3D

DATE: 07/21/09
PART NO: #LY09-070-08
WEIGHT:

NOTE:
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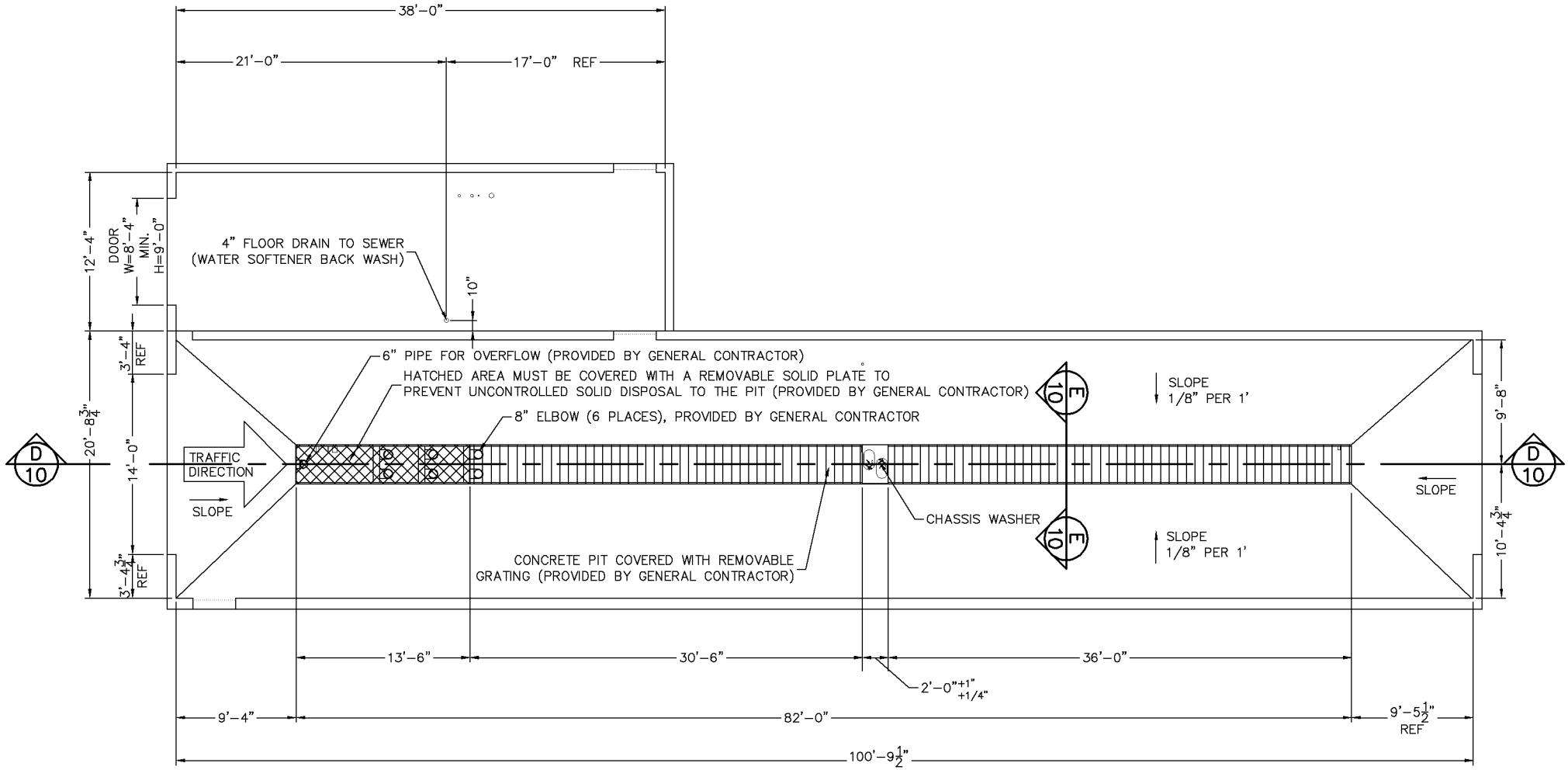
NOTE:
THE WASH SYSTEM TEMPERATURE REQUIRED:
WASH BAY: MIN. 33°F
EQUIPMENT ROOM: MIN. 33°F, MAX. 90°F

NOTE:
THE CONCRETE MUST CURE FOR 27 DAYS BEFORE INSTALLING TIRE GUIDES



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
CONCRETE LAYOUT

DATE: 07/21/09
PART NO: #LY09-070-09
WEIGHT:

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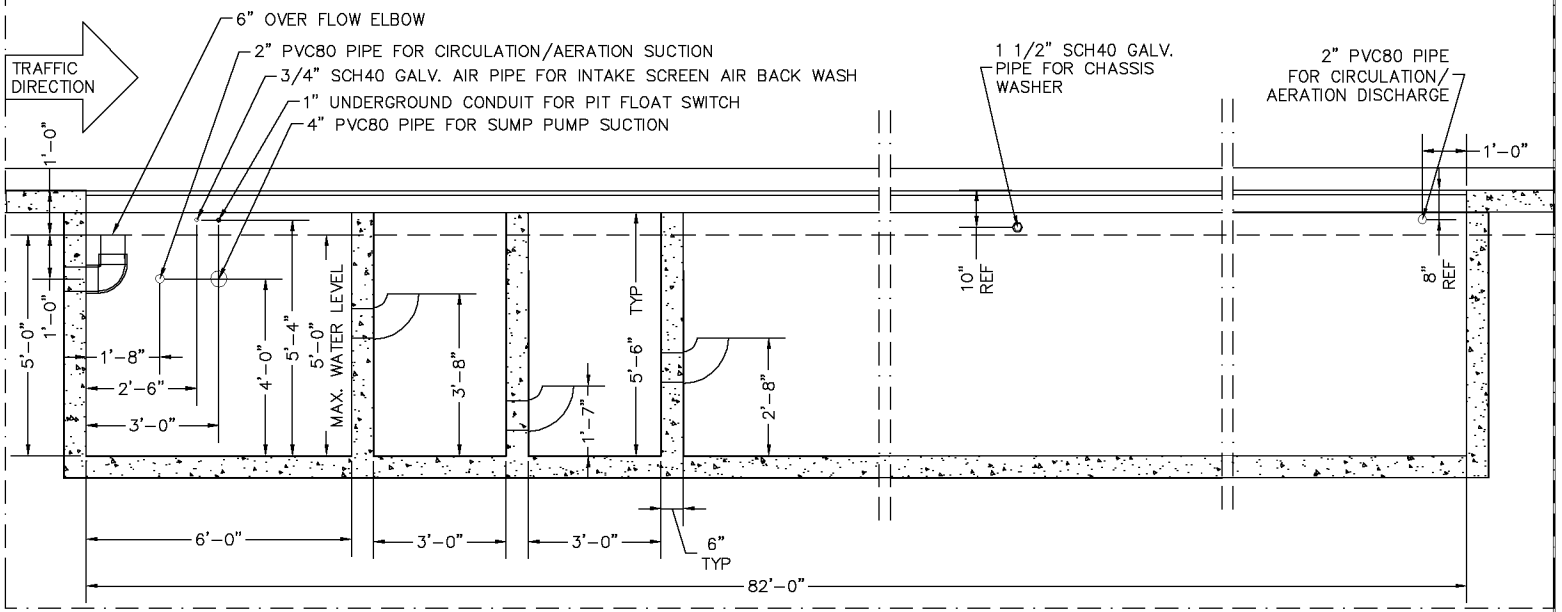
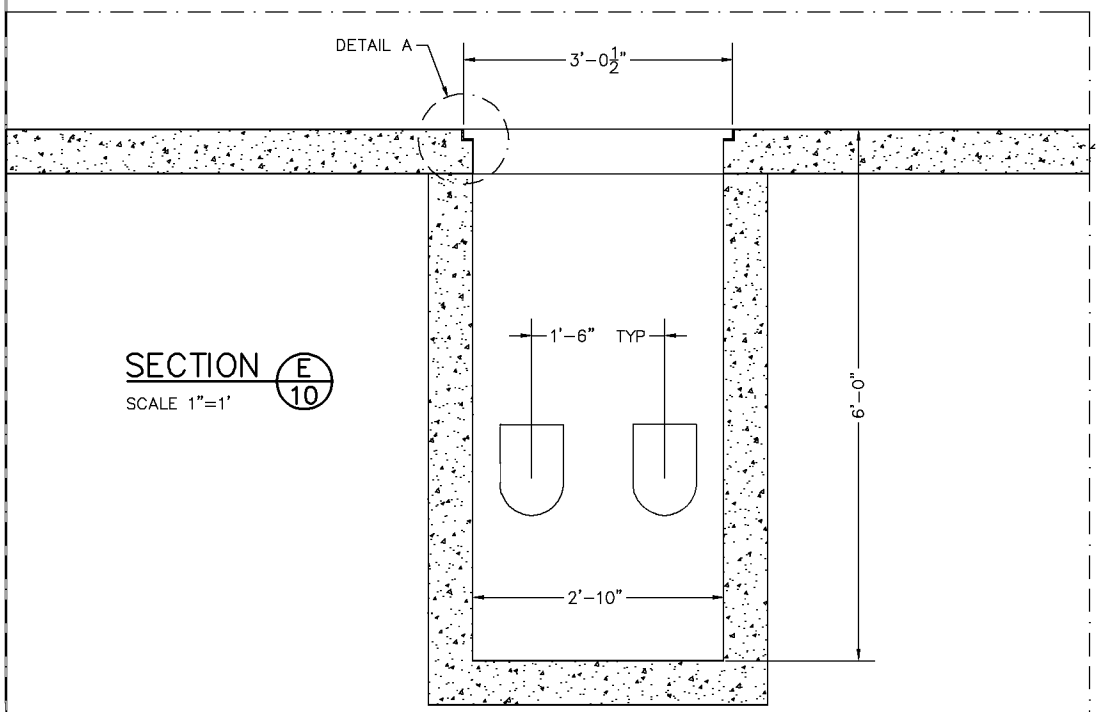
NOTE:
THE SUMP PUMP AND CIRCULATION /AERATION SUCTION PIPELINES TO BE LOCATED UNDER THE PIT WATER LEVEL FOR FULL LENGTH

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

SECTION D/10

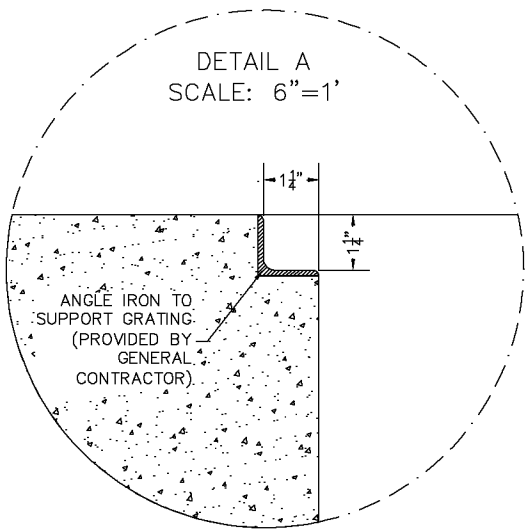
SCALE 1/2"=1'





SECTION E/10

SCALE 1"=1'



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SIL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: XX	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
PIT DETAIL

DATE: 07/21/09
PART NO: #LY09-070-10
WEIGHT:

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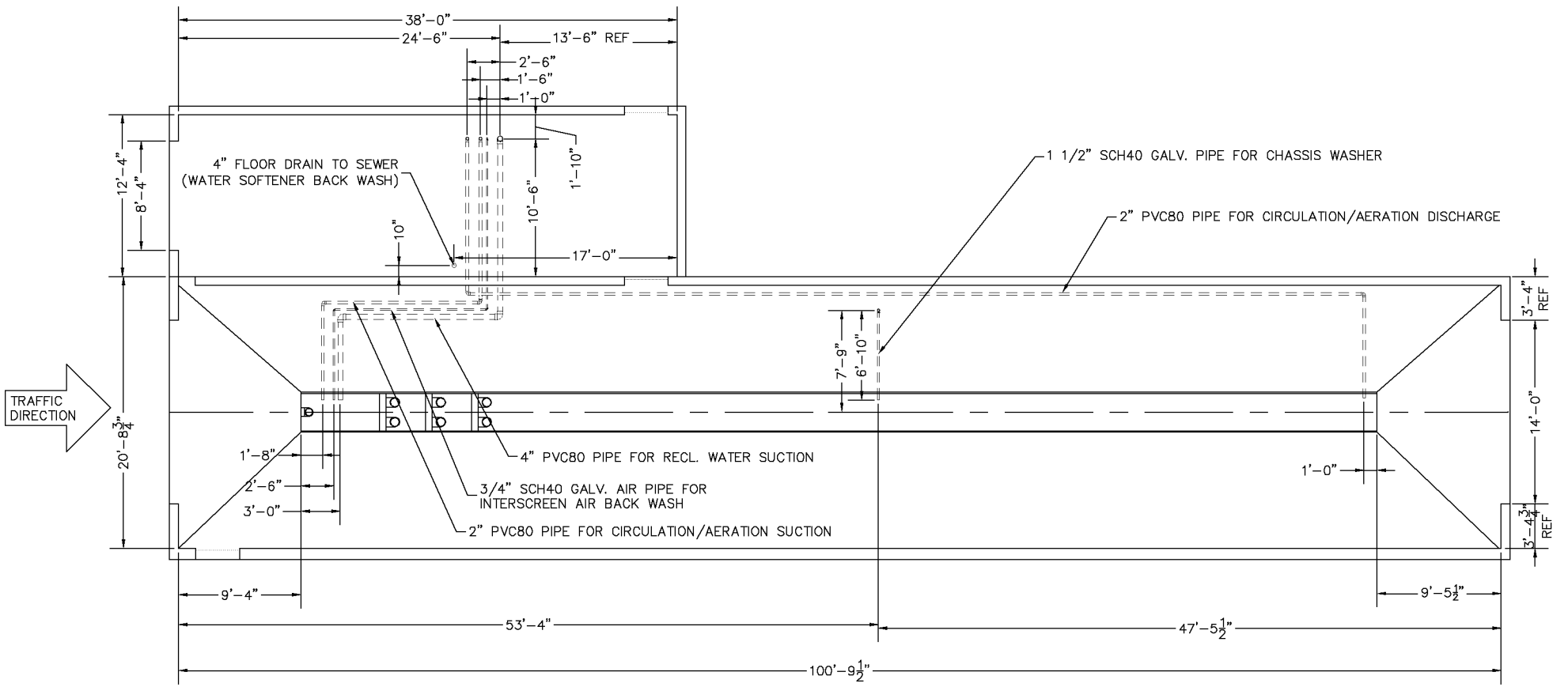
NOTE:
THE SUMP PUMP AND CIRCULATION /AERATION SUCTION PIPELINES TO BE LOCATED UNDER THE PIT WATER LEVEL FOR FULL LENGTH

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR

ABOVE GROUND PIPES

UNDERGROUND PIPES

NOTE:
UNDERGROUND PIPELINES:
1. STANDARD PIPE THREADS AT BOTH ENDS OF GALVANIZED PIPE
2. LEAVE MIN. 6" STUB ABOVE FINISHED SURFACES
3. LEAVE MIN. 6" STUB OUT IN RECLAIM PIT
4. LOCATE UNDERGROUND PIPELINES FROM 8" TO 14" DEPTH UNLESS OTHERWISE STATED



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	####
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
UNDERGROUND PIPES

DATE: 07/21/09
PART NO: #LY09-070-11
WEIGHT:

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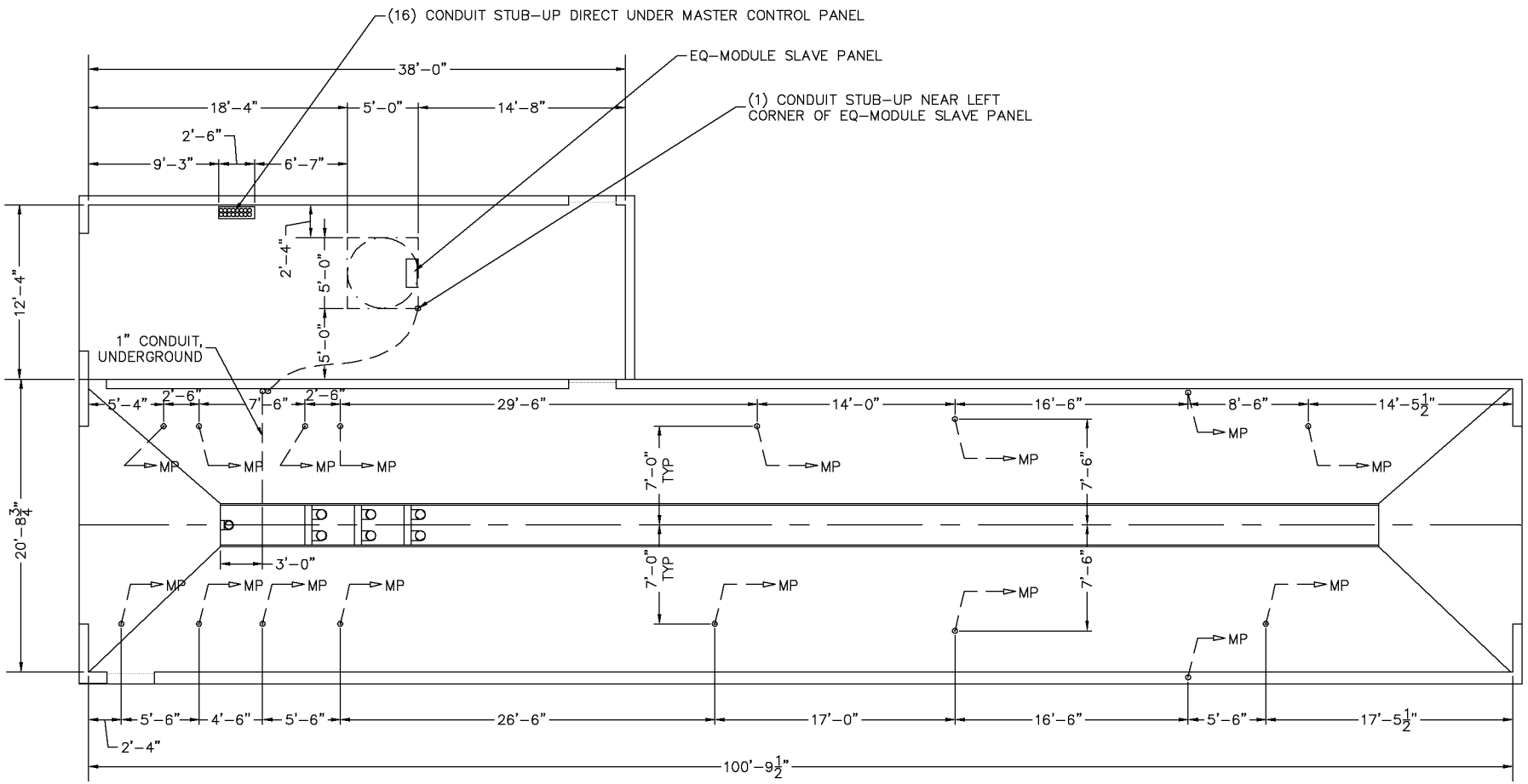
CONDUIT STUB–UP, 6" ABOVE FLOOR

1/2" UNDERGROUND CONDUIT
UNLESS OTHERWISE NOTED

NOTE:
ALL UNDERGROUND PIPES, UNDERGROUND CONDUITS AND SLEEVES ARE PROVIDED BY GENERAL CONTRACTOR



R.	DATE	DESCRIPTION	BY	APPR
C	05/11/11	THE WASH BAY AND EQUIPMENT ROOM UPDATED	SL	DK
B	02/22/11	CARD READER REPLACED BY ENCOMPASS READER	SL	DK
A	01/12/10	THE WHOLE SET LAYOUT COMPLETED	SL	PK

InterClean Equipment, Inc.

DESIGN:	DRAWN:
SUSAN	SUSAN
CHECK:	APPR:
PK	@@@
SCALE: 3/16"=1'	

CORALVILLE TRANSIT, CORALVILLE, IA
TRUCK WASH, RECLAIM WATER SYSTEM
UNDERGROUND CONDUITS

DATE: 07/21/09
PART NO: #LY09-070-12
WEIGHT:

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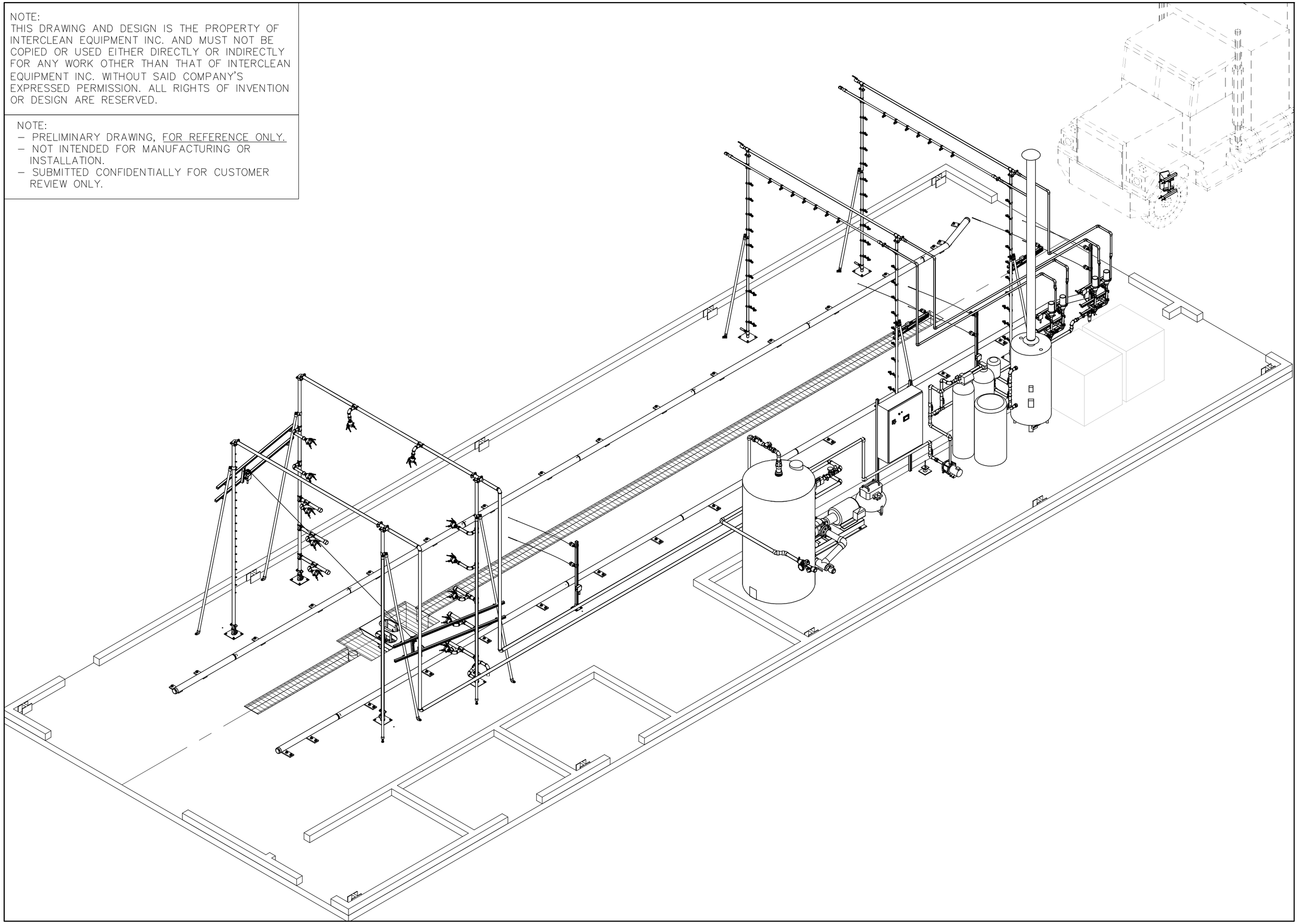

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE:	
NO SCALE	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
3-D VIEW

DATE:	12/03/14
PART NO:	#LY14-088-01
WEIGHT:	

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NOTE:
DURING INSTALLATION, MAKE SURE THE TIRE GUIDE AND ARCHES DO NOT INTERFERE WITH ENTRANCE OR EXIT OVERHEAD DOORS

NOTE:
THE CONCRETE MUST CURE FOR 27 DAYS BEFORE INSTALLING TIRE GUIDES

NOTE:
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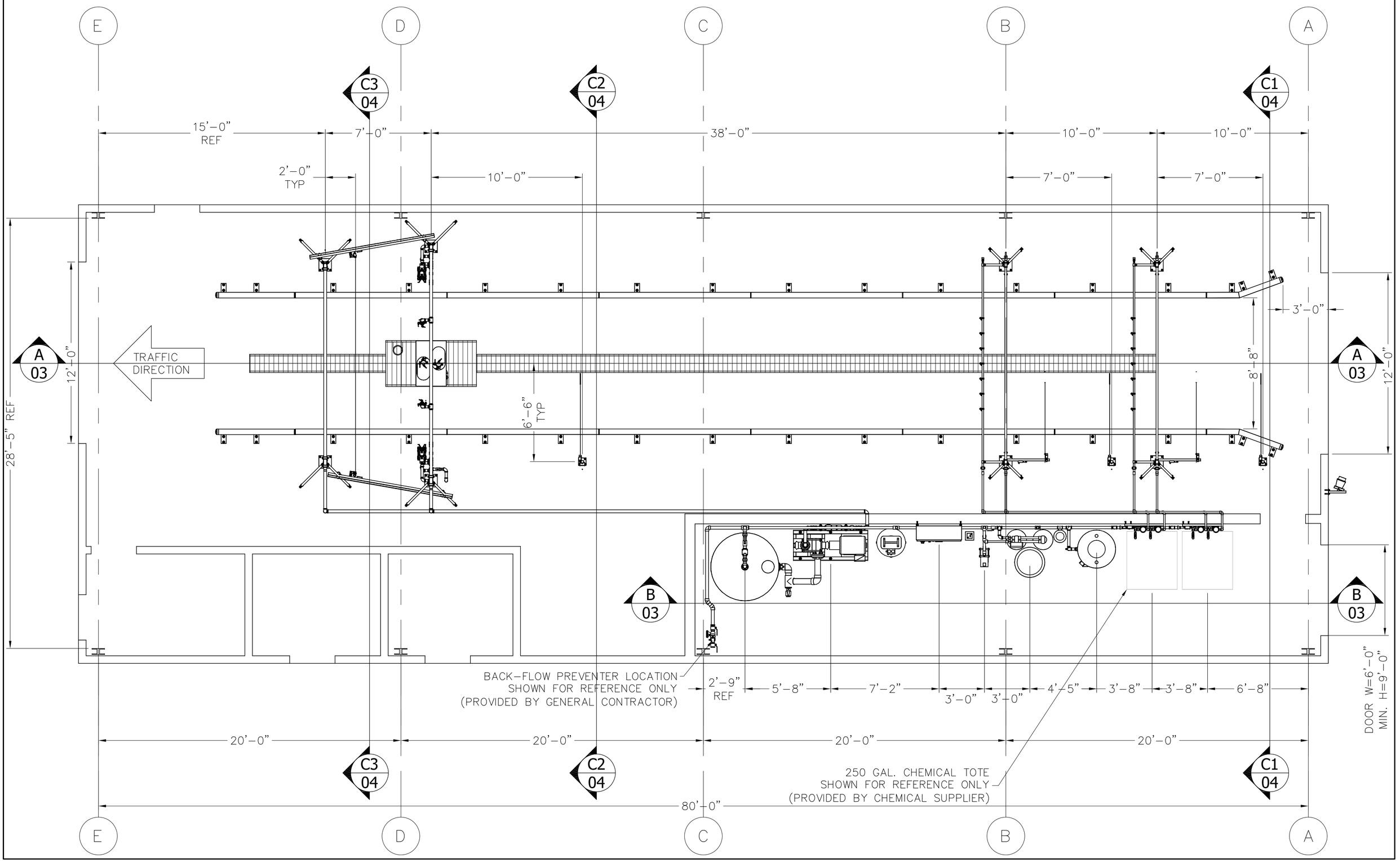

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE: 1/4"=1'	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
PLAN VIEW

DATE: 12/03/14
PART NO: #LY14-088-02
WEIGHT:

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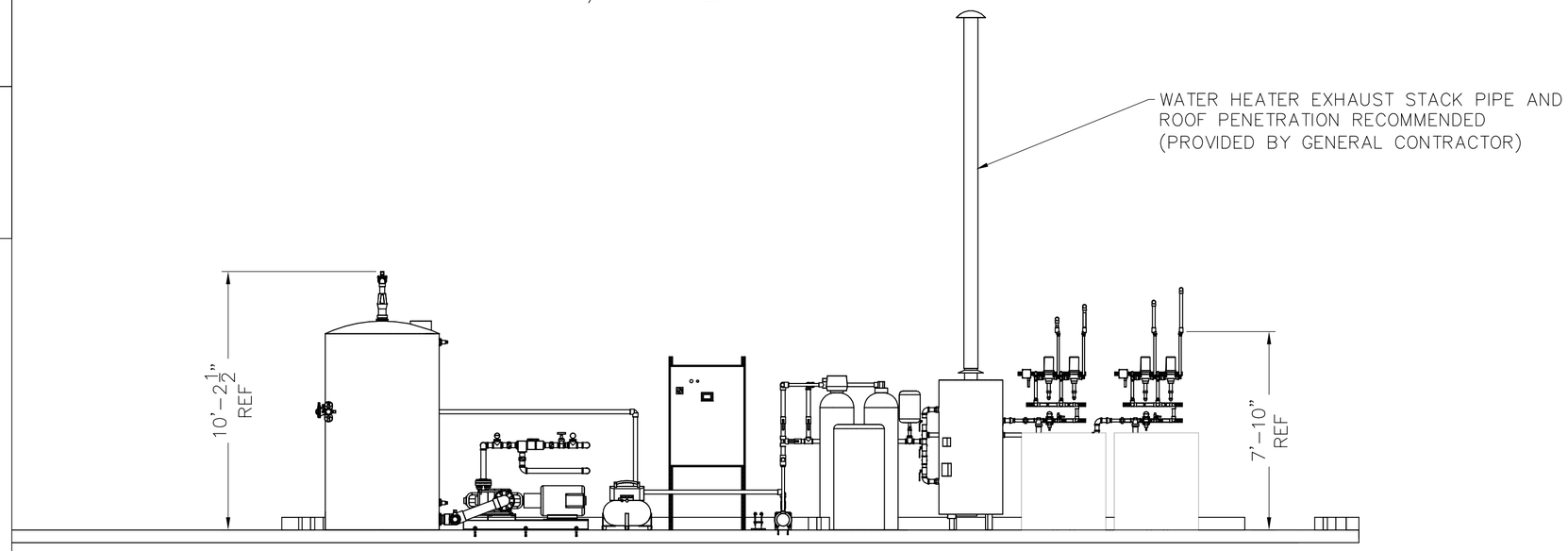
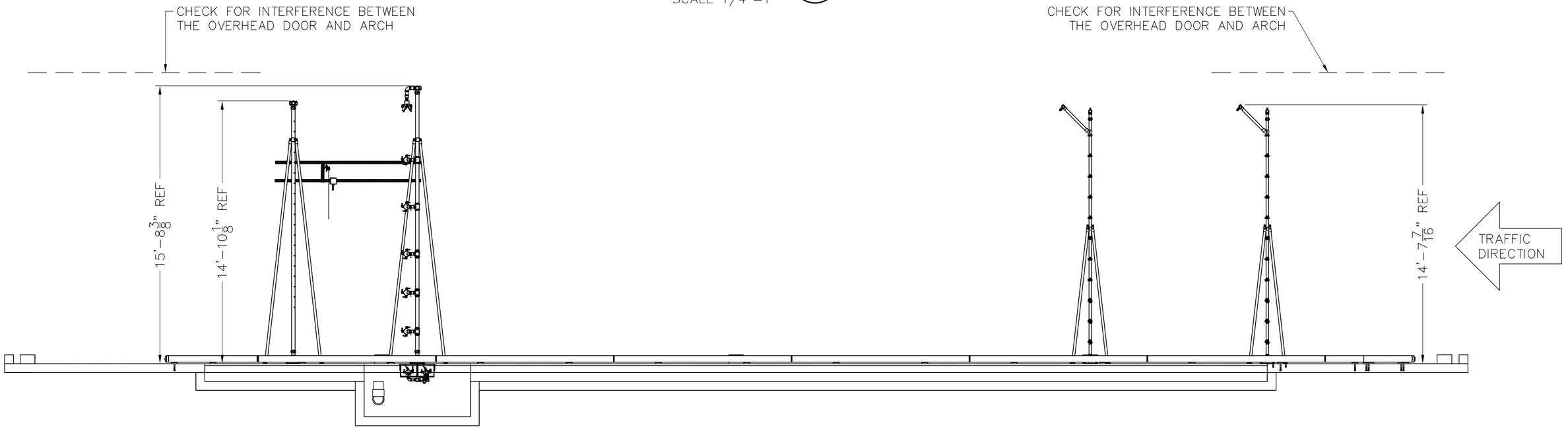
SECTION B/03

SCALE 1/4"=1'



SECTION A/03

SCALE 1/4"=1'



R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE: 1/4"=1'	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
SIDE VIEW

DATE: 12/03/14
PART NO: #LY14-088-03
WEIGHT:

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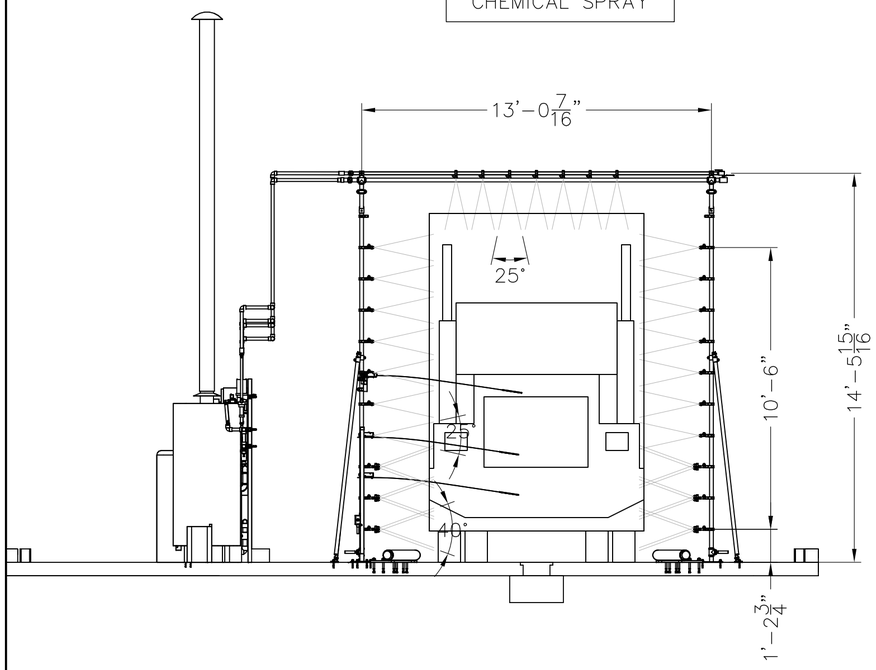
CHEMICAL SPRAY

SECTION C1 04

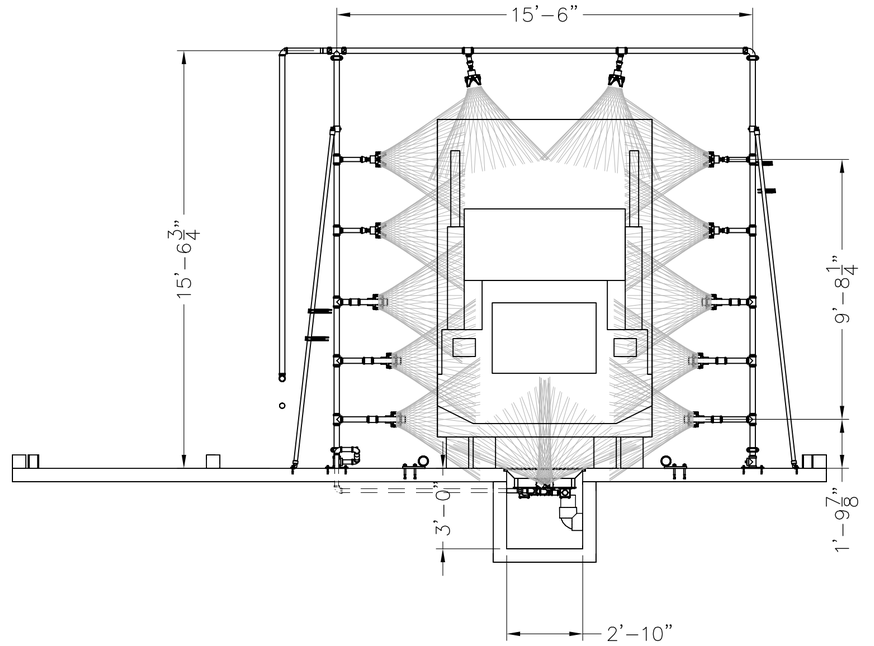
SCALE 1/4"=1'



SPINNER SPRAY

SECTION C2 04

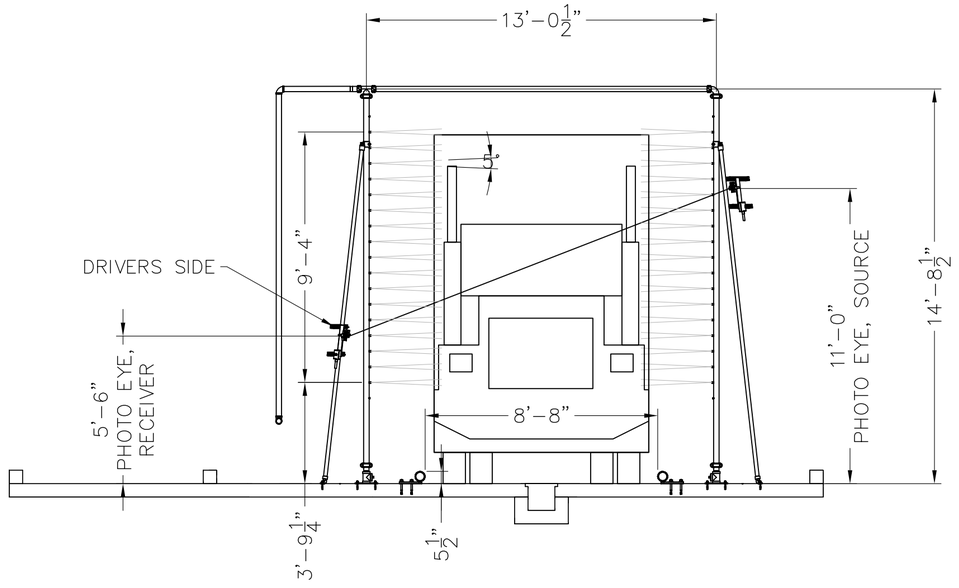
SCALE 1/4"=1'



REAR SPRAY

SECTION C3 04

SCALE 1/4"=1'



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R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE: 1/4"=1'	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
END VIEW

DATE: 12/03/14
PART NO: #LYI4-088-04
WEIGHT:

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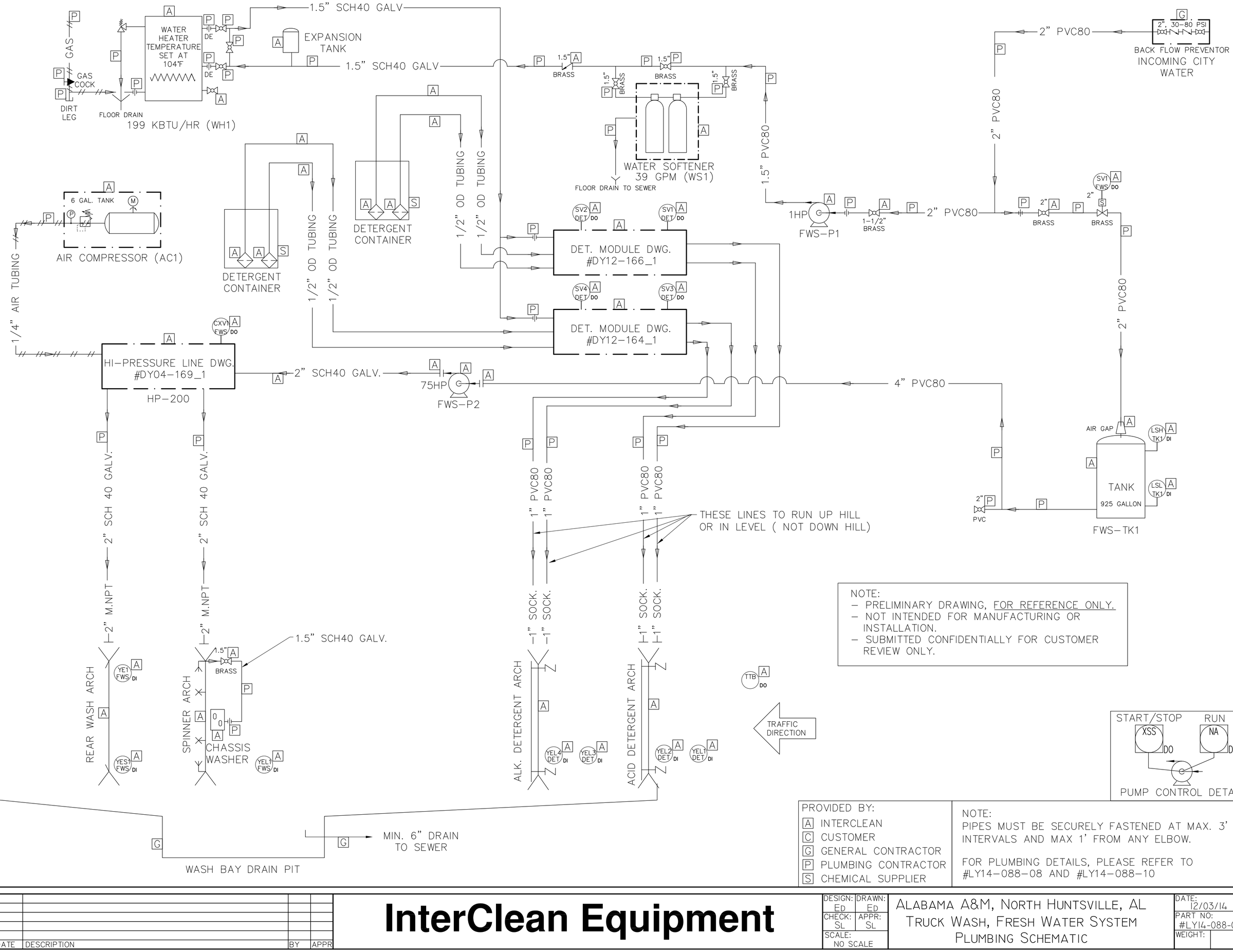

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PROVIDED BY:
- A INTERCLEAN
- C CUSTOMER
- G GENERAL CONTRACTOR
- P PLUMBING CONTRACTOR
- S CHEMICAL SUPPLIER

NOTE:
PIPES MUST BE SECURELY FASTENED AT MAX. 3' INTERVALS AND MAX 1' FROM ANY ELBOW.

FOR PLUMBING DETAILS, PLEASE REFER TO #LY14-088-08 AND #LY14-088-10

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE: NO SCALE	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
PLUMBING SCHEMATIC

DATE: 12/03/14
PART NO: #LY14-088-05
WEIGHT:

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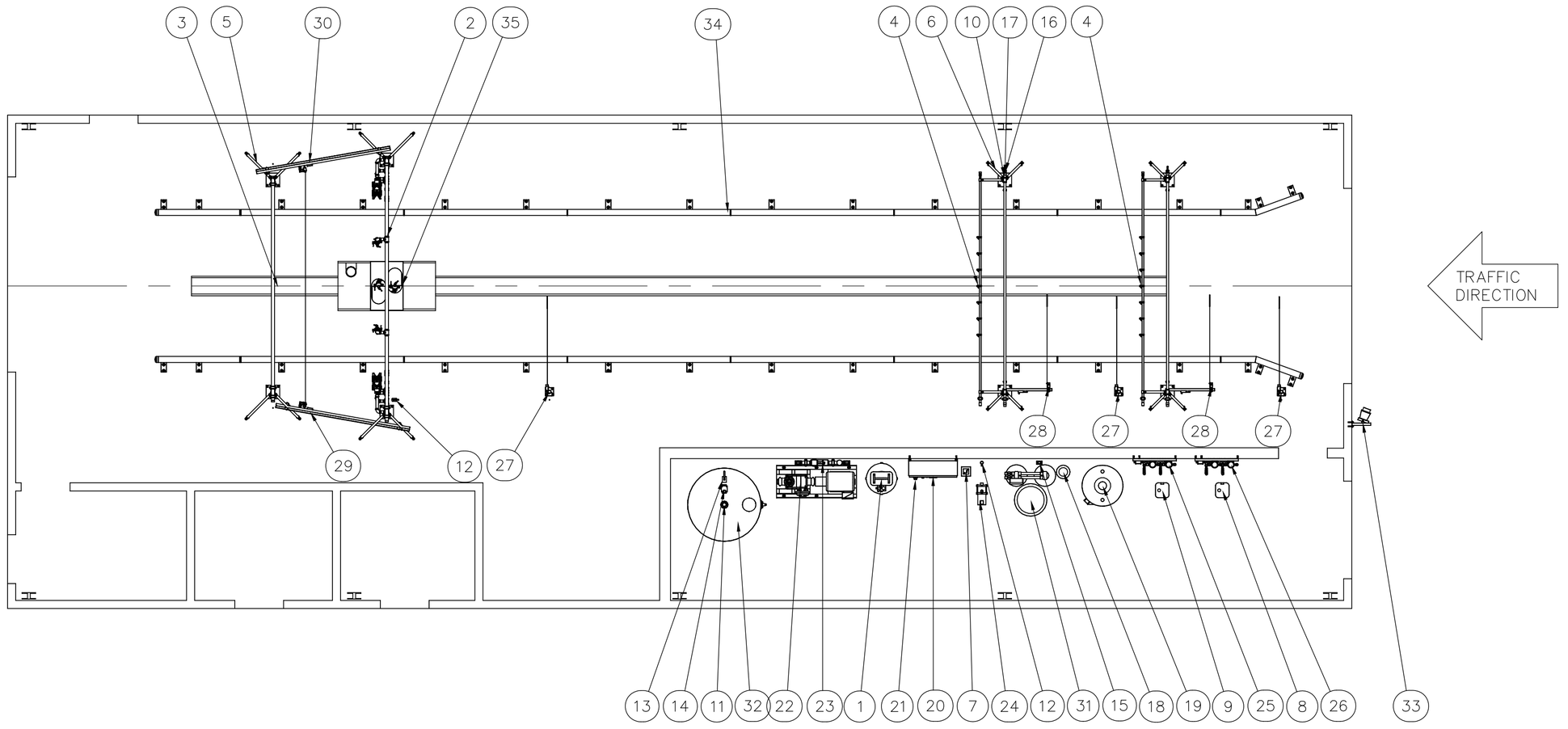
Parts List For LY14-088

ITEM	QTY	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME	ITEM	QTY	PRODUCTID	PRODUCTNAME	DRAWINGFILENAME
1	1	#DY13-571_1	Air Compressor, 6 Gal. Tank, 2.6CFM@90 psi, 120V	AC11511-00	19	1	HE441111-00	Water Heater, Nat. Gas, 199,900Btu,100 Gal., #G100-200	HE441111-00
2	1	#D99038_1	Spinner Arch Assembly, 12 Spinners, Galvanized	AR311c-00	20	1	#DY14-697_1	HMI with 4" Touch Screen, 24VDC	PA72221-00
3	1	#DY03-023_1	Arch Ass'y, Rear Wash, w/34x0530 Nozzles, W=13', H=14'-8"	AR31292-01	21	1	#DY14-581_1	Main Control Panel Assy, F.W.Type A, Nema 4, 460V, 60Hz	PA7321213-00
4	2	#DY00-210_1	Arch Ass'y, Chem., S.S., for Truck Wash, Side & Rear	AR322252-00	22	1	#DY03-063_1	High Pressure Pump Ass'y, Floor Mnt, 75Hp, 230/460V, 60Hz	PU2112221-00
5	8	#D97437_1	Arch Leg Ass'y, Floor Mount, H=12' 8 1/2", Galv.	AR3611-00	23	1	#DY04-169_1	Hi-Pressure Line Ass'y, 2 Gauges, Co-ax 3-Way & Gate Vavles	PU21213-03
6	8	#DY02-326_1	Arch Leg Assembly, Floor Mount, H=7ft-8in, SS 304	AR36121-01	24	1	#DY11-160_1	Pump, Booster, Floor Mnt, 1Hp, 460V, 60Hz, tefc, Gould.	PU22112321-00
7	1	#D99016_1	Spinner Nozzle Adjusting Tool Assembly	C61813-00	25	1	#DY12-164_1	Dosatron Pump (Aflas 1:20) Ass'y, 2 Pumps, Wall Mnt	PU23442-00
8	1	#DY07-624_1	Chemical w/Test Kit Ass'y, ICE-Citric, 5 Gallons	CH1121-5	26	1	#DY12-166_1	Dosatron Pump (Viton 1:50) Ass'y, 2 Pumps, Wall Mnt	PU23442-01
9	1	#DY07-625_1	Chemical w/Test Kit Ass'y, InterGreen, 5 Gallons	CH1211-5	27	3	#D95143_1	Vehicle Sensor Assembly, Two Limit Switches, Floor Mounted	SE3113-01
10	4	CO1516-125-05	Bushing, 1 1/4" x 1/2", 304 SS, # 150	CO1516-125-05	28	2	#D95118_1	Vehicle Sensor Ass'y, Limit Switch, Arch Mounted (1-1/4").	SE3123-00
11	1	CO161e-00	Fixed Air Gap, Inlet 2", Outlet Threaded 3", Cast Iron	CO161e-00	29	1	#DY00-101_1	Photo Eye Ass'y, Receiver, Cutler-Hammer, Arch Leg Mount	SE323311-00
12	2	CO2211-15	Valve, Ball, 1 1/2", NPT, Brass	CO2211-15	30	1	#DY00-102_1	Photo Eye Ass'y, Sender, Culter-Hammer, Arch Leg Mount	SE323321-00
13	1	CO2211-2	Valve, Ball, 2", NPT, Brass, Webstone #41707	CO2211-2	31	1	#DY07-628_1	Softener Ass'y, w/Salt & Test Kit, 110V, 60Hz, 18-39 GPM	SO3212-00
14	1	CO2221-32	Valve, Sol.Op. 2", NPT x NPT, Brass, 24VDC	CO2221-32	32	1	#D97258_1	Tank, 925 gallon, Field Ass'y, w/2 Float Level Switches	TA2112-00
15	1	CO2231-15	Valve, Swing Check, 1 1/2" F.NPT, Bronze	CO2231-15	33	1	#DY12-611_1	Traffic Light, LED, Wall Mount, Red & Green, 120 V	TC3312222-00
16	4	CO244-00	Valve, Freeze Prot. SS 1/2", HAT/FP(200 psi), #114-312100-035	CO244-00	34	1	#DY06-175_1	Tire Guides, CTW, Galv., L=71', OD=4.5", H= 5.5"	TGa141-70
17	4	CO451112-2	Pipe nipple, 1/2" x 2", NPT to NPT, 304SS., SCH. 40	CO451112-2	35	1	#DY08-251_1	Underchassis Module Ass'y, Galv., 2 Spinners, L=2', W=3', H=1'	UC131111-00
18	1	HE33-WH18	Water Heater Expansion Tank, 4.5 Gallon, Model WH-18	HE33-WH18					



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NOTE:
ITEMS SPECIFIED AND DETAILS INDICATED MAY BE SUBJECT TO SUPERSEDING PER LOCAL CODES AND REGULATIONS

R.	DATE	DESCRIPTION	BY	APPR

InterClean Equipment

DESIGN:	DRAWN:
ED	ED
CHECK:	APPR:
SL	SL
SCALE: 3/16"=1'	

ALABAMA A&M, NORTH HUNTSVILLE, AL
TRUCK WASH, FRESH WATER SYSTEM
EQUIPMENT LAYOUT

DATE: 12/03/14
PART NO: #LY14-088-07
WEIGHT:

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