Instructions - Parts

Therm-O-Flow® 20

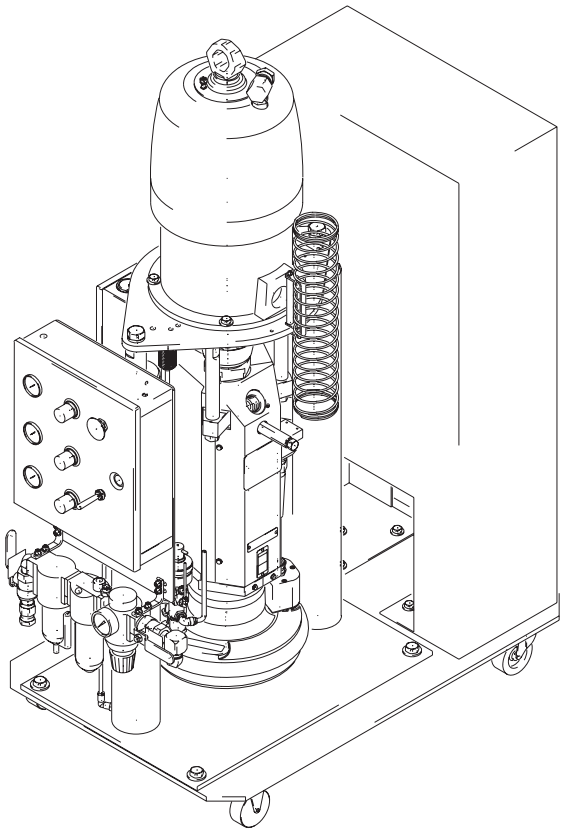
309858L

Used to handle abrasive, high-viscosity hot melt sealants and adhesives.

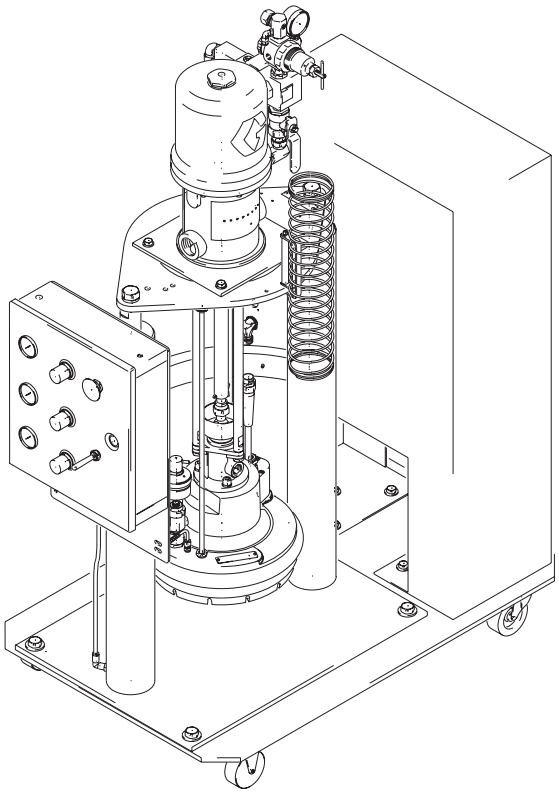
Air-Powered Ram Heated Pail Unloaders

5 gallon (20 liter) pail size, 3 in. (76 mm) dual post ram

Read warnings and instructions.
See page 3 for maximum working pressure and other model information.



Therm-O-Flow 20 with Bulldog®/King™ pump



Therm-O-Flow 20 with President™ pump

Graco Inc. P.O. Box 1441 Minneapolis, MN 55440-1441

PROVEN QUALITY. LEADING TECHNOLOGY.

Contents

Models

Part Number	Motor/Pump	Ratio	Max. Fluid Working Pressure	Voltage	Page
918522	President®	15:1	1800 psi (12 MPa, 124 bar)	480 VAC	page 30
918532	President®	15:1	1800 psi (12 MPa, 124 bar)	240 VAC	page 30
246653	President® (no control)	15:1	1800 psi (12 MPa, 124 bar)	240 VAC	page 30
918344	Bulldog®/Check-Mate™ 800	31:1	3100 psi (21 MPa, 214 bar)	480 VAC	page 32
918437	Bulldog®/Check-Mate™ 800	31:1	3100 psi (21 MPa, 214 bar)	240 VAC	page 32
C59398	King™	65:1	5850 psi (40 MPa, 403 bar)	480 VAC	page 34
234965	King™ (no control)	65:1	5850 psi (40 MPa, 403 bar)	480 VAC	page 34

Related Publications

Equipment	Manual No.
President® Air Motor	306982
Bulldog® Air Motor (31:1)	307049
King™ Air Motor (65:1)	309347
Air-powered Ram Module, 5 gal. (20 liter), 3 in. (76 mm)	310525
Check-Mate™ 800 Displacement Pump	308570
Heated Check-Mate™ 800 Pump Modules	310530
Hot Melt 15:1 President® Pump	307431

Manual Conventions

Warning

WARNING

A warning alerts you to the possibility of serious injury or death if you do not follow the instructions.

Symbols, such as fire and explosion (shown), alert you to a specific hazard and direct you to read the indicated hazard warnings (pages 4-5) for detailed information.

Caution

CAUTION

A caution alerts you to the possibility of damage to or destruction of equipment if you do not follow instructions.

Note

A note indicates additional helpful information.

⚠ WARNING

SKIN INJECTION HAZARD

High-pressure fluid from gun, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. **Get immediate surgical treatment.**

- Do not point the gun at anyone or at any part of the body.
- Do not put your hand or fingers over the gun fluid nozzle.
- Do not stop or deflect leaks with your hand, body, glove, or rag.
- Do not “blow back” fluid; this is not an air spray system.
- Follow **Pressure Relief Procedure** in this manual, when you stop spraying and before cleaning, checking, or servicing equipment.
- Use lowest possible pressure when flushing, priming, or troubleshooting.
- Engage trigger lock when not spraying.
- Tighten all fluid connections before operating the equipment.
- Check hoses, tubes, and couplings daily. Replace worn or damaged parts immediately. High pressure hose cannot be recoupled; replace the entire hose.

FIRE AND EXPLOSION HAZARD

Flammable fumes, such as solvent and paint fumes, in work area* can ignite or explode. To help prevent fire and explosion:

- Use equipment only in well ventilated area.
- Eliminate all ignition sources; such as pilot lights, cigarettes and plastic drop cloths (potential static arc).
- Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.
- Keep work area free of debris, including solvent, rags and gasoline.
- Ground equipment and conductive objects. See **Grounding**.
- Hold gun firmly to side of grounded pail when triggering into pail.
- Use only grounded hoses.
- If there is static sparking or you feel a shock, **stop operation immediately.** Do not use equipment until you identify and correct the problem.

ELECTRIC SHOCK HAZARD

Improper grounding, setup, or usage of the system can cause electric shock.

- All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.
- Connect only to grounded power source.
- Turn off and disconnect power at main switch before disconnecting any cables and before servicing equipment.

BURN HAZARD

This equipment is used with heated fluid, which can cause equipment surfaces to become very hot. To avoid severe burns:

- Do not touch hot fluid or equipment.
- Allow equipment to cool completely before touching it.

MOVING PARTS HAZARD

Moving parts can pinch or amputate fingers and other body parts. Pressurized equipment can start accidentally and cause serious injury.

- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Before checking or servicing equipment, follow the **Pressure Relief Procedure** in this manual. Disconnect power or air supply.
- Do not move or lift pressurized equipment.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Misuse can cause serious injury or death.

- For professional use only.
- Use equipment only for its intended purpose. Call your Graco distributor for information.
- Read manuals, warnings, tags, and labels before operating equipment. Follow instructions.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not alter or modify equipment. Use only Graco parts and accessories.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Data in all** equipment manuals. Read fluid and solvent manufacturer's warnings.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Comply with all applicable safety regulations.

TOXIC FLUID OR FUMES HAZARD

Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.

- Read MSDS's to know the specific hazards of the fluids you are using.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.

PERSONAL PROTECTIVE EQUIPMENT

You must wear proper protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from serious injury, including eye injury; hearing loss; and inhalation of toxic fumes. This equipment includes but is not limited to:

- Protective eyewear
- Gloves, clothing, and respirator as recommended by the fluid and solvent manufacturer
- Hearing protection

Installation

Key:

A Air Line Filter
B Bleed-type Master Air Valve - required
C Pump Bleed-type Master Air Valve - required
D Pump Air Regulator
E Main Air LIne Supply
F Electrical Control Panel
G Follower Blow-off Hose
H Pump Air Supply Hose
J Pump Mounting Bracket
K Hose Hanger
L Follower Blow-off Valve Regulator
M Follower Plate Bleed Stick
N Ram Air Regulators
P Air Line Lubricator
Q Depressurization Valve
R Air Motor Pressurization Kit (King/Bulldog units only)
S Pump
T Ram Control Lever
U Ram Module
V Heated Follower Plate
W Wipers
X Air Supply Bleed-type Master Air Valve
Y Air Supply Line Filter

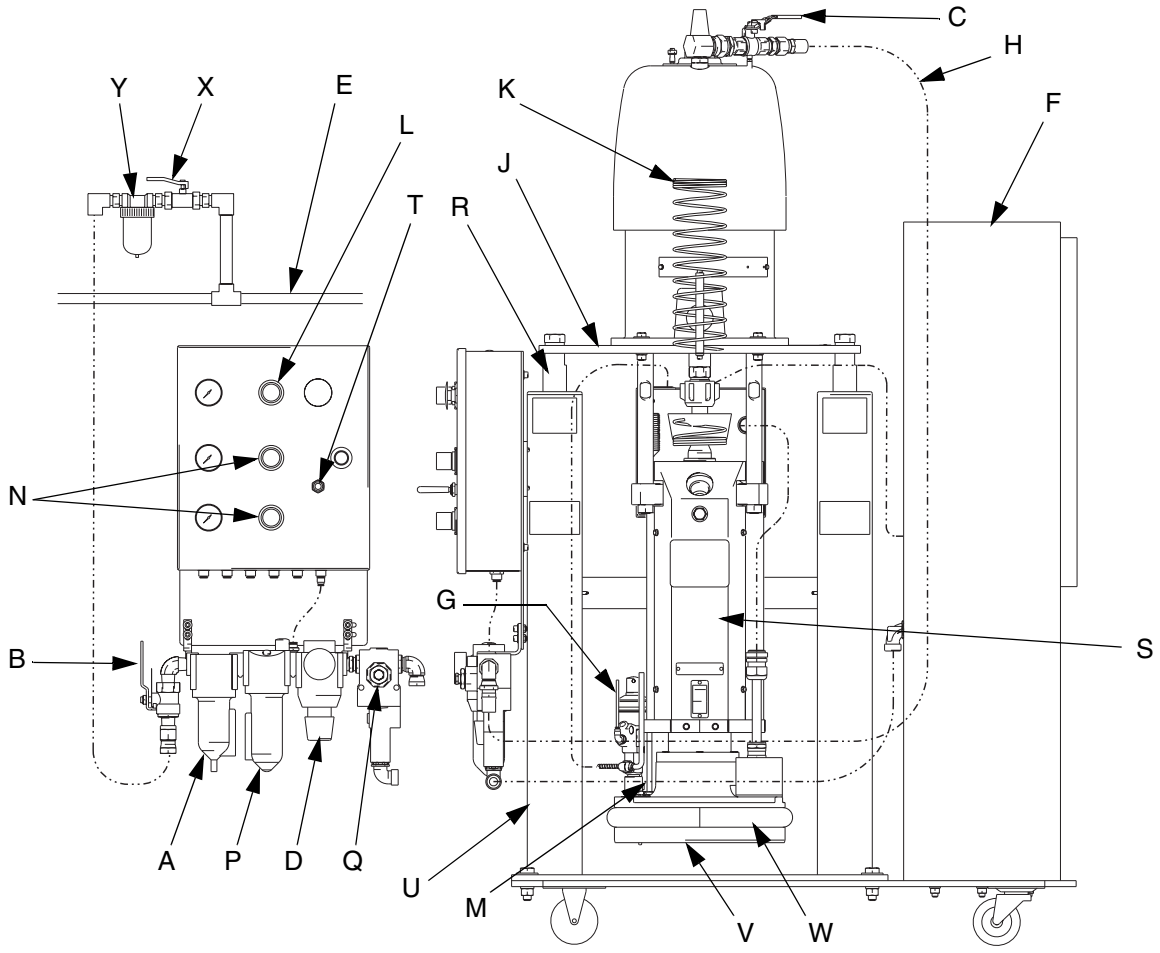


FIG. 1

Unpacking

Unpack the Therm-O-Flow 20 as follows:

1. Inspect the shipping box for damage; immediately contact the carrier if damaged.
2. Open the box and inspect the contents for loose or damaged parts.
3. Compare the packing slip against items in the box. Report problems immediately.
4. Store the box and packing materials to reuse if the equipment needs to be repackaged and shipped.

Typical Installation

The typical installation drawing, FIG. 1, is only a guide for selecting and installing system components and accessories. Contact your Graco distributor or Graco Technical Assistance for help in designing a system to suit your needs.

See **Accessories** section, page 57, for wiper rings and other accessories.

Accessories and Modules

Before you install the system, familiarize yourself with the parts discussed below. Refer to FIG. 1.

Air and Fluid Hoses

Make sure air and fluid hoses are properly sized for your system. Use only electrically conductive air and fluid hoses.

Air Line Modules

4-Regulator Air Control Module (246587)

Refer to page 36-38.

This module includes the following components:

- **Bleed-type Master Air Valve (B):** for shutting off and locking out the air supply from the entire supply unit.

WARNING


The bleed-type master air valve (C) is required to relieve air trapped between this valve and the pump after the pump air regulator is closed. Read warnings, page 4.

- **Pump Bleed-type Master Air Valve (C):** is installed so the valve is easily accessible and located downstream from the air regulator. It can be used for a safety lockout.
- **Ram Air Regulators (N):** separate air regulators to control the ram up and down air pressures.
- **Pump Air Supply Hose (H):** connects pump air regulator to the air motor.
- **Follower Blow-off Valve Regulator (L):** controls air pressure to the follower blow-off valve.
- **Air Filter (A) and Lubricator (P):** conditions air to the ram and pump. Pump air regulator (D) is part of this assembly. An air line tube connects the ram air to the ram air control module.
- **Pump Air Regulator (D):** adjusts air pressure to control pump speed and outlet pressure (located on the air control panel).
- **Automatic Depressurization Valve (Q):** exhausts air from the system at shut off. The built-in timer delays start up to allow material to heat thoroughly.

3-Regulator Air Control Modules (234236, not shown)

This module includes the following components:

- **Pump Bleed-type Master Air Valve (C):** is installed so the valve is easily accessible and located downstream from the air regulator. It can be used for a safety lockout.
- **Pump Air Regulator (D):** adjusts air pressure to control pump speed and outlet pressure (located on the air control panel).
- **Ram Air Regulator ((N):** separate air regulators to control the ram up and down air pressures.
- **Pump Air Supply Hose (H):** connects pump air regulator to the air motor.
- **Air Manifold (item 23, page 30):** divides main air supply into separate lines for the pump and ram.

Grounding

WARNING

The system must be properly grounded. Read warnings, page 4. Follow the instructions below.

Air and fluid hoses: use only electrically conductive hoses. Check the electrical resistance of your air and fluid hoses. If the total resistance to ground exceeds 29 megohms, replace the hose immediately.

Dispense valve: ground through connection to a properly grounded fluid hose and pump.

Fluid supply container: follow your local code.

Solvent pails used when flushing: follow your local code. Use only conductive, metal pails, placed on a grounded surface. Do not place the pail on a nonconductive surface, such as paper or cardboard, which interrupts grounding continuity.

To maintain grounding continuity when flushing or relieving pressure: follow the instructions in your separate gun manual for safely grounding your gun while purging.

Location

Refer to the dimensional drawings, page 60, for ram mounting and clearance dimensions.

Make sure:

- There is sufficient space for installing and using the equipment, including overhead clearance for the pump and ram when the ram is fully raised.
- Air regulators for the pump and ram are fully accessible.
- There is easy and safe access to an appropriate electrical power source. The National Electrical Code requires 3 feet (0.91 m) of open space in front of the electrical panel.

You can install the system in a permanent location or use a mobile platform.

Permanent Location

1. Follow the previous **Location** recommendations.
2. Level the base of the ram, using metal shims.
3. Using the holes in the base as a guide, drill holes for 1/2 in. (13 mm) anchors.
4. Bolt the ram to the floor anchors, which must be long enough to prevent the unit from tipping.

Securing Ram to a Mobile Platform

Use the Mobile Platform Kit (918414) to secure the ram to a mobile platform (included with unit). See page 30, item 10 or page 32 or 34, item 19.

1. Follow the previous **Location** recommendations.
2. Locate the mobile platform on a surface where it won't roll and brace the platform to ensure it remains stationary while you secure the ram.
3. Place the ram on the platform and line up the holes in its base with the holes in the platform.
4. Secure the ram to the platform with the nuts and bolts provided.
5. Make sure the ram and platform are stable in all operating positions so the ram won't tip.

Electrical Control Panel

Electrically Connect Hoses

Assemble hose and gun components. Follow the gun instructions.

Electrically connect hoses to the electrical control panel. FIG. 2. Connectors are located on the back of the electrical control panel.

Connect the plug from hose 1 to the Hose 1/Gun 1 receptacle on the back of the control panel.

Connect to a Power Source

The Electrical Control Panel is shipped attached and wired to the ram.

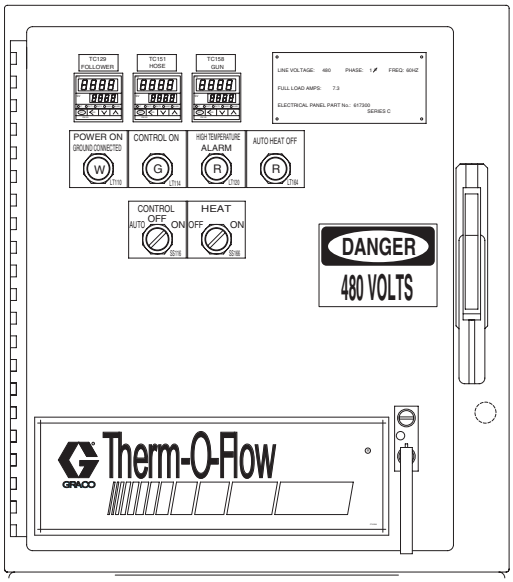


FIG. 2

Have a trained electrician connect the electrical control panel to a grounded electrical source that has the required service ratings:

Control Panel Model:	Zones:	VAC:	Hz:	Phase:	Full Load Amps
617300 (Standard)	3	480	60	1	7.3
617349	4	480	60	3	9.8
617484	3	240	60	1	13.8
617485	4	240	60	3	16.0

For information about specific terminal locations and connections, see **Electrical Schematic** for your electrical control, pages 48-55.

To connect the control panel to the electrical source:

1. Create an opening in the control panel housing for the conduit that will enclose the wire from the power source.
2. Thread the wire from the power source into the control panel housing.
3. Connect the power source wires to the appropriate terminals on the DISCONNECT switch.

Check Resistance

WARNING

The system must be properly grounded. See **Grounding**, page 8.

Supply Unit

Have a qualified electrician check resistance between each supply unit component and true earth ground. The resistance must be less than 0.25 ohms. If the resistance is greater than 0.25 ohms, a different ground site may be required. Do not operate the system until the problem is corrected.

Sensor

WARNING

- Read warnings, page 4.
- Do not open electrical control panel unless you are a trained professional.
- Make sure power is shut off to the control panel.
- Make sure main disconnect is OFF.

The supply unit includes either three or four heat sensors and controllers for each heated zone. To check sensor resistance:

1. Make sure the power is off and the disconnect switch is turned to OFF.
2. Check electrical resistance of the components at ambient room temperature 63°-77° F (17°-25° C). Refer to **Electrical Schematic** for your electrical control, pages 48-55.
3. Replace any parts whose resistance readings do not comply with the ranges in the chart below.

3-Zone RTD Sensors

Zone	Component	Terminals	Value Range
1	Follower	1311, 1321	108 ± 2% ohms
2	Dispense Hose	1531, 1541	108 ± 2% ohms
3	Dispense Gun	1601, 1611	108 ± 2% ohms

4-Zone RTD Sensors

Zone	Component	Terminals	Value Range
1	Follower	1311, 1321	108 ± 2% ohms
2	Dispense Hose	1531, 1541	108 ± 2% ohms
3	Dispense Gun	1601, 1611	108 ± 2% ohms
4	Pump	1381, 1391	108 ± 2% ohms

Heater

WARNING

- Read warnings, page 4.
- Make sure main disconnect is OFF.

To check heater resistance:

1. Make sure the power is off and the disconnect switch is set to OFF.
2. Check electrical resistance checks of the components at ambient room temperature (63°-77° F). Refer to **Electrical Schematic** for your electrical control, pages 48-55.
3. Replace any parts whose resistance readings do not comply with the ranges in the chart below.

Heaters for 3-Zone Control Panels

Zone	Component	Terminals	Value Range
1	Follower	2L1, 2L2	98-127 ohms
		2L2, 2L1	
2	Dispense Hose	1532, 1551	See Technical Data supplied with hose
3	Dispense Gun	1602, 1621	See Technical Data supplied with gun

Heaters for 4-Zone Control Panels

Zone	Component	Terminals	Value Range
	Follower	3L1 & 3L3	98-127 ohms
		3L2 & 3L3	
	Dispense Gun	1532 & 1551	See Technical Data supplied with gun
	Dispense Hose	1602 & 1621	See Technical Data supplied with hose
	Pump	5L1 & 5L2	187.2 ohms ± 24 ohms

Temperature Controller Settings

The basic program settings for each temperature controller meet the needs of most applications and are preset at the factory.

The input type, temperature scale, and over temperature alarm point are the critical controller settings that you must check before doing an auto-tune or using any controller in normal operation. See manual 309100 for operation of the temperature controls.

Graco Factory P, I, and d Settings

The table lists the P (proportional), I (integral), and d (derivative) settings for standard control panels. These settings are preset at the factory. Use the table for reference information only. See manual 309100 to assess these values.

Graco Factory P, I, and d Settings

Component	P	I	d
Follower	29.5	210	52
Pump	87.3	1492	373
Hose	8.9	39	9
Gun	41.4	89	22
	AL1 35	AL2 -35	

The P, I, and d values are usually generated by running an auto-tune process for each heat zone. The controllers automatically find the proper P, I, and d values during this auto-tune process. The values are selected to allow the heat zones to reach their maximum temperature as fast as possible without significantly exceeding desired temperature.

Flushing

.

WARNING

Read warnings, page 4.

The system was factory-tested using a light soluble oil. Flush the system before initial use to prevent material contamination.

To flush the system:

1. Select a solvent that is compatible with the equipment wetted parts and the material being flushed. Check with your Graco distributor or the material supplier for a recommended solvent.
2. Before flushing, be sure the entire system and flushing drums are properly grounded. Refer to **Grounding**, page 8.
3. Perform steps 1 through 7 of the **Loading Material** procedure, page 13, to load the solvent.
4. Run solvent through the system for about 1-2 minutes.
5. Remove the solvent drum.
6. Load material, page 13, or follow the **Shutdown** procedure, page 16.

Start Up

1. Check the tightness of material hoses and fittings to prevent leakage.
2. Check system air and electrical lines. Make sure that they will not interfere with moving components within the fixture.
3. To raise the arm:
   a. Close all air regulators.
   b. Set the ram control lever to UP.
   c. Slowly open the air regulators until the ram starts to move up.
   d. When the follower plate is above the height of the material pail, set the ram control lever to OFF.
4. Turn the main electrical disconnect (A) ON. FIG. 3.
5. Turn the CONTROL switch (65) to ON.

WARNING

Read warnings, page 4.

6. Open the dispense valve over a waste container during system heatup to relieve pressure as material expands.
7. Check the temperature controller set points and change them if necessary. See **Changing the Set Point** in manual 309100.
8. Wait until all system zones are heated to the preset temperatures.
9. The system is ready for **Loading Material**.

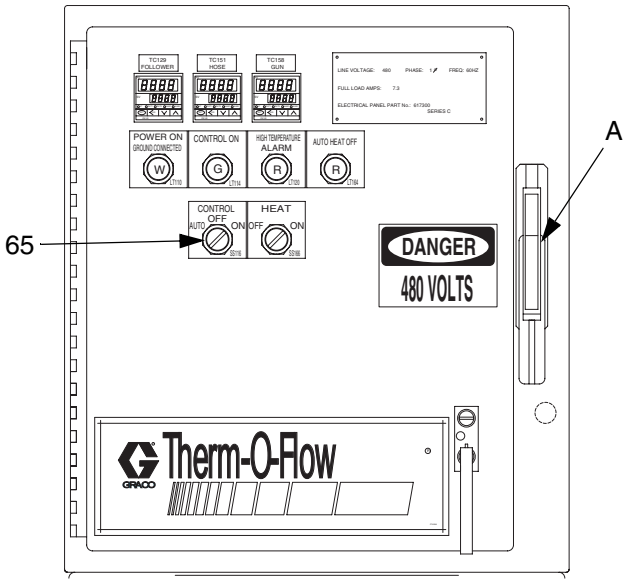


FIG. 3

Loading Material

WARNING


Material and equipment are hot. Avoid contact. Wear protective clothing. Read warnings, pages 4-5.

1. Make sure the follower plate is high enough to put the material pail under it.

CAUTION

Do not use a material pail that has been dented or damaged; damage to the follower wipers may result.

Do not tip the pail cover when removing it as this may spill dirt from the cover into the pail and contaminate the material.

2. Remove the pail cover by holding it level and lifting straight up. Place the pail under the elevated follower plate.

CAUTION

The use of a non-compatible lubricant can cause material contamination or inadequate performance. Check with the material supplier for a recommended lubricant.

3. Lubricate the follower wipers with a lubricant compatible with the material to be pumped.

WARNING

When raising or lowering the ram, keep hands and body away from ram plate and pail lip. Read warnings, page 4.

4. Make sure there is nothing between the follower plate and pail or between the ram tie bar and top of the ram posts. Then lower the pump into the pail.
   a. Set the ram control lever to DOWN, and slowly adjust the air regulator. FIG. 4, page 14.
   b. If necessary, stop lowering the follower plate to adjust the pail position to align with the follower plate.
   c. As the follower plate enters the pail, remove the bleed stick to allow trapped air between the follower plate and the top of the material to escape.

WARNING

Read warnings, page 4.

   d. When air stops exhausting from the bleed stick port, install the bleed stick to prevent hot material from leaking out the opening.

5. Adjust the ram DOWN air regulator pressure for normal operation.
6. Purge air out of the pump and fluid lines.
   a. Place a waste container under the pump bleed port.
   b. Open the bleed port and **slowly** adjust the pump air regulator to start the pump and fill the material passages.
   c. Allow material to flow from the bleed port until it is air-free, then shut off the pump and close the bleed port.
   d. Place a material waste container under the dispense valve.
   e. Dispense material until all air is purged.
7. Allow the system to heat for approximately 30 minutes.

Operation

Pressure Relief Procedure

WARNING


Read warnings, page 4, and follow the **Pressure Relief Procedure** whenever you:
- are instructed to relieve pressure
- stop operation
- check, clean, or service any of the equipment

1. Engage the gun trigger lock.
2. Shut off the main air supply to the pump.
3. Close all air bleed valves.
4. Disengage the gun trigger lock.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
6. Engage the gun trigger lock.
7. Have a container ready to catch the drainage, then open the drain valve or pump bleed valve.
8. Leave the drain valve open until you are ready to spray/dispense again.
9. *If you suspect that the spray tip/nozzle or hose is completely clogged, or that pressure has not been fully relieved after following the steps above,* very slowly loosen the nozzle retaining nut or hose end coupling to relieve pressure gradually, then loosen completely. Now clear the tip/nozzle or hose.
10. To relieve pressure in the ram, see the **Ram Pressure Relief Procedure**, page 21.

Raising and Lowering Ram

WARNING

When raising or lowering the ram, keep hands and body away from ram plate and pail lip. Read warnings, page 4.

The ram control lever on the control panel has 3 settings. FIG. 4.

- Ram UP raises the ram
- Ram DOWN lowers the ram
- Ram OFF puts the ram in neutral, stopping the air pressure from moving the ram either up or down.

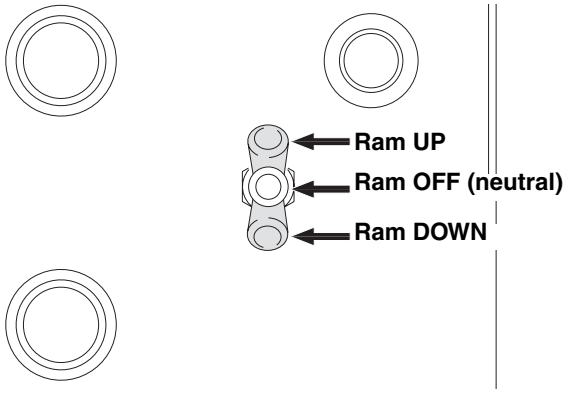


FIG. 4

Daily Start-up Procedure

WARNING



- Material and equipment are hot. Avoid contact. Wear protective clothing.
- Keep hands and fingers away from limit switches and other moving parts.
- Read warnings, pages 4-5.

There are 2 ways to start up the system:
- Manually start the system each day
- Use the optional 7-day timer to automatically heat up the system

Starting System Manually

1. Verify that the main disconnect is ON.
2. Turn the CONTROL switch (65) to ON. FIG. 5, page 17.

WARNING

Read warnings, page 4.

3. Turn the HEAT switch (66) to ON. Pump will not operate until 30 minutes have elapsed, allowing material to fully heat.

Internal timer controls pump startup. Adjust timer if shorter startup time is desired.

4. Open the dispense valve over a waste container to relieve pressure when material heats and expands.
5. After each of the dispense zones is heated to operating temperature, wait an additional 30 minutes to allow the material to heat fully.
6. Make sure that all material valves are open.
7. Turn the pump air supply ON and set the regulator for normal operation.
8. Dispense material into a waste container. Adjust the flow rate as needed.

Using Optional 7-Day Timer

The 7-day timer can be set to automatically turn the heat on to the system. Using the timer requires you to:

- Create a schedule and program it into the 7-day timer, located on the electrical control panel. Be sure to allow at least 30 minutes for the material to heat up before the supply unit is used. For timer programming information, see the electronic control panel documentation.
- Perform a nightly procedure to ready the system for automatic operation.

Nightly Procedure:

1. Turn the CONTROL switch (65) to AUTO. FIG. 5, page 17.
2. Turn the HEAT switch (66) to ON.

WARNING


3. Follow **Pressure Relief Procedure**, page 14.

WARNING

Read warnings, page 4.

4. Open the dispense valve over a waste container to relieve pressure when material heats and expands.
5. Make sure that all material valves are open.
6. Make sure the pump air supply has been turned off.

Changing Empty Pails

CAUTION

- To avoid damaging pumps, do not operate when pails are empty.
- Do not raise the ram and remove the follower plate from the pail until you are ready to immediately install a new pail, unless you are preparing to service the equipment.

WARNING


Due to material viscosity, you can only change pails when the unit is at full operating temperature.

- Avoid contact with hot material and equipment surfaces.
- Wear protective clothing.
- Read warnings, pages 4-5.

1. Stop the pump by closing either the bleed-type master air valve or the fluid dispensing valve.

WARNING

Improperly adjusted blow-off pressure can cause serious injury or damage equipment.

- Excessive pressure - follower plate may rise too quickly or pail may burst.
- Too little pressure - ram may lift pail off the ground.

2. To raise the ram out of the pail, set the ram control lever to UP. FIG. 4, page 14. At the same time, carefully equalize the pressure in the pail by using the Follower Blow-off Valve Regulator to cycle the follower blow-off valve open and close.

3. When the follower plate wipers clear the rim of the pail (i.e., when pressure under the plate is relieved), set the ram UP air regulator to 15-20 psi (103-138 kPa, 1-1.4 bar) to allow the ram to lift the plate to its most upright position.

4. Being careful not to damage the follower wiper or touch hot material, scrape material from the follower plate and wiper.

5. Follow **Loading Material** procedure, page 13-13, steps 1-6, except step 3 (lubricate the wiper).

6. Turn air on to the pump, and set the pump air regulator for normal operation.

Shutdown

1. Turn the CONTROL switch (65) to OFF. FIG. 5, page 17.

2. Turn OFF the main electrical disconnect.

3. Set the ram control lever to OFF. FIG. 4, page 14.

4. Shut off the air supply to the ram and pump.

WARNING


5. Follow **Pressure Relief Procedure**, page 14.

6. Remove the dispense device and clean as instructed in its manual.

Emergency Stop

1. On the electrical control panel:

   a. Turn OFF the main electrical disconnect.

   b. Turn the CONTROL switch (65) to OFF. FIG. 5, page 17.

2. Close the Bleed-type Master Air Valve (C), closest to the motor's air inlet, to stop the pump. See FIG. 1, page 6.

3. To stop the ram:

   a. Close the ram air lock-out valve.

   b. Set the ram control lever to OFF. FIG. 4, page 14.

Reading Electrical Control Panel Indicators

Use the table and FIG. 5 below to read electrical control panel indicators. For information on setting the temperature controllers, see **Setting Temperature Controllers** in Manual 309100.

Light No.	Indicator	Indicator Light is	Meaning
61	Power On/Ground Connected	ON	Power is on and ground is connected.
		OFF	Power is off and/or ground is disconnected.
		DIMLY LIT	There may be a problem with system power connections. Have a qualified electrician check connections before starting the system.
62	Control On	ON	The CONTROL switch (65) is set to either ON or AUTO and power is being supplied to the electrical control panel components.
		OFF	The CONTROL switch (65) is set to OFF.
63	High Temperature Alarm	ON	The temperature of heated component(s) is out of range; power to all heated components is interrupted. See **High Temperature Alarm**, page 18.
		OFF	Temperature of heated components is in range.
64	Auto Heat Off	ON	The Inactivity Timer has turned off heat for the supply unit. See **Auto Heat Off**, page 18.
		OFF	The supply unit is functioning normally.

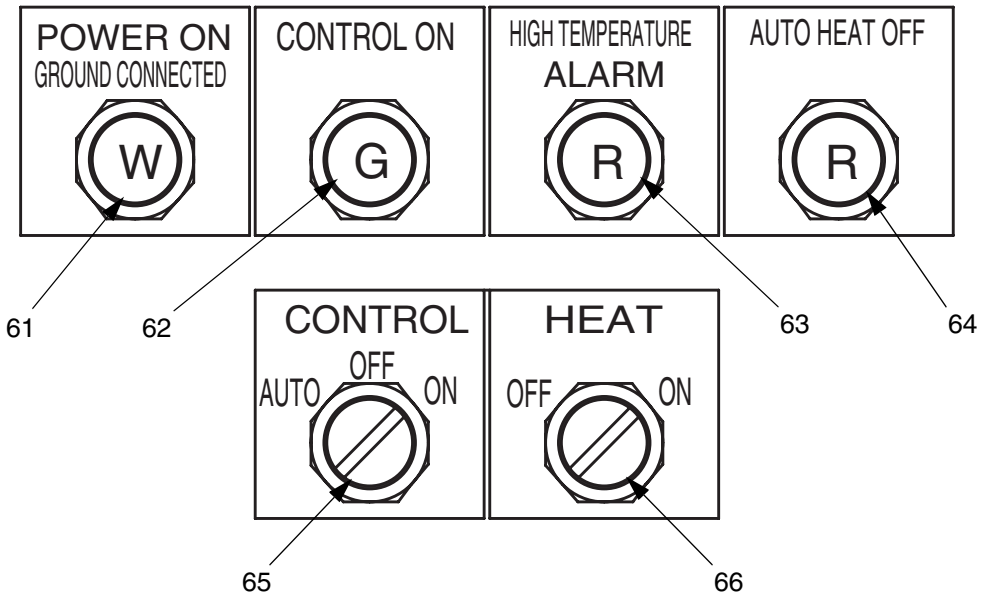


FIG. 5

High Temperature Alarm

Should a component temperature go outside the preset range for any of the zones, power to heated components is interrupted, and the HIGH TEMPERATURE ALARM light turns ON. FIG. 5, page 17. The alarm automatically turns OFF and the system resets when the temperature is back in range.

Auto Heat Off

Your system may have an inactivity (worklife) timer. If the pump does not operate for a set amount of time, the inactivity timer turns off power to the heaters, and the the AUTO HEAT OFF (64) light turns on.

To set the inactivity timer, see the documentation provided inside the control panel.

To reheat the supply unit:

1. Turn the HEAT switch (66) OFF, then ON. FIG. 6.
2. Wait until all supply unit components return to operating temperature.
3. Resume operation.

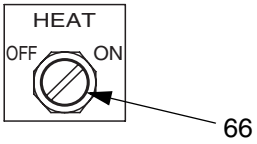


FIG. 6

Ground Fault Interrupt

The control panel includes a ground fault interrupt (GFI) circuit breaker (FIG. 7). If the main electrical disconnect is ON, but all lights on the electrical control panel are off, have a qualified electrician check the ground fault interrupt.

To reset:

WARNING

The main electrical disconnect must be OFF and qualified electrician must perform service. Read warnings, page 4.

1. Turn main electrical disconnect OFF.
2. Open electrical control box and locate the Ground Fault Interrupt switch (71). The GFI should be in a neutral position, between ON and OFF.
3. Turn GFI switch OFF, then ON.
4. Close the door and turn the main electrical disconnect ON.

For more information about the GFI switch, see the electrical control panel documentation.

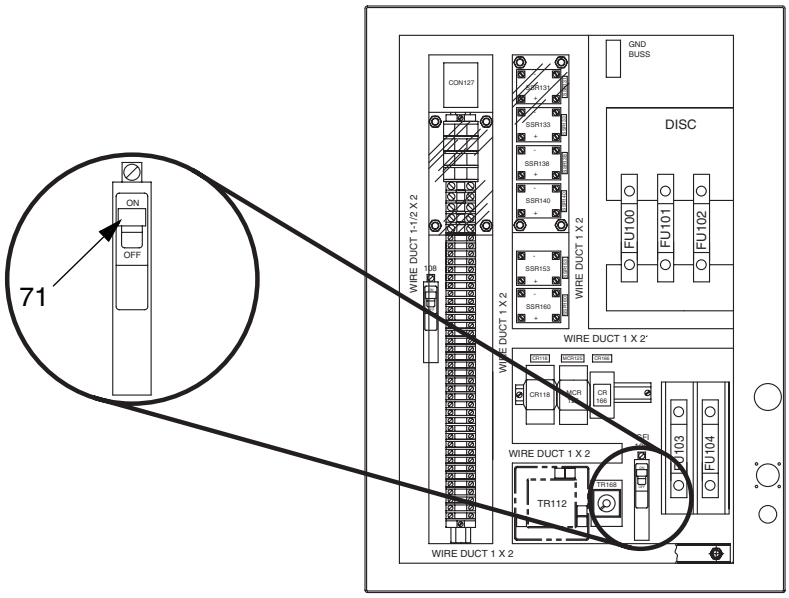


FIG. 7

Troubleshooting

Ram

Problem	Cause	Solution
Ram does not raise or lower.	Main air valve closed.	Open air valve.
	Air line clogged.	Clear air line.
	Ram air pressure too low.	Increase ram pressure.
	Worn or damaged piston.	Replace piston. See manual 310523.
	Control valve closed or clogged.	Open or clear valve or exhaust.
Ram raises or lowers too fast.	Ram air pressure too high.	Decrease ram pressure
Air leaks around cylinder rod.	Worn rod seal.	Replace o-rings in guide sleeve. See manual 310523.
Fluid squeezes past follower plate wipers.	Ram air pressure too high.	Decrease ram pressure.
	Worn or damaged wipers.	Replace wipers, page 22.
Pump won't prime properly or pumps air.	Main air valve closed.	Open air valve.
	Air line clogged.	Clear air line.
	Pump air pressure too low.	Increase pump pressure.
	Worn or damaged piston.	Replace piston. See manual 310523.
	Control valve closed or clogged.	Open or clear valve or exhaust.
	Control valve dirty, worn, or damaged.	Clean or service valve.
	Follower stopped by bent drum.	Replace drum.
Air pressure will not hold drum down or push plate up.	Main air valve closed.	Open air valve.
	Air line clogged.	Clear air line.
	Ram air pressure too low.	Increase ram pressure.
	Valve passage clogged.	Clean valve passage.
	Worn piston seal.	Replace seal.

Electrical Control Panel

Problem	Cause	Solution
Disconnect is ON, but no indicator lights are lit.	Ground fault interrupt has been activated.	Reset **Ground Fault Interrupt**, page 18.
	Fuse(s) blown.	Replace fuse(s).
High Temperature Alarm light on.	Heated component temperature is out of range.	See **High Temperature Alarm**, page 18.
Heat turns off after inactivity timer is triggered.	Pump inactive longer than programmed time period.	Reset **Auto Heat Off**, page 18.
Temperatures are in range, but pump will not start.	Internal timer has not reached the preset startup time.	Adjust timer to shorten startup time.

Heated Pump

See the pump manual for more information.

Problem	Cause	Solution
Rapid down or up stroke (pump cavitation).	Material not heated to proper temperature.	Check and adjust temperature set point.
	Air trapped in pump.	Purge air from the pump - page 13, step 6.
	Downstroke: Lower check in pump is worn. Upstroke: Upper check in pump is worn.	Repair pump. See pump manual.
	Plate is not melting material fast enough to supply pump.	Slow pump speed to match melt capacity.
Material leaks around pump outlet.	Outlet fitting is loose.	Tighten outlet fitting.
Material leaks around bleed port.	Bleed port fitting is loose.	Tighten bleed port fitting
Pump does not operate.	Air motor problem.	See **Air Motor** troubleshooting, below.
	Foreign object lodged in pump.	Follow **Pressure Relief Procedure**, page 14. Remove pump from air motor, page 23. Remove object and reassemble pump.
Wet-cup leaks.	Worn throat seal.	Tighten wet-cup and/or throat seal packings. If that does not stop leaking, replace wet-cup and/or throat seal packings.

Air Motor

See the air motor manual for more information.

Problem	Cause	Solution
Air motor stalled	Main air valve is dirty or damaged	Clean/rebuild main air valve.
Air continually exhausting around air motor shaft	Air motor shaft seal is damaged	Replace air motor shaft seal.
Air continually exhausting around the air valve/slide valve	Air valve/slide valve gasket is damaged	Replace the valve gasket.
Air continually exhausting from muffler while the motor is idle	Internal seal damage	Rebuild air motor.
Oil leaking from exhaust port	Too much lubricant mixed in with the air supply	Reduce lubricant supply.
Frost build-up on muffler	Air motor operating at too high a pressure or cycle rate	Reduce air motor pressure, cycle rate, or duty cycle.

Service

Before Servicing

1. Remove material pail.

   Follow **Changing Empty Pails** procedure, page 16, step 1-4. Follow the procedure's warnings and cautions.

WARNING

Read warnings, page 4.

2. Follow the **Pressure Relief Procedure**, page 14.
3. Follow the **Ram Pressure Relief Procedure**, below.

Ram Service

For more information on servicing the ram, see manual 310525.

Ram Pressure Relief Procedure

1. Follow the **Pressure Relief Procedure**, page 14.
2. Set the ram control lever (A) to DOWN. FIG. 8 and 9.
3. To stop the ram:
   a. Close the air valve (B).
   b. Set the ram control lever (A) to OFF to shut off the ram air supply.
4. Exhaust air from both sides of the ram:
   a. Set the ram control lever to DOWN until all air is exhausted from one side of the ram.
   b. Set the ram control lever to UP until all air is exhausted from the other side of the ram.

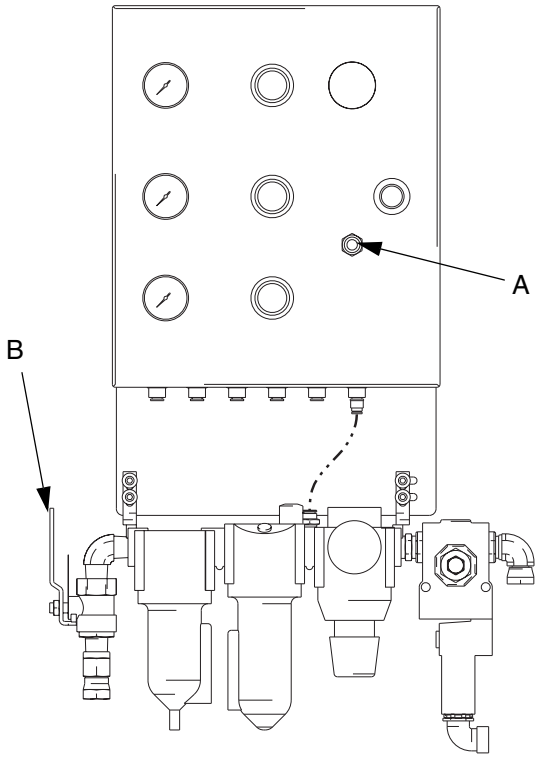


FIG. 8

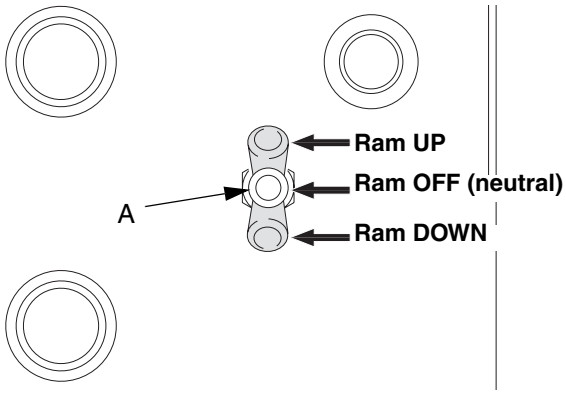


FIG. 9

Follower Service

To replace wires connecting the follower to the pump, see Manual 310530 or contact your Graco distributor.

Replacing Wipers

1. Follow **Before Servicing** procedure, page 21.
2. Separate the wiper joint, and bend back the strapping that covers the clamp (107). FIG. 10.
3. Unscrew the worm gear, then remove the wiper (102).
4. Thread the strapping through the new wiper (102).
5. Insert the strap end through the clamp (107) and tighten.
6. Use a rubber mallet to pound the wiper around the follower plate (101) until the wiper ends are butted tightly together.
7. Apply a lubricant to the wipers (102). Use a lubricant that is compatible with the material to be pumped. Check with the material supplier.

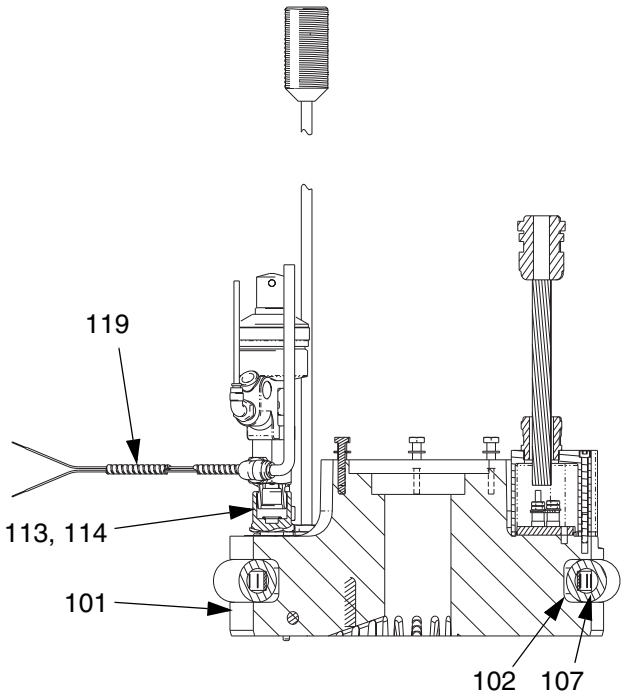


FIG. 10: Part No. 244754 shown

Replacing Heat Sensors

For more information about the follower plate, refer to pages 26-27.

1. Follow **Before Servicing** procedure, page 21.
2. Make sure the ram control lever is set to OFF.
3. Turn the CONTROL switch (65) to OFF. FIG. 5, page 17.
4. Turn OFF the main electrical disconnect.
5. Loosen the nut on sensor (119). FIG. 10.
6. Remove the sensor (119).
7. Loosen the cord grip (items 16, 17, 18 on page 30 or 23, 24, 25 on pages 32 and 34).
8. Open the electrical control box (13, on page 30).
9. Disconnect the 2 sensor wires. Note their location and refer to the **Electrical Schematic** for your electrical control, pages 48-55.
10. Connect the 2 wires from the new sensor (119) to the sensor terminals.
11. Close the electrical control box.
12. Coat the sensor with non-silicone heat-sink compound.
13. Slide the o-ring back into the cord grip, then tighten the cord grip.
14. Slide the sensor (119) into the opening in the follower plate (101).
15. Tighten the conduit locknut on the sensor.

Check-Mate 800 Pump/Motor Service

For specific information about servicing the Check-Mate 800 pump, see manual 308570 or 310530.

Removing Pump from Ram

1. Follow **Before Servicing** procedure, page 21.
2. Make sure the ram control lever is set to OFF.
3. Turn off the electrical power to the supply unit. Follow all applicable safety procedures and lockout rules.
4. Turn OFF the main electrical disconnect.
5. Bleed off pressure in the system and excess material by opening the dispense gun and catching the material in a waste container.
6. Turn the system CONTROL switch (65) to OFF. FIG. 5, page 17.
7. Disconnect all material hoses.
8. RTV sealant on the pump shroud may make it difficult to remove individual shroud pieces. Use a knife or a razor, to carefully scrape the sealant off the shroud seams.
9. **Pumps C03509 and C03512 only:** disconnect the junction box from the pump.
   a. Remove the junction box cover.
   b. Disconnect the heater wires and sensor wires that come from the pump.
   c. Remove the wires from the junction box.
   d. Disconnect the pump's back shroud and move it backwards out of the way.
10. Remove the follower from the pump, follow **Removing Follower Plate** procedure, page 24.
11. Separate the pump from the air motor, follow **Removing Pump from Air Motor** procedure, page 24.
12. Remove the pump and service it as needed. Refer to m
13. Reverse this procedure to reinstall the pump. Be sure to reapply RTV sealant to the seams of the shrouds before replacing them on the pump. for

Removing Pump from Air Motor

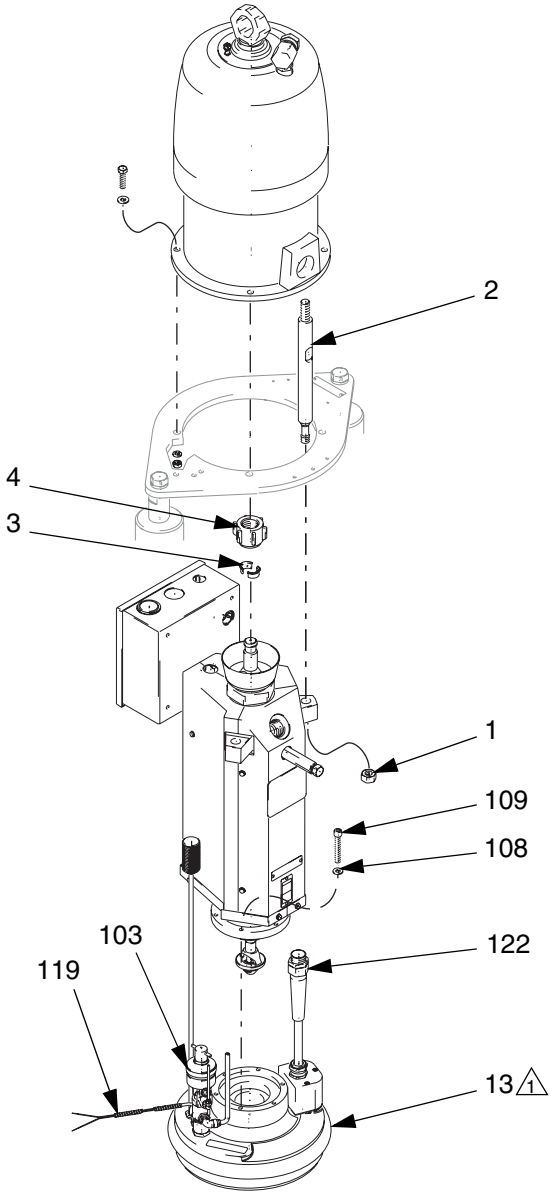
1. Follow steps 1-9 of **Removing Pump from Ram**, page 23.
2. Remove the remaining shrouds from the pump.
3. Remove the coupling nut (4), which attaches the pump to the air motor. Be careful not to lose the coupling collar (3). FIG. 11.
4. Remove the nuts (1) from the stand-off rods (2), and separate the pump from the air motor.
5. To access the bare pump, remove the pump's:
   - insulation
   - 2 heater bands
   - sensor block
6. Reverse the above procedure to reconnect the pump to the air motor. Be sure to:
   - Reinsert the coupling collar (3) into the coupling nut (4) with the large flanges pointing up
   - Apply RTV sealant to the pump shrouds before assembling them

For more information, see manual 310530, or call your Graco distributor.

Removing Follower Plate

Refer to page 41.

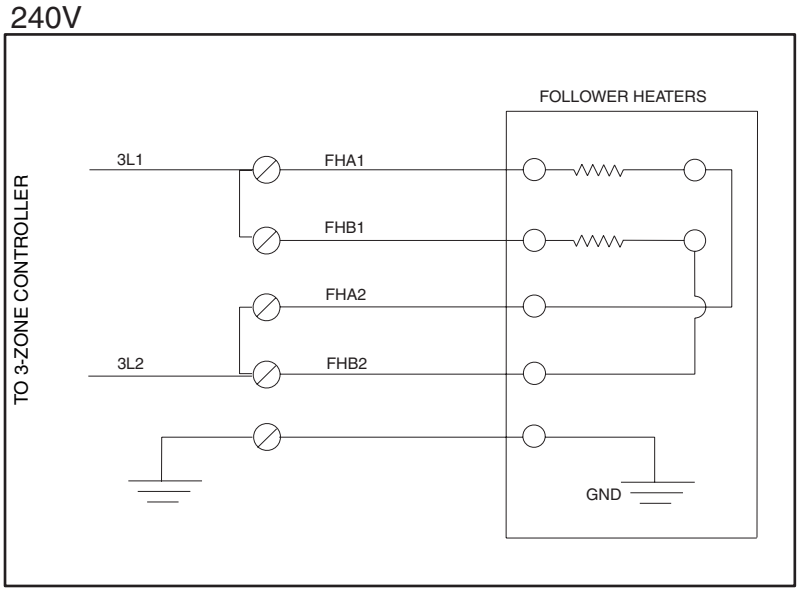
1. Remove the pump by following steps 1-12 of the **Removing the Pump Assembly** procedure.
2. Remove the sensor wires from the follower plate (13).
3. Disconnect the follower plate wires from the junction box on Bulldog/King pumps or control box on President pumps (FIG. 12, 13, or 14).
4. Loosen the coupling nut (122) from the follower conduits and from the sensor (119) conduit.
5. Remove the air line from the blow-off valve (103).
6. Remove the 6 screws (109) and washers (108).
7. Slide off the follower plate (13).

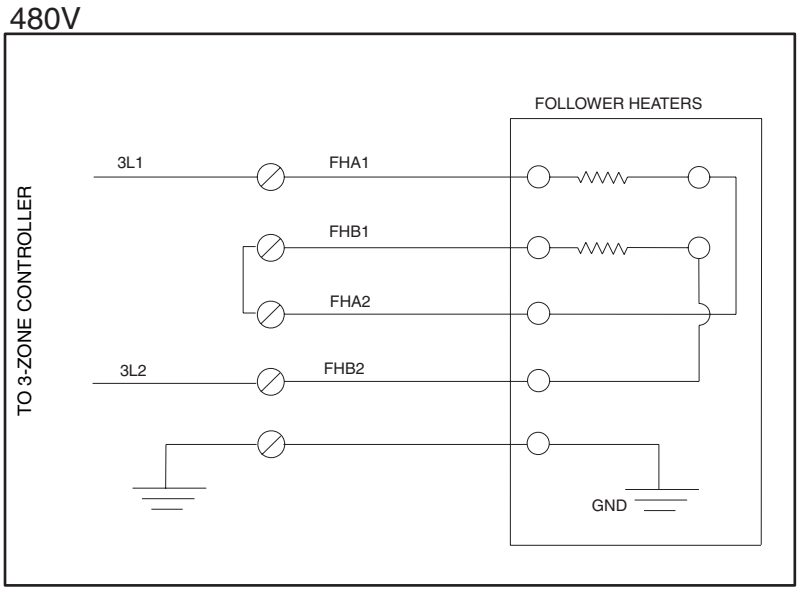


⚠1 Remove excess armored portion of sensor supplied with heated follower (13) prior to installing into junction box.

FIG. 11

240/480 Volt Ram Plate Assembly Wiring (3 Zone Control)





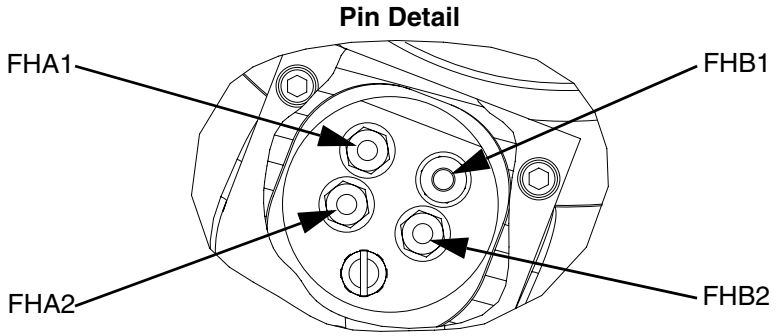


FIG. 12

240 Volt Ram Plate Assembly Wiring (4 Zone Control)

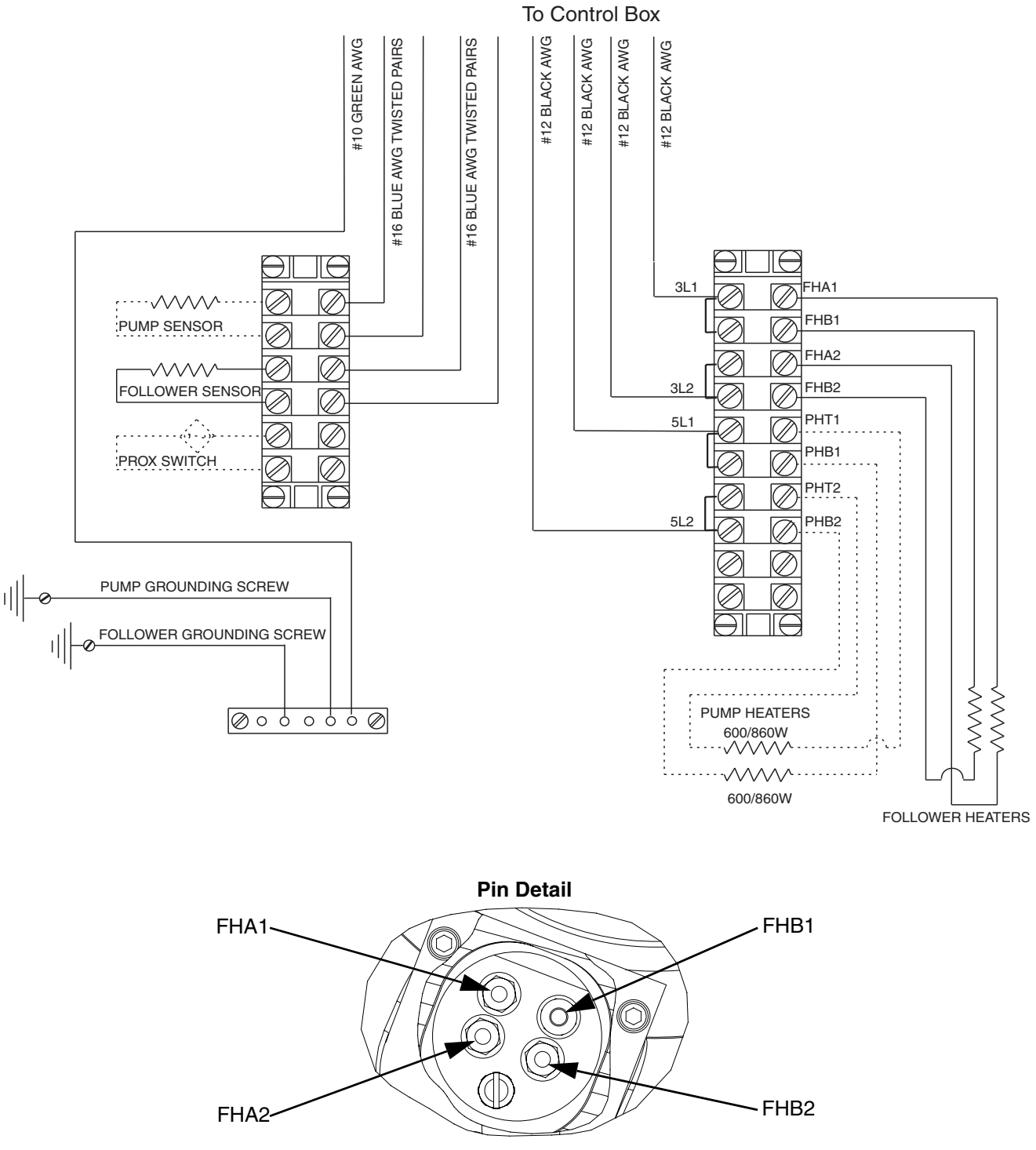
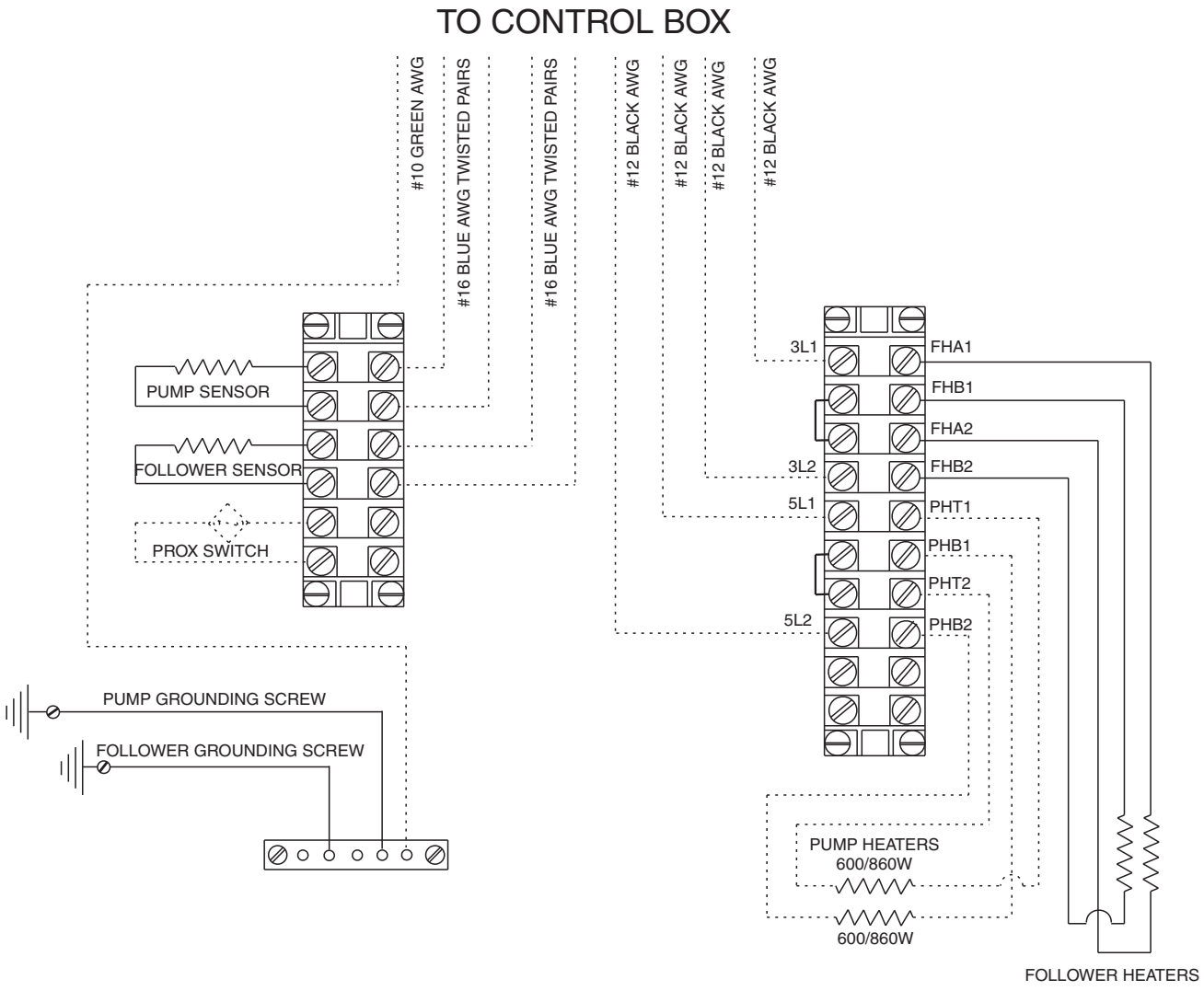


FIG. 13

480/575 Volt Ram Plate Assembly Wiring (4 Zone Control)



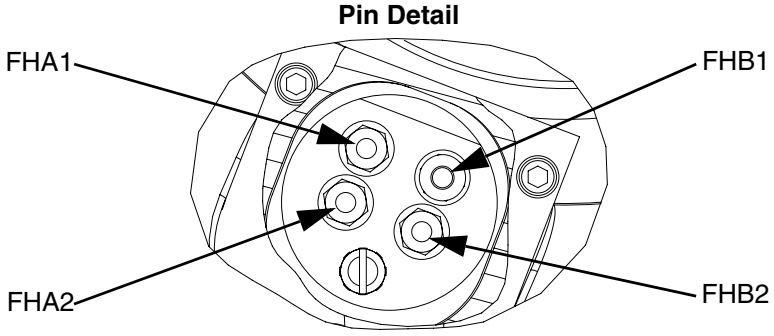


FIG. 14

President Pump/Motor Service

For more information on servicing the pump lower assembly, refer to manual 307431.

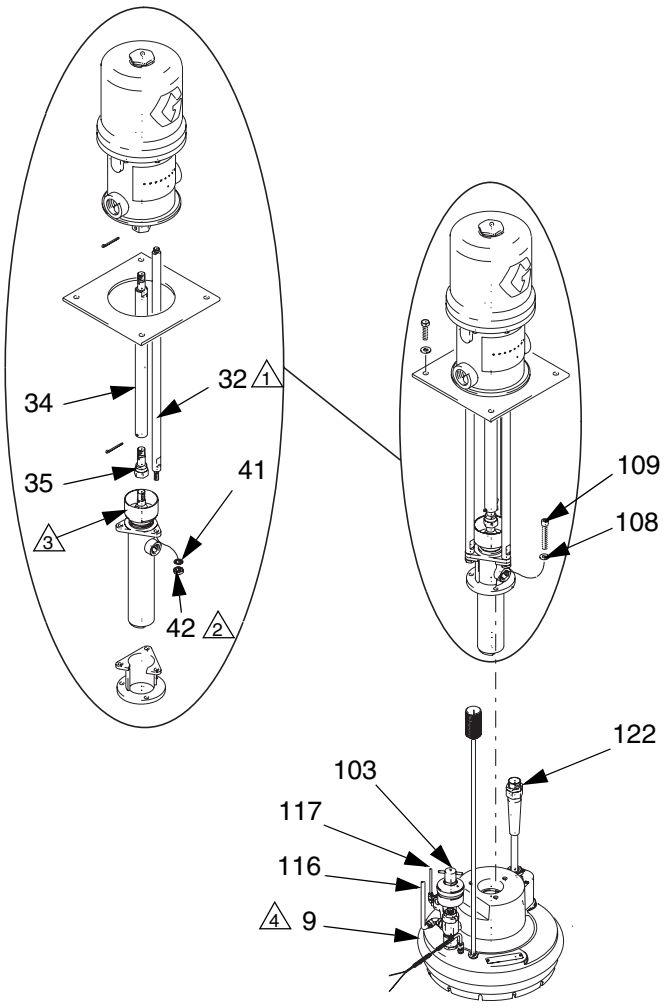
Removing Pump from Air Motor

1. Follow **Before Servicing** procedure, page 21.
2. Make sure the ram control lever is set to OFF.
3. Turn off the electrical power to the supply unit. Follow all applicable safety procedures and lockout rules.
4. Turn OFF the main electrical disconnect.
5. Bleed off pressure in the system and excess material by opening the dispense gun and catching the material in a waste container.
6. Turn the system CONTROL switch (65) to OFF. FIG. 5, page 17.
7. Disconnect all material hoses.
8. Remove the connecting rod connector (35) from the connecting rod (34). FIG. 15.
9. Remove the 3 nuts (42) and washers (41) from the stand-off rods (32).
10. Remove the pump and service it as needed.
11. Reverse this procedure to reinstall the pump. Torque the connecting rod nut to 30-40 ft-lb (40.67-54.23 N•m).

Removing Follower Plate

Refer to page 42.

1. Remove the pump by following steps 1-7 of **Removing Pump from Air Motor**, above.
2. Remove the sensor from the follower plate (9). FIG. 15.
3. Loosen the coupling nut (122) from the follower conduit.
4. Remove the air lines (116, 117) from the blow-off valve (103).
5. Remove the 6 screws (109) and washers (108).
6. Slide off the follower plate (9).



1 Torque to 20-30 ft-lbs (27-41 N•m)

2 Torque to 30-40 ft-lbs (41-54 N•m)

3 Fill packing nut 1/2 full of TSL (43)

4 Tie-wrap armored portion of sensor onto conduit leading up to junction box; continue to cable from junction box to main control box to point of access.

FIG. 15

Inspection Frequency

Ram

Periodically (once a month), inspect the ram guide sleeves, rods and cylinders for wear or damage, replace all worn parts. See the Service section of manual 310523 or 310525.

Pump

See the pump instructions for its inspection frequency.

Ground Fault Interrupt

Periodically (once a month) test the ground fault interrupt switch by pushing the TEST button. See the literature that came with the electrical control panel.

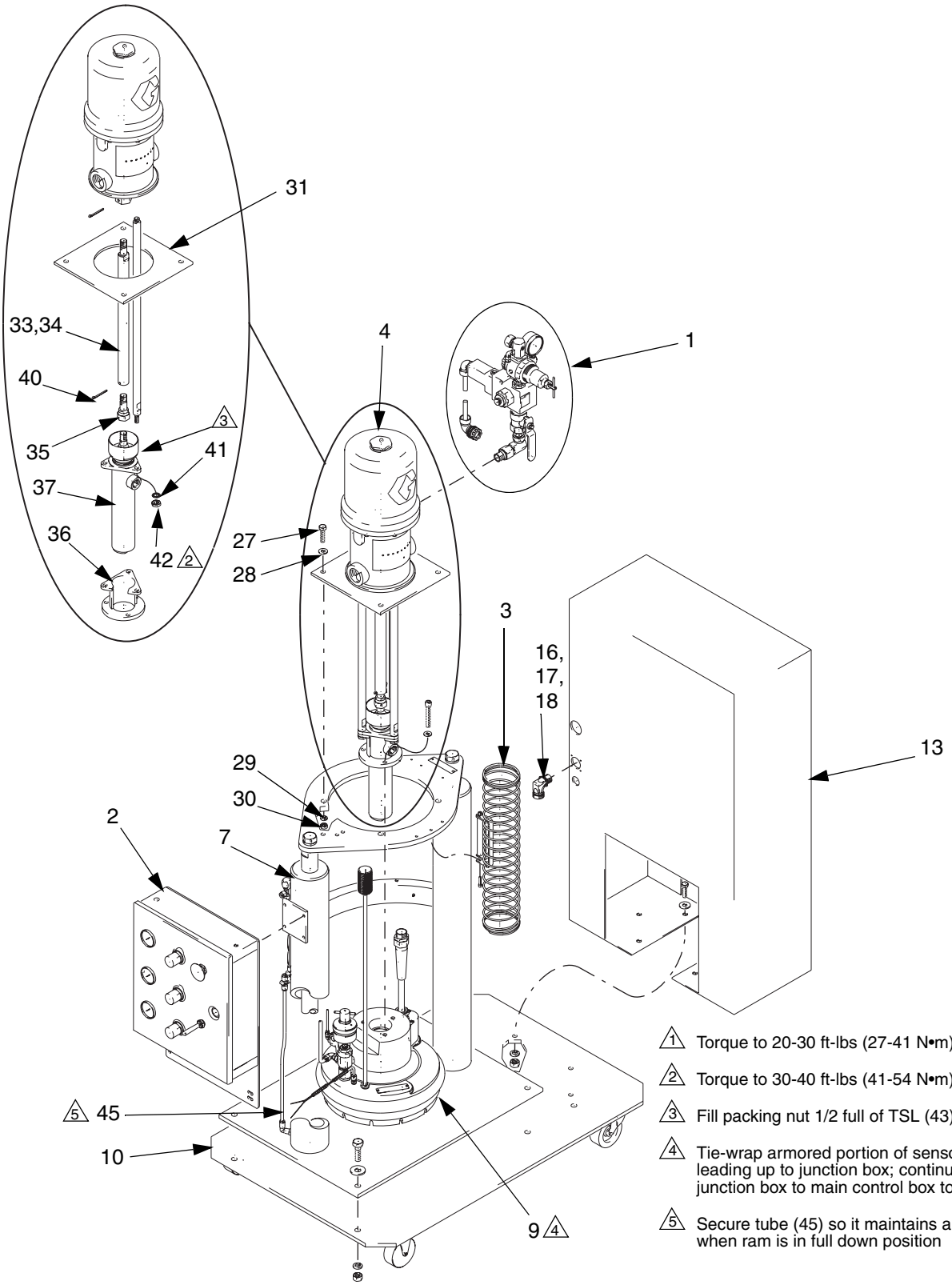
Removing/Replacing CB100 Controller

See manual 309100 for instructions on removing and/or replacing the temperature controllers on the system.

Parts

Therm-O-Flo 20 Models 918522, 918532, and 246653

3 in. (76 mm) Ram, 15:1 President, with silicone follower wiper, 918522 - 480 VAC, 918532 - 240 VAC



1 Torque to 20-30 ft-lbs (27-41 N•m)

2 Torque to 30-40 ft-lbs (41-54 N•m)

3 Fill packing nut 1/2 full of TSL (43)

4 Tie-wrap armored portion of sensor onto conduit leading up to junction box; continue to cable from junction box to main control box to point of access.

5 Secure tube (45) so it maintains a relaxed position when ram is in full down position

Model 918522

With Electrical Control, Includes 1-45

Model 246653

Without Electrical Control, Includes 1-12, 15, 22-45

Ref No.	Part No.	Description	Qty.
1	918506	KIT, depressurizing (see page 37)	1
2	234236	CONTROL BOX	1
3	C31197	KIT, hose support	1
4	207352	AIR MOTOR; see manual 306982	1
5	C14043	WARNING LABEL	4
6	C14005	WARNING LABEL	4
7	241086	RAM, 3 in., 5 gal.; see manual; 310525	1
8	C78267	JUMPER	1
9	244754	INDUCTOR, heated; see page 42	1
10	918414	MOBILE PLATFORM KIT	1
13	617300	ELECTRICAL CONTROL, 480 V, 3-zone; see page 48	1
16	C20571	CONNECTOR, 90°cable; 1/2 npt	1
17	C20874	O-RING, conduit sealing	1
18	C20715	LOCKNUT, conduit; 1/2 in.	1
27	100003	SCREW, hex; 3/8-16 UNC x 1.5 in.	4
28	100731	WASHER; 3/8 in.	4
29	100133	WASHER, lock; 3/8 in.	4
30	100307	NUT; 3/8-16 UNC	4
31	C31194	PLATE, pump mounting	1
32	198369	ROD, stand-off	3
33	156082	O-RING; buna-N	2
34	198412	ROD, connecting	1
35	207370	ROD, connecting	1
36	617400	ADAPTER, pump	1
37	918417	PUMP, hot melt; see manual 307431	1
38	100016	WASHER, lock; 1/4 in.	2
39	112166	SCREW; 1/4-20 UNC x 3/4 in.	2
40	101946	COTTER PIN	2
41	100133	WASHER, lock; 3/8 in.	3
42	100340	NUT; 3/8-16	3
43	206994	FLUID, TSL; 8 oz. (not shown)	1
45	517430	TUBE, coil; 1/4 in. OD	1

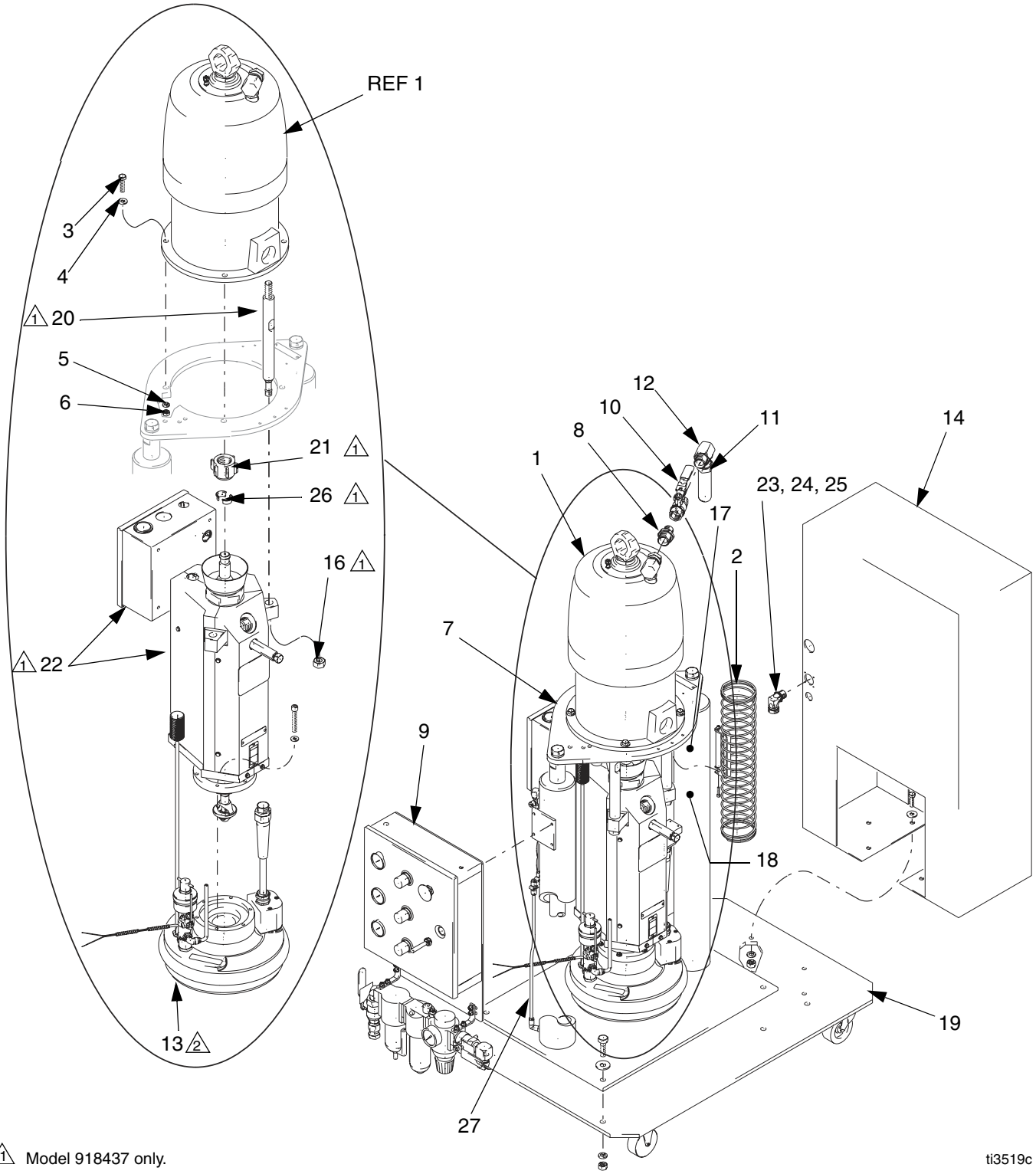
Model 918532

With Electrical Control, Includes 1-45

Ref No.	Part No.	Description	Qty.
1	918506	KIT, depressurizing (see page 37)	1
2	234236	CONTROL BOX	1
3	C31197	KIT, hose support	1
4	207352	AIR MOTOR; see manual 306982	1
5	C14043	WARNING LABEL	4
6	C14005	WARNING LABEL	4
7	241086	RAM, 3 in., 5 gal.; see manual; 310525	1
8	C78267	JUMPER	2
9	244754	FOLLOWER PLATE, heated; see page 42	1
10	918414	MOBILE PLATFORM KIT	1
13	617484	ELECTRICAL CONTROL, 240 V, 3-zone; see page 44	1
16	C20571	CONNECTOR, 90°cable; 1/2 npt	1
17	C20874	O-RING, conduit sealing	1
18	C20715	LOCKNUT, conduit; 1/2 in.	1
27	100003	SCREW, hex; 3/8-16 UNC x 1.5 in.	4
28	100731	WASHER; 3/8 in.	4
29	100133	WASHER, lock; 3/8 in.	4
30	100307	NUT; 3/8-16 UNC	4
31	C31194	PLATE, pump mounting	1
32	198369	ROD, stand-off	3
33	156082	O-RING; buna-N	2
34	198412	ROD, connecting	1
35	207370	ROD, connecting	1
36	617400	ADAPTER, pump	1
37	918417	PUMP, hot melt; see manual 307431	1
38	100016	WASHER, lock; 1/4 in.	2
39	112166	SCREW; 1/4-20 UNC x 3/4 in.	2
40	101946	COTTER PIN	2
41	100133	WASHER, lock; 3/8 in.	3
42	100340	NUT; 3/8-16	3
43	206994	FLUID, TSL; 8 oz.	1
45	517430	TUBE, coil; 1/4 in. OD	1

Therm-O-Flo 20 Models 918344 and 918437

3 in. (76 mm) Ram, 31:1 Bulldog, Therm-O-Flo 20 Heated Check-Mate 800, with silicone follower wiper, 918344 - 480 VAC, 918437 - 240 VAC



ti3519c

1 Model 918437 only.

2 Remove excess armored portion of sensor supplied with heated follower (13) prior to installing into junction box.

Model 918344

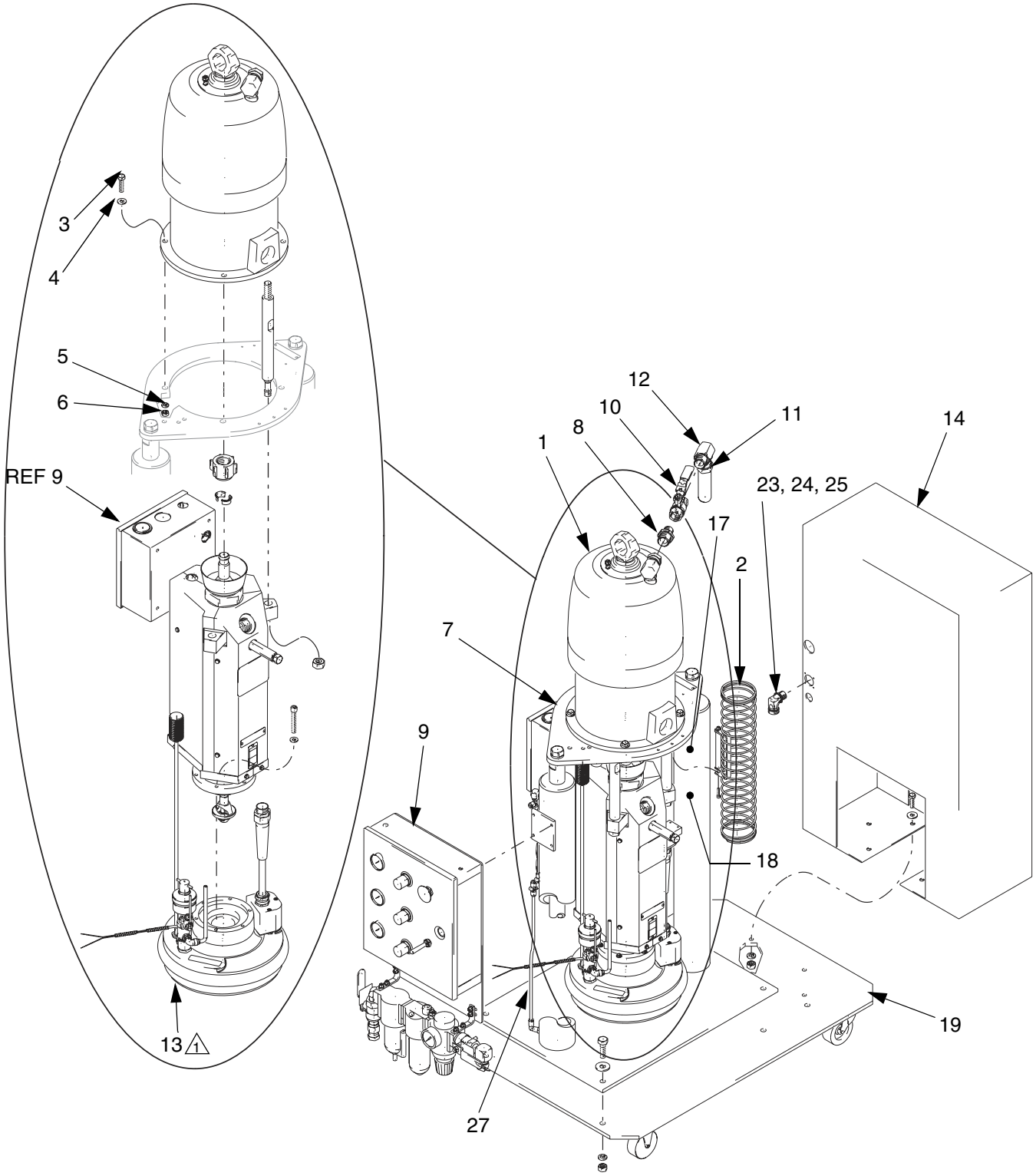
Ref. No.	Part No.	Description	Qty.
1	241201	PUMP, 31:1 Bulldog	1
2	C31197	KIT, hose support	1
3	100003	SCREW, hex; 3/8-16 UNC x 1.5 in.	4
4	C19200	WASHER; 3/8 in.	4
5	C19213	WASHER, lock; 3/8 in.	4
6	C19185	NUT, jam; 3/8-16 UNC	4
7	241086	RAM, 3 in., 5 gal.; see manual 310525	1
8	157191	ADAPTER	1
9	246587	AIR CONTROL MODULE	1
10	C06297	VALVE, ball; with locking handle	1
11	C06299	MUFFLER; #10-32 unf	1
12	155470	UNION, swivel, 90°	1
13	244757	INDUCTOR, heated; see page 41	1
14	617349	ELECTRICAL CONTROL, 480 V, 4-zone	1
15	C12025	HOSE, coupled (not shown)	1
17	C14043	WARNING LABEL	4
18	C14005	WARNING LABEL	4
19	918414	MOBILE PLATFORM KIT	1
23	C20571	CONNECTOR, 90° cable; 1/2 npt	1
24	C20874	O-RING, conduit sealing	1
25	C20715	LOCKNUT, conduit; 1/2 in.	1
27	C12509	TUBE, nylon	4

Model 918437

Ref. No.	Part No.	Description	Qty.
1	208356	AIR MOTOR, 31:1Bulldog	1
2	C31197	KIT, hose support	1
3	100003	SCREW, hex; 3/8-16 UNC x 1.5 in.	4
4	C19200	WASHER; 3/8 in.	4
5	C19213	WASHER, lock; 3/8 in.	4
6	C19185	NUT, jam; 3/8-16 UNC	4
7	241086	RAM, 3 in., 5 gal.; see manual; 310525	1
8	157191	ADAPTER	1
9	246587	AIR CONTROL MODULE	1
10	C06297	VALVE, ball; with locking handle	1
11	C06299	MUFFLER; #10-32 unf	1
12	155470	UNION, swivel, 90°	1
13	244757	INDUCTOR, heated; see page 41	1
14	617485	ELECTRICAL CONTROL, 240 V, 4-zone	1
15	C12025	HOSE, coupled	1
16	106166	NUT; M16 x 2	3
17	C14043	WARNING LABEL	4
18	C14005	WARNING LABEL	4
19	918414	MOBILE PLATFORM KIT	1
20	190000	ROD, tie	1
21	186925	NUT, coupling	1
22	C03512	PUMP, HCM-800, 240 VAC, 5 gal.; see manual 310530	1
23	C20571	CONNECTOR, 90°cable; 1/2 npt	1
24	C20874	O-RING, conduit sealing	1
25	C20715	LOCKNUT, conduit; 1/2 in.	1
26	184129	COLLAR, coupling	1
27	C12509	TUBE, nylon	4

Therm-O-Flo 20 Models C59398 and 234965

3 in. (76 mm) Ram, 65:1 King, Therm-O-Flo 20 Heated Check-Mate 800, with silicone follower wipers, 480 VAC



⚠1 Remove excess armored portion of sensor supplied with heated follower (13) prior to installing into junction box.

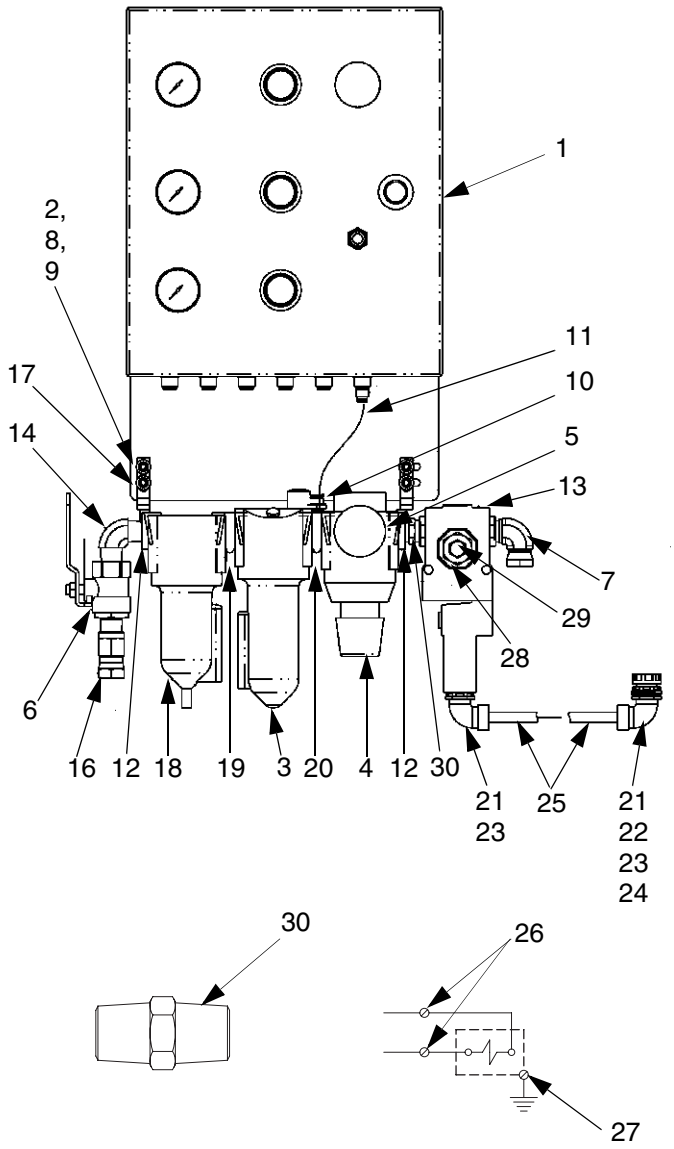
Models C59398 and 234965

Ref. No.	Part No.	Description	Qty.
1	241200	PUMP, 65:1 King; see manual 310530	1
2	C31197	KIT, hose support	1
3	100003	SCREW, hex; 3/8-16 UNC x 1.5 in.	4
4	C19200	WASHER; 3/8 in.	4
5	C19213	WASHER, lock; 3/8 in.	4
6	C19185	NUT, jam; 3/8-16 UNC	4
7	241086	RAM, 3 in., 5 gal.; see manual 310525	1
8	157191	ADAPTER; 1/2 x 3/4 npt	1
9	246587	AIR CONTROL MODULE	1
10	C06297	VALVE, ball; with locking handle	1
11	C06299	MUFFLER; #10-32 unf	1
12	155470	UNION, swivel, 90°	1
13	244757	INDUCTOR, heated; see page 41	1
14*	617349	ELECTRICAL CONTROL, 480 V, 4-zone	1
15	C12025	HOSE, coupled; 1/2 npt; 5 ft. (not shown)	1
17	C14043	WARNING LABEL	4
18	C14005	WARNING LABEL	4
19	918414	MOBILE PLATFORM KIT	1
23*	C20571	CONNECTOR, 90°cable; 1/2 npt	1
24*	C20874	O-RING, conduit sealing	1
25*	C20715	LOCKNUT, conduit; 1/2 in.	1
27	C12509	TUBE, nylon	4

* Model C59398 only.

Part No. 246587

4-Regulator Ram Air Control Module



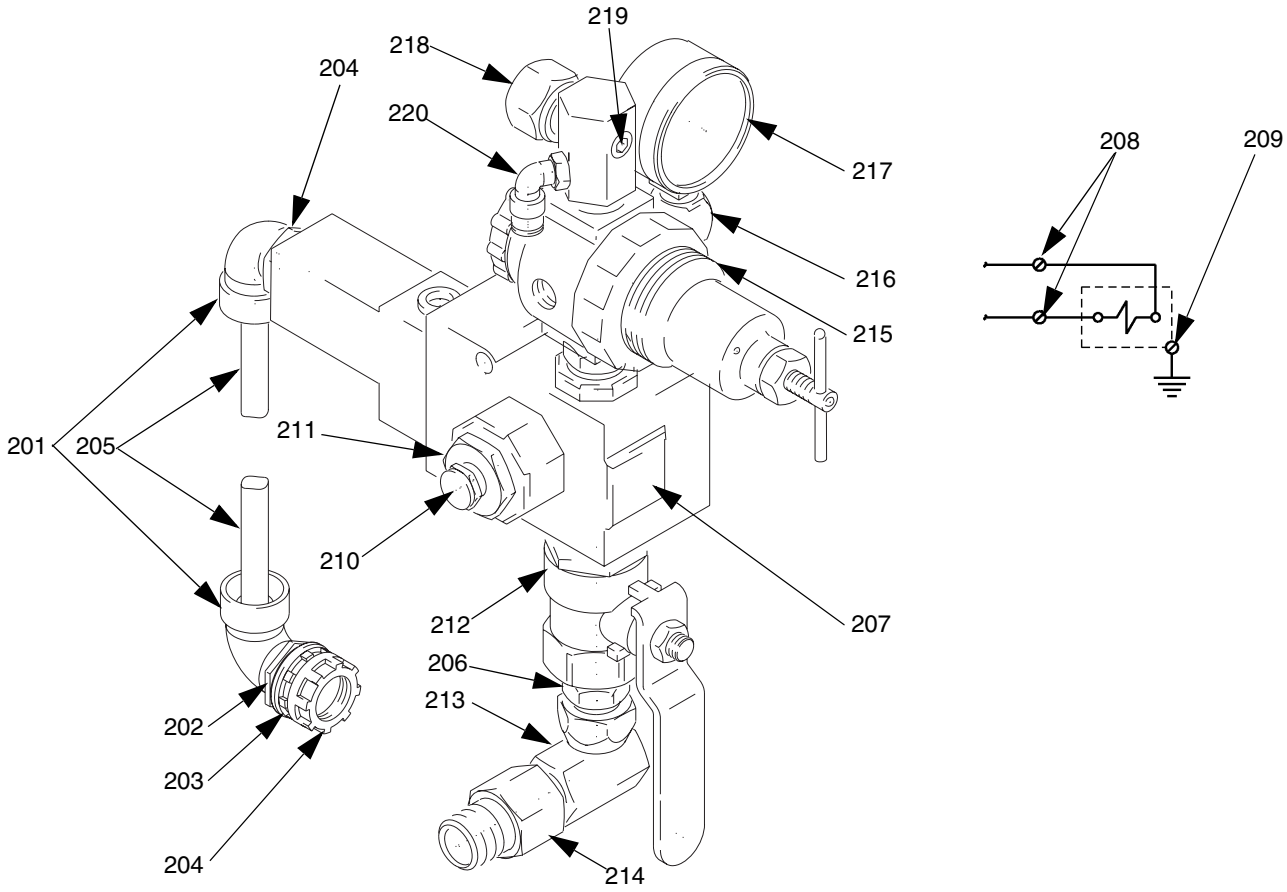
Ref. No.	Part No.	Description	Qty.
1	234236	CONTROL BOX	1
2	101682	SCREW; 1-1/4-20 x 5/8 in.	4
3	C11034	LUBRICATOR, oil	1
4	C11029	REGULATOR, air	1
5	C36260	GAUGE, air pressure	1
6	113269	VALVE, ball, vented	1
7	C19024	ELBOW, swivel; 1/2-14 npsm x 1/2-14 nptf	1
8	C19197	WASHER; 3/16 in.	4
9	108094	LOCKNUT; 1/4-28 UNF	4
10	115950	CONNECTOR; 5/16 tube x 1/4 npt	1
11		TUBE, nylon 5/16 in. OD	
12	C11037	INSERT, 1/2 npt	2
13	617546	VALVE, solenoid	1
14	116117	ELBOW, 90°; 1/2 npt	1
16	155865	ADAPTER 1/2-14 npt	1
17	C11055	BRACKET, mounting, filter-regulator-lubricator	2
18	C11033	FILTER, air	1
19	C11039	INSERT, interface	1
20	C11040	INSERT, interface	1
21	C20572	GRIP; cable, 90°	2
22	C20874	PACKING, o-ring, conduit sealing	1
23	C20715	FITTING, locknut, conduit	2
24	C20865	BUSHING, conduit	1
25	C20541	WIRE, copper, electrical	11’
26	C07403	WIRE, nut	2
27	617550	RING, terminal	1
28	C32390	FILTER, vent, breather	1
29	C19681	BUSHING, pipe	1
30	158491	FITTING, nipple	1

Part No. 918506

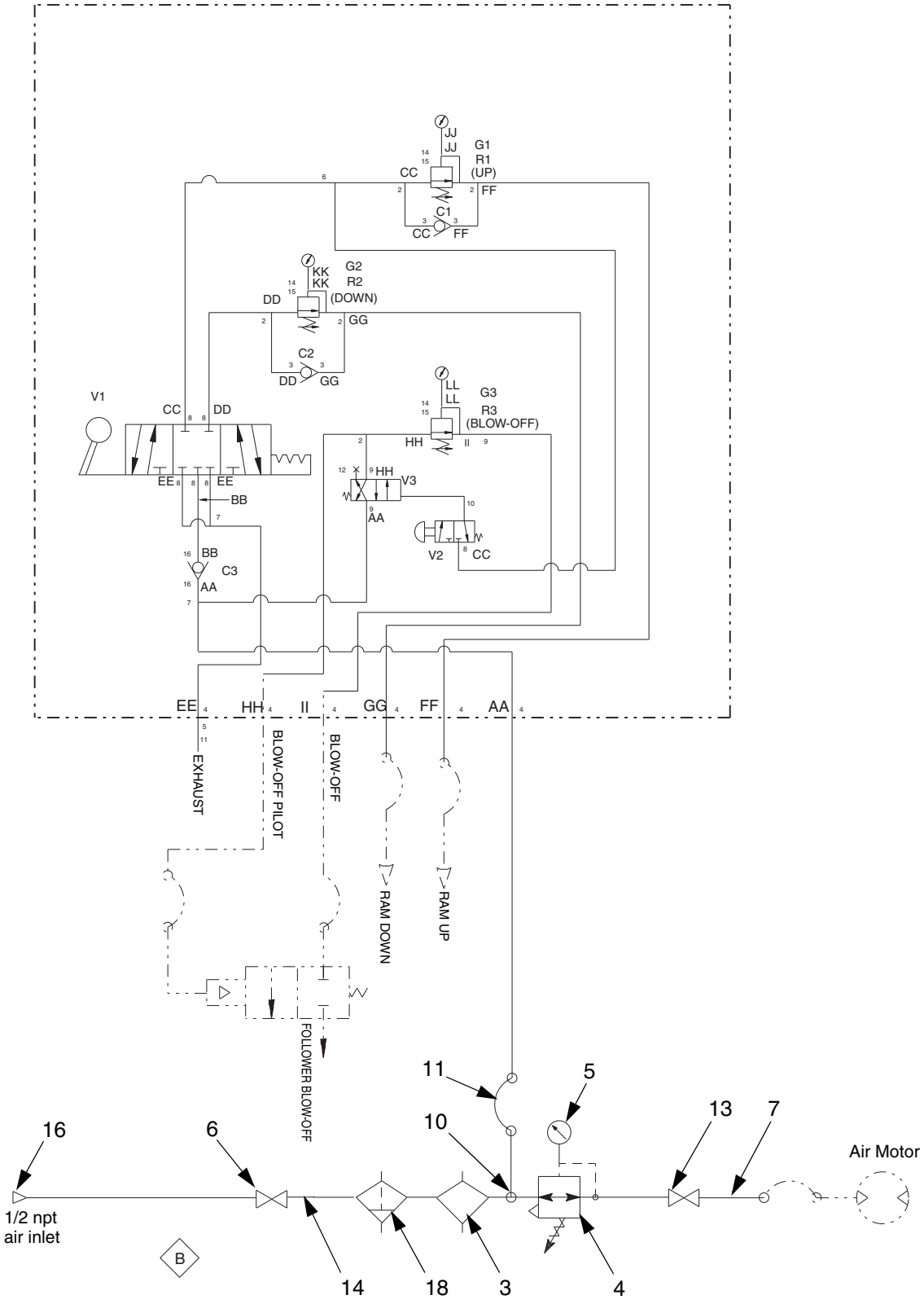
Depressurizing Kit

Ref. No.	Part No.	Description	Qty.
201	C20572	GRIP; 90° cable	2
202	C20874	O-RING, conduit sealing	1
203	C20715	LOCKNUT, conduit; 1/2 in.	2
204	C20865	BUSHING; conduit; 1/2 npt	1
205	C20541	CABLE, yellow, 3-conductor, 16 AWG, 11 ft. (3.35 m)	*
206	158491	NIPPLE; 1/2-14 npt	1
207	617546	SOLENOID VALVE, 3-way	1
208	C07403	WIRE NUT	2
209	617550	TERMINAL RING	1
210	C32390	FILTER, vent	1
211	C19681	BUSHING; 3/4 x 1/4 npt	1
212	113269	VALVE, ball, vented, .500	1
213	155470	UNION, swivel, 90°	1
214	110332	ADAPTER	1
215	104266	REGULATOR, air	1
216	100840	ELBOW, street	1
217	100960	Gauge, air pressure	1
218	162376	MANIFOLD, swivel, union	1
219	104765	PLUG, pipe headless	2
220	597151	FITTING, elbow, swivel, 1/8 npt	1

* *Comes in bulk rolls.*

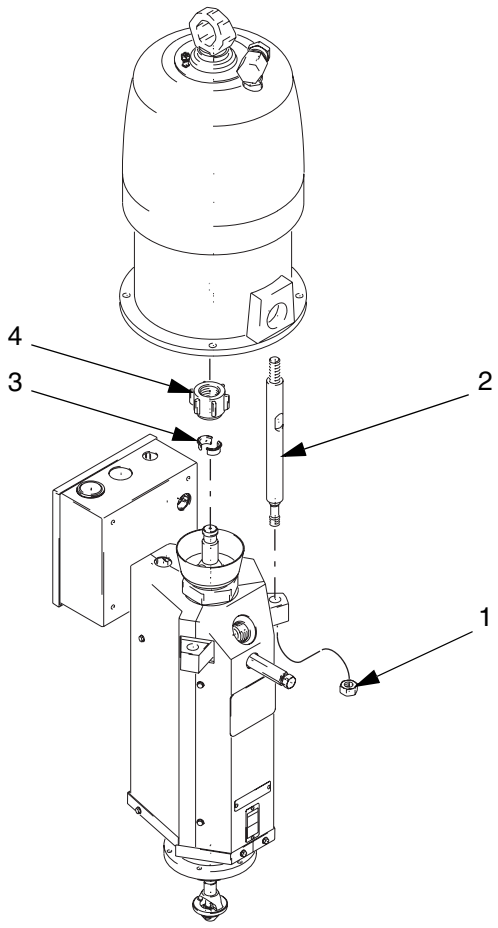


Part No. 246587



Part No. C03510

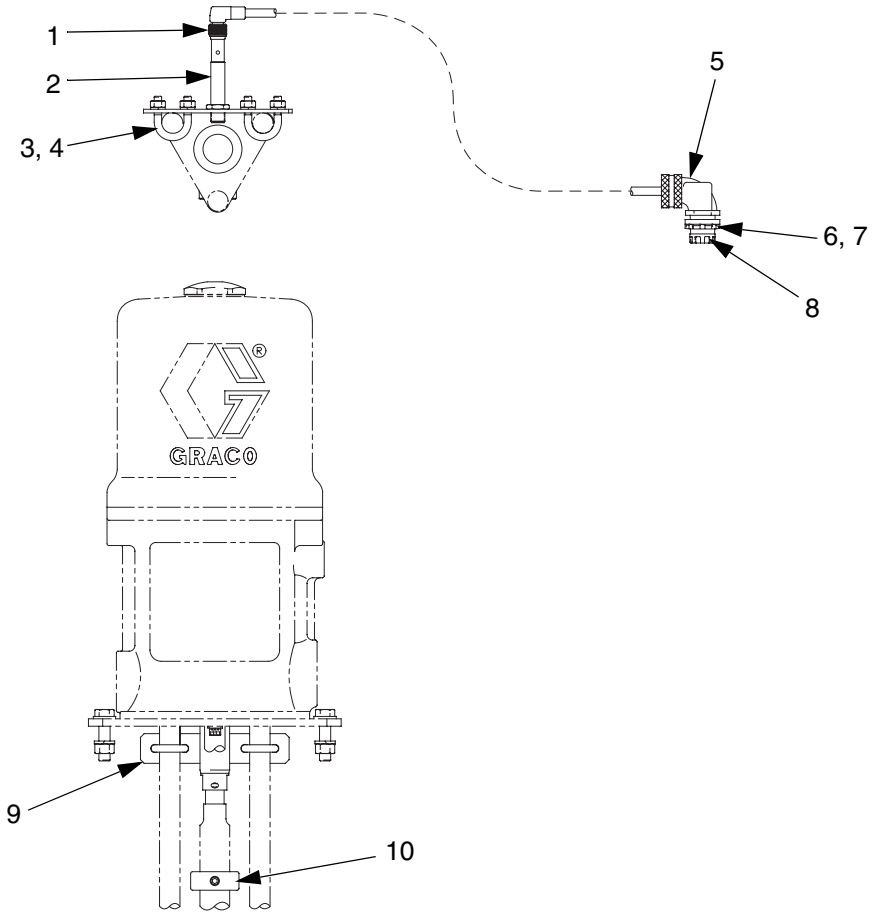
Pump Air Motor Mounting Kit



Ref. No.	Part No.	Description	Qty.
1	106166	NUT, M16 x 2	3
2	190000	ROD, tie	3
3	184129	COLLAR, coupling	2
4	186925	NUT, coupling; 1-1/4-12 UNF	1

Part No. 918433

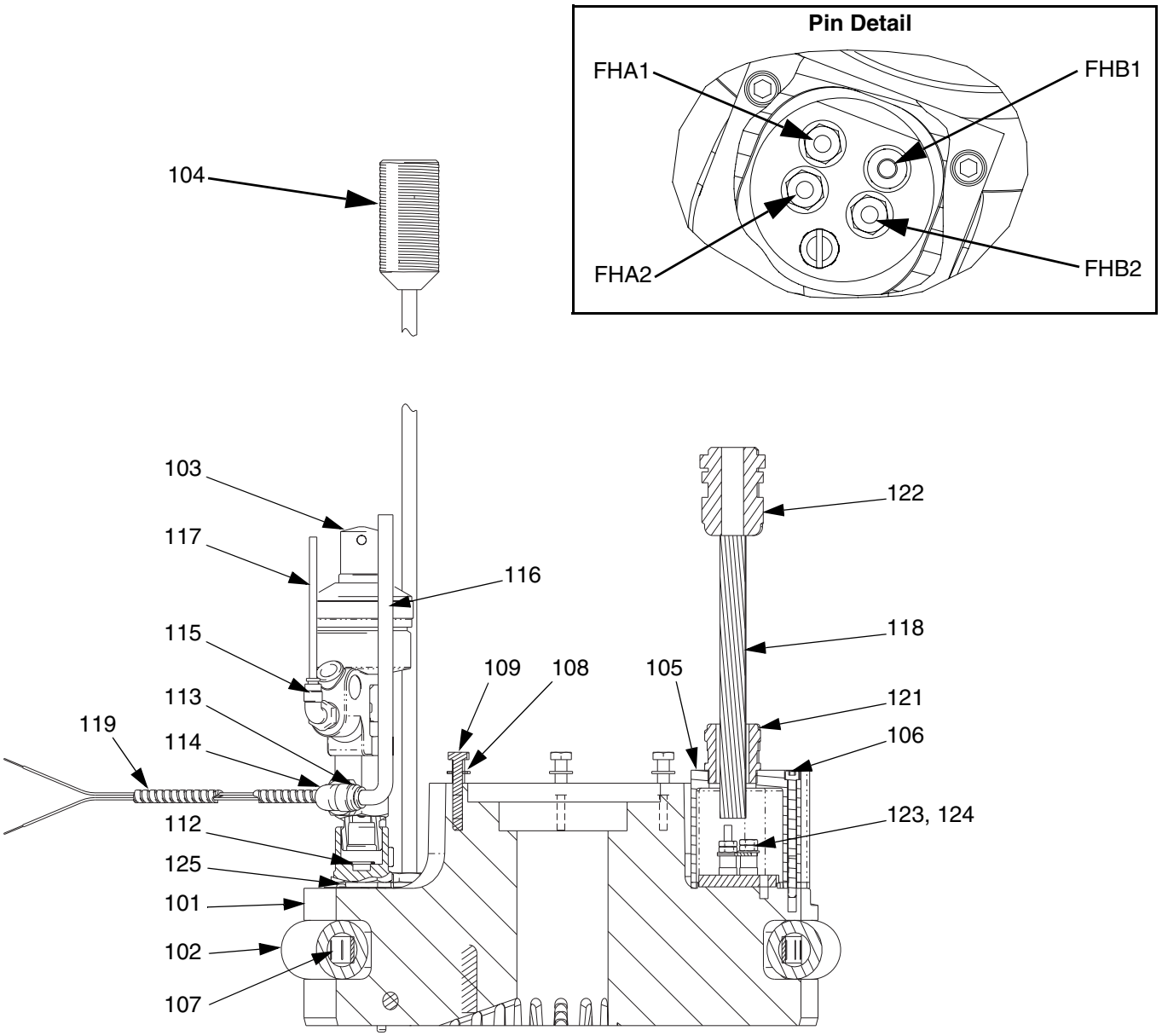
Proximity Switch Kit (pump activity) for use with President pumps



Ref. No.	Part No.	Description	Qty.
1	C50174	CABLE, proximity	1
2	517469	SWITCH, proximity	1
3	C19209	WASHER, lock; 1/4 in.	4
4	C20452	U-BOLT; 1/4-20 x 1/2 in.	2
5	C20571	CONNECTOR, cable; 1/2 npt	1
6	C20874	O-RING, conduit sealing	1
7	C20715	LOCKNUT, conduit; 1/2 in.	1
8	C20865	BUSHING; conduit; 1/2 npt	1
9	617417	BRACKET, switch mounting	1
10	517470	COLLAR, clamp	1
11	C78342	TIMER (not shown)	1
12	C78552	SOCKET, 8-receptacle (not shown)	1

Part No. 244757

Heated Follower Plate Kit with smooth bottom for use with Heated Check-Mate 800 pump modules

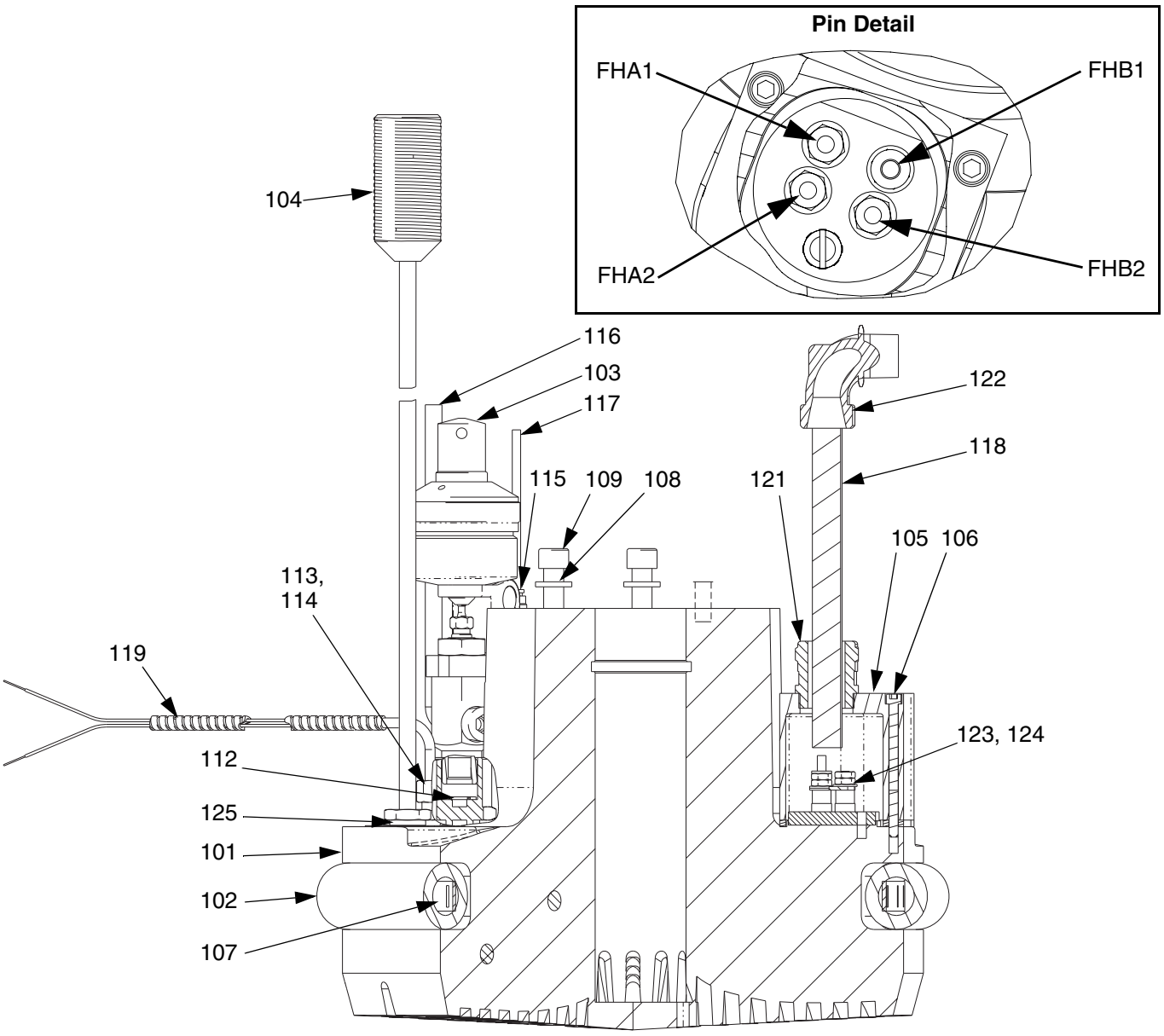


Ref. No.	Part No.	Description	Qty.
101	244710	PLATE, heated; smooth bottom	1
102	C31052	WIPER	1
103	207440	VALVE, automatic dispense; see manual 306715	1
104	198030	HANDLE, bleed	1
105	198027	COVER, connector	1
106	514930	SCREW	3
107	C31154	CLAMP; 4-1/8 in. to 7 in.	2
108	100016	WASHER, lock; 1/4 in.	6
109	114238	SCREW; 1/4-20 UNC x 1.5 in.	6
112	167730	GASKET; copper	1

Ref. No.	Part No.	Description	Qty.
113	100176	BUSHING; 3/8-18 x 1/4-18 npt	1
114	115948	ELBOW, 90°; 5/16 tube x 1/4 npt	1
115	115949	ELBOW, 90°; 5/32 tube x 1/4 npt	1
116		TUBE, PTFE; 5/16 in. OD	
117		TUBE, PTFE; 5/32 in. OD	
118	233594	CABLE ASSY.	1
119	517428	SENSOR, temperature	1
121	116536	CONNECTOR, strain relief	1
122	115845	CONNECTOR, strain relief	1
123	115159	WASHER	4
124	102931	NUT; 8-32 UNC	4
125	15C171	GASKET; silicone sponge	1

Part No. 244754

Heated Follower Plate Kit with finned bottom for use with President pump assemblies



Ref. No.	Part No.	Description	Qty.
101	244707	PLATE, heated; finned bottom; 15:1 pump	1
102	C31052	WIPER	1
103	207440	VALVE, automatic dispense; see manual 306715	1
104	198030	HANDLE, bleed	1
105	198027	COVER, connector	1
106	514930	SCREW	3
107	C31154	CLAMP; 4-1/8 in. to 7 in.	2
108	100133	WASHER, lock; 3/8 in.	3
109	100659	SCREW; 3/8-16 UNC x 1 in.	3
112	167730	GASKET; copper	1

Ref. No.	Part No.	Description	Qty.
113	100176	BUSHING; 3/8-18 x 1/4-18 npt	1
114	115948	ELBOW, 90°; 5/16 tube x 1/4 npt	1
115	115949	ELBOW, 90°; 5/32 tube x 1/4 npt	1
116		TUBE, PTFE; 5/16 in. OD	
117		TUBE, PTFE; 5/32 in. OD	
118	233594	CABLE ASSY.	1
119	517428	SENSOR, temperature	1
121	116536	CONNECTOR, strain relief	1
122	C20572	CONNECTOR, 90°cable; 1/2 npt	1
123	115159	WASHER	4
124	102931	NUT; 8-32 UNC	4
125	15C171	GASKET; silicone sponge	1

Part No 617300 and 617484

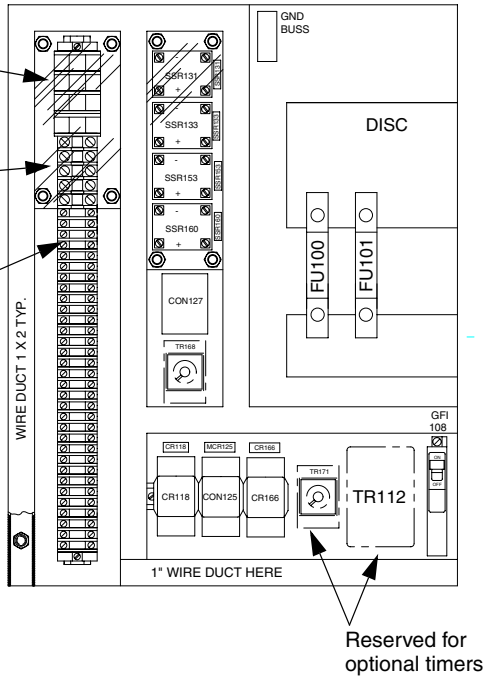
Standard, 3-zone Electrical Control Panel (interior)
617300 - 480 VAC, 617484 - 240 VAC

Terminals

120 V Terminals
FU109
FU175
FU177
FU179
TOTAL (4), TYPE CE6

480 V Terminals
2L1
2L2
3L1
3L2
GND
TOTAL (5), TYPE CD2

120 V Terminals
1081
1082
1082
1082
1101
1141
1142
1181
1311
1312
1321
1331
1531
1532
1541
1551
1601
1602
1611
1621
1641
1661
1662
1711
1752
1772
1792
(2) SPARE
GND
GND
TOTAL (31), TYPE CA1

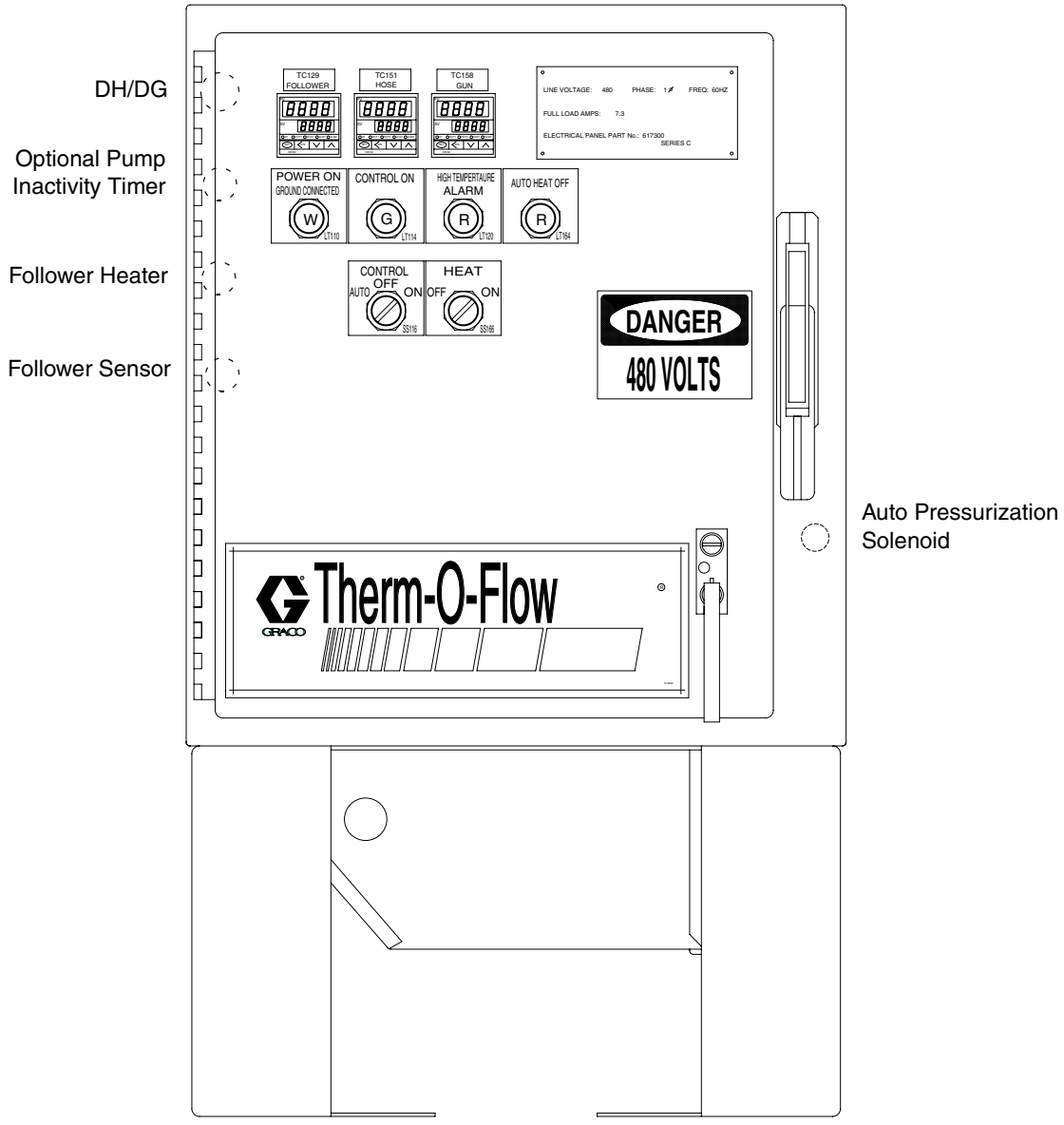


Spare Parts	Part No.
Temperature Controller	195764
Solid State Relay (or SSRs 153 and 160)	C78082
Timer, 7-day	C78167
Timer, Inactivity	C78342
Spare Fuses	
FU109, 120 V	15C344
FU175, 120 V	15C345
FU177, 120 V	15C343
FU179, 120 V	15C343
FU100/101, 600 V (for Part No. 617300)	15C347
FU100/101, 600 V (for Part No. 617485)	15C348
FU103/104, 250 V (for Part No. 617485)	15C496

To order other parts, contact your Graco distributor.

Part No 617300 and 617484

Standard, 3-zone Electrical Control Panel (exterior)
617300 - 480 VAC (shown), 617484 - 240 VAC



Part No 617349 and 617485

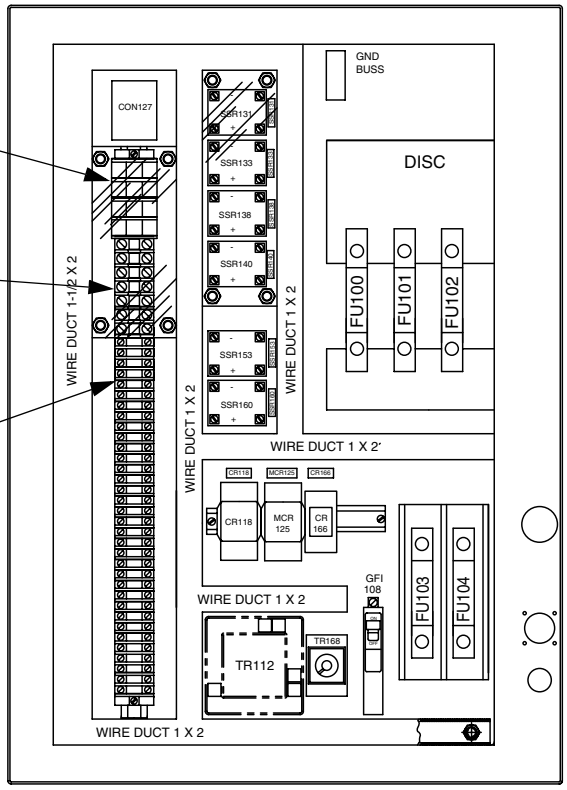
4-zone Electrical Control Panel (interior)
617349 - 480 VAC, 617485 - 240 VAC

Terminals

120 V Terminals
- FU109
- FU175
- FU177
- FU179
- TOTAL (4), TYPE CE6

480 V Terminals
- 3L1
- 3L2
- 5L1
- 5L2
- 6L1
- 6L2
- GND
- TOTAL (7)l, TYPE CD2

120 V Terminals
- 1081
- 1082
- 1082
- 1082
- 1101
- 1141
- 1142
- 1181
- 1311
- 1312
- 1321
- 1331
- 1381
- 1382
- 1391
- 1401
- 1531
- 1532
- 1541
- 1551
- 1601
- 1602
- 1611
- 1621
- 1641
- 1661
- 1662
- 1711
- 1752
- 1772
- 1792
- (1) SPARE
- GND
- GND
- TOTAL (34), TYPE CA1

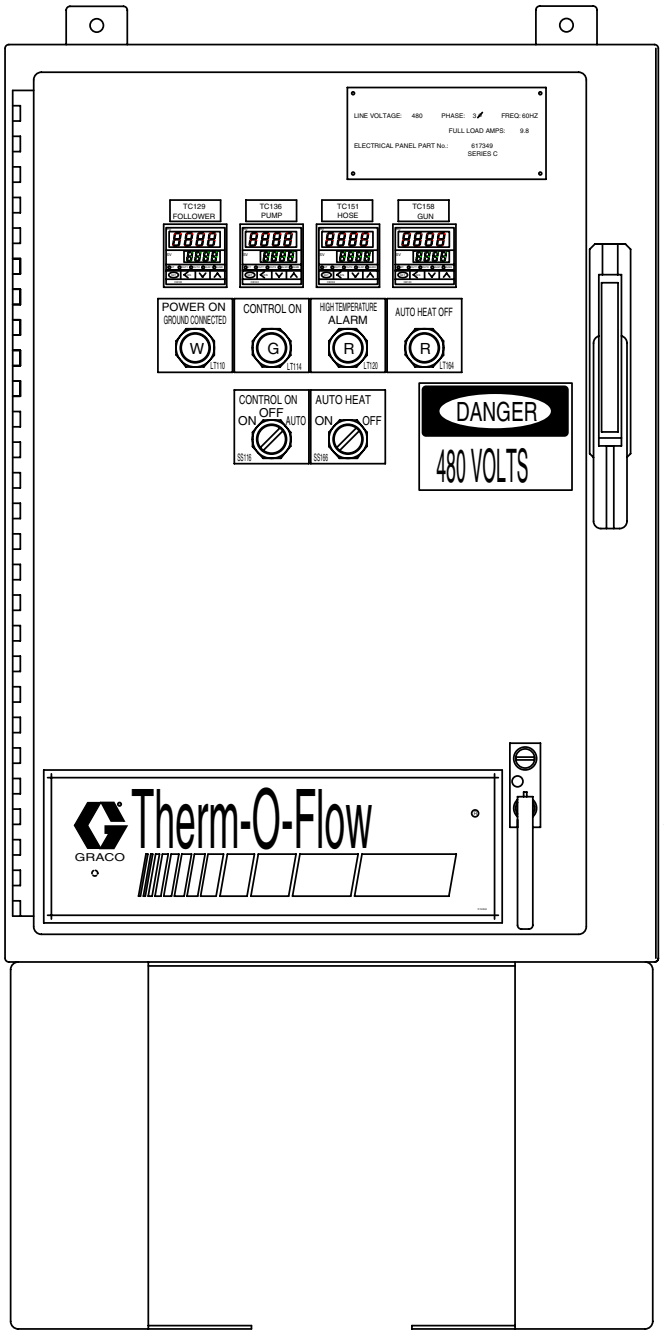


Spare Parts	Part No.
Temperature Controller	195764
Solid State Relay (or SSRs 153 and 160)	C78082
Timer, 7-day	C78167
Timer, Inactivity	C78342
Spare Fuses	
FU103/104, 600 V (for Part No. 617349)	15C495
FU109, 125 V	15C344
FU175, 125 V	15C345
FU177, 125 V	15C343
FU179, 125 V	15C343
FU100/101/102, 600 V (for Part No. 617349)	15C346
FU100/101/102, 250 V (for Part No. 617484)	15C349

To order other parts, contact your Graco distributor.

Part No 617349 and 617485

4-zone Electrical Control Panel (exterior)
617349 - 480 VAC (shown), 617485 - 240 VAC

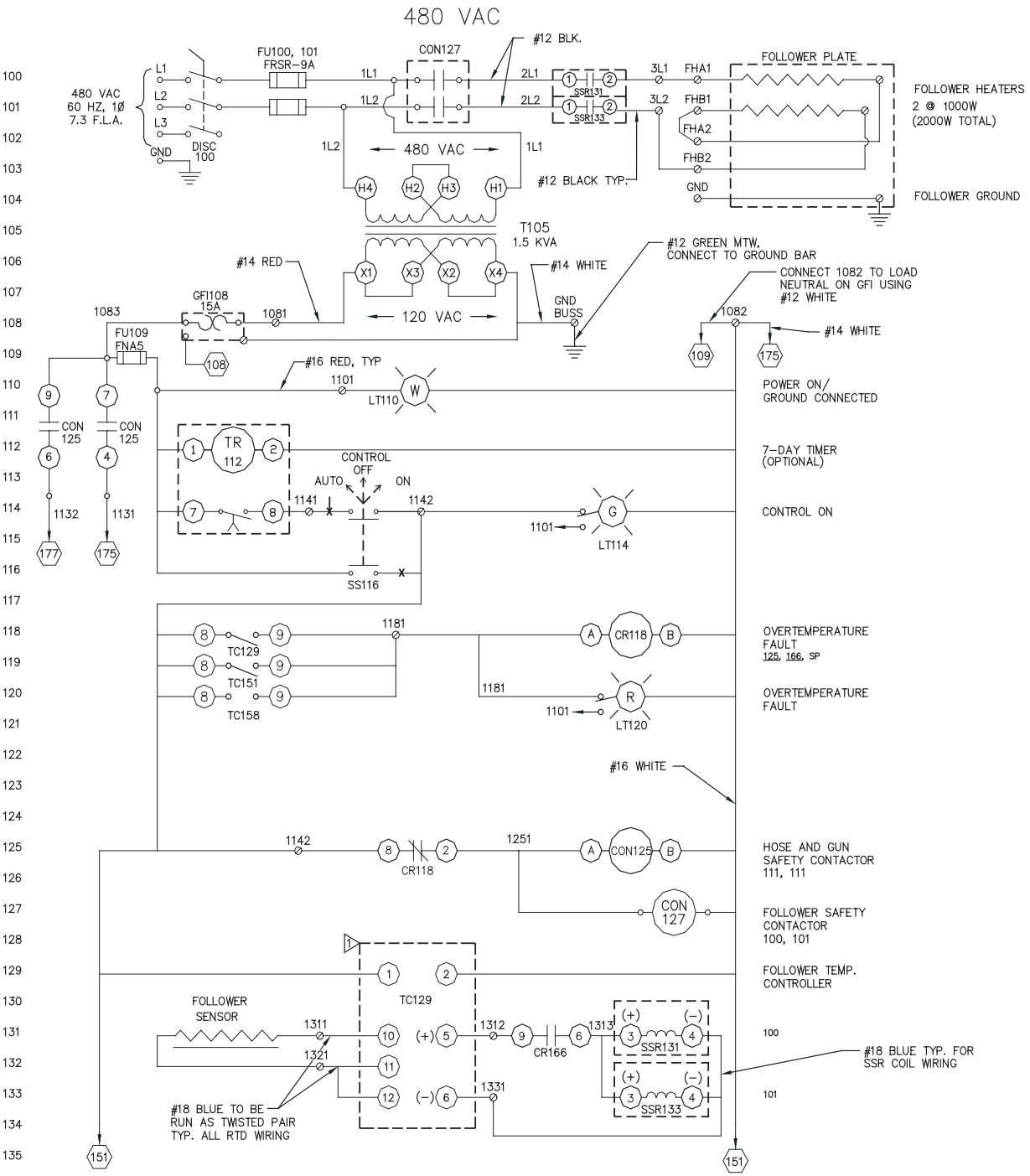


DH/DG

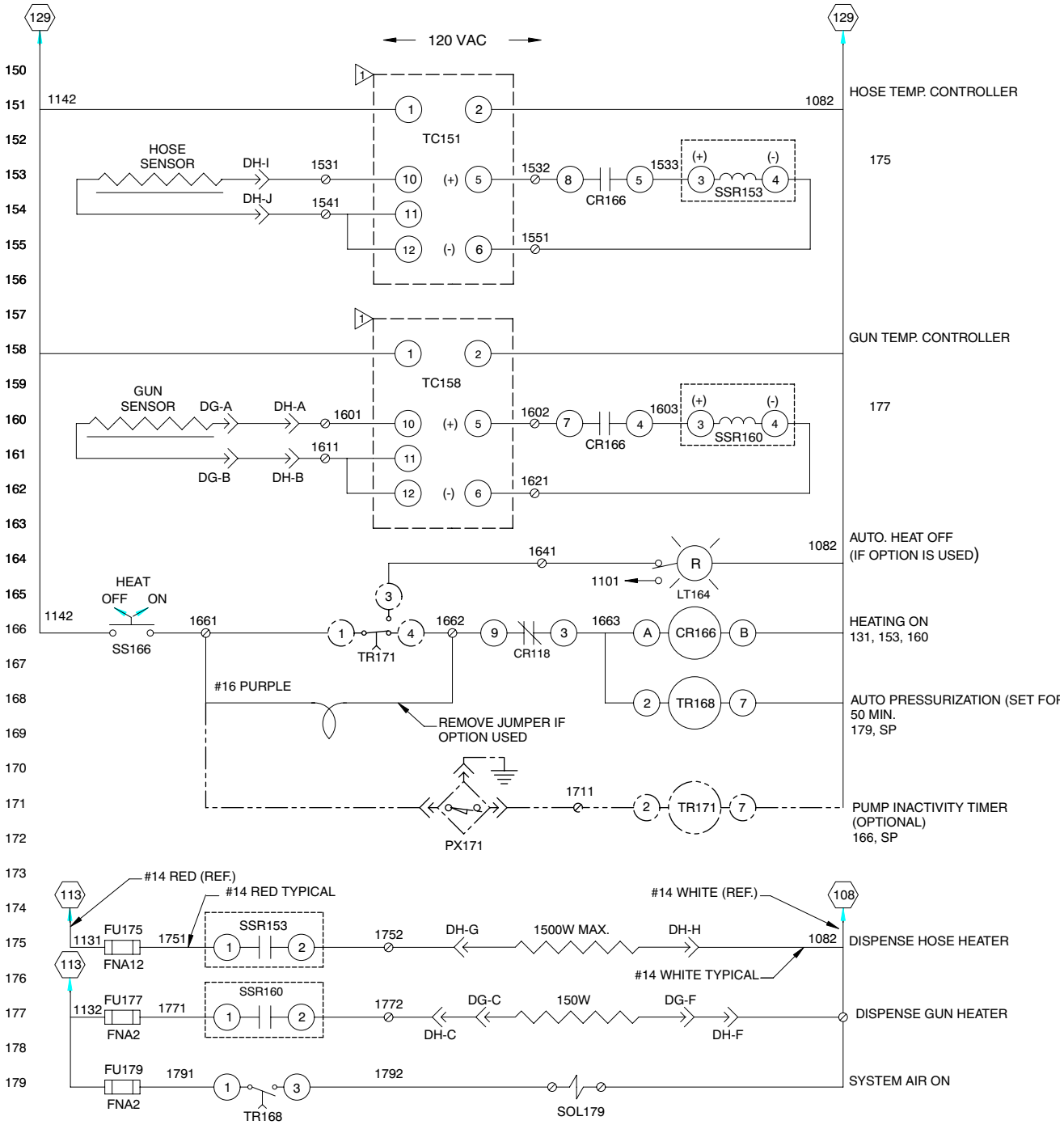
Auto Pressurization Solenoid

Electrical Schematic

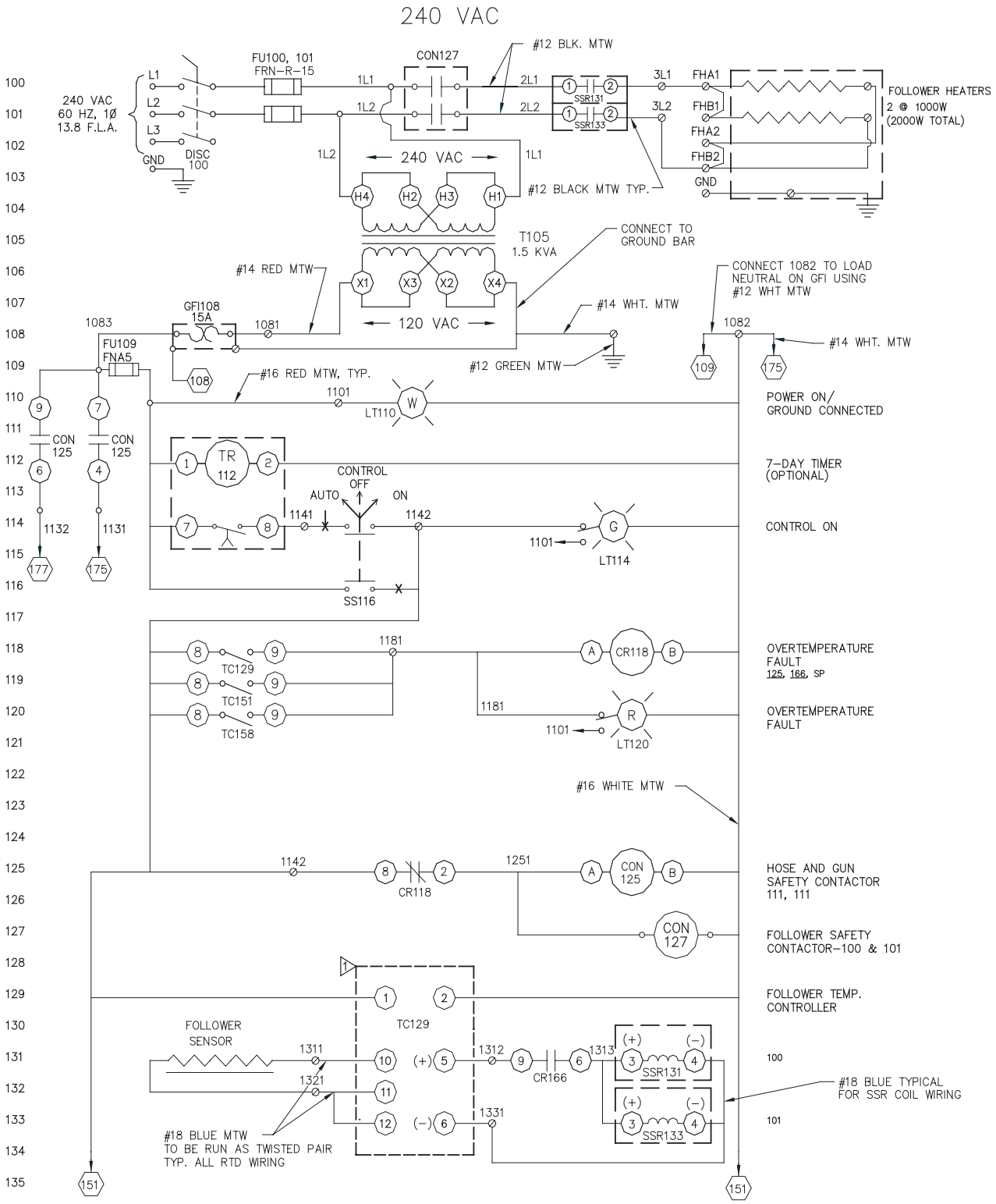
Part No. 617300



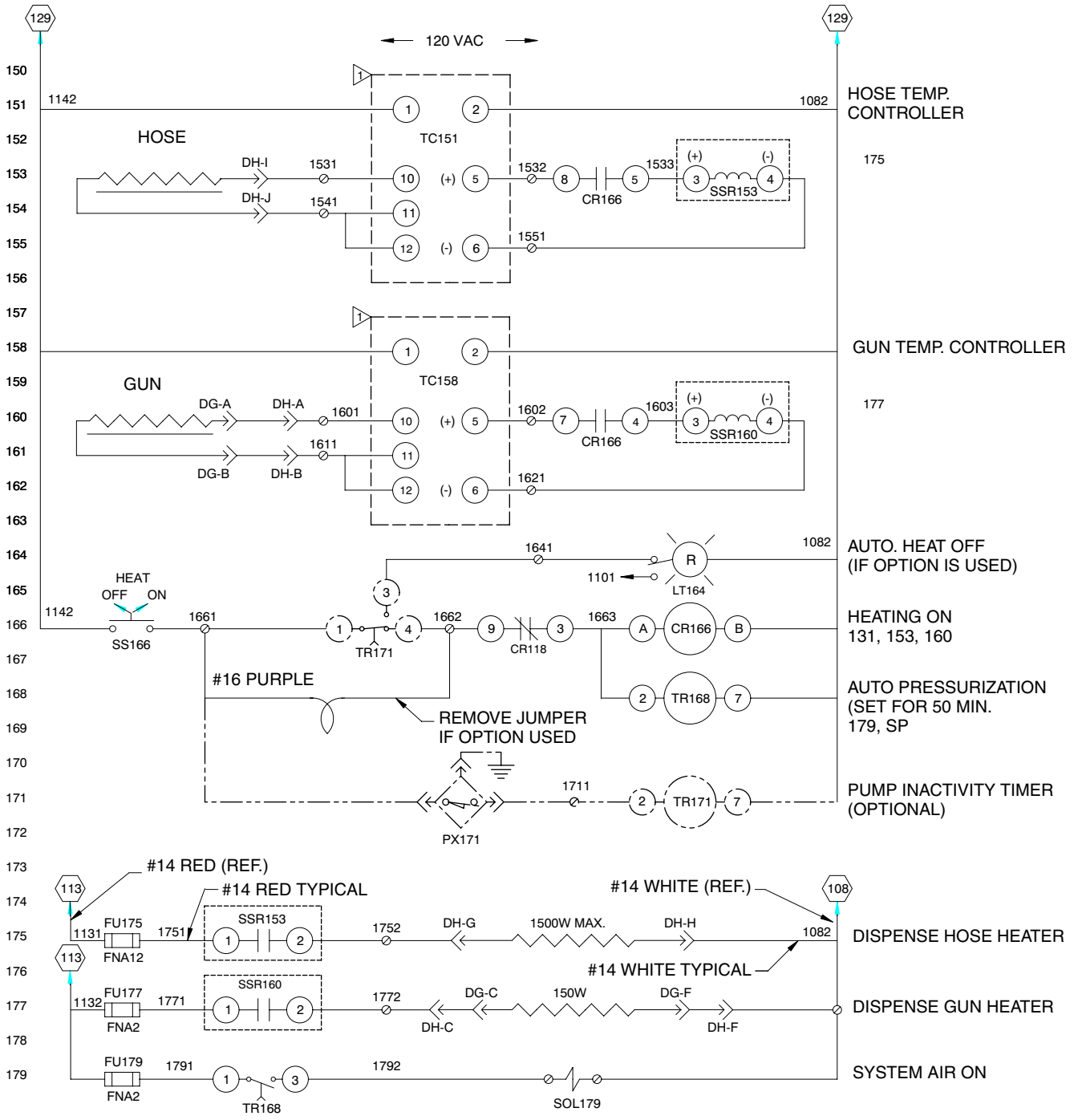
Part No. 617300



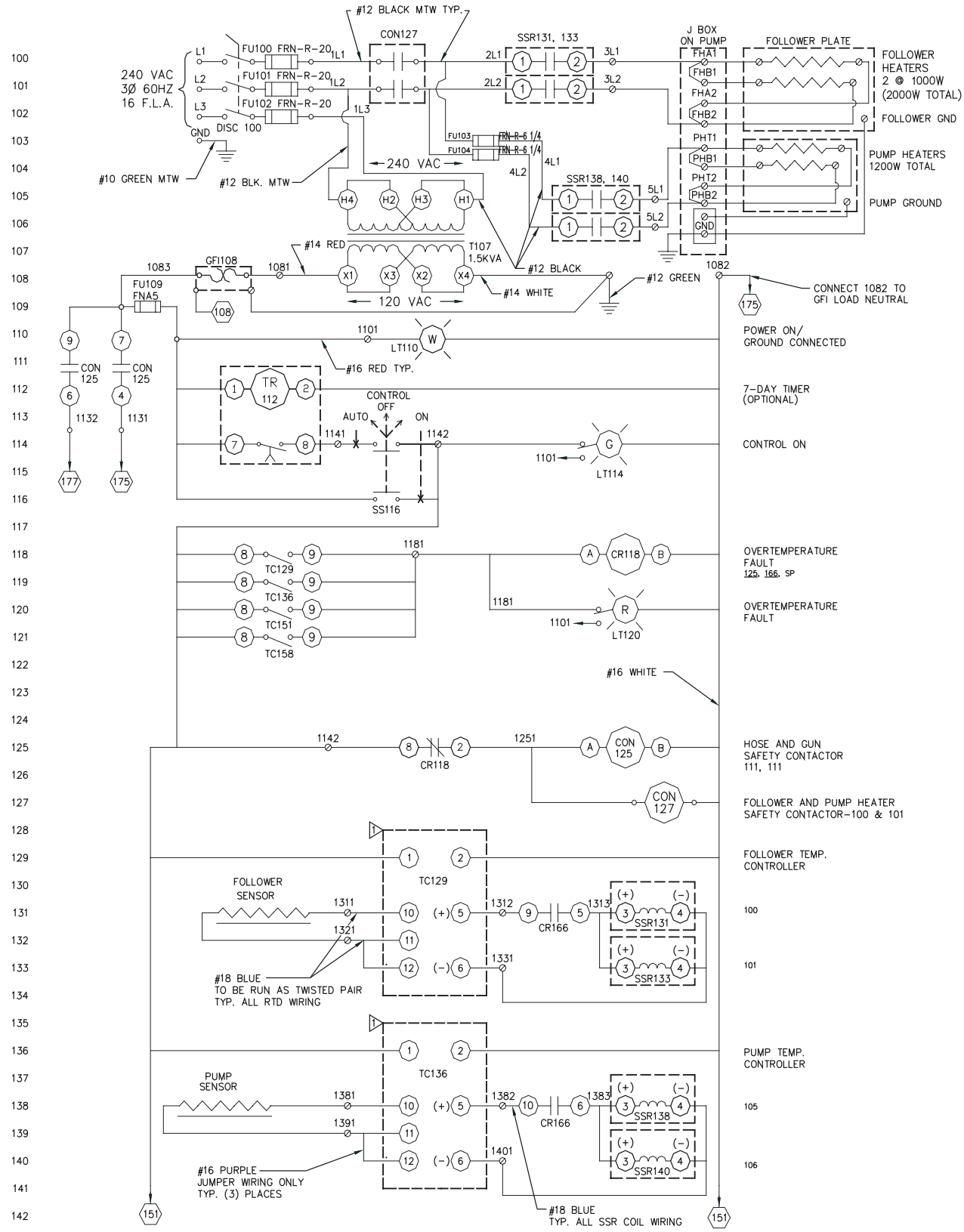
Part No. 617484



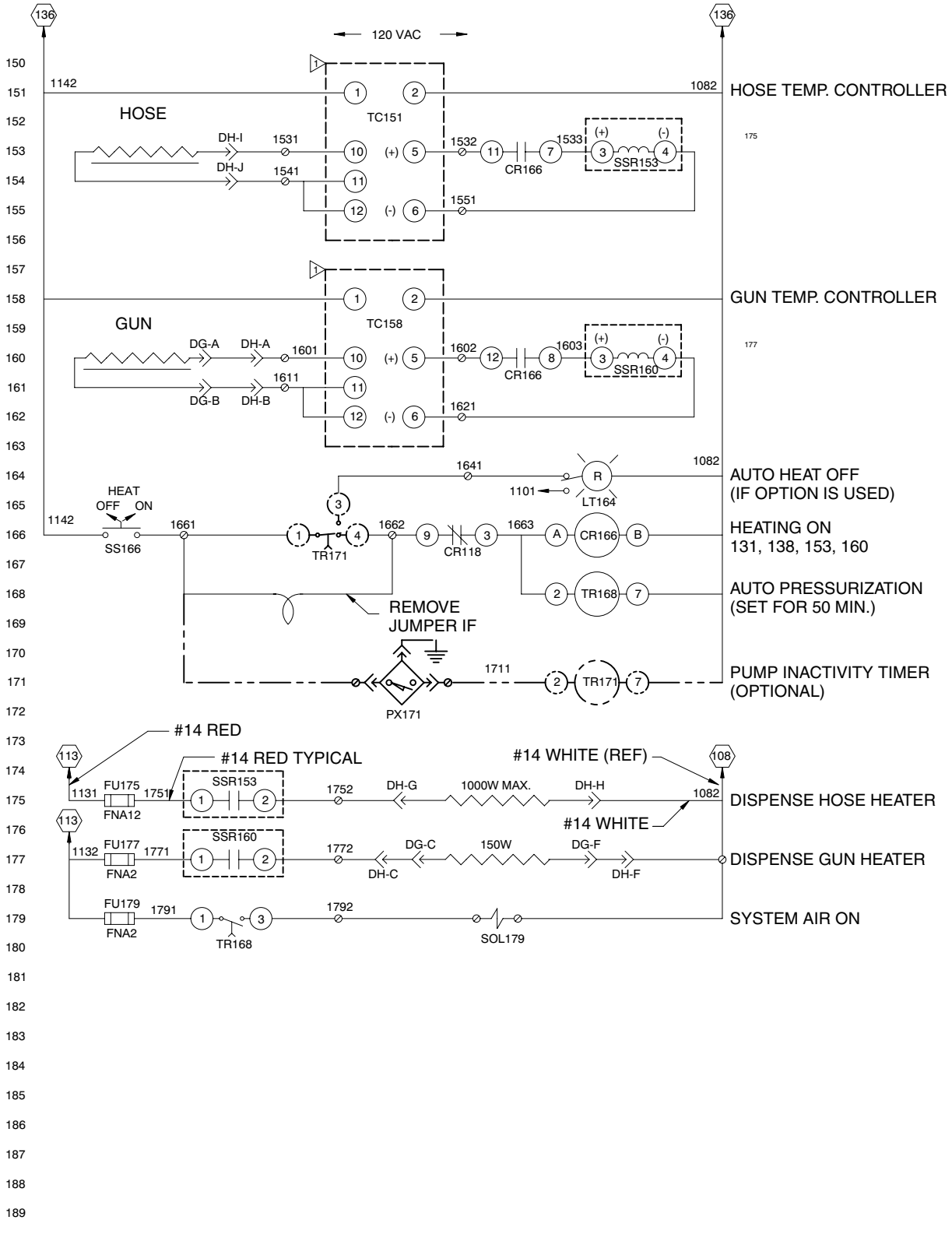
Part No. 617484



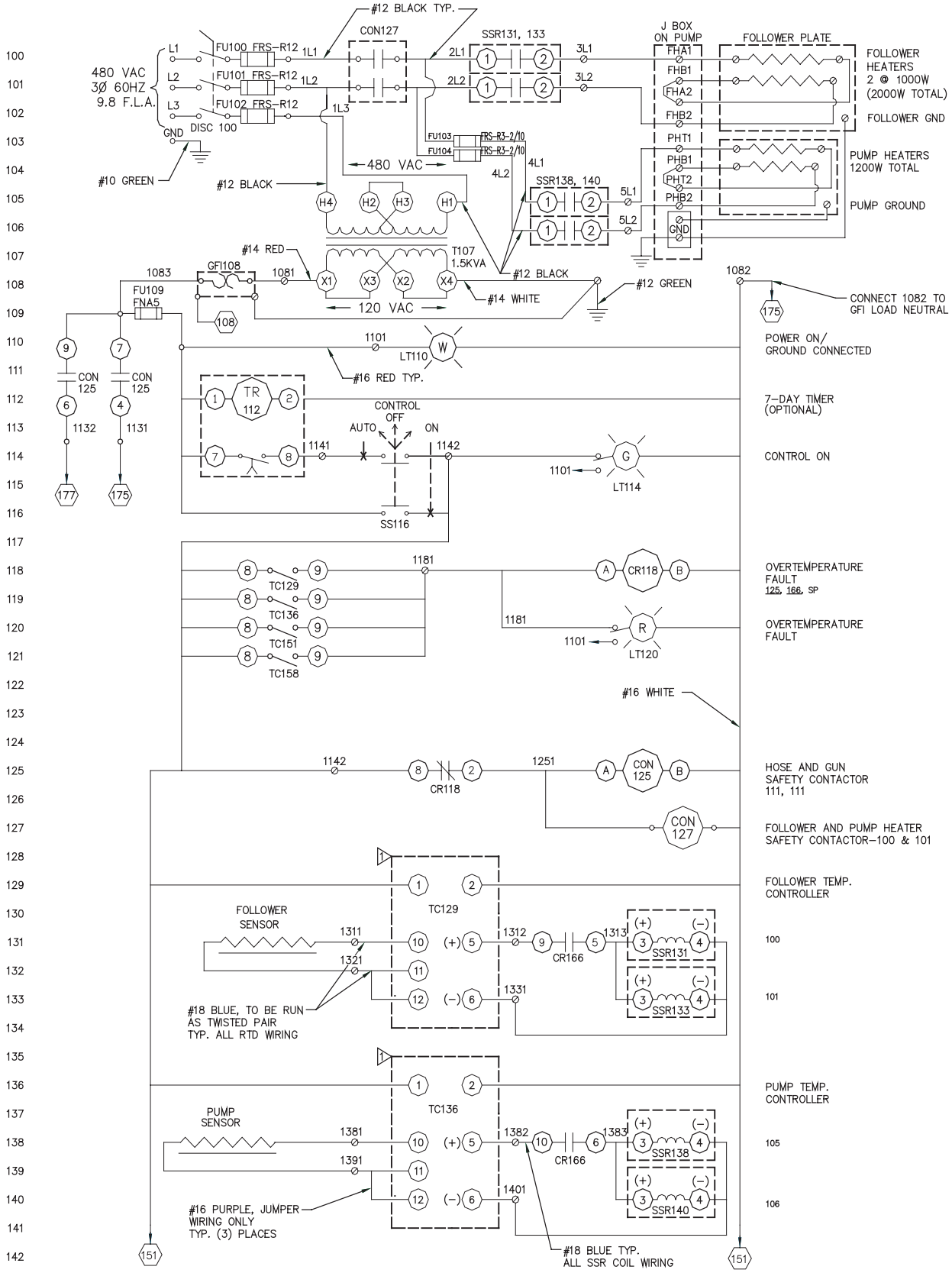
Part No. 617485



Part No. 617485



Part No. 617349



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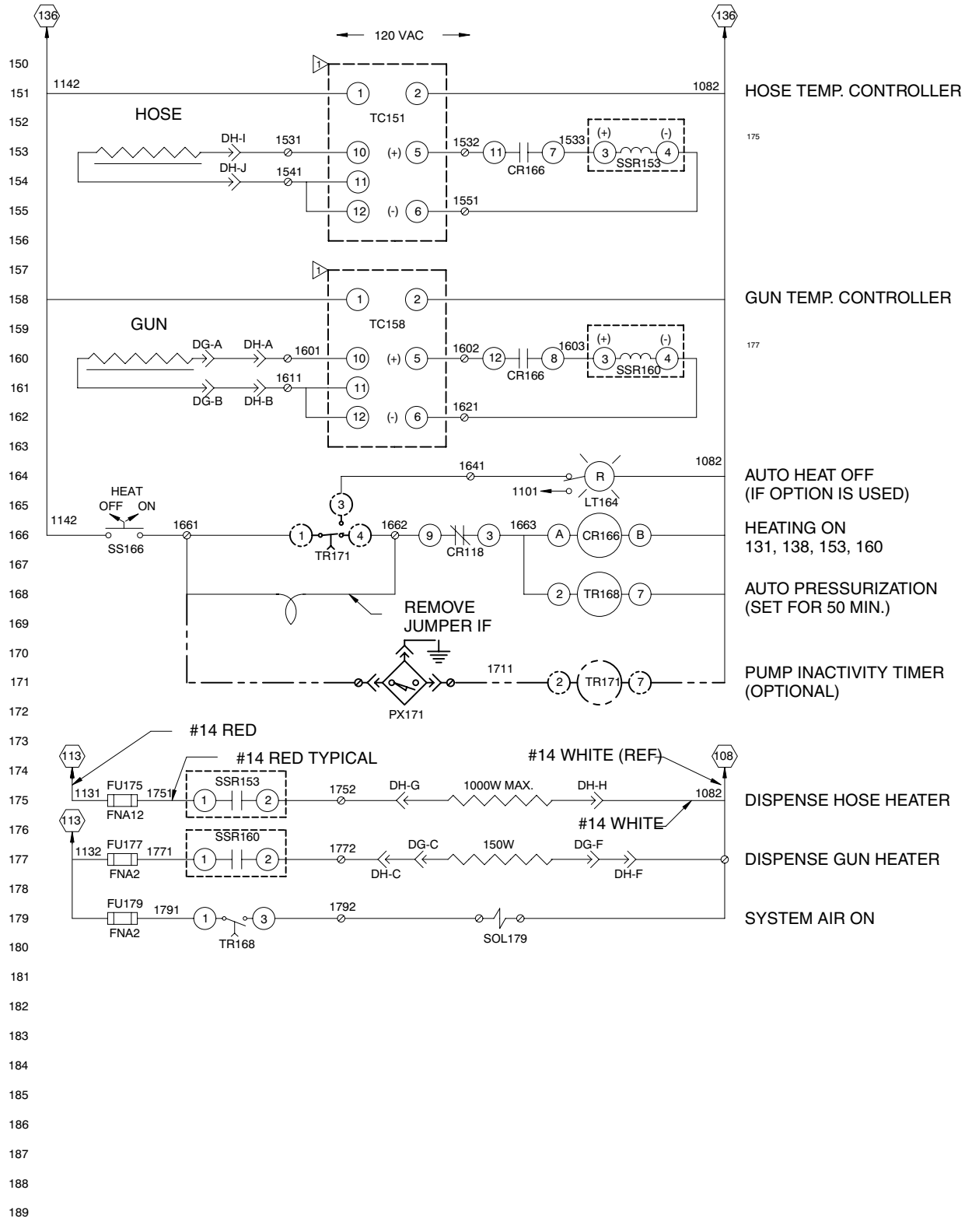
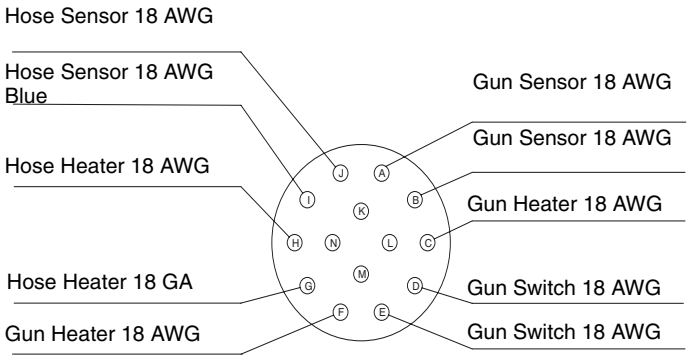


Pin Chart


Hose Sensor 18 AWG
Hose Sensor 18 AWG Blue
Hose Heater 18 AWG
Hose Heater 18 GA
Gun Heater 18 AWG
Gun Sensor 18 AWG
Gun Sensor 18 AWG
Gun Heater 18 AWG
Gun Switch 18 AWG
Gun Switch 18 AWG
J
A
I
B
K
H
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L
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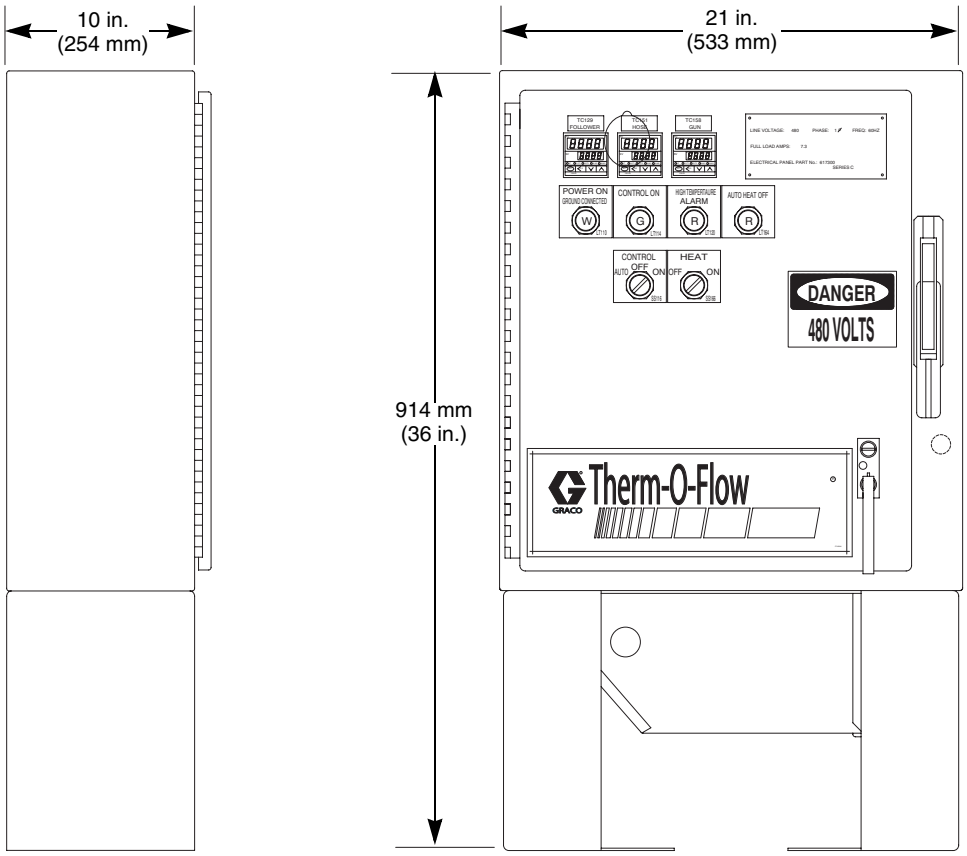
F
E

Accessories

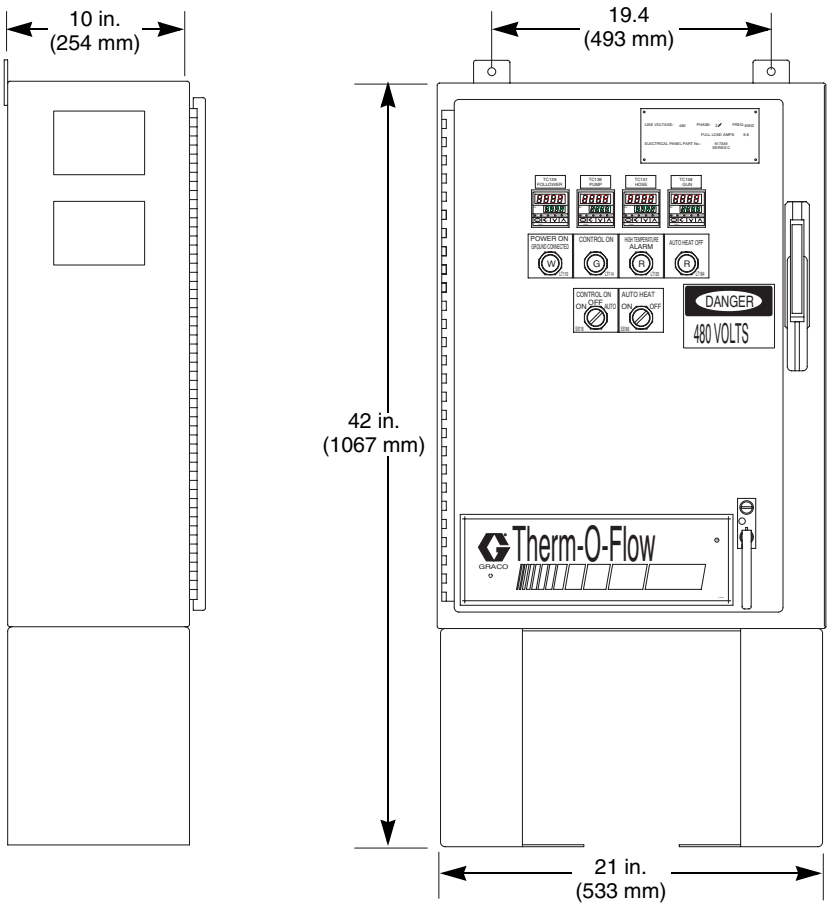
Description	Part No.
Heated 5 gal. Follower Plate Assembly For 240, 480 VAC, 12 in. (305 mm) OD Silicone Wiper Hose	
15:1 President - finned bottom	**244754**
CM800 Heated Module - smooth bottom	**244757**
Wiper Repair Kit	**C31065**
Follower Repair Kit For Therm-O-Flow 20 President and Bulldog/King units	**C31065**
Air Control Modules for Ram and Air Control 3 regulator module contains controls for ram up, ram down, and blow-off 4 regulator module contains controls for ram up, ram down, blow-off and motor 125 psi (0.9 MPa, 9 bar) Ram Maximum Working Pressure	
3 Regulator air control module for 15:1 President air motor	**234236**
4 Regulator air control module for Bulldog and Senator air motors	**246587**
Low Level Pail Kit Lights a red beacon signal when pail is empty	**918430**
Caster Base Plate For heated applications	**918414**
Hose Support Kit Supports hose to ram to prevent hose kinks. Used only in 20 liter (5 gal.) applications	**C31197**
Automatic Crossover Kit Switches ram operation to alternate ram automatically	**918393**
Pump Air Motor Mounting Kit For heated applications to connect the heated CM800 pump to King, Bulldog, and Senator air motors	**C03510**
Pump Inactivity Kit Shuts down heaters if there is no pump activity. Includes proximity switch, electronic timer, and hardware.	**617334**
Pump Rebuild Kit See manual 308570 for CheckMate 800 See manual 307431 for 15:1 President pump	
Ceramic Washer Electric terminal washer for heated Therm-O-Flow 20 plate	**15C176**
Heater/Sensor Repair Kit Includes heaters, sensors, and wires for replacing heaters and sensors	**C32202**
7 Day Timer Kit Includes electronic timer and hardware necessary to install timer in the electrical control panel	**C78167**

Dimensions

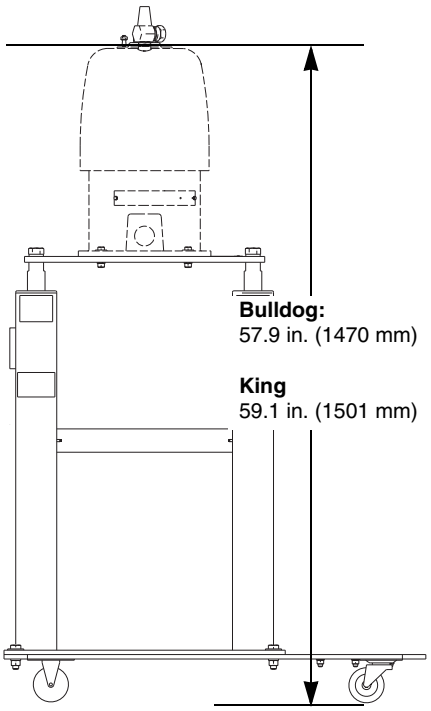
3-Zone Electrical Control Panel

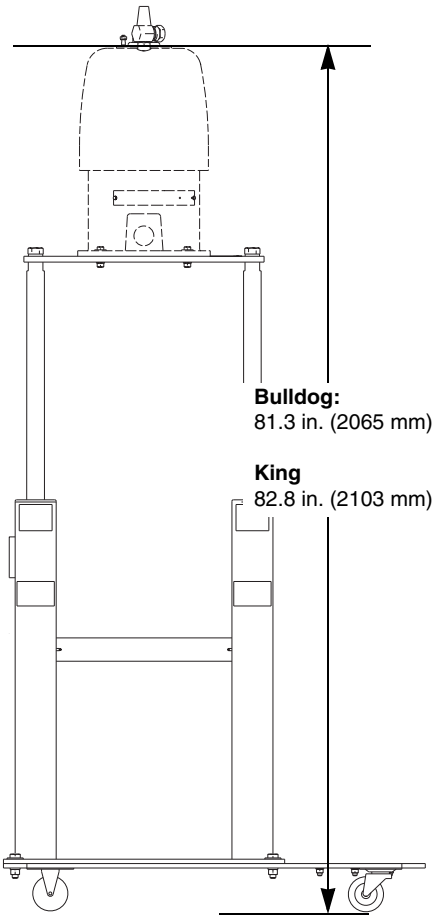


4-Zone Electrical Control Panel

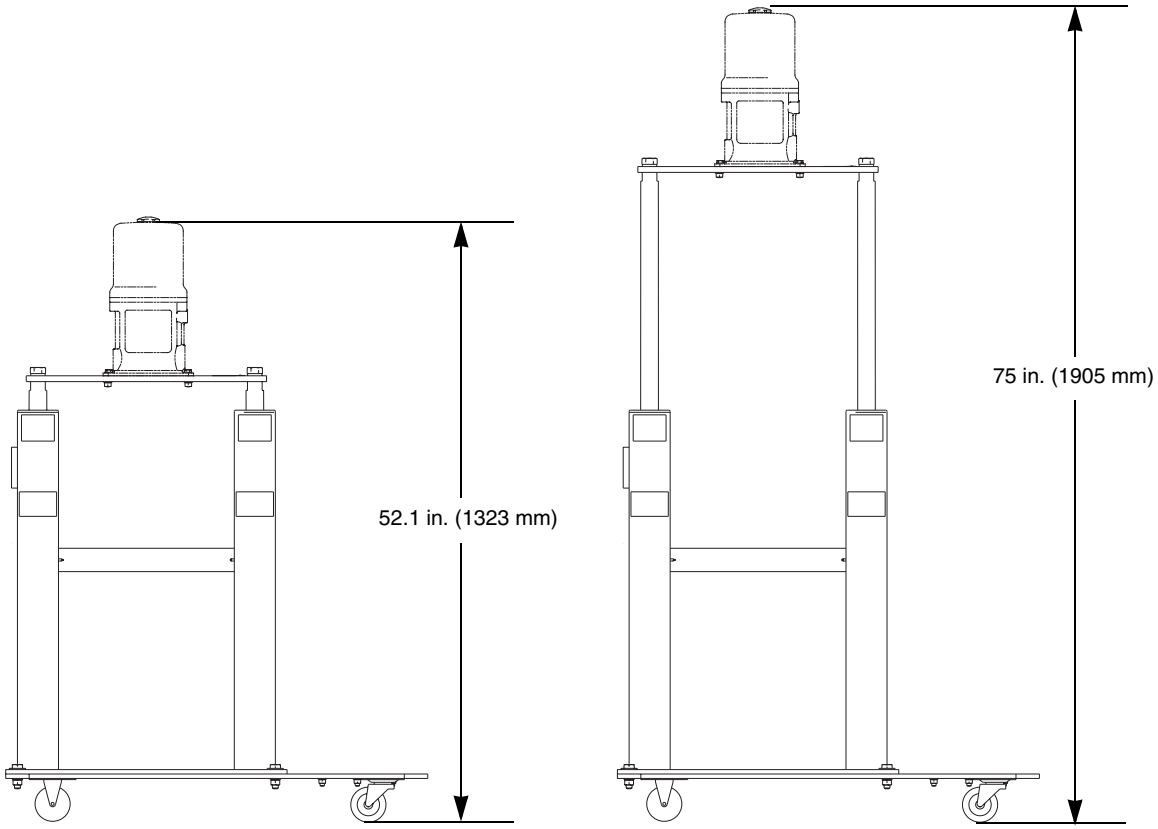


Therm-O-Flow 20 Bulldog/King Ram





15:1 Pump - President Air Motor Ram



Technical Data

Maximum ram inlet air pressure	125 psi (0.9 MPa, 9 bar)
Maximum pump inlet air pressure	
Bulldog pumps	100 psi (0.7 MPa, 7 bar)
President pumps	120 psi (0.8 MPa, 8 bar)
King pumps	60 psi (414 kPa, 4.1 bar)
Maximum fluid working pressure (pump lower only)	5850 psi (40 MPa, 403 bar)
Maximum fluid working pressure	
Bulldog pump units	3100 psi (21 MPa, 214 bar)
President pump units	1800 psi (12 MPa, 124 bar)
King pump units	3900 psi (27 MPa, 269 bar)
Weight (typical)	
Ram assembly	150 lbs (68 kg)
King/Bulldog pump and ram	700 lbs (318 kg)
President pump and ram	650 lbs (295 kg)
Wetted parts	
Ram	Carbon steel, aluminum, nitrile, nylon, nickel plating
Pump	To determine wetted parts: Therm-O-Flow 20 Bulldog/King - see manual 308570 Therm-O-Flow 20 President - call your Graco distributor
Floor space dimensions	36 in. wide x 24 in. deep (914 mm x 610 mm)
Overall height with ram lowered - raised	
King/Bulldog pump units	57.9 in. (1.47 m) - 81.3 in. (2.06 m)
President pump units	52.1 in. (1.3 m) - 75 in. (1.9 m)
Pump main air inlet	1/2 in. npt(f)
Fluid outlet	
King/Bulldog pumps	1 in. npt(f)
President pumps	1/2 in. npt(f)
Sound data	See individual component manuals

Temperature Controller Settings

New Style

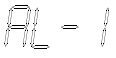
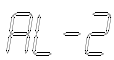
Symbol	Name
AL 1	First alarm (ALM1)
AL2	Second alarm (ALM2)
AFU	Auto-tuning (AT)
SFU	Self-tuning (ST)
P	Proportional band (P)
I	Intergral time (I)
d	Derivative time (D)
Ar	Anti-reset windup (ARW)
T	Heat-side proportioning cycle (T)
Pc	Cool-side proportioning band (Pc)
db	Deadband (db)
t	Cool-side proportioning cycle (Pc)
Pb	PV bias\P (Pb)
LCK	Set data lock function (LCK)

Older Style (E5KC)

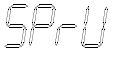
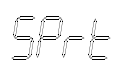
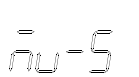
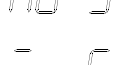
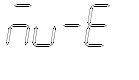
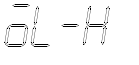
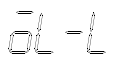
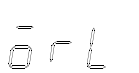
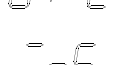
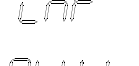
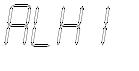
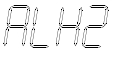
Level 0, Function Mode Parameter Names

Symbol	Name
SP	Set point
r-S	Run/Stop

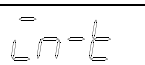
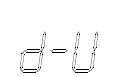
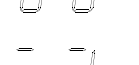
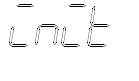
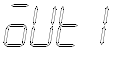
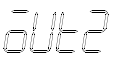
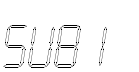
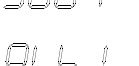
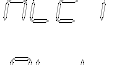
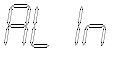
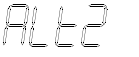
Level 1, Function Mode Parameter Names

Symbol	Name
	Auto-tuning Execute/Cancel
	Alarm value 1
	Alarm value 2
	Proportional band
	Integral time
	Derivative time
	Control period (heat)

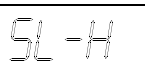
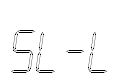
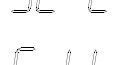
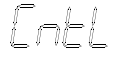
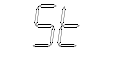
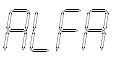
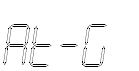
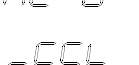
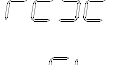
Level 2, Function Mode Parameter Names

Symbol	Name
	SP ramp time unit
	SP ramp set value
	MV at stop
	MV at PV error
	MV upper limit
	MV lower limit
	MV change rate limit
	Input digital filter
	Alarm 1 hysteresis
	Alarm 2 hysteresis
	Input shift upper limit
	Input shift lower limit

Setup, Function Mode Parameter Names

Symbol	Name
	Input type
	SP ramp set value
	MV at stop
	MV at PV error
	MV upper limit
	MV lower limit
	MV change rate limit
	Input digital filter
	Alarm 1 hysteresis
	Alarm 2 hysteresis
	Input shift upper limit

Expansion, Function Mode Parameter Names

Symbol	Name
	Input type
	SP ramp set value
	MV at stop
	MV at PV error
	MV upper limit
	MV lower limit
	MV change rate limit
	Input digital filter
	Alarm 1 hysteresis

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

FOR GRACO CANADA CUSTOMERS

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Graco Information

TO PLACE AN ORDER, contact your Graco distributor or call to identify the nearest distributor.
Phone: 612-623-6921 **or Toll Free:** 1-800-328-0211, **Fax:** 612-378-3505

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Graco reserves the right to make changes at any time without notice.

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