

ORIGINAL INSTRUCTIONS

Installation and Operation

Water Filtration System

WFS – 1545

WFS-1545 6F

Serial Number: _____

HST Spindles, LLC.

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WFS 1545 Operations Manual

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Nomenclature

NOTE: This message highlights a feature, function or procedure that may be helpful.

CAUTION: This message warns of a condition that may have unintended negative action or consequences. It indicates a need for heightened diligence.

WARNING: This message warns of a condition or procedure that has potential for physical injury or death. Often it is applied to a procedure that requires special equipment or qualified personnel.



This symbol warns of a potential shock hazard that may cause injury or death.

Images and Illustrations

Each unit is hand built to order and may have slight variations from the images depicted in this manual. Additionally, some images used are of a generic assembly and may not depict certain optional equipment that is included on any particular unit.

Application

This manual is for use with WFS 1545 and WFS 1545 6F Variant. The procedures described herein are for a generic installation and commissioning. The conditions vary from one facility to another and procedures outlined herein may require modification to accommodate specific facility requirements.

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SECTION I OVERVIEW



FACILITY
PLUMBING
CONNECTIONS

WFS 1545 OVERALL VIEW

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1. OVERVIEW

The **WFS 1545** standard filtration system and the **WFS 1545 6F** variant were specifically engineered to provide clean, temperature-controlled water for wafer dicing and similar processes. The system permits re-use of the process water used for dicing or grinding semiconductor wafers.

Although specifically designed for the semiconductor industry the unit can be applied to any process that requires refrigerated, and filtered water.

The WFS 1545 provides economies in two ways:

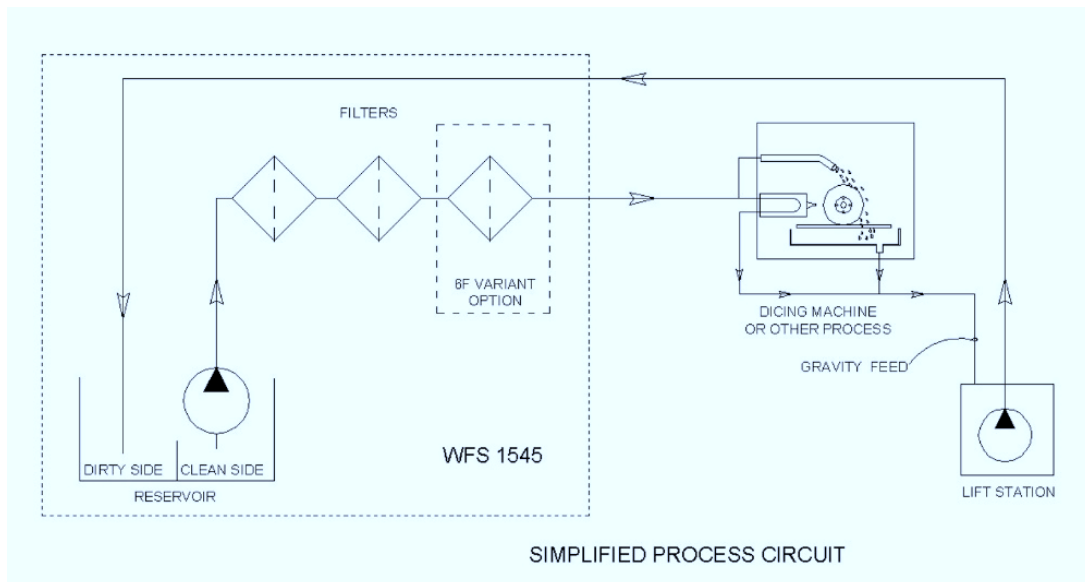
- Significantly reduces water consumption by reconditioning and reusing the water.
- Eliminates or reduces contaminated or hazardous liquid waste disposal by filtering out contaminants into a removable cartridge. The cartridge can be dried and the waste material can then be handled as solid waste.

The WFS1545 system consists of an Internal Circulating Loop and a Process Loop all on a self-contained skid. The Process Loop includes an off-skid Lift Station typically installed near the process machinery for collecting used water and returning it back to the WFS1545 skid. The WFS1545 system also includes a two chambered reservoir, chiller unit and two filtration loops.

a. PROCESS LOOP

The Process Loop recirculates temperature controlled, filtered and cooled water for dicing and grinding. The process pump draws water from the clean side of the reservoir and pumps it through two final filters and then to the process machine. The Lift Station collects the water from the process machine and returns it to the dirty side of the reservoir.

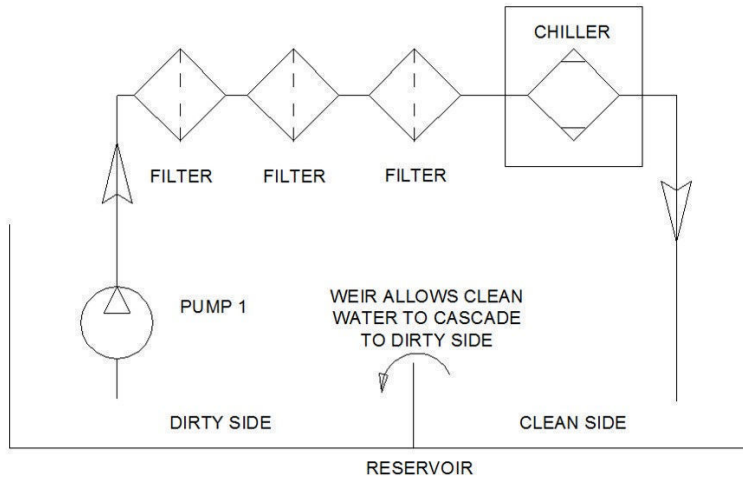
NOTE: The 6F variant provides three (3) final filters.



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b. INTERNAL RECIRCULATING LOOP

This loop constantly recirculates process water returned from the lift station through filters and cooling



SIMPLIFIED CIRCULATING LOOP SCHEMATIC

c. LIFT STATION

The lift station returns contaminated water from the dicing process to the WFS.

2. SPECIFICATIONS

a. PROCESS WATER

PROCESS WATER			
PRESSURE		FLOW	
PSI	Mpa	GPM	LPM
45	0.31	15	57

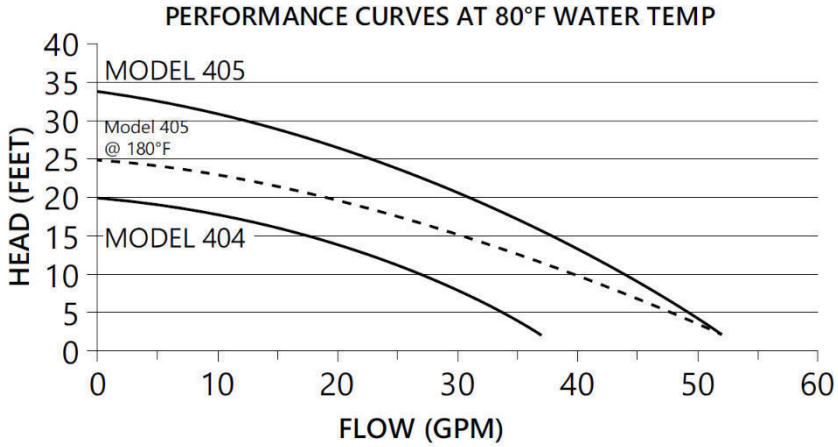
b. CHILLER

HP	Ambient °F (°C)	Capacity (Btu/h) at Rated Conditions/ Evaporator Temperature									
		10°F	15°F	20°F	25°F	30°F	35°F	40°F	45°F	50°F	55°F
		-12.2°C	-9.4°C	-6.7°C	-3.9°C	-1.1°C	1.7°C	4.4°C	7.2°C	10.0°C	12.8°C
1 1/2	90 (32.2)	---	---	11,800	13,200	14,600	16,100	17,600	19,100	20,700	22,300
	100 (37.8)	---	---	10,500	11,800	13,200	14,600	16,000	17,500	19,000	20,500
	110 (43.3)	---	---	9,300	10,500	11,800	13,000	14,400	15,700	17,100	18,500

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c. LIFT STATION

MODEL	HP	VOLTAGE	PHASE	FULL LOAD AMPS	LOCKED ROTOR AMPS	THERMAL OVERLOAD TEMP	STATOR WINDING CLASS	CORD LENGTH FT	DISCHARGE	AUTOMATIC
405-LTS	1/2	115	1	7.3	16	140°C / 284°F	F	10	2"	YES



d. RESERVOIR

The reservoir is made from polypropylene and divided into two chambers that are referred to as the Dirty Side and the Clean Side. Water continuously circulates from the Dirty Side through a cascade of three filters and a chiller unit and then back to the Clean Side of the reservoir. The clean water cascades over a weir and back into the dirty side. This is a continuous process and maintains clean, refrigerated water ready for process use.

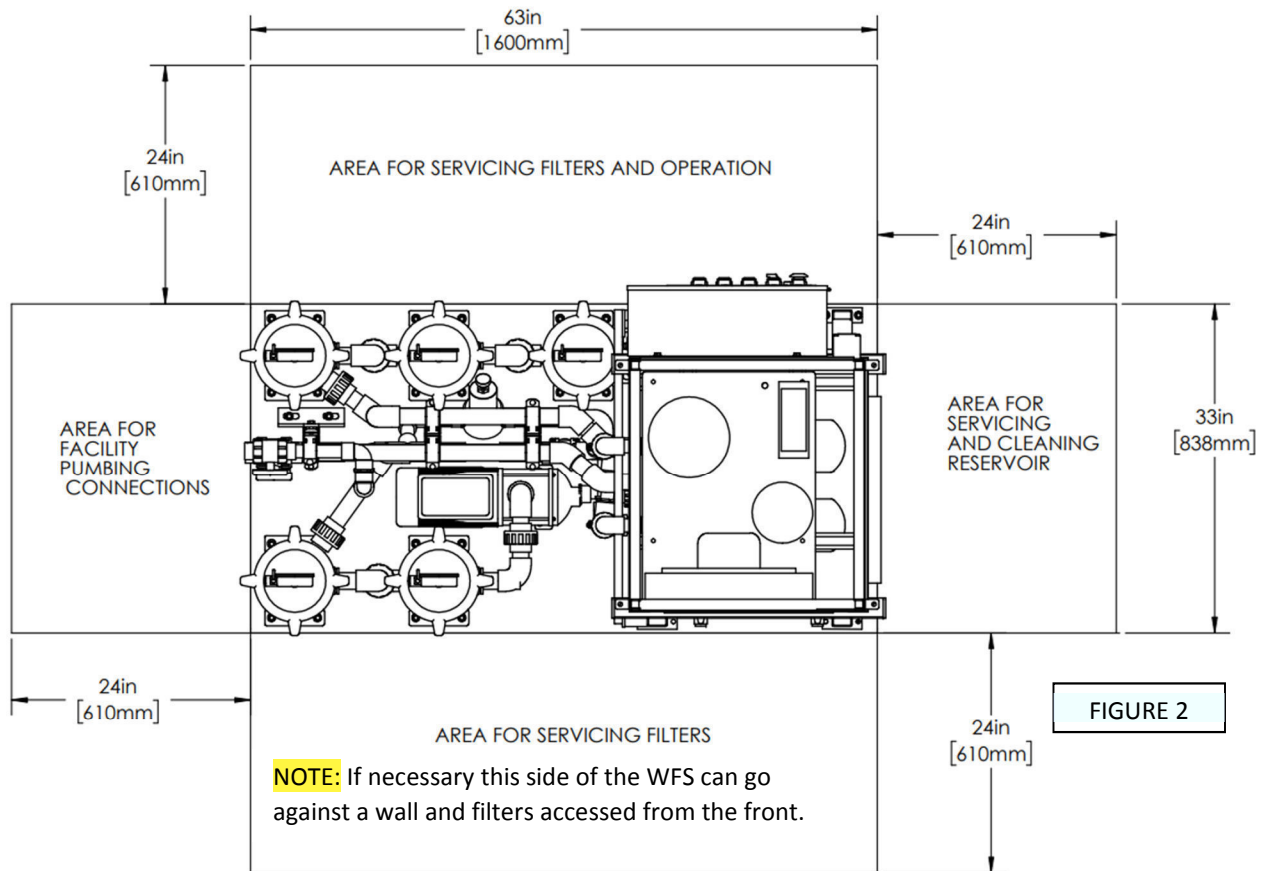
RESERVOIR CAPACITY		
	GALLONS	LITERS
MAXIMUM BRIM FULL CAPACITY	43.5	165.5
DIRTY SIDE NOMINAL OPERATING	20	76.6
CLEAN SIDE NOMINAL OPERATING	11	43

3. SETUP AND REQUIREMENTS

a. FLOOR SPACE

Prior to installation consider the space required for proper servicing. Figure 2 provides recommended clearances for servicing the various components on the WFS 1545.

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RECOMMENDED FLOOR SPACE FOR SERVICING THE WFS 1545

b. UNCRATING

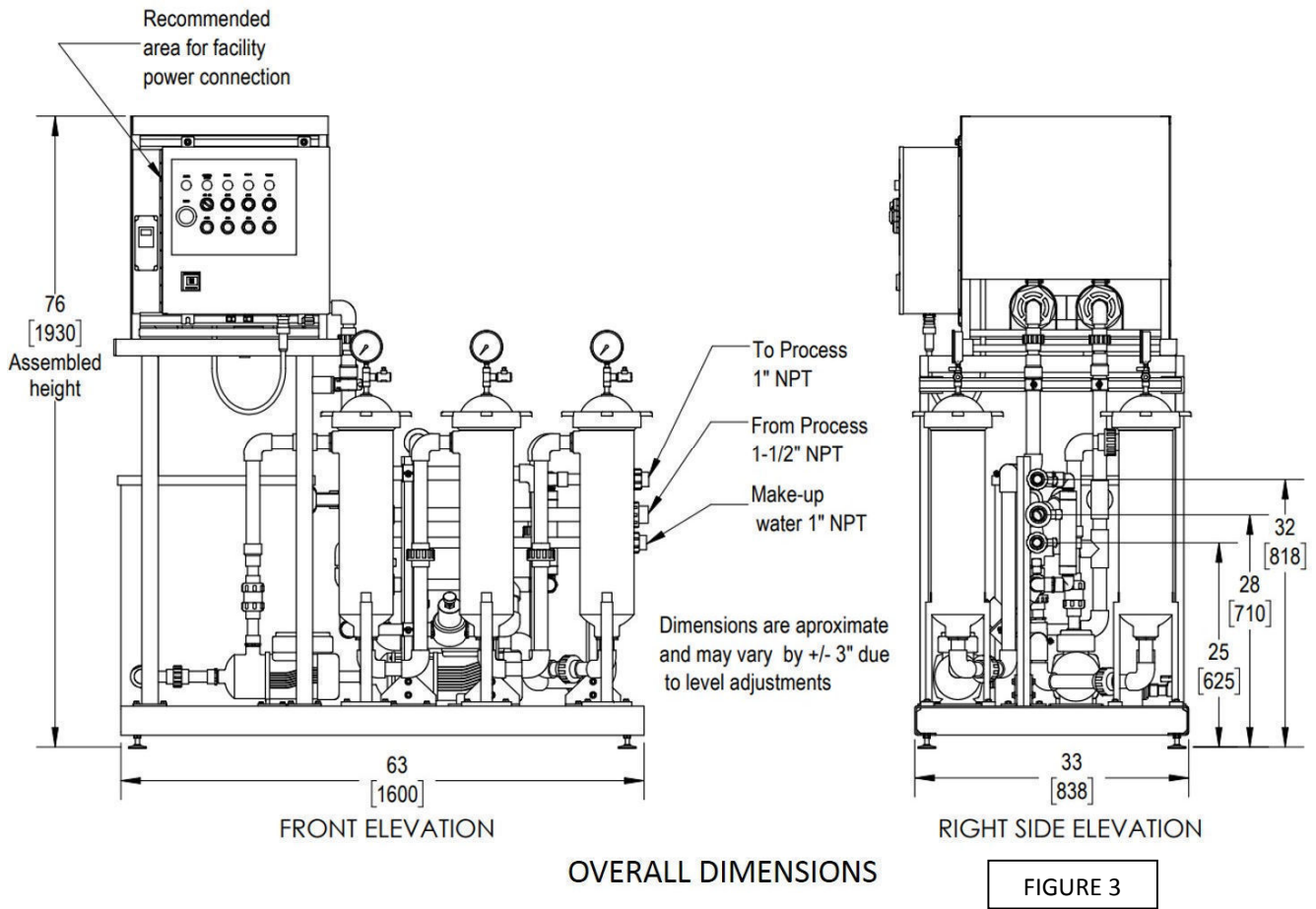
NOTE: Inspect “Tip and Tell” and shock indicators mounted on the outside of the crates for indication of mishandling and potential damage during shipment.

The WFS 1545 is shipped in two crates. Inspect both crates and report any damage to the carrier and the OEM before proceeding. The larger crate contains the base skid with filters and pump. The electrical control panel is strapped to the chiller support structure and ships with the base skid. A smaller crate contains the chiller unit.

The outside of the crates should be inspected for damage prior to uncrating. Additionally, “Tip and Tell” and shock indicators are attached to the exterior. They should be inspected prior to uncrating. If these indicators are missing or indicate that the crate has been subjected to damaging shock loads or tipped, you should notify your carrier prior to uncrating.

Figure 3 shows the minimum door height clearance required to accommodate passage of the main WFS platform prior to assembly.

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c. ELECTRICAL POWER REQUIREMENTS

WFS 1545 requires the following:
 3 phase 30 amp circuit
 230 VAC 50 hz or 220 VAC 60 hz

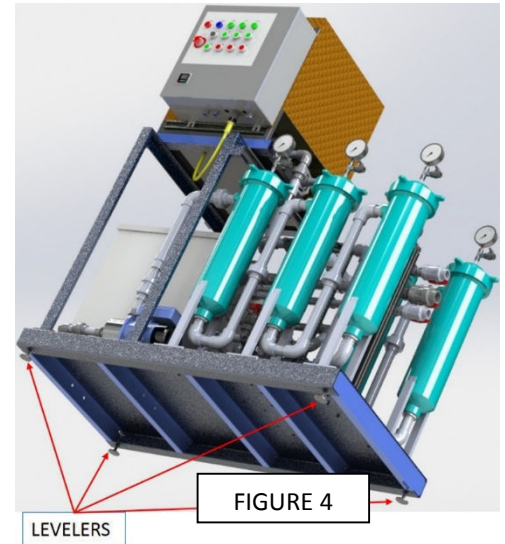
The Lift Station requires the following:
 115 VAC 50/60 hz
 7.5 Amps
 See manufactures design data in appendix

d. LEVELING THE BASE

Once the unit is properly situated the base must be leveled and supported at four (4) points. Figure 4 shows the leveler location. A standard spirit or bubble level will provide sufficient accuracy for leveling the unit.

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Before verifying that the platform is level, insure all four of the leveling legs are firmly on the floor. If any leg is not touching the floor, adjust by loosening the leveler lock nut and winding this ½ - 13 nut in a clockwise direction. Once the leg is firmly on the floor, wind the upper locknut (above the underside of the equipment base) in a clockwise direction until tight. Complete by winding the exposed ½-13 locknut 'up' in a counter-clockwise direction until tight. Next, using a bubble level or similar leveling tool, measure the level of the equipment base. Place the level-tool in an unobstructed surface of the equipment base. If the equipment is off-level by less than ¼ bubble, no adjustment is necessary. However, if more than ¼ adjust the respective legs accordingly. Ensure all leg locknuts are tight.

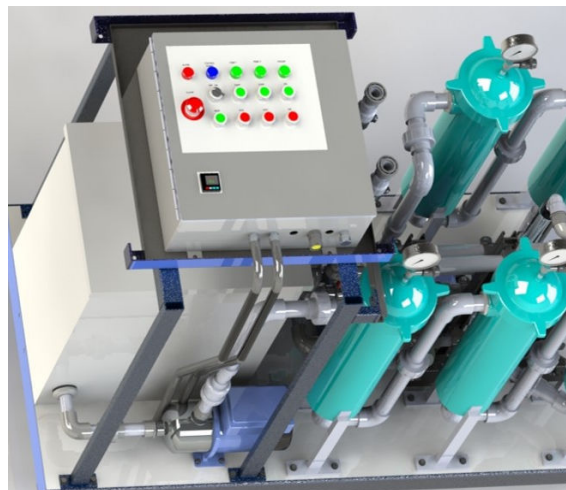


e. CHILLER ASSEMBLY

WARNING: Avoid personal injury. Installing the chiller and attaching the control panel requires lifting and maneuvering heavy and bulky items. Use proper equipment and have adequate unobstructed room for safe installation

After uncrating move the WFS base to an area where the chiller can be safely installed. Remove the shrink wrap holding the control panel on the chiller support frame and carefully support the control panel off to the side next to the Base frame.¹

CAUTION: Use care not to damage the flexible conduit going to the motors or other cables.



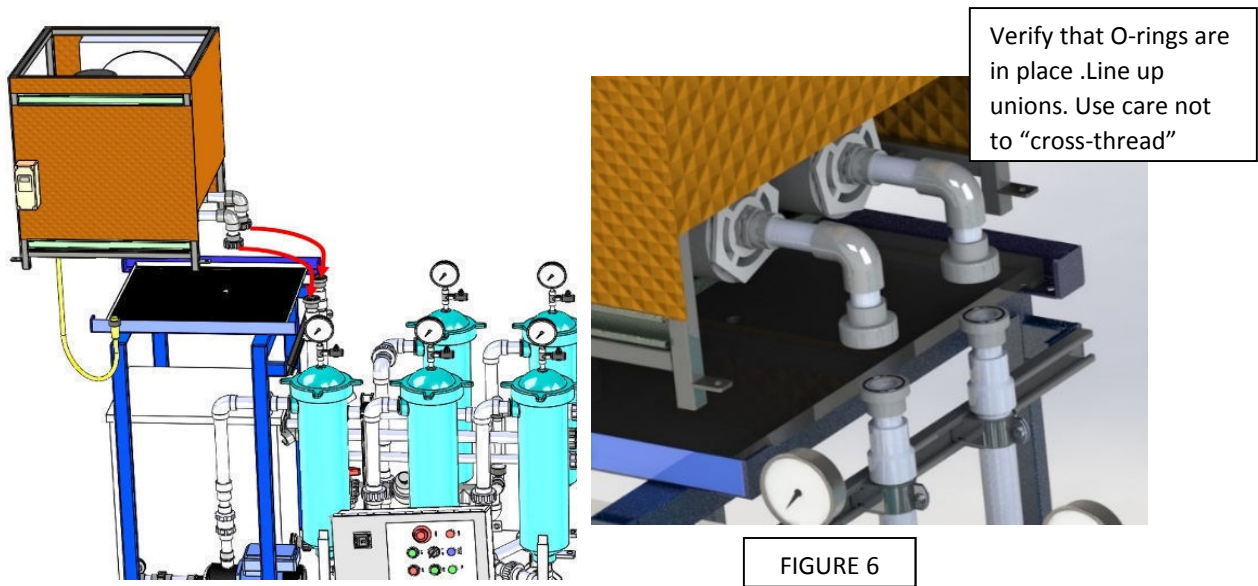
Remove shrink wrap from control panel and set down on side next to the base.

FIGURE 5

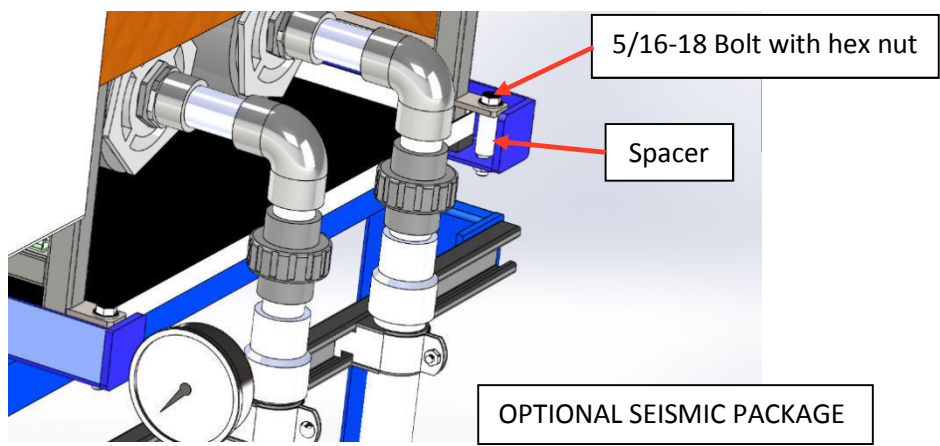
¹ For units with optional sensors the cables can be unplugged from the sensor to allow easier handling of the control cabinet.

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The installation requires lifting the chiller unit and placing it on the drip pan such that the two (2) unions line up with the mating parts on the base unit. See Figure 5. Check to make sure that the O-ring for each union is in place. Carefully move the chiller until the all of the union faces are in contact with the corresponding face on the base unit. Use caution when tightening the union nut to avoid “cross threading”. Do not over tighten. Check for leaks during commissioning of the system. See Figure 6



Units provided in seismically active areas² have provisions for bolting the chiller to the frame. Install the four (4) tie down bolts with spacers through the corner tabs of the chiller and bolt the chiller to the frame



f. CONTROL CABINET INSTALLATION

Once the chiller is properly mounted the control panel can be attached to the chiller frame. The chiller frame comes with four (4) “Spring Nuts” in the strut channel along with mounting bolts.

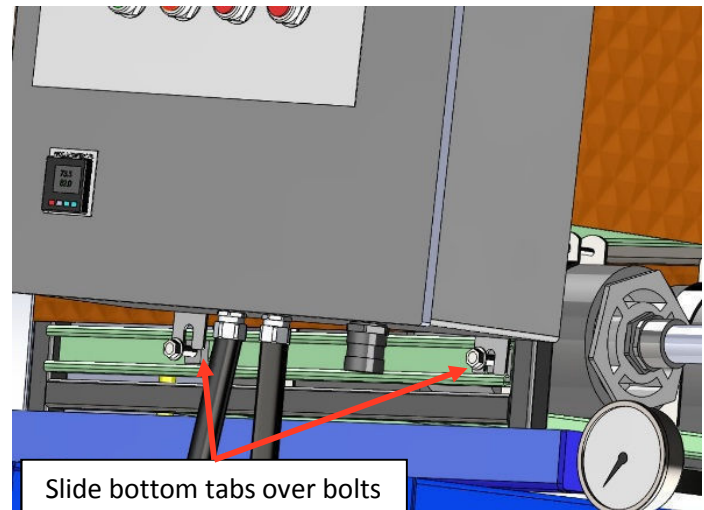
² These areas include Western North America, Southern Europe and Pacific Rim Countries.

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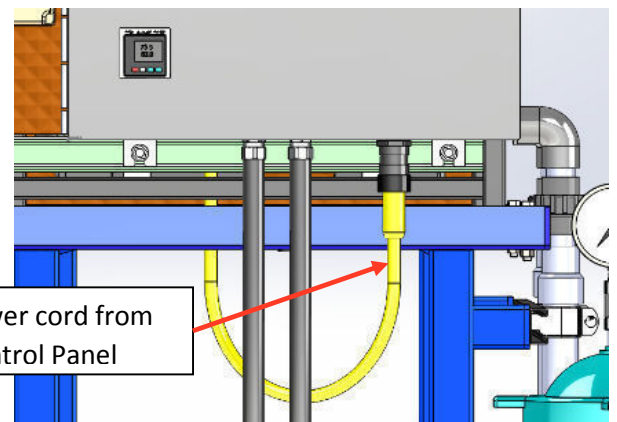
WARNING: The control panel is heavy and awkward. Use proper equipment and caution when lifting.

Remove the bolts from the top two spring nuts. Loosen the bolts on the bottom spring nuts about 5/16". Do not remove them. The bottom spring nuts should be 14" apart with the rightmost nut near the right end of the strut channel.

Lift the control cabinet over the lower bolts and slide the bottom mounting tabs over the bolts. Let the bottom bolts support the weight and bolt the top tabs to the top spring nuts. Tighten all four bolts.



Connect the yellow power cord to the round receptacle on the bottom of the Control Panel.



Note: Connect any sensor cables that may have been unplugged.

g. ELECTRICAL CONNECTION



WARNING!:

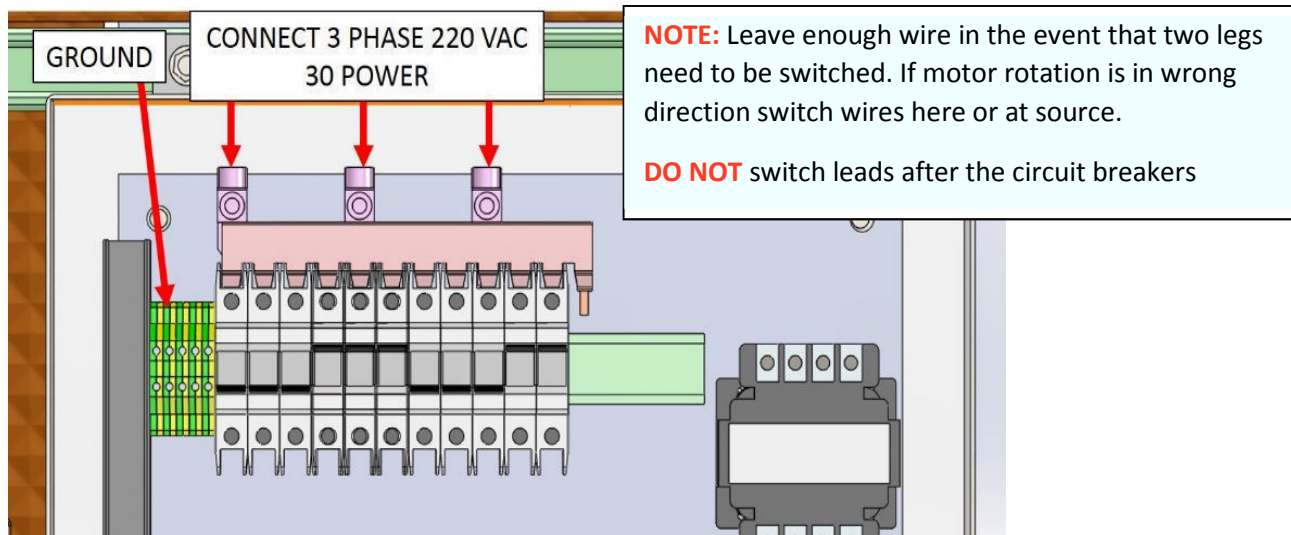
- Accidental contact with electrically live components can cause serious injury or death.
- Always disconnect electrical power from source and lock out/tag out when working inside the Control Panel
- Only trained and qualified personnel may open the Control Panel

CAUTION: Installation wiring must comply with local and national electrical codes.

The unit requires three (3) phase 220 VAC 60 Hz 30 Amp or 230 VAC 50 Hz 30 Amp power with grounding wire.

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The power wires attach to the three lugs provided on the top of the distribution bus bar. The ground wire must be attached to the grounding terminal to the left of the bus bar. See Figure 8.



h. PLUMBING CONNECTIONS

There are three (3) facility plumbing connections to the WFS Unit.

- Make-up Water 1" NPT
- Process Cooling Supply 1" NPT
- Process Cooling Return 1-1/4" NPT

The connection for the Process Cooling Supply is 1" NPT. This provides water filtered and cooled by refrigeration to cool the cutting, grinding or dicing process. This process is normally "open-loop". Therefore, a separate "Lift Station" is required to return the water back to the WFS. The customer is responsible to collect and direct the process water to the lift station pump.

The connection for the Process Cooling Return is 1-1/4" NPT. This connection directs return water from the Lift Station back to the reservoir.

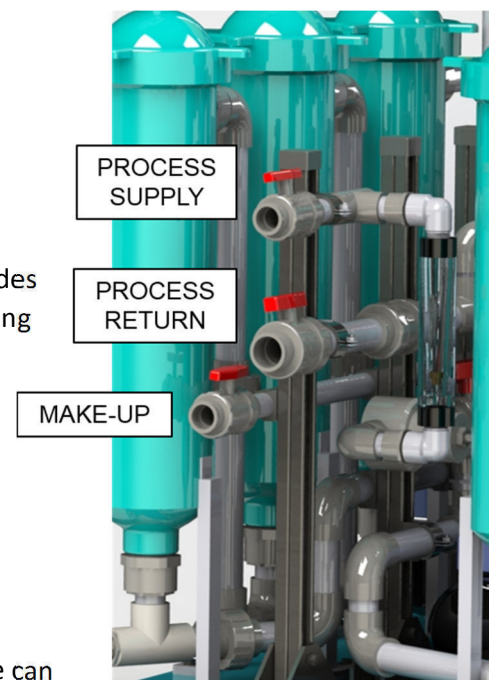
The connection for the Make-Up Water is 1" NPT. The water source can be provided from clean ordinary tap water.

i. LIFT STATION INSTALLATION

The inlet to the Lift Station (LS) is gravity fed from used process water and therefore must be mounted at a lower elevation than the process water collection point

The LS has two available inlet ports: one on top and the other on the side. Either can be used and the unused one plugged. The port is a 2" NPT.

A True Union check valve is provided with the LS. This should be installed on the discharge line as close to the unit as possible. The check valve arrow should be pointing up.



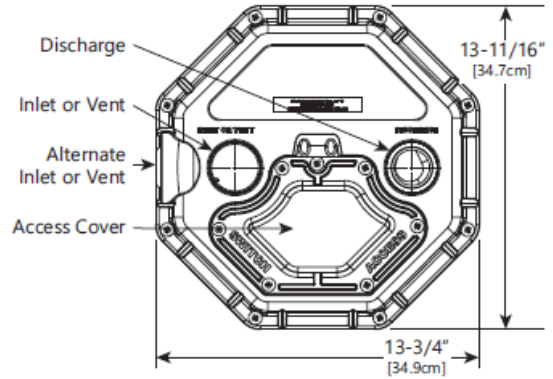
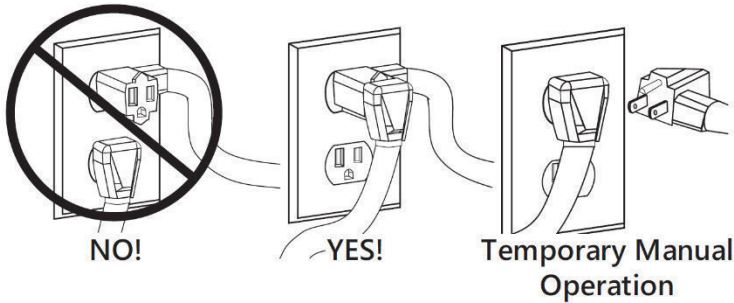
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The unit has a small integral reservoir with a float switch. The Lift Station pump turns on when the reservoir level triggers the float switch. It is normal for the lift station to cycle on and off during normal operation.



WARNING!

- Accidental contact with electrically live components can cause serious injury or death.
- Use appropriate GFI circuit protection



4. COMPONENTS
a. PUMPS

The system has three pumps with the Internal Circulating Loop and a Process Loop each having their own pump mounted on the main base. A third pump is built into the remote lift station. The system is designed to provide a nominal 15 GPM (57 LPM) at 45 PSI (0.31 MPa)

The Internal Circulating pump pulls water from the Dirty Side of the reservoir and pumps it through a cascade of three (3) filters, a chiller and returns the water back to the clean side of the reservoir.

The Process Loop pump pulls clean, refrigerated water from the Clean Side of the reservoir. Pumps it through a final cascade of two filters (3 filters for the F6 variant) and then out to the process.

The Lift Station pump returns used water back to the Dirty Side of the reservoir.

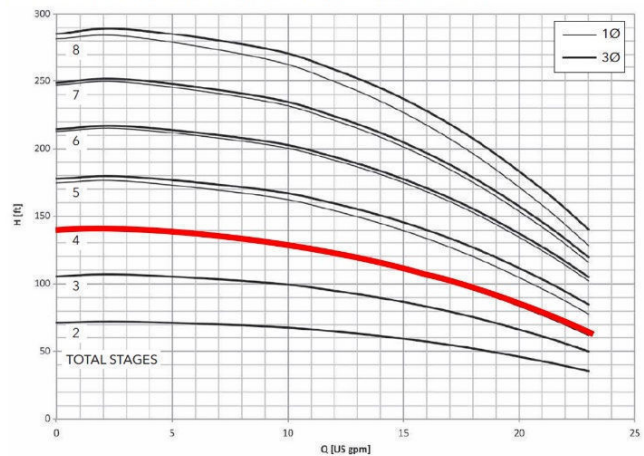
Internal Recirculating Pump

Gould # 3HM04N05T6PBQE

Nominal performance

- 0.75 hp
- 15 gpm
- 40 psi

3HM..N SERIES, (2 TO 8 STAGES)
OPERATING CHARACTERISTICS AT 60 HZ, 3500 RPM



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Process Pump

Nominal Performance

USA ONLY

Gould 3HM07N11T6PBQE

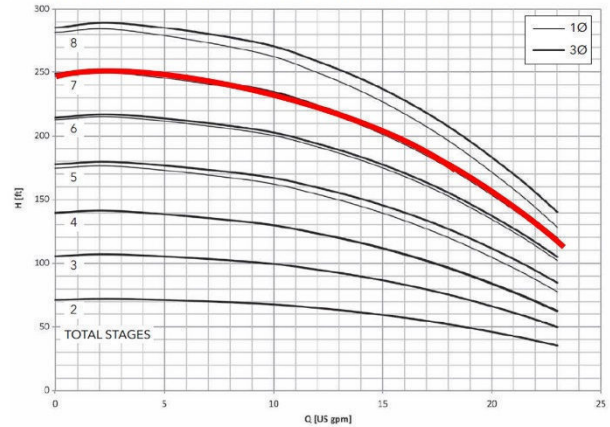
- 1.5hp
- 15gpm
- 75 psi max.)

EU ONLY Gould

3HM10N151T6PBQE

- 2.0 HP
- 15gpm
- 75 psi

3HM..N SERIES, (2 TO 8 STAGES)
OPERATING CHARACTERISTICS AT 60 HZ, 3500 RPM



NOTE: See link to Manufacturer's Information in appendix

b. FILTRATION

The WFS uses Pall or FSI X100 filters that use disposable filter cartridges for filtration of the process water. The filters are arranged in two cascading sets, one set of three filters for the Internal Recirculating Loop and one set of two filters³ for the Process Loop. We recommend having increasingly finer filtration as the water cascades through the filters.

i. Filter Housings

The filter housings are manufactured from talc filled polypropylene and rated for 100 psi maximum pressure and 110° F degrees maximum temperature.

ii. Filter Elements

Each filter housing is designed to hold three cartridge type filter elements. The housings accept filter cartridges of various composition and filtration rating. The customer must determine the type of filter element to best satisfy their requirements.

iii. Gauges

Each filter housing has a pressure gauge mounted directly on top. WFS. These gauges provide indication of the filter condition. The filter elements should be changed when the gages indicate a pressure increase in excess of 20 PSI.

NOTE: For detailed information concerning the filter housing see the link to manufacturer's design data in the appendix.

c. CHILLER

WFS 1545 chiller unit is specifically designed and built for use with processing semiconductors. However, it can be applied to any process that requires refrigerated and filtered water. The chiller

³ F6 Variant uses 3 filters on the process side

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uses a Tecumseh AWA45203XNXC condensing unit with a custom made evaporator. It requires 208-220 VAC 50-60 hz electrical power.

The evaporator uses custom made titanium coils enclosed in schedule 80 PVC housing. The wetted surfaces are PVC and titanium making the heat exchangers impervious to the effects of DI water.

NOTE: The condensing section of unit should be periodically cleaned. Use clean dry compressed air to blow dust out from cooling fins. For specific detailed information concerning the Tecumseh condensing unit see the design data page in the appendix.

d. TEMPERATURE CONTROLLER

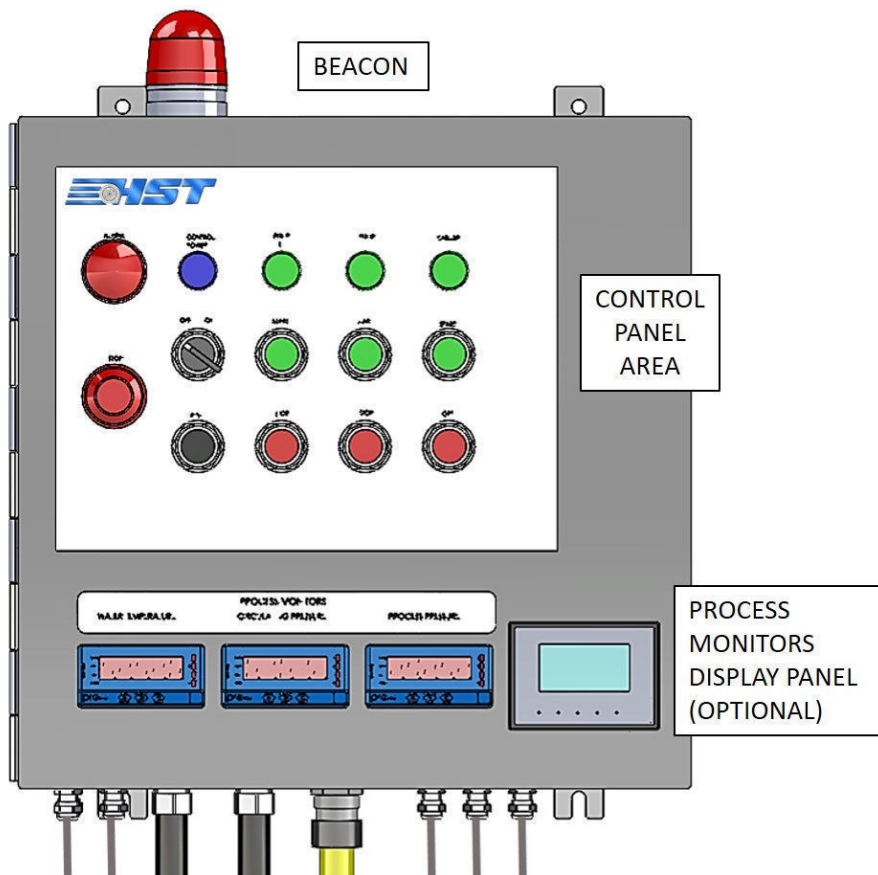
The water temperature for the Process Circuit is controlled by a RANCO ETC111000020 Electronic Temperature Controllers. This is mounted on the side of the main control cabinet. Water temperature can be increased or decreased by use of the up or down arrows on the face of the RANCO unit.

NOTE: For additional information see the Design Data section in the appendix.

e. FLOAT VALVE

A Hudson Float Valve is installed at a fixed position in the reservoir to maintain proper level and compensate for evaporation and minor leaks. It is recommended that a separate supply source be available for initial commissioning.

f. CONTROL CABINET



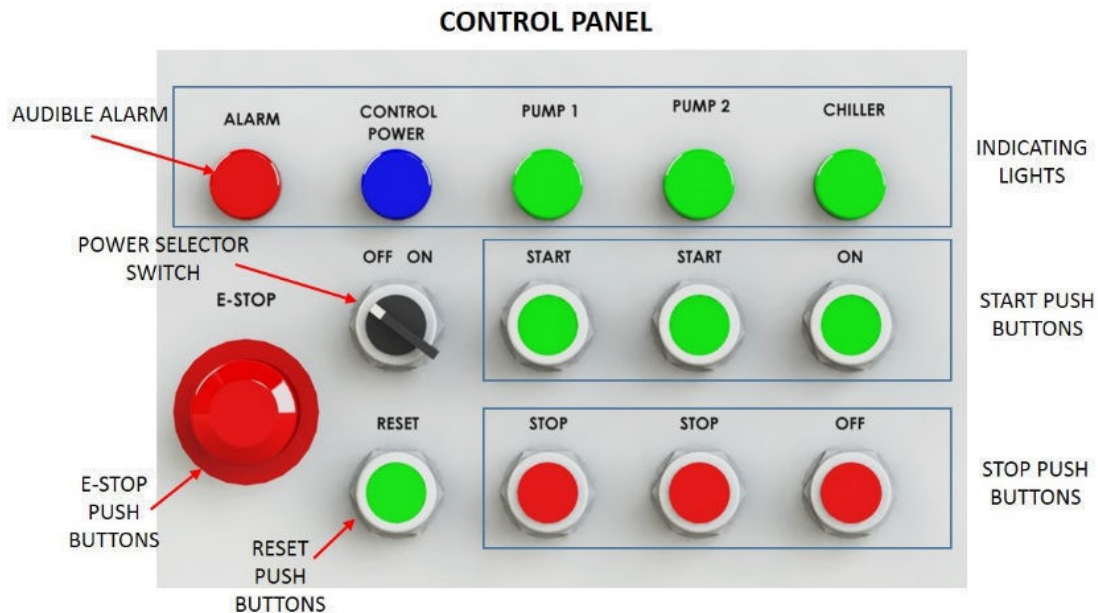
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WARNING!

- Accidental contact with electrically live components can cause serious injury or death.
- Always disconnect electrical power from source and lock out/tag out when working inside the Control Panel
- Only trained and qualified personnel may open the Control Panel

Controls and power distribution components are mounted in a NEMA 12 enclosure. The enclosure is mounted on the side of the Chiller. All selector switches, push buttons and indicating lights required to operate the unit are mounted on the front of the control panel.



i. Audible Alarm (Optional)

This lights up and may sound an audible alarm if a fault condition is detected. See ALARMS section 4.h

ii. E-Stop Push Button

The E-Stop push button stops all pumps and the chiller. It is detented. After it has been depressed it must be physically pulled out to permit resetting the controls.

iii. Power Selector Switch

This switch activates the control power. When it is first turned to the on position the red Alarm indicating light will illuminate. If the Alarm light does not illuminate verify that the E-Stop button has been pulled out.

iv. Reset Push Button

This button “resets” the control system after a fault is detected by an optional sensor or an E-Stop. It will clear the fault display if the fault condition no longer exists. It is also required when first turning on the power.

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With the power on and the E-Stop button pulled out the blue Control Power indicating light will illuminate when the Reset push button is depressed. The pumps and chillers can now be started.

v. Pump 1 Start / Stop Push Buttons

These buttons start and stop the Internal Recirculating Pump

vi. Pump 2 Start / Stop Push Buttons

These buttons start and stop the Process Water Pump

vii. Chiller On / Off Push Buttons

These buttons start and stop the Chiller

CAUTION: To avoid ice damage do not run the chiller for more than 30 seconds without the Recirculating Pump running.

viii. Indicating Lights

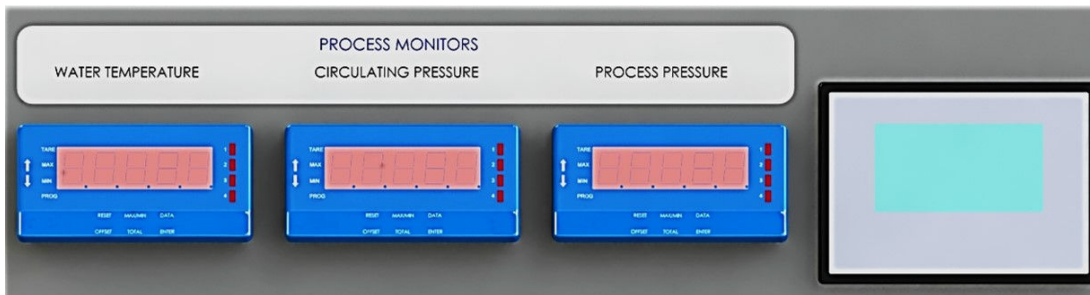
These illuminate when the corresponding pump or chiller is running.

ix. Beacon (Optional)

This illuminates when there is an alarm fault. As a reminder, it will also flash for 3 seconds once every minute if Alarm Override is active. See Section XXX ALARMS

g. OPTIONAL INSTRUMENTATION AND ALARMS

A variety of sensors and displays can be added to monitor process conditions and provide additional protection for pumps and equipment. This equipment may initiate alarms if process conditions exceed or fail to reach preset limits; a condition referred to as “out of window”. See Section 4.h ALARMS.



i. Water Temperature

This panel meter (PM-1) displays the water temperature that is going out to the process. The sensor is installed just before the Process Supply Ball Valve. The panel meter is set to trigger an alarm in the water temperature exceeds 80°F and may indicate a fault with the chiller.

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ii. Circulating Pressure

This panel meter (PM-2) displays the pressure at the circulating pump. The sensor is mounted in a tee just after the pump output. It measures the accumulative back pressure for all three recirculating filters. It is set to trigger an alarm if the pressure exceeds 70 PSI and may indicate a need to replace filter cartridges.

iii. Process Pressure

This panel meter (PM-3) displays the pressure at the process pump. The sensor is mounted in a tee just after the pump output. It measures the accumulative back pressure for all process filters. It is set to trigger an alarm if the pressure exceeds 70 PSI and may indicate a need to replace filter cartridges.

iv. Water Level Sensors

Two water level sensors mounted in the reservoir monitor the water level; one in the Dirty Side and one in the Clean Side. These will trigger an alarm if the water level is below their set point.

v. Leak Detector

A leak detecting strip is installed around the base of the WFS unit. A leak detecting relay (LD-1) is mounted inside the control cabinet that monitors the condition of the sensing strip. If it detects wetness it triggers an alarm. The trip point is adjustable with a small knob on the relay.

vi. HMI Touch Screen Display Panel

The HMI is set up with three different pages and these are accessed by selecting one of the "F" buttons, F1, F3, F5.

- F1 ALM displays an Alarm Silence button
- F2 MSG displays what fault is detected
- F3 OVR Allows for Alarm Override

See Section 4.h ALARMS

h. ALARMS (Optional)

The system responds in two different ways depending on the nature of the fault that triggered the alarm. The faults are designated as a Class 1 Alarm or a Class 2 Alarm.

It is necessary to press the "RESET" button to clear any alarms. Alarms will only clear if the fault no longer exists and the Reset button has been pressed.

i. Class 1 Alarm

This type of alarm indicates that there is a potentially damaging condition.

- Illuminates the beacon
- Illuminates the panel mounted alarm indicating light.
- Sounds the audible alarm tone
- **Stops the pumps and chiller**

ii. Class 2 Alarm

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This type of alarm indicate that some corrective action may need to be taken. But there is not imminent likelihood of damage.

- Illuminates the beacon
- Illuminates the panel mounted alarm indicating light.
- Sounds the audible alarm tone
- **Does not** stop the pumps and chiller

iii. Class 1 Triggers

- Leak
A leak has been detected and may indicate a serious problem.
- Low Water Level
The water level in either the Dirty Side or the Clean Side has been below the sensors for more than 6 seconds. This can result in pump damage.

NOTE: A low water fault will not clear unless the water level has been above the sensors for more than 3 seconds.

iv. Class 2 Triggers

- High Water Temperature
The temperature of the Process Water exceed 80°F. This may indicate a problem with the chiller.
- High Recirculating Pressure
Total head pressure at the recirculating pump exceeds 70 PSI. This may indicate the need to change out the filter cartridges in one or more filters.
- High Process Pressure
Total head pressure at the process pump exceeds 70 PSI. This may indicate the need to change out the filter cartridges in one or more of the filters. It may also indicate an obstruction to flow someplace in the line such as a partially closed valve.

b. HMI Touch Screen

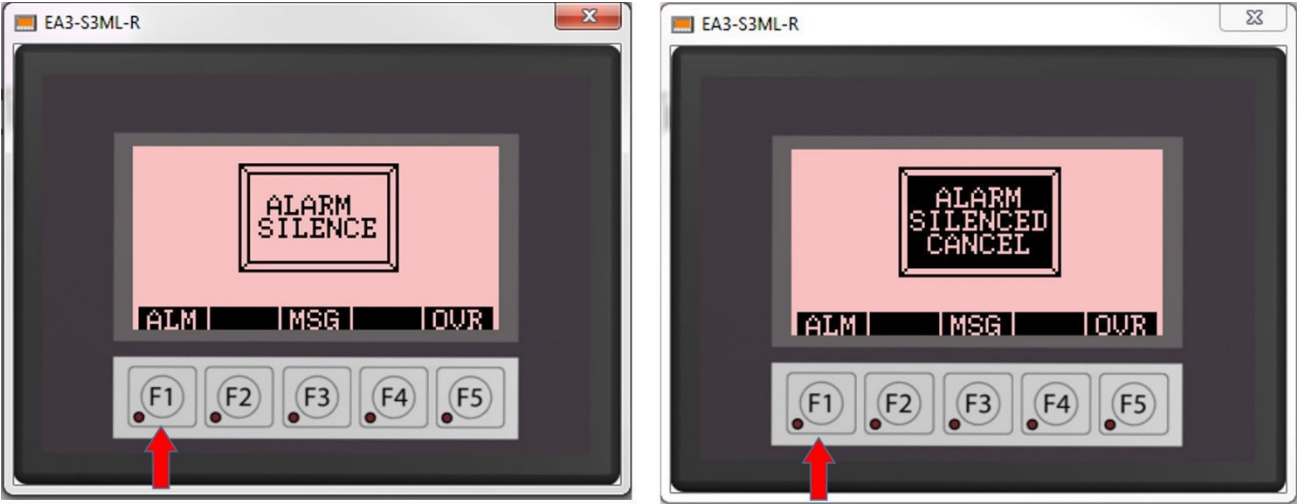
The HMI has three different screens where different information can be displayed or different functions can be accessed. The different screens and functions can be selected using the **F** buttons.

i. F1 ALM (Alarm Silence)

Pressing the F1 button on the screen will call up the Alarm Silence screen. Touching the ALARM SILENCE button will stop the audible tone for 60 seconds. The button image will change indicating that the silence mode has been selected. The beacon and panel light will remain illuminated. The alarm message on the F3 screen will remain displayed and the fault will not clear until the Reset Button is pressed.

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The Alarm Silence mode will clear after 60 seconds the tone will sound. The Alarm Silence can be selected unlimited number of times.



ii. F3 MSG (Message)

Pressing F3 will call up the Message Page. This page displays the alarm status and indicates which fault or faults triggered the alarm. If there are no faults this page will be blank. We recommend that this is the normal display mode.

The fault will continue to display until the Reset Button is pushed. This is true even if the fault has cleared itself.

E.g. the reservoir runs low and the Low Water Class 1 alarm is triggered. The pumps will stop and the alarm will sound. Before someone can come to inspect the unit the auto-fill valve restores the reservoir to the proper level. The fault has cleared. However, the display will still show the cause of the alarm "LOW WATER" and the pumps will not start until the reset button is pressed.



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iii. F5 OVR (Alarm Override)

Pressing the F5 Button will call up the Alarm Override screen. Touching the ALARM OVERRIDE button permits the pumps and chiller to operate with a Class 1 alarm condition. It also toggles the image to CANCEL ALARM OVERRIDE.

Alarm Override prevents nuisance tripping during start up when the reservoirs may get low prior to completely filling the system and reaching water flow equilibrium. The override mode also allows operation should the leak sensor strip become wet during a filter element change out.

The Alarm Override is canceled when the Cancel Alarm Override button is touched. Additionally it will clear itself after 10 minutes if not manually canceled.

While operating in the Alarm Override mode the alarm tone will sound and the beacon will pulse for 3 seconds once every minute as a reminder that the system is operating while in override mode.

CAUTION: Maintain increased diligence! While operating the system in the ALARM OVERRIDE mode the pumps can be damaged by operating with low water.



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SECTION II COMMISSIONING

COMMISSIONING

Commissioning the system after all of the proper connections and set-up have been completed consists primarily of filling the system including all plumbing lines and filter housings with water and bleeding air from the filter housings. This is accomplished in the following steps:

- Filling the Internal Circulating Loop
- Filling the Process Water Circuit
- Filling the Lift Station

Each of these steps listed below is an iterative process requiring starting and stopping the various pumps several times while maintaining sufficient water level to prevent pump cavitation.

NOTE: Because of the low flow capacity of the auto-fill valve it is helpful to have a second source of water to manually maintain reservoir level during commissioning.

1. COMMISSIONING PREREQUISITES

Verify and check the following:

- Close the ball valves for the three (3) facility plumbing connections to the WFS Unit.
- All plumbing connections to process and lift station are complete.
- Lift Station is installed and proper facility power is on.

NOTE: The lift station will not run until a certain water level in the holding tank is reached.

- Process cooling water is gravity drained and collected into the lift station. The lift station discharge is connected to the Process Water Return connection.
- Facility water supply is open to the Water Make-Up line.
- Verify that the proper three (3) phase electrical power with ground is connected.



WARNING! To be performed by qualified personnel only.

2. FILLING THE RESERVOIR

Obtaining and maintaining the proper operating level in all of the reservoir chambers is an iterative process. It requires starting and stopping pumps until all components in the system are fill with water and the system is at equilibrium. The description herein assumes that the system is starting with all of the filter housings, chiller chambers and process lines empty.

WARNING! Water from the air bleed valves may come out at high velocity. Keep personnel from their opening. If sensitive equipment is in the vicinity attach appropriate fittings and hose to direct water to safe container.

CAUTION: The pumps can pull water from the reservoir much faster than the make-up lines can restore. For that reason, the reservoir filling process requires careful observation until equilibrium is achieved.

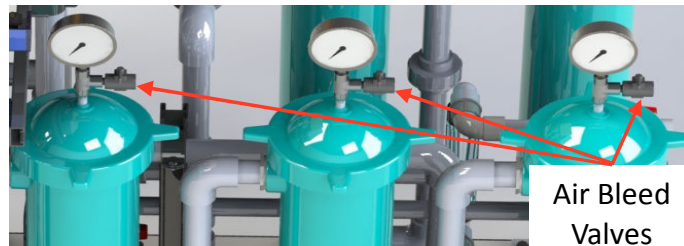
CAUTION: If the water level in the reservoir is too low, air will be drawn into the pump inlet and can cause damage.

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3. RECIRCULATING CIRCUIT

Filling the Internal Recirculating Circuit involves filling the reservoir to the proper level in both chambers. It also includes filling and bleeding air out of three filter housings. As the filter housings get filled the reservoir level will go down below the safe to run limit (Red Line). Pump # 1 must be stopped while the reservoir refills to the nominal operating level (Blue Line)

- I. Close all of the air bleed valves on top of the filter housings.



- II. Remove the reservoir cover so water level can be observed.
- III. Open the ball valve for the make-up water. The reservoir should begin to fill with water. The water should stop filling when the level in the Dirty Side reaches the blue line. The Clean Side will remain empty for the time being.
- IV. Once the water level in the reservoir reaches the fill level, turn Power Selector Switch to "ON" position
- V. Press Reset Push Button. Blue Control Power indicating light should come on.
- VI. While someone observes the pump rotation "jog" Pump 1 for two seconds. (i.e., depress the Pump 1 Start Push Button, then the Pump 1 Stop Push Button.) Verify that the rotation of the pump is in the direction indicated on the pump housing. If the pump rotation is not correct, have a qualified electrician correct the wiring on the incoming line as indicated in the note below.



WARNING! Pump Rotation. To be performed by qualified personnel only.

If the pump rotation is in the wrong direction turn off all electrical power to the WFS from the source. Verify that there is no electrical power in the control cabinet. Switch any two (2) incoming power wires at the connection terminals.

DO NOT switch the motor connections at the motor or to any individual motor. All pumps and chiller are synchronized. Once the power phases for Pump 1 are correct all other motors will be correct.

- VII. Start the pump and observe the water in the chamber. Stop the pump when the water drops to 6 inches (152 mm) from the bottom. Allow reservoir chamber to fill.

CAUTION: Use caution to avoid allowing water level to sink too low. Stop pump if there is any indication that air is getting into the pump inlet.

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- VIII. Repeat process until the water level in the clean side begins to cascade over the internal weir. The make-up valve will be able to compensate for any minor losses due to leakage or evaporation.
- IX. With Pump one running and water cascading from the Clean Side over the weir to the Dirty Side carefully open up the air-bleed valves one at a time starting at the filter housing closest to the reservoir. Close the valve as soon as water begins to squirt out. This may happen right away.

WARNING: Water from the air bleed valves may come out at high velocity. Keep personnel from their opening. If sensitive equipment is in the vicinity attach appropriate fittings and hose to direct water to safe container.

4. PROCESS SUPPLY CIRCUIT

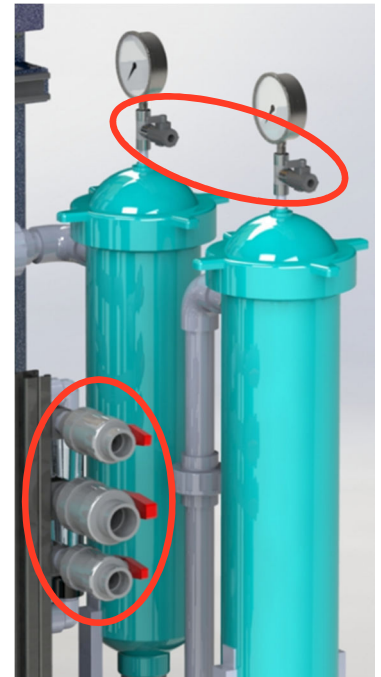
This procedure will fill the final filters, all plumbing lines to and from the process equipment and the lift station reservoir. It requires that the Lift Station is properly installed and powered.

NOTE: The Lift Station has a small internal reservoir with a float switch and will not cycle on until the water level in the internal reservoir reaches a certain level. The Lift Station will tend to cycle on and off.

NOTE: The filling process will require many pump starts and stops to reach equilibrium.

CAUTION: Use caution to avoid allowing water level to sink too low. Stop pump if there is any indication that air is getting into the pump inlet.

- I. Complete procedure outlined in section 2.a.
- II. Close Air Bleed valves on top of filter housings
- III. Open all three facility interface ball valves.
- IV. Verify there is facility water available for make-up.
- V. Remove reservoir cover so water level can be observed.
- VI. Verify that both chambers of the reservoir are filled to the proper level
- VII. Turn Power Selector Switch to "ON" position
- VIII. Press Reset Push Button. Blue Control Power indicating light should come on.
- IX. Depress Pump 1 start button and observe the water in the chamber. Water should be circulating over the internal weir. The system should be in equilibrium.



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- X. Stop the pump if the water drops to 5 inches (130 mm) from the bottom. Allow reservoir chamber to re- fill. Do not re-start the pump until reservoir reaches the fill line.
- XI. With pump # 1 running start pump # 2. Stop both pumps if the water drops to 5 inches (130 mm) from the bottom of the reservoir in either chamber. Allow reservoir chamber to re- fill. Do not re-start the pumps until reservoir reaches the fill line.
- XII. Repeat process **ix-xi**. Water will eventually begin to fill the Lift Station reservoir and be returned to the Dirty Side.
- XIII. Monitor the water level for several minutes with both pumps running.
- XIV. After several minutes of operation bleed air from the final filters. Carefully open up the air-bleed valves one at a time starting at the filter housing closest to the reservoir. Close the valve as soon as water begins to squirt out. This may happen right away.

WARNING !: Water from the air bleed valves may come out at high velocity. Keep personnel from their opening. If sensitive equipment is in the vicinity attach appropriate fittings and hose to direct water to safe container.

5. STARTING THE CHILLER

The chiller provides cooling by refrigeration for the process water. The temperature is controlled by a RANCO Electronic Temperature Controller mounted on the front of the WFS to the side of the control cabinet.

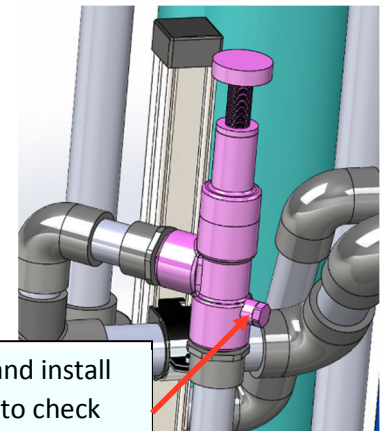
To avoid icing up internal components do not run the chiller unless Pump 1 is running.

The chiller is controlled by the corresponding On –Off push buttons. The cooling fan will start up immediately and the RANCO controller will illuminate and display current settings. After a few seconds the condensing pump will start up and start cooling water for the Process loop.

CAUTION: To avoid ice damage do not operate the chiller unless the Internal Circulating Pump is running.

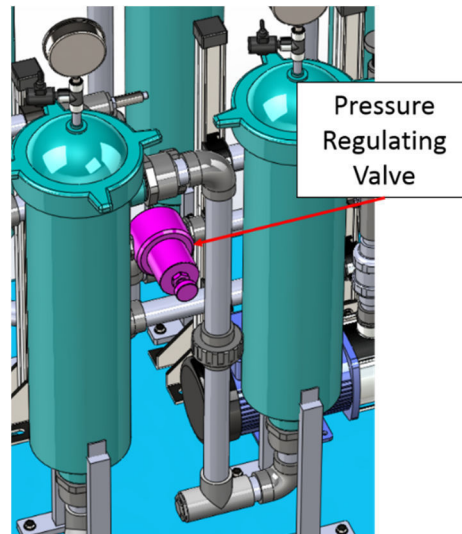
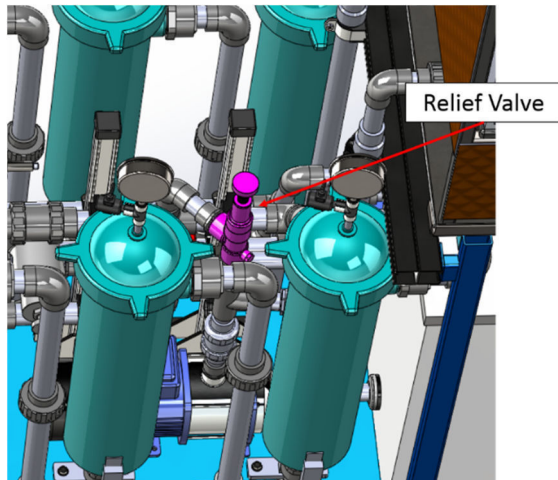
6. RELIEF VALVE PRESSURE SETTING

The relief valve limits the maximum system pressure is preset to 75 PSI prior to shipment. This valve is factory set. But it can be field adjusted if required. Turn knob clockwise to increase pressure and counter-clockwise to decrease pressure.



Remove plug and install pressure gage to check relief valve setting.

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7. PRESSURE REGULATING VALVE

This limits the down-stream pressure to the equipment. It is nominally set at 45 PSI. This can be field adjusted if required. Turn knob clockwise to increase pressure and counter-clockwise to decrease pressure.

SECTION III NORMAL OPERATION

Installation and plumbing configurations can vary significantly from one facility to another. For that reason, the procedures outlined herein are generic and may require “fine-tuning” to accommodate facility specific operation.

1) START-UP CHECK LIST

Prior to starting day to day operations, the following conditions should be verified:

- a. Water level in reservoirs is at or above fill lines
- b. All facility interface ball valves are open
- c. Lift Station has power
- d. All appropriate valves on the process equipment are open
- e. E-Stop push button is pulled out

2) POWER-UP

Turn Power Selector Switch to On. Red Alarm indicating light should illuminate. Press black Reset Push Button. Blue Power indicating light should illuminate.

3) PUMP AND CHILLER START-UP

When properly powered up all pumps and chiller are started by depressing the associated green push button. Each pump or chiller can be stopped independently by depressing the associated red push button. All pumps and chiller can be stopped simultaneously by depressing the E-Stop button.

a. Start Pump 1

This will begin the recirculating loop. The water level in the Dirty Side chamber may drop for a few seconds. Depending on facility specific conditions the water on the Dirty

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Side may overflow into the Clean Side when the system is shut down. Allow Pump 1 to run for 3-5 minutes to assure that the water in the Clean Side is properly filtered.

b. Start Pump 2

This will start the Process Cooling loop. The water level in both the Clean Side and Dirty may drop and the cascading may also stop for a few seconds. Within a few seconds the Lift Station should begin to return Process Water back to the Dirty Side chamber.

c. Start Chiller

The cooling fan will start up immediately and the RANCO controller will illuminate and display current settings. After a few seconds the condensing pump will start up and start cooling water for the Process loop.

4) SHUT-DOWN

The chiller and all pumps can be started or stopped by depressing the appropriately marked push button. All start push buttons are green and all stop push buttons are red.

a. Stop the chiller

b. Stop Pump 2

The Lift Station is controlled by an automated float sensor and can continue to return water to the Dirty Side reservoir for a period of time. This may cause the Dirty Side to overflow. The Lift Station will stop automaticity shortly after Pump 2 is stopped.

c. Stop Pump 1

d. Close Make-Up Water ball valve

We recommend closing the make-up water ball valve when the system is not in use. This is to prevent accidental overfilling in the event of a leaking float valve.

5) FILTER PRESSURE GAUGES

Pressure gauges are provided on every filter housing. By monitoring the pressure readings it is possible to determine when the filter elements should be changed.

6) BYPASS VALVE

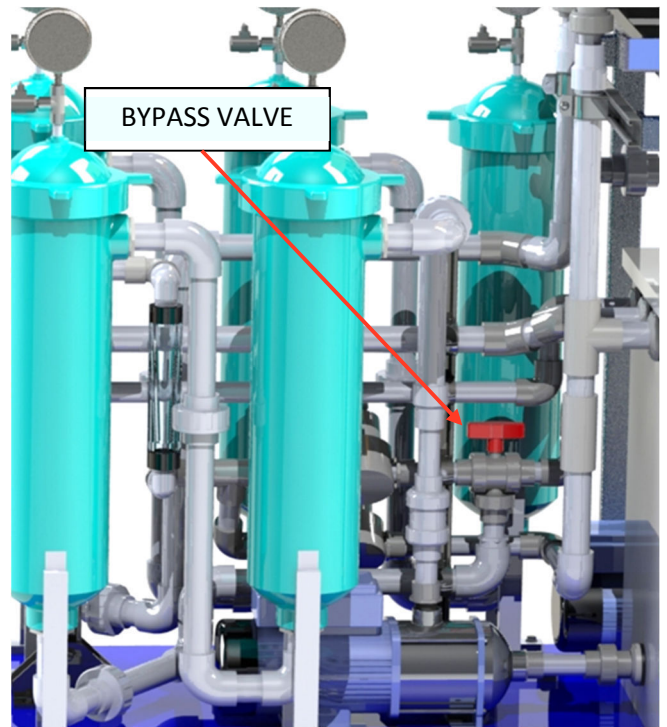
The pressure readings on the gauges associated with final process filter housings read the back pressure for the complete process loop. To acquire an accurate indication of the filter condition the bypass valve must be opened by turning the valve handle clockwise. This will temporarily take the process loop offline as it diverts the process water directly back to the Dirty Side chamber. It is not necessary to close any facility interface ball valves

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With the Bypass valve fully open the reading on process gauges do not include pressure increases caused by the overall system. This provides a more accurate reading of the increase caused by the filter pressure. Close the bypass valve to bring the process cooling loop back on-line.

Filter change out is recommended when the pressure increase through the filter housing exceeds 50 PSI.

CAUTION: There is no water flow to the process with the Bypass Valve open to reservoir.



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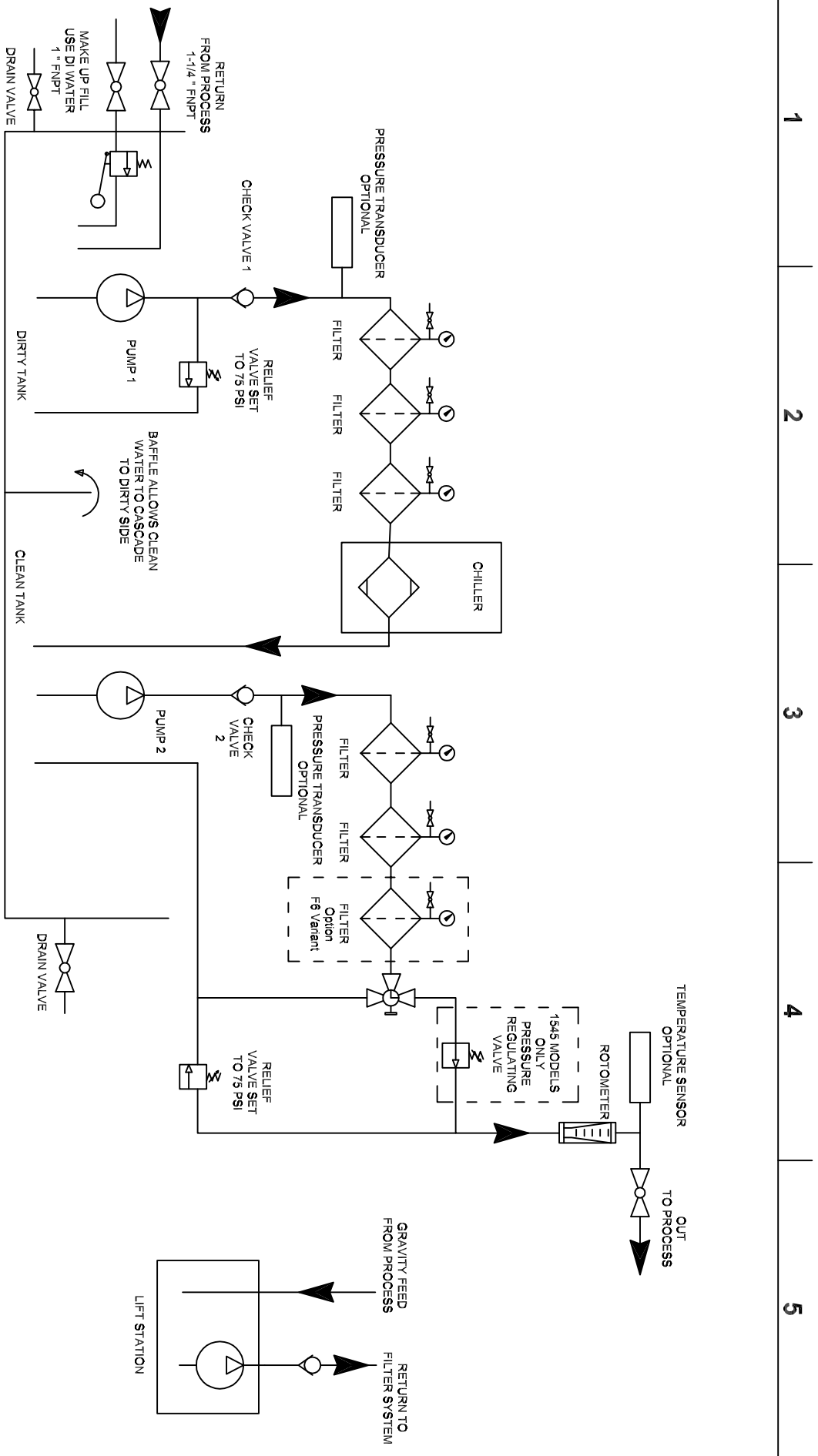
TROUBLESHOOTING

PROBLEM	POTENTIAL CAUSE
Pumps and Chiller will not operate	E-Stop Button in depressed detent Reset Push Button not depressed Leak Sensing Strip is wet Facility Power is off Circuit Breaker is off
Chiller will not start	Chiller Circuit Breaker is off Chiller Freon is low
Chiller cycles rapidly	Hysteresis setting on RANCO controller too small.
Water Temperature varies significantly	Hysteresis setting on RANCO controller is too large
A particular pump will not start	Pump circuit breaker is off
Lift Station does not return water	No power to Lift Station Internal Float switch failed
Water overflows reservoir	Float Valves jammed open with debris
Reservoir runs dry	Float Valves jammed closed with debris

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DESIGN DATA

PRODUCT	LINK
Gould HM Pumps	https://s3.amazonaws.com/pumpproducts/pdf/547800_5_Goulds+e-HM+Multistage+Pump+Technical+Brochure.pdf
FSI X 1000 Filter Housings	http://www.fsifilters.com/assets/files/literature/x100-convertible-filter-housing.pdf
Tecumseh AWA4520EXNXC Condensing Unit	https://www.tecumseh.com/globalassets/media/north-america/files/marketing-brochures/tc-013-idcu-catalog-rev-2-030615.pdf
Liberty 405 Sump Pump	https://www.libertypumps.com/Portals/0/Files/Install%20Manuals/7212000.pdf
Hudson Float Valve	http://hudsonvalve.com/products/
Ashcroft Pressure Gauge	http://ashcroft.com/drawingsandmodels_pdf/upload/drawing-industrial-gauge-10-100s-02l.pdf
RANCO ETC-111000	http://www.rancoetc.com/ranco-etc-111000-000-digital-temperature-controller
24 VDC power supply optional	https://cdn.automationdirect.com/static/specs/rhinopsp.pdf
Digital Panel Meters optional	https://cdn.automationdirect.com/static/specs/prosensedpm3.pdf
Pressure Transducer optional	https://cdn.automationdirect.com/static/specs/prosensespt25transmitters.pdf
Temperature Transmitter optional	https://cdn.automationdirect.com/static/specs/prosensextpttp.pdf
Liquid Level Sensors optional	https://cdn.automationdirect.com/static/specs/prosensevflswitches.pdf



SYMBOL LEGEND

Ball Valve	Flow Direction Indicator
Check Valve	Pressure Gage
Chiller	Pressure Regulating Valve
Filter	Pump
Gate Valve	Sensing Instrument
Floater Valve	Rotometer

PUMPS

	US	EU
PUMP 1	GOULD 3HM07N11T6P9QE	GOULD 3HM10N151T6P9QE
PUMP 2	GOULD 3HM04N05T6P9QE	GOULD 3HM04N05T6P9QE

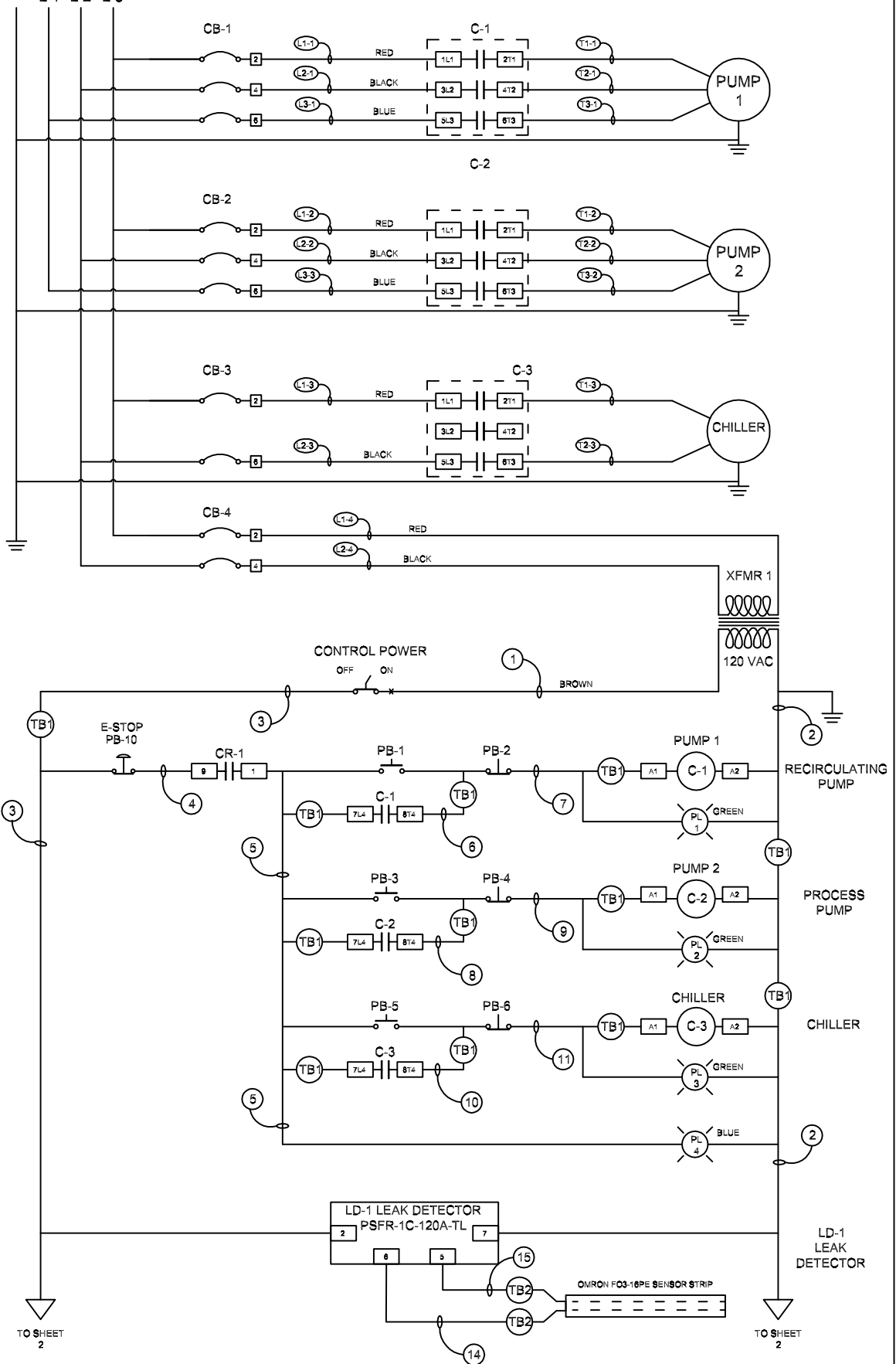
NOTES:
 1. ROTOMETER ADDED BY P&S. VALUE ADDED TANK DRAIN VALVES MOVER SPINDLE COOLANT RELIEF VALVE

DRAWN	C. VALENZE	DATE	01-10-2021
REVISION		DATE	
CHKD		DATE	

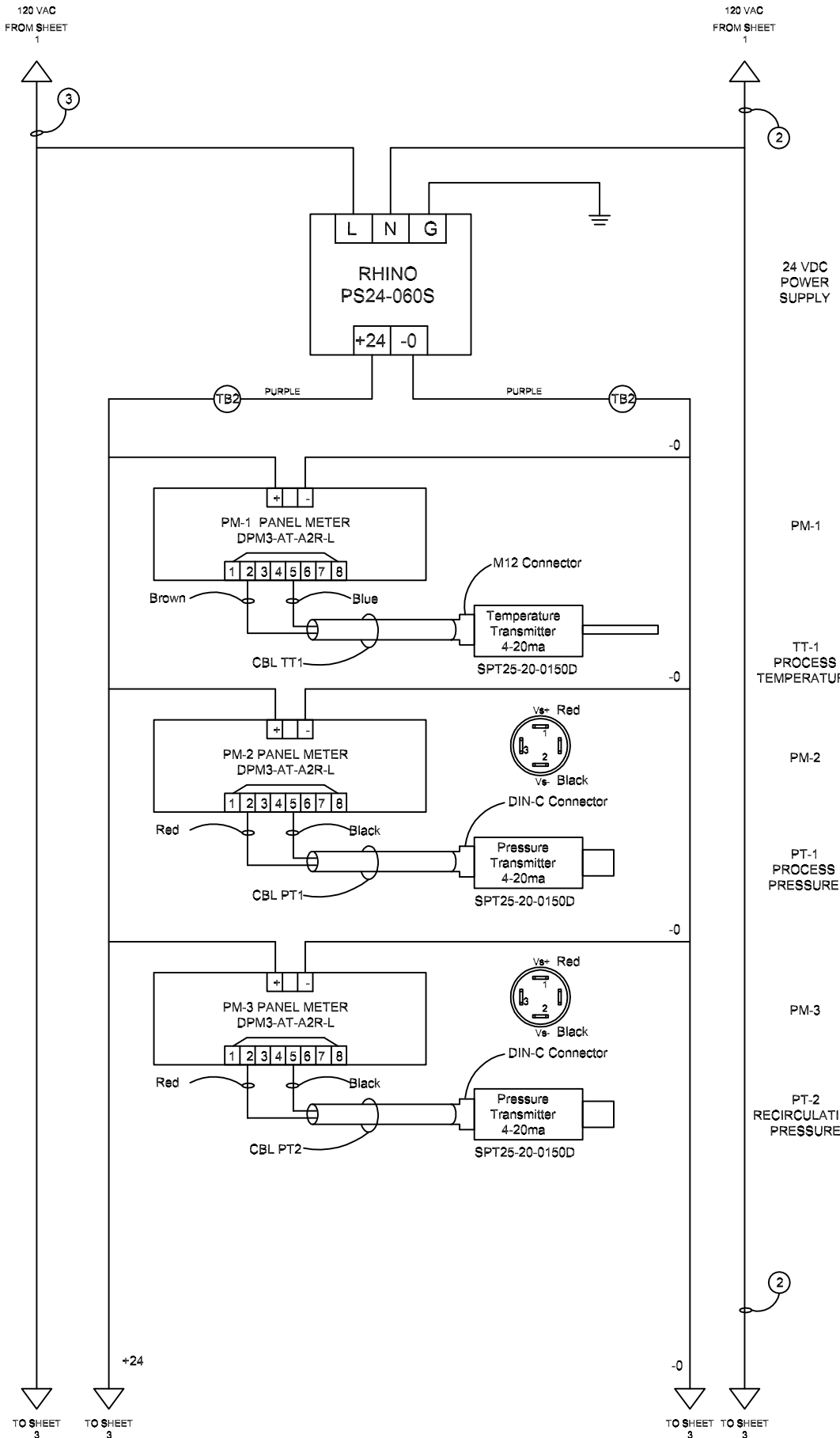
TITLE		HST SPINDLES	
WFS-1040 1545 PLUMBING SCHEMATIC		SIZE	A
DWG'NG	WFS 149000	REV	A
SHEET 1 OF 1			

230 VAC 50 Hz

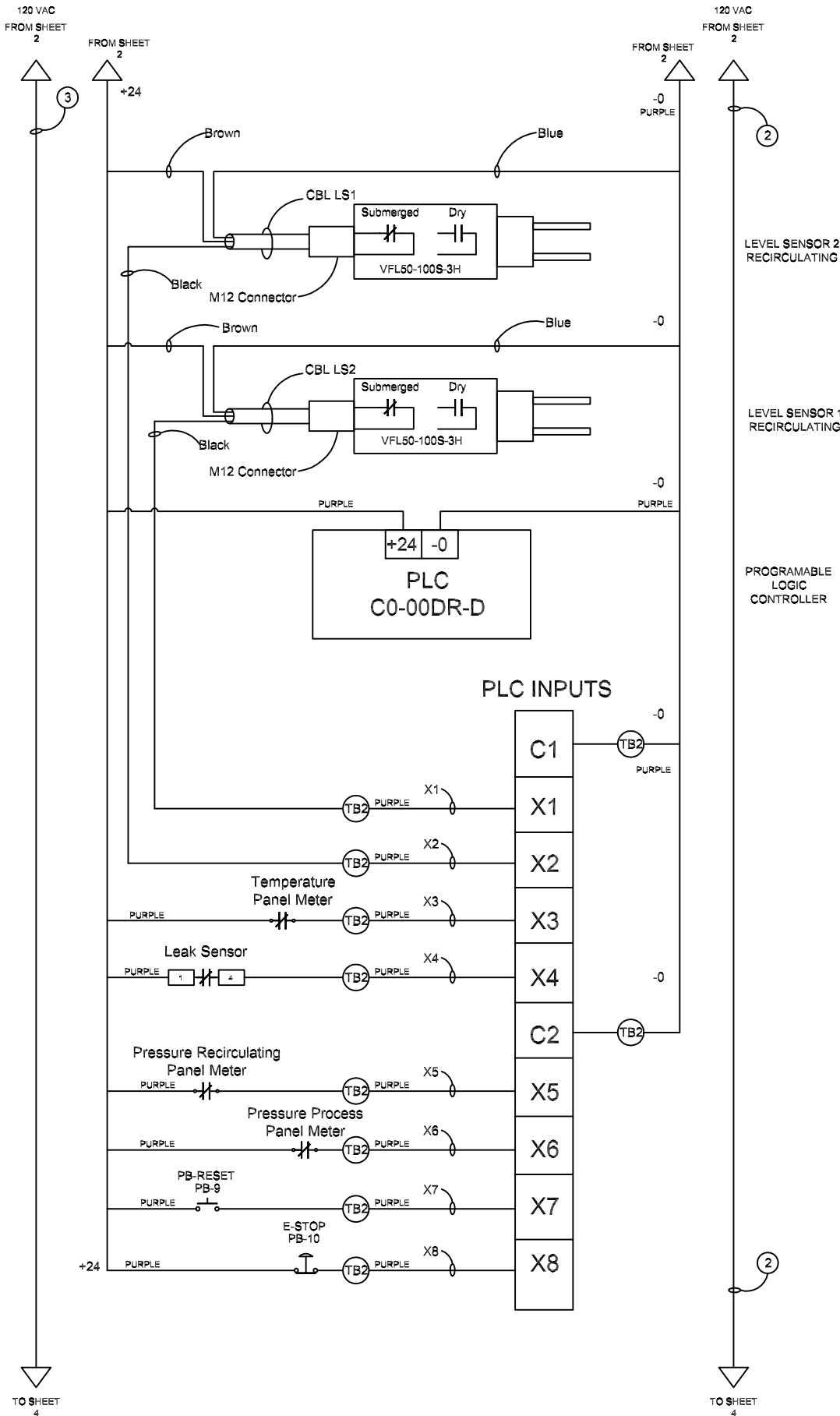
L 1 L 2 L 3



DRAWN C. VALENZE CHKD	DATE 12-24-2020	SIZE A	DWG No. WFS 159100	REV A
	DATE			
TITLE HST SPINDLES LLC 1367 ROUTE 3A, BOW, NH 03304		WFS-1040 / 145 ELECTRICAL SCHEMATIC WITH PLC V1		
SHEET 1 OF 5		TO SHEET 2		

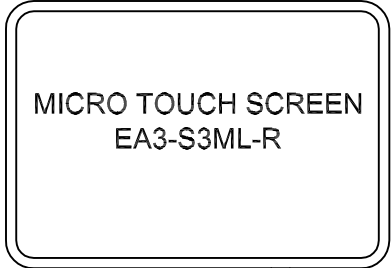


DRAWN C. VALENZE	DATE 12-24-2020	SIZE A	DWG No. WFS 159100	REV A
CHKD				
HST SPINDLES LLC 1357 ROUTE 3A, BOW, NH 03304 WFS-1040 / 145 ELECTRICAL SCHEMATIC WITH PLC V1				
SHEET 2 OF 5				



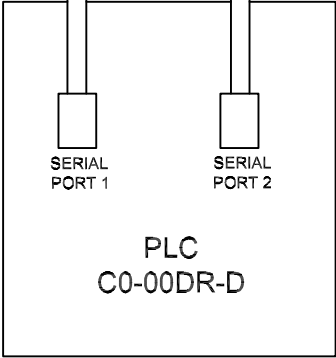
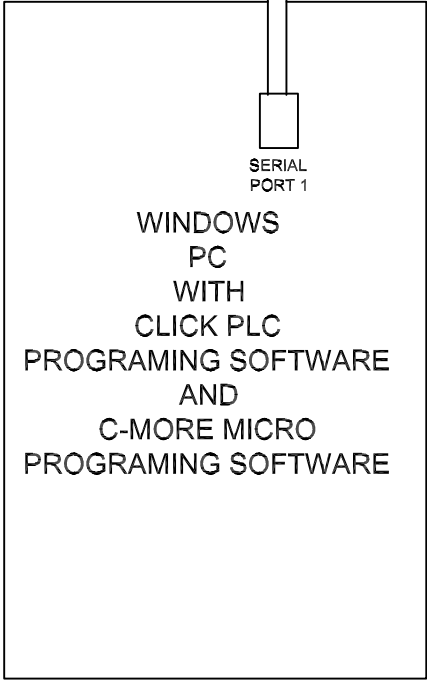
DRAWN C. VALENZE	DATE 12-24-2020
CHKD CHKD	DATE

SIZE A	DWG No. WFS 159100	REV A
TITLE HST SPINDLES LLC 1367 ROUTE 3A, BOW, NH 03304 WFS-1040 / 145 ELECTRICAL SCHEMATIC WITH PLC V1		
SHEET 3 OF 5		



DV-100
GRAPHIC INTERFACE CABLE

EA-MG-PGM-CBL
PROGRAMING INTERFACE CABLE



DRAWN C. VALENZE CHKD	DATE 12-24-2020 DATE	SIZE A	DWG No. WFS 159100	REV A
HST SPINDLES LLC 1367 ROUTE 3A, BOW, NH 03304		TITLE WFS-1040 / 145 ELECTRICAL SCHEMATIC WITH PLC V1		
SHEET 5 OF 5				