Flō Energy Solutions, Inc.

Multi-Path

STARTUP REFERENCE MANUAL

This document will assist the start-up technician with the Flō Multi-Path Start-Up and completion of the Start-Up Audit Form (SU-FOR-01). 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-01 Start-Up Audit Form. Any numeric sub-sections (i.e., 16.1 Display) in this manual are additional instructions to assist in guiding the technician through that section of the SU-FOR-01.

FLŌ ENERGY SOLUTIONS	Technical Manual	SU-GEN-01
Title:	Multi-Path Startup Manual	

CONTENTS

TOOLS AND MATERIALS

The tools and materials listed below will assist in the completion of the MPU start-up. The items are divided into two categories: Required and Highly Recommended.

Required tools are essential for every start-up, highly recommended tools are less frequently used at start-up, but are needed to perform firmware updates, Building Management System (BMS) integration or advanced diagnostics. When possible, bring the highly recommended tools with you to when performing Flō start-ups.

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	Manometer	ABS Pipe Primer / Glue
Digital Camera	6" Crescent Wrench	R410A Refrigerant Gauges
Female Spade Crimp Connector (Blue)	PVC Primer / Glue	Micro Flat Tipped Screwdriver
Digital Thermometer	Clear Silicone Sealant	Control Screwdriver
Psychrometer	Wire Crimper / Stripper	6" Wire Ties
Female Spade Crimp Connector (Red)	10” Channel Lock Pliers	Flat Tip Screwdriver Set
Volt / Amp Meter	Hex Key Set	Drill
R410A Refrigerant	Refrigerant Recovery Tank	Refrigerant Scale
Socket Set	Level	

Table 1. Required Tools and Materials

HIGHLY RECOMMENDED - Tools and Materials		
Laptop	5’ CAT 5 Ethernet Cable	USB Drive (4GB Ideally)

Table 2. Highly Recommended Tools and Materials

1. VISUAL UNIT INSPECTION

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, section 1.2 of this manual will guide you through the claim process. If no damage is found, proceed with the unit's start-up.

Figure 1. Flō Small Multi-Path Unit (9-30 Tons)

1.1. 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.

Figure 2. Flō Large Multi-Path Unit (26 and 31-70 Tons)

1.2. Making A Claim

A claim is a report, filed with Flō when a unit defect or damage is discovered. 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.

1.3. Unit Damage

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-01.
2. Obtain the unit serial number from the unit name plate.
3. Document the concern in the notes section 20 of SU-FOR-01.
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.

1.4. Unit Defect

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-01.
2. Document the defect in the notes section 20 of SU-FOR-01.
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 14 of the SU-FOR-01.
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.

2. 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.

The box size will determine which procedure to use. See section 3.1 for small boxes, 9 – 25 and 30-ton units. See section 3.2 for large boxes, 26 and 31 – 70-ton units.

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.

Figure 3. Small Unit - Closed Air Hood

Figure 4. Small Unit - Open Air Hood

2.1. Small Box, 9–25 and 30 Ton Units

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.

2.2. Large Box, 26 and 31–70 Ton Units

1. Remove the shipping screws from each side of the closed hood.

2. Lift the hood outward and attach the sides of the hood to the side of the unit using 5/16” sheet metal screws. Ensure that the flanges are facing inwards (under the hood). Use one screw for each of the pre-drilled holes.

3. Apply clear silicon caulking along the top and both sides of the rain hood. Take care to seal the top corners where the rain hood attaches to the unit.

Figure 5. Large Unit - Closed Air Hood

Figure 6. Large Unit - Open Air Hood

3. 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 must 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.

Figure 7. Small Box Barometric Relief Damper

Figure 8. Relief Damper - Shipping Screw

4. 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 20 on SU-FOR-01.

Figure 9. Level

5. 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.

Figure 10. Factory P-Trap Installed

5.1. P-Trap Installation

One or more black ABS type p-trap(s) will be provided with the MPU. ABS primer/cement should be used to join the connections of each 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.

Figure 11. Factory Provided 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.

5.2. 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 a p-trap must be constructed by the installation or start-up contractor, 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 the 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.

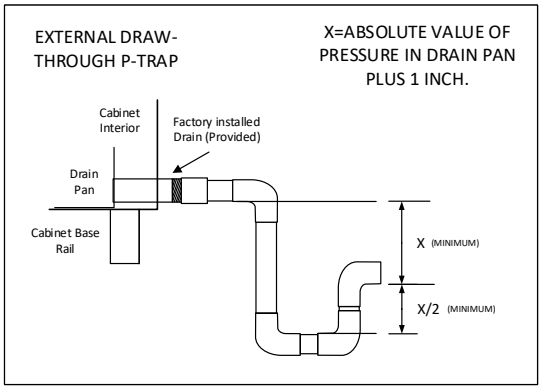

Figure 12. External Draw-through P-Trap

Drain Pan Pressure	Trap Dimensions	
Negative Static	X	X/2
(inches of water)	(inch)	(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

Table 3. Draw-Through P-Trap Dimensions

6. THERMAL EXPANSION VALVE (TXV)

It is important this tube does not vibrate or rub against any wires, piping or itself. Take care not to damage the capillary tubes during the removal of the cable tie.

6.1. TXV Capillary Tubes

1. Gently remove the cable ties from the TXV's capillary tubes.
2. Spread the capillary tubes apart.
3. Silicone the capillary tubes so that they cannot not rub together.

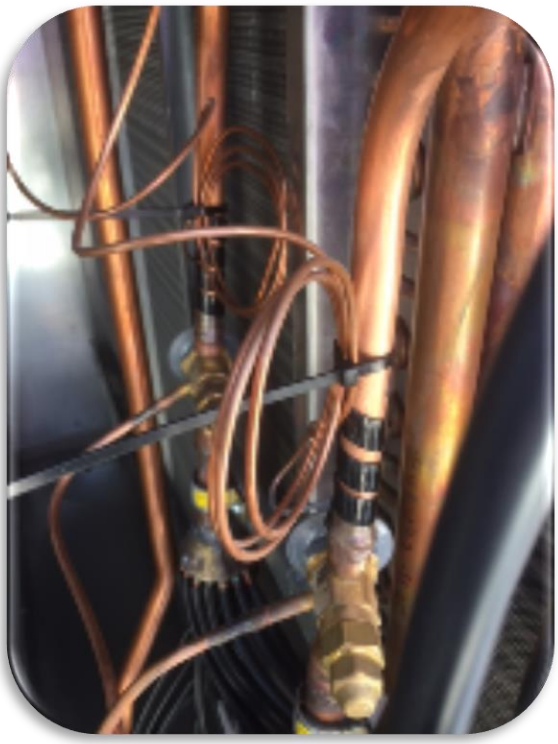

Figure 13. Secured Capillary Tubes

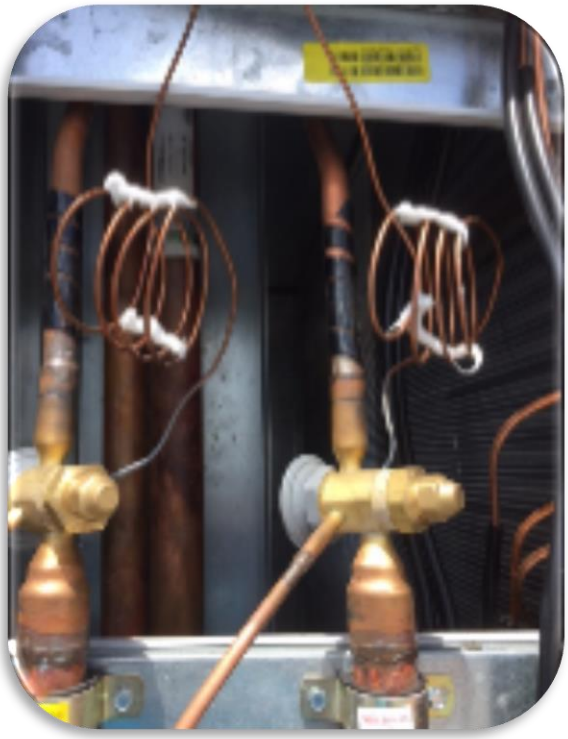

Figure 14. Capillary Tubes at Start-Up

7. HEAT RECLAIM (IF APPLICABLE)

If the unit is not equipped with a heat reclaim, proceed to section 8.

The following is required for a unit with reclaim installed.

7.1. Piping

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

7.2. Verifying The Sealed 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.

Figure 15. Clean, Sealed Pipe Chase

7.3. Reclaim Wiring

1. Verify that a two-conductor wire is connected between the LVTB in the Flō unit and the heat reclaim input control points on the refrigeration system's control board.

2. Verify the refrigeration controller is programmed to receive a signal from the HVAC unit controller to initiate Heat Reclaim.

3. Verify proper operation of the Heat Reclaim coil.

7.4. Reclaim Temp Sensor

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

Figure 16. Reclaim Temp Sensor Installation

NOTE: This image does not include insulation, Reclaim sensors must be insulated

8. DAMPER OPERATION

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.

Figure 17. MPU Damper Assembly

1. 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.

   See Figure 18 for OAD & RAD adjustment screw location. See Figure 19 for BAD adjustment screw location.

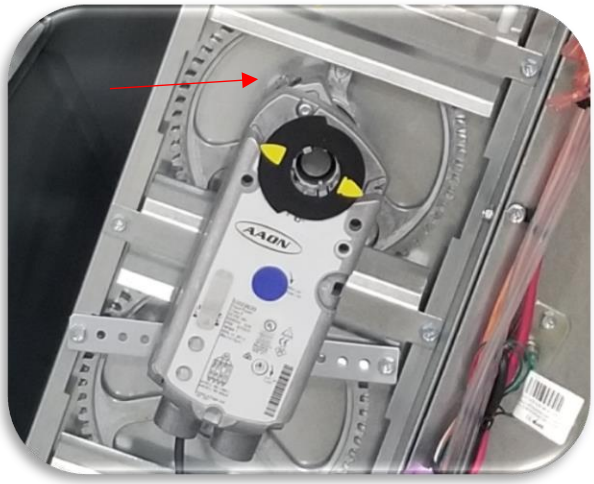

Figure 18. OAD & RAD Adjustment Screw Location

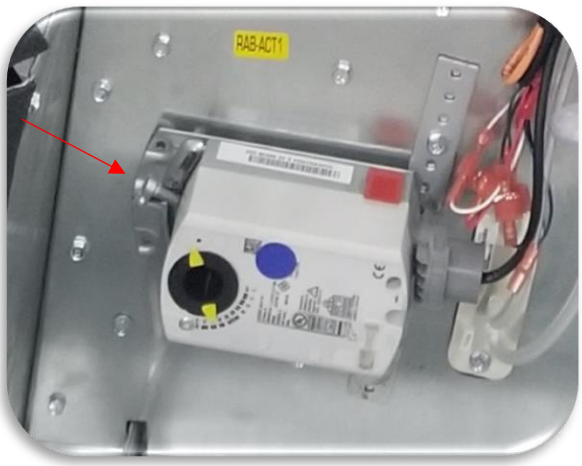

Figure 19. BAD Adjustment Screw Location

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

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

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

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

6. Remove all overrides.

9. BLOWER COMPARTMENT

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.

The gas heat exchanger or heating elements are below and visible from the blower compartment opening.

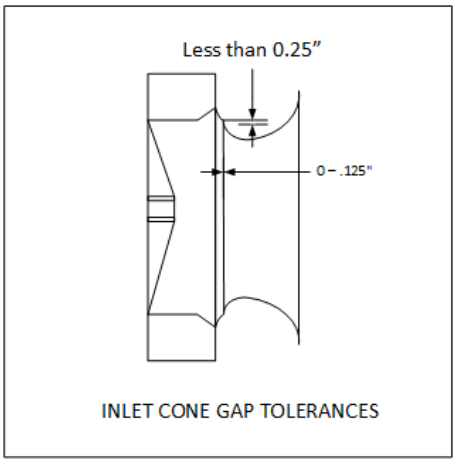

Figure 20. Supply Fan Inlet Cone Tolerances

Complete the following steps before energizing the MPU:

1. Ensure the MPU's disconnect is in the "OFF" position.

2. Remove the bolts and open the blower compartment.

3. Verify the gap and overlap clearances are within proper tolerances. Adjust, if necessary.

4. Spin the fan blade(s) to verify they spin freely.

Figure 21. Supply Fan Compartment

10. ELECTRICAL CONNECTIONS

Loose electrical connections create a risk of failure. Tighten any loose connections, verify no bare wires are visible and all connections are secure.

Complete the following steps before energizing the MPU:

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).

11. HEATING ASSEMBLY

Complete the following steps before energizing the MPU:

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.
3. Return the MPU to an operational status.

12. 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.

Figure 22. Clogged Filter Switch

12.1. Setting the 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.

13. SETTING THE DATE & TIME

1. Verify the Flō unit controller's date and time are set for your time zone.

2. If the date or time require adjustment, use the controller's user interface and navigation keys to set the date and/or time as necessary for your local time zone. Appropriate log in and pass code are required for this operation.

14. UNIT IMAGES

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-01 as well as below:

1. Unit name plate
2. Inside of each compartment of the unit
3. Controller alarm status screen
4. Controller network info screen
5. All sides of the unit with the doors closed
6. Outdoor air hood installation
7. Supply temperature sensor showing the location
8. Space Temperature sensor showing the location
9. Humidity/Dewpoint sensor showing the location

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

15. ELECTRICAL

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.

15.1. Voltage Line Connections

1. Verify that the installer did not run the supply power and control wires in the same conduit. Note any deficiencies in section 20 of SU-FOR-01.

2. Verify the high voltage is run correctly and terminated at the units disconnect. See Figure 23, 24, and 25. Note any deficiencies in section 20 of SU-FOR-01.

3. Using a multimeter, verify the unit nameplate matches the power supplied to the unit.

4. On the unit's high voltage terminal block, measure and record the voltage reading between L1 and L2.

5. Measure and record the voltage reading between L1 and L3.

6. Measure and record the voltage reading between L2 and L3.

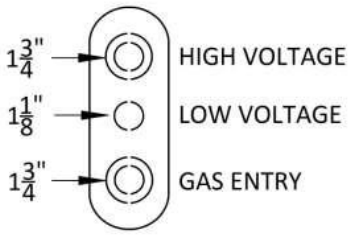

Figure 23. Utility Entry Knockouts

Figure 24. High Voltage Entry Point

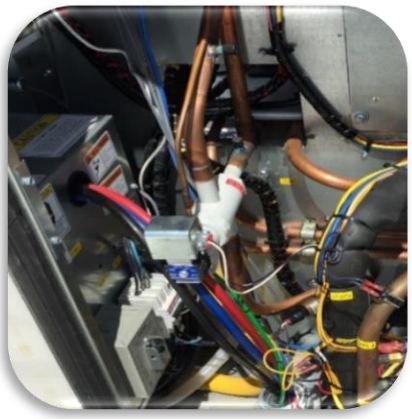

Figure 25. High Voltage Wiring Through Entry Point

15.2. Supply Fan Amperage

1. Connect the amperage meter to the load side (Terminal U of the VFD) for supply fan 1.
2. Record the amperage reading on SU-FOR-01 in the space for L1 under supply fan 1.
3. Connect the amperage meter to the load side (Terminal V of the VFD) for supply fan 1.
4. Record the amperage reading on SU-FOR-01 in the space for L2 under supply fan 1.
5. Connect the amperage meter to the load side (Terminal W of the VFD) for supply fan 1.
6. Record the amperage reading on SU-FOR-01 in the space for L3 under supply fan 1.
7. If the unit is equipped with two supply fans, repeat steps 1 - 6 for supply fan 2 and record the readings on SU-FOR-01 in the space provided.

15.3. Condenser Fan Amperage

1. Connect the amperage meter to either wire of the load side of the contactor for condenser fan A.
2. Record the amperage reading in the space provided for condenser fan A.
3. Repeat steps 1 and 2 for each condenser fan on the unit and record the amperage readings in the space provided on SU-FOR-01.

16. DIGITAL PHASE MONITOR

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

16.1. Display

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.

Figure 26. L1, L2 and L3 Voltages

Figure 27. Voltage and Phase Number

16.2. 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.

16.3. 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%**

16.4. 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 that matches the unit's nameplate voltage. If it doesn't match, set the voltage setting to match the nameplate.

   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
3. Press the right arrow button, verify, and record the Over/Under % setting.
4. Press the right arrow button, verify, and record the Trip Delay setting.
5. Press the right arrow button, verify, and record the Restart Delay setting.
6. Press the right arrow button, verify, and record the Phase Imbalance setting.
7. 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-01.

17. HEATING

The MPU has three available heating options: Gas, Electric and Hydronic. Hydronic heating is not commonly used and will not be covered in this document.

17.1. Gas Heating

When gas heating is initiated, the combustion motor starts, the vacuum switch closes, and the ignition control module is energized. The module sends 24 VAC to the main gas valve and high voltage to the igniter. If the burner flame has been detected, the spark is extinguished, and the flame continues.

If a flame has not been detected, the gas valve closes, the spark ceases and the induced draft blower continues to purge the heat exchanger.

The ignition module will attempt to light the burners again. If no flame be detected after 3 attempts, the module will lock out the system.

When a fault is detected, the gas train is shut down. Power to the ignition module must be cycled to reset the heater control.

There are three important gas pressure measurements which need to be checked and recorded during the Start-up of the Flō Unit:

1. Static Inlet Gas Pressure
2. Full Burn Inlet Gas Pressure
3. Manifold Gas Pressure

If discrepancies are found, adjustments will be required. If adjustments fail to correct the issue, record of the deficiency in the notes section of SU-FOR-01 and contact technical support.

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

Table 3. Acceptable Static Inlet Gas Pressures

17.2. Static Pressure

Static pressure is defined as the pressure exerted by a still (non-moving) liquid or gas. It is also commonly referred to as standing pressure.

1. Turn off the supply of gas to the MPU.
2. Remove the inlet test port hex plug from one MPU gas valve. See Figure 28.
3. Connect the manometer to this test port. Turn on the supply of gas to the MPU.
4. Record the gas pressure reading on SU-FOR-01.

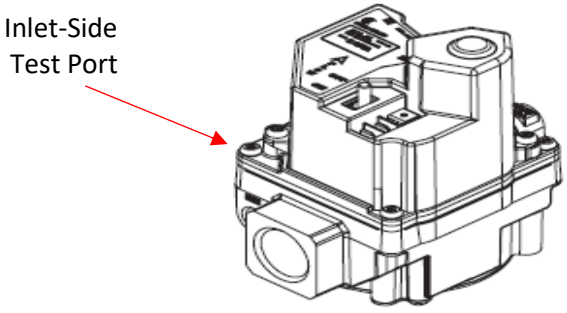

Figure 28. Gas Valve

17.3. Inlet Full Burn

The full burn inlet gas pressure is recorded while the Flō unit is operating in heating mode with all 4 stages of heat energized.

1. With the monometer connected to the inlet test port of one MPU gas valve, energize four stages of heat.
2. Record the inlet gas pressure at full burn reading on the Start-Up Form.
3. Turn off the supply of gas to the MPU.
4. Remove the monometer from the test port and reinstall the plug.

Minimum Full Burn Gas Pressures	
Natural Gas	Propane (LP)
6.0” WC	11.0” WC

Table 4. Acceptable Minimum Gas Pressures

If readings are outside of the acceptable range, adjustments must be made to the gas pressure regulator. If you are unable to adjust yourself, notify the site supervisor or general contractor. Record the final reading, notes and/or any discrepancies on SU-FOR-01.

17.4. Gas Manifold

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.

17.5. Gas Manifold Pressures

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%

Table 5. 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.
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-01.

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

Figure 29. Manometer Connected to Gas Port

17.6. 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.

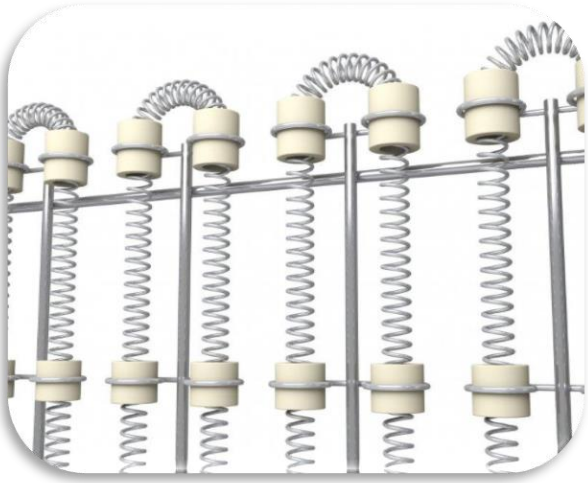

Figure 30. Electric Heating Elements

17.7. 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-01 form.

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

18. COOLING

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.

R410A Pressure	Temperature	
	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

Table 6. 410A Pressure/Temperature Chart

18.1. Refrigerant Pressure Transducers

Pressure transducers are mounted on Schrader valves and two ranges. 0-500 PSIG transducers are used for refrigerant suction pressures and 0-667 PSIG transducers are used for refrigerant discharge pressures.

18.2. Static Refrigerant Pressure Check

1. Remove the suction line service port refrigerant caps located on the insulated suction line, near the compressor.
2. Remove the liquid line service port refrigerant caps located near the liquid line driers.
3. Attach a calibrated refrigerant gauge to each service port.
4. If your gauges read zero, call Flō technical support right away (888-598-1198 option 1).
5. Measure the ambient temperature surrounding the unit's evaporator and condensing coils.
6. Using the R410A Refrigerant Pressure Chart, verify that the ambient temperature corresponds with the measured pressures.
7. Re-install all service caps.
8. Carefully remove each compressor warning tag.
9. Plug the low-pressure switch wires into the compressors.

18.3. Verify Sensing Bulb Location

Ensure sensing bulb is tight and mounted at either just below the 3 or 9 o'clock position on the pipe.

If the sensing bulb is not positioned just below 3 or 9, remove the insulation, adjust the sensing bulb to just below 3 or 9, tighten the bulb to the pipe and reapply the insulation. If a sensing bulb adjustment was required, add a note to section 20 on the SU-FOR-01.

18.4. Sub-Cooling & Superheat Conditions

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. 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.

18.5. 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 (Table 7).

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-01 form, section 18.

18.6. 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-01 form, section 18.

18.7. 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

Table 8. 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

Table 9. 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-01 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.

19. SENSORS

Sensors are at the heart of the MPU system. Factory installed sensors include transducers, switches, and temperature sensors. All sensors must be installed prior to the unit's start-up.

19.1. Verify Space Sensor Locations

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.

For all applications, to accurately calculate and control the space dew point, the space humidity sensor and temperature sensor must be mounted together as close to the same height as possible.

If there are any deficiencies are found, list the space sensor mounting deficiencies in the NOTES section 20 of the SU-FOR-01.

19.2. Verify Supply Air Sensor Location

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 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.

If there are any deficiencies are found, list the SAT mounting deficiencies in the NOTES section 20 of the SU-FOR-01.

19.3. Sensor Table Instructions

Complete section 19 in SU-FOR-01 following the steps below.

The following applies to the Unit Control Sensors

In column **A**, record the readings displayed on the controller for each sensor.

In column **B**, using meters and/or gauges, record the measured sensor readings for each sensor.

If column **A** and **B** readings are different, offsets need to be applied to the controller so that the measured reading matches the displayed reading on the controller.

In column **C**, record a positive (**+**) or negative (**-**) offset reference for each offset applied as well as the numeric value of the offset that you entered in the controller. If an offset is not required, leave column **C** blank for that sensor.

In column **D**, indicate PASS or Not Applicable (N/A) for each sensor. PASS should be used if no offset was required or you were able to apply the required offset in the controller. If a offset was required and was not applied or the controller wouldn't allow the offset, leave both PASS and N/A unchecked.

NOTE: The Monitoring Sensors table below Unit Control Sensors table require confirmation of the controller

readings for each sensor or a selection of the N/A checkbox if not applicable.

20. NOTES

The last page of SU-FOR-01 has a notes section. Use this section of the form to record comments, recommendations, defects and/ or unit damage.

Use the notes section to describe the work performed, any difficulties you encountered or recommendations for improvement.

Should you need additional assistance, contact Flō Technical Support at 1-888-598-1198 opt. 1 or E-Mail: techsupport@systemsflo.com.

21. SITE DEPARTURE

As a representative of Flō, you are required to perform a standard departure process with the Flō Start-Up Checkout Team and the customer. Perform the site departure process before you leave the customer site for the day or upon completion of service.

21.1. Departure Procedure

Before you depart from any Flō customer site:

1. Remove all debris and material from unit and roof
2. Verify power connections and disconnects are energized and no alarms exist in the unit controller
3. Verify all information in each section of SU-FOR-01 is complete prior to submission to Flō.
4. Verify you have digital pictures of and that you have sent them to startup@systemsflo.com each unit.
5. Call Flō checkout line 1-888-598-1198 opt. 2 at your schedule appointment time (if you have completed the start-up of the unit).
6. Secure access points, doors and/ or hatches.
7. Return keys and any other property to the store manager.