FLŌ ENERGY SOLUTIONS	Technical Manual	SU-GEN-04
Title:	Start-Up Air Cooled Condenser (6-70 Ton) Reference Manual	

Flō Energy Solutions, Inc.

Multi-Path

STARTUP AIR COOLED CONDENSER (6-70 TON) REFERENCE MANUAL

This document will assist the start-up technician with the Flō Air Cooled Condenser (6-70 Ton) Start-Up and completion of the Start-Up Air Cooled Condenser (6-70 Ton) Audit Form (SU-FOR-02). Completing the start-up per the detailed instructions in this manual and associated form will ensure a defect-free, optimally performing unit is delivered to the customer.

NOTE: Each numeric section (i.e., 16. DIGITAL PHASE MONITOR) in this manual directly corresponds to the same numeric section on the Flō SU-FOR-02 Start-Up Air Cooled Condenser (6-70 Ton) Audit Form. Any numeric sub-sections (i.e., 5.3 SUPPLY FAN WIRE CONNECTIONS) in this manual are additional instructions to assist in guiding the technician through that section of the SU-FOR-02.

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CONTENTS

TOOLS AND MATERIALS

The tools and materials listed below will assist in the completion of the MPU start-up.

The tool lists are included here for your convenience, include any additional items required by you to perform a superior start-up.

REQUIRED - Tools and Materials		
Smart Phone with Camera	Laptop with Window's 10	5' CAT 5 Ethernet Cable
Micro USB to USB Dongle	USB-A Drive	Prism 2 Software
USB-Link 2 and cables	Digital Thermometer	Psychrometer
Volt / Amp Meter	R410A Refrigerant Gauges	Manometer
Level	Control Screwdriver	Flat Tip Screwdriver Set
Wire Crimper / Stripper	6" Crescent Wrench	10" Channel Lock Pliers
Hex Key Set	Socket Set	6" Wire Ties
Female Spade Crimp Connector (Red)	Female Spade Crimp Connector (Blue)	Clear Silicone Sealant
P-Trap "See Start-up Manual"	PVC Primer / Glue	R410A Refrigerant
Refrigerant Recovery Tank	Refrigerant Scale	

Required Tools and Materials

1. EXTERIOR UNIT PREPARATION

The visual unit inspection confirms there is no physical unit damage prior to start-up. Inspect the unit for physical damage or deficiencies that may have occurred during the manufacture, transportation, or installation of the MPU.

Walk around the unit and look for any signs of physical damage. Open the access doors and verify they open and close easily. Verify the unit has clean filters and the P-Trap is correctly installed. Verify gas piping and electrical connections are completely installed prior to start-up.

If damage is found, Flō must be notified immediately and a claim, must be filed upon discovery of a unit damage or defect that prevents the complete unit start-up.

Examples of damage are, but are not limited to: Missing or Broken Parts and/or Crushed Components or Electrical Damage, etc.

Examples of defects are, but are not limited to: Scratches, Dents, Dings, Peeling Paint, Incorrect Number or Type of Sensor(s), Incorrect Filters, etc.

If no damage is found, proceed with the unit's start-up.

1.1. UNIT DAMAGE

1.1.1. MAKING A CLAIM

If the unit is damaged in a way that prevents the complete start-up or compromises future performance or unit longevity:

1. Select the 'YES' checkbox to the right of instruction 1 on SU-FOR-02.

2. Obtain the unit serial number from the unit name plate.

3. Document the concern in the notes section 22 of SU-FOR-02.

4. Take two digital images of the damage and email the images to techsupport@systemsflo.com immediately. When emailing Flō Tech Support, include "START-UP DAMAGE – Flō Serial #" in the subject line of the email

5. Contact technical support (888-598-1198 Opt. 1) to report the damage and file a claim.

The technical support department will document your claim and provide you with further instructions. If the unit is damaged, do not continue with the startup until you have contacted Flō and they have advised you on how to proceed.

Flō Small Multi-Path Unit (9-30 Tons)

Flō Large Multi-Path Unit (26 and 31-70 Tons)

1.1.2. UNIT DEFECTS

If there is a superficial, surface, cosmetic flaw or defect with the unit or accessories that will not prevent the unit start-up or compromise future performance or unit longevity:

1. Select the 'NO' checkbox to the right of instruction 1 on SU-FOR-02.

2. Document the defect in the notes section 22 of SU-FOR-02.

3. Take two digital images of the defect.

4. Submit the images of the defect to Flō using the following email address: startup@systemsflo.com. Images related to a defect can be sent in with the start-up images noted in section 22 of the SU-FOR-02.

5. The start-up checkout representative at Flō will follow up on the defect and advise on further action required (if applicable) during your scheduled checkout.

1.1.3. CABINET SCREWS

Visually inspect the exterior of the unit for missing screws. Verify all screws used in the unit construction are installed. Verify there are no loose or discarded screws on the roof or interior unit cabinets.

If you do find missing screws, install new screws in holes where cabinet screws are missing.

1.2. ROOF SEAMS

1. Ensure corners of the unit roof have been caulked, with no gaps or missing caulking from top to bottom of seam.

2. Ensure every seam on the roof (1 to 2 on 10-30 ton units, up to 6 on larger units) has been properly secured on the ends with screws and caulked at the ends.

1.3. LEVELING THE UNIT

During manufacturing, the stainless-steel drain pan is pitched toward the p-trap. It is important to level the unit on the roof curb before start-up to allow proper water removal. If the unit is not level, the condensate water will not drain properly from the unit and could spill into the building below.

It is best to check the level of the unit by placing the level underneath the bottom frame. Do not check for level on the top of the unit, because some models have a sloped design to allow for rainwater to run off.

If the unit is found to be out of level, note the installation deficiency in the notes section 22 on SU-FOR-02.

Level

1.4. OUTSIDE AIR HOOD

The Outdoor Air Hood (OAH) prevents rain from entering the unit, while allowing a pre-determined amount of fresh air to enter the conditioned space. During transportation, the OAH is secured in the closed position. During installation, the OAH must be opened and properly secured to its opening before starting the unit.

Additional painted 5/16" sheet metal screws are shipped with the unit to secure the OAH in the open position.

IMPORTANT: The OAH side flanges should be installed on the inside (under) the hood. Use all four screws to attach the OAH to its opening. If the flanges are installed on the outside of the air hood, this must be corrected.

1.4.1. OUTSDIE HOOD ASSEMBLE STEPS

Use caution: Roof damage can result from the sharp edges of the side pieces, if dropped.

1. Remove the two screws at the bottom of the hood that secure it in the shipping position.
2. Remove the screws that attach the side pieces of the hood to the top of the hood.
3. Rotate the side pieces so that the holes along each edge line up with the holes on the top piece. Ensure that the flanges are facing inwards (under the hood).
4. Using the painted 5/16” hex-head screws provided with the unit, attach each side panel.
5. Attach the hood assembly to the MPU, using one screw for each pre-drilled hole.
6. Apply clear silicon caulking along the top and both sides of the rain hood. Seal the top corners where the rain hood attaches to the unit.

Small Unit - Closed Air Hood

Small Unit - Open Air Hood

Large Unit - Closed Air Hood

Large Unit - Open Air Hood

1.5. BIRDSCREEN

Once the Outdoor air hood has been installed, check to ensure the bird screen has been properly installed with no large gaps around edges, and that there are no obstructions between the bird screen and the outdoor air damper

Bird screen

1.6. BAROMETRIC RELIEF DAMPER

The Barometric Relief Damper is a large, hinged flap that provides a low resistance path for excess air to exit the building when indoor pressure exceeds outdoor pressure. Flō small units have one barometric relief damper and large units have two. Each barometric relief damper has a 5/16” hex head shipping screw that needs to be removed and discarded before starting the MPU.

After the shipping screw has been removed, lightly press on the damper and ensure that is moves freely.

Small Box Barometric Relief Damper

Relief Damper - Shipping Screw

1.7. CONDENSATE P-TRAPS

All exiting drain connections must be used and individually trapped. These connections are 1.0” MPT fitting. For drains exiting directly onto the roof, place a small drip pad directly below the drain to protect the roof from potential damage. For drains piped into the building, the drainpipe should penetrate the roof external to the unit. This drain line should be pitched away from unit at least 1/8” per foot.

The P-Trap must be primed before start-up. Condensate drain traps and piping must conform to all applicable codes.

P-Trap Installed

Copper P-trap Installed

1.7.1. P-TRAP INSTALLTION

P-traps can be purchased from supply houses or made from PVC or copper depending on local codes. **Please follow the guide in following section on proper creation of P-trap for proper flow and to avoid future drainage issues!** ABS primer/cement should be used to join the connections of each PVC trap.

If you are plumbing a new drain or vent and must join two different kinds of plastic pipe, for example black ABS and white PVC, most plumbing codes do not allow ABS pipe to be solvent welded (glued) to PVC. A transition glue is available at most HVAC supply houses. Use the following steps to install each p-trap.

PVC P-Trap Installation

1. Install Teflon tape to the threads of the unit's male threaded p-trap connection point.

2. Using care not to over tighten and crack the ABS, install the elbow to the unit. The elbow should be installed, with the opening pointing downward, so that the condensation will flow out.

3. Using the proper cement, glue the p-trap's longest side directly to the elbow's opening. Positioning of this pipe, perpendicular, parallel or otherwise to the installed unit, should be determined by the customer.

4. Attach the second elbow to the shorter side of the p-trap.

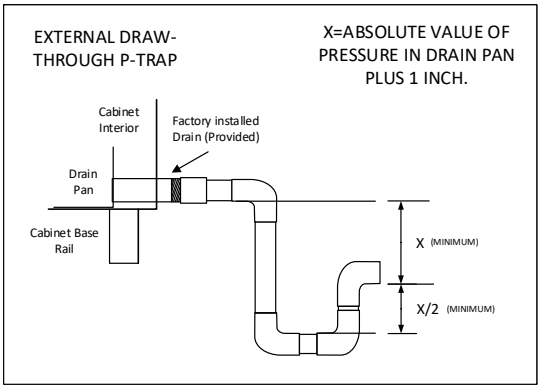
1.7.2. P-TRAP CONSTRUCTION

The X dimension should be at least equal to the absolute value of the negative static pressure in the drain pan (in inches of water column) plus one inch. If the installation or start-up contractor must construct a p-trap, use instructions below. See Figure 12 and Table 3.

To calculate the static pressure, add the pressure drops of all components upstream of the drain pan, including the cooling coil and return duct static pressures. Be sure to add an allowance pressure drop to the for dirty filters (worst-case scenario).

The height from the top of the bottom bend on the trap to the bottom of the leaving pipe must be at least equal to one half of the X dimension.

The absolute value of the fan inlet pressure will be greater than or equal to the absolute value of the static pressure in the drain pan. Inlet pressure is a safe value to use for drain pan static pressure.



External Draw-through P-Trap

Drain Pan Pressure Negative Static (inches of water)	Trap Dimensions X (inch)	X/2 (inch)
-0.50	1.50	0.75
-1.00	2.00	1.00
-1.50	2.50	1.25
-2.00	3.00	1.50
-2.50	3.50	1.75
-3.00	4.00	2.00
-3.50	4.50	2.25
-4.00	5.00	2.50
-4.50	5.50	2.75
-5.00	6.00	3.00
-5.50	6.50	3.25
-6.00	7.00	3.50
-6.50	7.50	3.75
-7.00	8.00	4.00
-7.50	8.50	4.25
-8.00	9.00	4.50

Draw-Through P-Trap Dimensions

1.8. WEATHER PROOFING

1. Walking around to each door, ensure the weather stripping around the door frame is installed completely, not drooping, or falling off.

2. Inspect the door handles to ensure they are not loose/falling out of door.

3. Inspect the hinges on each door to ensure they are secure, no stripped mounting screws, or that the hinges are separating from the cabinet.

2. DAMPER ASSEMBLY PREP

The Multi-Path damper assembly has three sections.

The TOP part of the assembly is the Outdoor Air Damper (OAD) section. The OAD section allows a pre-determined quantity of outside air to enter the unit.

The MIDDLE part of the assembly is the Return Air Damper (RAD) section. The RAD section allows a pre-determined quantity of air from the space to enter the unit. The air traveling through this assembly originates from the sales floor and mixes with the outdoor air before it flows across the cooling coil.

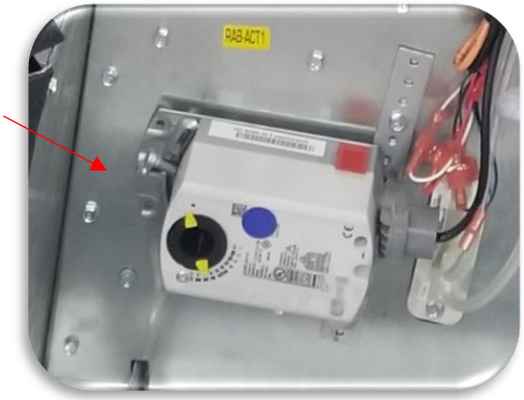
The BOTTOM part of the assembly is the By-Pass Air Damper (BAD) section. The BAD section allows air from the space to go underneath (By-Pass) the cooling coil.

MPU Damper Assembly

2.1. ACTUATORS SECURE

Verify each actuator is secure on the damper shaft by applying pressure to the dampers and observing the bracket and shaft. If shaft movement is detected, tighten the actuator adjustment screws.

OAD & RAD Adjustment Screw Location



BAD Adjustment Screw Location

2.2. FAIL SAFE DAMPER POSITIONS

With the power off. Ensure that the outdoor damper blades are 100% closed, and the return damper blades are 100% open.

Default Damper position

3. FILTER PREP

3.1. FILTER INSTALLATION

Ensure all filters are installed correctly, with the airflow direction arrow pointing towards the coil cabinet.

3.2. FILTER RACK

Ensure all filters can move freely in the filter rack and be removed easily without damage.

3.3. FILTER STATUS

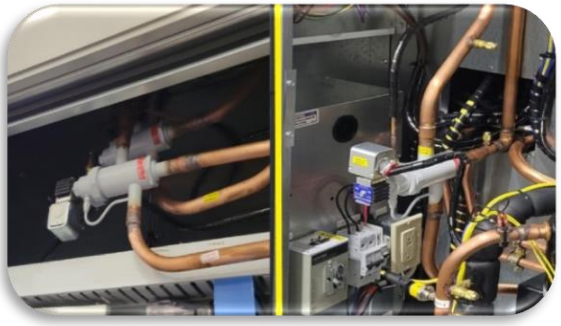
Check to see if the filters are clean or need to be changed.

4. COIL PREP

4.1. HEAT RECOVERY TYPE

Record the type of heat recovery in the unit on the startup form. This can be reheat, reclaim, or no heat recovery.

Reheat systems are self-contained within the unit, using a valve to direct high-pressure, high-temperature compressor discharge to a smaller coil in front of the evap coil to reheat the incoming air.



Reheat Valve(s)

Reclaim systems take excess heat, usually from the rack systems on a site, and use it to treat the incoming air on a unit.

Heat Reclaim

4.2. E-FIN COATING

If the unit is within 15 miles of a coastline, it should have a black e-fin coil coating on the condenser and evap coils. Ensure that the coating is complete, and that there is no chipping on the capillary lines or coils.

E-FIN Coated Coil

4.3. COPPER TUBE ISOLATION

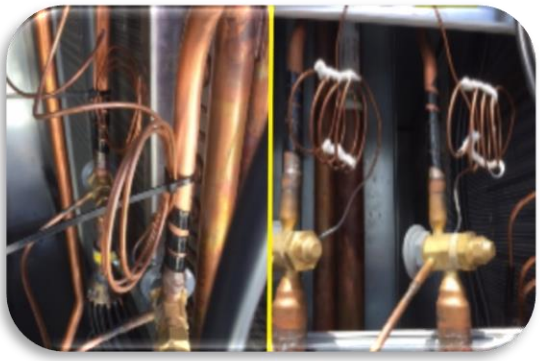
Ensure that the capillary lines and other copper lines are isolated so that they do not rub against themselves, the door interior or walls, any wiring, or the drain pan edge. Failure to do so may cause leaks, empty circuits, or shorts in wiring.

4.4. SUCTION LINES INSULATED

Ensure all Suction lines are fully insulated with Armaflex insulation.

4.5. TXV CAPILLARY TUBE FOR SENSING BULB

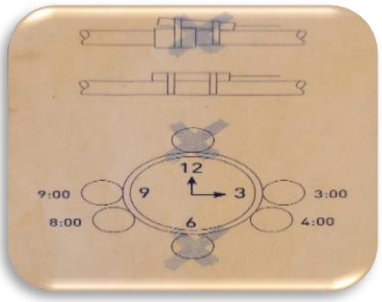
1. Gently remove the shipping cable ties from the TXVs capillary tubes.
2. Spread the capillary tubes apart.
3. Silicone the capillary tubes so they do not rub together.



TXV Capillary Tubes

4.6. TXV SENSING BULB PLACEMENT

Ensure the TXV bulbs are at a 8:00 to 9:00 or 3:00 to 4:00 position on the suction lines. This ensures proper operation of the TXV valves, and could affect circuit performance if not in the recommended positions. If the bulbs are positioned out of this range, remove insulation covering bulb, loosen band screw and slide bulb to proper position. Retighten band screw and replace insulation.



Sensing Bulb Location

4.7. SUPPLY FAN MESH

Ensure the mesh has been properly installed with no large gaps around edges, and that there are no obstructions between the mesh and the supply fan.

Supply Fan Mesh

4.8. HEAT RECLAIM (IF APPLICABLE)

If the unit is not equipped with a heat reclaim, proceed to section 4.10.

The following is required for a unit with reclaim installed.

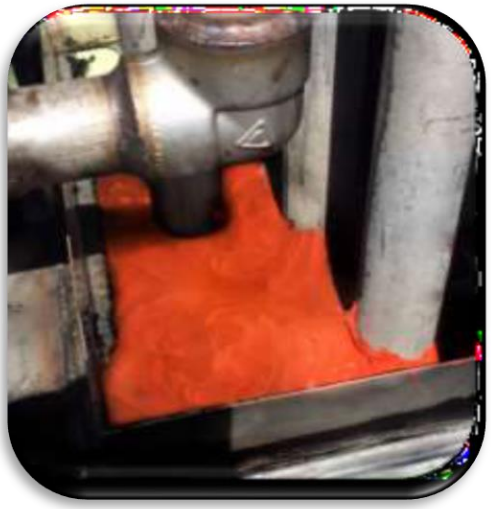
4.8.1. HEAT RECLAIM PIPING

Verify all piping connections have been made between the refrigeration system and the unit's heat reclaim coil.

4.8.2. HEAT RECLAIM PIPE CHASE

Verify the pipe chase opening is completely sealed. Most pipe chase openings occur in the bottom of the unit; however, penetrations may occur in the side or top of the unit. Please refer to the unit submittal for the exact location of the pipe chase opening.

NOTE: Pipe Chase must be sealed with an approved sealant based on local code. ROXUL Wool or fiber type insulation will not withstand internal pressures.



Clean, Sealed Pipe Chase

4.9. HEAT RECLAIM/REHEAT TEMP SENSOR

Verify temp sensor has been mounted to the heat reclaim input pipe and is insulated.

Reclaim Temp Sensor Installation
NOTE: This image does not include insulation, Reclaim/Reheat sensors must be insulated

4.10. PLASTIC EDGE GUARD

Ensure plastic edge guard has been installed on drain pan edge to protect cooper feeder tubes.

Plastic Edge Guard

4.11. UPPER TO LOW PAN DRAIN

Ensure drain from upper pan is installed correctly. Drain should be installed and secured about ½" to 1" above the bottom of the pan.

Upper to lower drain tube

4.12. DRAIN PAN SEALED

Ensure the edge of drain pan is caulked and completely sealed.

4.13. DRAIN PAN FLOAT SWITCH

Ensure drain pan float switch is installed and secure.

Drain Pan Float Switch

5. SUPPLY CABINET PREP

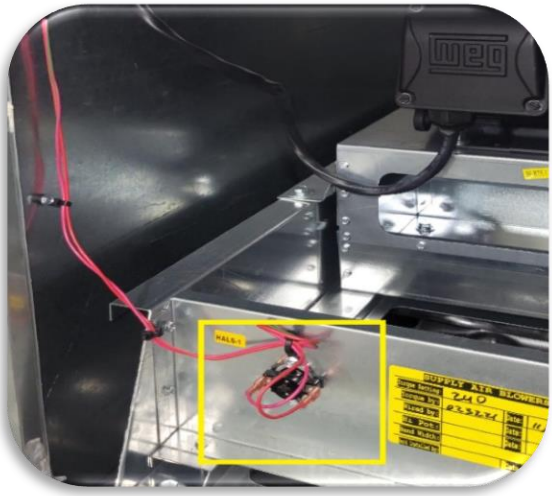
5.1. SUPPLY FAN NAMEPLATE

Take a photo of the name plate on the supply fan motor. Ensure motor amps match unit nameplate.

Supply Fan Nameplate

5.2. WIRES PROPERLY INSTALL & SECURED

Ensure the high/auxiliary limit switches in the supply fan cabinet are secure.



High/Auxiliary Limit Switch

Check all wiring in the supply fan cabinet, **including the supply motor conduit box** to ensure all connections are properly wired and secured.

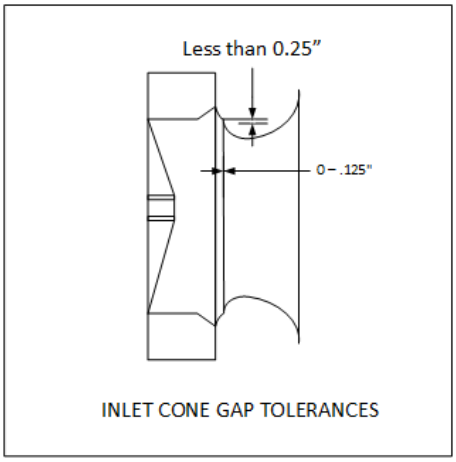
5.3. SUPPLY FAN WIRE CONNECTIONS

When checking the wiring inside the supply motor conduit box, ensure the wire connectors are sized appropriately for the wire gauge used. This is especially important on lower voltage/higher amperage units.

5.4. SUPPLY FAN SET SCREW

Check to ensure the screws/bolts on the supply motor base and on the blade shaft are tight. A space or gap must be maintained between the blower blade and its inlet cone. The inlet cone can be moved as necessary to center the cone in relation to the blade assembly. The blade assembly can be moved on the motor shaft to set the correct overlap in relation to the cone.

It is important to verify and maintain the tolerance between these gaps to maximize the blower performance and prevent unit damage.



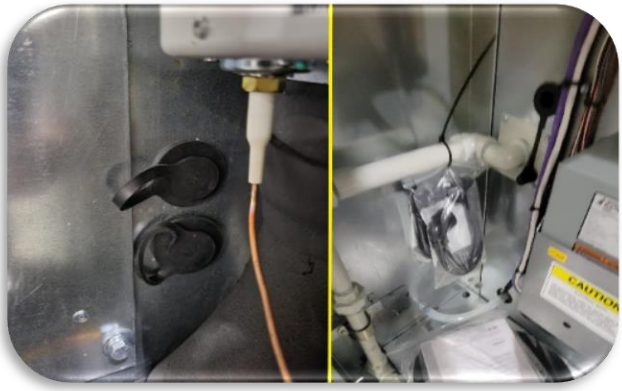
Supply Fan Inlet Cone Tolerances

5.5. SUPPLY FAN MOVEMENT

Spin the supply fan wheel manually to check the alignment of the wheel. Check for rubbing/wobbling.

5.6. SUPPLY FAN VENT PLUGS

Pull the vent plugs from supply fan cabinet outer wall (located low and to the right of the supply fan access door on a C-box, and in the controls cabinet rear wall on each side on the D box



Supply Fan Vent Plugs

5.7. VFD WIRE GROMMENTS

Ensure the wiring grommets on the bottom of the VFD/s are fully seated.

5.8. VFD WIRING

Ensure the VFD has been wired to the correct points using the unit wiring diagram supplied on the interior cabinet door, and that the ground wire has been run directly from the VFD ground to the ground in the supply motor conduit box.

5.9. CHECK HEAT EXCHANGERS/HEAT STRIPS

Verify that heat exchangers on NG/Propane units or the heating elements on electric heat units are free of debris, checking directly under and behind the supply motor assembly for plastic bags, paper, trash, screws, etc. sitting on top of the exchangers or elements.

1. Using a flashlight, inspect the heating assembly and remove any screws or debris.
2. Verify all wiring and connections for tightness and secure any loose connections.

6. COMPRESSOR PREP

6.1. CRANKCASE HEATER CHECK

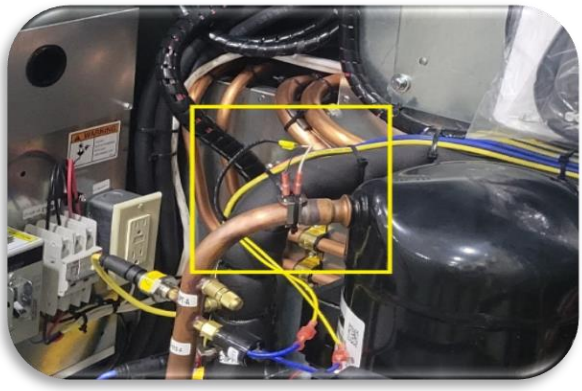
Ensure the crankcase heaters are free of any damage, mounted securely to the bottom of the compressors, that the wiring is covered/insulated from sharp edges. Check the tag or markings located on each crankcase heater to ensure they match the unit voltage.

6.2. CHECK SUCTION LINES FOR INSULATION

Inspect all suction lines in the cabinet for proper Armaflex insulation. Any tears or gaps in insulation should be repaired.

6.3. DIGITAL COMPRESSOR THERMISTOR

Ensure digital compressor thermistors have been positioned at the 12:00 position at the top of the discharge line, are not sitting on a joint, and are secured to the pipe so they do not slide easily. A small zip tie can be added if needed to secure the thermistor in place.



Digital Compressor Thermistor

7. CONDENSER PREP

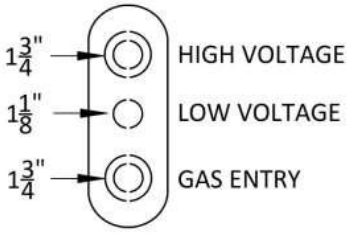
Ensure the condenser fan blades are positioned correctly, around 1/8” above the lip of the condenser fan shroud, that the blades spin freely, not contacting any wiring, motor mounts, or the fan blade guards.

8. ELECTRICAL PREP

From the factory, the MPU is wired for 3-phase, 208V, 460V or 575V based on the customer’s requirements. The unit is equipped with an appropriately sized, non-fused disconnect located on the exterior of the unit near the electrical cabinet.

Do not confuse the disconnect with the breaker providing over-current protection for the unit. Over-current protection is provided by a resettable breaker located in the electrical cabinet supplying power to the MPU.

Verify that the installer did not run the supply power and control wires in the same conduit.



Utility Entry Knockouts

Verify the high voltage is run correctly and terminated at the units disconnect.

High Voltage Wiring Through Entry Point

8.1. CHECK ALL WIRE CONNECTIONS

Loose electrical connections create a risk of failure. Tighten any loose connections, verify no bare wires are visible and all connections are secure. Ensure all wiring, wiring harnesses, fuses, transformers, terminal blocks, contactors, etc., are secure and without damage.

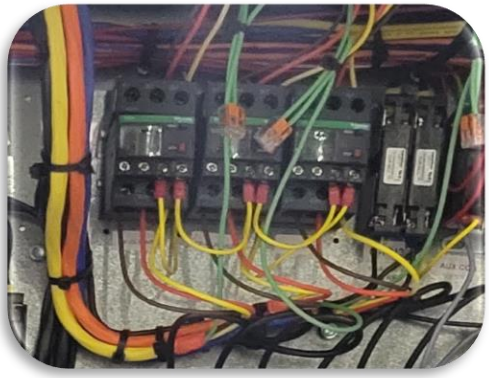
1. Using a hex wrench, verify all high voltage connections at the disconnect.
2. Continue to verify and tighten hex connections on each terminal block.
3. Tighten all flat tip high voltage and low voltage connections using an appropriately sized flat-tip screwdriver.
4. Verify all crimp on connections to ensure the wire is crimped tightly and the connector is secure at its terminating point.
5. Verify all isolation relays are plugged in tightly to their sockets.
6. Verify all wires are securely attached within the connector(s) and the connector is plugged tightly into its socket(s).

8.2. OHM OUT MAIN TERMINAL BLOCK

With the building wired to the disconnect, ohm out all three legs of the main terminal block to case ground. Ensure no continuity is present on any legs to ground. Ensure that there is some resistance is present between each leg.

8.3. CONDENSER FAN OVERLOADS

If equipped ensure overloads for condenser fans are set ½ an amp above the condenser amps listed on the unit nameplate.

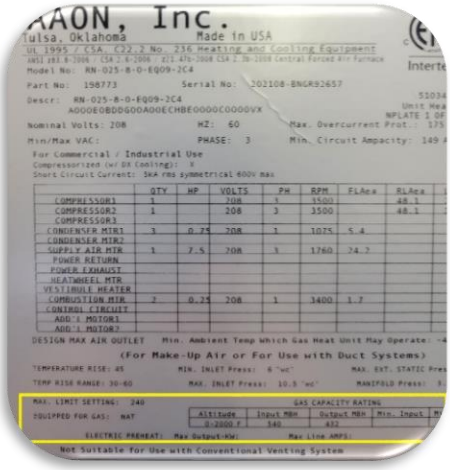


Condenser Fan Overloads

9. HEATING PREP

9.1. TYPE OF HEATING

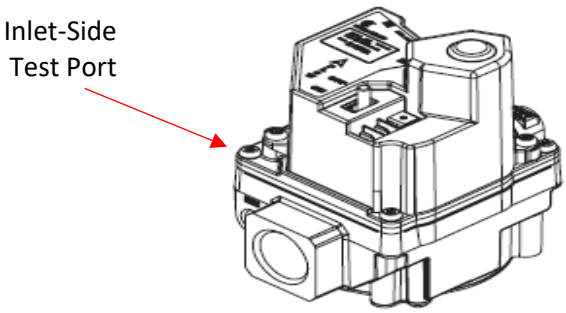
The MPU has two available heating options: Gas or Electric. Verify and record the type of heating on the startup sheet located on the unit nameplate.



Unit Nameplate with Type of Heat

9.2. STATIC GAS PRESSURE

Record static gas inlet pressure upstream of the gas valve on the startup form.



Gas Valve checking inlet pressure.

Acceptable Inlet Gas Pressures

9.3. GAS LEAK CHECK

Using a leak detector or bubble solution, check all joints on the piping to the unit from the regulator, and inside the heating cabinet for leaks. Repair if found.

10. CONTROLS PREP

10.1. CONTROLLER POWER

Using the wiring diagram on the door interior, ensure the power wiring to all control modules are terminal correct.

10.2. CHECK LVTB

Ohm out red side of the LVTB to ensure it is not grounded. Also ensure that a green ground wire from the common side of the customer service terminal block is installed.

10.3. SMOKE DETECTOR

Check to see if the smoke detector has been wired to the terminal block. If the smoke detector is not wired, the FLo start-up tech must not terminate the wires to the terminal block. Please immediately reach out to FLo technical support by email or phone.

10.4. CONTROLLER WIRES

Using the wiring diagram on the door interior, ensure the wiring to all control modules and terminal blocks are correct, with particular focus on communications wiring, inputs & outputs.

11. ALL CABINETS PREP

11.1. REMOVE ALL TRASH

Remove any trash found inside all cabinets including under the supply motor assembly.

11.2. DRAIN PAN CHECK

Ensure you check in and behind the unit drain pans.

11.3. CHECK ALL WIRING

Ensure wiring in each cabinet is secure and insulated from sharp edges and/or pinch points.

11.4. APPEARANCE CHECK

Acceptable Gas Pressure Ranges		
	Minimum	Maximum
Natural Gas	6.0” WC	10.5” WC
Propane (LP)	11.0” WC	13.0” WC

Ensure wiring in each cabinet is organized and neat in appearance.

11.5. ERRORS FOUND DURING START-UP

Please input any and all errors found during the preparation of the unit into the errors section near the back of the startup form.

YOU CAN NOW POWER THE UNIT ON FROM THE MAIN DISCONNECT

12. ELECTRICAL POWERED

12.1. SUPPLY LINE VOLTAGE

Once the prep section Using a multimeter set for up to 600VAC, take and record the voltage on the test sheet from the main terminal block(TB1).

L1 to L2

L2 to L3

L1 to L3

12.2. PHASE MONITOR

The Digital Phase Monitor (DPM) is a small electronic device which continuously monitors the MPU’s three phase high voltage values.

12.2.1.ANALOG PHASE MONITOR

Some units may contain an analog PBO. If the unit contains an analog PBO, ensure the jumper is installed on the correct voltage setting. The analog PBO will not operate if the supply voltage is 15% over/under required site voltage. If voltage is more than 15% over/under, please call into Flo technical support.

Analog Phase Monitor

12.2.2.DIGITAL PHASE MONITOR

The DPM display will show the voltage reading for each phase: A – B = L1, B – C = L2, C – A = L3.

If a voltage fault is detected by the DPM, the screen will toggle between the voltage screen showing the voltage values and words describing the fault. If the supply voltage falls outside of the operational parameters, the DPM will turn the MPU 'OFF' and a phase loss alarm will be generated in the unit controller.

Digital Phase Monitor

12.2.2.1. DPM OPERATION

Using the four 4 membrane buttons on the front of the DPM, the user can change the settings for their line voltage and preferred parameters. Selections are available by moving through the menu choices using the right and left arrow buttons while the up and down arrow buttons allow changes within each menu.

12.2.2.2. DPM SETTINGS

The Flō default settings for the device are:

- Line Voltage: **Voltage on Nameplate**
- Over & Under Voltage: **± 10%**
- Trip Time Delay: **5-Seconds**
- Re-Start Time Delay: **2-Minutes**
- Phase Imbalance: **5%**

12.2.2.3. DPM CONFIGURATION

1. Press the right arrow button until the Voltage Selection Screen is displayed.
2. Using the up and down arrows, verify that the voltage setting matches the unit's nameplate voltage. If it doesn't match, set the voltage setting to match the nameplate.
3. The choices available are:
   Single Phase - 200, 208, 220, 230 and 240V
   Three Phase - 200, 208, 220, 230, 240, 380, 415, 440, 460, 480, 575 and 600V
4. Press the right arrow button, verify, and record the Over/Under % setting.
5. Press the right arrow button, verify, and record the Trip Delay setting.
6. Press the right arrow button, verify, and record the Restart Delay setting.
7. Press the right arrow button, verify, and record the Phase Imbalance setting.
8. Press the right arrow button, the screen will display the three voltage values and the letters," OK". Verify and record the voltage readings on SU-FOR-02.

12.3. CRANKCASE HEATER AMPS

Using an amperage clamp meter, take and record the crankcase heater amps while the compressors are off. You

can take the amperage directly from the gray wires coming out of the crankcase heaters OR from the bottom side of the compressor contactor auxiliary contact using the diagram located on the cabinet door interior.

13. SUPPLY FAN POWERED

13.1. VFD PARAMETERS

Ensure the VFD parameters are correct by using the unit specific VFD parameters information sheet included with the job packet. If wrong change them and record the error.

13.2. SUPPLY FAN OPERATION CHECK

Once the parameters have been verified and match the unit specific VFD parameters sheet, place the VFD into local mode and press run.

13.3. SUPPLY FAN ROTATION CHECK

Ensure the supply fan blade assembly is spinning in the correct direction (clockwise when facing the blade side of the supply fan assembly, counterclockwise when facing the rear of the supply motor. Ensure the blade assembly is spinning without significant wobble and is not hitting the plenum while spinning.

Supply Fan Motor

13.4. VFD BACK IN AUTO MODE

Once rotation has been confirmed press stop on the VFD and put it back in auto/remote mode.

13.5. SUPPLY FAN ACCESS

Replace access panel to supply fan motor. Ensure bolts are not stripped out.

14. CONTROLS POWER

14.1. CONTROLLER PROGRAMING

14.1.1.I-CONTROLLER 2.0

Use CN-IC2-09 I-Controller 2.0 Firmware Loading USB PDF to load the program into the I-Controller 2.0

14.1.2.VCCX

Use SU-GEN-03 to check and/or change the program as needed based on the VCCX Config pdf.

14.2. SETTING THE DATE & TIME

Verify the Flō unit controller's date and time are set for your time zone.
If the date or time require adjustment, CN-IC2-04 i-Controller 2.0 Display Navigation REV.300 to set the date and/or time as necessary for your local time zone.

14.3. SETTING CLOGGED FILTER SWITCH

The Clogged Filter Switch (CFS) is a differential pressure switch that is intended to provide a rough indication to the unit controller that the filters are dirty.

The CFS is factory installed in the controls or compressor cabinet depending on unit size and field adjustment is required for proper function. Closure of the CFS will generate a clogged filter notice in the alarm log of the controller.

While airflow is consistent through different parts of the unit, air pressures are not – pressure is lowest right as air is being drawn into the fan plenum and highest just after leaving it, and each obstacle in the air path creates a "step" in pressure, including the filters. As the filters collect more dust and dirt, they will cause a larger pressure "step" that can cause the clogged filter switch to trip and show an alarm in the unit controller.

Clogged Filter Switch

The switch can be adjusted to trip at pressure differentials ranging from approximately 0.05" WC to 2.0" WC. Type of filter media desired and when a filter is considered to be "dirty" (in terms of pressure drop) will dictate which setting should be used.

1. To adjust the set point, turn the adjusting screw counterclockwise (↺) until motion has stopped.

2. Next, turn the adjusting screw 4 complete turns in a clockwise (↻) direction to engage the spring.
3. From this point, the next ten turns will be used for the actual calibration.

NOTE: Each full turn represents approximately 0.2" WC.

4. With the unit on, clean filters installed, and filter/damper cabinet doors closed, turn the adjusting screw clockwise (↻) until the switch opens and comes out of the alarm state.

5. Turn the adjusting screw further, according to Step 3, to set the desired pressure drop to indicate dirty filters. **The switch should be readjusted any time filter media is changed (brand, type, etc.).**

Please note: To properly calibrate and air switch, a digital manometer or other measuring device should be used to confirm the actual set point.

14.4. RETURN AIR TEMP VALIDATION

Using a cold spray or rub test, observe a change on the displayed value of Return Air Temp Sensor.

14.5. SENSOR LOCATIONS/READINGS

14.5.1.SPACE TEMP/HUMIDITY SENSOR

Sensors are at the heart of the MPU system.
The space temperature and humidity sensors are vital control points for the MPU. To provide the most accurate readings to the controller, these sensors are to be installed at head height in the center of the zone.

The sensors are to be located away from doors, windows, vents, supply air stream, heaters, appliances, refrigerated cases and outside walls that could affect the sensor readings.

It is important that the sensors are not obstructed by shelving or product as this will negatively influence the accuracy of the readings.

In the **first column**, record the readings displayed on the controller for each Space Temperature sensor and each Space Humidity Sensor installed.

In the **second column**, using a meter record the measured sensor readings for each Space Temperature sensor and each Space Humidity Sensor right beside the sensor.

In the **third column**, record offset applied if needed.

In the **fourth column**, check if sensor reading has passed.

In the **fifth column**, check if sensor is not used.

14.5.2.OUTDOOR TEMP/HUMIDITY SENSOR

These sensors are factory installed under the outdoor hood.

In the **first column**, record the readings displayed on the controller for each Space Temperature sensor and each Space Humidity Sensor installed.

In the **second column**, using a meter, record the measured sensor readings for each Space Temperature

sensor and each Space Humidity Sensor right beside the sensor.

In the **third column**, record offset applied if needed.

In the **fourth column**, check if sensor reading has passed.

In the **fifth column**, check if sensor is not used.

14.5.3.SUPPLY AIR SENSOR

On small boxes, verify that the Supply Air Sensor (SAT) is installed on the side of the supply duct that is below the condenser fans and opposite of the electrical drop inside the unit. When a concentric diffuser is used, verify that the SAT is as far as possible from the supply air opening. When traditional ductwork is used, install the SAT sensor no less than 10 feet away from the vertical drop.

14.5.4.MONITORING SENSORS

The Monitoring Sensors table requires confirmation of the controller readings for each sensor or a selection of the N/A checkbox if not applicable.

14.5.5.COMPRESSOR TRANDUCERS

Compressor transducers readings need to be checked with the compressors off.

If your gauges read zero, call Flō technical support right away (888-598-1198 option 1).

In the **first column**, record the readings displayed on the controller for each transducer installed.

In the **second column**, using a gauge record the measured readings for each transducer installed.

In the **third column**, check either yes if transducer is reading +/- 5 pounds or no if it is more than +/- 5 pounds.

In the **fourth column**, check if sensor is not used.
Re-install all service caps.

14.6. LOW PRESSURE SWITCHES

Carefully remove each compressor warning tag.
Plug the low-pressure switch wires into the compressors.

15. ALL CABINETS POWERED

15.1. REMOVE ALL TRASH

Remove any trash found inside all cabinets including under the supply motor assembly, in and behind the unit drain pans.

15.2. ERRORS FOUND DURING START-UP

Please input any and all errors found during the preparation of the unit into the errors section near the back of the startup form.

16. SUPPLY FAN VALIDATION

16.1. SUPPLY FAN FREQUENCY

Record the hertz the VFD(s) are at when the unit is occupied mode.

16.2. SUPPLY FAN AMERAGE

Record the amperage reading on each leg of the load side of the VFD(s)

17. DAMPER VALIDATION

Use the navigation guide to access the test modes on the controller.

17.1. ENABLE DAMPER TEST MODE

Prop door open and navigation controller to test mode.

17.2. CONFIRM ALL DAMPERS SEAL

Using the controller damper test mode, place all air flow dampers into the 0% position. Verify the OAD, RAD and BAD close completely.

17.3. CONFIRM OAD OPERATION

Override the OAD damper to 100%. Verify the damper fully opens.

17.4. CONFIRM RAD OPERATION

Override the RAD damper to 100%. Verify the damper fully opens.

17.5. CONFIRM BAD OPERATION

Override the BAD damper to 100%. Verify the damper fully opens.

17.6. DISABLE DAMPER TEST MODE

Remove all overrides. Confirm all dampers go back to normal position.

18. HEATING VALIDATION

For units with Gas Heat use 18.1.
For units with Electric Heat use 18.2.

18.1. GAS HEATING

18.1.1. EXCHANGER BURN OFF

You need to run all stage of heat for at least 5 minutes to burn off any residue that may remain since the heat exchange was installed.

18.1.2. GAS MANIFOLD PRESSURE

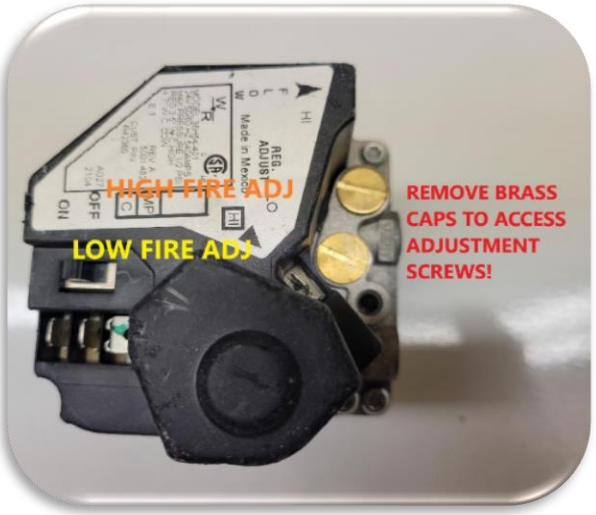
The correct manifold pressures are important for efficient gas furnace operation. If the gas pressures are too low, it will cause rough ignition, incomplete and inefficient combustion, and incorrect fan control response. An excessively high manifold pressure may cause the burners to over fire the heat exchanger.

Over firing the heat exchanger not only reduces the life of this component, but it also may result in repeated cycling of the burner on the high limit control. The Flō unit uses two-stage gas valves. The two operational stages are called Low Fire and High Fire. Both stages are tested and set before the unit leaves the factory but are always rechecked at the time of equipment start-up, due to the critical nature of the readings.

Manifold Gas Pressures		
	Low Fire	High Fire
Natural Gas	1.75” WC +/- 10%	3.5” WC +/- 10%
Propane (LP)	5.25” WC +/- 10%	10.5” WC +/- 10%

Acceptable Gas Manifold Pressures at the Manifold Pressure Port

1. Use the following procedure to verify the Manifold Gas Pressures are correct for each Flō gas valve.
2. Ensure that all stages of heat are ‘**OFF**’.
3. Remove the hex plug from the Flō unit’s gas manifold and connect the manometer to the gas port. See Figure 29.
4. Using the Flō controller, energize the gas valve’s low fire circuit.
5. Verify the burner has lit.
6. If there are adjustments needed, remove the regulator cover screw from the gas valve’s low outlet pressure regulator adjust the screw clockwise ↻ to increase pressure, or counterclockwise ↺ to decrease pressure to achieve the recommended manifold gas pressures in Table 5.



High Fire & Low Fire Adjustments

7. Using the Flō controller, energize the gas valve’s high fire circuit.
8. If there are adjustments needed, remove regulator cover screw from the gas valve’s high outlet pressure regulator and turn the screw clockwise ↻ to increase pressure, or counterclockwise ↺ to decrease pressure to achieve the recommended manifold gas pressures listed in Table 5.
9. Replace regulator cover screws.

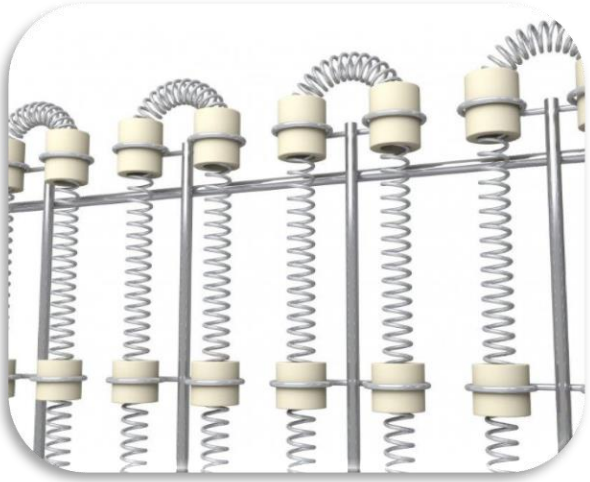
10. Document readings taken for each manifold in low and high fire on SU-FOR-02.

11. Repeat steps 1 thru 9 on the remaining gas valves.

Manometer Connected to Gas Port

18.2. ELECTRIC HEATING

All MPU units, using electric heat, are designed with four stages of heat. The number of energized stages will be determined by the required demand in the space.



Electric Heating Elements

18.2.1.ELECTRIC HEAT VERIFICATION

1. Go to “Heating Test Modes” and turn on “Full Capacity Test Mode” on the controller.

2. Record the average heat reading for each contactor on the SU-FOR-02 form.

3. Go to “Heating Test Modes” and turn off “Full Capacity Test Mode” on the controller.

19. COOLING VALIDATION

1. If conditions are not met to do a full cooling startup, it is still important to test the components in the cooling circuits, including condenser fan operation, compressor operation. You can use guide SU-IC2-02 for direct overrides of compressors and condenser fans.

2. Record amperage of each condenser fan on the startup form.

3. Ensure the condenser fans are pulling air through the condenser coil and out the top of the condenser fan shroud. You can use a piece of paper or cloth and place it near the condenser coil to verify this. It should be sucked up onto the exterior of the coil.

4. Record compressor amperage off of each leg on the startup form.

5. Using sound and gauge readings/amperages check for proper operation of the condenser fans and compressors.

6. Check the contactors for the condenser fans and compressors to ensure they are not making loud chattering noises or other abnormal sounds. This could be indicative of “trash” that has fallen into the contactor, loss of voltage on one or more legs, or incorrect phasing.

7. Ensure the reheat valve has run for 5-10 minutes before moving on to SH/SC.

19.1. SUB-COOLING & SUPERHEAT CONDITIONS

During start-up of each unit, the technician is required to perform static refrigerant pressure, sub-cooling and superheat measurements.

Multi-Path refrigeration circuits are charged with R410A refrigerant and factory tested.

Verify sub-cooling and superheat during the startup of each Flō unit. Adjust only if necessary. Perform the verification under full load, or as close to full load condition as possible.

The unit is under a 'full load' when the discharge pressure (converted using the PT chart in Table 7) is equal to the ambient temperature plus 15°F - 30°F.

The following criteria must be met to perform sub-cooling and superheat verification:

1. Unit is under a 'full load'.
2. The ambient temperature must be above 80°F.
3. Return temperature must be above 70°F.
4. All compressors must be running at full speed.

If all criteria above are met, begin verification of sub-cooling and superheat while the unit is in Comfort Cooling mode of operation.

NOTE: The unit must be running at least 15 minutes before checking sub-cooling and superheat.

If the criteria 1-4 above are not met, continue onto section 19.

19.2. CHECKING LIQUID SUB-COOLING

Measure the temperature of the liquid line as it leaves the condenser coil.

Read the gauge pressure at the liquid line close to the point where the temperature was taken. You must use liquid line pressure as it will vary from discharge pressure due to condenser coil pressure drop.

Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart.

R410A	Temperature	
Pressure	F°	C°
78	20	-6.7
87	25	-3.9
97	30	-1.1
107	35	1.7
118	40	4.4
130	45	7.2
142	50	10
155	55	12.8
170	60	16.6
185	65	18.3
201	70	21.1
217	75	23.9
235	80	26.7
254	85	29.4
274	90	32.2
295	95	35
317	100	37.8
340	105	40.6
365	110	43.3
391	115	46.1
418	120	48.9
446	125	51.7
476	130	54.4
507	135	57.2

410A Pressure/Temperature Chart

Subtract the measured liquid line temperature from the saturated temperature to determine the liquid sub-cooling.

Record what the initial sub-cooling reading is for each circuit on the SU-FOR-02 form, section 18.

19.3. CHECKING EVAPORATOR SUPERHEAT

Measure the temperature of the suction line close to the compressor.

Read gauge pressure at the suction line close to the compressor.

Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart (Table 7).

Subtract the saturated temperature from the measured suction line temperature to determine the evaporator superheat.

Record what the initial superheat is for each circuit on the SU-FOR-02 form, section 18.

19.4. ADJUSTING SUB-COOLING AND SUPERHEAT

Compare calculated sub-cooling to Table 8 for the appropriate coil and system type to determine if adjustments may be required.

Sub-Cooling	Min Range	Max Range
Air-Cooled	8°F	15°F
Water Source Heat Pump	4°F	8°F

Sub-Cooling Ranges

Compare calculated superheat to Table 9 for the appropriate coil and system type to determine if adjustments may be required.

Superheat	Min Range	Max Range
Air-Cooled	8°F	15°F
Water Source Heat Pump	8°F	15°F

Superheat Ranges

NOTE: A recheck of subcooling and superheat are required following any refrigerant and/or TXV adjustments. Allow the unit to run for 15 minutes minimum before checking sub-cooling and superheat readings again following adjustments.

A) Adjusting An Overcharged System

The system is overcharged if the sub-cooling temperature is too high and the evaporator is fully loaded (low loads on the evaporator result in increased sub-cooling) and the evaporator superheat is within the temperature range as shown in the table 9 (high superheat results in increased sub-cooling).

Correct an overcharged system by reducing the amount of refrigerant in the system to lower the sub-cooling.

B) Adjusting An Undercharged System

The system is undercharged if the superheat is too high and the sub-cooling is too low.

Correct an undercharged system by adding refrigerant to the system to reduce superheat and raise sub-cooling.

C) When TXV Adjustments May Be Required

If the sub-cooling is correct and the superheat is too high, the expansion valve may need adjustment to correct the superheat.

NOTE: Each turn of the thermal expansion valve (TXV) changes superheat approximately 2°F. Adjust the thermal expansion valve (TXV) counterclockwise to decrease superheat and clockwise to increase superheat.

D) Post Adjustment Verification

Repeat as required until readings are within the sub-cooling and superheat ranges. Ensure that you note on the SU-FOR-02 section 18 if you had to adjust refrigerant and/or the TXV on each circuit and what your final sub-cooling and superheat readings are once you are within the required ranges.

20. SAFETIES VALIDATION

20.1. DRAIN PAN FLOAT SWITCH

Lift the drain pan float switch up and confirm that the supply fan ramps down/shuts down within a minute. If the supply fan does not ramp down/shut down, ensure that the drain pan float switch is wired correctly and not crossed up with another sensor.

21. WRAP UP AND UNIT IMAGES

21.1. WRAP UP

1. Ensure that the factory installed smoke detector jumper has been removed. Flō will advise you that the smoke detector jumper is to be left in place.

2. Ensure that all shrader valves have caps, and that they are all tight.

3. If the unit has gas valve covers, ensure they are positioned over the gas valves and secure.

4. Power the unit down from the main disconnect, wait 5 minutes, and power it back on. This should clear any overrides used during the startup validation steps.

5. Check for any active alarms on the controller. If the unit has alarms, resolve before finishing.

6. Perform one final check of the unit to remove any trash or tools otherwise left behind.

21.2. WRAP UP

As part of the unit start-up, Flō requests that you take digital images of exterior and interior sections of the unit.

The required images are listed on SU-FOR-02 as well as below:

1. Unit name plate.
2. All sides of the unit with doors closed.
3. Supply temp sensor showing the location within the store.
4. Space temp sensor showing location within the store.
5. Reheat/reclaim sensor secured to piping and insulated.
6. Each controller(s) alarm status screen.
7. Each controller(s) network info screen.
8. The outdoor air hood removed has been properly installed.
9. Supply fan motor nameplate.
10. RH/Dewpoint sensor showing location within the store.
11. Inside of each compartment of the unit.
12. A closeup of all LVTB field connections.
13. Controller main menu screen showing date and time.
14. Controller information screen from the Carel controller.

Submit the unit images and completed startup form to startup@systemsflo.com prior to calling in for the start-up checkout.

The final two sections of the form can be used for any technician notes and any errors found while performing the startup.

You can also send photos of any unit errors that can be illustrated through photos along with the other pictures.

Once complete, call into the FLo startup checkout appointment line at 888-598-1198 and select option 2.