GRAVER WATER SYSTEMS
675 CENTRAL AVE. - SUITE 3
NEW PROVIDENCE NJ, 07974

OPERATION MANUAL

POWDEX
CONDENSATE POLISHING SYSTEM

SAN JUAN GENERATING SYSTEM
WATERFLOW, NM

VOLUME 1
Installation, Operation and Maintenance Manual

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1. MANUAL ORGANIZATION

1.1. LIABILITY FOR LANGUAGE TRANSLATION

All written materials provided with Graver Equipment including equipment tags and control panel labels are supplied in the English language. The purchaser and/or end user of Graver Equipment shall determine the need for translation of these instructions, warnings, tags, and labels into another language. The translation of instructions, warnings, tags, and labels into another language are the responsibility of the purchaser and/or end user of Graver Equipment.

1.2. MANUAL DISCLAIMER

This document and all information contained herein with the exception of third party manuals are the property of Graver Water Systems, LLC. The design concepts and information contained herein are proprietary to Graver Water Systems, LLC and are submitted in confidence. They must be used only for the express purpose for which this manual is intended. They must not be disclosed without the express written consent of Graver Water Systems LLC and must not be used in any manner detrimental to the interests of Graver Water Systems, LLC. All patent rights are reserved.

1.3. SAFETY DISCLAIMER

The safety procedures and cautions given throughout this manual are to be considered the minimum requirement and are not intended to supersede site, Federal, State, and/or local applicable practices. The Site Safety Supervisor should always be consulted for site-specific safety procedures prior to attempting any work.

The contents of this manual should be thoroughly read and understood before attempting to operate any of the equipment or perform any process function.

1.4. SAFETY ANNOTATION

In order to highlight key safety, operational and maintenance items throughout the manual the following headings and terms are utilized.

CAUTION: This indicates a task or operation that requires heightened alertness and prudence to ensure the safety of both the individual and the equipment

WARNING: This indicates a task or operation where there is imminent danger to the individual and equipment and requires isolation and Lock Out/Tag Out before performing the operation.

NOTE: This is used to highlight information that is critical to the maintenance, operation of the equipment.

2. SCOPE

Graver Water Systems at 675 Central Avenue –Suite 3, New Providence, New Jersey 07974 has furnished one (1) Powdex Condensate Polishing System to Public Service of New Mexico, San Juan Generating Station Unit 3 located in Waterflow, Colorado. The proposed system is designed to treat a total flow of 7000 gpm. The scope of supply includes:

- Two (2) 84” Diameter Powdex Condensate Polishing Vessel
- One (1) Advanced Pre-Coat system
- One (1) Air Surge Tank
- One (1) Control System

3. PURPOSE

The purpose of the Powdex Condensate Polishing System is to treat 100% of the total condensate flow from unit #3 or 7000 gpm, a 100% swing spare is provided to treat either unit 3 or Unit 4. The system is designed to operate at a temperature of 150 ºF and a pressure of 610 psig. Depending on the pre-coat material used the system can simultaneously remove dissolved solids such as silica as well as suspended material and organic contaminants.

4. RECEIVING AND HANDLING PROCEDURES

It is important when receiving any equipment to inspect the shipment for damage. Tanks and skid mounted equipment are often exposed to the elements as well as other hazards encountered during ground transport. The shipment should be checked for any damage to the coating system or corrosion on exposed surfaces. Piping, valves and instrumentation should be inspected to ensure that they are properly aligned and have not been damaged during shipment. Any issues should be reported to the freight companies' representative (Driver) as well as Graver Water Systems before accepting delivery. The specific receiving procedures for the major pieces of equipment are outlined below. Graver reserves the right to refuse to warrant any equipment that was damaged due to improper handling and storage at the site.

4.1. POWDEX CONDENSATE FILTER VESSEL

The Powdex Condensate Filter vessel is shipped fully assembled on a skid. All nozzle projections are protected but care should be taken during unloading and when moving the skid. Lifting lugs and slings should be utilized as necessary during the unloading and positioning of the skid to ensure that the load is properly supported at all times. If the skid is to be stored outside it should be protected from the elements and efforts should be taken to prevent the intrusion of Foreign Material into the vessel.

4.2. ADVANCED PRECOAT SYSTEM

The Advanced Precoat System is shipped fully assembled on a skid. The skid base can be used to handle the Advanced Precoat System but care should be taken to not damage any of the items contained on the skid. Pipe, piping supports and conduit should never be used as lifting points. If the skid itself cannot be utilized a sling using the skid as the primary support should be rigged. The system should be stored indoors to protect it from the elements. The open top tank shouldbe covered to prevent the accumulation of foreign material.

4.3. AIR SURGE TANK

The air surge tank is shipped as a single vessel and is supplied with lifting lugs. Vessel nozzles or legs should never be used to lift or handle the vessel. Lifting lugs and slings should be used to maintain proper weight distribution. Care should be taken when handling the vessel to prevent and damage to the nozzle projection. The tank should be closed during storage to prevent foreign material from accumulating in the vessel.

5. FIELD STORAGE PROCEDURES

5.1. DEFINITION

Short Term Storage

Short term storage is defined as a period not to exceed one (1) year from receipt at site to installation of equipment.

Long Term Storage

Long term storage is defined as a period beyond one (1) year to after receipt at site to installation of equipment.

5.2. GENERAL STORAGE POLICY

Because the equipment supplied as part of this water treatment system is varied in nature, different types of storage are required for the equipment, both in the short term and the long term. Also, since it is difficult to assess the specific site conditions where the equipment is to be stored, the requirements made herein are not to be substituted for good warehousing practice and protection, nor should the consignee only follow these requirements when good sense dictates more stringent action. THESE REQUIREMENTS SHOULD BE CONSIDERED AS A MINIMUM. However, failure to comply with these minimum requirements will void the warranty.

Additionally, the Operation Manual includes storage recommendations from manufacturers of standard equipment such as motors, pumps, valves, instruments, etc. Where this information is provided, we recommend that it be followed. This information is found in the Manufacturers' Literature volumes of the operation manual. If there is no manufacturer's literature covering the equipment, the procedures included herein are to be followed.

THESE RECOMMENDATIONS DO NOT APPLY TO HAZARDOUS MATERIALS WHICH SHOULD BE ISOLATED AND STORED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL AGENCIES. THESE ARE RECOMMENDATIONS AND IT SHOULD NOT BE CONSTRUED THAT BY ESTABLISHING THESE REQUIREMENTS GRAVER ASSUMES ANY IMPLIED RESPONSIBILITY FOR THE EQUIPMENT DURING STORAGE.

5.2.1. GENERAL RECOMMENDATION FOR SHORT TERM STORAGE

For short-term storage, it is recommended that all equipment be stored indoors in a controlled environment. Equipment that cannot be stored easily indoors can be stored outdoors provided the equipment is protected from the element. Protection should include the use of tarps and covers to prevent any foreign material from intrusion into the equipment. Uncoated surfaces should be sprayed with an appropriate corrosion inhibitor to prevent oxidation.

A periodic inspection should be conducted monthly to assure the integrity of the packing and the equipment during the storage period. Where desiccants are used in the packing, they

should periodically be inspected and changed, dependent on the temperature fluctuations and humidity conditions at the storage facility.

5.2.2. GENERAL RECOMMENDATION FOR LONG TERM STORAGE

For long-term storage, it is recommended that all equipment be stored indoors in a controlled environment. All equipment should be packaged and periodic inspection conducted to assure the integrity of the packing and the equipment during the storage period. Where desiccants are used in the packing, they should periodically be inspected and changed, dependent on the temperature fluctuations and humidity conditions at the storage facility.

Typically a blue colored desiccant indicates a dry active desiccant where as a pale pink color indicates a high humidity condition and a depleted desiccant. Color-coded desiccant is highly recommended. Once a month, the desiccant should be checked to see whether it has been totally expended or not. If expended, it should be immediately replaced or regenerated in accordance with the manufacturer's recommendations.

5.2.3. INSPECTION AND MAINTENANCE LOG

An inspection and maintenance log is to be maintained for each crate or individually packaged equipment. The log should be attached to the crate in a clear plastic folder. A copy of the maintenance procedure which describes the applicable inspection operations is to be included in the folder. An inspection checklist listing the applicable inspection operations with a sign-off and date shall be maintained. The inspections shall be made monthly. Any deterioration of the equipment must be reported to Graver Water Systems as soon as the issue is identified.

5.2.4. PROTECTIVE COATINGS

Frequently, equipment is supplied with one coat of primer or the manufacturer's standard paint systems that are for shipping protection only. A coating system that will protect equipment must be applied upon receipt. If equipment is supplied with a coating system that is intended for storage or service protection, it must be examined for bruises, mars, or scratches and repairs must be made according to the coating manufacturer's recommendations.

5.3. SPECIFIC STORAGE RECOMMENDATIONS

5.3.1. Pressure Vessels (or Enclosed Atmospheric Tanks)

Short Term Storage Recommendations

Upon receipt, check for shipping damage. Check all openings to ensure that they are sealed and remove a number of seals to determine if moisture or any other foreign material has entered the tank during shipment and if so, dry and remove and then reseal. Outdoor storage is permissible as long as the tank is elevated so that it does not come in direct contact with the wet ground. If there are drastic temperature changes expected during the storage period, it is recommended that a bag of desiccant be placed in the tank to absorb moisture. Tanks containing desiccant should be tagged and inspected monthly to insure that the desiccant is still capable of absorbing moisture. Color-coded desiccant is highly recommended. The amount and life of desiccant used is dependent on the specific manufacturer typically, 3 lbs. per 100 ft^3 is used as a general rule.

Long Term Storage Recommendations

The short term storage procedure should be followed as a minimum with the following exceptions. Indoor storage is recommended and color coded desiccant should be used to prevent moisture build-up in carbon steel tank. For open top tanks, structural steel and other miscellaneous weldments, the primary storage requirement is the application of a protective coatings or rust inhibitor.

5.3.2. Pressure Vessels or Tanks with Spray-On Epoxy Linings

Short Term and Long Term Storage Recommendations

Outdoor storage is permissible; however the tanks or vessels should be stored on a dry surface and should not contact the ground. Sudden temperature changes should be avoided in the storage area since both extreme heat and cold can have an effect on coatings and to some extent the vessel itself. During extreme cold weather (Freezing conditions) coatings may become brittle and movement or impacts of any kind can cause shipping and cracking. Similarly, direct sunlight can cause embrittlement and cracking of PVC or Plastisol-lined equipment and should be covered in a way the blocks the direct sunlight but allows for proper circulation of air. Welding or any activity that generates intense heat shall not be permitted in the area where the vessel is being stored. Desiccants or drying agent are not recommended for lined vessel as these may cause premature failure of the lining.

5.3.3. Pressure Vessels or Tanks with Rubber Linings

Short Term Storage Recommendations

Cover all openings and store away from direct sunlight. Vessels or tanks shall be stored in the shade or shall be covered in a way that blocks the direct sunlight but allows for proper circulation of air in the vessel or tank. Sudden temperature changes shall be avoided and a uniform ambient temperature between 40^{o}F and 95^{o}F shall be maintained. Ten gallons of demineralized water should be placed in the vessel or tank to ensure the humidity within the vessel or tank and to preserve the lining. The water shall not be permitted to freeze and the vessel should be sealed to minimize evaporative losses. The water level shall be checked periodically to ensure that there is sufficient water and that the water has gone septic. Welding or any activity requiring intense heat shall not be permitted on or near the vessel. Drying agents are not permitted as the cause premature failure of the rubber lining.

Long Term Storage Recommendations

In addition to the short term requirements, rubber-lined equipment shall be filled with demineralized water to keep the lining flexible, to minimize expansion and contraction and to keep the air from causing premature deterioration. In the case of long term storage the demineralized water in the vessel shall be changed quarterly and examined periodically for septic conditions. No visible bacteria growth or discoloration is permitted. Vessel/tanks linings should be visually inspected quarterly for damage or deterioration and as a minimum the durometer of the lining should be confirmed prior to being put into service. A Graver service engineer can perform this inspection on a per diem basis if required contact Graver Service (908) 516 1400 Vessels or tanks containing concrete subfill must be stored and handled in the

upright position and rough handling, bumping and mechanical shock must be avoided at all times.

5.3.4. Safety and Relief Valves

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. Store materials indoors and in accordance with the following manufacturers' recommendations for a period not to exceed two years:

The valves shall be sealed in polyethylene bags containing desiccant.

The bags are not punctured nor become punctured at any time during storage.

The temperature of the storage area remains within the range of not less than 50^{o}F and not more than 120^{o}F.

Periodic inspections are required to determine if damage to the packaging has occurred during storage. If damage has occurred the packaging must be replaced.

5.3.5. Resin Traps and Resin Baskets

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 32^{o}F or more than 120^{o}F. All openings or access to the trap should be sealed and the internal baskets should be stored in their original packaging.

5.3.6. Flanges, Pipes and Fittings

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. All unpainted surfaces such as steel must be prime coated and machined faces coated with a rust preventative. Units must be packed with openings closed and otherwise protected until ready to use. Examine flange faces for damage before use. All cartons must be properly identified as to their contents and monitored

5.3.7. Air Breathers

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. For short term storage items shall be stored indoors.

Long term storage includes t he short term storage requirements as well as the fact that the filter element should be removed from the filter housing and each element stored separately (i.e. each filter element should be stored in a separate polyethylene bag that can be sealed along with a desiccant to provide a low humidity environment). The desiccant should be checked monthly to ensure it has not been expended.

5.3.8. Valves, Actuators and Positioners

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. For short term storage items shall be stored indoors.

Long term storage includes the short term storage requirements and includes the fact that all valves must be sealed in polyethylene bags. On large valves *only*, where the valve cannot be easily stored in polyethylene bag solenoids, limit switches, gauges, and other electrical devices or instruments must be sealed in a polyethylene bag. Bags should be inspected monthly and if damaged should be replaced or resealed.

CAUTION: Under long term storage, the plastic seat, bonnet gasket and stem seals, will tend to set or cold flow under load. Therefore, the manufacturer's recommendations should be followed.

5.3.9. Motors

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as ensuring the motor shafts are fully coated with an appropriate rust preventative. Shafts on all motors are to be rotated periodically according to the manufacturer's recommendations, or at least once every 3 months. All drains are to be fully operable while in storage and/or the drain plugs removed. The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing at points other than through the bearing fits. Vertical motors must be stored in the vertical position. Quarterly inspections must be made and a visual inspection for the presence of water in the grease or existence of rust in the bearing(s). When either condition is detected the bearing(s) should be replaced and relubricated. Grease in the motors should be checked at the time of removal from storage, making sure that a supply of fresh grease is in each grease cavity in accordance with manufacturer's instructions. All external parts of the motors that are subjected to corrosion must be protected by a corrosion-resistant coating. In cases where motors are not installed in the original containers, but are removed and mounted on other pieces of machinery, the mounting must be such that the drains and breathers are fully operable. In this respect, the drains must be kept at the lowest point in the motor and/or drain plugs removed so that all condensate can automatically drain out.

5.3.10. Air Pressure Regulators

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as ensuring that all regulators are stored in polyethylene bags. The polyethylene bags should be inspected

periodically and replaced or resealed if damaged. Prior to startup, gaskets, "O" rings and seals should all be replaced if storage period exceeds two years.

5.3.11. Pressure Control Valves

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50°F or more than 120°F.

Long term storage includes the short term storage requirements as well as the application of a suitable rust preventative to unpainted surfaces. Valves must be sealed in polyethylene bags with a desiccant placed in the package. The polyethylene bags should be inspected periodically and replaced or resealed if damaged and the desiccant should be checked and replaced if exhausted. Prior to startup, replace gaskets, "O" rings and seats if storage period exceeds two years.

5.3.12. Switches

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50°F or more than 120°F.

Long term storage includes the short term storage requirements as well as ensuring that all switches are stored in polyethylene bags. The polyethylene bags should be inspected periodically and replaced or resealed if damaged.

5.3.13. Flow Indicators

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50°F or more than 120°F and a maximum humidity of 95%.

5.3.14. Panels, Racks, Solenoid Cabinets and other Control Cabinets

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at a temperature of not less than 50°F or more than 120°F and keep equipment dry and in an enclosed crate

5.3.15. Centrifugal Pumps

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. Do not remove pump(s) from skid and ensure blocks support the pump(s) evenly, and without distortion. Store indoors at temperatures of not less than 50°F or more than 120°F.

Long term storage includes the short term storage requirements as well as inspecting the pumps for rust and other visible deterioration. If deterioration is observed the area should be cleaned and a suitable corrosion inhibitor should be reapplied to the appropriate surfaces. Shafts and motors shall be rotated manually every six months or as recommended by the manufacturer.

5.3.16. Metering Pumps

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at temperatures of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as inspecting the pumps as per the manufacturers' recommendations. Oil seals, gaskets and piston cups are considered consumable items and are not covered under any extended warranty coverage.

5.3.17. Air Blower

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at temperatures of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as inspecting the pumps as per the manufacturers' recommendations.

5.3.18. Compressors

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at temperatures of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as inspecting the pumps as per the manufacturers' recommendations.

5.3.19. Instruments, Gauges, Other Miscellaneous Electrical Devices

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. These items should be stored indoors at temperatures of not less than 50^{o}F or more than 120^{o}F.

Long term storage includes the short term storage requirements as well as ensuring that all items are stored in polyethylene bags and properly marked. The polyethylene bags should be inspected periodically and replaced or resealed if damaged.

5.3.20. Plastic Lined Pipe

Short and Long Term Storage Recommendations

Upon receipt confirm that all materials have been received and were not damaged during shipment. Avoid storing in extreme cold temperatures since plastics become more brittle and subject to breakage with cold temperature, store above 0^{o}F. Handling below 40 ^{o}F should be avoided and

Long term storage should include the requirements of short term storage but ideally the pipe should be stored indoors. If indoor storage is not available the items should be protected from temperature extremes as well as the weather.

6. SAFETY PROCEDURES

6.1. GENERAL

The safety procedures described in this section and cautions given throughout this manual are to be considered the minimum requirement. They are superseded by any site, Federal, State, and/or local applicable practices.

Consult with your supervisor or Site Safety Supervisor for site-specific safety procedures prior to attempting any work.

ALWAYS FAMILIARIZE YOURSELF WITH THE MATERIAL DATA SHEETS (MSDS) FOR THE CHEMICAL STORED AND/OR USED IN YOUR WORK AREA.

EYE WASH BASINS AND SAFETY SHOWERS SHOULD BE AVAILABLE TO PERSONNEL THAT ARE IN AREAS WHERE STRONG CHEMICALS ARE USED.

GOGGLES, PROPER HEAD COVERING, PROTECTIVE CLOTHING, GAS AND OXYGEN MASKS SHOULD BE AVAILABLE.

ALL AREA PERSONNEL SHOULD BE TRAINED IN ARTIFICIAL RESPIRATION METHODS.

IF BREATHING STOPS DUE TO A LACK OF OXYGEN IN A TANK OR CLOSED SPACE, ARTIFICIAL RESPIRATION SHOULD BE STARTED AT THE EARLIEST POSSIBLE MOMENT.

IF BREATHING STOPS DUE TO ELECTRICAL SHOCK, REMOVE SOURCE. APPLY ARTIFICIAL RESPIRATION AT THE EARLIEST POSSIBLE MOMENT.

6.2. ENTERING AN ENCLOSED SPACE

Before entering an enclosed space:

1. Be sure that eye wash basins and safety showers are available and working.

2. Be sure that all valves to the tank are closed, locked and tagged (liquid, chemicals, air). Vent valves should be left open. Isolate automatic valves by closing manual valves on either side of the automatic valves. Tag and lock the valves in the safe position. Blank all pipe lines entering or leaving the vessel that do not have control valves or that cannot be locked and tagged out appropriately.

3. Be sure that the control panel is locked and tagged OUT OF SERVICE.

4. Be sure that adequate ventilation is supplied. Use blowers or suction fans. Allow sufficient time for the inside of the vessel to be completely ventilated.

5. Notify the Safety Department to perform a gas check (CO, CO_2, H_2, Freon, other odorless gasses) and issue a vessel entry permit.

6. Notify the appropriate Safety Personnel

7. Wear appropriate personnel protective equipment (PPE):
    a. Adequate safety line
    b. Air fed mask
    c. Gloves
    d. Protective clothing and shoes

8. Before entering perform a Job Safety Analysis (JSA) including the following:
    a. Adequate entry, Scaffolding and ladders are installed properly and inspected.
    b. Tank internal is clean and dry and does not pose any undue slip or trip hazard.
    c. Confirm that all entry points have been secured and locked out appropriately
    d. Anchor or remove any items that could fall into the enclosed space while work is being performed.
    e. Identify and mitigate any sharp or jagged edges that could potential cause harm during ingress or egress.

9. Be sure that a safety man (Hole Watch) is stationed outside the tank within visual contact at all times.

6.3. OPENING MANWAY ENCLOSURES

Manways/manholes are used to provide access to the inside of tanks and pressure vessels for inspection, cleaning and other service purposes. During operation the manway is tightly closed. Several closure methods are employed but all utilize clamps or bolts. A gasket provides a tight seal between the manway cover and the vessel.

WARNING:

BEFORE OPENING A MANWAY

1. Know where the eye wash basins and safety showers are located and confirm they are working.

2. Close and lock and tag out all valves to the tank (liquid, chemical, steam, and control air).

3. Reduce pressure of the vessel to zero. Leave a vent open.

4. Drain all liquid from the vessel. (Vessels with internal compartments require that the internal compartments be drained as well).

5. Tag the control panel and electric motors OUT OF SERVICE.

6. Confirm that the vessel has in fact been drained. Use the sample lines and valves that are provided to check that the vessel has been drained.

7. Secure the manway cover with davit, rope or chain.

8. Because gasket seals have been under pressure from the vessel or from the cover fastening, the manway cover may continue to be held securely so it is important to loosen the fastening bolts first. Move the cover to separate it from the vessel (tap, bump or pry it, taking care not to damage the tank lining). Check that no appreciable leakage occurs. Loosen the fastenings further and again check that there is no additional release of pressure. Personnel should not be in front of the manway when the cover is removed because, in some cases, foreign matter may be retained in the manway nozzle.

9. Remove the cover.

6.4. MANUAL VALVE OPERATION

None of the manual valves in the system require routine operation. They should not be tampered with, except by authorized maintenance personnel during system shutdown and maintenance. General rules for operating manual valves are:

1. Always close manual valves gradually while pumps are operating.
2. Never close a valve abruptly while fluid is flowing through the line. Closing a valve suddenly can produce a water hammer, compression wave that can damage system components.

6.5. CENTRIFUGAL PUMP SAFETY

Whenever electrical feed connections to a centrifugal pump are disconnected or altered in any way, the pump must be checked for proper rotational direction before operating. If the phases become reversed and the pump is run backward, the impeller could rotate off the shaft resulting in extensive equipment damage as well as creating a personnel hazard.

6.6. PERSONAL PROTECTIVE EQUIPMENT

Appropriate personal protective equipment is strongly recommended for personnel whenever they are exposed to potential hazards. Common sense, company safety policy, and applicable laws should be used to determine what safety equipment is appropriate for a particular operation.

Use of the following personal protective equipment is suggested. Additional protective equipment may be required for some hazards. Equipment for working with chemicals:

1. Neoprene gloves
2. Neoprene sleeves
3. Chemical goggles
4. Face shield
5. Neoprene apron, or rubber suit
6. Rubber boots

Equipment for working around electric power:

1. High voltage gloves, Class II
2. Safety glasses
3. Rubber sole shoes, or rubber boots

Equipment for handling sharp or abrasive materials:

1. Leather gloves
2. Safety glasses
3. Safety toe shoes

6.7. CONTROL PANELS AND CONTROL CABINETS

WARNING:

Electrical equipment and assemblies always contain the possibility of hazards from electrical shock or short circuits. Therefore, proper caution must be observed with the installation, operation, and maintenance of the control panel or control cabinet.

6.7.1. INSTALLATION

The control panel or control cabinet should be fastened to a part of the building structure that is capable of supporting its weight. Qualified electricians following the control diagrams and schematic wiring diagrams supplied by Graver Water Systems should make the electrical connections. If there are questions regarding interpretation of the drawings, they should be referred to Graver Water.

Before electrical power is turned on to the control panel or control cabinet, make sure that the metal enclosure is properly grounded, through the conduit system, and by a ground wire attached to the ground lug that is provided in the control panel or control cabinet.

Before electrical power is turned on to the control panel or control cabinet, the internal connections should be checked for accuracy with the control diagrams and schematic wiring diagrams supplied.

6.7.2. OPERATION

Automatic control circuits have been designed with the intention of providing a system with operating safety for equipment and personnel. Reasonably foreseeable component failures are considered, and interlocks are provided to safeguard against damage being caused by such failures. It must be remembered that component failures will probably result in degradation of system performance. Therefore, it is necessary to have competent operating personnel who understand the functions of the systems, to make periodic checks of the system performance (for example: valve and motor operation, instrument readings, and component response).

Manual control features are built into most systems which are designed for automatic operation. These make it possible to operate the equipment in case an automatic control has failed. The manual control features also make it possible to make experimental changes in the process sequences without having to rewire the automatic controls.

When operating with manual override to automatic controls, the following rules should be observed.

1. The operator shall be familiar with the equipment, and understand its operation.
2. Where a tank or vessel is connected by valves to portions of the system designed for operation at different pressures, all valves connecting to the high pressure must be fully closed before opening valves connecting to the low pressure piping. All valves connecting to the low pressure piping must be fully closed before opening valves connecting to the high pressure piping.
3. Follow the valve operating sequences given in this manual.

6.7.3. MAINTENANCE

The tracing of circuits with a continuity tester, removal or replacement of components, or revisions to electrical circuits, should be done with all power turned off to any electrical terminal inside the control panel with which the worker might come in contact. This usually means every circuit within a control panel or control cabinet is to be shut off. In order to properly shut off the voltages of a control panel, the following rules must be observed:

1. Consult the schematic wiring diagrams to determine what disconnecting switches need to be opened to shut off all of the voltages of the control panel. Very often it is not sufficient to disconnect the main power source to the control panel. Motor control circuits are usually supplied with power from the motor starters, and have to be disconnected by opening the motor circuit switch ahead of the motor starter.
2. Personnel familiar with the plant installation and the location of disconnect switches should be consulted. Shut off all power to the control panel. The switches should be locked or tagged in the OFF position until after work inside the control panel is completed.
3. After the switches have been turned OFF, but before work is started in the control panel, make voltage checks on the circuits inside the control panel. This is to confirm that the correct switches have been opened and that circuits have, in fact, no voltage present.

Sometimes troubleshooting has to be performed while the system is in operation, and power is on the control circuits. This is done by checking for the presence or absence of voltage at suitable test points in a control circuit. When checking circuits with the voltage on, the following rules must be observed:

1. Only a person who understands the operation of electrical controls, and who recognizes electrical terminals and other exposed conducting surfaces which might have voltage present, may perform this work.
2. The area of work must be properly illuminated so that all exposed electrical parts can be readily seen.
3. The person performing the work should have the wiring diagrams at hand, and should use them to locate the points where voltage is to be checked to determine circuit continuity and operation.
4. While work is performed in a control panel with voltage present, another person must be available to give assistance in case of accident. The second person should be familiar with the voltage shut off procedure, and be trained in artificial respiration methods.
5. Make sure that there is adequate clearance around the work, to prevent working in a cramped position. Many people work with one hand in a pocket, to prevent accidental contact of both hands across a voltage source. The Federal Occupational Safety and Health Act part 1910, OCCUPATIONAL SAFETY AND HEALTH STANDARDS specifies a minimum working distance around equipment with live electrical terminals (3 feet up to 150 volts; 4 feet 151 to 600 volts).

6. Several types of voltage testers are available. Solenoid type, multimeter, and ruggedized neon lamps are samples. Use of "homemade" rigs with conventional light bulbs which are easily broken (exposing bare wire at 120 volts) is prohibited.

7. One side of the voltage tester should be clipped to a terminal that is part of the electrical neutral side of the line. The test clips should be covered with insulation. This makes it possible for a worker to use only one hand to hold the insulated handle of the potential measuring probe of a voltage tester. The other hand should be kept close to the body (or in a pocket) avoiding contact with either electrical terminals or grounded parts of the structure.

8. The exposed outer end of the potential measuring probe should not exceed 1/8" in length. A short length of snug fitting insulating tubing can be used to cover a portion of the voltage probe so that it cannot contact other terminals than the one on which the tip is placed.

9. It is recommended that soft, thin dry leather gloves, or meterman's gloves, safety glasses and rubber soled shoes be used.

10. Rubber floor mats should be provided around the area.

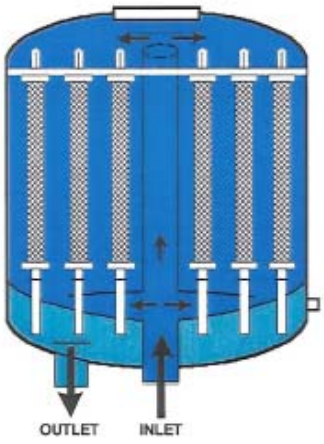
7. SYSTEM DESCRIPTION

7.1. POWDEX CONDENSATE FILTER VESSEL

7.1.1. Powdex Process Description

The Graver Powdex Process is an ion exchange unit operation using extremely fine particle size resins as a precoat on a specially design filter element designed to remove or substantially reduce dissolved salts and suspended matter, together with colloidal particles and other complexes present in the condensate stream. Filtration and ion exchange are simultaneously utilized to perform one or both of the following functions combining the desired aspect of these two distinct unit operations. The rapid exchange rates permit the use of thin layers of resin (1/8" to 3/8") that produce extremely pure effluent quality. In addition to the rapid exchange rates and greater utilization of the exchange capacity of the resins, the Powdex resins will effectively remove iron, copper, silica, and salts, whether soluble or suspended.

Figure 7.1.1 Powdex Sectional View

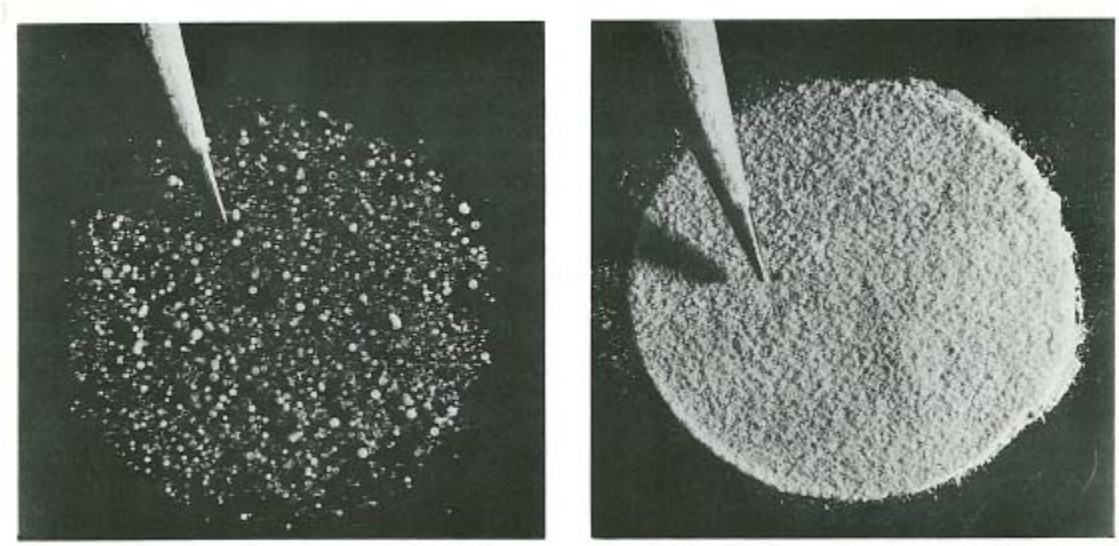


The Figure 7.1.1 above shows a sectional view of the Condensate Polishing Vessel. The resin is precoated on a specially designed element which functions to retain the resin. Condensate flows into the vessel and passes through the precoat material into the elements and out to service.

An indication of the relative size and surface area available between powdex and conventional size ion exchange resins can be seen in the Figure 7.1.2. Each photograph shows 0.1 grams of dry mixed cation and anion resin. Because of its fine particle size, the Powdex resin has more than 100 times the available surface area of the same weight of conventional (20 – 50) mesh resin.

Although the powdex resin is extremely fine, 90% of which is smaller than 325 mesh, the pressure drop across a freshly precoated element is less than 2 psi at a design flow rate of 2.8 gpm per square foot of filter area. This unusually low pressure drop is attributed to a clumping effect which is a phenomenon caused by electrostatic forced that exist when the Powdex cation and anions are mixed, causing the resins to swell to a volume which is 7.5 to 10 times greater than the original volume of the individual resins.

Figure 7.1.2 Conventional vs. Powdex Resin Size Comparison



A - Conventional 20-50 Mesh Resin

B - Powdex Resin

The powered resin precoat then becomes a heavy bulky floc material rather than a gritty particulate, which one might expect to exist with materials as fine as 325 mesh. This heavy bulky structure allows the powdex resin to act as a traditional filter aid trapping particulate in the precoat material while at the same time providing ion exchange capacity. This results in low operating pressure drops, long service runs (3 to 4 weeks) and a high crud-holding capacity.

The powdex resin is shipped in regenerated form and does not require acid or caustic regeneration; therefore, no acid or caustic regeneration facilities are required for the Condensate Polishing System. The spent powdex resin is in a chemically neutral form when exhausted and therefore no waste neutralizing equipment is required.

7.1.2. Powdex System Description

The Graver Powdex® Condensate Polishing System is a unique high quality water purification system. The system uses an extremely fine particle size ion exchange resin (30 to 80 micron) to simultaneously accomplish filtration and dissolved solids removal. The resin is applied to specially designed cylindrical elements which act to retain the resin. This application step is referred to as precoating, with the resin as the precoat. As a result of the resin ratio the anion and cation tend t o clump creating a larger particulate precoat which provided better filtration at lower pressure drops. The fine particle size means greater surface are and results in rapid ion exchange rates. This allows the system to remove low levels of dissolved solids, even at a flow rate of up to 3 gpm/ft^2.

Normally, the precoat consists of cation resin in the ammonia form and anion resin in the hydroxide form. Hydrogen form cation resin may also be used for pH control and during periods of high inlet dissolved solids. The ratio of cation to anion resin can be varied, depending on the type and quantity of the contaminants to be removed and whether the system is starting up or in normal service. Typical ratios of 2:1 to 1:1 cation to anion are employed. The thickness of the precoat (1/8 in. to 3/8 in.) is also dependent on the quality of the water to be treated. The Condensate Polishing System is capable of removing the following ionic species: magnesium, sodium, calcium, copper, iron, nickel, sulfate, chloride, and dissolved silica. The net result of the physical and chemical treatment of the condensate is therefore high quality condensate, ideal for the prevention of scale and fouling of boiler tubes, turbines, and process piping.

The Condensate Polishing System for Public Service of New Mexico, San Juan Generating station's unit 3 is comprised of two (2) skid-mounted 84 inch inside diameter by 8 feet 4 inches straight height powdex vessels each with 576 filter elements yielding 38,246 ft^2 of element surface area per vessel. An advance precoat system consisting of an advance precoat tank with a mixer, an auxiliary tank, and all associated pumps, piping, and controls. The system is designed to treat 100% of the condensate systems total flow of 7000 gpm at a design temperature of 150°F and a design pressure of 610 psig. The system can be operated in one of two modes: automatic or manual control.

Condensate flows into the powdex unit through the filter polisher inlet valve, filtering through the precoat into the elements, and out to service through the filter polisher outlet valve. The inlet flow is monitored and totalized through powdex inlet flow loop.

In addition, a low flow switch operating off the flow inlet loop initializes the operation of the vessel hold pump during a low flow condition. Since flow holds the precoat material to the elements, when the condensate flow drops below a minimum value the hold pump is required to prevent the loss of the applied precoat.

7.1.3. Technical Data

TABLE 7.1.3 TECHNICAL DATA: POWDEX FILTER VESSEL	
Quantity	Two (2)
Flow per Unit	7000 GPM
Material of Construction (Vessel)	ASTM 516 GR 70
Material of Construction (Internals)	304 Stainless Steel
DIMENSIONS	
Diameter	7 Feet 0 Inches
Height	8 Feet 4 Inches
Volume	1690 Gallons
Design Pressure	610 psig (ASME Code)
Design Temperature	150 ºF
Corrosion Allowance	Per ASME Code Section VIII, 2010 Edition
FILTER ELEMENTS	
Quantity	1152 or 576 per Vessel
Material	Stainless Steel Core/ Polypropylene Wound
Length	6 Feet 8 Inches
Total Area per Filter	265.6 ft^2
HOLDING PUMP	
Quantity	Two (2)
Manufacturer	Kontro
Model	GSA 3x2x6 CA4
Motor Horsepower	10 Hp
Motor Electrical (V, Ph, Hz)	460 V/ 3 Ph/ 60 Hz

7.1.4. Installation

The Powdex vessel is skid mounted and should be leveled prior to anchoring. The internal tube sheet must be tested for leakage at the tube sheet fitting welds. To perform the leak test open the 24" manway on the top of the vessel and the two 8" x 10" inspection manholes on the bottom of the vessel. Make sure that all the powdex valves are closed. Add water up to the top of the lower circumferential weld on the vessel which should be approximately 1/2" below the tube sheet fitting. Allow the water in the powdex vessel to sit for two (2) hours. After two (2) hours, check the tube sheet fitting welds by inspecting for leaks through the lower inspection manholes. . Repair all tube sheet fittings that are leaking .

Outline for Powdex Equipment Start-up.

This outline below is a typical start-up outline for a Condensate Polisher System. The actual start-up procedure is per plant procedures and the startup supervisor.

1. Inspect the condensate polisher system for location, materials, and installation per the Bill of Material and the Flow Diagrams.
   a. Powdex Vessel

b. Valves and actuators
c. Powdex Vessel Internals
    i. Lining
    ii. Tube sheet & tube sheet fittings
    iii. Manway gaskets
d. Check piping layout using the flow diagram and interconnecting piping drawings.
e. Pumps
    i. Compare nameplates with the bill of material and manufacturers' literature
    ii. Rotation of impeller
    iii. Clearance seals alignment
    iv. Lubrication
    v. Mechanical seal water supply (if needed)
f. Motors
    i. Compare nameplate with the Bill of Material and manufacturers' literature
    ii. Check phasing and voltage
    iii. Correct wiring size
    iv. Alignment with pump
    v. Bump for rotation
g. Valves
    i. Check bypass valve operation
    ii. Check pressure regulating valves
    iii. Check pressure relief valves
h. Instruments
    i. Conductivity cells
    ii. Flow meters\Flow transmitters
    iii. Pressure transmitters
    iv. Pressure switches
    v. Pressure regulators, water & air

2. Panel Check - All Rotating and Operating Components Disconnected
    a. Function check all panel instruments and loops.
    b. Check field wiring.

c. Check 24V terminals for 110V

d. Energize panel.

e. Obtain air supply - blow air lines and check air for quality.

f. Remote - manually stroke valves, set valve limit switches, set valve speed controls and low pressure air surge tank lockup.

g. Set limit switches, alarm points, and pressure switches. (Refer to Alarms and Setpoints.)

h. Dry run the Precoat and Backwash Sequence using the PLC in AUTO.

i. Check interlocks and fail-safe features.

j. Flush and Hydro System

k. Flush system until water is clear of debris.

l. Inlet and outlet piping and precoat piping.

m. Check leaks in the piping and vessels.

n. Perform leak test on tube sheet.

o. Calibrate analyzers.

p. Wet run, set initial flow rates.

q. Remove all isolation blanks for inlet and outlet service valves.

r. Adjust rate set valves as necessary.

s. Check amp draw on motors.

3. Load powdex elements - isolate unit per plant safety procedures.

a. Soak fiber elements overnight and backwash 3 times to remove detergent.

b. Perform precoat and check for element resin leakage (See: Appendix 1- Millipore Test Procedure.)

c. Place on line. Check performance.

The entire condensate polishing system must be thoroughly flushed with high quality water.

NOTE: If high quality water supply is limited at the plant, a preliminary flushing with service water followed by a short flushing with high quality water is permissible. The flushing must be performed on the condensate polishing system before installation of the Powdex elements. Before starting the flushing operation, check that the manhole and hand hole covers are securely fastened and not leaking. The system should be flushed in the following order:

1. Flush Condensate Polisher System Bypass Line.

2. Flush Polisher Inlet Header.

3. Flush Polisher Outlet Header.

4. Flush Powdex Vessels.

5. Flush Advance Precoat Tank.
6. Flush Backwash Piping.
7. Flush Precoating System Piping.
8. Flush Hold Pump Piping.
9. Flush Backwash Air Piping.

NOTE: Break the air line connection, as close to the condensate polisher vessel as possible, and blow this line out. Confirm that the air line has been properly cleaned out by blowing air through a clean white cloth for about one minute. If the cloth shows any contamination, give the air line additional purging. Any oil in the backwash air is detrimental to the Powdex elements. Therefore, if any oil is evident in the air after a thorough purging of the piping, an oil removal filter must be installed.

10. Reflush the Powdex Vessels.

Following the flushing operation, drain the powdex vessels and remove top manhole cover and lower inspection hand hole cover. Inspect the powdex vessel, including the lower compartment, for foreign material. Flush with a hose if necessary, using high quality water. If elements are not to be immediately installed, replace manhole and hand hole covers.

Inspect the manhole and hand hole gaskets before installing them back on the vessel. If the gaskets are damaged, they must be replaced.

The tube sheet fittings are installed and checked at the factory prior to shipping. The Powdex elements are shipped as assembled units with the correct fittings on the top an bottom. It is important to confir the correct elements have been received and a brief inventory should be taken to ensure that:

a. The correct number of elements was received
b. The elements are all the same part number. The graver part number and manufacturing date are stenciled on one end of the carton. Sealfast element assemblies can be identified by the part number 02-27

Before removing new element assemblies from the shipping boxes, be sure a clean area and large table are available. A Graver part number and the date of manufacturer are stenciled on one end of the boxes. Elements assemblies for Sealfast applications will be identified with a part number 02-27-XXX, the last 3 digits indicate the type of winding used to make the element. Make sure all boxes have the same part number. Some types of elements are not compatible with Sealfast hardware. Check with Graver before mixing elements with different part numbers.

1. Examine each element carefully before installation. They should be free of loose windings and each element should be straight. Contact Graver Service for recommendations if any bent or loosely wound elements are found.

2. Be sure that the top extension nut and cap are firmly in place and the locking nut is secure against the bottom cap.

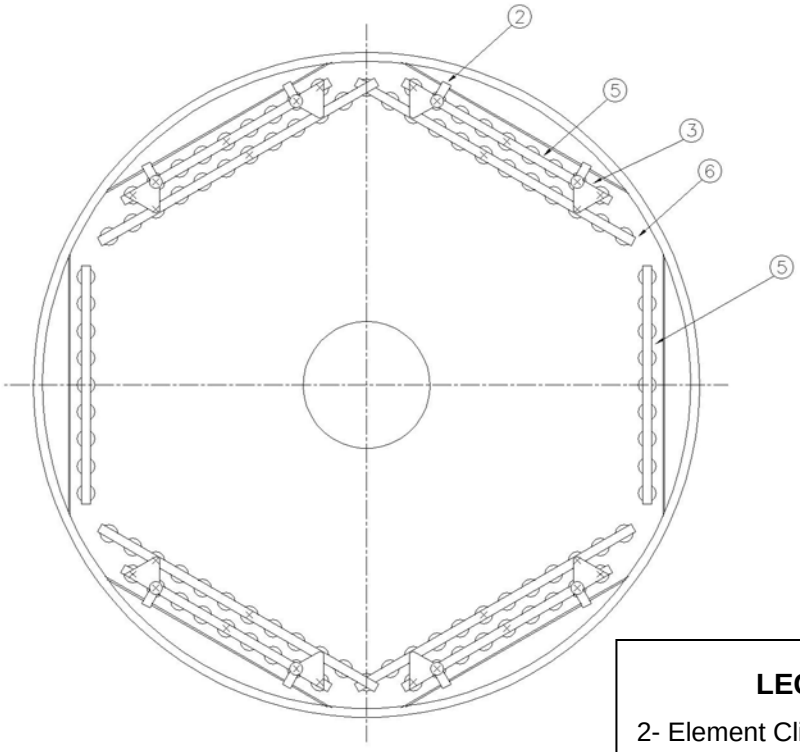
Installing Elements

1. Apply Rector Seal No. 5 to bottom male threads of each element as each is installed.
2. Each element is installed by inserting the bottom-threaded connector into the tube sheet adapter female (Position #1 per Internal Assembly Drawing 13486-M-D-3754).
3. After confirming good thread engagement, grasp the surface of the element windings with clean hands (or wearing gloves) and turn clockwise into adapter threads until element is hand tight and secured (Position #2 on Internal Assembly Drawing 13486-M-D-3754).
4. Powdex elements are to be installed through the top access manhole, working from the peripheral or outermost elements in towards the center, row by row in the steps illustrated in figures 7.1.3 thru 7.1.8

CAUTION: Do not use tools on the extension nut to install or remove elements. Damage to welded parts could result and compromise element integrity.

ELEMENT INSTALLATION STEPS

Figure 7.1.4 Element Installation: Step 1



LEGEND

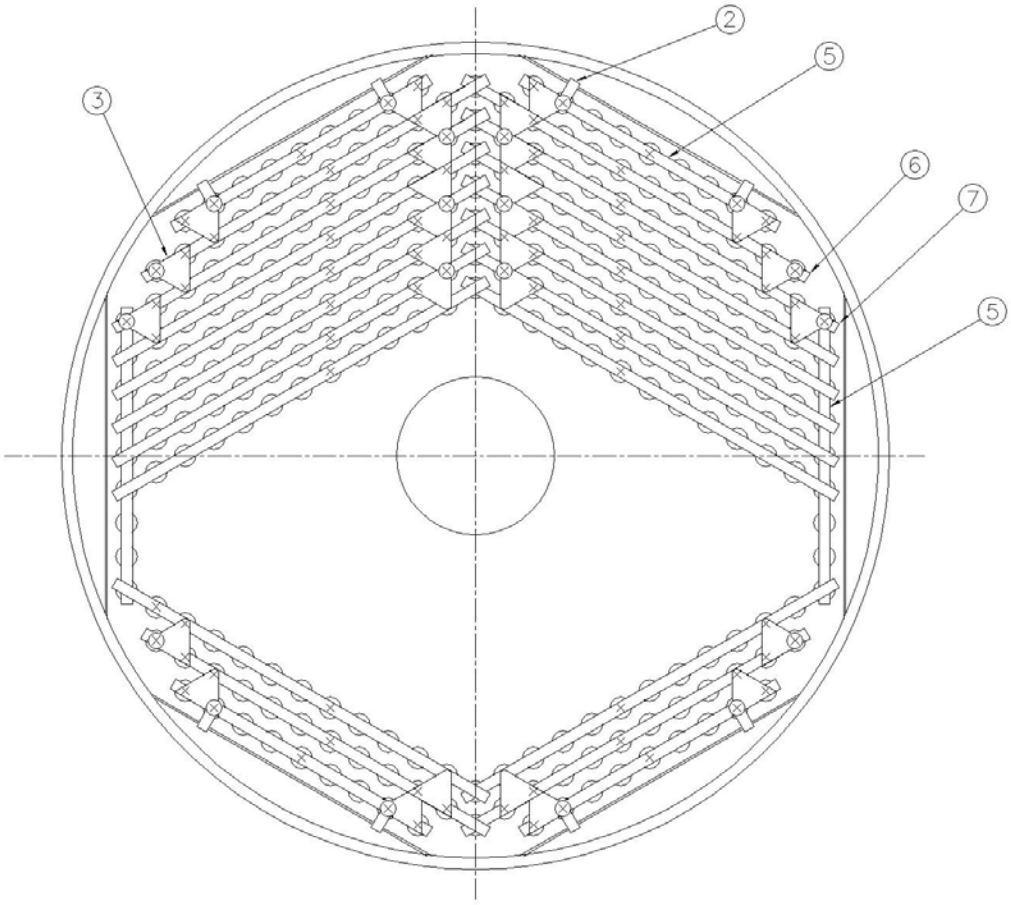
2- Element Clip

3- Element Link

5- Retaining Bar (A-8)

6- Retaining Bar (A-11)

Figure 7.1.5 Element Installation: Step 2



STEP #2

LEGEND

2- Element Clip

3- Element Link

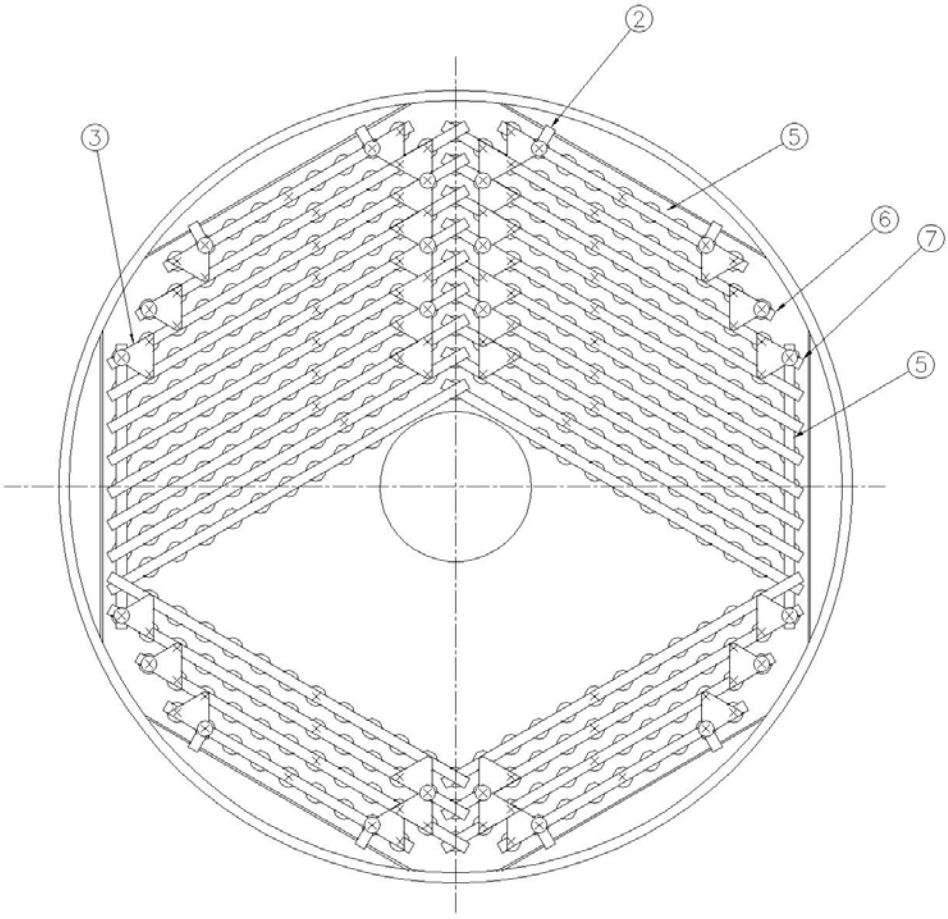
5- Retaining Bar (A-8)

6- Retaining Bar (A-11)

7-Retaining Bar (A-12)

5. As each outermost row of elements and retaining bars are installed, two element clips should be placed over the retaining bars, approximately at the ends of each row to hold the row of elements in its proper position.

Figure 7.1.6 Element Installation: Step 3



STEP #3

LEGEND

2- Element Clip

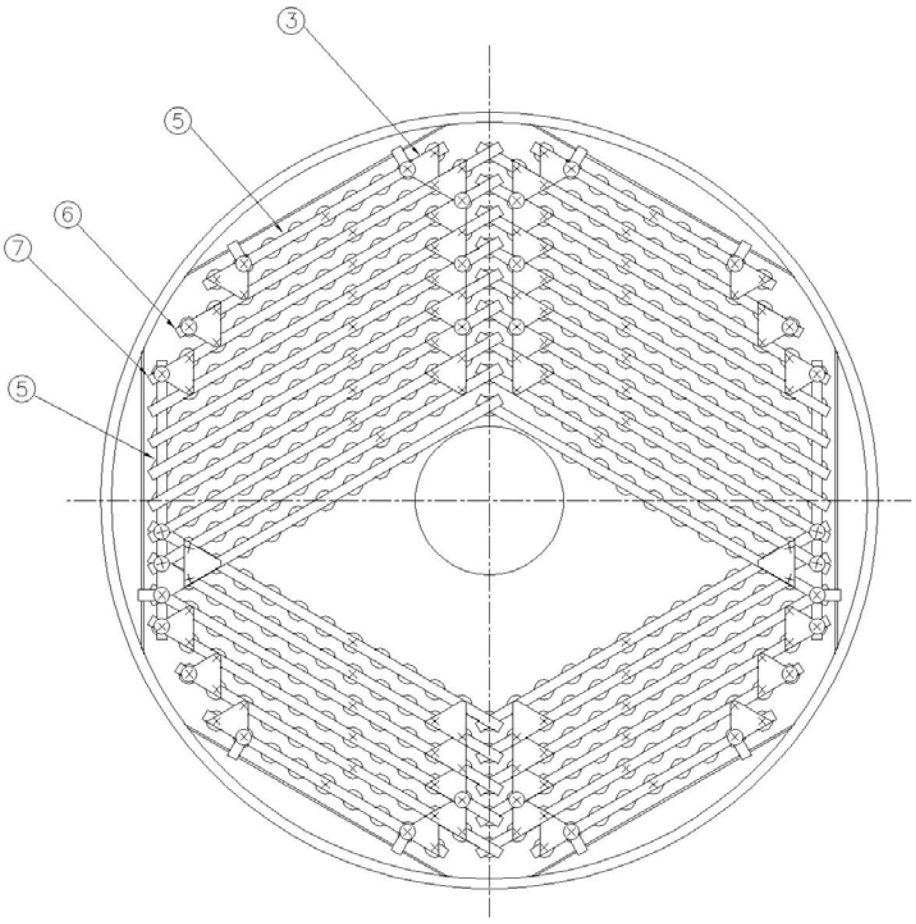
3- Element Link

5- Retaining Bar (A-8)

6- Retaining Bar (A-11)

6. As each succeeding rows of elements with retaining bars are installed, they must be secured to previously installed rows by means of element links as shown on Internal Assembly Drawing. Make sure no elements are crossed or touching. Continue with this procedure working towards the center until all elements, retaining bars, and element links are installed and secured. Refer to Detail "A" on Internal Assembly Drawing 13474-M-D-3754.

Figure 7.1.7 Element Installation: Step 4



STEP #4

LEGEND

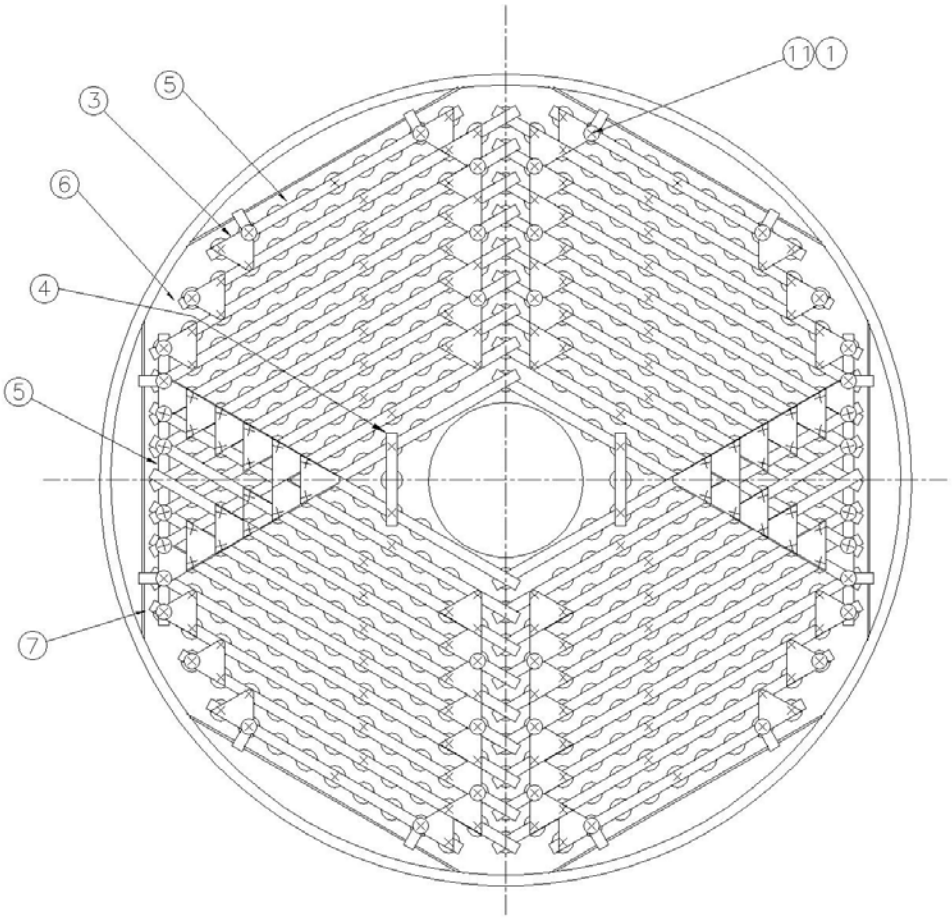
3- Element Link

5- Retaining Bar (A-8)

6- Retaining Bar (A-11)

7-Retaining Bar (A-12)

Figure 7.1.8 Element Installation: Step 5



STEP #5

LEGEND

3- Element Link

4- Retaining Bar (A-2)

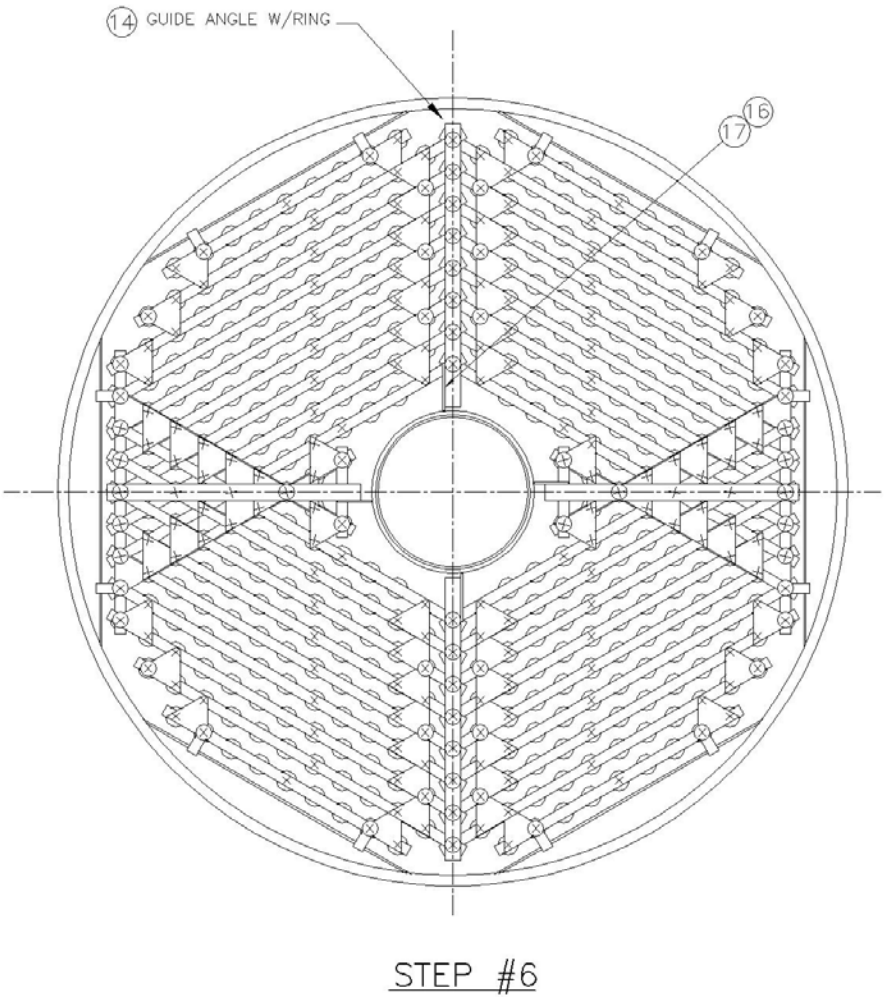
5- Retaining Bar (A-8)

6- Retaining Bar (A-11)

7-Retaining Bar (A-12)

11- Collar

Figure 7.1.9 Element Installation: Step 6



LEGEND

14- Guide Angles w/ Ring

16- 3/8" Ø -16 x 1-1/4" Long Bolt

17- 3/8" -16 Nut and Lock washer

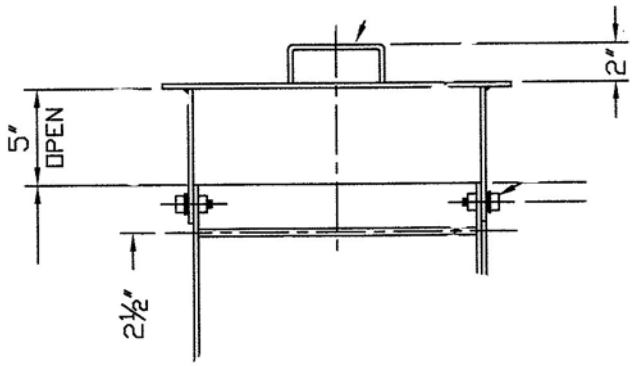
7. Hitch pins and Collars can be installed with the exception of those located on the centerline of the vessel. The distribution tube must be installed before installing these hitch pins and collars.

CAUTION: Do not sit or stand on top of retaining bars, as damage to elements will result.

Installing Distribution Tube

1. After installation of all the elements and the support lattice work the distribution tube is installed. The guide angles are installed along the vessel centerline and connected with a ring located in the center of the vessel. Refer to Internal Assembly Drawing 13486-M-D-3754. The guide angles are bolted to the ring using the 3/8" -16 bolt and nuts. Once the guide angles have been bolted in place the remaining hitch pins and collars can be installed.
2. The hat located at the top of the distribution tube should be adjusted to the maximum opening (See Figure 7.1.9 Hat adjustment) prior to installation of the distribution tube. The hat can be adjusted to optimize the application of the pre-coat.

Figure 7.1.10: Distributuion Tube- Hat Adjustment



3. The powdex distribution tube is carefully placed through the center ring using the handle located on the top of the hat to guide it into position. The bottom of the distribution tube is locked into the ring of the baffle plate by turning the handles in a clockwise direction. Ensure a plumb orientation by tightening the 1/4-inch alignment bolts through the guide angle ring and against the distribution tube.
4. Ensure that the element bundle and top support of the distribution tube are all secure.
5. Close the top manhole, then precoat the elements in accordance with the operating instructions.

NOTE: When the powdex elements and distribution tube are going to be installed into the powdex vessel, a Graver Engineer should be present to supervise installation of these items.

7.1.5. Maintenance

Normally, this equipment requires little maintenance except for the usual attention required for instrumentation and controls. Complete annual or periodic inspection should be made. This should include:

1. Internal inspection for evidence or corrosion or scaling.
2. Check packing of controllers and valves, replacing where necessary.
3. Check manhole gaskets replacing if there is evidence of leaks from that area.
4. Check operation of controllers. Make any necessary adjustments or replacements.
5. Recalibrate pressure gauges and other instruments.
6. Inspect all piping connections for evidence of corrosion.
7. Backwash and clean elements.

7.1.5.1. Lubrication Requirement

Figure 7.1.10 Hold Pump Lubrication Schedule

RECOMMENDED OIL GRADE

ISO Oil Type	HM
ISO Viscosity Grade	68

RECOMMENDED OIL CAPACITY

Frame Size	mls	US fl. Oz.
3x2x6	100	3.3

7.2. ONE (1) ADVANCED PRECOAT SYSTEM

7.2.1. Process Description

The Graver advanced precoat system is designed to provide a controlled precoat slurry concentration to the powdex vessels during precoat operations. Applying the precoat at a controlled concentration insures that it is applied uniformly and homogeneously over the entire length of the elements while preventing bridging between the elements. The improved flow distribution results in increasing resin utilization, longer runs, less waste, and improved water quality.

7.2.2. Technical Data

TABLE 7.2.1 TECHNICAL DATA: ADVANCED PRECOAT SKID	
ADVANCED PRECOAT TANK	
Diameter	7 Feet 0 Inches
Height	6 Feet 0 Inches
Volume	1720 Gallons
ADVANCED PRECOAT TANK MIXER	
Manufacturer	Chemineer
Model	50DTC
Motor Horsepower	1.5 hp
Motor Electrical (V, Ph, Hz)	460v/ 3ph/60 hz
PRECOAT INJECTION PUMP	
Manufacturer	Goulds
Model	3196 MTi / 3x7
Motor Horsepower	5 hp
Motor Electrical (V, Ph, Hz)	460 V, 3 Ph, 60 hz
AUXILIARY TANK	
Diameter	1 Foot 3 Inches
Height	7 Feet 0 Inches
Volume	65 Gallons
PRECOAT RECYCLE PUMP	
Manufacturer	Goulds
Model	3196 i-178/8 x 10-16H
Motor Horsepower	60 hp
Motor Electrical (V, Ph, Hz)	460 V, 3 Ph, 60 Hz

7.2.3. Installation

The Advanced precoat skid should be leveled and interconnecting piping checked for fit-up issues before permanently anchoring the skid. Gaps between the skid base and concrete should be filled with grout to ensure the skid is continuously supported.

7.2.4. Operation

7.2.4.1. Precoat Resin

The powdered resin precoat material when mixed with water has an unusual characteristic in that the resultant mixture is a uniform slurry containing cation and anion which is bulky in nature and results in a high porosity precoat. This bulky precoat allows the powdex vessels to operate at a high area flow rate (4 gpm/ft^2) and at a low operating pressure drop (1 to 25 psi) with efficient removal of dissolved and suspended contaminants that are present in the condensate. Precoat density and composition can be chosen to remove specific contaminants or to control cycle pH. Adding hydrogen form resin to the precoat helps lower the pH as well as controlling the clumping and supernatant turbidity of the resin slurry.

The Condensate Polishing System provides flexibility in treating a variety of water problems because of the large selection of precoat resins available. The various Graver precoat resin lines consist of either powdered resin only, cellulose only or powdered resin with cellulose. The Graver trade name for the powdered exchange resin is Powdex. Powdex can be supplied as powdered resin in a variety of forms (Hydrogen form Cation, Ammonia form Cation and Hydroxide form Anion) or in premixed ratios of Cation to Anion. The powdex resin can be used to make custom precoat slurry mixes to meet plant conditions. These custom precoat slurries must be made up in the precoat tank and require constant operator attention to assure the slurry is properly mixed. Graver recommends using the pre-mixed resin since they are easier to use and require less labor during the precoat process. Powdex premixed or custom blended slurries are typically prefered when ion exchange capacity is required rather than removal of particulate or collodial material

The Graver trade name for the cellulose precoat material is Ecocote. Ecocote is supplied as a straight cellulosic precoat material that can be used separately or in conjunction with Powdex resin to make custom slurries to meet the plants conditions. Just like the Powdex precoat custom slurries these slurries must be made up in the precoat tank and require constant operator attention to assure the slurry is properly mixed. Premixed slurries containing cellulose and resin material can be obtained and are refered to by the trade name Ecodex. Ecodex is available in various cellulose percentages (10%, 33%, 50%) with the powdex resin in a fixed ratio of one to one. Ecodex is utilized where ion exchange is required but where there is a high presence of particulate and colloidal material

The precoat resin dosage is based on a dry weight basis. Dosages range from 0.15 to 0.3 lbs[1] of mixed resin per ft^2 of filter area. If dissolved solids are the controlling factor, the higher precoat dosages 0.2 to 0.3 lbs/ft^2 are used. If suspended solids (pressure drop) is the controlling factor, the lower dosages 0.15 to 0.2 lbs/ft^2 are used. Precoat dosages of less than 0.15 lbs/ft^2 must never be used unless approved by Graver.

Precoat Resin Dosage[1]

Minimum Precoat Dosage	- 0.15 lbs/ft^2
Normal Precoat Dosage	- 0.15 to 0.20 lbs/ft^2
Maximum Precoat Dosage [2]	- 0.30 lbs/ft^2

Normal Operation	- 0.15 to 0.20 lbs/ft^2 at Cation/Anion ratio of 2 to 1.
Startup Operation	- 0.20 to 0.30 lbs/ft^2 at Cation/Anion ratio of 1 to 1.
Condenser Leak [3]	- 0.30 lbs/ft^2 at Cation/Anion ratio of 1 to 1.

1. All resin weights are dry lbs. and ratios are cation to anion.
2. Maximum dosage requires special techniques for mixing and application of precoat, due to the higher slurry concentrations.
3. Continued operation with condenser leakage is not recommended due to the resulting short run lengths and increased operating cost.
4. The normal slurry concentration will be 4 to 7% based on total dry weight of the powdex resin mixture

TABLE 7.2.2 PRECOAT RESIN DOSAGE

CONDITION	PRECOAT MATERIAL	RATIO (CATION:ANION)	DOSAGE	EXPECTED ENDPOINT
Start-Up			0.2 lbs/ft^2	Differential Pressure
High Suspended Solids	Ecodex P-201-H	1:1	0.2 lbs/ft^2	Chemical Exhaustion
High Dissolved Solids	Ecodex P-205-H [1]	1:1	0.2 lbs/ft^2	Differential Pressure
Extremely High Suspended Solids	Ecodex P-201-H [4] With Powdex PAO (Anion Overlay)	1:1	+ 0.02 lbs/ft^2	
Normal Operation	Ecodex P-202-H or Powdex Resin [2]	2:1	(0.15 lbs/ft^2 to 0.2 lbs/ft^2) [3]	Chemical Exhaustion or
			0.2 lbs/ft^2	Differential Pressure
Condenser Leak	Ecodex P-205-H or Powdex Resin (PAO + PCN[5])	1:1	0.3 lbs/ft^2	Chemical Exhaustion
			0.3 lbs/ft^2	Chemical Exhaustion

NOTES:
(1) P-207-H may be substituted for P-205-H.
(2) Cation resin usually in the ammonium form but can be blended with hydrogen form cation for pH control. ECODEX precoat formulations may also be mixed to suit cycle conditions.
(3) Use maximum dosage only if lower dosage proves inadequate.
(4) Extended use of anion overlay may cause element fouling.
(5) Consult Graver for ammonia operation.

7.2.4.2. Determining the Precoat Dosage

The preparation of the precoat resin slurry is the most important part of the Powdex Process. A properly prepared slurry will insure good condensate polisher effluent quality and protection of the Powdex filter elements. The latter is important for long operating life of the filter elements. The composition of the precoat mixture and precoat dosage will depend on the specific

application. Graver highly recommends the use of premixed precoat material either the Powdex Premix or Ecodex products.

The following chart can be used as a guide in the selection of precoat media

TABLE 7.2.3 PRECOAT RESIN SELECTION

OPERATION AND REMOVAL DESIRED	RESIN RATIO Cation:Anion Dry Wt.	TOTAL DOSAGE lbs/ft^2	DOSAGE lbs/ft^2	
			Cation	Anion
1. Initial Start or Restart				
Dissolved Solids (low)	1:1	0.2	0.1	0.1
Dissolved Solids (high)	1:1	0.3*	0.15	0.15
Suspended Solids	1:1	0.2	Ecodex	+ 0.02 Overlay
2. Normal				
Dissolved Solids	1:1	0.2	0.1	0.1
Suspended Solids	2:1	0.15	0.1	0.05
Suspended Solids		0.2	Ecodex	
3. Condenser Leak or System Upset	1:1	0.3*	0.15	0.15
*Use only if lower dosage proves inadequate.				

7.2.4.3. Calculating the Precoat Dosage (Powdex)

To calculate the number of bags required for a precoat, the following formula is used:

$$\textit{Precoat Required (Bags)} = \frac{\textit{Total Filtering Area (ft}^2\textit{)} \times \textit{Dosage (lbs/ft}^2\textit{)}}{\textit{Weight of a Container/Bag (lbs)}}$$

1. Find the total filtering area (A) of the Powdex Vessel. (The total filtering area from Table 7.1.2 is 265.6)

2. The weight of a container/bag is obtained from Table 7.2.4 where the weight is in dry pounds of the resin.

TABLE 7.2.4 PRECOAT RESIN PACKAGED WEIGHT

RESIN	WEIGHT (dry pounds)
Ammonia Form Cation PCN (Green Label)	22.5 lbs
Hydroxide Form Anion PAO (Yellow Label)	12.5 lbs
Hydrogen Form Cation PCH (Red Label)	19.0 lbs
Ecodex	12.0 lbs

The calculation for Ammonia Form Cation PCN is shown as an example:

Operation: Startup or Restart

Total Filtering Area = 265.6 ft^2

Total Dosage = 0.2 lbs/ft^2

Cation to Anion Ratio: 1 to 1

Cation Dosage = 0.1 lbs/ft^2

Anion Dosage = 0.1 lbs/ft^2

$$\textit{Precoat Required (Bags)} = \frac{\textit{Total Filtering Area } (ft^2) \times \textit{Dosage } (lbs/ft^2)}{\textit{Weight of a Pail/Bag (lbs)}}$$

Using this formula:

$\frac{265.6\ ft2 \times 0.1\ lbs/ft2}{22.5\ lbs.}$ = 1.18 bags Rounding to the nearest half bag gives 1.5 bags

NOTE: The composition of the powdex mixture and precoat dosage will depend on the specific application. Refer to the Precoat Dosage in Table 7.2.3 for the dosage to be used for a specific operation. In condensate service all cation used is in the ammonia form and all anion resin used is in the hydroxide form. Hydrogen form resin is only used in cases where elevated pH is encountered or severe clumping during slurry mixing is observed. Hydrogen form cation resin will convert to the amine form on line, and will be used in that form until it is necessary to remove the precoat because of ionic bleed through or high differential pressure.

TABLE 7.2.5 AMOUNT OF CATION AND ANION RESIN PER PRECOAT*

OPERATION	RESIN RATIO CATION/ANION	TOTAL DOSAGE lbs/ft^2	NUMBER OF BAGS
1. Startup or Restart	1:1	0.2	Cation Resin – 1.5 Bags Anion Resin – 2.5 Bags
2. Normal	2:1	0.15	Cation Resin – 1.5 Bags Anion Resin – 1 Bag
3.Condenser leak or system upset	1:1	0.3	Cation Resin – 2.0 Bags Anion Resin – 3.5 Bags

*These precoat dosage rates are only for custom slurry mixtures. Graver strongly recommends the use of Ecodex or Premixed powdex resin.

NOTE: Dosages shown for (1) and (2) are used when removal of chlorides, silica, iron, and copper is required. Dosage shown for (3) is used when only iron and copper removal is required. The resin used for the above calculation is Ammonia Form Cation PCN and Hydrogen Form Anion PAO.

7.2.4.4. Calculating the Precoat Dosage (Ecodex)

Ecodex Resin is used at a dosage of 0.2 to 0.3 dry lbs/ft^2 to total filtering area. Dry weight of the Ecodex resin is approximately 12 lbs per box. Various special blends are available to meet plant condition. Check with Graver Technical Department.

TABLE 7.2.6 AMOUNT OF ECODEX PER PRECOAT

OPERATION	RESIN RATIO CATION to ANION	TOTAL DOSAGE lbs/ft^2	NUMBER OF BAGS ECODEX RESIN
1. Startup or Restart	1:1	0.3	7 bags
2. Normal	1:1	0.15	4 bags
3.Condenser leak or system upset	1:1	0.3	7 bags

Note: Reseal partial used boxes, pails and or bags tightly, to prevent drying out and air contamination. Graver strongly recommends maintaining a running inventory of resin and a three months supply of resin be kept on hand.

7.2.4.5. Resin Recommendations Storage and Shelf Life

Powdex resin is classified as a stable, normally non-hazardous organic material. The containers are specially designed to retain moisture insuring exchange capacity for approximately one year. Always use oldest material first and carefully reseal partially used containers. The storage area must be dry and protected from weather and designed to avoid extremes of heat or cold. If the resin arrives frozen, allow the resin to thaw slowly before using. Avoid storage in heavy traffic areas to prevent damage to the containers. If containers are broken, discard any material that appears dry or discolored. Do not stack skids more than two high. If there is any doubt concerning the quality or condition of the material, contact Graver's Technical Department at 908-516-1400.

7.2.4.6. Advance Precoat Tank preparation

Graver advance precoat system is designed to provide a controlled slurry concentration to the powdex vessels. Applying the precoat at a controlled concentration insures that it is applied uniformly and homogeneously over the entire length of the elements preventing thin areas or bridging between the elements. The improved flow distribution provides increased resin utilization, longer runs, less waste, and improved water quality.

The source of clean water for use in the advanced precoat tank is tapped off the condensate piping. The advance precoat tank is refilled with water during the precoat operation. The advanced precoat tank must be clean before adding water into the tank. The advanced precoat tank can be cleaned by means of draining, rinsing and refilling t he tank until the water is clear. The precoat mixer automatically starts and shuts off when the advance precoat tank level switch reaches low-level setpoint.

A powdex vessel can be reconditioned (Backwash and Precoat Sequence) a day before the vessel is actually going to be placed into service. the advanced precoat tank preparation can only be preformed when the system has completed step 26 of the precoat sequence. Step 27 of the precoat sequence is when the precoat material is added to the tank. The operator must confirm the material has been added by pressing the Step Continue pushbutton on the Condensate Polisher Vessel Backwash and Precoat Sequencer control page of the operator interface display .

7.2.4.6.1. Advance Precoat with Custom Powdex Slurry

1. Obtain the precoat resin requirement to be applied from the Plant Chemical Lab.

2. Obtain the correct number and types of boxes of resin from storage.

3. Open the advance precoat tank top door and check the water quality and level. Drain and rinse the tank, if required. The tank is filled in Step 26 of the Backwash and Precoat Sequence using the Precoat Tank Fill Valve to the high level setpoint. If the level in the advance precoat tank is too high, the water can be drained through the manual advance precoat tank drain valve.

4. Start the advance precoat tank mixer. When the mixer is running, the mixer must not draw air into the water.

5. The slurry is prepared during precoat sequence Step 27.

6. Mix the precoat slurry as follows:

- Add the required amount of anion resin and mix for five minutes. Use care when adding the resin to avoid any dirt or debris from entering the tank. Make certain that the resin is thoroughly mixed and wetted. When completely mixed, a very fine particle size slurry results. It will have a milky yellowish appearance.
- After the anion resin is mixed, the cation resin is added to the advance precoat tank. The cation should be added slowly. When added in this manner, the cation resin will disperse quite rapidly. As the cation is added to the anion slurry, a very definite change in the visual characteristics of the slurry will start to take place. The slurry will start to form small clumps and these will get larger as more cation is added.

NOTE: This step is required only when making custom slurries.

7. When all of the cation resin has been added to the tank, the slurry should be thoroughly mixed for a period of ten minutes. After this period of time, the resin slurry should be homogenous and should have a clumpy appearance with the particles of resin ranging between 3/16 to 1/4 in. in size.

8. Perform the Settled Resin Volume test described in section 7.2.4.6.2

This test determines if the resin slurry can be properly precoated and if resin fines exist in the slurry that could possibly foul the elements and increase the pressure drop across the elements after a period of time.

7.2.4.6.2. Settled Resin Volume Test

The Settled Volume Test is carried out as follows:

1.) While the slurry is mixing, a one-liter sample is taken from the advance precoat tank and placed into a one-liter graduate.

2.) Allow this sample to settle for 10 minutes and observe the supernatant liquid and the volume of settled resin compared to the total sample volume, (500 ml of settled resin is a 50% V/V). This ratio will vary with the concentration of the slurry (percent dosage) and the acceptable range is 40 to 70% for 0.2 and 0.3 lbs/ft^2 precoats.

3.) Ratios as low as 10 to 20% are acceptable using 0.1 lbs/ft^2 overlay precoats as long as supernatant turbidity is within limits. After 10 minutes, approximately the bottom 20% of the settled resin must be compacted (without voids).

4.) The necessary quantity of Solution "A", if needed, is determined by trial. The quantity of Solution "A" used should put the slurry V/V % in the specified range as noted above.

5.) Observe the turbidity of the water above the settled resin (supernatant). This liquid must be clear enough to read average size typed print through the graduate after 10 minutes of settling. This is very important since excess turbidity will eventually foul the elements.

6.) "Solution A" may be required to reduce particle size (V/V) and turbidity but should only be used when necessary. It should be added in 10 ml increments, full strength, allowing 5 minutes between additions for mixing. Each subsequent sample must be allowed to settle for 10 minutes as described above and until an acceptable slurry is produced.

7.) Over-addition of "Solution A" will result in either high turbidity or a V/V that is too low. This condition can be corrected by adding a small amount of hydrogen form cation resin that will increase the V/V and reduce supernatant turbidity. If the amount of PCH resin added exceeds 10% of the total dry weight of PCN resin in the slurry, the filter polisher vessel effluent pH will be noticeably suppressed.

8.) Any further additions of "Solution A" after using PCH resin for adjustment must be made carefully with 10 ml increments of a 10% mixture (10 ml of full strength "Solution A"/100 ml of demineralized water).

9.) The amount of "Solution A" necessary to produce an acceptable V/V and particle size will vary with the following:

   a. Cation resin to anion resin ratio.

   b. Different lot number of resins.

   c. pH and temperature of water in advance precoat tank.

   d. The amount of PCH resin used.

   e. Mixing time.

10.) The following Precautions should be observed:

1. Do not precoat if the slurry that has a V/V more than about 70%.
2. Do not precoat if the supernatant turbidity is excessive.
3. Do not precoat with slurry that has a V/V less than about 40%.
4. Do not precoat with dosage of less than 0.15 lbs/ft^2 or more than 0.3 lbs/ft^2 dry basis.
5. Do not use Solution "A" unless required.
6. Do not allow an increasing initial pressure drop condition to continue.

The Powdex slurry is now ready to precoat the elements.

7.2.4.6.3. Advance Precoat with Premix or Ecodex Slurry

1. Obtain the precoat resin requirement to be applied from the Plant Chemical Lab.
2. Obtain the correct boxes of resin from storage.
3. Open the advance precoat tank top door and check the water quality and level. Drain and rinse the tank, if required. The tank is filled in Step 26 of the Backwash and Precoat Sequence using the Precoat Tank Fill Valve to the high level setpoint. If the level in the advance precoat tank is too high, the water can be drained through the manual precoat tank drain valve.
4. Start the advance precoat tank mixer.
5. Add all of the Ecodex or Premixed Powdex to the advance precoat tank and allow it to mix for 10 minutes or until the Ecodex is thoroughly wetted and dispersed.
6. Upon completion of the preparation Step 27, the operator must press the Step Continue pushbutton on the on the appropriate Condensate Polisher Vessel Backwash and Precoat Sequencer control page on the HMI to continue the precoat sequence.

7.2.5. Maintenance

Normally, this equipment requires little maintenance except for the usual attention required for instrumentation and controls. Complete annual or periodic inspection should be made. This should include:

1. Internal inspection and cleaning of precoat and auxilliary tanks.
2. Check packing of controllers and valves, replacing where necessary.
3. Check pump and mixer operations and insure they are maintained in accordance with vendors specification.

7.2.5.1. Lubrication Requirement

TABLE 7.2.7 Pre-coat injection and Recycle Pumps Lubrication Schedule

Type of Bearing	First Lubrication	Lubrication Intervals
Oil –lubricated bearings	Change oil after 200 hours	Change oil every 2000 operating hours or every three months
Grease-lubricated bearings	Grease-lubricated bearing are lubricated at the factor	Regrease bearings every 2000 operating hours or every three months.

TABLE 7.2.8 Pre-coat injection and Recycle Pumps Lubricant volumes

FRAME	Qts	Oz.	Ml
STi	0.5	16	400
MTi	1.5	47	1400
LTi	1.5	48	1400
XLT-I and i17	3	96	3000

TABLE 7.2.9 Pre-coat injection and Recycle Pumps Acceptable Lubricants

Brand	Lubricant Type
Castrol	Hyspin R&O 220
Chevron	GTS Oil 68, GST 220
Exxon	Teresstic EP 68, Teresstic 220
Mobil	DTE 26 300 SSU, DTE Oil BB, Mobil Gear 630
Phillips	Mangus Oil 315
Shell	Tellus Oil 68, Marlina 220, Tellus 220
Sunoco	Sunvis 968, Sunvis 9220
Texaco	Regal R&O 220, Rando HD 220
Royal Purple	Synfilm ISO VG 68, Synfilm GT 220, Synergy 220

TABLE 7.2.10 Advanced Pre-coat mixer Lubrication Schedule

	First Lubrication	Lubrication Intervals
Motor Lubrication	1) Motors without grease fittings are pre-lubricated and sealed for life. 2) Motors with grease fittings are supplied pre-lubricated	1) No Lubrication Required 2) Every 12 months when installed in clean dry locations or every 6 months for hot and dusty locations
Gear Drive Lubrication	Factory filled with Mobilux EP023	Every 5 years, more frequently if operated at temperatures in excess of 180 ºF

TABLE 7.2.11 Advanced Pre-Coat Mixer Recommended Lubricants

Temperature Range	Lubricant
30ºF (-1ºC) to 150ºF (66ºC)	Mobilux EP023 or Equal
-20ºF (-29ºC) to 50ºF (10ºC)	Mobilux EP Artic or Equal

7.3. THE ONE (1) AIR SURGE TANK

7.3.1. Process Description

The Graver Air Surge vessel is an ancillary vessel designed to supply high volumes of air for air scouring and backwashing Graver filtration equipment. The vessel is a pressure vessel that is equipped with a pressure switch for monitoring the air volume/ pressure. The vessel is designed to a pressure greater than the supply system and as a result only requires a thermal/sentinal relief valve.

7.3.2. Technical Data

TABLE 7.1.2 TECHNICAL DATA: AIR SURGE VESSEL PER UNIT	
Quantity	One (1)
Material of Construction (Vessel)	A-516 Grade 70
DIMENSIONS	
Diameter	9 Feet 0 Inches
Height	10Feet 6 Inches
Volume	668 ft^3
Design Pressure	150 psig
Design Temperature	140 ºF
Corrosion Allowance	Per ASME Code Section VIII, Div I

7.3.3. Installation

The air surge vessel is skid mounted and should be leveled. All interconnecting piping should be installed before anchoring the skid. Grout should be used to fill in any gaps that exist between the skid and the concrete. The anchor bolts should be sized based on the loads provided in the Graver drawing.

7.3.4. Maintenance

The air surge vessel maintenance primarily consists of inspecting the system for leaks and repairing these problems appropriately. The inspection should include the following items as a minimum.

1. Sentinel Relief Valve
2. Process Valve connections
3. All gasketed manways, handholes and valves.

8. INSTRUMENT & CONTROLS

8.1. CONTROL PHILOSOPHY

8.1.1. Information

8.1.1.1. General Information

The Operator Interface Display (OID) is the interface between the system operator and the programmable logic control system (PLC). The Operator Interface Display sends and receives process information and commands to and from the PLC.

The Operator Interface Display is for data display, command entry and data logging only. There is no control algorithms programmed in the Operator Interface Display

8.1.2. Conventions Used

8.1.2.1. Loop and Component Tagging

It is Graver's practice to refer to an instrument loop by its primary function letter. In accordance with ISA standards and practices F is used for Flow, P is used for Pressure, PD is used for differential pressure, and L is used for Level.

Both hard devices and soft functions use the full component name. The client provides the loop numbers. Thus a typical component number for a flow transmitter looks like FIT5520 and a typical component number for a process switch looks like PDS5600.

8.1.2.2. Operator Interface Display Pushbuttons

All screen function on the Operator Interface Display is generally accessed by means of the pointing devices supplied with the system.

Whenever reference is made to a pushbutton located on the Operator Interface Display, it appears in this document as **"Service"**. This function can be executed by de-pressing the mouse over the pushbutton image.

8.1.2.3. Alarm Displays

For the purpose of this document, messages that would be displayed on the Operator Interface Display alarm window will be shown in bold and within quotation marks. For example Flow Low would appear as **"FAL5520 - SYSTEM BACKWASH FLOW LOW"** throughout this document.

8.1.2.4. Logical Expressions

When a logical expression is used in the body of the text, it will appear as **AND**, **OR** or **NOT**.

8.1.3. Description of Condensate Polishing System

The Condensate Polisher (CP) consists of two (2) vessels. Vessels are sized for 100% of the total condensate flow. All of the condensate flow will pass through the vessel. When High Differential Pressure across a vessel is detected an alarm will be initiated. Station Operators will place the vessel in standby and Backwash & Precoat the vessel.

The Station Operators will have the ability to Backwash and Precoat the vessel in an automatic or manual mode.

8.1.4. Analog Process control And Display Loops

The following sections describe the operation of each analog loop displayed or controlled by the PLC for the Condensate Polishing System. It contains calibrated ranges, alarm setpoints and configuration information.

8.1.5. System Analog Loops

8.1.5.1. System Backwash Water Flow - Loop 1F1834

The System Backwash Water Flow is measured by existing flow 1FE1834 and transmitted by flow transmitter 1FIT1834. The D/P produced by this flow element is 0 to 200 inches water column, which represents a calibrated range of 0 to 500 GPM. The analog input is configured for an input signal of 4 to 20 mADC and a calibrated range of 0 to 500 GPM. The squared root extraction calculation will be performed at the transmitter.

This value is stored, displayed and logged as AF011010 by DCS.

The System Backwash Water Flow is automatically controlled to maintain a setpoint by using feedback control loop 1FIC1834.

This controller is configured with both an internal setpoint source **(INT)** and a batch setpoint **(BATCH)**. The controller will usually be operated in the **BATCH** mode.

While operating in the **BATCH** mode, this controller will only be enabled during the appropriate sequence steps and the required setpoints will be automatically loaded by the sequencers as required. When this controller is not required, it will be disabled and its output will be forced to 0 percent.

When operated in the **INT** mode, the setpoint will be manually entered by means of controller faceplate 1FIC1834 on the Operator Interface Display.

The low flow alarm setpoint is 310 GPM. Backwash flow is monitored during the Backwash steps of the sequence (Steps 5-23). Following a 20 second time delay after a backwash step has been started, and the flow falls below this setpoint, the **"1FAL1834 - SYSTEM BACKWASH FLOW LOW"** alarm will be activated and logged by DCS. This alarm will automatically clear when the flow measurement rises above the deadband setting for this setpoint.

The output AO020010 of this flow controller modulates valve 1FCV1834 as required to maintain the required flow. Valve 1FCV1834 is an air to open - air to close valve equipped with a direct acting positioner. An increasing signal to the positioner will cause the valve to open.

8.1.5.2. Precoat Tank Level - Loop 1L1834

The Precoat Tank Level is measured by level element 1LE1834 and transmitted by level transmitter 1LIT1834. The Level measured by this level element is 0 to 72 inches, which represents a calibrated range of 0 to 100 %. The analog input is configured for an input signal of 4 to 20 mADC and a calibrated range of 0 to 100 %.

This value is stored, displayed and logged as AL020010 by DCS.

The high-high level alarm setpoint is 87 percent. This value is stored in DCS. When the level rises above this setpoint, the **"1LAHH1834 - PRECOAT TANK LEVEL HIGH-HIGH"** alarm will be activated and

logged by DCS. This alarm will automatically clear when the level measurement drops below the deadband setting for this setpoint.

The high level setpoint is 77 percent. This value is stored in DCS. When the level rises above this setpoint during the Precoat Cycle, the sequence step 26 is allowed to complete.

The low level setpoint is 7 percent. This value is stored in DCS. When the level drops below this setpoint during the Precoat Cycle, the sequence step 28 is allowed to complete.

The low-low level setpoint is 5 percent. When the level drops below this setpoint during the Precoat Cycle, the **"1LALL1834 - PRECOAT TANK LEVEL LOW-LOW"** alarm will be activated and logged by DCS. When this level is reached, the Precoat Injection Pump and Precoat Tank Mixer should be stopped. This alarm will automatically clear when the level measurement rises above the deadband setting for this setpoint.

8.1.5.3. Air Surge Tank Pressure - Loop 1P1834

The Air Surge Tank Pressure is measured and transmitted by pressure transmitter 1PIT1834. The calibrated range is 0 to 150 PSIG. The analog input is configured for an input signal of 4 to 20 mADC and a calibrated range of 0 to 150 PSIG.

This value is stored, displayed and logged as AP011010 by DCS.

The low pressure setpoint is 80 PSIG. During a backwash when the pressure is equal to or falls below this setpoint and Step 4, 6, 8, 11, 13, 15, 17 or 19 has timed out, the **"1PAL1834 - AIR SURGE TANK PRESSURE LOW"** alarm will be activated and logged by DCS. This event will halt the sequence in current step and close the Backwash Inlet/Precoat Outlet Valve (1FV1833F) until the pressure is restored. This alarm will automatically clear when the pressure measurement rises above the deadband setting for this setpoint.

8.1.5.4. Powdex Inlet Cation Conductivity – Loop 1C1835

The Powdex Inlet cation conductivity is measured by conductivity sensor 1CE1835 and transmitted by conductivity transmitter 1CIT1835. The analog input is configured with an input signal of 4 to 20 mADC and a calibrated range of 0 to 0.5 uS/cm.

This value is stored, displayed and logged as AI000010 by DCS.

The high alarm setpoint is 0.3 uS/cm. This value is stored in DCS. When the conductivity rises above this setpoint, the **"1CAH1835 - POWDEX INLET CATION CONDUCTIVITY HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the conductivity measurement drops below the deadband setting for this setpoint.

8.1.5.5. Powdex Inlet Degassed Conductivity – Loop 1C1835A

The Powdex Inlet degassed conductivity is measured by conductivity sensor 1CE1835A and is transmitted by conductivity transmitter 1CIT1835A. The Degassed conductivity is monitored only when Nitrogen is injected into the sample through in-line solenoid valve 1SV1835. If the solenoid valve is NOT energized then the instrument reads cation conductivity. The analog input is configured with an input signal of 4 to 20 mADC and a calibrated range of 0 to 0.5 uS/cm.

This value is stored, displayed and logged as AI001010 by DCS.

The high alarm setpoint is 0.3 uS/cm. This value is stored in DCS. When the conductivity rises above this setpoint, the **"1CAH1835A - POWDEX INLET DEGASSED CONDUCTIVITY HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the conductivity measurement drops below the deadband setting for this setpoint.

8.1.5.6. Powdex Outlet Cation Conductivity – Loop 1C1835C

The Powdex Outlet cation conductivity is measured by conductivity sensor 1CE1835C and is transmitted by conductivity transmitter 1CIT1835C. The analog input is configured with an input signal of 4 to 20 mADC and a calibrated range of 0 to 0.5 uS/cm.

This value is stored, displayed and logged as AI002010 by DCS.

The high alarm setpoint is 0.3 uS/cm. This value is stored in DCS. When the conductivity rises above this setpoint, the **"1CAH1835C - POWDEX OUTLET CATION CONDUCTIVITY HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the conductivity measurement drops below the deadband setting for this setpoint.

8.1.5.7. Powdex Outlet pH - Loop 1A1835B

The Powdex Outlet pH is measured by pH sensor 1AE1835B and is transmitted by pH transmitter 1AIT1835B. The analog input is configured with an input signal of 4 to 20 mADC and a calibrated range of 0 to 14.0 pH.

This value is stored, displayed and logged as AI003010 by DCS.

The high alarm setpoint is 10 pH. This value is stored in DCS. When the pH rises above this setpoint, the **"1AAH1835B - POWDEX OUTLET PH HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the pH measurement drops below the deadband setting for this setpoint.

8.1.5.8. Powdex Outlet Sodium - Loop 1A1835D

The Powdex Outlet sodium is measured by sodium sensor 1AE1835D and is transmitted by sodium transmitter 1AIT1835D. The analog input is configured with an input signal of 4 to 20 mADC and a calibrated range of 0 to 10.0 ppb Na.

This value is stored, displayed and logged as AI004010 by DCS.

The high alarm setpoint is 7 ppb Na. This value is stored in DCS. When the sodium rises above this setpoint, the **"1AAH1835D - POWDEX OUTLET SODIUM HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the sodium measurement drops below the deadband setting for this setpoint.

8.1.6. Powdex Vessel Analog Loops

8.1.6.1. Powdex Vessel D/P - Loop 1PD1833A

The differential pressure across Powdex Vessel is measured and transmitted by D/P transmitter 1PDIT1833A. The calibrated range is 0 to 50 PSID. The analog input is configured for an input signal of 4 to 20 mADC and a calibrated range of 0 to 50.0 PSID.

This value is stored, displayed and logged as AP010010 by DCS.

The high alarm setpoint is 25 PSID. This value is stored in DCS. When the D/P rises above this setpoint, the **"1PDAH1833A - POWDEX VESSEL D/P HIGH"** alarm will be activated and logged by DCS. This alarm will automatically clear when the D/P measurement drops below the deadband setting for this setpoint.

8.1.6.2. Powdex Vessel Inlet Flow - Loop 1F1833

Powdex Vessel Inlet Flow is measured by flow element 1FE1833 and transmitted by flow transmitter 1FIT1833. The D/P produced by this flow element is 0 to 197.444 inches water column, which represents

a calibrated range of 0 to 3,000,000 lb/hr. The analog input is configured for an input signal of 4 to 20 mADC and a calibrated range of 0 to 3,000,000 lb/hr. The squared root extraction calculation will be performed at the transmitter.

This value is stored, displayed and logged as AF010010 by DCS.

The service Inlet & Outlet valves 1FV1833 & 1FV1833G are air to open - air to close valve. Each valve is equipped with a pneumatic lock-up relay. In the event of a loss of air to the system, this relay will lock the valve in its last position. Each valve is equipped with 4-way dual coil solenoid valves.

Inlet valve 1FV1833 and Outlet valve 1FV1833G are interlocked as follows. In order to open the Outlet valve 1FV1833G, Inlet valve 1FV1833 must be fully open. In order to close the Inlet valve 1FV1833, Outlet valve1FV1833G must be fully closed.

The total number of Kgallons treated by Vessel is totalized in the DCS and is displayed and logged as 1FQI1833-1 by DCS.

The number of Kgallons treated by Vessel for the current service run is also totalized in the DCS and is displayed and logged as 1FQI1833-2 by DCS. Flow totalizer 1FQI1833-2 is automatically reset to zero during the Backwash and Precoat, or Backwash Only sequence.

The low flow alarm setpoint is 400000 lb/hr. When the flow drops below this setpoint and the vessel is **NOT** in a Backwash and Precoat Sequence, Holding Pump will begin to run. If the Holding Pump fails to start the **"1FAL1833 – POWDEX VESSEL INLET FLOW LOW"** alarm will be activated and logged by DCS. This alarm will automatically clear when the flow measurement rises above 150000 lb/hr.

8.1.7. Discrete Control Loops

8.1.7.1. Service Vessel Interlocks and Alarms

8.1.7.1.1. Opening of the Vessel Service Inlet Valve

The respective Vessel Service Inlet Valve 1FV1833 will not be allowed to open until ALL of the following valves are verified to be fully closed:

a. Vessel BW Inlet / PC Outlet Valve 1FV1833F

b. Vessel Drain Valve 1FV1833B

c. Vessel PC Inlet / BW Outlet Valve 1FV1833A

d. Vessel Air Inlet Valve 1FV1833E

e. Vessel Fast Vent Valve 1FV1833C

f. Vessel Slow Vent Valve 1FV1833D

The differential pressure across the Vessel Service Inlet Valve 1FV1833 is monitored by differential pressure switch 1PDS1833 which is set at 25 PSID decreasing.

The Vessel Service Inlet Valve 1FV1833 will not open while the differential pressure across the valve is above the setpoint of 1PDS1833.

When the Vessel Service Inlet Valve 1FV1833 is commanded to open, the Vessel Pressurizing Bypass Valve 1SV1833 will energize first. This allows the pressure across service inlet valve to equalize to an acceptable pressure. Once the differential pressure drops below the setpoint of 1PDS1833, the Vessel Service Inlet Valve 1FV1833 will energize to open.

NOTE: For system safety, this is a hard-wired interlock.

8.1.7.1.2. Closing of the Vessel Service Inlet Valve

The Vessel Service Inlet Valve 1FV1833 will be prevented from closing, in either MANUAL or AUTOMATIC operation, until the Service Outlet Valve 1FV1833G is verified to be fully closed.

8.1.7.1.3. Opening of the Vessel Service Outlet Valve

The Service Outlet Valve 1FV1833G will be prevented from opening, in either MANUAL or AUTOMATIC operation, Vessel Service Inlet Valve 1FV1833 is verified to be fully opened.

8.1.7.1.4. Auxiliary Tank Level Switch – Loop 1L1834

The Auxiliary Tank Level Switch 1LS1834 monitors the water level in the Auxiliary Tank. Under normal conditions, the Precoat Tank is always filled with water. If the water level drops below the setpoint of this switch 1LS1834, interlock will be activated in either MANUAL or AUTOMATIC operation of Precoat Recycle Pump. The **"1LAL1834 - AUXILIARY TANK LEVEL LOW"** alarm will be activated and logged by DCS. This alarm will automatically clear when the level measurement rises above this switch.

8.1.7.1.5. Precoat Tank Mixer - Loop 1HS1834

The Precoat Tank Mixer is controlled locally through Start/Stop pushbutton station (1HS1834). An Operator runs the mixer during the Precoat preparation and injection steps. DCS has the capability to remotely stop the mixer at the end of the Precoat sequence.

8.1.7.1.6. Cooling Water Flow Switch - Loop 1F1835

The Cooling Water Flow Switch 1FS1835 monitors the cooling water flow for sampling system. If there is insufficient water flow for the sample cooling system, the low flow switch 1FS1835 will activate. The **"1FAL1835 - COOLING WATER FLOW LOW"** alarm will be activated and logged by DCS.

8.1.7.1.7. Precoat Injection Pump Seal Water - Loop 1SV1834

Precoat Injection Pump Seal Water Solenoid Valve 1SV1834 maintains lubrication during the Precoat Injection Step(s). The DCS output DO133010 remains energized as long as Precoat Injection Pump is running.

8.1.8. Vessel Operating Modes

8.1.8.1. Vessel Semi-Automatic Operating Modes

Each of the Vessels has the following semi-automatic operating modes:

a. Service

b. Standby

c. Backwash and Precoat

d. Backwash Only

e. Precoat Only

f. Cleaned and Filled

8.1.8.2. Service Mode

In the **Service** mode, condensate flows into the service vessel through the Vessel Service Inlet Valve 1FV1833 and exits the vessel through the Vessel Service Outlet Valve 1FV1833G:

The Service mode is selected by the operator by means of the **"Service"** push-button located on the DCS Display. The **Service** mode is observed when the Vessel Service Outlet Valve 1FV1833G is open. No other mode will exist when this valve is open.

The "**Service"** push-button is active when the following permissives are satisfied.

a. The Vessel is in the **Standby** mode

b. The Vessel Valve Controls are in the **AUTO** mode

c. Vessel Holding Pump is either in **AUTO** mode **OR HAND** mode

d. Vessel Service Inlet Valve (A) 1FV1833 is full opened

The vessel is placed in the **Service** mode when one of the following occurs:

a. The **"Service"** push-button is pressed

b. The Vessel Valve Control is in **Manual** mode **AND** the Vessel Service Outlet Valve 1FV1833G is manually opened

Whether operating in either the **MANUAL** or in **AUTO** mode, Vessel Service Outlet Valve 1FV1833G will not be allowed to open unless the Vessel Service Inlet Valve 1FV1833 is determined to be fully open.

8.1.8.3. Standby Mode

The **Standby** mode is selected by the operator by means of the **"Standby"** push-button located on the DCS Display. The **Standby** mode is observed when Vessel Service Inlet Valve 1FV1833 is fully opened **AND** the Vessel Service Outlet Valve 1FV1833G is fully closed. The **"Standby"** push-button is active when the following permissives are satisfied:

a. The vessel is in the **Service** mode

b. The Vessel Valve Controls are in the **AUTO** mode

c. Vessel Holding Pump is either in **AUTO** mode **OR HAND** mode

The Vessel Holding Pump is running when in the **"Standby"** Mode.

8.1.8.4. Backwash and Precoat Mode

The **Backwash and Precoat** Mode is selected by the operator by means of the **"Backwash & Precoat"** push-button located on the DCS Display. The **"Backwash & Precoat"** push-button is active when the following permissives are satisfied:

a. The vessel is in the **"Standby"** mode **OR** in the **"Cleaned and Filled"** mode

b. The vessel Valve Controls are in the **AUTO** mode

c. The Vessel Holding Pump is in **AUTO** mode

d. The Precoat System Valve Controls are in the **AUTO** mode

e. Backwash Water Supply Flow Controller 1FIC1834 is in the **AUTO** mode

f. Backwash Water Supply Flow Controller 1FIC1834 is in the **BATCH** mode

g. The Precoat Injection Pump is in **AUTO** mode

h. The Precoat Recycle Pump is in **AUTO** mode

The entire Backwash and Precoat sequence is performed as indicated in Section 8.1.9 of this document.

At the end of the Backwash and Precoat sequence the Vessel will automatically be placed in the **Standby** mode.

8.1.8.5. Backwash Only Mode

The **Backwash Only** mode is primarily used as a maintenance tool and is not generally selected by the Operator.

The **Backwash Only** mode is selected by the operator by means of the **"Backwash Only"** push-button located on the DCS Display. The **"Backwash Only"** push-button is active when the following permissives are satisfied:

a. The vessel is in the **"Standby"** mode **OR** in the **"Cleaned and Filled"** mode

b. The vessel Valve Controls are in the **AUTO** mode

c. The Vessel Holding Pump is in **AUTO** mode

d. The Precoat System Valve Controls are in the **AUTO** mode

e. Backwash Water Supply Flow Controller 1FIC1834 is in the **AUTO** mode

f. Backwash Water Supply Flow Controller 1FIC1834 is in the **BATCH** mode

During a **Backwash Only** Sequence, the automatic step sequencer starts at Step 1 – Closure through Step 23 – Fast Fill and then jumps to Step 39 – Standby (Home) position.

At the end of the Backwash Only sequence, the Vessel will automatically be placed in the **Cleaned and Filled** mode.

In the **Cleaned and Filled** mode, all vessel valves remain closed and the Vessel Holding Pump is not running.

8.1.8.6. Precoat Only Mode

The **Precoat Only** mode is primarily used as a maintenance tool and is not generally selected by the Operator.

The **Precoat Only** Mode is selected by the operator by means of the **"Precoat Only"** push-button located on the DCS Display. The **"Precoat Only"** push-button is active when the following permissives are satisfied:

a. The vessel is in the **"Standby"** mode **OR** in the **"Cleaned and Filled"** mode

b. The vessel Valve Controls are in the **AUTO** mode

c. The Vessel Holding Pump is in **AUTO** mode

d. The Precoat System Valve Controls are in the **AUTO** mode

e. Backwash Water Supply Flow Controller 1FIC1834 is in the **AUTO** mode

f. Backwash Water Supply Flow Controller 1FIC1834 is in the **BATCH** mode

g. The Precoat Injection Pump is in **AUTO** mode

h. The Precoat Recycle Pump is in **AUTO** mode

During a **Precoat Only** Sequence, the automatic step sequencer starts at Step 24 – Finish Fill and then continues through to Step 39 – Standby (Home) position.

At the end of the Backwash and Precoat sequence the Vessel will automatically be placed in the **Standby** mode.

8.1.9. BACKWASH AND PRECOAT SEQUENCE

The step sequencer is designed to allow the pre-filters to be backwashed with a sequence of steps which optimizes the effectiveness of the backwash extending the filter elements life. The step sequencer operates in a semi-automatic manner allowing the valves to cycle automatically from step to step. The operator has the ability to stop a step and advance or reverse through the sequence as well as to start and stop the timing of any particular step.

Once the sequence start button has been depressed, the backwash sequence will continue through the required steps of the sequence pausing only where operator input or action is necessary. The current step number and the seconds remaining in the current step are displayed on the Operator Interface Displays. The operator may stop the step timing by depressing the **"TIMING ON/OFF"** push-button on the sequence control page. This will have no effect on the valve position. The purpose of this feature is to allow an extension of any step in progress. The step timing can be started by once again depressing the **"TIMING ON/OFF"** on the sequence control page. The status of the timing is always displayed on each of the Operator Interface Displays.

Advancing from step to step can be controlled by the operator. In order to advance or reverse the sequencer step, the step must first be stopped by depressing the **"STEP STOP"** push-button on the sequence control page. This will stop the timing of the step and cause all of the valves to close and all motors to stop. This push-button is active only when the sequence has been started. The sequence can be moved one step forward by depressing the **"STEP ADVANCE"** push-button on the sequence control page. This push-button is active only when a sequence is in progress **AND** the operator has stopped the step. The sequence can be moved one step backward by depressing the **"STEP REVERSE"** push-button on the sequence control page. This push-button is active only when a sequence is in progress **AND** the operator has stopped the step. Upon reaching the desired step number, the step may be started by depressing the **"STEP START"** push-button located on the sequence control page. This push-button is active only when a sequence is in progress **AND** the operator has stopped the step. This will energize valve and motor outputs and start the step timing function for the related step.

During the sequence an Operator intervention will be required during Precoat cycle. In order to keep the sequence continuous and ease of operation, **"Step Continue"**, **"Return To Standby"** and **"Additional Precoat"** push-buttons are programmed as described in the sequence. Step Continue push-button is active only during steps 27 & 32. The Return To Standby and Additional Precoat push-buttons are active only during step 30.

NOTE: the System Operator cannot manipulate the "Backwash with Air" steps. The **"TIMING ON/OFF"** and the **"STEP STOP"** push buttons will have no effect during these steps. In addition, the Step Timer value for the "Backwash with Air" steps cannot be changed by a System Operator.

8.1.9.1. Backwash And Precoat Sequence

The following pages describe the entire Backwash and Precoat Sequence.

The step timer values are only suggested times.

Figure 8.1.9.1 Backwash and Precoat Sequence Steps

Step 1 – Closure	
Step Termination:	Step Timer **AND** Vessel Service Inlet Valve 1FV1833 Full Closed Limit Switch
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	The sequence initiates with the vessel in the **Standby** mode with the Service Outlet Valve 1FV1833G closed. During this step the Service Inlet Valve 1FV1833 is allowed to close, thus isolating the vessel from the inlet and outlet headers.
Flow Rate:	Retaining Flow: 146 GPM
Vessel Valves Open:	None
System Valves Open:	None
Motors Running:	Vessel Holding Pump
Remarks:	None

Step 2 – Depressurize	
Step Termination:	Step Timer
Step Timer Preset:	30 Seconds (0.5 Minute)
Description:	Vessel is Depressurized through Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	N/A
Vessel Valves Open:	Fast Vent Valve 1FV1833C
System Valves Open:	None
Motors Running:	None
Remarks:	None

Step 3 – Drain 1 and Wash Preparation	
Step Termination:	Vessel Drain Valve 1FV1833B Full Open Limit Switch
Step Timer Preset:	N/A
Description:	The condensate polisher vessel is being prepared to remove the Precoat from the powdex elements.
Flow Rate:	N/A
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	None
Motors Running:	None
Remarks:	None

Step 4 – Drain 1 and Wash	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	180 Seconds (3.0 Minutes)
Description:	During this step, water is introduced into the vessel counter to the service flow in order to remove exhausted resin from the elements. The Backwash Water Supply Flow Controller 1FIC1834 is enabled to start the flow of backwash water. The System Air Supply Valve 1FV1834D opens. The backwash water flows into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 5. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 5 – Backwash 1 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 6 – Backwash 1	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 7. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 7 – Backwash 1 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 8 – Backwash 1	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 9. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 9 – Backwash 1 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 10 – Backwash 1	
Step Termination:	Step Timer
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. The vessel is near empty at this time. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 11 – Drain Valve Closure	
Step Termination:	Vessel Drain Valve 1FV1833B Full Closed Limit Switch **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	N/A
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel starts to fill with Backwash Water. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 12. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator. If the Vessel Drain Valve 1FV1833B fails to close as confirmed by limit switch feedback, the **"DRAIN VALVE NOT FULL CLOSED"** alarm will be activated and logged by DCS and the sequencer will not advance to the next step.

Step 12 – Backwash 2 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel begins to rise. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 13 – Backwash 2	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel continues to fill with Backwash Water. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 14. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 14 – Backwash 2 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to increase. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 15 – Backwash 2	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Water level in the vessel continues to increase. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 16. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 16 – Backwash 2 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to increase. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 17 – Drain 2 and Wash	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	180 Seconds (3.0 Minutes)
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel begins to drain through the Vessel Drain Valve 1FV1833B. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 18. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 18 – Backwash 3 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel continues to drain. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 19 – Backwash 3	
Step Termination:	Step Timer **AND** Air Surge Tank Pressure Acceptable
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	Before backwashing with air, air surge tank must be at acceptable pressure. If the air surge tank pressure is not acceptable when the step timer times out, Vessel BW Inlet / PC Outlet Valve 1FV1833F closes. When the air surge tank pressure is acceptable, Vessel BW Inlet / PC Outlet Valve 1FV1833F reopens and after a short time delay, the step terminates, and the program advances to Step 20. If air surge tank does not come up to the acceptable pressure within a reasonable time, an alarm will be activated to alert the operator.

Step 20 – Backwash 3 with Air	
Step Termination:	Step Timer
Step Timer Preset:	2 Seconds
Description:	During this step, water continues to flow into the vessel counter to the service flow in order to remove exhausted resin from the elements. Backwash Air is injected into the vessel to scrub the elements. Water level in the vessel continues to decrease. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The System Air Supply Valve 1FV1834D remains open. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM Backwash Air Flow: 10549 SCFM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B Air Inlet Valve 1FV1833E
System Valves Open:	System Air Supply Valve 1FV1834D Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 21 – Backwash 3	
Step Termination:	Step Timer
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel continues to drain. Water level in the vessel is near empty. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C. The water and exhausted resin exits the vessel through the Vessel Drain Valve 1FV1833B.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F Drain Valve 1FV1833B
System Valves Open:	Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	None

Step 22 – Drain Valve Closure	
Step Termination:	Vessel Drain Valve 1FV1833B Full Closed Limit Switch
Step Timer Preset:	N/A
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel begins the Fill Process. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	If the Vessel Drain Valve 1FV1833B fails to close as confirmed by limit switch feedback, the **"DRAIN VALVE NOT FULL CLOSED"** alarm will be activated and logged by DCS and the sequencer will not advance to the next step.

Step 23 – Fast Fill	
Step Termination:	Step Timer
Step Timer Preset:	300 Seconds (5.0 Minutes)
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel continues fill. The step timer is set to timeout when the water is exiting the Vessel Fast Vent Valve 1FV1833C. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Fast Vent Valve 1FV1833C.
Flow Rate:	Backwash Water Flow: 366 GPM
Vessel Valves Open:	Fast Vent Valve 1FV1833C BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	If a **Backwash Only** sequence is being performed, the step sequencer will jump to Step 39 – Standby (Home) when the step timer has timed out. Steps 24 through 38 will not be performed. At this time Vessel in Sequence will display **Cleaned and Filled** mode.

Step 24 – Finish Fill	
Step Termination:	Step Timer
Step Timer Preset:	120 Seconds (2.0 Minutes)
Description:	During this step, water continues to flow into the vessel counter to the service. The vessel continues fill. The Backwash Water Supply Flow Controller 1FIC1834 remains enabled. The backwash water flow into the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F. The air is vented from the vessel through the Vessel Slow Vent Valve 1FV1833D to remove any trapped air in the Vessel.
Flow Rate:	Backwash Water Flow: 60 GPM
Vessel Valves Open:	Slow Vent Valve 1FV1833D BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Backwash Water Supply Flow Controller 1FIC1834 Backwash Water Supply Valve 1FV1834
Motors Running:	Transfer Pump
Remarks:	If a **Backwash Only** sequence is being performed, the step sequencer will jump to Step 39 – Standby (Home) when the step timer has timed out. Steps 24 through 38 will not be performed. If a **Precoat Only** sequence is being performed, the sequencer will begin from this step.

Step 25 – Closure	
Step Termination:	Step Timer
Step Timer Preset:	30 Seconds (0.5 Minute)
Description:	During this step, all vessel valves are allowed to close in preparation for the Precoat steps.
Flow Rate:	N/A
Vessel Valves Open:	None
System Valves Open:	None
Motors Running:	None
Remarks:	None

Step 26 – Advance Precoat Tank Fill	
Step Termination:	Level in advance Precoat Tank reaching the high setpoint on level Transmitter 1LIT1834
Step Timer Preset:	N/A
Description:	During this step the Advance Precoat Tank is filled with condensate water through Advance Precoat Tank Fill Valve 1FV1834C to prepare resin slurry for the Precoat Cycle.
Flow Rate:	N/A
Vessel Valves Open:	None
System Valves Open:	Advance Precoat Tank Fill Valve 1FV1834C
Motors Running:	Advance Precoat Tank Mixer Transfer Pump
Remarks:	None

Step 27 – Prepare Precoat and Establish Recycle	
Step Termination:	Operator presses **Step Continue** pushbutton
Step Timer Preset:	N/A
Description:	During this step two Recirculation loops are established to prepare for Precoat Injection step. The first Recirculation loop is between the Vessel and the Auxiliary Tank. Water is circulated into the Vessel Precoat Inlet Valve 1FV1833A and out of Vessel BW Inlet / PC Outlet Valve 1FV1833F through Precoat Recycle Pump and Auxiliary Tank Recycle Inlet Valve 1FV1834A. The second Recirculation loop is established between the Advance Precoat Tank and the Precoat Injection pump. This loop allows the operator to fill the tank with Precoat material and maintain uniform slurry prior to injection step.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump
Remarks:	None

Step 28 – Precoat Injection	
Step Termination:	Level in Advance Precoat Tank falls below the Low Level setpoint on Level Transmitter 1LIT1834
Step Timer Preset:	N/A
Description:	Precoat from the Advance Precoat Tank flows into the Precoat recirculation loop and also is re-circulated back to the Advance Precoat Tank. The Precoat slurry that flows into the Precoat recirculation loop through Precoat Injection Valve 1FV1834B enters the condensate polisher vessel through Vessel Precoat Inlet Valve 1FV1833A. After the Precoat slurry enters the vessel, the carrying water passes through the septa into the Powdex elements, out Vessel BW Inlet / PC Outlet Valve 1FV1833F, through Auxiliary Tank Recycle Inlet Valve 1FV1834A and into the Auxiliary Tank. As the Precoat slurry is injected into the condensate polisher vessel, the level in the Advance Precoat Tank decreases. Any excess returning liquid from the condensate polisher vessel is discharged to sump through the overflow on the Auxiliary Tank. The level in the Advance Precoat Tank gradually decreases throughout this step.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A Precoat Injection Valve 1FV1834B
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump
Remarks:	None

Step 29 – Precoat Completion	
Step Termination:	Step Timer
Step Timer Preset:	300 Seconds (5.0 Minutes)
Description:	Water is added to the Advance Precoat Tank through Advance Precoat Tank Fill Valve 1FV1834C to displace the remaining Precoat slurry from the Advanced Precoat Tank and the Precoat Injection Pump to the condensate polisher vessel.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A Precoat Injection Valve 1FV1834B Advance Precoat Tank Fill Valve 1FV1834C
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump Transfer Pump
Remarks:	None

Step 30 – Precoat Retain	
Step Termination:	System Operator pressing the **"Additional Precoat"** or the **"Return To Standby"** push-button on the sequence control page
Step Timer Preset:	N/A
Description:	During this step the resin is held on the elements by means of a closed recirculation loop. Slurry is pumped by the Precoat Recycle Pump into the service vessel through the Vessel Precoat Inlet Valve 1FV1833A. The water exits the vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F and is recycled through the Auxiliary Tank Recycle Inlet Valve 1FV1834A back to the Precoat Recycle Pump.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A
Motors Running:	Advance Precoat Tank Mixer Precoat Recycle Pump
Remarks:	The System Operator should check the quality of before placing the vessel into the **Standby** mode by checking the absence of Precoat material in the Precoat Tank and by checking Millipore filters. If the quality is satisfactory, the System Operator should depress the **"Return To Standby"** push-button, on the sequence control page. This will cause the sequencer to advance to the Step 35 - Transfer To Standby. If the quality is unsatisfactory, the System Operator should depress the **"Additional Precoat"** push-button, on the sequence control page. This will cause the sequencer to advance to Step 31 to prepare for additional Precoat.

Step 31 – Advance Precoat Tank Fill	
Step Termination:	Level in advance Precoat Tank reaching the high setpoint on level Transmitter 1LIT1834
Step Timer Preset:	N/A
Description:	During this step the Advance Precoat Tank is filled with condensate water through Advance Precoat Tank Fill Valve 1FV1834C to prepare resin slurry for the Precoat Cycle.
Flow Rate:	N/A
Vessel Valves Open:	None
System Valves Open:	Advance Precoat Tank Fill Valve 1FV1834C
Motors Running:	Advance Precoat Tank Mixer Transfer Pump
Remarks:	None

Step 32 – Prepare Precoat and Establish Recycle	
Step Termination:	Operator presses **Step Continue** pushbutton
Step Timer Preset:	N/A
Description:	During this step two Recirculation loops are established to prepare for Precoat Injection step. The first Recirculation loop is between the Vessel and the Auxiliary Tank. Water is circulated into the Vessel Precoat Inlet Valve 1FV1833A and out of Vessel BW Inlet / PC Outlet Valve 1FV1833F through Precoat Recycle Pump and Auxiliary Tank Recycle Inlet Valve 1FV1834A. The second Recirculation loop is established between the Advance Precoat Tank and the Precoat Injection pump. This loop allows the operator to fill the tank with Precoat material and maintain uniform slurry prior to injection step.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump
Remarks:	None

Step 33 – Additional Precoat	
Step Termination:	Level in Advance Precoat Tank falls below the Low Level setpoint on Level Transmitter 1LIT1834
Step Timer Preset:	N/A
Description:	Precoat from the Advance Precoat Tank flows into the Precoat recirculation loop and also is re-circulated back to the Advance Precoat Tank. The Precoat slurry that flows into the Precoat recirculation loop through Precoat Injection Valve 1FV1834B enters the condensate polisher vessel through Vessel Precoat Inlet Valve 1FV1833A. After the Precoat slurry enters the vessel, the carrying water passes through the septa into the Powdex elements, out Vessel BW Inlet / PC Outlet Valve 1FV1833F, through Auxiliary Tank Recycle Inlet Valve 1FV1834A and into the Auxiliary Tank. As the Precoat slurry is injected into the condensate polisher vessel, the level in the Advance Precoat Tank decreases. Any excess returning liquid from the condensate polisher vessel is discharged to sump through the overflow on the Auxiliary Tank. The level in the Advance Precoat Tank gradually decreases throughout this step.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A Precoat Injection Valve 1FV1834B
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump
Remarks:	None

Step 34 – Precoat Completion	
Step Termination:	Step Timer
Step Timer Preset:	300 Seconds (5.0 Minutes)
Description:	Water is added to the Advance Precoat Tank through Advance Precoat Tank Fill Valve 1FV1834C to displace the remaining Precoat slurry from the Advanced Precoat Tank and the Precoat Injection Pump to the condensate polisher vessel.
Flow Rate:	Precoat Flow: 1903 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A Precoat Injection Valve 1FV1834B Advance Precoat Tank Fill Valve 1FV1834C
Motors Running:	Advance Precoat Tank Mixer Precoat Injection Pump Precoat Recycle Pump Transfer Pump
Remarks:	None

Step 35 – Transfer to Standby	
Step Termination:	Step Timer **AND** Vessel Holding Pump Running
Step Timer Preset:	30 Seconds (0.5 Minute)
Description:	During this step vessel resin retaining flow is transferred from the Precoat Recycle Pump to the Vessel Holding Pump. The Precoat Recycle Pump continues to re-circulate water into the service vessel through Vessel Precoat Inlet Valve 1FV1833A. The water exits the service vessel through the Vessel BW Inlet / PC Outlet Valve 1FV1833F and is recycled through the Auxiliary Tank Recycle Inlet Valve 1FV1834A back to the Precoat Recycle Pump. The Vessel Holding Pump is allowed to start.
Flow Rate:	Precoat Flow: 1903 GPM Retaining Flow: 146 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A BW Inlet / PC Outlet Valve 1FV1833F
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A
Motors Running:	Precoat Recycle Pump Vessel Holding Pump
Remarks:	None

Step 36 – Backwash Inlet Valve Closure	
Step Termination:	Step Timer
Step Timer Preset:	30 Seconds (0.5 Minute)
Description:	During this step vessel resin retaining flow is provided by the Vessel Holding Pump and Precoat Recycle Pump. Vessel BW Inlet / PC Outlet Valve 1FV1833F is allowed to close and the Vessel Precoat Inlet Valve 1FV1833A remains open. This allows Vessel to build initial pressure through Precoat Recycle Pump. The Auxiliary Tank Recycle Inlet Valve 1FV1834A remains open.
Flow Rate:	Retaining Flow: 146 GPM
Vessel Valves Open:	Precoat Inlet Valve 1FV1833A
System Valves Open:	Auxiliary Tank Recycle Inlet Valve 1FV1834A
Motors Running:	Precoat Recycle Pump Vessel Holding Pump
Remarks:	None

Step 37 – Isolate	
Step Termination:	Step Timer
Step Timer Preset:	30 Seconds (0.5 Minute)
Description:	During this step vessel resin retaining flow is provided by the Vessel Holding Pump. Vessel Precoat Inlet Valve 1FV1833A is allowed to close. Thus Isolating the Vessel from Precoat area to prepare for Pressurization. The Auxiliary Tank Recycle Inlet Valve 1FV1834A is allowed to close.
Flow Rate:	Retaining Flow: 146 GPM
Vessel Valves Open:	None
System Valves Open:	None
Motors Running:	Vessel Holding Pump
Remarks:	None

Step 38 – Pressurize	
Step Termination:	Step Timer **AND** Vessel Service Inlet Valve 1FV1833 Full Open Limit Switch
Step Timer Preset:	60 Seconds (1.0 Minute)
Description:	During this step the Vessel Pressurizing Bypass Valve 1SV1833 opens. This will allow the service vessel to become pressurized. After the differential pressure drops below the setpoint of 1PDS1833, the Vessel Service Inlet Valve 1FV1833 will be allowed to open. When Vessel Service Inlet Valve 1FV1833 is fully open, it releases the automatic sequence and resets it to the Home position.
Flow Rate:	Retaining Flow: 146 GPM
Vessel Valves Open:	Service Inlet Pressurizing Solenoid Valve 1SV1833 Service Inlet Valve 1FV1833
System Valves Open:	None
Motors Running:	Vessel Holding Pump
Remarks:	The **"SEQUENCE COMPLETE"** alarm will be activated and logged by DCS.

Step 39 – Standby (Home)

8.2. ALARMS & SETPOINTS

DCS Alarm Tag	Alarm Description
	1FAL1834 – System Backwash Flow Low
	1LAHH1834 – Precoat Tank Level High-High
	1LALL1834 – Precoat Tank Level Low-Low
	1PAL1834 – Air Surge Tank Pressure Low
	1CAH1835 – Powdex Inlet Cation Conductivity High
	1CAH1835A – Powdex Inlet Degassed Conductivity High
	1CAH1835C – Powdex Outlet Cation Conductivity High
	1AAH1835B – Powdex Outlet pH High
	1AAH1835D – Powdex Outlet Sodium High
	1PDAH1833A – Powdex Vessel D/P High
	1FAL1833 – Powdex Vessel Inlet Flow Low
	1LAL1834 – Auxiliary Tank Level Low
	1FAL1835 – Cooling Water Flow Low
	Drain Valve Not Full Closed
	Sequence Complete

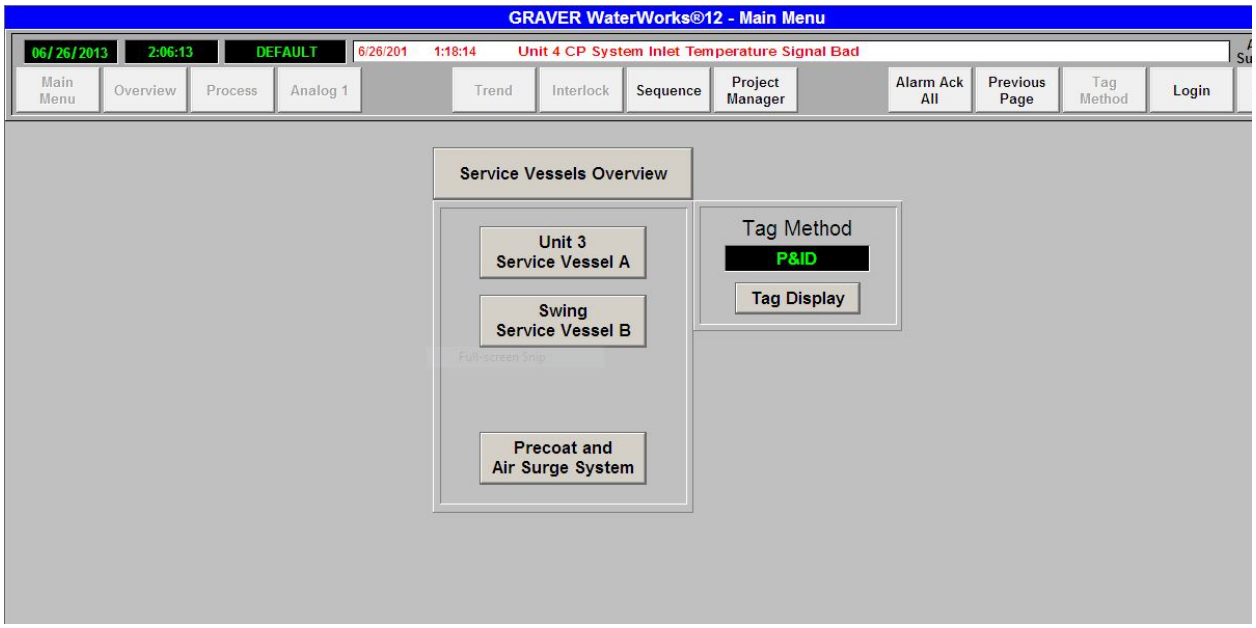
8.3. OPERATOR INTERFACE DISPLAY

8.3.1. GENERAL

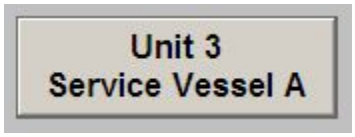
The Graver WaterWorks® 2000 Lite System Operator Interface Display (OID) is the interface between the system operator and the programmable logic controller. The OID sends and receives process information and commands to and from the programmable logic controller. The Graver WaterWorks® 2000 Lite System consists of an Allen-Bradley Control Logix 5561 Programmable Logic Controller (PLC) and the OID which is located on the Condensate Polisher Control Panel.

8.3.2. SCREEN NAVIGATION

The face of the operator interface display has a 15-inch multisync graphic display. The picture area will display the various graphic screens provided one at a time. The terms "Display Page" and "Screen" are interchangeable. Most functions are defined by the same function on each screen.



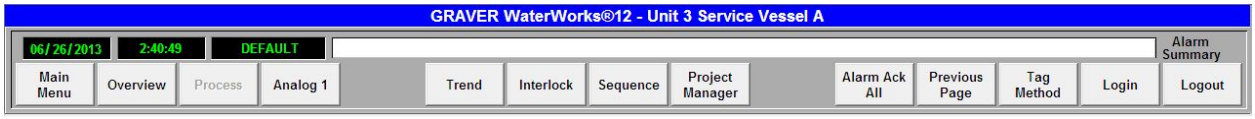
Utilizing the function keys on the Operator Interface Display, it is possible to move to the screens that contain information on the Condensate Polisher System. The standard symbol on the screen for the buttons is a GRAY square or rectangle. Inside the square or rectangle is the description of the function and the function key associated with the function. If the description is not inside the square or rectangle, then the text beside the symbol describes the function.



Using the function key on the operator terminal performs the function. Pressing the function key gives simultaneous control of both direction and speed. When the function key is utilized, the perimeter of the pushbutton will be highlighted, indicating to the operator that this function can be performed. If the function does not highlight, then pressing that pushbutton will have no effect on the system.

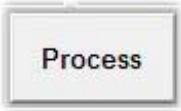
When a function key is pressed, the desired function is implemented by the PLC and then the operator interface screen updates its display. This update process may take a few seconds due to the large amount of data being transmitted across the system.

The operator is also able to move to various screens by using the navigation functions at the top of each control page. If a description and function key is grayed out, that screen is not available. For example on the banner below, the operator cannot access the Process Screen.



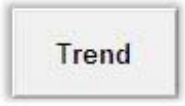
Pressing the **"Main Menu"** function key on the operator terminal will open the "Main Menu Screen".

Pressing the **"Overview"** function key on the operator terminal will open the "Overview Screen" for the system.



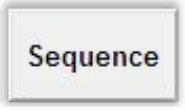
Pressing the **"Process"** function key on the operator terminal will open the "Process Screen" for the associated system

Pressing the **"Analog 1"** function key on the operator terminal will open the "Analog 1 Screen" for the associated system.



Pressing the **"Trend"** function key on the operator terminal will open the "Trend Screen" for the current screen.

Pressing the **"Interlock"** function key on the operator terminal will open the associated "Interlock Screen" for the current screen.



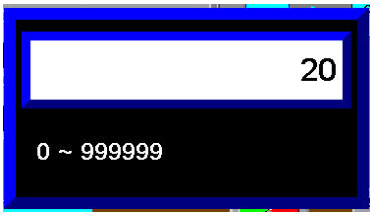
Pressing the **"Sequence"** function key on the operator terminal will open the associated "Sequencer Screen" for the current screen.

Pressing the **"Previous Page"** function key on the operator terminal will return to the previous screen.

Pressing the "**Alarm Ack All**" function key on the screen will acknowledged all alarms and silence the alarm horn.

8.3.3. KEYPAD CONTROLS

8.3.3.1. NUMERIC PAD



This pop-up is used to enter data values. If a value entered is not within the minimum and maximum range, a warning will appear notifying the operator to enter a new value. To change a value, type in the new value using the numeric keypad on the operator terminal then press the enter pushbutton.

8.3.4. GRAPHIC SCREENS

The Graphic Screens included in this project are as follows:

1. **Main Menu** – This screen provides the operator a menu of all graphic screens in the project. From this screen, the operator can navigate to any graphical screen in the project.

2. **Powdex Service Vessel A** – These screens provides the operator access to all control functions for the Powdex Filter Vessels. The status of each automatic operated valve and motor is provided with color change from green to red for valve closed (motor stopped) and valve open (motor running), respectively. A "pop-up" screen for motor controls and operator adjustment of the backwash water inlet is provided.

3. **Swing Service Vessel B** – These screens provides the operator access to all control functions for the Powdex Filter Vessels. The status of each automatic operated valve and motor is provided with color change from green to red for valve closed (motor stopped) and valve open (motor running), respectively. A "pop-up" screen for motor controls and operator adjustment of the backwash water inlet is provided.

4. **Precoat and Air Surge System** – This screen provides the operator access to all control functions for the Precoat and Air Surge System. The status of each automatic operated valve and motor

is provided with color change from green to red for valve closed (motor stopped) and valve open (motor running), respectively. A “pop-up” screen for motor controls is provided.

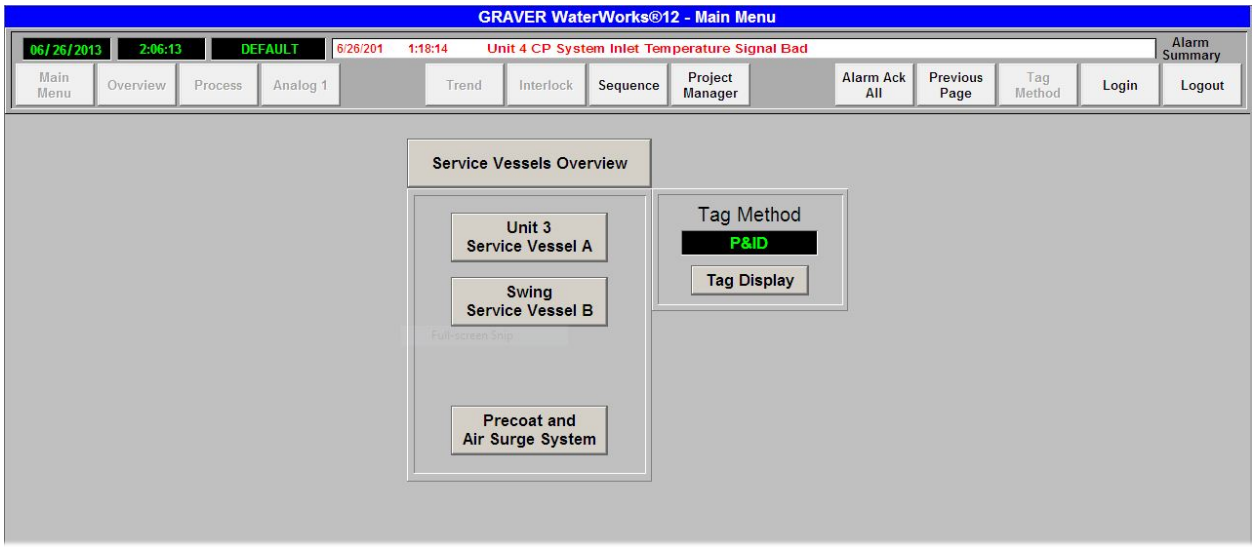
5. **Analog Bar Graph Indicators** – The analog bar graph indicators provides the operator with familiar analog bar graph type indicators for all process transmitters supplied for this system. The value of each process variable (PV) is displayed on bar graph type indicators.

6. **Trend** – This screen provides the operator with the trend of the differential pressure, flow, conductivity, and silica of the powdex vessels. A trend screen is also provided for the precoat system for agitator speed, pump speed, precoat tank level, air surge pressure, and backwash water flow.

7. **Alarm Summary** – This screen provides the operator with a listing of all alarms and their status with color change for unacknowledged and acknowledged alarms.

8.3.4.1. MAIN MENU SCREEN

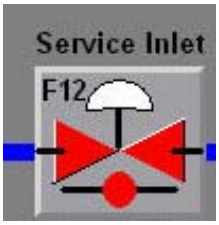
The Main Menu Screen provides the operator with a menu of all graphical screens in the project. From this screen, the operator can navigate to any graphical screen in the project.

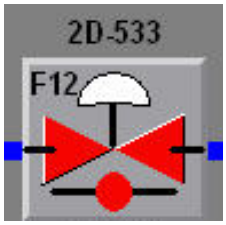


8.3.4.2. TAG INDICATOR METHOD

The Tag Indicator Method Display Option on the Main Menu gives the operator option to view the all the screens either as a description of the equipment or as the equipment tag number.

DESCRIPTION **CUSTOMER**





8.3.4.3. LOGIN/LOGOUT

Login button on the Main Menu is used to password protect access to the programs functionality. Pressing the Login key causes a login dialog box to appear. Here the operator will enter the desired Log On name and password.

Logout button on the Main Menu is used to logout of the program. Pressing the Logout key causes the system to Logout the user and intiate the default permissions for access to the program.

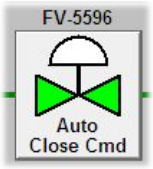
8.3.5. AUTO/MANUAL VALVE CONTROLS

8.3.5.1. AUTO/MANUAL MODE SELECTOR

Many of the valves are provided with automatic or manual control through the operator interface. A selection box on the screen provides for switching from automatic to manual valve control. The valve mode select box is labeled and displayed on that screen. It contains a function key. Pressing the F4 Vessel A Valve Mode function key on the operator terminal toggles the valves between AUTO and MANUAL modes. While in the MANUAL mode, the valves can be opened and closed by pressing the function key on operator terminal that corresponds to the function key that is on the valve.

8.3.5.2. VALVE ICON DESCRIPTION

The **Manual Control/Pre-Load Bar** under the valve icon indicates the position the valve will assume if valve mode selector is placed in the MANUAL position. This feature allows the operator to control all valves manually from the operator interface and to define the position of the valves prior to placing the system into manual. This accomplishes a “bumpless” transfer to the manual position.



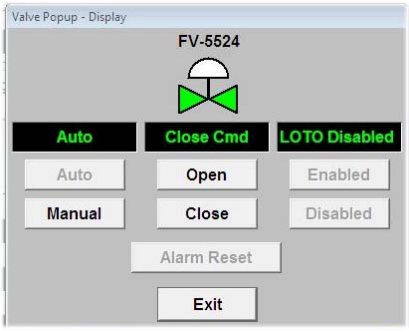
FULL OPEN	TRAVEL	FULL CLOSED
Valve body is all RED and colorblind dot turns RED.	Valve body is RED and YELLOW and color-blind dot is YELLOW.	Valve body is all YELLOW and colorblind dot turns YELLOW.
Black colorblind line appears.	Black colorblind line appears.	Black colorblind lines disappears
Manual Control/Pre-Load Bar appears.	Manual Control/Pre-Load Bar is not present.	Manual Control/Pre-Load Bar disappears
Limit switch is made.	One limit switch is made.	No limit switch is made.

8.3.5.3. VALVE ICON DESCRIPTION

NOTE: The color of the valve body does not always indicate the true position of the valve, unless the valve has limit switches indicating the true position to the PLC. If a valve is not equipped with limit switches, then that valve is assumed full open or full closed depending on what position the PLC is requesting. Certain valves can also be tagged out to prevent operation in MANUAL mode.

8.3.5.4. INDIVIDUAL VALVE CONTROL

When the Valve Auto-Manual Mode Selection is in AUTOMATIC, the desired position that the valve is to move upon entering the MANUAL mode can be preloaded by depressing the individual valve pushbuttons. Thus if the System Operator wanted to move to manual and hold all valves in their current position, the preloads would be set to match the color of the valve.

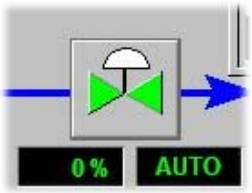


When the Valve Auto-Manual Mode Selection is in MANUAL, setting the valve pushbutton will cause the individual valve to open and resetting the valve pushbutton will cause the individual valve to close.

When the Valve Auto-Manual Mode Selection is placed back into AUTOMATIC, all of the valve preloads will be reset and the valve will assume the position as determined by the automatic system logic.

On the vessel valves, interlocks are provided to avoid opening any auxiliary valve while the vessel is not fully isolated from the condensate headers.

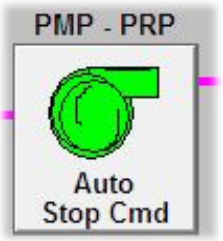
8.3.5.5. CONTROL VALVES



Control valves are set from the operator interface display by selecting the corresponding control valves button that “pops up” the setpoint controller window. The percent the control valve is open and the status of the valve (AUTO or MANUAL) is found underneath the control valve.

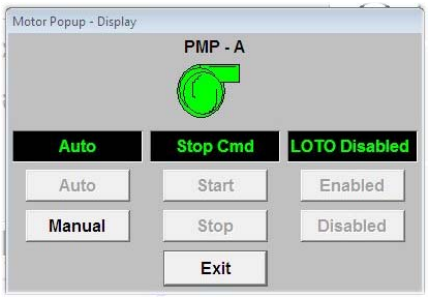
8.3.6. MOTOR CONTROLS

8.3.6.1. GENERAL



Motors may be controlled from the operator interface screens. Motors have different operating modes depending upon their type and their function. The selected mode will appear on the motor control box. When a motor is running, the symbol is RED. When a motor is off, the symbol is YELLOW. The BLACK line through the symbol will appear when the motor or pump is running to help colorblind operators.

8.3.6.2. PLC CONTROLS



Motors can be controlled from the operator interface by selecting the corresponding pump’s or motor’s function key which “pops up” a motor controller window. These screens are found from the main control screens by selecting the corresponding motor or pump function key. Some motors have “F1 HAND” - “F2 AUTO” - “F3 OFF” function keys. Normal operation is to place the motors in AUTO by pressing the corresponding function key. In most cases, a motor placed in HAND will run regardless of any safety interlocks that would inhibit automatic operation. In some cases, an interlock is required that inhibits the motor from manually or automatically starting. To stop the pump in HAND Mode, the operator must press the OFF function key.

8.3.6.3. TRIP INDICATION

A motor will trip if the motor fails to operate when the PLC requests the motor to run. A yellow T is displayed in the display box on the operator interface control screen. When a motor trips, the PLC stops trying to run the motor and gives a motor trouble alarm.

On the motor control pop-up window, a flashing green MOTOR TRIPPED is displayed in the motor display box. Also the motor will have a yellow T on the right hand side of the motor symbol. When a motor trips, the PLC stops trying to run the motor and gives a motor trouble alarm. To clear the TRIP indication, push the tripped motor's STOP function key on the motor control pop-up window. The alarm must also be acknowledged by pressing the ALARM ACK ALL function key from any screen. The trip itself is not cleared yet. The motor should not be turned back on until the cause of the motor trip has been found and corrected.

CAUTION: When working on electric motors and pumps, follow the recommended procedure found in the manufacturers' literature.

WARNING: Before working on motorized equipment, disconnect power from the starter and follow standard plant safety procedures. A motor placed in "stop" status is not sufficient protection from accidentally running.

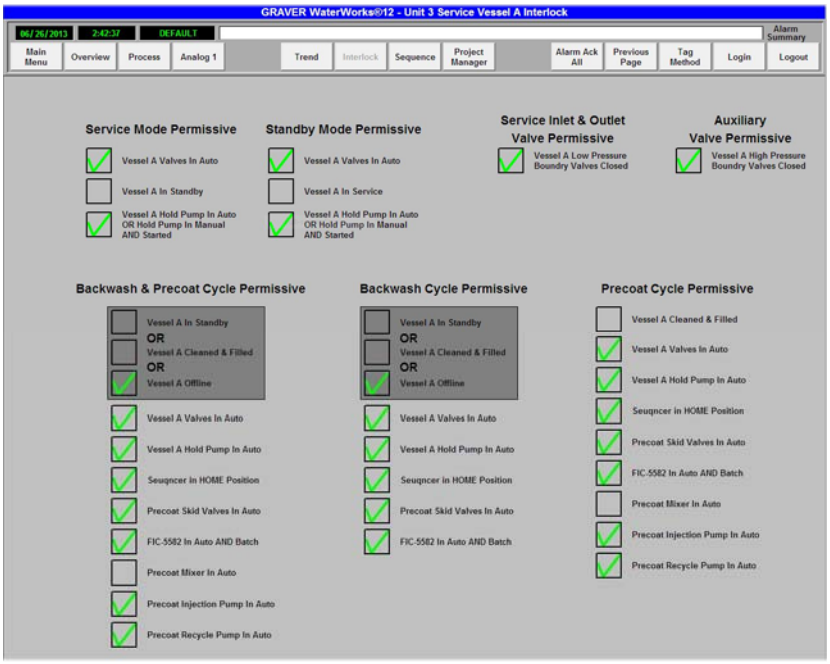
8.3.7. VESSEL OPERATING MODES

The operating mode of the powdex service vessel is shown in the status box located on each of the powdex service vessel control screen. The operating mode of the powdex service vessel is selected by pressing the F3 Vessel Controls function key. This will bring up the Vessel Controls pop-up window.

On the Vessel Controls pop-up window, the required mode is selected by pressing the appropriate function key on the operator terminal. The Condensate Polishing System has five operating modes: Service, Standby, Backwash/ Precoat, Backwash Only, and Precoat Only. The operating mode selected will be **GREEN** with a green arrowhead pointing to the operating mode. If the powdex vessel is in the CLEANED AND FILLED state, the CLEAN AND FILLED operating mode is shown in the vessel status box.

8.3.8. VESSEL INTERLOCKS

The Condensate Polisher System is equipped with an Interlock Display screen to aid the operator in backwashing and precoating the powdex service vessels. Pressing the Interlock function key on the operator terminal brings up the Interlock Screen. This screen displays all of the required permissives required to place a start a Backwash and Precoat Sequence. The interlocks that are satisfied appear with a green checkmark. Those interlocks that are yet to be satisfied are shown with an open green square.

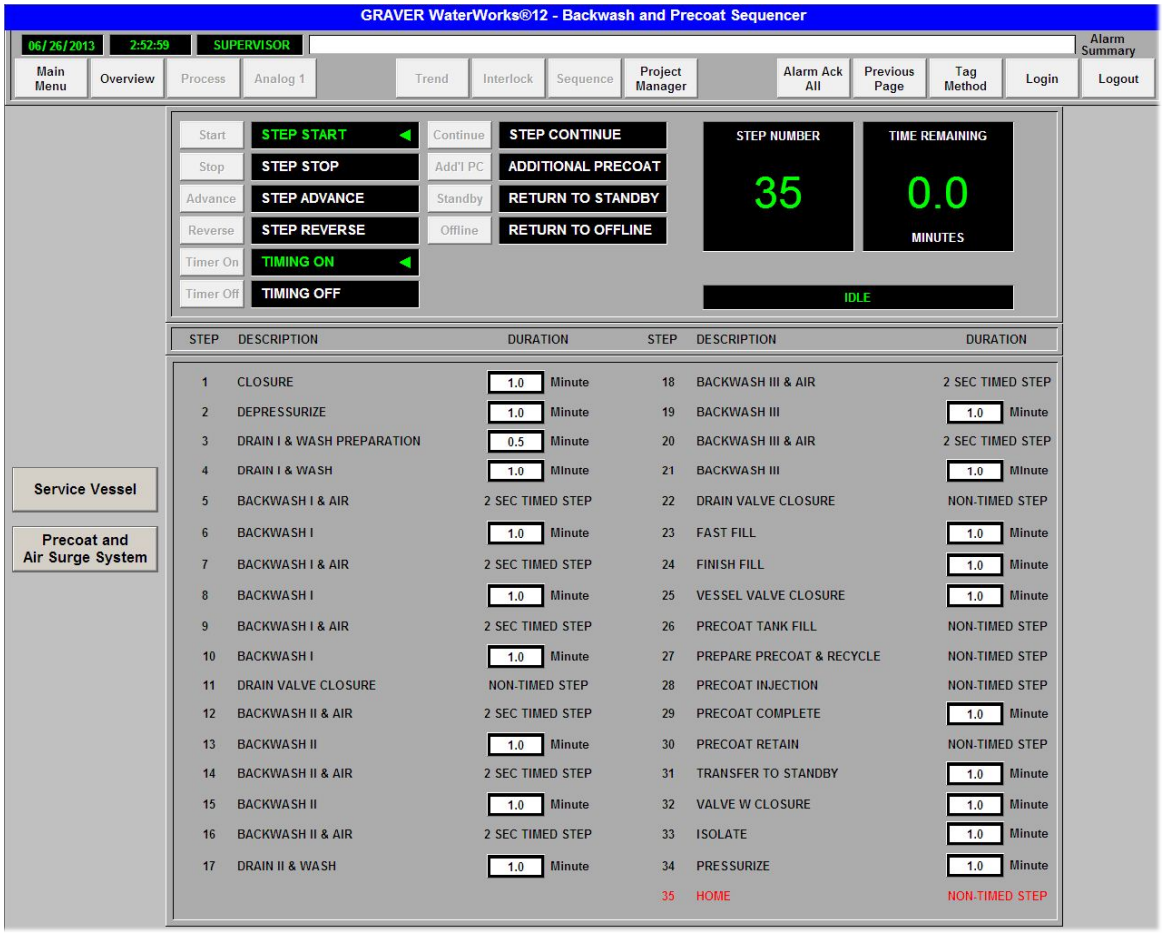


8.3.9. SEQUENCE CONTROLLERS

Sequence controllers are used to control operations that require completion through a series of steps. In addition, each step requires a number of operations to occur at the same time. For example, during a precoating sequence, various valves are required to open and close, and pumps to come on and off simultaneously for a set period of time. These sequences are programmed into the PLC and displayed on the Sequencer screen on the operator interface display.

Before a sequence is initiated, the type of precoating sequence: BACKWASH/PRECOAT, BACKWASH ONLY, or PRECOAT ONLY must be chosen by pressing the corresponding function key on the appropriate powdex service vessel control screen. Once the type of sequence is chosen, the sequence automatically starts,

The sequencer will operate specific valves and motors for a specific time, thus performing the required steps. During the operation of the sequence, the screen displays in WHITE numbers the current step number and the time remaining for that step. In addition, the text of the current step will be in GREEN.



In the automatic mode, the operator may stop the step timing by depressing the “TIMING ON/OFF” pushbutton on the sequence control page of the OID. Pressing the “TIMING ON/OFF” pushbutton will have no effect on the valve position. The purpose of this feature is to allow an extension of any step in progress without going to the Manual Step Mode. The step timing can be started again by depressing the “TIMING ON/OFF” pushbutton on the sequence control page. The status of the timing is always displayed on the OID.

In the Manual Step Advance Mode, the operator controls all advancing from step to step. The step timer is used as an operator reference only. The operator is responsible for checking all of the interlocking and process requirements that occur at the end of the step.

In order to advance or reverse the sequencer step, the step must first be stopped by depressing the “STEP STOP” pushbutton on the on the sequence control page of the HMI. This will stop the timing of the step, and cause the valves to close and motors to stop. This pushbutton is active only when a sequence is in progress.

The sequence step can be moved forward by depressing the “STEP ADVANCE” pushbutton on the on the sequence control page of the OID. This pushbutton is active only when a sequence is in progress and the step has been stopped by the operator. No outputs are energized during this action.

The sequence step can be moved backward by depressing the “STEP REVERSE” pushbutton on the sequence control page of the OID. This pushbutton is active only when a sequence is in progress and the step has been stopped by the operator. No outputs are energized during this action.

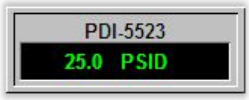
The manual step advance and reverse pushbuttons will only move through the steps required for the selected sequence in progress.

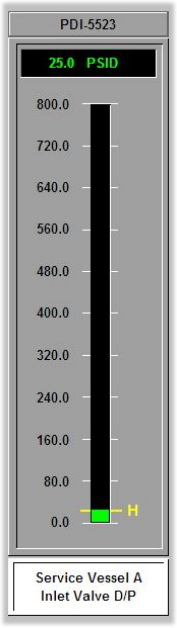
Upon reaching the desired step number, the step may be started by depressing the “STEP START” pushbutton on the sequence control page. This will energize the outputs and start the step timing function.

Step time duration can be changed on designated sequence controls screens. Reading across the page: the step number, description, and step duration are displayed. The step time can only be changed on steps that have a rectangular symbol next to it. This is accomplished by keypad pad, as previously discussed. If the step is designated as a non-timed step, the screen displays NOT-TIMED.

8.3.10. ANALOG DISPLAYS

The control screens contain analog boxes. These boxes display all analog points in the Condensate Polisher System. The green color indicates that the current state of the device is normal. When the device is either higher or lower than the alarm setpoints, the numbers and units in the analog display will turn yellow and blink. The display will stay blinking yellow once the operator acknowledges the alarm. The display will not go back to green until the condition has returned to normal.

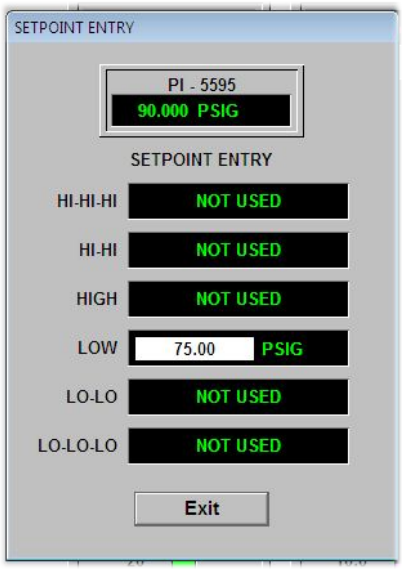




Each analog box has a corresponding analog bar graph on the analog screen. The analog screen can be accesses by pressing the corresponding on the K4 Analog 1 or K5 Analog 2 function key on operator terminal.

8.3.11. ANALOG CONTROLLERS - SETPOINT CONTROLLERS

Setpoint controllers perform sophisticated PLC control. Setpoint controllers are used to control flow and pressure. The controller accomplishes this by adjusting the output to the controlled device to maintain a desired setpoint value, based on the current operating conditions.



Each screen containing an analog controller has an Analog 1 function key and an associated "pop-up" for all indicators and setpoint controllers. Also, each control valve that is controlled by an analog controller appears on the operator interface screen as shown on the left. Press the associated function key on the valve symbol or bringing up the analog screen that corresponds the current screen can access the control valve analog controller faceplate.

The analog controller has a vertical bargragh on the left indicating the "SP" (setpoint value), a vertical bargraph to the right indicating "PV" (process variable or current operating point), and a horizontal bargraph below indicating "% OUTPUT". Near each of these bargraphs, there is an associated digital numeric display. Beneath the bargraphs are two function keys labeled Auto/Manual, External/Internal, and two sets of up/down arrow buttons.

Pressing the Auto/Manual function key toggles the controller between AUTO and MANUAL modes. The color of these words is also toggled between GREEN and WHITE when pressing the function key. The arrowhead also appears when the function is GREEN for colorblindness. The current mode will be indicated by which word AUTO or MANUAL is GREEN. In the AUTO mode, the output of the controller is continuously adjusted by the setpoint. While in AUTO, the output arrow keys do not function. In MANUAL mode, the controller's output remains fixed at its current output until the operator changes the output.

The "OUTPUT" arrow keys only operate in the MANUAL mode. With the controller in MANUAL, pressing the corresponding arrow keys changes the output. The output changes by one count each time that a button is depressing. Holding the button depressed will cause the output to move more rapidly in the desired direction. The bargraph and numeric display will indicate the new output.

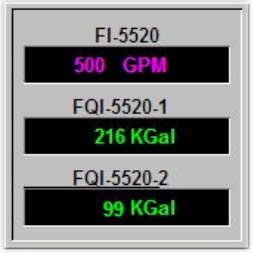
NOTE: No automatic control is performed while the station is in manual mode and changing the setpoint has no effect.

Some setpoint controllers may have an internal or an external setpoint source. The source of the setpoint may be selected by depressing the External/Internal function key. This function key is active only in AUTO mode.

When the controller is in the internal mode, the setpoint can be manually changed. To increase or decrease the setpoint, press and hold the corresponding up/down keys labeled SETPOINT until the desired setpoint is reached. The bargraph and numeric display will change to indicate the new setpoint value. The SETPOINT arrow keys function in either the AUTO or MANUAL modes, however the setpoint has no effect on the controllers output in MANUAL mode. The process variable will track the setpoint value only in the AUTO mode.

When the analog controller is in the EXTERNAL setpoint mode, the setpoints are set by means of the Setpoint Boxes. The current settings are displayed on the right of the controller. To view the current setting the operation must press the Analog 1 function key. The normal mode for the analog controllers is in the AUTO mode and in the EXTERNAL mode.

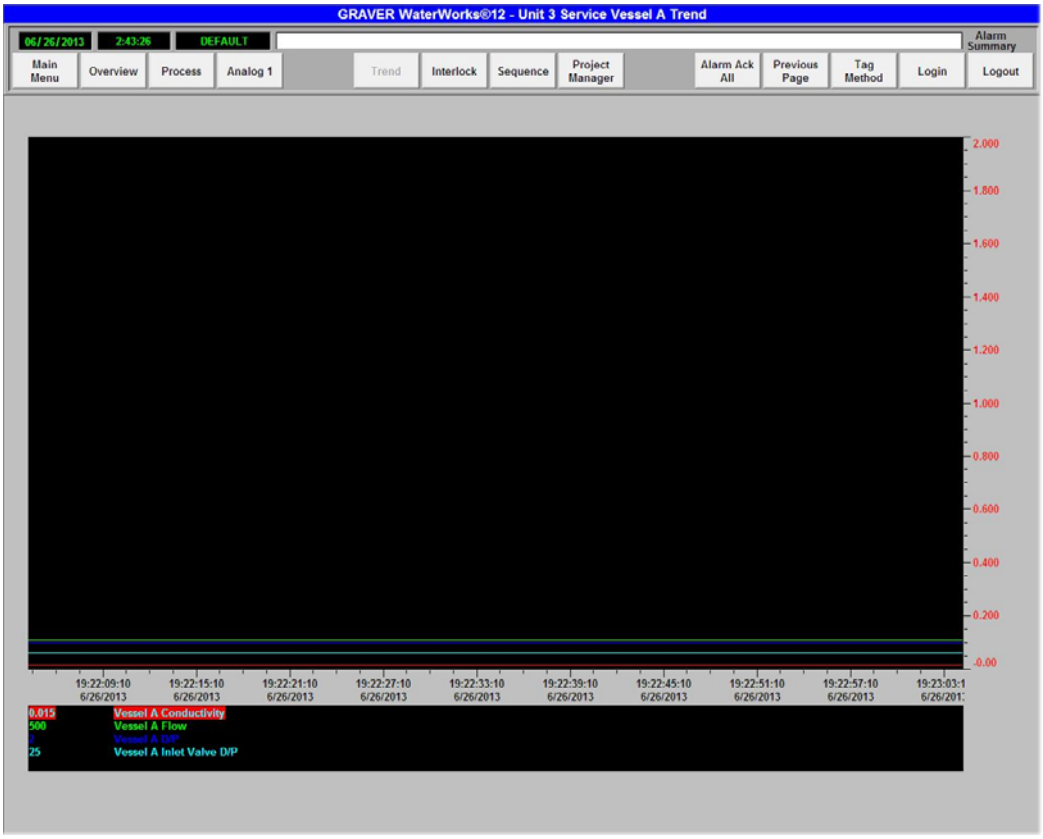
8.3.12. FLOW TOTALIZER



The filter polisher vessels have flow totalizers. These flow totalizers inform the operators the quantity of water that has entered the filter polisher vessels. The totalizer at the top of the flow totalizer pop-up is the running total flow through the unit. Pressing the TOTAL RESET function key, can reset this counter. The batch totalizer informs the operator the amount of water that has entered the vessel since the last regeneration. The amount under the Tag Number is the amount since the last regeneration. The amount under the Batch Totalizer Setpoint is the Service Run setpoint.

8.4. TREND SCREENS

The Condensate Polisher System is equipped with Trend screens to aid the operator in operation of the powdex service vessels. Pressing the K6 Trend function key on the operator terminal brings up the Trend Screen for the associated vessel or system.



8.5. ALARMS

8.5.1. ALARM RESPONSES

On the top of each control screen on the operator interface, there is a title bar describing the currently displayed control page. Underneath the title bar is the "alarm banner". When an alarm occurs, it will be displayed on the current control screen in the “alarm banner” area.

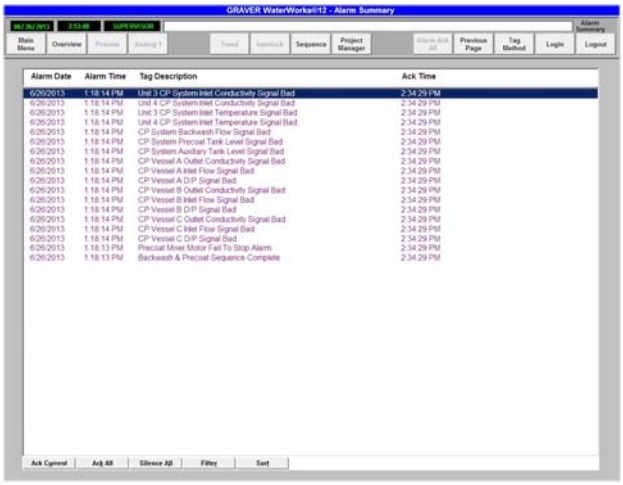
The alarm will be displayed with the description of the alarm and then the "state" of the alarm. When an

alarm first occurs, it will always be in the “Unacknowledged” state and the letters in the alarm banner will be flashing RED. If the event the alarm returns to normal before it is acknowledged, the banner clears and the alarm goes to the alarm summary. Also once the operator acknowledges the alarm, the banner clears and the alarm goes to the alarm summary.

Also, found in the upper right on every control screen is the ALARM ACK ALL function key. To silence an alarm, the operator must press the ALARM ACK ALL function key on the operator terminal.

8.5.2. ALARM SUMMARY

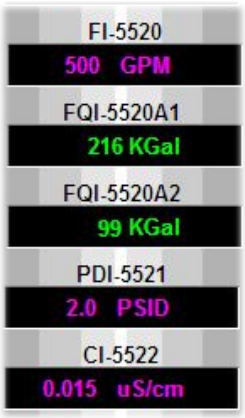
It is also important that in addition to acknowledging the alarm is to press the ALARMS function key to get a summary of all the alarms that have occurred. This screen will inform the operator if more than one alarm has occurred at the same time because only the last alarm that has occurred can be displayed in the alarm banner. All current alarm conditions will be displayed on the “Alarm Summary” control page.



Keep in mind that acknowledging an alarm does not clear it from the Alarm Summary screen. The operator must also determine the cause of the alarm and relieve the source. Once the source or condition that caused the alarm is returned to normal and it is acknowledged, the alarm will be automatically removed from the Alarm Summary ” screen.

8.5.3. NUMERIC DISPLAY

The numeric display text will change from WHITE to flashing GREEN when an alarm is activated and unacknowledged. Once the alarm is acknowledged, the text remains a flashing GREEN. Once the alarm returns to normal, the text will return to a steady WHITE. If the numeric display is faulted, the text will flash MAGENTA and once the alarm is acknowledge the text remains a flashing MAGENTA.



9. BILL OF MATERIALS

1. When discussing a certain item, use the release the item is in and the item number. The release and item number are discuss in more detail below.
2. The Bill of Material is divided into releases. These releases define the various subsystems you have purchased, such as "Vessels" or I & C Instruments". Each release is a group of related components that have been assigned the same release number (such as 011M or 010E). The components in the release are broken down to individual items and given an item number (such as 011M-0005). Each release should be considered a separate document with its own issue (revision) level. Within each release, each item is identified by an item number. The list of releases is found on the next page.
3. Release numbers are made up of two numerals followed by a letter. The letter is an "M" for Equipment Releases or an "E" for Instrument Releases.
4. A Packing List will accompany all shipments that will describe each major item by Bill of Material release and item numbers. When contacting Graver please refer to these numbers.
5. To locate an item in the Bill of Material, find the appropriate release and the items will be sorted by an item number.
6. Please have the applicable Bill of Material release and item numbers available when contacting Graver Water regarding material. This information will eliminate confusion and will allow Graver Water personnel to reply in an expeditious manner.
7. The Used on Destination category in Bill of Material describes what subsystem the material is used on.

TABLE 9.1.0 BILL OF MATERIAL: TABLE OF RELEASES

RELEASE	SUBSYSTEMS
011E	Field Instruments
011M	Powdex Polisher Skid
021E	Precoat Skid Instruments
021M	Advance Precoat Skid
022M	Air Surge Tank
031E	Analyzer Rack
100M	Interconnecting Piping

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
Release: 010E Field Instruments						
1	1	CPDT.DIFF000051	PDIT..FOX.IDP10-D-10-300		PDIT-5500	Unit 3 D/P
			SMART ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTER, MANUFACTURER:.....: INVENSYS - FOXBORO CATALOG NO.:.....: IDP10-T22D01F-M1-L1 CAPSULE RANGE (PSIG):....: 10 TO 300 PSI CAPSULE RANGE (Metric):..: -0.21 TO 2.1 MPa MAXIMUM WORKING PRESSURE:: 3625 PSIG POWER SUPPLY:.....: LOOP POWERED OUTPUT SIGNAL:.....: 4-20 MADC W/ DIGITAL SIGNAL BASED ON HART PROTOCOL ENCLOSURE RATING:.....: NEMA 4X, IP65, IP66 MOUNTING:.....: STANDARD MOUNTING BRACKET FOR 2" PIPE PROCESS CONNECTIONS:.....: FLANGE - 1/4-18 NPT FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL DIAPHRAGM MATERIAL:.....: 316L STAINLESS STEEL FILL FLUID:.....: SILICONE INDICATOR TYPE:.....: LCD OUTPUT METER CALIBRATED RANGE:.....: 0 TO 50 PSID INDICATOR RANGE:.....: 0 TO 50 PSID OUTPUT - LINEAR / SQ. ROO: LINEAR			
2	1	CVLV.MFLD000068	VLV.MFLD.3V.AGCO.M4THPS.TBXFL			
			THREE VALVE INSTRUMENT MANIFOLD, PER ASME B31.1 SPECIFICATION, MANUFACTURER.....: ANDERSON-GREENWOOD CATALOG NO.....: M4THPS-4-XP BODY MATERIAL.....: 316 STAINLESS STEEL BONNET MATERIAL.....: 316 STAINLESS STEEL STEM MATERIAL.....: 316 STAINLESS STEEL SEAT.....: INTEGRAL PACKING MATERIAL.....: GRAFOIL PROCESS CONNECTION.....: 1/2" FNPT INSTRUMENT CONNECTION....: FLANGE			
3	1	CTIT.RTD_000012	TIT.RTD.FOX.RTT20		TIT-5501	Unit 3 Inlet Temperature
			SMART TEMPERATURE INDICATING TRANSMITTER FOR SINGLE SENSOR , MANUFACTURER.....: INVENSYS - FOXBORO CATALOG NUMBER.....: RTT20-T1SNQFD-L3-M1 OUTPUT SIGNAL.....: 4-20 MADC, W/DIGITAL SIGNAL BASED ON HART PROTOCO POWER SUPPLY.....: LOOP POWERED ENCLOSURE RATING.....: NEMA 4X, ALUMINUM WITH INDICATOR			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001004 Field Instruments			(continued)			

Release: 010E Field Instruments

```
MOUNTING.................: L-SHAPED BRACKET FOR 2" PIPE OR PANEL MOUNTING
TAG......................: STAINLESS STEEL WIRED TAG
MEASURMENT INPUT TYPE....: RTD, PLATINUM, 100 OHM
ELECTRICAL SAFETY........: FM, NONINCENDIVE
INCLUDED OPTION 1........: MOUNTING BRACKET FOR 2" PIPE OR SURFACE
INCLUDED OPTION 2........: 3-LINE LCD INDICATOR/CONFIGURATOR
CALIBRATION RANGE........: 50 to 250 Degrees F
```

4	1	CTE.RTD__000025	TE/TW.RTD.FOX.01		TE-5501 / TW-5501	Unit 3 Inlet Temperature

```
RTD TEMPERATURE ELEMENT WITH THERMOWELL, SINGLE ELEMENT, SPRING LOADED,
MANUFACTURER.............: INVENSYS - FOXBORO
THERMOWELL...............: .
CATALOG NO...............: TT-2CC407000
TYPE.....................: STANDARD THREADED MOUNT, TAPERED
PROCESS CONNECTION.......: 1" - 11.5 NPT
THERMOWELL MATERIAL......: TYPE 316 STAINLESS STEEL
STEM LENGTH (L)..........: 8.75  INCHES
INSERTION LENGTH (U).....: 7.0  INCHES
LAG EXTENSION (E)........: 0.0 INCHES
RTD SENSOR...............: .
CATALOG NO...............: PR-14W-BS-007
SENSOR TYPE..............: 100 OHM PLATIUM, SINGLE ELEMENT
MEASUREMENT RANGE........: -328 TO 1562  DEGREES F
SHEATH MATERIAL..........: 316 STAINLESS STEEL
NO. OF LEADWIRES.........: THREE
LEADWIRE TERMINATION.....: EXPLOSION PROOF AND WEATHERPROOF HEAD
ENCLOSURE RATING.........: NEMA 4X
```

5	1	CPIT.GAGE000035	PIT.FOX.D.10-300		PIT-5595	Air Surge Tank Pressure

```
SMART ELECTRONIC GAGE PRESSURE TRANSMITTER,
MANUFACTURER.............: INVENSYS - FOXBORO
CATALOG NUMBER...........: IGP20-T22D01F-M1-L1
CAPSULE RANGE (PSIG).....: 10 TO 300 PSIG
CAPSULE RANGE (KPa)......: 0.07 TO 2.1 MPa
MAXIMUM WORKING PRESSURE.: 3625 PSIG
POWER SUPPLY.............: LOOP POWERED
OUTPUT SIGNAL............: 4-20 MADC W/  DIGITAL SIGNAL BASED ON HART PROTOCO
ENCLOSURE RATING.........: NEMA 4X, IP65, IP66
MOUNTING.................: STANDARD MOUNTING BRACKET FOR 2" PIPE
PROCESS CONNECTIONS......: FLANGE - 1/4-18  NPT
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001004 Field Instruments			(continued)			

Release: 010E Field Instruments

```
FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL
DIAPHRAGM MATERIAL.......: 316L STAINLESS STEEL
FILL FLUID...............: SILICONE
INDICATOR TYPE...........: LCD OUTPUT METER
CALIBRATED RANGE.........: 0 - 200 PSIG
INDICATOR RANGE..........: 0 -200 PSIG
```

6 1 CVLV.MFLD000022 VLV.MFLD.2V.AGCO.M4TP.TBXFL.SS

```
TWO VALVE INSTRUMENT MANIFOLD, PER ASME B31.1 SPECIFICATION,
MANUFACTURER.............: ANDERSON-GREENWOOD
CATALOG NO...............: M4TPHPS-4XP
BODY MATERIAL............: 316 STAINLESS STEEL
SEAT.....................: INTEGRAL
PACKING MATERIAL.........: GRAFOIL
PROCESS CONNECTION.......: 1/2" FNPT
INSTRUMENT CONNECTION....: FLANGE
```

Release: 011E Field Instruments

1 2 CPDT.DIFF000050 PDIT..FOX.IDP10-C-28"-840" FIT-5520, FIT-5540 Vessel Inlet Flow

```
SMART ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTER,
MANUFACTURER:............: INVENSYS - FOXBORO
CATALOG NO.:.............: IDP10-T22C01F-M1-L1
CAPSULE RANGE (PSIG):....: 28 TO 840 INCHES OF WATER COLUMN
CAPSULE RANGE (Metric):..: 7 TO 210 kPa
MAXIMUM WORKING PRESSURE:: 3625 PSIG
POWER SUPPLY:............: LOOP POWERED
OUTPUT SIGNAL:...........: 4-20 MADC W/ DIGITAL SIGNAL BASED ON HART PROTOCOL
ENCLOSURE RATING:........: NEMA 4X, IP65, IP66
MOUNTING:................: STANDARD  MOUNTING BRACKET FOR 2" PIPE
PROCESS CONNECTIONS:.....: FLANGE - 1/4-18  NPT
FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL
DIAPHRAGM MATERIAL:......: 316L STAINLESS STEEL
FILL FLUID:..............: SILICONE
INDICATOR TYPE:..........: LCD OUTPUT METER
CALIBRATED RANGE:........: 0 to 200 INCHES WATER COLUMN
INDICATOR RANGE:.........: 0 TO 9000 GPM
OUTPUT - LINEAR / SQ. ROO: SQUARE ROOT
```

GRAVER WATER

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001005	Powdex Vessels - I&C		(continued)			
Release: 011E Powdex Vessels - I&C						
			FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL DIAPHRAGM MATERIAL:.....: 316L STAINLESS STEEL FILL FLUID:.....: SILICONE INDICATOR TYPE:.....: LCD OUTPUT METER CALIBRATED RANGE:.....: 0 to 40.0 PSID INDICATOR RANGE:.....: 0 to 40.0 PSID OUTPUT - LINEAR / SQ. ROO: LINEAR			
5	2	CVLV.MFLD000068	VLV.MFLD.3V.AGCO.M4THPS.TBXFL THREE VALVE INSTRUMENT MANIFOLD, PER ASME B31.1 SPECIFICATION, MANUFACTURER.....: ANDERSON-GREENWOOD CATALOG NO.....: M4THPS-4-XP BODY MATERIAL.....: 316 STAINLESS STEEL BONNET MATERIAL.....: 316 STAINLESS STEEL STEM MATERIAL.....: 316 STAINLESS STEEL SEAT.....: INTEGRAL PACKING MATERIAL.....: GRAFOIL PROCESS CONNECTION.....: 1/2" FNPT INSTRUMENT CONNECTION....: FLANGE			Vessel D/P Xmtr
6	2	CPDT.DIFF000052	PDIT..FOX.IDP10-E-100-3000 SMART ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTER,, MANUFACTURER:.....: INVENSYS - FOXBORO CATALOG NO.:.....: IDP10-T22E01F-M1-L1 CAPSULE RANGE (PSIG):....: 100 TO 1000 PSI CAPSULE RANGE (Metric):..: 0.7 TO 21 MPa MAXIMUM WORKING PRESSURE:: 3625 PSIG POWER SUPPLY:.....: LOOP POWERED OUTPUT SIGNAL:.....: 4-20 MADC W/ DIGITAL SIGNAL BASED ON HART PROTOCOL ENCLOSURE RATING:.....: NEMA 4X, IP65, IP66 MOUNTING:.....: STANDARD MOUNTING BRACKET FOR 2" PIPE PROCESS CONNECTIONS:.....: FLANGE - 1/4-18 NPT FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL DIAPHRAGM MATERIAL:.....: 316L STAINLESS STEEL FILL FLUID:.....: SILICONE INDICATOR TYPE:.....: LCD OUTPUT METER CALIBRATED RANGE:.....: 0 to 800 PSID INDICATOR RANGE:.....: 0 to 800 PSID OUTPUT - LINEAR / SQ. ROO: LINEAR		PDIT-5523, PDIT-5543	Vessel Inlet Valve D/P

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001005 Powdex Vessels - I&C (continued)						
Release: 011E Powdex Vessels - I&C						
7	2	CVLV.MFLD000068	VLV.MFLD.3V.AGCO.M4THPS.TBXFL THREE VALVE INSTRUMENT MANIFOLD, PER ASME B31.1 SPECIFICATION, MANUFACTURER.....: ANDERSON-GREENWOOD CATALOG NO.....: M4THPS-4-XP BODY MATERIAL.....: 316 STAINLESS STEEL BONNET MATERIAL.....: 316 STAINLESS STEEL STEM MATERIAL.....: 316 STAINLESS STEEL SEAT.....: INTEGRAL PACKING MATERIAL.....: GRAFOIL PROCESS CONNECTION.....: 1/2" FNPT INSTRUMENT CONNECTION....: FLANGE			Vessel Inlet Vlv D/P Xmtr
8	1	CDESC.CAB000007	DESC.CAB.J-BOX JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW: RATING.....: NEMA TYPE 4 HEIGHT.....: 24 INCHES WIDTH.....: 16 INCHES DEPTH.....: 8 INCHES SPECIFICATION.....: 13486-E-A-1100 LAYOUT & DETAILS.....: 13486-E-D-6502-01 WIRING DIAGRAMS.....: 13486-E-D-6502-02		Discrete Junction Box 2D	Powdex Vessel A
9	1	CDESC.CAB000007	DESC.CAB.J-BOX JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW: RATING.....: NEMA TYPE 4 HEIGHT.....: 24 INCHES WIDTH.....: 16 INCHES DEPTH.....: 8 INCHES SPECIFICATION.....: 13486-E-A-1100 LAYOUT & DETAILS.....: 13486-E-D-6504-01 WIRING DIAGRAMS.....: 13486-E-D-6504-02		Discrete Junction Box 3D	Powdex Vessel B
10	2	CBOX.N4__000112	BOX.SAG.N4.SCE-24H1608LP SINGLE DOOR ENCLOSURE, NEMA TYPE 4, MANUFACTURER.....: SAGINAW CONTROL AND ENGINEERING			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001005 Powdex Vessels - I&C			(continued)			
Release: 011E Powdex Vessels - I&C						
			CATALOG NO.....: SCE - 24H1608LP ENCLOSURE RATING.....: NEMA 4 ENCLOSURE HEIGHT.....: 24 INCHES ENCLOSURE WIDTH.....: 16 INCHES ENCLOSURE DEPTH.....: 8 INCHES MATERIAL.....: CARBON STEEL EXTERIOR FINISH.....: ANSI #61 POLYESTER POWDER COAT INTERIOR FINISH.....: ANSI #61 POLYESTER POWDER COAT			
11	2	CBOXPLATE000082	BOXPLATE.CS.SCE-24P16 EQUIPMENT MOUNTING PANEL , MANUFACTURER.....: SAGINAW CONTROL & ENGINEERING CATALOG NO.....: SCE-24P16 HEIGHT.....: 21 INCHES WIDTH.....: 13 INCHES FINISH.....: WHITE POWDERED COATING MATERIAL.....: CARBON STEEL			
12	8	CTB.TB___000002	TB.GE.CR151B2 TERMINAL BLOCK MANUFACTURER.....: GENERAL ELECTRIC CATALOG NUMBER.....: CR151-B2 POINTS.....: TWELVE			
13	4	CTB.TB___000003	TB.GE.CR151B6 TERMINAL BLOCK MANUFACTURER.....: GENERAL ELECTRIC CATALOG NUMBER.....: CR151-B6 POINTS.....: SIX			
14	1	CDESC.CAB000007	DESC.CAB.J-BOX JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW: RATING.....: NEMA TYPE 4 HEIGHT.....: 16 INCHES WIDTH.....: 14 INCHES DEPTH.....: 6 INCHES SPECIFICATION.....: 13486-E-A-1100		Analog Junction Box 2A	Powdex Vessel A

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001005	Powdex Vessels - I&C		(continued)			

Release: 011E Powdex Vessels - I&C

LAYOUT & DETAILS.....: 13486-E-D-6503-01
WIRING DIAGRAMS.....: 13486-E-D-6503-02

15 1 CDESC.CAB000007 DESC.CAB.J-BOX — Analog Junction Box 3A — Powdex Vessel B

JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED
IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW:
RATING.....: NEMA TYPE 4
HEIGHT.....: 16 INCHES
WIDTH.....: 14 INCHES
DEPTH.....: 6 INCHES
SPECIFICATION.....: 13486-E-A-1100
LAYOUT & DETAILS.....: 13486-E-D-6505-01
WIRING DIAGRAMS.....: 13486-E-D-6505-02

16 2 CBOX.N4__000113 BOX.N4.SCE-1614CHNF

CONTINUOUS HINGE ENCLOSURE,
MANUFACTURER.....: SAGINAW CONTROL & ENGINEERING
CATALOG NO.....: SCE-1614CHNF
ENCLOSURE RATING.....: NEMA 4
ENCLOSURE HEIGHT.....: 16 INCHES
ENCLOSURE WIDTH.....: 14 INCHES
ENCLOSURE DEPTH.....: 6 INCHES
MATERIAL.....: CARBON STEEL
EXTERIOR FINISH.....: ANSI #61 POLYESTER POWDER COAT
INTERIOR FINISH.....: ANSI #61 POLYESTER POWDER COAT

17 2 CBOXPLATE000083 BOXPLATE.CS.SCE-16P14

EQUIPMENT MOUNTING PANEL ,

MANUFACTURER.....: SAGINAW CONTROL & ENGINEERING
CATALOG NO.....: SCE-16P14
HEIGHT.....: 14.75 INCHES
WIDTH.....: 12.88 INCHES
FINISH.....: WHITE POWDERED COATING
MATERIAL.....: CARBON STEEL

18 4 CTB.TB___000002 TB.GE.CR151B2

TERMINAL BLOCK
MANUFACTURER.....: GENERAL ELECTRIC

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001005 Powdex Vessels - I&C			(continued)			

Release: 011E Powdex Vessels - I&C

```
CATALOG NUMBER.....: CR151-B2
POINTS.....: TWELVE
```

19 4 CNAMEPLT_000002 SMALL GRAVER NAMEPLATE A-9653

```
SMALL GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176706)
```

20 2 CREG.AFR_000037 AFR.NUM.P42B-08G

```
AIR FILTER REGULATOR WITH GAUGE,
MANUFACTURER.....: NUMATICS
CATALOG NO.....: P42B-08G
MAX INLET PRESSURE.....: 150 PSIG
OUTPUT PRESSURE RANGE....: 0 TO 125 PSIG
LINE CONNECTION.....: 1"  FNPT
OUTPUT GAUGE.....: INCLUDED
```

21 2 CVLV.BALL000001 VLV.BALL.CONB.APOLLO.1/2".BR Air Drain Valve

```
FULL PORT BALL VALVE,
MANUFACTURER.....: CONBRACO-APOLLO
CATALOG NUMBER.....: 77-103-01
END CONNECTIONS.....: 1/2" FNPT
BODY MATERIAL.....: BRONZE/BRASS
WORKING PRESSURE.....: 600 PSIG
```

22 2 CVLV.BALL000019 VLV.BALL.CONB.APOLLO.1".B Air Isolation

```
FULL PORT BALL VALVE,
MANUFACTURER.....: CONBRACO-APOLLO
CATALOG NUMBER.....: 77-105-01
END CONNECTIONS.....: 1" FNPT
BODY MATERIAL.....: BRONZE / BRASS
WORKING PRESSURE.....: 600 PSIG
```

Release: 011M Powdex Vessels - I&C

1 2 CSKID_ASS000011 POWDEX VESSEL SKID ASSEMBLY

```
Powdex Vessel Skid Assembly
.                          : POWDEX VESSEL SKID ASSEMBLY
TAG.....: POWDEX VESSEL SKID
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On

Release: 011M Powdex Vessels - I&C

REFERENCE DRAWING.....: 13486-M-D-3750-001,002,003,004

2 2 CVSLPRES_000009 POWDEX VESSEL

SERVICE.....: Powdex Vessel
ASME CODE.....: Section VIII, Division I, latest edition
CERTIFICATE.....: Required
COUNTRY/STATE.....: USA/NM
SIZE.....: 84" ID x 8'-4" STR
DESIGN PRESSURE.....: 610 PSIG
DESIGN TEMPERATURE.....: 140 DEG F
TAG.....: POWDEX VESSEL
REFERENCE DRAWING.....: 13486-M-D-3751-001

3 2 CINTPDXTS000001 PDX TUBESHEET

VESSEL DIAMETER, INCHES..: 84

4 2 CINT_PDX_000018 PDX DIST TUBE/GUIDE ANGLES GEN

ITEM.....: DISTRIBUTION TUBE AND GUIDE ANGLES 84" VESSEL
MATERIAL.....: 304 STAINLESS STEEL
TAG.....: DISTRIBUTION TUBE AND GUIDE ANGLES

5 2 CNAMEPLT_000001 LARGE GRAVER NAMEPLATE A-5855

LARGE GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176703)

ENGRAVED WITH

CONDENSATE POLISHER "A"
GRAVER JOB # 13486
PO# 01032363

CONDENSATE POLISHER "B"
GRAVER JOB # 13486
PO# 01032363

7 1152 CINT_PDX_000028 POWDEX TUBE SHEET FITTING

1.5" TUBE SHEET FITTING
PART NUMBER.....: 01-23-031
SIZE.....: 1-1/2" OD X 18" LONG

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001	POWDEX CONDENSATE POLISHER (continued)					
Release: 011M POWDEX CONDENSATE POLISHER						
			MATERIAL.....: 304 SS			
8	1152	CINT_PDX_000029	POWDEX INT SEALFAST ADAPTER			
			1.5" SEALFAST ADAPTER			
			PART NUMBER.....: 02-23-134			
			MATERIAL.....: 303 SS			
			.....: SHIP TO AND INSTALLED BY THE			
9	1152	CINT_PDX_000091	80" PP POWDEX SEALFAST ELEMENT			
			80" SEALFAST ELEMENT ASSEMBLY			
			PART NUMBER.....: D022735800-PRODEA (80 INCH)			
			SIZE.....: 2"			
			MATERIAL.....: SS CORE/POLYPROPYLENE WOUND			
			MATERIAL.....: SS/POLYPROPYLENE			
10	548	CINT_PDX_000032	POWDEX HITCH PIN			
			HITCH PIN			
			PART NUMBER.....: 01-24-003			
			MATERIAL.....: 304 SS			
11	24	CINT_PDX_000033	POWDEX ELEMENT CLIP	A-26594		
			ELEMENT CLIP			
			MATERIAL.....: 304 SS			
12	164	CINT_PDX_000034	POWDEX ELEMENT LINK 3"OC			
			ELEMENT LINK			
			MATERIAL.....: 304 SS			
13	4	CINT_PDX_000035	POWDEX RETAINING BAR A-2			
			RETAINING BAR A-2			
			MATERIAL.....: 304 SS			
14	4	CINT_PDX_000036	POWDEX RETAINING BAR A-3			
			RETAINING BAR A-3			
			MATERIAL.....: 304 SS			
15	4	CINT_PDX_000037	POWDEX RETAINING BAR A-4			
			RETAINING BAR A-4			
			MATERIAL.....: 304 SS			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001	POWDEX CONDENSATE POLISHER (continued)					
Release: 011M POWDEX CONDENSATE POLISHER						
16	12	CINT_PDX_000043	POWDEX RETAINING BAR A-10			
			RETAINING BAR A-10 MATERIAL.....: 304 SS ITEM.....: SIZE A-12 MATERIAL.....: 304SS			
17	8	CINT_PDX_000046	POWDEX RETAINING BAR A-13			
			RETAINING BAR A-13 MATERIAL.....: 304 SS			
18	72	CINT_PDX_000047	POWDEX RETAINING BAR A-14			
			RETAINING BAR A-14 MATERIAL.....: 304 SS			
19	2	CPUMP_CEN000097	3x2X5 KONTRO MAG DRIVE PUMP			
			MANUFACTURER.....: KONTRO TYPE.....: HORIZONTAL MODEL/SIZE.....: GSA 3X2X5 CA4 SUCTION/DISCHARGE CONNECT: 3" 300# RF / 2" 300# RF CASING MATERIAL.....: 316SS IMPELLER TYPE/MATERIAL...: 316SS SHAFT/SLEEVE MATERIAL....: 316SS BASEPLATE.....: CARBON STEEL LUBRICATION.....: OIL ASSEMBLY.....: PUMP AND MOTOR TO BE FACTORY ASSEMBLED ON A . : COMMON BASEPLATE MOTOR HP/MANUFACTURER....: 10 HP/WEG PREMIUM EFFICIENT ENCL/INSUL/FRAME SIZE/S.F: TEFC/CLASS F WITH B RISE/213TC/1.25 VOLTAGE/PHASE/HERTZ/RPM..: 460/3/60/3600 . : MOTOR TO BE NON-OVERLOADING FOR ENTIRE RANGE . : SUITABLE FOR OPERATING AT 6000 FT ABOVE SEA LEVEL SERVICE.....: 201 GPM 140 F CONDENSATE VS 60 TDH AT 610 PSIG . : SUCTION PRESSURE TAG.....: HOLD PUMP			
20	2	CVBFLHPA_000044	18" AUTO HP BFLY VALVE, 300#		FV-5524 (AA), FV-5544 (AB)	
			SIZE.....: 18" (450 mm) BODY RATING.....: ANSI Class 300			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
BODY TYPE.................: Wafer
BODY MATERIAL.............: Carbon Steel
DISC MATERIAL.............: Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAT/SEAL MATERIAL........: RTFE
MANUFACTURER..............: TYCO
MODEL NUMBER..............: SERIES 37
ACTUATOR MODEL/TYPE.......: MORIN B270U /DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY
.                          : MOUNT AXIS PARALLEL TO FLOW
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO 8342 NEMA 4X, DUAL H COIL SOLENOID, 120/1/60
.                          : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
.                          : SPEED CONTROL, VB-12 LOCK UP, POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                          : IN BOTH DIRECTIONS USING 80 PSIG AIR
TAG.......................: POLISHER INLET VALVE,
```

21	2	CVBFLHPA_000044	18" AUTO HP BFLY VALVE, 300#		FV-5525 (EA), FV-5545 (EB)

```
SIZE......................: 18" (450 mm)
BODY RATING...............: ANSI Class 300
BODY TYPE.................: Wafer
BODY MATERIAL.............: Carbon Steel
DISC MATERIAL.............: Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAT/SEAL MATERIAL........: RTFE
MANUFACTURER..............: TYCO
MODEL NUMBER..............: SERIES 37
ACTUATOR MODEL/TYPE.......: MORIN B270U /DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY
.                          : MOUNT AXIS PARALLEL TO FLOW
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO 8342 NEMA 4X, DUAL H COIL SOLENOID, 120/1/60
.                          : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
.                          : SPEED CONTROL, VB-12 LOCK UP, POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                          : IN BOTH DIRECTIONS USING 80 PSIG AIR
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			
Release: 011M POWDEX CONDENSATE POLISHER						
			TAG.....: POLISHER OUTLET VALVE,			
22	2	CVBFLHPA_000040	10" AUTO HP BFLY VALVE, 300#		FV-5527 (FA), FV-5547 (FB)	
			SIZE.....: 10" (250 mm)			
			BODY RATING.....: ANSI Class 300			
			BODY TYPE.....: Wafer			
			BODY MATERIAL.....: Carbon Steel			
			DISC MATERIAL.....: Stainless Steel			
			SHAFT MATERIAL.....: Stainless Steel			
			SEAT/SEAL MATERIAL.....: RTFE			
			MANUFACTURER.....: TYCO			
			MODEL NUMBER.....: SERIES 37			
			ACTUATOR MODEL/TYPE.....: KEYSTONE 79U-091/DOUBLE ACTING PNEUMATIC			
			. : 80 PSIG AIR SUPPLY			
			. : MOUNT AXIS PERPENDICULAR TO FLOW			
			ACCESSORIES.....: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,			
			. : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60			
			. : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF			
			. : SPEED CONTROL, POSITION INDICATOR			
			SERVICE.....: CONDENSATE WATER AT 610 PSIG 140 DEGREE F			
			. : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE			
			. : IN BOTH DIRECTIONS USING 80 PSIG AIR			
			TAG.....: POLISHER PREOCAT INLET VALVE,			
23	2	CVBFLHPA_000040	10" AUTO HP BFLY VALVE, 300#		FV-5529 (UA), FV-5549 (UB)	
			SIZE.....: 10" (250 mm)			
			BODY RATING.....: ANSI Class 300			
			BODY TYPE.....: Wafer			
			BODY MATERIAL.....: Carbon Steel			
			DISC MATERIAL.....: Stainless Steel			
			SHAFT MATERIAL.....: Stainless Steel			
			SEAT/SEAL MATERIAL.....: RTFE			
			MANUFACTURER.....: TYCO			
			MODEL NUMBER.....: SERIES 37			
			ACTUATOR MODEL/TYPE.....: KEYSTONE 79U-091/DOUBLE ACTING PNEUMATIC			
			. : 80 PSIG AIR SUPPLY			
			. : MOUNT AXIS PERPENDICULAR TO FLOW			
			ACCESSORIES.....: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
                    .                    : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
                    .                    : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
                    .                    : SPEED CONTROL, POSITION INDICATOR
                    SERVICE..............: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
                    .                    : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
                    .                    : IN BOTH DIRECTIONS USING 80 PSIG AIR
                    TAG..................: POLISHER DRAIN VALVE,
```

24 2 CVBFLHPA_000040 10" AUTO HP BFLY VALVE, 300# FV-5526 (WA), FV-5546 (WB)

```
                    SIZE.................: 10" (250 mm)
                    BODY RATING..........: ANSI Class 300
                    BODY TYPE............: Wafer
                    BODY MATERIAL........: Carbon Steel
                    DISC MATERIAL........: Stainless Steel
                    SHAFT MATERIAL.......: Stainless Steel
                    SEAT/SEAL MATERIAL...: RTFE
                    MANUFACTURER.........: TYCO
                    MODEL NUMBER.........: SERIES 37
                    ACTUATOR MODEL/TYPE..: KEYSTONE 79U-091/DOUBLE ACTING PNEUMATIC
                    .                    : 80 PSIG AIR SUPPLY
                    .                    : MOUNT AXIS PERPENDICULAR TO FLOW
                    ACCESSORIES..........: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
                    .                    : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
                    .                    : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
                    .                    : SPEED CONTROL, POSITION INDICATOR
                    SERVICE..............: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
                    .                    : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
                    .                    : IN BOTH DIRECTIONS USING 80 PSIG AIR
                    TAG..................: POLISHER BACKWASH INLET/PRECOAT OUTLET VALVE,
```

25 2 CVBFLHPA_000039 8" AUTO HP BFLY VALVE, 300# FV-5531 (VA), FV-5551 (VB)

```
                    SIZE.................: 8" (200 mm)
                    BODY RATING..........: ANSI Class 300
                    BODY TYPE............: Wafer
                    BODY MATERIAL........: Carbon Steel
                    DISC MATERIAL........: Stainless Steel
                    SHAFT MATERIAL.......: Stainless Steel
                    SEAT/SEAL MATERIAL...: RTFE
```

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
MANUFACTURER.............: TYCO
MODEL NUMBER.............: SERIES 37
ACTUATOR MODEL/TYPE......: KEYSTONE 79U-065/DOUBLE ACTING PNEUMATIC
.                         : 80 PSIG AIR SUPPLY
.                         : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES..............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                         : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
.                         : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
.                         : SPEED CONTROL, POSITION INDICATOR
SERVICE..................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                         : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                         : IN BOTH DIRECTIONS USING 80 PSIG AIR
TAG......................: POLISHER VENT VALVE,
```

26	2	CVBFLHPA_000039	8" AUTO HP BFLY VALVE, 300#		FV-5528 (MA), FV-5548 (MB)

```
SIZE.....................: 8" (200 mm)
BODY RATING..............: ANSI Class 300
BODY TYPE................: Wafer
BODY MATERIAL............: Carbon Steel
DISC MATERIAL............: Stainless Steel
SHAFT MATERIAL...........: Stainless Steel
SEAT/SEAL MATERIAL.......: RTFE
MANUFACTURER.............: TYCO
MODEL NUMBER.............: SERIES 37
ACTUATOR MODEL/TYPE......: MORIN B050U/DOUBLE ACTING PNEUMATIC
.                         : 80 PSIG AIR SUPPLY
.                         : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES..............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                         : 3/4" ASCO 8344G076 NEMA 4X, SIGL H COIL SOLENOID,
.                         : 120/1/60 TUBED WITH SWAGELOK FITTING AND
.                         : POSITION INDICATOR, VALVE OPEN IN 0.2-0.4 SEC.
SERVICE..................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                         : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                         : IN BOTH DIRECTIONS USING 80 PSIG AIR
TAG......................: POLISHER AIR INLET VALVE,
```

27	1	CVBFLHPA_000041	12" AUTO HP BFLY VALVE, 300#		FV-5500 (B)

```
SIZE.....................: 12" (300 mm)
BODY RATING..............: ANSI Class 300
```

GRAVER WATER

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
BODY TYPE.................: Wafer
BODY MATERIAL.............: Carbon Steel
DISC MATERIAL.............: Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAT/SEAL MATERIAL........: RTFE
MANUFACTURER..............: TYCO
MODEL NUMBER..............: SERIES 37
ACTUATOR MODEL/TYPE.......: MORIN B270U S061, AIR TO CLOSE/SPRING TO OPEN
.                          : 80 PSIG AIR SUPPLY
.                          : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES...............: 2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO 8320 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
.                          : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
.                          : SPEED CONTROL, POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                          : IN BOTH DIRECTIONS USING 80 PSIG AIR
TAG.......................: POLISHER BYPASS VALVE
```

28	2	CVBFLHPA_000044	18" AUTO HP BFLY VALVE, 300#		FV-5503 (B1), FV-5504 (B2)

```
SIZE......................: 18" (450 mm)
BODY RATING...............: ANSI Class 300
BODY TYPE.................: Wafer
BODY MATERIAL.............: Carbon Steel
DISC MATERIAL.............: Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAT/SEAL MATERIAL........: RTFE
MANUFACTURER..............: TYCO
MODEL NUMBER..............: SERIES 37
ACTUATOR MODEL/TYPE.......: MORIN B270U /DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY
.                          : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
.                          : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
.                          : SPEED CONTROL, VB-12 LOCK UP, POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                          : IN BOTH DIRECTIONS USING 80 PSIG AIR
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001	POWDEX CONDENSATE POLISHER (continued)					

Release: 011M POWDEX CONDENSATE POLISHER

TAG.....: POLISHER UNIT #3 SWING INLET BLOCK VALVE, B1
.....: POLISHER UNIT #3 SWING OUTLET BLOCK VALVE, B2

29 2 CVBFYHPM_000069 18" MAN HP BFLY VALVE, 300# V-5605, V-5619

SIZE.....: 18" (450mm)
BODY RATING.....: ANSI Class 300
BODY TYPE.....: Wafer
BODY MATERIAL.....: Carbon Steel
DISC MATERIAL.....: Stainless Steel
SHAFT MATERIAL.....: Stainless Steel
SEAT/SEAL MATERIAL.....: RTFE
MANUFACTURER.....: TYCO
MODEL NUMBER.....: SERIES 37
OPERATOR.....: CWG OPERATOR W/50 FEET OF CHAIN
ACCESSORIES.....: POSITION INDICATOR
SERVICE.....: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.....: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.....: IN BOTH DIRECTIONS
TAG.....: POLISHER INLET BLOCK VALVE,

30 2 CVBFYHPM_000069 18" MAN HP BFLY VALVE, 300# V-5613, V-5627

SIZE.....: 18" (450mm)
BODY RATING.....: ANSI Class 300
BODY TYPE.....: Wafer
BODY MATERIAL.....: Carbon Steel
DISC MATERIAL.....: Stainless Steel
SHAFT MATERIAL.....: Stainless Steel
SEAT/SEAL MATERIAL.....: RTFE
MANUFACTURER.....: TYCO
MODEL NUMBER.....: SERIES 37
OPERATOR.....: GEAR OPERATOR
ACCESSORIES.....: POSITION INDICATOR
SERVICE.....: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.....: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.....: IN BOTH DIRECTIONS
TAG.....: POLISHER OUTLET BLOCK VALVE,

31 2 CVBFYHPM_000062 4" MAN HP BFLY VALVE, 300# V-5612, V-5626

SIZE.....: 4" (100mm)
BODY RATING.....: ANSI Class 300

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
BODY TYPE.................: Wafer
BODY MATERIAL.............: Carbon Steel
DISC MATERIAL.............: Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAT/SEAL MATERIAL........: RTFE
MANUFACTURER..............: TYCO
MODEL NUMBER..............: SERIES 37
OPERATOR..................: LEVER
ACCESSORIES...............: POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
.                          : IN BOTH DIRECTIONS
TAG.......................: HOLD PUMP SUCTION VALVE
```

32	2	CVBALAUTO000007	1" AUTO BALL VALVE, CS, SW		FV-5530 (QA), FV-5550 (QB)	

```
SIZE......................: 1"
CONNECTION................: Socket Welded
BODY MATERIAL.............: Carbon Steel
BALL MATERIAL.............: 316 Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAL/SEAT MATERIAL........: TFM-1600
MANUFACTURER..............: TYCO
MODEL NUMBER..............: F180
ACTUATOR..................: KEYSTONE 79U-003/DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY
.                          : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
.                          : (2) PARKER PF SPEED CONTROL,  POSITION INDICATOR
SERVICE...................: CONDENSATE WATER AT 610 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
TAG.......................: POLISHER VENT VALVE,
```

33	2	CVBALM___000125	1" CS MAN BALL VALV SW		V-5606, V-5620	

```
SIZE......................: 1"
BODY MATERIAL.............: CS
BALL MATERIAL.............: 316 SS
SHAFT MATERIAL............: 316 SS
END CONNECTIONS...........: SOCKET WELD
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			
Release: 011M POWDEX CONDENSATE POLISHER						
			ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 . : THREE PIECE SEAT.....: TFM-1600 TAG.....: POLISHER VENT			
34	2	CVBALM___000123	1/2" CS MAN BALL VALV SW		V-5607, V-5621	
			SIZE.....: 1/2" BODY MATERIAL.....: CS BALL MATERIAL.....: 316 SS SHAFT MATERIAL.....: 316 SS END CONNECTIONS.....: SOCKET WELD ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 . : THREE PIECE SEAT.....: TFM-1600 TAG.....: POLISHER A-VALVE BYPASS			
35	2	CVBALM___000001	1/2 SS MAN BALL VALV SC		V-5677, V-5678	
			SIZE.....: 1/2" BODY MATERIAL.....: 316 SS BALL MATERIAL.....: 316 SS SHAFT MATERIAL.....: 316 SS END CONNECTIONS.....: THREADED ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 . : THREE PIECE SEAT.....: TFM-1600 TAG.....: POLISHER INLET VALVE DP SWITCH			
36	4	CVBALM___000001	1/2 SS MAN BALL VALV SC		V-5614, V-5615, V-5628, V-5629	
			SIZE.....: 1/2" BODY MATERIAL.....: 316 SS BALL MATERIAL.....: 316 SS SHAFT MATERIAL.....: 316 SS END CONNECTIONS.....: THREADED			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			
Release: 011M POWDEX CONDENSATE POLISHER						
			ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 .: THREE PIECE SEAT.....: TFM-1600 TAG.....: POLISHER PRESSURE GAUGE ROOT VALVE			
37	2	CVBALM___000001	1/2 SS MAN BALL VALV SC		V-5616, V-5630	
			SIZE.....: 1/2" BODY MATERIAL.....: 316 SS BALL MATERIAL.....: 316 SS SHAFT MATERIAL.....: 316 SS END CONNECTIONS.....: THREADED ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 .: THREE PIECE SEAT.....: TFM-1600 TAG.....: POLISHER EFFLUENT SAMPLE,			
38	2	CVBALM___000001	1/2 SS MAN BALL VALV SC		V-5600, V-5601	
			SIZE.....: 1/2" BODY MATERIAL.....: 316 SS BALL MATERIAL.....: 316 SS SHAFT MATERIAL.....: 316 SS END CONNECTIONS.....: THREADED ACTUATOR TYPE.....: LEVER MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 .: THREE PIECE SEAT.....: TFM-1600 TAG.....: HEADER DP TRANSMITTER ROOT VALVE			
39	1	CVBALM___000009	1/2" BALL VALVE, SS, SC		V-5602	
			SIZE.....: 1/2" BODY MATERIAL.....: 316 Stainless Steel BALL MATERIAL.....: 316 Stainless Steel SHAFT MATERIAL.....: 316 Stainless Steel END CONNECTIONS.....: THREADED ACTUATOR TYPE.....: LEVER			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			

Release: 011M POWDEX CONDENSATE POLISHER

SEAT/SEAL.....: TFE/TFE
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
. : THREE PIECE
SEAT.....: TFM-1600
TAG.....: CONDENSATE INLET HEADER SAMPLE VALVE

40 2 CVCHECK__000048 3" CHECK VALVE, 300#, CS/SS V-5611, V-5625

TYPE.....: Dual Check
SIZE.....: 3"
PRESSURE RATING.....: ANSI Class 300
END CONNECTION.....: Wafer
BODY MATERIAL.....: Carbon Steel
TRIM MATERIAL.....: Stainless Steel
SEAT MATERIAL.....: BUNA
MANUFACTURER.....: MISSION
MODEL NUMBER.....: G-30SMF
TAG.....: HOLD PUMP DISCHARGE

41 2 CVCHECK__000007 1/2" CHECK VALVE, DURABLA, SS V-5609, V-5623

SIZE.....: 1/2" (15mm)
PRESSURE RATING.....: 2500 psig
END CONNECTION.....: 1/2" (15 mm) FNPT Inlet/1" (25 mm) MNPT Outlet
BODY MATERIAL.....: Stainless Steel
TRIM MATERIAL.....: Stainless Steel
MANUFACTURER.....: DURABLA
MODEL NUMBER.....: BASIC CHECK, PROD CODE 8003-49
. : SUITABLE FOR 550 PSIG 140 F WATER SERVICE
TAG.....: A VALVE BYPASS

42 2 CVSOL____000003 1/2" SS SOLENOID VALVE, 2 WAY SV-5523, SV-5543

OPERATION.....: 2-WAY NORMALLY CLOSED
BODY MATERIAL.....: 316 Stainless Steel
CONNECTIONS.....: 1/2" FNPT
ORIFICE.....: 3/8"
COIL.....: 120 VOLTS, 60 HZ, CLASS H
ENCLOSURE.....: NEMA 4
MANUFACTURER.....: ASCO
TAG.....: A VALVE BYPASS

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			
Release: 011M POWDEX CONDENSATE POLISHER						
43	2	CSTRAINER000008	1/2" Y STRAINER, CS, SW		STR-5608, STR-5622	
			SIZE.....: 1/2"			
			TYPE.....: Y			
			CONNECTION.....: Socket Weld			
			BODY MATERIAL.....: Carbon Steel			
			SCREEN MATERIAL.....: Stainless Steel			
			MANUFACTURER.....: SSI			
			MODEL NUMBER.....: 600YSWSB			
			PRESSURE RATING.....: 610 140 F OPERATION			
			.: BOLTED BONNET			
			DRAIN CONNECTION.....: 1/4 INCH SW			
			PERFORATION.....: 1/32 INCH PERF SS			
			TAG.....: A VALVE BYPASS STRAINER			
44	4	CGAUGPRES000016	PRESSURE GAUGE 800 PSIG		PI-5532, PI-5533, PI-5552, PI-5553	
			RANGE.....: 0 - 800 PSIG			
			CONNECTION SIZE.....: 1/2 INCH MNPT			
			MATERIAL OF CONSTRUCTION..: 316 SS			
			MOUNTING.....: LOWER			
			MANUFACTURER.....: ASHCROFT			
			MODEL.....: 1279SS			
			DIAL SIZE.....: 4-1/2 INCH			
			TAG.....: PRESSURE GAUGE			
45	4	SADHESIVE000002	RECTOR SEAL #5 1/2 PINT			
			MANUFACTURER.....: RECTORSEAL CORP			
			MODEL NUMBER.....: RECTORSEAL #5			
			PART NUMBER.....: 25551			
			SIZE.....: 1/2 PINT			
			GRAVER PART NUMBER.....: 0125551			
46	172	CINT_PDX_000048	POWDEX SHAFT COLLAR			
			SHAFT COLLAR			
			PART NUMBER.....: 01-24-001			
			MATERIAL.....: 303 SS			
47	1	CINT_PDX_000049	POWDEX HEX WRENCH			
			HEX WRENCHES, 1/8 INCH			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001			POWDEX CONDENSATE POLISHER (continued)			
Release: 011M POWDEX CONDENSATE POLISHER						
			PART NUMBER.....: 01-22-70			
			MATERIAL.....: CS			
48	2	CVBFYHPM_000061	3" MAN HP BFLY VALVE, 300#		V-5610, V-5624	
			SIZE.....: 3" (80mm)			
			BODY RATING.....: ANSI Class 300			
			BODY TYPE.....: Wafer			
			BODY MATERIAL.....: Carbon Steel			
			DISC MATERIAL.....: Stainless Steel			
			SHAFT MATERIAL.....: Stainless Steel			
			SEAT/SEAL MATERIAL.....: RTFE			
			MANUFACTURER.....: TYCO			
			MODEL NUMBER.....: SERIES 37			
			OPERATOR.....: LEVER			
			ACCESSORIES.....: POSITION INDICATOR			
			SERVICE.....: CONDENSATE WATER AT 610 PSIG 140 DEGREE F			
			.: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE			
			.: IN BOTH DIRECTIONS			
			TAG.....: HOLD PUMP DISCHARGE VALVE			
49	2	CVRLF____000052	1/2x1 RELIEF VALVE, LESER CS		PRV-5534, PRV-5554	
			MANUFACTURER.....: LESER			
			BODY MATERIAL.....: Crome Alloy/SS			
			DISC MATERIAL.....: 420 Stainless Steel			
			INLET CONNECTION.....: 1/2" MNPT			
			OUTLET CONNECTION.....: 1" FNPT			
			SET PRESSURE.....: 610 PSI			
			.: W/PACK LEVER			
			TAG.....: THERMAL RELIEF VALVE			
50	4	CVBALM___000009	1/2" BALL VALVE, SS, SC		V-5617, V-5618, V-5631, V-5632	
			SIZE.....: 1/2"			
			BODY MATERIAL.....: 316 Stainless Steel			
			BALL MATERIAL.....: 316 Stainless Steel			
			SHAFT MATERIAL.....: 316 Stainless Steel			
			END CONNECTIONS.....: THREADED			
			ACTUATOR TYPE.....: LEVER			
			SEAT/SEAL.....: TFE/TFE			
			MANUFACTURER.....: TYCO			

GRAVER WATER

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001001		POWDEX CONDENSATE POLISHER	(continued)			

Release: 011M POWDEX CONDENSATE POLISHER

```
MODEL NUMBER.............: F180
.                        : THREE PIECE
SEAT.....................: TFM-1600
TAG......................: FLOW TRANSMITTER ROO VALVE
```

Release: 031E POWDEX CONDENSATE POLISHER

1	1	CPDT.DIFF000050	PDIT..FOX.IDP10-C-28"-840"		FIT-5582	Backwash Water Flow

```
SMART ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTER,
MANUFACTURER:............: INVENSYS - FOXBORO
CATALOG NO.:.............: IDP10-T22C01F-M1-L1
CAPSULE RANGE (PSIG):....: 28 TO 840 INCHES OF WATER COLUMN
CAPSULE RANGE (Metric):..: 7 TO 210 kPa
MAXIMUM WORKING PRESSURE:: 3625 PSIG
POWER SUPPLY:............: LOOP POWERED
OUTPUT SIGNAL:...........: 4-20 MADC W/ DIGITAL SIGNAL BASED ON HART PROTOCOL
ENCLOSURE RATING:........: NEMA 4X, IP65, IP66
MOUNTING:................: STANDARD  MOUNTING BRACKET FOR 2" PIPE
PROCESS CONNECTIONS:.....: FLANGE - 1/4-18  NPT
FLANGE & ADAPTER MATERIAL: 316 STAINLESS STEEL
DIAPHRAGM MATERIAL:......: 316L STAINLESS STEEL
FILL FLUID:..............: SILICONE
INDICATOR TYPE:..........: LCD OUTPUT METER
CALIBRATED RANGE:........: 0 TO 200 INCHES WATER COLUMN
INDICATOR RANGE:.........: 0 TO 700 GPM
OUTPUT - LINEAR / SQ. ROO: SQUARE ROOT
```

2	1	CFE.ORF__000002	FLOW ELEMENT - ORIFICE PLATE		FE-5582	Backwash Water Flow

```
ORIFICE PLATE,  PADDLE TYPE, CONCENTRIC BORE
FLUID....................: WATER
MAXIMUM FLOW RATE........: 700 GPM
NORMAL FLOW RATE.........: 560 GPM
PRESSURE.................: 50 PSIG
TEMPERATURE..............: 140 DEGREES F
PLATE MATERIAL...........: TYPE 316 STAINLESS STEEL
PLATE THICKNESS..........: 1/8 INCH
ORIFICE MOUNTING.........: BETWEEN 6" ANSI CLASS 300 ORIFICE FLANGES
PIPE INNER DIAMETER......: 6.065 INCHES
TAP LOCATION.............: FLANGE
D/P PRODUCED AT MAX. FLOW: 200 INCHES WATER COLUMN
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001006	Advnced Precoat Skid - I&C		(continued)			
Release: 031E Advnced Precoat Skid - I&C						
			REQUIRED ORIFICE DATA....: CALCULATION SHEET			
3	1	CVLV.MFLD000068	VLV.MFLD.3V.AGCO.M4THPS.TBXFL			Backwash Water Flow Xmtr
			THREE VALVE INSTRUMENT MANIFOLD, PER ASME B31.1 SPECIFICATION,			
			MANUFACTURER.....: ANDERSON-GREENWOOD			
			CATALOG NO.....: M4THPS-4-XP			
			BODY MATERIAL.....: 316 STAINLESS STEEL			
			BONNET MATERIAL.....: 316 STAINLESS STEEL			
			STEM MATERIAL.....: 316 STAINLESS STEEL			
			SEAT.....: INTEGRAL			
			PACKING MATERIAL.....: GRAFOIL			
			PROCESS CONNECTION.....: 1/2" FNPT			
			INSTRUMENT CONNECTION....: FLANGE			
4	1	CLIT.CAP_000026	LT.DREX.509.U III.RM.74"		LE-5580, LIT-5580	Precoat Tank Level
			TWO WIRE. ELECTRONIC LEVEL TRANSMITTER WITH HART PROTOCOL,			
			MANUFACTURER.....: DREXELBROOK			
			CATALOG NUMBER.....: 509-0075-706-00 W/ TRANSMITTER 409-1030-F04-00			
			POWER.....: 12 - 30 VDC LOOP POWERED			
			OUTPUT.....: 4-20 MA DC PLUS HART			
			ENCLOSURE RATING.....: NEMA 4X			
			SENSOR MOUNT: INTEGRAL/RE: REMOTE WITH CABLE 380-0050-012-00			
			SENSOR INFORMATION.....: .			
			___CATALOG NUMBER.....: 700-0002-057-I074.0BBO			
			___MOUNTING.....: 1 INCH NPT			
			___MATERIAL.....: TYPE 316 SS W/ FLUOROCARBON TYPE INSULATION			
			___LENGTH.....: 74 INCHES			
			___PROCESS CONNECTION....: 1 INCH NPT			
			INCLUDED OPTION 1.....: 50 FEET GENERAL PURPOSE CABLE, PN 380-050-012-00			
			INCLUDED OPTION 2.....: STANDARD CONDULET, PN 285-0001-062-00			
			INCLUDED OPTION 3.....: STAINLESS STEEL TAG, PN 010-TAGS-010-S2			
			CALIBRATED RANGE.....: 0 to 72 Inches			
			INDICATOR RANGE.....: 0 to 100 Percent			
5	1	CLIT.CAP_000025	LT.DREX.509.U III.RM.78"		LE-5581, LIT-5581	Auxiliary Tank Level
			TWO WIRE. ELECTRONIC LEVEL TRANSMITTER WITH HART PROTOCOL,			
			MANUFACTURER.....: DREXELBROOK			
			CATALOG NUMBER.....: 509-0075-706-00 W/ TRANSMITTER 409-1030-F04-00			
			POWER.....: 12 - 30 VDC LOOP POWERED			
			OUTPUT.....: 4-20 MA DC PLUS HART			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001006	Advnced Precoat Skid - I&C		(continued)			

Release: 031E Advnced Precoat Skid - I&C

```
ENCLOSURE RATING.........: NEMA 4X
SENSOR MOUNT: INTEGRAL/RE: REMOTE WITH CABLE 380-0050-012-00
SENSOR INFORMATION.......: .
___CATALOG NUMBER........: 700-0002-057-I078.0BBO
___MOUNTING..............: 1 INCH NPT
___MATERIAL..............: TYPE 316 SS W/ FLUOROCARBON TYPE INSULATION
___LENGTH................: 78 INCHES
___PROCESS CONNECTION....: 1 INCH NPT
INCLUDED OPTION 1........: 50 FEET GENERAL PURPOSE CABLE, PN 380-050-012-00
INCLUDED OPTION 2........: STANDARD CONDULET, PN 285-0001-062-00
INCLUDED OPTION 3........: STAINLESS STEEL TAG, PN 010-TAGS-010-S2
CALIBRATED RANGE.........: 0 to 76 Inches
INDICATOR RANGE..........: 0 to 100 Percent
```

6	1	CDESC.CAB000007	DESC.CAB.J-BOX		Discrete Junction Box 1D	Advanced Precoat Skid

```
JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED
IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW:
RATING...................: NEMA TYPE 4
HEIGHT...................: 24 INCHES
WIDTH....................: 16 INCHES
DEPTH....................: 8 INCHES
SPECIFICATION............: 13486-E-A-1100
LAYOUT & DETAILS.........: 13486-E-D-6500-01
WIRING DIAGRAMS..........: 13486-E-D-6500-02
```

7	1	CBOX.N4__000112	BOX.SAG.N4.SCE-24H1608LP

```
SINGLE DOOR ENCLOSURE, NEMA TYPE 4,
MANUFACTURER.............: SAGINAW CONTROL AND ENGINEERING
CATALOG NO...............: SCE - 24H1608LP
ENCLOSURE RATING.........: NEMA 4
ENCLOSURE HEIGHT.........: 24 INCHES
ENCLOSURE WIDTH..........: 16 INCHES
ENCLOSURE DEPTH..........: 8 INCHES
MATERIAL.................: CARBON STEEL
EXTERIOR FINISH..........: ANSI #61 POLYESTER POWDER COAT
INTERIOR FINISH..........: ANSI #61 POLYESTER POWDER COAT
```

8	1	CBOXPLATE000082	BOXPLATE.CS.SCE-24P16

```
EQUIPMENT MOUNTING PANEL ,
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001006	Advnced Precoat Skid - I&C		(continued)			

Release: 031E Advnced Precoat Skid - I&C

```
                    MANUFACTURER.............: SAGINAW CONTROL & ENGINEERING
                    CATALOG NO...............: SCE-24P16
                    HEIGHT...................: 21 INCHES
                    WIDTH....................: 13 INCHES
                    FINISH...................: WHITE POWDERED COATING
                    MATERIAL.................: CARBON STEEL
```

9 3 CTB.TB___000002 TB.GE.CR151B2

```
                    TERMINAL BLOCK
                    MANUFACTURER.............: GENERAL ELECTRIC
                    CATALOG NUMBER...........: CR151-B2
                    POINTS...................: TWELVE
```

10 1 CDESC.CAB000007 DESC.CAB.J-BOX Analog Junction Box 1A Advanced Precoat Skid

```
                    JUNCTION BOX, FURNISHED COMPLETELY FABRICATED, PAINTED, ASSEMBLED, WIRED, AND TESTED
                    IN ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW:
                    RATING...................: NEMA TYPE 4
                    HEIGHT...................: 16 INCHES
                    WIDTH....................: 14 INCHES
                    DEPTH....................: 6 INCHES
                    SPECIFICATION............: 13486-E-A-1100
                    LAYOUT & DETAILS.........: 13486-E-D-6501-01
                    WIRING DIAGRAMS..........: 13486-E-D-6501-02
```

11 1 CBOX.N4__000113 BOX.N4.SCE-1614CHNF

```
                    CONTINUOUS HINGE ENCLOSURE,
                    MANUFACTURER.............: SAGINAW CONTROL & ENGINEERING
                    CATALOG NO...............: SCE-1614CHNF
                    ENCLOSURE RATING.........: NEMA 4
                    ENCLOSURE HEIGHT.........: 16 INCHES
                    ENCLOSURE WIDTH..........: 14 INCHES
                    ENCLOSURE DEPTH..........: 6 INCHES
                    MATERIAL.................: CARBON STEEL
                    EXTERIOR FINISH..........: ANSI #61 POLYESTER POWDER COAT
                    INTERIOR FINISH..........: ANSI #61 POLYESTER POWDER COAT
```

12 1 CBOXPLATE000083 BOXPLATE.CS.SCE-16P14

```
                    EQUIPMENT MOUNTING PANEL ,
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001006	Advnced Precoat Skid - I&C		(continued)			

Release: 031E Advnced Precoat Skid - I&C

MANUFACTURER.....: SAGINAW CONTROL & ENGINEERING
CATALOG NO.....: SCE-16P14
HEIGHT.....: 14.75 INCHES
WIDTH.....: 12.88 INCHES
FINISH.....: WHITE POWDERED COATING
MATERIAL.....: CARBON STEEL

13 1 CTB.TB___000002 TB.GE.CR151B2

TERMINAL BLOCK
MANUFACTURER.....: GENERAL ELECTRIC
CATALOG NUMBER.....: CR151-B2
POINTS.....: TWELVE

14 2 CNAMEPLT_000002 SMALL GRAVER NAMEPLATE A-9653

SMALL GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176706)

15 1 CREG.AFR_000037 AFR.NUM.P42B-08G Instrument Air

AIR FILTER REGULATOR WITH GAUGE,
MANUFACTURER.....: NUMATICS
CATALOG NO.....: P42B-08G
MAX INLET PRESSURE.....: 150 PSIG
OUTPUT PRESSURE RANGE....: 0 TO 125 PSIG
LINE CONNECTION.....: 1" FNPT
OUTPUT GAUGE.....: INCLUDED

16 1 CVLV.BALL000001 VLV.BALL.CONB.APOLLO.1/2".BR Air Drain

FULL PORT BALL VALVE,
MANUFACTURER.....: CONBRACO-APOLLO
CATALOG NUMBER.....: 77-103-01
END CONNECTIONS.....: 1/2" FNPT
BODY MATERIAL.....: BRONZE/BRASS
WORKING PRESSURE.....: 600 PSIG

17 1 CVLV.BALL000019 VLV.BALL.CONB.APOLLO.1".B Air Isolation

FULL PORT BALL VALVE,
MANUFACTURER.....: CONBRACO-APOLLO

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001006	Advnced Precoat Skid - I&C		(continued)			

Release: 031E Advnced Precoat Skid - I&C

```
CATALOG NUMBER.....: 77-105-01
END CONNECTIONS.....: 1" FNPT
BODY MATERIAL.....: BRONZE / BRASS
WORKING PRESSURE.....: 600 PSIG
```

Release: 031M Advnced Precoat Skid - I&C

1 1 CSKID_ASS000012 PRECOAT SKID ASSEMBLY

```
Precoat Skid Assembly
TAG.....: Precoat Skid Assembly
REFERENCE DRAWING.....: 13486-M-D-4250-001
```

2 1 CTK_CHEM_000014 PRECOAT TANK 84"OD X 6'-0"

```
PRECOAT TANK
SIZE.....: 84"OD X 6'-0" STRAIGHT
TYPE.....: VERTICAL
MATERIAL OF CONSTRUCTION.: 304 STAINLESS STEEL
TAG.....: PRECOAT TANK
```

3 1 CNAMEPLT_000001 LARGE GRAVER NAMEPLATE A-5855

```
LARGE GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176703)

ENGRAVED WITH

ADVANCE PRECOAT TANK
GRAVER JOB #13486
PO# 01032363
```

4 1 CTK_CHEM_000015 AUX TANK 30"X7'-0" 304SS

```
AUXILIARY TANK
SIZE.....: 30"OD X 7'-0" HG
TYPE.....: VERTICAL
MATERIAL OF CONSTRUCTION.: 304 STAINLESS STEEL
TAG.....: AUXILIARY TANK
```

5 1 CPUMP_CEN000095 8X10-16H GOULDS 3196 DI/SS

```
MANUFACTURER.....: GOULDS
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
TYPE.....................: HORIZONTAL
MODEL/SIZE...............: 3196 i-17/8 X 10-16H
SUCTION/DISCHARGE CONNECT: 10" 150# FF/8" 150# FF
CASING MATERIAL..........: DUCTILE IRON
IMPELLER TYPE/MATERIAL...: OPEN/STAINLESS STEEL
SHAFT/SLEEVE MATERIAL....: SAE 4140/STAINLESS STEEL
BASEPLATE................: CAST IRON
MECHANICAL SEAL/PACKING..: JC 5610Q XF(55)1XO(58)H SINGLE SEAL
COUPLING.................: REXNORD-OMEGA REX ES-30
LUBRICATION..............: OIL
ASSEMBLY.................: PUMP AND MOTOR TO BE FACTORY ASEMBLED ON A
.                        : COMMON BASEPLATE
MOTOR HP/MANUFACTURER....: 60 / BALDOR SEVERE DUTY PREMIUM EFFICIENCY
ENCL/INSUL/FRAME SIZE/S.F: TEFC/ F WITH B RISE / 404T / 1.15
VOLTAGE/PHASE/HERTZ/RPM..: 460 / 3 / 60 / 1200 W/120V SPACE HEATER
.                        : MOTOR TO BE NON-OVERLOADING FOR ENTIRE RANGE
.                        : AT 6000 FT ABOVE SEA LEVEL
SERVICE..................: 2613 GPM VS 60 FT TDH OF CONDENSATE
TAG......................: PRECOAT  RECYCLE PUMP
```

6 1 CPUMP_CEN000096 3X4-7 MTi GOULDS 3196 DI/SS

```
MANUFACTURER.............: Goulds
TYPE.....................: Horizontal
MODEL/SIZE...............: 3196 MTi/3x7
SUCTION/DISCHARGE CONNECT: 4" (100 mm) 150# FF/3" (80 mm) 150# FF
CASING MATERIAL..........: Ductile Iron
IMPELLER TYPE/MATERIAL...: Open/316 SS
SHAFT/SLEEVE MATERIAL....: Stainless Steel/None
BASEPLATE................: CAST IRON
MECHANICAL SEAL/PACKING..: JC 5610Q SINGLE SEAL FOR EXTERNAL FLUSHING
COUPLING.................: REXNORD-OMEGA REX ES-2
LUBRICATION..............: OIL
ASSEMBLY.................: PUMP AND MOTOR TO BE FACTORY ASEMBLED ON A
.                        : COMMON BASEPLATE
MOTOR HP/MANUFACTURER....: 5 / BALDOR SEVERE DUTY PREMIUM EFFICIENCY
ENCL/INSUL/FRAME SIZE/S.F: TEFC / F WITH B RISE / 184T / 1.15
VOLTAGE/PHASE/HERTZ/RPM..: 460 / 3 / 60 / 1800
.                        : MOTOR TO BE NON-OVERLOADING FOR ENTIRE RANGE
.                        : AT 6000 FT ABOVE SEA LEVEL
SERVICE..................: 145 GPM VS 40 FT TDH OF 5% POWDEX SLURRY
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

TAG.....: PRECOAT INJECTION PUMP

7 1 CVBFLA___000008 10" CI Lined Auto Bfly Valve FV-5584 (X)

SIZE.....: 10"
BODY RATING.....: ANSI 125
BODY TYPE.....: Wafer
BODY MATERIAL.....: Cast Iron
DISC MATERIAL.....: Stainless Steel
SHAFT MATERIAL.....: Stainless Steel
MANUFACTURER.....: TYCO
MODEL NUMBER.....: AR1
SEAT/SEAL MATERIAL.....: EPDM
ACTUATOR TYPE.....: KEYSTONE 79U-036/DOUBLE ACTING PNEUMATIC
ACCESSORIES.....: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
. : ASCO HT8342G001, SINGLE H COIL SOLENOID, 120/1/60,
. : TUBED WITH SWAGELOK FITTING AND
. : (2) PARKER PF SPEED CONTROL,
. : 0-100% OPEN LIMIT STOP, POSITION INDICATOR
TAG:.....: PRECOAT RETURN VALVE, X
ACTUATOR MOUNTING.....: MOUNT AXIS PERPENDICULAR TO FLOW, 80 PSIG AIR
SERVICE.....: CONDENSATE WATER AT 100 PSIG 140 DEGREE F
. : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE

8 1 CVBFLA___000010 4" CI Lined Auto Bfly Valve FV-5585 (N)

SIZE.....: 4"
BODY RATING.....: ANSI 125
BODY TYPE.....: Wafer
BODY MATERIAL.....: Cast Iron
DISC MATERIAL.....: Stainless Steel
SHAFT MATERIAL.....: Stainless Steel
MANUFACTURER.....: TYCO
MODEL NUMBER.....: AR1
SEAT/SEAL MATERIAL.....: EPDM
ACTUATOR TYPE.....: KEYSTONE 79U-006/DOUBLE ACTING PNEUMATIC
ACCESSORIES.....: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
. : ASCO HT8342G001, SINGLE H COIL SOLENOID, 120/1/60,
. : TUBED WITH SWAGELOK FITTING AND
. : (2) PARKER PF SPEED CONTROL,
. : 0-100% OPEN LIMIT STOP, POSITION INDICATOR
TAG:.....: BACKWASH SUPPLY

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
ACTUATOR MOUNTING.....: MOUNT AXIS PERPENDICULAR TO FLOW
SERVICE...............: CONDENSATE WATER AT 100 PSIG 140 DEGREE F
.                      : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
```

9 1 CVCONTROL000075 4" FISHER C-DISC 2052/22 CS FCV-5582

```
MANUFACUTRER..........: Fisher Controls
SIZE..................: 4" (100 mm)
TYPE/MODEL............: Butterfly/Control Disc
CONNECTION............: Wafer
PRESSURE RATING.......: ANSI Class 150
BODY MATERIAL.........: WCC Steel
DISC/PLUG MATERIAL....: Stainless Steel
SHAFT MATERIAL........: Stainless Steel
SEAT/SEAL MATERIAL....: PTFE
PACKING/BUSHING MATERIAL.: PEEK/PTFE
ACTUATOR..............: Diaphragm, 2052/2, air to open/spring  to close
AIR SUPPLY PRESSURE...: 80 PSIG AIR SUPPLY
POSITIONER............: DVC 6200 W/HART PROTOCOL, ACCEPTING 4-20 MA
.                      : SIGNAL,  INCREASE SIGNAL TO OPEN VALVE
ACCESSORIES...........: AIR SET 67CRF, PRESSURE GAUGE, TUBE WITH
.                      : SWAGELOK SS FITTING
SERVICE...............: FLOW CONTROL OF 100-502 GPM 145 F CONDENSATE,
.                      : 30-50 PSIG P1, 25 PSIG P2,
TAG...................: BACKWASH WATER FLOW CONTROL VALVE
```

10 1 CVBFYM___000006 12" CI Lined Manual Bfly Vlv V-5661

```
Size..................: 12"
Body Rating...........: ANSI 125
Body Type.............: Wafer
Body Material.........: Cast Iron
Disc Material.........: Stainless Steel
Shaft Material........: Stainless Steel
Manufacturer..........: TYCO
Model Number..........: AR1
Seat/Seal Material....: EPDM
Actuator Type.........: HW GEAR BOX
Description...........: POSITION INDICATOR
Description...........: CONDENSATE AT 100 PSIG 140 DEGREE F
Description...........: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
Description...........: IN BOTH DIRECTION
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

TAG.....: PRECOAT RECYCLE PUMP SUCTION

11 1 CVBFYM___000005 10" CI Lined Manual Bfly Vlv V-5670

Size.....: 10"
Body Rating.....: ANSI 125
Body Type.....: Wafer
Body Material.....: Cast Iron
Disc Material.....: Stainless Steel
Shaft Material.....: Stainless Steel
Manufacturer.....: TYCO
Model Number.....: AR1
Seat/Seal Material.....: EPDM
Actuator Type.....: GEAR BOX
Description.....: POSITION INDICATOR
Description.....: 5% RESIN SLURRY AT 100 PSIG 140 DEGREE F
Description.....: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
Description.....: IN BOTH DIRECTION
TAG.....: PRECOAT RECYCLE PUMP DISCHARGE

12 1 CVBFYM___000001 3" CI Lined Manual Bfly Vlv V-5664

Size.....: 3"
Body Rating.....: ANSI 125
Body Type.....: Wafer
Body Material.....: Cast Iron
Disc Material.....: Stainless Steel
Shaft Material.....: Stainless Steel
Manufacturer.....: TYCO
Model Number.....: AR1
Seat/Seal Material.....: EPDM
Actuator Type.....: LEVER
Description.....: POSITION INDICATOR
Description.....: 5% RESIN SLURRY AT 100 PSIG 140 DEGREE F
Description.....: TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
Description.....: IN BOTH DIRECTION
TAG.....: PRECOAT TANK OUTLET

13 1 CVBALAUTO000004 2" AUTO BALL VALVE, CS, SW FV-5586 (FS)

SIZE.....: 2"
CONNECTION.....: Socket Welded
BODY MATERIAL.....: Carbon Steel

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
BALL MATERIAL.............: 316 Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAL/SEAT MATERIAL........: TFM-1600
MANUFACTURER..............: TYCO
MODEL NUMBER..............: F180
ACTUATOR..................: KEYSTONE 79U-006/DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY, MOUNT AXIS PERPENDICULAR TO
.                          : FLOW, TUBE WITH SWAGLOK TUBE FITTINGS
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO HT8342G001, SINGLE H COIL SOLENOID, 120/1/60,
.                          : (2) PARKER PF SPEED CONTROL,
SERVICE...................: CONDENSATE WATER AT 100 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
TAG.......................: PRECOAT INJECTION PUMP DISCHARGE, (FS)
.                          : 0-100% OPEN LIMIT STOP, POSITION INDICATOR
```

14 1 CVBALAUTO000004 2" AUTO BALL VALVE, CS, SW FV-5583 (P)

```
SIZE......................: 2"
CONNECTION................: Socket Welded
BODY MATERIAL.............: Carbon Steel
BALL MATERIAL.............: 316 Stainless Steel
SHAFT MATERIAL............: Stainless Steel
SEAL/SEAT MATERIAL........: TFM-1600
MANUFACTURER..............: TYCO
MODEL NUMBER..............: F180
ACTUATOR..................: KEYSTONE 79U-006/DOUBLE ACTING PNEUMATIC
.                          : 80 PSIG AIR SUPPLY, MOUNT AXIS PERPENDICULAR TO
.                          : FLOW, TUBE WITH SWAGLOK TUBE FITTINGS
ACCESSORIES...............: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
.                          : ASCO HT8342G001, SINGLE H COIL SOLENOID, 120/1/60,
.                          : (2) PARKER PF SPEED CONTROL,
SERVICE...................: CONDENSATE WATER AT 100 PSIG 140 DEGREE F
.                          : TO CLOSE BUBBLE TIGHT VS FULL DIFF PRESSURE
TAG.......................: PRECOAT TANK FILL (P)
.                          : 0-100% OPEN LIMIT STOP, POSITION INDICATOR
```

15 2 CVBALM___000128 2" CS MAN BALL VALV SW V-5560, V-5565

```
SIZE......................: 2"
BODY MATERIAL.............: CS
BALL MATERIAL.............: 316 SS
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: SOCKET WELD
ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
. : THREE PIECE
SEAT.....: TFM-1600
TAG.....: PROCOAT TANK DRAIN
. : PREPRECOAT INJECTION PUMP RECYCLE

16 1 CVBALM___000127 1 1/2" CS MAN BALL VALV SW V-5666

SIZE.....: 1-1/2"
BODY MATERIAL.....: CS
BALL MATERIAL.....: 316 SS
SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: SOCKET WELD
ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
. : THREE PIECE
SEAT.....: TFM-1600
TAG.....: PRECOAT INJECTION PUMP SUCTION

17 1 CVBALM___000125 1" CS MAN BALL VALV SW V-5658

SIZE.....: 1"
BODY MATERIAL.....: CS
BALL MATERIAL.....: 316 SS
SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: SOCKET WELD
ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
. : THREE PIECE
SEAT.....: TFM-1600
TAG.....: AUX TANK FILL

18 1 CVBALM___000105 1" BALL VALVE, CS, SW, PTFE V-5659

SIZE.....: 1"
BODY MATERIAL.....: Carbon Steel
BALL MATERIAL.....: 316 Stainless Steel

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
SHAFT MATERIAL.....: 316 Stainless Steel
END CONNECTIONS.....: Socket Welded
ACTUATOR TYPE.....: Lever
SEAT/SEAL.....: PTFE/PTFE
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
.                  : THREE PIECE
SEAT.....: TFM-1600
TAG.....: AUX TANK DRAIN
```

19 2 CVBALM___000001 1/2 SS MAN BALL VALV SC — V-5653, V-5654

```
SIZE.....: 1/2"
BODY MATERIAL.....: 316 SS
BALL MATERIAL.....: 316 SS
SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: THREADED
ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
SEAT.....: TFM-1600
TAG.....: FLOW TRANSMITTER ROOT VALVE
```

20 3 CVBALM___000001 1/2 SS MAN BALL VALV SC — V-5657, V-5662, V-5668

```
SIZE.....: 1/2"
BODY MATERIAL.....: 316 SS
BALL MATERIAL.....: 316 SS
SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: THREADED
ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
SEAT.....: TFM-1600
TAG.....: PRESSURE GAUGE ROOT VALVE
```

21 1 CVBALM___000123 1/2" CS MAN BALL VALV SW — V-5655

```
SIZE.....: 1/2"
BODY MATERIAL.....: CS
BALL MATERIAL.....: 316 SS
SHAFT MATERIAL.....: 316 SS
END CONNECTIONS.....: SOCKET WELD
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

ACTUATOR TYPE.....: LEVER
MANUFACTURER.....: TYCO
MODEL NUMBER.....: F180
. : 3-PIECE BODY
SEAT.....: TFM-1600
TAG.....: PUMP SEAL ROOT VALVE

23	1	CVCHECK__000006	10" CHECK VALVE, 150#, CS/SS		V-5669

TYPE.....: Dual Check
SIZE.....: 10"
PRESSURE RATING.....: ANSI Class 150
END CONNECTION.....: Wafer
BODY MATERIAL.....: Carbon Steel
TRIM MATERIAL.....: Stainless Steel
SEAT MATERIAL.....: BUNA
MANUFACTURER.....: CRANE
MODEL NUMBER.....: G-15SMF-14
TAG.....: PRECOAT RECYCLE PUMP DISCHARGE

24	1	CVCHECK__000004	4" CHECK VALVE, 150#, CS/SS		V-5656

TYPE.....: Dual Check
SIZE.....: 4"
PRESSURE RATING.....: ANSI Class 150
END CONNECTION.....: Wafer
BODY MATERIAL.....: Carbon Steel
TRIM MATERIAL.....: Stainless Steel
SEAT MATERIAL.....: BUNA
MANUFACTURER.....: CRANE
MODEL NUMBER.....: G-15SMF-14
TAG.....: BACKWASH WATER INLET

25	1	CVCHECK__000001	3" CHECK VALVE, 150#, CS/SS		V-5563

TYPE.....: Dual Check
SIZE.....: 3"
PRESSURE RATING.....: ANSI Class 150
END CONNECTION.....: Wafer
BODY MATERIAL.....: Carbon Steel
TRIM MATERIAL.....: Stainless Steel
SEAT MATERIAL.....: BUNA
MANUFACTURER.....: CRANE

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
                                MODEL NUMBER.............: G-15SMF-14
                                TAG......................: PRECOAT INJECTION PUMP DISCHARGE
```

26 1 CMIXER___000027 MIXER SINGLE IMPELLER

```
                                TYPE.....................: GEAR DRIVE, CLAMP MOUNT
                                SHAFT....................: 316 SS
                                IMPELLER.................: 316 SS IMPELLER
                                MANUFACTURER.............: CHEMINEER
                                USAGE....................: 5% POWDEX SLURRY
                                ........................: MOUNTING: CLAMP
                                ........................: MOTOR: 1.5 HP, 460V/3PH/60HZ, CLASS F INSULATION,
                                ........................: 1800RPM, TEFC, CHEMICAL DUTY, 1.15 SF, 56C FRAME
                                ........................: TAG: PRECOAT TANK MIXER
```

27 2 CVRLF____000072 2x2 RLF VLV, LESER CS PRV-5591, PRV-5592

```
                                MANUFACTURER.............: LESER
                                BODY MATERIAL............: CARBON STEEL
                                DISC MATERIAL............: STAINLESS STEEL
                                INLET CONNECTION.........: 2" NPT
                                OUTLET CONNECTION........: 2" FNPT
                                MODEL....................: 4592.2492 V86 V88
                                SET PRESSURE.............: 100 PSIG
                                SERVICE CONDITIONS.......: CONDENSATE AT 140F
                                TAG......................: PRESSURE RELIEF VALVE
```

28 1 CSTRAINER000008 1/2" Y STRAINER, CS, SW STR-5667

```
                                SIZE.....................: 1/2"
                                TYPE.....................: Y
                                CONNECTION...............: Socket Weld
                                BODY MATERIAL............: Carbon Steel
                                SCREEN MATERIAL..........: Stainless Steel
                                MANUFACTURER.............: IFC
                                MODEL NUMBER.............: Y300SWST
                                PRESSURE RATING..........: 100 PSIG
                                DRAIN CONNECTION.........: 1/4"
                                PERFORATION..............: 1/32" PERFORATION
                                TAG......................: PUMP SEAL WATER STRAINER
```

29 3 CGAUGPRES000002 PRESSURE GAUGE 60 PSIG PI-5588, PI-5589, PI-5590

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001002	ADVANCE PRECOAT SKID		(continued)			

Release: 031M ADVANCE PRECOAT SKID

```
RANGE.....................: 0 - 60 PSIG
CONNECTION SIZE...........: 1/2 INCH MNPT
MATERIAL OF CONSTRUCTION..: 316 SS
MOUNTING..................: LOWER
MANUFACTURER..............: ASCHROFT
MODEL.....................: 1279
DIAL SIZE.................: 4-1/2 INCH
TAG.......................: PRESSURE GAUGE
```

30 1 CVLV.SOV2000018 ASCO.8262G220-1/4" SV-5587

```
SINGLE COIL SOLENOID VALVE, 2-WAY NORMALLY CLOSED
MANUFACTURER..............: AUTOMATIC SWITCH COMPANY
CATALOG NO................: HT8262H220
OPERATION.................: 2-WAY NORMALLY CLOSED
BODY MATERIAL.............: STAINLESS STEEL
PORT CONNECTIONS..........: 1/4" FNPT
ORIFICE...................: 5/32"
MAX. OPERATING D/P........: 200 PSIG
MAX. OPERATING TEMP.......: 180 DEG F
COIL VOLTAGE..............: 120VOLTS, 60 HZ, 1 PH, CLASS H
COIL ENCLOSURE............: NEMA 4X
TAG.......................: PUMP SEAL SOLENOID VALVE,
```

35 1 CPLATFORM000030 PLATFORM

```
PLATFORM
MATERIAL OF CONSTRUCTION..: CARBON STEEL, GALVANIZED
```

Release: 032M ADVANCE PRECOAT SKID

1 1 CVSLPRES_000010 AIR SURGE TANK

```
SERVICE...................: Air Surge  Tank
ASME CODE.................: Section VIII, Division I, latest edition
CERTIFICATE...............: Required
COUNTRY/STATE.............: USA/NM
SIZE......................: 108" X 10'-6" STR
DESIGN PRESSURE...........: 150 PSIG
DESIGN TEMPERATURE........: 140 DEG F
LINING....................: NONE
TAG.......................: AIR SURGE TANK
REFERENCE DRAWING.........: 13486-M-D-4000-001
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001003	AIR SURGE TANK		(continued)			

Release: 032M AIR SURGE TANK

2 1 CNAMEPLT_000001 LARGE GRAVER NAMEPLATE A-5855

LARGE GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176703)

ENGRAVE WITH:
AIR SURGE TANK
GRAVER JOB #13486
PO# 01032363

3 1 CVBFLHPA_000039 8" AUTO HP BFLY VALVE, 300# FV-5596 (MS)

SIZE.....: 8" (200 mm)
BODY RATING.....: ANSI Class 300
BODY TYPE.....: Wafer
BODY MATERIAL.....: Carbon Steel
DISC MATERIAL.....: Stainless Steel
SHAFT MATERIAL.....: Stainless Steel
SEAT/SEAL MATERIAL.....: RTFE
MANUFACTURER.....: TYCO
MODEL NUMBER.....: SERIES 37
ACTUATOR MODEL/TYPE.....: KEYSTONE 79U-065/DOUBLE ACTING PNEUMATIC
. : 80 PSIG AIR SUPPLY
. : MOUNT AXIS PERPENDICULAR TO FLOW
ACCESSORIES.....: (2) WESTLOCK 2004, SPDT L/S NEMA 4X,
. : ASCO 8342 NEMA 4X, SIGL H COIL SOLENOID, 120/1/60
. : TUBED WITH SWAGELOK FITTING AND (2) PARKER PF
. : SPEED CONTROL, POSITION INDICATOR
SERVICE.....: COMPRESSED AIR AT 100 PSIG, VALVE TO CLOSE
. : BUBBLE TIGHT VS FULL DIFF PRESSURE
. : IN BOTH DIRECTIONS
TAG.....: AIR SURGE TANK OUTLET , (MS)

4 1 CVCHECK__000010 8" CHECK VALVE, 300#, CS/SS V-5676

TYPE.....: Dual Check
SIZE.....: 8"
PRESSURE RATING.....: ANSI Class 300
END CONNECTION.....: Wafer
BODY MATERIAL.....: Carbon Steel
TRIM MATERIAL.....: Stainless Steel

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description (continued)	Drawing No.	Tag	Used On
J13486001003 AIR SURGE TANK						
Release: 032M AIR SURGE TANK						
			SEAT MATERIAL.....: BUNA			
			MANUFACTURER.....: MISSION			
			MODEL NUMBER.....: G-30SMF			
			TAG.....: AIR SURGE TANK OUTLET			
5	1	CVBALM___000012	2" BALL VALVE, CS, SW		V-5671	
			SIZE.....: 2"			
			BODY MATERIAL.....: Carbon Steel			
			BALL MATERIAL.....: 316 Stainless Steel			
			SHAFT MATERIAL.....: 316 Stainless Steel			
			END CONNECTIONS.....: Socket Welded			
			ACTUATOR TYPE.....: Lever			
			SEAT/SEAL.....: TFE/TFE			
			MANUFACTURER.....: TYCO			
			MODEL NUMBER.....: F180			
			.: THREE PIECE			
			SEAT.....: TFM-1600			
			TAG.....: AIR INLET			
6	1	CVBALM___000063	3/4" BALL VALVE, CS, SC		V-5674	
			SIZE.....: 3/4"			
			BODY MATERIAL.....: Carbon Steel			
			BALL MATERIAL.....: 316 Stainless Steel			
			SHAFT MATERIAL.....: 316 Stainless Steel			
			END CONNECTIONS.....: Threaded			
			ACTUATOR TYPE.....: Lever			
			SEAT/SEAL.....: TFE/TFE			
			MANUFACTURER.....: TYCO			
			MODEL NUMBER.....: F180			
			.: THREE PIECE			
			SEAT.....: TFM-1600			
			TAG.....: AIR SURGE TANK DRAIN			
7	2	CVBALM___000009	1/2" BALL VALVE, SS, SC		V-5672, V-5673	
			SIZE.....: 1/2"			
			BODY MATERIAL.....: 316 Stainless Steel			
			BALL MATERIAL.....: 316 Stainless Steel			
			SHAFT MATERIAL.....: 316 Stainless Steel			
			END CONNECTIONS.....: THREADED			
			ACTUATOR TYPE.....: LEVER			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description (continued)	Drawing No.	Tag	Used On
J13486001003 AIR SURGE TANK						
Release: 032M AIR SURGE TANK						
			SEAT/SEAL.....: TFE/TFE MANUFACTURER.....: TYCO MODEL NUMBER.....: F180 SEAT.....: TFM-1600 TAG.....: AIR SURGE TANK PRESSURE GAUGE . : AIR SURGE TANK PRESSURE TRANSMITTER ROOT VALVE			
8	1	CGAUGPRES000009	0-160 PSI PRESSURE GAUGE		PI-5599	
			RANGE.....: 0 - 160 psig CONNECTION SIZE.....: 1/2" MNPT MATERIAL OF CONSTRUCTION..: 316 Stainless Steel MOUNTING.....: Lower MANUFACTURER.....: ASHCROFT MODEL.....: 1279SS DIAL SIZE.....: 4-1/2 INCH TAG.....: AIR SURGE TANK PRESSURE GAUGE			
9	1	CVRLF____000034	1/2x1 RELIEF VALVE, LESER CS		PRV-5597	
			MANUFACTURER.....: LESER BODY MATERIAL.....: Chrome Alloy/SS DISC MATERIAL.....: 316 Stainless Steel INLET CONNECTION.....: 1/2" MNPT OUTLET CONNECTION.....: 1" FNPT SET PRESSURE.....: 125 PSIG SERVICE CONDITIONS.....: 125 PSIG 100 F COMRESSED AIR . : SUPPLY WITH LEVER TAG.....: AIR SURGE TANK PRESSURE RELIEF VALVE			
10	1	CREG.PRES000022	2" NORGREN REGULATOR R18		PCV-5598	
			MANUFACTURER.....: Norgren SIZE.....: 2" (50 mm) CONNECTION.....: NPT BODY MATERIAL.....: STEEL TRIM MATERIAL.....: STAINLESS STEEL SERVICE.....: 402 SCFM INLET PRESSURE, P1.....: 100 - 125 PSIG OUTLET PRESSURE, P2.....: 80 - 100 PSIG SPRING RANGE.....: 5-125 PSIG TAG.....: AIR SURGE TANK PRESSURE REGULATOR,			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001003 AIR SURGE TANK (continued)						
Release: 032M AIR SURGE TANK						
11	1	CVBALAUTO000034	3/4" AUTO BALL VALVE, SS, SC		V-5675	

```
SIZE.....................: 3/4"
CONNECTION...............: Threaded
BALL MATERIAL............: Stainless Steel
MANUFACTURER.............: ECOMPRESSEDAIR
MODEL NUMBER.............: TEC-44-3/4" 115VAC
ACTUATOR.................: MOTORIZED
TAG......................: AIR SURGE TANK AUTO DRAIN
```

Release: 900E AIR SURGE TANK

1 1 CDESC.CAB000001 DESC.CAB-UNIVERSAL

```
CONTROL CABINET, FURNISHED COMPLETELY PAINTED, ASSEMBLED, WIRED, AND TESTED IN
ACCORDANCE WITH THE GRAVER DRAWINGS LISTED BELOW:
RATING...................: NEMA 4
HEIGHT...................: 7 FEET - 6 INCHES
WIDTH....................: 10 FEET - 6 INCHES
DEPTH....................: 3 FEET - 0 INCHES
SPECIFICATION............: 13486-E-A-1100
LAYOUT & DETAILS.........: 13486-E-D-1000 - SHEETS 1 THRU 9
WIRING DIAGRAMS..........: 13486-E-D-2000 - SHEETS 1 THRU 35
FIELD TERMINATION DIAGRAM: 13486-E-D-5000 - SHEETS 1 THRU 5
```

2 1 CBOX.N4__000111 BOX.GMLT.N4.STANDARD.3BAY

```
CUSTOM, FREE STANDING ENCLOSURE, THREE DOOR, NEMA 4, COMPLETE WITH CUTOUTS
MANUFACTURER.............: GAMLET OR EQUAL
ENCLOSURE RATING.........: NEMA 4
ENCLOSURE HEIGHT.........: 7 FEET - 6 INCHES
ENCLOSURE WIDTH..........: 10 FEET - 6 INCHES
ENCLOSURE DEPTH..........: 3 FEET - 0 INCHES
MATERIAL.................: CARBON STEEL
EXTERIOR FINISH..........: SEE SPECIFICATION 13486-E-A-1100
INTERIOR FINISH..........: SEE SPECIFICATION 13486-E-A-1100
```

3 1 CBOXPLATE000076 BOXPLATE.CS.CUSTOM.24hx24w SUB-PANEL 5

```
CUSTOM EQUIPMENT MOUNTING PANEL,

MANUFACTURER.............: GAMLET OR EQUAL
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009 Main Control Panel			(continued)			
Release: 900E Main Control Panel						
			HEIGHT.....: 24 INCHES WIDTH.....: 24 INCHES FINISH.....: WHITE ENAMEL MATERIAL.....: CARBON STEEL			
4	1	CBOXPLATE000077	BOXPLATE.CS.CUSTOM.78hx79w CUSTOM EQUIPMENT MOUNTING PANEL, MANUFACTURER.....: GAMLET OR EQUAL HEIGHT.....: 78 INCHES WIDTH.....: 79 INCHES FINISH.....: WHITE ENAMEL MATERIAL.....: CARBON STEEL			SUB-PANEL 1
5	1	CBOXPLATE000078	BOXPLATE.CS.CUSTOM.78hx41w CUSTOM EQUIPMENT MOUNTING PANEL, MANUFACTURER.....: GAMLET OR EQUAL HEIGHT.....: 78 INCHES WIDTH.....: 41 INCHES FINISH.....: WHITE ENAMEL MATERIAL.....: CARBON STEEL			SUB-PANEL 2
6	2	CBOXPLATE000079	BOXPLATE.CS.CUSTOM.78hx30w CUSTOM EQUIPMENT MOUNTING PANEL, MANUFACTURER.....: GAMLET OR EQUAL HEIGHT.....: 78 INCHES WIDTH.....: 30 INCHES FINISH.....: WHITE ENAMEL MATERIAL.....: CARBON STEEL			SUB-PANELS 3 & 4
7	10	CBOXPLATE000080	STANDOFF 1.5 x 52 TERMINAL BLOCK STANDOFF BRACKET, MANUFACTURER.....: GAMLET OR EQUAL HEIGHT.....: 52 INCHES WIDTH.....: 1-1/2 NCHES FINISH.....: WHITE ENAMEL MATERIAL.....: CARBON STEEL			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009 Main Control Panel			(continued)			

Release: 900E Main Control Panel

8 20 CBOXPLATE000081 CABLECLAMP - 1" X 8"

FIELD CABLE CLAMP,
MANUFACTURER.....: GAMLET OR EQUAL
HEIGHT.....: 1 INCHES
WIDTH.....: 8 INCHES
FINISH.....: WHITE ENAMEL
MATERIAL.....: CARBON STEEL

9 1 CSTD_PART000053 STD-E-D-1219-CS

UNIVERSAL PANEL INSERT FOR OPEREATOR INTERFACE AND IKEY MODEL PM-2000-KB-USB KEYBOARD,
MANUFACTURER.....: GRAVER
CATALOG NUMBER.....: STD-E-D-1219
DRAWING NUMBER.....: STD-E-D-1219.01 - Revision A
HEIGHT.....: 3 FEET - 2 INCHES (965.2 mm)
WIDTH.....: 2 FEET - 4 INCHES (711.2 mm)
DEPTH.....: 10 INCHES (254 mm)
MATERIAL.....: CARBON STEEL
EXTERNAL FINISH.....: FINISH COAT TO MATCH ENCLOSURE
INTERNAL FINISH.....: FINISH COAT TO MATCH ENCLOSURE

10 1 CSTD_PART000050 STD-E-D-1228-CS

ADAPTER PLATE FOR TRANSDUCTION MODEL TR-5190 INDUSTRIAL DISPLAY UNIT,
MANUFACTURER.....: GRAVER
CATALOG NUMBER.....: STD-E-D-1228
DRAWING NUMBER.....: STD-E-D-1228-01
HEIGHT.....: 21.5 INCHES (546.1 mm)
WIDTH.....: 25.75 INCHES (654 mm)
MATERIAL.....: CARBON STEEL
EXTERNAL FINISH.....: FINISH COAT TO MATCH ENCLOSURE
INTERNAL FINISH.....: FINISH COAT TO MATCH ENCLOSURE

11 1 CPLC.CPU_000049 PLC.AB.1756L71.2MB

CONTROL LOGIX 5571 CONTROLLER PROCESSOR MODULE,
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-L71
USER MEMORY.....: 2 MBYTES

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

12 1 CPLC.ENET000005 PLC.AB.1756ENBT

ETHERNET COMMUNICATION INTERFACE MODULE FOR A CONTROL LOGIX 5500 CONTROLLER
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-ENBT
COMMUNICATION RATE.....: 10 / 100 Mbps
TCP/IP CONNECTIONS.....: 64
CONTROL LOGIX CONNECTIONS: 48 PER TCP/IP CONNECTION, 128 MAXIMUM
BACKPLANE CURRENT.....: 900 mA@5VDC, 350mA@24VDC, 12.99W

13 3 CPLC.CNET000001 PLC.AB.1756CNB

CONTROLNET COMMUNICATION INTERFACE MODULE FOR A CONTROL LOGIX 5500 CONTROLLER
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-CNB
COMMUNICATION RATE.....: 5 Mbps
CONNECTIONS.....: 64 PER MODULES
BACKPLANE CURRENT.....: 970 mA @ 5VDC, 1.7mA @ 24VDC, 4.98W

14 3 CPLC.AI08000003 PLC.AB.1756IF8

ANALOG INPUT MODULE FOR CONTROL LOGIX 5500 CONTROLLER
(REQUIRES 36 PIN REMOVABLE TERMINAL BLOCK)
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-IF8
MODULE TERMINAL BLOCK....: PURCHASED SEPARATELY
NUMBER OF INPUTS.....: 8 SINGLE ENDED, 4 DIFFERENTIAL, 2 HIGH SPEED DIFF.
INPUT RANGE (mADC).....: 0-20.5 mADC
INPUT RANGE (VDC).....: +/- 10.25V, 0-5.125V, 0-10.25V
BACKPLANE CURRENT.....: 150 mA @ 5.1V and 65mA @ 24V
BACKPLANE POWER.....: 2.33 WATTS
THERMAL DISSIPATION.....: 7.84 BTU/HR VOLTAGE - 13.30 BTU/HR CURRENT
INPUTS PER COMMON.....: 8 (SINGLE ENDED) OR 1 (DIFFERENTIAL)

15 1 CPLC.AO04000004 PLC.AB.1771OFE2

PLC I/O MODULE - 4 POINT ANALOG OUTPUT
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1771OFE2
MODULE TERMINAL BLOCK....: 1771-WC
NUMBER OF OUTPUTS.....: 4 DIFFERENTIAL
OUTPUT RANGE (mADC).....: 4-20mADC
OUTPUT RANGE (VDC).....: N/A

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

```
                                BACKPLANE CURRENT........: 1.5 ADC
                                RESOLUTION...............: 12 Bit res + sign
                                LOOP POWER...............: FROM PLC RACK
```

16 7 CPLC.DI16000011 PLC.AB.1756IA16

```
                                SIXTEEN POINT AC DIGITAL INPUT MODULE FOR A CONTROL LOGIX 5500 CONTROLLER.
                                (REQUIRES 20 PIN REMOVABLE TERMINAL BLOCK)
                                MANUFACTURER.............: ALLEN-BRADLEY
                                CATALOG NO...............: 1756-IA16
                                MODULE TERMINAL BLOCK....: PURCHASED SEPARATELY
                                NUMBER OF INPUTS.........: 16
                                OPERATING VOLTAGE........: 74 - 132 VAC
                                BACKPLANE CURRENT........: 105 mA @ 5.1V and 2 mA @ 24V, 0.58W
                                BACKPLANE POWER..........: 0.58 WATTS
                                THERMAL DISSIPATION......: 18.41 BTU/HR
                                INPUTS PER COMMON........: 8
```

17 4 CPLC.DO16000010 PLC.AB.1756OA16

```
                                SIXTEEN POINT AC DIGITAL OUTPUT MODULE  FOR A CONTROL LOGIX 5500 CONTROLLER.
                                (REQUIRES 20 PIN REMOVABLE TERMINAL BLOCK)
                                MANUFACTURER.............: ALLEN-BRADLEY
                                CATALOG NO...............: 1756-OA16
                                MODULE TERMINAL BLOCK....: PURCHASED SEPARATELY
                                NUMBER OF OUTPUTS........: 16
                                OPERATING VOLTAGE........: 74-265 VAC
                                BACKPLANE CURRENT........: 400 mA @ 5.1V and 2 mA @ 24V
                                THERMAL DISSIPATION......: 22.17 BTU/HR
                                OUTPUTS PER COMMON.......: 8
                                CURRENT RATING PER OUTPUT: 0.5 A @ 60 DEG C
```

18 1 CPLC.DI16000012 PLC.AB.1756IA16I

```
                                SIXTEEN POINT ISOLATED AC DIGITAL INPUT MODULE  FOR A CONTROL LOGIX 5500 CONTROLLER.
                                (REQUIRES 36 PIN REMOVABLE TERMINAL BLOCK)
                                MANUFACTURER.............: ALLEN-BRADLEY
                                CATALOG NO...............: 1756-IA16I
                                MODULE TERMINAL BLOCK....: PURCHASED SEPARATELY
                                NUMBER OF INPUTS.........: 16
                                OPERATING VOLTAGE........: 79-132 VAC
                                BACKPLANE CURRENT........: 125 mA @ 5.1V and 3 mA @ 24V
                                BACKPLANE POWER..........: 0.71 WATTS
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

THERMAL DISSIPATION.....: 16.71 BTU/HR
INPUTS PER COMMON.....: 1

19 1 CPLC.DO16000011 PLC.AB.1756OA16I

SIXTEEN POINT ISOLATED AC DIGITAL OUTPUT MODULE FOR A CONTROL LOGIX 5500 CONTROLLER.
(REQUIRES 36 PIN REMOVABLE TERMINAL BLOCK)
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-OA16I
MODULE TERMINAL BLOCK....: PURCHASED SEPARATELY
NUMBER OF OUTPUTS.....: 16
OPERATING VOLTAGE.....: 74-265 VAC
BACKPLANE CURRENT.....: 300 mA @ 5.1V and 2 mA @ 24V
THERMAL DISSIPATION.....: 18.76 BTU/HR
OUTPUTS PER COMMON.....: 16
CURRENT RATING PER OUTPUT: 1.0 A @ 60 DEG C

20 12 CPLC.TB__000001 PLC.AB.1756TBNH

REMOVABLE TERMINAL BLOCK FOR CONTROL LOGIX I/O MODULE
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-TBNH
CONNECTIONS.....: 20 PIN
TERMINATIONS.....: SCREW CLAMP

21 5 CPLC.TB__000003 PLC.AB.1756TBCH

REMOVABLE TERMINAL BLOCK FOR CONTROL LOGIX I/O MODULE
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-TBCH
CONNECTIONS.....: 36 PIN
TERMINATIONS.....: SCREW CLAMP

22 15 CPLC.GEN_000009 PLC.AB.1756N2

BLANK FILLER CARD FOR CONTROL LOGIX 5500 I/O CHASSIS
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NUMBER.....: 1756-N2

23 1 CPLC.RK__000005 PLC.AB.1756A17 Local Rack

I/O CHASSIS FOR A CONTROL LOGIX 5500 CONTROLLER
MANUFACTURER.....: ALLEN-BRADLEY
CATALOG NO.....: 1756-A17
NUMBER OF I/O SLOTS.....: SEVENTEEN

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009 Main Control Panel			(continued)			

Release: 900E Main Control Panel

24 2 CPLC.RK__000003 PLC.AB.1756A10 Racks 2 & 3

```
I/O CHASSIS FOR A CONTROL LOGIX 5500 CONTROLLER
MANUFACTURER.............: ALLEN-BRADLEY
CATALOG NO...............: 1756-A10
NUMBER OF I/O SLOTS......: TEN
```

25 3 CPLC.PS01000010 PLC.AB.1756PA75

```
POWER SUPPLY  FOR A CONTROL LOGIX 5500 CONTROLLER
MANUFACTURER.............: ALLEN-BRADLEY
CATALOG NO...............: 1756-PA75
INPUT VOLTAGE............: 82 -132 VAC / 170 -265 VAC, 50/60 HZ
OUTPUT CURRENT / VOLTAGE.: 1.5A @1.2VDC, 4A @3.3VDC, 13A@5VDC, 2.8A@24VDC
```

26 3 CPLC.GEN_000016 PLC.AB.1786TPS

```
STRAIGHT CONTROLNET T-TAP
MANUFACTURER.............: ALLEN-BRADLEY
CATALOG NUMBER...........: 1786-TPS
```

27 2 CCABLE___000018 TERMINATOR.75_OHM

```
75 OHM, TERMINATOR CAP
CONNECTOR TYPE...........: BNC
```

28 3 CCABLE___000045 CABLE.RG-6.6FT

```
COAXIAL CABLE FOR CONTROLNET,
CABLE LENGTH.............: 6 FEET
CABLE TYPE...............: RG-6
CONNECTOR TYPE...........: MALE BNC
```

29 1 CCPU.COMM000019 CPU.COMM.NTRON.305FX.SC

```
UNMANAGED INDUSTRIAL ETHERNET SWITCH,
MANUFACTURER.............: N-TRON
CATALOG NUMBER...........: 305FX - SC
DEVICE PROTOCOL..........: ETHERNET
TRANSFER RATE............: 10 MBPS / 100 MBPS AUTOSENSING
PORTS....................: (4) - RJ-45 10/100 BASE TX & (1) - FX 100 MM-SC
MOUNTING.................: DIN RAIL MOUNT
POWER SUPPLY.............: REDUNDANT 10 - 30 VDC
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009 Main Control Panel			(continued)			
Release: 900E Main Control Panel						
30	1	CCABLE___000057	CABLE.ETHERNET.7FT.YELLOW			
			ETHERNET PATCH CABLE, CABLE LENGTH.....: 7 FEET CABLE TYPE.....: CAT 5E, 100 MHz, STRAIGHT PINNING CABLE JACKET COLOR.....: YELLOW CONNECTOR TYPE.....: RJ - 45			
31	1	CCABLE___000058	CABLE.ETHERNET.25FT.YELLOW			
			ETHERNET PATCH CABLE, CABLE LENGTH.....: 25 FEET CABLE TYPE.....: CAT 5E, 100 MHz, STRAIGHT PINNING CABLE JACKET COLOR.....: YELLOW CONNECTOR TYPE.....: RJ - 45			
32	4	CRLAY.CR_000007	RELAY.AB.700P200		CR-0256,CR-1138,CR-2138,CR-2538	
			CONTROL RELAY, MANUFACTURER.....: ALLEN-BRADLEY CATALOG NO.....: 700-P200-A1 NEMA RATING.....: GENERAL PURPOSE CONTACTS.....: 2 N.O. CONVERTIBLE CONTACT RATING.....: 10 AMPERE COIL VOLTAGE.....: 120 VOLTS, 60 HZ			
33	6	CSS.3PM__000092	SS.AB.800T.3P.122		SS-3310,SS-3328,SS-3410,SS-3430,SS-3510,SS-3530	
			SELECTOR SWITCH, THREE POSITION MAINTAINED MANUFACTURER.....: ALLEN BRADLEY CATALOG NO.....: 800T-J2-KD7-AXEX RATING.....: NEMA 4/13 KNOB.....: BLACK, WHITE INSERT CAM CODE.....: KD7 CONTACT BLOCK1.....: 800T-XA (1NO-1NC) CONTACT BLOCK2.....: NO CONTACTS CONTACT BLOCK3.....: 800T-XD2 (1NC) CONTACT BLOCK4.....: NO CONTACTS LEGEND PLATE.....: NONE			

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

34 8 CLEGEND__000016 LEGEND.AB.800T-OFF-AUTO-RUN

CUSTOM LEGEND PLATE,
MANUFACTURER.....: ALLEN BRADLEY
CATALOG NUMBER.....: 800T-X559E
SIZE.....: STANDARD
COLOR.....: GRAY
ENGRAVING.....: OFF - AUTO - RUN

35 1 CHORN.N4_000001 ALARM HORN.N4 AH-053

ALARM HORN FOR NEMA 4 CONTROL CABINET
MANUFACTURER.....: FEDERAL
CATALOG NUMBER.....: 350
ENCLOSURE RATING.....: NEMA 4
OPERATING VOLTAGE.....: 120 VAC, 50/60 HZ.
INCLUDED OPTION 1.....: MODEL 8435666 NEMA 4 GASKET KIT

36 1 CCB.PANEL000014 CB.PANEL.SQ-D.QO116L125G

SIXTEEN (16) SPACE DISTRIBUTION PANEL FOR PLUG-IN TYPE CIRCUIT BREAKERS,
MANUFACTURER.....: SQUARE D
CATALOG NUMBER.....: QO116L125G
MOUNTING.....: SURFACE
NUMBER OF SPACES.....: SIXTEEN (16)
MAINS RATING.....: 125 AMPERE
MAINS TYPE.....: CONVERTIBLE

37 1 CCB.COVER000002 CB.COVER.SQ-D.QOC16US

CIRCUIT BREAKER DISTRIBUTION PANEL INDOOR COVER WITH DOOR FOR SURFACE MOUNT PANEL
WITH TWELVE (12) SPACES,
MANUFACTURER.....: SQUARE D
CATALOG NUMBER.....: QOC16US

38 16 CCB.PLUG_000021 CB.PLUG.SQ-D.QO.1P.15A.RING

CIRCUIT BREAKER, PLUG-IN TYPE, SUITABLE FOR USE WITH RING TERMINALS,
MANUFACTURER.....: SQUARE - D
CATALOG NUMBER.....: QO115-5237
NUMBER OF POLES.....: SINGLE POLE
AMPERE RATING.....: 15 AMPERE
INTERRUPT RATING.....: 10,000 AMPERE RMS

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009 Main Control Panel			(continued)			

Release: 900E Main Control Panel

39 2 CPWRS____000043 PWRS.ACOP.A24MT550 - L

SINGLE OUTPUT, REGULATED, DC POWER SUPPLY WITH UNDER / OVER VOLTAGE CONTACT,
MANUFACTURER.....: ACOPIAN
CATALOG NO.....: A24MT550 - L
INPUT VOLTAGE.....: 120 VOLTS AC, 60 HZ
OUTPUT #1.....: 24 VDC /5.5 AMPS
INCLUDED OPTION 1.....: UNDER / OVER VOLTAGE ALARM CONTACT

40 2 CPWRS____000028 PWRS.ACOP.MOUNTING

MOUNTING KIT,
MANUFACTURER.....: ACOPIAN
CATALOG NO.....: GB-8

41 2 CDESC.GEN000041 DIODE.6A.50PIV

RECTIFIER DIODE, 6 AMP FORWARD CURRENT, 50 PIV, AXIAL LEADS

42 4 CFUSE.HLD000007 FUSE.HLD.BUSS.S-8301-10

FUSE HOLDER WITH SCREW TERMINALS, 10 POLE,
MANUFACTURER.....: BUSSMANN OR EQUAL
CATALOG NUMBER.....: S-8301-10
NUMBER OF POLES.....: TEN
VOLTAGE RATING.....: 600 VOLTS
MAXIMUM CURRENT.....: 30 AMPS
FUSE TYPE.....: 1/4" X 1-1/4"
MOUNTING.....: SURFACE

43 50 CFUSE____000006 FU.1/4inch.AGC-125mA

FAST ACTING GLASS FUSE,
MANUFACTURER.....: BUSSMANN OR EQUAL
CATALOG NO.:.....: AGC-1/8
TYPE:.....: GLASS
SIZE.....: 1/4" X 1-1 /4"
CURRENT RATING.....: 125 mA
VOLTAGE RATING.....: 250 VOLTS

44 5 CFUSE____000005 FU.1/4inch.AGC-750mA

FAST ACTING FERRULE FUSE
MANUFACTURER.....: BUSSMANN OR EQUAL
CATALOG NO.:.....: AGC-3/4

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

```
TYPE:.....: AGC
SIZE.....: 1/4INCH X 1 1 /4 INCH
CURRENT RATING.....: 750mA
VOLTAGE RATING.....: 250 VOLTS
```

45 10 CSIG.I/I_000017 ACROMAG.270I

```
SIGNAL ISOLATOR , TWO WIRE, INPUT LOOP POWERED, DIN-STYLE,
MANUFACTURER.....: ACROMAG
CATALOG NUMBER.....: 270i-20MA-DIN-NCR
ENCLOSURE RATING.....: NEMA 1
INPUT SIGNAL.....: 4-20mA DC INTO 50 OHMS
OUTPUT SIGNAL.....: 4-20mA DC INTO 600 OHMS
POWER SUPPLY.....: 12 TO 50 VDC FROM INPUT LOOP
TAG NUMBERS:
FY-5520, PDY-5521, PDY-5500, TY-5501, PDY-5510, TY-5511, FY-5540, PDY-5541, FY-5560,
PDY-5561
```

46 56 CTB.TB___000002 TB.GE.CR151B2

```
TERMINAL BLOCK
MANUFACTURER.....: GENERAL ELECTRIC
CATALOG NUMBER.....: CR151-B2
POINTS.....: TWELVE
```

47 1 CNAMEPLT_000001 LARGE GRAVER NAMEPLATE A-5855

```
LARGE GRAVER NAMEPLATE
"GRAVER WATER - DIVISION OF THE GRAVER COMPANY"
(INVENTORY ITEM NO. 0176703)
```

48 1 CDISC.SW_000014 DS.SQD.QO2000NS Main Disconnect

```
MOLDED CASE DISCONNECT SWITCH,
MANUFACTURER.....: SQUARE D
CATALOG NUMBER.....: QO2000NS
ENCLOSURE RATING.....: GENERAL PURPOSE
CURRENT RATING.....: 120 / 240 VAC - 100 AMP
POLES.....: 2 POLES WITH NEUTRAL BUS
```

49 10 CFUSE____000039 FU.BUSS.KTK-R-7

```
LOW VOLTAGE, BRANCH RATED FUSE,
MANUFACTURER.....: BUSSMANN OR EQUAL
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001009	Main Control Panel		(continued)			

Release: 900E Main Control Panel

```
CATALOG NO.:.............: KTK-R-7
TYPE:....................: CLASS CC REJECTION-STYLE  FUSE
SIZE.....................: 13/32" X 1.5"
CURRENT RATING...........: 7 AMP
VOLTAGE RATING...........: 600 VOLT
```

50 3 CFUSE.HLD000014 FUSE.HLD.BC6033S

```
CLASS CC FUSE HOLDER,  THREE POLE,
MANUFACTURER.............: BUSSMANN OR EQUAL
CATALOG NUMBER...........: BC6033S
NUMBER OF POLES..........: THREE
VOLTAGE RATING...........: 600 VOLTS
MAXIMUM CURRENT..........: 30 AMPS
FUSE TYPE................: KTK-R, FNQ-R
MOUNTING.................: SURFACE
```

Release: 950E Main Control Panel

1 1 CCPU.WORK000013 WORKSTATION.TR5190

```
INDUSTRIAL. PANEL MOUNT WORKSTATION WITH INTEGRAL DISPLAY,  TOUCHSCREEN, AND TWO
100/1000 Mbps ETHERNET PORTS,
MANUFACTURER.............: TRANSDUCTION
CATALOG NUMBER...........: TR-5190-PM
ENCLOSURE RATING.........: NEMA 4 BAKED EPOXY - BLACK
DISPLAY TYPE / SIZE......: 19" TFT LCD SCREEN
DISPLAY RESOLUTION.......: 1280 X 1024 PIXELS (XGA)
MICROPROCESSOR...........: PENTIUM P4
RANDOM ACCESS MEMORY.....: 2  GBYTES DRAM
HARD DRIVE (MINIMUM).....: TWO (2) 160 GBYTE, SEAGATE, 7200 RPM
CD ROM DRIVE (MINIMUM)...: LG CD/DVD-R/W
POWER SUPPLY.............: 100 TO 240 VOLTS, 47 TO 63 HZ
CHASSIS SLOTS / TYPE.....: 2 ISA SLOTS,  4 PCI SLOTS, 1 SBC SLOT
PORTS....................: 1 PARALLEL, 2 SERIAL, 2 USB, 1SVGA, 2-PS/2
OPERATING SYSTEM SOFTWARE: MICROSOFT WINDOWS XP PROFESSIONAL
INCLUDED OPTION 1........: IDE RAID CONTROLLER W/ 2 SEAGET DRIVES
INCLUDED OPTION 2........: THREE YEAR WARRANTY
```

2 1 CCPU.KEY_000007 CPU.KEY.TIP.PM-2000-TB-USB

```
INDUSTRIAL KEYBOARD WITH FULLY SEALED TRACKBALL,
MANUFACTURER.............: IKEY
```

Customer Indented B/M for Project 13486 SAN JUAN GENERATING STATION
WATERFLOW, NM

Item	Qty	Part No.	Description	Drawing No.	Tag	Used On
J13486001010	Operator Interface Station		(continued)			

Release: 950E Operator Interface Station

```
CATALOG NUMBER.....: PM-2000-TB-USB
ENCLOSURE RATING.....: NEMA 4, 4X, 12 AND 13
INTEGRAL MOUSE TYPE.....: FULLY SEALED TRACKBALL
KEYBOARD CONNECTOR TYPE..: 10 FOOT USB CABLE
MOUSE CONNECTOR TYPE.....: 10 FOOT USB CABLE
MOUNTING.....: PANEL MOUNT WITH GASKETED MTG FLANGE
```

3 1 CSOFT.MMI000044 INTOUCH.10.1.RT.KEYLESS.3k

```
HUMAN-MACHINE INTERFACE GRAPHICS PACKAGE FOR RUN-TIME ENVIRONMENTS, FURNISHED WITH
I/O SERVER,
MANUFACTURER.....: INVENSYS, INTOUCH, VERSION 10.1
OPERATING SYSTEM SOFTWARE: WINDOWS 7, WINDOWS XP
MEDIA TYPE.....: CD-ROM
SOFTWARE ACTIVATION TYPE.: KEYLESS
MAXIMUM NUMBER OF TAGNAME: 3,000 TAGS
INCLUDED OPTION 1.....: FURNISHED WITH I/O SERVER PACK
REGISTRATION CLIENT'S NAM: PUBLIC SERVICE OF NEW MEXICO
REGISTRATION ADDRESS LINE: SAN JUAN GENERATING STATION
REGISTRATION ADDRESS LINE: COUNTRY ROAD 6800
REGISTRATION CITY, STATE.: WATERFLOW, NM 87421
REGISTRATION COUNTRY.....: USA
REGISTER TO (PERSON).....: CURTIS JONES
PHONE.....: 505-598-7638
```

4 1 CSOFT.GEN000019 SOFT.GEN.SNAGIT.V10.0

```
WINDOW SCREEN PRINTING UTILITY
MANUFACTURER.....: TECHSMITH
CATALOG NUMBER.....: SNAGIT-32 VERSION 10.0
OPERATING SYSTEM SOFTWARE: WINDOWS 2000 / XP / VISTA
MEDIA TYPE.....: CD-ROM
```

1. RECOMMENDED SPARE PARTS LIST

1.1. CUSTOMER SERVICE

Graver Water Systems is an ISO 9001:2008 certified organization dedicated to meeting the requirements of our customers.

1.1.1. AFTERMARKET PARTS

Graver Water Systems Aftermarket Parts Department is equipped to help determine and supply replacement parts for your recently purchased Graver Water Treatment System. Our U.S. based customer service representatives are also able to find and supply parts for older Graver (formerly Ecodyne Corporation, Graver Water Division) Water Treatment systems as well as many of our competitors' designs. Knowledgeable customer service representatives coupled with historical archives dating back more than 50 years make our aftermarket parts department your single source for parts and information.

CONTACT US AT:

SPAREPARTS@GRAVER.COM

PHONE(TOLL FREE):***1-877-472-8379 (GRAVERW)***

FAX: ***908-516-1401***

1.1.2. SERVICE

Graver Water has a fully staffed service department of experienced service engineers available upon request to start-up or troubleshoot your water treatment system. Whether it's chemical, mechanical, electrical, or PLC related, our service department is available to assist you.

Graver's support services include:

- Start-up
- Commissioning
- Erection supervision
- Training
- Equipment evaluation and upgrade / replacement recommendations

CONTACT US AT:

SERVICE@GRAVER.COM

PHONE(TOLL FREE):***1-877-472-8379 (GRAVERW)***

FAX: ***908-516-1401***

2. DRAWINGS

When referring to drawings Graver water systems utilizes a numbering system that allows easy identification of specific drawings. Drawings are identified by the Graver project number, discipline and sheet size. A secondary identifier number is used to provide an accurate description of what is contained on the drawing followed by the number of pages and the revision number. For example: **13486-T-A-3000-001-Rev A**

13486- This is the Graver assigned Project number for Public Service of New Mexico, San Juan Generating Station

T – Indicates the document or drawing is from the Technical discipline

A – Indicates the drawing or document is designed for ANSI A size paper (8 ½ x 11)

3000 – Indicates it is a process description document

001 – Indicates the sheet of the drawing or the volume for manuals and technical documentation.

Rev A – Indicates it is the first or A revision of the document.

TABLE 11.1 DRAWING NUMBERING TABLE: ELECTRICAL ENGINEERING

GRAVER JOB NUMBER	DISCIPLINE	ANSI SHEET SIZE	SECONDARY IDENTIFIER RANGE	SECONDARY IDENTIFIER DESCRIPTION
	E – Electrical Engineering	**A** (8½"x 11")	1000- 1099	**Layout & Details – Control Panel**
		B (11"x 17")	1100- 1699	**Specification- Control Panel**
		C (17" x 22")	1700- 1799	**Procedure-Configuration (PC,Software, etc.)**
		D (22" x 34")	1800- 1899	**Screens –HMI/DCS**
		E (34"x 44")	1900- 1999	**Procedure – Testing & Reports (FAT &SAT)**
			2000- 2099	**Schematic Wiring Diagram**
			2100- 2999	**I/O List**
			3000- 3499	**Data Cut Sheets**
			3500- 3899	**Instrument Loop Diagrams**
			3900- 3999	**Instrument List**
			4000- 4099	**Logic Diagrams**
			4100- 4999	**Control Philosophy**
			5000- 5099	**Field Termination Diagram**
			5100- 5999	**Field Wired Device List**
			6000- 6099	**Layout & Details – Solenoid Valve Cabinet**
			6100- 6499	**Specification-Solenoid Valve Cabinet**
			6500- 6999	**Local Cabinets**
			7000- 7099	**Assembly Drawings**
			7100- 7199	**Specification-Assembly**
			7200- 7999	**Installation Details**
			8000- 8099	**Racks**
			8100- 8999	**Specification-Racks**
			9000- 9999	**Miscellaneous**

TABLE 11.2 DRAWING NUMBERING TABLE: MECHANICAL ENGINEERING

GRAVER JOB NUMBER	DISCIPLINE	ANSI SHEET SIZE	SECONDARY IDENTIFIER RANGE	SECONDARY IDENTIFIER DESCRIPTION
	M – Mechanical Engineering	**A** (8 ½ "x 11")	0100- 0109	**Process & Instrumentation Diagram (P&ID)**
		B (11"x 17")	0110- 0119	**Plot Plan**
		C (17" x 22")	0120- 0129	**Hydraulic Profile**
		D (22" x 34")	0130- 0999	**Not Used**
		E (34"x 44")	1000- 1249	**Reactivator**
			1250- 1299	**Thickener**
			1300- 1499	**Sugar Clarifier**
			1500- 1599	**Lamella Clarifier**
			1600- 1999	**Lamella Thickener**
			2000- 2249	**Gravity Filter**
			2250- 2449	**Pressure Filter**
			2500- 2749	**Storage Tank**
			2750- 2999	**Degasifier/Aerator/Deaerator**
			3000- 3249	**Vessel – Other (Non-Pressure Vessel)**
			3250- 3499	**Deep Bed CP- Service Vessel**
			3500- 3749	**Deep Bed CP- Regeneration Vessel**
			3750- 3999	**Powdex/AFA- Service Vessel**
			4000- 4249	**Powdex/AFA- Air Surge Tank**
			4250- 4499	**Precoat Skid**
			4500- 4749	**Resin Trap**
			4750- 4999	**Hot Water Tank**
			5000- 5249	**Deaerating Heater**
			5250- 5499	**IX Softener/Demineralizer**
			5500- 5749	**Oil Coalescer**
			5750- 5999	**Hot Process Softener**
			6000- 6249	**Pressure Vessel - Other**
			6250- 6499	**Chemical Feed Skid**
			6500- 6749	**Chemical Dilution Skid**
			6750- 6999	**Pump/Blower Skid- Non Chemical Feed**
			7000- 7249	**Skid- Other**
			7250- 7499	**Piping**
			7500- 7749	**Platforms, Supports & Structural Elements**
			7750- 7999	**Sludge Dewatering Equipment**
			8000- 8249	**Data Sheets/Lists**
			8250- 8499	**Specifications**
			8500- 9999	**Other/Special/Miscellaneous**

TABLE 11.3 DRAWING NUMBERING TABLE: QUALITY ASSURANCE-QUALITY CONTROL

GRAVER JOB NUMBER	DISCIPLINE	ANSI SHEET SIZE	SECONDARY IDENTIFIER RANGE	SECONDARY IDENTIFIER DESCRIPTION
	Q – Quality Assurance-Quality Control	**A** (8 ½ "x 11")	1000- 1999	**Inspection & Quality Plans**
		B (11"x 17")	2000- 2999	**Weld Procedures**
		C (17" x 22")	3000- 3999	**Test Procedures**
		D (22" x 34")	4000- 4999	**Test Reports/ Data**
		E (34"x 44")	5000- 9000	**Miscellaneous**

TABLE 11.4: DRAWING NUMBERING TABLE: TECHNICAL-PROCESS ENGINEERING

GRAVER JOB NUMBER	DISCIPLINE	ANSI SHEET SIZE	SECONDARY IDENTIFIER RANGE	SECONDARY IDENTIFIER DESCRIPTION
	T– Technical Process Engineering	**A** (8 ½ "x 11")	1000- 1999	**Sequence Charts**
		B (11"x 17")	2000- 2999	**Process Calculations/Process Definition Documents**
		C (17" x 22")	3000- 3999	**Process Descriptions**
		D (22" x 34")	4000- 4999	**Specifications**
		E (34"x 44")	5000- 9000	**Miscellaneous**

TABLE 11.5: DRAWING NUMBERING TABLE: PROJECT ADMINISTRATION

GRAVER JOB NUMBER	DISCIPLINE	ANSI SHEET SIZE	SECONDARY IDENTIFIER RANGE	SECONDARY IDENTIFIER DESCRIPTION
	P – Project Administration	**A** (8 ½ "x11")	1000- 1999	**Project Schedule**
		B (11"x 17")	2000- 2999	**Drawing Lists**
		C (17" x 22")	3000- 3999	**Reports**
		D (22" x 34")	4000- 4999	**Material/Shipping Lists**
		E (34"x 44")	5000- 9000	**Miscellaneous**

TABLE 11.6: MECHANICAL ENGINEERING DRAWINGS

DRAWING NUMBER	DESCRIPTION	REV
13486-M-A-8500	**SPECIFICATION:** PIPING	A
13486-M-D-0100-001	**FLOW DIAGRAM:** POWDEX VESSEL	C
13486-M-D-0100-002	**FLOW DIAGRAM:** POWDEX VESSEL	C
13486-M-D-0110	**PLOT PLAN:** POWDEX FILTER SYSTEM	B
13486-M-D-3751-001	**OUTLINE:** POWDEX FILTER VESSEL	C
13486-M-D-4000-001	**OUTLINE:** AIR SURGE TANK	A
13486-M-D-3750-001	**ASSEMBLY:** POWDEX VESSEL SKID	C
13486-M-D-3750-002	**ASSEMBLY:** POWDEX VESSEL SKID	C
13486-M-D-3750-003	**ASSEMBLY:** POWDEX VESSEL SKID	C
13486-M-D-4250-001	**ASSEMBLY:** ADVANCED PRECOAT SKID	C
13486-M-D-3754	**ASSEMBLY:** POWDEX VESSEL INTERNALS	C
13486-M-D-4253-001	**LAYOUT:** LOADING PLATFORM	D
13486-M-D-0100-003	**FLOW DIAGRAM:** PRECOAT & AIR SURGE TANK	C
13486-M-D-3750-004	**ASSEMBLY:** POWDEX VESSEL SKID	C

TABLE 11.7: ELECTRICAL ENGINEERING DRAWINGS

DRAWING NUMBER	DESCRIPTION	REV
13486-E-A-7100	Specification: Electrical and Pneumatic Assembly	B
13486-E-A-1100	Specification: Main Control Panel	B
13486-E-D-1000-001	Layout and Details: Main Control Panel-Front Elevation	B
13486-E-D-1000-002	Layout and Details: Main Control Panel-Plan View	B
13486-E-D-1000-003	Layout and Details: Main Control Panel-L&R Side Elevations	B
13486-E-D-1000-004	Layout and Details: Main Control Panel-Int. Subpanels 1 & 2	B
13486-E-D-1000-005	Layout and Details: Main Control Panel-Int. Subpanels 3 & 4	B
13486-E-D-1000-006	Layout and Details: Main Control Panel- Equipment List	B
13486-E-D-2000-001	Schematic Wiring Diagram- Control Power Dist. System	B
13486-E-D-2000-002	Schematic Wiring Diagram- DC Power supplies	B
13486-E-D-2000-003	Schematic Wiring Diagram- PLC System & Network Diagram	B
13486-E-D-2000-004	Schematic Wiring Diagram- PLC Power Supply -I/O Card	B
13486-E-D-2000-005	Schematic Wiring Diagram- Racks 2 & 3 I/O card Loading	B
13486-E-D-2000-006	Schematic Wiring Diagram- Analog Loop & Valve Control	B
13486-E-D-2000-007	Schematic Wiring Diagram- Analog Loops	B
13486-E-D-2000-008	Schematic Wiring Diagram- Valve Control (Sht 1)	B
13486-E-D-2000-009	Schematic Wiring Diagram- Valve Control (Sht 2)	B
13486-E-D-2000-010	Schematic Wiring Diagram- Analog Inputs (Sht 1)	B
13486-E-D-2000-011	Schematic Wiring Diagram- Analog Inputs (Sht 2)	B
13486-E-D-2000-012	Schematic Wiring Diagram- Vessel A Valve Control (Sht 1)	B
13486-E-D-2000-013	Schematic Wiring Diagram- Vessel A Valve Control (Sht 2)	B
13486-E-D-2000-014	Schematic Wiring Diagram- Vessel A Valve Control (Sht 3)	B
13486-E-D-2000-015	Schematic Wiring Diagram- Analog Loops (Sht 1)	B
13486-E-D-2000-016	Schematic Wiring Diagram- Analog Loops (Sht 2)	B
13486-E-D-2000-017	Schematic Wiring Diagram- Bypass Valve Control	B
13486-E-D-2000-018	Schematic Wiring Diagram- Swing Vessel Isolation Valve	B
13486-E-D-2000-019	Schematic Wiring Diagram- Analog Loops (Sht 1)	B
13486-E-D-2000-020	Schematic Wiring Diagram- Analog Loops (Sht 2)	B
13486-E-D-2000-021	Schematic Wiring Diagram- Bypass Valve Control	B
13486-E-D-2000-022	Schematic Wiring Diagram- Swing Vessel Isolation Valve	B
13486-E-D-2000-023	Schematic Wiring Diagram- Analog Inputs (Sht 1)	B
13486-E-D-2000-024	Schematic Wiring Diagram- Analog Inputs (Sht 2)	B
13486-E-D-2000-025	Schematic Wiring Diagram- Valve Control (Sht 1)	B
13486-E-D-2000-026	Schematic Wiring Diagram- Valve Control (Sht 2)	B
13486-E-D-2000-027	Schematic Wiring Diagram- Valve Control (Sht 3)	B
13486-E-D-2000-028	Schematic Wiring Diagram- Analog Inputs (Sht 1)	B
13486-E-D-2000-029	Schematic Wiring Diagram- Analog Inputs (Sht 2)	B
13486-E-D-2000-030	Schematic Wiring Diagram- Valve Control (Sht 1)	B
13486-E-D-2000-031	Schematic Wiring Diagram- Valve Control (Sht 2)	B

TABLE 11.7: ELECTRICAL ENGINEERING DRAWINGS (CONTINUED)

DRAWING NUMBER	DESCRIPTION	REV
13486-E-D-2000-032	Schematic Wiring Diagram- Valve Control (Sht 3)	B
13486-E-D-2000-033	Schematic Wiring Diagram- Motor Controls (Sht 1)	B
13486-E-D-2000-034	Schematic Wiring Diagram- Motor Controls (Sht 2)	B
13486-E-D-2000-035	Schematic Wiring Diagram- Motor Controls (Sht 3)	B
13486-E-D-5000-001	Field Termination Diagram – Terminal Blocks A & B	B
13486-E-D-5000-002	Field Termination Diagram – Terminal Blocks C & D	B
13486-E-D-6500-001	Layout and Details: Junction Box 1D Advanced Precoat	B
13486-E-D-6500-002	Wiring Diagram: Junction Box 1D Advanced Precoat	B
13486-E-D-6501-001	Layout and Details: Junction Box 1A Advanced Precoat	B
13486-E-D-6501-002	Wiring Diagram: Junction Box 1A Advanced Precoat	B
13486-E-D-6502-001	Layout and Details: Junction Box 2D Powdex Vessel A	B
13486-E-D-6502-002	Wiring Diagram: Junction Box 2D Powdex Vessel A	B
13486-E-D-6503-001	Layout and Details: Junction Box 2A Powdex Vessel A	B
13486-E-D-6503-002	Wiring Diagram: Junction Box 2A Powdex Vessel A	B
13486-E-D-6504-001	Layout and Details: Junction Box 3D Powdex Vessel B	B
13486-E-D-6504-002	Wiring Diagram: Junction Box 3D Powdex Vessel B	B
13486-E-D-6505-001	Layout and Details: Junction Box 3A Powdex Vessel B	B
13486-E-D-6505-002	Wiring Diagram: Junction Box 3A Powdex Vessel B	B
13486-E-D-7200-001	Schematic Tubing Diagram: Advanced precoat skid	B
13486-E-D-7201-002	Schematic Tubing Diagram: Vessel A	B
13486-E-D-7202-001	Schematic Tubing Diagram: Vessel B	B

TABLE 11.8: QUALITY ASSURANCE- QUALITY CONTROL DRAWINGS

DRAWING NUMBER	DESCRIPTION	REV
13486-Q-A-1000-001	Manufacturing Inspection and Quality Plan	A
13486-Q-A-2000-001	Weld Procedure/ Performance Qualification: FCAW/Semi	A
13486-Q-A-2001-001	Weld Procedure/ Performance Qualification: GMAW/Semi	A
13486-Q-A-2002-001	Weld Procedure/ Performance Qualification: GMAW/Semi	A
13486-Q-A-2003-001	Weld Procedure/ Performance Qualification: SMAW/Semi	A
13486-Q-A-2004-001	Weld Procedure/ Performance Qualification: GTAW/Semi	A
13486-Q-A-2005-001	Weld Procedure/ Performance Qualification: GTAW/Semi	A
13486-Q-A-2006-001	Weld Procedure/ Performance Qualification: SAW/Semi	A
13486-Q-A-2007-001	Weld Procedure/ Performance Qualification: SAW/Semi	A
13486-Q-A-2008-001	Weld Procedure/ Performance Qualification: FCAW/Semi	A
13486-Q-A-2009-001	Weld Procedure/ Performance Qualification: SMAW/Semi	A
13486-Q-A-2010-001	Weld Procedure/ Performance Qualification: GMAW/Semi	A
13486-Q-A-2011-001	Weld Procedure/ Performance Qualification: GTAW/Semi	A
13486-Q-A-2012-001	Weld Procedure/ Performance Qualification: GMAW/Semi	A