ORIGINAL INSTRUCTIONS

Installation and Operation

Water Filtration System

WFS – 101545

Serial Number: _____

HST Spindles, LLC.

1357 Route 3A

Bow, NH 03304 USA

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WFS 101545 Operations Manual

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SECTION I OVERVIEW

1) 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 101545 with serial numbers 210610 and higher. 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.

2) GENERAL DESCRIPTION

The WFS 101545 filtration system was specifically engineered to provide temperature-controlled water for wafer dicing and similar processes. The system permits re-use of process and cooling water used for dicing or grinding semiconductor wafers. The WFS 101545 provides complete water conditioning packaged on a compact rigid skid. The valving and redundant features allow for change out of filter elements and resin beds without process interruption. The unit provides the following water conditioning:

- Cooling by refrigeration
- Filtration
- Deionization[1]

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

[1] Deionization is accomplished by customer supplied resin beds. The unit provides valving and space for three 14" diameter resin beds.

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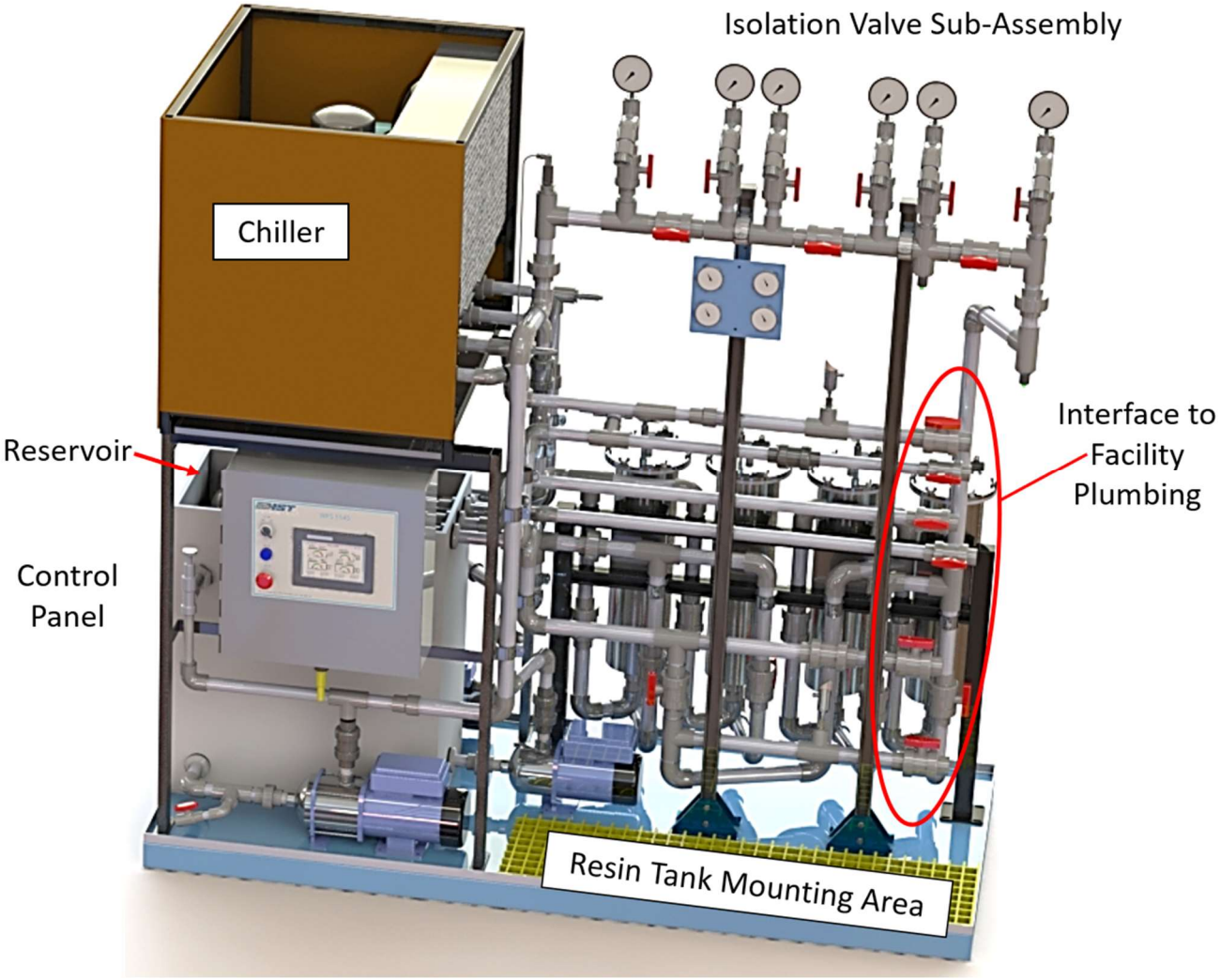


The WFS 101545 provides economies in two ways:

- Significantly reduces DI water consumption by reconditioning and reusing the water.
- Eliminates or reduces contaminated or hazardous liquid waste disposal by filtering out contaminates into a removable cartridge. The cartridge can be dried and the waste material can then be handled as solid waste.
- The unit uses standard 2.5 x 20” filter elements. These come in a wide variety of configurations. They are available from numerous commercial sources so the end user is free to source them from their preferred vendor. The end user is not forced to go to the OEM to purchase consumables.

The system provides two (2) separate cooling circuits. One is specifically for cooling the dicing or sawing process. The other provides cooling water to the spindle or drive motors. Used process water is cooled by refrigeration, filtered and deionized. Used spindle cooling water is cooled by refrigeration in a separate circulating loop.

In addition to the built-in filtering and refrigeration capabilities, the WFS has provisions to accept three (3) customer supplied 2.5 cubic foot (70.8 liter) resin tanks for additional filtering and/ or deionization.

The system has three water circulating loops:

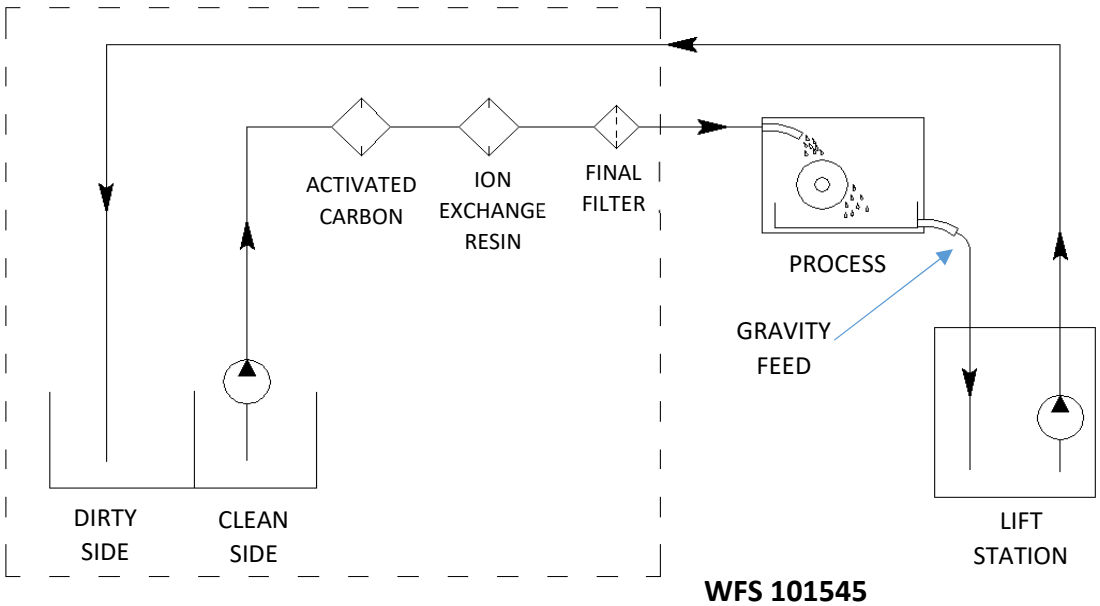
- Process Loop
- Spindle Loop
- Internal Recirculating Loop.

Additionally, a separate Lift Station pump is provided to return process water back to the WFS.

a. Process Loop

The Process Loop recirculates temperature controlled, filtered and deionized water for dicing and grinding. It is rated to provide 15 GPM at 45 PSI.

SIMPLIFIED SCHEMATIC OF THE PROCESS LOOP

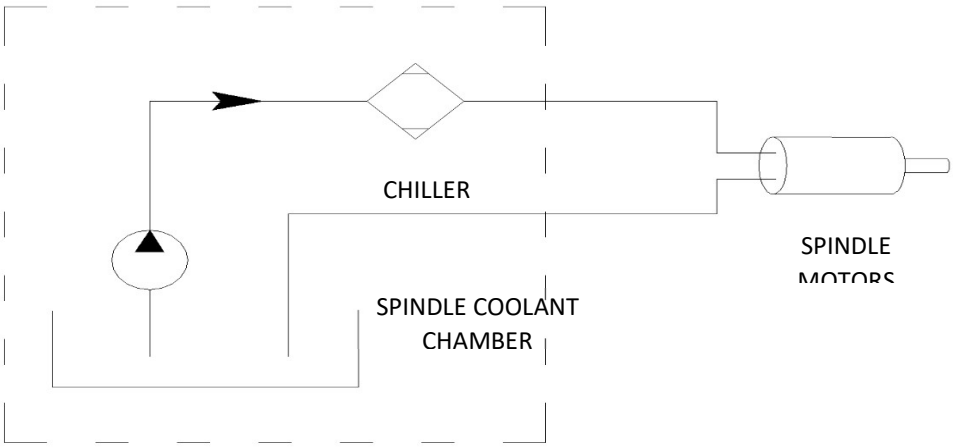


WFS 101545

b. Spindle Loop

This loop recirculates water cooled by refrigeration for the dicing spindle motors.

SIMPLIFIED SCHEMATIC OF THE SPINDLE

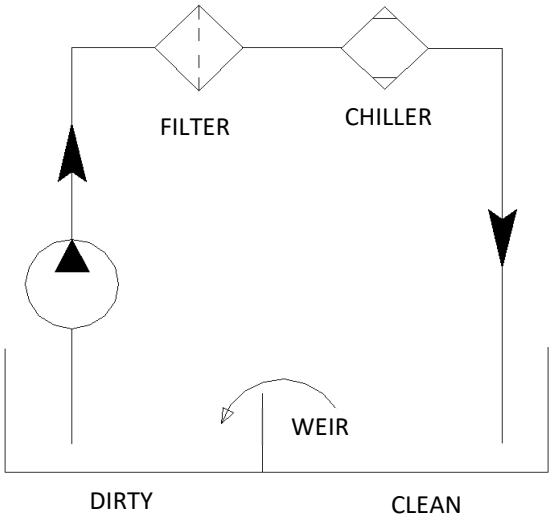


The spindle coolant loop is rated at 10 GPM at 45 PSI

c. Internal recirculating Loop

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

SIMPLIFIED SCHEMATIC OF THE INTERNAL RECIRCULATING LOOP



WFS 101545

d. Lift Station

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

3) SPECIFICATIONS

a. Pump 1

Recirculating water

- Gould # 5HM04N11T6PBQE
- 25gpm
- 45psi

RECIRCULATING WATER			
PRESSURE		FLOW	
PSI	Mpa	GPM	LPM
45	0.31	30	114

b. Pump 2

Process Water

USA ONLY
Gould 3HM07N11T6PBQE

- 1.5hp
- 15gpm
- 75 psi max

EU ONLY Gould
3HM10N151T6PBQE

- 2.0 HP
- 15gpm
- 75 psi

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

c. Pump 3

Spindle Water

Gould # 3HM04N05T6PBQE

- 1 hp
- 10gpm
- 50psi

SPINDLE WATER			
PRESSURE		FLOW	
PSI	Mpa	GPM	LPM
45	0.31	10	38

d. Chiller

The chiller operates two zones; Zone 1 Process and Zone 2 Spindle. Each zone has approximately 1/2 of the total chiller capacity.

WFS 101545 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 uses a Copeland FFAP-03OZ condensing unit with a two custom made evaporator units. It requires 208 -220 VAC 50-60 hz three phase electrical power.

The evaporators use custom made titanium evaporation 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.

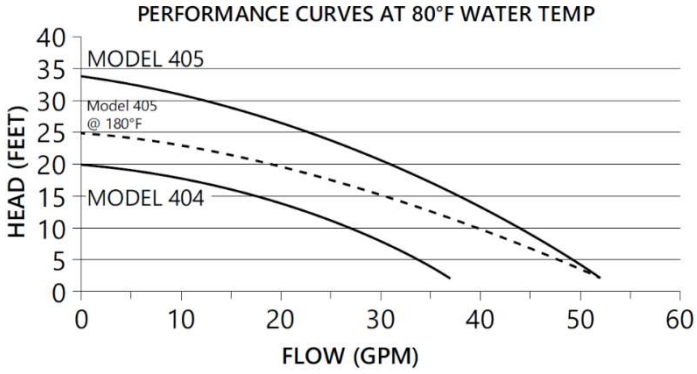
Copeland FFAP-03OZ

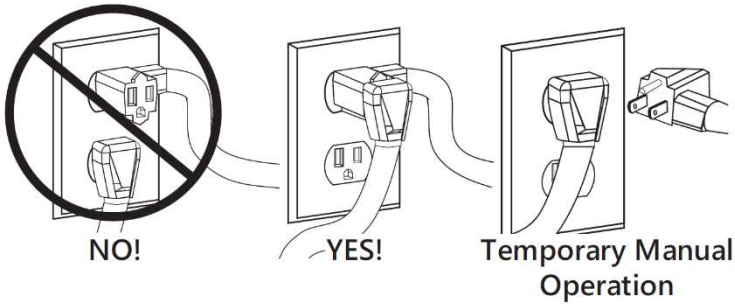
Model	Capacity (BTU/Hr) 90° Amb, 25° Evap				90° Amb, -20° evap
	R-404A	R-134a	R-407C	R-22	R-404A
FFAP-030Z	21,600	14,100	19,700	20,800	8,330

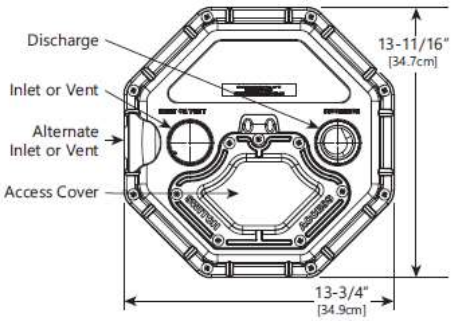
e. Lift Station

This is a self contained pumping system with internal reservoir and float switch. It is designed to collect water from the open-loop process and return it to the WFS. It utilizes a Liberty 405 Sump Pum with associated check valve

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







f. Filtration

The WFS uses proprietary stainless-steel housings that require three 20" disposable filter cartridges for filtration of the process water. The filters housings are arranged in two parallel sets of two. One set of two filters for the Internal Recirculating Loop and one set of two filters for the Process Loop.

Valving is provided to isolate any single filter housing to permit filter element change out without process interruption.

i. Filter Housings

The filter housings are manufactured from 304 stainless steel and rated for 100 psi maximum pressure and 110^{o} F degrees maximum temperature. 316 stainless is available at special order.

ii. Filter Elements

Each filter housing is designed to hold three cartridge type filter elements 20in x 2.5in. 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. Filter elements are customer supplied and can be sourced from a variety of providers.

iii. Gauges

Each filter housing has a pressure gauge remote mounted and displayed facing the control panel. These gauges provide indication of the filter condition. The filter elements should be changed when the gages indicate a pressure increase in excess of 15 PSI or in accordance with the filter element specifications.

g. Reservoir

The reservoir is made from polypropylene and divided into three chambers referred to as the Dirty Side, the Clean Side and Spindle. The reservoir allows return water accumulation to prevent pump cavitation. It also provides a certain amount of dwell time to allow heavy particulate to settle out.

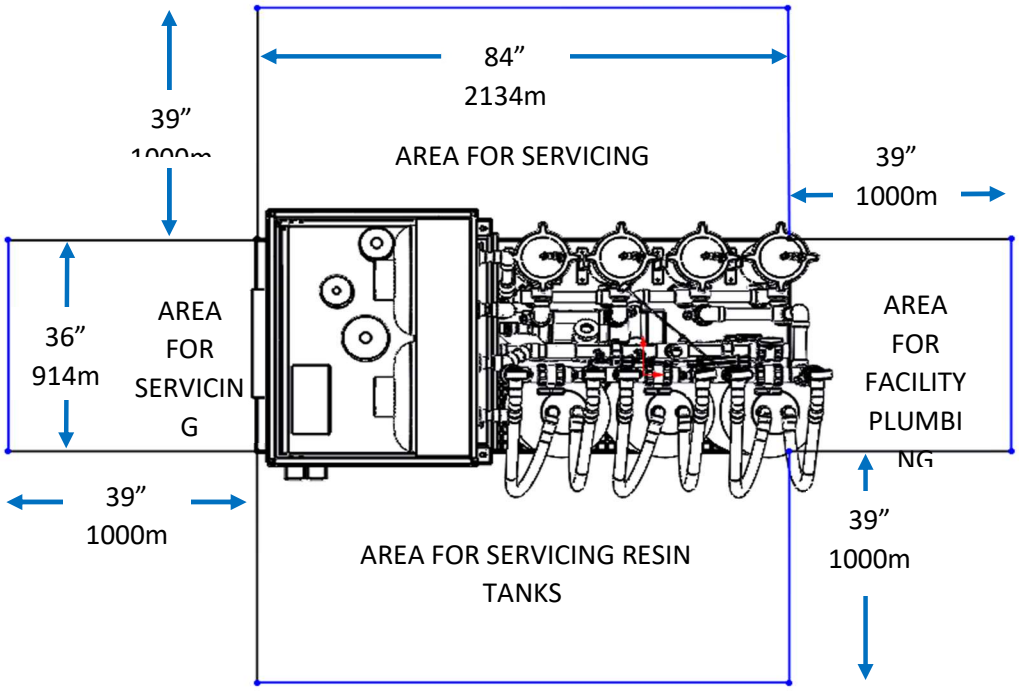
Two independent float valves maintain the proper fill levels in Dirty Side and the Spindle chambers. These valves compensate for minor losses due to evaporation or small leaks and splashing resulting from the process.

RESERVOIR CAPACITY GALLONS		
CHAMBER	**BRIM FULL**	**NOMINAL**
ALL	51	35
CLEAN SIDE	8.5	8.5
DIRTY SIDE	13	10.5
SPINDLE	20.6	16

4) SETUP

a. Floor Space

Prior to installation consider the space required for proper servicing. Figure 4-1 provides recommended clearances for servicing the various components on the WFS 101545.



RECOMMENDED FLOOR SPACE FOR SERVICING THE WFS 101545

FIGURE 4-1

b. Uncrating

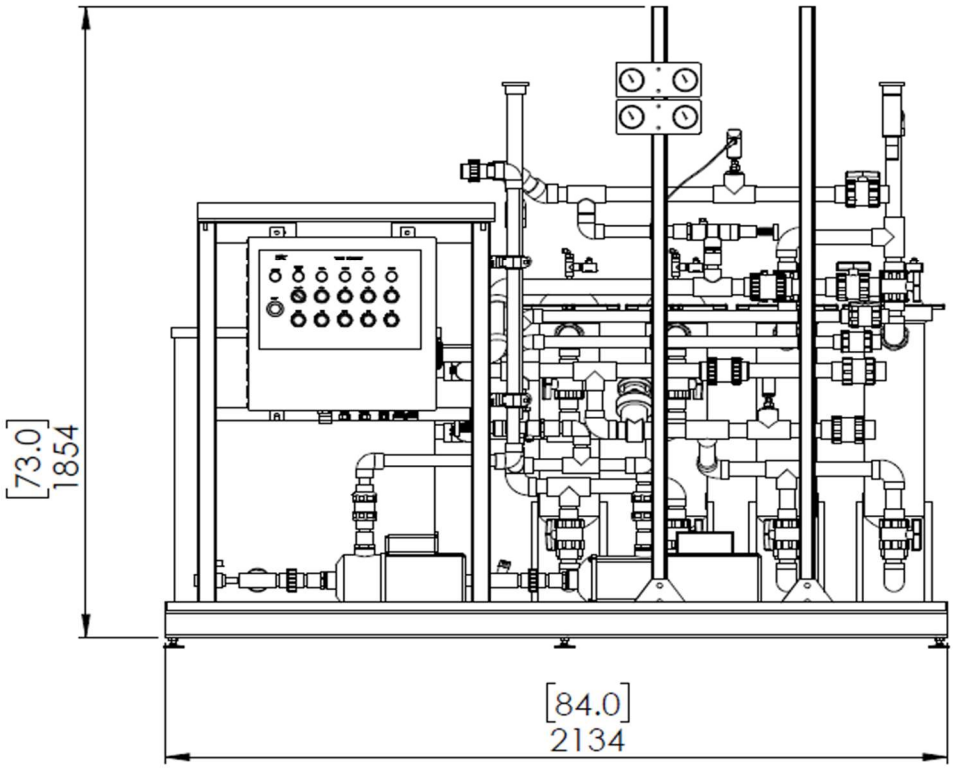
NOTE: Inspect “Tip and Tell” and shock indicators mounted on the outside of the crates for indication of mishandling and potential damage during shipment.

The outside of the crate 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.

The refrigeration unit is shipped in the smaller crate. The WFS base assembly and the Isolation Valve Sub-Assembly are both contained in the larger crate.

Inspect both crates and report any damage to the carrier and the OEM before proceeding.

Figure 4-2 shows the minimum door height clearance required to accommodate passage of the main WFS platform prior to assembly.



FRONT ELEVATION

FIGURE 4-2

c. Electrical Power Requirements

WFS requires the following:
3 phase 40 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 Base

Prior to assembly the base must be properly leveled and supported at six (6) points. Figure 4-3 shows the leveler location. A standard spirit or bubble level will provide sufficient accuracy for leveling the unit.

Before verifying that the platform is level, insure all six of the leveling legs are firmly on the floor. If any leg is not touching the floor, adjust by loosening the [visible] copper plated leg 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 (copper plated) 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.

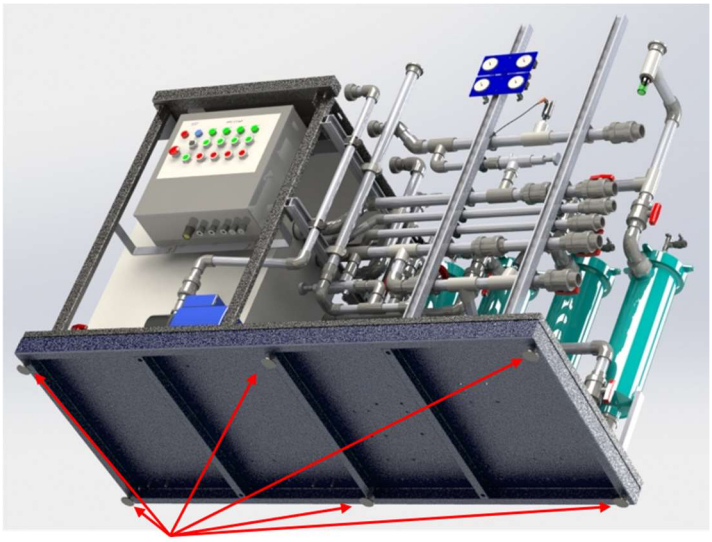


FIGURE 4-3

e. **Assembly**

The Isolation Valves Sub-Assembly (IVSA) and the Chiller must be installed on site. Figure 4-4 The chiller unit is shipped in a separate crate and the Isolation Valves Sub-Assembly is shipped in the same crate as the main unit.

i. Isolation Valve Sub Assembly Installation (ISVA)

CAUTION: Use care to not damage the Resitivity Sensor wires when removing the retaining straps that secure the IVSA during shipment and when installing the IVSA.

CAUTION: Use care when connecting the IVSA unions. Make sure the O-Rings are properly seated. Do not cross thread parts. Do not over tighten.

NOTE: The connector for the pressure transducer is keyed. One tab is slightly larger than the other.

NOTE: Check for leaks during commissioning

Support the IVSA as the retaining straps are removed. Lift and place the unit on the associated unions and clamp to the vertical strut channel. Verify that the O-rings are properly seated and tighten the unions.

Install the connector on cable CBL-PT2 on the pressure transducer. Tight the center screw.

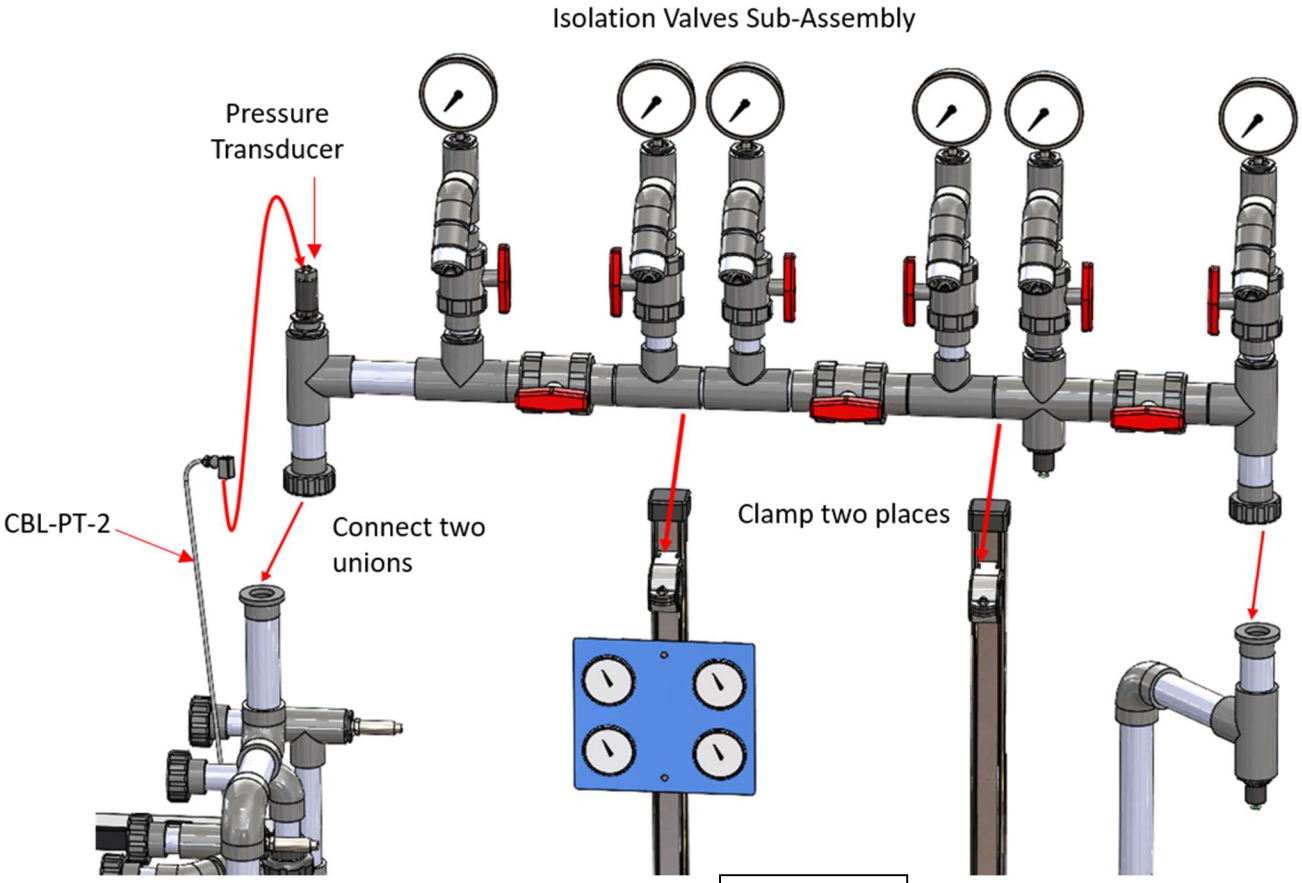


FIGURE 4-4

ii. Preparing The Chiller for Installation

- Remove the chiller from its crate and inspect for damage.
- Remove the drip pan and the four carriage bolts from the Chiller Support Frame.
- Install the carriage bolts into the four slots on the chiller base.
- Install the Drip Pan
- Thread the Power Cord and Solenoid Control Cord through the Drip Pan See Figure 4-5

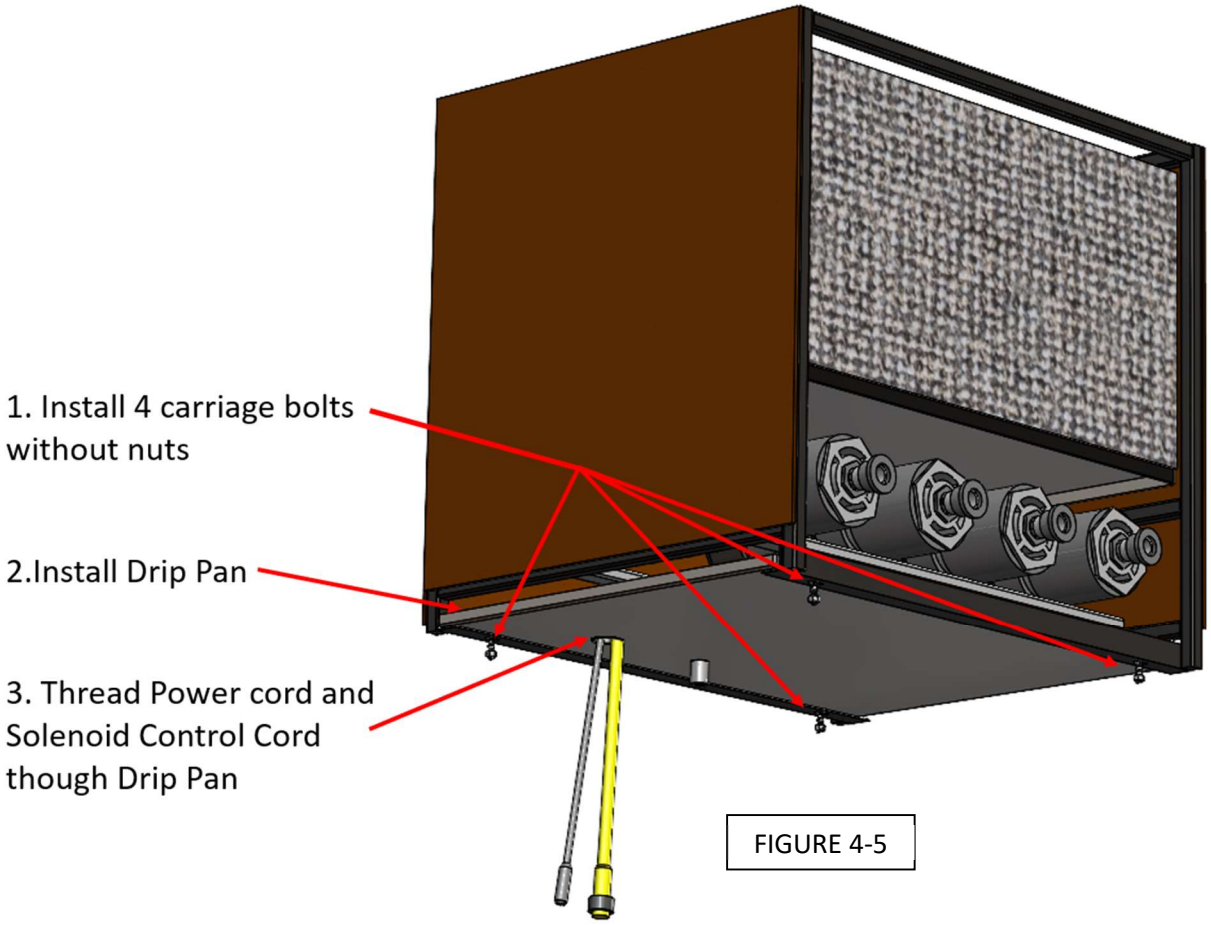


FIGURE 4-5

iii. Installing The Chiller

CAUTION: The Chiller is heavy and awkward. Use proper equipment and personnel for installation.

CAUTION: Ther may be sharp edges on some of the metal parts use proper Personal Protective Equipment (PPE)

CAUTION: Use care when connecting the chiller unions. Make sure the O-Rings are properly seated. Do not cross thread parts. Do not over tighten.

NOTE: Check for leaks during commissioning

Carefully place the prepared chiller on the Chiller Support Frame so the four carriage bolts fall into the slots on the Support Frame.

Ease the chiller into a position where all four unions line up with the mating parts. The union faces must be "flat" to one another. **Verify that the O-rings are in place**. Tighten the union.

Install washers and nuts on the carriage bolts and tighten.

Connect the Power Cord and the Solenoid Control Cord to the round receptacles on the bottom of the Control Panel. See Figure 4-6

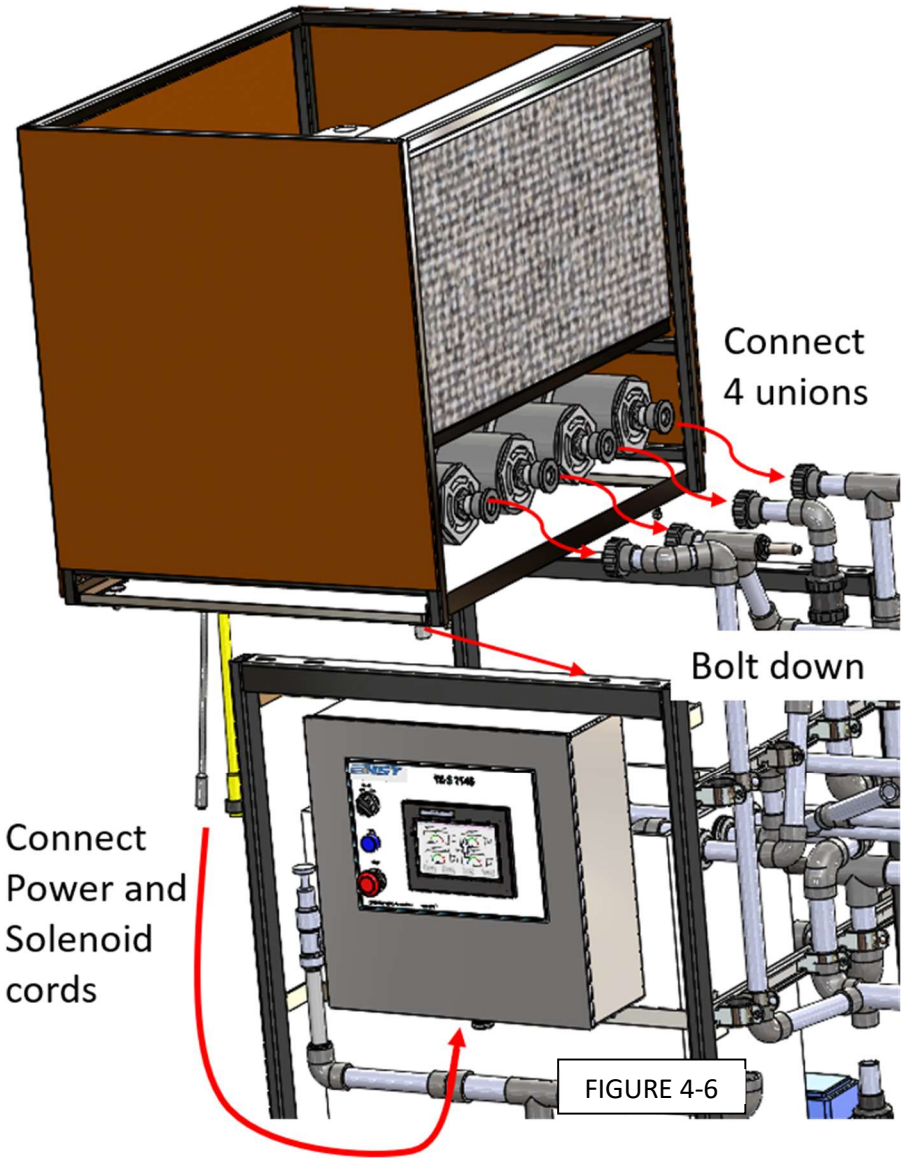


FIGURE 4-6

f. Facility Interface

i. Plumbing Connections

There are six (6) facility plumbing connections to the WFS Unit.

- Make-up Water for the Spindle Coolant Circuit
- Make-up Water for the process Cooling circuit

- Spindle Cooling Supply
- Spindle Cooling Return
- Process Cooling Supply
- Process Cooling Return

Figure 4-7 shows the approximate location of the plumbing connections.

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

The connection for the for the Process Coolant Make-Up Water is 1" NPT. This water source can be from water deionized by another source or from clean ordinary tap water.

The connection for the Spindle Cooling Supply is 1-1/4" NPT. This provides water cooled by refrigeration to cool the spindle motors. This is a "closed-circuit" loop circuit and does not require a lift station.

The connection for the Spindle Cooling Return is 1" NPT. This connection directs return water from the spindle cooling loop back to the reservoir.

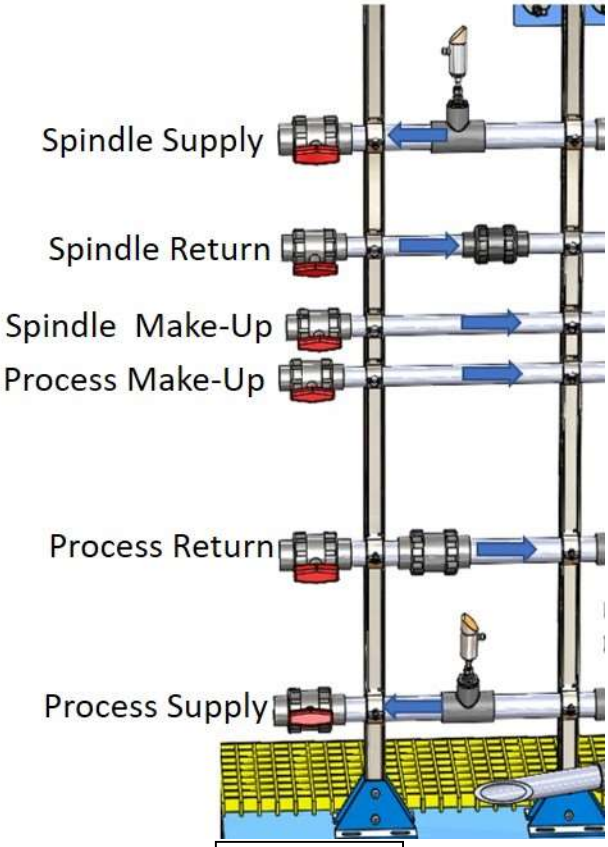


FIGURE 4-7

The connection for the Process Cooling Supply is 1-1/4" NPT. This provides water filtered, de-ionized[2] 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.

ii. Electrical Hook-Up

The unit requires three (3) phase 220 VAC 60 Hz 40 Amp or 230 VAC 50 Hz 40 Amp power with grounding wire.

[2] Deionization is accomplished by customer supplied resin tanks.

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 4-8.

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

WARNING: Only qualified and licensed personnel should install facility wiring.

WARNING: Electrical Shock hazard

NOTE: All pumps and the chiller have been "phased" together. If pump rotation is not correct during commissioning change wire phase ONLY AT FACILITY CONNECTION.

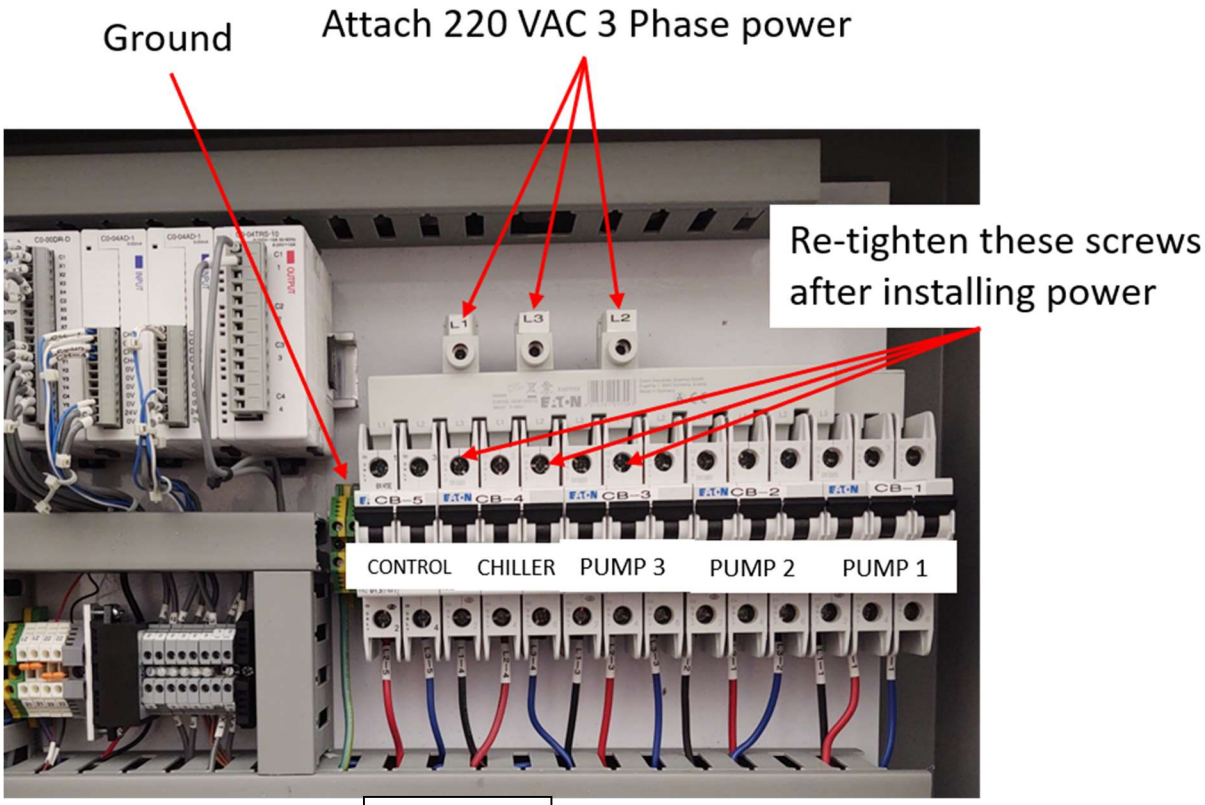


FIGURE 4-8

5) OPERATOR CONTROLS

Other than the mechanical ON/OFF switch and the E-Stop push button all controls are through a touch screen HMI. See Figure 5-1

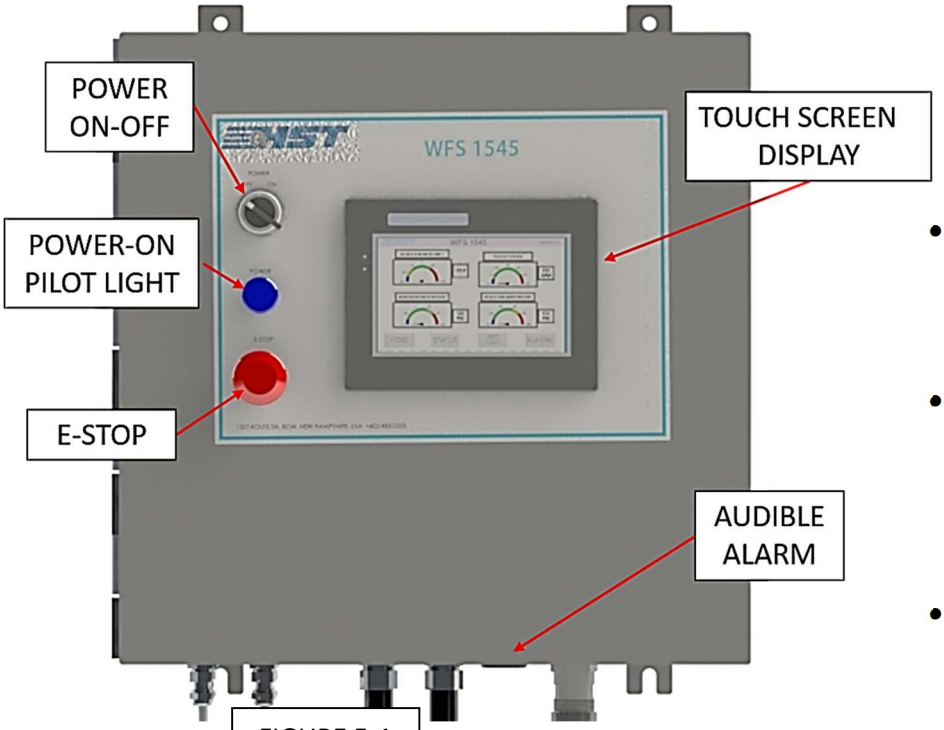


FIGURE 5-1

WARNING!

The Control cabinet contains High Voltage electrical connections.

- 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

Operator controls consist of four components

- Power ON-OFF selector switch
- Power On Pilot Light
- E-Stop detented push button
- Touch Screen HMI

a. Power ON-Off Selector Switch

This switch activates the control power. This turns control power on.

WARNING: This switch **DOES NOT** turn off AC power within the control cabinet. High Voltage AC current is still on inside the cabinet even when this switch is in the OFF position. Disconnect power from outside source before opening the control cabinet.

b. 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.

NOTE: Control Power remains on even with this switch depressed.

c. Power On Pilot Light

This is illuminated when electrical power is on to the control system.

d. Audible Alarm (Optional)

An audible alarm is sounded if a fault condition is detected. See ALARMS section **5.e.vi**

e. Touch Screen HMI Display Panel

All functions other than Power ON-OFF or E-Stop are controlled or displayed through the Touch Screen HMI. These include the following:

- Pump and Chiller Start-Stop
- Temperature Set-Points
- Alarm Set Points
- Alarm On-Off
- System Status

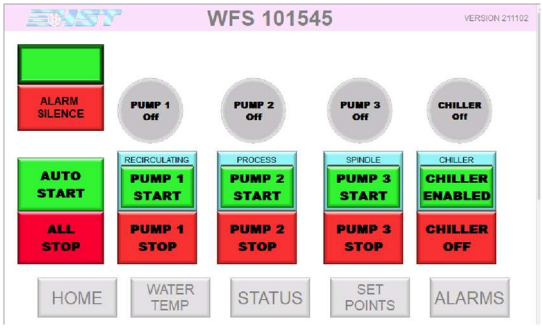


FIGURE 5-2

The Touch Screen can display four (5) different pages:

- Home
- Water Temperature
- Status
- Set Points
- Alarms

Each page provides certain specific information and provides control or settings.

i. Page Selection

Each page displays the five different page selections at the bottom. An operator can go to any page at any time.

- Two pages are used to program the various set points: WATER TEMP and SET POINTS.
- One page is used to start the pumps and provide alarm condition: HOME PAGE
- One Page displays the data from all the transducers such as pressures: STATUS
- One page displays specific alarms: ALARMS

ii. Home

On initial start up the HOME pages is displayed. This page provides the following control, information or access. See Figure 5-3

- Page Selection
- Pump / Chiller On-Off push Buttons
- Pump / Chiller On-Off Indicating Lights
- Alarm Status and Control
- E-Stop Depress notification
- Pump Requirement Notification

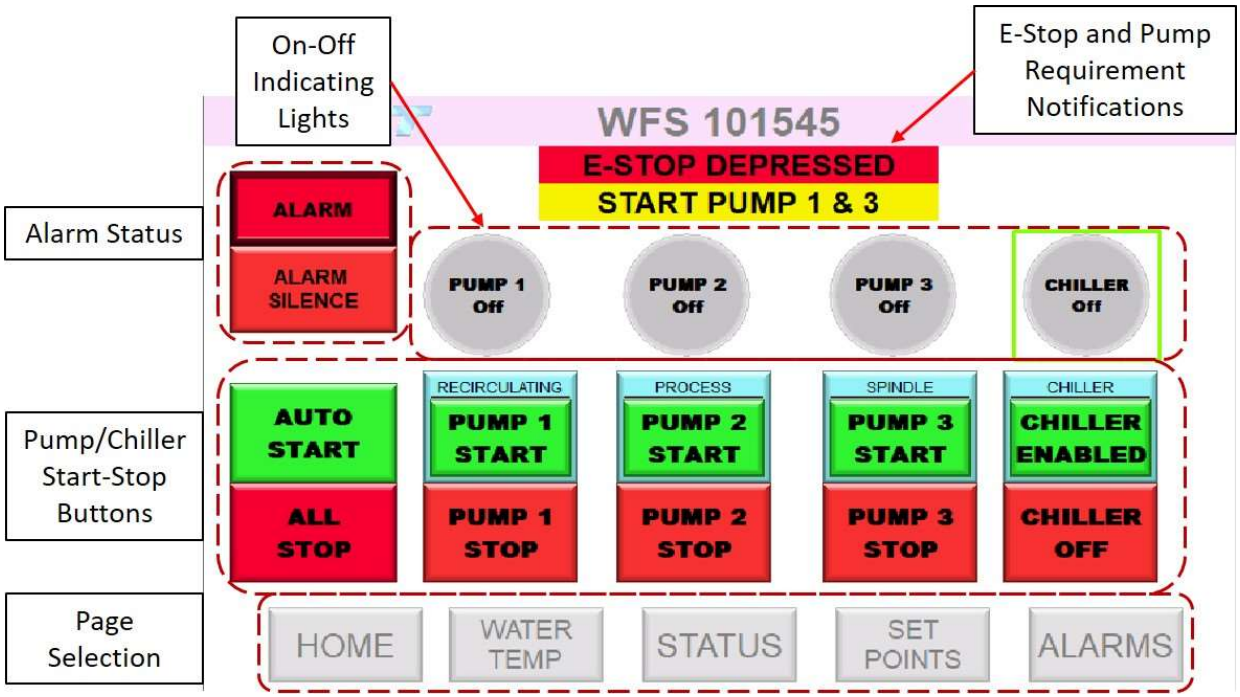


FIGURE 5-3

START / STOP / ENABLE The pumps are started and stopped and the chiller is enabled by pressing the appropriately labeled push button. If conditions permit (no critical alarms) each pump will start or stop immediately when the associated button is touched. The chiller is only enabled. The chiller will only run if the temperature controller is calling for cooling.

When a pump is running or the chiller is enabled the associated indicating light will illuminate.

NOTE: To prevent freezing in the evaporator tubes the chiller can only be enabled when Pump 1 and Pump 3 are both running. If the Chiller Enable button is selected when either of these pumps are not running a yellow indicating message will appear notifying the need to first start these pumps.

NOTE: The chiller has an automatic "BUMP START" feature that may cause the chiller to start momentarily and stop three times before starting continuous operation. This is normal.

AUTO START/STOP After initial set-up, the start-up sequence can be initiated by pressing AUTO START. This will start the pumps in proper sequence and enable the chiller to run on demand. The ALL STOP button does exactly what it says.

ALARM When there is an alarm condition an audible tone will pulse and the "ALARM" light will illuminate. Touching the "ALARM SILENCE" button will silence the audible tone

for 10 minutes. The ALARM indicating light will remain illuminated reminding the operator that there is an alarm condition.

FIGURE 5-4

The Alarm indicator may illuminate along with an audible alarm tone for a brief moment during start-up until the process flow exceeds set point.

To view the specific cause of the alarm, select the ALARMS page.

NOTE: This does not clear or cancel the fault that caused the alarm.

E-STOP DEPRESSED This notification simply lets the operator know that the E-Stop button is depressed and needs to be manually pulled out before the system can be started

FIGURE 5-5

iii. Water Temp

The water temperature for the Zone 1 Recirculating Water and the Zone 2 Spindle Water is set on this page. The controls for each zone are labeled. The page also displays an analog indication of the actual water temperatures. See Figure 5-6

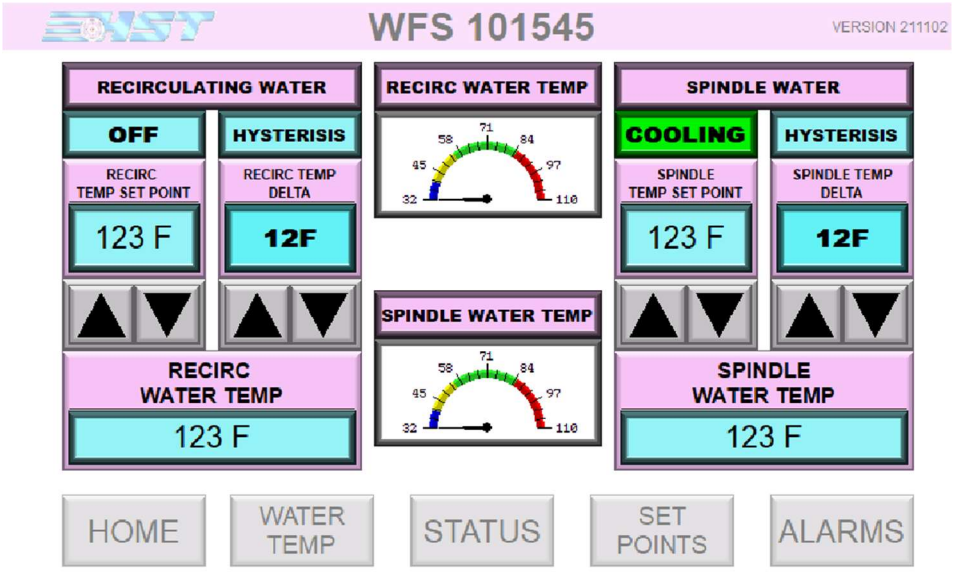


FIGURE 5-6

TEMP SET POINT The desired water temperature is set using the UP/DOWN arrows. The set point is displayed above the arrows (TEMP SET POINT) and the actual temperature is displayed below (WATER TEMP).

The indicating light above TEMP SET POINT displays the status of the chiller and whether or not the system is calling for refrigeration. Actual cooling is only done when the Chiller compressor is running.

TEMP DELTA (HYSTERISIS) This prevents the compressor motor from rapid cycling or "chattering". This sets the hysteresis for the chiller operation. When the controller senses that the recirculating water temperature is higher than the TEMP SET POINT the cooling cycle will start. It will continue to cool the water until the temperature is below the set point by the amount set on the TEMP DELTA. For example, if the TEMP SET POINT is set for 70°F and the TEMP DELTA is set for 3°F the cooling cycle will start when the water temperature reaches 70°F (after a predetermined internal delay). The cooling cycle will stop when the water temperature drops below 67°F (70-3).

The set point range is from 1° to 10°F. Factory default is 3°.

NOTE: There may be a delay before the cooling cycle stops even after the temperature is below the TEMP DELTA

The Chiller compressor will run only if the following conditions are met.

- Recirculating Pump (PUMP 1) is running
- Spindle Water Pump (PUMP 3) is running
- CHILLER is enabled or ON.
- The water temperature is above the set point or the Chiller has been running and has not reached TEMPERATURE DELTA (HYSTERISIS) set point.
- Internal time delays have been satisfied

iv. Status

The STATUS page can be accessed from any other page simply by touching the STATUS button at the bottom of the current page. See Figure 5-7

The STATUS page was designed to provide a quick overview of the WFS system status. The page provides a digital and analog display of the following parameters:

- SPINDLE FLOW (GPM)
- SPINDLE WATER TEMP (°F)
- PROCESS FLOW RATE (GPM)
- PROCESS PUMP PRESSURE (PSI)
- RECIRCULATING WATER TEMPERATURE (°F)
- RECIRCULATING PUMP PRESSURE (PSI)

This page does not permit any changes to the various set points.

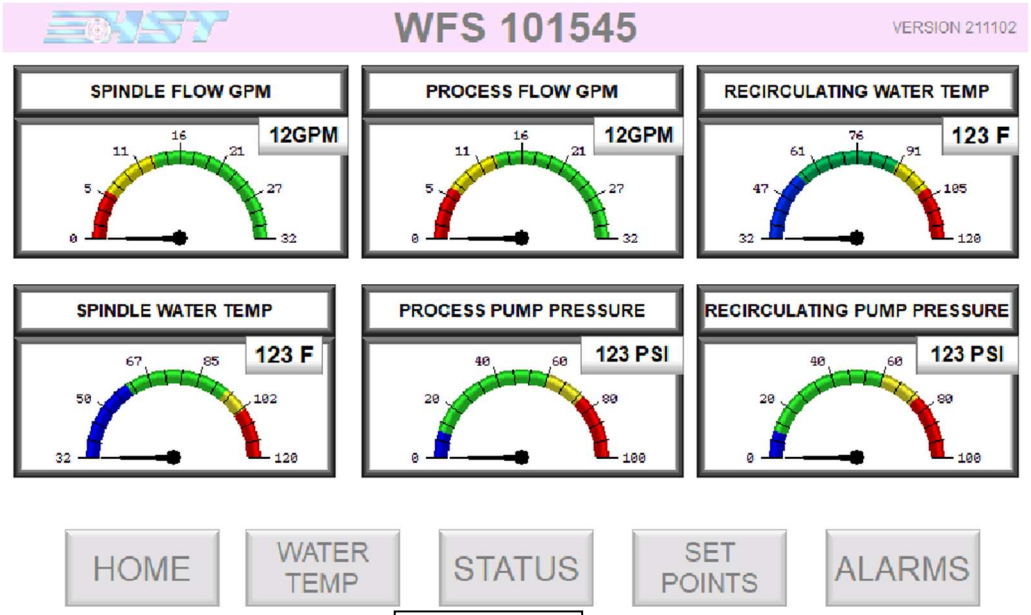


FIGURE 5-7

v. Set Points

The SET-POINT page can be accessed from any other page simply by touching the SET POINTS button at the bottom of the current page. It also provides a digital display of the current process status. See Figure 5-8

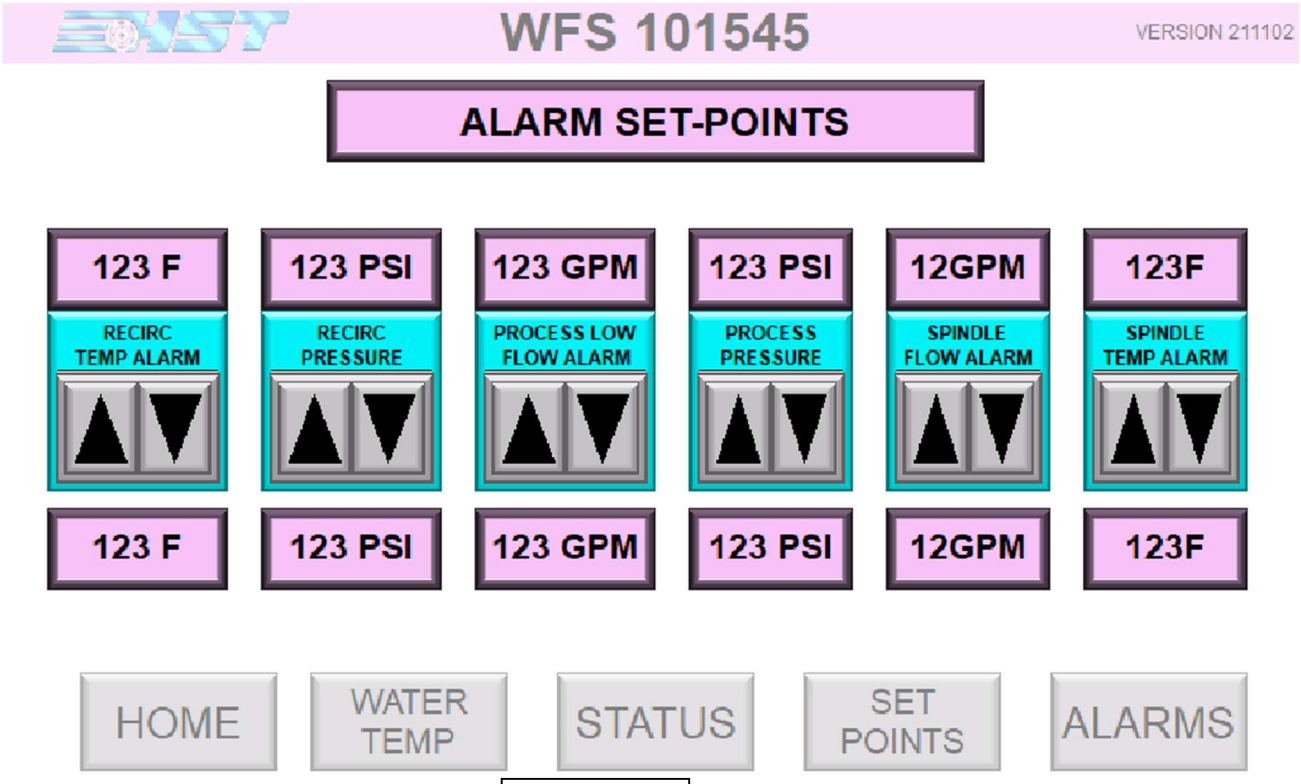


FIGURE 5-8

This page permits the operator to select the trip point for when an alarm notification will be triggered. It can be used to notify when the filter needs to be switched over. It can provide notification if a critical process parameter is exceeded. For instance, if a maximum temperature for the process water was 75°F the TEMP ALARM could be set for that temperature and would trigger an alarm if it was exceeded.

Factory Set Points:

- RECIRC TEMP 80°F
- RECIRC PRESSURE 63 PSI
- PROCESS LOW FLOW 7 GPM
- PROCESS PRESSURE 63 PSI
- SPINDLE LOW FLOW 7 GPM
- SPINDLE TEMP 80°F

vi. Alarms

Audible alarms are triggered when a parameter is outside of the ALARM SET-POINT operating window or if a leak is detected. The ALARM PAGE displays which specific parameter is initiating the alarm and allows the alarm to be disabled. Figure 5-9

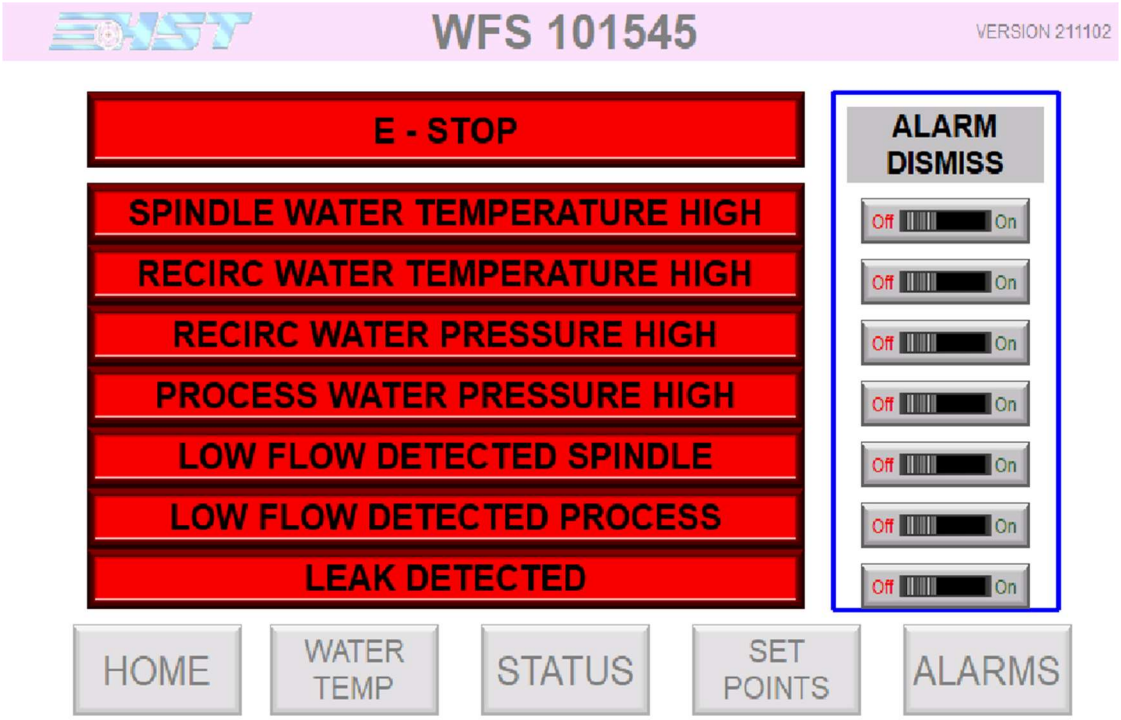


FIGURE 5-9

ALARM DISMISS To dismiss or ignore a particular alarm move the associated slide switch to "ON" position by touching the "ON" side of the image. This will permanently silence the alarm and ignore the fault.

CAUTION: The alarm condition still exists. There is no longer a warning of the faulty condition.

LEAK DETECTED A LEAK DETECTED alarm will also initiate an ALL STOP command shutting down all pumps and the chiller. This is to protect against a broken line. However, it may be accidentally tripped during normal filter change. To prevent potential process interruption during a filter or resin bed change set the bottom slide switch to "ON" during those operations.

f. Resitivity Sensors

Two (2) Resilite RES7130 resistivity sensors are provided to monitor water condition to the Process Circuit. These sensors have a fixed setting of 1 Meg Ohm. They will indicate resistivity in excess of 1 Meg Ohm with a green light. If resistivity becomes less than 1 Meg Ohm the light will change to red.

These sensors provide an indication as to when to change out the customer supplied resin beds. See figure 5-10

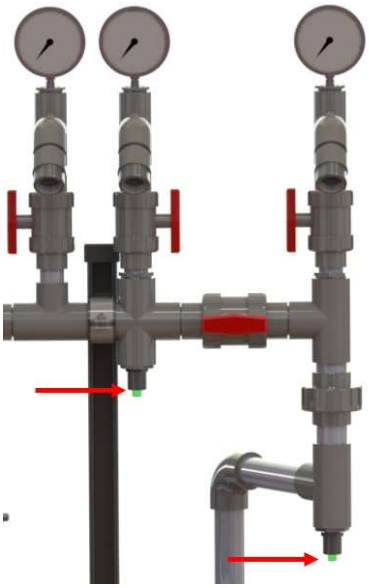


FIGURE 5-10

6 FILTER HOUSING AND FILTER ELEMENT CHANGE OUT

The system utilizes four stainless steel filter housings. The housings are rated for a nominal 60 PSI at 110°F with a flow rate of 50 GPM. See Figure 5-11

WARNING: For use with water only

- Do not exceed 100 PSI
- Do not use with air or gasses
- Do not use with flammable liquids

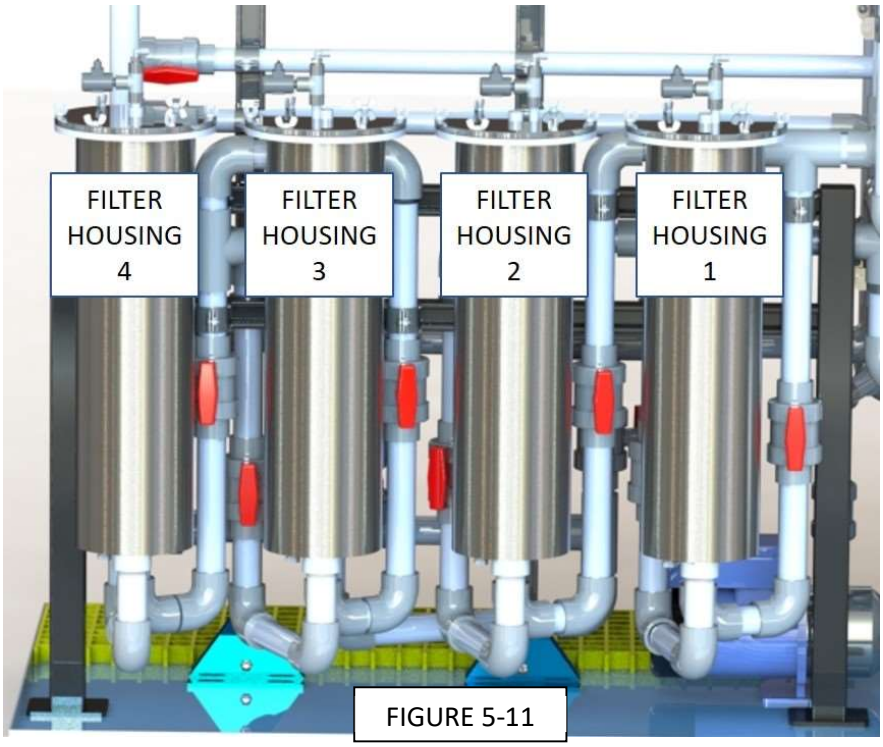


FIGURE 5-11

Each filter housing holds three 2.5” diameter x 20” long filter replaceable filter cartridges. These cartridges come in a wide variety of composition and micron size. The first two units # 1 & 2 filter the recirculating water. Units #3 & 4 are the final filters for the process water. They catch any loose particles that may come from the resin beds.

Housings: The filter housing assembly is comprised of the following parts:.

- Wing Nuts: Six wing nuts hold down the top cover
- O-Ring: The top cover seals on a 3.5 x 180 mm Buna O-Ring
- Cartridge Nuts: Three cartridge nuts center and seal the top of the filter cartridges
- Tie Rods: Three tie rods span the filter cartridge and with the Cartridge Nut hold the elements firmly in place.
- Centering Crosses: Three centering crosses prevent the bottom of the cartridge elements from being off center and aligning with the sealing rings.
- Seal Rings: The seal rings provide a high-pressure sealing surface to the bottom of the filter cartridge.
- Drain Plug: A 3/8 NPT drain plug drains the dirty chamber.

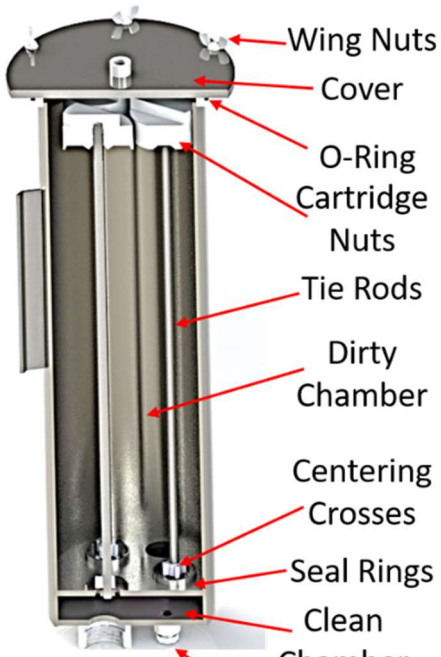


FIGURE 5-12

a. Filter Element Installation

The filter elements or cartridges are provided by the customer. The specific filtration / particulate size and element medium is determined by individual customer requirements.

i. Remove the cover. The six wing nuts should be loosened in a "Star" pattern in the sequence shown. See Figure 5-13
ii. Remove the three Cartridge nuts
iii. If there are existing filter cartridges installed remove them.
iv. Install new filter elements. Make certain that the bottom of the cartridge is over the centering cross. If the cartridge has a rubber element on each end make certain that it remains in position as you lower the element over the tie rod. See Figure 5-14

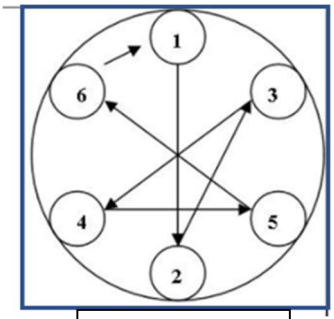


FIGURE 5-13

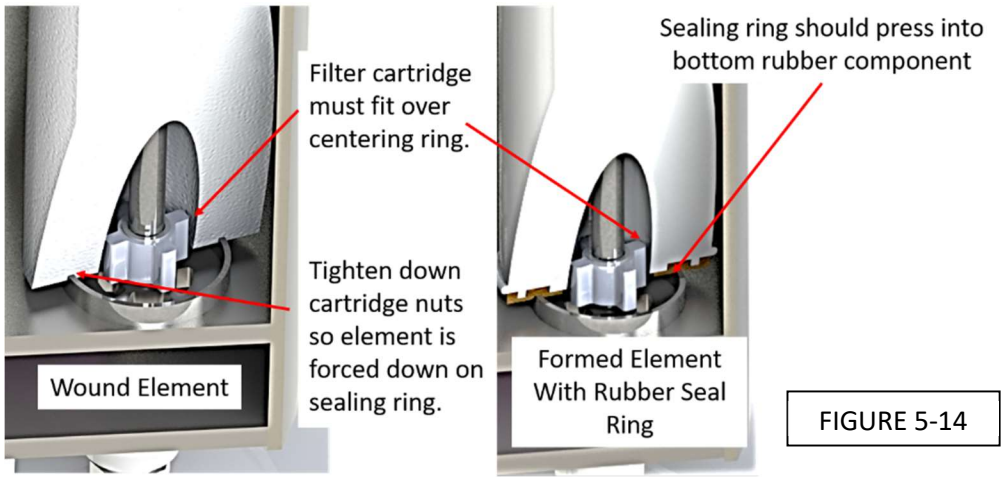


FIGURE 5-14

v. Tighten the Cartridge Nuts down on the filter elements. Be sure to center the element as the nuts are tightened down. Visually check to make sure the bottom of the filter element is centered over the sealing ring.

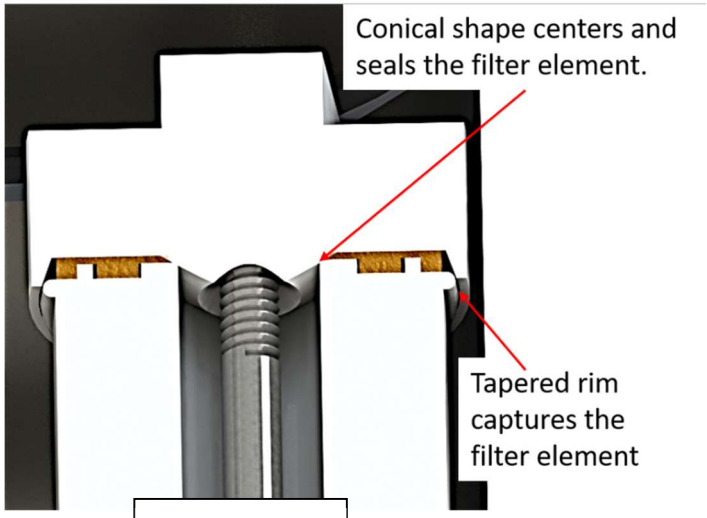


FIGURE 5-15

vi. Verify the position and condition of the O-Ring. If the O-ring exhibits any signs of wear or cracks replace with new. It may be necessary to stretch a replacement O-ring to permit it to lay flat completely in the grove. See Figure 5-16

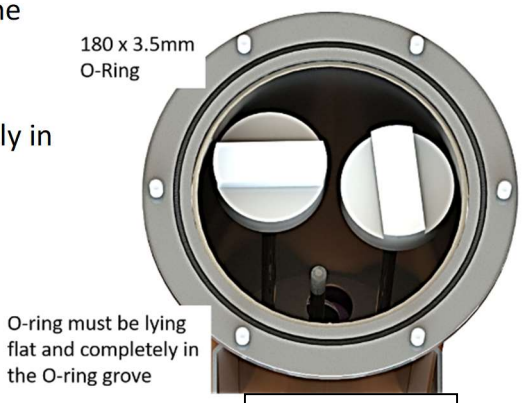


FIGURE 5-16

vii. Replace Cover and tighten Wing Nuts. Follow a star pattern tightening sequence for the wing nuts. Do not fully tighten each nut on the first pass. Make several rounds snugging the nuts down a little tighter each time. Check for leaks when under full pressure and re-tighten wing nuts as required. See Figure 5-17

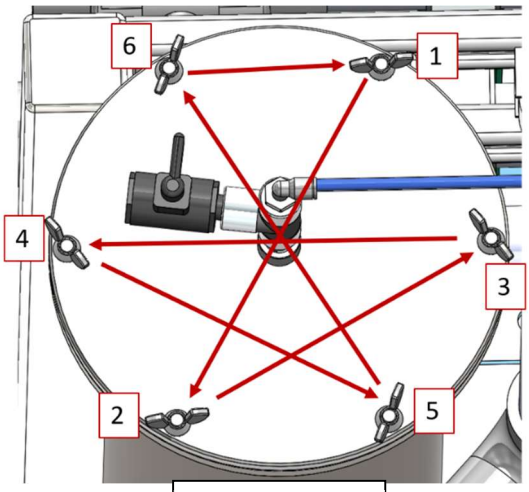


FIGURE 5-17

NOTE: Prior to starting a filter element change out it may be desirable to "DISMISS" the leak detection alarm to prevent process interruption. To do this turn the bottom slide switch on the alarm page to "ON".

b. Configuration

The Filter Housings are configured as two groups of two parallel circuits. One circuit handles the recirculating water and the other circuit provides final filtration for the process water. This configuration permits the isolation of one filter housing for cartridge change out while one stays on-line. Therefore, cartridges can be changed out without process interruption. See Figure 5-18

Each filter housing has a “In-Flow” ball valve and an “Out-Flow”. During normal operation only the valves on one housing should be open while the other housing valves are closed.

When the pressure reading indicates that filter elements require change-out both the In-Flow and the Out-Flow valves on the standby unit should be opened. After all valves are opened the In-Flow and Out-Flow valves on the unit that was in service can be closed.

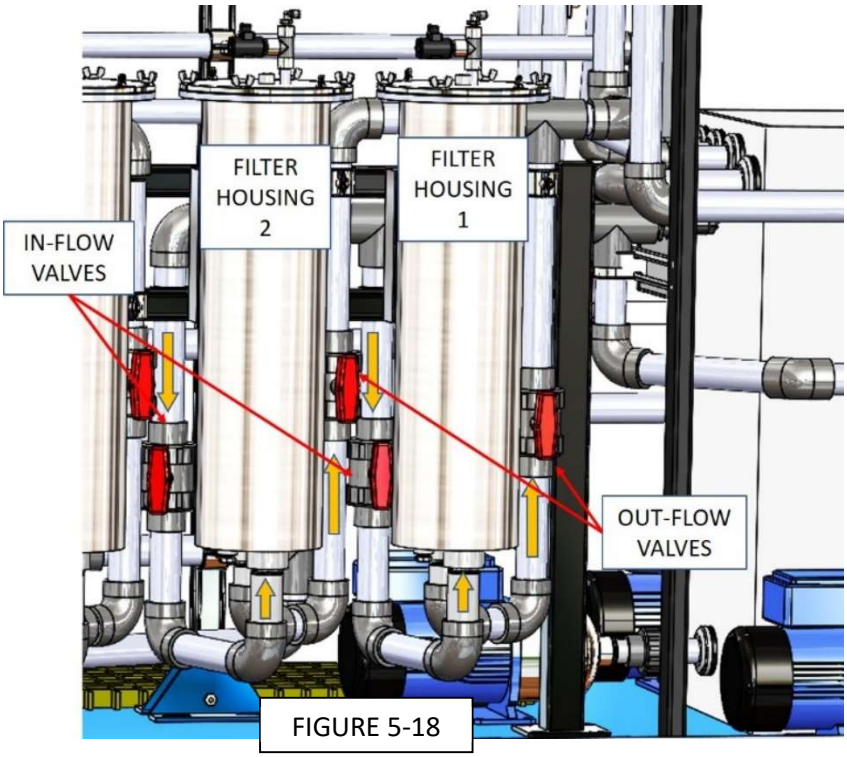


FIGURE 5-18

Open the air-bleed valve on top to remove any residual pressure. Then the top cover can be removed to replace the used filter elements.

c. Air Bleed Valves

On top of each filter housing is an air bleed valve. These permit the housing to fill with water during commissioning. See Figure 5-19

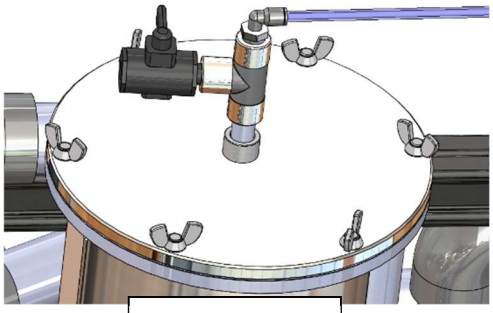


FIGURE 5-19

d. Leak Detector

A leak detection system will shut down all pumps and the chiller in the event that a leak is detected. The sensing strip is applied down the center of the base. If even a small amount of water is detected the system initiates an E-Stop. (See Figure5-20)

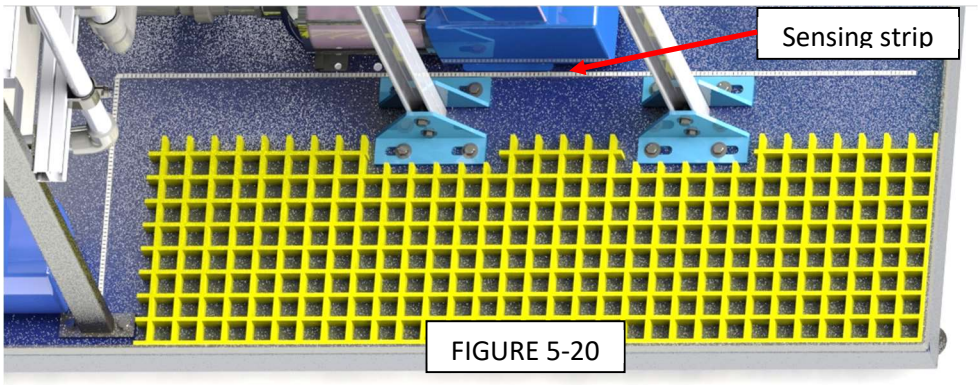


FIGURE 5-20

The pumps will not re-start until the strip is dried off.

e. Nuisance Tripping

WARNING! The following procedure can only be performed by qualified personnel.

WARNING! Disconnect all power before opening the control cabinet

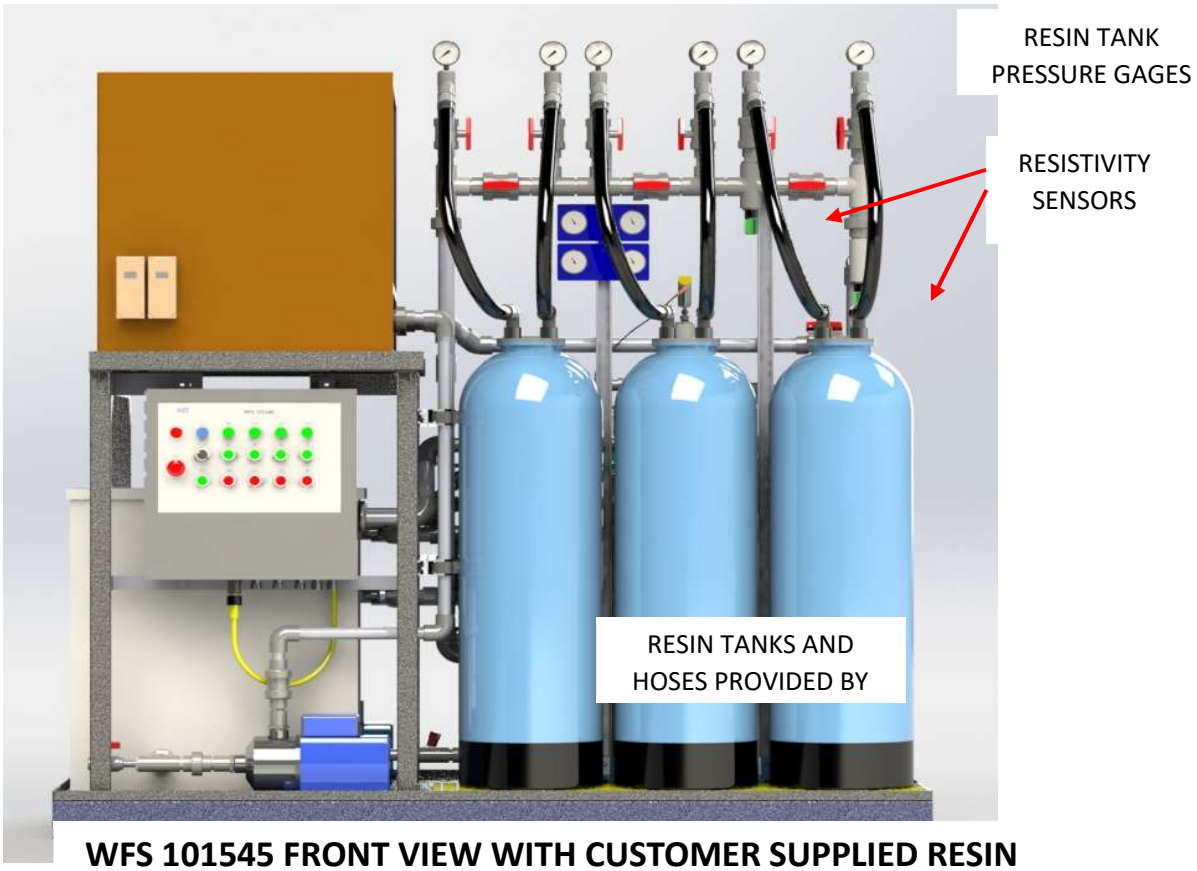
WARNING! The control cabinet contains high voltage wiring that can cause injury or death.

If the system experiences nuisance shut downs from the leak detection system the sensitivity can be adjusted by turning the adjustment know clockwise on the leak detection relay inside the control cabinet. See Figure 5-21

FIGURE 5-21

f. Resin Tanks

The WFS 101545 can accommodate three (3) customer supplied resin tanks up to 15" in diameter. These tanks interface with the Isolation Valve Sub-assembly. The interface connection is 1" NPT . See figure 5-22



WFS 101545 FRONT VIEW WITH CUSTOMER SUPPLIED RESIN TANKS

FIGURE 5-22

It is anticipated that the customer will utilize two (2) ionic exchange resin beds and one activated carbon vessel. (Collectively these are all referred to as resin beds or resin tanks unless specifically speaking about the activated carbon filter)

g. Resin Tank Gages

There are two gauges associated with each resin tank. By subtracting the high pressure reading (discharge side) from the lower pressure (in-let side) a delta pressure reading is obtained. This delta pressure is the actual pressure drop through the resin tank and indicates the condition of the resin bed.

h. Resin Tank Change-Out

The customer supplied resin tanks can be changed out without interruption to the process. Two (2) resistivity sensors provide indication when a particular resin bed has reached end of life and requires change-out.

Changing out a particular resin tank is accomplished by first bringing the stand-by unit online and then taking the active unit offline.

Use caution to avoid water splashing onto the base structure. If the leak detecting strip gets wet all of the pumps and chiller will stop.

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
- Filling the Spindle Water Circuit

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 valves it is helpful to have a second source of water to manually maintain reservoir level during commissioning.

1. COMMISIONING PREREQUISITES

Verify and check the following:

- Proper filter elements have been installed in the filter housings and the cover has been properly secured.
- Close the ball valves for the four (4) facility plumbing connections to the WFS Unit. Leave the water make-up valves open.
- 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. It will cycle on and off when a constant flow of water is supplied.

- All plumbing lines are connected to the process machine to permit process cooling water to gravity drain and collect in the lift station. The lift station discharge is connected to the Process Water Return connection.
- Valving on the machine will permit the spindle water to return back to the WFS.
- Facility water supply is open to the Water Make-Up lines.
- All Air Bleed Valves are closed.
- 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, air has been blead from the filter housings 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.

If the water level in any chamber is less than 10 inches above bottom of the tank stop the pumps until the chamber has been re-filled.

3. FILLING THE RECIRCULATING FILTER HOUSINGS

- Fill all three chambers of the reservoir to the top of the spindle chamber.
- Verify all four associated valves with the recirculating filter housings are open.
  - 2 In-Flow valves
  - 2 Out-Flow Valves
- Turn the POWER switch to on and wait for the touchscreen to initialize and come on.
- On the Alarms page turn the bottom slider switch to "ON"
- With someone watching for rotation do a quick start-stop of pump one. If the rotation is not correct change any two of the power supply wires. Figure C3-2 See section 4.f.ii figure 4-8

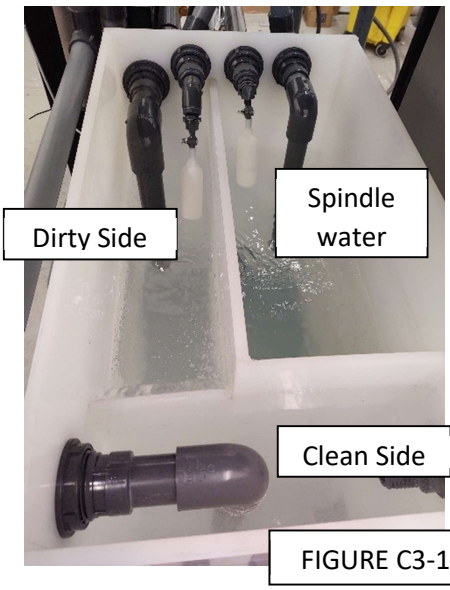


FIGURE C3-1

Switch places with any two wires at this point to change pump rotation

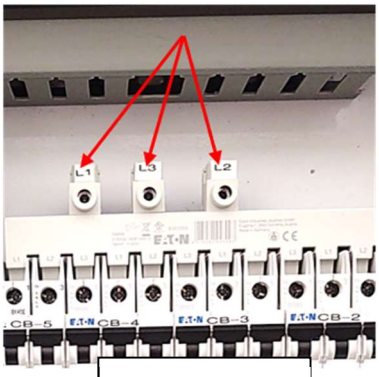


FIGURE C3-2

WARNING! To be performed by qualified personnel only.

WARNING! Do not change the phase at the pump. All pumps and the chiller have been synchronized. After Pump 1 rotation is verified correct all other pumps and the chiller will also be correct.

- After verification of pump rotation start Pump One. Water is pulled from the Dirty Side chamber and pumped through filter housing 1 or 2 (both during commissioning). From the filters it goes through the chiller and is returned to the clean side.
- Crack open air bleed valve on Housing 1. Air will start coming out. Immediately close the valve as soon as water starts coming out. Repeat this procedure for Housing 2.
- Close the In-Flow and Out-Flow valves on Housing 2. It will be on stand-by.
- The Recirculating system is ready to start with Filter Housing #1 in operation.
-

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. FILLING THE PROCESS FILTER HOUSINGS

This procedure assumes it is performed immediately after **Section 3** and all other conditions remain the same.

- Fill all three chambers of the reservoir to the top of the spindle chamber.
- Verify all four associated valves with the process filter housings (#3 & 4) are open.
  - 2 In-Flow valves
  - 2 Out-Flow Valves
- Open the bypass valve. See Figure C4-1
- On the Alarms page turn the second from the bottom slider switch to “ON”.

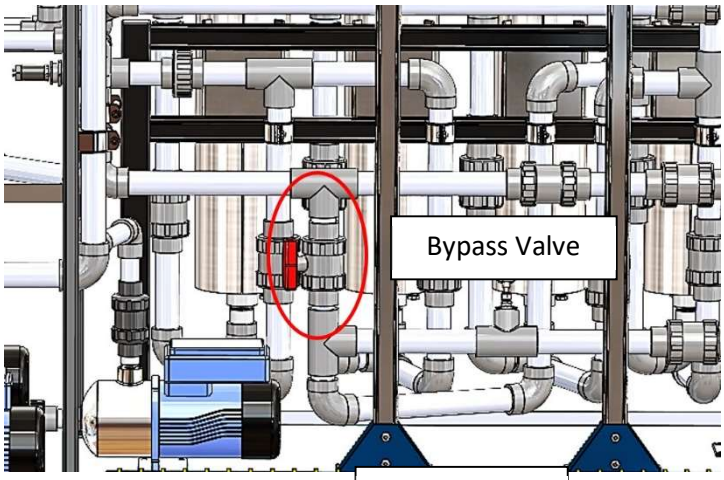


FIGURE C4-1

- NOTE. To prevent inadvertent pump stop, the bottom slider switch should remain on until commissioning is complete.
- Start Pump 2 Crack open air bleed valve on Housing 3. Air will start coming out. Immediately close the valve as soon as water starts coming out. Repeat this procedure for Housing 4.
- Close the In-Flow and Out-Flow valves on Housing 4. It will be in stand-by
- After stopping Pump 2 close the Bypass valve.
- Open the Process Supply and Process Return valves
- Start the Pump 2. Water will flow out to the process machine. Water from the process machine should drain down into the Lift Station. When the water reaches a certain level in the Lift Station reservoir it will pump it back through the Process Return line.
- The Process Circuit is ready to start operation on Filter Housing #3
  CAUTION: Maintain sufficient water level in the “CLEAN SIDE” reservoir until equilibrium is reached. (Water is returning at the same rate it is being pumped out.)

5. STARTING THE SPINDLE CIRCUIT.

- Verify the water level in the spindle chamber of the reservoir is full.
- Open the Spindle Supply and Spindle Return
- Start Pump 3. Water should flow out to the spindle or drive motor coolant loop and return to the spindle reservoir.

CAUTION: Maintain sufficient water level in the “SPINDLE” reservoir until equilibrium is reached. (Water is returning at the same rate it is being pumped out.)

6. STARTING THE CHILLER

With both Pump 1 and Pump 3 running the Chiller can be Enabled. It will automatically cycle to keep each zone at the selected set-point See Sect 5.e.iii

NOTE: The chiller has a “Bump Start” design feature. This may cause the chiller to perform three rapid Start-Stop sequences before commencing with normal operation. The chiller also has built in delays that regulate how quickly the unit can recycle.

7. RESERVOIR PROCESSS FLOW

Durning normal operation, after equilibrium is established, the reservoir level is maintained by two float valves. These can compensate for evaporation and minor losses due to splashing during process cooling.

To maintain proper filtration and cooling water should cascade from the Clean Side into the Dirty Side.

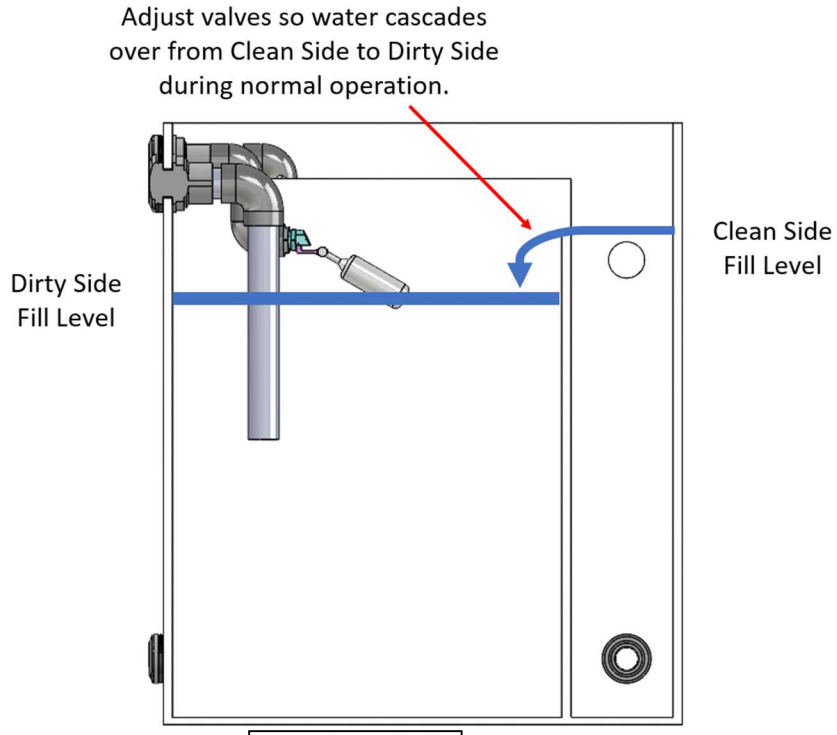


FIGURE C7-1

8. PRESSURE SETTINGS

The maximum pressures are limited by two relief valves. One valve limits the Process Pressure and the other the Spindle Pressure. They are factory set at 75 PSI.

They can be field adjusted by turning the top knob in to increase and out to decrease pressure. See Figure C8.1

WARNING Do not adjust pressure above 100 PSI

CAUTION Settings that are too low can cause excessive heat generation.

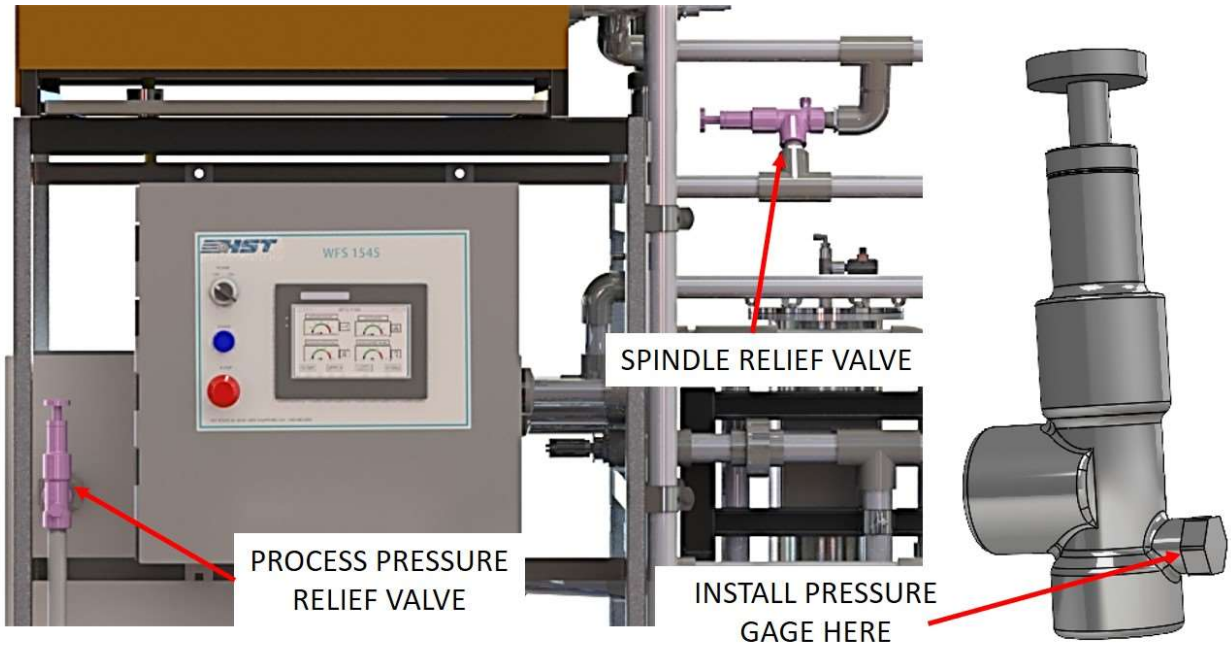
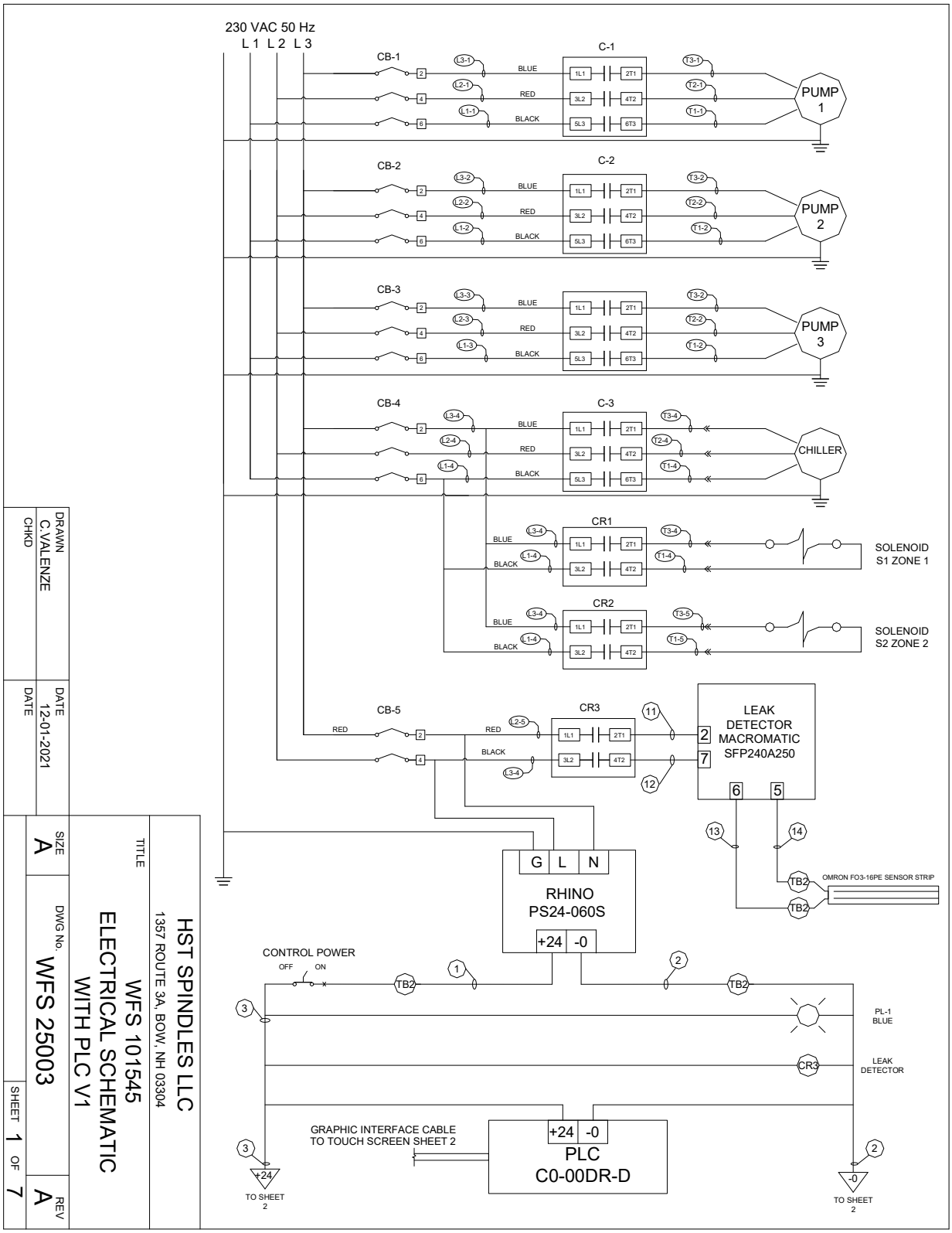

WFS 154S
SPINDLE RELIEF VALVE
PROCESS PRESSURE
RELIEF VALVE
INSTALL PRESSURE
GAGE HERE

FIGURE C8-1

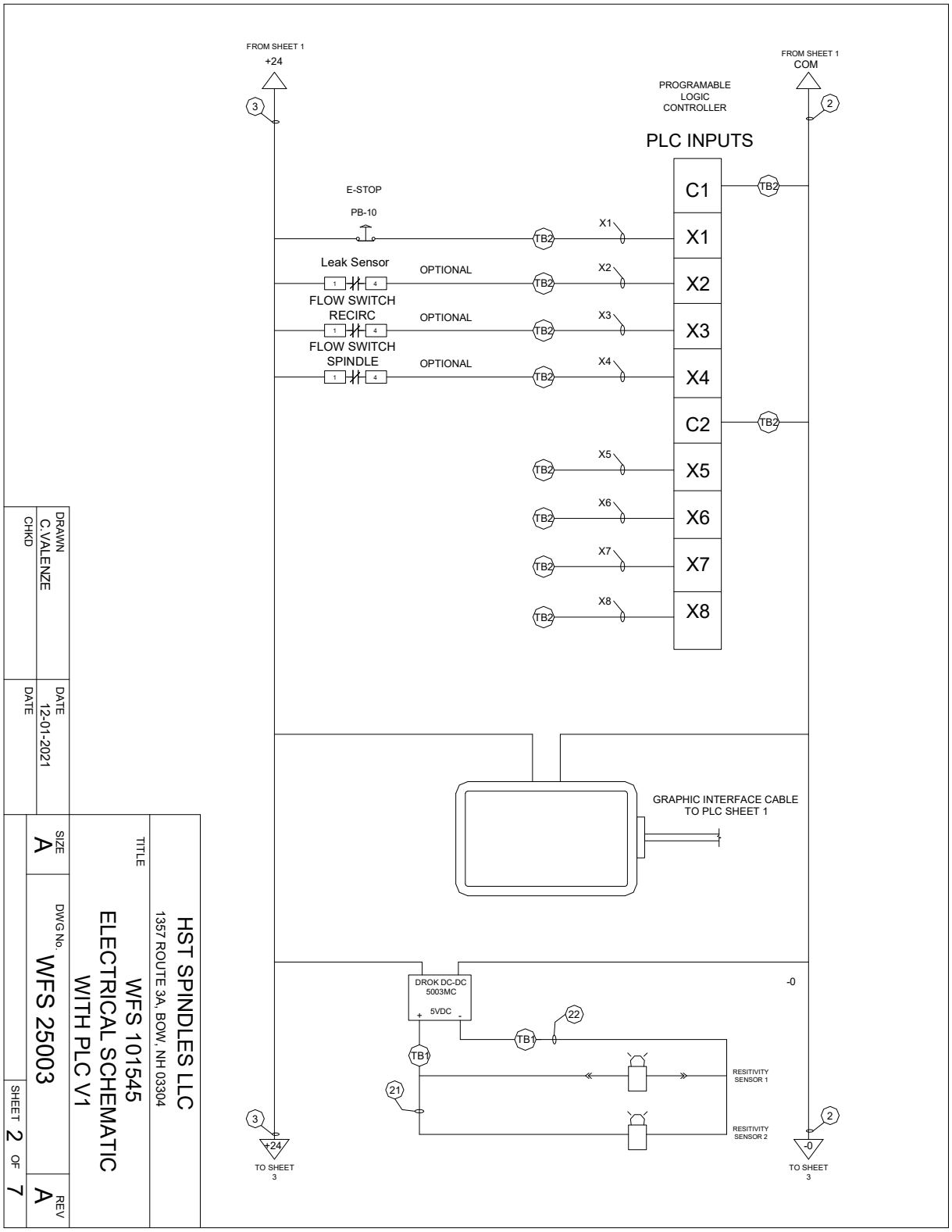
APPENDIX

`

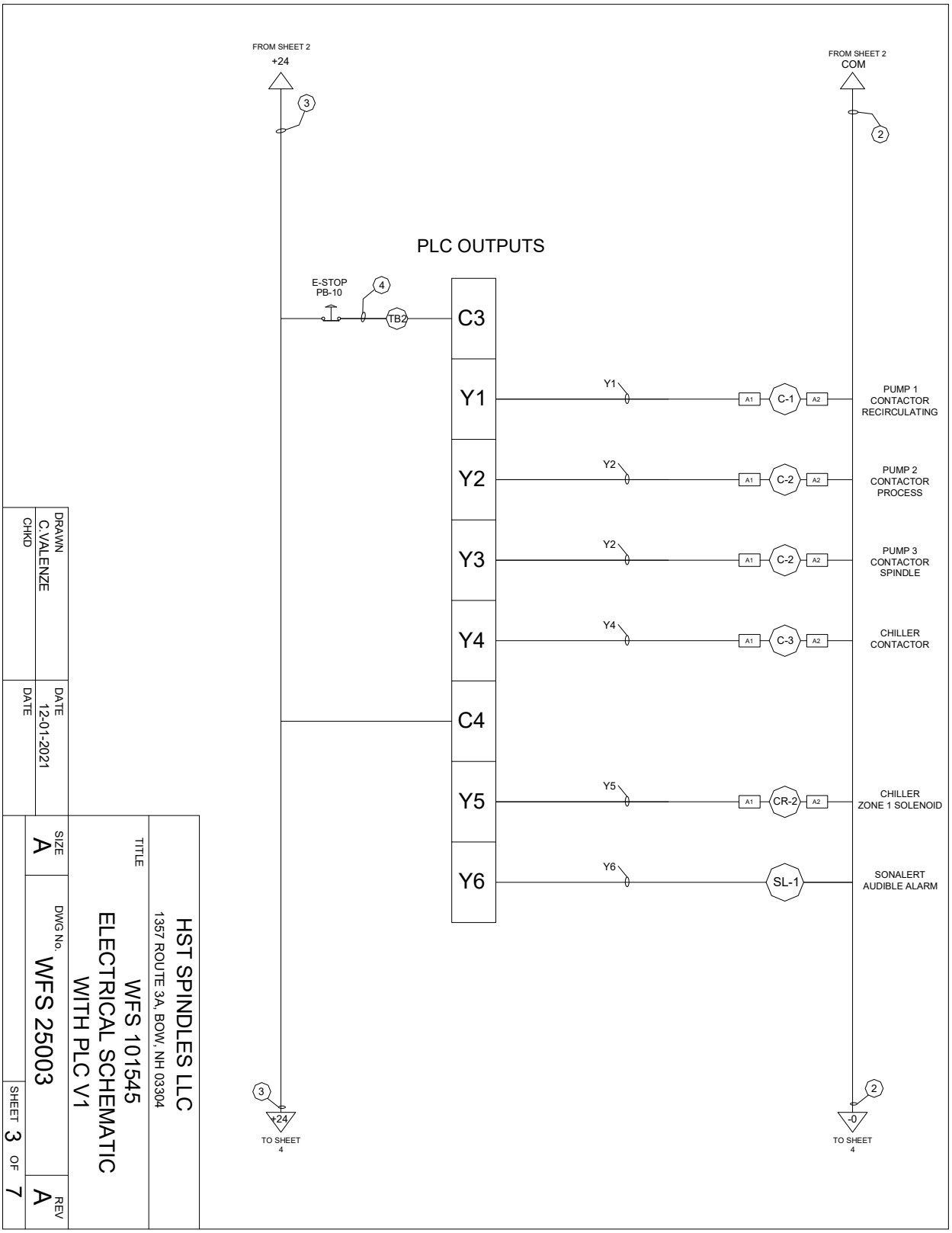
ELECTRICAL SCHEMATIC
SHEET 1 OF 7



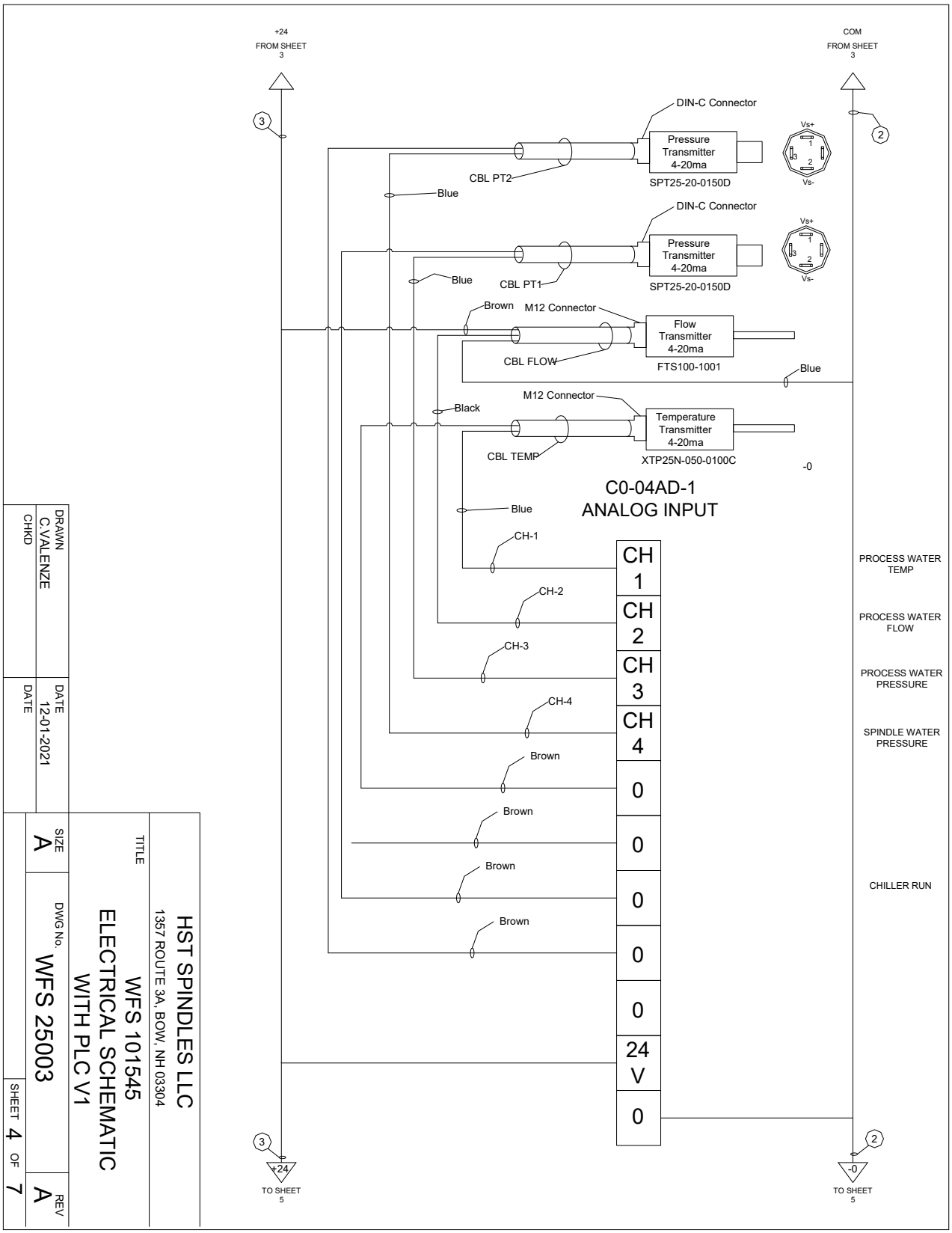
ELECTRICAL SCHEMATIC
SHEET 2 OF 7



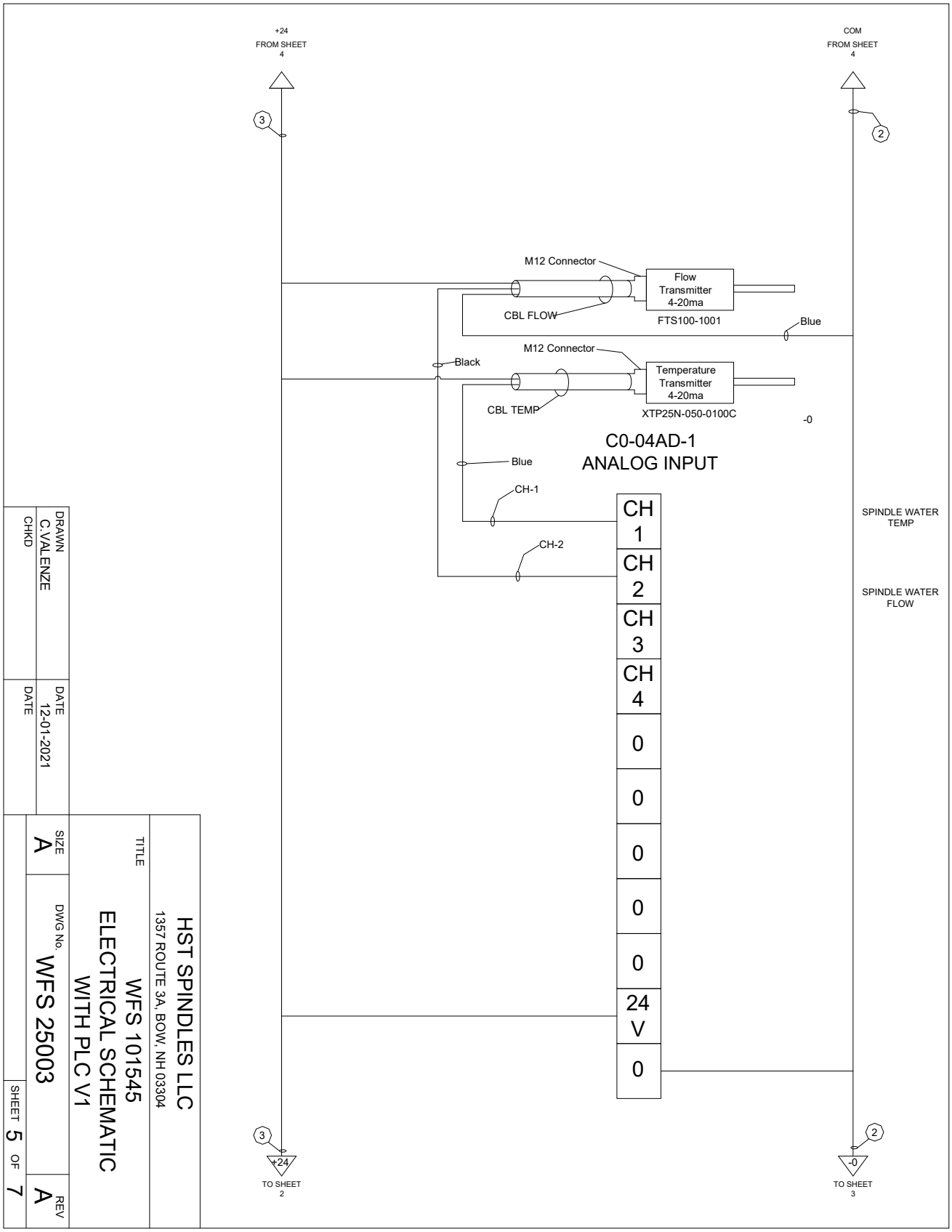
ELECTRICAL SCHEMATIC
SHEET 3 OF 7



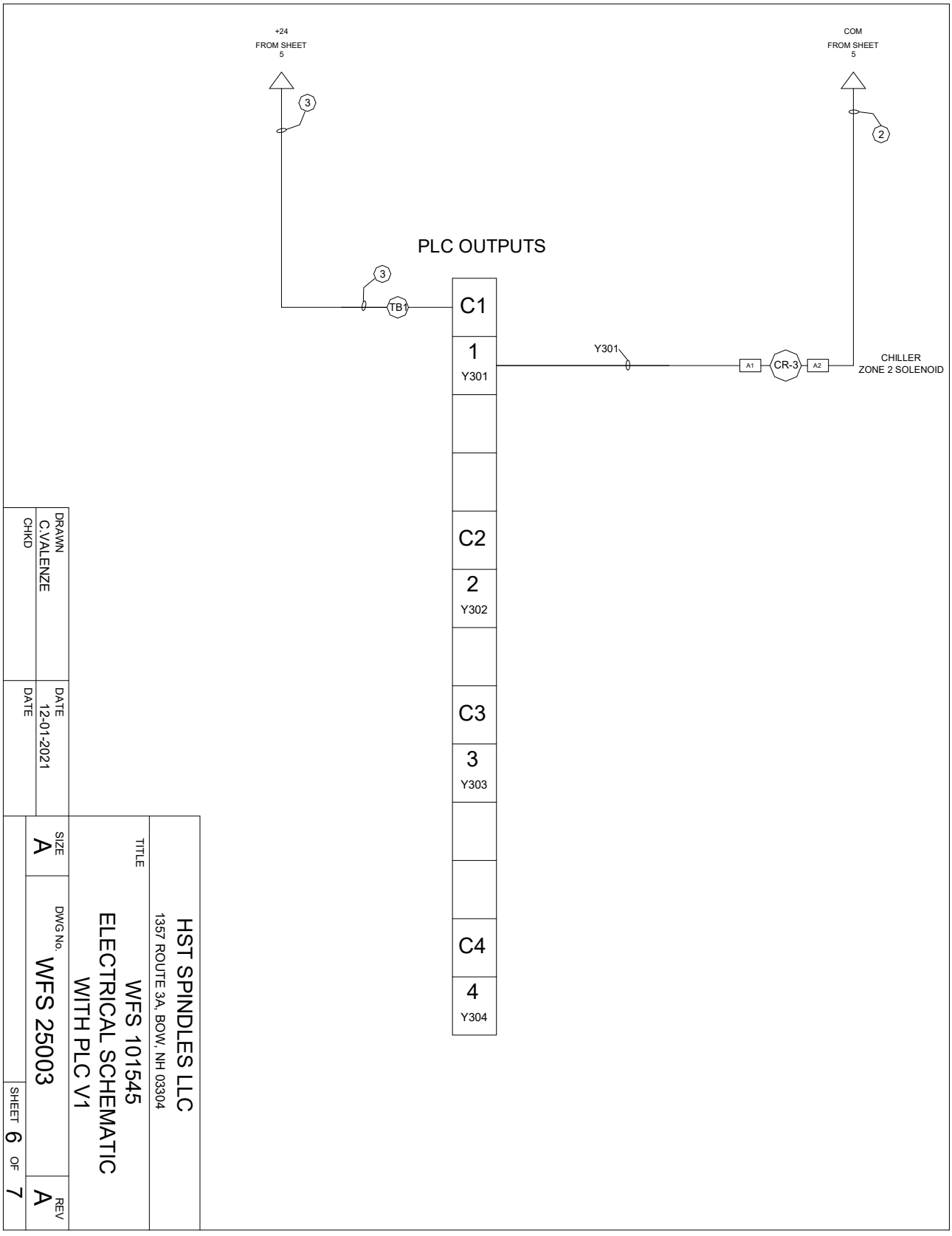
ELECTRICAL SCHEMATIC
SHEET 4 OF 7



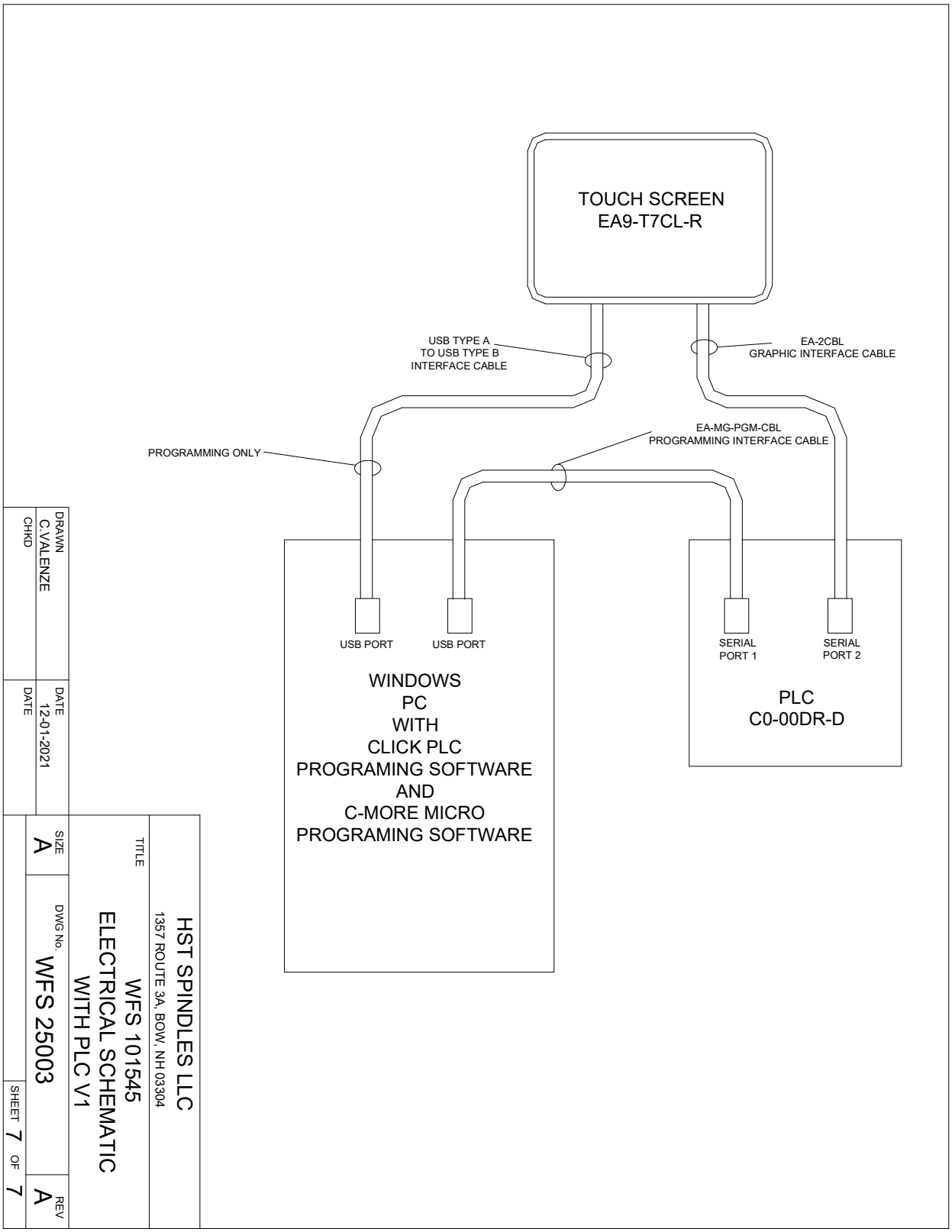
ELECTRICAL SCHEMATIC
SHEET 5 OF 7



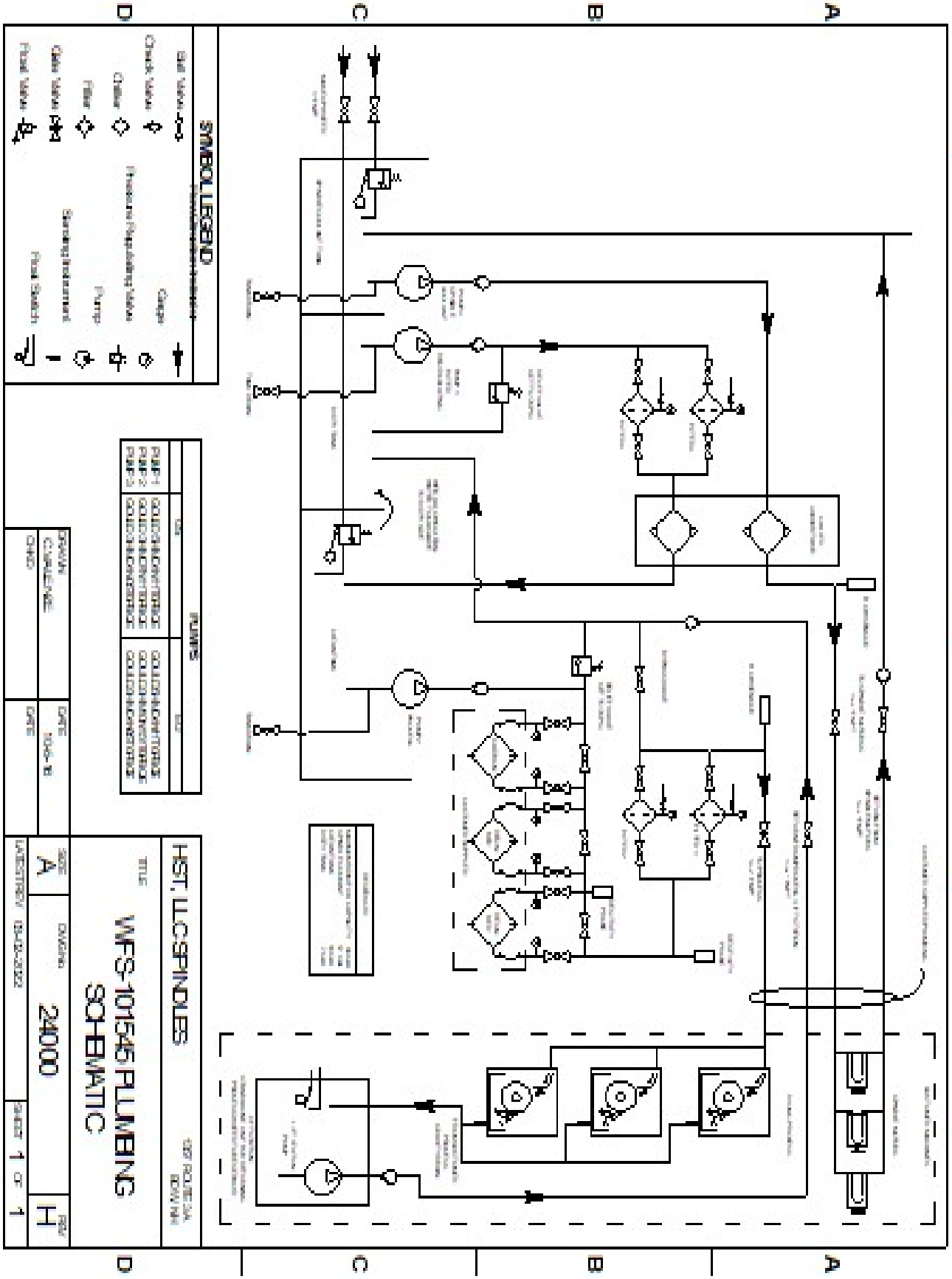
ELECTRICAL SCHEMATIC
SHEET 6 OF 7



ELECTRICAL SCHEMATIC
SHEET 7 OF 7



PLUMBING SCHEMATIC



TROUBLESHOOTING

PROBLEM	POTENTIAL CAUSE
Pumps and Chiller will not operate	E-Stop Button in depressed detent Tripped Circuit Breaker Leak Sensing Strip is wet Facility Power is off
Chiller will not start	Chiller Circuit Breaker is off Chiller Freon is low
Chiller cycles rapidly	Hysteresis setting on controller too small.
Water Temperature varies significantly	Hysteresis setting on 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

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
Copeland Air-Cooled Condensing Unit	https://climate.emerson.com/documents/copeland-scroll-air-cooled-refrigeration-condensing-units-en-2884068.pdf
IFM SA4110 Flow Sensors	https://www.ifm.com/us/en/product/SA4110
Resilite RES 7130 Resistivity Sensor	https://www.servapure.com/assets/images/PDF/Resilite%20Red-Green%20Purity%20Lights.pdf
Hudson Float Valve	http://www.sharkpw.com/Upload/CPDCategoryDocuments/Shark%20Hudson%20Float%20Valve_1407.pdf http://hudsonvalve.com/products/
Omron 61F-GPN-V50 Leak Detection	http://www.ia.omron.com/data_pdf/cat/61f-gpn-v50_ds_e_5_5_csm10.pdf?id=566
Ashcroft Pressure Gauge	http://ashcroft.com/drawingsandmodels_pdf/upload/drawing-industrial-gauge-10-100s-02l.pdf
All sensors, PLC And touch screen	https://www.automationdirect.com/adc/home/home