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VEOLIA

Installation, Operation and Maintenance Manual

Actiflo® Package Plant

Document No: IOM_0001_ACP

Révision: 01 -- Date: October 2016

WATER TECHNOLOGIES

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1 INTRODUCTION

This document describes the functions of the various components of the Actiflo® Package Plant clarifier, describes the procedures for the installation, start-up and standard operation of the system. It also plans preventive maintenance measures and describe procedures for the regular maintenance of the equipment.

The components of the Actiflo® Package Plant clarifier are supplied by Veolia Water Technologies Canada (VWTC). This equipment of superior quality and proven design will insure years of operation without problems. However, in order to maintain peak efficiency and performance of the system, it is imperative to take into consideration the preventive measures and procedures described in this manual. These measures include the operation and maintenance of its components.

To obtain any additional information regarding characteristics, operation or maintenance of this equipment, or if a problem persists, please do not hesitate to contact us.

The Actiflo® system is manufactured in Canada by:

Veolia Water Technologies Canada
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: 514-334-7230
Fax: 514-334-5070

For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada – After Sales Support
1-844-SER-VWT9 | 1-844-737-8989 | vwtservicecanada@veolia.com

Our business hours are from
Monday to Friday
8:30am to 5pm EST

1.1 OBJECTIVES OF THIS MANUAL

- Describe the installation of the unit and its ancillary components.
- Describe and explain the functions of the various components of the Actiflo® clarifier and reaction tanks, if installed.
- Describe the procedure for the start-up and standard operation of the system.
- Plan preventive maintenance measures and describe procedures for the regular maintenance of the equipment.

1.2 SAFETY

Operation of the Actiflo® system should be done by qualified personnel only.

It is imperative to ensure the security of all operators during the operation and maintenance of all mechanical equipment. In order to avoid accidents, it is important to determine the correct way to proceed and conveniently select appropriate clothing for the job. All workers having access to the equipment must scrupulously respect all the standard rules of safety as well as the precautions described in this manual.

Workers, which are directly responsible for the operation and maintenance of the equipment, must be aware of standard rules of safety.

The following safety rules should be followed:

- Safety devices such as handrail and belt guards should be installed and inspected regularly.
- Access to the building should be limited to authorize personnel only.
- Non-authorized personnel must never approach rotating shafts, connections, etc., in order to avoid injuries.
- The owner should implement a safety program and provide training for operation staff.
- Material Safety Data Sheets (MSDS) should be available for each chemical product.
- Appropriate protective gear including safety glasses, hard hat, boots, gloves, and ear protection should be worn at all times.

Protection systems or any other type of safety device supplied by the manufacturer must be carefully installed. If these are not supplied by the manufacturer, the user must supply and install the safety devices necessary for the protection of employees responsible for the operation of the equipment.

WARNING: The lamella pack is pre-installed in the settling tank section of the Actiflo® clarifier. It is made of a very flammable material. Do not expose it to open flames or sparks. Do not allow any welding works nearby unless special precautions have been taken.

WARNING: The operation staff should be aware that coagulant is highly corrosive and polymer solution can be very slippery. Spills should be cleaned immediately according to the MSDS instructions.

WARNING: The microsand may contains fine particles of silica. Therefore, it must be handle safely and with caution by qualified staff. Consult the MSDS for further instructions.

1.3 STANDARDS

Unless specified otherwise, the equipment described in this manual is consistent with the most recent construction standards that are applicable, including:

American Society of Mechanical Engineers	ASME
Canadian Standards Association	CSA
Canadian Electrical Manufacturers Association	CEMA
National Electrical Manufacturers Association	NEMA
American Society for Testing and Materials	ASTM
American National Standard Institute	ANSI

Table 1: List of applicable standards

1.4 MODIFICATIONS DONE BY THE CLIENT

Please note that it is mandatory to contact Veolia Water Technologies Canada Inc. before undertaking any modification work to the equipment supplied in this project. In fact, any alteration made to any equipment (mechanical, control, computers, etc.) without prior notification and consent by VWTC voids the warranty of the mentioned equipment. Furthermore, the client is responsible for any additional cost necessary to restore the equipment to its original state.

1.5 FIELD INSTALLATION – PAINT PROTECTION

IMPORTANT NOTE TO CONTRACTORS

You are about to install Actiflo® Package Plant unit and is related equipment. Veolia Water Technologies Canada Inc. wants to warn you about potential problems related to installation of large steel units protected against corrosion by paint.

VWTC maintains a comprehensive quality program to prevent equipment from being affected by corrosion. Our fabrication methods are specially adapted to manufacturing of painted equipment. Every step of our fabrication and assembly process is checked to reduce corrosion issues. Each unit is also delivered under strict measures, meant to reduce potential corrosion problems and long product life.

However, we have identified that handling unit at job site is a key element of corrosion protection process. This operation completely escapes our control and is your responsibility. Consequently, we invite you to perform a thorough review of your installation procedures before handling VWTC products. Protecting units during and after installation is paramount to maintain corrosion risks to a bare minimum.

Likewise, after installation of units, you must insure complete equipment protection from working environment before unit is put into service. This will prevent damages caused by work not related to VWTC products taking place on site. Contractor is responsible for installation of any additional protection necessary at job site.

In order to maintain quality products free of defects, VWTC requests from contractor, that he takes all necessary measures to reduce risks of paint or equipment damage leading to steel corrosion. Among most important protection measures of paint protection, here are the principal ones:

- Making all men, working close to units, conscious of paint fragility and potential corrosion problems. Please encourage them to act with extreme care while working around installation.
- Protecting units from weld projection or falling debris, by covering unit with adequate plastic or cardboard hoods and padding.
- Protecting unit's tank bottom when installing mixers or other equipment inside unit.
- Keeping area and unit clean at all times.

All measures taken by contractor to insure paint protection will assure transfer to client of a quality product and will benefit to all.

1.6 WARRANTY

All equipment manufactured by **Veolia Water Technologies Canada Inc.** (herein defined as "Veolia Canada") is guaranteed to be free from defects in material and workmanship for a period of twelve (12) months from the date at which unit is placed in service, eighteen (18) months from the date of shipment, whichever occurs first. All equipment found with defects during this period will be replaced at

no extra charge when shipped prepaid FOB to the manufacturer's shop. All parts sold by Veolia Canada are warranted the same way for a period of three (3) months from date of shipment.

If the customer promptly notifies Veolia Canada in writing of a claimed defect in the equipment and said equipment is found not to be in conformity with this warranty, Veolia Canada will, at its option and expenses, repair or replace such defective part, prepaid FOB to the manufacturer's shop.

Veolia Canada must be given notice of such defect, and, where requested, such material must be returned to the manufacturer's shop, transportation charges prepaid, with written approval for the shipment by Veolia Canada

This warranty shall be void if start-up of equipment is not authorized by Veolia Canada, or if repairs and/or alterations are made without a written authorization by Veolia Canada. If the equipment or parts supplied by Veolia Canada are altered in any way without Veolia Canada consent, the present warranty will not be valid and have no effect.

The customer will use only Veolia Canada parts for all labour covered by this warranty.

The foregoing warranty excludes responsibility or liability for:

(a) Failures not reported promptly within the warranty period, above specified.
(b) Damage due to accident, abuse, shipment, improper installation or operation, or abnormal operation condition.
(c) Damage caused by client's replacement, repair or inspection of parts.
(d) Lesion or personal accidents, material damage or any direct or indirect expenses or loss of profit related to this warranty.
(e) Damage, loss, expenses, lesion or personal accidents directly or indirectly related to the installation, the operation or the failure of the equipment supplied by Veolia Canada

The foregoing warranty is exclusive and replaces all other warranties, expressed or implied, including but not limited to any warranty of bargaining or modification for a particular purpose.

This warranty does not cover the following:

(a) Costs of repair, modification or other work done or requested by the customer or the management and all indirect costs.
(b) All expenses related to regular maintenance of parts as prescribed in the operation and maintenance manuals supplied by Veolia Canada
(c) Costs of dismantling, installation, transportation and insurance.
(d) Travelling and living expenses for the personnel carrying out the repair under such warranty.
(e) This warranty is not a performance or production warranty.

Veolia Canada has the right to examine or to ask for details about defects before empowering the present warranty.

2 RECEIVING

Preliminary field-testing, inspection, and checkout of the unit, following installation, shall be performed by a qualified representative of both the supplier and the general contractor. Tests shall be conducted to demonstrate to the engineer that all system components furnished by the equipment supplier are fully operational, that all connecting piping is leak proof and properly anchored, and that the entire system furnished by the supplier is ready for continuous safe operation. The purpose of the checkout shall be to ensure that each individual system component has been correctly installed, shall operate fully in the manner intended, and is ready to perform its function as part of an integrated system when placed in continuous operation.

MISSING EQUIPMENT/SHIPPING DAMAGE NOTIFICATION

The condition of all delivered equipment must be verified by the responsible party upon arrival at site. Verification that all equipment has been delivered as per contract must also be done upon arrival at site. Notification of missing or damaged items must be sent to Veolia Water Technologies Canada (VWTC) within 10 days of receipt of equipment. If there is no documented notification of missing or damaged parts within 10 days, VWTC is not responsible for replacement of any items found to be missing or damaged at the time of installation and start-up of the supplied equipment. It is the responsibility of the party receiving the equipment to ensure all packaging is opened at the time of receipt to uncover and document any and all damages to the Freight Company and VWTC.

Photographs and written documentation should be provided on all damaged equipment.

2.1 STORAGE

The following instructions outline the duties and responsibilities of the responsible party for equipment storage. The responsible party shall assume responsibility for the equipment upon arrival at the project site. These instructions shall define the minimum expectations for storage of all equipment.

While this storage specification taken into account common environmental issues that may affect the system during storage, common sense should be the overriding factory in determining the best method to ensure the integrity and proper storage of the VWTC equipment.

Should it be necessary to delay installation and subsequent operation of a unit for more than one month from date of shipment, special precautions must be taken. If possible, all equipment should be stored indoors in a dry and sheltered environment having a relatively constant temperature (especially for gear reducers, motors, bearings, etc.).

Air may contain excessive moisture, pollutants, microorganisms, and other particulates that accelerate the deterioration of some materials. Humidity and pollutants can produce an aggressive atmosphere.

The storage environment into which a system is placed can have a dramatic effect on the long-term usefulness of some spare parts. Key environmental factors are:

1) Temperature
2) Relative Humidity
3) Pollutants

The environmental indoor conditions should not exceed the following ranges:

Min/Max Temperature Range between:	8°- 28°C (46°- 82°F)
Relative Humidity Range between:	40% +/- 5% (RH)

A. OUTDOOR STORAGE:

Pre mounted settling or filtering tanks can be stored outside with the following storage specifications:

1) Drain water completely with special attention for sections without drain on lower point.
2) Remove all motored, electronic equipment and instruments and store them indoor (heated and ventilated area).
3) Tanks must be stored with adequate support underneath to prevent distortion and to raise equipment above any undesirable ground or floor conditions. It will also prevent flooding damages.
4) Completely cover the equipment with a tarp or similar protections shield to prevent direct exposure to the elements (dust, rain, snow, etc.). The tarp should fit tightly around the equipment to prevent accumulation beneath tarp.
5) Make sure that the plastic tarp is in perfect condition. Repair plastic tarp if needed.
6) Remove all snow, dust or water accumulation from the top of the units.

B. INDOOR STORAGE:

All other equipment have to be stored indoors in a climate controlled environment under a clean dust free non-aggressive and dry environment, including but not limited to electrical enclosures, spare parts, etc.

1) The equipment should be stored in a manner to be kept free from allowing insects, rodents, etc. from entering the equipment.
2) Cover the equipment with a tarp or similar protective shield to prevent direct exposure to dust or any other contamination. However, never enclose the unit or components totally in plastic covers; always leave adequate ventilation of air to prevent condensation.
3) Storage volume depends on the size of the project.
4) Equipment must be checked on a weekly basis for tarp/wrap integrity and accumulation.
5) To avoid damage, do NOT stack crates.
6) To avoid damage, do NOT stack enclosures.
7) Do not store spares in barns, equipment sheds or any other building without the capacity for heating and cooling as needed.

C. SPECIAL MAINTENANCE REQUIREMENTS DURING STORAGE:

Mixers, Scraper and Recirculation Pumps

Long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically (every month). Five (5) complete rotations of the output shafts are recommended each time.

Periodic checks should be made to ensure that no rusting or other damage has occurred. Should such be noted, corrective action should be quickly initiated. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position. Refer to manufacturer documentation.

All motors must be removed and store indoor (in a heated and ventilated area). All motors must be run every 3 month as a preventive measure against the formation of corrosion.

Instrumentation

All instruments must be store inside. Refer to manufacturer documentation.

Electrical Equipment and Spare Parts

It is required that all electrical equipment is stored indoors in a climate controlled environment under a clean dust free non-aggressive and dry environment, including but not limited to electrical enclosures, spare parts, etc.

1) The electrical equipment should be stored in a manner to be kept free from allowing insects/rodents from entering the equipment.
2) Completely cover the equipment with a tarp or similar protective shield to prevent direct exposure to dust or any other contamination.
3) Storage volume depends on the size of the project.
4) Equipment should be checked on a weekly basis for tarp/wrap integrity and accumulation.
5) To avoid damage, do not stack crates.
6) To avoid damage, do not stack enclosures.
7) Do not store spares in barn, equipment sheds or any other building without the capacity for heating and cooling as needed.

Others Equipments

It is recommended that tanks and pumps be stored indoors and on a raised surface to avoid flooding however if this cannot be done, they must be places on secure, high ground and meet all other specifications provided in this document. The responsible party must be sure to elevate the equipment off of the ground.

If the equipment are stored outdoor they must be kept on a high ground not susceptible to flooding and elevate the equipment at least 10 inches (250 mm) of the ground. If there is reason known to the responsible party that more than 10 inches of elevation is required, appropriate measures should be taken. Completely cover the equipment with a tarp or similar protections shield to prevent direct

exposure to the elements (dust, rain, snow, etc.). The tarp should fit tightly around the equipment to prevent accumulation beneath tarp. Equipment to be checked on a weekly basis for tarp integrity and accumulation.

To avoid possible module damage, do not stack module crates.

Equipment Cleaning

VWTC is not responsible for cleaning of any equipment prior to installation and start-up due to the storage of the equipment. This is the complete responsibility of others.

The cleaning of the equipment, if necessary, must be completed prior to the VWTC start-up technician arriving at site.

Handling

Equipment will arrive at the project site in several different shipments, from various freight companies and in several different packaging containers. Typically a flatbed truck is used which requires a fork lift or a crane to remove the various items.

Control panels are shipped in a separate crate or wrapped for protection and should be removed from the flat bed with a fork lift along with all other items. Weight dependent upon system configuration.

3 GENERAL INSTALLATION

The Actiflo® package plant may be pre-mounted. However, for freight purpose and practical reasons, the installation of some items must be completed on site by the contractor. Please find below the list of tasks that need to be performed by the contractor at job site:

- Installation should be performed by qualified contractors.
- The contractor must ensure that the necessary lifting equipment is available on site to carry out the installation.
- All nuts & bolts need to be verified, accounted for and tightened.

WARNING:	The settling tubes are very flammable, do not use any open flames near it and do not allow any welding works in the nearby area unless safety precautions have been taken. Once the settling tubes are submerged in water (normal use), this warning is no longer applicable.

- Refer to all field installation drawings for the installation of each Actiflo® unit.
- If any paint touch-ups are required, refer to documentation for recommended paint preparation and application instructions.
- After installation completion, clean the tank sections of all debris and objects that could damage the rotating mechanisms, damage pumps or clog the recirculation line.
- Microsand is supplied in 50 lbs. bags in quantities required for the first fill. Sand will be added to the maturation tank during process start up. Sand should be poured slowly once tank is filled with water. Initial sand loading should be performed with supervision of start-up personnel.

4 UNIT HANDLING

- Install each unit at the designated location at site. Lifting lugs are on top of each unit to facilitate handling and shall be removed after proper installation of Actiflo® unit in order to install the handrails.
- For equipment handling please refer to the following sketch and pictures for proper handling of the tank.
- The general contractor is responsible for the equipment unloading and handling.

WARNING: Do not use the welded lugs on Actiflo® package unit sides to lift the tank. These are for transportation purpose only.

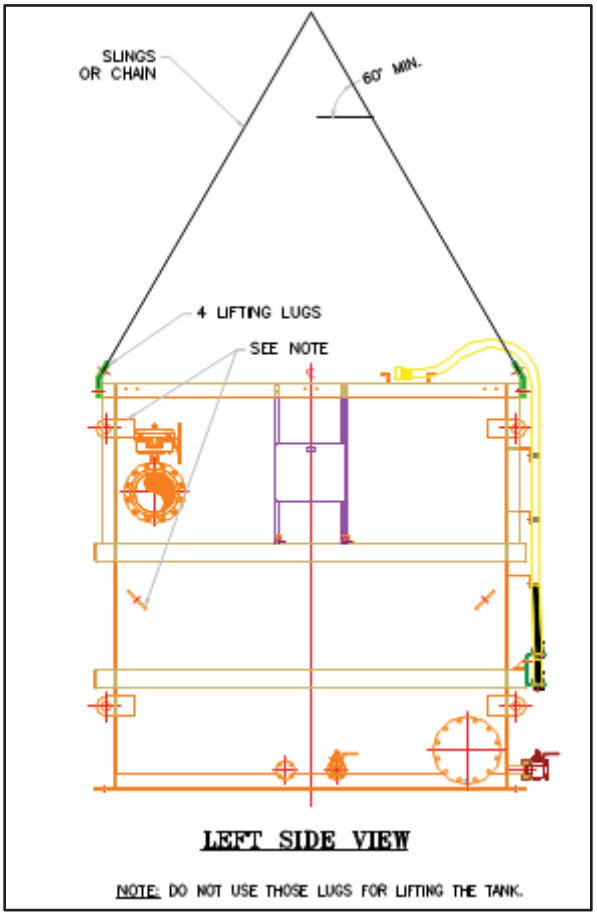


Figure 1: Actiflo® lifting lugs location

ATTENTION: DO NOT LIFT THIS WAY

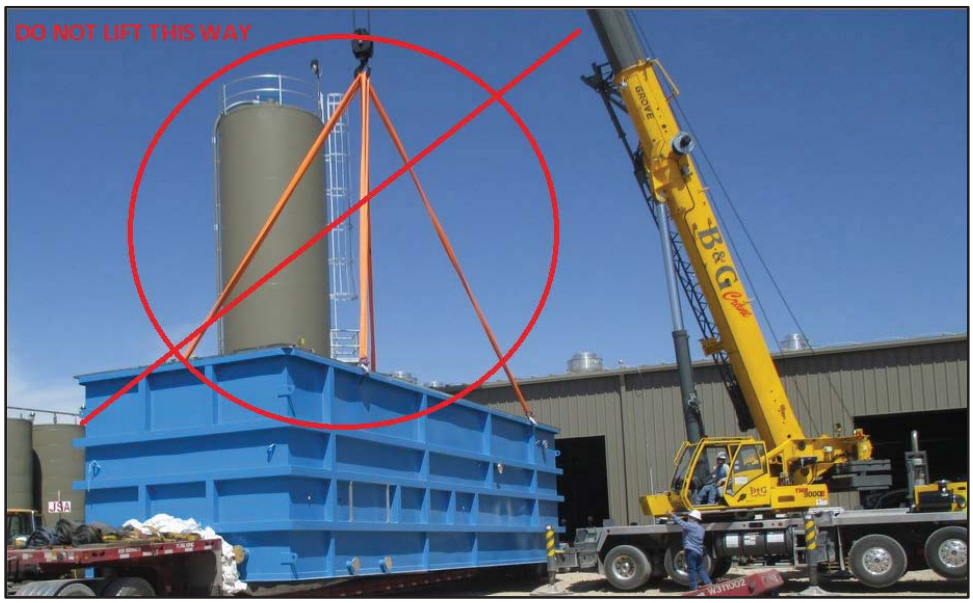


Figure 2: Actiflo® lifting (1)

PROPER LIFTING: ALWAYS HAVE AT LEAST TWO LIFTING POINTS

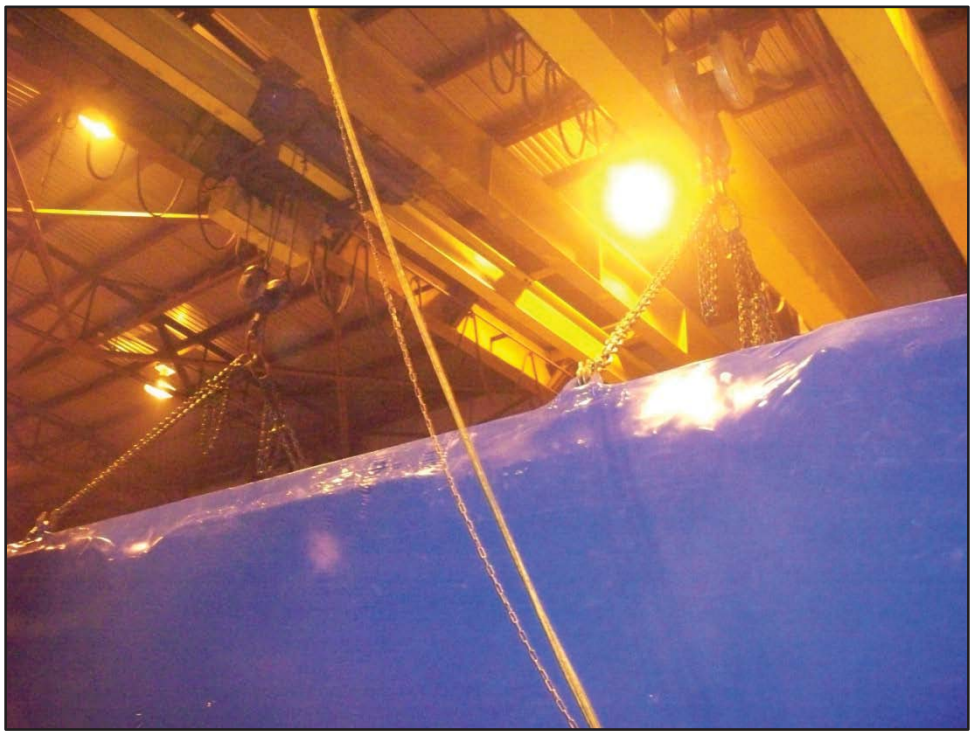


Figure 3: Actiflo® lifting (2)

Figure 4: Actiflo® lifting (3)

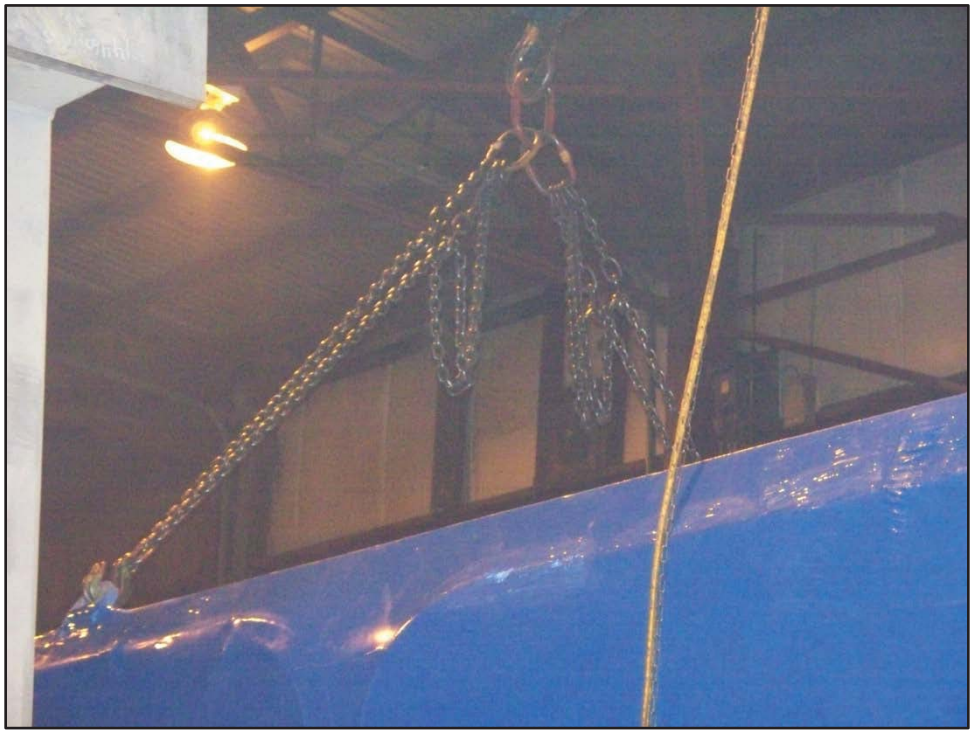


Figure 5: Actiflo® lifting (4)

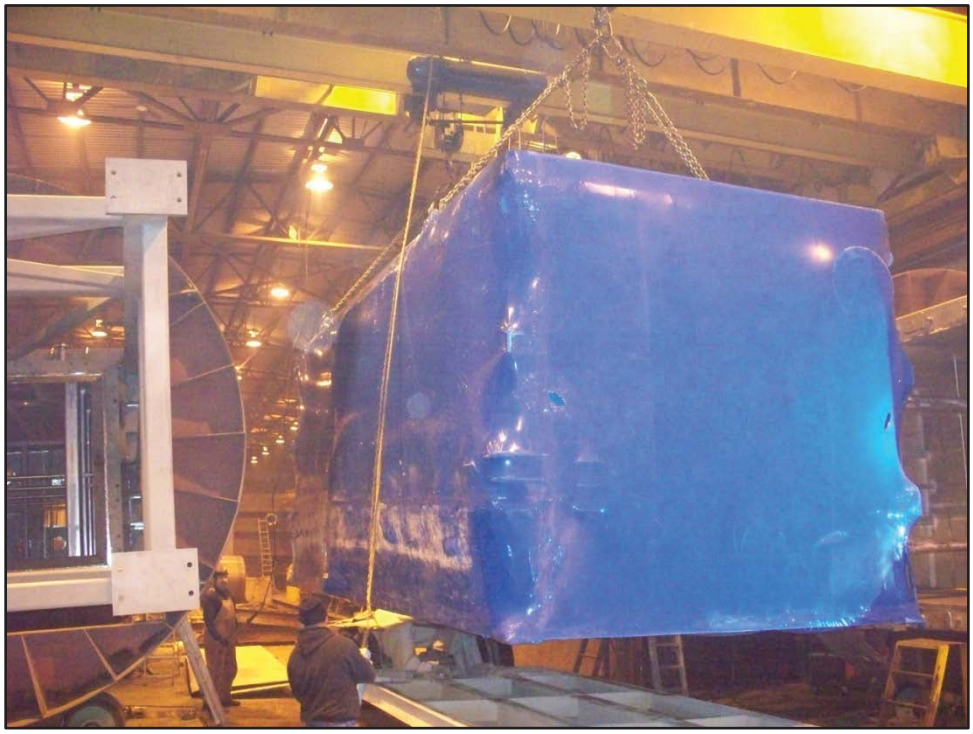


Figure 6: Actiflo® lifting (5)

4.1 LEVELING

- Unit base frame must be leveled within proper tolerance (max. 1/8” every 15 ft).

4.2 ANCHORING TO CONCRETE FLOOR

- Refer to field installation drawing for tank anchors location.
- Drill appropriate holes in concrete support piers, in line with the anchoring holes of the Actiflo® base and fasten the tank structure with anchors (may be provided by others).
- Add leveling/finishing grout under the base frame where required.

4.3 UNWRAPPING

- Unwrap the equipment and remove any temporary supports and plywood protections from the unit. Be cautious when removing instrumentation protection.

5 MECHANICAL INSTALLATION

5.1 GRATING

- Install grating on each unit. The grating may already be mounted as part of shop assembly.

5.2 HANDRAIL

- Install hand railing on each unit at the site. Please refer to the field installation drawings.

5.3 SETTLING SECTION

- Lamella packs are already installed in settling section.
- If required, be very cautious when manipulating the lamella packs in cold temperatures. They become very brittle and may break easily.

Warning: Lamella pack is highly flammable. Submerge with water as soon as possible.

5.4 TROUGH

- The troughs already installed in the settling section should be leveled using the adjustment nuts. All troughs must be at the same elevation. Tolerance should be 1/8”, so that water is distributed evenly within settling section.

5.5 SCRAPER DRIVE INSTALLATION

- Remove the transportation plate from the rake assembly.
- Lower the shaft of the rake using the eyebolt.
- Connect the rake drive to the shaft.
- Remove the eyebolt from the rake shaft.
- Add the lubricant in the primary gear box. Use Chevron lubricating oils FM Grade ISO 460 or equivalent FDA approved. Please be careful about the amount of oil that is put in the scraper drive assembly as too much oil may overflow into the tank. The oil level should correspond to about half of the height of the gear.
- Rectify alignment if necessary.
- All electrical connections must be completed.
- Rotation of the rake must be clockwise (CW).
- Ensure that there is no contact between the rake arm and the bottom of the hopper.
- Clean the tank sections of all debris and objects that could damage the rotating mechanisms.

- Inspect the recirculation inlet pipe. It should be free of any debris.

Note:	Pay particular attention to remove temporary material (wood, cardboard) at the bottom of the scraper that was used to prevent movement during transport.

5.6 HYDROCYCLONE SUPPORT

- Refer to the field installation drawings for proper hydrocyclone installation.
- Install the hydrocyclone assembly support on the maturation tank with supplied screws, nuts and washers at the site.
- Install the piping connections. It is important to drop one (1) meter (approximately 3 feet) at the sludge outlet of each hydrocyclone, to avoid backflow through hydrocyclone. Discharge of sludge pipe must not be submerged.

Note:	Disruption in hydrocyclone pressure distribution will potentially affect separations performances, hence adequate return of microsand to the process.

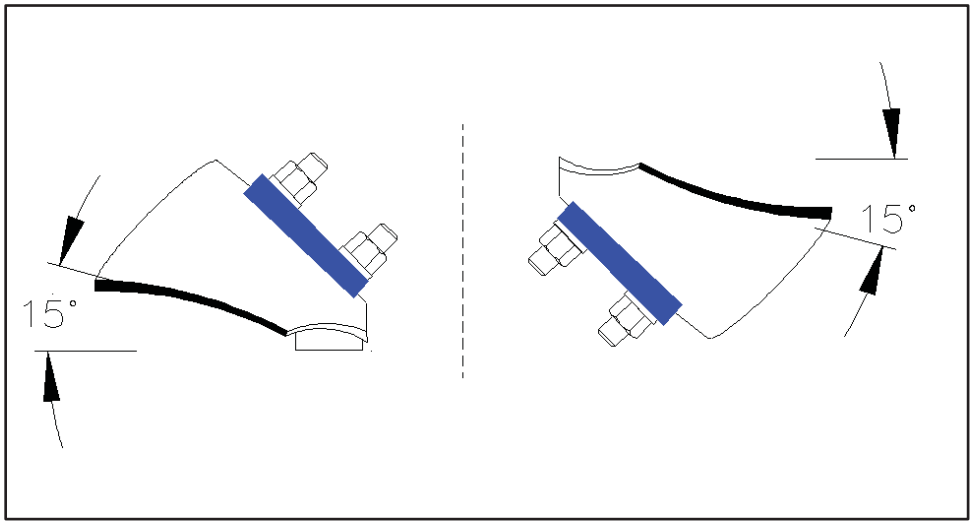
5.7 COAGULATION / INJECTION / MATURATION TANK MIXER

- Refer to field installation drawings for proper mixers installation.
- The mixers are delivered separately. The shafts are already assembled to the gear box. The contractor must assemble the impellers on the shafts at job site.
- Install the motor on the appropriate tank mixer following instructions given in the supplier's equipment manual.
- Verify the mixer blade installation and orientation.
- Verify that set screws are well tightened to secure the hub onto the shaft.
- Follow manufacturer recommendations for oil check and fill up procedure (manufacturer manual).
- All electrical connections must be completed.
- Refer to the following sketches for proper hubs installation in section 5.8.

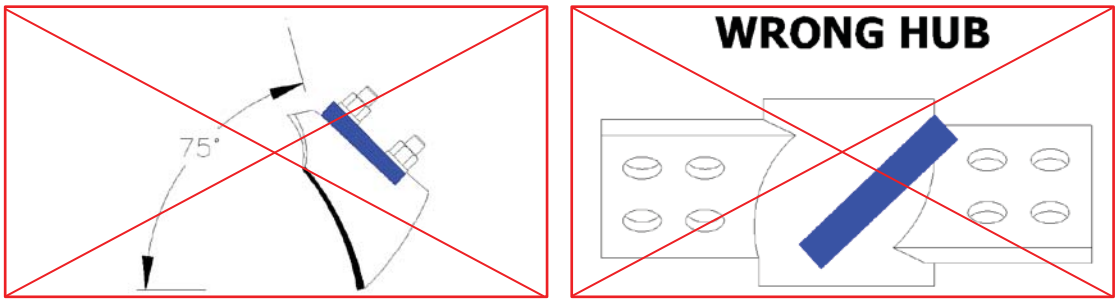
5.8 IMPELLER INSTALLATION

WARNING:

- Ensure the use of a right hub (\ ) in the tanks.
- The leading edge of the blade shall be at 15° from horizontal and not at 75°.
- The screws and nuts must be installed on the wing with nuts on the opposite side from the blade or with screw head contacting blade or on blade side.



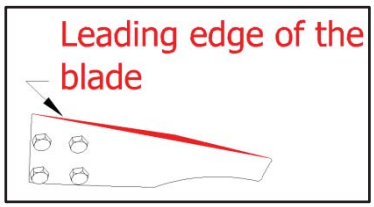
INSTALLATION: TWO POSSIBLE CHOICES



WRONG HUB INSTALLATION

Figure 7: Mixer hub installation

LEGEND	
CW-UP	Clockwise – Up
CW-DWN	Clockwise – Down
CCW-UP	Counterclockwise – Up
CCW-DWN	Counterclockwise – Down



POSSIBLE MIXER INSTALLATION:

Refer to the field installation drawings for your particular application.

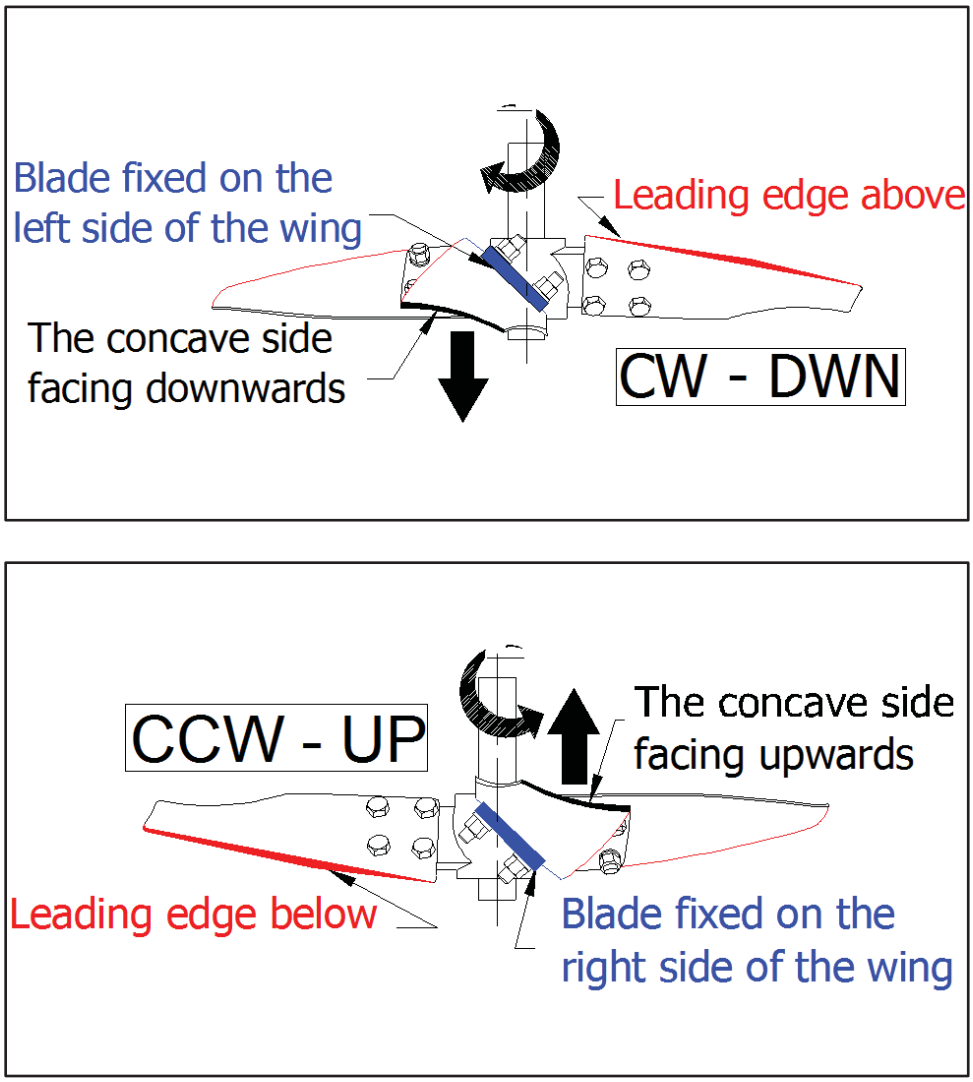


Figure 8: Mixer blade installation

5.9 STAIRS (Optional)

- Refer to field installation drawings for proper stairs installation.
- The stairs are delivered separately. The contractor must assemble and install the stairs at job site. Grout may be used underneath stairs legs to make sure that top of grating on tank matches stairs elevation.

5.10 LADDER AND SAFETY GATE (Optional)

- Install the ladder in place and fasten to unit at job site. Install the safety gate (optional) in the access opening of the ladder with the supplied screws and nuts. Refer to the field installation drawings.

6 PERIPHERAL EQUIPMENT INSTALLATION

6.1 MICROSAND RECIRCULATION PUMP SYSTEM

- Refer to field installation drawings for proper microsand recirculation pump system location and installation.
- Pump base frame must be leveled within proper tolerance.
- Drill appropriate holes in concrete floor and fasten the pump and flexible pipe supports with anchors.
- Connect the drip pan to a drain to avoid any leakage on the floor.

6.2 COAGULATION pH METER

- Refer to field installation drawings for proper coagulation pH meter installation.
- Install the coagulation pH meter with probe mounted to handrail on the settling tank side using supplied screws, nuts and washers. Refer to field installation drawings for proper location and installation.

6.3 CLARIFIED WATER TURBIDIMETER

FOR 1720E

- Install on a support on the effluent side of the tank. Refer to field installation drawings and manufacturer installation recommendations, for proper location and installation.

FOR SOLITAX

- Install the turbidimeter with probe mounted to handrail on the settling tank side using supplied screws, nuts and washers. Refer to field installation drawings and manufacturer installation recommendations, for proper location and installation.

6.4 RAW WATER TURBIDIMETER (Optional)

FOR SS7

- Install on a support beside the raw water valve. Refer to field installation drawings for proper location and installation.
- The connection and installation in the inlet piping to the sample port are by others and should respect manufacturer recommendations.

FOR SOLITAX

- Install in line pipe. Refer to field installation drawings and manufacturer installation recommendations, for proper location and installation.
- The connection and installation are by others.

6.5 RAW WATER FLOWMETER (Optional)

- Follow manufacturer installation recommendations (refer to manufacturer manual), to ensure adequate operation.

6.6 CLARIFIED WATER FLOWMETER (Optional)

- Follow manufacturer installation recommendations (refer to manufacturer manual), to ensure adequate operation.

6.7 PRESSURE SWITCH (Optional)

- Install on a support on the same side of the tank as the recirculation pump. Refer to field installation drawings and manufacturer installation recommendations, for proper location and installation.

6.8 PRESSURE TRANSMITTER (Optional)

- Install on the piping at the outlet of each recirculation pump. Refer to field installation drawings for proper location and installation.

7 PIPING CONNECTION

Note: Remove the flange protecting grease prior to the installation of the valves and pipes.

7.1 WATER COLLECTOR

- Install a pipe from the Actiflo® unit effluent flange to the clarified water collector.

7.2 TANK DRAIN

- Install a pipe from the tank drain valves to the trench drain.

7.3 SETTLED WATER TANK PARTIAL DRAIN

- Install a pipe from the pre-installed partial drain valve, located on Actiflo® effluent side, to the trench drain.

7.4 HYDROCYCLONE SLUDGE OUTLET

- Install a pipe from the hydrocyclone chamber sludge outlet flange to the trench drain.

Important: Provide sufficient pipe slope and size to prevent any backflow to the hydrocyclone chamber. It is important to drop one (1) meter (approximately 3 feet) at the sludge outlet of each hydrocyclone to avoid backflow through hydrocyclone. Discharge of sludge pipe must not be submerged.

7.5 POLYMER FEEDING

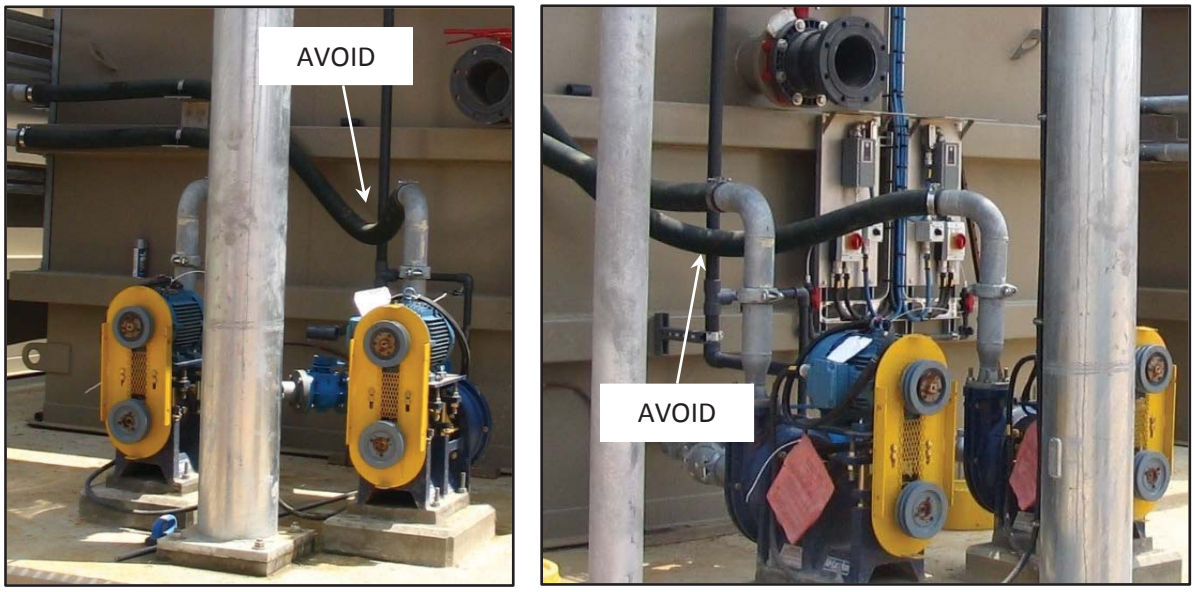
- Connect the supplied polymer injection tubing from the Actiflo® maturation and injection reservoirs to the appropriate hydrocyclone assembly support polymer distributor outlet.
- Supply polymer feeding pipe from the polymer metering pump skid outlet to the hydrocyclone assembly support polymer distributor inlet for the Actiflo® unit.

7.6 RECIRCULATION FLEXIBLE PIPE

- Refer to field installation drawings for proper recirculation pipe installation.
- Inspect the recirculation inlet pipe. It should be free of any debris.
- Connect the flexible pipe section using the connections provided.

- Pipe straps are supplied on the unit to secure the pipe along the tank wall. Install the recirculation flexible pipe in order to avoid any pipe drop that could cause sand accumulation and vibrations.
- Refer to the following pictures for proper installation.

MICROSAND RECIRCULATION PUMP ADEQUATE HOSE INSTALLATION



MICROSAND RECIRCULATION PUMP INCORRECT HOSE INSTALLATION

Figure 9: Microsand recirculation pump hose installation

7.7 CLARIFIED WATER TURBIDIMETER

FOR SS7

- Pipe the clarified water turbidimeter to an appropriate drain.
- Complete piping, if necessary, from the coupling located on the unit to the turbidimeter sampling inlet.

Important:	Provide sufficient slope to ensure correct draining. If connected to another drain line, make sure to avoid any backflow to the instrument. To avoid turbidimeter clogging, sample water piping must be connected prior to any coagulant or other viscous chemical product addition.

FOR SOLITAX

- N/A

7.8 RAW WATER TURBIDIMETER (Optional)

FOR SS7

- Pipe the raw water turbidimeter to an appropriate drain.
- Pipe the raw water turbidimeter bubble trap to appropriate sampling point connection.

FOR SOLITAX

- Refer to pipe orientation for supplied bracket to be mounted on inlet piping.

7.9 LAMELLA CLEANING SYSTEM (Optional)

- Refer to field installation drawings for proper system location and installation.
- Close all valves situated on the cleaning system conduct.
- Inspect the pipe inlet; it should be free of any debris.
- Connect the compressed air supply to pipe.
- Before feeding the system with air, reopen valves and refer to operation and maintenance manual.

8 TORQUE VALUES

BOLT	304 STAINLESS STEEL		316 STAINLESS STEEL	
SIZE	DRY	LUBRICATED	DRY	LUBRICATED
	in-lbs	in-lbs	in-lbs	in-lbs
1/4-20	75	64	79	67
1/4-28	94	80	99	84
5/16-18	132	112	138	117
5/16-24	142	121	147	125
3/8-16	236	201	247	210
3/8-24	259	220	271	230
7/16-14	376	320	393	334
7/16-20	400	340	418	355
	ft-lbs	ft-lbs	ft-lbs	ft-lbs
1/2-13	43	37	45	38
1/2-20	45	38	47	40
9/16-12	56	48	59	50
9/16-18	62	53	65	55
5/8-11	92	78	96	82
5/8-18	103	88	108	92
3/4-10	127	108	131	111
3/4-16	124	105	129	110
7/8-9	194	165	202	172
7/8-14	193	164	201	171
1 -8	286	243	299	254
1 -14	259	220	270	230
1-1/8 -7	413	351	432	367
1-1/8 -12	390	332	408	347
1-1/4 -7	523	445	546	464
1 1/4 -12	480	408	504	428
1-1/2 -6	888	755	930	791
1-1/2 -12	703	598	732	622

Table 2: Torque values for 304 and 316 stainless steel bolt

Notes:

1) Suggested maximum torque values is a guide based upon lab testing on dry or near dry fasteners wiped clean.
2) The use of this information is at sole risk of the user.
3) Values through 7/16" diameters are stated in inch-pounds; 1/2" diameter and over are stated in foot-pounds.

9 ELECTRICAL INSTALLATION

Note: Electrical work should be performed by a qualified contractor. Refer to control panel and electrical diagram for proper wiring installation.

9.1 GROUNDING

- Connect tanks earthing lugs in order to ground the tank.

9.2 CONTROL PANEL

- Supply wiring between unit (junction box optional) and the control panel.
- Supply power (575V or 460V / 3 ph / 60 Hz) to the control panel. Refer to technical datasheet.
- Before permanently wire the control panel, verify the rotation of each motor (clockwise or counter clockwise).

9.3 TANK MIXER

- Connect each mixer motor to control panel or junction box.

Warning: Never run a mixer without the tank being completely filled with water.

9.4 SCRAPER

- Connect scraper motor to control panel or junction box.

9.5 RECIRCULATION PUMP

- Connect each recirculation pump motor.

9.6 CLARIFIED WATER TURBIDIMETER

- Recommended supplier wiring instructions are given in the supplier manual.

Warning: Never cut the original cable between turbidimeter unit and its power supply unit. This cable must remain at full length.

9.7 COAGULATION pH METER

- Connect coagulation pH meter to junction box.

9.8 WATER LEVEL SWITCH

- Complete connection if any.
- Recommended supplier wiring instructions are given in the supplier manual.

9.9 RAW WATER FLOWMETER (Optional)

- Supply wiring between unit and control panel.
- Complete connection if any.
- Recommended supplier wiring instructions are given in the supplier manual.

9.10 RAW WATER TURBIDIMETER (Optional)

- Supply wiring between unit and control panel.
- Complete connection if any.
- Recommended supplier wiring instructions are given in the supplier manual.

9.11 PRESSURE TRANSMITTER (Optional)

- Supply wiring between unit and control panel.
- Complete connection if any.
- Recommended supplier wiring instructions are given in the supplier manual.

9.12 PRESSURE SWITCH (Optional)

- Supply wiring between unit and control panel.
- Complete connection if any.
- Recommended suppliers wiring instructions are given in the supplier manual.

10 ACTIFLO® CLARIFICATION PROCESS

10.1 GENERAL INFORMATION

The Actiflo® process is a compact system that will provide quality clarified water by a flocculation and high rate settling process.

Suspended particles and dissolved solids, previously destabilized with the injection of a coagulant in the raw water, are fixed to the microsand with the help of a flocculant (polyelectrolyte) added to the water. The floc being formed is subsequently separated from the water by counter-current lamellar settling with an ascending hydraulic flux.

Excellent efficiency of the Actiflo® process is reached using two proven techniques:

- Injection of microsand serves as support to the ballasted flocs and works as weight in order to create a very dense floc, thus providing a very high rate of settling.
- Lamellar settling allows increased settling surface in a reduced tank volume by using a set of inclined parallel tubes.

10.2 OPERATION PRINCIPLES

Raw water goes through four (4) successive steps that are part of the Actiflo® treatment process:

10.2.1 COAGULATION

Raw water is mixed with a coagulant using a rotating mixer in a rectangular-shaped tank. This insures a homogeneous diffusion of the coagulant in the water. The standard hydraulic retention time for this step is approximately two (2) minutes at nominal flow rate.

10.2.2 INJECTION

A precise amount of microsand and flocculant (polyelectrolyte) are added and mixed in the water using a rotating mixer in a rectangular-shaped tank. The energy induced by the mixer accelerates the contact between the flocs, the polyelectrolyte and microsand, thereby ensuring the formation of ballasted flocs. The standard hydraulic retention time for this step is approximately two (2) minutes at nominal flow rate.

10.2.3 MATURATION

The flocs previously formed are then maintained in suspension for a certain time in a large rectangular tank with the help of a rotating mechanical mixer. The smooth agitation of the water insures a gradual increase in floc size, reaching floc maturation. The standard hydraulic retention time for this step is approximately six (6) minutes at nominal flow rate.

10.2.4 COUNTER-CURRENT LAMELLAR SETTLING

Ballasted flocs precipitate to the bottom of a hopper and the clarified water is collected at the surface using troughs. The sludge is drawn out of the hopper by a pump and is directed toward a series of hydrocyclones. The hydrocyclones located above the injection tank separate the microsand from the sludge. The microsand is recirculated into the system via the underflow of the hydrocyclones while the sludge is evacuated through the overflow. The hydraulic retention time for the settling step is about three (3) minutes at nominal flow rate.

10.3 CHARACTERISTICS AND PERFORMANCES

By combining ballasted flocculation with lamellar settling, the Actiflo® process allows the system to operate at increased loading rates. This design feature can be very beneficial when raw water turbidity and flow rate vary greatly.

The Actiflo® process also accepts activated carbon dosages aimed at reducing taste and odours.

While at design flow, the time to complete all three (3) stages of treatment, i.e. coagulation / injection / maturation, is only 10 minutes. This very short hydraulic retention time enables the process to respond quickly to adjustments in chemical dosages. Ballasted flocculation produces high quality clarified water, even when operating under difficult conditions, such as very cold and/or very coloured waters or waters with a high turbidity.

Actiflo® pilot plant tests have demonstrated the efficiency of this process as well as its ability to rapidly respond to changes in raw water flow rate and/or characteristics.

11 DESCRIPTION OF COMPONENTS

11.1 ACTIFLO® CLARIFIERS

11.1.1 GENERAL DESCRIPTION

An Actiflo® clarifier is composed of coagulation, injection and maturation tanks, a lamellar settling tank with a hopper, a series of lamellar tubes and troughs for the collection of clarified water, a microsand recirculation circuit, piping and a control panel.

11.1.2 COAGULATION TANK

Raw water enters the Actiflo® at the bottom of the coagulation tank. Coagulant is added upstream of this tank to improve contact time.

The coagulation tank is equipped with a mechanical mixer composed of a shaft and a four-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is downward.

The mixer is driven by a motor and a helical gear speed reducer. It is a totally enclosed fan cooled motor (TEFC) and operates at a constant speed. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator.

A manual drainage valve, located in the coagulation tank, allows draining this tank through the existing draining network.

11.1.3 INJECTION TANK

Coagulated water enters the top portion of the injection tank by going over a flooded overflow, which communicates directly with the coagulation tank. An accurate amount of microsand and polymer is added at the tank water surface. The polymer may also be directly added in the bottom injection or maturation tanks.

The injection tank is equipped with a mechanical mixer composed of a shaft and a four-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is upward.

The mixer is driven by a motor and a helical gear speed reducer. It is a totally enclosed fan cooled motor (TEFC) and operates at a constant speed. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator.

A manual drainage valve, located in the injection tank, allows draining this tank and the maturation tank through the existing draining network.

11.1.4 MATURATION TANK

Water and flocculated solids originating from the injection tank enter at the bottom of the maturation tank through a common opening.

The maturation tank is equipped with a mechanical mixer composed of a shaft and a four-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is downward. The maturation tank is equipped with baffles to insure better mixing.

The mixer is driven by a motor and a helical gear speed reducer. It is a totally enclosed fan cooled motor (TEFC) and may operate at a constant or variable speed. An adjustment to the rotating speed can be proven necessary when the incoming water flow rate is greatly reduced. In this case, it might be advantageous to compensate for losses in hydraulic energy by increasing the speed of rotation of the maturation mixer. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator. The unit automatic shutdown sequence is also initiated.

A manual drainage located, in the injection tank, allows draining the maturation tank through the existing draining network.

11.1.5 SETTLING TANK

The settling tank is composed of a set of lamella tubes, a sludge collection system and a clarified water collector.

The water coming from the maturation tank contains a suspension of microsand-ballasted flocs and enters the settling tank after going through a vertical baffle. The solids settle in the hopper while clarified water flows through the lamella pack to the clarified water troughs.

11.1.5.1 Lamella Pack

The lamella pack consists of several polystyrene tubes positioned at an angle of 60° from horizontal plane. They are disposed in such a way that they form hexagonal-shaped cells (honeycomb). Smaller solids that did not settle directly in the hopper will deposit on the lamella pack surface and subsequently settle in the sludge collection hopper by their own weight. Clarified water flows upwards to the collection troughs and out of the clarifier.

Warning: The lamella pack is installed in the settling tank section of the Actiflo® clarifier. It is made of a very flammable material. Do not expose it to open flames or sparks. Do not allow any welding works nearby unless special precautions have been taken.

11.1.5.2 Sludge Collection Hopper

The collection of sludge takes place within a pyramidal hopper located at the base of settling tank where the settling solids are pumped to the hydrocyclones.

11.1.5.3 Circular Scraper

The settling tank has a circular scraper equipped with a stainless steel drive shaft and scrapers. Rubber scrapers are fitted onto the metal support. The scraper is mounted vertically. The scraper moves the microsand that has settled at the bottom of the hopper to its center where a basin captures the accumulated sludge. The scraper is powered by a gear motor combination. This motor is totally enclosed fan cooled (TEFC).

11.1.5.4 Clarified Water Troughs

Clarified water is collected above the lamella modules by stainless steel troughs. The dimension and position of the square-edged notches are designed in order to obtain an optimal hydraulic distribution of the flow rate inside the settling tank.

11.1.5.5 Partial Drainage

A manual valve, installed below the settling lamellas, allows for partial draining of the settling tank to facilitate the preventive maintenance of the lamellar plates.

11.1.5.6 Complete Drainage

There is two (2) ways to achieve a complete drainage of the clarifier:

1) By opening the coagulation, injection and hopper drain manual valves.
2) By opening the coagulation and injection manual drainage valves and turning the recirculation pump on.

Warning: It is important that the recirculation pump does not operate without water.

11.1.6 MICROSAND RECIRCULATION PIPING

11.1.6.1 Collection of Sludge and Microsand

Sludge containing microsand is collected in the hopper and pumped to the hydrocyclones through galvanized steel pipes and flexible non-abrasive pipes that can withstand highly abrasive conditions.

In case of clogging, a clean-out assembly is provided to backwash and flush the suction line by connecting a pressurized service water hose.

11.1.6.2 Microsand Recirculation Pumps

The clarifier is provided with a centrifugal pump (second pump optional) equipped with a pulley and drive belt arrangement. A backup pump is also supplied. The backup pump may be used to supplement the first pump if higher influent solids are experienced. The impeller and the inside of the volute are coated with a material (usually natural rubber) resistant to microsand abrasion. The motor is totally enclosed fan cooled (TEFC). In case of a thermo-mechanical overload, the motor will automatically shut down and an alarm will warn the operator.

The recirculation pump operates at a constant pressure. An increase in pressure may be caused by an obstruction of the discharge pipe and a decrease in pressure may be caused by unpriming of the pump or an obstruction of the inlet pipe. An optional pressure switch/pressure transmitter could be located at the pump discharge. If the measured pressure becomes too low, the pump stops and an alarm will warn the operator.

11.1.6.3 Hydrocyclones

The sludge and microsand are pumped by the recirculation pump to a dedicated hydrocyclone where the microsand is separated from the sludge particles. This process allows the recycling of clean microsand back into the system. Sludge-microsand separation is accomplished by a vortex effect exerting a centrifugal force on the mixture of particles.

The microsand grains, more dense than sludge particles, descend along the internal surface of the hydrocyclone, while the sludge particles ascend. The microsand is returned to the injection tank while the sludge is evacuated out of the system through the hydrocyclone overflow piping.

11.1.7 MICROSAND

The recycling of microsand into the injection tank along with the polyelectrolyte solution (polymer), serves as support for the flocs formation. The floc, ballasted with the microsand grain, becomes considerably heavier and therefore can settle more rapidly. The microsand has the following characteristics:

- Effective size: 85 µm or 135 µm (refer to technical datasheet)
- Uniformity coefficient: < 1.6
- Available in bags of 22.7 kg (50 lbs)

A small portion of the microsand is lost in the process; therefore periodic addition of microsand in the system is required. Microsand is available from VWTC.

Warning: The microsand may contains fine particles of silica. Therefore, it must be handle safely and with caution by qualified staff. Consult the MSDS for further instructions.

11.1.8 COAGULANT

The coagulant to be used can either be alum $Al_2(SO_4)_3 \bullet 14\ H_20$, PASS (Poly Aluminum Silicate Sulphate) or PAC (Poly Aluminum Chloride). It is injected at the head of the process directly into the pipe leading to the tank.

By reacting with the alkaline components of the water, the coagulant forms a precipitate, which sticks to the colloidal particles in suspension and organic components in the raw water, thereby producing a floc. In some cases, an alkali (i.e. caustic soda) must be added to the water upstream of the clarifier, prior to the addition of coagulant.

The coagulant gets rapidly dispersed in the water when it is introduced into the coagulation tank.

Warning: The operation staff should be aware that coagulant is highly corrosive. Spills should be cleaned immediately according to the MSDS instructions.

11.1.9 FLOCCULANT (POLYELECTROLYTE)

The polyelectrolyte is a white powder generally sold in 50 lbs bags. The powder is naturally hygroscopic so it must be stored in a dry environment.

Polyelectrolyte is pumped into the injection and maturation tank along with the microsand. It forms a coating on the microsand particles in order to activate them and facilitate fixing of the floc onto the sand particle surface. Other injection points of polymer can also be used, that is, at the inlet of the maturation tank and at various locations inside the maturation tank.

Warning: The operation staff should be aware that polymer solution could be very slippery. Spills should be cleaned immediately according to the MSDS instructions.

11.1.10 CONTROL PANEL

The Actiflo® clarifier operation is fully automated but manual control is possible from the control panel interface. The control panel normally includes but is not limited to components such as fuses, starters, selectors, warning lights, PLC (Programmable Logic Controller) and operator interface.

The electrical circuit of the control panel performs the necessary functions for a fully automatic operation and equipment protection of the Actiflo® unit. The control panel gives the operator access to every mechanical component of the system. In addition, all the alarms are channelled through the control panel, which in turn warns the operator in the event of equipment malfunction.

Refer to the functional description of control system in the «Electricity and Control» section of the complete operation and maintenance manual for a control panel detailed description.

12 START-UP & OPERATION

12.1 START-UP

12.1.1 PRELIMINARY VERIFICATION

Before starting the Actiflo®, the following points must be checked:

- Remove any debris from the settling tank to prevent hydrocyclone clogging.
- Every section of the Actiflo® must be filled with water.
- Valves configuration on the microsand recirculation lines is adequate.
- Chemical metering systems must be ready to operate.
- Chemical storage tanks must be full.
- Chemical metering pumps must be calibrated and set for the desired dosage. These can however be adjusted once that the system is operational.
- All the field instruments must be calibrated (flowmeter, pressure transmitter).
- Verify the oil level in the mixers gear reducers and the grease in the recirculation pumps.
- Verify the rotation of each mixer.
- Verify the rotation of each recirculation pump; remove the belt to prevent impeller unscrewing if the rotation is the wrong way.
- Verify the proper installation of the mixer impellers, especially the height above tank floor (refer to technical sheet and field installation drawing).
- Adjust motor overload protection to the proper value as indicated on each motor nameplate.
- Record the pressure at the hydrocyclone inlet gauge. Refer to technical datasheet.

Once all these conditions have been checked, the system can be put into operation.

12.1.2 INITIAL MICROSAND LOADING

The standard microsand load in an Actiflo® clarifier is approximately 2000 lbs per MGD of design or 5 kg per m^3/h, flow rating of unit.

The addition of microsand is done by pouring it directly in the injection tank until the required concentration is reached. It is preferable to begin by adding a small quantity of microsand and measure the resulting microsand concentration in the hydrocyclone underflow after a whole recirculation cycle has been completed (15 to 20 minutes). The quantity of microsand should be increased until the optimal concentration in the underflow is reached (typically 80 to 200 ml/litre).

Warning: The microsand may contains fine particles of silica. Therefore, it must be handle safely and with caution by qualified staff. Consult the MSDS for further instructions.

12.1.3 AUTOMATIC START-UP

Refer to the functional description of control system of the «Electricity and Control» section of the complete operation and maintenance manual to start the Actiflo® system in automatic mode.

12.2 NORMAL OPERATION

Note:	In the case of a discrepancy between this section of the manual and the functional description of control system, the latest shall prevail.

12.2.1 ACTIFLO® CLARIFIERS

12.2.1.1 Microsand Monitoring

Although a minor amount of microsand is constantly discharged out of the process and a sand concentration between 5 and 15 g/L is sufficient for satisfactory operation of the Actiflo® process, the microsand concentration should always be maintained at recommended levels (5 to 15 g/L). This insures that the system is always prepared to treat the worst possible raw water conditions. Therefore, the operators should monitor the microsand concentration 2-3 times per day. The concentration can easily be estimated using the following methods.

A. Sampling from Hydrocyclone Inlet Sampling Valve

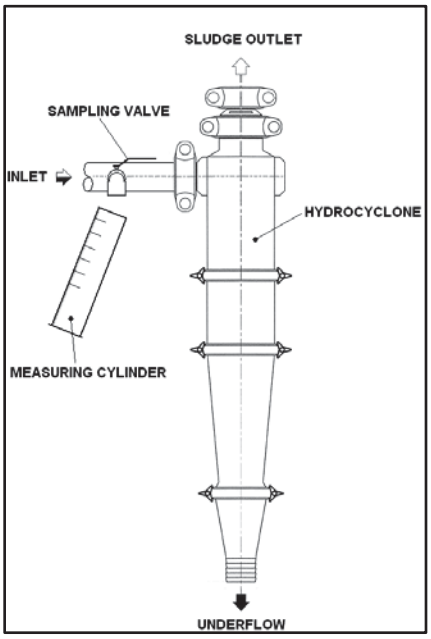
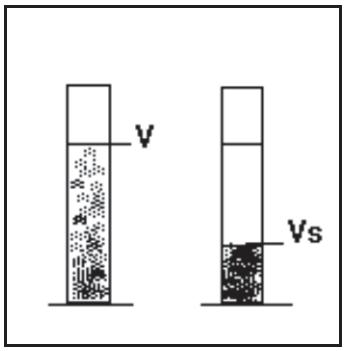


Figure 10: Microsand sampling from hydrocyclone inlet sampling valve

a. Verify that each operating hydrocyclone has an uninterrupted conical discharge. If you have a splashguard covering the apex tip, place it in the up position to verify this and make sure it stays in that position.
b. Obtain a 1000-2000 ml graduated cylinder to take the hydrocyclone inlet sample.
c. Open the ball valve located at the inlet piping of the hydrocyclone and fill the cylinder as close to the 1000 ml or 2000 ml mark as possible without over spilling. Caution: the 1000 ml cylinder may fill quickly and with force.
d. Allow the sample to settle for 3 minutes.
e. Record the volume of the settled sand (Vs) in ml along with the total sample volume (V) in ml. Refer to next figure.



f. Repeat steps c) through e) on the same hydrocyclone two (2) more times.
g. Use the same sampling procedure as you did on the first hydrocyclone and repeat steps c) through f) for all hydrocyclones in operation on the system. For example, if you have two hydrocyclones operating on a given system you should have six (6) values for Vs and six (6) values for V.
h. To determine the concentration of sand in the entire system you must next average all collected values of Vs. Also, average all collected values of V. Now you can use the following two (2) equations to first determine Cs (microsand concentration in the hydrocyclone inlet) and lastly Cm (microsand concentration in the Actiflo® system).

Note: For the most accurate determination of microsand in any given system the sampling procedure above should be performed three (3) times throughout a 24 hour period. Three (3) separate values of Cm should be averaged to determine one final microsand concentration for the day. It is also important to record and trend the final daily value of Cm to give indication of microsand loss over an extended period of time.

B. Sampling from Hydrocyclone Underflow

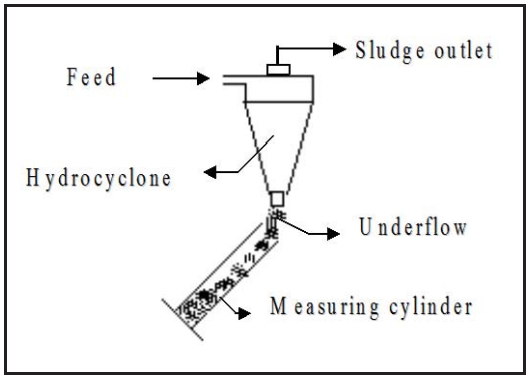
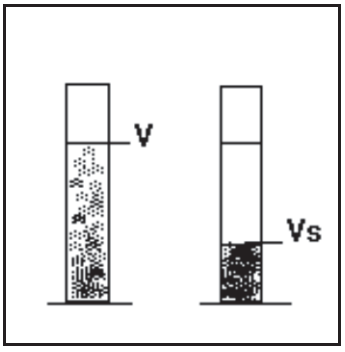


Figure 11: Microsand sampling from hydrocyclone underflow

a. Verify that each operating hydrocyclone has an uninterrupted conical discharge. If you have a splashguard covering the apex tip, place it in the up position to verify this. After verification the splashguard should be returned to the down position prior to sampling.
b. Obtain a 1000-2000 ml graduated cylinder to take the hydrocyclone underflow sample. The underflow discharge must be sampled entirely and not partially. However, it is important to be consistent and obtain the sample from the identical section of the underflow discharge every time a grab is taken. If the underflow discharge is constantly or periodically roping, the underflow discharge should be sampled with a swirling motion that catches the outer and center portions of the underflow in each sample.
c. Fill the cylinder as close to the 1000 ml or 2000 ml mark as possible without over filling/spilling. Caution: the 1000 ml cylinder may fill quickly and with force.
d. Allow the sample to settle for 3 minutes.
e. Record the volume of the settled sand (Vs) in ml along with the total sample volume (V) in ml. Refer to next figure.



f. Repeat steps c) through e) on the same hydrocyclone two (2) more times.
g. Use the same sampling procedure as you did on the first hydrocyclone and repeat steps c) through f) for all hydrocyclones in operation on the system. For example if you have two (2) hydrocyclones operating on a given system you should have six (6) values for Vs and six (6) values for V.

h. To determine the concentration of sand in the entire system you must next average all collected values of Vs. Also, average all collected values of V. Now you can use the following two (2) equations to first determine Cs (microsand concentration in the hydrocyclone underflow) and lastly Cm (microsand concentration in the Actiflo® system).

C. Sand Concentration of Hydrocyclone Inlet

The microsand concentration of the hydrocyclone entrance is calculated with the following formula:

$$C_S = \frac{1000}{V} \times V_S \times 1.5$$

Where:
C_s: Microsand concentration in the hydrocyclone entrance (g/l)
V: Sample volume taken in a graduated cylinder (ml)
V_s Volume of the settled microsand after settling for 3 minutes (ml)
1.5: Density of the settled microsand (kg/l)

System Sand Concentration

Knowing the flow rate of the hydrocyclone entrance (gpm) and the microsand concentration (g/l) of the hydrocyclone entrance, the microsand concentration (g/l) in the Actiflo® system is determined using the following formula:

$$C_m = \frac{Q_{Hydro} \times N \times C_S}{Q_{in}}$$

Where:
C_m: Microsand concentration in the Actiflo® system (g/l)
C_s: Microsand concentration in the hydrocyclone entrance (g/l)
Q_{Hydro}: Hydrocyclone entrance flowrate (gpm)
N: No. of hydrocyclones in operation
Q_{in}: Influent flow rate (gpm)

D. Sand Concentration of Hydrocyclone Underflow

The microsand concentration of the hydrocyclone underflow is calculated with the following formula:

$$C_S = \frac{1000}{V} \times V_S \times 1.5$$

Where:
C_s: Microsand concentration in the hydrocyclone underflow (g/l)
V: Sample volume taken in a graduated cylinder (ml)
V_s: Volume of the settled microsand after settling for 3 minutes (ml)
1.5: Density of the settled microsand (kg/l)

System Sand Concentration

Knowing the flow rate of the hydrocyclone underflow (gpm) and the microsand concentration (g/l) of the hydrocyclone underflow, the microsand concentration (g/l) in the Actiflo® system is determined using the following formula:

$$C_m = \frac{UF \times N \times C_s}{Q_{in}}$$

Where:
C_m: Microsand concentration in the Actiflo® system (g/l)
C_s: Microsand concentration in the hydrocyclone underflow (g/l)
UF: Hydrocyclone underflow flowrate (gpm)
N: No. of hydrocyclones in operation
Q_{in}: Influent flow rate (gpm)

E. Microsand Addition

Some microsand is lost at the hydrocyclone overflow and at the Actiflo® effluent. Periodic microsand addition is required to compensate for these losses (in typical conditions, normal loss is from 3 to 6 g/m^3). The addition of microsand is done directly in the flocculation tank. Since microsand contains a small proportion of very fine particles, the turbidity of the clarified water could increase slightly for a short period following the addition of microsand.

In standard operation mode, if a sustained increase of the raw water turbidity happens, it may be necessary to increase the concentration of microsand in the system to maintain the removal efficiency.

12.2.1.2 Microsand Recirculation Pumps

Each Actiflo® has one (1) or two (2) recirculation pumps and associated piping. It is essential that a recirculation pump be in operation continuously. When the pump stops, sludge and microsand accumulate in the hopper; this may clog the recirculation line. When the recirculation pump needs to be stopped, the mixer in the maturation tank must be stopped first, followed by the scraper. The scraper will operate for a short period of time before stopping the pump. This allows the hopper to be emptied before stopping the pump. The duration may be adjusted by the operator on the control panel.

Recirculation Pumps Options:

If the pumps are protected by a pressure switch (optional) / pressure transmitter (optional), alarms will be issued in any of the following situations:

- Thermo-mechanical overload of the pump: this is normally a sign of overheating of the pump motor and can be caused by a mechanical breakdown or a pressure surge. The operator must correct this problem by verifying the pump and motor as well as the outlet piping and then reactivate the overload relay located inside the control panel.

- Low pressure at the pump outlet: this can be caused by incomplete priming of the pump or closed isolation valve or clogging of the pump suction line. The operator must make sure that there is no obstruction at the inlet of the pump and in such case, the sludge suction piping must be cleaned according to the following procedure:

  - Stop the pump.
  - Close the valve on the pump suction side.
  - Connect a service water hose to the clean-out outlet.
  - Open the service water valve.
  - Let the service water run for approximately five (5) minutes.
  - Put the equipment back into normal operation.
  - Restart the pump.

The low pressure alarm set point is adjustable via the low pressure switch and is usually set at 3 to 5 psi below the normal operating pressure of the pump. When an alarm is activated, the pump stops automatically and the alarm light blinks on the control panel. The operator must acknowledge the alarm by pressing the ALARM ACKNOWLEDGE button located on the control panel, fix the problem and then reset the system by pressing the ALARM RESET button. The pump will restart automatically.

12.2.1.3 Hydrocyclones

The operator must make sure that the hydrocyclone outlets are free of obstruction at all times. Debris, as small as 13 mm (1/2"), can clog the underflow.

Waste sludge is evacuated from the Actiflo® at the hydrocyclone overflow (70% to 90% of the hydrocyclone flow rate). A small amount of microsand is lost at the overflow. It is important to check on a daily basis if the loss is higher than normal. This can be verified by collecting a 1 L sample of the overflow into an *Imhoff* cone and measuring the volume of settled microsand after 2 or 3 minutes. Record the value and compare it with past measurements. Refer to troubleshooting section.

The same procedure is used to measure the concentration of sand at the hydrocyclone underflow (10% to 30% of the hydrocyclone flow rate):

- Collect a 1 L sample from the underflow (mixture of microsand and water).
- Allow the sample to settle for 2 or 3 minutes and then measure the volume of settled microsand.
- The volume of microsand should range between 80 and 200 ml/L of water (5 to 15 g/L).

Warning:	It is important to keep the cone underflow of the hydrocyclone at all times during operation of the Actiflo®. In absence of this cone, a premature wear of the tank wall may occur due to the sandblasting of the hydrocyclone.

12.2.1.4 Mixers

The mixers all have a specific rotation direction and speed. In the event of a mixer motor overload, the mixer automatically stops and an alarm warns the operator. The operator must press the ALARM ACKNOWLEDGE button, correct the problem and then reset the system by pressing ALARM RESET button. If the operator cannot correct the problem, the Actiflo® should be shut down, as it is impossible to produce clarified water with a mixer out of service.

12.2.1.5 Circular Scraper

When an overload occurs to the scraper motor or when a very high torque is detected, the motor shuts down automatically and an alarm warns the operator and the Actiflo® will stop as per the stop sequence.

12.2.1.5.1 SGT90 and Moeller Easy Relay Configuration (UNITED STATES)

a) Scraper Load Cell Adjustment (HIGH TORQUE)

Procedure to adjust the HIGH TORQUE alarm set point on the Moeller Easy Relay

Figure 12: Moeller Easy Relay

In normal operation, the display indicates the values of inputs/output. To change the values of alarm set points:

Press:	**OK**	
Press:	▼	
Press:	▼	
Press:	**OK**	(On Parameter)
Press:	▼	(Cursor on A1)
Press:	**OK**	(On A1)
Press:	▼	(Cursor on I2)

Press: **OK** (Edit I2)
Press: ◄►▲▼ (to modify the HIGH TORQUE alarm set point)
Press: **OK**
Press: **ESC**
Press: **ESC**
Press: **ESC**

b) Scraper Load Cell Adjustment (HIGH HIGH TORQUE)

Procedure to adjust the HIGH HIGH TORQUE alarm set point on the Moeller Easy Relay

In normal operation, the display indicates the values of inputs/output. To change the values of alarm set points:

Press: **OK**
Press: ▼
Press: ▼
Press: **OK** (On Parameter)
Press: ▼ (Cursor on A2)
Press: **OK** (On A2)
Press: ▼ (Cursor on I2)
Press: **OK** (Edit I2)
Press: ◄►▲▼ (to modify the HIGH HIGH TORQUE alarm set point)
Press: **OK**
Press: **ESC**
Press: **ESC**
Press: **ESC**

12.2.1.5.2 HPL 220 Configuration (CANADA)

Mode	Function	Parameter	▼	▲	Display	Default
Meas'mt	Display measurement		Min. peak	Max. peak	Meas'mt [%]	
Limits	Limit 1 prog./display	Off,5-100%	Decrease	Increase	Limit 1	80
Limits	Limit 2 prog./display	Off,5-100%	Decrease	Increase	Limit 2	Off
Ts [S]	Start timer	0.0-25.0 Sec.	Decrease	Increase	Ts [Sec]	2.0 Sec.
Tr [S]	Alarm reaction timer 1	0.0-25.0 Sec.	Decrease	Increase	Tr [Sec]	0.1 Sec.
Tr [S]	Alarm reaction timer 2	0.0-25.0 Sec.	Decrease	Increase	Tr [Sec]	0.1 Sec.
Hyst's	Hysteresis 1	5-50%	Decrease	Increase	Hyst's [%]	10
Hyst's	Hysteresis 2	5-50%	Decrease	Increase	Hyst's [%]	10
Units						
Full scale	Max. input	20-100%	Decrease	Increase	'Full scale'	100
Offset	Offset adjustment ±	±10%(F.S.)	Decrease	Increase	Meas'mt [%]	---
Input	Input select	Vdiff, 10V, 20mA	Vdiff-10V-20mA	20mA-10V-Vdiff	"Inp"	Vdiff

Figure 13: HPL 220 Configuration parameters

a) Typical Adjustment

- Limits 1: Refer to the technical product data sheet
- Limits 2: Refer to the technical product data sheet
- Ts: 0
- Tr 1: 0
- Tr 2: 0
- Hyst's 1: 5
- Hyst's 2: 5
- Full Scale: 30 mV (with 500 N load cell and 10 VDC)
- Offset: 0
- Input: Vdiff

b) Limit 1 & 2 Adjustment

The limit 1 and 2 values can be adjusted by 0.5% increment and need to be set in the range from 0.5% to 100% of the load cell total value.

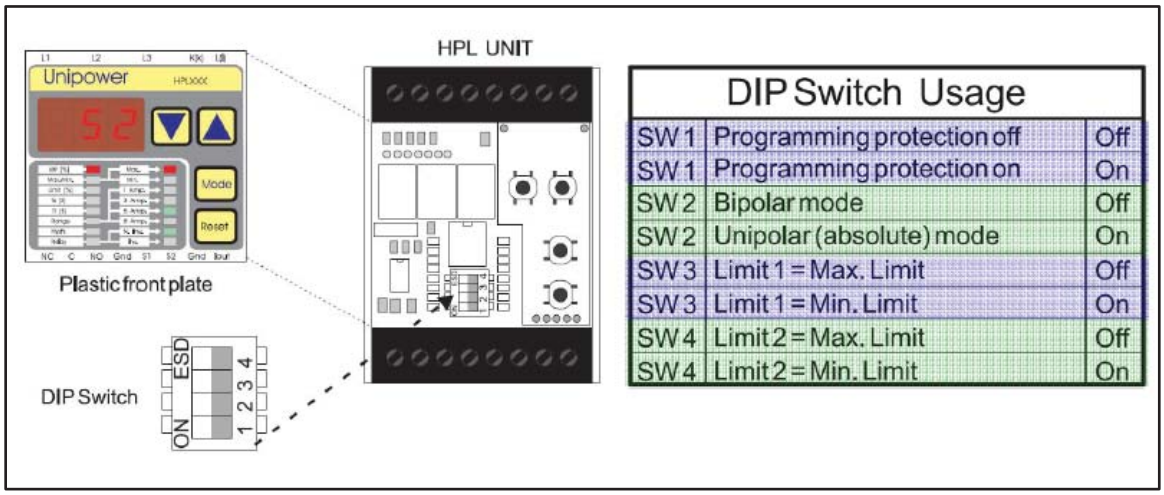
For example: The load should be limited at 238 N and the load cell can accept up to 500 N.

$$HPL_{Limit} = \frac{F_{Required}}{F_{Full\ Load}} \times 100$$

$$HPL_{Limit} = \frac{238}{500} \times 100 = 47.6\% \approx 48\%$$

The percentage value remain between the 0, 5% to 100% which is acceptable.

c) Dip Switch



DIP Switch Usage		
SW 1	Programming protection off	Off
SW 1	Programming protection on	On
SW 2	Bipolar mode	Off
SW 2	Unipolar (absolute) mode	On
SW 3	Limit 1 = Max. Limit	Off
SW 3	Limit 1 = Min. Limit	On
SW 4	Limit 2 = Max. Limit	Off
SW 4	Limit 2 = Min. Limit	On

Figure 14: HPL 220 DIP Switch settings

1) Turn-off the HPL 220
2) Remove the cover
3) Set the dip switches according to the following:
   - SW1: **OFF**
   - SW2: **ON**
   - SW3: **OFF**
   - SW4: **OFF**
4) Reassemble the HPL 220

12.2.2 DOSAGE OF CHEMICALS

12.2.2.1 Coagulant

The coagulant is injected into the raw water feed line.

In either case, the dosage to be used varies according to the characteristics of the raw water. An increase in turbidity of the raw water must signify an increase in product dosage. The proper dosage is determined by a jar test.

The concentration of coagulant at the inlet of the system is calculated from the flow rate of the raw water and metering pumps:

$$Coagulant\ Concentration\ (mg/L) = \frac{Metering\ Pump\ Rate\ (mg/h)}{Raw\ Water\ Flow\ Rate\ (L/h)}$$

12.2.2.2 Flocculant (polyelectrolyte)

The polyelectrolyte is used in solution with a concentration ranging from 0.5 to 2.5 g/L, the produced solution is viscous. In order to obtain a high quality polymer, it is recommended to use non chlorinated filtered water for its preparation and transport. The concentration of polyelectrolyte in the clarifier should be between 0.40 to 0.90 mg/L. Depending on the quality of the raw water, this concentration can be increased or decreased. The polyelectrolyte concentration in the system is calculated from the flow rate of the raw water and metering pumps:

$$Polyelectrolyte\ Concentration\ (mg/L) = \frac{Metering\ Pump\ Rate\ (mg/h)}{Raw\ Water\ Flow\ Rate\ (L/h)}$$

The ideal dosage of polyelectrolyte can be determined with a jar test (refer to the jar test procedure in this manual).

Insufficient polymer dosage will cause free flocs to appear that are not ballasted by the microsand and which will not be correctly eliminated in the settling tank. The clarified water might have a higher turbidity and/or color, and an important aluminum concentration.

However, excess in polyelectrolyte dosage can produce very sticky sludge, which is difficult to recycle.

12.2.2.3 Alkali, pH Adjustment

The water pH is the most important factor to consider in a coagulation process. When using alum, maximum coagulation efficiency is reached when pH readings are between 5.5 and 7.0. If the raw water has a low pH, it is important to increase it by adding an alkaline product (ex. caustic soda, etc.) to the water upstream of the coagulation step.

Upstream of the coagulation step, the hydraulic residence time of the alkali must be long enough, allowing time for it to completely dissolve in the water, increasing the precision in the adjustment of the water pH.

13 SURVEY OF OPERATIONS

In order to insure a reliable survey of the Actiflo® system operation and to provide the operators with a useful data bank, we suggest to the operators to record the following parameters:

ON A HOURLY BASIS:

- Turbidity, raw water
- Color, raw water
- pH, raw water
- Turbidity, clarified water
- Color, clarified water
- PH, clarified water

EVERY EIGHT HOURS:

- Flow rate, raw water
- Flow rate, coagulant metering pump and calculated concentration
- Flow rate, polyelectrolyte metering pump and calculated concentration
- Flow rate, alkali metering pump and calculated concentration
- Alkalinity, clarified water
- Pressure at the recirculation pump outlet
- Pressure at the hydrocyclones inlet
- Microsand concentration at the hydrocyclone underflow

ON A DAILY BASIS:

- Total quantity of clarified water
- Mixers speed
- Electric current drawn by the mixers
- Other parameters of interest: dissolved iron and manganese, total organic carbon, etc.
- Alkalinity, raw water
- Average raw water flow

ON A WEEKLY BASIS:

- Flow rate of the hydrocyclone underflow
- Flow rate of the hydrocyclone overflow

13.1 AUTOMATION

Refer to the functional description of control system in the «Electricity and Control» section of the complete operation and maintenance manual.

13.2 SHUT DOWN

In manual mode, when the microsand recirculation pump needs to be stopped, the following procedure must be followed in order to prevent possible clogging problems:

- Stop the mixer in the maturation tank. This allows the microsand to settle in the maturation tank instead of in the hopper.
- After approximately 30 minutes, verify that the underflow of the hydrocyclone does not contain any microsand.
- The microsand recirculation pump can then be stopped without any risk of clogging the recirculation line.

13.3 TROUBLESHOOTING

13.3.1 INCREASE IN CLARIFIED WATER TURBIDITY

If the turbidity of the clarified water should increase suddenly, verify the following parameters:

- The flow rate of raw water: if it is greatly increased or diminished, dosage flow rate of coagulant and polyelectrolyte should be adjusted in consequence.
- The flow rate of coagulant and polyelectrolyte: the metering pumps must inject an accurate dosage of these chemicals, such that the desired concentrations in the system can be obtained.
- The quality of raw water: if the turbidity, colour and/or the alkalinity of the raw water are increased or decreased, it is normally necessary to adjust the concentration of coagulant in the system. This dosage can be predetermined with the help of a jar test. However, a change in the quality of the raw water does not usually require an adjustment in polyelectrolyte concentration.
- The concentration of microsand in the underflow of the hydrocyclone: this must approach a value between 80 and 200 ml/L (5 to 15 g/L). Deterioration in the raw water quality can necessitate an increase in the quantity of microsand in the system.
- Sludge-sand recirculation rates: these flow rate generated by the recirculation pump must be kept constant.
- Maturation mixer rotation speed: mixer speed can be read directly on the display of the corresponding variable frequency drive.

13.3.2 INCREASE IN CLARIFIED WATER COLOUR

Clarified water color (apparent and true) is one of the parameters to follow since it indicates the performance of the Actiflo® process and the proper dosage of coagulant and pH adjustment. The next figure shows the troubleshooting guide if clarified water color increases and actions to take.

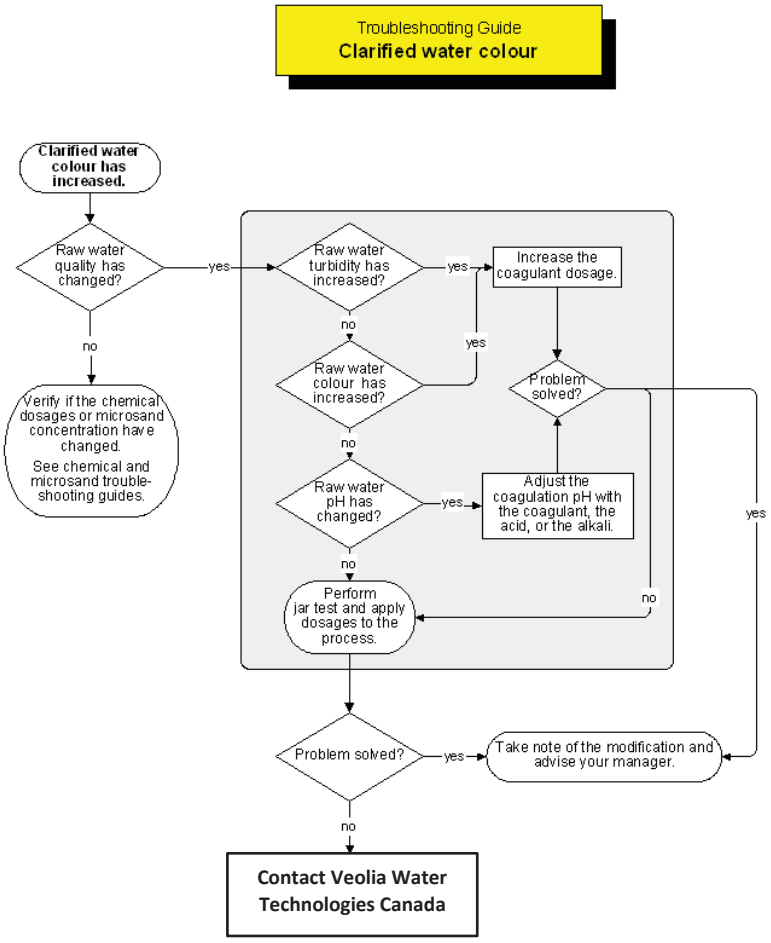


Figure 15: Clarified water colour - Troubleshoothing guide

13.3.3 STOPPING OF MICROSAND RECIRCULATION PUMP

In manual mode, when the microsand recirculation pump needs to be stopped, one must, in order to prevent possible clogging problems, proceed as follow:

- Stop the mixer in the maturation tank. This allows the microsand to settle in this tank instead of in the hopper.
- After approximately 30 minutes, verify that the underflow of the hydrocyclone does not contain any more sand.
- Afterwards, one can stop the pumping of sand without any risks of clogging the microsand recirculation circuit.

13.3.4 POWER FAILURE

Refer to the functional description of control system in the «Electricity and Control» section of the complete operation and maintenance manual.

14 JAR TEST PROCEDURE

14.1 INTRODUCTION

In order to simulate the Actiflo® process, a modified jar test procedure was developed. The procedure can be useful for optimizing process chemistry (pH, chemical dosages, etc.), which will produce settled water low in turbidity and with a high filterability index. Furthermore, the modified jar test procedure has the capability to evaluate or predict process performances of an existing Actiflo® unit and bring accurate diagnosis on operating troubleshooting.

14.2 MATERIAL REQUIRED

- Phipps & Bird jar test apparatus or equivalent lab stirrer allowing up to 300 RPM rotational speed
- Circular beakers (1 litre)
- Microsand
- Polymer (Allied Colloids, serial LT or equivalent)
- Coagulant (Alum, ferric chloride, PAC, PASS 100 or equivalent)
- Acid or base for pH and alkalinity adjustment (NaOH, aluminates, HCl, H_2SO_4, lime, carbonate, bicarbonate, CO_2, or equivalent)
- Turbidimeter (Hach 2100AN or equivalent)
- pH-meter (serial Hach EC or equivalent) and calibration solutions (pH=4, pH=7 and pH=10)
- Chronometer or stopwatch
- Micro pipettes 5 ml-1000 ml
- Disposable syringes 1 ml-5 ml

14.3 LABORATORY PROCEDURES

1. Record settled and raw water parameters values at the plant (turbidity, colour, dissolved aluminum, etc.) if the purpose of this test is to simulate the full scale unit.
2. Fill up the beakers with raw water.
3. Set the beakers on the bench.
4. Make sure raw water temperature corresponds to the desired temperature.
5. Set the paddle between 0.5 and 1.0 cm from the bottom of the beaker.
6. Start mixing and adjust rotation speed to 150 rpm.
7. If needed, add acid, base or equivalent and adjust at the optimum coagulation pH.
8. Add coagulant simultaneously in all beakers with micro-syringes from 0, 0.5, 1.0, 2.0 or 5 minutes after reaching the right pH in accordance with contact times simulated.
9. “A” minutes after adding coagulant (“A” corresponding to full-scale plant retention time in coagulation tank at the desired flow), add all microsand and half the quantity of polymer using a syringe.

10. After a delay of “B” minutes (“B” corresponding to full-scale plant retention time in injection tank at the desired flow), add the rest of polymer.
11. After a maturation contact time of “C” minutes (“C” corresponding to full-scale plant retention time in maturation at the desired flow), stop stirring and allow the water to settle for the next 3 minutes.
12. Sample settled water from 5 to 10 cm below the supernatant surface using a 100 ml syringe. Proceed slowly. Make required analysis.

Note: Contact times “A”, “B” and “C” will be explained and a table given for various flow conditions, during operator training sessions. Values for operation at typical design rate of 40 m/h are as follows: A: 2 min.; B: 2 min.; C: 6 min.

14.4 ANALYSIS

Turbidity, colour and other parameters.

1. Measure turbidity (NTU) using a turbidimeter.
2. Measure apparent colour (ACU) using a spectrometer.
3. Measure pH using pH meter.
4. Measure any other required parameters.

15 MAINTENANCE

15.1 ACTIFLO® CLARIFIER

15.1.1 LAMELLA PACK

WARNING

- Comply with all safety rules and policies if you need to access the settling tank.
- If you must go under the lamellas, make sure of the support beams integrity and the cleanliness of the lamellas.
- Before lowering the water under the lamellas, make sure you have removed some of the accumulated sludge in the lamellas (visible from the top of the clarifier) to reduce the supported weight.
- In the case of excessive plugging, the sludge weight can damage the lamellas and in extreme cases, collapse and cause serious injury to anyone under the modules.
- If lamellas are exposed to very cold temperatures, do not proceed with dewatering the lamellas because the cold makes them too fragile. It is then cleaned by keeping a layer of water above and uses the water jet to create pulsations in the lamella cells to loosen sludge.

15.1.1.1 Lamellas fouling

To maintain the Actiflo® performance, the lamellas should be cleaned regularly. The nature of the raw water, the quality of the clarified water produced and the flow rates handled are factors influencing the fouling. The lamellas fouling can be of two types:

- Visible (observable fouling from above lamellas)
- Invisible (fouling in the lower area of the lamellas)

The visible fouling may be an indicator of an invisible fouling in the lower area. In the case of significant invisible fouling, the lamellas can be damaged.

15.1.1.2 Cleaning frequency

There is a need for a regular cleaning of the lamella modules, by water jet or air jet, to maintain the Actiflo® clarifier performance. The recommended cleaning frequency is once every week. This may be more or less spaced according to the fouling rate observed. The cleaning frequency interval is the operator responsibility, although a minimum frequency is recommended.

15.1.1.3 Required equipment

Depending on whether the cleaning is carried out by air or water, it is suggested to use a PVC pipe fitted at its upstream end of a hose connector and elbow, nozzle or sprayer at its downstream end to direct water or air along the inclined axis of the lamellas. The length of PVC pipe should be sufficient for it to be handled from the top of the Actiflo® unit while allowing access to the bottom of the modules.

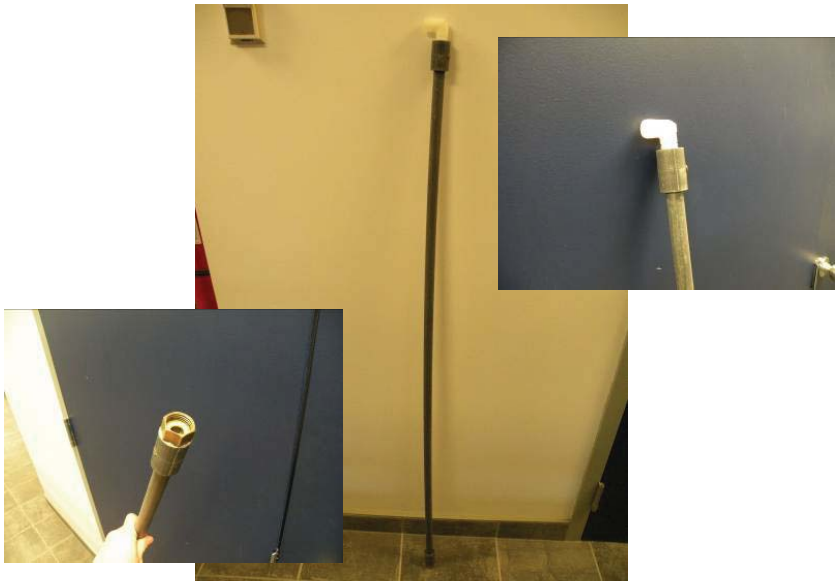


Figure 16: Suggested material for lamella cleaning

15.1.1.4 Lamella cleaning procedure

Lamellas cleaning can be achieved in 3 ways:

- Manual cleaning with water;
- Manual cleaning with air;
- Automatic cleaning with integrated system under the lamella modules (optional).

15.1.1.5 Manual cleaning with water

The cleaning procedure with water is:

1. Stop the Actiflo® unit according to the normal procedure;
2. Start the microsand recirculation system, in manual mode, including the scraper, if necessary, to assist in the disposal of cleaning sludge;
3. Slowly drain the basin using the partial drain located under the lamellas so as to have a lowering rate of 2 to 5 cm/min and start cleaning during emptying;
4. Open water jet on a wall of the decanter to prevent damage to the lamellas;

5. Clean the lamellas with a low pressure water jet (approximately 20 to 25 psi) using a cleaning tool (refer to previous figure). Repeat to clean every lamella. The water jet should be directed parallel to the lamella axis to clean the entire length;
6. With the aid of a high intensity light beam, validate the quality of the cleaning. When the lamellas are properly cleaned, it is possible to see through them;
7. Once completed, close the water jet on a wall of the decanter to prevent damage to the lamellas;
8. Finally, return the Actiflo® unit to service, to the sewer or to production depending on the quality of clarified water to be produced.

15.1.1.6 Manual cleaning with air

The cleaning procedure with air is:

1. Stop the Actiflo® unit according to the normal procedure;
2. Start the microsand recirculation system, in manual mode, including the scraper, if necessary, to assist in the disposal of cleaning sludge;
3. Insert the cleaning tool through the lamellas so that it goes below the lamella module and then inject air. Repeat to clean every lamella section;
4. Slowly drain the basin using the partial drain located under the lamellas so as to have a lowering rate of 2 to 5 cm/min;
5. Clean the lamellas with a low pressure water jet (approximately 20 to 25 psi) using a cleaning tool (refer to previous figure). Repeat to clean every lamella. The water jet should be directed parallel to the lamella axis to clean the entire length;
6. With the aid of a high intensity light beam, validate the quality of the cleaning. When the lamellas are properly cleaned, it is possible to see through them;
7. Once cleaning is completed, return the Actiflo® unit to service, to the sewer or to production depending on the quality of clarified water to be produced.

15.1.1.7 Automatic Cleaning with Integrated System under the Lamella Modules (Optional)

Please contact Veolia Water Technologies Canada to validate if this option is applicable. Refer to section 1 for contact.

The automatic cleaning system will clean the lamella modules according to a programmed sequence. The variation of the water level and air injection will be used for cleaning.

- The partial drain valve: used to drain the settling tank of the Actiflo® unit down to a few inches under the lamella.
- Backwash air valve: inject air under the lamellas with proper flow rate and pressure. Refer to technical datasheet.

Manual backwash sequence:

- Stop the Actiflo® unit according to the normal procedure.
- Open the partial drain valve to lower the level under the through.
- Open the backwash air valve and continue lowering the water level.
- Close the backwash air valve.
- Continue draining for a short time (with partial drain).
- Close the partial drain valve.
- Restart the Actiflo® unit.

Note:	Open confirmation from partial drain valve is needed to allow the opening of the air valve. Close confirmation from partial drain valve is needed to allow Actiflo® to restart.

15.1.1.8 Severe Obstruction

If the lamellas are severely obstructed or if the cleaning system is temporally down. It is recommended, every week, to stop the unit and partially drain the clarifier such that the lamellas are exposed (with the partial drain valve on the hopper). The lamellas can then be cleaned using a garden hose at 30 to 40 psi (maximum pressure). Remove any substance that is stuck to the settling module and which could interfere with the process efficiency.

15.1.2 MIXERS

For each mixer:

- Make sure that the gearbox remains clean.
- Check on a regular basis the oil level in the gearbox.
- Change the oil in the gearbox.
- Refer to the mixer manufacturer manual for complete inspection and maintenance requirements.

15.1.3 MICROSAND RECIRCULATION PUMPS

- Every day, proceed to a visual inspection of the packing adjustment.
- Every 1000 hours of service (every 6 weeks at 24 hr/day), lubricate the bearings and check belt tension.
- Twice a year, proceed to an inspection of the pump: dry seal, impeller, rubber coating, bearings, etc.
- Refer to the pump manufacturer manual for complete inspection and maintenance requirements.

15.1.4 HYDROCYCLONES

- After the first year, inspect the inside surface. Replace worn sections if needed. The first inspection will determine the frequency of replacement.
- Refer to the hydrocyclone manufacturer manual for complete inspection and maintenance requirements.

15.1.5 SCRAPER

- Every 8700 hours of operation, change the oil in the gear motor.
- Refer to the gear motor manufacturer manual for complete inspection and maintenance requirements.

15.2 CONTROL PANEL

For each panel, including junction boxes:

- Replace fuses when needed.
- In case of an electrical problem other than a fuse, contact a certified electrician and verify the circuits.
- Refer to the electrical drawings.

15.3 INSTRUMENTATION

For each instrument equipped with a controller/transmitter:

- Calibrate instrument on a regular basis.
- Refer to the manufacturer manual for calibration instructions and maintenance requirements.

15.4 VALVES

15.4.1 MANUAL VALVES

- No preventive maintenance required.
- Refer to the manufacturer manual, if needed.

15.4.2 AUTOMATIC VALVES

- Refer to the manufacturer manual for complete inspection and maintenance requirements.

15.5 PERIPHERAL EQUIPMENT

- Any other peripheral equipment needing maintenance should be inspected on a regular basis.
- Refer to the manufacturer manual for complete inspection and maintenance requirements.

15.6 PAINT INSPECTION

To maintain the life expectancy or life-cycle of Sherwin Williams Macropoxy 646 PW or Duraplate UHS coating system applied as an internal lining system for potable or fresh water tank, a well-planned inspection schedule is required. When the coating system is applied adequately to properly prepare steel substrate, it can last up to 15 years or more.

The recommend inspection schedule is:

- Inspect after 12 months following the initial application of the coating system. If the substrate is exposed, if the surface is damage or require repairs, perform spot repairs according to the coating system manufacturer instructions specified in the following section.
- Repeat inspection every 3 years and repair.

15.7 PAINT REPAIR PROCEDURE

This procedure applies to Sherwin Williams Macropoxy 646 PW or Duraplate UHS coating system applied as an internal lining system for potable or fresh water tank.

If the painted surface is damage or require repairs perform the following:

1. Clean the surface with solvent according to surface preparation standard SSPC SP1 to remove any contamination.
2. Perform abrasive blasting of the surface according to surface preparation standard SSPC SP10 or perform power tool cleaning to bare metal as per SSPC SP11.
3. Surface preparation must create or expose existing profile to meet the minimum requirement set in the Sherwin Williams product data sheet.
4. Lessen the unevenness between the existing coating and steel by sanding the edges of the existing coating to a smoother transition.
5. Sand 5 to 10 cm on the existing coating surrounding the repair area in order to obtain a matte and rough surface.
6. Clean again the surface according to SSPC SP1 to remove any contamination or dust.
7. Apply Macropoxy 646 PW or Duraplate UHS, depending on the paint type used in the project, to restore specified dry film thickness (DFT) measurement.

15.8 LUBRICATION

- Refer to the following table for the lubrication schedule.
- Refer to the manufacturer equipment manual for complete lubrication, inspection and maintenance requirements.

15.8.1 LUBRICATION SCHEDULE

Equipment to be serviced	Component serviced	Type of lubrication	Lubricant manufacturer	Lubricant brand name	Quantity of lubricant	Lubrication schedule	Comments
Scraper (SEW Eurodrive)	Reducer box (Applicable for ACP-400R and up)	Food grade oil	Chevron	FM Grade ISO 460 or equivalent	8 - 14 L (2.1 - 3.7 gallons)	Change oil every 8700 hours of continuous operation	Fill by the glass window up to the oil level plug or to about half of the height of the slewing ring (10L approx.)
	Gearmotor	Food grade oil	Klüberoil	4UH1-460 N	1.9 L (0.5 gallon) for primary gear reducer and 14.0 L (3.7 gallons) for secondary reducer	Check oil and oil level every 6 months Change oil every 3 years	When changing oil, also replace oil seal (do not install it in the same track).
	Gearmotor bearings	Food grade grease	Aral	Aralube BAB EP2	Low RPM bearings: Fill the cavities between the rolling elements one-third full with grease High RPM bearings: Fill the cavities between the rolling elements two-third full with grease	Replace anti-friction bearing grease every 3 years	Regreasing recommended at the same time as changing the oil or replacing bearings
	Motor bearings	Food grade grease	Aral	Aralube BAB EP2		Every 10000 hours of operation, check ball bearings and change if necessary	The motor anti-friction bearings are covered on both sides and cannot be regreased

Table 3: Lubrication schedule

Equipment to be serviced	Component serviced	Type of lubrication	Lubricant manufacturer	Lubricant brand name	Quantity of lubricant	Lubrication schedule	Comments
Mixers (Envirequip)	Motor bearings						The bearings are sealed for life. No additional lubrication required.
	Reducer box	Food grade oil	Chevron	FM ISO FM 220	5.4 L (1.4 gallons)	Check oil and oil level every 6 months Change oil every 2 years or 10000 hours	
	Reducer box bearings	Food grade grease	Mobil	Grease FM 222 (NLGI 2)	The bearing cavity should be packed to approximately 1/3 full with grease	Regrease bearings every 6 months	
Mixers (PMSL) (Food Grade)	Motor bearings	Grease	Esso	Alvania R3	0.14 oz - 0.32 oz (4.0 g - 9.0 g) (refer to manufacturer's instruction)	Regrease bearings every 12000 hours	Motors are not equipped with grease fittings. Lubrication is carried out during periodical overhauls when the motor is taken apart.
	Reducer box	Food grade oil	Chevron	Lubricating Oil FM	19 L (5 gallons) Except ACP2-75: 26.5 L (7 gallons)	Check oil level weekly (mixer must be off) Change oil in mixer drive every 6 months or 2500 hours.	After the initial break-in period, two weeks of operation, the oil should be changed while the equipment is at operating temperature.
	Reducer box bearings	Food grade grease	Bell Ray	No-Tox HD Grease #2		Add grease to all bearings, couplings, and seals every 6 months or 2500 hours.	

Table 3: Lubrication schedule

Equipment to be serviced	Component serviced	Type of lubrication	Lubricant manufacturer	Lubricant brand name	Quantity of lubricant	Lubrication schedule	Comments
Mixers (PMSL) (Synthetic)	Motor bearings	Grease	Esso	Alvania R3	0.14 oz - 0.32 oz (4.0 g - 9.0 g) (refer to manufacturer's instruction)	Regrease bearings every 12000 hours of operation	Motors are not equipped with grease fittings. Lubrication is carried out during periodical overhauls when the motor is taken apart.
	Reducer box	Synthetic grade oil	Chevron	Tegra 320	19 L (5 gallons) Except ACP2-75 : 26.5 L (7 gallons)	Check oil level weekly (mixer must be stopped) Change oil in mixer drive every 6 months or 2500 hours.	After initial start-up, sample the oil after the first 100 hours or three months of operation; thereafter, take samples for analysis every 2500 hours of operation or six months, whichever occurs first. Note that the initial oil analysis results may show remnants of the factory preservative oil.
	Reducer box bearings	Food grade grease	Chevron	Black Pearl EP (NLGI 2)		Add grease to all bearings, couplings and seals every 6 months or 2500 hours.	
Recirculation pump (McLanahan)	Pump	Grease	Shell	Alvania Grease 3 (NLGI 2)	Inject grease by six strokes of a regular size grease gun (2" diameter body)	Regrease bearings every 1000 hours of operation	
	Motor bearings	Grease	Esso	Polyrex® EM (NLGI 2)			Does not require lubrication as bearing life is 20000 hours
Recirculation pump (Seepex)	Pump	Grease	Please refer to manufacturer's operation and maintenance manual				
	Motor bearings	Grease	Esso	Polyrex EM (NLGI 2)	0.61 oz (17.3 g)	Regrease bearings every 4750 hours of operation	

Table 3: Lubrication schedule

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6 – OPERATION AND MAINTENANCE

6.2 – HYDRA-POL POLYMER PREPARATION SYSTEM

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VEOLIA

Hydra-Pol ™

Polymer Preparation System

Installation, Operation and Maintenance Manual

Document No: IOM_0001_HYDP
Revision: 02
Date: 2018.05.07

WATER TECHNOLOGIES

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TABLE OF CONTENTS

1 INTRODUCTION

This document provides handling, storage, installation, operation and maintenance instructions for the Hydra-Pol™ polymer preparation system. The components of the Hydra-Pol™ are supplied by Veolia Water Technologies Canada (**VWTC**).

To obtain any additional information regarding characteristics or instructions on this equipment, please do not hesitate to contact us.

The system was designed in Canada by:

Veolia Water Technologies Canada
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: 514-334-7230
Fax: 514-334-5070

For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada After Sales Support
1-844-SER-VWT9 | 1-844-737-8989 | vwtservicecanada@veolia.com

Our business hours are from
Monday to Friday
8:30am to 5pm EST

2 SAFETY

2.1 INTRODUCTION

It is important that the operator has understood the instructions of use, security and maintenance before using the Hydra-Pol™ system. The manufacturer cannot be held responsible for use or improper maintenance resulting from a breach or non-compliance with instructions. The Operation and Maintenance manual contents must be kept permanently close to the system in a safe place.

It is important for Operations and Maintenance individuals to understand the nature of the chemicals they are working with. Hydra-Pol™ systems are for the preparation and dosage of different chemicals, some of which can pose extreme slip/trip hazards if spilled. Other chemicals create fine dust and pose a risk to respiratory health.

The safety rules and guidelines issued to the operators are the primary precautions that are necessary for the prevention of accidents. The operators should be very familiar with these rules. The safety pictograms used in the plant are to be respected at all times.

Operators should always wear the safety equipment that is provided or required by their management. Such items as hard hats, safety shoes, safety glasses, gloves, breathing protection, protective clothing, protection harness and hearing protection are very basic and go a long way in preventing accidents.

Operators should be aware of the location of eye wash stations, safety showers, self-contained breathing apparatus, first aid stations, and other safety equipment furnished for the plant.

Good housekeeping will also eliminate safety hazards such as tripping or slipping. When spills happen, the floor should be cleaned as soon as possible (see Chemicals Hazards section).

2.1.1 Utility Hazards

Utility hazards exist on a system including high-voltage electricity, pressurized water, and high pressure air. Care should be taken when utilizing this system.

2.1.1.1 Electrical

Electrical connections must be made by certified electricians in compliance with all applicable codes and regulations. Electrical equipment should never be worked on unless it is turned off and locked and tagged out. The lockout system key should belong to the person doing the repair or the on-site electrician. This will remove the potential danger for electrical shock or accidental start-up.

Even though most electrical motors and switch boxes are designed to be water tight, the presence of water around electrical equipment always presents a hazard and therefore should be used with care.

2.1.1.2 Pressurized Water

Only the proper pressure fittings should be used in the piping system. Leaks should be repaired as soon as possible. Isolation valves on piping that are being repaired should be shut tight and locked out. Lock out the water inlet and remove pressure before starting any maintenance.

2.1.2 Equipment Hazards

2.1.2.1 Rotating Parts

<u>General instructions</u>

Since the system includes equipment with rotating parts (Dry polymer feeder and mixer), operators should avoid wearing loose clothing and jewellery. Loose clothing can present one of the biggest safety hazards that exist when working near equipment in process.

<u>Dry polymer Feeder</u>

- Never introduce hands into a running micro-batch feeder.
- Never open the inspection hatch when the feeder is running.
- It is however necessary fitting upstream the machine a fix safety grid or a hopper high enough to prevent damages to limbs according to the Machine Directive inforce. The same approach is necessary for the outlet: it is required using a vertical outlet or similar systems meant to prevent foreign bodies from entering the machine and cause damage to it, to persons or to their limbs. Always ensure the Machine Directive in force is being followed.
- Lock out the system before starting any maintenance.

<u>Mixer</u>

- Never introduce hands into the preparation tank if the system is not locked out.
- Lock-out the motor starter before starting any maintenance.

2.1.2.2 Operation and Maintenance

The system in its normal use can present a hazard if not operated or repaired in a safe manner.

All equipment should only be operated and repaired according to the recommended procedures of the manufacturer, and by qualified individuals.

Only recommended spare parts should be used.

Maintenance on pumps, piping, etc. should be performed only after valves are locked and tagged or slip blanks are installed to completely isolate the equipment being worked on. Instrumentation and controls should always be kept in good working order to help assure the safe operation of equipment. Never remove instruments or controls out of service until having communicated with the operator and have established a plan to define the operation maintenance steps. If air operated valves are used for isolation, the air line should be removed to prevent inadvertent operation of the valves. When possible the valve can also be locked in position.

When maintenance is finished on equipment, the protective caps provided must be reinstalled. If a protection must be left off, unwary personnel should be notified by using safety pictograms or installing temporary protection. Equipment should never be inspected or maintenance attempted while the equipment is operating. All pumps and various automatic valves may cause harm to an operator if care is not taken.

2.1.3 Chemical Hazards

Dry Polymer Material Safety Data Sheets (MSDS) should be available close to the system.

Since chemicals or chemical dosage are used during normal operation of treatment facility, the risks of exposure to toxic chemicals or chemical burns are present.

All plant personnel should be required to wear proper protective clothing when handling or working near these chemicals. A minimum wardrobe should include, but not be limited to, a plastic hard hat, coat, boots and gloves of a resistant material as well as a pair of safety glasses. Safety glasses, even with shields, are not adequate for use in areas where very acidic or basic materials are handled.

In the presence of water, polymer becomes very slippery. Spill recovery or remediation kits that include cat litter, rock salt and absorbent pads are very helpful in preventing trip/slip risks that result from polymer spills. In case of spill, wear appropriate personal protective equipment. Ventilate area. Prevent material from entering sewers, remove as much dry polymer as possible with a vacuum.

If the polymer has been wetted, the operator will remove as much as possible the wet polymer with a can and then, he will add an absorbent material (cat litter). He will let it soak it up for a while before he will shovel it into a disposal container. After the spill has been dried then a floor drain will allow washing the containment with a hose garden (warmest water possible).

3 SHIPPING

Most of the equipment and material for this project will be drop shipped from **VWTC** facilities and delivered directly to the site.

- All items delivered will be clearly identified with **VWTC**'s name, **VWTC**'s project name, **VWTC**'s project number.
- All shipments will have a clear Packing List identifying all parts in the shipment.
- All equipment will be tagged with the corresponding tag numbers shown on the design drawings (if applicable).

If there are more stringent requirements in the contract documents, they will take precedence over the above. If any of these requirements are not being followed, please notify the **VWTC** Project Manager immediately.

4 RECEIVING

The condition of all delivered equipment must be verified by the responsible party upon arrival at site. Verification that all equipment has been delivered as per contract must also be done upon arrival at site. Notification of missing or damaged items must be sent to Veolia Water Technologies Canada within five (5) working days of receipt of equipment. If there is no documented notification of missing or damaged parts within five (5) working days, Veolia Water Technologies Canada is not responsible for replacement of any items found to be missing or damaged at the time of installation and start-up of the supplied equipment. It is the responsibility of the party receiving the equipment to ensure all packaging is opened at the time of receipt to uncover and document any and all damages to the Freight Company and Veolia Water Technologies Canada.

Photographs and written documentation should be provided for all damaged equipment.

5 HANDLING

5.1 GENERAL

Equipment will arrive at the project site in several different shipments, from various freight companies and in several different packaging containers. Typically a flatbed truck is used which requires a fork lift or a crane to remove the items.

The Contractor is responsible for unloading and handling the equipment.

5.2 STAINLESS STEEL MATERIAL HANDLING

In order to minimize potential corrosion damage or unsightly surface marking, measures shall be taken to prevent contamination by iron, aluminium, copper, chlorides, and sulphides from lifting equipment. Stainless steel slippers or wooden packers should be used on forklift trucks to prevent contamination. Any resultant incidental contamination shall be removed at the earliest opportunity.

6 STORAGE

6.1 GENERAL

The following instructions outline the duties and responsibilities of the responsible party for equipment storage. The responsible party shall assume responsibility for the equipment upon arrival at the project site. These instructions shall define the minimum expectations for storage of all equipment. While this storage specification takes into account common environmental issues that may affect the system during storage, common sense should be the overriding factor in determining the best method to ensure the integrity and proper storage of the **VWTC** equipment.

For contractual purposes, **VWTC** demands the Client to send pictures of major equipment once it is placed in storage, any time it gets moved during storage and again prior to removing from storage. For outside storage, pictures must be sent every month. Alternatively, a written document (check list, etc.) confirming that proper storage conditions are maintained will suffice. Failing to do so would cancel the proposed warranty.

Should it be necessary to delay installation and subsequent operation of a unit for more than one month from date of receipt at Site, special precautions must be taken.

Although some equipment can be stored outdoors, indoor storage is preferred for most equipment.

The storage environment into which a system is placed can have a severe effect on the long-term usefulness of some parts. Key environmental factors are:

- Temperature
- Relative humidity
- Pollutants

Air may contain excessive moisture, pollutants, microorganisms, and other particulates that accelerate the deterioration of some materials. Humidity and pollutants can produce an aggressive atmosphere.

Indoor storage refers to storage in a climate controlled environment in a clean, non-aggressive, dry (non-condensing) and sheltered environment having a relatively constant temperature (especially for gear reducers, motors, bearings, etc.). Storage volume depends on the size of the project.

The environmental indoor conditions should not exceed the following ranges:

Min/Max Temperature Range between:	5°- 40°C
Relative Humidity (RH) Range between:	35% - 70%

1. Equipment should be stored in such a manner that it is free from allowing insects/rodents etc. from entering the equipment.
2. Cover the equipment with a tarp or similar protective shield to prevent direct exposure to dust or any other contamination. However, never enclose the unit or components totally in plastic covers; always leave adequate ventilation of air to prevent condensation.

Equipment must be checked on a weekly basis for tarp/wrap integrity and accumulation of dust or contaminants.

To avoid damage, do NOT stack crates.

To avoid damage, do NOT stack enclosures.

Do not store equipment or spares parts in barns, equipment sheds, or any other building without the capacity for heating and cooling as needed.

6.2 STAINLESS STEEL MATERIAL STORAGE

Stainless steel materials and products shall be stored separately from carbon steels and nonferrous materials. Materials should be stored under conditions that minimise the accumulation of dust and deposits. Any resultant incidental contamination shall be removed at the earliest opportunity.

6.3 SPECIAL MAINTENANCE REQUIREMENTS DURING STORAGE

After three (3) months of storage, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically (every month). Five (5) complete rotations of the output shafts are recommended each time.

Periodic checks should be made to ensure that no rusting or other damage has occurred. Should such be noted, corrective action should be taken immediately. Prior to putting the unit into service, drain lubricant and refill to the proper level as determined by the mounting position. Refer to manufacturer documentation.

All motors must be run every 3 month as a preventive measure against the formation of corrosion.

6.4 EQUIPMENT CLEANING

VWTC is not responsible for cleaning of any equipment prior to installation and start-up due to the storage of the equipment. This is the complete responsibility of others.

7 HYDRA-POL™ PRINCIPLE AND DESCRIPTION

7.1 POLYMER HYDRATION PRINCIPLE

Dry polymers must be diluted with water before use. The Hydra-Pol™ system is designed to handle all kind of dry polymer encountered in water treatment application (cationic, anionic and non-ionic). The uses of the Hydra-Pol™ polymer make up system allow activating between 90% and 100% of the dry polymer and help to minimize shipping and handling costs.

The challenge of dry polymer wetting is that the best activation each dry polymer particle should be wetted individually. When a clump of particles is wet, it forms an agglomeration called fisheyes that will dissolve slowly.

To avoid large agglomeration, the first polymer wetting and dilution must be done with a ratio between the service water and the dry polymer dosage. The wetting cone is designed for an optimal dissolving of dry polymer. The whirl created in the cone a high shearing stream that allows the polymer dispersion. After the powder dosage it cleans the cone. After the fast dispersion, the polymer hydration starts by forming a gel layer all around the polymer particles.

This dilution ratio is different depending on the type of polymer and the particle size. Anionic polymer must be more diluted than cationic polymer (see Table below).

The wetted polymer needs an aging time to reach its full activity; this aging time depends also on polymer type.

Polymer Powder	First Dilution	Aging Time
Anionic	0.2% – 0.25%	60 – 90 min
Cationic	0.3% – 0.5%	45 – 60 min

The polymer hydration changes its properties:

- Increase in molecule weight
- Charge interaction increase molecule size
- Entanglement in molecule increase viscosity
- Increase of conductivity

Dry polymers are susceptible to caking if stored under humid conditions. Caking interferes with the dilution process. It is recommended to store dry polymer in dry environment and respect powder life time.

7.2 DESIGN SUMMARY

7.2.1 Datasheet

If this polymer preparation system is integrated to a processing plant, refer to the Detailed Technical Documentation section of the Operation and Maintenance Manual for the preparation system datasheet.

7.2.2 P&ID

If this polymer preparation system is integrated to a processing plant, refer to the Process and/or Detailed Technical Documentation section of the Operation and Maintenance Manual for the preparation system drawings.

7.2.3 General Arrangement Drawings

If this polymer preparation system is integrated to a processing plant, refer to the Process and/or Detailed Technical Documentation section of the Operation and Maintenance Manual for the preparation system drawings.

7.3 COMPONENTS DESCRIPTION

The components of the Hydra-Pol™ system provide four main functions:

- Dry polymer storage and dosing
- Polymer wetting and transfer to the maturation tank
- Polymer maturation
- Polymer solution storage

7.3.1 Dry Polymer Storage and Dosing

7.3.1.1 Hopper with Vacuum or Bulk Bag Unloader

An integrated vacuum can fill a storage hopper located above the feeder. This vacuum allows manual transfer of polymer from dry bulk bags or other containers to the Hydra-Pol™ system.

The Hydra-Pol™ system is available with a bulk bag unloader option. It may be configured with a hoist and trolley or with a special frame for forklift loading. Each bulk bag unloader includes four (4) attachment points that raise the bulk bag to the polymer preparation system. An iris valve allows the discharge of the powder to a storage hopper.

7.3.1.2 Volumetric Feeder

WAM, model MBF, is a volumetric feeder that doses a dry material at a constant rate. It includes a homogenizer agitator installed in a hopper for a better material flow. The feed screw is made of stainless steel 304. The feeder includes, at the outlet, a T nozzle which directs the flow of the material, allows for isolation of the dosing screw, and has an inspection window where the powder dosing can be observed. The feeder contains a level switch, preventing the volumetric feeder from running when empty. A transition hopper is optional. It can be integrated with the volumetric feeder. It is made of stainless steel 304 and has a capacity of 100 L.

The feeder is also composed of a plunger which closes the T nozzle (at the exit of the metering) of the wetting cone. The operation of this device is controlled by a solenoid valve that allows a flow of water to the cylinder.

7.3.2 Polymer Wetting and Transfer to the Maturation Tank

7.3.2.1 Isolation Valve

An isolation ball valve is placed at the entry of the system to close the water inlet to the Hydra-Pol™. Two (2) others valves are placed at the outlet of the storage tank to drain or to close the conduit of the system. The valve is made of PVC with EPDM seals.

7.3.2.2 Solenoid Valve

Two solenoid valves are placed in the system. The first valve monitors the pressure of the inlet to the service water line. When the switch detects a fault, a switch commands the solenoid valve to close.

The second valve is used to let the water flow to the cylinder that triggers the opening of the dispenser. The return of this cylinder water flow goes to the wetting cone.

7.3.2.3 Service Water Pressure Switch

The pressure switch activation will trigger an error message and close the service water inlet valve if the inlet pressure is below its set point.

7.3.2.4 Pressure Gauge

The gauge is used to read the water inlet pressure.

7.3.2.5 Wetting Cone and Eductor

The wetting cone is a device that wets the metered powder and prevents material accumulation in the cone at the feeder output. It includes a tangential inlet to the cone that is controlled by a manual ball valve. It is very important to have the right amount of flow from this inlet into the cone to avoid having too little flow and a resulting accumulation of half-dry powder. However too much flow is also an issue, as it can cause water to splash up out of the cone and into the T nozzle.

An eductor, installed at the bottom of the wetting cone, draws the powder into the water flow through the system.

7.3.2.6 Check Valve

A check valve is placed after the output of the eductor. It prevents the return of the solution into the wetting cone when the system stops.

7.3.2.7 Static Mixer

The static mixer is a device which uses the flow energy to mix the water and the pre-wet polymer powder by means of mixing elements.

7.3.2.8 Level Switch

A level switch is installed in the hopper to signal the operator and stop the system when the level of powder becomes too low.

7.3.3 Polymer Maturation

7.3.3.1 Preparation Tank

The cylindrical preparation tank, made of stainless steel, allows the maturation process of the polymer solution. As stated in section 7.1, this timing depends on the volume of the batch, type of polymer and dosage. The tank plastic cover includes an access trap made of stainless steel. A butterfly valve is installed at the bottom of the tank to allow the transfer of the polymer solution to the storage tank. A hydrostatic pressure transmitter installed at the bottom of the tank to measure the level in the tank. An overflow is installed at the top of the tank.

7.3.3.2 Mixer

A mixer is installed on the cover of the preparation tank to allow maturation of the polymer solution. During the batching sequence, the mixer does not begin to run until the water level has reached the impellers. This level is set during commissioning and also dictates the point during the batching sequence when the volumetric feeder begins dosing.

7.3.3.3 Butterfly Valve

An open/closed actuated butterfly valve allows the solution transfer from the preparation tank to the storage tank when tanks are superimposed.

7.3.3.4 Conductivity Probe (optional)

A conductivity probe is installed in the preparation tank. Given experience, this conductivity probe will be able to reflect how the batch turned out. The conductivity is dependent on the service water, the temperature, the mixing/blending of the polymer, the polymer type and the dosage of polymer.

7.3.3.5 Pressure Transmitter

A hydrostatic pressure transmitter installed at the bottom of the tank measures the level in the tank. This level is set on commissioning and is integral to the batching sequence.

7.3.4 Polymer Solution Storage

7.3.4.1 Storage Tank

The cylindrical storage tank, made of stainless steel, allows the storage of the polymer solution. A support structure mounts the preparation tank above the storage tank. However, with tanks that have a larger capacity, tanks can be installed side by side and a pump allows the solution to be transfer from the

preparation tank to the storage tank. Anchor points are provided for fastening. An overflow is installed at the top of the tank.

7.3.4.2 Pressure Transmitter

A hydrostatic pressure transmitter installed at the bottom of the tank measures the level in the tank. This level is set on commissioning and controls when the batch in the preparation tank is transferred to the storage tank.

7.3.4.3 Control Panel

A control panel allows the fully automated system operation. It also allows the transmission of alarm signals to an external system.

8 INSTALLATION

8.1 SERVICE WATER

The Hydra-Pol™ system needs a clean water supply for the polymer activation a clean water supply. This water must meet quality criteria. The installer must connect the water supply as indicated on the general arrangement drawing.

8.1.1 Flowrate and Inlet Pressure

The required flow and pressure indicated on the technical data sheet are important to ensure proper system operation. These conditions must be met as a requirement for starting a batching sequence. When setting these inlet water standards, the dynamic head losses have to be taken into account. Non-compliance can lead to overflows at the wetting cone or plugging of the wetting cone due to improper blending. Inlet pressure is not to exceed 120 psig working pressure and must exceed 65 psig.

8.1.2 Water Temperature

The water temperature for the polymer make-up must preferably be between 10°C and 30°C. The ideal temperature is 15°C.

8.1.3 Water Quality

The service water should have preferably a low residual chlorine content (<0.5 mgCl_2/L). Chlorine can quickly deteriorate polymer solutions and thus reduce their effectiveness. Water having a high content of hardness (> 300 ppm $CaCO_3$) or alkalinity (>75 ppm) should also be avoided.

Parameter	Impact	Upper Allowable Limit
Total Hardness	High hardness causes precipitation in makedown vessels (most prevalent in high charge products)	<300 mg/L as Ca CO_3
pH	Low pH causes precipitation in makedown vessels	Makedown water pH in range of 6.0 to 8.0
Conductivity	High conductivity slows dissolution and reduces viscosity Low conductivity slows dissolution and reduces viscosity	< 10,000 µS/cm See following notes on conductivity
Chloride	No specific impacts distinct from that of conductivity as indicated above.	None specified. Refer to Conductivity limits.
Suspended Solids	High TSS promotes flocculation in makedown tank. Possible plugging of feed system.	< 5 mg/l (filtration at 100 µm).
Temperature	Warmer water promotes dissolution. Low temperature result in increased mixing time and potential for incomplete dissolution. Higher solution viscosities develop in low temperature solutions.	10 to 30°C
Metals(Fe^{2+}, Cu^{2+}...)	Cleavage of polymer chain and loss of activity.	< 1 mg/l each
Residual Oxidant	Degradation of polymer chain.	< 0.5 mg/l
Microbiological Activity	Degradation of polymer chain	< 10^3 CFU/ml aerobic or SRB

8.2 RECOMMENDED ARRANGEMENT

The installation should be performed by qualified personnel.

Select a location providing:

- An easy access to the system and an easy polymer handling.
- At least a clearance of one meter in front of the electrical panel.
- At least 72 inches of clearance behind the feeder for the maintenance.

In the presence of water, polymer becomes very slippery, it is recommended to take this hazard into account in the equipment layout.

It is recommended:

- To build a curb all around the area or install a plastic secondary containment.
- To secure the access to the top of tanks without entering into the secondary containment.
- To install a resistant coating and easy-to-wash on floors and curbs.
- To install tempered water hose close to the system.
- To install a closed floor drain in the secondary containment into which deteriorated polymer and the total volume of the Hydra-Pol™ tanks can be emptied.
- To design a concrete pad under the polymer tank to avoid flood damage to the instruments.
- To do not install equipment in areas of extreme heat, cold, dust or humidity. Avoid areas where objects or fluids can drop from overhead. Units are to be installed as close to the point of application as possible.

After selecting the optimal location, the installer will:

- Unpack the components.
- Install the preparation tank above the storage tank (if any) on a sturdy level surface. Fasten to prevent movement.
- Position powder dosing skid as the corresponding drawings on a sturdy level surface. Fasten to prevent movement.

8.3 PIPES CONNECTIONS

The installer has to connect the following pipes:

- Service water inlet.
- Tanks overflows and drains (they should be directed to an appropriate location according to local regulations).
- Pipe between the dosing system and the preparation tank. The dosing system should be located as close as possible from the preparation tank to reduce at the maximum the interconnecting pipe as shown on the General Arrangement drawing. Any extension of the pipe could bring an additional backpressure on the educator and change its performance.
- Transfer pipe between the two tanks (model over Hydra-Pol™ 7500).

8.4 ELECTRICAL REQUIREMENT

Electrical connections and maintenance must only be performed by qualified personnel. Electrical elements have to be connected according to local regulations. The Hydra-Pol™ system is usually provided with its own control panel.

The electrician has to connect:

- The mixer motor to the control panel
- Main power supply to the control panel
- Cables of instruments to the control panel

It is recommended to ground the dosing system frame and the two tanks (if made of steel).

9 INSTALLATION AND PRE START-UP INSPECTION

9.1 PRE-OPERATIONAL CHECKOUT

Included in appendices of this manual are standard **VWTC** checklist forms to be completed by the installer and returned to **VWTC** project manager prior **VWTC** onsite installation inspection. **VWTC** will schedule our field service visits prior to return of completed checklists but it is our policy to not dispatch field personnel to the jobsite until the completed and signed checklist is received by our project manager or field service manager.

9.2 START-UP CHECKOUT

9.2.1 Mechanical, Electrical and Control Start-Up

The mechanical and electrical start-up of the polymer make-up system includes the connection, verification and inspection of the following elements:

- Mounting
- Motors
- Mixers
- I/O Check
- Tubing and process connections
- Power connections and supply
- Valves
- Instrument calibration

9.2.1.1 Initial Checking and Adjustment

Prior to calibration the following elements will be verified:

FUNCTIONAL START-UP CHECKOUT	
Vacuum	Check that the air filter is in place.
	Check suction of the system. Do not put your hands on the suction nozzle.
Hoist & Trolley	Check that the hoist and the trolley operate correctly.
Feeder	Check whether foreign substances or water have entered the feeder. In such a case, clean thoroughly.
	Avoid any friction between the metering screw and the body. This requires opening the hopper and removing the T nozzle. Inspecting the screw/auger to be sure that it is flush with the walls of the hopper and inside the T nozzle is very important because removing the material can be difficult and risky.
	Check that the inspection hatch is closed (stainless steel feeder only).
	Check oil level in gear reducer.
	Check that the metering screw rotates counter clockwise when looking from the rear of the drive unit.
	Check that the feeder is working properly.
	Minimum speed and maximum speed must be verified.
Wetting Cone	Check that the wetting cone is completely clean and free from dirt or foreign objects.
	Check that the water flows tangentially into the cone.
	Ensure that the water speed is sufficient to create a vortex.
	Ensure that water speed is not too great to create splashing up into the T nozzle.
	Check that the metered powder falls vertically in the middle of the wetting cone.
Eductor	Check that the eductor is completely clean and free from dirt or foreign objects.
	Check that the service water pressure is higher than 65 psig in operation.
	Check that the eductor is working properly.
Piping	Check that the pipework are completely clean and free from dirt or foreign objects.
Manual valves	Check that all manual valves are working properly.
	The manual valves control the whirl and blending of the powder. Ensure that the flow is appropriate.
Automatic valves	Check that all automatic/electric valves are connected to the control panel.
	Check that all automatic/electric valves are working at proper times and the limit switches are set.
Instruments	Check that all instruments are properly calibrated.
	Check that all instruments are properly installed.
Pressure switch	Check that the pressure switch works properly by closing the water inlet valve.
	Check that the pressure switch is connected to the control panel.
	Check that the pressure switch works properly.
	Check the pressure gauge is working correctly.
Mixer	Check all bolts and nuts are properly tightened.
	Check the oil level in the gearbox.
	Check if installation of the mixer shaft is adequate.
	Check the direction of rotation of the agitator.
	Adjust the motor overload protection to the value shown on each motor nameplate.
	During start-up, listen for unusual noises and check for excessive vibration.
	Check the temperature of the motor and the gear reducer. The temperature should not exceed 180°F (82°C).
Static mixer	Check that the static mixer works properly.
Level transmitter	Check the calibration of the level transmitter.

9.2.2 Hydraulic Test

Due to the nature of the materials used in the Hydra-Pol™ systems, it is important that the hydraulic integrity of the system is verified even before the Control Start-Up is performed. The hydraulic inspection and testing is comprised of the following elements:

- Connect all fittings and walk the piping to be sure that the hydraulic pathway meets operational specifications.
- Verify that the service water system is ready to provide water and that the client is ready to accept water into their downstream system.
  - NOTE: this step is of extreme importance as during the construction phase, often communication with other workers is complicated and difficult. Be sure that you yourself check the discharge point and that no one is working in the area and that all risks are mitigated.
- Briefly allow water through the system by manually operating the valves. Check for leaks. Provided no leaking or loose connections are found, continue to the next step.
- Verify that the preparation tank and storage tank are clean and have head space to accept a few minutes of water. Manually operate the valves and booster pumps to allow for the operational pressure of the system is met. Walk the Hydra-Pol™ to verify that all tubing fittings are tight, that the T nozzle plunger is pulled back, and that the whirl in the wetting code is adequate.
  - NOTE: this step is of importance. If the whirl of the wetting cone is not adequate, then the wetting cone will clog with polymer and the clean-up will take hours.
- Allow the preparation and storage tank to fill with service water. Check that the level set-points give the desired volume for the sequencing and batching in the Process Start-Up section.
- Stop the system and do a final walk-through of all hydraulic and mechanical integrity.

9.2.3 Control Start-Up

The control start-up for the polymer make-up system include; connection, verification and inspection of the following elements:

- The alarms, start-up and shut down of the motors.
- The transmission of the electric signals of the different components as well as their configuration parameters if needed.
- The pumps alarm transmission to the plant system.
- I/O verification of instrumentation.
- Sequencing.
- The proper functioning of the electrical and process alarms.
- The variable frequency drives connection.
- The control panel.
- Other elements of control, if required.

Start-up and shut down sequencing will be checked:

- Normal start and stop sequencing.
- Alarms stop sequencing.
- Clearing alarms and restarting the process.

9.2.4 Process Start-Up

Once the mechanical, electrical, hydraulic and control start-up of the preparation system have been completed, the equipment commissioning can begin. The following steps will be performed.

9.2.4.1 Screw Calibration Procedure

Tests will be performed using water for the initial testing and the specific chemical for the final test.

- Calibration of the dosing screw at minimum, full range and intermediate speeds to set the functional output curve.
- Preparation unit concentration and dosage settings.

Powder polymer is injected into a preparation tank using a dosing apparatus. The apparatus operating time is calculated based on its capacity and the desired concentration.

9.2.4.1.1 Dosage Calculation

The operating dosing time is calculated based with the following formula:

$$T_s = \frac{CONC \times \left(\left(LEV_{stop} - LEV \right) \times SURF \right)}{CAP} \times 60$$

T_s:	Dosing apparatus operating time (sec)
CONC:	Polymer concentration adjustable to operator interface (g/l)
LEV:	Preparation tank current level (m)
LEV_{stop}:	Preparation stop level set point (m)
SURF:	Preparation tank surface (m^2)
CAP:	Dosing apparatus capacity adjustable to operator interface (kg/min)

Note: This formula may also be used to perform a manual preparation in case of automatic system failure. To ensure dosing accuracy of the tank, capacity must be validated by the operator.

9.2.4.1.2 Feeder Capacity

The feeder capacity must be checked by weighing the discharged amount of polymer powder/time.

The operator must repeat four (4) times the following procedure:

- Set a frequency on the VFD – Start with 60 Hz.
- Hold a sample shovel just under the outlet of the powder feeder.
- Then turn the switch for FEEDER to position H for a specific time.
- Weigh the contents in the sample shovel.

EXAMPLE (dry polymer):

Obtained value 2000 g/20 sec = 6 kg/min = feeder capacity

Assume that 0,3% concentration is to be mixed in a 400 L tank (see the actual value on the data sheet). The amount needed for each batch will be:

$$\frac{0.3 \times Size\ of\ tank\ (dm^3)}{100} = \frac{0.3 \times 400}{100} = 1.2\ kg$$

The dosing time of the powder feeder will then be:

$$\frac{1.2\ [Amount\ of\ polymer\ in\ kg]}{6\ [Capacity\ of\ feeder\ in\ kg/min]} = 0.2\ minute$$

This dosing time is set on the interface. Record the test procedures and test results/settings within the manual.

9.2.5 Process Start-Up Records

The personal in charge of the commissioning will furnish inspection sheets for equipment including:

- Project name
- Tag number and description
- Manufacturer
- Model and serial number
- Date, time and person who will perform calibration
- Calibration data to include:
  - Input, output and error at minimum, intermittent and maximum output range
- Space for comments
- Certification by installer and acknowledgment by contractor and date
- Adjustment of the service water flow rate and pressures (if required)

10 TROUBLESHOOTING GUIDE

COMPONENT	ISSUES	POSSIBLE CAUSES	ACTION
SERVICE WATER INLET	Service water low pressure.	Service water feed system low pressure.	Inspect service water system and booster pumps.
		Obstruction.	Clean pipes.
VACUUM	Reduction of the suction capacity at the vacuum filling of the polymer powder.	Clogging of the dust filter.	Remove the external filter and clean. Verify that the lid and viewport have no leaks.
		Max level in the powder hopper is exceeded and/or malfunctioning level sensors.	Stop the filling. Inspect the feedback from level indicators. If not reflective of material's level, inspect wiring and ability to detect material.
		The feeder shutter at the outlet of the feeder is not shut.	Filling must not be done while the feeder is operating. Wait until the feeder has stopped.
WETTING CONE	Clogging of the wetting cone.	The feeder shutter at the outlet of the feeder is not shut.	Check the function of the solenoid valve to the feeder shutter, or clean the shutter from possible polymer powder clogging.
		The water whirl in the wetting cone is too small.	Check water pressure.
FEEDER	Feeder does not run.	No power to the feeder.	Check the button or the on / off switch of the machine is turned on.
			Check that the isolating switch is in the on position.
			Check that the inverter is not set to 0 Hz.
			Check if there are short circuits, blown fuses or tripped breakers.
			Check that the power supply corresponds to control and motor requirements.

			Check if there are error messages in the drive controller screen.
	Feeder screw or agitator is damaged.	Foreign body inside feeder.	Remove foreign body and replace damaged components
	Feeder screw or agitator stops.	Hygroscopic material inside feeder has absorbed humidity.	Unload feeder completely when shutting down for long periods.
	Feeder – Rotating components unscrewed, no material handled.	Motor incorrectly wired.	Rewire (metering screw must turn counter clockwise when viewed from behind drive unit).
	Feeder – Sticking of hygroscopic products; Agglomeration of viscous materials; Contamination of the product.	Long shutdown period.	Unload feeder completely when shutting down for longer periods.
	Feeder makes scraping or grinding noise.	Foreign body inside feeder. Poor alignment of gearbox, hopper wall welding.	Visually inspect the hopper and the level of the auger by removing the T nozzle.
TANK	Maturation tank or storage tank overflow.	Level transmitter default.	Inspect level transmitter.
	Incorrect concentration of the polymer solution.	Wrong dosing time set point	Calibrate the dosing screw and adjust parameter.
		Polymer density change.	Calibrate the dosing screw and adjust parameter.
TRANSFER VALVE	Transfer valve not closing tight.	Debris present in the valve.	Remove the foreign object and check for possible damages.
		The adjustment of the travel stop is incorrect.	Adjust the actuator travel stop according to the manufacturer's instructions.
		Prepared polymer solution concentration is too high	Adjust the concentration

Note: If the preparation sequence is interrupted by a power failure or by component failure then the current polymer batch will be lost and will have to be drained. Broken components will have to be replaced before starting a new polymer batch.

11 MAINTENANCE

Any manipulation of metering equipment and chemicals should be done by qualified and trained personnel. Refer to product MSDS for safe material handling.

ITEM	DESCRIPTION	WEEKLY	MONTHLY	BI-MONTHLY	YEARLY	COMMENTS
MIXER	Gearbox visual inspection and noise	X				
	Check gearbox oil level	X				
PREPARATION TANK AND STORAGE TANK	Empty storage and preparation tanks. Check the presence of foreign matter at the bottom. Clean if necessary.				Every 6 months	Dispose of chemical residues appropriately
PIPING	Check for leaks.	X				
	Rinse pipes with lukewarm water.				Every 6 months	
LEVEL TRANSMITTER	Calibrate on a regular basis and / or when readings become inaccurate (specific to each type of use).				Every 6 months	
STATIC MIXER	Visual check. Clean if required	X				
FEEDER	If the feeder uses MBTX, MBTN or MBTT type shaft seals, check these on a monthly basis to make sure they are in good working condition.		X			Grease monthly
DISSOLVER CONE	Inspect the cone for the presence of polymer agglomeration. In case of loss of suction, remove and clean eductor with hot water. Inspect weekly to ensure that there is no accumulation of polymer or fouling and, if necessary, clean by draining the cone and the eductor with water.	X				
VALVES	Inspected and clean if required. Refer to supplier's maintenance manual.				Every 6 month	
DOSING SKID FRAME OR BULK BAG UNLOADER	Check the appearance of the structure, paying particular attention to the state of welds.		X			
	Check that all bolts are correctly tightened, in particular the vibrator fixing bolts.		X			

12 SPARE PARTS

It is highly recommended to keep in stock spare parts in sufficient quantity for all critical components to the proper functioning of the system.

Only the use of original Veolia spare parts will ensure proper and reliable operation of the system.

When ordering a spare part, please give the following information:

- Veolia's project number
- Veolia's project name
- Part number

APPENDIX A

START-UP CHECKOUT CHECKLIST
(TO BE COMPLETED BY CONTRACTOR)

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VEOLIA	HYDRA-POL START-UP CHECKOUT CHECKLIST		
Project		Date	
Structure		Revision	
Number		Doc. N°	
Reactor		Written by	

N°	ITEMS	X	COMMENTS
1	**AUXILIARY COMPONENTS TEST PROCEDURE**		
1.1	Place Main Disconnect to "ON"		
1.2	Put Water inlet valve in manual mode "OPEN" position		
1.3	Check service water pressure when valve placed in OPEN position		
1.4	Check water whirl in wetting cone		
1.5	Adjust manual wetting cone valve for desired whirl level		
1.6	Check service water is going to mixing tank		
1.7	Close manual water inlet valve		
1.8	Verify that water pressure switch alarm activates after **2 seconds**		
1.9	Open manual water inlet valve		
1.10	Verify that water pressure switch alarm is disabled		
1.11	Simulate (if possible) the function of powder hopper level switch		
1.12	Start powder vacuum conveyor (if supplied)		
1.13	Stop powder vacuum conveyor (if supplied)		
1.14	Start hoist & trolley (if supplied)		
1.15	Stop hoist & trolley (if supplied)		
1.16	AUXILIARIES COMPONENTS TEST PROCEDURE COMPLETED		
2.0	**MANUAL WET TEST PROCEDURE**		
2.1	Place Main Disconnect to "ON"		
2.2	Put water inlet valve in manual mode "OPEN" position		
2.3	Check service water pressure when valve placed in OPEN position		
2.4	Check water whirl in wetting cone		
2.5	Adjust manual wetting cone valve for desired whirl level		
2.6	Check service water is going to mixing tank		
2.7	Wait water level in mixing tank reaches mixer level + 100 mm (fully covering the impeller)		
2.8	Place mixer selector in manual mode "START" position		
2.9	Confirm impeller rotation follows supplier requirement		
2.10	Put feeder discharge valve in manual mode "OPEN" position		
2.11	Check feeder discharge valve is "OPEN"		
2.12	Place blending motor (if applicable) selector in manual mode "START" position		
2.13	Check blending motor (if applicable) is in"RUN" mode		

N°	ITEMS	X	COMMENTS
2.14	Place feeder motor selector in Manual mode "START" position		
2.15	Check feeder motor (if applicable) is in "RUN" mode		
2.16	Confirm screw feeder rotation follows requirement		
2.17	Place feeder motor selector in manual mode "STOP" position		
2.18	Place blending motor (if applicable) selector in manual mode "STOP" position		
2.19	Put feeder discharge valve in manual mode "CLOSE" position		
2.20	Put mixer in manual mode "STOP" position		
2.21	Put water inlet valve in manual mode "CLOSE" position		
2.22	Put mixing tank transfer valve in manual mode "OPEN" position		
2.23	Verify that water transfers from mixing tank to storage tank		
2.24	Put mixing tank transfer valve in manual mode "CLOSE" position		
2.25	MANUAL WET TEST PROCEDURE COMPLETED		
3.0	**FEEDER CALIBRATION PROCEDURE**		
3.1	Place polymer powder in storage hopper		Follow IOM for specific requirements
3.2	Put water inlet valve in manual mode "OPEN" position		
3.3	Check service water pressure when valve placed in OPEN position		
3.4	Check water whirl in wetting cone		
3.5	Adjust manual wetting cone valve for desired whirl level		
3.6	Check service water is going to mixing tank		
3.7	Wait water level in mixing tank reaches mixer level + 100 mm (fully covering the impeller)		
3.8	Place mixer selector in manual mode "START" position		
3.9	Put feeder discharge valve in manual mode "OPEN" position		
3.10	Check feeder discharge valve is "OPEN"		
3.11	Place blending motor (if applicable) selector in manual mode "START" position		
3.12	Install powder test sampling collection device at feeder discharge		
3.13	Place feeder motor selector in manual mode "START" position		
3.14	Let feeder run for 2-3 minutes until flowrate reach steady state is reached		
3.15	Place feeder motor selector in manual mode "STOP" position		
3.16	Dispose collected powder in storage hopper		
3.17	Install powder test sampling collection device at feeder discharge		
3.18	Place feeder motor selector in manual mode "START" position		
3.19	Run feeder for 1 minute and weigh collected powder sample		
3.20	Dispose collected powder in storage hopper		
3.21	Place feeder motor selector in manual mode "STOP" position		
3.22	Repeat 4 times the powder sampling procedure (1 min for each test)		
3.23	Remove highest and lowest weighted values and determine feeder real capacity by calculating the average value between the three closest values		
3.24	Insert feeder real capacity value in Hydra-Pol HMI (feeder calibration screen)		

N°	ITEMS	X	COMMENTS
3.25	Place all motor selectors on "STOP"		
3.26	Place all valve switches on "OFF"		
3.27	FEEDER CALIBRATION PROCEDURE IS COMPLETED		
4.0	**AUTOMATIC START-UP PROCEDURE**		
4.1	Put all valve selector switches in "AUTO" position		
4.2	Put all motor selector switches in "AUTO" position		
4.3	Check service water pressure when valve placed in AUTO position		
4.4	Check water whirl in wetting cone		
4.5	Adjust manual wetting cone valve for desired whirl level		
4.6	Check service water is going to mixing tank		
4.7	Confirm that mixer starts automaticaly		
4.8	Confirm that feeder discharge valve opens		
4.9	Confirm that blending motor starts		
4.10	Confirm that feeder starts		
4.11	Confirm that powder is fed to wetting system		
4.12	Confirm that feeder motor stops when feeding time is completed		
4.13	Confirm that blending motor stops		
4.14	Confirm that feeder discharge valve closes		
4.15	Confirm that water inlet valve closes when water level reaches HIGH LEVEL		
4.16	Confirm that mixer stops when mixing time is completed		
4.17	Confirm that mix tank discharge valve opens when mixing time is completed and liquid level in storage tank is under low level storage tank		
4.18	Confirm that mix tank discharge valve closes after transfer		
4.19	Confirm that new batch restarts automaticaly		
4.20	AUTOMATIC START-UP PROCEDURE IS COMPLETED		
5.0	**HYDRASTAT START-UP PROCEDURE**		
5.1	Calibrate probes according to MFG procedure		
5.2	Start SC-200 according to MFG procedure		
5.3	Wait until 2-3 automatic batches are completed		
5.4	Put Hydra-Stat in "Autocalibration mode" on HMI		
5.5	Hydra-Stat will generate setpoints and reference curve		
5.6	If make-up concentration is changed, new auto-calibration is required		

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APPENDIX B

COMPONENTS DATA SHEETS AND MAINTENANCE MANUALS

If this polymer preparation system is integrated to a processing plant, refer to the Manufacturer Operation and Maintenance Manual section of the Operation and Maintenance Manual for the preparation system component manufacturer manuals.

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6 – OPERATION AND MAINTENANCE

6.3 – SULFURIC ACID DOSING SKID

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Installation, Operation and Maintenance Manual

ELECTROMAGNETIC PUMPS – DOSING SKID SYSTEM

DOCUMENT NO: IOM_0041_PCH

SEPTEMBER 2016, REVISION 1

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TABLE OF CONTENTS

1 INTRODUCTION

This document provides installation, operation and maintenance instructions for a dosing skid equipped with a solenoid driven diaphragm metering pump (electromagnetic pump). For specific information regarding the pump installed on the dosing system, refer to the manual of the manufacturer.

The skid components are supplied by Veolia Water Technologies Canada (VWTC).

Skid design and equipment selection are done by VWTC.

To obtain any additional information regarding characteristics or instructions on this equipment, please do not hesitate to contact us.

The system was designed in Canada by:

Veolia Water Technologies Canada
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: 514-334-7230
Fax: 514-334-5070

For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada After Sales Support
1-844-SER-VWT9 | 1-844-737-8989 | vwtservicecanada@veolia.com

Our business hours are from
Monday to Friday
8:30am to 5pm EST

2 SAFETY

2.1 INTRODUCTION

Your safety is of the utmost concern. Dosing pumps and systems can handle harsh or toxic chemicals and exposure can lead to serious injury or death. Always wear appropriate protective clothing (for example, safety glasses, gloves, coveralls, etc.) and follow safe handling procedures. Pay attention to what you're doing and note safety advisories where they are shown throughout this manual. Some examples of safety issues and precautions for chemical dosing systems are:

- Do not use dosing skid systems for flammable liquids.
- Prior to working on any portion of the skid system, disconnect pump(s) from power supply, de-pressurize the system and drain chemicals from the lines.
- Inspect tubing regularly and replace as necessary. When inspecting tubing, wear protective clothing and safety glasses.
- If skid system is exposed to sunlight, use UV-resistant tubing.
- Follow directions and warnings provided with chemicals from the chemical manufacturer. User/Owner is responsible for determining chemical compatibility with chemical feed pump(s) and system components.
- Secure chemicals, metering pump(s) and system, making them inaccessible to children, pets, and unauthorized personnel.
- Always wear protective clothing, including gloves and safety goggles when working on or near chemical metering pump(s) and system.
- All connections (threaded, screwed or bolted) may only be loosened when the system is not under pressure.
- Installation and start-up of chemical dosing system will require both mechanical (plumbing) and electrical work. Only qualified and licensed plumbers and electricians should perform this.

2.2 FALL HAZARDS

Common causes of slips are due to wet or oily surfaces and occasional spills.

Operators should reduce the risk of slipping on wet flooring by:

- Cleaning all spills immediately.
- Marking spills and wet area by using a cone or other warning device.

2.3 CHEMICALS HAZARDS

WHMIS Material Safety Data Sheets (MSDS) should be available for each chemical product. Since chemicals or chemical dosage are used during normal operation of treatment facility, the risks of fire, explosion and exposure to toxic chemicals or chemical burns are present. Chemicals typically used with dosing system are coagulant and polymer.

Operators should be made aware of the following:

- All chemicals which are used and any potentially dangerous reaction that could occur.
- Toxicity of all chemicals that are used or could be formed via reactions.
- Acidic or basic properties of all materials used.
- Potential fire or explosion hazards posed by the chemicals.
- Antidotes for exposure to toxic materials.
- Protective clothing that is recommended.
- Chemicals spills may be slippery.

2.4 ELECTRICAL CONNECTIONS

Electrical connections must be made by certified electricians in compliance with all applicable codes and regulations.

3 SHIPPING

Most of the equipment and material for this project will be drop shipped and delivered directly to the site.

- All items delivered will be clearly identified with VWTC's name, VWTC's project name and VWT's project number.
- All shipments will have a clear packing list identifying all parts in the shipment.
- All equipment will be tagged with the corresponding tag numbers shown on the design drawings (if applicable).

If there are more stringent requirements in the contract documents, they will take precedence over the above. If any of these requirements are not being followed, please notify the VWTC project manager immediately.

4 RECEIVING

The condition of all delivered equipment must be verified by the responsible party upon arrival at site. Verification that all equipment has been delivered as per contract must also be done upon arrival at site. Notification of missing or damaged items must be sent to VWTC within 10 days of receipt of equipment. If there is no documented notification of missing or damaged parts within 10 days, VWTC is not responsible for replacement of any items found to be missing or damaged at the time of installation and start-up of the supplied equipment. It is the responsibility of the party receiving the equipment to ensure all packaging is opened at the time of receipt to uncover and document any and all damages to the Freight Company and VWTC.

Photographs and written documentation should be provided on all damaged equipment.

5 HANDLING

5.1 GENERAL

The Contractor is responsible for the equipment unloading and handling.

5.2 POLYPROPYLENE MATERIAL HANDLING

Care should be taken to avoid damages to the surface of the polypropylene panels due to dragging or from sharp objects.

6 STORAGE

6.1 GENERAL

The following instructions outline the duties and responsibilities of the responsible party for equipment storage. The responsible party shall assume responsibility for the equipment upon arrival at the project site. These instructions shall define the minimum expectations for storage of all equipment.

While this storage specification takes into account common environmental issues that may affect the system during storage, common sense should be the overriding factor in determining the best method to ensure the integrity and proper storage of the VWTC equipment.

For contractual purposes, VWTC demands the Client to send pictures of major equipment once it is placed in storage, any time it gets moved during storage and again prior to removing from storage. For outside storage, pictures must be sent every month. Alternatively, a written document (check list, etc.) confirming that proper storage conditions are maintained will suffice. Failing to do so would cancel the proposed warranty.

Should it be necessary to delay installation and subsequent operation of a unit for more than one month from date of receipt on site, special precautions must be taken.

Although some equipment can be stored outdoors, indoor storage is preferred for most equipment.

The storage environment into which a system is placed can have a severe effect on the long-term usefulness of some spare parts. Key environmental factors are:

- Temperature
- Relative humidity
- Pollutants

Air may contain excessive moisture, pollutants, microorganisms, and other particulates that accelerate the deterioration of some materials. Humidity and pollutants can produce an aggressive atmosphere.

6.1.1 INDOOR STORAGE

Indoor storage refers to storage in a climate controlled environment under a clean non-aggressive, in a dry (non-condensing) and sheltered environment having a relatively constant temperature (especially for gear reducers, motors, bearings, etc.).

The environmental indoor conditions should not exceed the following ranges:

Min/Max temperature range between: 5°- 40°C
Relative humidity range between: 35% - 70% (RH)

1. Equipment should be stored in a manner to be kept free from allowing insects/rodents etc. from entering the equipment.
2. Cover the equipment with a tarp or similar protective shield to prevent direct exposure to dust or any other contamination. However, never enclose the unit or components totally in plastic covers; always leave adequate ventilation of air to prevent condensation.
3. Equipment stored near a window should be protected from UV rays.
4. Storage volume depends on the size of the project.
5. Equipment must be checked on a weekly basis for tarp/wrap integrity and accumulation.
6. To avoid damage, do NOT stack crates.
7. To avoid damage, do NOT stack enclosures.

8. Do not store spares in barns, equipment sheds, or any other building without the capacity for heating and cooling as needed.

6.2 EQUIPMENT CLEANING

VWTC is not responsible for cleaning of any equipment prior to installation and start-up due to the storage of the equipment. This is the complete responsibility of others.

7 INSTALLATION

7.1 GENERAL

The installation of the chemical dosing skids must be completed on site by the installation contractor.

Please find below the list of tasks that need to be performed by the contractor at job site:

- Installation should be performed by a qualified contactor.
- The installation contractor must ensure that the necessary lifting equipment is available on site to carry out the installation.
- All nuts & bolts need to be verified, accounted for and tightened.

7.2 SYSTEM OVERVIEW

The system is designed to pump chemicals at precisely controlled rates into another process or system.

Proper arrangement of piping and appurtenances on both the supply side and the process side are critical to the successful operation of the overall system. These are the responsibility of the installer of the system, and attention should be paid to the comments below:

Most VWTC pre-engineered skids will have electromagnetic pump(s) mounted on them at the factory, and the pump(s) will be connected to the piping integral to the skid with tubing.

7.2.1 SUPPLY SIDE

Dosing chemicals are usually sourced from a barrel or tote container. The source may be located above the centerline of the pump(s) which is referred to a 'flooded suction' or it may be located slightly below the centerline of the pump(s) which is referred to as 'suction lift'. Connections to and from the solution tank are most commonly made with hard piping. The solution tank should be covered to prevent contamination.

7.2.1.1 FLOODED SUCTION

This is the most trouble free type of installation. Since the supply line tubing is filled with chemical, priming is accomplished quickly and the chance of losing prime is reduced.

Recommended for very low flow rate applications, e.g. 2 ml/hr, or where pumping solutions such as sodium hypochlorite or hydrogen peroxide which can form air bubbles.

Supply line should gradually slope downward from the solution tank to the skid suction connection.

It is strongly recommended to add a drain provision on the suction side to facilitate emptying and flushing of the system for maintenance.

The next figure illustrates a typical pump skid system for flooded suction (chemical source above the pump centerline).

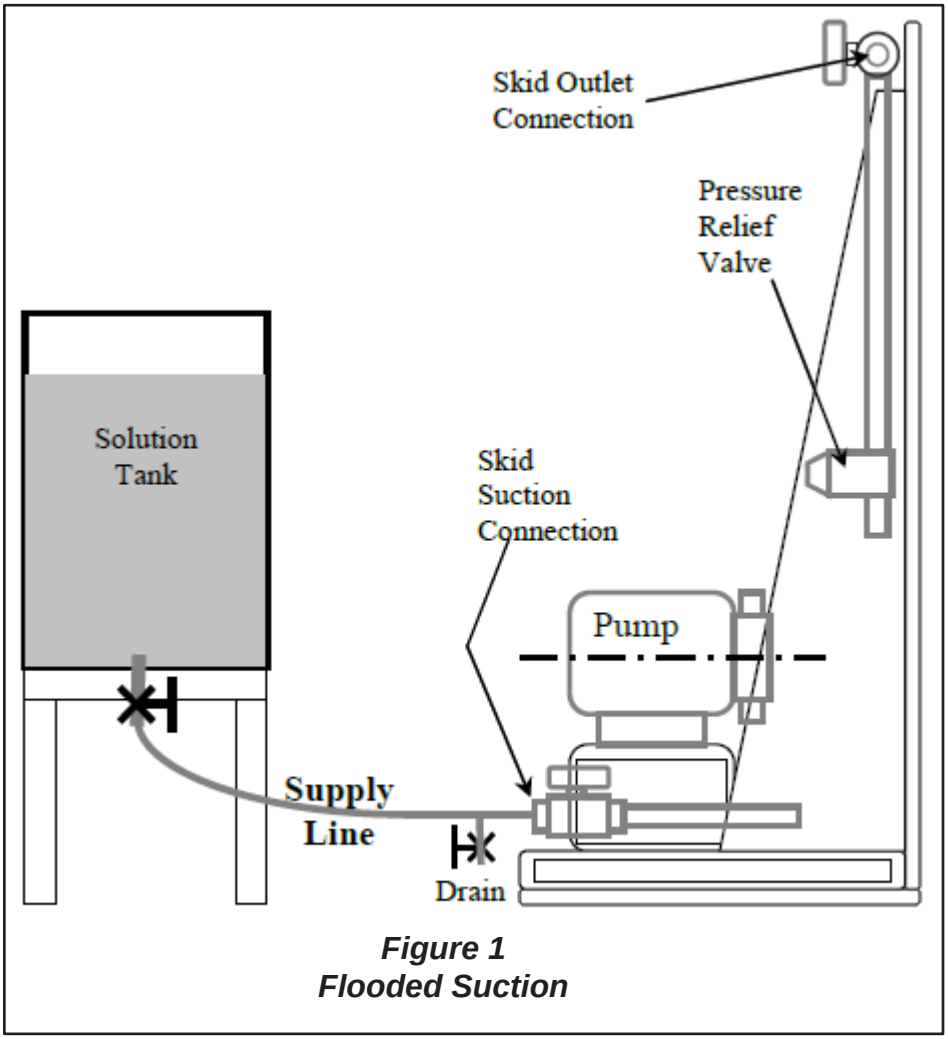


Figure 1
Flooded Suction

7.2.1.2 SUCTION LIFT

This is the most common arrangement for chemical metering applications since there is less chance of spillage.

Note that the maximum recommended lift is 5 feet (1.5 m). Verify specific recommended lift in pump manual.

Since the supply line will be in a vacuum condition, attention should be paid to the vapor pressure of the pumped liquid. Vapor formation in the supply line will prevent the pump from pumping.

Supply line should gradually slope up to the skid suction connection to prevent air pocket(s) which can impede flow.

It is strongly recommended to add a drain provision on the suction side to facilitate emptying and flushing of the system for maintenance.

The next figure illustrates a typical pump skid system with a suction lift arrangement.

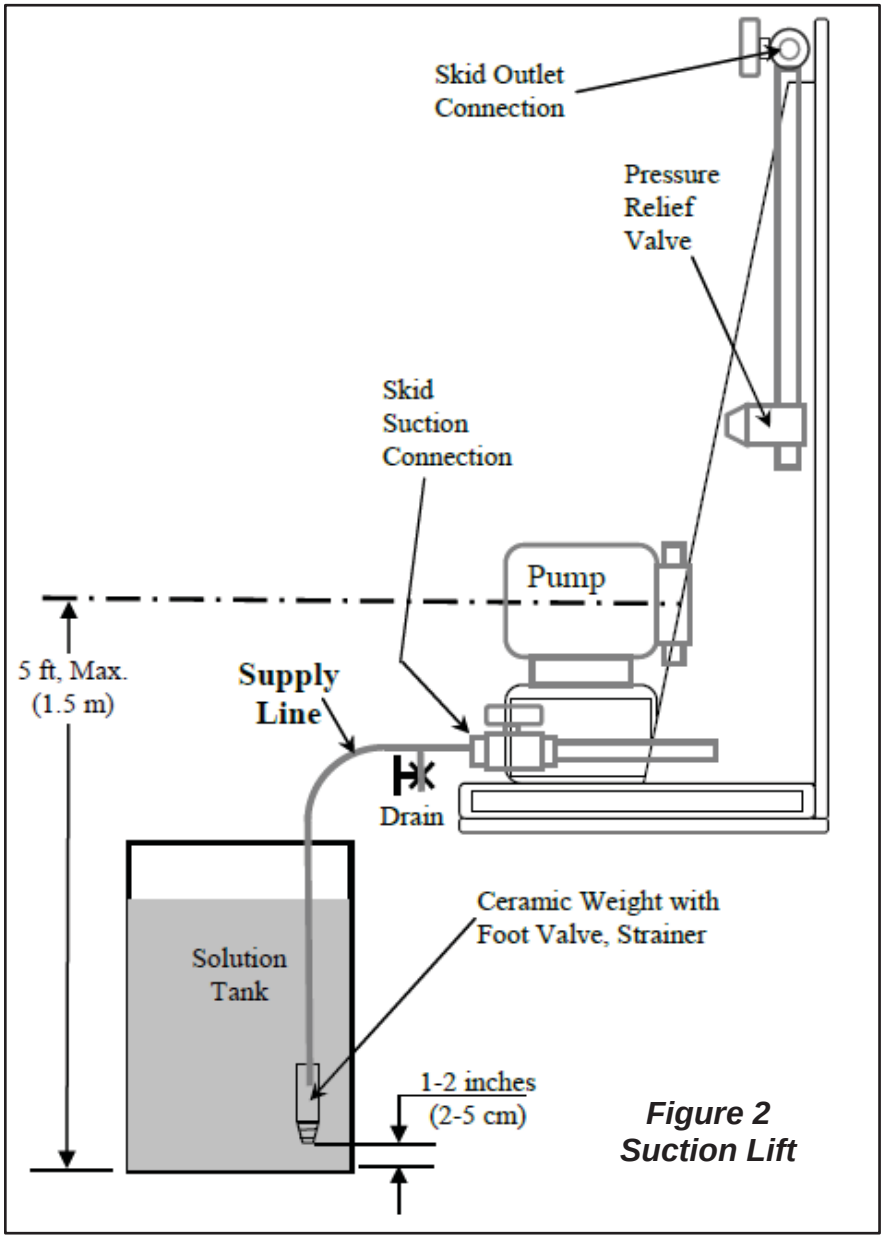


Figure 2
Suction Lift

Process Side

The injection point in the served process or system must be higher than the top of the solution supply tank to prohibit gravity feeding unless suitable backpressure is always present at the injection point.

In applications where the injection point is below the solution supply tank (e.g. injection into a well) or where the injection point may be at reduced pressure (e.g. injection into the suction side of a pump), installation of a back pressure/anti-siphon valve in the process feed line will prevent gravity feeding.

Note comments on process side piping/tubing on the next illustration.

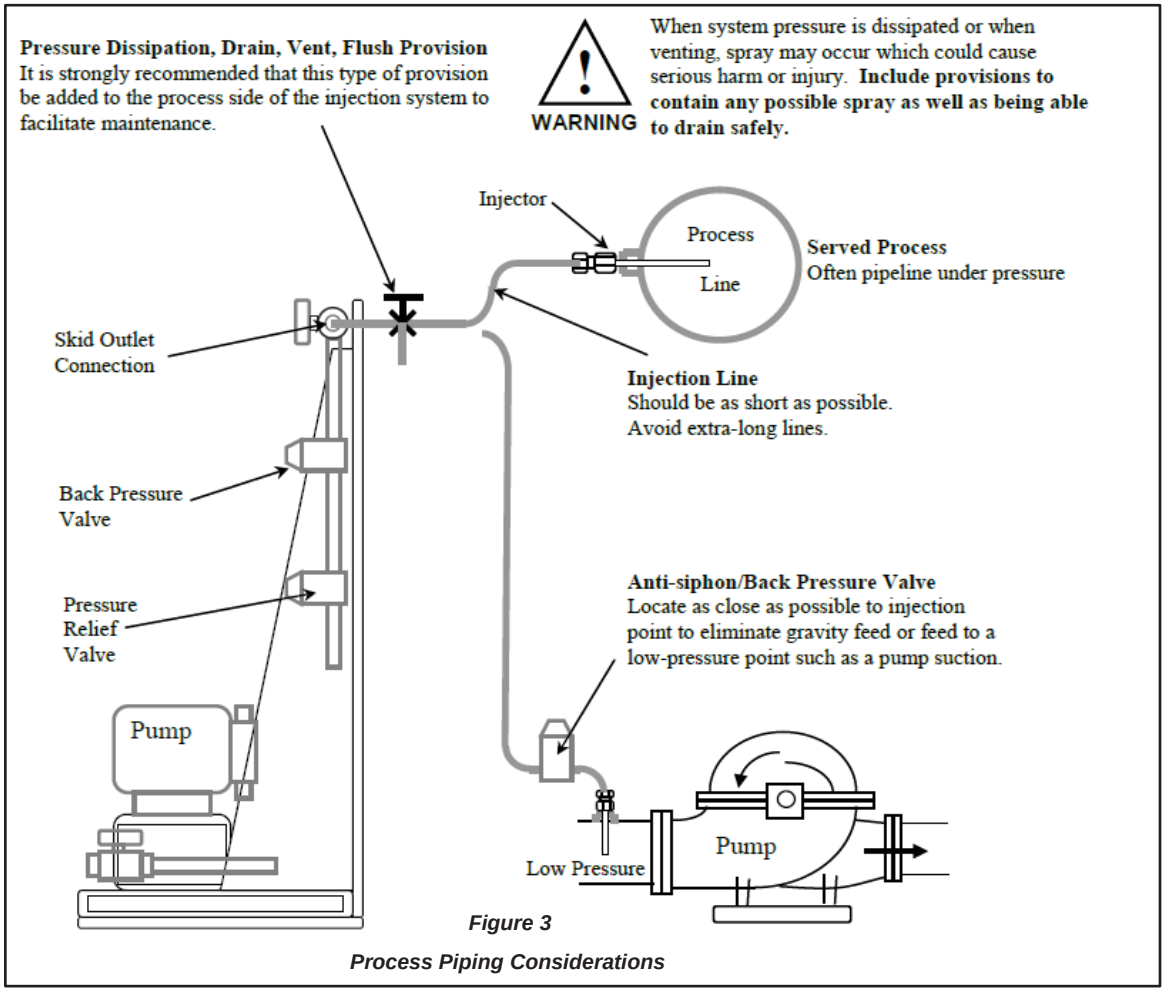
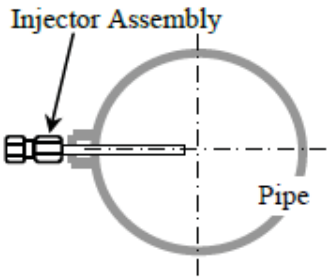


Figure 3

Process Piping Considerations



Injection Point

Injected chemicals may be corrosive to piping. To minimize corrosive effects, locate injector tip near center of process flow where velocities and mixing are at their highest rate. Trim tip as necessary. For larger pipe installations, longer injection assemblies are available.

Figure 4
Injection Point

Installation

Prior to attempting installation, familiarize yourself with the layout and components furnished with your pre-engineered skid system. These vary from system to system. Review the documentation supplied with your order.

Skid systems (and pumps) have been tested with water at the factory.

Some dosing chemicals will react with water, e.g., acids, polymers, etc. Check MSDS for the chemical to be handled. If adverse reaction with water is indicated, ensure that all portions of the skid piping, its components (and the pump) are free from the water prior to filling skid system with chemical.

Securely attach skid in its installation position to prevent falling or tipping.

Installation area should provide ease of access to skid components (and pumps) and the area should be kept free of clutter to enable safe operation and maintenance.

Note that skids are designed for ambient temperatures of 104°F (40°C) maximum. It is preferable that skid systems (and pumps) be located out of direct sunlight. If skid system is exposed to sunlight, provide protection for the pump/motor to prevent overheating and if skid is exposed to sunlight, use UV resistant tubing.

Connect the pump suction and discharge (refer to next figure) to the corresponding piping connections on the skid-mounted piping. Refer to installation drawing for location(s) of these piping connections. This is usually done with tubing, however always ensure that the connection material is compatible with the chemical to be pumped and suitable for the pressures and temperatures. Tubing connection fittings are usually plastic in which case they should be hand-tight only.

Figure 5
Typical Pump-to-Skid Tubing Connections

7.2.2 INTERCONNECTING PIPING

The next series of steps are the connection of your piping/tubing which include the chemical supply line, discharge line, pressure relief/bypass line and an air bleed return line.

These are your responsibility:

Ensure that for all piping, tubing, fittings and other appurtenances, their materials are compatible with the liquid to be pumped and the design is suitable for the pressures and temperatures of the application. System design must ensure safety for operation and maintenance as well as for anyone who may be in proximity to the system. Failure to do so may result in damage to equipment, personal injury or death.

7.2.3 SUCTION LINE

This line connects the source of the dosing chemical to the pre-engineered skid. Please refer to Figure 1 and Figure 2 on pages 10 and 11 respectively. If the source is below the centerline of the pump (suction lift condition), ensure that the suction line has a gradual rise up to the skid suction connection. If the source is above the centerline of the pump, ensure that the suction line has a gradual slope down to the skid suction connection. The purpose of this is to prevent air pocket(s) in the suction line which could affect proper operation of the pump. Include whatever provisions you consider necessary to facilitate the maintenance and operation such as isolation valve(s), drain and/or flush connections, etc., making sure that this sub-system enables SAFE OPERATION.

A foot valve is supplied with pumps, for use in suction lift arrangement.

7.2.4 DISCHARGE LINE

This line connects the skid to your served process. Please refer to the general description on page 12 and 13 and Figure 3 and Figure 4. This line should include the injector assembly that is usually furnished with the pump. If the injection point is below the dosing chemical source or if injecting into a low pressure area such as the suction of a pump, an anti-siphon/back pressure valve should be located as close as possible to the injection point to prevent unwanted chemical feeding. Include whatever provisions you consider necessary to facilitate maintenance and operation such as isolation valve(s), drain and/or flush connections, etc., making sure that this sub-system enables SAFE OPERATION.

7.2.5 AIR BLEED VALVE BYPASS LINE (if applicable)

Although most metering pumps are self-priming, they cannot pump against pressure when handling air in the priming cycle. An air bleed is necessary to enable the pump to prime, and an air bleed valve is provided for this. During the priming process, the air bleed valve is opened with the opening knob. Air will pass through the air bleed bypass line until the pump body is filled with process fluid. When the process fluid flows through the bypass line without any air bubbles, the pump is primed. The opening knob is then closed and the pump is ready for operation. Connect the air bleed bypass line to a suitable receptacle. This is often the suction source but can be a separate container. Firmly fix the outlet of the air bleed bypass line within the receiving receptacle to prevent any possible spraying.

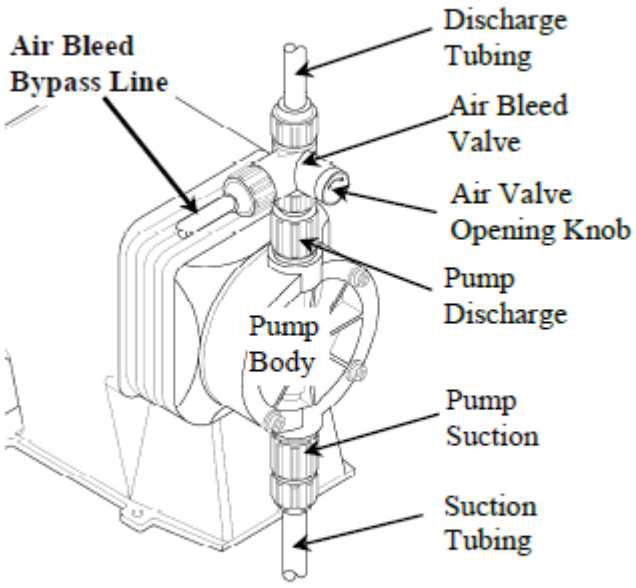


Figure 6
Air Bleed Valve Configuration

Check all piping and tubing connections on the skid to ensure they are tight.

Check all other system piping and/or tubing connections to ensure they are tight.

7.3 START-UP

7.3.1 INITIAL PRIME

The pump must be primed before it can function within the system. This will require an initial start of the pump.

Thoroughly review the installation, operation and maintenance manual for your pump prior to starting. Follow pump start-up instructions. Failure to do so may result in damage to equipment or serious injury.

Flooded Suction System

1. Close skid discharge valve and column isolation valve.
2. Open air bleed valve (turn opening knob counter clockwise, refer to Figure 6).
3. Open all valve(s) on the suction side – Skid suction connection valve and any valve(s) in your suction line.
4. Connect pump/motor to power source (pump/motor off).
5. Start pump using manufacturer's recommendations for initial operation settings.
6. Observe flow through air bleed bypass. When solid stream (no air bubbles) is observed, pump is primed.
7. Shut off pump.
8. Close air bleed valve (turn opening knob clockwise).

System with Suction Lift

With a suction lift configuration, the entire suction arrangement (suction line and skid suction piping) as well as the pump must be purged of air before the pump can function. The pump can evacuate the air, however this may take considerable time.

Optional:
If the dosing chemical can be handled safely, it may be helpful to add dosing chemical to the suction assembly via the top of the calibration column. This requires the installation of a foot valve at the entrance to the suction line within the chemical source container. Open the air bleed valve turning the opening knob counter clockwise (refer to Figure 6). Open column isolation valve. Open all valves in the suction line. Add dosing chemical into the top of the calibration column until liquid remains visible. Follow steps, below. Note that air bleed valve is open.

1. Close skid discharge valve and column isolation valve.
2. Open air bleed valve (turn opening knob counter clockwise, refer to Figure 6).
3. Open all valve(s) on the suction side – skid suction connection valve and any valve(s) in your suction line.
4. Connect pump/motor to power source (pump/motor off).
5. Start pump using manufacturer's recommendations for initial operation settings.
6. Observe flow through air bleed bypass. When solid stream (no air bubbles) is observed, pump is primed.
7. Shut off pump.
8. Close air bleed valve (turn opening knob clockwise).

7.3.2 SETTING VALVES

If furnished with your pre-engineered skid system, the pressure relief valve and back pressure valve will be pre-set at the factory. These pressure settings are related to the piping and components furnished with your skid as well as the pump(s) if furnished with the skid. Your system requirements may require changes to these settings and the valves will have to be re-set after maintenance. A general description and the setting procedures for these components are as follows:

Pressure Relief Valve (PRV)

A pressure relief valve must always be used with a chemical metering system that uses a positive displacement pump. This device is designed to protect the pump and system from over pressurization and it must be set to relieve at the maximum allowable pressure for the weakest point in the total system. This may be in your piping on the discharge side of the skid.

It is extremely important that you determine this pressure limitation and set the PRV accordingly.

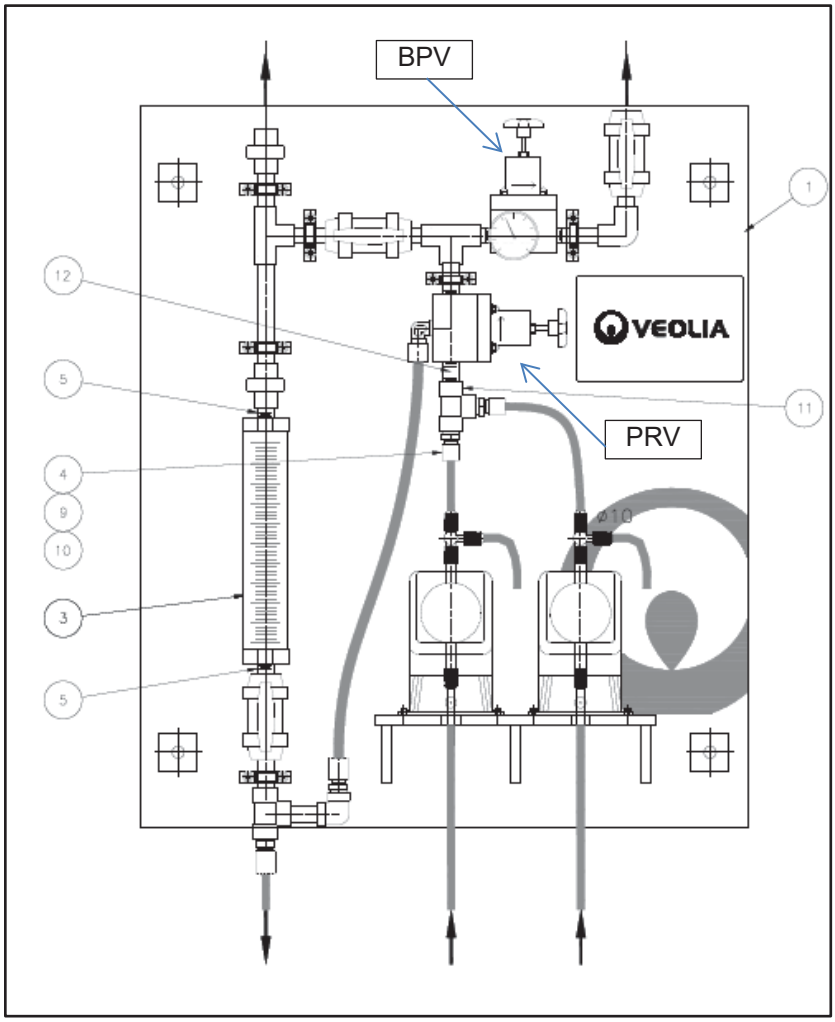


Figure 7 - Skid component locations (TYPICAL)

Back Pressure Valve (BPV)

The back pressure valve enables the pump to work against a constant pressure and will also function as an anti-siphon valve. This is especially important for injection systems that operate at low pressures or where there may be fluctuations in injector system pressure. The BPV is typically set at 50 PSIG, but a lower set pressure may be required depending upon your pump and your system configuration.

7.3.3 SETTING VALVES PROCEDURE

Prior to setting valve pressure, the skid discharge piping should be filled with liquid.

1. Set pulsation dampener air pressure (see above).
2. Adjust PRV and BPV to their lowest pressure setting (fully open).
3. Adjust skid discharge valve and/or system piping to allow venting from the skid discharge piping.
4. With pump primed, run pump until air is evacuated from the skid discharge piping.
5. Shut off pump.

7.3.3.1 SET PRESSURE RELIEF VALVE (PRV)

With pressure relief valve and back pressure valve fully open (lowest pressure setting):

1. Close skid discharge valve.
2. Start pump, monitor skid discharge gauge pressure. It should pulse slightly.
3. Gradually increase pressure at PRV until the skid pressure gauge reads the maximum allowable pump and/or system pressure at the highest pulsation pressure.
4. Shut down pump.
5. PRV is now set.

7.3.3.2 SET BACK PRESSURE VALVE (BPV)

After the pressure relief valve has been set, check to see that the BPV is fully open (lowest pressure setting):

1. Adjust skid discharge valve and/or system piping to allow free discharge from the skid discharge piping. Capture free discharge in an appropriate manner.
2. Start pump, monitor skid discharge gauge pressure.
3. Gradually increase pressure at BPV until correct pressure is indicated on the skid discharge gauge.
4. Shut down pump.
5. BPV is now set
6. Re-adjust system discharge piping/tubing to enable flow into the served process.

Check all system piping/tubing connections to ensure that they are properly tightened (hand-tight for plastic fittings) and leak-free.

Pumping system is now ready for operation.

7.3.4 FLOW CALIBRATION

Chemical metering systems are designed to provide chemicals to a process at precise flow rates. Metering pump output (flow rate) can be set as a function of both stroke lengths and stroke frequency. A calibration column is used to determine pump flow rate and to enable flow rate adjustments. The column must be filled with the dosing chemical prior to performing the calibration.

Use extreme care when handling chemicals.
Avoid any spray, splatter or spilling.
Always wear appropriate protective clothing.

Filling calibration Column

For a skid system with a cross-connect, the calibration column is filled by the pump.

1. Turn the column isolation valve to allow flow from the cross-connect into the calibration column.
2. Then turn the flow diverter valve to direct flow from the discharge header through the cross-connect into the calibration column.
3. Once the liquid level in the calibration column reaches slightly above the topmost scale mark, turn the flow diverter valve to re-direct flow into the system. Do not overfill.
4. Close column isolation valve.
5. Calibration column is filled and ready for the calibration procedure.

Note: While the calibration column is being filled in this manner, dosing chemical will not be provided to the served process.

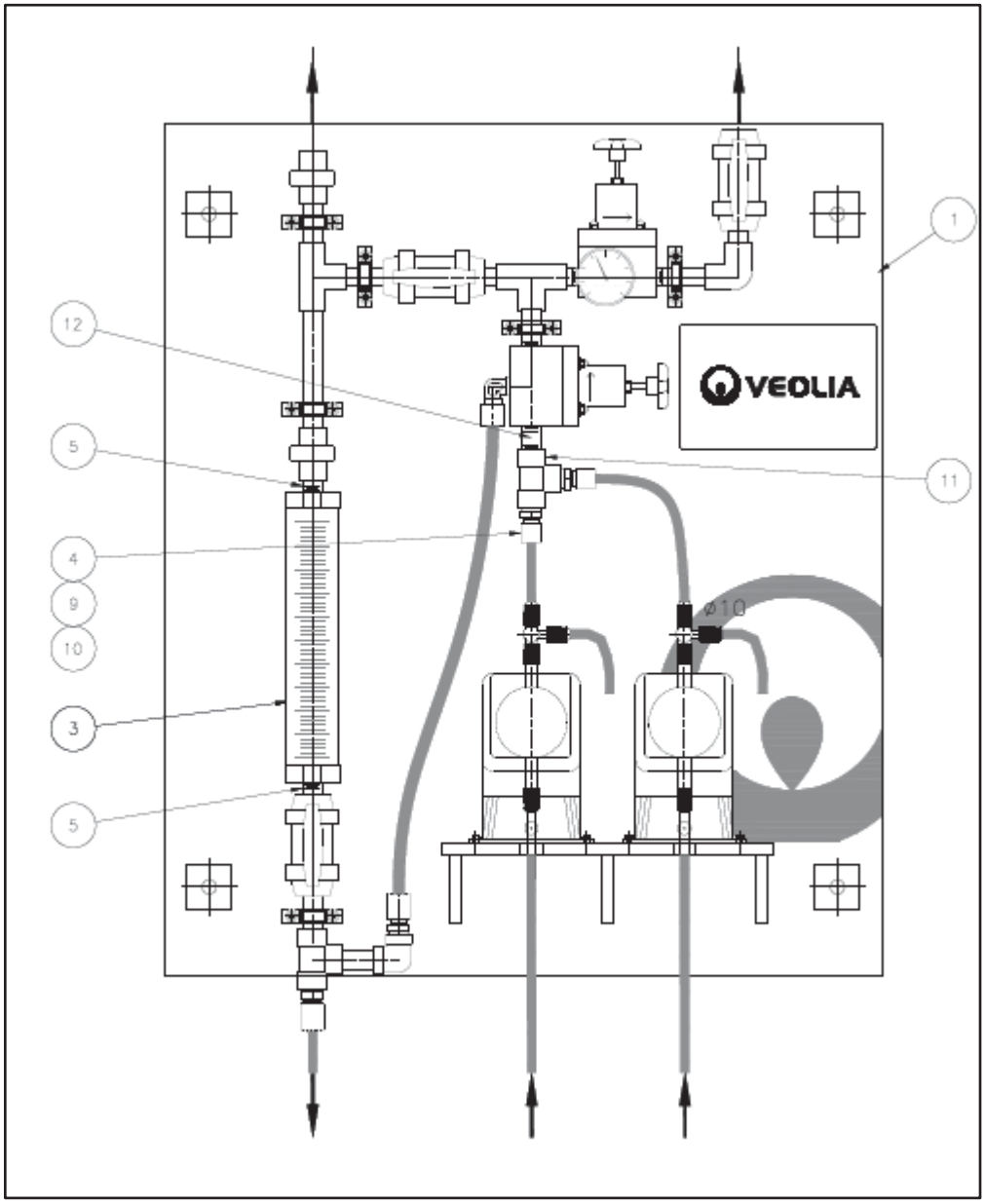


Figure 8 - Skid system with cross-connect (EXAMPLE)

For systems on suction lift (refer to Figure 2 on page 11)

1. Partially fill the calibration column through the top.
2. Open the column isolation valve briefly to vent any air that may be present in the suction header piping. Close the column isolation valve.
3. Fill the calibration column too slightly above the top scale mark.

Calibration column is filled and ready for the calibration procedure.

7.3.5 FLOW CALIBRATION PROCEDURE

The calibration column is filled to slightly above the top mark of the scale. The pump is then run in the system while being fed from the calibration column. After a 30 second time period, the liquid level reading on the scale will be a direct readout of the pump flow rate in US Gal/hr (note that a milliliter scale is also shown on the calibration column).

With the pump running in the system:

1. Open the column isolation valve so that the column feeds into the suction header, and immediately close the skid suction valve (refer to Figure 9 and 10).
2. Observe the liquid level in the calibration column. When it reaches the top scale mark, begin timing.
3. Allow 30 seconds to pass.
4. Open the skid suction valve and immediately close the column isolation valve.
5. Read pump output flow rate directly on the scale in US Gal/hr.

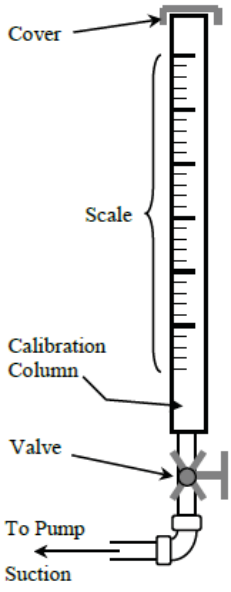


Figure 9
Calibration Column

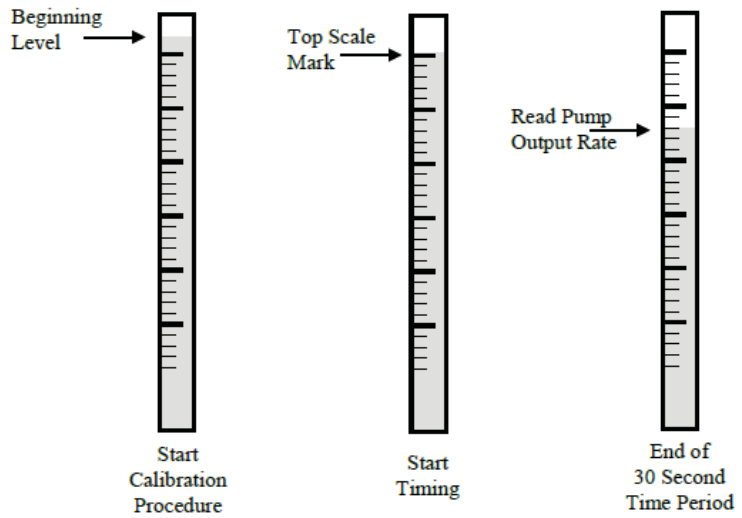


Figure 10
Liquid Levels During Calibration

Once the calibration is complete, compare the reading to the desired rate for your system. Refer to your pump operation manual and adjust flow rate up or down accordingly (this is usually done by changing stroke frequency). After pump adjustment is made, repeat calibration procedure. Continue until the desired flow rate is achieved.

7.4 ROUTINE MAINTENANCE

Before performing any Maintenance on your skid system or pump,

Skid components, pump(s) and your process piping may be under pressure!
Prior to working on any portion of the skid system, disconnect pump(s) from power supply, de-pressurize the entire system and drain chemicals from the lines.
Flush and neutralize as necessary.
Always wear suitable protection (gloves, safety glasses/goggles, etc.).

Routine maintenance will depend upon your service requirements: dosing chemical(s) being handled, environmental conditions, duty cycle(s) of pump(s), etc. When working on any component of your system, i.e., pump, valves, pulsation dampener, refer to the installation, operation and maintenance manual for that particular item. Some operational and maintenance checks that need to be performed are:

ITEM	MAINTENANCE	DAILY	WEEKLY	MONTHLY	YEARLY
Strainer	Check this for the presence of trapped solids and clean as necessary.		X		
Piping/Tubing Integrity	Routinely check piping, tubing, isolation valves and connections for leaks. Replace tubing as necessary.		X		
System Operation	Perform flow calibration regularly to ensure that dosing chemical is being added at the proper rate.			X	
Pressure Relief and Back Pressure Valves	Check to ensure that bolts are tight. Recommend monthly. Diaphragms should be replaced on an annual basis.				X
Calibration Column	If handling sticky chemicals, may require cleaning to view liquid level inside. Perform as				

ITEM	MAINTENANCE	DAILY	WEEKLY	MONTHLY	YEARLY
	necessary.				
Foot Valve	The pumps come equipped with a foot valve for the suction line. This valve should be checked for solids build up and blockages.		**X**		

7.5 TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	REMEDY
Pump doesn't deliver product	Air entering suction line	Check fittings for tightness Check integrity of tubing Check level in suction source-must be above foot valve at inlet
	Air trapped in suction line	Re-configure suction line to eliminate air pocket(s)
	Suction line kinked or clogged	Inspect, replace tubing
	Chemical source empty	Refill, re-prime pump
	Pump not primed, air/gas in system	Re-prime pump
	Air/gas bubbles forming in chemical	Reduce suction lift or change to flooded suction Consider chemical storage temperature
	Strainer clogged	Check strainer, clean
	Pressure Relief Valve Open	Check Pressure Relief Valve integrity Check Pressure Relief Valve setting
	Pump problem(s) may be: Diaphragm wear, rupture Check valves worn or clogged Low pump flow setting Voltage/electrical difficulty	Refer to pump instructions
Piping Vibration/chatter	Pulsation Dampener malfunction	Check Pulsation Dampener Integrity Check Dampener air pressure
Injection rate too high, too low	Pump output setting incorrect	Perform flow calibration
	Chemical concentration too high, low	Adjust chemical source strength
	Siphoning into well or low pressure point	Add Back Pressure Valve at injection point.
	Injector clogged, scaled, restricted	Check injector for solids or corrosion Clean as necessary or replace
Injection rate varies	Back Pressure Valve	Check Back Pressure Valve integrity Check Back Pressure Valve setting
Tubing failure	Sunlight/UV exposure	Change to UV-resistant tubing
	Corrosive attack	Determine material compatibility, change as necessary
Leaky fittings	Loose fittings	Tighten fittings-plastic fittings should be hand-tight only
	Corrosive attack	Determine material compatibility, change as necessary

6 – OPERATION AND MAINTENANCE

6.4 – COAGULANT AND $KMnO_4$ DOSING SKID

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Installation, Operation and Maintenance Manual

PULSAR SHADOW MECHANICAL DIAPHRAGM METERING PUMP DOSING SKID SYSTEM

DOCUMENT NO: IOM_0021_PCH

MARCH 2016, REVISION 1

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WATER TECHNOLOGIES

TABLE OF CONTENTS

1 INTRODUCTION

This document provides installation, operation and maintenance instructions for a chemical dosing skid equipped with Pulsafeeder Pulsar Shadow mechanical diaphragm metering pump(s). For specific information regarding the pump installed on the dosing system, refer to the manual of the manufacturer.

The skid components are supplied by Veolia Water Technologies Canada (VWTC).

To obtain any additional information regarding characteristics or instructions on this equipment, please do not hesitate to contact us.

The system was designed in Canada by:

Veolia Water Technologies Canada
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: 514-334-7230
Fax: 514-334-5070

For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada After Sales Support
1-844-SER-VWT9 | 1-844-737-8989 | vwtservicecanada@veolia.com

Our business hours are from
Monday to Friday
8:30am to 5pm EST

2 SAFETY

2.1 INTRODUCTION

Your safety is of the utmost concern. Dosing pumps and systems can handle harsh or toxic chemicals and exposure can lead to serious injury or death. Always wear appropriate protective clothing (for example, safety glasses, gloves, coveralls, etc.) and follow safe handling procedures. Pay attention to what you're doing and note safety advisories where they are shown throughout this manual. Some examples of safety issues and precautions for chemical dosing systems are:

- Do not use dosing skid systems for flammable liquids.
- Prior to working on any portion of the skid system, disconnect pump(s) from power supply, de-pressurize the system and drain chemicals from the lines.
- Inspect tubing regularly and replace as necessary. When inspecting tubing, wear protective clothing and safety glasses.
- If skid system is exposed to sunlight, use UV-resistant tubing.
- Follow directions and warnings provided with chemicals from the chemical manufacturer. User/Owner is responsible for determining chemical compatibility with chemical feed pump(s) and system components.
- Secure chemicals, metering pump(s) and system, making them inaccessible to children, pets, and unauthorized personnel.
- Always wear protective clothing, including gloves and safety goggles when working on or near chemical metering pump(s) and system.
- All connections (threaded, screwed or bolted) may only be loosened when the system is not under pressure.
- Installation and start-up of chemical dosing system will require both mechanical (plumbing) and electrical work. Only qualified and licensed plumbers and electricians should perform this.

2.2 FALL HAZARDS

As per OSHA statistic's, the majority of falls results from trips and slips. Common causes of slips are due to wet or oily surfaces and occasional spills.

Operators should reduce the risk of slipping on wet flooring by:

- Cleaning all spills immediately.
- Marking spills and wet area by using a cone or other warning device.

2.3 CHEMICALS HAZARDS

WHMIS Material Safety Data Sheets (MSDS) should be available for each chemical product. Since chemicals or chemical dosage are used during normal operation of treatment facility, the risks of fire, explosion and exposure to toxic chemicals or chemical burns are present. Chemicals typically used with dosing system are coagulant and polymer.

Operators should be made aware of the following:

- All chemicals which are used and any potentially dangerous reaction that could occur.
- Toxicity of all chemicals that are used or could be formed via reactions.
- Acidic or basic properties of all materials used.
- Potential fire or explosion hazards posed by the chemicals.
- Antidotes for exposure to toxic materials.
- Protective clothing that is recommended.
- Chemicals spills may be slippery.

2.4 ELECTRICAL CONNECTIONS

Electrical connections must be made by certified electricians in compliance with all applicable codes and regulations.

3 SHIPPING

Most of the equipment and material for this project will be drop shipped and delivered directly to the site.

- All items delivered will be clearly identified with VWTC's name, VWTC's project name and VWT's project number.
- All shipments will have a clear Packing List identifying all parts in the shipment.
- All equipment will be tagged with the corresponding tag numbers shown on the design drawings (if applicable).

If there are more stringent requirements in the contract documents, they will take precedence over the above. If any of these requirements are not being followed, please notify the VWTC Project Manager immediately.

4 RECEIVING

The condition of all delivered equipment must be verified by the responsible party upon arrival at site. Verification that all equipment has been delivered as per contract must also be done upon arrival at site. Notification of missing or damaged items must be sent to VWTC within five (5) working days of receipt of equipment. If there is no documented notification of missing or damaged parts within five (5) working days, VWTC is not responsible for replacement of any items found to be missing or damaged at the time of installation and start-up of the supplied equipment. It is the responsibility of the party receiving the equipment to ensure all packaging is opened at the time of receipt to uncover and document any and all damages to the Freight Company and VWTC.

Photographs and written documentation should be provided for all damaged equipment.

5 HANDLING

5.1 GENERAL

Equipment will arrive at the project site in several different shipments, from various freight companies and in several different packaging containers. Typically a flatbed truck is used which requires a fork lift or a crane to remove the items.

The Contractor is responsible for unloading and handling the equipment.

5.2 POLYPROPYLENE MATERIAL HANDLING

Care should be taken to avoid damages to the surface of the polypropylene panels due to dragging or from sharp objects.

6 STORAGE

6.1 GENERAL

The following instructions outline the duties and responsibilities of the responsible party for equipment storage. The responsible party shall assume responsibility for the equipment upon arrival at the project site. These instructions shall define the minimum expectations for storage of all equipment.

While this storage specification takes into account common environmental issues that may affect the system during storage, common sense should be the overriding factor in determining the best method to ensure the integrity and proper storage of the VWTC equipment.

For contractual purposes, VWTC demands the Client to send pictures of major equipment once it is placed in storage, any time it gets moved during storage and again prior to removing from storage. Alternatively, a written document (check list, etc.) confirming that proper storage conditions are maintained will suffice. Failing to do so would cancel the proposed warranty.

Should it be necessary to delay installation and subsequent operation of a unit for more than one month from date of receipt at site, special precautions must be taken.

The chemical dosing skid shall be stored indoor at a temperature above 5°C. The storage environment into which a system is placed can have a severe effect on the long-term usefulness of some spare parts. Key environmental factors are:

- Temperature
- Relative humidity
- Pollutants

Air may contain excessive moisture, pollutants, microorganisms, and other particulates that accelerate the deterioration of some materials. Humidity and pollutants can produce an aggressive atmosphere.

6.2 PVC PIPING STORAGE CONDITIONS

Pipe units should be stored and placed on level ground. Caution shall be taken to avoid compression, damage or deformation to the ends of the pipes. Racks or dunnage shall be used to prevent damage to the bottom pipes during storage and to support them. Supports should be spaced to prevent pipe bending.

When exposure in excess of one year to direct sunlight is unavoidable, the pipes should be covered with an opaque material while permitting adequate air circulation above and around the pipes as required preventing excess heat accumulation. The interior of the pipes, as well as all end surfaces, should be kept free from dirt and foreign matter until the pipes are ready to be used.

7 SKID OVERVIEW

The dosing skid system is designed to pump chemicals at precisely controlled rates into another process or system.

Proper arrangement of piping and appurtenances on both the supply side are critical to the successful operation of the overall system. These are the responsibility of the owner/operator of the system, and attention should be paid to the comments below:

SUPPLY SIDE

Dosing chemicals are usually sourced from a storage tank. When the source is located above the centerline of the pump(s) this is referred to as a 'flooded suction'. Connections to and from the solution tank are most commonly made with hard piping. The feed tank should be covered to prevent contamination.

Supply line should gradually slope downward from the feed tank to the skid suction connection.

It is strongly recommended to add a drain provision on the suction side to facilitate emptying and flushing of the system for maintenance.

8 INSTALLATION

Prior to attempting installation, familiarize yourself with the layout and components furnished with your dosing skid system. These vary from system to system and review the documentation supplied with your system. Inspect your skid system for damages which may have occurred during transit. If damages are discovered, immediately file a claim with the carrier and contact Veolia Water Technologies for any required parts or components.

Skid systems, including pump(s), have been tested with water prior to shipment.

Some dosing chemicals will react with water, e.g., acids, polymers, etc. Check the MSDS for the chemical to be handled. If adverse reaction with water is indicated, ensure that all portions of the skid piping, its components and the pump, are free of water prior to filling the skid system with chemical.

Skid systems may be wall or floor mounted. Mounting holes are provided or can be drilled on the skid for both types of mounting. Securely attach the skid in its installation position to prevent falling or tipping.

The installation area should provide ease of access to skid components, including pump(s), and the area should be kept free of clutter to enable safe operation and maintenance.

Note that pumps/motors are designed for ambient temperatures of 104°F (40°C) maximum. It is preferable that skid systems and pump(s) be located out of direct sunlight. If the skid system is exposed to sunlight, provide protection for the pump/motor to prevent overheating and if the skid is exposed to sunlight, use UV resistant tubing.

If skid is exposed to sunlight, use UV-resistant tubing.

Most chemical dosing skids will have pump(s) mounted on them before shipment, and the pump(s) will be connected to the skid integral piping with tubing.

8.1 OWNER-INSTALLED PIPING / TUBING

The next series of steps are the connection of your piping/tubing which include the chemical supply line, discharge line, pressure relief/bypass line and an air bleed return line.

These are <u>your</u> responsibility and ensure that for all piping, tubing, fitting and other appurtenances, their materials are compatible with the liquid to be pumped and the design is suitable for the pressures and temperatures of the application. System design must ensure safety for operation and maintenance as well as for anyone who may be in proximity to the system. Failure to do so may result in damage to equipment, personal injury or death.

8.2 SUCTION LINE

This line connects the source of the dosing chemical to the dosing skid. Include whatever provisions you consider necessary to facilitate the maintenance and operation such as isolation valve(s), drain and/or flush connections, etc., making sure that this sub-system enables safe operation.

8.3 DISCHARGE LINE

This line connects the dosing skid to the served process. Include whatever provisions you consider necessary to facilitate maintenance and operation, such as isolation valve(s), drain and/or flush connections, etc., making sure that this system enables **SAFE OPERATION**.

9 INITIAL START-UP

The pump must be primed before it can function within the system. This will require an initial start of the pump.

Thoroughly review the installation, operation and maintenance manual for your pump prior to starting. Follow pump start-up instructions. Failure to do so may result in damage to equipment or serious injury.

FLOODED SUCTION SYSTEM

1. Close skid discharge valve and column isolation valve.
2. Connect pump/motor to power source (pump/motor off).
3. Start pump using manufacturer's recommendations for initial operation settings.
4. Shut off pump.

9.1 SETTING VALVES

If furnished with your dosing skid system, the pressure relief valve and back pressure valve will be preset prior to shipment. These pressure settings are related to the piping and components furnished with your skid as well as the pump(s) if furnished with the skid. Your system requirements may demand changes to these settings and the valves will have to be reset after maintenance such as diaphragm replacement. A general description and the setting procedures for these components are as follows.

9.2 PRESSURE RELIEF VALVE

A pressure relief valve (PRV) must always be used with a chemical metering system that uses a positive displacement pump. This device is designed to protect the pump and system from over pressurization and it must be set to relieve at the maximum allowable pressure for the weakest point in the total system. This may be in your piping on the discharge side of the skid. The pressure relief valves are factory set and cannot be modified. If the pressure set point is surpassed, the valve will need to be replaced. The pressure setting is indicated on the P&ID drawings.

Most dosing skid systems include a pressure relief valve and suction header where the PRV is directly connected from the discharge header to the suction header. If your skid system does not include a suction header, or if you are providing your own PRV, relief flow from the pressure relief port on the PRV must be directed to either the suction source or a separate receptacle. This is usually done with tubing.

Care must be taken to channel any free flow from the pumping system into an appropriate receptacle. Eliminate any possibility of splashing, spraying or spillage. Always wear suitable protective equipment (gloves, safety goggles/glasses, coveralls, etc.) when working with or around chemical dosing systems.

Check all system piping/tubing connections to ensure that they are properly tightened (handtight for plastic fittings) and leak free.

Pumping system is now ready for operation.

9.3 FLOW CALIBRATION

Chemical metering systems are designed to provide chemicals to a process at precise flow rates. Metering pump output (flow rate) can be set with a variable frequency drive (VFD). A calibration column is used to determine pump flow rate and to enable flow rate adjustments.

The procedures for filling the calibration column and for calibrating the pumps are described below. Review both complete procedures before proceeding with next steps.

FILLING THE CALIBRATION COLUMN BY OPENING THE COLUMN ISOLATION VALVE

- Use extreme care when handling chemicals.
- Avoid any spray, splatter or spilling.
- Always wear appropriate protective clothing.

FOR SYSTEMS WITH FLOODED SUCTION:

1. Open column isolation valve.
2. Liquid level in the column should rise to the level in the suction source. This may be higher than the top of the column, so prevent overfill by closing the column isolation valve when the liquid level in the calibration column reaches slightly above the top scale mark.
3. If the liquid level in the suction source is lower than the top scale mark, close the column isolation valve and add liquid through the top of the column to a point slightly above the top scale mark.

Calibration column is filled and ready for the calibration procedure.

9.4 VARIABLE FREQUENCY DRIVE SETTINGS

When powered up, the operator should check the direction of rotational direction of the pump. The following checklist indicates the steps to set the VFD parameters of an AC Tech drive. Other VFD may require different parameters.

1. Set start control source to terminal strip or local keypad.
2. Set acceleration parameter.
3. Set deceleration parameter.
4. Set motor overload in %.
5. Set start method on start on power up.
6. Set input function to 4-20 mA.
7. Set relay output to run (energizes when the drive is running).
8. Set drive mode to vector speed.
9. Set motor rated voltage.
10. Set motor rated current.
11. Set motor rated speed.
12. Run motor auto-calibration.

For more information refer to the VFD manual.

10 OPERATION PROCEDURES

The calibration column is filled to slightly above the top mark of the scale. The pump is then run in the system while being fed from the calibration column. After a 30 second time period, the liquid level reading on the scale will be a direct readout of the pump flow rate in US Gallons/hr (note that a millilitre scale is also shown on the calibration column).

With the pump running in the system:

1. Open the column isolation valve so that the column feeds into the suction header and immediately close the skid suction valve.
2. Observe the liquid level in the calibration column. When it reaches the top scale mark, begin timing.
3. Allow 30 seconds to pass.
4. Open the skid suction valve and immediately close the column isolation valve.
5. Read pump output flow rate directly on the scale in US Gallons/hr.

Once the calibration is complete, compare the reading to the desired rate for your system. Refer to your pump operation manual and adjust flow rate up or down accordingly (this is usually done by changing the frequency). After pump adjustment is made, repeat calibration procedure. Continue until the desired flow rate is achieved.

11 ROUTINE MAINTENANCE

Before performing any maintenance on your skid system or pump(s), skid components, pump(s) and your process piping may be under pressure!

Prior to working on any portion of the skid system:

- Disconnect pump(s) from power supply.
- De-pressurize the entire system.
- Drain chemicals from the lines.
- Flush and neutralize as necessary.
- Always wear suitable protection (gloves, safety glasses/goggles, etc.).

Routine maintenance will depend upon your service requirements: dosing chemical being handled, environmental conditions, duty cycle(s) of pump(s), etc. When working on any component of your system, i.e., pump(s) and valves, refer to the installation, operation and maintenance manual for that particular item.

Some operational and maintenance checks that need to be performed are:

Piping/Tubing Integrity: Routinely check piping, tubing, isolation valves and connections for leaks. Replace tubing as necessary. Recommend weekly check.

System Operation: Perform flow calibration regularly to ensure that dosing chemical is being added at the proper rate. Recommend monthly.

Pressure Relief: Check to ensure that bolts are tight. Recommend monthly. Diaphragms should be replaced on an annual basis.

Calibration Column: If handling sticky chemicals, may require cleaning to view liquid level inside. Perform as necessary.

Mechanical Diaphragm Metering Pump: Maintenance shall be as recommended in Manufacturer O&M Manual.

Note: Special tools may be required for dismantling and re-assembly of the pump. Before starting the dismantling, refer to the installation, operation and maintenance manual of the pump.

12 TROUBLESHOOTING GUIDE

DIFFICULTY	PROBABLE CAUSE	REMEDY
Pump does not start	Coupling disconnected	Connect coupling
	Faulty power source	Check power source
	Blown fuse and circuit breaker	Replace - Eliminate overload
	Broken wire	Locate and repair
	Wired improperly	Check diagram
	Pipe line blockage	Open valves
No Delivery	Motor not running	Check power source and wiring diagram
	Supply tank empty	Fill tank
	Lines clogged	Clean and flush
	Closed line valves	Open valves
	Ball check valves held open with solids	Clean and inspect
	Vapor lock, cavitation	Increase suction pressure
	Prime lost	Reprime, and check for leak
	Strainer clogged	Remove and clean. Replace screen if necessary
Low delivery	Motor speed too low	Check voltages, frequency, wiring and terminal connections. Check nameplate vs specifications
	Check valves worn or dirty	Clean, replace if damaged
	Calibration system error	Evaluate and correct
	Product viscosity too high	Lower viscosity by increasing product temperature. Increase pump and/or piping size
	Product cavitating	Increase suction pressure. Cool product as necessary
Delivery gradually drops	Check valve leakage	Clean, replace if damaged
	Leak in suction line	Locate and correct
	Strainer fouled	Clean or replace screen
	Product change	Check viscosity
	Supply tank vent plugged	Unplug vent
Delivery erratic	Leak in suction line	Locate and correct
	Product cavitating	Increase suction pressure
	Entrapped air or gas in product	Consult factory for suggested venting
	Motor speed erratic	Check voltage and frequency
	Fouled check valves	Clean, replace if necessary
Delivery higher than rated	Suction pressure higher than discharge pressure	Install backpressure valve or consult factory for piping recommendations
	Back pressure valve set too low	Increase setting
	Back pressure valve leaks	Repair, clean or replace
Pump loses internal oil	Diaphragm ruptured	Replace
	Leaky seal	Replace
	Cover gasket leaks	Replace or retighten
	Pump overfilled	Remove excess oil
Noisy gearing, knocking	Discharge pressure too high	Reduce pressure
	Water hammer	Install pulsation dampener
	Stroke length at partial setting	Non-destructive knocking is characteristic of lost motion pumps
	No oil or level incorrect	Replace or refill oil
Pump noisy	Pipe size too small	Increase size of piping - Install pulsation dampener
	Pipe runs too long	Install pulsation dampener in line
	Surge chambers flooded	Replace with air or inert gas. If a pulsation dampener is installed, replace diaphragm and recharge
	No surge chambers used	Install pulsation dampener
Motor overheats	Pump overloaded	Check operating conditions against pump design
	High or low voltage	Check power source
	Loose wire	Trace and correct
	Excessive discharge pressure	Correct conditions so ratings of pump are note exceeded

If problem(s) persist, please contact Veolia Water Technologies

13 LUBRICATION SCHEDULE - INSPECTION

ITEM	ACTION	FREQUENCY	TYPE OF LUBRICANT
Wet end inspection	Inspection (If diaphragm has failed, replace eccentric oil)	Refer to section 11	Refer to eccentric oil change
Check valve	Inspection	Refer to section 11	See note
Oil seals (qty 4) Pump shaft seal Motor adapter seal Gearbox oil seal Eccentric box seal	Inspection	Refer to section 11	See note
Motor bearing	Inspection/Lubrication	Refer to section 11	Lubricant (refer to motor nameplate)
Eccentric oil	Change oil	2 years (normal service) 1 year (severe service)	Pulsalube 9M (refer to Pulsafeeder Shadow maintenance manual)
Gear oil	Change oil	5 years (normal service) 2 years (severe service)	Pulsalube 8G (refer to Pulsafeeder Shadow maintenance manual)

Note: PULSAR Shadow KOPkits contain all replacement parts normally used in a preventive maintenance program

14 SPARE PARTS

It is highly recommended to keep in stock spare parts in sufficient quantity for all critical equipment to the proper functioning of the process.

Only the use of original Veolia spare parts will ensure proper and reliable operation.

When ordering a spare part, please give the following information:

- Veolia project number.
- Project name.
- Part number

15 DRAWINGS

If this dosing system is integrated to a processing plant, refer to the Process and/or Detailed Technical Documentation section of the Operation and Maintenance Manual for the dosing system drawings.

16 COMPONENTS TECHNICAL DATA SHEET

If this dosing system is integrated to a processing plant, refer to the Detailed Technical Documentation section of the Operation and Maintenance Manual for the dosing system data sheets.

17 MANUFACTURERS OPERATION AND MAINTENANCE MANUAL

If this dosing system is integrated to a processing plant, refer to the Manufacturer Operation and Maintenance Manual section of the Operation and Maintenance Manual for the dosing system manufacturer manuals.

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6 – OPERATION AND MAINTENANCE

6.5 – POLYMER DOSING SKID

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Installation, Operation and Maintenance Manual

SEEPEX PROGRESSIVE CAVITY PUMP DOSING SKID SYSTEM

DOCUMENT NO: IOM_0011_PCH

FEBRUARY 2016, REVISION 1

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ISO 9001:2008
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TABLE OF CONTENTS

1 INTRODUCTION

This document provides installation, operation and maintenance instructions for a polymer dosing skid equipped with Seepex progressive cavity pump(s). For specific information regarding the pump installed on the dosing system, refer to the manual of the manufacturer.

The skid components supplied by Veolia Water Technologies Canada (VWTC).

To obtain any additional information regarding characteristics or instructions on this equipment, please do not hesitate to contact us.

The system was designed in Canada by:

Veolia Water Technologies Canada
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: 514-334-7230
Fax: 514-334-5070

For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada After Sales Support
1-844-SER-VWT9 | 1-844-737-8989 | vwtservicecanada@veolia.com

Our business hours are from
Monday to Friday
8:30am to 5pm EST

2 SAFETY

2.1 INTRODUCTION

Your safety is of the utmost concern. Dosing pumps and systems can handle harsh or toxic chemicals and exposure can lead to serious injury or death. Always wear appropriate protective clothing (for example, safety glasses, gloves, coveralls, etc.) and follow safe handling procedures. Pay attention to what you're doing and note safety advisories where they are shown throughout this manual. Some examples of safety issues and precautions for chemical dosing systems are:

- Do not use dosing skid systems for flammable liquids.
- Prior to working on any portion of the skid system, disconnect pump(s) from power supply, de-pressurize the system and drain chemicals from the lines.
- Inspect tubing regularly and replace as necessary. When inspecting tubing, wear protective clothing and safety glasses.
- If skid system is exposed to sunlight, use UV-resistant tubing.
- Follow directions and warnings provided with chemicals from the chemical manufacturer. User/Owner is responsible for determining chemical compatibility with chemical feed pump(s) and system components.
- Secure chemicals, metering pump(s) and system, making them inaccessible to children, pets, and unauthorized personnel.
- Always wear protective clothing, including gloves and safety goggles when working on or near chemical metering pump(s) and system.
- All connections (threaded, screwed or bolted) may only be loosened when the system is not under pressure.
- Installation and start-up of chemical dosing system will require both mechanical (plumbing) and electrical work. Only qualified and licensed plumbers and electricians should perform this.

2.2 FALL HAZARDS

As per OSHA statistic's, the majority of falls results from trips and slips. Common causes of slips are due to wet or oily surfaces and occasional spills.

Operators should reduce the risk of slipping on wet flooring by:

- Cleaning all spills immediately.
- Marking spills and wet area by using a cone or other warning device.

2.3 CHEMICALS HAZARDS

WHMIS Material Safety Data Sheets (MSDS) should be available for each chemical product. Since chemicals or chemical dosage are used during normal operation of treatment facility, the risks of fire, explosion and exposure to toxic chemicals or chemical burns are present. Chemicals typically used with dosing system are coagulant and polymer.

Operators should be made aware of the following:

- All chemicals which are used and any potentially dangerous reaction that could occur.
- Toxicity of all chemicals that are used or could be formed via reactions.
- Acidic or basic properties of all materials used.
- Potential fire or explosion hazards posed by the chemicals.
- Antidotes for exposure to toxic materials.
- Protective clothing that is recommended.
- Chemicals spills may be slippery.

2.4 ELECTRICAL CONNECTIONS

Electrical connections must be made by certified electricians in compliance with all applicable codes and regulations.

3 SHIPPING

Most of the equipment and material for this project will be drop shipped and delivered directly to the site.

- All items delivered will be clearly identified with VWTC's name, VWTC's project name and VWT's project number.
- All shipments will have a clear Packing List identifying all parts in the shipment.
- All equipment will be tagged with the corresponding tag numbers shown on the design drawings (if applicable).

If there are more stringent requirements in the contract documents, they will take precedence over the above. If any of these requirements are not being followed, please notify the VWTC Project Manager immediately.

4 RECEIVING

The condition of all delivered equipment must be verified by the responsible party upon arrival at site. Verification that all equipment has been delivered as per contract must also be done upon arrival at site. Notification of missing or damaged items must be sent to VWTC within five (5) working days of receipt of equipment. If there is no documented notification of missing or damaged parts within five (5) working days, VWTC is not responsible for replacement of any items found to be missing or damaged at the time of installation and start-up of the supplied equipment. It is the responsibility of the party receiving the equipment to ensure all packaging is opened at the time of receipt to uncover and document any and all damages to the Freight Company and VWTC.

Photographs and written documentation should be provided for all damaged equipment.

5 HANDLING

5.1 GENERAL

Equipment will arrive at the project site in several different shipments, from various freight companies and in several different packaging containers. Typically a flatbed truck is used which requires a fork lift or a crane to remove the items.

The Contractor is responsible for unloading and handling the equipment.

5.2 POLYPROPYLENE MATERIAL HANDLING

Care should be taken to avoid damages to the surface of the polypropylene panels due to dragging or from sharp objects.

6 STORAGE

6.1 GENERAL

The following instructions outline the duties and responsibilities of the responsible party for equipment storage. The responsible party shall assume responsibility for the equipment upon arrival at the project site. These instructions shall define the minimum expectations for storage of all equipment.

While this storage specification takes into account common environmental issues that may affect the system during storage, common sense should be the overriding factor in determining the best method to ensure the integrity and proper storage of the VWTC equipment.

For contractual purposes, VWTC demands the Client to send pictures of major equipment once it is placed in storage, any time it gets moved during storage and again prior to removing from storage. Alternatively, a written document (check list, etc.) confirming that proper storage conditions are maintained will suffice. Failing to do so would cancel the proposed warranty.

Should it be necessary to delay installation and subsequent operation of a unit for more than one month from date of receipt at site, special precautions must be taken.

The polymer dosing skid shall be stored indoor at a temperature above 5°C. The storage environment into which a system is placed can have a severe effect on the long-term usefulness of some spare parts. Key environmental factors are:

- Temperature
- Relative humidity
- Pollutants

Air may contain excessive moisture, pollutants, microorganisms, and other particulates that accelerate the deterioration of some materials. Humidity and pollutants can produce an aggressive atmosphere.

6.2 PVC PIPING STORAGE CONDITIONS

Pipe units should be stored and placed on level ground. Caution shall be taken to avoid compression, damage or deformation to the ends of the pipes. Racks or dunnage shall be used to prevent damage to the bottom pipes during storage and to support them. Supports should be spaced to prevent pipe bending.

When exposure in excess of one year to direct sunlight is unavoidable, the pipes should be covered with an opaque material while permitting adequate air circulation above and around the pipes as required preventing excess heat accumulation. The interior of the pipes, as well as all end surfaces, should be kept free from dirt and foreign matter until the pipes are ready to be used.

7 SKID OVERVIEW

The dosing skid system is designed to pump chemicals at precisely controlled rates into another process or system. Dilution water provides a minimum dilution ratio of 3:1 of dilution water to dosing chemical.

Proper arrangement of piping and appurtenances on both the supply side are critical to the successful operation of the overall system. These are the responsibility of the owner/operator of the system, and attention should be paid to the comments below:

SUPPLY SIDE

Dosing chemicals are usually sourced from a preparation system. When the source is located above the centerline of the pump(s) this is referred to as a 'flooded suction'. Connections to and from the solution tank are most commonly made with hard piping. The solution tank should be covered to prevent contamination.

Supply line should gradually slope downward from the solution tank to the skid suction connection.

It is strongly recommended to add a drain provision on the suction side to facilitate emptying and flushing of the system for maintenance.

8 INSTALLATION

Prior to attempting installation, familiarize yourself with the layout and components furnished with your dosing skid system. These vary from system to system and review the documentation supplied with your system. Inspect your skid system for damages which may have occurred during transit. If damages are discovered, immediately file a claim with the carrier and contact Veolia Water Technologies for any required parts or components.

Skid systems, including pump(s), have been tested with water prior to shipment.

Some dosing chemicals will react with water, e.g., acids, polymers, etc. Check the MSDS for the chemical to be handled. If adverse reaction with water is indicated, ensure that all portions of the skid piping, its components and the pump, are free of water prior to filling the skid system with chemical.

Skid systems may be wall or floor mounted. Mounting holes are provided or can be drilled on the skid for both types of mounting. Securely attach the skid in its installation position to prevent falling or tipping.

The installation area should provide ease of access to skid components, including pump(s), and the area should be kept free of clutter to enable safe operation and maintenance.

Note that pumps/motors are designed for ambient temperatures of 104°F (40°C) maximum. It is preferable that skid systems and pump(s) be located out of direct sunlight. If the skid system is exposed to sunlight, provide protection for the pump/motor to prevent overheating and if the skid is exposed to sunlight, use UV resistant tubing.

If skid is exposed to sunlight, use UV-resistant tubing.

Most chemical dosing skids will have Seepex pump(s) mounted on them before shipment, and the pump(s) will be connected to the skid integral piping with tubing.

8.1 OWNER-INSTALLED PIPING / TUBING

The next series of steps are the connection of your piping/tubing which include the chemical supply line, discharge line, pressure relief/bypass line and an air bleed return line.

These are your responsibility and ensure that for all piping, tubing, fitting and other appurtenances, their materials are compatible with the liquid to be pumped and the design is suitable for the pressures and temperatures of the application. System design must ensure safety for operation and maintenance as well as for anyone who may be in proximity to the system. Failure to do so may result in damage to equipment, personal injury or death.

8.2 SUCTION LINE / TRANSPORT WATER LINE

This line connects the source of the dosing chemical to the dosing skid. Include whatever provisions you consider necessary to facilitate the maintenance and operation such as isolation valve(s), drain and/or flush connections, etc., making sure that this sub-system enables safe operation.

8.3 DISCHARGE LINE

This line connects the dosing skid to the served process. Include whatever provisions you consider necessary to facilitate maintenance and operation, such as isolation valve(s), drain and/or flush connections, etc., making sure that this system enables **SAFE OPERATION**.

9 INITIAL START-UP

The pump must be primed before it can function within the system. This will require an initial start of the pump.

Thoroughly review the installation, operation and maintenance manual for your pump prior to starting. Follow pump start-up instructions. Failure to do so may result in damage to equipment or serious injury.

FLOODED SUCTION SYSTEM

1. Close skid discharge valve and column isolation valve.
2. Connect pump/motor to power source (pump/motor off).
3. Start pump using manufacturer's recommendations for initial operation settings.
4. Shut off pump.

9.1 SETTING VALVES

If furnished with your dosing skid system, the pressure relief valve and back pressure valve will be preset prior to shipment. These pressure settings are related to the piping and components furnished with your skid as well as the pump(s) if furnished with the skid. Your system requirements may demand changes to these settings and the valves will have to be reset after maintenance such as diaphragm replacement. A general description and the setting procedures for these components are as follows.

9.2 PRESSURE RELIEF VALVE

A pressure relief valve (PRV) must always be used with a chemical metering system that uses a positive displacement pump. This device is designed to protect the pump and system from over pressurization and it must be set to relieve at the maximum allowable pressure for the weakest point in the total system. This may be in your piping on the discharge side of the skid. The pressure relief valves are factory set and cannot be modified. If the pressure set point is surpassed, the valve will need to be replaced. The pressure settling is indicated on the P&ID drawings.

Most dosing skid systems include a pressure relief valve and suction header where the PRV is directly connected from the discharge header to the suction header. If your skid system does not include a suction header, or if you are providing your own PRV, relief flow from the pressure relief port on the PRV must be directed to either the suction source or a separate receptacle. This is usually done with tubing.

Care must be taken to channel any free flow from the pumping system into an appropriate receptacle. Eliminate any possibility of splashing, spraying or spillage. Always wear suitable protective equipment (gloves, safety goggles/glasses, coveralls, etc.) when working with or around chemical dosing systems.

Check all system piping/tubing connections to ensure that they are properly tightened (handtight for plastic fittings) and leak free.

Pumping system is now ready for operation.

9.3 FLOW CALIBRATION

Chemical metering systems are designed to provide chemicals to a process at precise flow rates. Metering pump output (flow rate) can be set with a variable frequency drive (VFD). A calibration column is used to determine pump flow rate and to enable flow rate adjustments.

The procedures for filling the calibration column and for calibrating the pumps are described below. Review both complete procedures before proceeding with next steps.

FILLING THE CALIBRATION COLUMN BY OPENING THE COLUMN ISOLATION VALVE

- Use extreme care when handling chemicals.
- Avoid any spray, splatter or spilling.
- Always wear appropriate protective clothing.

FOR SYSTEMS WITH FLOODED SUCTION:

1. Open column isolation valve.
2. Liquid level in the column should rise to the level in the suction source. This may be higher than the top of the column, so prevent overfill by closing the column isolation valve when the liquid level in the calibration column reaches slightly above the top scale mark.
3. If the liquid level in the suction source is lower than the top scale mark, close the column isolation valve and add liquid through the top of the column to a point slightly above the top scale mark.

Calibration column is filled and ready for the calibration procedure.

9.4 VARIABLE FREQUENCY DRIVE SETTINGS

When powered up, the operator should check the direction of rotational direction of the pump. The following checklist indicates the steps to set the VFD parameters of an AC Tech drive. Other VFD may require different parameters.

1. Set start control source to terminal strip or local keypad.
2. Set acceleration parameter.
3. Set deceleration parameter.
4. Set motor overload in %.
5. Set start method on start on power up.
6. Set input function to 4-20 mA.
7. Set relay output to run (energizes when the drive is running).
8. Set drive mode to vector speed.
9. Set motor rated voltage.
10. Set motor rated current.
11. Set motor rated speed.
12. Run motor auto-calibration.

For more information refer to the VFD manual.

10 OPERATION PROCEDURES

The calibration column is filled to slightly above the top mark of the scale. The pump is then run in the system while being fed from the calibration column. After a start-up period, the liquid level reading on the scale will be a direct readout of the pump flow rate in US Gallons/hr (note that a millilitre scale is also shown on the calibration column).

With the pump running in the system:

1. Open the column isolation valve so that the column feeds into the suction header and immediately close the skid suction valve.
2. Observe the liquid level in the calibration column. When it reaches the top scale mark, begin timing.
3. Allow 30 seconds to pass.
4. Open the skid suction valve and immediately close the column isolation valve.
5. Read pump output flow rate directly on the scale in US Gallons/hr.

Once the calibration is complete, compare the reading to the desired rate for your system. Refer to your pump operation manual and adjust flow rate up or down accordingly (this is usually done by changing the frequency). After pump adjustment is made, repeat calibration procedure. Continue until the desired flow rate is achieved.

11 ROUTINE MAINTENANCE

Before performing any maintenance on your skid system or pump(s), skid components, pump(s) and your process piping may be under pressure!

Prior to working on any portion of the skid system:

- Disconnect pump(s) from power supply.
- De-pressurize the entire system.
- Drain chemicals from the lines.
- Flush and neutralize as necessary.
- Always wear suitable protection (gloves, safety glasses/goggles, etc.).

Routine maintenance will depend upon your service requirements: dosing chemical being handled, environmental conditions, duty cycle(s) of pump(s), etc. When working on any component of your system, i.e., pump(s) and valves, refer to the installation, operation and maintenance manual for that particular item.

Some operational and maintenance checks that need to be performed are:

Piping/Tubing Integrity:	Routinely check piping, tubing, isolation valves and connections for leaks. Replace tubing as necessary. Recommend weekly check.
System Operation:	Perform flow calibration regularly to ensure that dosing chemical is being added at the proper rate. Recommend monthly.
Pressure Relief:	Check to ensure that bolts are tight. Recommend monthly. Diaphragms should be replaced on an annual basis.
Calibration Column:	If handling sticky chemicals, may require cleaning to view liquid level inside. Perform as necessary.
Progressive Cavity Pump:	Weekly check oil level. Oil should be changed on a 3 years basis. Motor bearings shall be repacked with grease every 3 years. Pump bearings shall be repacked every 3000 operating hours.

Note: Special tools are required for dismantling and re-assembly of the pump. Before starting the dismantling, refer to the installation, operation and maintenance manual of the pump.

12 TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	REMEDY
Pump doesn't deliver product	Air entering suction line	Check fittings for tightness Check integrity of tubing Check level in suction source-must be above foot valve at inlet
	Air trapped in suction line	Re-configure suction line to eliminate air pocket(s)
	Suction line kinked or clogged	Inspect, replace tubing
	Chemical source empty	Refill, re-prime pump
	Pump not primed, air/gas in system	Refer to pump instructions
	Air/gas bubbles forming in chemical	Reduce suction lift or change to flooded suction Consider chemical storage temperature
	Strainer clogged	Check strainer, clean
	Pressure relief valve open	Check pressure relief valve integrity Check pressure relief valve settings
	Pump problem(s) may be: Stator wear, rupture Check valves worn or clogged Low pump flow setting Voltage/electrical difficulty	Refer to pump instructions
	TSE alert is triggered (overheating)	Check overheating causes Acknowledge the alert/release relay: - Press reset button (at TSE control for 1 sec) - Shut-off operating voltage at the TSE control unit (terminal 1-3) - Actuate external contact (reset button close for 1 sec)
Piping Vibration/chatter	Pulsation dampener malfunction (if applicable)	Check pulsation dampener integrity Check dampener air pressure
Injection rate too high, too low	Pump output setting incorrect	Perform flow calibration
	Chemical concentration too high, low	Adjust chemical source strength
	Injector clogged, scaled, restricted	Check injector for solids or corrosion Clean as necessary or replace
Tubing failure	Sunlight/UV exposure	Change to UV resistant tubing
	Corrosive attack	Determine material compatibility, change as necessary
Leaky fittings	Loose fittings	Tighten fittings-plastic fittings should be handtight only
	Corrosive attack	Determine material compatibility, change as necessary

If problem(s) persist, please contact Veolia Water Technologies

13 LUBRICATION SCHEDULE

ITEM	ACTION	FREQUENCY	TYPE OF LUBRICANT
Gear reducer	Check oil level Change Oil	Weekly 3 years	ISO VG 220 (mineral oil) (ambient T°: -5 to 40°C)
Motor Bearing	Repack with grease	3 years	NLGI EP 2 (grease) (refer to motor nameplate)
Pump Bearing	Repack with grease	3000 operating hours	NLGI EP 2 (grease)
Pump Pin Joints	Repack with grease	Rotor replacement or 10000 operating hours whichever is first	Seepex special joint grease only (refer to Seepex manual)

14 SPARE PARTS

It is highly recommended to keep in stock spare parts in sufficient quantity for all critical equipment to the proper functioning of the process.

Only the use of original Veolia spare parts will ensure proper and reliable operation.

When ordering a spare part, please give the following information:

- Veolia project number.
- Project name.
- Part number

15 DRAWINGS

If this dosing system is integrated to a processing plant, refer to the Process and/or Detailed Technical Documentation section of the Operation and Maintenance Manual for the dosing system drawings.

16 COMPONENTS TECHNICAL DATA SHEET

If this dosing system is integrated to a processing plant, refer to the Detailed Technical Documentation section of the Operation and Maintenance Manual for the dosing system data sheets.

17 MANUFACTURERS OPERATION AND MAINTENANCE MANUAL

If this dosing system is integrated to a processing plant, refer to the Manufacturer Operation and Maintenance Manual section of the Operation and Maintenance Manual for the dosing system manufacturer manuals.

PACKAGE NUMBER: 6115-S-265-001
PURCHASE ORDER NUMBER: OC-671670

AGNICO EAGLE MINES
AMARUQ WTP, NUNAVUT
VEOLIA Project 5000 218 009

Operation and Maintenance Manual
Volume 2

Prepared by:
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Revision: 1
Date: August 2018

VEOLIA DOCUMENT NO: 5000218009_OMM_0001_GEN_VWT

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Amaruq WTP, Nunavut

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Operation & Maintenance Manual
Amaruq WTP, Nunavut

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For technical support or service needs, for spare parts or to get assistance during your warranty period, you may contact us at the following number during regular business hours or write us at:

Veolia Water Technologies Canada – After Sales Support
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Our business hours are from:
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8:30am to 5pm (EST)

Have the following information on hand for each request or call:

Project Name:
VWTC Reference Number:

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OPERATION AND MAINTENANCE MANUAL

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7 – MANUFACTURER MAINTENANCE MANUAL

7.1 – MANUFACTURER LIST

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SECTION		MANUFACTURER LIST
7.2		
	001	ALLEN BRADLEY
		Model 836T, Pressure switch
	002	ANDRITZ
		Model D4L, Centrifuge
	003	ASCO
		EF8210G004, Solenoid valve
		EF8210G022, Solenoid valve
		8210G089, Solenoid valve
		8210G094, Solenoid valve
		(EF) 8345G001, Solenoid valve
	004	ASCHROFT
		Type 1009, Pressure gauge
		Type 101, Diaphragm seal
		Type 310, Diaphragm seal
	005	BALDOR
		Intergral horsepower series, Motor
	006	CFF
		Series SS-2, Ball valve
	007	CHEMLINE
		Type 21, Ball valve
		Type SM2, Metering ball valve
		Series BT-BC-FV-FT, Ball check and foot valves
		Type 57, Butterfly valve
		Series E, Electric actuator
		Series PA, Pneumatic actuator
		Series GV, Globe valve
		Series SB12, Back pressure/relief valve
		Series SG, Diaphragm seal w/ pressure gauge
		Series FC/FS, Variable area flow meter
	008	ENDRESS + HAUSER
		Proline Promag 50W, Electromagnetic flowmeter
		Liquiphant M FTL51, Level switch (vibronic)
		Soliswitch FTE31, Level switch (paddle type)
		Cerabar T PMC131, Pressure transducer
		Cerabar S PMC71, Pressure transmitter
	009	ENVIREQUIP
		Series EVG/EVGX, Mixers
		c/w Nord gear box
	010	FLOWROX
		Series PVE, Pinch valve
	011	FLSMIDTH KREBS
		Model U10-Gmax-9.5 SQIN, Hydrocyclone
	012	FLYGT
		ENM-10, Level switch

SECTION		MANUFACTURER LIST
	013	GRUNDFOS
		DDA Series, Dosing pump
		CRN Series, Multi-stage centrifugal pump
	014	HACH
		Model Solitax sc, Turbity sensor
		Model sc200, Universal controller
		Model DPD1R1, pH sensor
		Model DRD1R5, ORP sensor
	015	HAPMAN
		Vacuum conveyor system
	016	KOFLO
		Model 1.5-40C-4-6-2, Static Mixer
		Model 2-40C-4-6-2, Static Mixer
	017	McLANAHAN
		Model M3H-CR 3/3, Microsand recirculation pump (P2-011/012/021/022)
		Model M3H-CR 1.5/1.5, Multiflo extraction pump (P2-014/023)
	018	NORD
		Clincher Series, Gear reducer
		c/w Nord motor
	019	ONYX VALVE
		Series PSW, Pressure gauge isolator ring
	020	PMP
		Model A201, Ball valve
	021	PRATT
		Series 601, Ballcentric plug valve
	022	PRIMARY FLUID SYSTEM
		Accudraw PVC Series, Calibration cylinder
		Accudraw Glass Series, Calibration cylinder
		Accupulse Series, Pulsation dampener
	023	PULSAFEEDER
		Pulsar Shadow Series, Mechanical diaphragm dosing pump
	024	SCHUTTE & KOERTING
		Figure 264, Eductor
	025	SEEPEX
		Series BN 05-12, Progressive cavity pump (cationic polymer) (P9-621/622/623)
		Series BN 05-12, Progressive cavity pump (anionic polymer) (P9-524/525/526)
		Series BN 17-06, Progressive cavity pump (sludge treatment) (P5-011/012)
	026	SULZER
		Model EJ 15D-2, Submersible pump
	027	WAM
		MBF Series, Micro batch feeder
		SBB Series, Flexible intermediate bulk container discharger (FIBC Discharger)
		VL Series, Slide gate valve

7 – MANUFACTURER MAINTENANCE MANUAL

7.2 – MANUFACTURER INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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ALLEN BRADLEY

MODEL 386T, PRESSURE SWITCH

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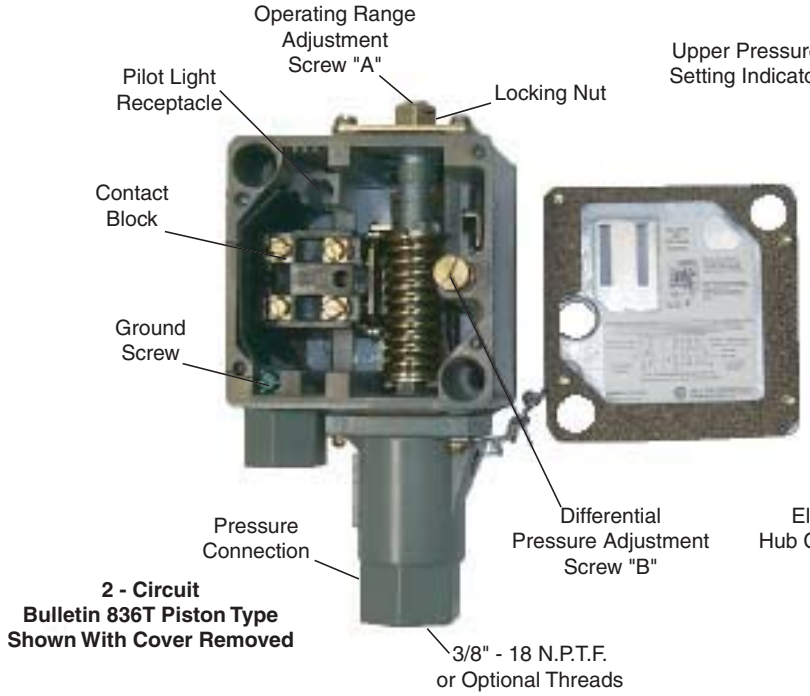
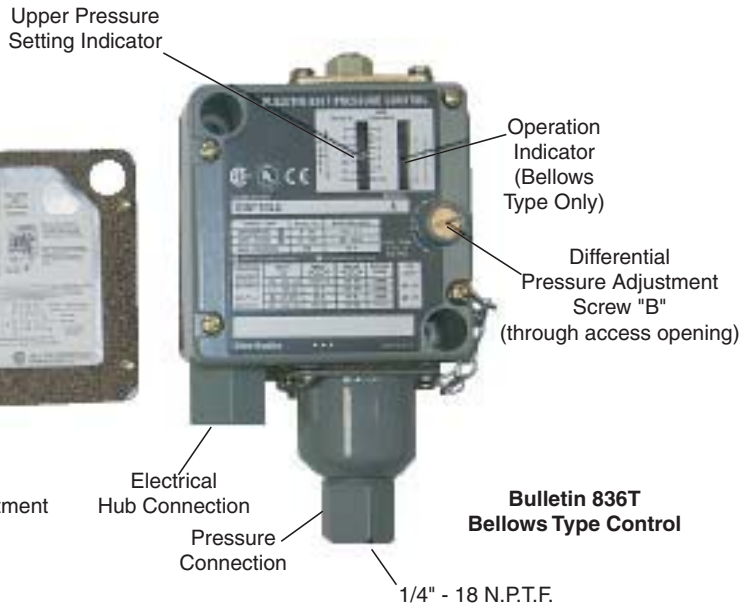
Bulletin 836T Pressure Controls

ATTENTION: To prevent electrical shock, disconnect from power source before installing or servicing.



2 - Circuit Bulletin 836T Piston Type Shown With Cover Removed



Bulletin 836T Bellows Type Control

DESCRIPTION - Bulletin 836T, Type 1, 4, & 13 oiltight pressure controls are designed for use on machine tool applications where a stream of oil or water may flow over the enclosure. Other applications would include areas where it is desirable to resist the entrance of lint, dust, and dirt into the enclosure.

The operating range pressure and differential are adjustable externally.

Bellows type devices are available from vacuum to pressures up to 650 psi.

ATTENTION: Copper alloy bellows may be used on water or air and other liquids or gases not corrosive to this alloy. Type 316 stainless steel bellows are available and are used for the more corrosive liquids and gases.

Piston type devices are available for pressures up to 5000 psi.

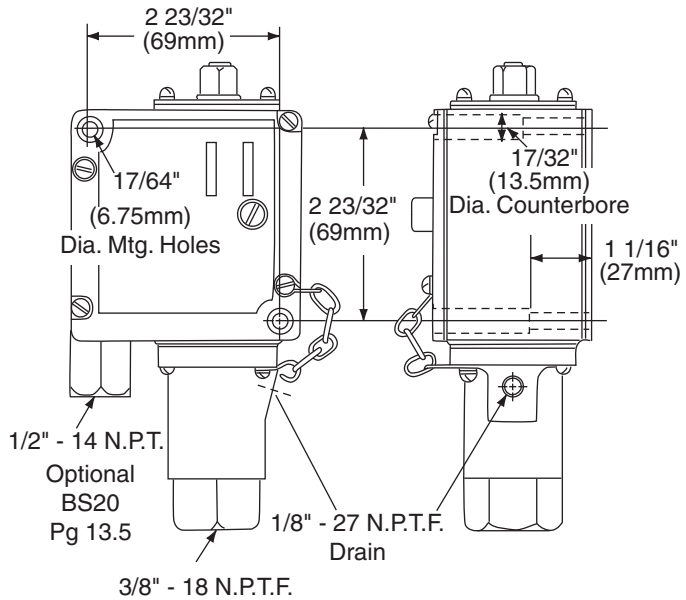
ATTENTION: Stainless steel piston type controls are designed for use on oil, water and waterbased fluids but must not be used on air or gases.

The 2 - Circuit contact block has one set of normally open and one set of normally closed contacts. These contacts may be arranged for single pole double-throw operation or separate circuit operation having the same polarity.

A 4 - Circuit contact block assembly with two normally open and two normally closed contacts is also available. An isolated terminal is furnished to provide a termination point when an optional power source is used. These contacts may be arranged for double pole double-throw operation or two isolated single pole double-throw, electrically isolated circuits. Circuits must be of the same polarity.

MOUNTING - The pressure control should be mounted securely to a firm base using two mounting screws. The recommended fastener for mounting is a 1/4"-20 or M6X1 metric screw. The applied torque should not exceed 70 lb-in (8 Nm).The mounting holes (see sketch) are easily accessible without removing the front cover assembly.

ATTENTION: The control should not be supported by only the electricaland pressure connections. A support wrench should be used when tightening the electrical hub and pressure connections.



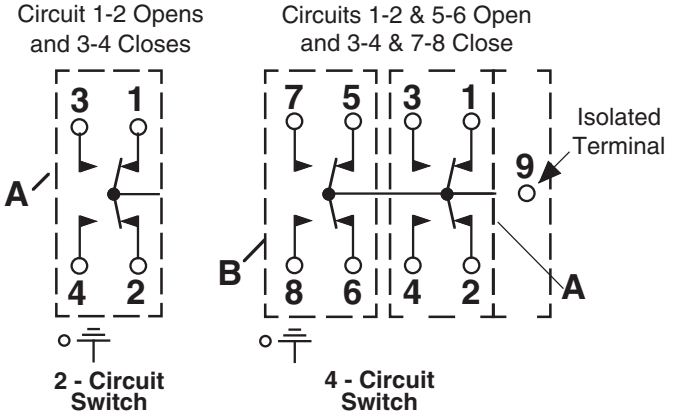
Piston Type Shown

OPERATION - A toggle mechanism operates the snap action switch at a predetermined pressure setting. For the 2 - Circuit snap switch the pressure causes the normally closed circuit 1-2 to open and normally open circuit 3-4 to close. This is known as the trip pressure. When the pressure returns to a lower predetermined setting, the circuit 1-2 will close and circuit 3-4 will open. This is known as the reset pressure. The difference between "trip" and "reset" pressure is the differential.
Similarly, for the 4 - Circuit snap switch, both normally closed circuits, 1-2 & 5-6 would open and both normally open circuits, 3-4 & 7-8 would close on increasing pressure. On decreasing pressure, the contacts would return to their original state at a predetermined setting.

Catalog number 836T-T251J can also be operated in a vacuum. At a higher vacuum setting (lower pressure toward 30" Hg) the 2 - Circuit switch contacts 1-2 will be closed and 3-4 open. At a lower vacuum (higher pressure toward 0 psi) circuit 1-2 will open and circuit 3-4 will close.

EXAMPLE: Control set to close contacts at 15" Hg vacuum, open at 5" Hg vacuum. For the 2 - Circuit switch, circuit 1-2 would be used. For the 4 - Circuit switch, circuits 1-2 or 5-6 would be used.

CONTACT BLOCK WIRING SYMBOL
(Increasing Pressure Operation)



A or B circuits must be the same polarity.

ADJUSTMENT - Generally, unless otherwise specified, controls shipped from the factory are set at the maximum operating range pressure and minimum differential.

The following procedure should be used to set the control to a particular requirement.

OPERATING RANGE ADJUSTMENT: Turn lock nut on adjustment screw "A" counterclockwise to loosen. Turn range adjustment screw "A" clockwise to raise upper and lower pressure settings. To decrease the upper and lower settings, turn screw "A" counterclockwise. The approximate upper pressure setting is shown by an indicator in the left window between the calibration scales on the nameplate. When the proper setting is reached, tighten the lock nut on screw "A" clockwise.

DIFFERENTIAL ADJUSTMENT: When the differential screw "B" is up against the underside of the differential access opening in the cover the control will function at minimum differential. To increase the differential, turn adjustment screw "B" clockwise. This will decrease the lower setting only. The higher setting will not change. Similarly, to decrease the differential turn the differential adjustment screw "B" counterclockwise. This will raise the lower setting only.
Condensed instructions can be found on the inside of the front cover.

NOTE: The use of a pressure gauge is desirable when setting the control.

ATTENTION: The adjustment screw "A" should not be forced beyond the range of the control indicated on the calibrated scale. The adjustment screw "B" should not be adjusted beyond the maximum specified differential of the control.

Operating variables in a system may cause changing pressure requirements. It is recommended that a periodic inspection of the gauge pressure be made and the pressure control adjusted to compensate when necessary for these changes.

PISTON TYPE APPLICATIONS -

ATTENTION: All pistons are provided with a 1/8 inch threaded drainopening which should be connected to an oil return line leading to anoil reservoir which is vented to atmosphere. This reservoir may be at ahigher level of elevation than the control. The controls with seal ringsusually do not require return lines. However, the 1/8 inch threaded drainopening should never be plugged on either type of piston control. Thisalso includes the shipping plug which must be removed upon installa-tion. Filters should be used to reduce contamination of hydraulic fluid.

PILOT LIGHT OPTION - A high intensity neon glow pilot light is available for 120 volt, 60 hertz applications and can be installed at the factory or in the field. To order pilot light kit specify catalog number of existing control and add N9 to this number. Optional pilot lights are available on special orders.

The pilot light is wired to the contact block as follows:

A. **2 - Circuit**
Always connect lamp wires to same set of terminals used for the load. To light on increasing pressure connect across 1-2. To light on decreasing pressure connect across 3-4.

B. **4 - Circuit**
Consists of 2 electrically isolated single pole-double throw circuits. Connect lamp wires to same set of terminals used for load. To light on increasing pressure connect across 1-2 or 5-6. To light on decreasing pressure connect across 3-4 or 7-8.
(or)
An isolated terminal, 9, is provided as a termination point when an optional power source is used. This provides a convenient means for various circuit connections when separation of the load and pilot light is required. Circuits must be the same polarity for pilot light connections and switching of auxiliary equipment.

PAINTING - Standard controls are supplied with a removable paint mask on the nameplate. Remove the mask on final installation.

CONTACT BLOCK REPLACEMENT - To order Bulletin 836T Contact Block 2 - Circuit (SPDT-DB) Replacement Kit specify Catalog Number 836T-N1. For the 4 - Circuit (DPDT-DB) Contact Block Replacement Kit specify Catalog Number 836T-N2.

REPAIRS - Due to the integral construction of the Bulletin 836T Pressure Control, it is recommended it be returned to the factory for repairs (excluding contact block replacement). The control will be adjusted for optimum performance and tested to specifications.

ANDRITZ

MODEL D4L, CENTRIFUGE

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VEOLIA WATER TECHNOLOGIES CANADA, INC.
AGNICO EAGLE AMARUQ MINE WTP
SAINT-LAURENT, QC, CANADA

Operation & Maintenance Manual
VOLUME I

CENTRIFUGE SKID SYSTEM

Model: D4LC30CHP

Serial No.'s: 132907052 & 132907053

ANDRITZ Separation, Inc.

1010 Commercial Blvd South
Arlington, TX 76001

Phone: 817-465-5611
Fax: 817-472-8589

Andritz Job No: 831476

REVISION NO.:	0.0	MAY 2018

IMPORTANT!

This manual should be read in its entirety before attempting to install, operate, or repair the equipment supplied by ***ANDRITZ.*** One copy must be kept in the area of equipment installation and be available to operators and maintenance personnel. Failure to follow the instructions contained herein could result in invalidation of warranties or injury to personnel.

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DIRECTORY OF PARTIES TO THE PROJECT

END USER/OWNER	VEOLIA WATER TECHNOLOGIES CANADA, INC
	4105 Sartelon Saint-Laurent, QC Canada, H4S 2B3 Plant site: Agnico Eagle Amarunq Mine Baker Lake, NU, Canada X0C 0A0
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Contact: Clément Bekaert, Engineer & Project Manager E-mail: clement.bekaert@veolia.com Phone: +1 514-334-7230 Mobile: +1 514-246-6232 Fax: +1 514-334-5070	4105 Sartelon Saint-Laurent, QC Canada, H4S 2B3
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Aftermarket Services Phone: +1 817-419-1768 Fax: +1 817-419-1968	1010 Commercial Blvd South Arlington, TX 76001, USA Phone: +1 817-465-5611 Fax: +1 817-419-1929

MECHANICAL ENGINEER:	ELECTRICAL ENGINEER:
APPROVED BY:	APPROVED BY:
DATE: 6/6/18	DATE: 6/6/2018

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CHAPTER 1

CENTRIFUGE SKID DELIVERY AND INSTALLATION

WARNING: 

1.1 GENERAL SAFETY FOR LIFTING AND TRANSPORTATION

Qualifications

Personnel in charge of machine operation/lifting and transportation, must have the necessary qualifications.

Method

Use only recommended tools and methods.

Do not stand under the loaded hoist or place any parts of the body (hands, feet, etc.) under the machine being lifted.

Do not place fingers, hands, feet, or head in areas where there may be risk of pinching. Beware of sharp edges from worn parts.

CAUTION: An unattended or falling load can cause bodily harm or death as well as consequential equipment damage.

1.2 RECEIVING

The centrifuge skid unit arrives preassembled minus the conveyor. The conveyor frame will be offloaded individually. Refer to M818524-4 for lifting points to offload the skid. Use extreme caution when offloading so as not to dislocate the assembled equipment.

1.3 STORAGE INSTRUCTIONS FOR THE CENTRIFUGE SKID

Short term storage is a period of three months or less where the machine is out of service. ANDRITZ recommends indoor storage for the centrifuge skid system, including its motors, ancillary equipment, tools and spares.

1.3.1 Short Term Storage – 3 Months or Less

The centrifuge skid must be stored in a dry, dust-free, ventilated area with sufficient space around the skid so that it will not come into accidental contact with other equipment or environmental or workplace contaminants. The centrifuge and auxiliary equipment on the skid must be covered and completely enclosed with at least two layers of tarp if stored outside and one layer of tarp if stored inside. The centrifuge skid must be stored in an area where the ambient temperature is greater than 50 ºF.

If the centrifuge has been in use before storage, then it must be washed internally thoroughly, and all electrical switch gear must be locked out, before placing it in storage. New equipment may be stored as it arrives from the manufacturer.

Each centrifuge is lubricated before shipping. However, if the centrifuge has been in use, protect the bearing block bearings from moisture by injecting a third to a half an ounce of grease through the lubricators. Turn the rotating assembly by hand so that rolling elements are properly coated. Repeat this procedure every 6 months during storage.

Loosen the belts and coat the pulley with a light lubricant such as WD-40. This procedure is required to keep the belts from becoming deformed and to protect the pulley from corrosion during storage.

Check the manufacturer's manual of each auxiliary equipment for long-term storage recommendations.

CAUTION: A total filling of the bearing housing will result in abnormal heating during startup, which might then require partial disassembly to remove excess grease.

NOTE: The other bearings and the Cyclo reducer are enclosed in a tight housing filled with lubricant, and no maintenance is required.

1.3.2 Tools, Parts and Ancillary Equipment

Tools and spares (if supplied) must be crated and stored on blocks or a wooden pallet. Ancillary equipment should be left as it is shipped (wrapped on a pallet or crated).

1.3.3 Long Term Storage

It is recommended that a centrifuge skid system which is to be stored for a period in excess of three months be stored indoors in a heated building with the temperature maintained at a minimum of 50°F (10°C). This should be a warehouse-type building with no rotating machines that may cause floor vibration; the machine must be isolated from floor vibration.

Prior to storage, the machine should be tagged with a list of instructions followed during storage and special precautions to be taken before start-up.

This procedure does not imply any extension of ANDRITZ Standard Warranty.

Prior to start-up after long-term storage, it is mandatory that an ANDRITZ Service Engineer supervise the startup.

If the centrifuge has been in service before putting into long-term storage, then it must be washed internally thoroughly, and all electrical switch gear must be locked out before placing it in storage. The centrifuge must be covered and completely enclosed by a layer of tarp. The centrifuge must be stored in an area where the ambient temperature is greater than 50ºF (10ºC). It is recommended to store the centrifuge inside.

Tools and spares should be crated and stored on blocks or wooden pallet. Ancillary equipment should be left as it is shipped (wrapped on a pallet or crated).

1.3.4 Preparation of Loose Parts for Storage

All loose parts should be placed in a box lined with rust inhibitor paper. Do not put paper on the base of the box, but apply to sides. All machined, unpainted surfaces should be coated with Mobilarma® 355 or equivalent.

1.3.5 Preparation of Machined Surfaces

All exposed, unpainted steel surfaces on the centrifuge should also be coated with Mobilarma® 355 or equivalent.

1.3.6 Preparing to Crate for Long Term Storage Preparation

The entire centrifuge skid should be covered with a tarp made of rust inhibitor, waterproof paper. The tarp should be 8” (200mm) to 10” (250mm) above the base of the machine.

The following standard notes should then be stenciled on the outside surface of the tarp on both sides of the centrifuge, as follows:

TAG / STENCIL	Rotate the assembly by hand at least 5 revolutions in order to rotate the centrifuge.

1.4 STORAGE INSTRUCTIONS FOR CONTROL PANELS

ANDRITZ control panels are covered with stretch wrapping material and bolted to or braced securely in an enclosed wooden crate for shipment. The control panel crate provides exterior protection against weather precipitation and impact damage that could occur during shipment. Control panels with legs are securely bolted to a shipping skid to provide stability for movement of the control panel with a forklift after it is uncrated at the jobsite. The control panel should always remain secured to the shipping skid until it is ready to be removed and placed in its final destination. Control panels without legs are securely braced in the crate with wooden braces. These braces must be removed prior to lifting the control panel from the crate. Removal of control panels either from the crate or from the shipping skid should be done via the use of the lifting eyes on the control panel and with load-rated lifting straps.

The following statements are guidelines for proper short-term and long-term storage of industrial control panels that are delivered to the jobsite. Failure to adhere to the following storage requirements will render any written or implied ANDRITZ warranty null and void. It needs to also be understood that the shipping crate is not designed to be used as a long-term weather proof shelter for the control panel and that waterproof tarps should be placed over the top of the crate to prevent water seepage and material degradation if the crate is going to be subjected to the outdoors for any period of time; outdoor exposure should be only temporary and kept to a minimum.

1.4.1 Short Term Storage for Control Panels (3 Months or Less)

The industrial control panel should be stored indoors in a clean, dry, vibration-free, non-corrosive environment and be kept at a uniform temperature to prevent condensation. The control panel should be placed on a flat surface and in an upright position. If the control panel is removed from its shipping crate, it should be kept in its stretch wrapped material until it is ready for installation. The industrial control panel should not be tipped or laid flat during storage unless intentionally shipped in that manner by the factory. Proper measures should be taken to protect the control panel from exposure to excess dirt, temperature, and humidity. The control panel should be stored in an area where it will not be subjected to a lot of traffic by personnel, lift trucks, and so forth where potential injury to personnel or damage to the equipment could occur.

1.4.2 Long Term Storage for Control Panels

The industrial control panel should be stored indoors in a dry, vibration-free, non-corrosive environment and be kept at a uniform temperature to prevent condensation. The crate should be set on a flat surface and prepped for long-term storage by completely stretch wrapping it to keep it insulated from any excess dirt and any encroaching insects, vermin, etc.. The crated control panel should be stored in an area where it will not be subjected to a lot of traffic by personnel, lift trucks, and so forth where potential injury to personnel or damage to the equipment could occur.

NOTE: If necessary, temporary electrical heating should be installed to prevent condensation within the control panel, approximately 150 watts per section is usually adequate for the average control panel for most environments. All loose packing of flammable materials should be removed prior to energizing space heaters.

1.5 HANDLING

The skids will arrive as shown in drawing M831476-2. The conveyors and vent piping will be shipped loose. It is the contractor's responsibility to ensure the sling and spreader bar(s) are adequately sized to handle the load. It is also the responsibility of the contractor to ensure the crane is sized to lift and place the load as required. The weight of the skid is approximately 5,883 kgs (12,970 lbs).

1.6 CENTRIFUGE SETUP

The contractor should prepare the foundation as shown in drawing M831476-2 with anchor bolts located, as shown in the detail. The skid should be located such that the sludge inlet and centrate connections can be located. Once in place the skid should be levelled in all directions to within 1/16 inch. High strength grout should be used around the anchor bolts.

The conveyor and vent piping can then be installed. The reminder of the piping connection as well as wiring should be completed. The shipping straps which secure the machine to the stand can be removed.

The rotating assembly is locked on both ends by one radial screw. The bolts can be backed off to allow the rotation assembly to turn freely.

1.6.1 Connections

All connecting piping must be self-supporting. Refer to drawing M831476-3 for all connection locations and sizes.
The following connections need to be made:

- Product flanges
- Wash water connection
- Polymer connection
- Check that the flexible expansion joints can absorb both vertical and horizontal displacement. Axial compression – 38mm, (1 ½"), Axial extension – 16mm ($^{5}/_{8}$"), Lateral offset – 19mm (¾").
- Check feed pump

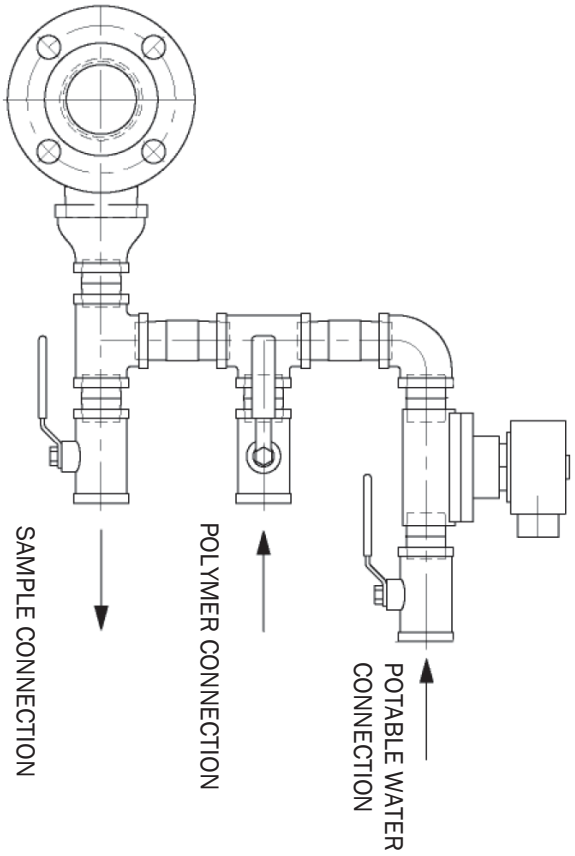

Figure 1-2 Installation of the Feed Head

1.6.2 Installation of the Electricals

Refer to electrical drawings, Chapter 2, §2.2, for all required electrical connections.

1.6.3 Auxiliary Verifications

- Supplied Tools
- Lubrication amounts
- Standard tools
- Test product
- Power and fluids
- Electrician / Automation engineer on site

An Installation Checklist has been included at the end of this chapter.

1.7 INSTALLATION CHECKLIST

This checklist, as well as ensuring equipment is correctly installed will also maximize the efficiency of the Andritz field technician's visit to the site during installation and start-up.

TABLE 1-1. INSTALLATION CHECKLIST FOR ANDRITZ CENTRIFUGES

Check List	**Yes**	**No**	**Not Applicable**
CENTRIFUGE CABLES			
• Inverters			
• Centrifuge Connections			
• Wire Connection			
• Command circuit (relays, I/O/Automate)			
POWER			
• Electricity			
• Raw water or rinse circuit			
• Compressed air			
INSTALLATION			
• Leaks			
• Rotation direction of peripheral motors			
• Sensors			
• Measurement controls (flow meter, flow indicators)			
PRODUCT			
• Quality and quantity			
PRODUCT EVACUATION			
• Trap / Hopper			
• Scroll pump			
MAINTENANCE MEANS FOR MACHINE DISMANTLE			
• Rails, lifting beams			
ELECTRICIAN / AUTOMATION ENGINEER ON SITE			
• Presence required			

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CHAPTER 2

PROJECT DRAWINGS

2.1 MECHANICAL DRAWINGS

The following certified mechanical drawings are included:

M831476-1 D4L Centrifuge Skid General Arrangement

M831476-2A D4L Centrifuge Skid, Skid Assembly General Arrangement Unit 0601

M831476-2B D4L Centrifuge Skid, Skid Assembly General Arrangement Unit 0602

M831476-3 Manifold Assembly

M831476-4 D4L Centrifuge Skid, Skid Assembly General Arrangement (to be provided in submittal of final O&M)

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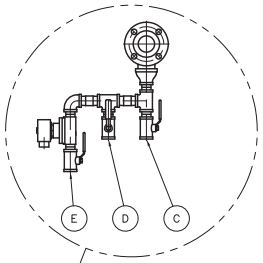
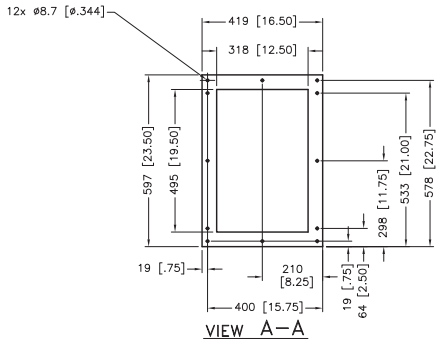
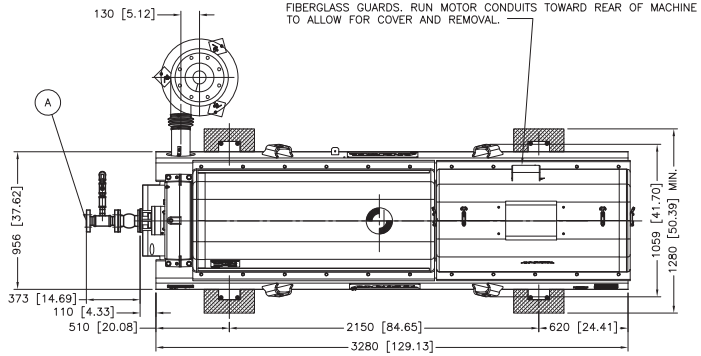
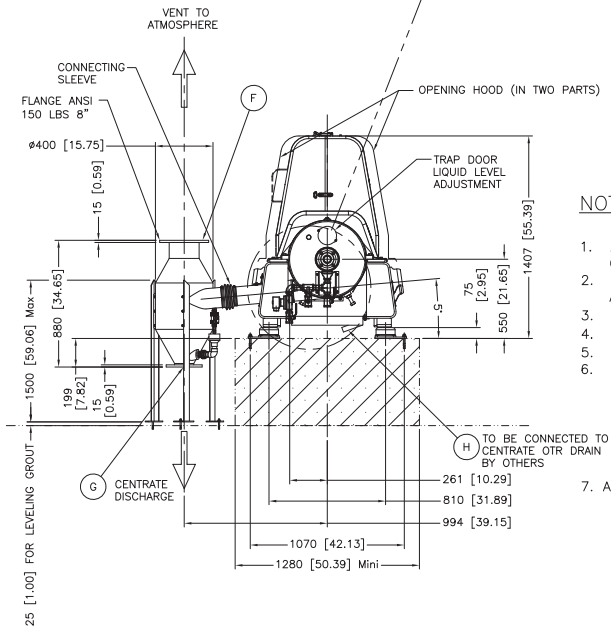
PIPING CONNECTIONS		
PORT	SIZE	DESCRIPTION
A	2"–150 LB ANSI FLANGE	FEED INLET
B	RECTANGULAR 12–1/2" x 19–1/2"	SEDIMENTS DISCHARGE
C	1" NPT	SLUDGE SAMPLE
D	1" NPT	POLYMER CONNECTION
E	1" NPT	WASHWATER CONNECTION
F	8"–150 LB ANSI FLANGE	VENT
G	5"–150 LB ANSI FLANGE	EFFLUENTS OUTLET
H	ø1.327"	FRAME DRAIN



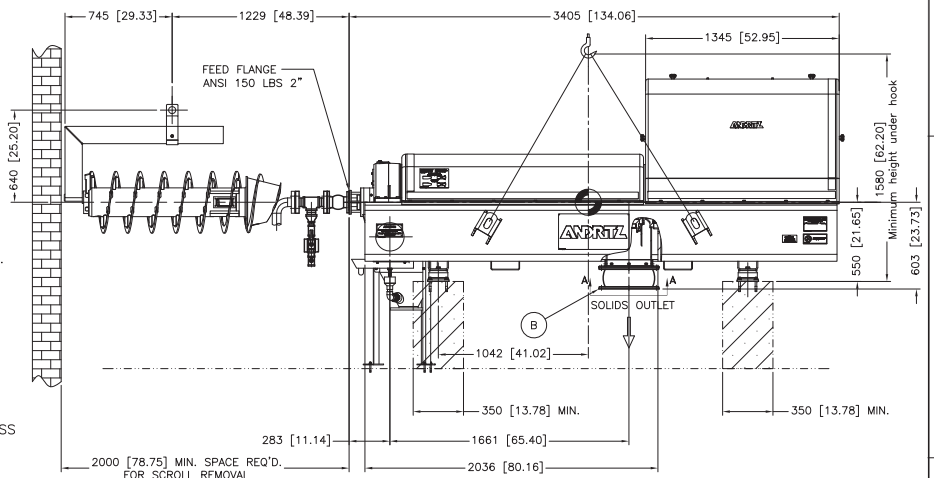






NOTES:

1. ALL PIPING TO AND FROM MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
2. SEE FOUNDATION DETAILS FOR DESIGN LOADS AND CONNECTION DETAILS.
3. ALL DIMENSIONS ARE IN mm WITH inches IN [ ].
4. DRY WEIGHT OF MACHINE 3059 kg [6744 lbs].
5. SCROLL WEIGHT 510 kg [1124 lbs].
6. PROCESS REQUIREMENTS
   WASHWATER: 35.2–70.4GPM @ 43.5–58PSI
   SHUTDOWN: 15min
   CIP: 10min
   AIR FLOW: 118CFM
   MINIMUM SLUDGE INLET PRESSURE: 7.5PSI AT CENTRIFUGE FEED FLANGE.
7. ALL CHUTES TO BE SUPPORTED BY OTHERS UNLESS NOTED OTHERWISE.



ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD, SOUTH
ARLINGTON, TEXAS 76017
Phone: (817)465-5611
Telefax: (817)472-8589

CERTIFIED CORRECT FOR INSTALLATION
BY: T.BARTOSH DATE: 4/10/18
PROJECT No. 831476

THESE DWGS. REFLECT CUSTOMER'S CHANGES AND APPROVAL ON PREVIOUS DWG. TRANSMITTALS

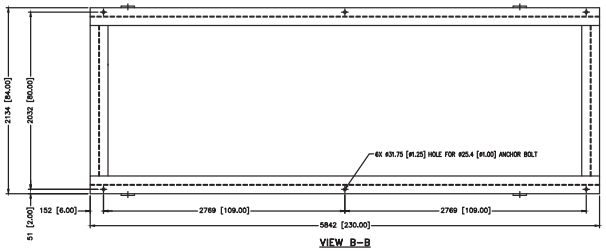
ESTIMATED WEIGHT IN LBS:	DRAWN BY: QG	DATE 04/10/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: JG	DATE 4/10/18
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION	
MILL FINISH ALL OVER		

ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

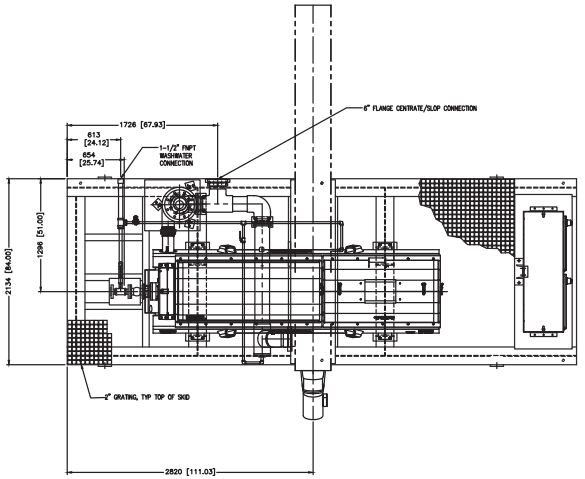
TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE
GENERAL ARRANGEMENT

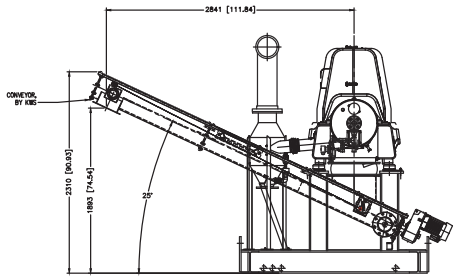
SIZE	DRAWING NUMBER	REV
D	M831476–1	0

SCALE 1/16 | FILE M831476–1 | SHEET 1 OF 1

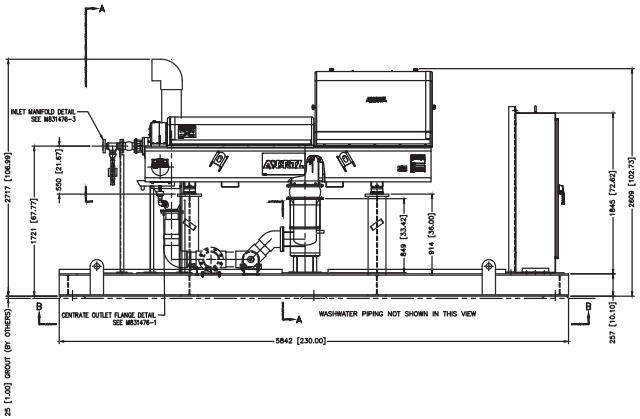


VIEW B–B





VIEW A–A
WASHWATER PIPING NOT SHOWN IN THIS VIEW



UNIT 0601

NOTES:
1. FOUNDATION DESIGN TO BE BY OTHERS.
2. ALL DIMENSIONS ARE IN mm WITH Inches IN [ ].
3. PIPING TO/FROM SKID IS BY OTHERS.
4. PROCESS REQUIREMENTS: SEE NOTE 6 ON DRAWING M831476-1.
5. APPROXIMATE DRY WEIGHT OF SKID: 5883 kg [12,970 lbs].
   APPROXIMATE OPERATING WEIGHT OF SKID: 6677 kg [14,720 lbs].
6. SKID TO BE LEVEL IN ALL DIRECTIONS WITHIN 1.6mm [.063 inch].

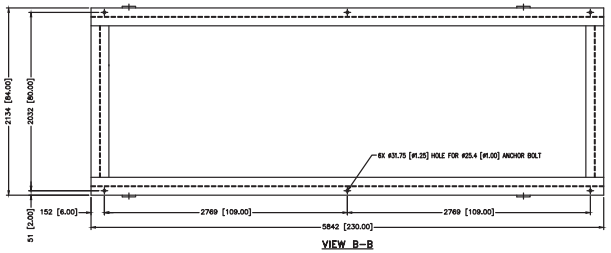
ASAP DOCUMENT No.–

8090 COMMERCIAL BLVD. SUITE 200 ARLINGTON, TEXAS 76001 Phone: (817)465-5611 Telefax (817)465-5888	ESTIMATED WEIGHT IN LBS:	DRAWN BY: OO	DATE 06/05/18
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE
CERTIFIED CORRECT FOR INSTALLATION BY: T.BARTOSH DATE: 6/6/18	FABRICATION TOLERANCES .XXX±0.005 ANGLE ± HOLE±0.020	APPROVED BY: JG	DATE 6/6/18
PROJECT No. 831476	MACHINING TOLERANCES .XXX±0.005 ANGLE ± HOLE±0.020	THIRD ANGLE PROJECTION	
THESE ENGR. REFLECT CUSTOMER'S CHANGES AND APPROVAL OR PRIORITY ENG. TRANSMITTALS	MILL FINISH ALL OVER		

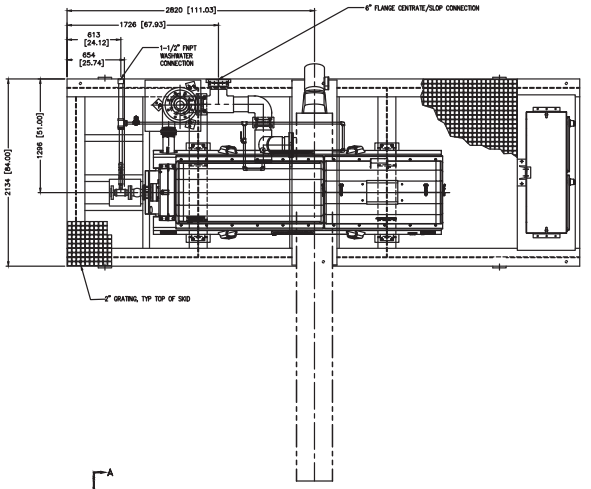
ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

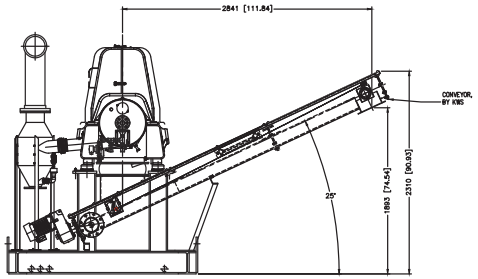
TITLE: VEOLIA ADNOC AMARUG
DAL CENTRIFUGE SKID ASSEMBLY
GENERAL ARRANGEMENT UNIT 0601

SIZE	DRAWING NUMBER	REV
E	M831476-2A	0
SCALE 1/16	FILE M831476-2A	SHEET 1 OF 1

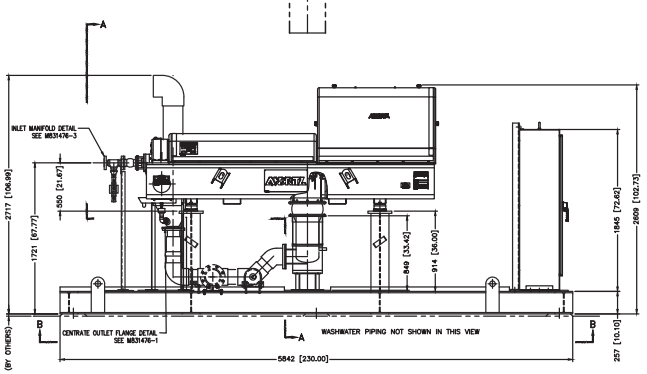


VIEW B–B





VIEW A–A
WASHWATER PIPING NOT SHOWN IN THIS VIEW



NOTES:
1. FOUNDATION DESIGN TO BE BY OTHERS.
2. ALL DIMENSIONS ARE IN mm WITH inches IN [ ].
3. PIPING TO/FROM SKID IS BY OTHERS.
4. PROCESS REQUIREMENTS: SEE NOTE 6 ON DRAWING M831476-1.
5. APPROXIMATE DRY WEIGHT OF SKID: 5883 kg [12,970 lbs].
   APPROXIMATE OPERATING WEIGHT OF SKID: 6677 kg [14,720 lbs].
6. SKID TO BE LEVEL IN ALL DIRECTIONS WITHIN 1.6mm [.063 inch].

UNIT 0602

REV	BY	REVISION	CG	JW	6/6/18
A	NONE	UPDATED PER CUSTOMER COMMENTS		APVD	DATE

ASAP DOCUMENT No.–

1600 CONGRESS, SUITE 100W
ARLINGTON, TEXAS 76006
Phone: (817)465-5611
Telefax: (817)472-3502

CERTIFIED CORRECT FOR INSTALLATION
BY: J.WHITSON DATE: 6/6/18

PROJECT No. A31478

THESE DRAWINGS ARE SUBJECT TO CHANGES AND REVISIONS AS NECESSARY DUE TO FIELD CONDITIONS

ESTIMATED WEIGHT IN LBS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

FABRICATION TOLERANCES
.XX±.010 ANGLE ±0.5°

MACHINING TOLERANCES
.XX±.005 ANGLE ±0.25°

MILL FINISH ALL OVER

DRAWN BY: QG
DATE: 06/05/18

CHECKED BY: JW
DATE: 6/6/18

APPROVED BY: JW
DATE: 6/6/18

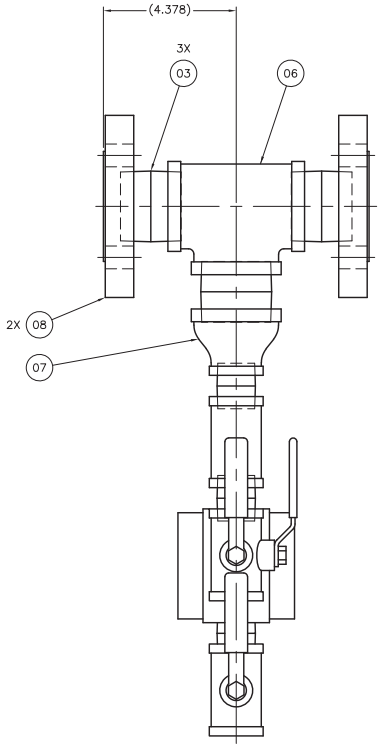
THIRD ANGLE PROJECTION

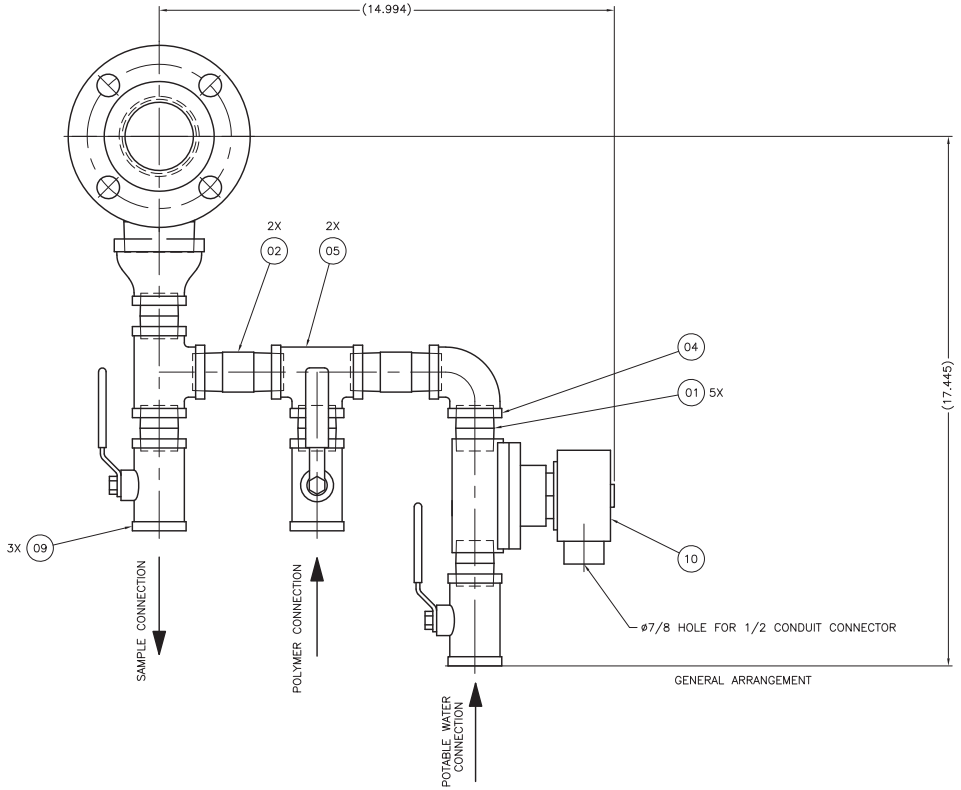
ANDRITZ SEPARATION, INC.
1010 COMMERCE PARK DRIVE SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA ASHCO AMARILLO
D4L CENTRIFUGE SKID ASSEMBLY
GENERAL ARRANGEMENT UNIT 0602

SIZE: E | DRAWING NUMBER: M831476-2B | REV: A
SCALE: 1/16 | FILE: M831476-2B | SHEET 1 OF 1

No	PART No	QTY	DESCRIPTION	MATERIAL
01	PINIX1.0CMN	5	CLOSE NIPPLE, 1"	316L
02	PINIX1.0CMN3	2	NIPPLE, 1 x 3 LG	316L
03	PINIX2.0CMN	3	CLOSE NIPPLE, 2"	316L
04	PI90X1.0CFN	1	90° ELBOW, 1"	316L
05	PITEX1.0CFN	2	TEE, 1" FNPT	316L
06	PITEX2.0CFN	1	TEE, 2" FNPT	316L
07	PIREX2X1CFN	1	REDUCER, CONC., 2 X 1 SCH 40 FNPT	316L
08	PIFLX2.0FFN	2	FLANGE, 2 (150 LB) THREADED	316L
09	VBLX1.0FFN	3	BALL VALVE, 1" FNPT	316L
10	131417950	1	ASCO EF8210G4, 1" SOLENOID VALVE	BRASS





6 NOTE:
1. ALL THREADED PIPE JOINTS TO BE SEALED WITH RECTORSEAL 5 PIPE THREAD SEALANT

ANDRITZ-RUTHNER, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76017
Phone: (817)465-5611
Telefax: (817)472-8589

CERTIFIED CORRECT FOR INSTALLATION
BY: T.BARTOSH DATE: 4/10/18
PROJECT No.: 831476
THESE DWGS. REFLECT CUSTOMER'S CHANGES AND APPROVAL ON PREVIOUS DWG. TRANSMITTALS

ESTIMATED WEIGHT IN LBS:	DRAWN BY: TB	DATE 4/10/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: TB	DATE 4/11/18
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION	
MILL FINISH ALL OVER		

ANDRITZ
ANDRITZ-RUTHNER, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: CENTRIFUGE
MANIFOLD ASSEMBLY

SIZE	DRAWING NUMBER	REV
D	M831476-3	0

SCALE 1/2 | FILE M831476-3 | SHEET 1 OF 1

2.2 ELECTRICAL DRAWINGS

The following certified electrical drawings are included:

E831476-T1 D4L Centrifuge Skid Drawing Report List

E831476-BM1 D4L Centrifuge Skid Bill of Materials

E831476-BM2 D4L Centrifuge Skid Bill of Materials

E831476-P1 D4L Centrifuge Skid Panel Layout

E831476-P2 D4L Centrifuge Skid Back Panel Layout

E831476-P3 D4L Centrifuge Skid Terminal Block Plan (AC)

E831476-P4 D4L Centrifuge Skid Terminal Block Plan (DC)

E831476-P5 D4L Centrifuge Skid Nameplates

E831476-P6 D4L Centrifuge Skid Control Panel Skid Mounting Angle

E831476-SL1 D4L Centrifuge Skid Single Line Schematic

E831476-S1 D4L Centrifuge Skid Power Distribution Schematic

E831476-S2 D4L Centrifuge Skid 480VAC Power Distribution

E831476-S3 D4L Centrifuge Skid Power Distribution

E831476-S4 D4L Centrifuge Skid Low Voltage Power Distribution

E831476-S5 D4L Centrifuge Skid AC Ctrl Power Distribution (Cont.)

E831476-S6 D4L Centrifuge Skid DC Power Distribution

E831476-S7 D4L Centrifuge Skid Communications

E831476-S8 D4L Centrifuge Skid OIT Schematic

E831476-S9 D4L Centrifuge Skid PLC Power Supply and CPU

E831476-S10 D4L Centrifuge Skid Bank 1 Slot 1 Digital Inputs

E831476-S11 D4L Centrifuge Skid Bank 1 Slot 2 Digital Inputs

E831476-S13 D4L Centrifuge Skid Bank 1 Slot 3 Digital Outputs

E831476-S15 D4L Centrifuge Skid Bank 1 Slot 4 Analog Inputs

E831476-S16 D4L Centrifuge Skid Bank 1 Slot 5 Analog Outputs

E831476-S20	D4L Centrifuge Skid Field Devices
E831476-N1	D4L Centrifuge Skid Network Architecture
E831476-PP1	D4L Centrifuge Skid Point to Point (Centrifuge Loads)
E831476-PP2	D4L Centrifuge Skid Point to Point Instrumentation JB
E831476-PP3	D4L Centrifuge Skid Point to Point (Cont. for Customer Use)
E831476-PP4	D4L Centrifuge Skid Point to Point Sludge
E831476-PP5	D4L Centrifuge Skid Point to Point Polymer
E831476-PP6	D4L Centrifuge Skid Point to Point Conveyor
E831476-IOM1	D4L Centrifuge Skid I/O Map List
E831476-IOM2	D4L Centrifuge Skid I/O Map List

For reference:

E831476-PID	D4L Centrifuge Skid, Skid I&C Legend
E831476-PID-2	D4L Centrifuge Skid, Skid P&ID

ANDRITZ Separation

VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
0

SH	LOCATION	SEC	DWGDESC	FILENAME
1		TRANSMITTALS	DRAWING REPORT LIST	E831476-T1
2	CFG-CP	BILL OF MATERIALS	BILL OF MATERIALS	E831476-BM1
3	CFG-CP	BILL OF MATERIALS	BILL OF MATERIALS	E831476-BM2
4	CFG-CP	PANEL LAYOUT	PANEL LAYOUT	E831476-P1
5	CFG-CP	PANEL LAYOUT	BACKPANEL LAYOUT	E831476-P2
6		PANEL LAYOUT	TERMINAL BLOCK PLAN (AC)	E831476-P3
7		PANEL LAYOUT	TERMINAL BLOCK PLAN (DC)	E831476-P4
8		PANEL LAYOUT	NAMEPLATES	E831476-P5
9	CFG-CP	PANEL LAYOUT	CONTROL PANEL SKID MOUNTING ANGLES	E831476-P6
10		SINGLE LINE SCHEMATICS	SINGLE LINE SCHEMATIC	E831476-SL1
11	CFG-CP	SCHEMATICS	DRAWING REPORT LIST	E831476-S1
12	CFG-CP	SCHEMATICS	480VAC POWER DISTRIBUTION	E831476-S2
13	CFG-CP	SCHEMATICS	POWER DISTRIBUTION SCHEMATIC	E831476-S3
14	CFG-CP	SCHEMATICS	LOW VOLTAGE POWER DISTRIBUTION	E831476-S4
15	CFG-CP	SCHEMATICS	AC CTRL POWER DISTRIBUTION (CONT.)	E831476-S5
16	CFG-CP	SCHEMATICS	DC POWER DISTRIBUTION	E831476-S6
17	CFG-CP	SCHEMATICS	COMMUNICATIONS	E831476-S7
18	CFG-CP	SCHEMATICS	OIT SCHEMATIC	E831476-S8
19	CFG-CP	SCHEMATICS	EMBEDDED PLC POWER SUPPLY	E831476-S9
20	CFG-CP	SCHEMATICS	BANK 1 SLOT 1 DIGITAL INPUTS	E831476-S10
21	CFG-CP	SCHEMATICS	BANK 1 SLOT 2 DIGITAL INPUTS	E831476-S11
22	CFG-CP	SCHEMATICS	BANK 1 SLOT 3 DIGITAL OUTPUTS	E831476-S13
23	CFG-CP	SCHEMATICS	BANK 1 SLOT 4 ANALOG INPUTS	E831476-S15
24	CFG-CP	SCHEMATICS	BANK 1 SLOT 5 ANALOG OUTPUTS	E831476-S16
25	CFG-CP	SCHEMATICS	FIELD DEVICES	E831476-S20
26	CFG-CP	NETWORK ARCHITECTURE	NETWORK ARCHITECTURE	E831476-N1
27		POINT TO POINT	POINT TO POINT (CENTRIFUGE LOADS)	E831476-PP1
28		POINT TO POINT	POINT TO POINT INSTRUMENTATION (B	E831476-PP2
29		POINT TO POINT	POINT TO POINT (CONT FOR CUST USE)	E831476-PP3
30		POINT TO POINT	POINT TO POINT SLUDGE	E831476-PP4
31		POINT TO POINT	POINT TO POINT POLYMER	E831476-PP5
32		POINT TO POINT	POINT TO POINT CONVEYOR	E831476-PP6
33		REPORTS	I/O MAP LIST	E831476-IOM1
34		REPORTS	I/O MAP LIST	E831476-IOM2

SCHEMATIC SYMBOL LEGENDS

Code	Schematic Symbol	Description
AB		Alarm Beacon
AH		Alarm Horn
CB		Circuit Breaker
CR		Relay Coil
		Contact N.O.
		Contact N.C.
DI		Diode
DS		Disconnect
DV		Analog Device
EGND		Earth Ground
FAN		Enclosure Fan/Exhaust
FLT		Level Switch N.C.
		Level Switch N.O.
FS		Flow Switch N.O.
		Flow Switch N.C.
FU	X	Fuse X=Amp Rating
GNDx		Ground X=Isolation Ground Number
LS		Limit Switch N.C.
		Limit Switch N.C.; Held Open
		Limit Switch N.O.
		Limit Switch N.O.; Held Closed
LT		Pilot Light X=color (A=amber,B=blue, G=green,R=red)
		Pilot Light – Push to Test X=color (A=amber,B=blue, G=green,R=red)
M		Contactor Coil
MOT		Motor
OIT		Operator Interface Terminal
OL		Overload Relay

Code	Schematic Symbol	Description
PB		Pushbutton N.O.
		Pushbutton N.C.
		Pushbutton N.O.; Mushroom Head
		Pushbutton N.C.; Mushroom Head
PCS		Pull Cord N.C.
		Pull Cord N.O.
PE		Photo Eye N.O.
		Photo Eye N.C.
PDB		Distribution Block (Power or Ground)
PLUG		Male Plug
PS		Pressure Switch N.C.
		Pressure Switch N.O.
PX		Proximity Switch N.C.
		Proximity Switch N.O.
R		Resistor/Heater
RECPT		120VAC Receptacle
RTD		RTD Transmitter
SOL		Solenoid
SS	OX	Selector Switch N.O.; 2 Pos; Maintained
	OX	Selector Switch N.C.; 2 Pos; Spring Left
	OOX	Selector Switch N.C; 3 Pos; Keyed; Maintained
	OOX	Selector Switch N.O.; 3 Pos; Spring Center
SSLT	OX	Illuminated Selector Switch N.O.; 2 Pos
TAS		Temperature Switch N.O.
		Temperature Switch N.C.
TI		Timer
WLT		Work Light
XF		Transformer

TERMINAL BLOCK LEGEND

Type	Schematic Symbol	Description
PLC	IN-XX X	PLC Input
	OUT-XX X	PLC Output
TB	WIRE#	Terminal Block
	STRIP# WIRE# GNDx	Ground Terminal Block X=Isolation Ground Number
	WIRE# GNDx	Chassis Ground Bar
LUG	▼ ▼ ▼	Lug Line Side
	V V V	Lug Load Side

COMPONENT TAGGING AND WIRE NUMBERS

This drawing set was created based on a page line number standard. All device numbers, wire numbers, and referencing follows this standard unless existing devices or wiring is being documented. The following illustrations explain how section, sheet and row numbers are used.

Cross Reference

1255
Sheet
Row

Wire Number

11001
Sheet
Row
Position

Device Naming

PB050A
Function Code
Sheet
Position*

Wire Number **
11001
#12BLK
Wire Color
Wire Gauge
Wire Line

* First Position Blank
** Hidden on wire network with terminal displaying wire number.

WIRING LINES

Wire
To be wired by others
Metal Jumper

MISC. LEGENDS

▲ Supplied By Others

X Revision/Change
X=Revision Number

ANDRITZ SEPARATION, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:	CFG-CP	

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ D4L CENTRIFUGE SKID DRAWING REPORT LIST

SIZE	DRAWING NUMBER	REV
B	E831476-T1	1

PREV. SHEET: | NEXT SHEET: 2 | SHEET 1 OF 34

CENTRIFUGE - CONTROL PANEL COMPONENTS (CFG-CP)

LOC	ITEMS	QTY	CATALOG	MFG	DESCRIPTION	TAGS
CFG-CP	1	1	A72XM5418SSN4	HOFFMAN	FREESTANDING ENCLOSURE, STAINLESS STEEL 304, NEMA 4X, 72"H x 54"W x 18"D, TWO-DOOR, 3 POINT LATCH, FOR FLANGE MOUNT DISCONNECTS	
CFG-CP	2	1	A72PM54	HOFFMAN	PANEL FOR FREE-STAND TYPE 4,4X,12, FITS ENCLOSURE 72.00X54.00	
CFG-CP	3	1	800H-2HRW2KB6	AB	30.5□□□ TYPE 4/4X/13 SEL SWITCH-ILLUM, 2 POS, UNIVERSAL LED, 12-120AC 50/60HZ, WHITE, STD KNOB MAINT, KB6 MAINTAINED CAM, NO CONTACTS	SSLT436
CFG-CP	4	2	800T-XD1M	AB	CONTACT BLOCK, MAX DUTY BLOCK 1 N.O.	SSLT436
CFG-CP	5	1	800H-TFRXT6A4	AB	NON-ILLUMINATED PUSH BUTTON TRIGGER ACTION, TWO POSITION MAINTAINED, MUSHROOM HEAD, RED, FINGER GUARDS ON TERMINALS, 2-NCLB/2-NC CONTACTS	PB501
CFG-CP CFG-CP	6	2	20-HIM-C6S.	AB	POWERFLEX ARCHITECTURE CLASS REMOTE ENHANCED HIM, IP66 □NEMA 4X/12□INDOOR USE ONLY INC. 1202 C30 CABLE	OIT118 OIT153
CFG-CP	7	1	2711P-T10C22D9P	AB	PANELVIEW PLUS 7 PERFORMANCE TERMINAL, TOUCH SCREEN, 10.4 INCHES, TFT COLOR, TWO ETHERNET PORTS, 24V DC, WINDOWS CE OS LICENSE, PERFORMANCE MODEL	OIT814
CFG-CP	8	1	855BS-N35BL4	AB	ROUND 90□□□ BEACON 1/2" CONDUIT MOUNT, STANDARD, 24/48V AC/DC FULL VOLTAGE, LED STROBE SELECTABLE SINGLE/DOUBLE FLASH, RED	AB1313
CFG-CP CFG-CP	9	2	300837153	ANDRITZ	ANDRITZ SEPARATION STD LOGO	
CFG-CP	10	1	871P-G1	EDWARDS SIGNALING	VIBRATING HORN 24VDC NEMA 4X	AH1304
CFG-CP	11	1	1609-D1000N	AB	UPS, NEXT GEN, DELUXE MODEL, 1000VA, 120VAC INPUT/OUTPUT	UPS445
CFG-CP	12	1	P-R2-K2RF0	GRACE PORT	GFCI RECEPTACLE UL TYPE 4X GFCI/ R□45 ETHERNET	PORT430
CFG-CP	13	3	1609-SBAT	AB	40C BATTERY, UPS ACCESSORY	UPS445
CFG-CP	14	1	199-DR1	AB	ZINC/STEEL DIN RAIL EN 50022 □35□□□ x 7.5□□□ x 1□□□	
CFG-CP	15	1	20G11NE041AA0NNNNN	AB	AC DRIVE, □/EMBEDDED ETHERNET/IP, 600VAC, 3PH, FILTERED, CM □UMPER REMOVED, AC INPUT □/DC TERMINALS, PRECHARGE, DB TRANSISTOR, 40HP ND, 30HP HD, FR5	VFD104
CFG-CP	16	1	20G11NE011AA0NNNNN	AB	AC DRIVE, □/EMBEDDED ETHERNET/IP, 600VAC, 3PH, FILTERED, CM □UMPER REMOVED, AC INPUT □/DC TERMINALS, PRECTARGE, DB TRANSISTOR, 10HP ND, 7.5HP HD, FR3	VFD139
CFG-CP	17	1	800FP-SM22PX21	AB	22□□□, 2 POSITION SELECTOR SWITCH, PLASTIC, MAINTAINED, BLACK, STD KNOB, STD ORIENTATION, 2 N.O. 1 N.C. STD BLOCK	SS436
CFG-CP	18	1	M22-IVS	EATON	ADAPTER, DIN RAIL□FOR M22 MODULAR SWITCHES□MOUNTS ONE SWITCH TO DIN RAIL	SS436
CFG-CP	19	1	1492-FB2C30-L	AB	2 POLE FUSE BLOCK - CLASS CC	FU359
CFG-CP	20	2	FNQ-R-6	BUSSMANN	FUSE - CLASS CC 6A	FU359
CFG-CP CFG-CP	21	2	1492-FB1C30-L	AB	1 POLE FUSE BLOCK - CLASS CC	FU365 FU457
CFG-CP	22	1	FNQ-R-10	BUSSMANN	FUSE - CLASS CC 10A	FU457
CFG-CP	23	1	4983-DC120-20	AB		SP412
CFG-CP	24	1	104-C09E□22	AB	IEC CONTACTOR, DC-OPERATED REVERSING, 104-C SERIES	M1351
CFG-CP CFG-CP	25 47	2	100-SB10	AB	AUXILIARY CONTACT, SIDE MOUNT	M1351 M1354
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	26	10	700-HLT12Z24	AB	HL TYPE TERMINAL BLOCK RELAY, DPDT □C/O□,10A CONTACT RATING, W/SCREW TERMINALS, 24VDC, TOUCH SAFE, LIGHT INDICATOR, SURGE SUPPRESSOR	CR1307 CR1310 CR1319 CR1339 CR1342 CR1345 CR1348 CR2008 CR446 CR448
CFG-CP	27	1	140M-C2E-B25	AB	IEC MOTOR PROTECTION CIRCUIT BREAKER, STANDARD MAGNETIC TRIP, 140M □C-FRAME□	MPCB236
CFG-CP	28	1	140M-C-AFAR10A01	AB		MPCB236
CFG-CP CFG-CP	29	2	700-HC24A1-3-4	AB	HC TYPE MINIATURE ICE CUBE RELAY, BLADE TERMINALS AND SOCKET 700-HN103	MCR507 MCR510
CFG-CP CFG-CP	29	2	700-HN103	AB	SCREW TERMINAL SOCKET, GUARDED TERMINAL CONSTRUCTION	MCR507 MCR510
CFG-CP CFG-CP	30	2	100-SA20	AB	AUXILIARY CONTACT, SIDE MOUNT 2 NO	MCR507 MCR510
CFG-CP	31	1	100-C23D200	AB	100-C CONTACTOR, 4-POLE	CR436
CFG-CP	32	1	100-FA20	AB	AUXILIARY CONTACT, FRONT MOUNT	CR436
CFG-CP	33	1	700-HN177.	AB	END BARRIER FOR 700-HL, BLACK	CR446
CFG-CP	34	1	700-TB□08B.	AB	□UMPER LINK, 8-WAY, BLUE	CR446
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	35	5	1492-SPM1C030	AB	SUPPLEMENTARY PROTECTORS, 1-POLE, TRIP CURVE C, 3 A, NO NEUTRAL	CB401 CB428 CB501 CB555 CB562
CFG-CP	36	1	1492-SPM1C040	AB	SUPPLEMENTARY PROTECTORS, 1-POLE, TRIP CURVE C, 4 A, NO NEUTRAL	CB522
CFG-CP CFG-CP	37	2	1492-SPM1C050	AB	SUPPLEMENTARY PROTECTORS, 1-POLE, TRIP CURVE C, 5 A, NO NEUTRAL	CB516 CB519
CFG-CP	38	1	1606-XLE240EN	AB	SWITCHED MODE POWER SUPPLY, 1606 SERIES	PW604
CFG-CP	39	1	1492-SPM1C150	AB	SUPPLEMENTARY PROTECTORS, 1-POLE, TRIP CURVE C, 15 A, NO NEUTRAL	CB436
CFG-CP	40	1	FNQ-R-15	BUSSMANN	FUSE - CLASS CC 15A	FU365
CFG-CP	41	1	140G-G6C3-C60	AB	140G - MOLDED CASE CIRCIUT BREAKER, G-FRAME, 65KAIC, T/M - THERMAL MAGNETIC, RATED CURRENT 60A	CB101

CENTRIFUGE - CONTROL PANEL COMPONENTS (CFG-CP)

LOC	ITEMS	QTY	CATALOG	MFG	DESCRIPTION	TAGS
CFG-CP	42	2	140G-G-T C3H	AB	140G - FRAME-G, TERMINAL COVER, 3 POLE, QTY 2, HIGH	CB101
CFG-CP	43	1	140G-G-MTL63.	AB	140G - G-FRAME, MULTI TERMINAL LUG, QTY 3, 6X14-2.2.5-35□	CB101
CFG-CP	44	1	140G-G-TLC13	AB	140G - G-FRAME, TERMINAL LUG, QTY 3, 1X14-1/0 □2.5-50□	CB101
CFG-CP	45	1	140G-G-FCX04	AB	140G - FLEX-CABLE MECHANISM, NON-METALIC FLANGE HANDLE, 4 FT, FOR G-FRAME CIRCUIT BREAKERS	CB101
CFG-CP	48	1	1497B-A13-M11-0-N	AB	CONTROL POWER TRANSFORMER, TYPE 1497B, 2.0KVA, VOLTAGE PRIMARY: 600/575/550V 60H□□, SECONDARY 120V/240V 60H□□WITHOUT FUSE BLOCK	XF362
CFG-CP	49	1	FSC-2	SCHNEIDER ELECTRIC	FINGERSAFE COVER, 2 COVERS PER KIT, FOR 250-5000VA CLASS 9070 TRANSFORMERS	XF362
CFG-CP	50	1	1769-ECR	AB	COMPACT I/O END CAP RIGHT SIDE	
CFG-CP	51	1	1769-OF4	AB	1768/1769 COMPACTLOGIX SYSTEM, 4 CHANNEL ANALOG CURENT/VOLTAGE OUTPUT MODULE	PLC1601
CFG-CP	52	1	1769-IF8	AB	1768/1769 COMPACTLOGIX SYSTEM 8, 8 CHANNEL ANALOG CURRENT/VOLTAGE INPUT MODULE	PLC1501
CFG-CP	53	1	1769-OW16	AB	1769 COMPACTLOGIX RELAY OUTPUT MODULE 16 POINTS	PLC1301
CFG-CP CFG-CP	54	2	1769-IQ16	AB	1769 COMPACTLOGIX PLC 1500 COMPACT SERIES DC INPUT MODULE 16 POINT SINK/SOURCE	PLC1001 PLC1101
CFG-CP	55	1	1769-PA4	AB	COMPACT LOGIX SYSTEM, POWER SUPPLY 120/240VAC INPUT 4AMP□□ 5VDC OUTPUT	PLCPS907
CFG-CP	56	1	1769-L30ER	AB	COMPACTLOGIX 5370 L3 CONTROLLER, DUAL ETHERNET W/DLR CAPABILITY, 1MB MEMORY, 8 I/O EXPANSION, 16 ETHERNET IP NODES, WITH 1GB SD CARD	PLCIO935
CFG-CP	57	1	T60060-3CR	BUSSMANN	3 POLE FUSE BLOCK - CLASS T	FU104
CFG-CP	58	3	□S-50	BUSSMANN	FUSE - CLASS T	FU104
CFG-CP	60	1	1783-US8T	AB	UNMANAGED ETHERNET SWITCH, R□45, 8 PORT	ETH701
CFG-CP	61	1	T32F717D	ENM	ELAPSED TIME METER 24VDC, DIN RAIL MOUNT	ETM1316
CFG-CP	62	1	LEDA1S35	HOFFMAN	LED ENCLOSURE LIGHT, ON/OFF SWITCH, SCREW MOUNTED 90VAC-260VAC 13.82"	WLT401
CFG-CP	63	1	LEDA20C	HOFFMAN	LED LIGHT INPUT CONNECTOR/CABLE ASSEMBLY 2000□□□ FOR AC LED LIGHTS	WLT401
CFG-CP	64	1	DW2503	IFM EFECTOR		SM636
CFG-CP	65	1	2S2/0-HEX	LUGS DIRECT	MECHANICAL LUG DOUBLE WIRE DOUBLE BARREL 2/0-14AWG	
CFG-CP	66	1	US3□2I	MERSEN	FUSE BLOCK FOR DC FUSES	FU145
CFG-CP	67	1	HS□20	MERSEN	600VAC 20A CLASS □HS FUSE	FU145
CFG-CP	68	1	RLW-004605	MTE	RLW LINE/LOAD REACTOR IMPEDANCE 5□□, 46A, OPEN REACTOR	LR104
CFG-CP	69	8	3035467	PHOENIX CONTACT	UNIVERSAL TERMINAL BLOCK - UTTB 4 DOUBLE LEVEL YELLOW	TBEXT
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	70	10	3047293	PHOENIX CONTACT	END COVER UT DOUBLE LEVEL D-UTTB 2,5/4 GRAY	TBAC1 TBAC3 TBCDI TBCDO TBEXT
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	71	26	0800886	PHOENIX CONTACT	END BRACKET - E/NS 35 N	TBAC1 TBAC2 TBAC3 TBCAI TBCAO TBCDI TBCDO TBDC1 TBEXT
CFG-CP CFG-CP	72	4	3214314	PHOENIX CONTACT	END COVER UT THREE LEVEL D-UT 2,5-3L GRAY	TBCAI TBCAO
CFG-CP CFG-CP	73	28	3214301	PHOENIX CONTACT	3 LEVEL TERMINAL BLOCK WITH PE FOOT UT 2,5-PE/L/L, 24A MAX	TBCAI TBCAO
CFG-CP	74	2	0824581	PHOENIX CONTACT	MARKER FOR TERMINAL BLOCK, WIDTH 5.2□□□ UT-2,5	TBCAI
CFG-CP	75	1	2963860	PHOENIX CONTACT	DIN RAIL MOUNTED RECEPTACLE SINGLE OUTLET 15A NEMA 5-15	RECPT439
CFG-CP CFG-CP CFG-CP	76	69	3044102	PHOENIX CONTACT	UNIVERSAL TERMINAL BLOCK - UT 4 SINGLE LEVEL GRAY	TBAC2 TBDC1 TBDC2
CFG-CP CFG-CP	77	4	3047028	PHOENIX CONTACT	END COVER UT 4,6 SINGLE LEVEL D-UT 2,5/10	TBAC2 TBDC1
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	78	124	3044814	PHOENIX CONTACT	UNIVERSAL TERMINAL BLOCK - UTTB 4 DOUBLE LEVEL GRAY	TBAC1 TBAC3 TBCDI TBCDO
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	79	76	3030271	PHOENIX CONTACT	PLUG-IN □UMPER FOR UT 4 TERMINAL BLOCKS, 10 POSITIONS, RED	CB612 CB615 CB618 CB621 CB624 CB630 TBAC1 TBCDI

1010 COMMERCIAL BLVD., SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES
1. QUANTITIES SHOWN IN THIS BILL OF MATERIALS ARE FOR 1 (ONE) MACHINE/TRAIN ASSEMBLY, AND TYPICAL FOR 1 (ONE) MACHINES/TRAINS TO BE ORDERED.
2. HOFFMAN OR EQUAL

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY: HL	DATE 04/04/18	
CHECKED BY: BJM	DATE 04/04/18	
APPROVED BY: CMP	DATE 04/04/18	
LOCATION: CFG-CP		

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BILL OF MATERIALS

SIZE	DRAWING NUMBER	REV
B	E831476-BM1	1

PREV. SHEET: 1 | NEXT SHEET: 3 | SHEET 2 OF 34

CENTRIFUGE - CONTROL PANEL COMPONENTS (CFG-CP)

LOC	ITEMS	QTY	CATALOG	MFG	DESCRIPTION	TAGS
CFG-CP CFG-CP	80	68	0824589	PHOENIX CONTACT	MARKER FOR TERMINAL BLOCK, WIDTH 6.2□ □ UT-4	TBAC1 TBCDI
CFG-CP	81	2	3047167	PHOENIX CONTACT	PARTITION PLATE FOR UT 4,6 SINGLE LEVEL ATP-UT	TBAC2
CFG-CP CFG-CP	82	2	2800835	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER 1 POSITION 0.5A SFB CURVE	CB627 CB636
CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP CFG-CP	83	8	2801305	PHOENIX CONTACT	BASE ELEMENT SCREW CONNECTION	CB612 CB615 CB618 CB621 CB624 CB627 CB630 CB636
CFG-CP CFG-CP	84	2	2800837	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER 1 POSITION 2A SFB CURVE	CB615 CB630
CFG-CP CFG-CP	85	2	2800838	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER 1 POSITION 3A SFB CURVE	CB612 CB624
CFG-CP CFG-CP	86	2	2800836	PHOENIX CONTACT	THERMOMAGNETIC DEVICE CIRCUIT BREAKER 1 POSITION 1A SFB CURVE	CB618 CB621
CFG-CP	92	1	3011038	PHOENIX CONTACT	MULTI-LEVEL TERMINAL BLOCK - DLKB 2,5-PE	TB1
CFG-CP	96	1	VPCI-111	CORTEC	CORROSION INHIBITOR FOR MOISTURE, AIRBORNE CONTAMINANTS, H2S, SO2, NH3, ETC. 11 CUBIC FEET COVERAGE	

CENTRIFUGE - CONTROL PANEL COMPONENTS (CFG-FLD)

LOC	ITEMS	QTY	CATALOG	MFG	DESCRIPTION	TAGS
CFG-FLD	87	3	3045208	PHOENIX CONTACT	UNIVERSAL TERMINAL BLOCK - UT 6 BLACK	TB3PH
CFG-FLD	88	1	3044157	PHOENIX CONTACT	UNIVERSAL GROUND TERMINAL BLOCK - UT 6-PE	TB3PH
CFG-FLD	89	1	RS-2E	CCC	MODEL RS SAFETY STOP CONTROL ;2 SP/DT SWITCHES NO LIGHT W/EPOXY COATING, NEMA 1,3,3R,4,4X	PCS510
CFG-FLD	90	1	RS-28	CCC	;*****USE CROSBY 1011261 SS-450 AS REPLACEMENT********** ; CABLE END FITTING CABLE CLAMP	PCS510
CFG-FLD	91	15	RS-26	CCC	3/32 ORANGE NYLON COATED CABLE, ;FOOT□	PCS510
CFG-FLD	93	1	NG501A	IFM EFECTOR	INDUCTIVE SENSOR, M18X1 DIAMETER METAL HOUSING, 2 DC WIRE DC, 8.2DC, NORMALLY OPEN NO,MICRO QUICK DISCONNECT, SENSING RANGE 8.□ □, FLUSH MOUNTABLE, EX II	PRS641
CFG-FLD	94	1	ENC05A	IFM EFECTOR	CORDSET ANGLED CONNECTOR M12 FEMALE 5PIN - 4 WIRE, ATEX, FOR USE IN HAZARDOUS AREAS, LENGHT 5M	PRS641

ON-SITE INSTALLED PROGRAMMING SOFTWARE (PROVIDED BY OTHERS)

COMPONENT	MFG	DESCRIPTION	VERSION
PLC	AB	STUDIO50000	24.00
OIT	AB	FACTORY TALK VIEW ME	8.0

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1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

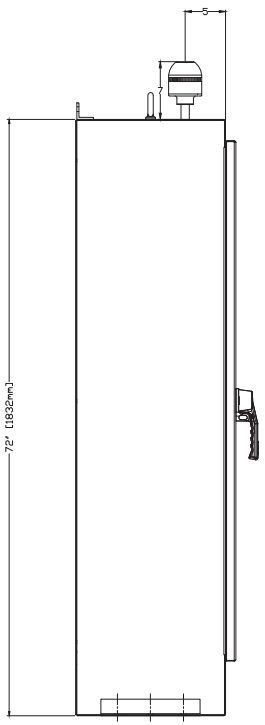
LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

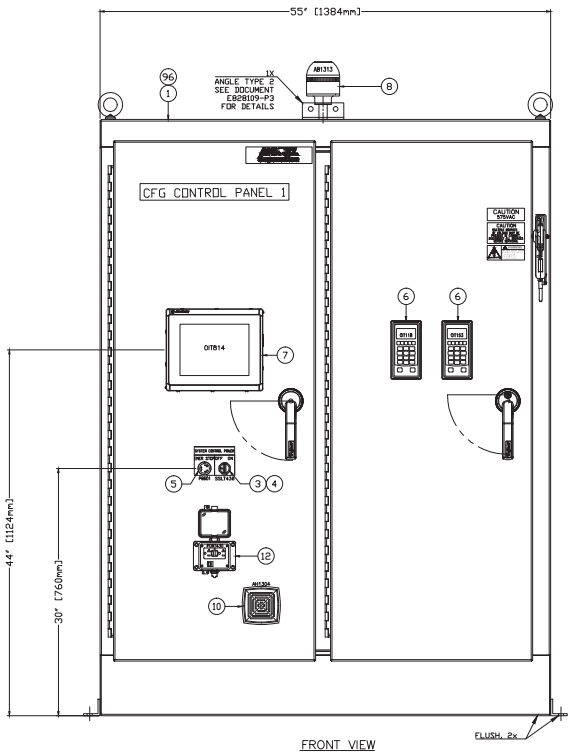
TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BILL OF MATERIALS

SIZE: B | DRAWING NUMBER: E831476-BM2 | REV: 1

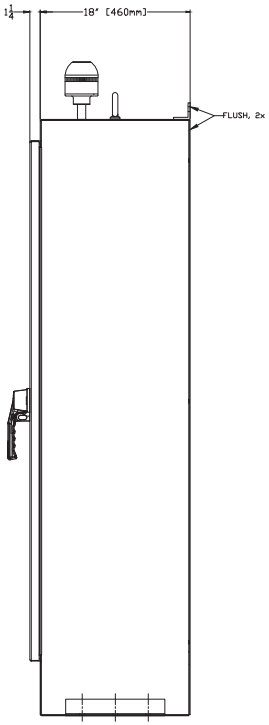
PREV. SHEET: 2 | NEXT SHEET: 4 | SHEET 3 OF 34



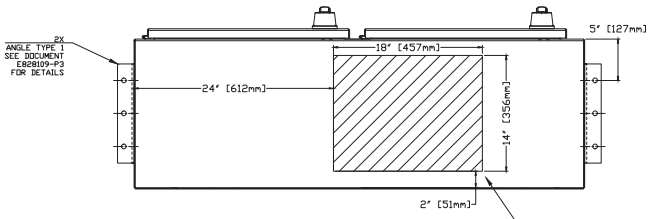
LEFT SIDE VIEW



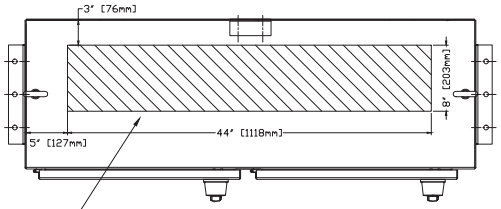
FRONT VIEW



RIGHT SIDE VIEW



BOTTOM VIEW



TOP VIEW

CONDUIT ENTRY AREAS

NOTES:

1. ENCLOSURE IS NEMA 4X 304L SS, WITH FLANGE DISCONNECT. THREE POINT LATCH AND PIANO HINGES.
2. ALL PUSHBUTTON OPERATORS ARE HEAVYDUTY NEMA 4X RATED. CONTACTS ARE RATED 10 AMPS AT 600 VAC.
3. ALL WIRING TO CONFORM TO CANADIAN ELECTRIC CODE AND INCLUDES PERMANENT WIRE MARKERS.
4. ALL CONTROL PANEL COMPONENTS WITH GROUND SYMBOLS OR GROUND SCREWS SHALL BE CHASSIS GROUND.
5. PANEL IS UL508A LISTED AND CSA LISTED.
6. KEYNOTE CALL OUTS REFER TO BILL OF MATERIAL ON SHEET E831476-BM1.
7. CONTROL WIRE SHALL CONFORM TO UL STANDARDS, AND SHALL BE TYPE MTW, COLOR CODED BY VOLTAGE AND FUNCTIONS, WITH IDENTIFICATION FERRULES APPLIED AT EACH WIRE END.

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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

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1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

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APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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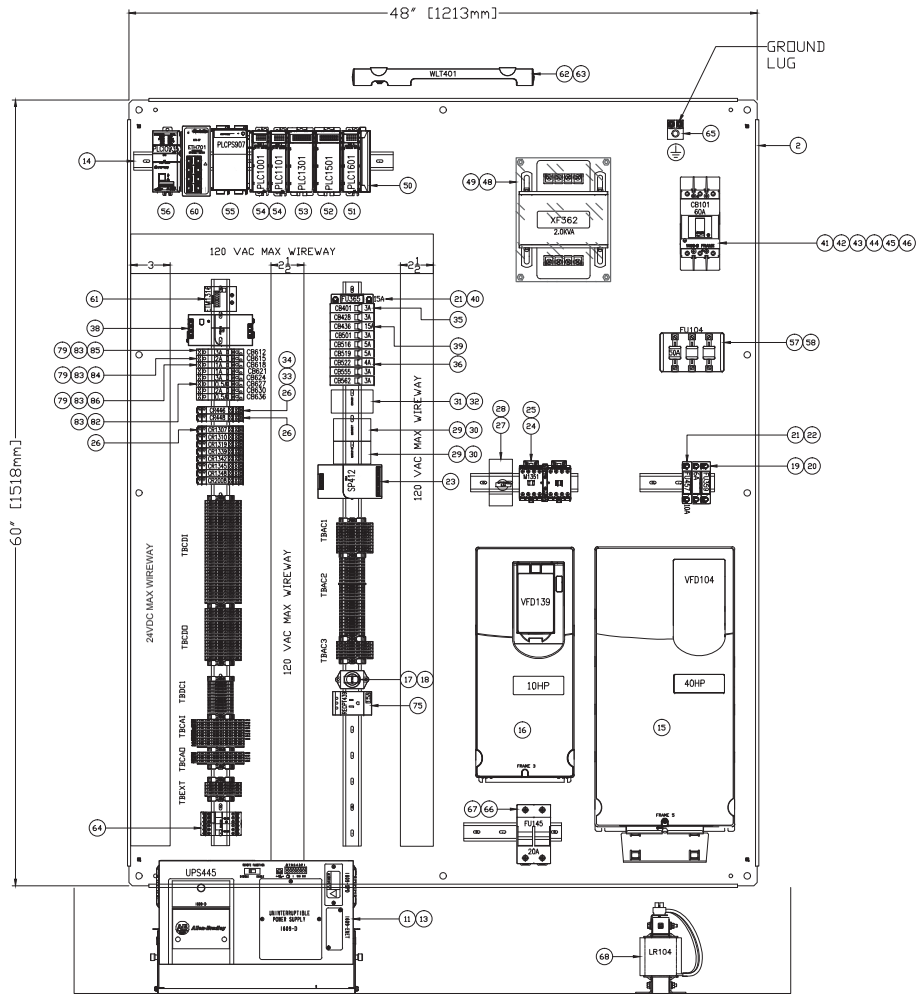
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
PANEL LAYOUT

SIZE	DRAWING NUMBER	REV
B	E831476-P1	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
3	5	4 34



SUBPANEL LAYOUT

NOTES:

1. ENCLOSURE IS NEMA 4X 304L SS, WITH FLANGE DISCONNECT. THREE POINT LATCH AND PIANO HINGES.
2. ALL PUSHBUTTON OPERATORS ARE HEAVYDUTY NEMA 4X RATED. CONTACTS ARE RATED 10 AMPS AT 600 VAC.
3. ALL WIRING TO CONFORM TO CANADIAN ELECTRIC CODE AND INCLUDES PERMANENT WIRE MARKERS.
4. ALL CONTROL PANEL COMPONENTS WITH GROUND SYMBOLS OR GROUND SCREWS SHALL BE CHASSIS GROUND.
5. PROVIDE 20% SPARE TERMINALS.
6. PANEL IS UL508A LISTED AND CSA LISTED.
7. KEYNOTE CALL OUTS REFER TO BILL OF MATERIAL ON SHEET E831476-BM1.
8. CONTROL WIRE SHALL CONFORM TO UL STANDARDS, AND SHALL BE TYPE MTW, COLOR CODED BY VOLTAGE AND FUNCTIONS, WITH IDENTIFICATION FERRULES APPLIED AT EACH WIRE END.

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THIRD ANGLE PROJECTION

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LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

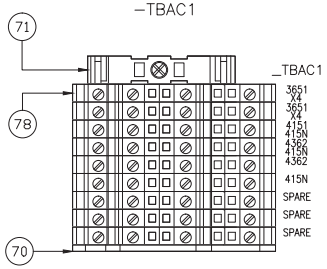
TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BACKPANEL LAYOUT

SIZE	DRAWING NUMBER	REV
B	E831476-P2	1

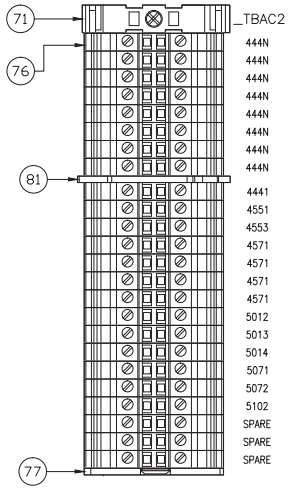
PREV. SHEET: 4 | NEXT SHEET: 6 | SHEET 5 OF 34

TOP

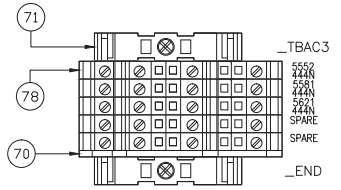
120VAC DISTRIBUTION FROM CPT –TBAC1



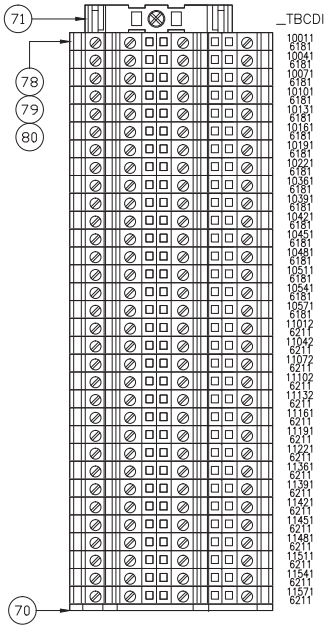
120VAC DISTRIBUTION FROM POWER CTRL SWITCH –TBAC2



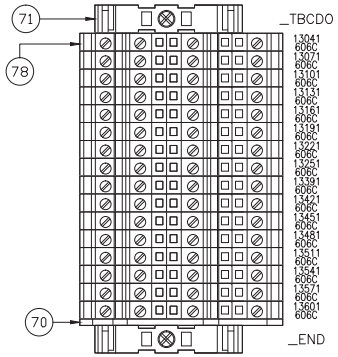
120VAC POWER TO FIELD PROCESS AREA INSTRUMENTS –TBAC3



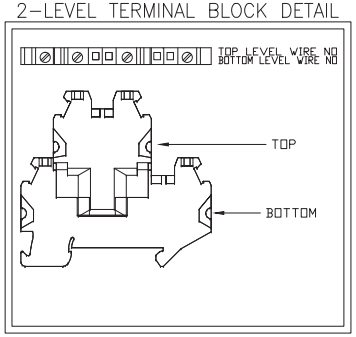
120VAC CONTROLLER (PLC) DIGITAL INPUTS –TBCDI



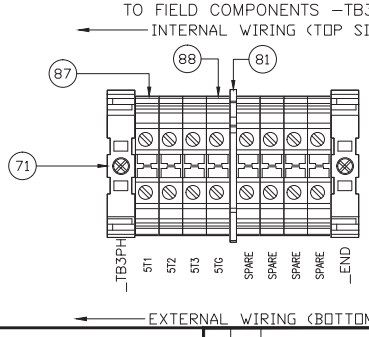
120VAC CONTROLLER (PLC) DIGITAL OUTPUTS –TBCDO



2–LEVEL TERMINAL BLOCK DETAIL



3 PHASE AC POWER TO FIELD COMPONENTS –TB3PH



1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:	CFG–CP	

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465–5611

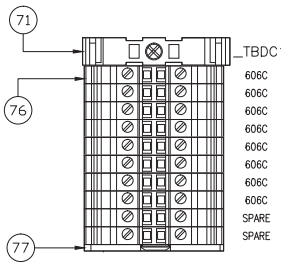
TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
TERMINAL BLOCK PLAN (AC)

SIZE	DRAWING NUMBER	REV
B	E831476–P3	1

PREV. SHEET: 5 | NEXT SHEET: 7 | SHEET 6 OF 34

TOP

24VDC DISTRIBUTION FROM DC POWER SUPPLY –TBDC1

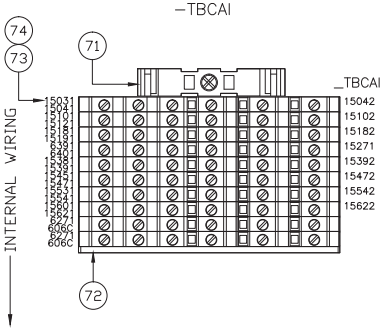


24VDC POWER TO FIELD PROCESS INSTRUMENTS –TBDC2

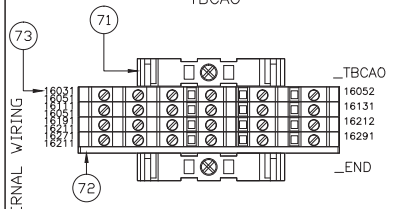
NON–APPLICABLE

INTERNAL WIRING
EXTERNAL WIRING

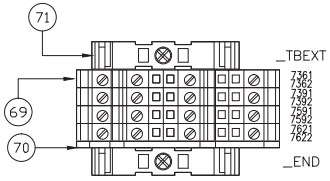
4–20mA CONTROLLER (PLC) ANALOG INPUTS –TBCAI



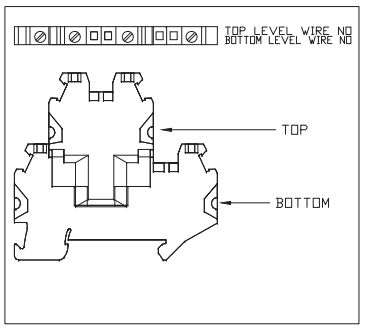
4–20mA CONTROLLER (PLC) ANALOG OUTPUTS –TBCAO



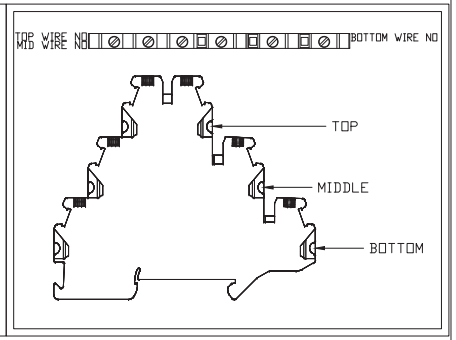
DRY CONTACTS FOR CUSTOMER USE –TBEXT



2–LEVEL TERMINAL BLOCK DETAIL



3–LEVEL TERMINAL BLOCK DETAIL



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ARLINGTON, TEXAS 76001
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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No. 831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:	CFG–CP	

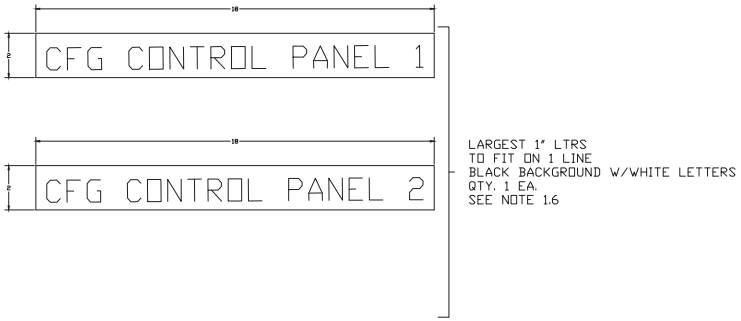
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465–5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
TERMINAL BLOCK PLAN (DC)

SIZE	DRAWING NUMBER	REV
B	E831476–P4	1

PREV. SHEET: 6 | NEXT SHEET: 8 | SHEET 7 OF 34

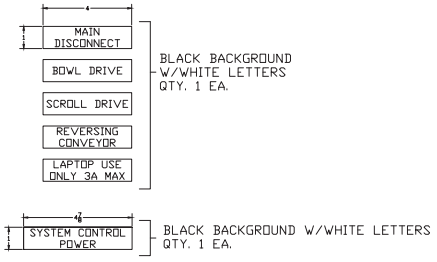
NAMEPLATES:

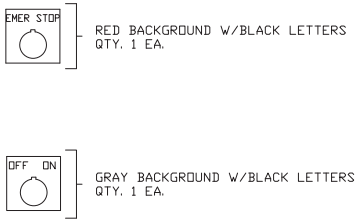


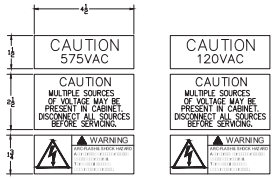
NOTES:

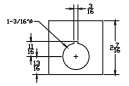
1. FURNISH NAMEPLATES AS INDICATED ON DRAWINGS
   - 1.1. LETTERS SHALL BE GOTHIC UPPER CASE (CAPITAL LETTERS), MINIMUM HEIGHT SHALL BE 1/8 INCH WITH A 3/64 INCH SPACE BETWEEN LINES.
   - 1.2. NAMEPLATES SHALL BE MADE OF LAMINATED ENGRAVING STOCK HAVING CORE AND SURFACE COLORS AS SHOWN ON DRAWINGS.
   - 1.3. THE CHARACTERS SHALL BE ENGRAVED USING AN INDUSTRY STANDARD ENGRAVING MACHINE.
   - 1.4. NAMEPLATES SHALL BE ATTACHED TO THE ENCLOSURE USING HIGH PERFORMANCE ADHESIVE
   - 1.5. ALL LEGEND PLATES SHALL CONFORM TO ISA RECOMMENDED PRACTICE PUBLICATION ISARP60.6.
   - 1.6. LAYOUT AND WIRING DESIGN TYPICAL FOR BOTH CONTROL PANELS, EXCEPT FOR NAMEPLATE.

MACHINE NAMEPLATE KITS
(QUANTITIES PER MACHINE)









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APPROVED FOR CONSTRUCTION	
BY: BJM DATE:	
PROJECT No.831476	

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:	DRAWN BY: HL	DATE 04/04/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER	CHECKED BY: BJM	DATE 04/04/18
	APPROVED BY: CMP	DATE 04/04/18
THIRD ANGLE PROJECTION	LOCATION: CFG-CP	

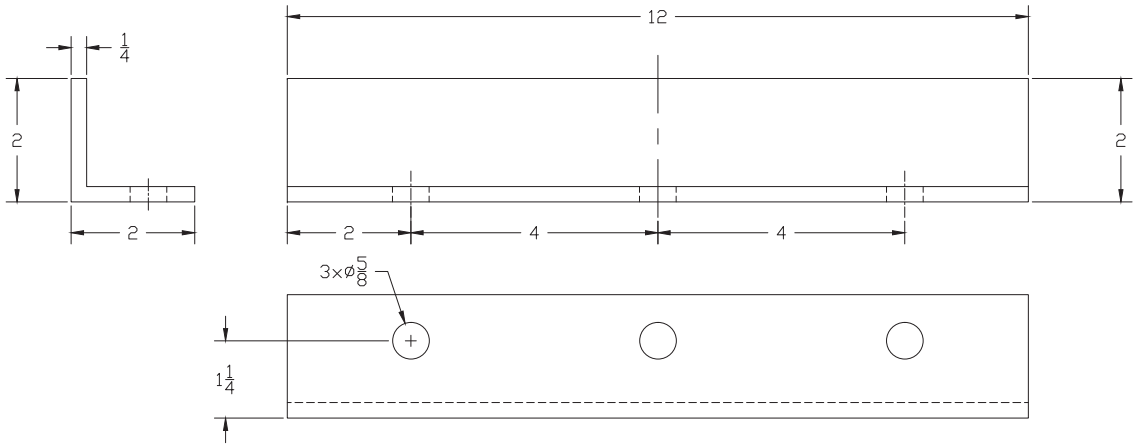
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ D4L CENTRIFUGE SKID NAMEPLATES

SIZE	DRAWING NUMBER	REV
B	E831476-P5	1

PREV. SHEET: 7 | NEXT SHEET: 9 | SHEET 8 OF 34

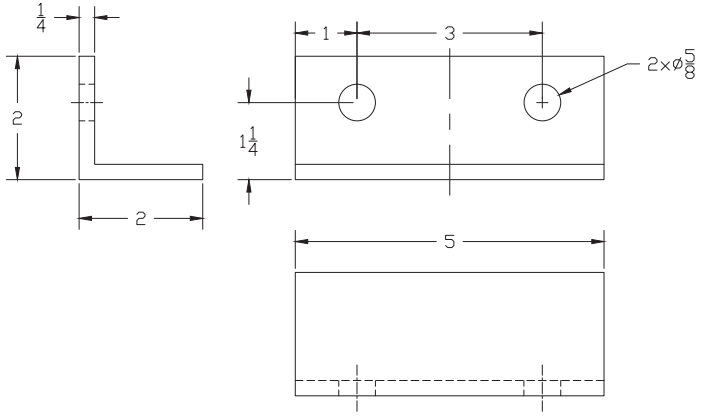
ANGLE TYPE 1 :
QTY 2



NOTES:

1. ANGLE MATERIAL: SAME AS CENTRIFUGE CONTROL PANEL ENCLOSURE
2. ANGLES SHALL BE WELDED TO CENTRIFUGE CONTROL PANEL (CFG–CP) AS SHOWN ON DOCUMENT E828109–P1
3. REINFORCE ZONES WHERE ANGLES ARE TO BE WELDED ACCORDINGLY

ANGLE TYPE 2
QTY 2



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Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

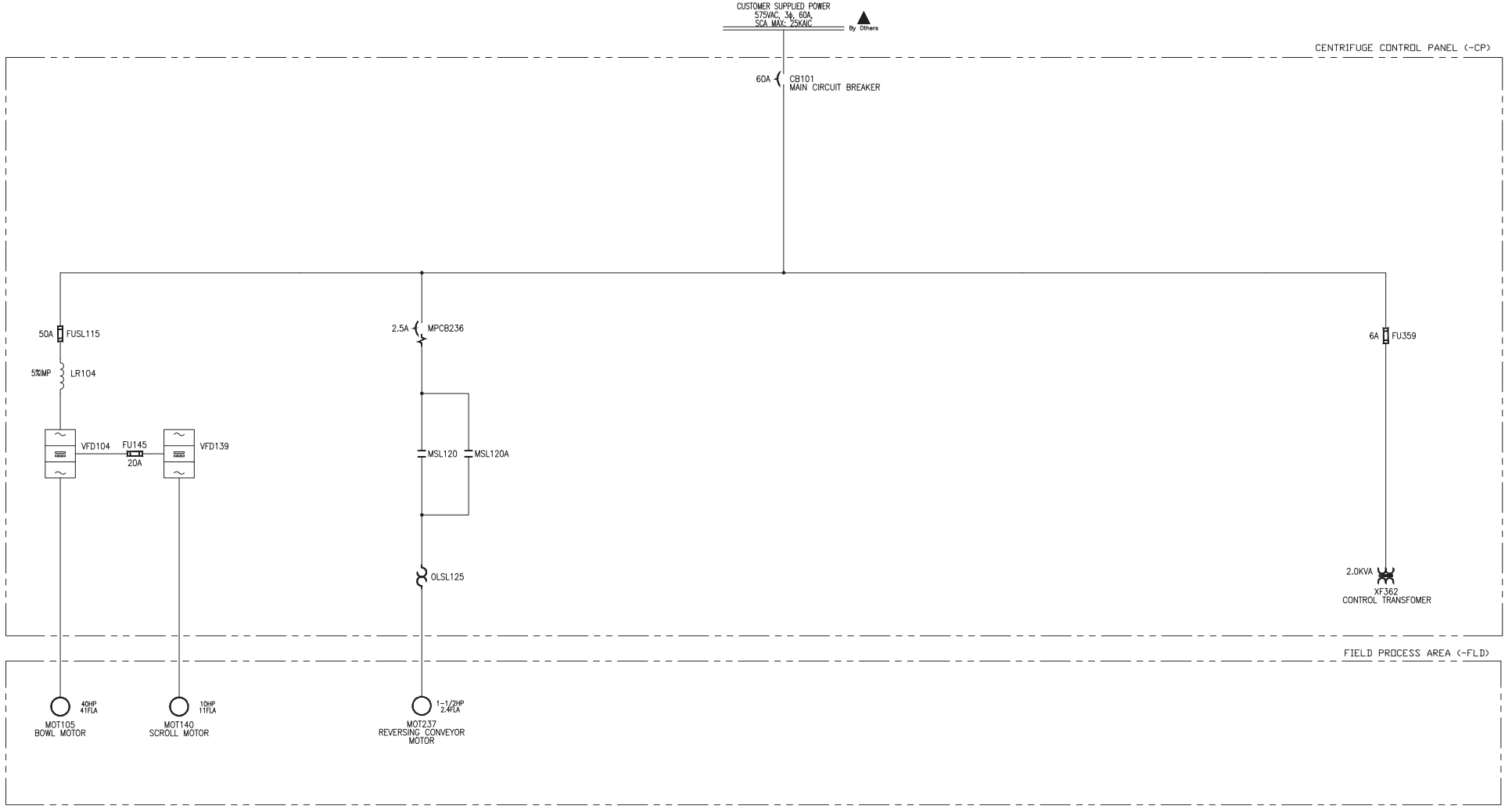
LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
CONTROL PANEL SKID MOUNTING ANGLES

SIZE: B | DRAWING NUMBER: E831476–P6 | REV: 1

PREV. SHEET: 8 | NEXT SHEET: 10 | SHEET 9 OF 34



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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

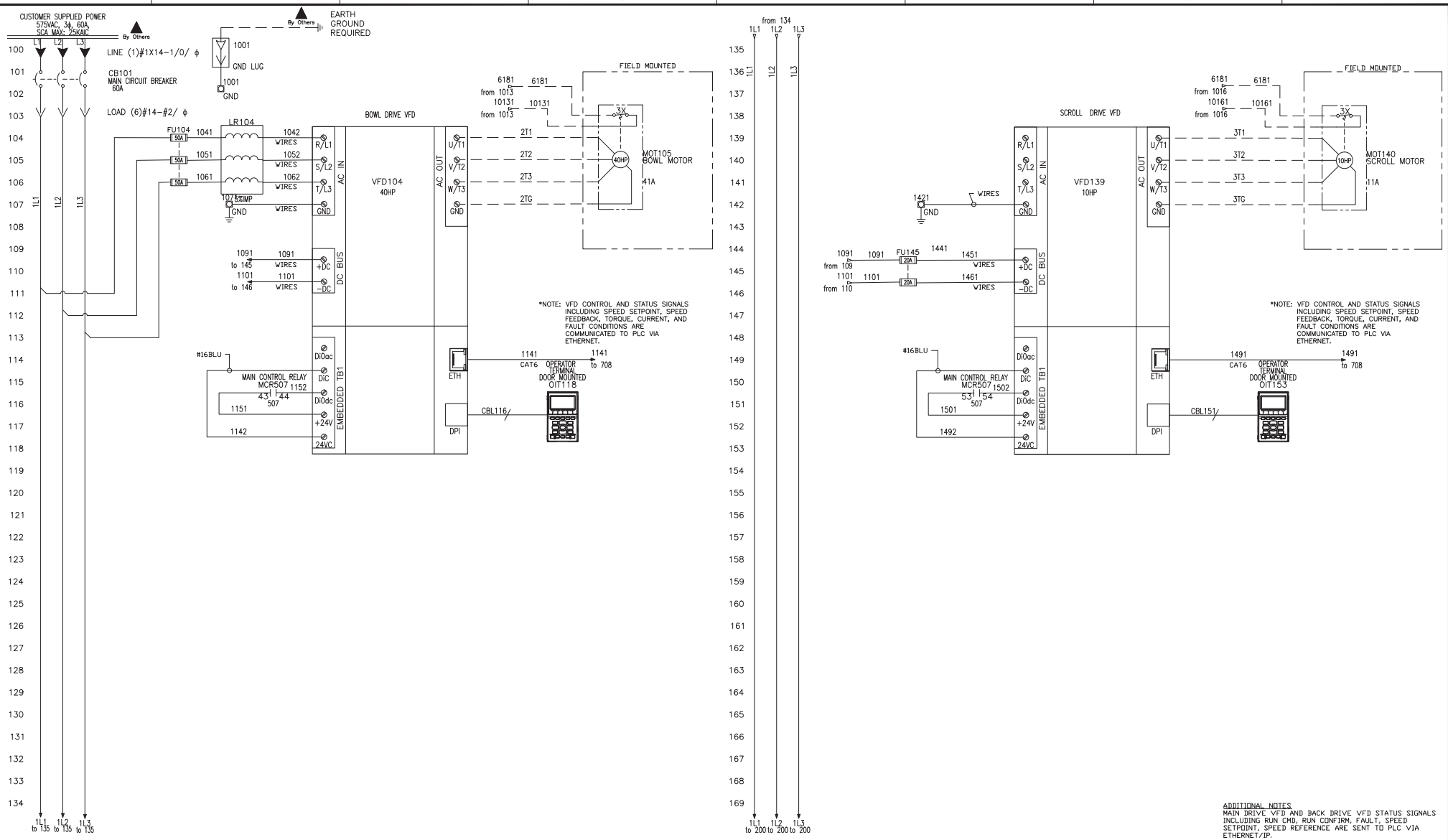
LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
SINGLE LINE SCHEMATIC

SIZE	DRAWING NUMBER	REV
B	E831476-SL1	1

PREV. SHEET: 9 | NEXT SHEET: 11 | SHEET 10 OF 34



ADDITIONAL NOTES
MAIN DRIVE VFD AND BACK DRIVE VFD STATUS SIGNALS INCLUDING RUN CMD, RUN CONFIRM, FAULT, SPEED SETPOINT, SPEED REFERENCE ARE SENT TO PLC VIA ETHERNET/IP.

1010 COMMERCIAL BLVD. SOUTH
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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

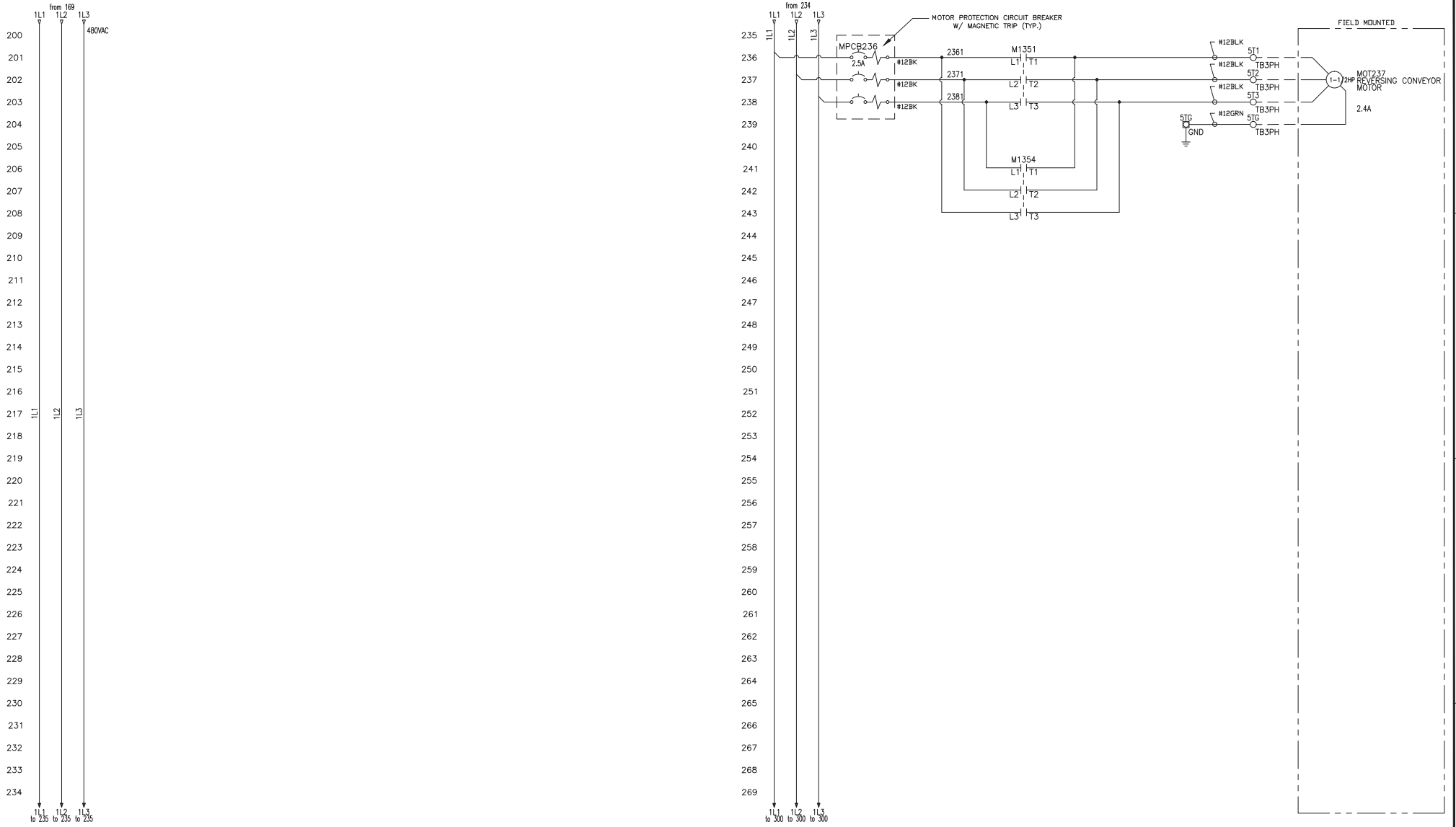
DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POWER DISTRIBUTION SCHEMATIC

SIZE	DRAWING NUMBER	REV
B	E831476-S1	1

PREV. SHEET: 10 | NEXT SHEET: 12 | SHEET 11 OF 34



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APPROVED FOR CONSTRUCTION

BY: BJM DATE:

PROJECT No.831476

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REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

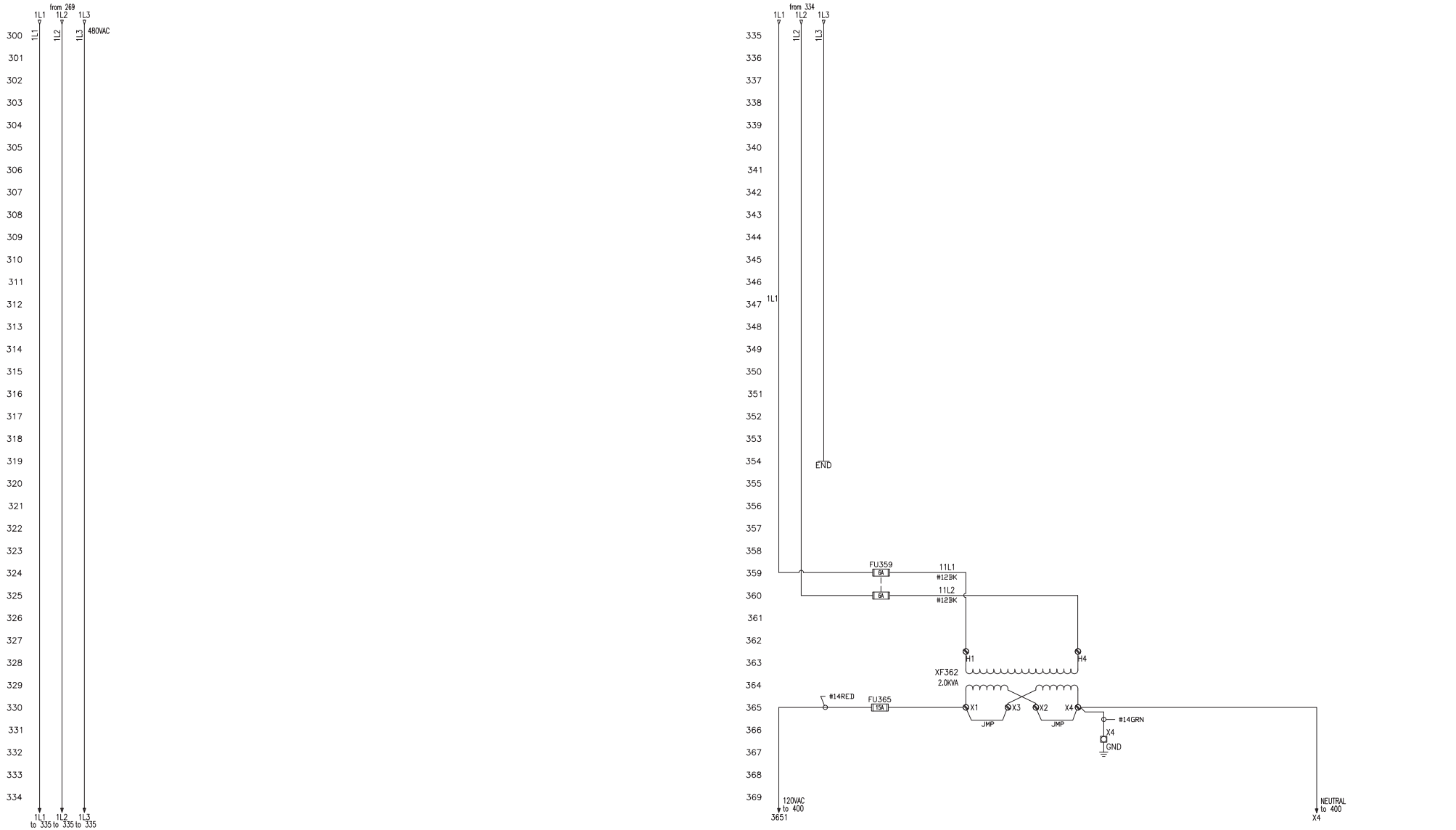
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE

VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
480VAC POWER DISTRIBUTION

SIZE	DRAWING NUMBER	REV
B	E831476-S2	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
1.1	1.3	1.2 34



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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
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REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

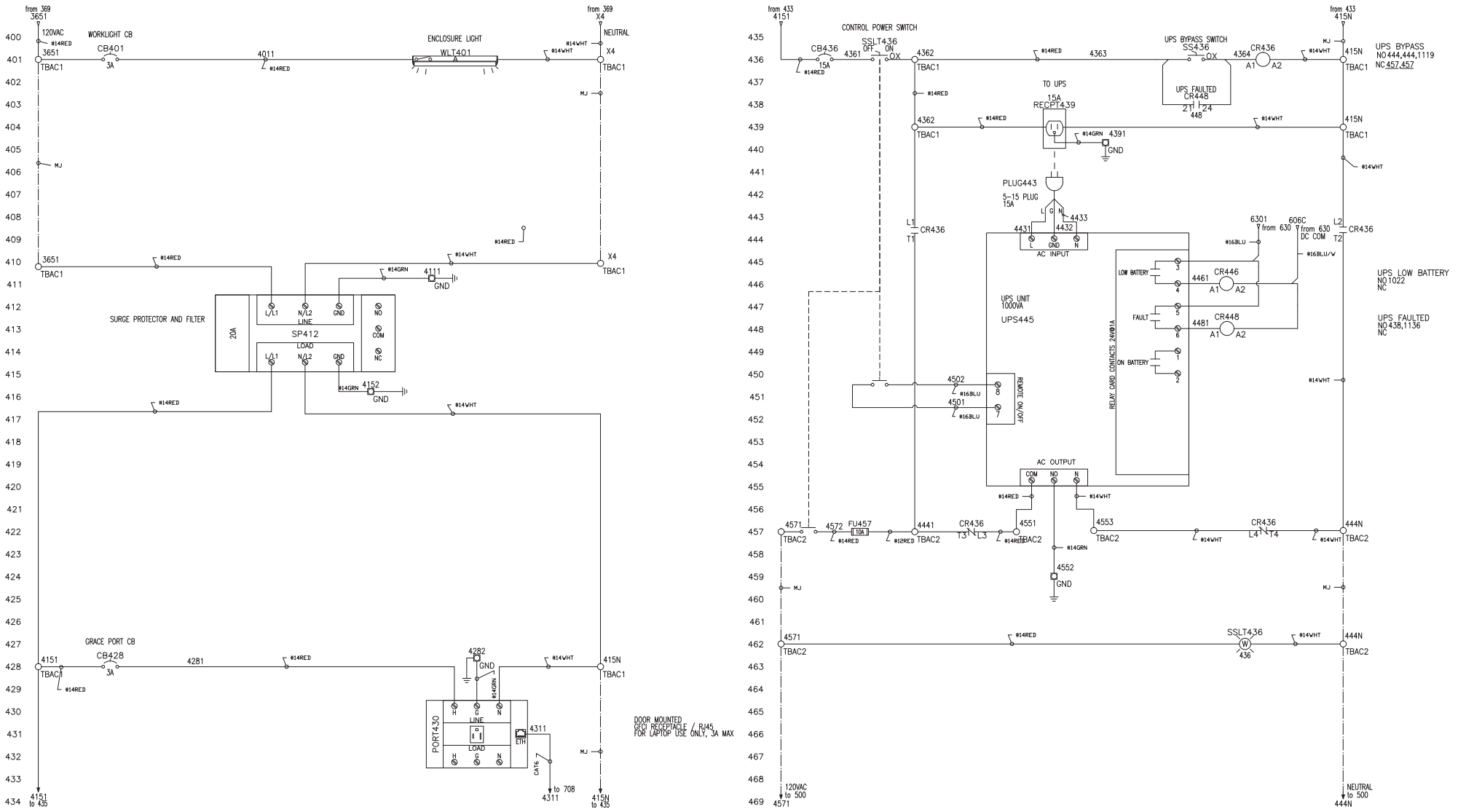
LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POWER DISTRIBUTION SCHEMATIC

SIZE	DRAWING NUMBER	REV
B	E831476-S3	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
12	14	13 34



1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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APPROVED FOR CONSTRUCTION

BY: BJM DATE:

PROJECT No.831476

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ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

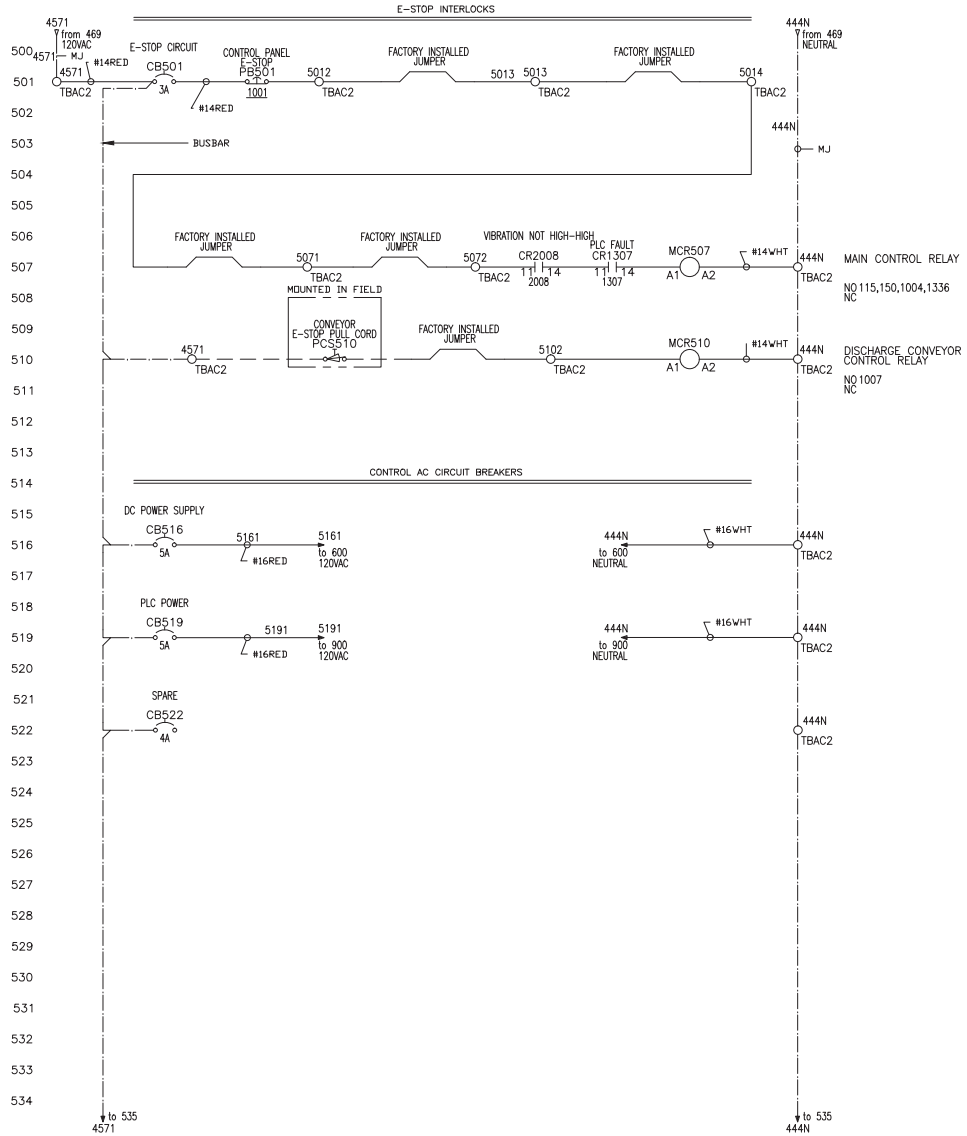
DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

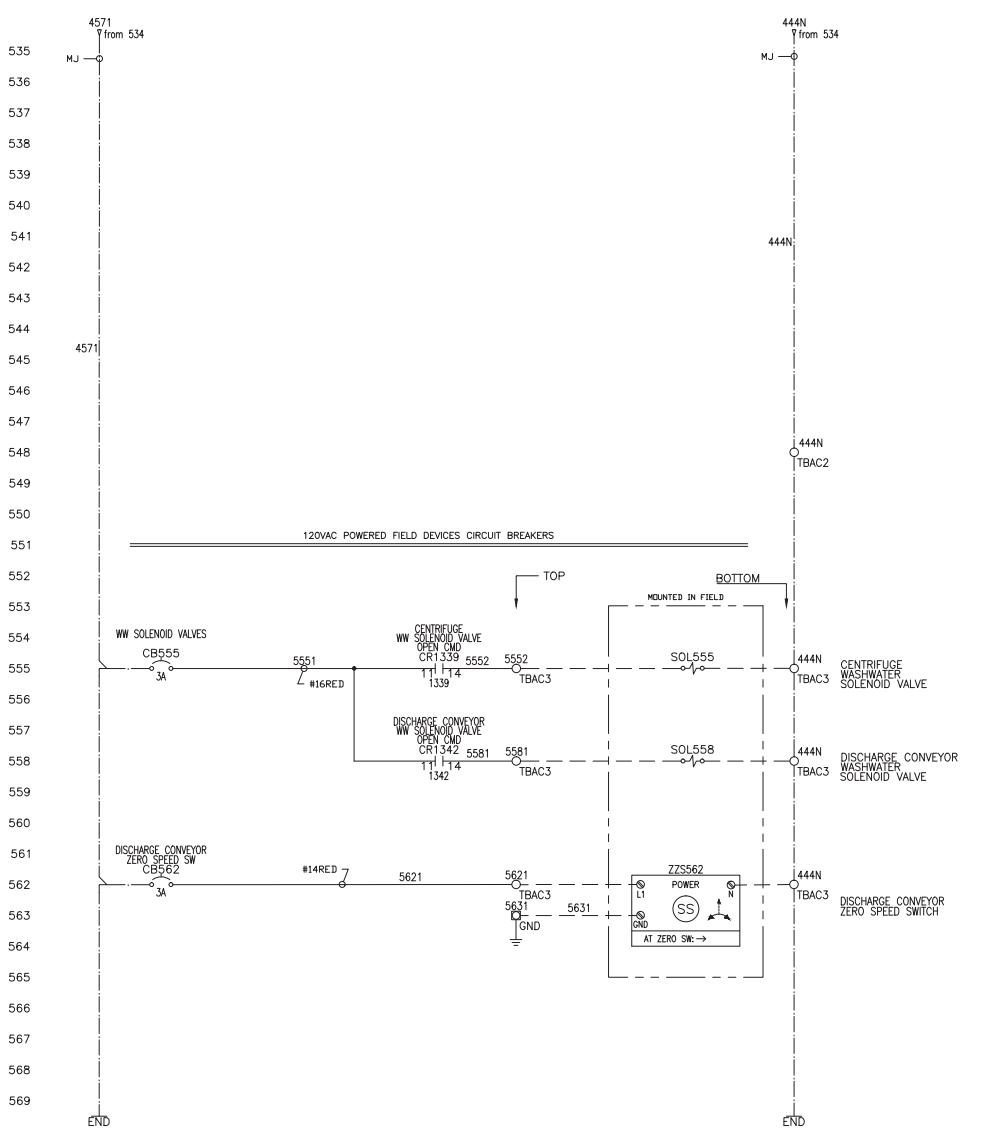
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
LOW VOLTAGE POWER DISTRIBUTION

SIZE	DRAWING NUMBER	REV
B	E831476-S4	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
13	15	14 34





1010 COMMERCIAL BLVD. SOUTH ARLINGTON, TEXAS 76001 Phone: (817)465-5611 Telefax: (817)472-8589	NOTES
APPROVED FOR CONSTRUCTION BY: BJM DATE: PROJECT No.831476	THIS DRAWING IS COPY RIGHTED THIS DRAWING IS A TRADE SECRET AND ONLY ENTRUSTED TO THE RECEIVER FOR HIS MEMORIAL USE, WITHOUT THE STATED WRITTEN CONSENT OF ANDRITZ SEPARATION INC. IT MUST NOT BE COPIED, NOR MADE AVAILABLE TO THIRD PARTIES, INCLUDING COMPETITORS, NOR MADE ACCESSIBLE TO SUCH PARTIES. ANY ILLEGAL USE BY THE RECEIVER OR THIRD PARTIES FOR WHICH HE IS RESPONSIBLE CAN CONSTITUTE A CAUSE FOR LEGAL ACTION. THIS DRAWING MUST BE RETURNED ON REQUEST OF THE COMPANY.

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

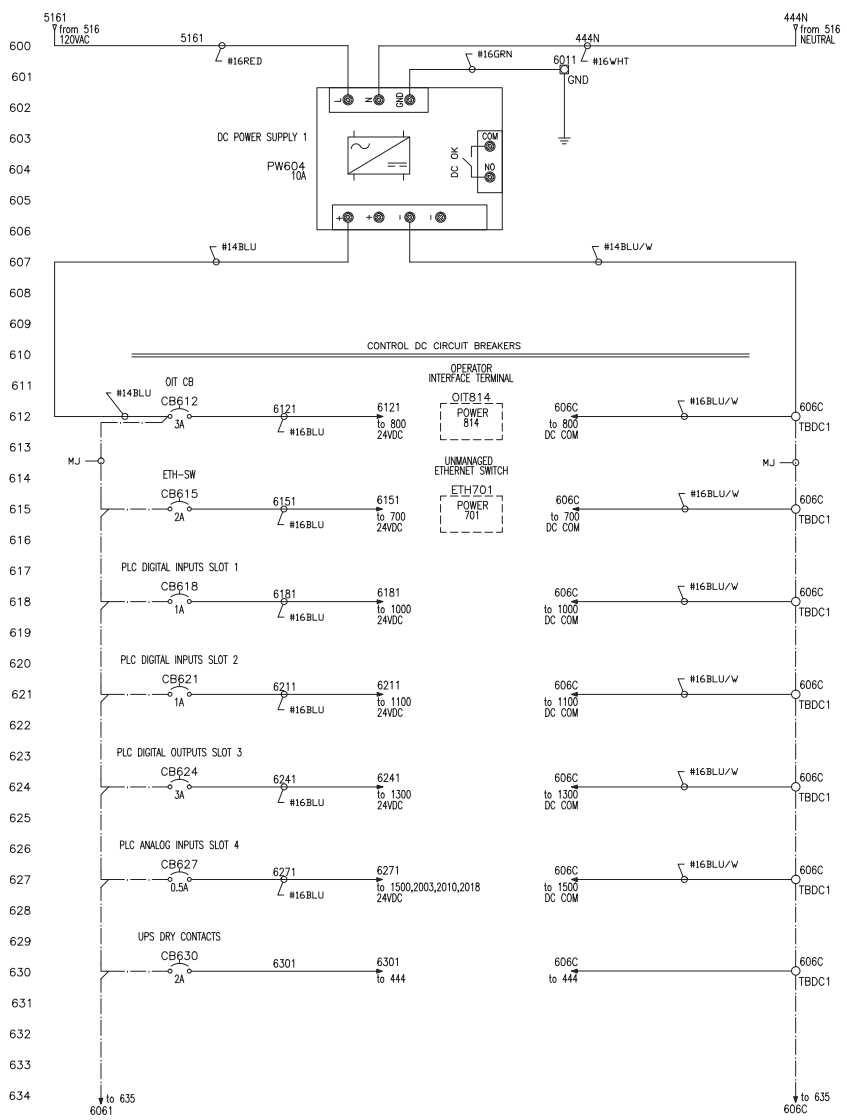
ESTIMATED WEIGHT IN LBS:	DRAWN BY: HL	DATE 04/04/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER	CHECKED BY: BJM	DATE 04/04/18
THIRD ANGLE PROJECTION	APPROVED BY: CMP	DATE 04/04/18
	LOCATION:	

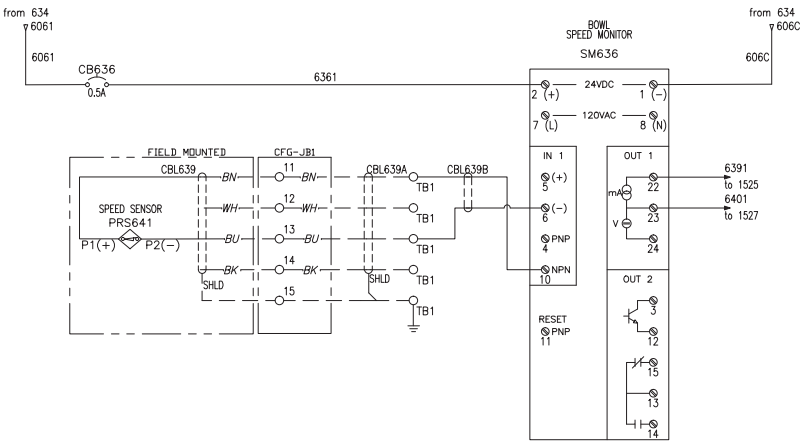
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
AC CTRL POWER DISTRIBUTION (CONT.)

SIZE	DRAWING NUMBER	REV
B	E831476-S5	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
14	16	15 34





1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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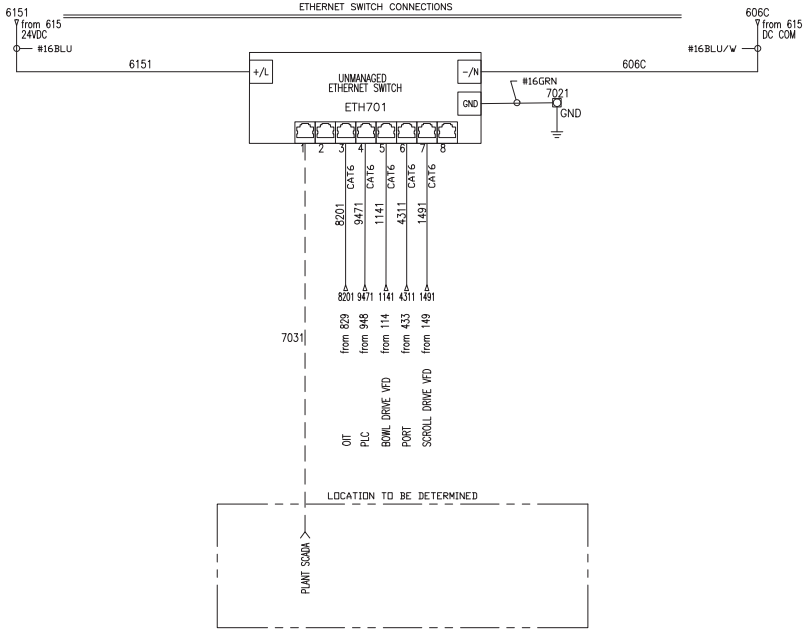
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
DC POWER DISTRIBUTION

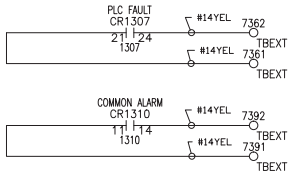
SIZE	DRAWING NUMBER	REV
B	E831476-S6	1

PREV. SHEET: 15 | NEXT SHEET: 17 | SHEET 16 OF 34

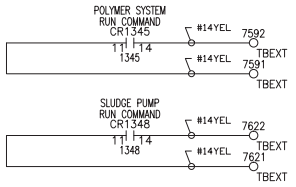
ETHERNET SWITCH CONNECTIONS



DRY CONTACTS FOR CUSTOMER USE (NON-MCR INTERLOCKED) 6A RATED CONTACTS RESISTIVE



DRY CONTACTS (MCR INTERLOCKED) 6A RATED CONTACTS RESISTIVE



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BY: BJM DATE:
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1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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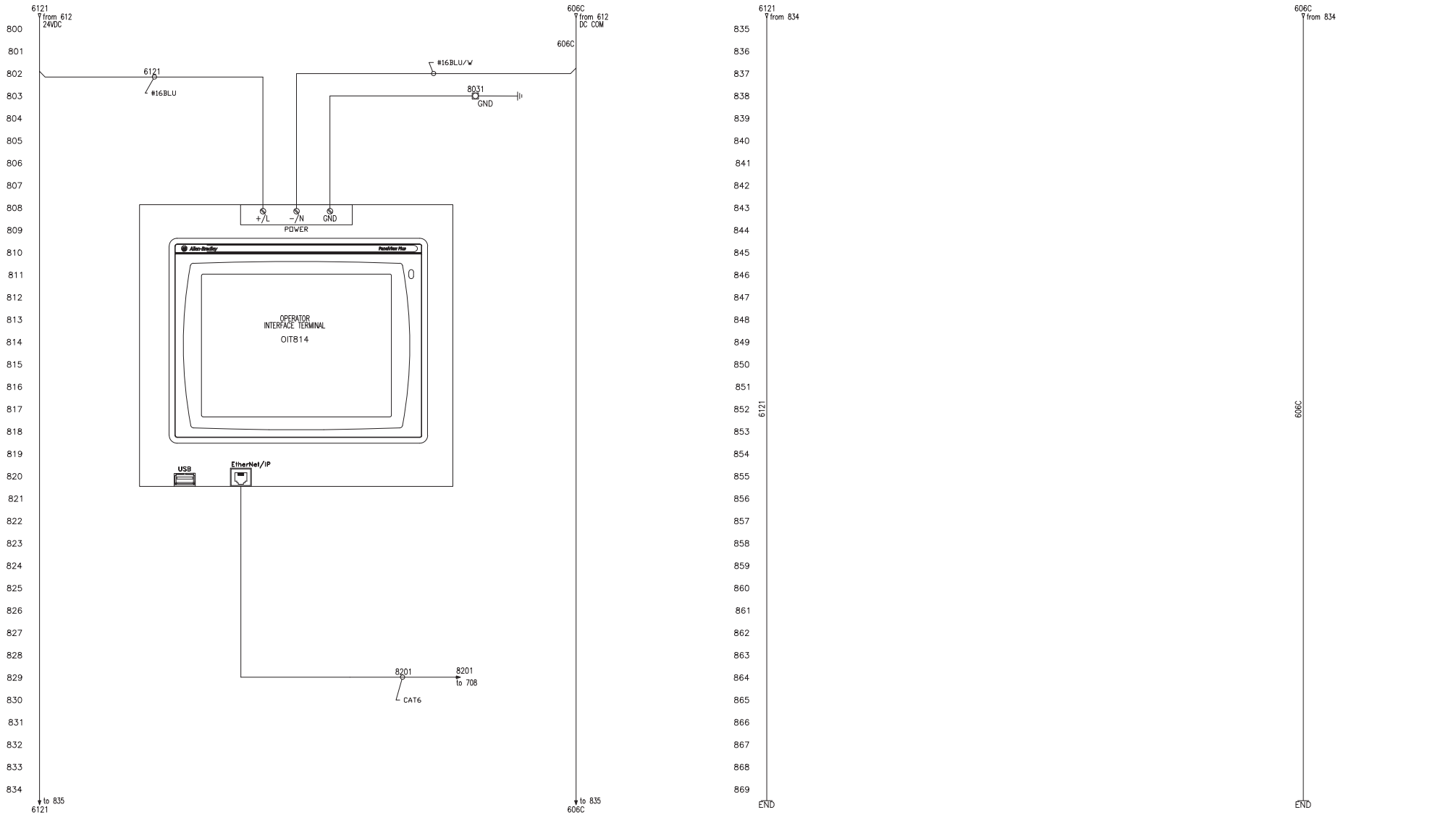
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
COMMUNICATIONS

SIZE	DRAWING NUMBER	REV
B	E831476-S7	1

PREV. SHEET: 16 | NEXT SHEET: 18 | SHEET 17 OF 34



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BY: BJM DATE:
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REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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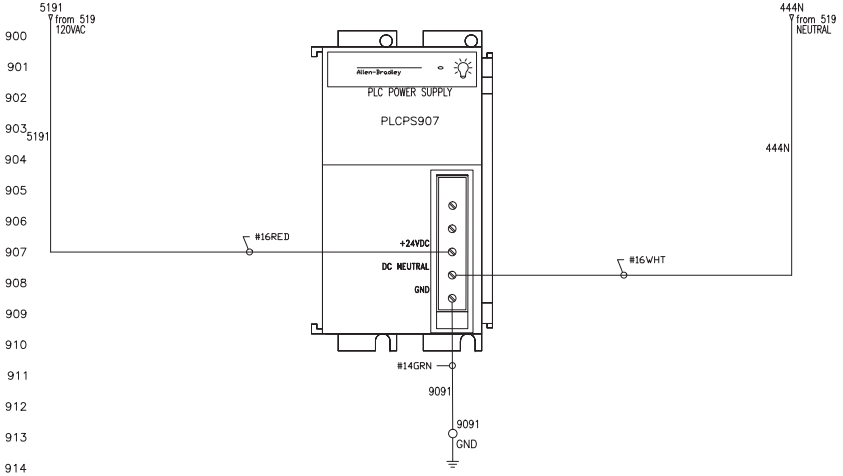
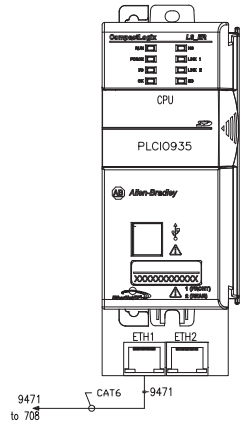
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
OIT SCHEMATIC

SIZE	DRAWING NUMBER	REV
B	E831476-S8	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
17	19	18 34





1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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BY: BJM DATE:
PROJECT No.831476

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ESTIMATED WEIGHT IN LBS:

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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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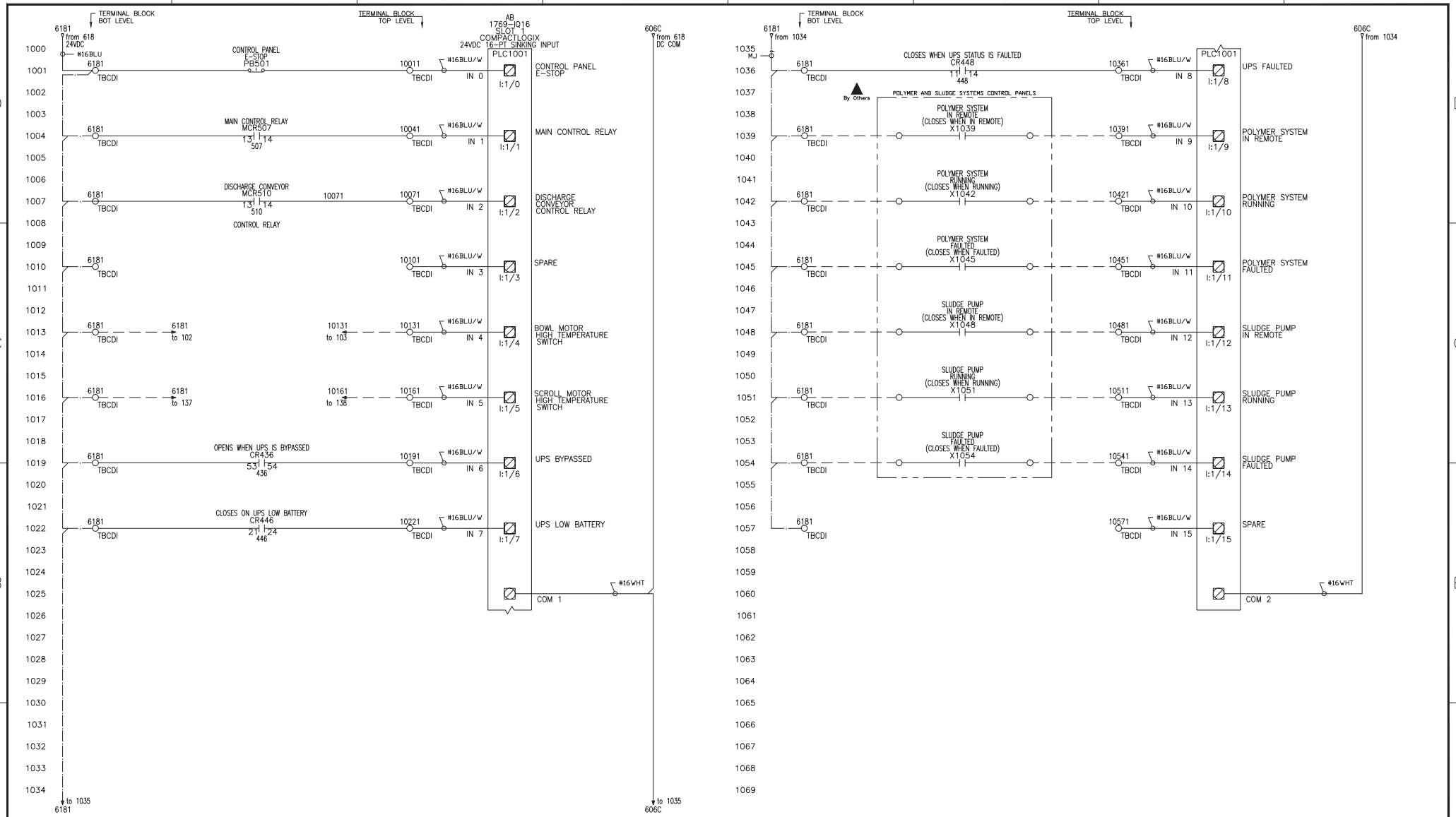
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
PLC POWER SUPPLY AND CPU

SIZE	DRAWING NUMBER	REV
B	E831476-S9	1

PREV. SHEET:	NEXT SHEET:	SHEET	OF
18	20	19	34



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1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANGLE±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANGLE.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

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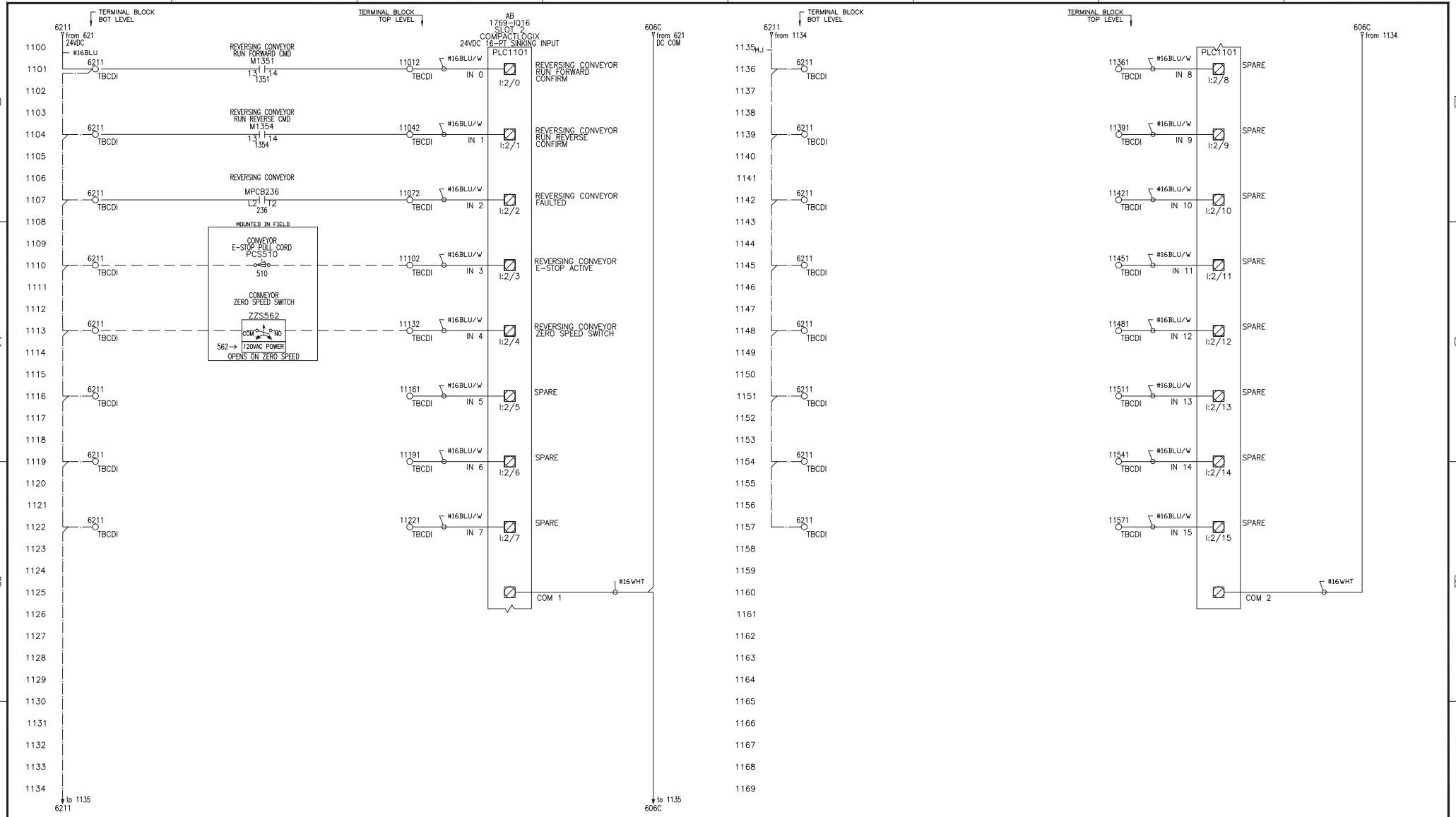
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BANK 1 SLOT 1 DIGITAL INPUTS

SIZE	DRAWING NUMBER	REV
B	E831476-S10	1

PREV. SHEET: 19 | NEXT SHEET: 21 | SHEET 20 OF 34



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REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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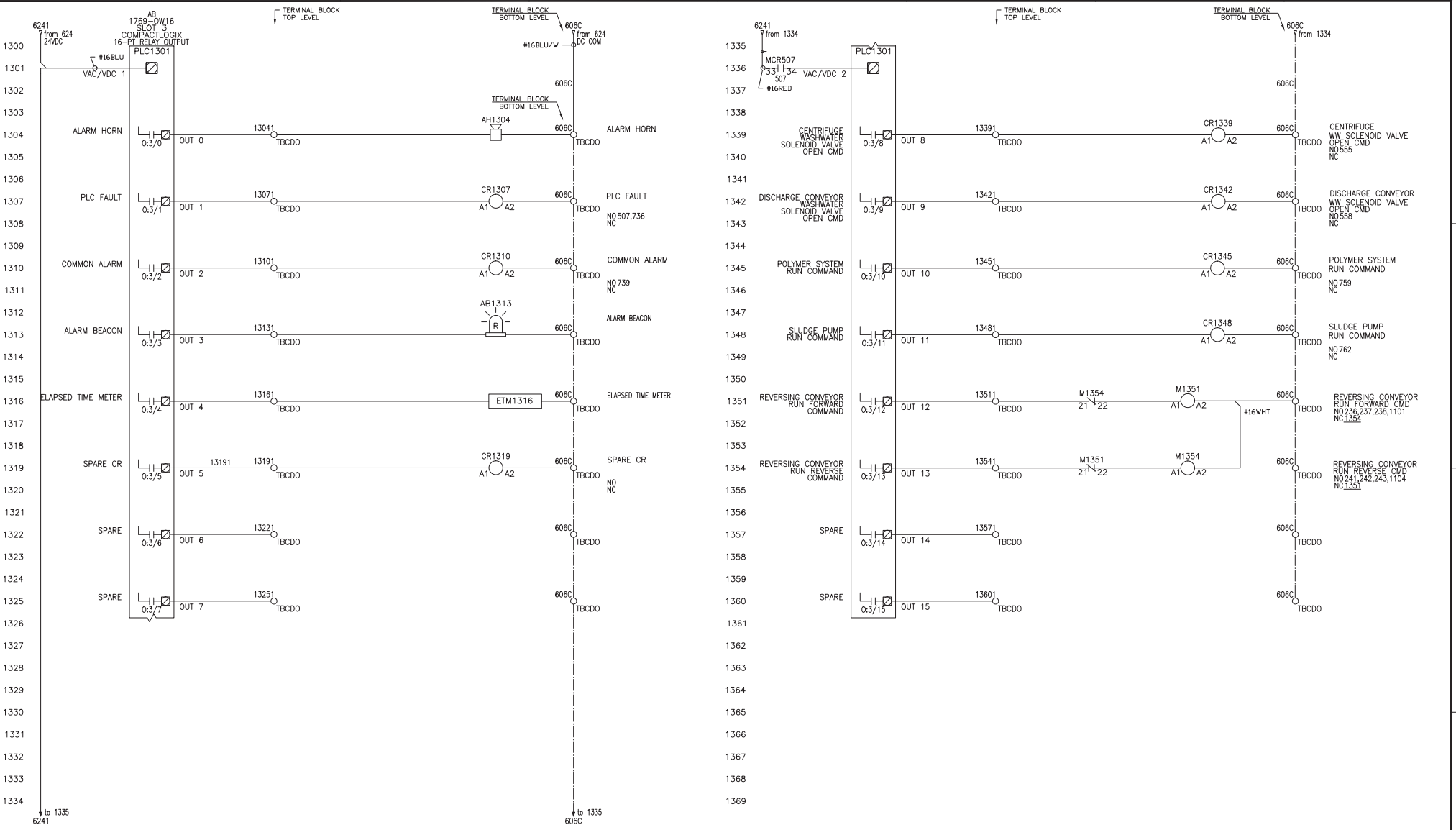
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BANK 1 SLOT 2 DIGITAL INPUTS

SIZE	DRAWING NUMBER	REV
B	E831476-S11	1

PREV. SHEET: 20 | NEXT SHEET: 22 | SHEET 21 OF 34



1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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ARLINGTON, TEXAS 76001
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BY: BJM DATE:
PROJECT No. 831476

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ESTIMATED WEIGHT IN LBS:	DRAWN BY: HL	DATE 04/04/18
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER	CHECKED BY: BJM	DATE 04/04/18
	APPROVED BY: CMP	DATE 04/04/18
THIRD ANGLE PROJECTION	LOCATION:	

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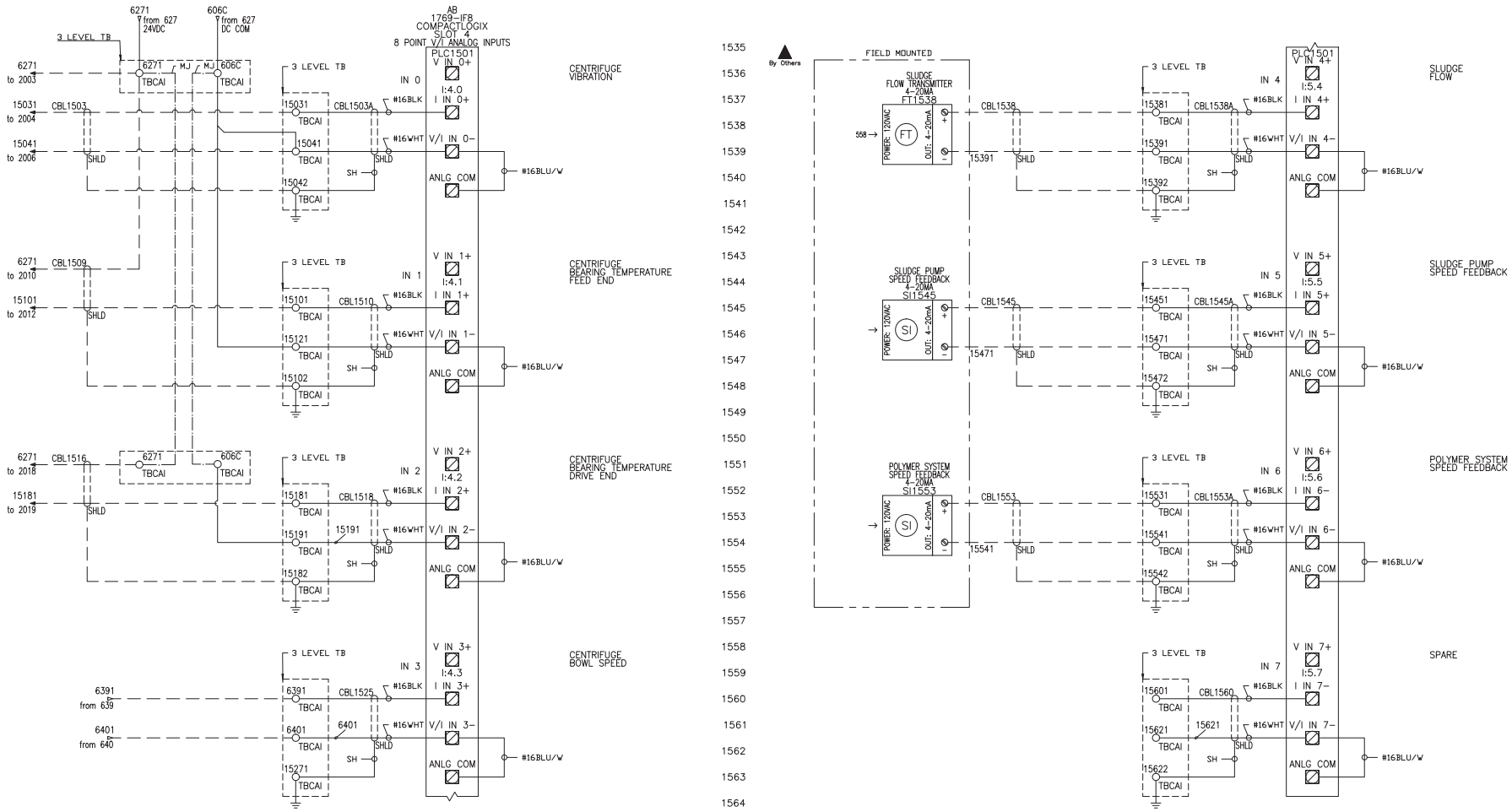
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BANK 1 SLOT 3 DIGITAL OUTPUTS

SIZE	DRAWING NUMBER	REV
B	E831476-S13	1

PREV. SHEET: 21 | NEXT SHEET: 23 | SHEET 22 OF 34



1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

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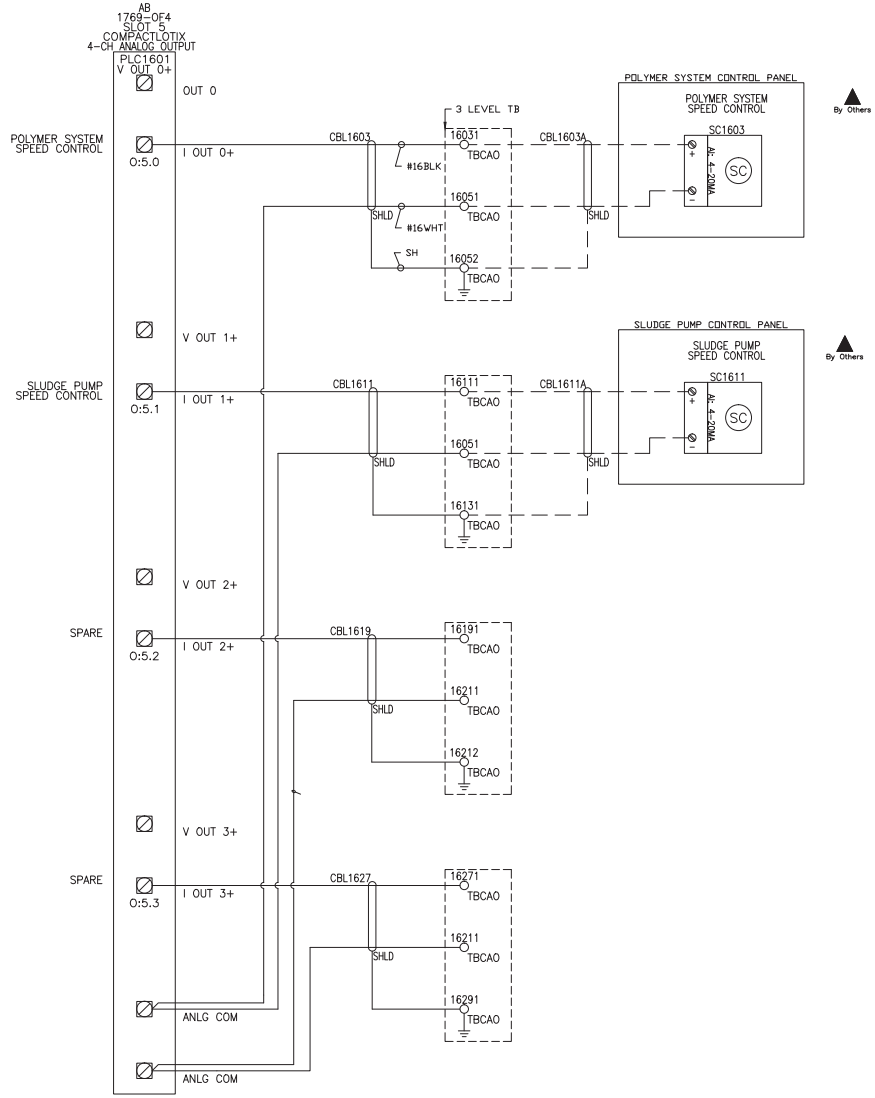
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BANK 1 SLOT 4 ANALOG INPUTS

SIZE	DRAWING NUMBER	REV
B	E831476-S15	1

PREV. SHEET: 22 | NEXT SHEET: 24 | SHEET 23 OF 34



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BY: BJM DATE:
PROJECT No.831476

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REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

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MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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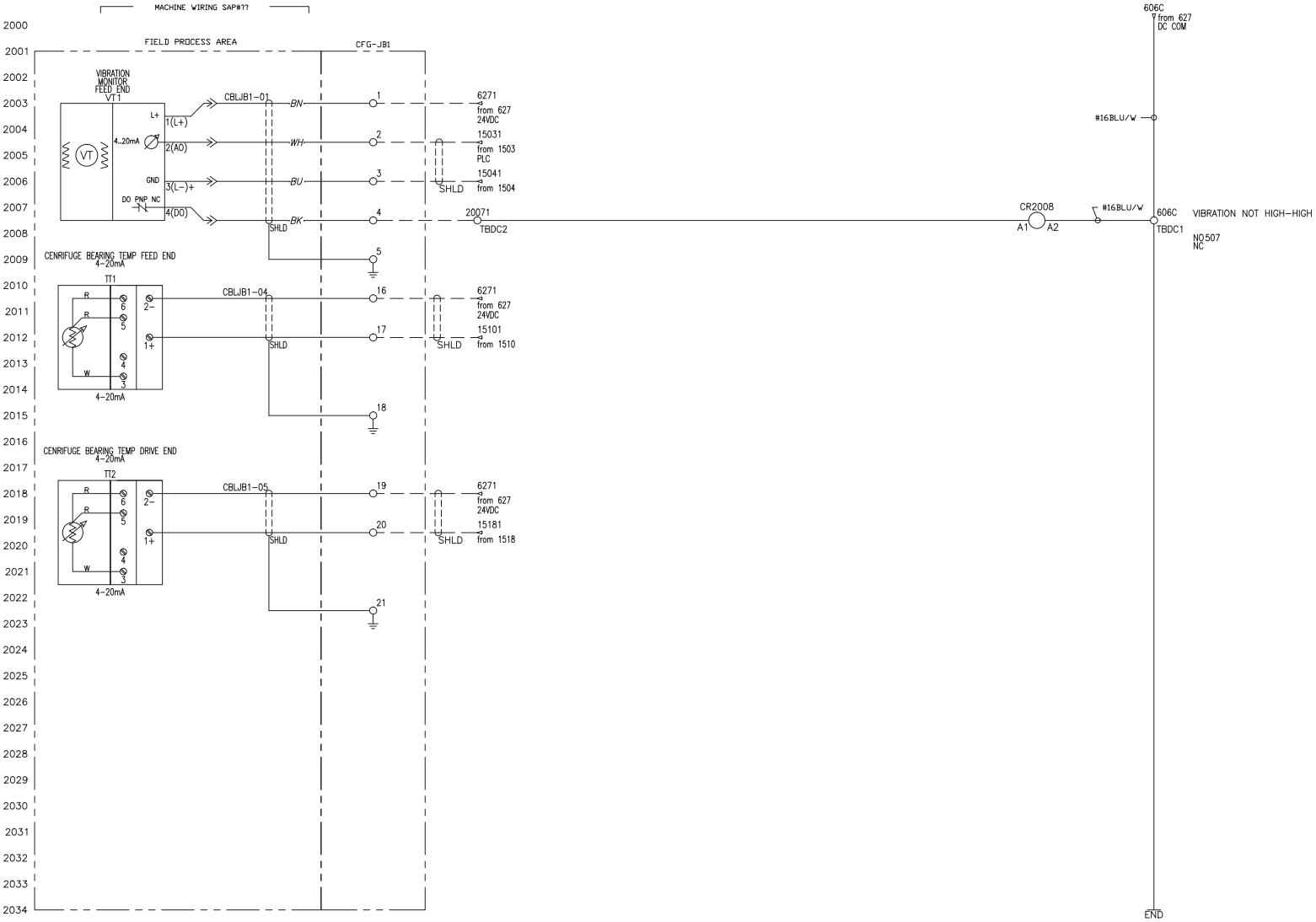
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
BANK 1 SLOT 5 ANALOG OUTPUTS

SIZE	DRAWING NUMBER	REV
B	E831476-S16	1

PREV. SHEET: 23 | NEXT SHEET: 25 | SHEET 24 OF 34



1		CERTIFIED	HL	BJM	04/13/18	
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18	
REV	EIR	REVISION	BY	APVD	DATE	

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UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER	CHECKED BY: BJM	DATE 04/04/18	
	APPROVED BY: CMP	DATE 04/04/18	
THIRD ANGLE PROJECTION	LOCATION:		

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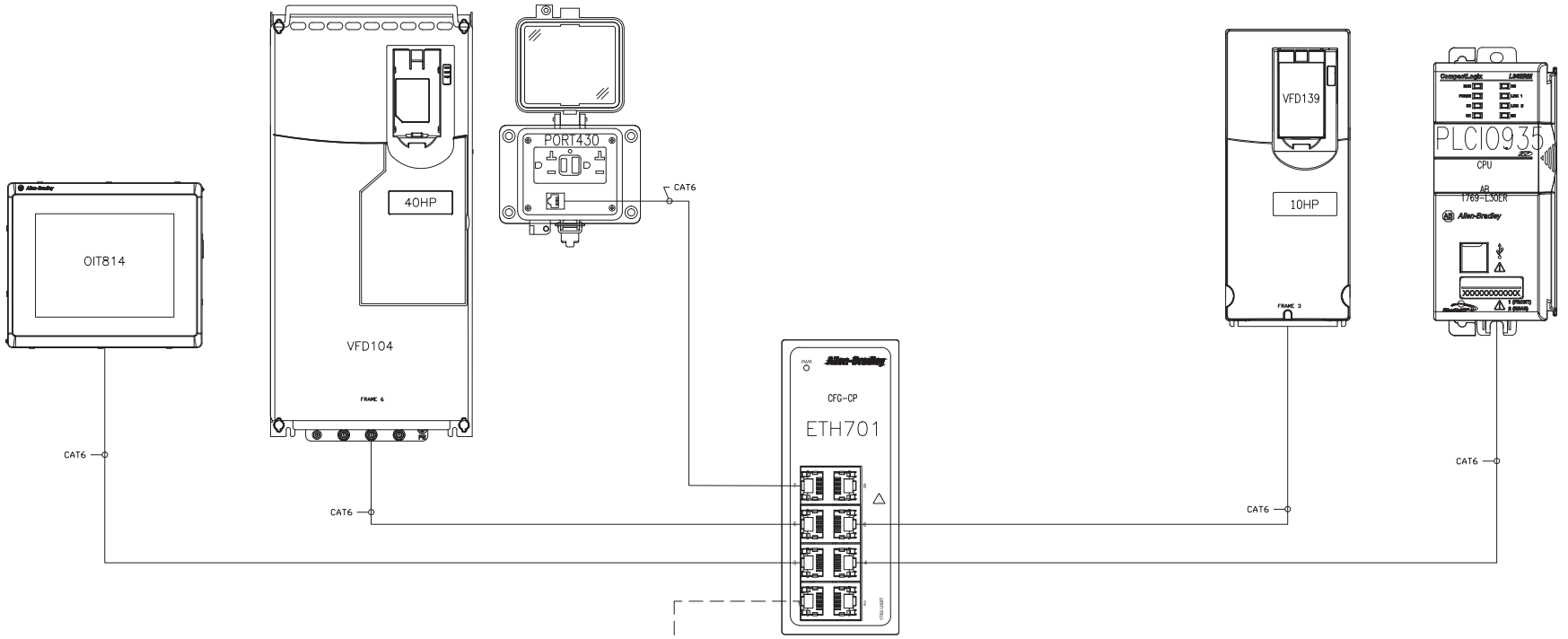
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
FIELD DEVICES

SIZE	DRAWING NUMBER	REV
B	E831476-S20	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
24	26	25 34



1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18
REV	EIR	REVISION	BY	APVD	DATE

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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

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CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

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1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
NETWORK ARCHITECTURE

SIZE	DRAWING NUMBER	REV
B	E831476-N1	1

PREV. SHEET: 25 | NEXT SHEET: 27 | SHEET 26 OF 34

CUSTOMER FURNISHED SWITCHGEAR/PANELBOARD

CENTRIFUGE CONTROL PANEL (–CP)

FIELD PROCESS AREA (–FLD)

CUSTOMER SUPPLIED POWER
575VAC, 3Ø, 60A
SCA MAX: 25KAIC

CB101
MAIN CIRCUIT BREAKER
60A

CUSTOMER SCADA

PLANT SCADA CAT 6 — ETH

TBCDI
6181
10131
VFD104
U/T1
V/T2
W/T3
GND
CFG–FLD
MOT105
BOWL MOTOR
40HP
41FLA

TBCDI
6181
10161
VFD139
U/T1
V/T2
W/T3
GND
CFG–FLD
MOT140
SCROLL MOTOR
10HP
11FLA

TBAC3
5551
5552
SOL555
CENTRIFUGE WASHWATER SOLENOID VALVE

TBAC3
5551
5581
SOL558
DISCHARGE CONVEYOR WASHWATER SOLENOID VALVE

NOTES

CONTROL PANEL MUST BE SUPPLIED WITH POWER SOURCE GROUND FOR PROPER OPERATION OF INSTRUMENTS.

1. MOTOR GROUND WIRE MUST GO DIRECTLY TO VFD GROUND TERMINAL (PE).
2. THIS POINT TO POINT DRAWING IS DERIVED FROM PROJECT SCHEMATICS. REFER TO PROJECT SCHEMATICS FOR FURTHER CLARIFICATION.
3. IF TERMINAL NUMBERS ARE KNOWN FOR EQUIPMENT SUPPLIED BY OTHERS. PLEASE PROVIDE NUMBERS FOR COMPLETION OF DRAWING.

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ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

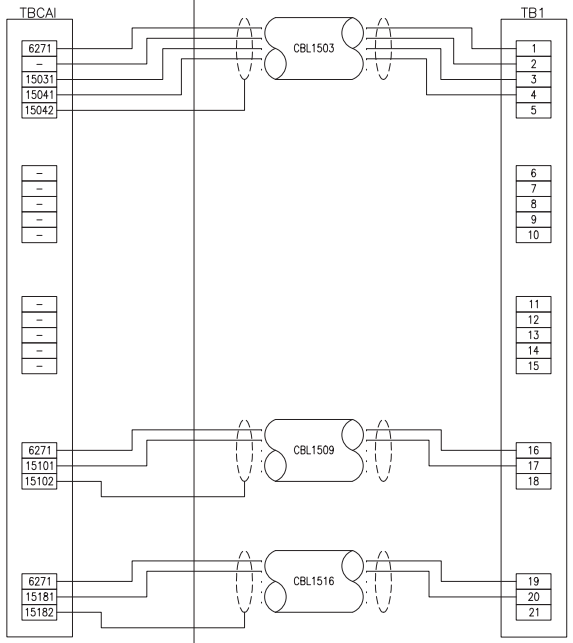
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT (CENTRIFUGE LOADS)

SIZE	DRAWING NUMBER	REV
B	E831476–PP1	1

PREV. SHEET: 26 | NEXT SHEET: 28 | SHEET 27 OF 34

CUSTOMER SCADA	CENTRIFUGE CONTROL PANEL (–CP)	INSTRUMENTATION JB (CFG–JB1)	FIELD PROCESS AREA (–FLD) (SEE MACHINE WIRING DOCUMENTATION)	NOTES



SAP#XXXXXXX
STANDARD MACHINE WIRING

1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT INSTRUMENTATION JB

SIZE	DRAWING NUMBER	REV
B	E831476–PP2	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
27	29	28 34

CENTRIFUGE CONTROL PANEL (–CP)	FIELD PROCESS AREA (–FLD)	NOTES

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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No. 831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465–5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT (CONT FOR CUST USE)

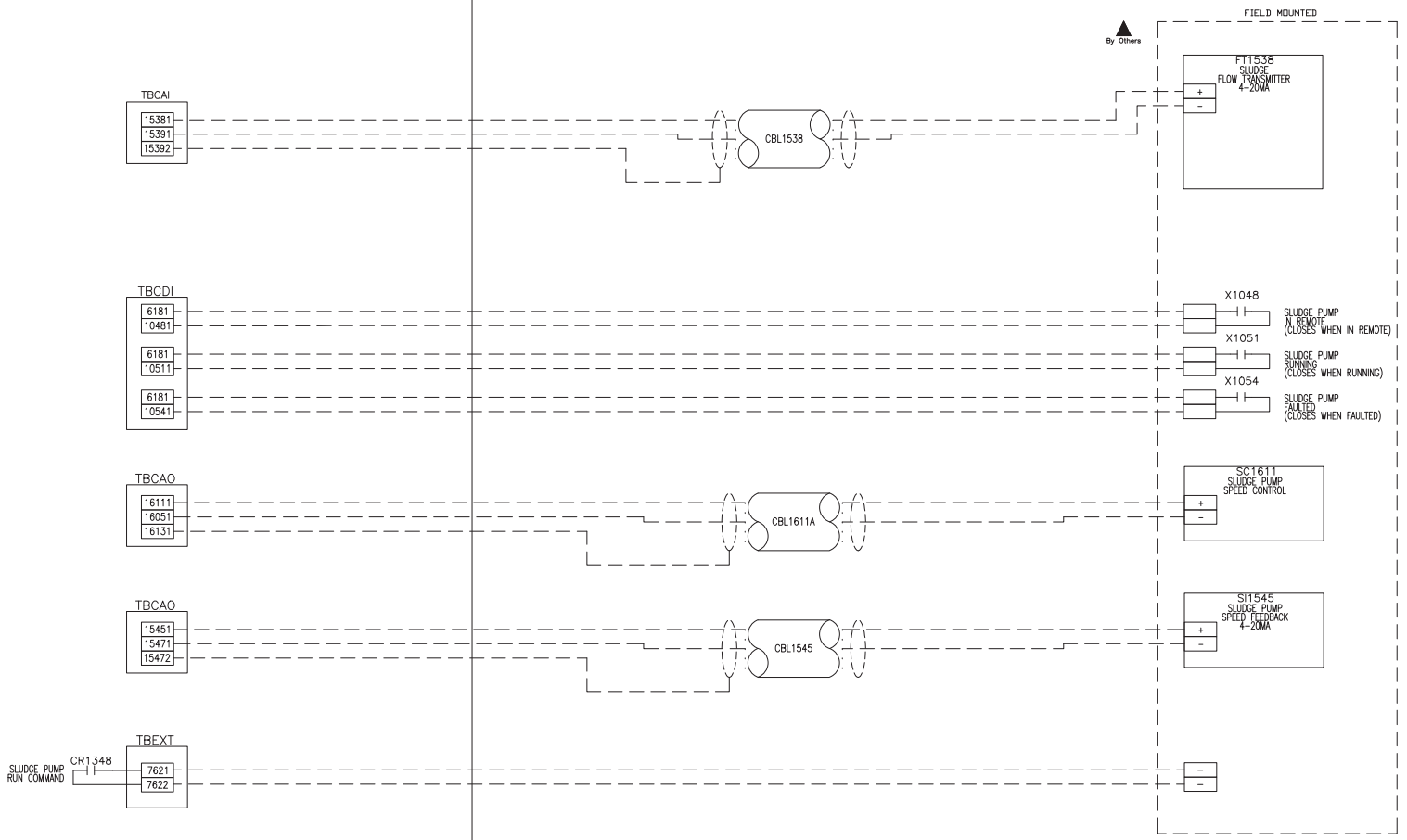
SIZE	DRAWING NUMBER	REV
B	E831476–PP3	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
28	30	29 34

CENTRIFUGE CONTROL PANEL (-CP)

FIELD PROCESS AREA (-FLD)

NOTES



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APPROVED FOR CONSTRUCTION

BY: BJM DATE:

PROJECT No.831476

NOTES

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0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED:
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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT SLUDGE

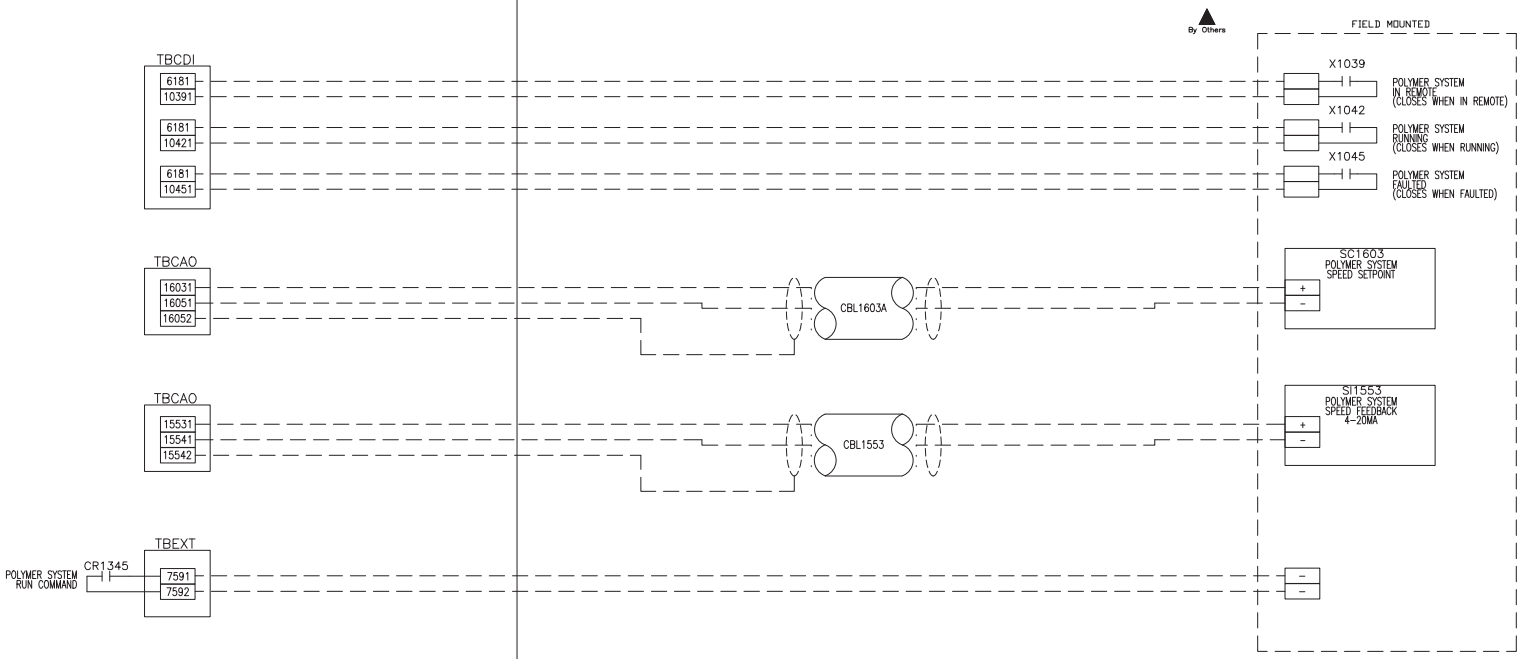
SIZE: B | DRAWING NUMBER: E831476-PP4 | REV: 1

PREV. SHEET: 29 | NEXT SHEET: 31 | SHEET 30 OF 34

CENTRIFUGE CONTROL PANEL (-CP)

POLYMER SYSTEM CONTROL PANEL (POL-CP)

NOTES



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APPROVED FOR CONSTRUCTION

BY: BJM DATE:

PROJECT No.831476

NOTES

REV	BY	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18

LOCATION:

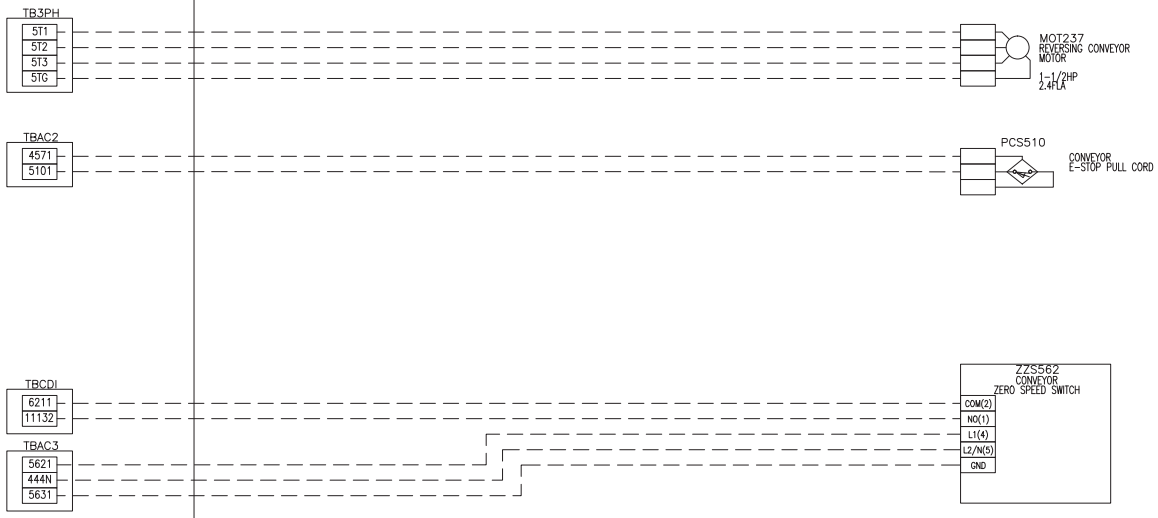
ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT POLYMER

SIZE	DRAWING NUMBER	REV
B	E831476-PP5	1

PREV. SHEET: 30 | NEXT SHEET: 32 | SHEET 31 OF 34

CUSTOMER SCADA	CENTRIFUGE CONTROL PANEL (–CP)	FIELD PROCESS AREA (–FLD)	NOTES



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ARLINGTON, TEXAS 76001
Phone: (817)465-5611
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APPROVED FOR CONSTRUCTION
BY: BJM DATE:
PROJECT No.831476

NOTES

REV	EIR	REVISION	BY	APVD	DATE
1		CERTIFIED	HL	BJM	04/13/18
0		APPROVAL DRAWINGS: INITIAL RELEASE	HL	BJM	04/04/18

ESTIMATED WEIGHT IN LBS:

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DIMENSIONS ARE IN INCHES
FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
APPROVED BY:	CMP	DATE 04/04/18
LOCATION:		

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
POINT TO POINT CONVEYOR

SIZE	DRAWING NUMBER	REV
B	E831476-PP6	1

PREV. SHEET: 31 | NEXT SHEET: 33 | SHEET 32 OF 34

CFG PLC I/O MAP LIST

TAGNAME	ADDR	TERM	TERMDESC	DESCA	DESCB	DESCC	DESCD	DESCE	LREF
PLC 1001	I:1/0		IN 0	CONTROL PANEL	E-STOP				1001
PLC 1001	I:1/1		IN 1	MAIN CONTROL RELAY					1004
PLC 1001	I:1/2		IN 2	DISCHARGE	CONVEYOR	CONTROL RELAY			1007
PLC 1001	I:1/3		IN 3	SPARE					1010
PLC 1001	I:1/4		IN 4	MAIN DRIVE MOTOR	HIGH TEMPERATURE	SWITCH			1013
PLC 1001	I:1/5		IN 5	SCROLL DRIVE MOTOR	HIGH TEMPERATURE	SWITCH			1016
PLC 1001	I:1/6		IN 6	UPS BYPASSED					1019
PLC 1001	I:1/7		IN 7	UPS LOW BATTERY					1022
PLC 1001			COM 1						1025
PLC 1001	I:1/8		IN 8	UPS FAULTED					1036
PLC 1001	I:1/9		IN 9	POLYMER SYSTEM	IN REMOTE				1039
PLC 1001	I:1/10		IN 10	POLYMER SYSTEM	RUNNING				1042
PLC 1001	I:1/11		IN 11	POLYMER SYSTEM	FAULTED				1045
PLC 1001	I:1/12		IN 12	SLUDGE PUMP	IN REMOTE				1048
PLC 1001	I:1/13		IN 13	SLUDGE PUMP	RUNNING				1051
PLC 1001	I:1/14		IN 14	SLUDGE PUMP	FAULTED				1054
PLC 1001	I:1/15		IN 15	SPARE					1057
PLC 1001			COM 2						1060
PLC 1101	I:2/0		IN 0	REVERSING CONVEYOR	RUN FORWARD	CONFIRM			1101
PLC 1101	I:2/1		IN 1	REVERSING CONVEYOR	RUN REVERSE	CONFIRM			1104
PLC 1101	I:2/2		IN 2	REVERSING CONVEYOR	FAULTED				1107
PLC 1101	I:2/3		IN 3	REVERSING CONVEYOR	E-STOP ACTIVE				1110
PLC 1101	I:2/4		IN 4	REVERSING CONVEYOR	ZERO SPEED SWITCH				1113
PLC 1101	I:2/5		IN 5	SPARE					1116
PLC 1101	I:2/6		IN 6	SPARE					1119
PLC 1101	I:2/7		IN 7	SPARE					1122
PLC 1101			COM 1						1125
PLC 1101	I:2/8		IN 8	SPARE					1136
PLC 1101	I:2/9		IN 9	SPARE					1139
PLC 1101	I:2/10		IN 10	SPARE					1142
PLC 1101	I:2/11		IN 11	SPARE					1145
PLC 1101	I:2/12		IN 12	SPARE					1148
PLC 1101	I:2/13		IN 13	SPARE					1151
PLC 1101	I:2/14		IN 14	SPARE					1154
PLC 1101	I:2/15		IN 15	SPARE					1157
PLC 1101			COM 2						1160
PLC 1301			VAC/VDC 1						1301
PLC 1301	O:3/0		OUT 0	ALARM HORN					1304
PLC 1301	O:3/1		OUT 1	PLC FAULT					1307
PLC 1301	O:3/2		OUT 2	COMMON ALARM					1310
PLC 1301	O:3/3		OUT 3	ALARM BEACON					1313
PLC 1301	O:3/4		OUT 4	ELAPSED TIME METER					1316
PLC 1301	O:3/5		OUT 5	SPARE CR					1319
PLC 1301	O:3/6		OUT 6	SPARE					1322
PLC 1301	O:3/7		OUT 7	SPARE					1325
PLC 1301			VAC/VDC 2						1336
PLC 1301	O:3/8		OUT 8	CENTRIFUGE	WASHWATER	SOLENOID VALVE	OPEN CMD		1339
PLC 1301	O:3/9		OUT 9	DISCHARGE CONVEYOR	WASHWATER	SOLENOID VALVE	OPEN CMD		1342
PLC 1301	O:3/10		OUT 10	POLYMER SYSTEM	RUN COMMAND				1345
PLC 1301	O:3/11		OUT 11	SLUDGE PUMP	RUN COMMAND				1348

CFG PLC I/O MAP LIST

TAGNAME	ADDR	TERM	TERMDESC	DESCA	DESCB	DESCC	DESCD	DESCE	LREF
PLC1301	O:3/12		OUT 12	REVERSING CONVEYOR	RUN FORWARD	COMMAND			1351
PLC1301	O:3/13		OUT 13	REVERSING CONVEYOR	RUN REVERSE	COMMAND			1354
PLC1301	O:3/14		OUT 14	SPARE					1357
PLC1301	O:3/15		OUT 15	SPARE					1360
PLC1501	I:4.0	V IN 0□	IN 0	CENTRIFUGE	VIBRATION				1501
PLC1501		I IN 0□							1503
PLC1501		V/I IN 0-							1504
PLC1501		V/I IN 0-							1504
PLC1501		ANLG COM							1506
PLC1501		ANLG COM							1506
PLC1501	I:4.1	V IN 1□	IN 1	CENTRIFUGE	BEARING TEMPERATURE	FEED END			1509
PLC1501		I IN 1□							1510
PLC1501		V/I IN 1-							1512
PLC1501		V/I IN 1-							1512
PLC1501		ANLG COM							1513
PLC1501		ANLG COM							1513
PLC1501	I:4.2	V IN 2□	IN 2	CENTRIFUGE	BEARING TEMPERATURE	DRIVE END			1516
PLC1501		I IN 2□							1518
PLC1501		V/I IN 2-							1519
PLC1501		V/I IN 2-							1519
PLC1501		ANLG COM							1521
PLC1501		ANLG COM							1521
PLC1501	I:4.3	V IN 3□	IN 3	CENTRIFUGE	BOWL SPEED				1524
PLC1501		I IN 3□							1525
PLC1501		V/I IN 3-							1527
PLC1501		V/I IN 3-							1527
PLC1501		ANLG COM							1528
PLC1501		ANLG COM							1528
PLC1501	I:5.4	V IN 4□	IN 4	SLUDGE	FLOW				1536
PLC1501		I IN 4□							1538
PLC1501		V/I IN 4-							1539
PLC1501		V/I IN 4-							1539
PLC1501		ANLG COM							1541
PLC1501		ANLG COM							1541
PLC1501	I:5.5	V IN 5□	IN 5	SLUDGE PUMP	SPEED FEEDBACK				1544
PLC1501		I IN 5□							1545
PLC1501		V/I IN 5-							1547
PLC1501		V/I IN 5-							1547
PLC1501		ANLG COM							1548
PLC1501		ANLG COM							1548
PLC1501	I:5.6	V IN 6□	IN 6	POLYMER SYSTEM	SPEED FEEDBACK				1551
PLC1501		I IN 6-							1553
PLC1501		V/I IN 6-							1554
PLC1501		V/I IN 6-							1554
PLC1501		ANLG COM							1556
PLC1501		ANLG COM							1556
PLC1501	I:5.7	V IN 7□	IN 7	SPARE					1559
PLC1501		I IN 7-							1560
PLC1501		V/I IN 7-							1562
PLC1501		V/I IN 7-							1562

ROCKWELL AUTOMATION

1010 COMMERCIAL BLVD. SOUTH
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APPROVED FOR CONSTRUCTION

BY: BJM DATE:

PROJECT No.831476

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ESTIMATED WEIGHT IN LBS:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020 MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020 MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY: HL	DATE 04/04/18	
CHECKED BY: BJM	DATE 04/04/18	
APPROVED BY: CMP	DATE 04/04/18	

LOCATION:

ANDRITZ

ANDRITZ SEPARATION INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001

PHONE: (817) 465-5611

TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
I/O MAP LIST

SIZE	DRAWING NUMBER	REV
B	E831476-IOM1	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
32	34	33 34

CFG PLC I/O MAP LIST

TAGNAME	ADDR	TERM	TERMDESC	DESCA	DESCB	DESCC	DESCD	DESCE	LREF
PLC 1501		ANLG COM							1563
PLC 1501		ANLG COM							1563
PLC 1601		V OUT 0□	OUT 0						1601
PLC 1601	O:5.0		I OUT 0□	POLYMER SYSTEM	SPEED CONTROL				1603
PLC 1601			V OUT 1□						1609
PLC 1601	O:5.1		I OUT 1□	SLUDGE PUMP	SPEED CONTROL				1611
PLC 1601			V OUT 2□						1617
PLC 1601	O:5.2		I OUT 2□	SPARE					1619
PLC 1601			V OUT 3□						1625
PLC 1601	O:5.3		I OUT 3□	SPARE					1627
PLC 1601		ANLG COM							1631
PLC 1601		ANLG COM							1633

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ESTIMATED WEIGHT IN LBS:

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FABRICATION TOLERANCES
.XXX±.040 ANG±1° HOLE±.020
MACHINING TOLERANCES
.XXX±.005 ANG±.5° HOLE±.020
MILL FINISH ALL OVER

THIRD ANGLE PROJECTION

DRAWN BY:	HL	DATE 04/04/18
CHECKED BY:	BJM	DATE 04/04/18
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LOCATION:

ANDRITZ SEPARATION INC.
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TITLE: VEOLIA AGNICO AMARUQ
D4L CENTRIFUGE SKID
I/O MAP LIST

SIZE	DRAWING NUMBER	REV
B	E831476-IOM2	1

PREV. SHEET:	NEXT SHEET:	SHEET OF
33		34 34