

## Reactor® E-30i and E-XP2i

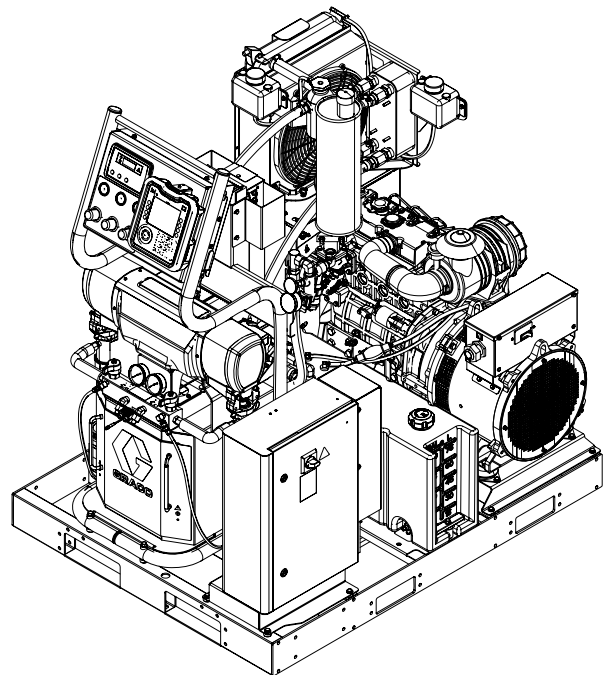
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Electric, Heated, Integrated Plural Component Proportioning System With Integrated Generator. For spraying polyurethane foam and polyurea coatings. For professional use only. Not for use in explosive atmospheres or hazardous locations.



### Important Safety Instructions

Read all warnings and instructions in this manual. **Save these instructions.**



















# Contents

Warnings .....	3	Replace Fans .....	65
Important Two-Component Material Information .....	7	Repair Booster Heater .....	67
Proportioner Models .....	9	Repair Heated Hose .....	70
Systems .....	11	Repair Fluid Temperature Sensor (FTS) .....	71
Accessories .....	12	Replace Heat Exchangers .....	73
Supplied Manuals .....	13	Replace Power Supply .....	76
Related Manuals .....	13	Replace Circulation Pump .....	77
Troubleshooting .....	14	Repair Sight Glass and Filter .....	78
Error Codes and Troubleshooting .....	14	Remove Fuel Tank .....	79
Load Center Diagnostics .....	37	Replace Battery .....	79
Repair .....	45	Repair Fusible Link Harness .....	80
Before Beginning Repair .....	45	Remove Radiator .....	82
Pressure Relief Procedure .....	45	Repair Advanced Display Module (ADM) .....	83
Flushing .....	46	Repair Engine Control Module .....	83
Flush Inlet Strainer Screen .....	47	Replace Motor Control Module (MCM) .....	84
Shutdown .....	48	Replace High Power Temperature Control Module (HPTCM) .....	84
Drain Coolant .....	49	Replace Low Power Temperature Control Module (LPTCM) .....	84
Refill Proportioner Coolant Loop .....	50	Remove Proportioner .....	86
Refill Engine Coolant Loop .....	51	Repair Engine .....	88
Coolant Specifications .....	51	12V Charge Alternator .....	88
Change Pump Lubricant .....	52	Parts .....	89
Remove Pump .....	53	Electrical Schematics .....	131
Install Pump .....	55	Dimensions .....	146
Repair Drive Housing .....	55	Technical Specifications .....	149
Repair Motor Brushes .....	58	Notes .....	153
Repair Electric Motor .....	60	Graco Standard Warranty .....	154
Repair Circuit Breaker Module .....	61		
Replace Relays and Fuses .....	63		
Replace Transducers .....	64		






# Warnings







The following warnings are for the setup, use, grounding, maintenance and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbol refers to procedure-specific risks. When these symbols appear in the body of this manual refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 <b>WARNING</b>	
	<p><b>ELECTRIC SHOCK HAZARD</b></p> <p>This equipment must be grounded. Improper grounding, setup, or usage of the system can cause electric shock.</p> <ul style="list-style-type: none"> <li>• Turn off and disconnect power at main switch before disconnecting any cables and before servicing equipment.</li> <li>• Connect only to grounded power source.</li> <li>• All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.</li> </ul>
	<p><b>TOXIC FLUID OR FUMES</b></p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> <li>• Read MSDSs to know the specific hazards of the fluids you are using.</li> <li>• Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.</li> </ul>
	<p><b>CARBON MONOXIDE HAZARD</b></p> <p>Exhaust contains poisonous carbon monoxide, which is colorless and odorless. Breathing carbon monoxide can cause death.</p> <ul style="list-style-type: none"> <li>• Do not operate in an enclosed area.</li> </ul>
	<p><b>PERSONAL PROTECTIVE EQUIPMENT</b></p> <p>You must wear appropriate 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, inhalation of toxic fumes, and burns. This equipment includes but is not limited to:</p> <ul style="list-style-type: none"> <li>• Protective eyewear, and hearing protection.</li> <li>• Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.</li> </ul>

 <h1>WARNING</h1>	
  	<h3>SKIN INJECTION HAZARD</h3> <p>High-pressure fluid from dispensing device, 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. <b>Get immediate surgical treatment.</b></p> <ul style="list-style-type: none"> <li>• Engage trigger lock when not dispensing.</li> <li>• Do not point dispensing device at anyone or at any part of the body.</li> <li>• Do not put your hand over the fluid outlet.</li> <li>• Do not stop or deflect leaks with your hand, body, glove, or rag.</li> <li>• Follow the <b>Pressure Relief Procedure</b> when you stop dispensing and before cleaning, checking, or servicing equipment.</li> <li>• Tighten all fluid connections before operating the equipment.</li> <li>• Check hoses and couplings daily. Replace worn or damaged parts immediately.</li> </ul>
   	<h3>FIRE AND EXPLOSION HAZARD</h3> <p>Flammable fumes, such as solvent and paint fumes, in work area can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well ventilated area.</li> <li>• Do not fill fuel tank while engine is running or hot; shut off engine and let it cool. Fuel is flammable and can ignite or explode if spilled on hot surface.</li> <li>• Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc).</li> <li>• Keep work area free of debris, including solvent, rags and gasoline.</li> <li>• Do not plug or unplug power cords, or turn light switches on or off when flammable fumes are present.</li> <li>• Ground all equipment in the work area. See <b>Grounding</b> instructions.</li> <li>• Use only grounded hoses.</li> <li>• Hold gun firmly to side of grounded pail when triggering into pail.</li> <li>• If there is static sparking or you feel a shock, <b>stop operation immediately</b>. Do not use equipment until you identify and correct the problem.</li> <li>• Keep a working fire extinguisher in the work area.</li> </ul>
  	<h3>THERMAL EXPANSION HAZARD</h3> <p>Fluids subjected to heat in confined spaces, including hoses, can create a rapid rise in pressure due to the thermal expansion. Over-pressurization can result in equipment rupture and serious injury.</p> <ul style="list-style-type: none"> <li>• Open a valve to relieve the fluid expansion during heating.</li> <li>• Replace hoses proactively at regular intervals based on your operating conditions.</li> </ul>



 <b>WARNING</b>	
	<p><b>PRESSURIZED ALUMINUM HAZARD</b></p> <p>Use of fluids that are incompatible with aluminum in pressurized equipment can cause serious chemical reaction and equipment rupture. Failure to follow this warning can result in death, serious injury, or property damage.</p> <ul style="list-style-type: none"> <li>• Do not use 1,1,1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents.</li> <li>• Many other fluids may contain chemicals that can react with aluminum. Contact your material supplier for compatibility.</li> </ul>
	<p><b>PLASTIC PARTS CLEANING SOLVENT HAZARD</b></p> <p>Many solvents can degrade plastic parts and cause them to fail, which could cause serious injury or property damage.</p> <ul style="list-style-type: none"> <li>• Use only compatible water-based solvents to clean plastic structural or pressure-containing parts.</li> <li>• See <b>Technical Data</b> in this and all other equipment instruction manuals. Read fluid and solvent manufacturer's MSDSs and recommendations.</li> </ul>
 	<p><b>EQUIPMENT MISUSE HAZARD</b></p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> <li>• Do not operate the unit when fatigued or under the influence of drugs or alcohol.</li> <li>• Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See <b>Technical Data</b> in all equipment manuals.</li> <li>• Use fluids and solvents that are compatible with equipment wetted parts. See <b>Technical Data</b> in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS from distributor or retailer.</li> <li>• Do not leave the work area while equipment is energized or under pressure. Turn off all equipment and follow the <b>Pressure Relief Procedure</b> when equipment is not in use.</li> <li>• Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.</li> <li>• Do not alter or modify equipment.</li> <li>• Use equipment only for its intended purpose. Call your distributor for information.</li> <li>• Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.</li> <li>• Do not kink or over bend hoses or use hoses to pull equipment.</li> <li>• Keep children and animals away from work area.</li> <li>• Comply with all applicable safety regulations.</li> </ul>




 <b>WARNING</b>	
	<p><b>BATTERY HAZARD</b></p> <p>The battery may leak, explode, cause burns, or cause an explosion if mishandled.</p> <ul style="list-style-type: none"> <li>• Only use the battery type specified for use with the equipment. See <b>Technical Data</b>.</li> <li>• Battery maintenance must only be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from battery.</li> <li>• When replacing the battery, use the same lead-acid automotive battery, with 800 CCA minimum, specified for use with the equipment. See <b>Technical Data</b>.</li> <li>• Do not dispose of battery in fire. The battery is capable of exploding.</li> <li>• Follow local ordinances and/or regulations for disposal.</li> <li>• Do not open or mutilate the battery. Released electrolyte has been known to be harmful to the skin and eyes and to be toxic.</li> <li>• Remove watches, rings, or other metal objects.</li> <li>• Only use tools with insulated handles. Do not lay tools or metal parts on top of battery.</li> </ul>
 	<p><b>MOVING PARTS HAZARD</b></p> <p>Moving parts can pinch, cut or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> <li>• Keep clear of moving parts.</li> <li>• Do not operate equipment with protective guards or covers removed.</li> <li>• Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the <b>Pressure Relief Procedure</b> and disconnect all power sources.</li> </ul>
	<p><b>ENTANGLEMENT HAZARD</b></p> <p>Rotating parts can cause serious injury.</p> <ul style="list-style-type: none"> <li>• Keep clear of moving parts.</li> <li>• Do not operate equipment with protective guards or covers removed.</li> <li>• Do not wear loose clothing, jewelry or long hair while operating equipment.</li> <li>• Equipment can start without warning. Before checking, moving, or servicing equipment, follow the <b>Pressure Relief Procedure</b> and disconnect all power sources.</li> </ul>
	<p><b>BURN HAZARD</b></p> <p>Equipment surfaces and fluid that's heated can become very hot during operation. To avoid severe burns:</p> <ul style="list-style-type: none"> <li>• Do not touch hot fluid or equipment.</li> </ul>

## Important Two-Component Material Information

### Isocyanate Conditions

					
<p>Spraying or dispensing materials containing isocyanates creates potentially harmful mists, vapors, and atomized particulates.</p> <p>Read material manufacturer's warnings and material MSDS to know specific hazards and precautions related to isocyanates.</p> <p>Prevent inhalation of isocyanate mists, vapors, and atomized particulates by providing sufficient ventilation in the work area. If sufficient ventilation is not available, a supplied-air respirator is required for everyone in the work area.</p> <p>To prevent contact with isocyanates, appropriate personal protective equipment, including chemically impermeable gloves, boots, aprons, and goggles, is also required for everyone in the work area.</p>					

### Moisture Sensitivity of Isocyanates

					
<p>Cross-contamination can result in cured material in fluid lines which could cause serious injury or damage equipment. To prevent cross-contamination of the equipment's wetted parts, <b>never</b> interchange component A (isocyanate) and component B (resin) parts.</p>					



Isocyanates (ISO) are catalysts used in two component foam and polyurea coatings. ISO will react with moisture (such as humidity) to form small, hard, abrasive crystals, which become suspended in the fluid. Eventually a film will form on the surface and the ISO will begin to gel, increasing in viscosity. If used, this partially cured ISO will reduce performance and the life of all wetted parts.

The amount of film formation and rate of crystallization varies depending on the blend of ISO, the humidity, and the temperature.




To prevent exposing ISO to moisture:

- Always use a sealed container with a desiccant dryer in the vent, or a nitrogen atmosphere. **Never** store ISO in an open container.
- Keep the ISO lube pump reservoir (if installed) filled with appropriate lubricant. The lubricant creates a barrier between the ISO and the atmosphere.
- Use only moisture-proof hoses compatible with ISO.
- Never use reclaimed solvents, which may contain moisture. Always keep solvent containers closed when not in use.
- Always lubricate threaded parts with ISO pump oil or grease when reassembling.

### Material Self-Ignition

					
<p>Some materials may become self-igniting if applied too thickly. Read material manufacturer's warnings and material MSDS.</p>					

### Keep Components A and B Separate

					
<p>Cross-contamination can result in cured material in fluid lines which could cause serious injury or damage equipment. To prevent cross-contamination of the equipment's wetted parts, <b>never</b> interchange component A (isocyanate) and component B (resin) parts.</p>					

## **Foam Resins with 245 fa Blowing Agents**

Some foam blowing agents will froth at temperatures above 90°F (33°C) when not under pressure, especially if agitated. To reduce frothing, minimize preheating in a circulation system.

## **Changing Materials**

Changing the material types used in your equipment requires special attention to avoid equipment damage and downtime.

- When changing materials, flush the equipment multiple times to ensure it is thoroughly clean.
- Always clean the fluid inlet strainers after flushing.
- Check with your material manufacturer for chemical compatibility.
- When changing between epoxies and urethanes or polyureas, disassemble and clean all fluid components and change hoses. Epoxies often have amines on the B (hardener) side. Polyureas often have amines on the B (resin) side.

## Proportioner Models

### E-30i Series

Part	Available Auxiliary Current at 240 V, 60 Hz*★	Includes:		Voltage (phase)	Total System Load † (Watts)	Max Flow Rate lb/min (kg/min)	Approximate Output per Cycle (A+B) gal. (liter)	Maximum Fluid Working Pressure psi (MPa, bar)
		Booster Heat (4000 Watts)	Air Compressor (5000 Watts)					
259079	50 Amps			240 V (1)	7,700	30 (13.5)	0.0272 (0.1034)	2000 (13.8, 138)
259080	32 Amps	✓		240 V (1)	11,700	30 (13.5)	0.0272 (0.1034)	2000 (13.8, 138)
259089 ♦	30 Amps		✓	240 V (1)	7,700	30 (13.5)	0.0272 (0.1034)	2000 (13.8, 138)
259090 ♦	12 Amps	✓	✓	240 V (1)	16,700	30 (13.5)	0.0272 (0.1034)	2000 (13.8, 138)

### E-XP2i Series

Part	Available Auxiliary Current at 240 V, 60 Hz*★	Includes:		Voltage (phase)	Total System Load † (Watts)	Max Flow Rate gpm (lpm)	Approximate Output per Cycle (A+B) gal. (liter)	Maximum Fluid Working Pressure psi (MPa, bar)
		Booster Heat (4000 Watts)	Air Compressor (5000 Watts)					
259081	32 Amps	✓		240 V (1)	11,700	2.0 (7.6)	0.0203 (0.0771)	3500 (24.1, 241)
259091 ♦	12 Amps	✓	✓	240 V (1)	16,700	2.0 (7.6)	0.0203 (0.0771)	3500 (24.1, 241)

† Total system watts used by system, based on maximum heated hose length of 310 ft (94.5 m) for each unit.

\* Full load amps available for auxiliary equipment when all bare-system components are operating at maximum capabilities. Available auxiliary current is based on 310 ft (94.5 m) of heated hose. An additional 3.0 amps of auxiliary current is available for each 50 ft (15.2 m) section of heated hose that is not used.



★ Available auxiliary current will be less when the engine is de-rated for site altitude. Reduce the Available Auxiliary Current in the chart by 2.5 Amps per 1000 ft (300 m) elevation increments. If the available auxiliary current is less than zero, the system configuration may not support the full load at that altitude.

♦ Includes Complete Air Compressor Kit 24K335.

Refer to Circuit Breaker Configuration Options in the Operation manual.

See [Approvals](#), page 10.

## Approvals

Model	Approvals:
259079	 <p><b>Intertek</b></p> <p>Conforms to ANSI/UL Std. 73 Certified to CAN/CSA Std. C22.2 No. 68</p>
259080	 <p><b>Intertek</b></p> <p>Conforms to ANSI/UL Std. 499 Certified to CAN/CSA Std. C22.2 No. 88</p>
259081	

## Systems

Part	Maximum Fluid Working Pressure psi (MPa, bar)	Proportioner	Remote Display Module Kit	Heated Hose		Gun	
				50 ft (15 m)	10 ft (3 m)	Model	Part
AP9079	2000 (13.8, 138)	259079		24K240	246050	Fusion™ AP	246101
AP9080	2000 (13.8, 138)	259080		24K240	246050	Fusion™ AP	246101
AP9081	3500 (24.1, 241)	259081		24K241	246055	Fusion™ AP	246100
AP9179	2000 (13.8, 138)	259079	✓	24K394	246050	Fusion™ AP	246101
AP9180	2000 (13.8, 138)	259080	✓	24K394	246050	Fusion™ AP	246101
AP9181	3500 (24.1, 241)	259081	✓	24K395	246055	Fusion™ AP	246100
CS9079	2000 (13.8, 138)	259079		24K240	246050	Fusion™ CS	CS0101
CS9080	2000 (13.8, 138)	259080		24K240	246050	Fusion™ CS	CS0101
CS9081	3500 (24.1, 241)	259081		24K241	246055	Fusion™ CS	CS0000
CS9179	2000 (13.8, 138)	259079	✓	24K394	246050	Fusion™ CS	CS0101
CS9180	2000 (13.8, 138)	259080	✓	24K394	246050	Fusion™ CS	CS0101
CS9181	3500 (24.1, 241)	259081	✓	24K395	246055	Fusion™ CS	CS0000
P29079	2000 (13.8, 138)	259079		24K240	246050	Probler® P2	GCP2R1
P29080	2000 (13.8, 138)	259080		24K240	246050	Probler® P2	GCP2R1
P29081	3500 (24.1, 241)	259081		24K241	246055	Probler® P2	GCP2R0
P29179	2000 (13.8, 138)	259079	✓	24K394	246050	Probler® P2	GCP2R1
P29180	2000 (13.8, 138)	259080	✓	24K394	246050	Probler® P2	GCP2R1
P29181	3500 (24.1, 241)	259081	✓	24K395	246055	Probler® P2	GCP2R0

## Systems with Air Compressor

Part	Maximum Fluid Working Pressure psi (MPa, bar)	Proportioner	Air Compressor	Remote Display Module Kit	Heated Hose		Gun	
					50 ft (15 m)	10 ft (3 m)	Model	Part
AP9089	2000 (13.8, 138)	259089	✓		24K240	246050	Fusion™ AP	246101
AP9090	2000 (13.8, 138)	259090	✓		24K240	246050	Fusion™ AP	246101
AP9091	3500 (24.1, 241)	259091	✓		24K241	246055	Fusion™ AP	246100
AP9189	2000 (13.8, 138)	259089	✓	✓	24K394	246050	Fusion™ AP	246101
AP9190	2000 (13.8, 138)	259090	✓	✓	24K394	246050	Fusion™ AP	246101
AP9191	3500 (24.1, 241)	259091	✓	✓	24K395	246055	Fusion™ AP	246100
CS9089	2000 (13.8, 138)	259089	✓		24K240	246050	Fusion™ CS	CS0101
CS9090	2000 (13.8, 138)	259090	✓		24K240	246050	Fusion™ CS	CS0101
CS9091	3500 (24.1, 241)	259091	✓		24K241	246055	Fusion™ CS	CS0000
CS9189	2000 (13.8, 138)	259089	✓	✓	24K394	246050	Fusion™ CS	CS0101
CS9190	2000 (13.8, 138)	259090	✓	✓	24K394	246050	Fusion™ CS	CS0101
CS9191	3500 (24.1, 241)	259091	✓	✓	24K395	246055	Fusion™ CS	CS0000
P29089	2000 (13.8, 138)	259089	✓		24K240	246050	Probler® P2	GCP2R1
P29090	2000 (13.8, 138)	259090	✓		24K240	246050	Probler® P2	GCP2R1
P29091	3500 (24.1, 241)	259091	✓		24K241	246055	Probler® P2	GCP2R0
P29189	2000 (13.8, 138)	259089	✓	✓	24K394	246050	Probler® P2	GCP2R1
P29190	2000 (13.8, 138)	259090	✓	✓	24K394	246050	Probler® P2	GCP2R1
P29191	3500 (24.1, 241)	259091	✓	✓	24K395	246055	Probler® P2	GCP2R0

## Accessories

Kit Number	Description
24N449	50 ft (15 m) CAN cable (for remote display module)
24K207	Fluid Temperature Sensor (FTS) with RTD
24K338	Remote Display Module Kit
24K335	Complete Air Compressor Kit
125970	Air Compressor (without air supply tank)
24M490	Air Compressor (mounted 30 gallon tank)
24M125	Air Tank (12 gallons, 113.5 liters)
24M178	Air Dryer (desiccant)
24M258	Compressor Rack (frame only)
24K336	Hose Rack

Kit Number	Description
15V551	ADM Protective Covers (10 pack)
15M483	Remote Display Module Protective Covers (10 pack)
24K334	Feed Pump Shutdown Kit
24K333	Fuel Line and Cable Extension Kit
24K337	Light Tower Kit
24M174	Drum Level Sticks
24L911	Pallet Support Kit
121006	150 ft (45 m) cable (for remote display module)
24N365	RTD Test Cables (to aide resistance measurements)



## Supplied Manuals

The following manuals are shipped with the Reactor. Refer to these manuals for detailed equipment information.

Manuals are also available at [www.graco.com](http://www.graco.com).

Manual	Description
3A1705	Reactor E-30i and E-XP2i, Operation
16K761	Reactor E-30i and E-XP2i, Startup Instructions
16K913	Reactor E-30i and E-XP2i, Shutdown Instructions
SEBU7992	Perkins® Engine, Repair-Parts
–	Mecc Alte Self-Regulating Alternator Series NPE, Repair-Parts

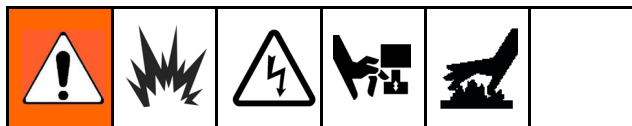
## Related Manuals

Manuals are available at [www.graco.com](http://www.graco.com).

Component manuals in English:

System Manuals	
3A1705	Reactor E-30i and E-XP2i, Operation
Displacement Pump Manual	
309577	Electric Reactor Displacement Pump, Repair-Parts
Feed System Manuals	
309572	Heated Hose, Instructions-Parts
309852	Circulation and Return Tube Kit, Instructions-Parts
309815	Feed Pump Kits, Instructions-Parts
309827	Feed Pump Air Supply Kit, Instructions-Parts
Spray Gun Manuals	
309550	Fusion™ AP Gun
312666	Fusion™ CS Gun
313213	Probler P2 Gun
Accessory Manuals	
3A1902	Compressor Rack, Instructions-Parts
3A1903	Hose Rack, Instructions-Parts
3A1904	Fuel Tank/Battery Move Kit, Instructions-Parts
3A1905	Feed Pump Shutdown Kit, Instructions-Parts
3A1906	Light Tower Kit, Instructions-Parts
3A1907	Remote Display Module, Instructions-Parts
3A2574	Pallet Support Kit, Instructions-Parts

# Troubleshooting





## Error Codes and Troubleshooting


### Note

Error codes are stored in the error log and displayed on the Error and Troubleshooting screens on the ADM.

There are three types of errors that can occur. Errors are indicated on the display as well as by the light tower (optional).

Alarms are indicated by . This condition indicates a parameter critical to the process has reached a level requiring the system to stop. The alarm needs to be addressed immediately.

Deviations are indicated by . This condition indicates a parameter critical to the process has reached a level requiring attention, but not sufficient enough to stop the system at this time.

Advisories are indicated by . This condition indicates a parameter that is not immediately critical to the process. The advisory needs attention to prevent more serious issues in the future.

Error Code	Error Location	Type	Name	Cause	Solution
A1NM	MCM	ALARM	No Motor Current	Loose or bad motor or wire connection.	Check for tight motor wire termination in green connector. If loose, contact Graco distributor for re-work instructions. Check for tight motor brush wire terminal screw. See <a href="#">Repair Motor Brushes, page 58</a> .
				Motor brushes completely worn down.	Check motor brushes and replace if needed.
				Bad MCM.	Replace MCM. See <a href="#">Replace Motor Control Module (MCM), page 84</a> .

Error Code	Error Location	Type	Name	Cause	Solution
A4CH	Hose	ALARM	High Relay Current Hose	Wiring problem.	Check wiring between HPTCM and contactor. Look for shorted wire between HPTCM and contactor terminals A1 and A2.
				Shorted contactor.	Measure resistance between A1 and A2 terminals. The resistance should be about 289Ω. If contactor is measuring less than 100Ω, then the contactor is shorted and should be replaced.
A4CM	MCM	ALARM	High MCM Current	MCM is drawing too much current from the system.	If problem continues replace MCM. See <a href="#">Replace Motor Control Module (MCM), page 84</a> .
A4DA A4DB	Boost A Boost B	ALARM	High Heater Current	Short circuit in booster heater wiring.	Check wiring for touching wires.
				Bad heater.	Measure resistance of heater(s), replace if needed. See <a href="#">Repair Booster Heater, page 67</a> .
A4DH	Hose	ALARM	High Heater Current	Short circuit in hose wiring.	Check continuity of transformer windings, normal reading are about 0.2Ω on both primary and secondary. If reading is 0Ω replace transformer.
					Check for shorts between the primary winding and the support frame of the transformer.

Error Code	Error Location	Type	Name	Cause	Solution
A4NM	MCM	ALARM	High Motor Current	Short circuit of motor wiring.	Check wiring to the motor to ensure no bare wires are touching and that no wires are shorted to ground.
				Motor will not rotate.	Replace motor <a href="#">Repair Electric Motor, page 60.</a>
				Chemical pump is stuck	Repair or replace chemical pump. See <a href="#">Remove Pump, page 53.</a>
A7CH	Hose	ALARM	Unexpected Relay Current	Shorted HPTCM.	Replace Module. See <a href="#">Replace High Power Temperature Control Module (HPTCM), page 84.</a>
A7DA	Boost A	ALARM	Unexpected Heater Current	Shorted LPTCM.	Replace Module. See <a href="#">Replace Low Power Temperature Control Module (LPTCM), page 84.</a>
A7DB	Boost B				
A7DH	Hose	ALARM	Unexpected Heater Current	Turned off main power switch with heaters and motor ON.	Turn off heat and motor power at ADM before turning off the main power switch.
				Turned on hose circuit breaker with hose heat on.	Turn on circuit breaker with hose heat off.
				Failed to power off after loading software.	Power off after software downloaded.
				Shorted HPTCM.	Replace Module. See <a href="#">Replace High Power Temperature Control Module (HPTCM), page 84.</a>
A8DA	Boost A	ALARM	No Heater Current	Tripped circuit breaker.	Visually check circuit breaker for a tripped condition.
A8DB	Boost B				
A8DH	Hose			Loose/broken connection.	Check heater wiring for loose wires.

Error Code	Error Location	Type	Name	Cause	Solution
CACA CACB CACH CACM CACP	Boost A Boost B Hose MCM Remote Display Module	ALARM	Communication Error	Module does not have software or dial is set to wrong position.	Insert a system token into the missing GCA module and cycle the power. Wait until the red light on the module stops flashing before removing the token. Verify the dial on the module is in the correct position: 0 for hose, A for boost A, B for boost B.  MCM switch: 0 for E-30i, 1 for E-XP2i
				No 24 VDC supply to module.	Green light on each module should be lit. If green light is not lit, check to make sure each CAN cable connection is tight. Verify the power supply is outputting 24 VDC. If not, replace power supply. See System Repair manual.
				Loose or broken CAN cable.	Check the CAN cables running between GCA modules and tighten if needed. If the problem still persists move each cable around the connector and watch the flashing yellow light on the GCA modules. If the lights stops replace the CAN cable.
				Bad module	(CACA or CACB) Replace LPTCM. See <a href="#">Replace Low Power Temperature Control Module (LPTCM)</a> , page 84.  (CACH) Replace HPTCM. See <a href="#">Replace High Power Temperature Control Module (HPTCM)</a> , page 84.  (CACM) Re-place MCM. See <a href="#">Replace Motor Control Module (MCM)</a> , page 84.  (CACP) Replace Remote Display Module. See Remote Display Module manual for instructions.

Error Code	Error Location	Type	Name	Cause	Solution
DADX	MCM	ALARM	Pump Runaway	Flow rate is too large	Mix chamber too large for system selected. Use mix chamber rated for system.
					Ensure the system has chemical and the feed pumps are operating correctly.
					No material in pumps. Verify pumps are supplying chemical. If necessary, replace or refill drums.
					Inlet ball valves are closed. Open ball valves.
DE0X	MCM	ALARM	Pump Cycle Switch Fault	Faulty or missing cycle switch.	Check wiring between cycle switch and MCM port 6.
F9DX	MCM	ALARM	Pressure Flow Cutback	Mix chamber is too large for the set pressure.	Reference the pressure flow curves in the operation manual and select a tip size that is the correct size for the set pressure.
H1MH	Hose	ALARM	Low Line Frequency	Line frequency is below 55 Hz.	Check frequency. If out of tolerance, see supplied 120/240V alternator manual for repair instructions.
H4MH	Hose	ALARM	High Line Frequency	Line frequency is above 65 Hz.	Check frequency. If out of tolerance, see supplied 120/240V alternator manual for repair instructions.
K8NM	MCM	ALARM	Locked Rotor	Locked rotor.	Replace motor. See <a href="#">Repair Electric Motor, page 60</a> .
				Chemical pump is stuck.	Repair or replace pump. See <a href="#">Remove Pump, page 53</a> .
L1AX	ADM	ALARM	Low Chemical Level A	Tanks low on material.	Fill tanks with material.
L1BX			Low Chemical Level B		

Error Code	Error Location	Type	Name	Cause	Solution
MBN0	MCM	ADVISORY	Motor Brush Wear	Brushes have worn down and need replacing.	Replace Brushes. See <a href="#">Repair Motor Brushes, page 58</a> .
MMUX	USB	ADVISORY	USB Log Full	USB logs have reached a level where data loss will occur if logs are not downloaded.	Use a USB drive and download all logs.
P4AX P4BX	MCM	ALARM	Over Pressure A Over Pressure B	System pressurized before allowing heat to reach setpoint.	Turn on the heat and allow the hose to reach the setpoint before turning on the pumps.
				Bad pressure transducer.	Verify the ADM pressure reading the analog gauges at the manifold. Replace transducers if they do not match. See <a href="#">Replace Transducers, page 64</a> .
P6AX P6BX	MCM	ALARM	Pressure Transducer Fault A Pressure Transducer Fault B	Loose/bad connection.	Check to ensure the pressure transducer is properly installed and all wires are properly connected.
				Bad sensor.	Check if the error follows the transducer. Disconnect transducer cable from #8 and #9 connectors on MCM. Reverse A and B connections and check if the error follows. If the error follows the transducer, replace the pressure transducer. See <a href="#">Replace Transducers, page 64</a> . If the error does not follow, replace MCM. See <a href="#">Replace Motor Control Module (MCM), page 84</a> .

Error Code	Error Location	Type	Name	Cause	Solution
P7AX P7BX	MCM	ALARM	Pressure Imbalance A High (P7AX)  Pressure Imbalance B High (P7BX)	Pressure difference between A and B material is greater than the defined value.	Ensure the material flow is equally restricted on both material lines.
				Pressure imbalance is defined too low.	Ensure that the pressure imbalance value, on the System Setup screen, is at an acceptable maximum pressure to prevent unnecessary alarms and abort dispenses.
				Out of material.	Fill tanks with material.
				Fluid leaking from heater inlet rupture disk (372).	Check if heater and PRESSURE RELIEF/SPRAY valve (SA or SB) are plugged. Clear. Replace rupture disk (372). Do not replace with a pipe plug.
				Feed system defective.	Check feed pump and hoses for blockage. Check that the feed pumps have the correct air pressure.
P0AX	MCM	ADVISORY	Pressure Imbalance A High	See P7AX.	
P0BX	MCM	ADVISORY	Pressure Imbalance B High	See P7BX.	
T1DE	Engine Heat Exchanger	ALARM	Low Temperature Coolant Outlet	Radiator fan will not stop.	Replace fan relay. See <a href="#">Replace Load Center Relays and Fuses, page 63.</a>
				Engine thermostat is stuck open.	Replace thermostat. See Perkins dealer.



Error Code	Error Location	Type	Name	Cause	Solution
T2AE T2BE	Heat Exchanger	DEVIATION	Low Temperature Hx A  Low Temperature Hx B	Coolant circulation pump not working.	Check for 240 VAC on pump. If there is the correct voltage, replace circulation pump. See <a href="#">Replace Circulation Pump, page 77</a> .
				Air lock in circulation pump.	Check for coolant flow in sight glass.
				No voltage to coil of valve.	Turn on the manual valve switch, on the load center, to manually turn on the solenoids and see if the temperature rises. If not, check voltage output on J6 connector on the load center and ensure the LEDs are on. Follow <a href="#">Load Center Diagnostics, page 37</a> . If necessary, replace the load center board. See <a href="#">Replace Load Center, page 63</a> .  If voltage is present, measure the resistance of the coil, it should be 12.5 $\Omega$ , if coil is open replace coil.  If voltage is present, test the coil with screwdriver. The screwdriver should magnetically stick inside the coil. If screwdriver sticks, then the coil is good. , Replace the plunger on valve or replace the complete valve assembly. See <a href="#">Replace Control Valve, page 76</a> .

Error Code	Error Location	Type	Name	Cause	Solution
T2DA T2DB	Boost A Boost B	ALARM	Low Chemical Temperature	Flow is too high at current setpoint.  Bad heater(s)	Use a smaller mix chamber that is rated for the unit in use.  Confirm resistance of heater is 23–26.5 ohms. Replace if OL/open loop.
T2DH	Hose	ALARM	Low Chemical Temperature	Cold chemical in unheated portion of system passed hose FTS at startup.	Recirculate heated chemical back to drum in cold conditions before startup.
T2DE	Heat Exchanger	ADVISORY	Low Temperature Coolant Outlet	Radiator fan will not stop.  Engine thermostat is stuck open.	Replace fan relay. See <a href="#">Replace Load Center Relays and Fuses, page 63</a> .  Replace thermostat. See Perkins distributor to replace.
T3NM	MCM	ADVISORY	High Motor Temperature	Motor is operating outside of pressure flow curve. The system is running at a lower setpoint to preserve motor life.	Run the system at a lower duty cycle or with a smaller mix chamber. See performance charts in system operation manual.
T4AE T4BE	Heat Exchanger	ALARM	High Chemical Temperature Hx A (T4AE)  High Chemical Temperature Hx B (T4BE)	Manual override switch on load center board is in the on position.  A or B side control valve solenoid is stuck in the open position. Debris in valve diaphragm or plunger preventing spring-loaded closed function.  Short on load center board. If the blue and red LEDs are on while the heat is off, then the load center board is bad.  (T4BE only) J6 connector on load center “Heat Valves” location is not centered.	Open cabinet cover and turn switch to the off position.  Disconnect connector from solenoid coil. If temperature does not decrease, rebuild solenoid. See <a href="#">Replace Control Valve, page 76</a> .  Follow <a href="#">Load Center Diagnostics, page 37</a> . If necessary, replace load center board. See <a href="#">Replace Load Center, page 63</a> .  Reconnect J6 connector on load center in centered location.

Error Code	Error Location	Type	Name	Cause	Solution
T4CA T4CB T4CH	Boost A Boost B Hose	ALARM	(T4CA or T4CB) LPTCM Over Temperature  (T4CH) HPTCM Over Temperature	Cooling fan not operating.  Overheated module.	If fan is not working check wiring between CB03 and fan. If wiring is good, replace fan. See <a href="#">Replace Electrical Enclosure Fan, page 66.</a>  Turn controller off. Wait a few minutes. If the condition does not clear or regenerates consistently, replace module.  See <a href="#">Replace High Power Temperature Control Module (HPTCM), page 84,</a> or <a href="#">Replace Low Power Temperature Control Module (LPTCM), page 84.</a>
T4CM	MCM	ALARM	High MCM Temperature	High ambient temperature.  Overheated control module.	Ensure ambient temperature is below 120°F(48°C) before using the system.  Stop the pumps. Wait a few minutes. If the condition does not clear or regenerates consistently, replace MCM. See <a href="#">Replace Motor Control Module (MCM), page 84.</a>
T4DA T4DB	Boost A Boost B	ALARM	High Chemical Temperature	Bad RTD or bad RTD placement against heater rod.  Bad Low Power Temperature Control Module.	Swap A and B heater power cables and RTD cables and see if issue follows. If so, replace RTD. See <a href="#">Replace RTD, page 68.</a>  Swap the A and B LPTCMs and see if the issue follows the module. If so replace LPTCM. See <a href="#">Replace Low Power Temperature Control Module (LPTCM), page 84.</a>
T4DE	Heat Exchanger	ALARM	High Temperature Coolant Outlet	Radiator fan not functioning properly.  Plugged radiator.  High ambient temperature.	Check fan relay (K4) and fuse (30 Amp ATO "F3") on load center board. Replace if needed. See <a href="#">Replace Load Center Relays and Fuses, page 63.</a>  Replace if needed. See <a href="#">Remove Radiator, page 82.</a>  Ensure ambient temperature is below 120°F(48°C) before using the system.

## Troubleshooting

Error Code	Error Location	Type	Name	Cause	Solution
T4DH	Hose	ALARM	High Chemical Temperature	Hose portion exposed to an excessive heat source, like hot sun or coiled hose, can pass fluid more than 27°F (15°C) over temperature setting to the FTS.	Shade exposed hose from hot sun or expose FTS to same environment when at rest. Uncoil entire hose before heating to avoid self-heating.
				Bad High Power Temperature Control Module.	Replace HPTCM. See <a href="#">Replace High Power Temperature Control Module (HPTCM), page 84</a> .
T4NM	MCM	ALARM	High Motor Temperature	Cooling fans are not operating properly.	Ensure ambient temperature is less than 120°F (48°C).  Check to see that the fans are moving. Measure voltage to fans. There should be 240 VAC. If no voltage is measured, check wiring between fan and circuit breaker CB03.  If the fans have voltage but are not moving, replace fan.  Use an air hose to blow out around the fan housings and remove any built-up debris.
				Bad electric motor.	Replace motor. See <a href="#">Repair Electric Motor, page 60</a> .

Error Code	Error Location	Type	Name	Cause	Solution
T6AE	Heat Exchanger A	ALARM	RTD Fault	Broken or loose RTD cable or connection.	Check all wiring and connection to RTD.
T6BE	Heat Exchanger B			Bad RTD.	Switch the RTD with another and see if the error message follows the RTD. Replace RTD if the error follows the RTD.
T6DA	Boost A				
T6DB	Boost B				
T6DE	Engine Heat Exchanger				
T6DH	Hose	ALARM	RTD Cable or FTS Fault	Broken RTD cable in hose or bad FTS.	Expose each hose RTD connection to check and retighten any loose connector. Measure hose RTD cable and FTS continuity. See <a href="#">Check RTD Cables and FTS, page 70</a> . Order RTD Test Kit 24N365 for measurement.  See Temporary Manual Hose Temperature Control instructions, in the operation manual, to finish the job until repair can be completed.

Error Code	Error Location	Type	Name	Cause	Solution
T8AE T8BE	Heat Exchanger	ALARM	Temperature Not Rising Hx A (T8AE)  Temperature Not Rising Hx B (T8BE)	No coolant flow.	Check coolant level. Check for coolant flow in sight glass.  Ensure that the circulation pump has 240 VAC. If not, replace the circulation pump. See <a href="#">Replace Circulation Pump, page 77</a> .
				Low chemical supply temperature.	Recirculate heated chemical back to drum in cold conditions before spraying. Chemical below 32°F(0°C) at startup.
				System stored below 20°F(-7°C) causing slow coolant valve operation.	Ensure ambient temperature is above 20°F(-7°C).
				(T8AE only) J6 connector on load center "Heat Valves" location is not centered.	Reconnect J6 connector on load center in centered location.
				Bad valve solenoid.	Turn on the manual valve switch, on the load center, and see if the solenoid shifts. if not replace solenoid. See <a href="#">Replace Control Valve, page 76</a> .
				Bad load center.	Follow <a href="#">Load Center Diagnostics, page 37</a> . If necessary, replace load center. See <a href="#">Replace Load Center, page 63</a> .

Error Code	Error Location	Type	Name	Cause	Solution
T8DA T8DB	Boost A Boost B	ALARM	Temperature Not Rising	Bad heater rod (boost).  Low chemical supply temperature.  Bad heated hose.	Measure resistance, 23 – 26 $\Omega$ , of heater rod, replace if reading open. See <a href="#">Replace Heater Element, page 67</a> .  Recirculate heated chemical back to drum in cold conditions before spraying. Chemical below 32°F(0°C) at startup.  Measure hose resistance, replace if reading open. See Heated Hose manual for repair.
T8DH	Hose	ALARM	Temperature Not Rising	Started spraying before engine and hose reached operating temperature.  Low chemical supply temperature.	Wait until operating temperatures have been reached on engine and hose before spraying.  Recirculate heated chemical back to drum in cold conditions before spraying. Chemical below 32°F(0°C) at startup.
V1CM	MCM	ALARM	Bus Under Voltage	Tripped circuit breaker.	Visually check circuit breaker for a tripped condition.
V1MH	Hose	ALARM	Low Line Voltage	Loose or bad connection.  Low generator line voltage  High auxiliary inrush current.	Check wiring for loose wires.  Measure voltage across main power switch. Voltage should measure between 190 and 264 VAC.  Ensure compressor or air drier are setup to be continuous run and sized according to manual.
V4CM V4MH	MCM HPTCM	ALARM ALARM	Bus Overvoltage High Line Voltage	Incoming line voltage is too high.	Measure voltage across main power switch. Voltage should measure between 190 and 264 VAC. If voltage is too high, see supplied alternator manual for generator specifications and repair.

Error Code	Error Location	Type	Name	Cause	Solution
WBNM	MCM	ALARM	Motor Sensor Fault	Bad Connection between MCM (Port 10) and brush wear/over temperature board.	Check connection and cables.
				Bad brush wear/over temperature board.	Replace Motor. See <a href="#">Replace Motor Control Module (MCM), page 84.</a>
WMCE	MCM	ALARM	Load Center Fault	Bad connection between MCM (Port 2) and load center board.	Check connection and cables.
				Bad load center.	Replace load center. See <a href="#">Replace Load Center, page 63.</a>
WSCX	ADM	ADVISORY	Invalid CAN Configuration	Duplicate node on CAN network.	Verify LPTCM are set to A and B.
WSUX	USB	ADVISORY	USB Invalid Configuration	A valid configuration file can't be found for the USB.	Insert a system token into the ADM and cycle the power. Wait until the lights on USB port stop flashing before removing the token.
				Bad ADM.	Replace ADM. See <a href="#">Repair Advanced Display Module (ADM), page 83.</a>
WXUD	ADM	ADVISORY	USB Download Error	Log download failed.	Backup and reformat the USB drive. Retry download.
WXUU	ADM	ADVISORY	USB Upload Error	Custom language file failed to upload	Perform normal USB download and use the new disptext.txt file to upload the custom language.
WX00	MCM	ALARM	External Input	The alarm external input has been driven low.	An active alarm is being generated by the external trigger. If the external alarm is not configured check for a short in the wiring going to MCM port 7, pins 1 and 3.



# System



Before performing any troubleshooting procedures:

1. Relieve Pressure. See [Pressure Relief Procedure, page 45](#).
2. Turn main power switch OFF.
3. Allow equipment to cool.

Problem	Cause	Solution
Reactor ADM does not turn on.	No power.	Turn main power switch ON.
		Turn circuit breakers ON, see <a href="#">Repair Circuit Breaker Module, page 61</a> .
		Check circuit breaker (CB10). See <a href="#">Repair Circuit Breaker Module, page 61</a> .
Electric motor does not operate.	Loose connections.	Check MCM connection 13.
	Tripped circuit breaker (CB02).	Reset breaker, see <a href="#">Repair Circuit Breaker Module, page 61</a> . Check 240VAC at output of breaker.
	Worn brushes.	Check both sides. Length must be 0.7 in. (17 mm) minimum. To replace, see <a href="#">Repair Motor Brushes, page 58</a> .
	Broken or misaligned brush springs.	Realign or replace, see <a href="#">Repair Motor Brushes, page 58</a> .
	Brushes or springs binding in brush holder.	Clean brush holder and align brush leads for free movement.
	Shorted armature.	Replace motor, see <a href="#">Repair Electric Motor, page 60</a> .
	Check motor commutator for burn spots or other damage.	Remove motor. Have motor shop resurface commutator, if possible.

Problem	Cause	Solution
Electric motor cooling fans not working.	Tripped circuit breaker (CB03).	Reset circuit breaker (CB03). Check 240VAC at output of breaker.
	Loose wire.	Check. See <a href="#">Electrical Schematics, page 131</a> .
	Fan blade obstructed.	Remove obstruction.
	Defective fan.	Replace. See <a href="#">Replace Motor Fan, page 65</a> .
Pump output low.	Obstructed fluid hose or gun; fluid hose ID too small.	Open, clear; use hose with larger ID.
	Worn piston valve or intake valve in displacement pump.	See pump manual.
	Pressure setpoint too high.	Reduce setpoint and output will increase.
Fluid leak in pump packing nut area.	Worn throat seals.	Replace. See pump manual.
No pressure on one side.	Fluid leaking from heater inlet rupture disk (372).	Check if heater and PRESSURE RELIEF/SPRAY valve (SA or SB) are plugged. Clear. Replace rupture disk (372) with a new one; do not replace with a pipe plug.
Air compressor does not start.	Tripped circuit breaker (CB04).	Reset circuit breaker (CB04).
	Not wired correctly.	See <a href="#">Electrical Schematics, page 131</a> .
	Compressor starter overheated from rapid multiple start and stop procedures.	Let starter cool down for 2 minutes then press reset on the air compressor electrical enclosure and start.
Air compressor shuts down randomly.	Loose wire connections.	Check and retighten all wire connections in the air compressor electrical enclosure.
Air compressor supply tank does not drain water.	Pilot air ball valve (1017) is closed.	Open ball valve.
	Water drain valve (1016) shuttle valve is stuck.	Replace drain valve.
Air compressor water drain valve constantly blows air.	Water drain valve (1016) shuttle valve is stuck in the center position.	Close and re-open the pilot air valve (1017).
Water in air line supplying proportioner.	Desiccant pellets saturated with moisture (blue color changed to pink).	Replace desiccant pellets. Order desiccant replacement kit 288810. See manual 309921.
	Very high humidity conditions.	Open manual water drain valve (1016) regularly. See <a href="#">Systems with Air Compressors, page 97</a> .

# Coolant System



Problem	Cause	Solution
<b>Proportioner Coolant Loop</b>		
Air bubbles in sight glass.	Air trapped in heat exchanger coolant.	See <a href="#">Refill Proportioner Coolant Loop, page 50.</a>
	Coolant hoses between the proportioner coolant loop and engine coolant loop were modified and created a high point air pocket.	Ensure there is constant elevation of hoses from proportioner coolant loop to engine coolant loop.
	Proportioner coolant loop expansion bottle is empty.	See <a href="#">Refill Proportioner Coolant Loop, page 50.</a>
Heat exchanger coolant flow stopped. No flow in sight glass.	Circulation pump stopped running.	Check circuit breaker. Check voltage.
	Bypass control valve does not open.	Repair or replace valve. See <a href="#">Replace Control Valve, page 76.</a>
Material slowly heats up.	Coolant filter plugged.	Clean or replace filter in sight glass. See <a href="#">Repair Sight Glass and Filter, page 78.</a> Order replacement filter kit 24L922.
	A and B control valves are not opening fully.	Repair or replace valve. See <a href="#">Replace Control Valve, page 76.</a>
	System stored below 20°F(-7°C).	Ensure system ambient temperature is above 20°F(-7°C).
Heat exchanger coolant in sight glass is a milky color.	Possible material leaking into coolant.	Drain Proportioner coolant loop. See <a href="#">Drain Coolant, page 49.</a> Check for pressurized material leaks.
A or B material heats up slower than the other.	Control valve opening too slow.	Repair or replace valve. See <a href="#">Replace Control Valve, page 76.</a>
	System stored below 20°F(-7°C).	Ensure system ambient temperature is above 20°F(-7°C).
	Control valve coil failed.	Repair or replace valve coil. See <a href="#">Replace Control Valve, page 76.</a>
A or B material cooling down slower than the other.	Control valve coil not allowing valve to normally close.	Repair or replace valve coil. See <a href="#">Replace Control Valve, page 76.</a>
	Control valve stuck in open position.	Repair valve. See <a href="#">Replace Control Valve, page 76.</a>
	Bad load center.	Replace the load center board. See <a href="#">Replace Load Center, page 63.</a>

Problem	Cause	Solution
<b>Engine Coolant Loop</b>		
Engine coolant does not reach full temperature.	Radiator fan does not shut off.	Check fan relay. Check fan wiring.
	Radiator core becoming plugged.	Replace radiator. See <a href="#">Remove Radiator, page 82</a> .
	Engine thermostat not opening.	Replace engine thermostat.
Engine temperature normal, but heat exchanger temperature is low or slowly increases.	Coolant level is low in expansion bottle.	<a href="#">Refill Engine Coolant Loop, page 51</a> .
	No coolant flow in engine coolant loop.	
	Heat exchanger in the engine coolant loop is plugged.	Replace heat exchanger. See <a href="#">Replace Heat Exchangers, page 73</a> .
Expansion bottle levels are not rising when coolant is heating.	Radiator or heat exchanger bottle cap not opening.	Replace cap.
Coolant level in engine coolant expansion bottle rises too high and too fast.	Expansion bottle cap and radiator cap are switched.	Switch radiator caps. Radiator cap is marked 16 lbs and expansion bottle is marked 8 lbs.
	Spring loaded gasket inside radiator cap does not seal.	Replace radiator cap.
Coolant level in proportioner coolant expansion bottle does not rise when hot.	Expansion bottle cap and radiator cap are switched.	Switch radiator caps. Radiator cap is marked 16 lbs and expansion bottle is marked 8 lbs.
Coolant level in proportioner coolant expansion bottle rises too high and too fast.	Expansion bottle cap stuck open.	Replace expansion bottle cap.

# Hose Heat System



Before performing any troubleshooting procedures:

1. Relieve Pressure. See [Pressure Relief Procedure, page 45](#).
2. Turn main power switch OFF.
3. Allow equipment to cool.

Problem	Cause	Solution
Hose heats but heats slower than usual or it does not reach temperature.	Ambient temperature is too cold.	Use auxiliary hose heat system.
	FTS failed or not installed correctly.	Check FTS, see <a href="#">Repair Fluid Temperature Sensor (FTS), page 71</a> .
Hose does not maintain temperature while spraying.	A and B setpoints too low.	Increase A and B setpoints. Hose is designed to maintain temperature, not to increase it.
	Ambient temperature is too cold.	Increase A and B setpoints to increase fluid temperature and keep it steady.
	Flow too high.	Use smaller mix chamber. Decrease pressure.
	Hose was not fully preheated.	Wait for hose to heat to correct temperature before spraying.
Hose temperature exceeds setpoint.	A and/or B heaters are overheating material.	Check primary heaters for either a RTD problem or a failed element attached to RTD, see <a href="#">Electrical Schematics, page 131</a> .
	Faulty FTS connections.	Verify that all FTS connections are snug and that pins of connectors are clean. Unplug and re-plug RTD wires, cleaning off any debris.
	Ambient temperature is too high.	Cover hoses or move to a location with a lower ambient temperature.

Problem	Cause	Solution
Erratic hose temperature.	Faulty FTS connections.	Verify that all FTS connections are snug and that pins of connectors are clean. Unplug and re-plug FTS wires along length of hose, cleaning off any debris.
	FTS not installed correctly.	FTS should be installed close to end of hose in same environment as gun. Verify FTS installation, see <a href="#">Repair Fluid Temperature Sensor (FTS)</a> , page 71.
Hose does not heat.	FTS failed.	Check FTS, see <a href="#">Repair Fluid Temperature Sensor (FTS)</a> , page 71.
	FTS not installed correctly.	FTS should be installed close to end of hose in same environment as gun. Verify FTS installation, see <a href="#">Repair Fluid Temperature Sensor (FTS)</a> , page 71.
	Loose hose electrical connections.	Check connections. Repair as necessary.
	Circuit breakers tripped.	Reset breakers (CB20 and CB02), see <a href="#">Repair Circuit Breaker Module</a> , page 61.
	Hose zone not turned on.	Turn on hose heat zone.
	A and B temperature setpoints too low.	Check. Increase if necessary.
	Failed HPTCM.	Remove HPTCM and install a new HPTCM. New modules come with most current software. Update other modules if necessary. See software upgrade instruction manual.
	Contactor not functioning.	Verify contactor actuates when the hose heat zone is turned on. The button in the middle of the contactor should pull in. If not, check electrical connections.

Problem	Cause	Solution
Hoses near Reactor are warm, but hoses downstream are cold.	Shorted connection or failed hose heating element.	With power off, check the hose resistance with and without the whip hose attached. With the whip hose attached, the reading should be less than 3 ohm. Without the whip hose attached, the reading should be OL (open loop). See <a href="#">Check Hose Heat Connectors, page 70</a> .
Low hose heat.	A and B temperature setpoints too low.	Increase A and B setpoints. Hose designed to maintain temperature, not increase temperature.
	Hose temperature setpoint too low.	Check. Increase if necessary to maintain heat.
	Flow too high.	Use smaller mix chamber. Decrease pressure.
	Low current; FTS not installed.	Install FTS, see operation manual.
	Hose heat zone not turned on long enough to reach setpoint.	Allow hose to heat up, or preheat fluid.
	Loose hose electrical connections.	Check connections. Repair as necessary.
	Ambient temperature is too low	Relocate hoses to a warmer area or increase A and B setpoints.

# Booster Heater



Before performing any troubleshooting procedures:

1. Relieve Pressure. See [Pressure Relief Procedure, page 45](#).
2. Turn main power switch OFF.
3. Allow equipment to cool.

## Problems

Try the recommended solutions in the order given for each problem, to avoid unnecessary repairs. Also, determine that all circuit breakers, switches, and controls are properly set and wiring is correct before assuming there is a problem.

Problem	Cause	Solution
Booster heater(s) does not heat.	Heat turned off.	Turn on heat zones.
	Temperature control alarm.	Check ADM for error codes.
	Signal failure from RTD.	Signal failure from RTD.
Control of booster heat is abnormal; high temperature overshoots (T4DA, T4DB) occurs intermittently.	Dirty RTD connections.	Examine RTD cables connected to LPTCMs. Confirm RTDs are not plugged into opposite heat zone. Unplug and re-plug RTD connectors. Unplug and re-plug RTD connectors. Ensure RTD tip contacts the heater element.
	RTD not contacting heater element.	Loosen ferrule nut, push in RTD so tip contacts heater element. Holding RTD tip against heater element, tighten ferrule nut 1/4 turn past tight.
	Failed heater element.	See <a href="#">Replace Heater Element, page 67</a> .
	Signal failure from RTD.	See (T4DA, T4DB), <a href="#">Error Codes and Troubleshooting, page 14</a> .



# Load Center Diagnostics

Reference [Replace Relays and Fuses, page 63](#), and [Load Center Wiring Diagram, page 140](#). The LEDs on the load center board are helpful diagnostic tools when troubleshooting problems with the engine. Before referencing the Engine Troubleshooting, page 37, complete the following steps:

1. Identify which LEDs are on and off.
2. Determine if the LEDs are expected to be in the state observed. Determine if an unlit LED should be on by referring to the LED Expected Operation table.

## Note

The starter, fuel shutoff solenoid, glow plugs, and radiator fan operations are sequenced during startup by the Engine Control Module.

3. If the LEDs light as expected, focus troubleshooting attention to components listed in Table 1. If the LEDs do not light as expected, first focus troubleshooting attention to components listed in Table 2.
4. For potential causes and solutions related to the components in Tables 1 and 2, see Engine Troubleshooting, page 37.

## LED Expected Operation

LED	ON State
D1	On when fuel is being fed to the engine – from shortly before the starter cranks until the engine is turned off.
D2	On when starter is cranking – from shortly after the Fuel LED lights (beginning approximately 8 seconds after the green start button on the Engine Control Module is pressed) and until shortly after the engine turns over.
D3	On when glow plugs are warming the engine - from when the green start button is pressed on the Engine Control Module until shortly after the engine starts and comes up to speed.
D4	On when radiator fan is running – from shortly before the starter cranks until shortly after the main power switch is turned on, then intermittently thereafter as required by engine temperature. (If the main power switch is left off, the fan will run continuously.)

Table 1 lists a likely order of potential failures in the load center output-side components.

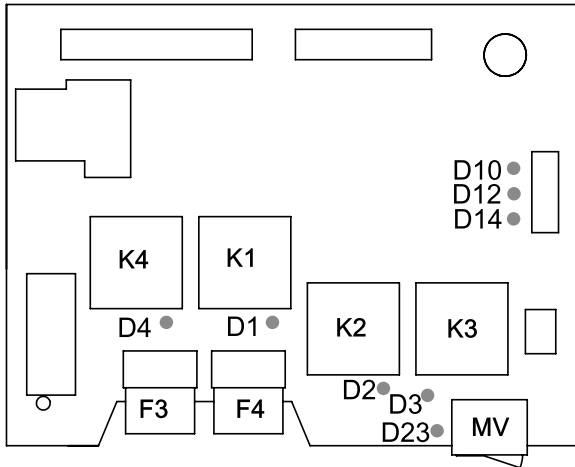
**Table 1 – LEDs Light As Expected**

	Fuel (D1)	Starter (D2)	Glow Plugs (D3)	Radiator Fan (D4)
1	Engine Harness (E) and its connections			
2	Engine Fuel Shutoff Solenoid (FD)	Starter Solenoid Relay (CR6)	Glow Plugs Solenoid Relay (CR7)	
3		Engine Starter Motor (ES)		

Table 2 indicates a likely order of potential failures in the load center input-side power, cable, or control components.

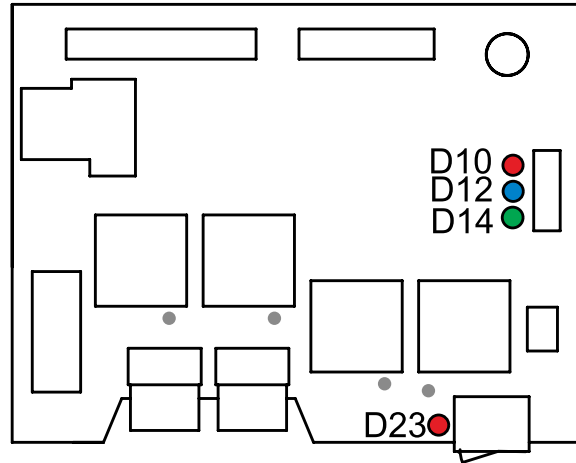
**Table 2 – LEDs Do Not Light As Expected**

	Fuel (D1)	Starter (D2)	Glow Plugs (D3)	Radiator Fan (D4)
1	Battery			
2	Battery cables and its connections			
3	Radiator Fan Fuse F4 ("PWR - ATO 20A")			Load Center Fuse F3 ("FAN - ATO 30A")
4	Fusible Link Harness (C) and its connections			
5	Engine Harness (E) and its connections			
6	Engine Control Module Harness (F) and its connections			
7	Load Center Fuel Relay (K1)	Load Center Starter Relay (K2)	Load Center Glow Relay (K3)	Load Center Fan Relay (K4)
8	Load Center Board			
9	Engine Control Module			



Load Center Component Identification  
Figure 1

- F3 Load Center Power Fuse
- F4 Radiator Fan Fuse
- K1 Fuel Relay
- K2 Starter Relay
- K3 Glow Plug Relay
- K4 Radiator Fan Relay
- MV Manual Valve Switch



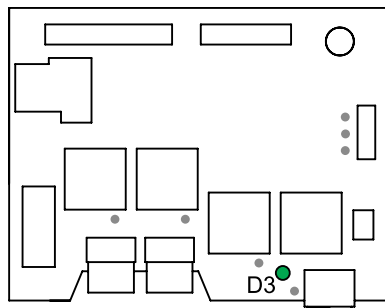
Manual Valve Switch ON (engine off)  
Figure 2

LED	Related Component	Color	ON-State Description
D1	Fuel Shutoff Solenoid	Green	Fuel shutoff solenoid on the engine is open.
D2	Starter	Red	Starter is cranking.
D3	Glow Plugs	Green	Glow plugs are heating.
D4	Radiator Fan	Green	Radiator fan is on.
D10	A Coolant Valve	Red	A-side (red) coolant valve is open.
D12	B Coolant Valve	Blue	B-side (blue) coolant valve is open.
D14	Bypass Coolant Valve	Green	Bypass coolant valve is open.
D23	Manual Valve Switch	Red	Manual valve switch is in the ON position.

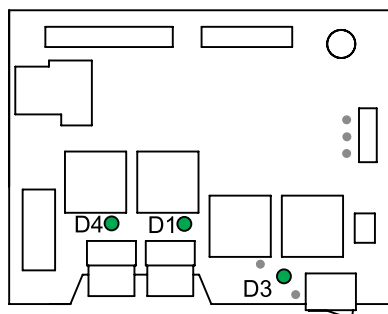
LED	Description
●	Off
●	On
✱	Flashing

### LED Sequence for Engine Startup and Operation

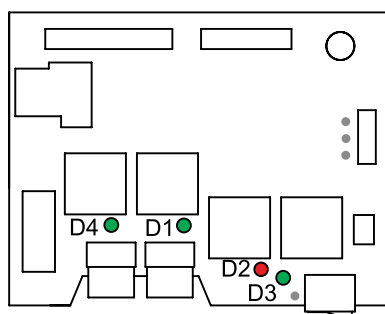
1. After pressing green start button on Engine Control Module, glow plugs start warming engine.



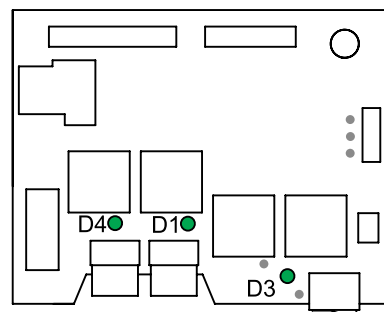
2. Fuel and radiator fan turn on shortly before engine starting; glow plugs continue to warm engine.



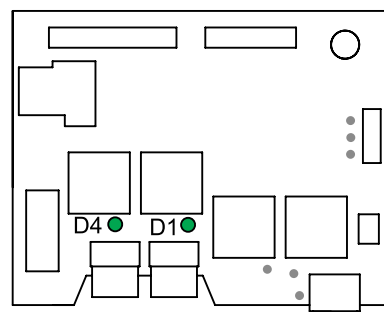
3. Engine starting; fuel, fan, and glow plugs continue to operate.



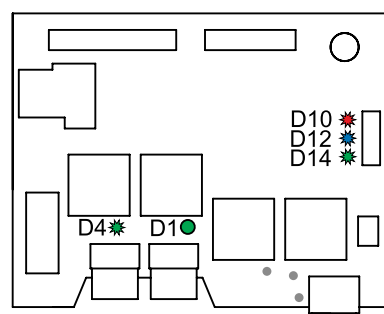
4. Engine starting; glow plugs continue to warm engine.



5. Engine is running; with main power switch off, the radiator fan runs continuously.



6. Engine is running; electronics take control of and cycle the fan and valves beginning shortly after main power switch is turned on.




# Engine






Problem	Cause	Solution
Engine Control Module does not power up from sleep mode.	Discharged or failed battery.	Verify battery voltage is 11 - 13 volts DC. Charge or replace battery as required. See <a href="#">Replace Battery, page 79</a> .
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including grounds) related to Engine Control Module. Check Engine Harness (E), Engine Control Module Harness (F), Fusible Link Harness (C), and battery cables. See <a href="#">Harness Identification, page 131</a> . Verify voltage is 11 - 13 volts DC from starter to ground.
	Blown Load Center board fuse.	Determine cause of blown fuse F4 "PWR - ATO 20A". Repair issue then replace fuse. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Blown fusible link.	Verify continuity through fusible link harness from starter to 12V charge alternator. If required, replace Fusible Link Harness (C). See <a href="#">Harness Identification, page 131</a> . See <a href="#">Repair Fusible Link Harness, page 80</a> .
	Failed Engine Control Module.	Replace module. See <a href="#">Repair Engine Control Module, page 83</a> .
	Failed Load Center board.	Replace board. See <a href="#">Replace Load Center, page 63</a> .

Problem	Cause	Solution
Reference <a href="#">Load Center Diagnostics, page 37</a> .		
Engine does not turn over.	Main power switch on electrical enclosure is in the ON position.	Turn switch to OFF position.
	Discharged or failed battery.	Verify battery voltage is 11 - 13 volts DC.
		Charge or replace battery as required. See <a href="#">Replace Battery, page 79</a> .
	Loose or corroded battery cable connector.	Verify cable connectors. See <a href="#">Replace Battery, page 79</a> .
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including grounds) related to starter. Check Engine Harness (E), Engine Control Module Harness (F), Fusible Link Harness (C), Disconnect Check Harness (H), and battery cables. See <a href="#">Harness Identification, page 131</a> . Verify voltage is 11 - 13 volts DC from starter to ground.
	Blown Load Center board fuse.	Determine cause of blown fuse F4 "PWR - ATO 20A". Repair issue then replace fuse. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Failed starter relay.	Replace relay K2 located on Load Center board. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Failed starter solenoid relay.	Replace solenoid relay CR6 located on side of engine. See <a href="#">Replace Engine Solenoid Relays, page 64</a> .
	Blown fusible link.	Verify continuity through fusible link harness from starter to solenoid relay CR6. If required, replace Fusible Link Harness (C). See <a href="#">Harness Identification, page 131</a> .
	Failed engine starter (ES).	Contact local Perkins distributor for service.



Problem	Cause	Solution
Reference <a href="#">Load Center Diagnostics, page 37.</a>		
Engine turns over, but does not start.	Low fuel level.	Refill fuel tank.
	Lost prime.	Ensure fuel tank is at least half full, prime with bulb until fuel is flowing through return line to tank.
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including to grounds) related to engine fuel shutoff solenoid. Check Engine Harness (E), Engine Control Module Harness (F), and Fusible Link Harness (C). See <a href="#">Harness Identification, page 131.</a>
	Blocked air intake.	Replace air filter.
	Blocked exhaust system.	Check that exhaust system is open (rain cap is free to move, no exhaust obstructions or plugging). Remove blockage.
	Blocked fuel filter.	Inspect/replace fuel filter.
	Failed fuel relay.	Replace relay K1 located on Load Center board. See <a href="#">Replace Relays and Fuses, page 63.</a>
	Failed engine fuel shutoff solenoid.	Verify engine fuel shutoff solenoid (FD) related wiring according to schematics (see Cause "Loose or incorrect wiring connections", above).
		Contact local Perkins distributor for service.
	Failed glow plug relay.	Replace relay K3 located on Load Center board. See <a href="#">Replace Engine Solenoid Relays, page 64.</a>
	Failed glow plug solenoid relay.	Replace solenoid relay CR7 located on side of engine. See <a href="#">Replace Engine Solenoid Relays, page 64.</a>
	Failed glow plug assembly.	Verify glow plug related wiring according to schematics (see Cause "Loose or incorrect wiring connections", above).
		Contact local Perkins distributor for service.

Problem	Cause	Solution
Reference <a href="#">Load Center Diagnostics, page 37</a> .		
Engine shuts down, Engine Control Module shows no errors.	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including grounds) related to engine fuel shutoff solenoid. Check Engine Harness (E), and Engine Control Module Harness (F). See <a href="#">Harness Identification, page 131</a> .
	Failed fuel relay.	Replace relay K1 located on Load Center board. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Failed engine fuel shutoff solenoid.	Verify engine fuel shutoff solenoid (FD) related wiring according to schematics (see Cause "Loose or incorrect wiring connections", above).
		Contact local Perkins distributor for service.
Engine shuts down, Engine Control Module shows High Coolant Temperature Shutdown icon. 	Low engine coolant level.	Inspect coolant system for leaks. Repair as necessary and refill system.
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including grounds) related to radiator fan. Check Engine Harness (E), and Engine Control Module Harness (F). See <a href="#">Harness Identification, page 131</a> .
	Blown radiator fan fuse.	Determine cause of blown fuse F3 "FAN - ATO 30A". Repair issue then replace fuse. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Failed radiator fan relay.	Replace relay K4 located on Load Center board. See <a href="#">Replace Relays and Fuses, page 63</a> .
	Obstructed radiator fan.	Remove obstructions.
	Failed radiator fan.	Replace fan. See <a href="#">Replace Radiator Fan, page 66</a> .
	Failed engine coolant temperature sensor.	Replace engine coolant temperature sensor located behind radiator connected to MCM port 5. See <a href="#">Replace Engine RTD, page 88</a> .
	Plugged radiator or coolant system.	Clean or replace radiator. See <a href="#">Remove Radiator, page 82</a> .
		Contact local Perkins distributor for service.

Problem	Cause	Solution
Engine shuts down. Engine Control Module shows Low Oil Pressure Shutdown icon. 	Low oil level.	Check oil level and refill.
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections (including grounds) related to oil pressure switch. Check Engine Harness (E), and Engine Control Module Harness (F). See <a href="#">Harness Identification, page 131</a> .
	Failed oil pressure switch.	Replace oil pressure switch Contact local Perkins distributor for service.
Engine shuts down. Engine Control Module shows Under Frequency Shutdown icon or Generator Low Voltage Shutdown icon  	Low fuel level.	Refill fuel tank.
	Lost prime.	Ensure fuel tank is at least half full, prime with bulb until fuel is flowing through return line to tank.
	Blocked air intake.	Replace air filter.
	Blocked exhaust system.	Check that exhaust system is open (rain cap is free to move, no exhaust obstructions or plugging). Remove blockage.
	Blocked fuel filter.	Replace fuel filter.
	Generator overloaded.	Confirm auxiliary electrical loads wired into the electrical enclosure by the customer are within the system's available auxiliary power limits.
	Loose or incorrect wiring connections.	Refer to schematics, verify wiring connections related to Engine Control Module, Check AC Sense Harness (M). See <a href="#">Harness Identification, page 131</a> .
	Blown voltage sense fuses.	Replace fuses F6 and F7 located in the junction box above the 120/240 V alternator. Use repair kit 24M723.



# Repair






 	<p>Repairing this equipment requires access to parts that may cause electric shock or other serious injury if work is not performed properly. Be sure to shut off all power to equipment before repairing.</p>
---	--

## Before Beginning Repair

<b>NOTICE</b>
<p>Proper system setup, startup, and shutdown procedures are critical to electrical equipment reliability. The following procedures ensure steady voltage. Failure to follow these procedures will cause voltage fluctuations that can damage electrical equipment and void the warranty.</p>

1. Flush if necessary. See [Flushing, page 46](#).
2. See [Shutdown, page 48](#).

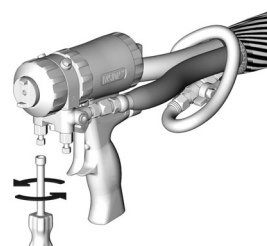
## Pressure Relief Procedure

    	<p>This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection, splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop spraying and before cleaning, checking, or servicing equipment.</p>
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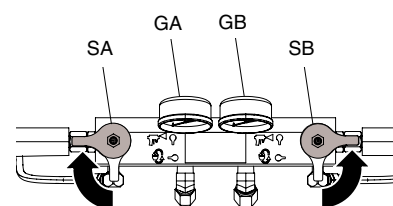
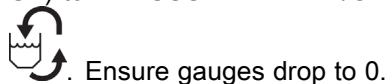
*The Fusion AP gun is shown.*

1. Relieve pressure in gun and perform gun shutdown procedure. See gun manual.

2. Close gun fluid inlet valves A and B.



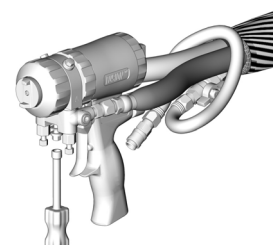
3. Shut off feed pumps and agitator, if used.
4. Route fluid to waste containers or supply tanks. Turn PRESSURE RELIEF/SPRAY valves (SA, SB) to PRESSURE RELIEF/CIRCULATION





5. Engage gun piston safety lock.



6. Disconnect gun air line and remove gun fluid manifold.




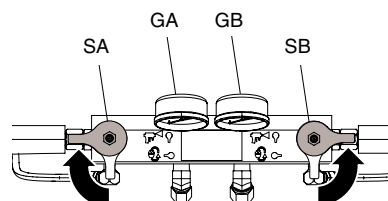
## Flushing

					
<p>To prevent fire and explosion, flush equipment only in a well-ventilated area. Do not spray flammable fluids. Do not turn on heaters while flushing with flammable solvents.</p>					

- Flush out old fluid with new fluid, or flush out old fluid with a compatible solvent before introducing new fluid.
- Use the lowest possible pressure when flushing.
- All wetted parts are compatible with common solvents. Use only moisture-free solvents.

- To flush feed hoses, pumps, and heaters separately from heated hoses, set PRESSURE RELIEF/SPRAY valves (SA, SB) to PRESSURE

RELIEF/CIRCULATION  . Flush through bleed lines (N).



- To flush entire system, circulate through gun fluid manifold (with manifold removed from gun).
- To prevent moisture from reacting with isocyanate, always leave the system filled with a moisture-free plasticizer or oil. Do not use water. Never leave the system dry. See [Important Two-Component Material Information, page 7](#).

## Flush Inlet Strainer Screen



The inlet strainers filter out particles that can plug the pump inlet check valves. Inspect the screens daily as part of the startup routine, and clean as required.

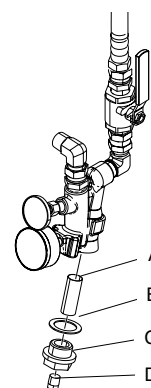
Isocyanate can crystallize from moisture contamination or from freezing. If the chemicals used are clean and proper storage, transfer, and operating procedures are followed, there should be minimal contamination of the A-side screen.

### Note

Clean the A-side screen only during daily startup. This minimizes moisture contamination by immediately flushing out any isocyanate residue at the start of dispensing operations.

1. Close the fluid inlet valve at the pump inlet and shut off the appropriate feed pump. This prevents material from being pumped while cleaning the screen.
2. Place a container under the strainer base to catch drain off when removing the strainer plug (C).

3. Remove the screen (A) from the strainer manifold. Thoroughly flush the screen with compatible solvent and shake it dry. Inspect the screen. No more than 25% of the mesh should be restricted. If more than 25% of the mesh is blocked, replace the screen. Inspect the gasket (B) and replace as required.
4. Ensure the pipe plug (D) is screwed into the strainer plug (C). Install the strainer plug with the screen (A) and gasket (B) in place and tighten. Do not overtighten. Let the gasket make the seal.
5. Open the fluid inlet valve, ensure that there are no leaks, and wipe the equipment clean. Proceed with operation.






tt17290b

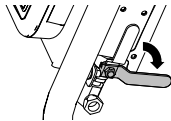
Figure 3

## Shutdown

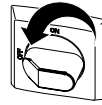
### NOTICE



Proper system setup, startup, and shutdown procedures are critical to electrical equipment reliability. The following procedures ensure steady voltage. Failure to follow these procedures will cause voltage fluctuations that can damage electrical equipment and void the warranty.

1. Press  to stop the pumps.
2. Turn off heat zones.
3. Relieve pressure. See [Pressure Relief Procedure, page 45](#).
4. Press  to park the Component A Pump.
5. Press  to deactivate the system.
6. Turn off the air compressor, air dryer, and breathing air.
7. Close the main air shutoff valve.



8. Turn main power switch off.




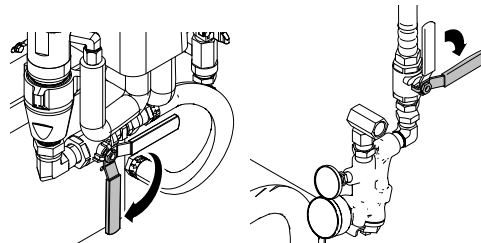
				
<p>To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.</p>				

9. Allow engine dwell time.



### NOTICE

Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.

10. Press  on the engine control module.
11. Open air compressor bleed valve to relieve pressure and remove water from tank.
12. Close all fluid supply valves.



## Drain Coolant

					
To avoid burns, do not perform maintenance on the coolant system until the coolant system has reached ambient temperature.					

Drain coolant from the engine and proportioner coolant loops once a year or if the coolant lines need to be disconnected, in order to install a wall between the generator and proportioner.

1. Perform [Shutdown](#), page 48.
2. Remove the cabinet door from the front of the proportioner.
3. Turn on manual valve switch (MV), located on the load center (LC), to manually open the A and B heat exchanger control valves and bypass control valve.

### Note

The 12V battery must be connected to operate valves. The load center (LC) LEDs will stay on when the manual valve switch (MV) is in the on position.

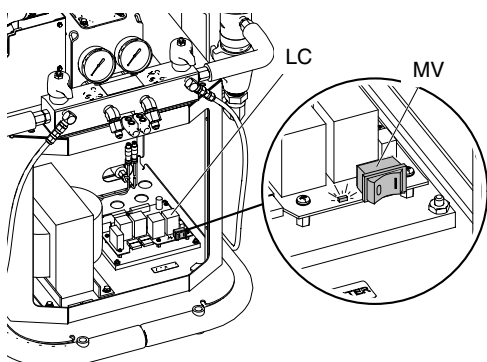
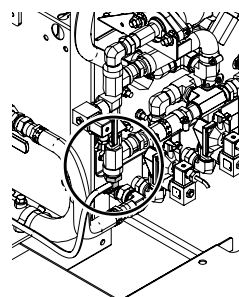


Figure 4

LED Component	LED Color
Manual valve switch (MV)	Red
A Side Control Valve	Red
B Side Control Valve	Blue
Bypass Valve	Green

4. To drain proportioner coolant loop:
  - a. Remove the proportioner coolant loop fill bottle (HF) cap. See [Fig 5](#).
  - b. Place the other end of the drain tube in a waste container. Open the drain valve. Drain coolant until coolant is no longer visible in the sight glass.

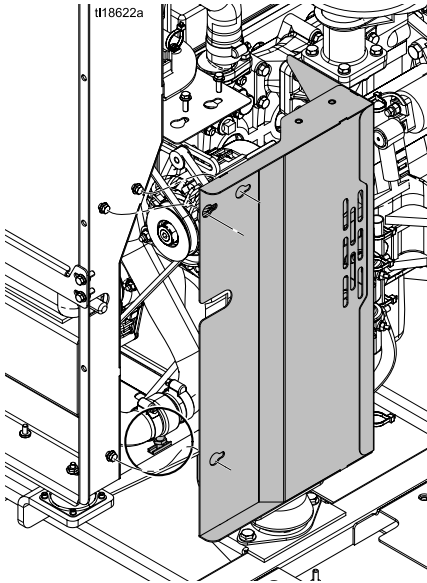


Proportioner Coolant Loop Drain Valve  
Figure 5

- c. To refill coolant loop, see [Refill Proportioner Coolant Loop](#), page 50.

5. To drain engine coolant loop:

- a. Remove the engine coolant loop (RC) cap. See [Fig 5](#).
- b. Remove engine guards as shown. Let the guards rest on the engine to access the drain valve.



Engine Coolant Loop Drain Valve  
Figure 6

- c. Place a waste container under the drain valve. Open the drain valve and drain coolant.
- d. To refill coolant loop, see [Refill Engine Coolant Loop, page 51](#).
- e. Replace engine shrouds. Torque screws to 25 ft-lbs (33.8 N·m).

## Refill Proportioner Coolant Loop

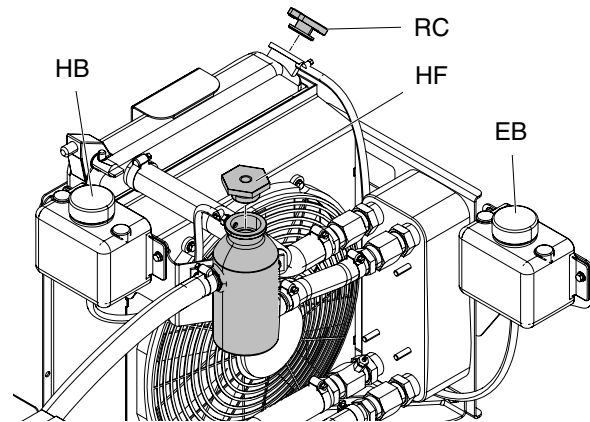
### Note

Air needs to be purged from the proportioner coolant loop when it is filled with new coolant or when air enters the coolant system. It takes about one full warm-up and cool-down cycle to purge air from coolant.

To avoid burns, do not perform maintenance on the coolant system until the coolant system has reached ambient temperature.					

Only use coolant solutions that are compatible with the system. See [Coolant Specifications, page 51](#).

1. Before refilling coolant loop, perform steps 1–3 from [Drain Coolant, page 49](#). Drain coolant loop if necessary.
2. Remove the caps from the metal proportioner coolant loop fill bottle (HF) and expansion bottle (HB). Fill the proportioner coolant loop fill bottle (HF) to the top and add more coolant to expansion bottle (HB) until the coolant is at the cold fill line. See [Coolant Specifications, page 51](#).




Coolant System Bottles  
Figure 7

3. Replace cap.
4. Press start button twice on the engine control module.
5. Turn main power switch on.



6. Inspect coolant flow in sight glass (SG) for bubbles and to verify that the coolant is flowing.
7. Inspect coolant loops for leaking fittings or valves.
8. The coolant has reached operating temperature when the radiator fan turns on. When the fan turns on, turn the main power switch off.



9. Press  to stop the generator.
10. After the coolant system temperature lowers to ambient temperature, refill or add coolant to the expansion bottle (HB) cold level indicator line.
11. Turn off manual valve switch (MV) to close the A and B heat exchanger control valves (VA, VB) and bypass control valve (VC).

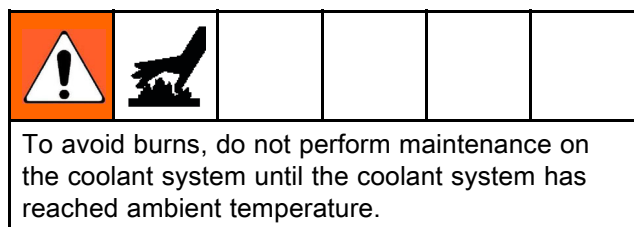
#### Note

When the manual valve switch (MV) is in the off position, the load center (LC) LEDs only turn on when the system opens the valves.

12. If necessary, refill or add coolant to the expansion bottle (HB) cold level indicator line. See [Fig 5](#).

## Refill Engine Coolant Loop


Refill the engine coolant loop when the coolant is below the cold level line at ambient temperature.



Only use coolant solutions that are compatible with the system. See [Coolant Specifications, page 51](#).

1. Perform [Shutdown, page 48](#).
2. Remove the engine radiator coolant cap (RC) and fill until the coolant reaches the bottom


of the neck. See [Fig 5](#). Replace cap. See [Coolant Specifications, page 51](#).

3. Remove the cap from the engine coolant loop bottle (EB) and fill until the coolant is at the hot level. Replace cap.
4. Press start button  twice on the engine control module.
5. Turn main power switch on.



6. Inspect coolant loops for leaking fittings or valves.
7. The coolant has reached operating temperature when the radiator fan turns on. When the fan turns on, turn the main power switch off.



8. Press  to stop the generator.
9. Add more coolant to expansion bottle (EB) after the coolant system temperature lowers to ambient temperature. Repeat until coolant level stays at cold level when at ambient temperature. It may take a few cycles to remove all air out of coolant system.

## Coolant Specifications

Only refill the coolant loops with a solution of 50% distilled or soft water and 50% green ethylene glycol antifreeze with a corrosion inhibitor. Do not use common tap water; it contains chlorides and minerals which form scale on the coolant system walls. Use only antifreeze that meets specification ASTM D3306–89, BS658, or AS 2108. A pre-diluted mix is recommended, such as PEAK Ready Use 50/50 Pre-Diluted.

## Change Pump Lubricant

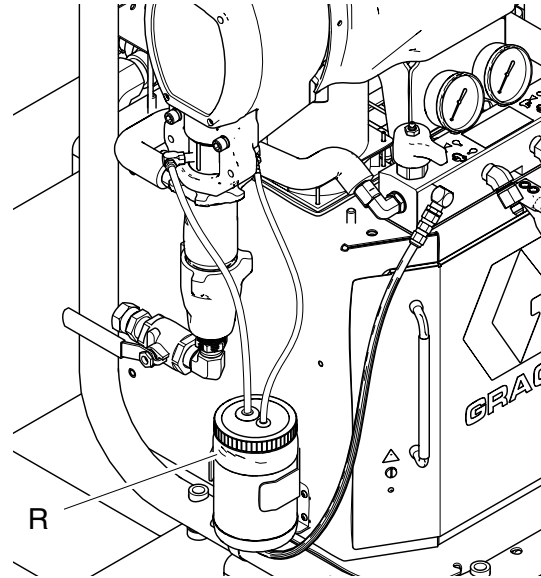
Check the condition of the ISO pump lubricant daily. Change the lubricant if it becomes a gel, its color darkens, or it becomes diluted with isocyanate.

Gel formation is due to moisture absorption by the pump lubricant. The interval between changes depends on the environment in which the equipment is operating. The pump lubrication system minimizes exposure to moisture, but some contamination is still possible.

Lubricant discoloration is due to continual seepage of small amounts of isocyanate past the pump packings during operation. If the packings are operating properly, lubricant replacement due to discoloration should not be necessary more often than every 3 or 4 weeks.

To change pump lubricant:



1. Follow [Pressure Relief Procedure, page 45](#).
2. Lift the lubricant reservoir (R) out of the bracket and remove the container from the cap. Holding the cap over a suitable container, remove the check valve and allow the lubricant to drain. Reattach the check valve to the inlet hose.
3. Drain the reservoir and flush it with clean lubricant.
4. When the reservoir is flushed clean, fill with fresh lubricant.
5. Thread the reservoir onto the cap assembly and place it in the bracket.
6. The lubrication system is ready for operation. No priming is required.



Pump Lubrication System  
Figure 8






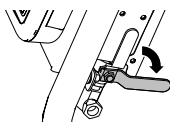
## Remove Pump

 	<p>Pump rod and connecting rod move during operation. Moving parts can cause serious injury such as pinching or amputation. Keep hands and fingers away from connecting rod during operation.</p>
---	---

### Note



See manual 309577 for pump repair instructions.

1. Press  to stop the pumps.
2. Turn off heat zones.
3. Flush pump.
4. Press  to park the Component A Pump.
5. Press  to deactivate the system.
6. Turn off the air compressor, air dryer, and breathing air.
7. Close the main air shutoff valve.



8. Turn main power switch off.




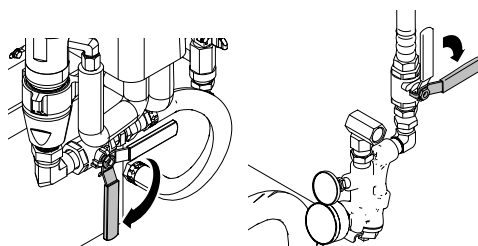
 				
<p>To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.</p>				


9. Allow engine dwell time.

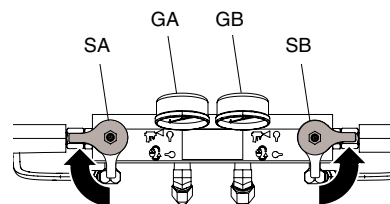
### NOTICE

Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.

10. Press  on the engine control module.
11. Open air compressor bleed valve to relieve pressure and remove water from tank.
12. Shut off both feed pumps. Close all fluid supply valves.



13. Route fluid to waste containers or supply tanks. Turn PRESSURE RELIEF/SPRAY valves (SA, SB) to PRESSURE RELIEF/CIRCULATION . Ensure gauges drop to 0.



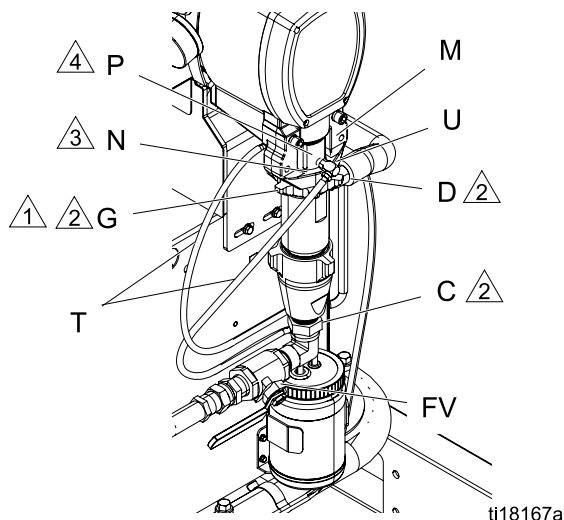
**Note**

Use drop cloth or rags to protect Reactor and surrounding areas from spills.

**Note**

Steps 14–16 apply to pump A. To disconnect pump B, go to steps 17 and 18.

14. Disconnect fittings at fluid inlet (C) and outlet (D). Also disconnect steel outlet tube from heater inlet.
15. Disconnect tubes (T). Remove both tube fittings (U) from wet-cup.
16. Loosen locknut (G) by hitting firmly with a non-sparking hammer. Unscrew pump far enough to separate and push up finger guard (P), to expose rod retaining pin. Push retaining wire clip up. Push pin out. Continue unscrewing pump.



Pump A  
Figure 9

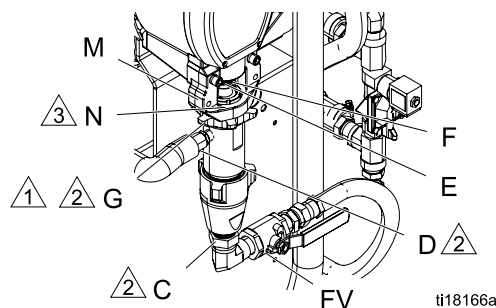
- 1 Flat side faces up.
- 2 Lubricate threads with ISO oil or grease.
- 3 Pump top threads must be nearly flush with bearing face (N).
- 4 Finger guard (P) not used on E-30i model.

**Note**

Steps 17 and 18 apply to pump B.

17. Disconnect fluid inlet (C) and outlet (D). Also disconnect steel outlet tube from heater inlet.

18. Push retaining wire clip (E) up. Push pin (F) out. Loosen locknut (G) by hitting firmly with a non-sparking hammer. Unscrew pump.



Pump B  
Figure 10

- 1 Flat side faces up.
- 2 Lubricate threads with ISO oil or grease.
- 3 Pump top threads must be nearly flush with bearing face (N).

## Install Pump

### Note

Steps 1–5 apply to pump B. To reconnect pump A, proceed to step 6.

1. Ensure locknut (G) is screwed on pump with flat side up. Screw pump into bearing housing (M) until pin holes align. Push pin (F) in. Pull retaining wire clip (E) down. See [Fig. 10, page 54](#) for view and assembly notes.
2. Continue screwing pump into housing until fluid outlet (D) is aligned with steel tube and top threads are +/- 1/16 in. (2 mm) of bearing face (N).
3. Tighten locknut (G) by hitting firmly with a non-sparking hammer.
4. Reconnect fluid inlet (C) and outlet (D).
5. Go to step 13.

### Note

Steps 6–12 apply to pump A only.

6. Ensure star-shaped locknut (G) is screwed on pump with flat side up. Carefully twist and extend displacement rod 2 in. (51 mm) above wet-cup. See [Fig. 9, page 54](#) for view and assembly notes.
7. Start threading pump into bearing housing (M). Place finger guard (P) over rod when it is accessible through window of bearing housing. When pin holes align, insert pin. Pull retaining wire clip down.

### Note




Finger guard is not used on E-30i model.

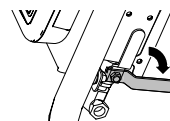
8. Seat finger guard (P) on wet-cup. Continue threading pump into bearing housing (M) until top threads are +/- 1/16 in. (2 mm) of bearing face (N). Ensure that barbed fittings at wet-cup flush ports are accessible.
9. Connect component A outlet tube loosely at pump and at heater. Line up tube, then tighten fittings securely.
10. Tighten star-shaped locknut (G) by hitting firmly with a non-sparking hammer.

11. Apply thin film of TSL to barbed fittings. Using two hands, support tubes (T) while pushing straight onto barbed fittings. **Do not let tubes kink or buckle.** Secure each tube with a wire tie between two barbs.
12. Reconnect fluid inlet (C).
13. Purge air and prime the system. See Reactor operation manual.

## Repair Drive Housing



### Removal

1. Press  to stop the pumps.
2. Turn off heat zones.
3. Flush pump.
4. Press  to park the Component A Pump.
5. Press  to deactivate the system.
6. Turn off the air compressor, air dryer, and breathing air.
7. Close the main air shutoff valve.



8. Turn main power switch off.




				
To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.				

9. Allow engine dwell time.

### NOTICE

Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.

10. Press  on the engine control module.
11. Open air compressor bleed valve to relieve pressure and remove water from tank.
12. Perform [Pressure Relief Procedure, page 45](#).
13. Remove screws (61) and motor shield (56), see [Fig. 11](#).

#### Note

Examine bearing housing (303) and connecting rod (305). If these parts need replacing, first remove the pump (306), see [Remove Pump, page 53](#).

14. Remove cover (77) and screws (78).
15. Disconnect cycle counter switch cable from port #6 on the MCM. Cut zip ties on harness with counter switch cable inside.
16. Remove front plate (289) and two screws (299). Remove screws (326), and washers (314) from inside the mounting bracket
17. Disconnect pump inlet and outlet lines. Remove screws (313), washers (315), and bearing housing (303).

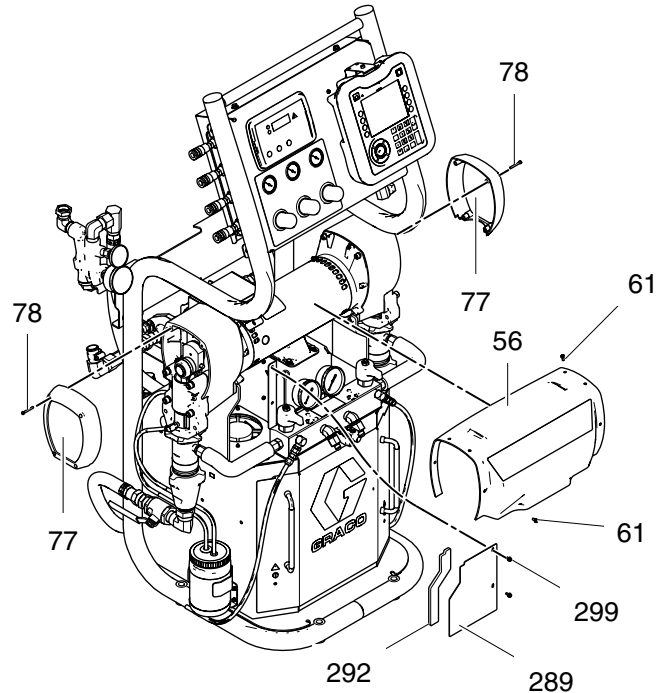
### NOTICE

Do not drop gear cluster (304) when removing drive housing (302). Gear cluster may stay engaged in motor front end bell (R) or drive housing.

18. Remove screws (312, 319) and washers (314) and pull drive housing (302) off motor (301).

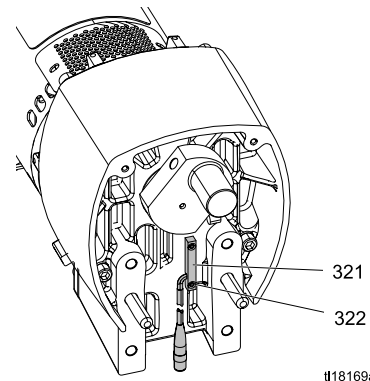
#### Note

The A side drive housing includes cycle counter switch (321). If replacing this housing, remove pins (322) and switch. Reinstall pins and switch on new drive housing. Switch wire connects to port #6 on the MCM.



ti18474a

Figure 11



ti18169a

Figure 12

## Installation

1. Apply grease liberally to washers (307, 308, 318), all gears, and inside drive housing (302).
2. Install one bronze washer (308) in drive housing, then install steel washers (307, 318) as shown.
3. Install second bronze washer (308) on gear cluster (304) and insert gear cluster in drive housing.

### Note

Drive housing crankshaft must be in line with crankshaft at other end of motor.  
See [Fig. 12, page 56](#).

4. Push drive housing (302) onto motor (301).  
Install screws (312, 319) and washers (314).

### Note

If bearing housing (303), connecting rod (305), or pump (306) were removed, reassemble rod in housing and install pump, see [Install Pump, page 55](#).

5. Route cycle counter switch cable (321) under the motor fan and inside the conduit. Connect to port #6 on the MCM and close conduit with tie wraps.
6. Install bearing housing (303), screws (313), and washers (315). Pumps must be in phase (both at same position in stroke).
7. Install cover (77) and screws (78).
8. Install motor shield (56) and screws (61), see [Proportioners](#).

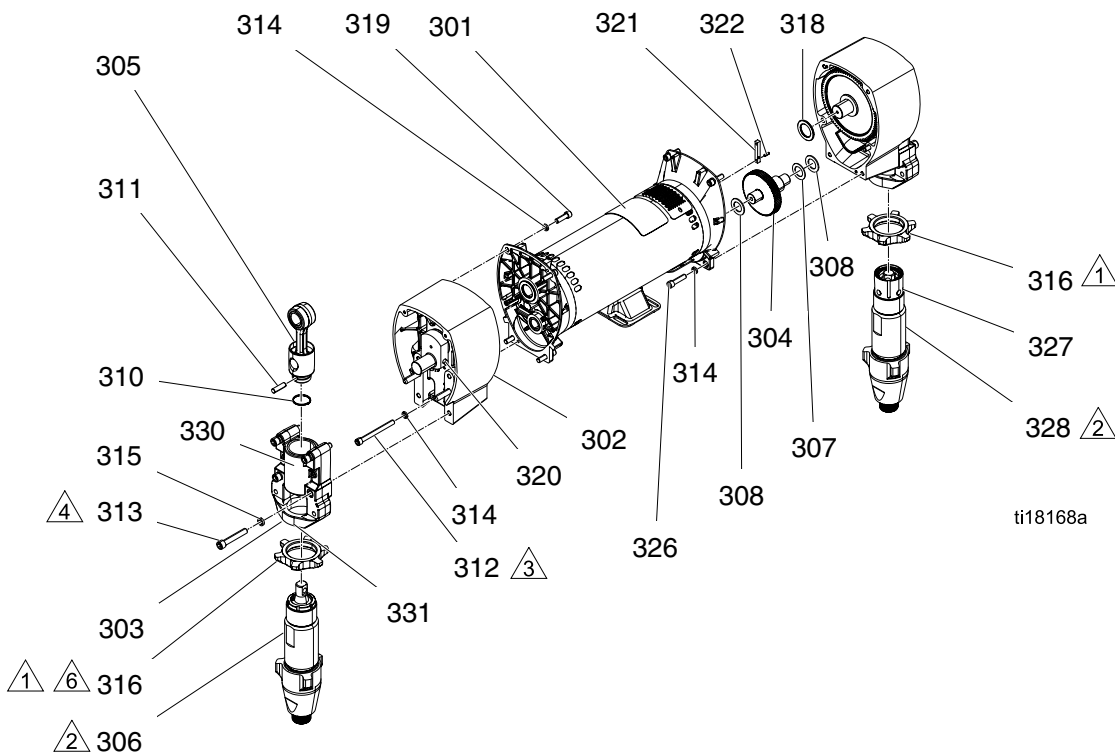





Figure 13

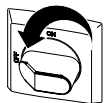
## Repair Motor Brushes



### Brush Removal

#### Note

Replace brushes worn to less than 0.7 in. (17 mm). Brushes wear differently on each side of motor; check both sides. Brush Repair kit 234037 (includes brushes and springs) is available.


1. Press  to stop the pumps.
2. Turn off heat zones.
3. Perform [Pressure Relief Procedure, page 45](#).
4. Press  to park the Component A Pump.
5. Press  to deactivate the system.
6. Turn main power switch off.






				
To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.				

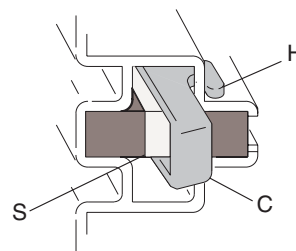
7. Allow engine dwell time.

NOTICE				
Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.				

8. Press  on the engine controller.

				
To prevent electric shock and burns, wait for 5 minutes for stored voltage to discharge.				

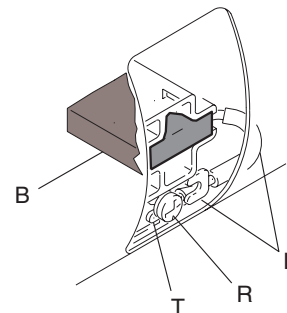
9. Remove motor cover, screws. Remove brush inspection covers, and screws from top and bottom of motor.
10. Remove two screws (299) and front plate (289). See [Fig. 19, page 65](#).
11. Remove two screws (299) from back plate (290). Rest fan and back plate (290) behind motor. See [Fig. 19, page 65](#).
12. Push in spring clip (C) to release hooks (H) from brush holder. Pull out clip and spring (S). Note spring orientation.



#### Note

The top brush has a pair of thin wires for brush wear signal. Unplug at spade connector provided.

13. Use a screw driver or 5/16 nut driver to loosen terminal screw (R). Pull away brush lead (L), being careful motor lead terminal (T) remains in place. Remove and discard brush (B).



14. Inspect commutator for excessive pitting, burning, or gouging. Black color on commutator is normal. Have commutator resurfaced by qualified motor repair shop if brushes wear too quickly.
15. Repeat steps 12 and 13 for the other side.

## Brush Installation

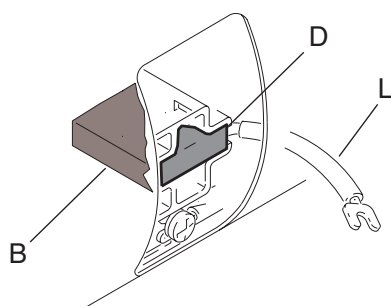
### NOTICE

When installing brushes, follow steps carefully. Improper installation damages parts beyond use.

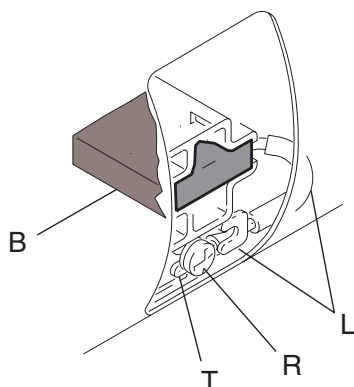
#### Note

Install brush with a pair of thin wires in top of motor. Plug spade terminal into connector.

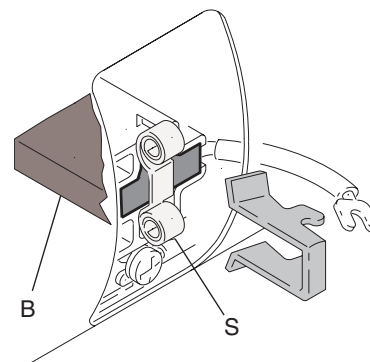
1. Install new brush (B) so lead (L) is in long slot (D) of holder.



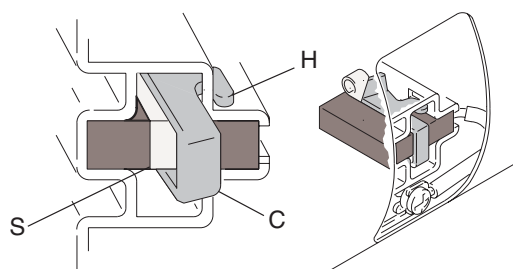
2. Slide terminal (L) under terminal screw (R). Make sure motor lead terminal (T) is still connected at screw. Tighten screw.



3. Install spring (S) so it will uncoil onto brush (B), as shown. Spring will be damaged if installed backwards.



4. Install spring clip (C) and push in until hooks (H) catch slots in housing. Incorrect installation may jam clip.





Do not touch brushes, leads, springs, or brush holders while equipment is plugged in, to reduce the risk of electric shock and serious injury.

### NOTICE

Do not run pumps dry for more than 30 seconds while checking brushes, to avoid damaging pumps.

5. Reinstall brush inspection covers and screws. Reinstall motor cover and screws..

## Repair

6. Reinstall fan assembly and plates.
7. Test brushes with both pump pins (F) disconnected. See [Fig. 12, page 56](#).
  - a. Start engine.
  - b. Activate system.
  - c. Press circulate  to enter jog mode.
  - d. Press  to start motor.
  - e. Select J 1 (jog mode). Slowly increase jog setting to J 6. Inspect brush and commutator contact area for excessive arcing. Arcs should not "trail" or circle around commutator surface. Run motor for 20-30 min at J 6 to seat brushes.

## Repair Electric Motor

### Removal

#### NOTICE

Be careful not to drop or damage the motor. The motor is heavy and may require two people to lift.

1. Remove drive housing and pump assemblies. See [Repair Drive Housing, page 55](#).
2. Disconnect electric motor (301) power cable from port #13 on the MCM.
3. Remove two screws (299) and motor fan assembly. Rest the motor fan assembly behind the motor without straining the fan power cable. See [Fig. 19, page 65](#).
4. Remove screws (326) and washers (314). Test brushes with both pump pins (F) disconnected. See [Fig. 13, page 57](#).
5. Disconnect brushwear/over temperature cable from port #10 on MCM. Cut tie wraps around harness to remove cable.
6. Remove four screws (273) holding motor (301) to bracket. Lift motor off unit.

### Installation

1. Place motor on unit. Thread motor cables into conduit as before. See [Electrical Schematics, page 131](#).
2. Fasten motor with screws (273) until screws are fully threaded in mounting bracket. Do not tighten screws until drive housing and pumps are connected to the motor.

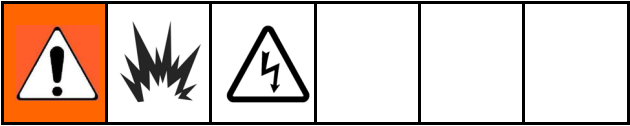
#### Note

If necessary, loosen screws (273) to align the motor (301) with side brackets.

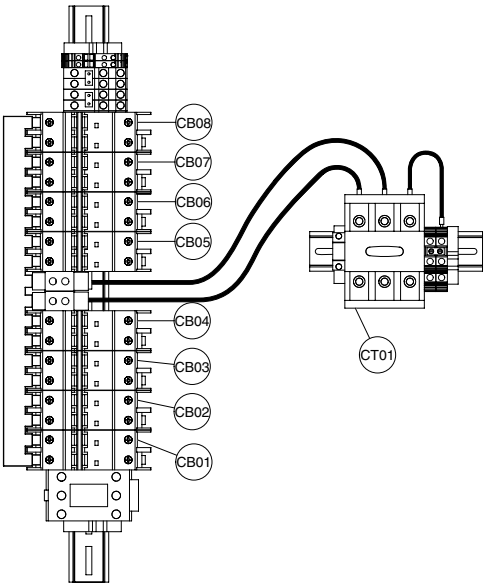
3. Install drive housing and pump assemblies, see [Installation, page 57](#).
4. Install screws (326) and washers (314). Tighten screws (273).
5. Route motor (301) power cord from motor through conduit and connect to port #13 on MCM. Route brushwear/over temperature cable up from motor and connect to port #10 on MCM. Insert cables in conduit and use tie wraps to secure the conduit together and the pallet.
6. Connect motor fan assembly to motor (301). See [Fig. 19, page 62](#).
7. Install front bracket.
8. Install drive housing covers and motor cover.
9. Return to service.



# Repair Circuit Breaker Module

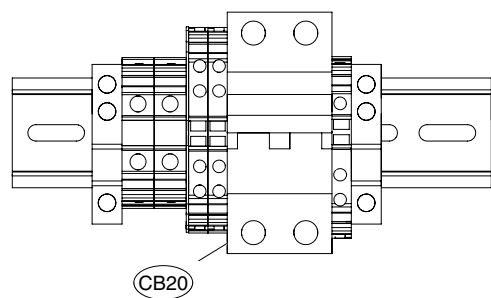


- 1. See [Before Beginning Repair](#), page 45.
- 2. Using an ohmmeter, check for continuity across circuit breaker (left to right). If no continuity, trip breaker, reset, and retest. If still no continuity, replace breaker as follows:
  - a. Refer to [Electrical Schematics](#), page 131, and tables on next page.
  - b. Install new breaker and reconnect wires.



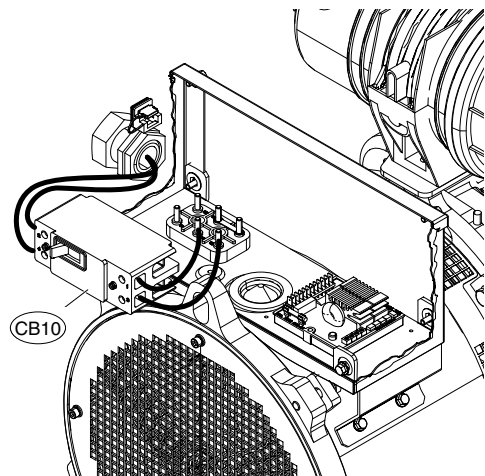
Circuit Breakers  
Figure 14

Ref.	Size	Component
CB01	30 A	High Power Temperature Control Module (HPTCM)
CB02	20 A	Motor Control Module (MCM)
CB03	5 A	Two Motor Fans, Cabinet Fan, Power Supply, and Coolant Circulation Pump
CB04	30 A	Auxiliary Power (Air Compressor)
CB05	10 A	Auxiliary Power
CB06	20 A	Auxiliary Power
CB07	15 A	E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) A
		E-30i: Auxiliary
CB08	15 A	E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) B
		E-30i: Auxiliary



Circuit Breakers Inside Cabinet  
Figure 15

Ref.	Size	Component
CB20	50 A	Heated Hose

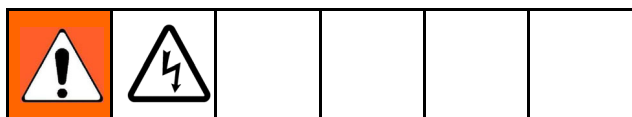


Circuit Breakers Inside Alternator Assembly  
Figure 16

Ref.	Size	Component
CB10	90 A	120/240V Alternator

## Replace Relays and Fuses

### Replace Load Center Relays and Fuses

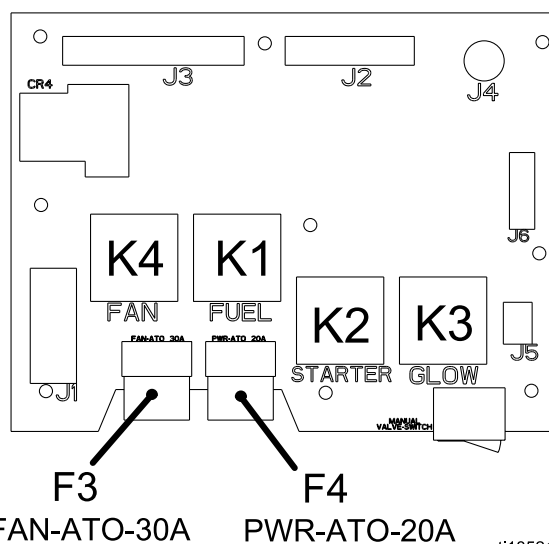


1. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 79](#).
2. Remove the bad relay or fuse from the load center (242) and install a new relay or fuse. See [Fig. 17](#).
3. Connect battery cable. See [Replace Battery, page 79](#).

### Relay and Fuse Identification Table

See [Load Center Wiring Diagram, page 140](#).

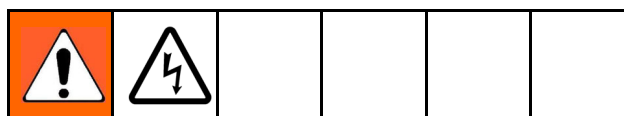
Repair Kit	Ref	Component
24L958	K1	Fuel Relay
	K2	Starter Relay
	K3	Glow Plug Relay
	K4	Fan Relay
24L959	F3 FAN-ATO - 30A	Fuse for load center relay K4 and radiator fan.
	F4 PWR-ATO - 20A	Fuse for load center relays K1, K2, K3 and their related components; Engine Control Module power; and coolant valve control.



ti18521a

Load Center Relay and Fuse Identification  
Figure 17

### Replace Load Center

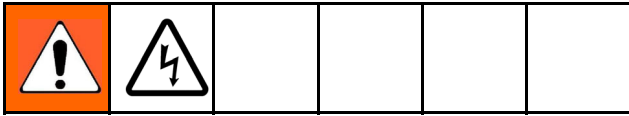


#### NOTICE

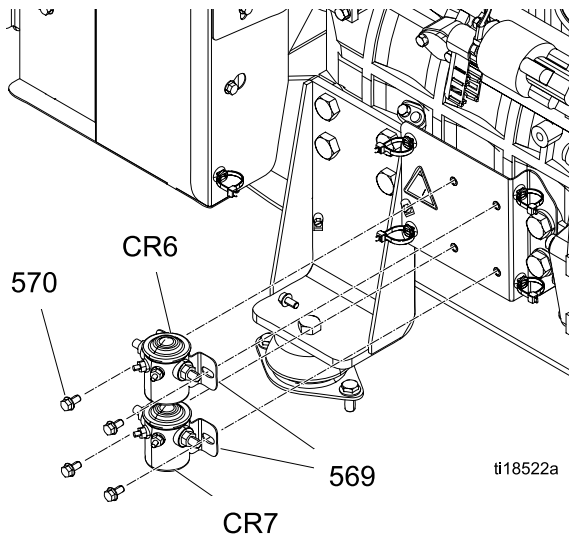
Before handling board, put on a static conductive wrist strap to protect against static discharge which can damage board. Follow instructions provided with wrist strap.

1. Perform [Shutdown, page 48](#).
2. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 79](#)
3. Disconnect all connectors. See [Load Center Wiring Diagram, page 140](#)
4. Remove four bolts (250) and load center (242).
5. Install new load center (242) and reconnect all connectors. See [Load Center Wiring Diagram, page 140](#)
6. Connect battery cable. See [Replace Battery, page 79](#).

## Replace Engine Solenoid Relays



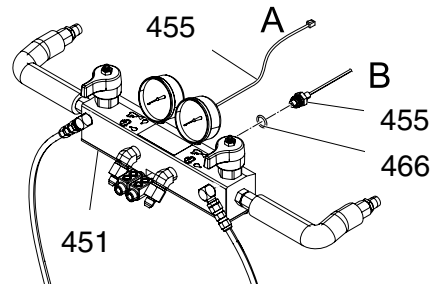
1. Perform [Shutdown, page 48](#).
2. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 79](#).
3. Remove two bolts (570) and solenoid relay (569). The starter solenoid relay (CR6) is above the glow plug solenoid relay (CR7).
4. Disconnect cables from the old relay and connect to the new relay. See [Load Center Wiring Diagram, page 140](#).



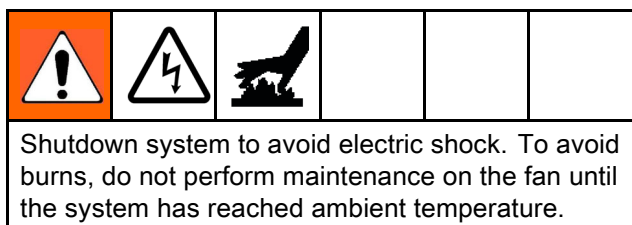
Starter (top) and Glow Plug (bottom) Solenoid Relays  
Figure 18

## Replace Transducers

1. Perform [Shutdown, page 48](#).
2. Perform [Pressure Relief Procedure, page 45](#).
3. Disconnect transducer cables (455) from #8 and #9 connectors on the MCM. Reverse A and B connections and check if error code P6AX or P6BX follows the transducer. See [Error Codes and Troubleshooting, page 14](#).
4. If transducer fails test, thread cable through top of cabinet. Note path as cable must be replaced in same way.
5. Install o-ring (466) on new transducer (455).
6. Install transducer in manifold. Mark end of cable with tape (red=transducer A, blue=transducer B).
7. Route cable into cabinet and thread into bundle as before.
8. Connect A side pressure transducer cable to MCM port #9. Connect B side pressure transducer cable to MCM port #8.



## Replace Fans



## Replace Motor Fan



1. Perform [Shutdown, page 48](#).
2. Remove two screws (299) and front plate (289).
3. Remove three screws (299) from back plate (290).
4. Refer to [Electrical Schematics, page 131](#). Using an ohmmeter, check for continuity across circuit breaker CB03 (left to right). If no continuity, trip breaker, reset, and retest. If still no continuity, replace breaker. See [Repair Circuit Breaker Module, page 61](#).
5. Remove bolts (251) and fan (212).
6. Install new fan (212) in reverser order.

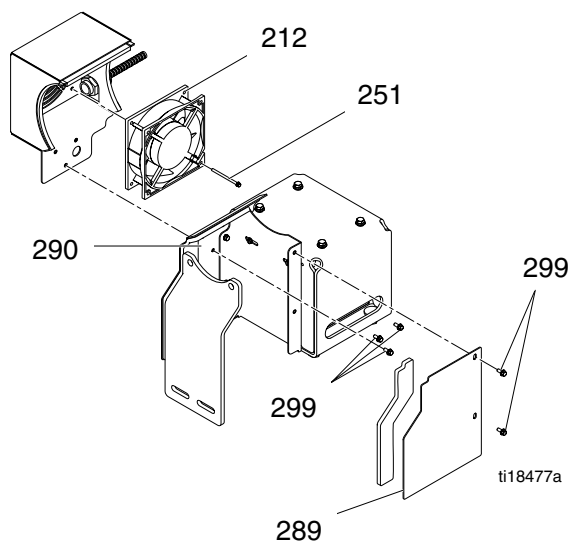


Figure 19

## Replace Proportioner Module Fan



1. Perform [Shutdown, page 48](#).
2. Remove cabinet panel (70).
3. See [Electrical Schematics, page 131](#). Using an ohmmeter, check for continuity across circuit breaker CB03 (left to right). If no continuity, trip breaker, reset, and retest. If still no continuity, replace breaker. For instructions, see [Repair Circuit Breaker Module, page 61](#).
4. Remove fan (212).
5. Install new fan (212) in reverser order of disassembly.

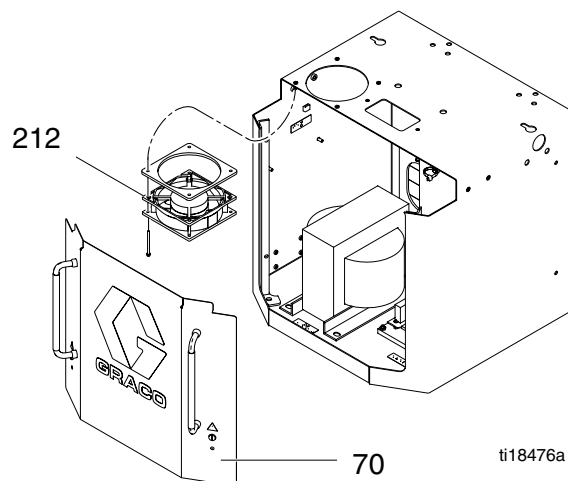


Figure 20

## Replace Radiator Fan



1. Perform [Shutdown](#), page 48.
2. Remove four screws (605) and disconnect power cable (PC).
3. Install new fan (605) to radiator bracket (601) with screws (605).

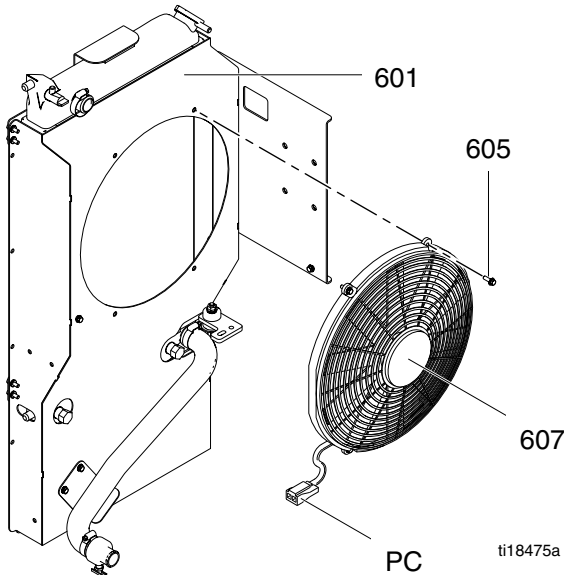


Figure 21

## Replace Electrical Enclosure Fan



1. Perform [Shutdown](#), page 48.
2. Open electrical enclosure door (502). Loosen four nuts (558) and remove fan (561).
3. Refer to [Electrical Schematics](#), page 131. Using an ohmmeter, check for continuity across circuit breaker (top to bottom). If no continuity, trip breaker, reset, and retest. If still no continuity, replace breaker. For instructions, see [Repair Circuit Breaker Module](#), page 61.
4. Install new fan (561) in reverse order of disassembly so that the fan blows out of the electrical enclosure.

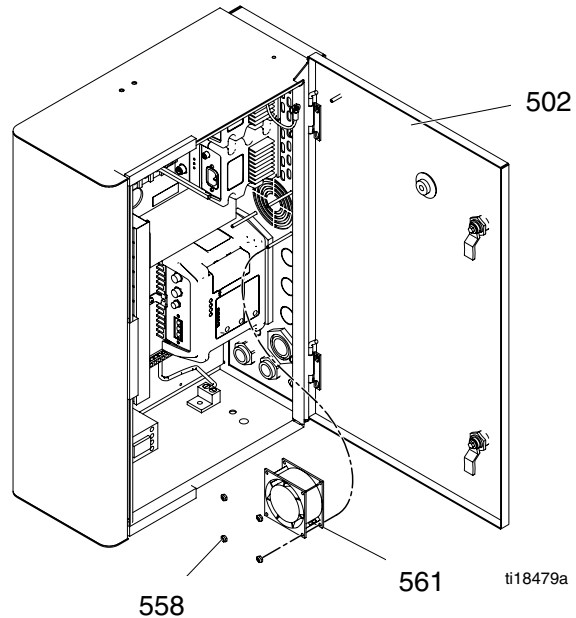





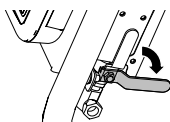
Figure 22

## Repair Booster Heater

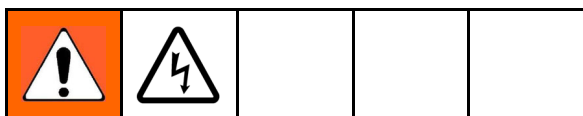
### Replace Heater Element



1. Press  to stop the pumps.
2. Turn off heat zones.
3. Flush pump.
4. Press  to park the Component A Pump.
5. Press  to deactivate the system.
6. Turn off the air compressor, air dryer, and breathing air.
7. Close the main air shutoff valve.



8. Turn main power switch off.




To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.

9. Allow engine dwell time.

### NOTICE

Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.

10. Press  on the engine control module.
11. Open air compressor bleed valve to relieve pressure and remove water from tank.
12. Perform [Pressure Relief Procedure, page 45](#).
13. Wait for heater to cool.
14. Remove heater shroud (271).
15. Disconnect heater element wires from heater wire connector. Test with ohmmeter.

Total Heater Wattage	Element	Ohms
4,000	2000	23–26.5

### Note

The A-side heater element is located in the booster heater end nearest the B-side pump and the B-side heater element is located near the A-side pump.

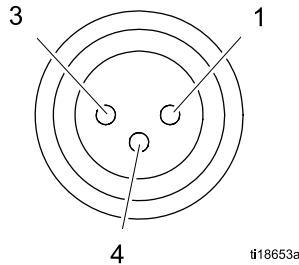
16. To remove heater element, first remove RTD (360) to avoid damage. See step 7, [Replace RTD, page 68](#)
17. Remove heater element (357) from housing (351). Be careful not to spill any fluid left in housing. See [Fig. 23, page 66](#).
18. Inspect element. It should be relatively smooth and shiny. If there is a crusted, burnt, ash-like material adhered to element or sheath shows pitting marks, replace element.
19. Install new heater element (357), holding mixer (359) so it does not block RTD port (P).
20. Reinstall RTD (360), [Replace RTD, page 68](#).
21. Reconnect heater element leadwires to heater wire connector.
22. Replace heater shroud (271).

### Line Voltage

The heater outputs its rated wattage at 240 VAC. Low line voltage will reduce power available and the heater will not perform at full capacity.

## Repair Overtemperature Switch

1. Perform [Shutdown, page 48](#).
2. Wait for booster heater to cool.
3. Remove heater shroud.
4. Open the split loom about 18 in. (457 mm) away from where the overtemperature switch is attached to the heater. Verify "J23 TCM-A/B" and "J23 OVERTEMP-SW" cables are connected. . See [Electrical Schematics, page 131](#).
5. Disconnect overtemperature switch (358) from splitter cable. Test across pins 1 and 3 of connector labeled "J23 OVERTEMP-SW" with ohmmeter.



- a. If the resistance **is not** approximately 0 ohms, the overtemperature switch needs to be replaced. Go to step 6.
- b. If the resistance **is** approximately 0 ohms, test the splitter cable to ensure it is not cut or open. Reconnect the overtemperature switch and splitter. Disconnect the splitter from port 1 on both LPTCMs. Test from pin 1 to 3 at both "TCM-A-1 J23" and "TCM-B-1 J23". Resistance should be approximately 0 ohms.

### Note

The splitter may have failed if one or both of the readings is above approximately 0 ohms. If the readings is approximately 0 ohms, then there may have been a bad connector/connection causing the problem.

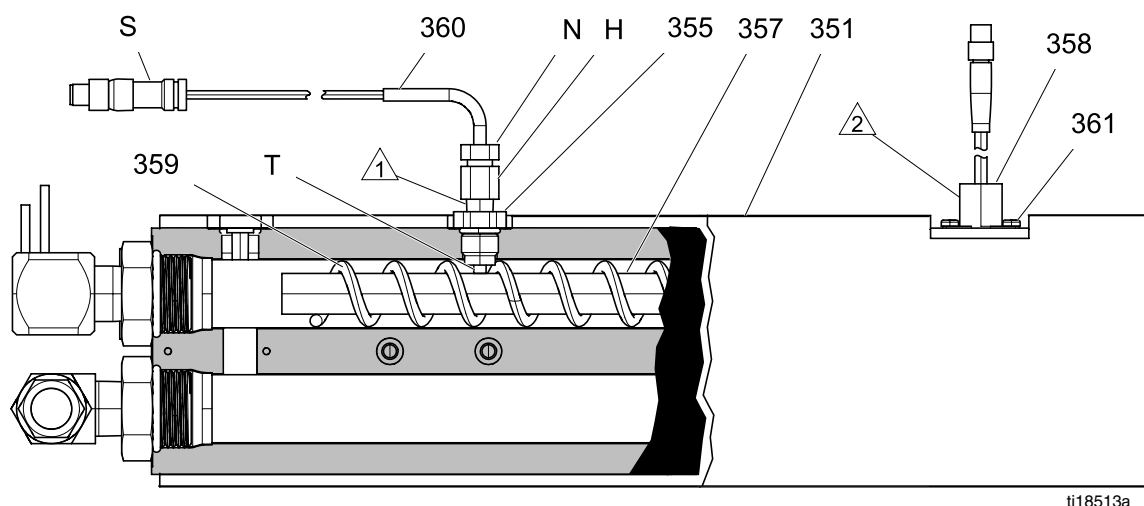
6. If switch fails test, remove screws. Discard failed switch. Apply a thin layer of thermal compound 110009, install new switch in same location on housing (351), and secure with screws (361). Reconnect cables.

## Replace RTD

1. Perform [Shutdown, page 48](#).
2. Wait for heater to cool.
3. Remove heater shroud.
4. B Side RTD: disconnect RTD cable "TCM-B-2 HT-RTD-B" (360) from B side LPTCM (543). See [Electrical Schematics, page 131](#).
5. A side RTD:
  - a. Follow "J24 HT- RTD-A" RTD cable (360) and open split loom about 18 in. (457.2 mm) away from the heater attachment. Disconnect "J24 HT- RTD-A" and "J24 TCM-A" connectors. See [Electrical Schematics, page 131](#).
  - b. Visually inspect "J24 TCM-A" connector and replace extension cable (58) if necessary. Continue to next step if the extension cable connector is not damaged.
  - c. Visually inspect "TCM-A-2 J24" connection to A side LPTCM. Continue to next step to replace RTD (360).



6. Loosen ferrule nut (N). Remove RTD (360) from heater housing (351), then remove RTD housing (H). Do not remove the adapter (355) unless necessary. If adapter must be removed, ensure that mixer (359) is out of the way when replacing the adapter.
7. Replace RTD (360).
  - a. Apply PTFE tape and thread sealant to male threads and tighten RTD housing (H) into adapter (355).
  - b. Push in RTD (360) so tip contacts heater element (357).
  - c. Holding RTD (360) against heater element, tighten ferrule nut (N) 1/4 turn past tight.
8. Route wires (S) as before through split loom and reconnect RTD cable (360) to the B side LPTCM or the A side extension cable (58).
9. Replace heater shroud.
10. Follow startup instructions in the operation manual. Turn on A and B heat simultaneously to test. Temperatures should rise at same rate. If one is low, loosen ferrule nut (N) and tighten RTD housing (H) to ensure RTD tip contacts element (357).



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Figure 23

## Repair Heated Hose

Refer to the heated hose manual 309572 for hose replacement parts.

### Check Hose Heat Connectors

1. Perform [Shutdown](#), page 48.

#### Note

Whip hose must be connected.

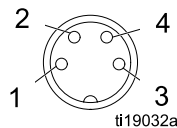
2. Disconnect hose connector (V) at Reactor, see [Fig. 24](#).
3. Using an ohmmeter, check between the connectors (V). There should be continuity.
4. If hose fails test, retest at each length of hose, including whip hose, until failure is isolated.

### Check RTD Cables and FTS

1. Perform [Shutdown](#), page 48.
2. Disconnect RTD cable (C) at Reactor.
3. Test with an ohmmeter between pins of cable connector C.

#### Note

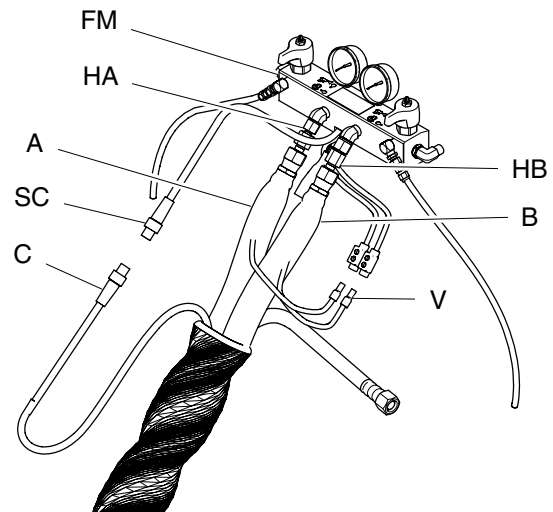
Do not touch outer ring with test probe.



Pins	Result
3 to 1	approximately 1090 ohms
3 to 4	approximately 1090 ohms
1 to 4	0.2 - 0.4 ohms
2 to any	infinity (open)

4. Retest at each length of hose, including whip hose, until failure is located.

5. If the FTS is not reading properly at the end of the hose, connect FTS directly to RTD cable (C) at the manifold.
6. If the FTS reads properly at the manifold but not at the end of the hose, check cable (C) connections. Verify they are tight.



Heated Hose  
Figure 24

#### Note

To assist in taking readings, order RTD Test Kit 24N365. Kit includes two cables: one cable with a compatible female M8 connector and another cable with a male M8 connector. Both cables have stripped wire at the other end for easy test probe access.

Pins / Wire Color	Result
3 to 1 / brown to blue	approximately 1090 ohms
3 to 4 / blue to black	approximately 1090 ohms
1 to 4 / brown to black	0.2 - 0.4 ohms
2 to any / N/A	infinity (open)

## Repair Fluid Temperature Sensor (FTS)

### Installation

The Fluid Temperature Sensor (FTS) is supplied with the system. Install FTS between main hose and whip hose. See Heated Hose manual 309572 for instructions.

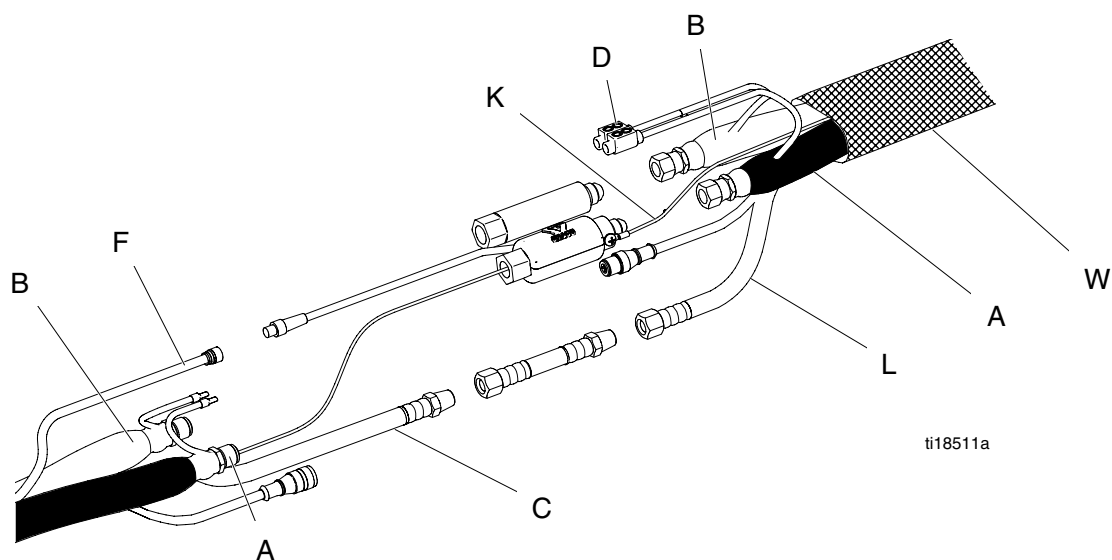


Figure 25

### Test/Removal

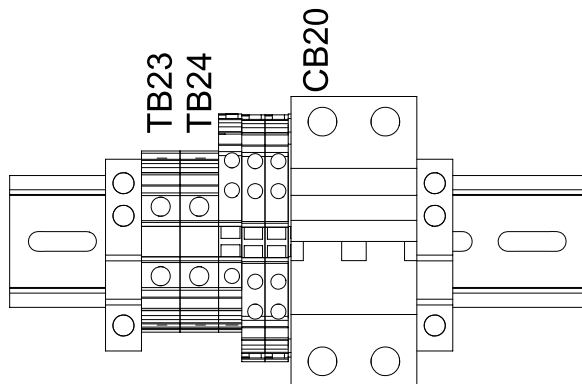
1. Perform [Shutdown, page 48](#).
  2. Remove tape and protective covering from FTS. Disconnect hose cable (F).
  3. If FTS is not reading properly at the end of the hose, see [Check RTD Cables and FTS, page 70](#).
  4. If FTS fails, replace FTS.
- a. Disconnect air hoses (C,L) and electrical connectors (D).
  - b. Disconnect FTS from whip hose (W) and fluid hoses (A, B).
  - c. Remove ground wire (K) from ground screw on underside of FTS.
  - d. Remove FTS probe (H) from component A (ISO) side of hose.

## Transformer Primary Check

1. See [Shutdown, page 48](#).
2. Locate the two smaller (10 AWG) wires, labeled 1 and 2, coming out of transformer. Trace these wires back to terminal blocks TB23 and TB24. Use an ohmmeter to test for continuity between two wires; there should be continuity.

## Transformer Secondary Check

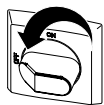
1. See [Shutdown, page 48](#).
2. Locate the two larger (6 AWG) wires, labeled 3 and 4, coming out of transformer. Trace these wires back to circuit breaker CB20 (906). Open the circuit breaker to turn the color indicator on the circuit breaker GREEN. Use an ohmmeter to test for continuity between two transformer wires in circuit breaker terminals 1 and 3; there should be continuity.
3. Close the circuit breaker CB20 (906).




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Figure 26

4. Confirm main power switch is off before starting generator.



5. Start the generator.


Press start button  twice on the engine control module. The controller will automatically sequence glow plug warming and crank operations. Allow engine to reach full operating speed.




### Note




Engine will not start if main power switch is in the on position.

6. Turn main power switch on.



7. Press  to turn on hose heat zone.

				
<p>This equipment is used with heated fluid which can cause equipment surfaces to become very hot. To avoid severe burns:</p> <ul style="list-style-type: none"> <li>• Do not touch hot fluid or equipment.</li> <li>• Allow equipment to cool completely before touching it.</li> <li>• Wear gloves if fluid temperature exceeds 110°F (43°C).</li> <li>• Do not turn on hose heat without fluid in hoses.</li> </ul>				

				
<p>Thermal expansion can cause overpressurization, resulting in equipment rupture and serious injury, including fluid injection. Do not pressurize system when preheating hose.</p>				

8. To verify voltage on the secondary leads of the transformer, measure between the terminals 2 and 4 on CB20. This will verify the circuit breaker is working properly.

Model	Secondary Voltage
310 ft	90 Vac*
210 ft	62 Vac*

\* For 240 Vac line voltage.

9. See the Diagnostic Run Screen on the ADM. The Diagnostic Run Screen displays the incoming (240 Vac) to the HPTCM (TCM-H) "Hose Voltage" and the hose current. The diagnostic screen will show if the circuit breaker has been tripped for the incoming power to the HPTCM.

10/21/11 02:48	Diagnostic	Recipes
E-30i Active	No Active Errors	
Hx A Chem. 82 °F	Hx B Chem. 82 °F	CPM 0
Boost A Chem. 82 °F	Boost B Chem. 82 °F	Hose Chem. 82 °F
Boost A Current 0 A	Boost B Current 0 A	Hose Current 0 A
Boost A PCB 82 °F	Boost B PCB 82 °F	Hose PCB 82 °F
Pressure A 0 psi	Pressure B 0 psi	Hose Voltage 0 V
MCM Bus 0 V	Coolant Outlet 200 °F	Total Cycles 5

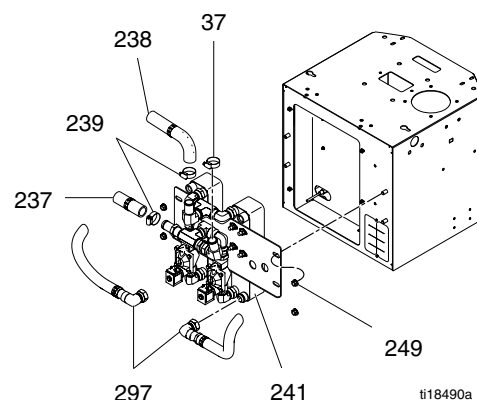
## Replace Transformer

1. Perform [Shutdown, page 48](#).
2. Open Reactor cabinet.
3. Remove bolts holding transformer (226) to cabinet floor.
4. Disconnect the transformer wires. See [Reactor Cabinet Wiring Diagram, page 139](#)
5. Remove transformer (226) from cabinet.
6. Install new transformer (226) in reverse order.

## Replace Heat Exchangers

1. If a wall is installed between the generator and the proportioner, remove the proportioner from the pallet. See [Remove Proportioner, page 86](#).

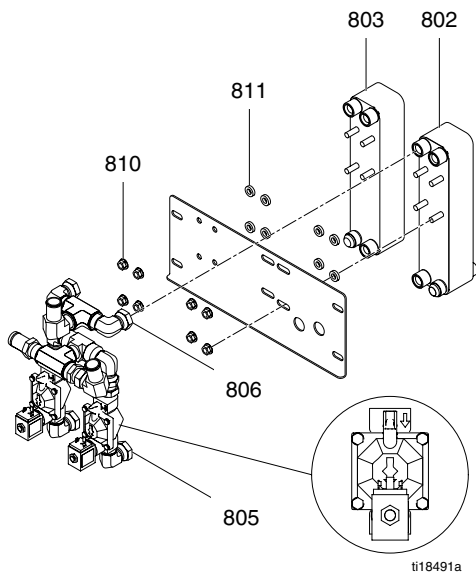
2. Perform [Flushing, page 46](#).
3. Perform [Shutdown, page 48](#).
4. Perform [Drain Coolant, page 49](#).
5. For proportioner heat exchangers:
  - a. Remove fuel tank. See [Remove Fuel Tank, page 79](#).
  - b. Disconnect both RTD connectors (284). See [Replace Proportioner RTD, page 75](#).
  - c. Disconnect A and B material lines from swivel fittings (297).



Proportioner Heat Exchangers  
Figure 27

- d. Disconnect hose clamps (37, 239) from heat exchanger assembly (241).
- e. Remove four nuts (249) and the heat exchanger assembly (241). Pull heat exchanger assembly out of coolant hoses.
- f. Install a new heat exchanger assembly (241) by following the removal steps in reverse order. Orient control valves as shown. Continue to next step to remove heat exchangers (802) or (803).

- g. Disconnect two swivel fittings (805) and swivel fittings on heat exchanger outlet (806) from the heat exchangers (802, 803).

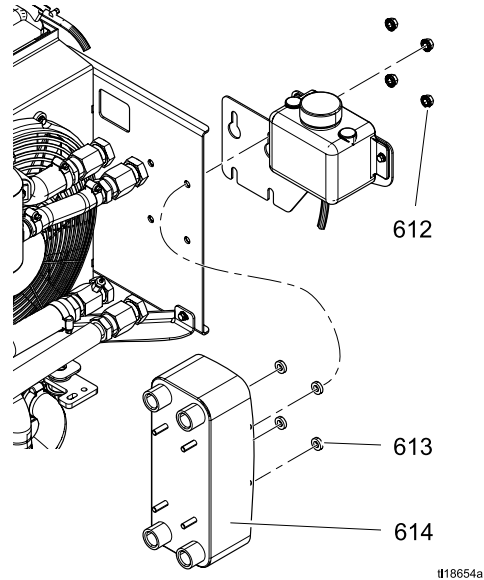


Proportioner Heat Exchangers  
Figure 28

- h. Remove four nuts (810) and washers (811) for replacing heat exchangers (802) or (803).

## 6. For the engine heat exchanger:

- a. Disconnect swivel fittings (617) and (618) from heat exchanger (614).
- b. Remove nuts (612), washers (613), and heat exchanger (614). Set expansion bottle and bracket aside.
- c. Install new heat exchanger (614) in reverse order by following the removal steps in reverse order.



Engine Heat Exchanger  
Figure 29

## Replace Proportioner RTD

1. Perform [Shutdown](#), page 48.
2. Remove Reactor cabinet cover.
3. Disconnect RTD from splitter (277).

### NOTICE

Chemical will release when either RTD is removed from the heat exchangers. To prevent damage to load center and other electronics, protect all electronics from chemicals released from the heat exchanger RTD ports.

The RTD probe cannot be removed from the compression nut.

### NOTICE

To ensure accurate temperature readings, only use RTD Kit 24L972.

4. Remove compression fitting (283) from the back of the heat exchanger with RTD (284) attached.
5. Tighten compression fitting (283) on RTD sheath (284).
6. Apply thread sealant to compression fitting pipe threads (283) and install in heat exchanger.
7. Connect new RTD to splitter (277).

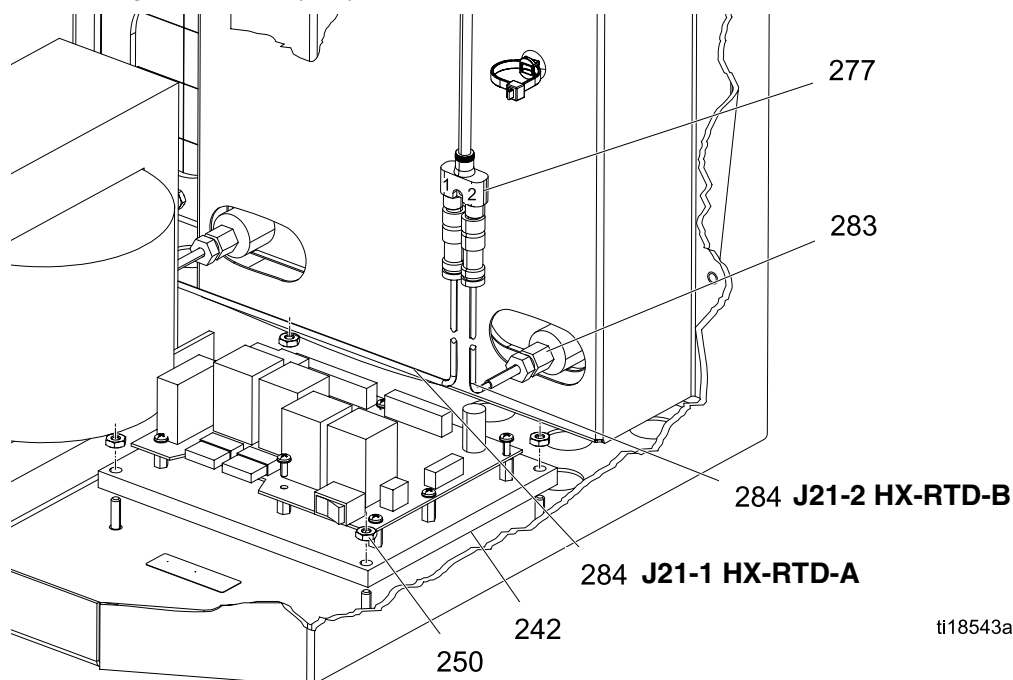


Figure 30

## Replace Control Valve

Follow these instructions to replace a control valve solenoid coil or remove the component A control valve, component B control valve, or the bypass control valve.

1. Perform [Shutdown](#), page 48.
2. Drain coolant from the proportioner coolant loop. See [Drain Coolant](#), page 49.
3. To repair the control valve, remove the four nuts (VN) and washers (VW). Remove the front of the control valve, diaphragm, and gaskets. Purchase Valve Repair Kit 125774. For complete installation instructions see the Control Valve Kits manual 3A1932.
4. To remove the solenoid coil (SC), loosen connector screw and disconnect the coolant valve harness (D). Remove the nut (SN) and washer (SW) from coil. Purchase Valve Coil Replacement Kit 125787. For complete installation instructions see the Control Valve Kits manual 3A1932.

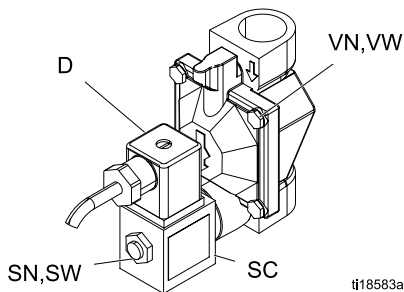
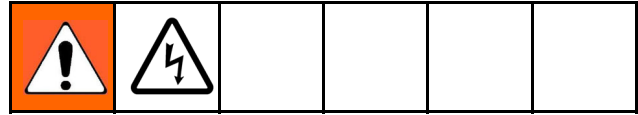
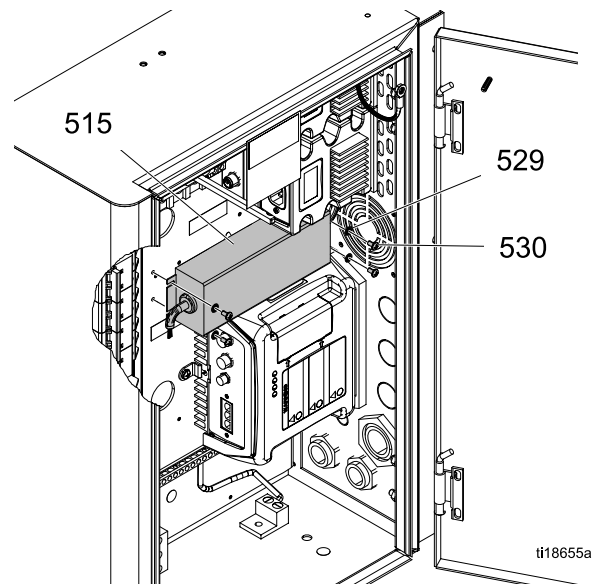


Figure 31

## Replace Power Supply



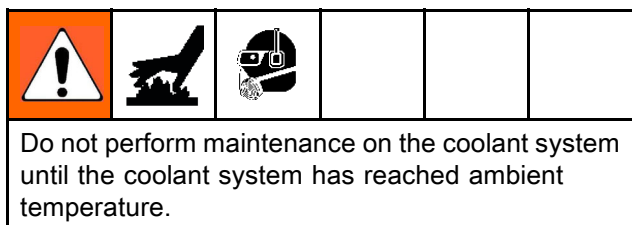
1. Perform [Shutdown](#), page 48.
2. Disconnect power supply cables (515) from HPTCM and terminal blocks. See [Electrical Schematics](#), page 131.
3. Remove fan assembly, screws (530), washers (529), and power supply (515).
4. Install new power supply (515) in reverse order.



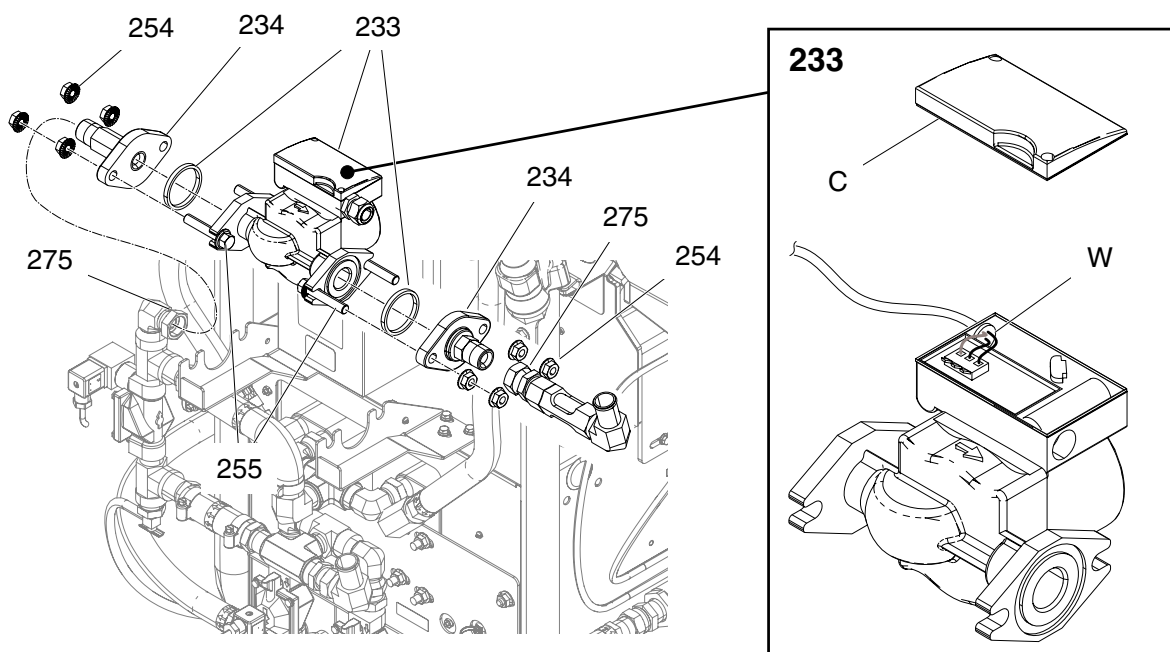
24 VDC Power Supply  
Figure 32



## Replace Circulation Pump



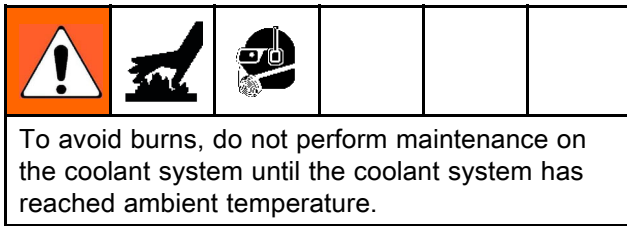
1. Perform [Shutdown](#), page 48.
2. Perform [Drain Coolant](#), page 49.
3. If a wall is installed and the circulation pump can not be accessed, remove the proportioner. See [Remove Proportioner](#), page 86.
4. Disconnect pump fittings (234) from swivel fitting (275).
5. Remove pump cover (C).
6. Press in tabs to disconnect power wires (W).
7. Remove four outside nuts (254). Hold on to the pump flanges (234) and remove the circulation pump (233). Remove four inside nuts (254) to remove flanges from the pump.
8. Place o-rings, supplied with the new circulation pump (233), between the pump and the flange fittings (234). Insert screws (255) through the pump and flange fittings (234) and tighten four nuts on screws (255).
9. Place circulation pump (233) on brackets (223) so that coolant will flow towards the sight glass. Install four nuts (254) on screws (255).
10. Connect power wires to pump and replace cover. See [Reactor Cabinet Wiring Diagram](#), page 139.
11. Connect flange fittings (234) to swivel on the elbow flange fitting (234) and fitting (275).



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Figure 33

## Repair Sight Glass and Filter



1. Drain the proportioner coolant loop. See [Drain Coolant, page 49](#).
2. Loosen hose clamp (37) and pull coolant hose (112) off of elbow fitting (248).

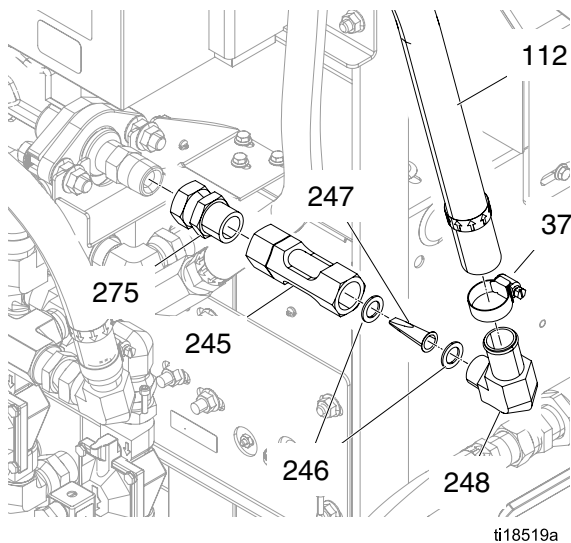


Figure 34

3. Remove elbow fitting (248).
4. Pull out filter (247). Inspect washers (246) and filter. Brush out filter and sight glass (245). Replace if necessary.

5. Insert washer (246) and filter (247) in elbow fitting (248). Connect elbow fitting (248) and sight glass (245).

### Note

To prevent an air pocket from forming inside the coolant lines between the proportioner and generator, ensure there is a constant rise in elevation. Ensure elbow fitting is turned 55°. Failure to have a constant rise in elevation will reduce heating efficiency.

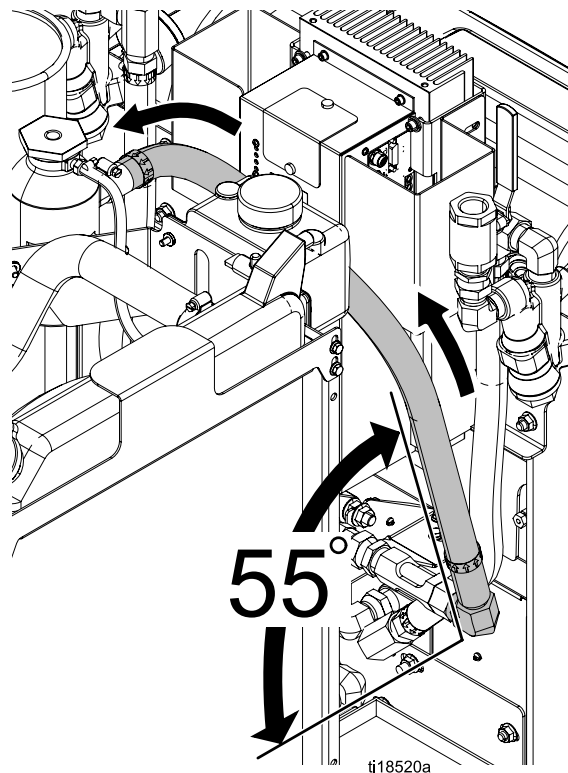


Figure 35

## Remove Fuel Tank

1. Perform [Shutdown, page 48](#).
2. Disconnect fuel lines (38, 39). Keep elevated or plug to prevent siphoning.
3. Remove screws (24) and clamps (30).
4. Slide the fuel tank off the B side of the pallet.
5. Inspect for any damage.
6. Slide fuel tank on to pallet and secure to pallet. Reconnect fuel lines (38, 39).
7. Squeeze prime bulb (P) to prime engine. Press the prime bulb repeatedly until fuel begins to return to the fuel tank.

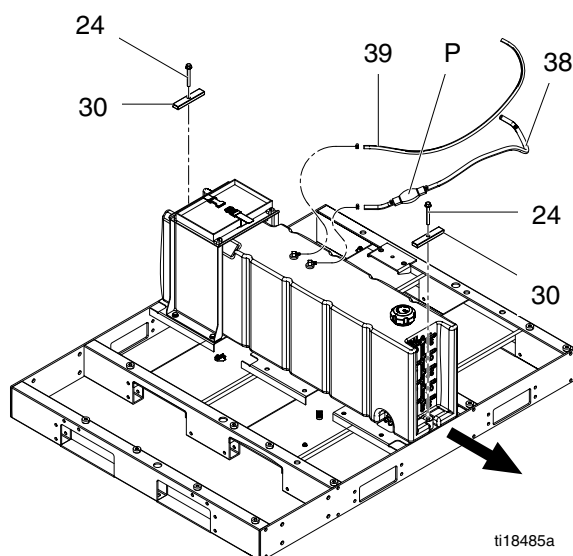


Figure 36

See [Technical Specifications, page 149](#) for battery requirements and recommended battery size.

1. Remove plastic caps (PC) from battery terminals and disconnect battery cables from battery.
2. Disconnect strap and remove battery.
3. Place new battery on bracket and secure with strap.
4. Reconnect battery cables and cover battery terminals with plastic caps (PC). Ensure red cable is connected to the positive (+) battery post. Connect black cable to the negative (-) battery post.

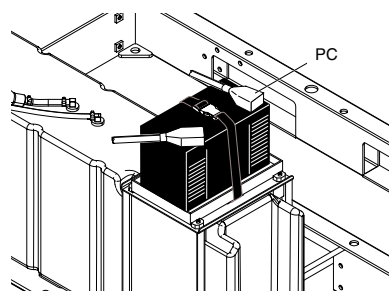


Figure 37

### NOTICE

Always connect the red battery cable to battery positive (+) terminal and the black battery cable to the battery negative (-) terminal. Failure to properly connect the battery cable to the battery will damage the fusible link harness. Do not bypass the fusible link when damaged. The fusible link prevents damage to other system components.

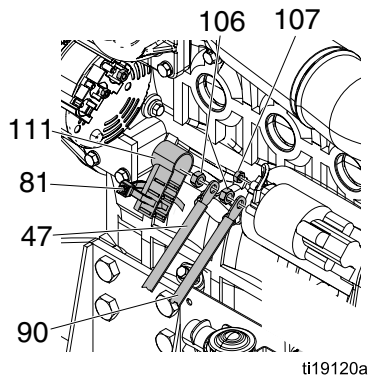
## Replace Battery

<p>Improper battery installation or maintenance may result in electric shock, chemical burns, or explosion. Battery maintenance must only be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.</p>					

## Repair Fusible Link Harness

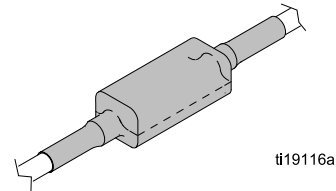
Follow this procedure to replace fuses inside the fusible link harness (90). See [Electrical Schematics, page 131](#), for fusible link harness connections and wire identification.

1. Perform [Shutdown, page 48](#).
2. Disconnect battery from system.
3. Determine which fuse (F8, F9) needs to be replaced.
  - a. Cut cable tie (81) and remove red insulator cap (111) over the positive stud on the engine starter. Remove the outside nut (106) and red battery cable (47) . Disconnect fusible link harness (90) ring terminal from the engine starter.

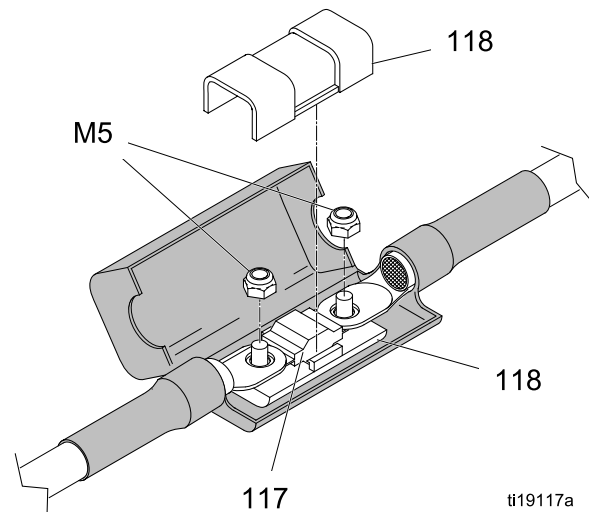


- b. Using a multimeter, measure continuity through the harness ring terminals. See Table 1.
  - c. If one of the two wire paths measures “open”, then the fuse (F8, F9) in that path is blown and needs to be replaced.

4. Remove fusible link harness (90) from engine.
5. Carefully cut open heat shrink encasing the fuse holder along lines shown.



6. Pull away heat shrink. Squeeze the fuse holder cover and disconnect from base latches. If latches break off, replace entire fuse holder with fuse holder (118) shipped loose with the system.



7. Remove two M5 nuts from fuse holder base.
8. Replace blown 60 amp fuse in the fuse holder base with new fuse (117). New fuse (117) is shipped loose with the system.

**Table 1 Fusible Link Harness Connections**

Fuse (117)	Wire No.	Ring Terminal Location	Wire No.	Ring Terminal Location
F8	C010 and C030	Engine starter positive power lug	C020	12 V charge alternator B+ terminal
F9	C010 and C030	Engine starter positive power lug	C040	Starter solenoid relay (CR6)
			C050	Glow plug solenoid relay (CR7)

9. Replace M5 nuts over fuse and ring terminals. Torque to 44 in.-lbs (5 N•m).
10. Connect fuse holder cover to fuse holder base. Wrap entire fuse holder and heat shrink 3–4 times with tape (44).

**NOTICE**

Ensure tape entirely covers heat shrink. Failure to seal the cut heat shrink with tape may allow fluid to contact fusible link and damage the fusible link.

11. Connect fusible link harness (90) and battery cable to engine starter with nuts (106). Secure to solenoid relay bracket with cable ties (81), shipped loose with system.
12. Snap the cap insulator (111) over the red battery cable (47). Position the red cap insulator so that the stud is not exposed.

13. Insert cable tie (81) through cap insulator (111) and tighten to the red battery cable (47). Ensure that the stud is not exposed.
14. Reconnect black battery cable to the negative (-) battery terminal and the red battery cable to the positive (+) battery terminal.

**NOTICE**

Always connect the red battery cable to battery positive (+) terminal and the black battery cable to the battery negative (-) terminal. Failure to properly connect the battery cable to the battery will damage the fusible link harness. Do not bypass the fusible link when damaged. The fusible link prevents damage to other system components.

## Remove Radiator

### NOTICE

Do not damage fins on radiator. Damaged radiator fins will result in poor radiator performance or cause a coolant leak.

1. Drain the engine coolant loop. Follow [Drain Coolant, page 49](#).
2. Remove radiator air exhaust duct, if used.
3. Remove screws (17) and back panel (8).

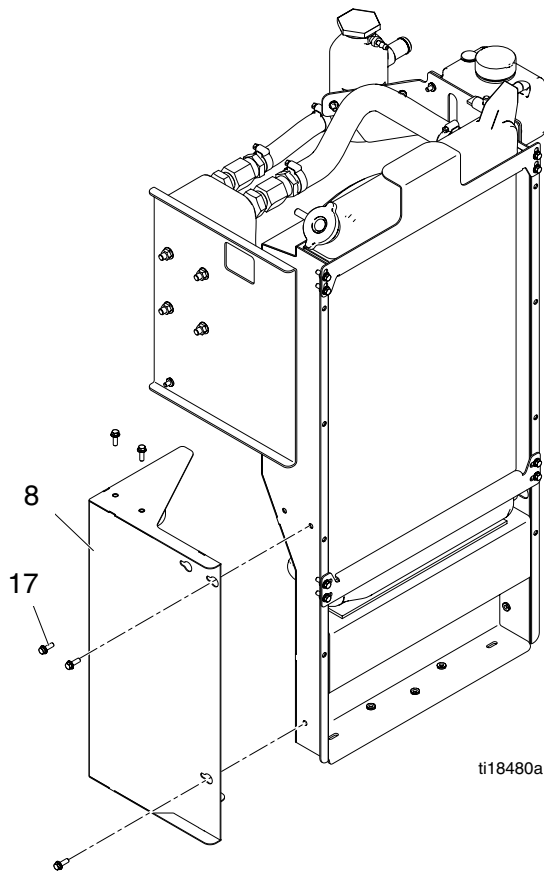


Figure 38

4. Remove eight screws (605), top bracket (604), and bottom bracket (606).
5. Loosen hose clamps (622) and coolant hose from radiator (603) inlet and outlet.
6. Carefully swing the bottom of the radiator (603) away from the engine and lift out of cover (601).

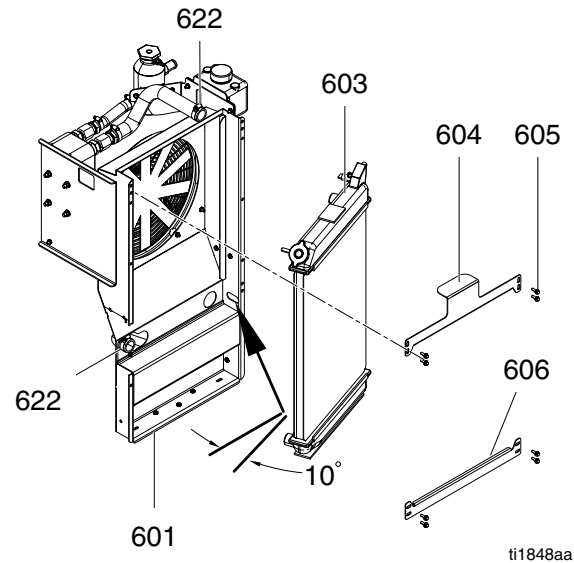


Figure 39

7. Inspect radiator for any obstructions. Replace or have serviced, if necessary.
8. Install new radiator assembly in reverse order.
9. Follow [Refill Engine Coolant Loop, page 51](#).

## Repair Advanced Display Module (ADM)

1. Loosen screw in bracket (402). Lift up on bracket (402) and remove ADM (27).
2. Disconnect CAN cable (57).
3. Inspect ADM for damage. Replace if necessary.

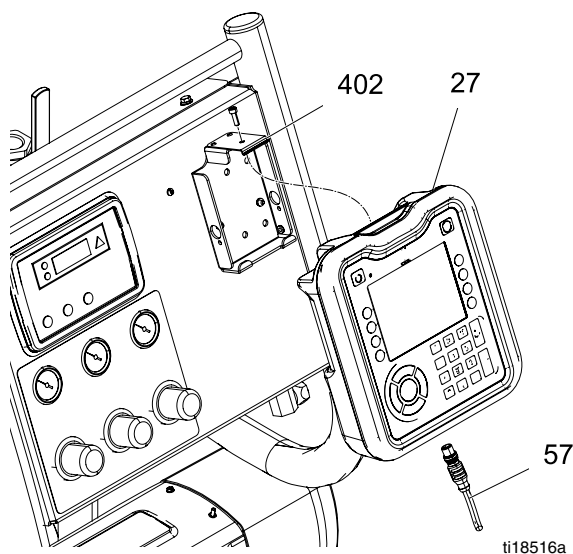


Figure 40

## Repair Engine Control Module

1. Perform [Shutdown](#), page 48.
2. Remove two top screws (17) and loosen the two side screws to lower the back panel (28).
3. Disconnect harness (M) and harness (F) connectors from the back of the engine control module (428). See [Engine Control Module Wiring Diagram](#), page 142
4. Loosen engine control module mounting screws and remove the engine control module (428).
5. Install new engine control module (428) in air control panel. Secure clips in place and tighten mounting screws.
6. Connect all wire harnesses and close the back panel with two screws (17).

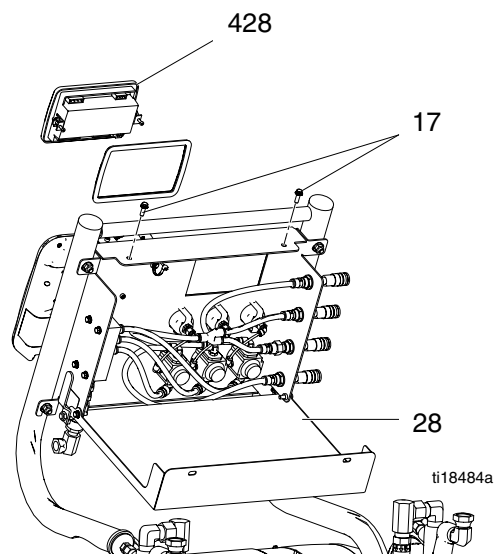


Figure 41

## Replace Motor Control Module (MCM)

See [Fig. 42, page 85](#).

1. Perform [Shutdown, page 48](#).
2. Remove four screws (73, 74) and two guards (68).
3. Disconnect connectors from MCM (205). Disconnect two power cables. See [Electrical Schematics, page 131](#).
4. Loosen top two bolts (258) and remove five lower screws (258) and washers (256, 257). Two mounting locations use lock tooth washer (282).
5. Lift the MCM (205) out of bracket.
6. Install two screws (258) and washers (256, 257) in top of new MCM (205).
7. Slide MCM (205) in bracket and allow the MCM to rest on the top two screws (258).
8. Install mounting screws (258) and washers (256, 257). Only two mounting locations use lock tooth washer (282).
9. Ensure rotary switch is set to proper position for E-30i or E-XP2i system. 0= E-30i and 1= E-XP2i.
10. Connect connectors to MCM. See [Electrical Schematics, page 131](#).

## Replace High Power Temperature Control Module (HPTCM)

See [Fig. 44, page 85](#).

1. Perform [Shutdown, page 48](#).

2. Remove hole plug, screw (551), and washer (554) from the back side of the electrical enclosure.
3. Open electrical enclosure door (502).
4. Disconnect all connectors from the HPTCM (542) inside and outside the power distribution box.
5. Remove screw (551) and washer (554) from mounting bracket (536).
6. Install new HPTCM module (542). Reassemble parts in reverse order.

## Replace Low Power Temperature Control Module (LPTCM)

See [Fig. 43, page 85](#).

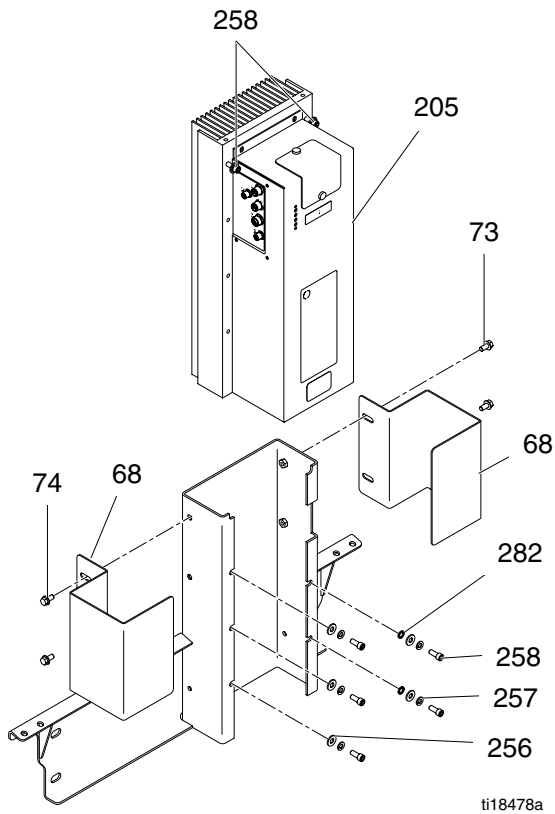
1. Perform [Shutdown, page 48](#).
2. Open electrical enclosure door (502).
3. Disconnect all connectors from the LPTCM (543) inside and outside the power distribution box.
4. Loosen mounting bolts on LPTCM (543) and disconnect module from base (544).

### Note

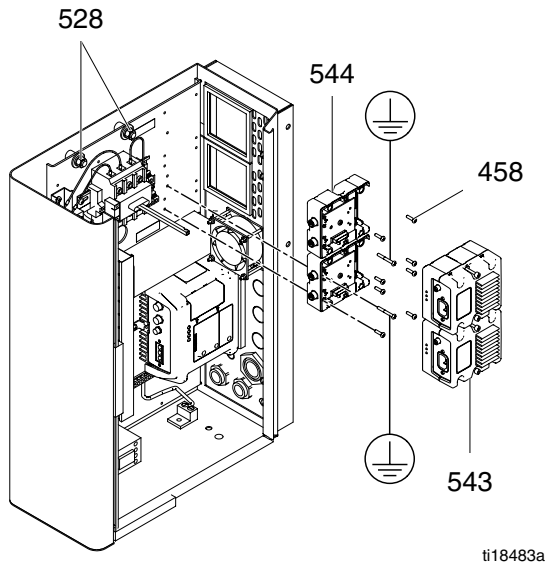
Loosen nuts (528) to slide the back electrical panel to the left to remove module or base mounting bolts.

5. If the base needs to be replaced, disconnect CAN cables, remove four mounting screws (458), and remove ground screw in base (544).
6. Reassemble parts in reverse order.

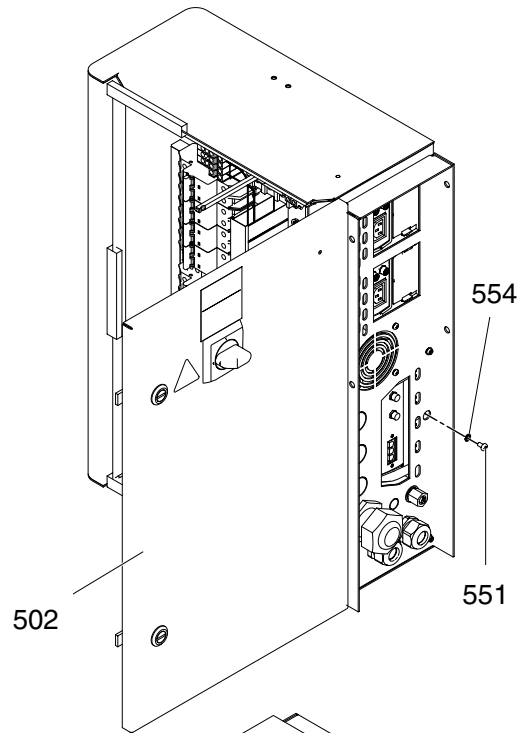




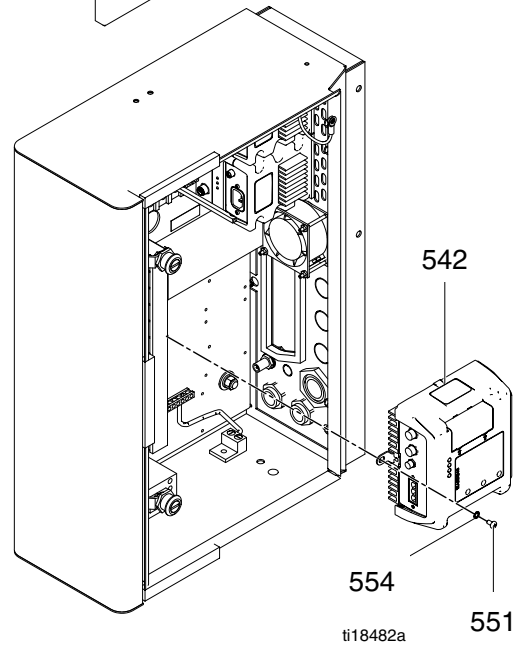
MCM Repair  
Figure 42



LPTCM Repair  
Figure 43



HPTCM Repair  
Figure 44



## Remove Proportioner

Only remove the proportioner from the pallet to repair the heat exchangers or coolant valves between the proportioner and generator.

<p>The back of the proportioner could slide off of the pallet and support brackets during removal and installation. Never remove the proportioner from the system pallet alone. Always use two or more people and supports remove and install the proportioner from the pallet.</p>				

1. Perform [Shutdown](#), page 48.
2. Drain the proportioner coolant loop. See [Drain Coolant](#), page 49.
3. Place an empty pallet in front of the proportioner (23) and center the pallet cross beam with the proportioner.

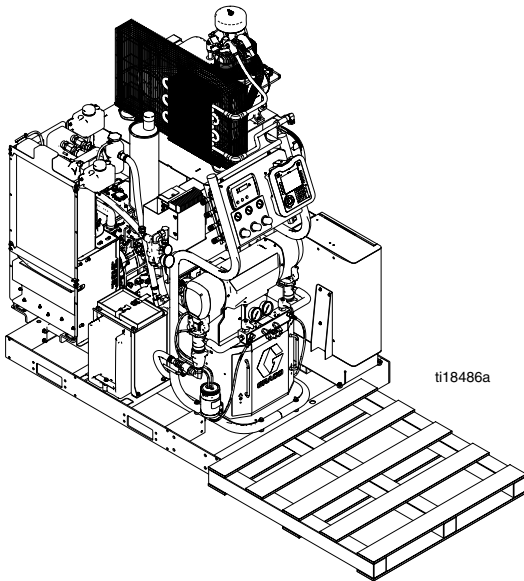


Figure 45

4. Loosen the coolant clamps (37) and disconnect the proportioner coolant outlet and inlet coolant lines (112, 113).

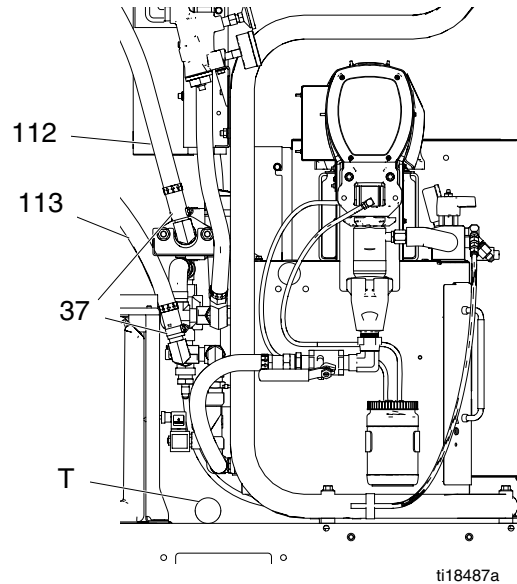


Figure 46

5. Cut the cable tie (T) that secures the wire harnesses behind the A side of the proportioner (23) to the pallet (1).
6. Disconnect engine wire harness E connectors (49) from J1 and J2 from the load center (242). See [Load Center Wiring Diagram](#), page 140. Cut engine harness cable ties inside the proportioner cabinet and pull out the backside of the cabinet.
7. Disconnect the engine coolant temperature cable (59).

### Note

The cable connections will be almost under the fuel tank mounting location. If necessary, remove fuel tank or access the connector from other side of wall.

8. If a wall is installed between the proportioner (23) and generator continue to step 9. See [Remove Fuel Tank](#), page 79, if the fuel tank (29) is mounted on the pallet (1).

9. Loosen the front two mounting screws (24) and remove the back two mounting screws (24).

### NOTICE

The back of the proportioner could slide off of the pallet and support brackets during removal and installation. To prevent damage to the proportioner, always use two or more people and supports.

10. Use 6 in. x 6 in. x 11 in. pieces of wood (S1, S2, S3, and S4) to support the proportioner during the removal and installation process.

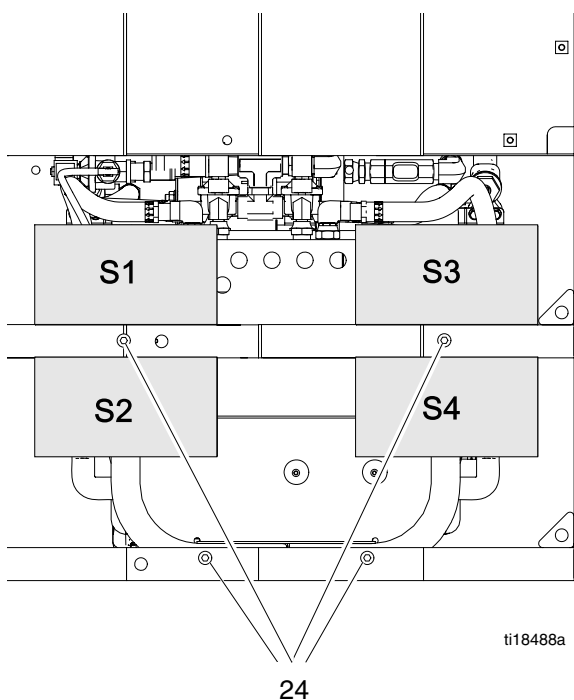


Figure 47

11. Place two supports near both sides of the front of the proportioner (23). Have one person carefully

tip the proportioner forward and the other person center the four supports under both sides of the proportioner frame.

12. Have one person hold the proportioner in place and the other remove the two front mounting screws (24).

### NOTICE

Do not strain wire harness between proportioner and electrical enclosure to prevent damage to connectors.

13. Carefully slide the proportioner (23) off the pallet support brackets and on to the wood supports. Continue to slide the proportioner off the front of the pallet until there is enough space to service the backside components.

14. Secure the proportioner frame to the empty pallet you positioned on the floor with c-clamps.

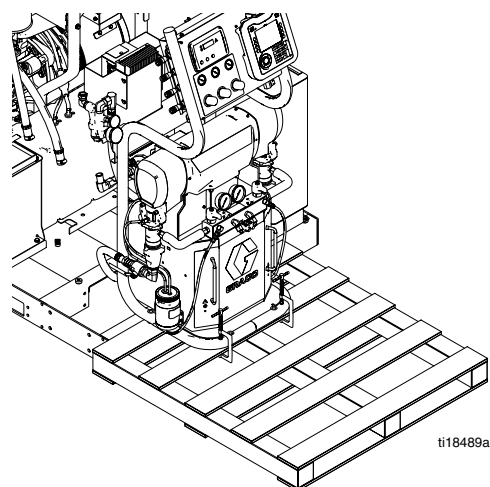


Figure 48

## Repair

15. The proportioner is ready for servicing.
16. To install the proportioner (23) on the pallet (1), ensure the wood proportioner frame supports, inside the proportioner pallet (1), are aligned with both sides of the proportioner frame.
17. Guide cables behind the proportioner (23) when sliding the proportioner back to the mounting position. Secure the proportioner frame to the pallet with four mounting screws (924). Torque to 40 ft-lbs (54 N•m).
18. Route the engine wire harness E connectors (49) through the back of the proportioner (23) and connect wire harness connectors to J1 and J2 connectors on the load center (242). Reconnect engine coolant temperature cable (59).
19. Secure all harnesses to pallet and inside cabinet with cable ties.

## Repair Engine

Contact your nearest Perkins distributor for repair and maintenance.

## Replace Engine RTD

1. Perform [Shutdown](#), page 48.
2. Drain the engine coolant loop. See [Drain Coolant](#), page 49.
3. Disconnect RTD cable (632) from extension cable (59).
4. Remove compression fitting (619) and RTD (632) from the fitting. The RTD probe (632) cannot be removed from the compression nut (619).
5. Apply anaerobic sealant to compression fitting threads (619) and install in fitting at a 30° angle.

### Note

To prevent poor heating performance, use RTD Kit 24L974.

6. Connect new RTD cable (632) to extension cable (59).
7. Refill the engine coolant loop. See [Refill Engine Coolant Loop](#), page 51.

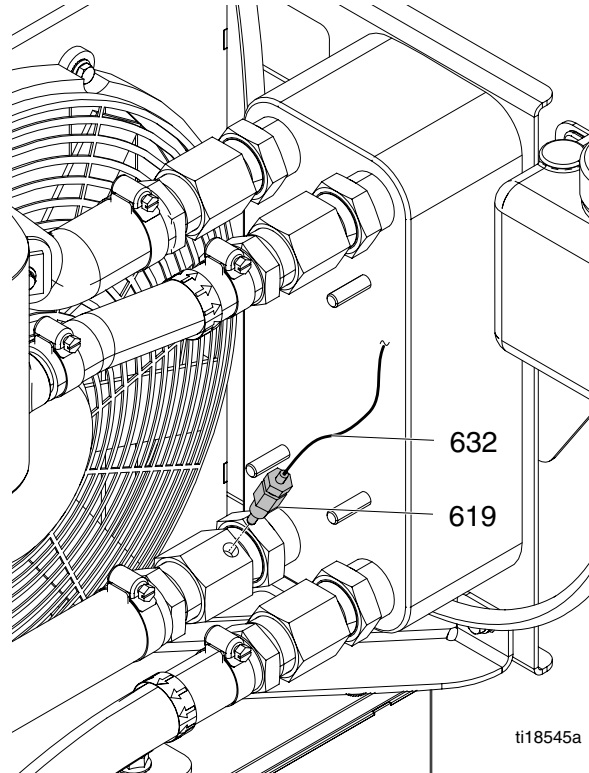


Figure 49

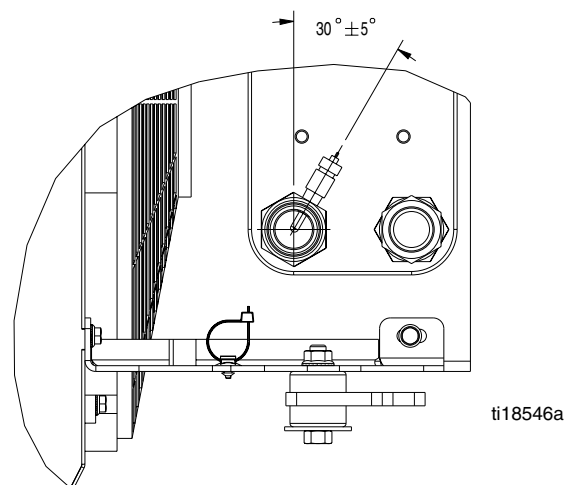


Figure 50

## 12V Charge Alternator

Contact your nearest Perkins distributor for repair and maintenance.

# Parts

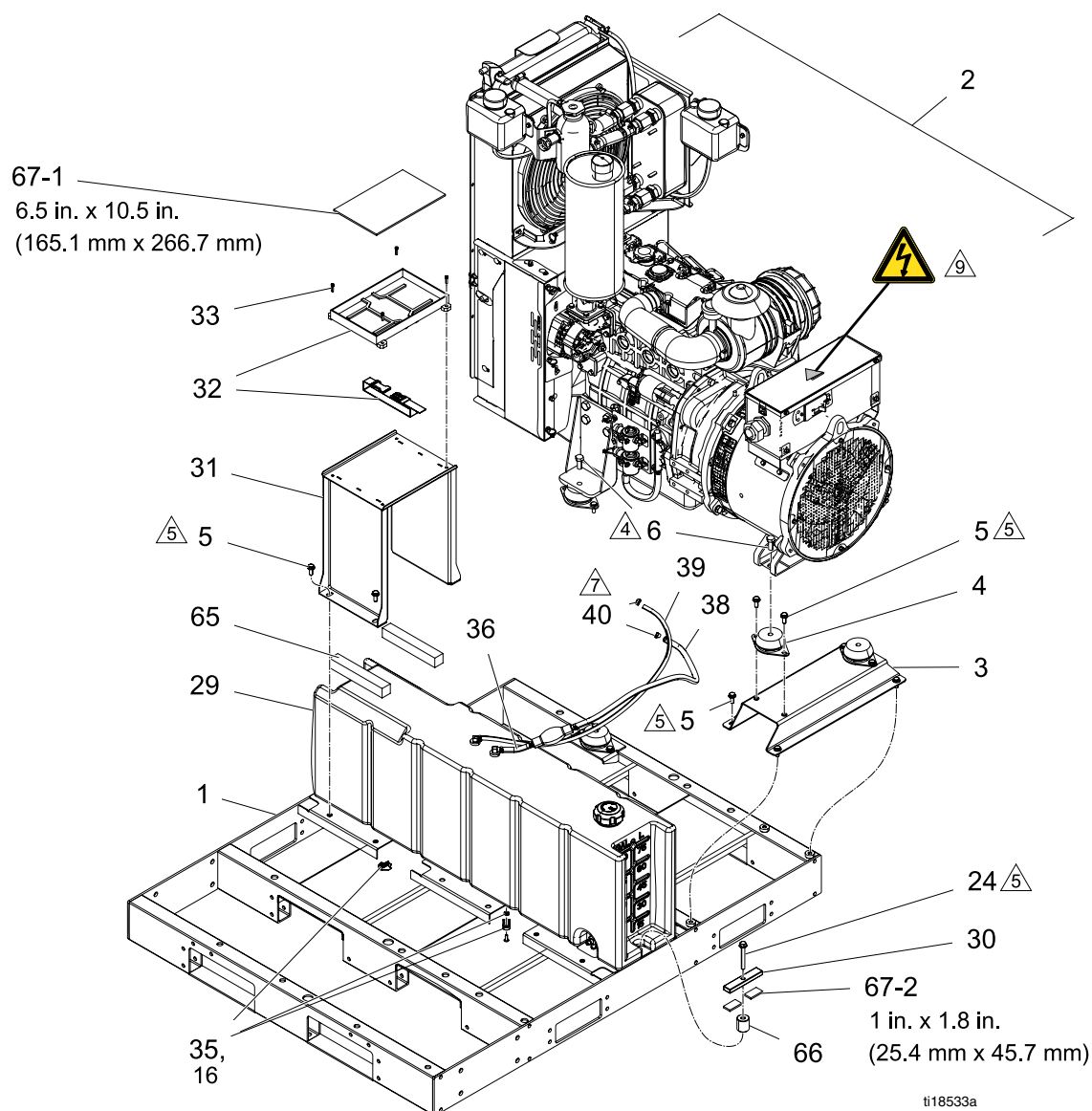
## Systems

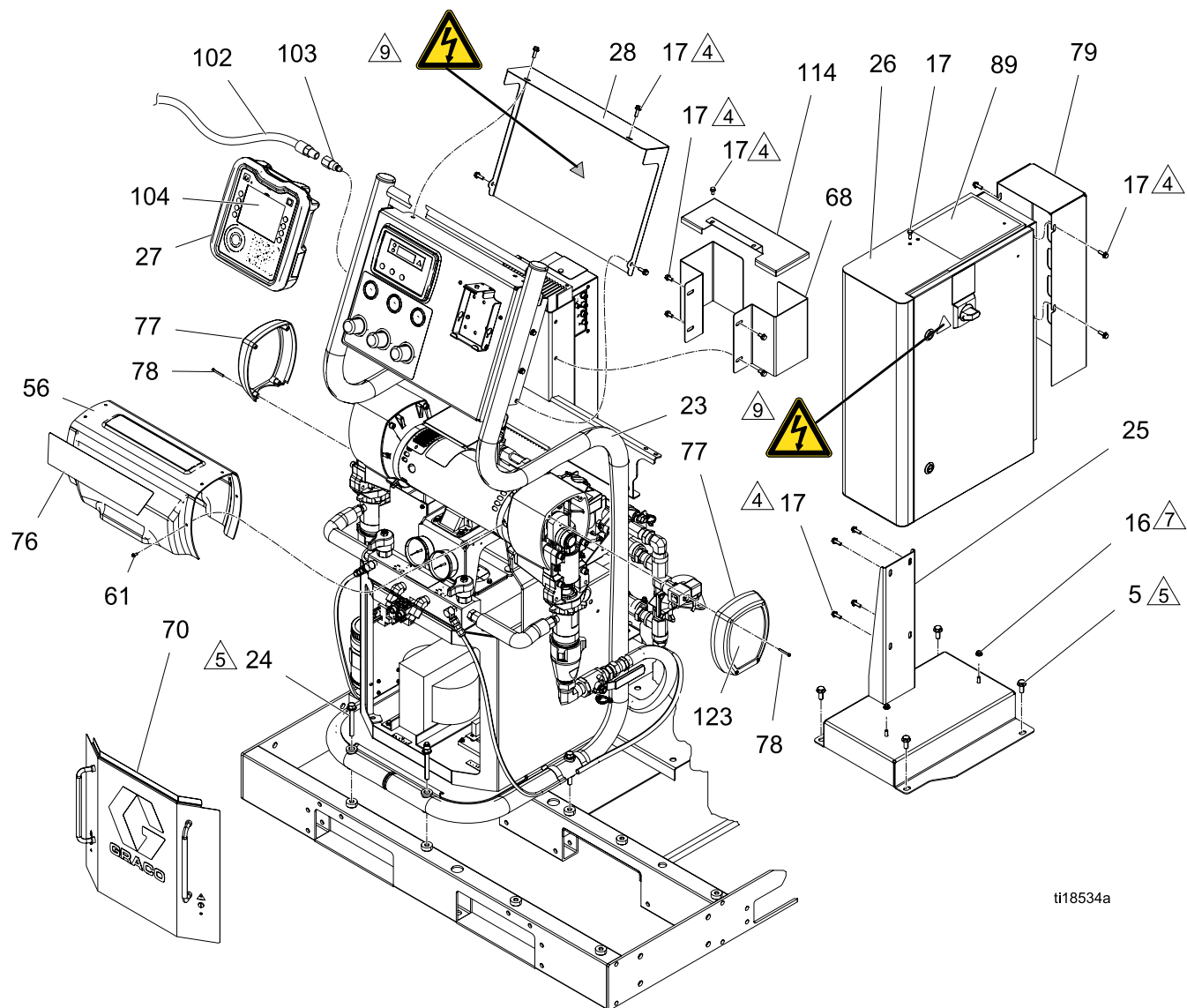
259079, E-30i

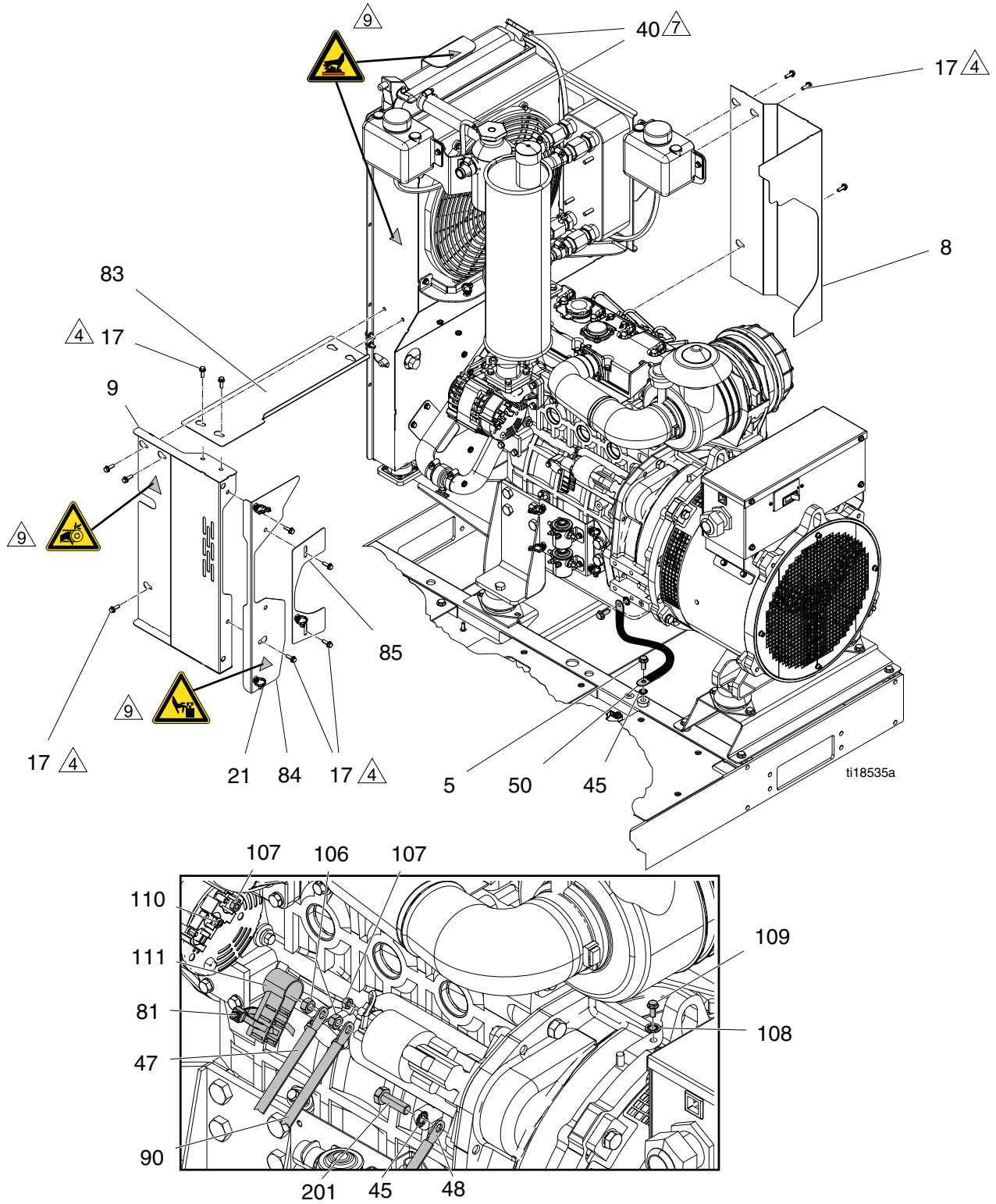
259080, E-30i with Booster Heat

259081, E-XP2i with Booster Heat

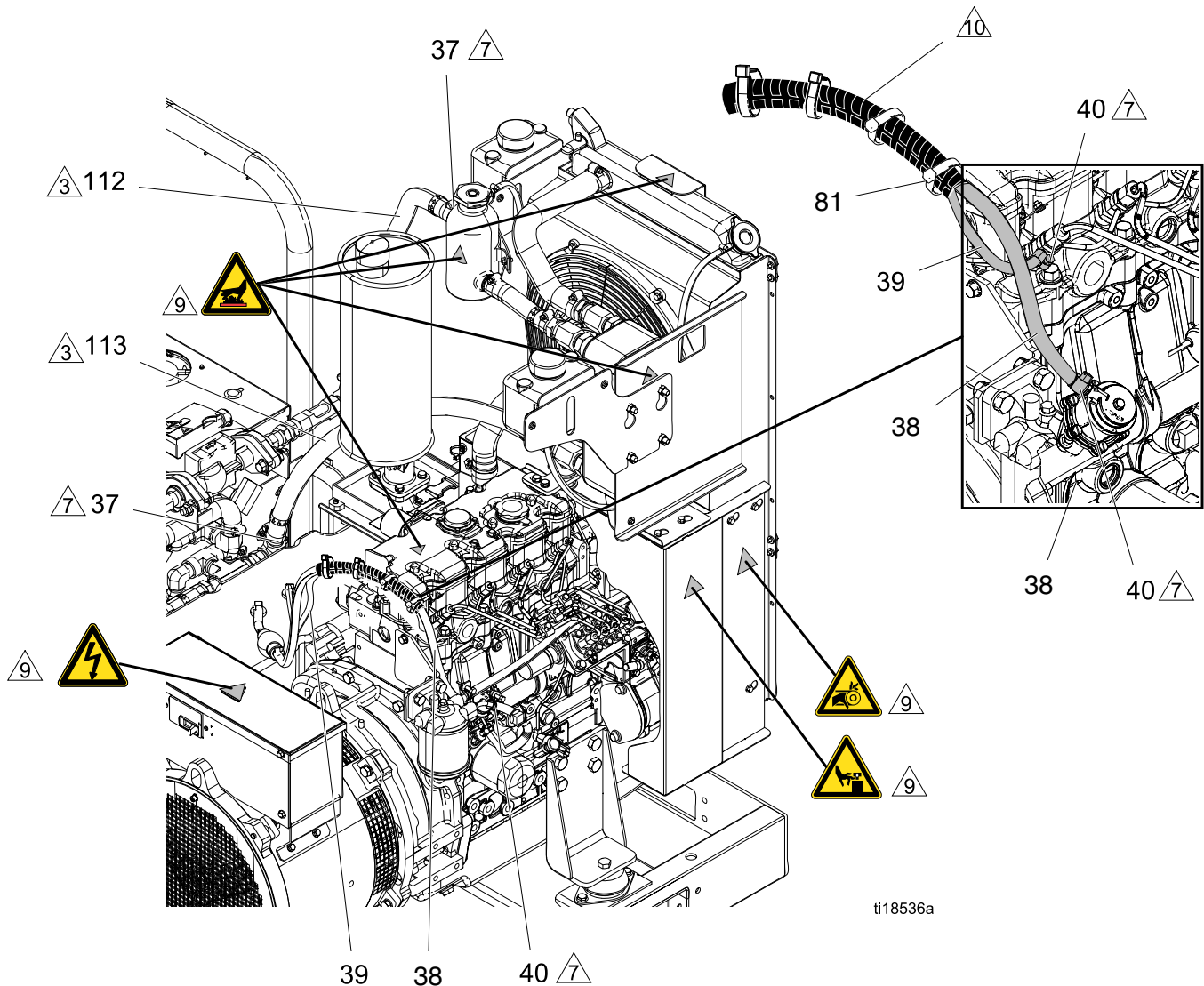
For systems with an air compressor, see [259089](#), [259090](#), and [259091](#), page 97.



















ti18536a

-  Apply anaerobic sealant to all non-swiveling pipe threads.
-  Apply lubrication to all push-on hoses prior to assembly.
-  Torque to 25 ft-lbs (33.8 N•m).
-  Torque to 40 ft-lbs (54 N•m).
-  Torque to 15–20 in.-lbs (1.7–2 N•m).

-  Torque to 25 in-lbs (2.8 N•m).
-  Safety and warning labels are from label sheet (55).
-  Bundle fuel lines above engine, inside flexible plastic split conduit, with cable ties (81) to avoid direct contact.



Ref	Part	Description	Quantity		
			259079	259080	259081
1	24J658	BASE, pallet	1	1	1
2	—	GENERATOR, diesel, 22kw, see <a href="#">22kW Diesel Generator, page 121</a>	1	1	1
3	16H732	SUPPORT, generator	1	1	1
4	24L953	KIT, isolator (4 pack)	1	1	1
5	111192	SCREW, cap flange hd; 0.875 in. (22 mm), 3/8–16	22	22	22
6	105324	SCREW, cap, hex hd; 1.2 in (30 mm), M12 x 1.75	4	4	4
8	16H898	GUARD, engine, right	1	1	1
9	16H894	GUARD, engine, left	1	1	1
16	115942	NUT, hex, flange head; 1/4–20	4	4	4
17	113161	SCREW, flanged, hex hd; 0.5 in. (13 mm), 1/4–20	36	36	36
21	125625	TIE, cable, fir tree	5	5	5
23	—	PROPORTIONER, E–30i, (230v, 1ph), see <a href="#">Proportioners, page 101</a>	1		
	—	PROPORTIONER, E–30i, (4.0kw, 230v, 1ph), see <a href="#">Proportioners, page 101</a>		1	
	—	PROPORTIONER, E–xp2i, (4.0kw, 230v, 1ph), see <a href="#">Proportioners, page 101</a>			1
24	125626	SCREW, hex hd, flanged; 3 in. (76 mm), 3/8–16	6	6	6
25	16H456	BRACKET, mounting	1	1	1
26	—	ENCLOSURE, electrical, heat, see <a href="#">Electrical Enclosure, page 118</a>		1	1
	—	ENCLOSURE, electrical, non-heat, see <a href="#">Electrical Enclosure, page 118</a>	1		
27	24L948	MODULE, ADM	1	1	1
28	16H880	COVER, air panel	1	1	1
29	24K390	TANK, fuel, see <a href="#">Fuel Tank, page 128</a>	1	1	1
30	16J889	BRACKET, support, fuel tank	2	2	2

## Parts

Ref	Part	Description	Quantity		
			259079	259080	259081
31	24J690	SUPPORT, battery	1	1	1
32	125166	TRAY, battery	1	1	1
33	107251	SCREW, pan hd; 1 in. (25.4 mm), #10–24	4	4	4
34✖	24M174	STICKS, level, A and B side, 55 gal. (208 l)	1	1	1
35	16K214	HOLDER, cable, tie	4	4	4
36	16N585	HOSE, FUEL, 5/16 in., 0.33 ft (0.1 m)	1	1	1
37	125370	CLAMP, hose, dia. 11/16-1-1/2 in.	4	4	4
38	16N584	HOSE, FUEL, 5/16 in., 3 ft (1 m)	1	1	1
39	16N583	HOSE, fuel, 3/16 in.; 4 ft (1.2 m)	1	1	1
40	125163	CLAMP, hose, 7/32 in.-5/8 in.	6	6	6
43✖	206995	FLUID, TSL™, 1 qt.	2	2	2
44✖	106569	TAPE, electrical	1	1	1
45	100639	WASHER, lock	3	3	3
47●❖	—	CABLE, battery, 30 in. (762 mm), red	1	1	1
48●❖	—	CABLE, battery, 30 in. (762 mm), black	1	1	1
49●	16K301	HARNESS E, DC, diesel, engine	1	1	1
50	125751	CABLE, grounding, braided, engine	1	1	1
51●	125752	HARNESS M, AC, sense, genset control	1	1	1
52●	125753	CABLE, AC, power, 240v alternator	1	1	1
53●	16K299	HARNESS H, DC, disconnect check	1	1	1
54●	125756	HARNESS N, AC, power, reactor cart	1	1	1
55▲	16K939	LABEL, identification	1	1	1
56	16K398	SHIELD, motor, E-30i	1	1	1
57●	121002	CABLE, CAN, female / female, 5 ft (1.5 m)	1	1	1
58●	125358	CABLE, M8, 4-pin, mf, 1.6 ft (0.5 m), molded		1	1
59●	122837	CABLE, M8, 4-pin, mf, 9.8 ft (3 m), molded	2	2	2
60●	123652	CABLE, CAN, male / female, 11.4 ft (3.5 m)	1	1	1
61	115492	SCREW, slot hex wash hd; 0.375 in. (9.5 mm), 8–32	8	8	8
62●	125762	CABLE, volex, 16 AWG, male, 76 in. (1930 mm)		2	2
65	16K362	FOAM, support block	2	2	2

Ref	Part	Description	Quantity		
			259079	259080	259081
66	16K363	SPACER, fuel tank	2	2	2
67	16H910	GASKET, radiator isolation	1	1	1
68	16K765	GUARD, MCM cables	2	2	2
70	246976	COVER, assembly (main cabinet)	1	1	1
71✕	24K207	KIT, FTS, RTD, single hose; see heated hose manual	1	1	1
72●	125760	HARNESS, splitter, parallel, M8-3		1	1
76	16M127	LABEL, integrated reactor, E-30i	1	1	
76	16M128	LABEL, integrated reactor, E-XP2i			1
77	193546	COVER, drive	2	2	2
78	114818	SCREW, self-tap, fil hd; 1.25 in. (31.75 mm), 8-32	8	8	8
79	16M207	COVER, electrical, side, panel	1	1	1
81✕	125871	TIE, cable, 7.50 in.	33	33	33
83	16M317	GUARD, engine, top	1	1	1
84	16M319	GUARD, alternator, mount	1	1	1
85	16M321	GUARD, alternator, plate	1	1	1
87✕	16K761	INSTRUCTIONS, startup; not shown	1	1	1
88✕	16K913	INSTRUCTIONS, shutdown; not shown	1	1	1
89▲	15G280	LABEL, warning	1	1	1
90●	24L964	HARNESS, DC, link, fusible	1	1	1
91●	125754	CABLE, AC, alternator breaker, black	1	1	1
92●	125755	CABLE, AC, alternator breaker, red	1	1	1
93●	125822	CABLE, AC, alternator, neutral to ground	1	1	1
94●	16K297	HARNESS F, DC, genset controller	1	1	1
95✕	16M399	LABEL, cable, self-laminate, top level	1	1	1

## Parts

Ref	Part	Description	Quantity		
			259079	259080	259081
96✖	552069	LABEL, metallized	2	2	2
98●	120448	SUPPRESSOR, box snap, ferrite	1	1	1
99●	125835	CLIP, ferrite bead	3	3	3
100●	125839	CLIP, ferrite bead	1	1	1
102	109124	HOSE, coupled, 48 in. (1219.2 mm), 1/4–18 NPT	1	1	1
103	169967	FITTING, line air; 1/4–18 NPT (f)	1	1	1
104	15V551	SHIELD, membrane, ADM (10 pack)	1	1	1
105✖	16M459	TOKEN, GCA, Integrated Reactor	1	1	1
106	105329	NUT, hex; M8 x 1.25	2	2	2
107	114816	NUT, hex; M6 x 1	3	3	3
108	100186	WASHER, lock, internal tooth	1	1	1
109	15V909	SCREW, 1/2 in. (12 mm), M8 x 1.25	1	1	1
110	110911	NUT, hex; M5 x 0.8	1	1	1
111	126054	INSULATOR, cap	1	1	1
112✖	16N577	HOSE, coolant, 1 in. ID, 2.66 ft (0.81 m)	1	1	1
113✖	16N578	HOSE, coolant, 1 in. ID, 2.92 ft (0.89 m)	1	1	1
114	24N281	COVER, MCM	1	1	1
115✖	169970	FITTING, airline; 1/4–18 NPT (m)	3	3	3
116✖	15V837	SENSOR, RTD, 18 in. (457 mm)	1	1	1
117✖	16P405	FUSE, bolt-down, 60A	1	1	1
118✖	16P406	HOLDER, fuse, bolt-down	1	1	1
123	15M508	LABEL, end cover	2	2	2

▲ Replacement Warning labels, signs, tags, and cards are available at no cost.

● See [Electrical Schematics, page 131](#).

❖ Included in Battery Cable Kit 24L962.

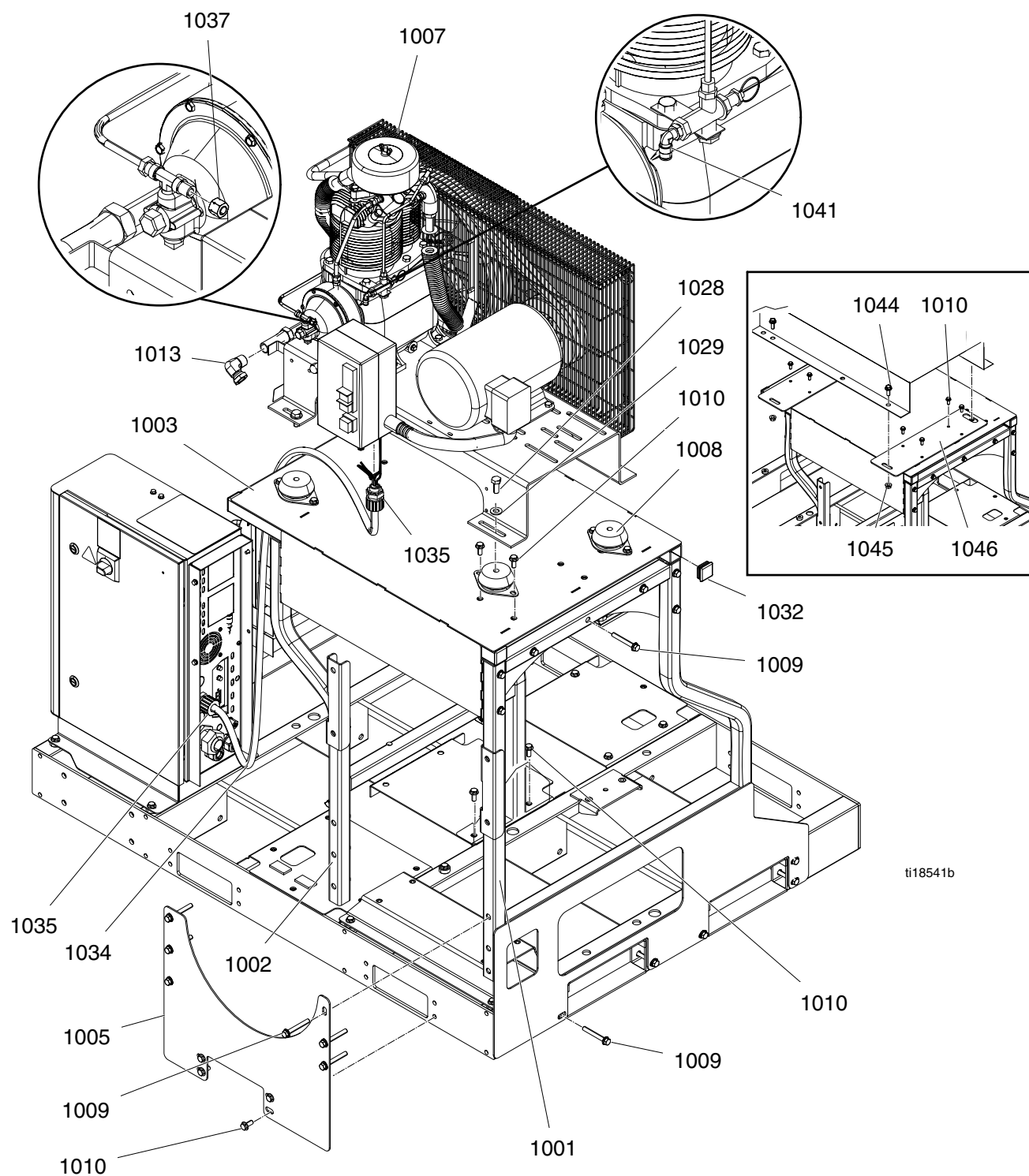
\* Included in Complete Coolant Hose Kit 24L939. See [Complete Coolant Hose Kit, page 110](#).

✖ Not shown.

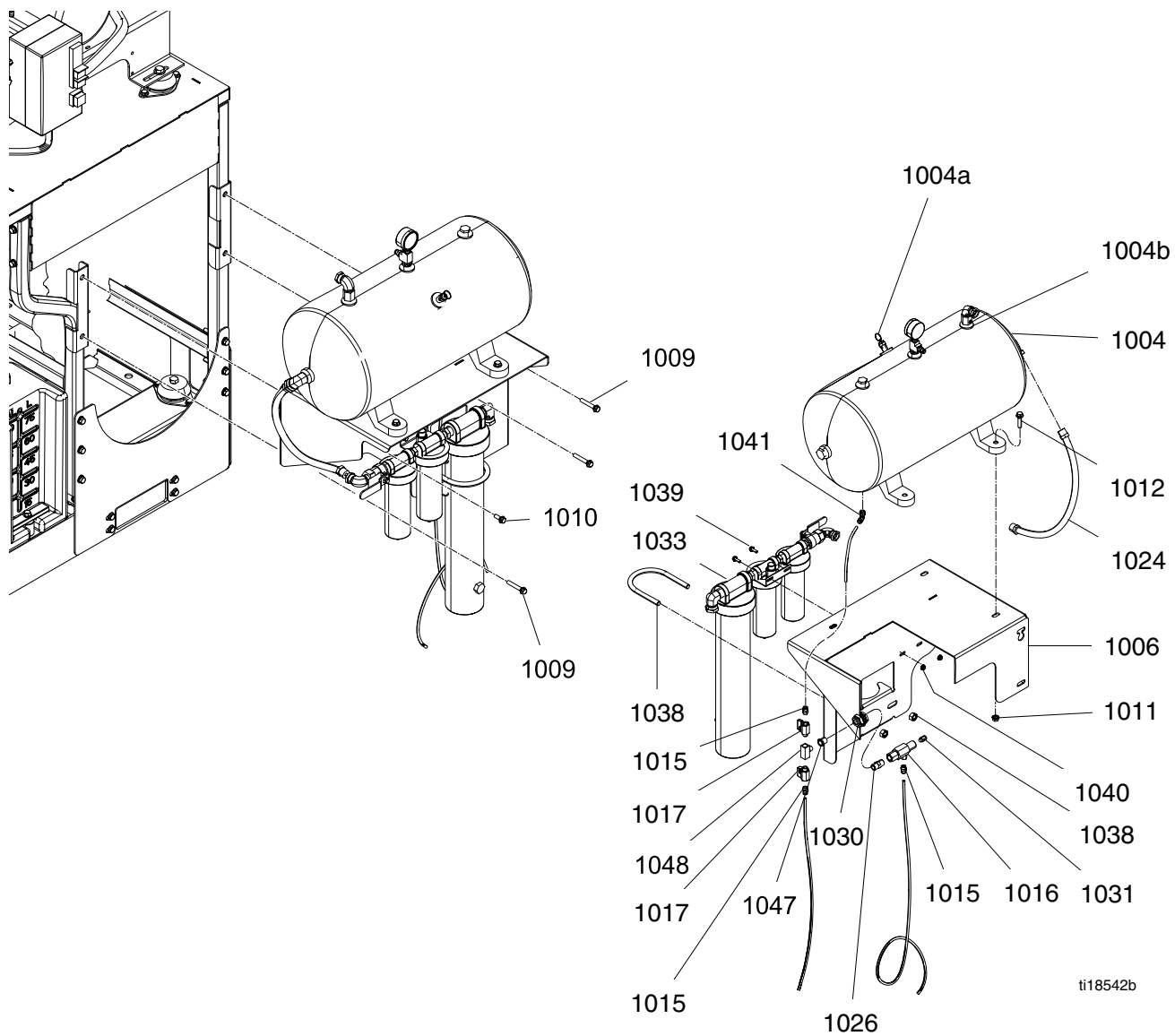
259089, E-30i with Air Compressor

259090, E-30i with Booster Heat and Air Compressor

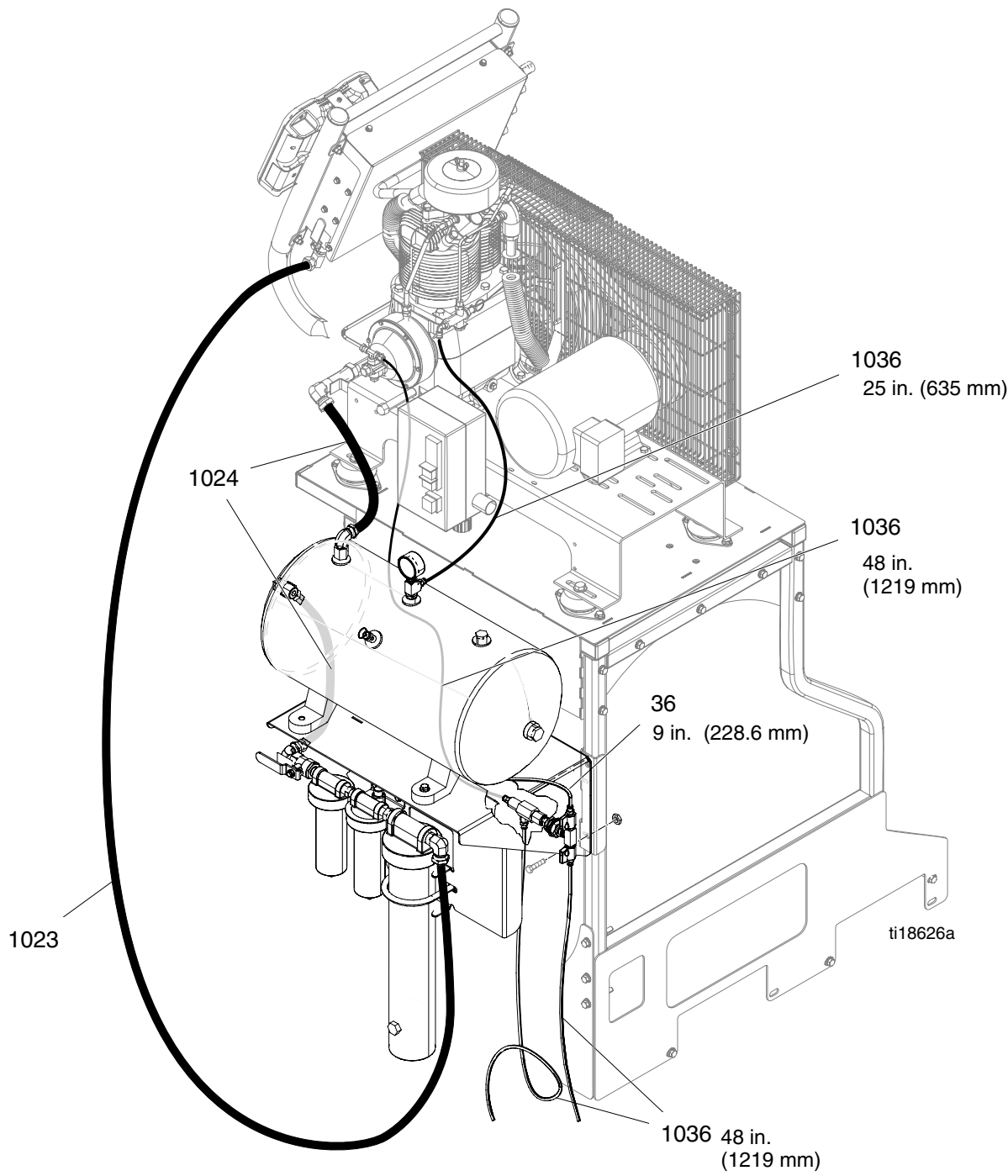
259091, E-XP2i with Booster Heat and Air Compressor



Apply anaerobic sealant to all non-swivel pipe threads.



Apply anaerobic sealant to all non-swivel pipe threads.



Ref	Part	Description	Quantity		
			259089	259090	259091
1014*	259079	Reactor, E-30i	1		
	259080	Reactor, E-30i with heat		1	
	259081	Reactor, E-XP2i with heat			1

\* For parts, see [259079](#), [259080](#), and [259081](#), page 89.

## Air Compressor Parts

All air compressor parts are included in the Air Compressor Accessory Kit. See [Accessories](#), page 12.

Ref	Part	Description	Qty	Ref	Part	Description	Qty
1001*	24M147	RACK, compressor, rear	1	1026	297436	STRAIGHT, nipple, hex. 3/8	1
1002*	24M146	RACK, compressor, front	1	1028	105324	SCREW, cap, hex hd; 1.18	4
1003*	24M145	RACK, compressor, top	1			in. (30 mm), M12 x 1.75	
1004	24M125	TANK, ASM, 12 gal, air receiver (includes 1004a and 1004b)	1	1029	109570	WASHER, plain	4
				1030	16N177	BULKHEAD, brass, 3/8	1
				1031	115671	CONNECTOR, male; 1/4	1
1004a	125967	VALVE, safety relief, 200 psi (1.4 MPa, 14 bar)	1			OD x 1/8 NPT 9(f)	
				1032*	111218	CAP, tube, square	4
1004b	16N185	VALVE, check, 1/2 m x f	1	1033	24M178	SYSTEM, desiccant air dryer; see manual 309921	1
1005*	16K133	GUSSET, compressor, support, side	1				
				1034	16M827	HARNESS, wire, 3 pole, 8/3	1
1006*	24M150	BRACKET, air tank/dryer	1	1035	16M826	CORD, grip, 3/4 in.	2
1007	125970	COMPRESSOR, air, 5 HP	1	1036	24M675	KIT, tube, nylon, rd; 1/4 in.	1
1008	24L953	KIT, isolator (4 pack)	1			OD, 16 ft (4.8 m)	
1009*	121488	SCREW, hex hd, flanged; 2.75 in. (70 mm), 3/8–16	28	1037	16M960	NUT, compression, with sleeve; 1/4 OD	1
1010*	111192	SCREW, cap flange hd; .875 in. (22 mm), 3/8–16	15	1038	126017	BOLT, U, 1/2-13, 4 OD pipe	1
				1039	113796	SCREW, flanged, hex hd	2
1011*	112958	NUT, hex, flanged; 3/8–16	4	1040	115942	NUT, hex, flange head	2
1012	112785	SCREW, hex hd, flanged; 1.5 in. (38 mm), 3/8–16	4	1041	114109	ELBOW, male, swivel	2
1013	120375	ADAPTER, elbow, 3/4–14 NPTF X 1/–142 NPSM	1	1044*	111195	SCREW, cap, flange hd; 1.25 in. (31.75 mm), 1/2–13	4
1014	—	PROPORTIONER, see table for part number		★			
				1045*	112731	NUT, hex, flanged; 1/2–13	2
				★			
1015	125428	CONNECTOR, male, 1/4 NPT (f)	3	1046*	16N165	PLATE, compressor, adapter	2
				★			
1016	125991	VALVE, drain, automatic	1	1047	126109	FITTING, bushing adapter, 3/8–18 NPT (m) x 1/4–18 NPT (f)	1
1017	15B565	VALVE, ball	2				
1023	214656	HOSE, coupled, 61209,10 ft (3 m)	1	1048	126110	FITTING, tee, male branch, 1/4–18 NPT	1
1024	218093	HOSE, coupled; 1/2–14 NPT	2				

\* Included in Compressor Frame Kit 24M258.

★ Parts for adapting to the mounting feet of the optional Quincy PTL5–5B air compressor.

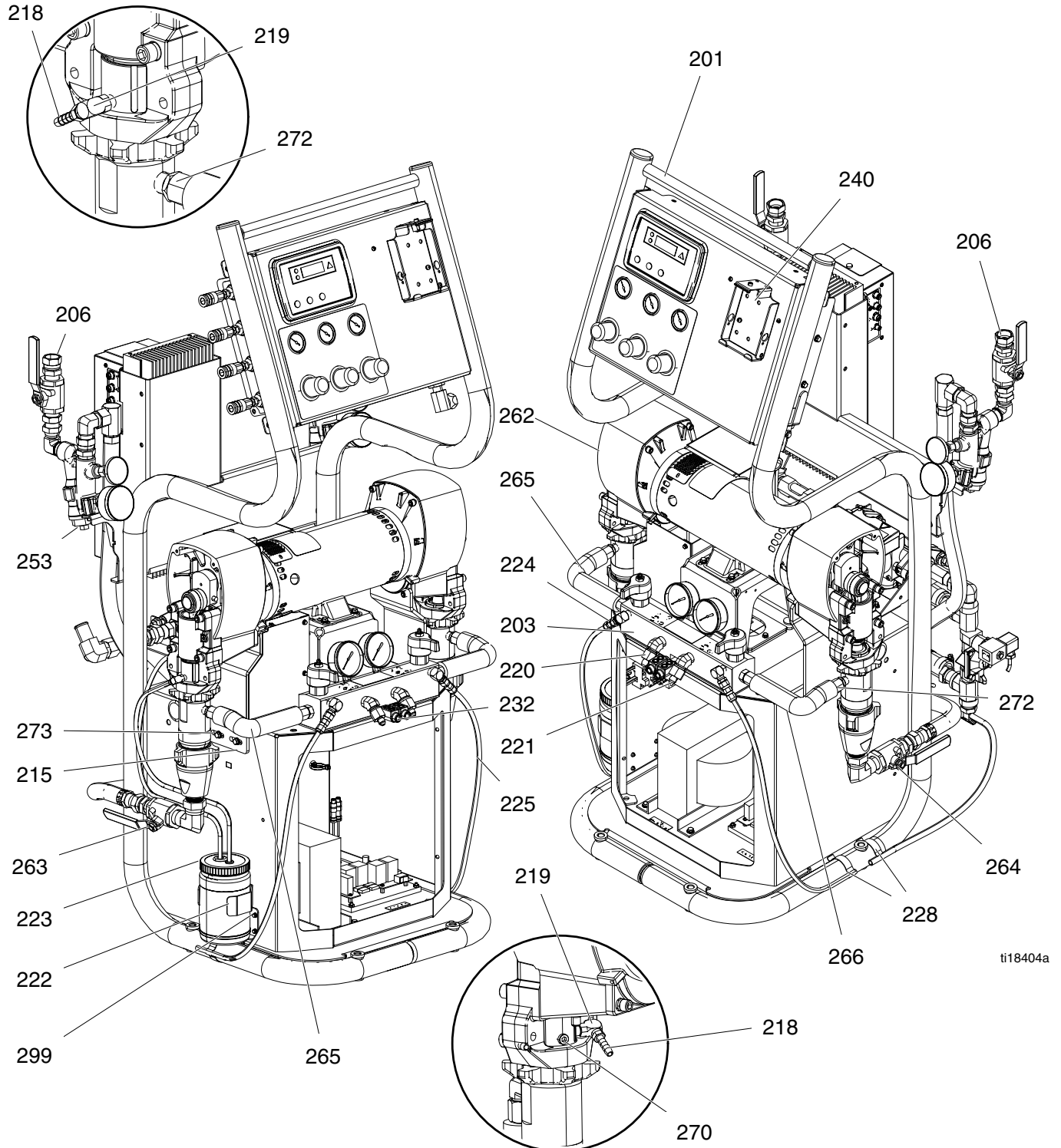


# Proportioners

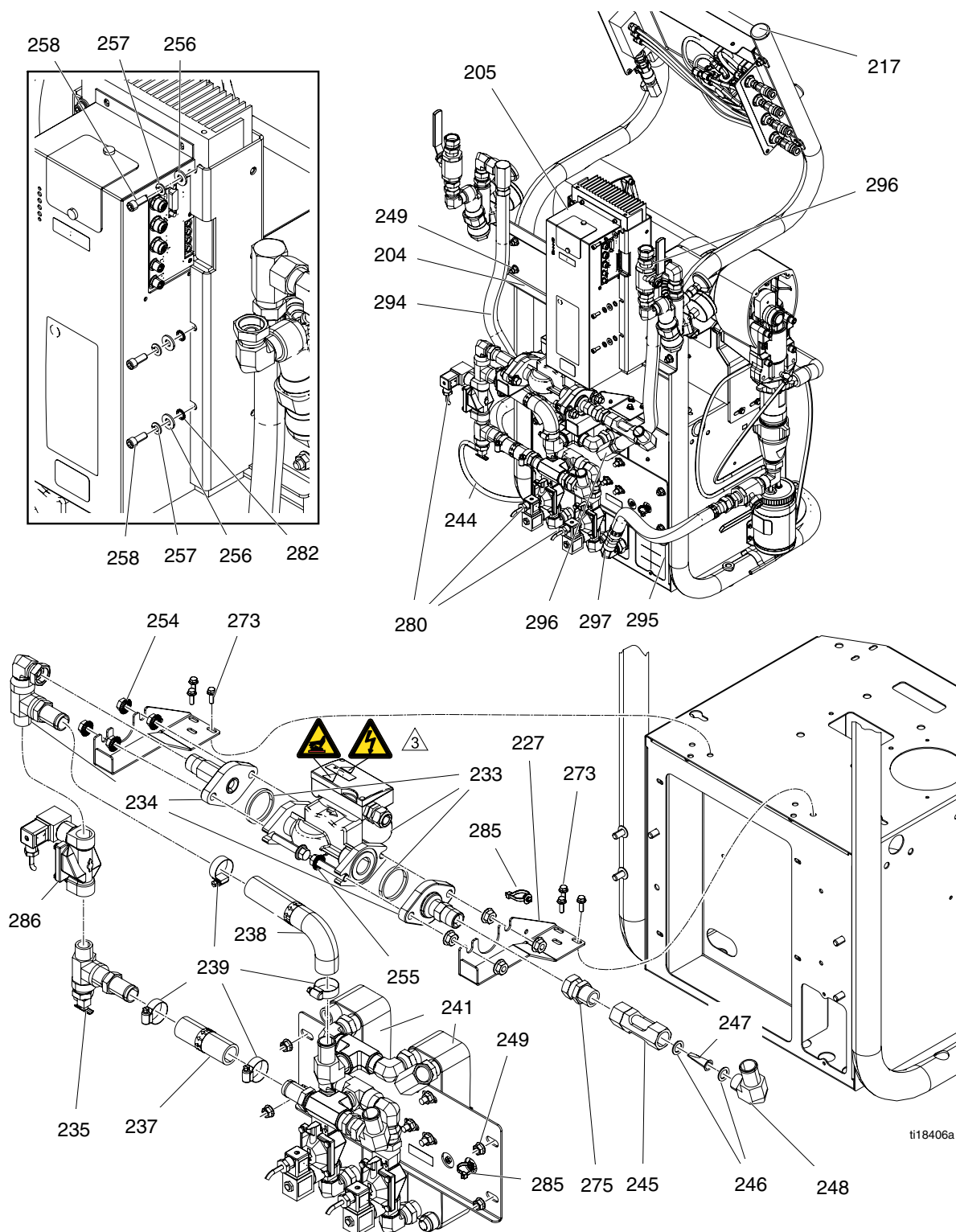
E-30i

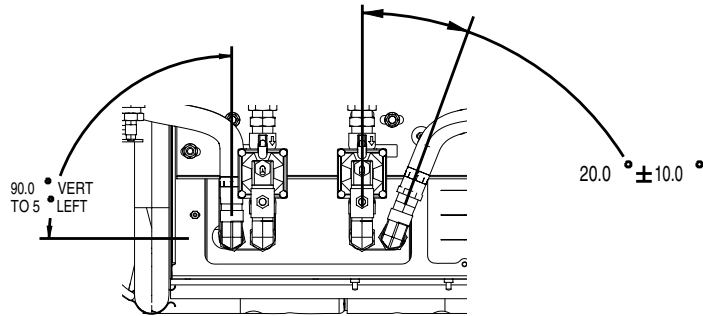
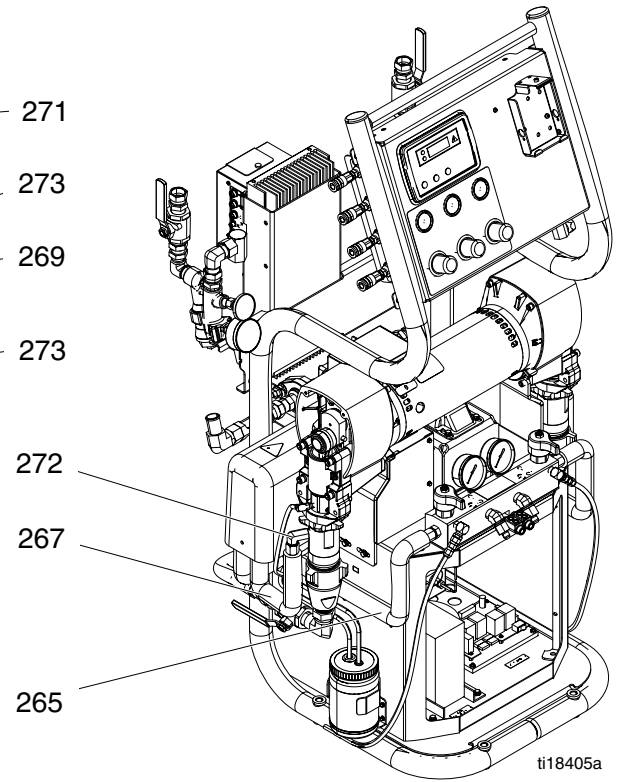
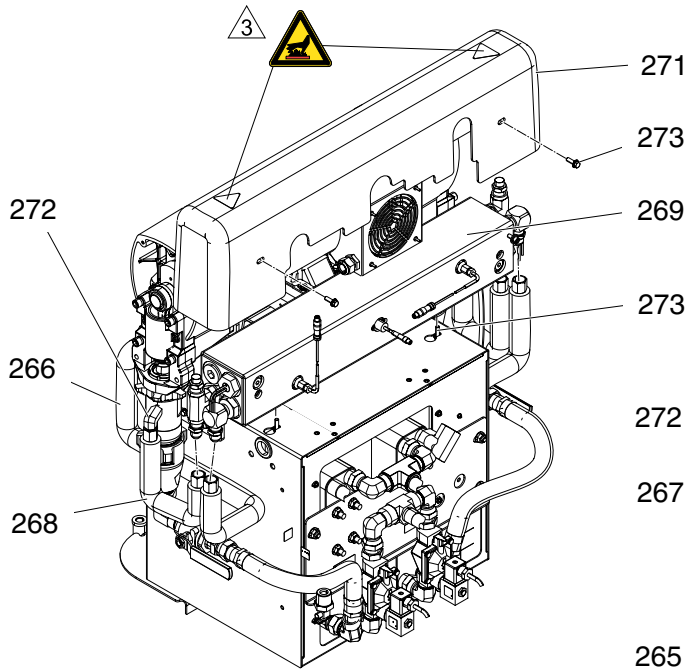
E-30i with Booster Heat

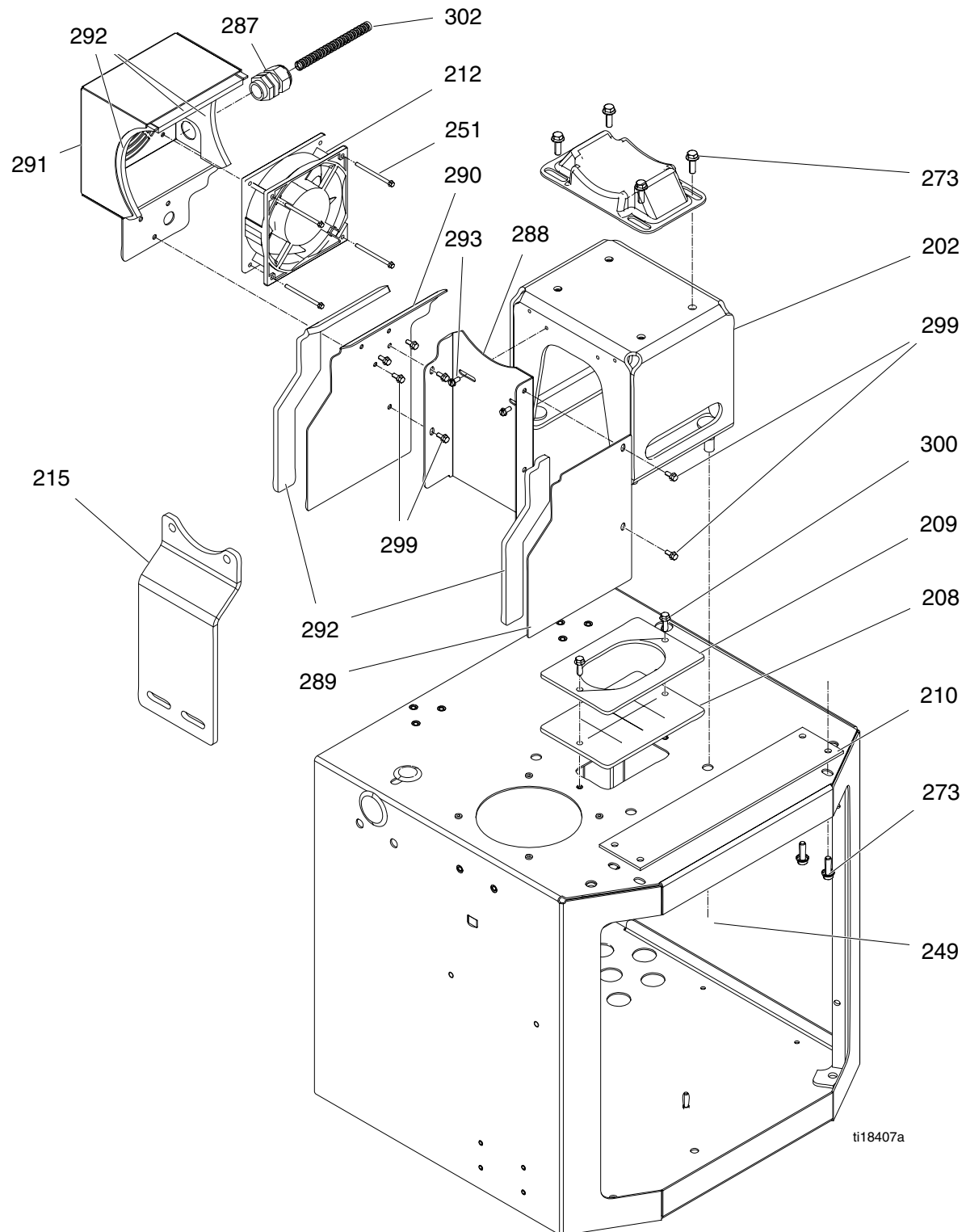
E-XP2i with Booster Heat

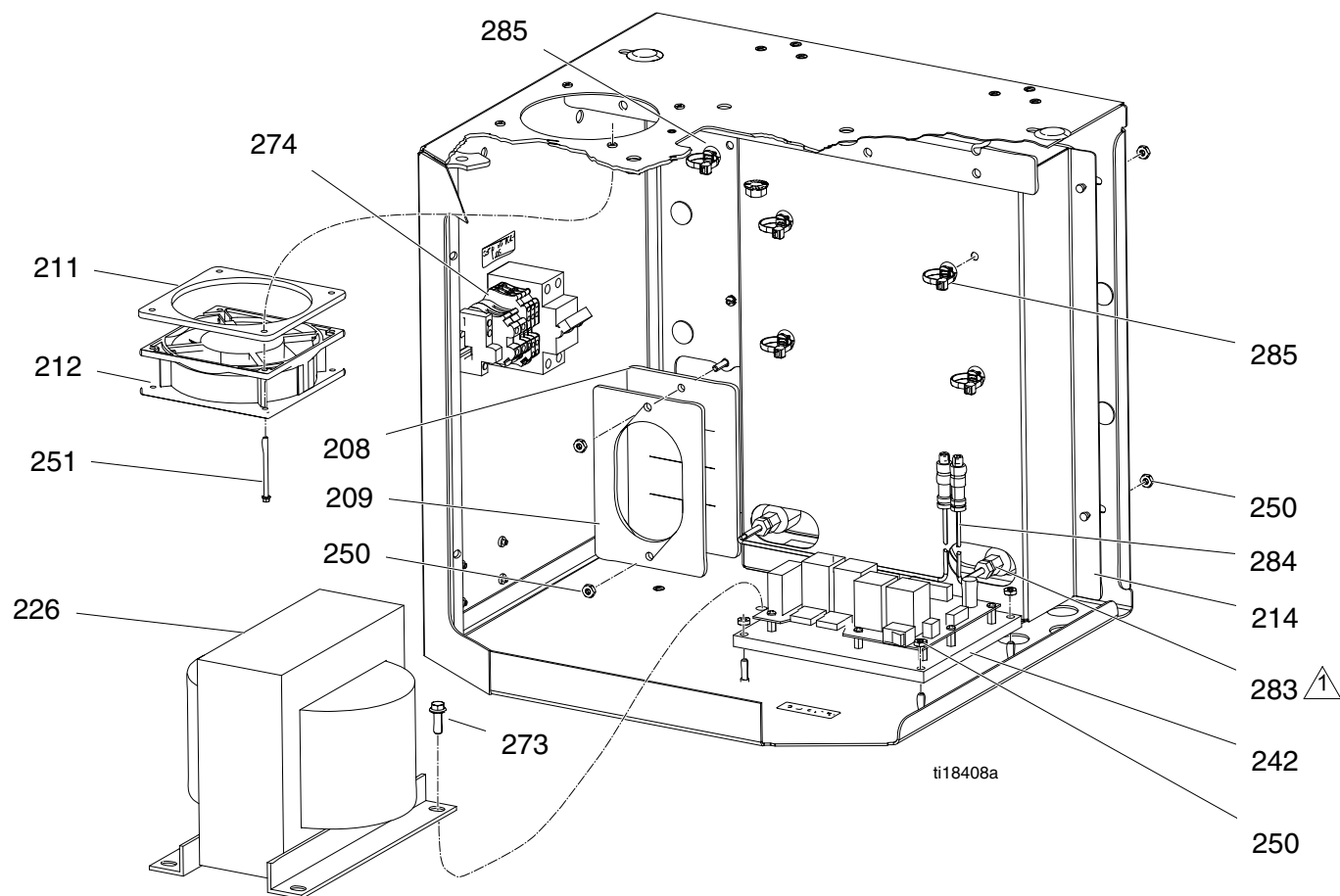


ti18404a









- <sup>1</sup> Apply anaerobic polyacrylate pipe sealant to all non-swiveling pipe threads.
- <sup>2</sup> Apply grease to tube fitting threads. Torque to 43 ft-lbs (58 N•m).
- <sup>3</sup> Safety and warning labels are from label sheet (279).

Ref	Part	Description	Quantity		
			E-30i	E-30i with Booster Heat	E-XP2i with Booster Heat
201	—	FRAME	1	1	1
202	16H758	SUPPORT, motor	1	1	1
203	24K382	MANIFOLD, fluid; see <a href="#">Fluid Manifold, page 117</a>	1	1	1
204	24J710	BRACKET, MCM	1	1	1
205	24L949	KIT, module, MCM	1	1	1
206	24L934	KIT, assembly, pair, inlet; see <a href="#">Fluid Inlet Kit, page 130</a>	1	1	1
208	15H189	BOOT, wire feed through	2	2	2
209	15G816	COVER, plate, wire way	2	2	2
210	15B456	GASKET, manifold	1	1	1
211	15B360	GASKET, fan	1	1	1
212	115834	FAN, cooling	2	2	2
214	16J758	COVER, heat exchanger	1	1	1
215	16K357	STRAP, motor	2	2	2
217	112125	PLUG, tube	2	2	2
218	116746	FITTING, barbed, plated; 1/4 hose ID, 1–8–27 NPT	2	2	2
219	191892	FITTING, elbow, street, 90°, 1/8 NPT	2	2	2
220	117502	FITTING, reducer #5 JIC x #8 JIC	1	1	1
221	117677	FITTING, reducer #6 JIC x #10 JIC	1	1	1
222	297216	BRACKET, reservoir, lube	1	1	1
223	258707	RESERVOIR, bottle, assembly	1	1	1
224	205447	COUPLING, hose	2	2	2
225	—	TUBE, PTFE	6	6	6
226	15K742	TRANSFORMER, 4090 VA, 230/90 VAC	1	1	1
227	16H761	BRACKET, mounting, pump	2	2	2
228	186494	CLIP, spring	7	7	7
230	255716	KIT, heater wire connector		1	1
232	261821	CONNECTOR, wire, 6 AWG	1	1	1
233	24L915	KIT, pump, centrifugal, circulation	1	1	1
234	24J699	KIT, fitting, pump	1	1	1
235	24K286	KIT, fitting, drain	1	1	1

Ref	Part	Description	Quantity		
			E-30i	E-30i with Booster Heat	E-XP2i with Booster Heat
237	16N576	HOSE, coolant, 1 in. ID, 4 in. (101.6 mm)	1	1	1
238	125170	HOSE, formed, 1 in. ID lower	1	1	1
239	125371	CLAMP, hose, dia. 3/4–1–3/4 in.	4	4	4
240	—	PANEL, air control; see <a href="#">Air Control Panel, page 115</a>	1	1	1
241	—	EXCHANGER, heat, assembly; see <a href="#">Heat Exchanger Assembly, page 129</a>	1	1	1
242★	24L957	KIT, load center	1	1	1
243	125871	TIE, cable, 7.5 in. (190.5 mm)	4	4	4
244	16N582	HOSE, rubber, 5/16 in., 2 ft (0.6 m)	1	1	1
245 ●	—	INDICATOR, flow, sight	1	1	1
246 ●■	—	WASHER, plain	2	2	2
247 ●■	—	STRAINER	1	1	1
248	125477	FITTING, 1 in. beaded barb x 3/4–14 NPT(m)	1	1	1
249	112958	NUT, hex, flanged, 3/8–16	16	16	16
250	113505	NUT, keps, hex hd	14	14	14
251	125858	SCREW, serrated flange, 2 in. (51 mm), 6–32	8	8	8
253	111800	SCREW, cap, hex hd, 0.625 in. (16 mm), 5/16–18	4	4	4
254	125943	NUT, serrated flange, hex hd, 7/16–14	8	8	8
255	125944	SCREW, serrated flanged, hex hd, 2.25 in. (57 mm), 7/16–14	4	4	4
256	110755	WASHER, plain	7	7	7
257	100016	WASHER, lock	7	7	7
258	121112	SCREW, cap, socket head, 0.625 in. (16 mm), 1/4–20	7	7	7
262	24L924	PROPORTIONER, module, E–30i; see <a href="#">Proportioner Module, page 111</a>	1	1	
	24L925	PROPORTIONER, module, E-XP2i; see <a href="#">Proportioner Module, page 111</a>			1

Ref	Part	Description	Quantity		
			E-30i	E-30i with Booster Heat	E-XP2i with Booster Heat
263-1 ❖	—	KIT, A-side, inlet, E-30i	1	1	
263-3 ❖	—	KIT, A-side, inlet, E-XP2i			1
264-2 ❖	—	KIT, B-side, inlet, E-30i	1	1	
264-4 ❖	—	KIT, B-side, inlet, E-XP2i			1
265	16K227	TUBE, A-side, outlet		1	1
	16K224	TUBE, A-side, outlet	1		
266	16K229	TUBE, B-side, outlet		1	1
	16K225	TUBE, B-side, outlet	1		
267	16K226	TUBE, A-side, inlet		1	1
268	16K228	TUBE, B-side, inlet		1	1
269	24L936	HEATER, assy, 4.0kw, hybrid, 2 zone; see <a href="#">Dual Zone 4.0 Kw Fluid Heater, page 113</a>		1	1
270	104765	PLUG, pipe headless	2	2	2
271	16K361	COVER, horizontal heater		1	1
272	121311	FITTING, connector, 3/8–18 NPT x #8 JIC	2		
	125643	FITTING, elbow, 3/8 NPT x #8 JIC		2	2
273	113796	SCREW, flanged, hex hd, 0.75 in. (19 mm), 1/4–20	22	24	24
274	24J721	MODULE, fan/transformer breaker	1	1	1
275	157785	FITTING, swivel, 3/4–14 NPS x 3/4–14 NPT	1	1	1
277+	125806	CABLE, splitter, M8, 4-pin, ffm 1.5m	1	1	1
278+	123656	CABLE, 5 pin, male/female	1	1	1
279 ▲	16K894	LABEL, identification	1	1	1
280+	16K646	HARNESS, DC, valve, coolant	1	1	1
281+	16M660	LABEL, cable	1	1	1
282	558685	WASHER, 1/4 external tooth lock	2	2	2
283 ◆	—	FITTING, compression, 1/8 NPT, sst	2	2	2
284 ◆	—	SENSOR, RTD, 1 kohm, 4pin, 4.25in	2	2	2



Ref	Part	Description	Quantity		
			E-30i	E-30i with Booster Heat	E-XP2i with Booster Heat
285	125625	TIE, cable, fir tree	7	7	7
286	24L916	VALVE, solenoid, 3/4 NPT, 12 VDC	1	1	1
287	121172	GRIP, cord, .39-.56, 1/2	2	2	2
288	16K385	SHIELD, airflow, side	1	1	1
289	16K386	SHIELD, airflow, front	1	1	1
290	16K387	SHIELD, airflow, back	1	1	1
291	16K388	COVER, back fan	1	1	1
292	16K390	FOAM, airflow shield, border	1	1	1
293	115492	SCREW, mach, slot hex washer hd, 0.375 in. (9.5 mm), 8-32	2	2	2
294	16K312	HOSE, coupled, 26 in. (660 mm), 3/4-14 NPT	2	2	2
295 ❖	16K311	HOSE, coupled, 18 in. (457 mm), 3/4-14 NPT	2	2	2
296	156589	FITTING, union, adapter, 90°	4	4	4
297 ❖	125535	FITTING, #12 JIC swivel x 3/4 NPT(m)	2	2	2
299	125856	SCREW, 8-32, serrated flange	11	11	11
300	125857	SCREW, 10-24, serrated flange	2	2	2

▲ Replacement Warning labels, signs, tags, and cards are available at no cost.

★ Includes four 30 Amp 12 vdc relays. Purchase Relay Repair Kit 24L958. Includes two fuses. Purchase Fuse Repair Kit 24L959.

\* Order 125774 Valve Repair Kit to replace all internal valve parts. Order 125787 Coil Repair Kit to replace coil.

◆ Included in RTD Repair Kit 24L972.

● Included in Sight Glass Kit 24L921.

■ Included in Five Pack Repair Kit 24L922.

\* Included in Complete Coolant Hose Kit 24L939. See [Complete Coolant Hose Kit, page 110](#)

❖ Included in Pump Inlet Assembly Kit. See [Pump Inlet Assembly Kits, page 110](#).

+ See [Electrical Schematics, page 131](#).

## Pump Inlet Assembly Kits

Description	Kit	Includes:		
E-30i A Side	24L926	263-1	295	297
E-30i B Side	24L927	263-3	295	297
E-XP2i A Side	24L928	263-2	295	297
E-XP2i B Side	24L929	263-4	295	297
Qty:		1	1	1

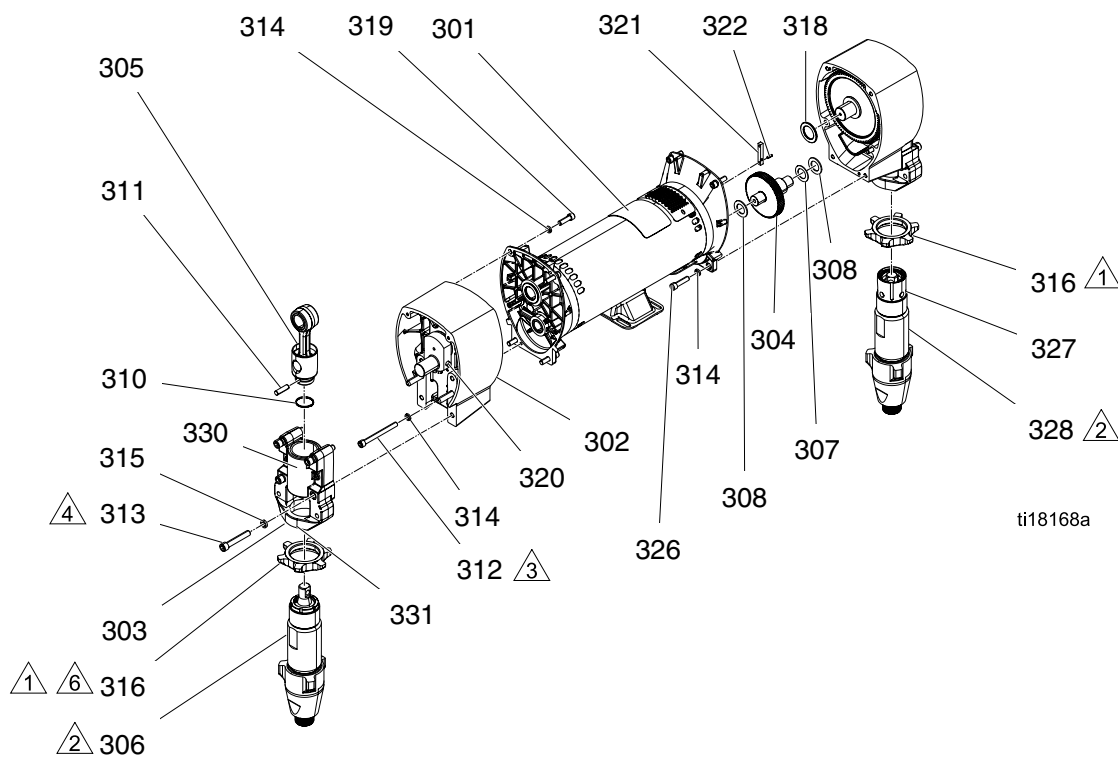
## Complete Coolant Hose Kit, 24L939

Ref	Description	Qty.
<a href="#">Systems, page 89</a>		
112	HOSE, coolant, 1 in. ID, 2.66 ft (0.81 m)	1
113	HOSE, coolant, 1 in. ID, 2.92 ft (0.89 m)	1
<a href="#">Proportioners, page 101</a>		
244	HOSE, rubber, 5/16 in., 1 ft (0.3 m)	1
298	HOSE, coolant, 1 in. ID, 0.33 ft (.1 m)	1
<a href="#">22 kW Diesel Generator, page 121</a>		
562	CLAMP, hose, dia. 3/4-1-3/4 in.	1
<a href="#">Radiator, page 123</a>		
620	HOSE, formed, 1-1/4 upper radiator	1
621	HOSE, coolant, 1 in. ID; 6 in. (152.4 mm)	1
622	CLAMP, hose, dia. 3/4-1-3/4 in.	4
623	CLAMP, hose, dia. 11/16-1-1/2 in.	2
627	HOSE, formed, 1-1/4 lower radiator	1
640	HOSE, formed, 1-1/4 upper engine	1
641	CLAMP, hose 7/32 in. - 5/8 in.	4
642	HOSE, formed, 1-1/4 lower engine	1

# Proportioner Module

24L924, Module for E-30i

24L925, Module for EXP2i



Flat side faces up.



Lubricate threads with ISO oil or grease. Assemble pump cylinders flush to one full thread under-flush of housing surface.



Torque to 115–135 in-lbs (13–15 N•m).



Torque to 20–30 ft-lbs (27–40.6 N•m).



Crankshaft must be in line with crankshaft at other end of motor.



Torque to 70–80 ft-lbs (95–108 N•m).

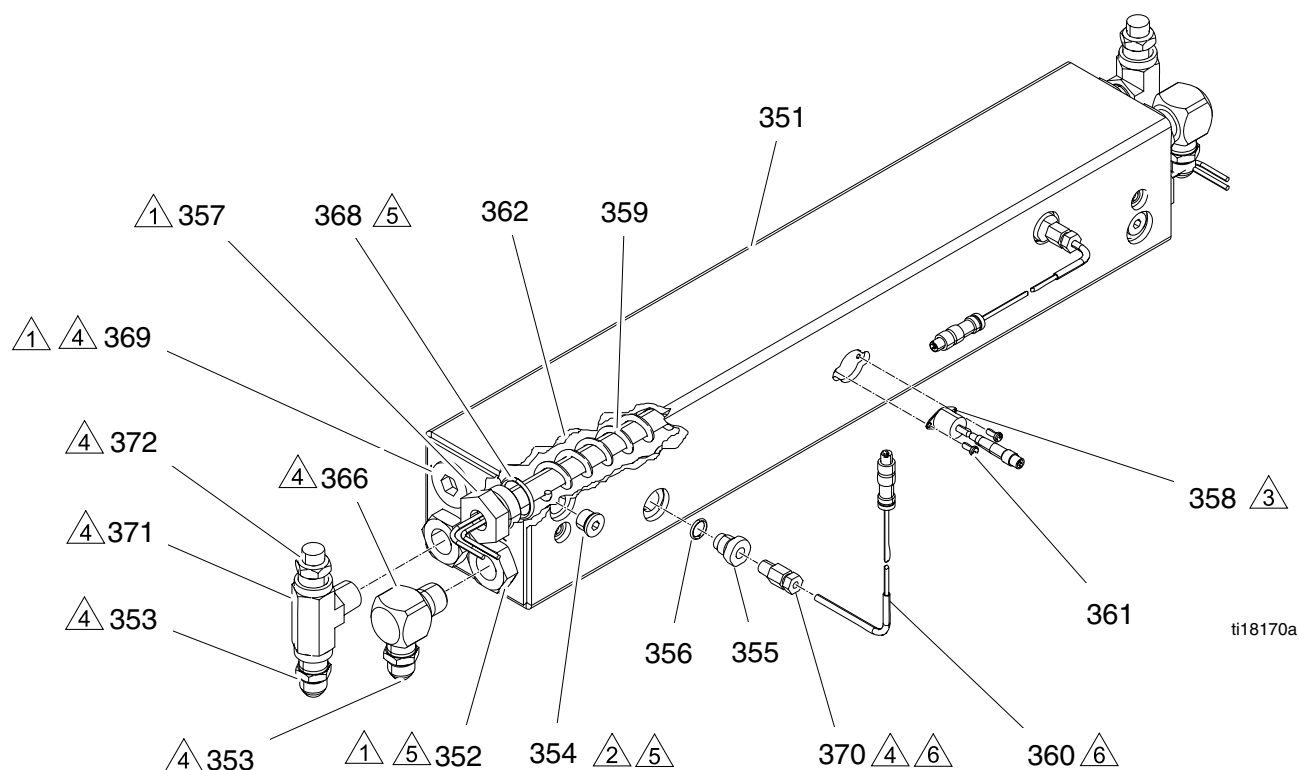
## Parts

Ref	Part	Description	Quantity	
			24L924	24L925
301	24L923	MOTOR, electric	1	1
302	245969	HOUSING, drive	2	2
303	240724	HOUSING, bearing		2
	245795	HOUSING, bearing	2	
304	243951	GEAR, combination	2	2
305	241278	ROD, connecting	2	2
306	245971	PUMP, displacement, B		1
	245972	PUMP, displacement, B	1	
307	114699	WASHER, thrust (steel)	2	2
308	114672	WASHER, thrust (copper)	4	4
310	183169	SPRING, retaining	2	2
311	183210	PIN	2	2
312	114686	SCREW, cap, socket hd; 5/16–18 x 3–1/4 in. (83 mm)	4	4
313	114666	SCREW, cap, socket hd; 3/8–16 x 2–1/4 in. (57 mm)	8	8
314	104008	WASHER, lock, spring	12	12
315	106115	WASHER, lock (hi-collar)	8	8
316	193031	NUT, retaining		2
	193394	NUT, retaining	2	
318	116192	WASHER, thrust	2	2
319	101864	SCREW, cap, socket hd; 5/16–18 x 1 in. (25 mm)	4	4
320	116618	MAGNET	1	1
321	125757	SWITCH, reed, M8-4pin cable	1	1
322	116838	PIN, spring	2	2
326	102962	SCREW, cap socket hd; 5/16–18 x 1–1/4 in. (31 mm)	4	4
327	104765	PLUG, pipe headless	2	2
328	246831	PUMP, displacement, A		1
	246832	PUMP, displacement, A	1	
329	15C588	GUARD, finger; not shown		1
330▲	192840	LABEL, warning	2	2
331	187437	LABEL, torque	2	2







▲ Replacement Danger and Warning labels, tags, and cards are available at no cost.

# Dual Zone 4.0 Kw Fluid Heater

24L936



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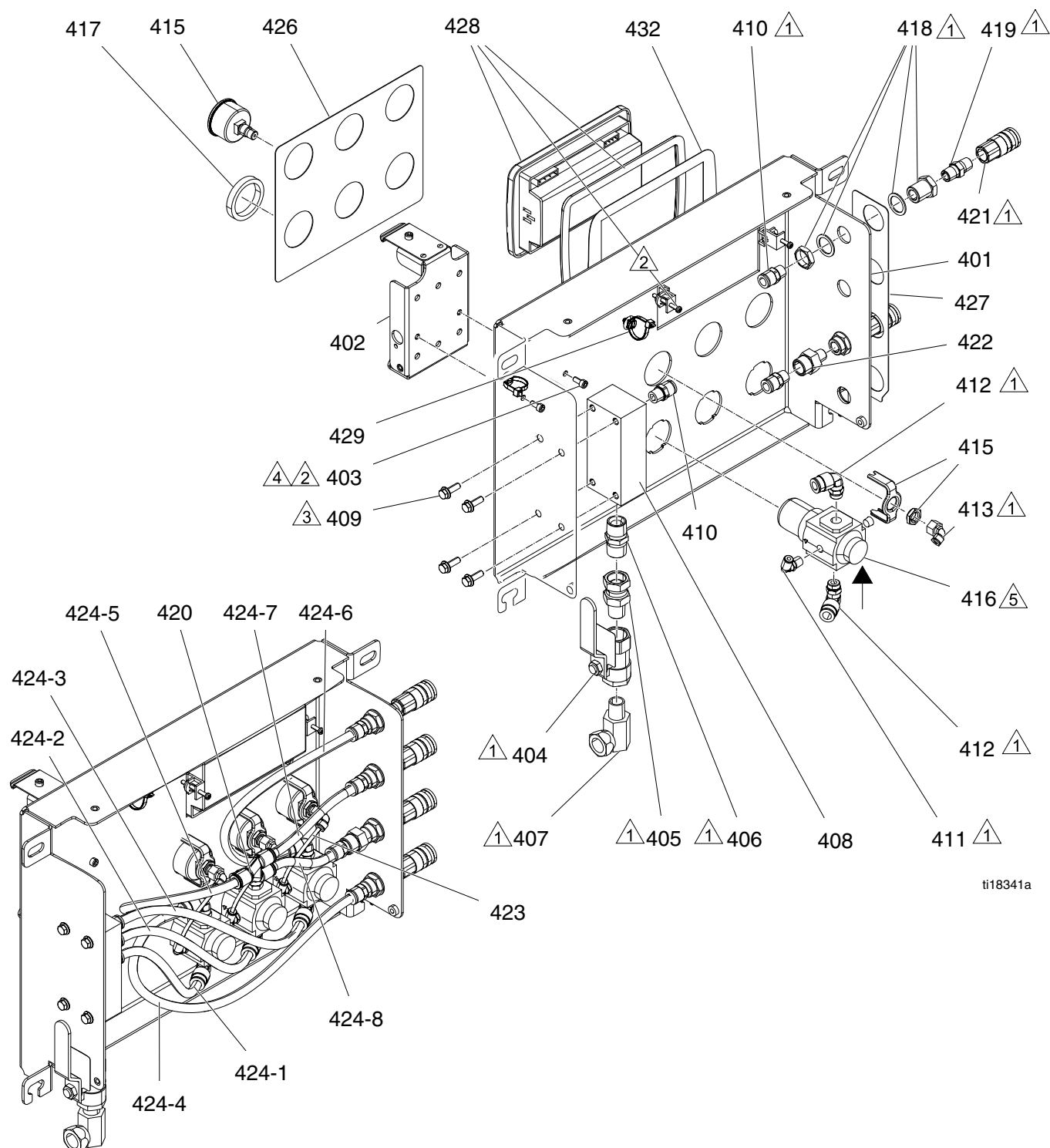
-  Torque to 120 ft-lbs (163 N•m).
-  Torque to 23 ft-lbs (31 N•m).
-  Apply thermal paste.
-  Apply pipe sealant and PTFE tape to all non-swiveling threads and threads without o-rings.
-  Apply lithium grease lubricant to o-rings before assembling in block (1).
-  Remove tape from probe tip and Orientate sensor as shown. Insert probe until it bottoms on heating element. Tighten ferrule on sensor probe 1/4 turn past finger tight.

**24L936**

Ref	Part	Description	Qty
351	15M878	BLOCK, horizontal	1
352	15H302	REDUCER, #14 SAE x 1/2-14 NPT(f)	4
353	121319	ADAPTER, 1/2-14 NPT x #8 JIC	4
354	15H304	PLUG, 9/16 SAE	2
355	15H306	ADAPTER, thermocouple, 9/16-18 x 1/8-27 NPT(f)	2
356	120336	O-RING, packing	2
357	16A111	HEATER, immersion, (2000W, 230V)	2
358	123408	HARNESS, M8 x thermal switch, 3-PIN	1
359	15B135	MIXER, immersion heater	2
360*	-	SENSOR, RTD, 1 kohm, 90°, 4 pin, tip	2
361	124131	SCREW, machined, pan hd, 0.375 in. (9.5 mm), #6-32	2
362	15M177	INSULATOR, foam, heater, horizontal	1
366	158683	ELBOW, 90°, 1/2-14 NPT x 1/2-14 NPT	2
368	124132	O-RING, fluoroelastomer	4
369	15H305	PLUG, hollow hex 1-3/16 SAE	2
370*	-	COMPRESSION, 1/8 NPT, SST	2
371	125644	BRANCH TEE, 1/2 NPT	2
372	248177	HOUSING, rupture, disc	2

\* *Included in 24L973 Heater RTD Repair Kit.*

## Air Control Panel



tj18341a

## Parts



Apply pipe sealant to all non-swiveling pipe threads.



Apply anaerobic pipe sealant to threads.



Torque to 25 +/- 2 ft-lbs (34 N•m)



Torque to 10 +/- 2 ft-lbs (14 N•m)



See parts illustration for air flow direction.

Ref	Part	Description	Qty	Ref	Part	Description	Qty
401	16H452	BRACKET, air control	1	415	116257	GAUGE, pressure, 0–160 psi (0–1 MPa, 0–11 bar)	3
402	277853	BRACKET, mounting, booth control	1	416	116513	REGULATOR, air	3
403	117026	SCREW, SHCS, 0.5 in. (12 mm), M5 x 0.8	2	417	116514	NUT, regulator, plastic	3
404	113331	VALVE, ball, vented, 1/2 in.	1	418	104641	BULKHEAD, 1 in. (25.4 mm), 3/4–20 x 1/4–18 NPT	4
405	190451	UNION, adapter, 1/2 NPT x 1/2 NPSM	1	419	156971	NIPPLE, short, 1/4–18 NPT	4
406	158491	NIPPLE, 1/2–14 NPT	1	420	125539	UNION, Y, 3/8 OD tubing	1
407	155470	SWIVEL, union, 90°, 1/2–14 NPSM x 1/2–14 NPT	1	421	114558	COUPLER, line, air, 1/4–18 NPT	4
408	16H482	MANIFOLD, 1/2 NPT x 1/4 NPT	1	422	16H531	FITTING, flow control, 1/4–18 NPT	1
409	113796	SCREW, flanged, hex hd, 0.75 in. (19 mm), 1/4–20	4	423	—	TUBE, nylon, round, black	1
410	122161	FITTING, air, 1/4 NPT x 3/8 OD	7	★	—		
411	198171	FITTING, elbow, 1/8 NPT x 5/32 OD	3	424	—	HOSE, nylon, 250 psi; see identification table	9
412	115841	FITTING, elbow, 1/4 NPT(f) x 3/8 OD	6	★	—		
413	15T498	FITTING, 90°, swivel, 5/32 OD x 1/8 NPT(f)	3	426	16K325	LABEL, instructions	1
				427	16K326	LABEL, instructions	1
				428	24M665	MODULE, engine controller	1
				429	125625	TIE, cable, fir tree	2
				432▲	16K940	LABEL, safety	1

▲ Replacement Warning labels, signs, tags, and cards are available at no cost.

★ Included in Tubing Repair Kit 24M650.

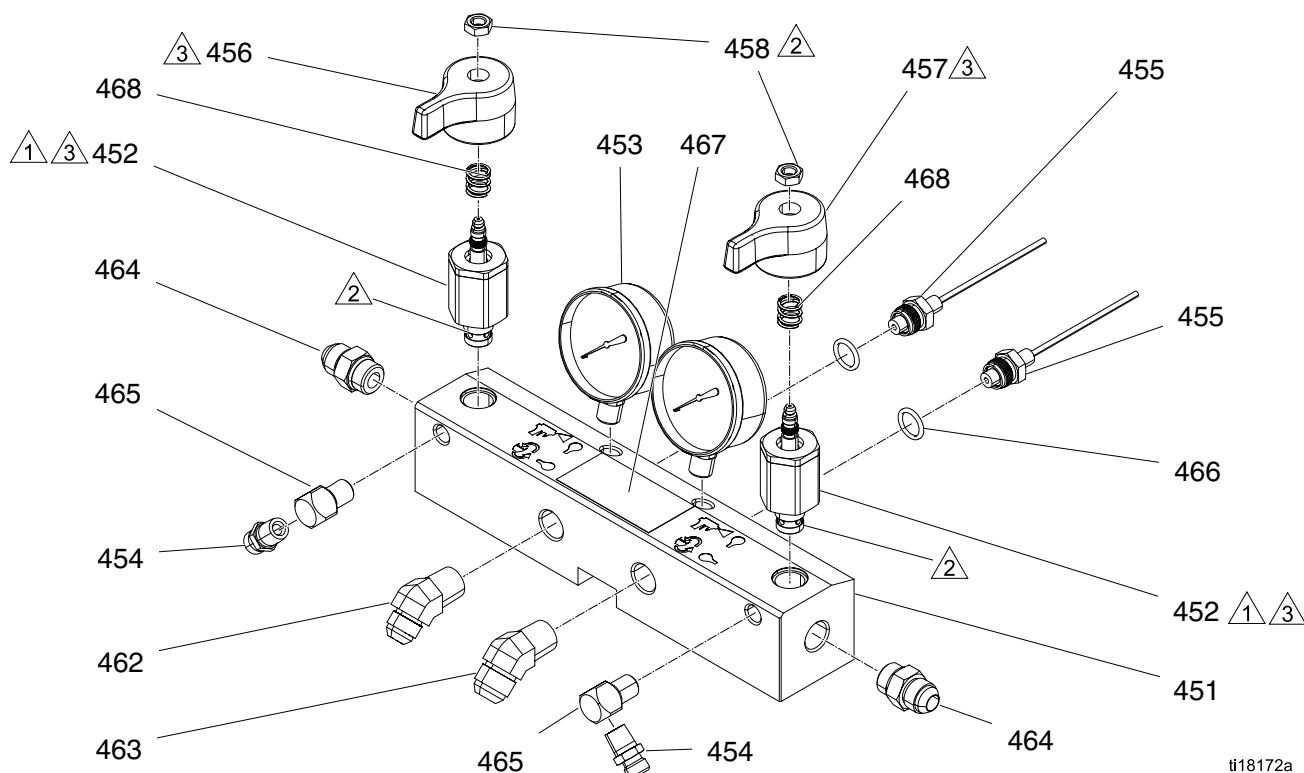
## 424 Identification Table

Ref	Length in. (mm)	Qty.
424-1	11 (279.4)	1
424-2	13.5 (342.9)	1
424-3	16.5 (419.1)	1
424-4	16 (406.4)	1
424-5	16.5 (419.1)	1
424-6	15 (381)	1
424-7	6.5 (165.1)	1
424-8	5.5 (139.7)	1
423	4 (101.6)	3



# Fluid Manifold

## 24K382



ti18172a

1 Torque to 355–395 in.-lbs (40–44.6 N•m)

2 Apply sealant (113500) to threads.

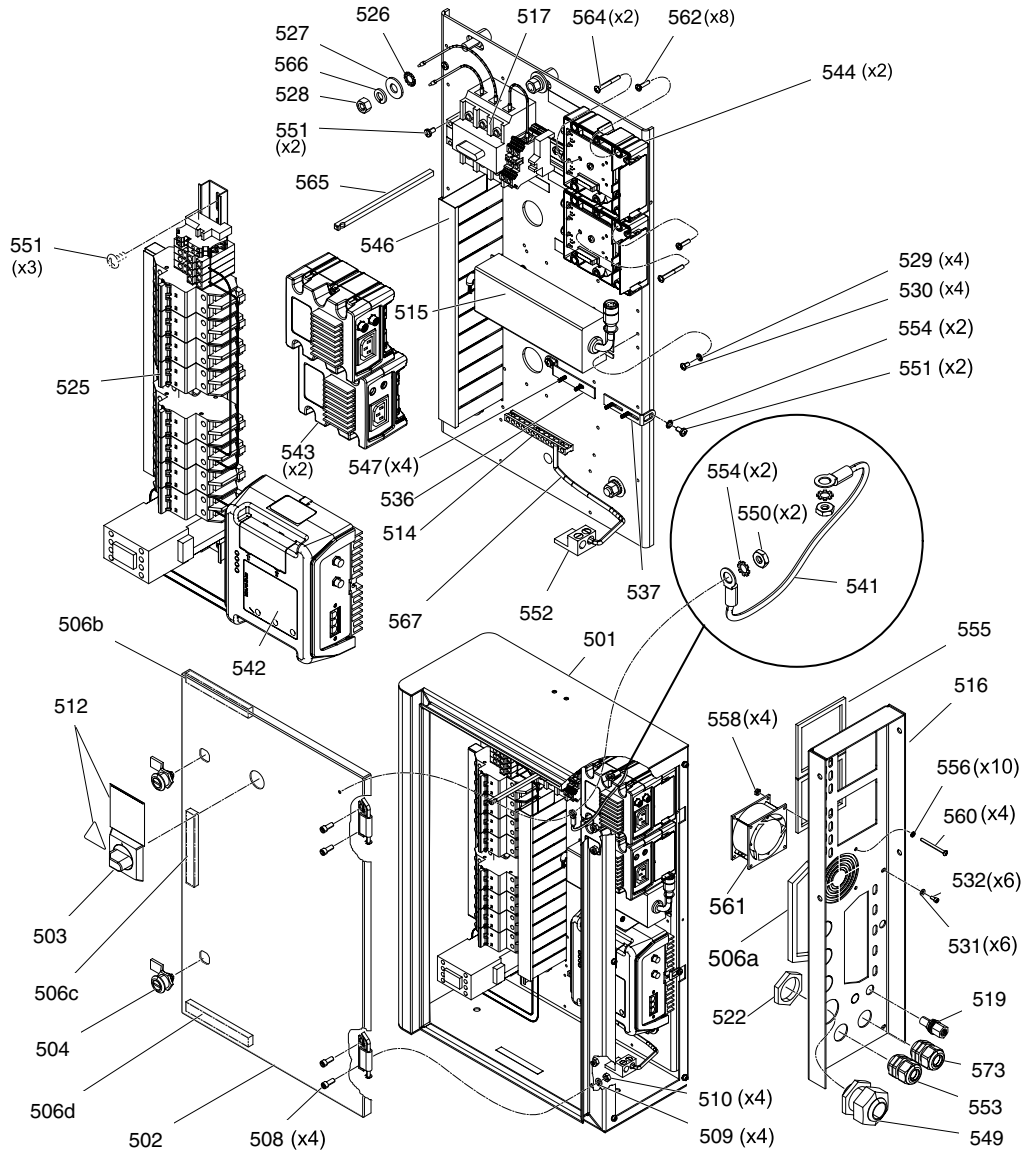
3 Valve must be closed with handle position as shown on drawing.

\*\* Apply PTFE tape or thread sealant to tapered threads.

Ref	Part	Description	Qty	Ref	Part	Description	Qty
451	255228	MANIFOLD, fluid	1	464	121309	ADAPTER, #8 SAE x #8 JIC	2
452★	255071	VALVE, drain valve	2	465	100840	ELBOW, street, 1/4–18 NPT	2
452a★	158674	O-RING, BUNA-N	1	466	111457	O-RING, PTFE	2
452b★	247779	SEAL, seat, valve	1	467▲	189285	LABEL, caution	1
453	102814	GAUGE, press, fluid	2	468	150829	SPRING, compression	2
454	162453	FITTING, 1/4 NPSM X 1/4 NPT	2	▲	Replacement Warning labels, signs, tags, and cards are available at no cost.		
455	15M669	SENSOR, pressure, fluid outlet	2	★	Included in the following complete valve kits: ISO Valve Kit (left/red) handle 255149. Resin Valve Kit (right/blue handle) 255150. Valve Set Kit (both handles and grease gun) 255148.		
456	15J915	HANDLE, red	1				
457	15J916	HANDLE, blue	1				
458	112309	NUT, hex, jam	2				
462	117556	NIPPLE, #8 JIC x 1/2 NPT	1				
463	117557	NIPPLE, #10 JIC x 1/2 NPT	1				

# Electrical Enclosure

Electrical Enclosure with Heat  
Electrical Enclosure without Heat



## Electrical Enclosure with Heat

## Electrical Enclosure without Heat

Ref	Part	Description	Quantity	
			With Heat	Without Heat
501	257155	ENCLOSURE, medium	1	1
502	16H766	DOOR, enclosure, electric	1	1
503	16K893	HANDLE, selector, on/off	1	1
504	122315	LATCH, quarter turn	2	2
506	15V932	GASKET, hphm (includes 506a-506d)	1	1
507	15X754	BRACKET, mounting, electrical	1	1
508	101682	SCREW, cap, sch, 0.625 in. (16 mm), 1/4–20	4	4
509	100016	WASHER, lock	4	4
510	100015	NUT, hex mscr, 1/4–20	4	4
512▲	16K930	LABEL, identification	1	1
514	122313	BAR, ground, kit	1	1
515	123374	POWER SUPPLY, 24 VDC, 2.5 A, 60 W	1	1
516	16M049	PANEL, side	1	1
517	24L947	MODULE, disconnect breaker	1	1
519	121612	CONNECTOR, thru, M12, m x f	1	1
522	120859	NUT, strain relief, M40 thread	1	1
523✕	125789	CABLE, can, female / female 0.5m	2	1
525	24J728	MODULE, din rail assy	1	1
526	100023	WASHER, flat	4	4
527	100133	WASHER, lock, 3/8	4	4
528	100307	NUT, hex, 3/8–16	4	4
529	157021	WASHER, lock, int	4	4
530	100035	SCREW, mach, pan hd, 0.3125 in. (8 mm) #8–32	4	4
531	112905	WASHER, plain	6	6
532	112788	SCREW, cap, socket hd, 0.375 in. (9.5 mm), #8–32	6	6
536	15R535	BRACKET, mounting, GCA high power	1	1
537	15U651	BRACKET, high power, GCA	1	1
538✕	15W902	CABLE, M8, male / ferrules	1	1

## Parts

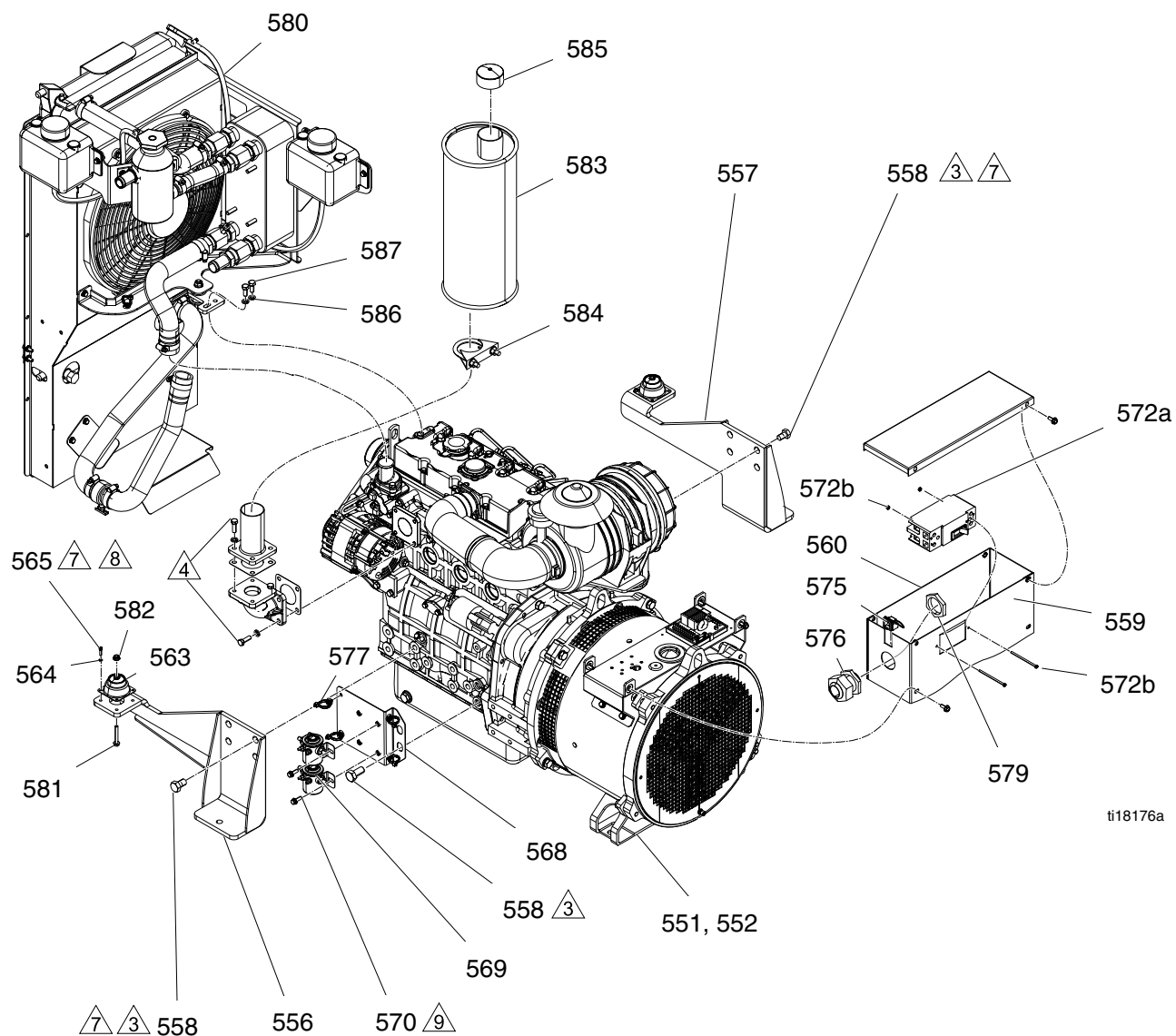
Ref	Part	Description	Quantity	
			With Heat	Without Heat
541	194337	WIRE, grounding, door	1	1
542	24L950	MODULE, HPTCM	1	1
543	24L951	MODULE, LPTCM	2	
544	289697	MODULE, GCA, cube, base	2	
546	125683	CONDUIT	1	1
547	117831	SCREW, mach., pan hd, 1/2 in. (13 mm), #6–32	4	4
548✖	125684	HARNESS, wire, hphm	1	1
549	120858	BUSHING, strain relief, M40 thread	1	1
550	100166	NUT, full hex	2	2
551	103833	SCREW, mach, crbh, 0.375 in. (9.5 mm), #10–32	7	7
552	117666	TERMINAL, ground	1	1
553	121603	GRIP, cord, .51-.71, 3/4	2	2
554	C38163	WASHER, lock, ext. tooth	4	4
555	15V933	GASKET, lphm	2	
556	115322	WASHER, lock, external, 4mm	10	10
557	277674	ENCLOSURE, cube door	2	
558	111280	NUT, locking	4	4
559✖	121597	CABLE, can, 90 female/90 female, .	1	
560	120094	SCREW, pan hd, phillips, zinc, 2 in. (51 mm), #8–32	4	4
561	125784	FAN, 3x3, 230 V	1	1
562	114417	SCREW, self tap, pan hd, 8–32 x 0.625 in. (16 mm)	8	
563✖	16K800	HARNESS, AC, fan, cooling box	1	1
564	121070	SCREW, machine, #8 x1.375	2	
565	125677	ROD, connecting, on/off	1	1
566	100639	WASHER, lock	2	2
567	125859	WIRE, chassis, ground	1	1
568✖	15Y824	WIRE, chassis, ground	1	1
569✖	16K799	CABLE, volex, female, 16 AWG	2	
573	121171	GRIP, cord, 0.35–0.63, 3/4 NPT	1	1

See [Electrical Schematics, page 131](#).

✖ Not shown.

▲ Replacement Warning labels, signs, tags, and cards are available at no cost.

# 22kW Diesel Generator



ti18176a

△<sub>1</sub> Torque to 26 ft-lbs (35.25 N•m)

△<sub>2</sub> Torque to 15 ft-lbs (20 N•m)

△<sub>3</sub> Torque to 100 ft-lbs (135.6 N•m)

△<sub>4</sub> Torque to 40 ft-lbs (54 N•m)

△<sub>6</sub> Apply sealant (red) to threads.

△<sub>7</sub> Apply sealant (blue) to threads.

△<sub>8</sub> Torque to 15 ft-lbs (20 N•m)

△<sub>9</sub> Torque to 15–20 in.-lbs (1.7–2 N•m)

△<sub>10</sub> Apply lubrication to engine end of hose prior to assembly.

## 22kW Diesel Generator

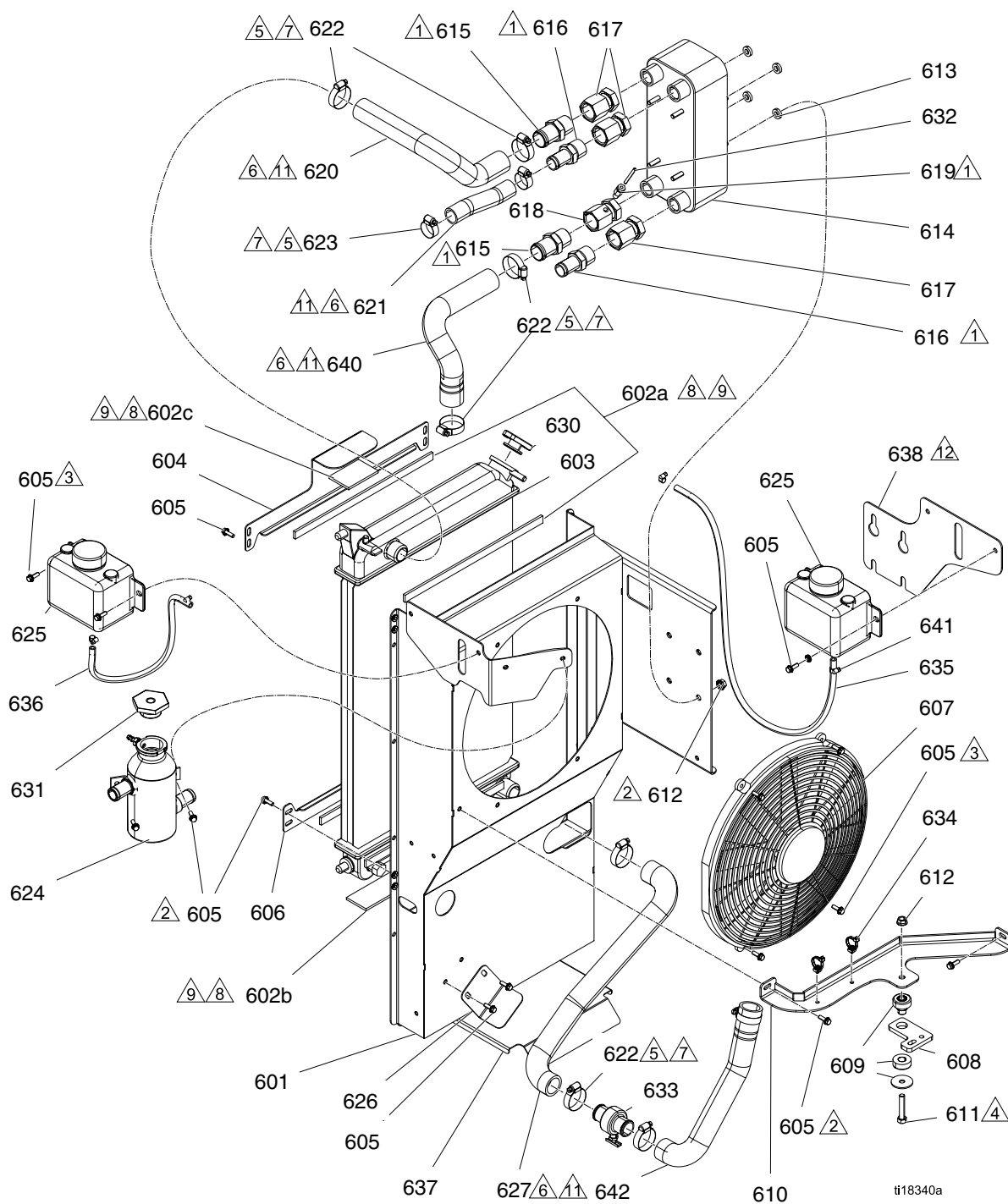
Ref	Part	Description	Qty.	Ref	Part	Description	Qty.
551	—	ENGINE, diesel, Perkins	1	572		SCREW	2
552	—	ALTERNATOR, 22 kw, diesel engine	1	a			
556	16J883	BRACKET, engine mount, left	1	572		WASHER	2
557	16J884	BRACKET, engine mount, right	1	b			
558	125532	SCREW, M14 hex head x 30 mm	10	572		NUT	2
559	16H904	ENCLOSURE, alternator, front	1	c			
560	16H906	ENCLOSURE, alternator, front	1	575	125631	BUSHING, cable, lay-in strain relief	1
562	125371	CLAMP, hose, dia. 3/4-1-3/4 in.	1	576	120858	BUSHING, strain relief, M40 thread	1
* 563	125394	ISOLATOR, mount, radiator, bottom	2	577	125625	TIE, cable, fir tree	4
564	100079	WASHER, lock, spring	8	579	120859	NUT, strain relief, M40 thread	1
565	106245	SCREW, cap, sch, 0.625 in. (16 mm) x #8-32	8	580	—	See <a href="#">Radiator, page 123</a>	1
568	16J799	BRACKET, engine relay	1	581	120736	SCREW, hex flange hd, M6 x 1	2
569	24L963	KIT, relay, solenoid, 12v, intermittent	2	582	115942	NUT, hex, flange head	2
570	113161	SCREW, flanged, hex hd, 1/2 in. x 1/4-20	4	583	—	MUFFLER, 2 in. (50.8 mm) exhaust	1
572	24L965	CIRCUIT, breaker, 90A	1	584	125161	MUFFLER, clamp	1
				■			
				585	125685	CAP, exhaust	1
				■			
				586	104572	WASHER, lock spring	2
				587	105328	SCREW, cap, hex hd, M8 x 1.25	2

■ Included in Muffler Kit 24L943.

\* Included in Complete Coolant Hose Kit 24L939.  
See [Complete Coolant Hose Kit, page 110](#).

## Radiator

*See assembly notes on next page.*



## Parts

- △<sub>1</sub> Apply pipe sealant to all non-swiveling pipe threads.
- △<sub>2</sub> Torque to 25 +/- 2 ft-lbs (34 N•m).
- △<sub>3</sub> Torque to 10 +/- 2 ft-lbs (14 N•m).
- △<sub>4</sub> Torque to 40 +/- 2 ft-lbs (54 N•m).
- △<sub>5</sub> Torque to 15–20 in.-lbs (1.7–2 N•m).
- △<sub>6</sub> Install rubber hose onto bead barb fitting to 0.13 in. (3.3 mm) maximum from hex.
- △<sub>7</sub> Locate and install edge of hose clamp 0.38 in. (9.6 mm) maximum from the end of rubber hose.

- △<sub>8</sub> Secure adhesive side of gasket to parts opposing radiator, not radiator.
- △<sub>9</sub> See parts list for length.
- △<sub>10</sub> Torque to 23 +/- 2 ft-lbs (31 N•m).
- △<sub>11</sub> Apply lubrication to all press-on hoses prior to assembly.
- △<sub>12</sub> Loosen all four nuts to approximately 0.18 in. (4.5 mm) from mounting plate. Place bracket (638) over nuts and slide down under flange of nuts until it stops. Re-torque nuts to 25 ft-lbs (33.8 N•m).

Ref	Part	Description	Qty	Ref	Part	Description	Qty
601	16H872	COVER, radiator mount	1	615	125356	FITTING, 1 in. NPT X 1.25	2
602	16H910	GASKET, radiator isolation; see 602a-602c	1	◆		barbed hose	
602a	—	GASKET, radiator isolation; 14 in. (355.6 mm), 0.63 in. dia.	4	616	125139	FITTING, barb, beaded hose	2
602b	—	GASKET, radiator isolation; 14 in. (355.6 mm), 2 in. dia.	1	◆			
602c	—	GASKET, radiator isolation; 3 in. (76.2 mm), 2 in. dia.	1	617	158383	FITTING, union, adapter, straight	3
603	—	RADIATOR	1	618	125171	FITTING, modified, union	1
❖				◆			
604	16H868	BRACKET, top	1	619*	—	FITTING, compression, 1/8 NPT, SST	1
605	113161	SCREW, flanged, hex hd; 1/4–20 x 1/2 in. (13 mm)	20	620	125359	HOSE, formed, 1 1/4 upper radiator	1
606	16H870	BRACKET, bottom	1	* ◆	16N579	HOSE, coolant, 1 in. ID; 6 in. (152.4 mm)	1
607	16H717	FAN, 16 in., 12V	1	* ◆	125371	CLAMP, hose, dia. 3/4-1-3/4 in.	4
608	16K156	BRACKET, plate	1	* ◆	125370	CLAMP, hose, dia. 1 1/16-1-1/2 in.	2
609	125579	ISOLATOR, mount, radiator, top	1	❖● *			
610	16H876	BRACKET, support	1	624	—	TANK, aluminum, coolant	1
611	111803	SCREW, cap, hex hd; 3/8–16 x 2 in. (50.8 mm)	1	●			
612	112958	NUT, hex, flanged	5	625	125204	BOTTLE, overflow	2
613	16J741	WASHER, nylon, 30% glass .750 OD	4	626	16H901	BRACKET, hose support	1
614	—	EXCHANGER, heat	1	627	125360	HOSE, formed, 1 1/4 lower radiator	1
◆							



Ref	Part	Description	Qty	Ref	Part	Description	Qty
630	24L940	CAP, radiator; 16 psi (110 kPa, 1.1 bar)	1	637	16M323	GUARD, engine bottom	1
❖				638	16M141	BRACKET, overflow bottle	1
631	24L967	CAP, pressure, coolant, 8-10 psi (55-70 kPa, 0.5-0.7 bar)	1	640	125361	HOSE, formed, 1-1/4 upper engine	1
●				*			
632*	—	SENSOR, RTD 1 K OHM	1	641	125163	CLAMP, hose 7/32 in. - 5/8in.	4
633	125175	COUPLING, hose, drain	1	*			
634	125625	TIE, cable, fir tree	2	642	125382	HOSE, formed, 1-1/4 lower engine	1
635	16N580	HOSE, rubber, 5/16 in., 3.33 ft (1 m)	1	*			
636	16N581	HOSE, rubber, 5/16 in., 1.25 ft (0.4 m)	1				

◆ *included in Heat Exchanger Kit 24L946.*

❖ *Included in Radiator Repair Kit 24L937.*

● *Included in Coolant Bottle Repair Kit 24L942.*

■ *Included in Radiator Isolator Kit 24L945.*

\* *Included in RTD Sensor Kit 24L974.*

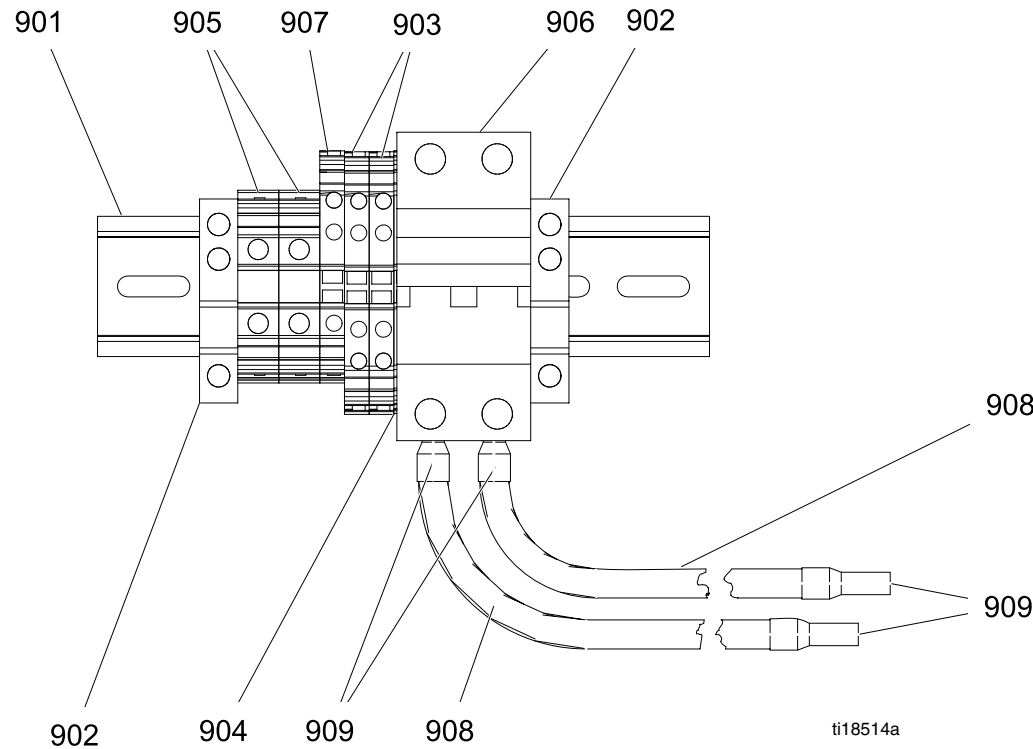
\* *Included in Complete Coolant Hose Kit 24L939.  
See [Complete Coolant Hose Kit, page 110](#).*

See [Electrical Schematics](#), page 131.



24J721, Transformer and Fan Circuit Breaker Module

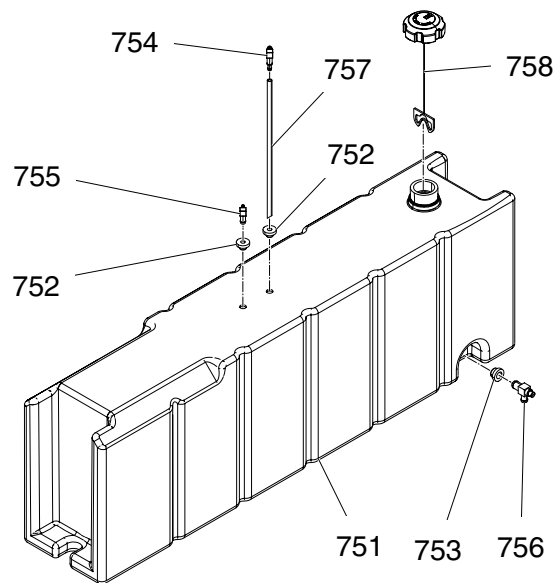
See [Electrical Schematics](#), page 131.



Ref	Part	Description	Qty	906	24L960	KIT, circuit, breaker, 50 amp, 2 pole	1
901	514014	RAIL, mount	1	907	125767	CIRCUIT, block, three wire ground	1
902	125667	TERMINAL, stop, end	2	908	—	WIRE, cu, electrical, 8 AWG, black	2
903	125816	TERMINAL, block, 2 level, 4 conduct	2	909	—	FERRULE, wire, 8 AWG	4
904	125814	TERMINAL, block, end cap	1				
905	125815	TERMINAL, block, feed thru	2				

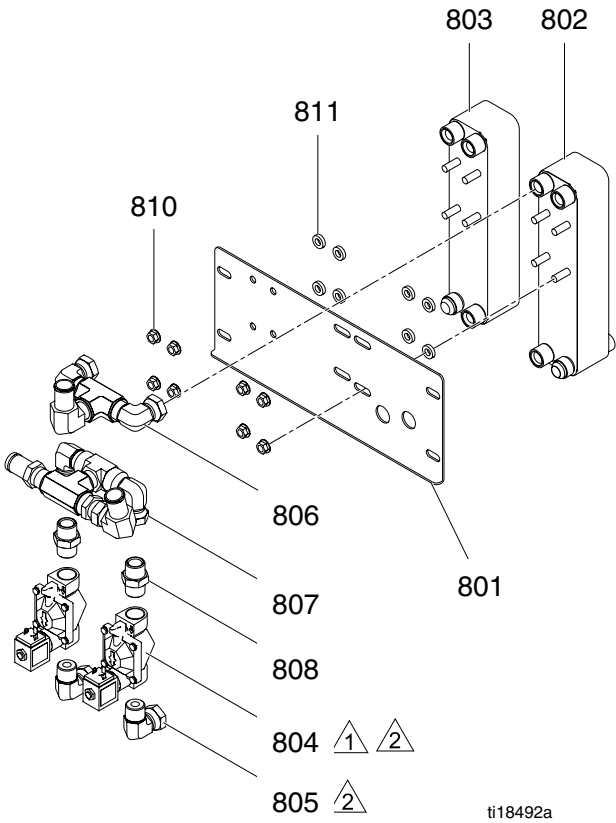
# Fuel Tank

24K390



Ref	Part	Description	Qty	Ref	Part	Description	Qty
751	-	TANK, fuel	1	755	125648	FITTING, 3/16 barbed	1
752	125645	GROMMET, tank	2	756	125649	VALVE, drain	1
753	125646	GROMMET, tank	1	757	125651	TUBE, suction	1
754	125647	FITTING, suction, 5/16 barbed	1	758	24L955	CAP, fuel	1

# Heat Exchanger Assembly



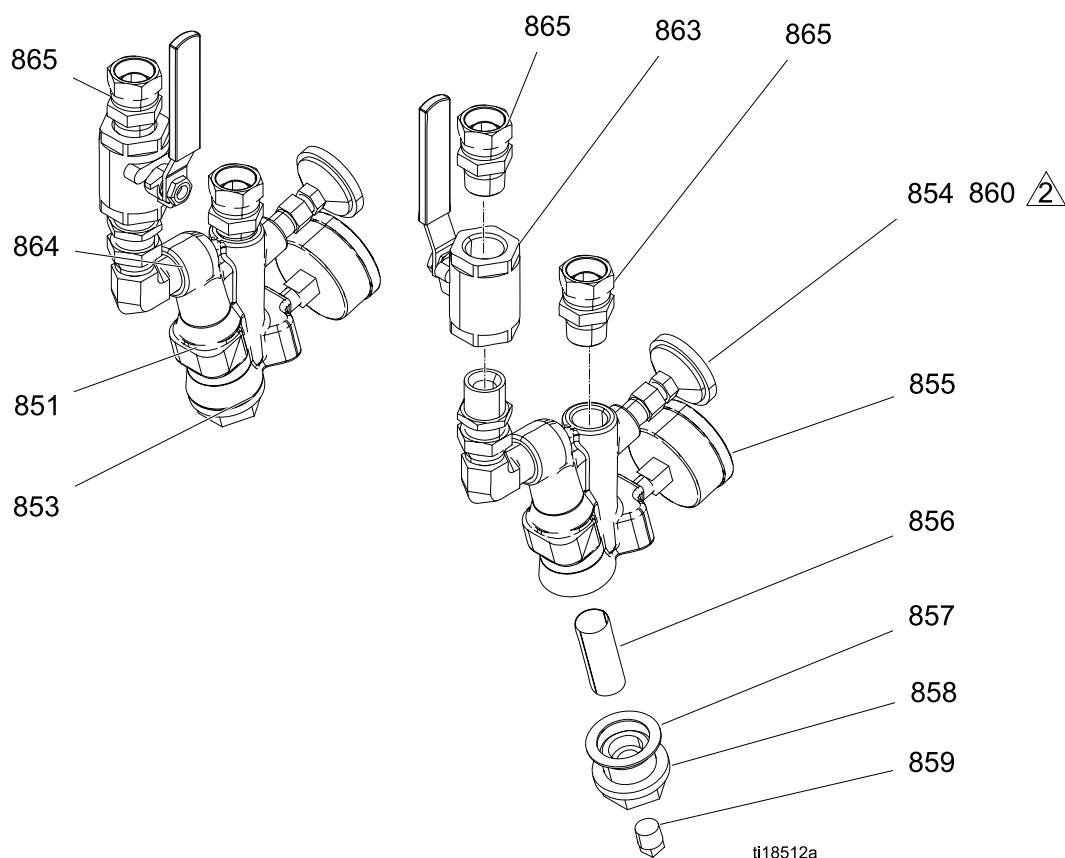
- 1 Ensure flow direction arrows on solenoids valves (804) are pointing down.
- 2 Apply anaerobic pipe sealant to all non-swiveling fittings before assembling.

Ref	Part	Description	Qty	Ref	Part	Description	Qty
801	16H759	BRACKET, heat exchanger	1	807	24J703	KIT, fitting, inlet, heat exchanger	1
802	24L917	EXCHANGER, heat, side A	1	808	C20487	NIPPLE, hex	2
803	24L918	EXCHANGER, heat, side B	1	810	112958	NUT, hex, flanged	8
804	24L916	VALVE, solenoid, 3/4 NPT, 12 VDC	2	811	16J741	WASHER, nylon, 30% glass, 3/4 OD	8
*							
805	160327	UNION ADAPTER, 90°	2				
806	24J702	KIT, FITTING, outlet, heat exchanger	1				

\* Order 125774 Valve Repair Kit to replace all internal valve parts.  
Order 125787 Coil Repair Kit to replace coil.

# Fluid Inlet Kit

## 24L934



Apply sealant to all tapered pipe threads. Apply sealant to female threads. Apply to at least the first four threads and approximately 1/4 turn wide.



Apply thermal paste to the stem of dial before assembling into housing.

Ref	Part	Description	Qty	Ref	Part	Description	Qty
851	160327	UNION ADAPTER, 90°	2	858	15H199	PLUG, strainer, WYE, inlet	2
853	15J119	MANIFOLD, strainer, WYE, inlet	2	859	104813	PLUG, pipe	2
854	102124	THERMOMETER, dial	2	860	15D757	HOUSING, thermometer, VISCON HP	2
855	120300	GAUGE, pressure, fluid	2	863	109077	VALVE, BALL 3/4 NPT	2
856	180199	FILTER, replacement	2	864	160032	NIPPLE, 1-1/4 in. x 2 in. 3/4 NPT	2
857	15H200	GASKET, strainer, WYE, inlet	2	865	157785	FITTING, swivel	4

## Electrical Schematics

### Harness Identification

All wire harnesses are identified by a letter. The first letter on each wire in a wire harness corresponds with the wire harness. Use the table below to identify the wire harness, system component connections, and wiring diagram page number(s). The wiring diagram will show every wire included.

Harness Identifier	Ref	Part	System Components	Wiring Diagram
C	(90)	24L964	Engine	<a href="#">Engine, page 143</a>
D	(280)	16K646	Load Center Coolant Valves	<a href="#">Load Center, page 140</a> <a href="#">Coolant Valve Wiring Diagram, page 140</a>
E	(49)	16K301	Engine Load center	<a href="#">Engine, page 143</a> <a href="#">Load Center, page 140</a>
F	(94)	16K297	Load Center Engine Engine Control Module	<a href="#">Load Center, page 140</a> <a href="#">Engine, page 143</a> <a href="#">Engine Control Module, page 142</a>
H	(53)	16K299	Load Center Electrical Enclosure	<a href="#">Load Center, page 140</a> <a href="#">Electrical Enclosure, page 133</a>
K	(52)	125753	Alternator Enclosure Electrical Enclosure	<a href="#">Alternator Enclosure, page 144</a> <a href="#">Electrical Enclosure, page 133</a>
M	(51)	125752	Alternator Enclosure Engine Control Module	<a href="#">Alternator Enclosure, page 144</a> <a href="#">Engine Control Module, page 142</a>
N	(54)	125756	Reactor Electrical Enclosure MCM	<a href="#">Reactor, page 139, 135</a> <a href="#">Electrical Enclosure, page 133</a>

### Engine Harness Wire Color Code

This table refers to Engine Harness E (49), Engine Control Module Harness F (94), and Disconnect Check Harness H (53).

Color	Purpose
Red	Battery Positive (Lines Always Energized)
Black/White	Engine Load Grounds
Orange	Starter
White	Glow Plugs
Gray	Fuel Shutoff Solenoid (FD)

Color	Purpose
Violet	Radiator Fan
Black/Yellow	Monitoring Grounds
Brown	Oil Pressure Switch
Dark Blue	Water Temperature

## Wire Label Identification Code

The plastic wire wrap labels applied to many of the cables in the system use a code that indicates both the near-end and far-end connections made with the labeled wire. The first half of the code describes the module and port that the near-end of the cable connects to. The second half of the code describes where the far-end of the cable connects. For example, "TCM-H-6 TCM-B" denotes that the connector nearest the label connects to the HPTCM, port 6 ("TCM-H-6" is "Temperature Control Module - Hose - port 6") and the far-end connects to the LPTCM-B ("TCM-B" is Temperature Control Module - Zone B"). This code is used throughout the wiring schematics on the following pages.

## Circuit Breaker Identification

Ref.	Size	Component
CB01	30 A	High Power Temperature Control Module (HPTCM)
CB02	20 A	Motor Control Module (MCM)
CB03	5 A	Two Motor Fans, Cabinet Fan, Power Supply, and Coolant Circulation Pump
CB04	30 A	Auxiliary Power (Air Compressor)
CB05	10 A	Auxiliary Power
CB06	20 A	Auxiliary Power

Ref.	Size	Component
CB07	15 A	E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) A
		E-30i: Auxiliary
CB08	15 A	E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) B
		E-30i: Auxiliary

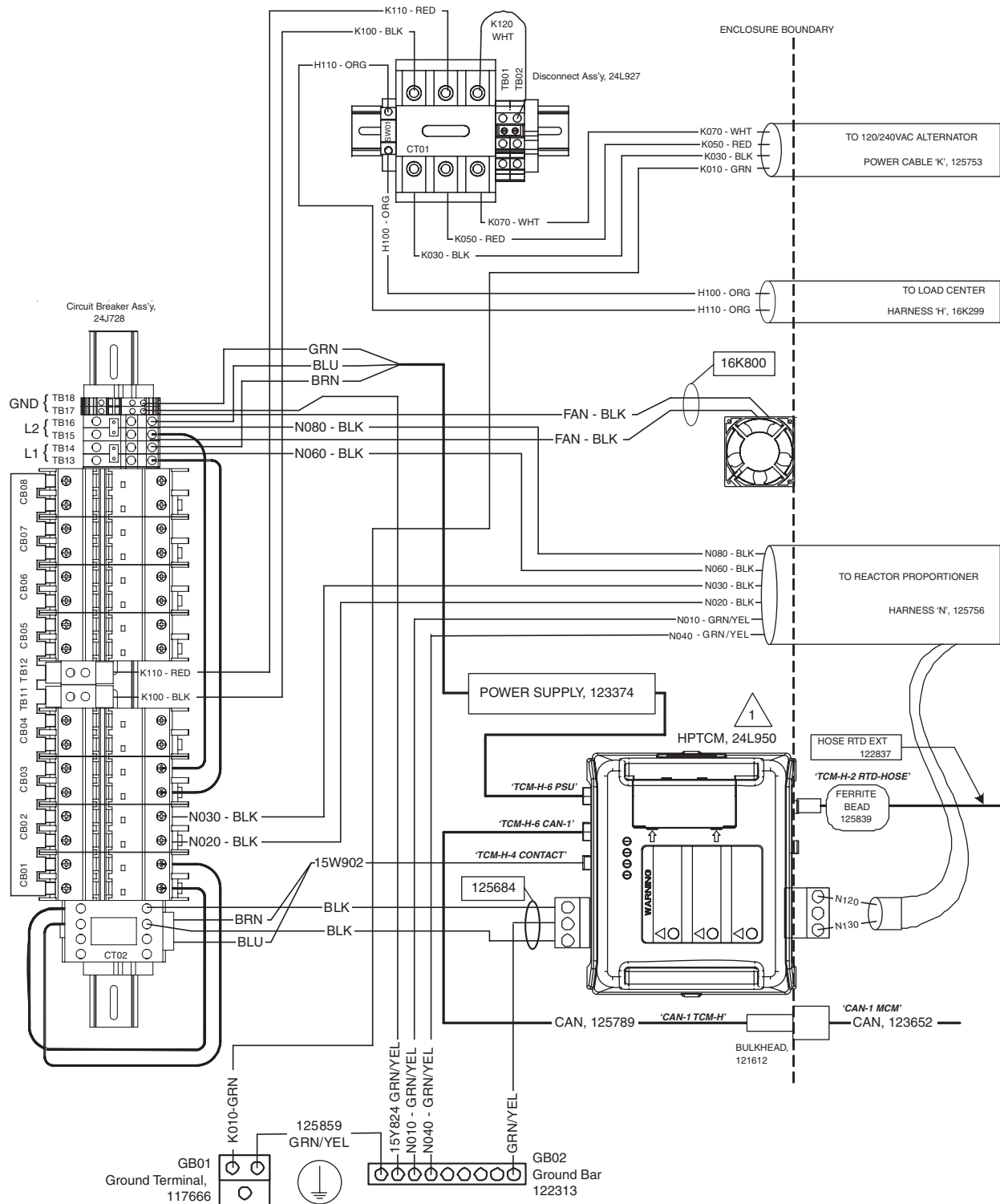
## Available Circuit Breakers

Part	Amps
126123	1
126124	3
126125	5
126126	10
126127	15
126128	20

Part	Amps
126129	25
126130	30
126131	40
24L960	50
123668	63



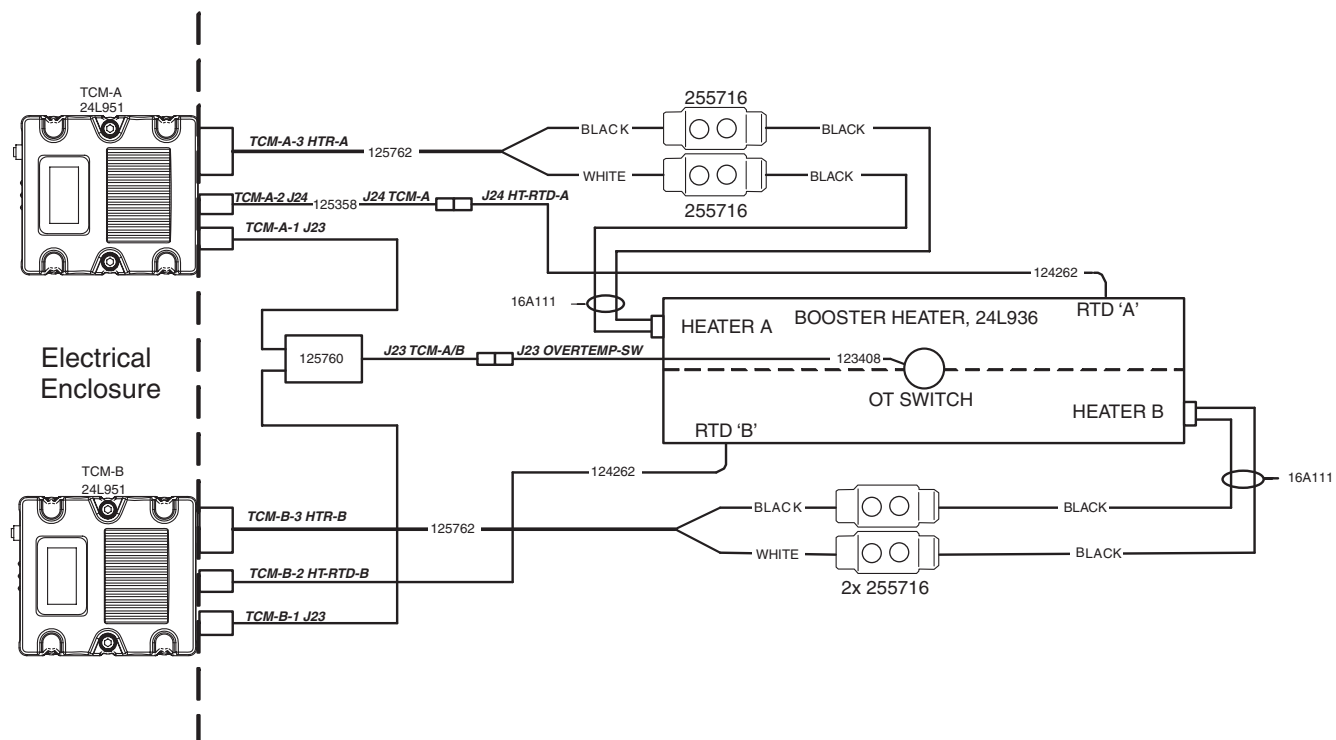
# Electrical Enclosure Wiring Diagram



Rotary switch set to "0".

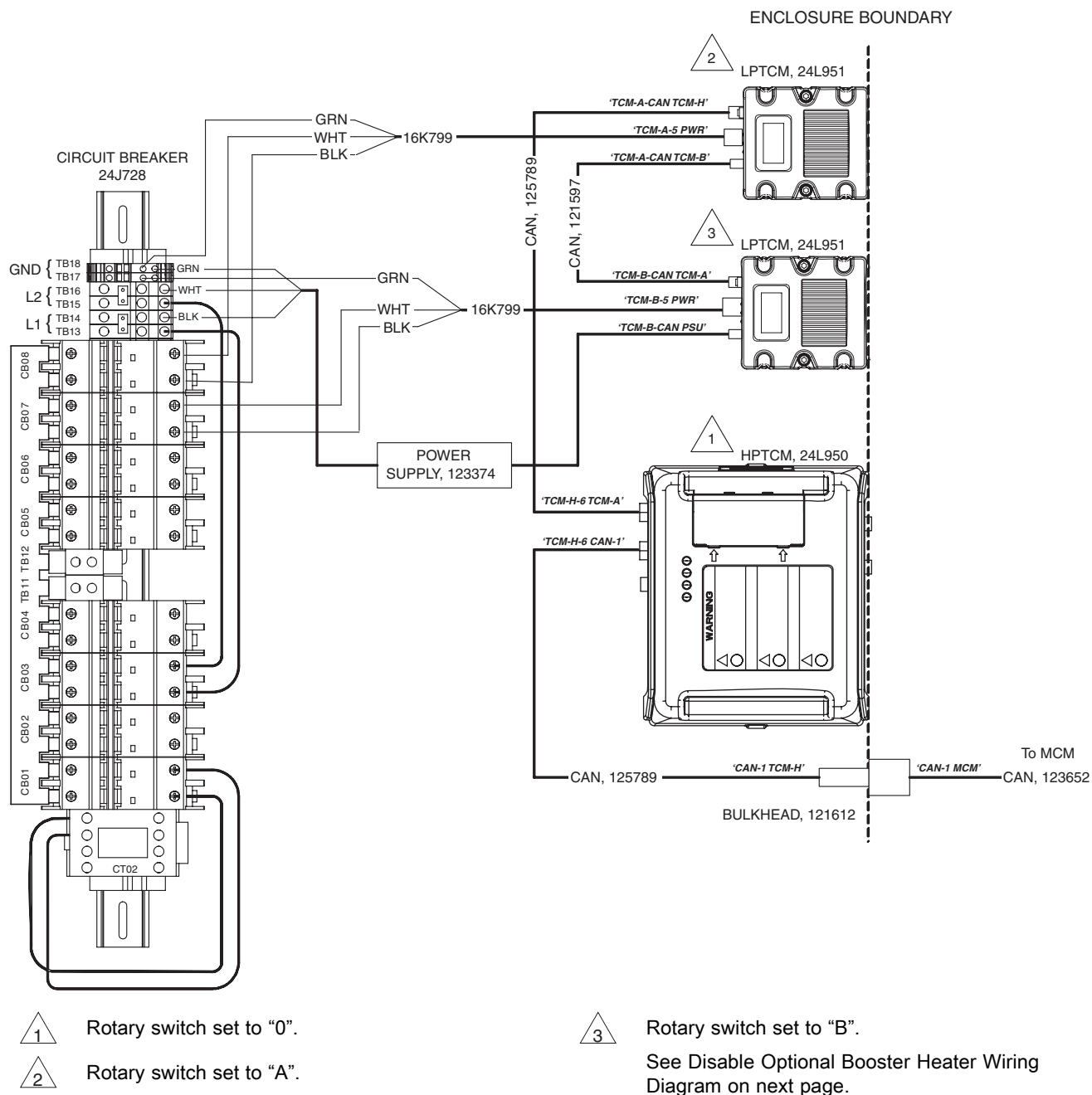
See [Circuit Breaker Identification, page 132](#), for circuit breaker identification table.

## Outside Electrical Enclosure With Optional Heater Wiring Diagram

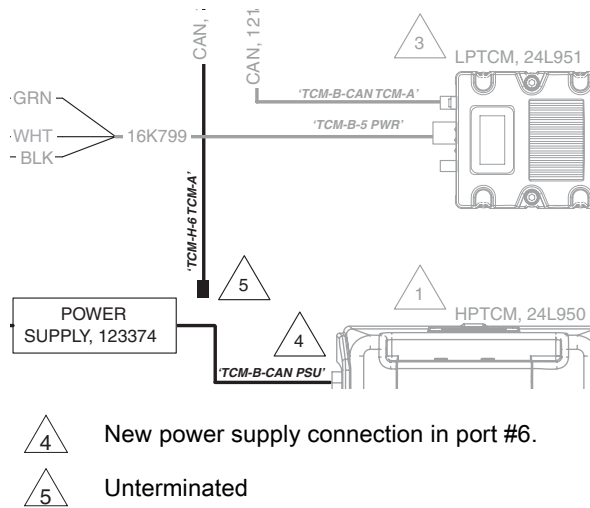


Heater viewed from the back of the proportioner.

# Booster Heater Wiring Diagram

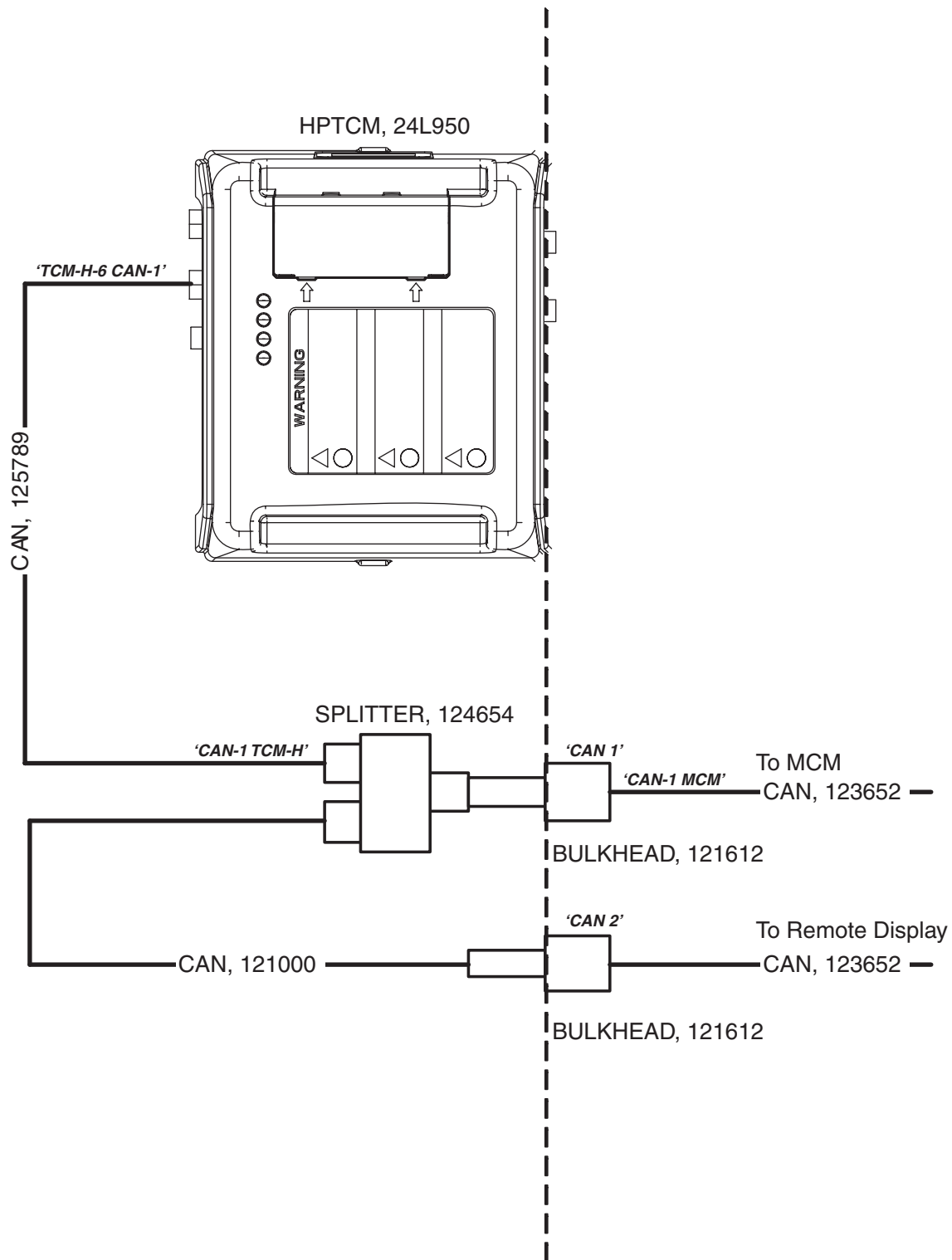


## Disable Optional Booster Heater Wiring Diagram



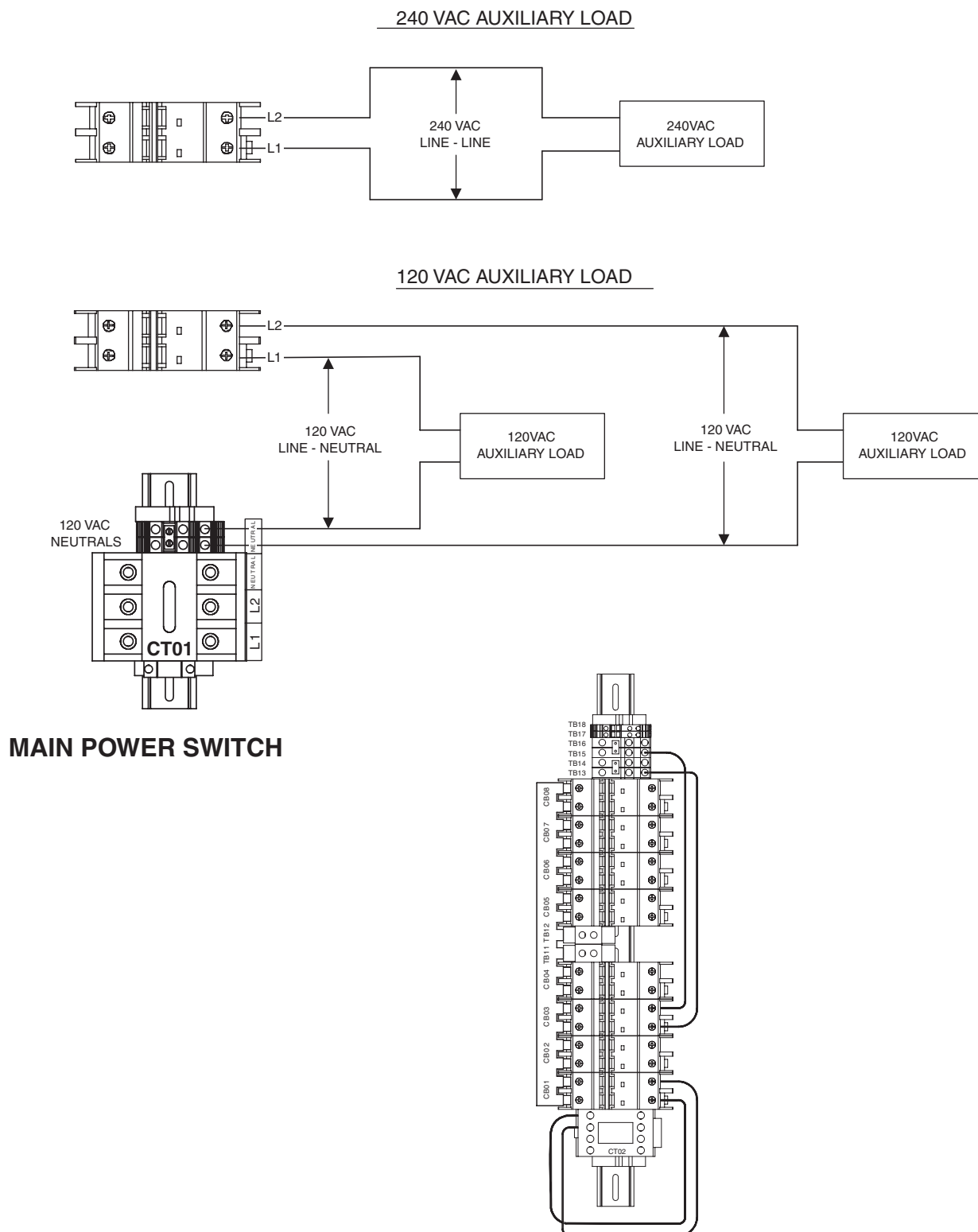
# Optional Remote Display Module Wiring Diagram

ENCLOSURE BOUNDARY

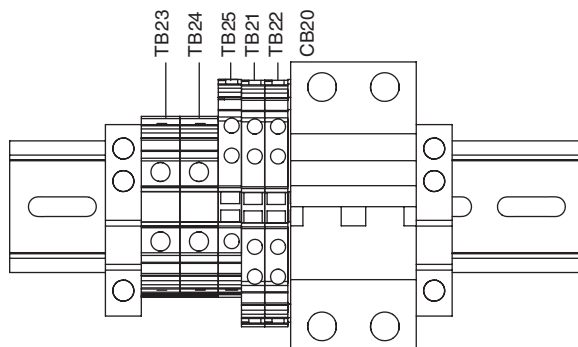
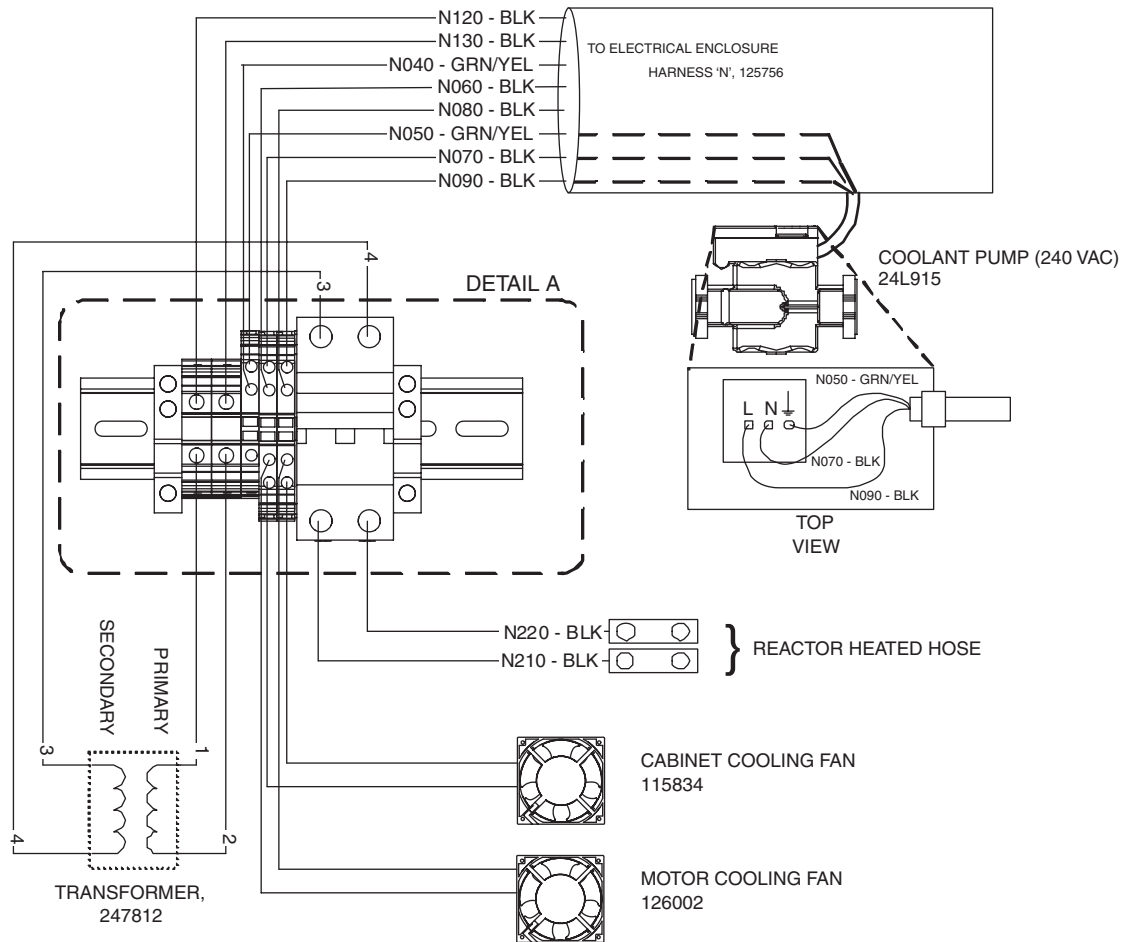


## Optional Customer Auxiliary Power Wiring Diagram

See [Circuit Breaker Identification, page 132](#), for circuit breaker identification table and other available circuit breakers. Before making any changes to the standard auxiliary circuit breaker configuration, refer to Circuit Breaker Configuration Options in the Reactor Operation Manual.

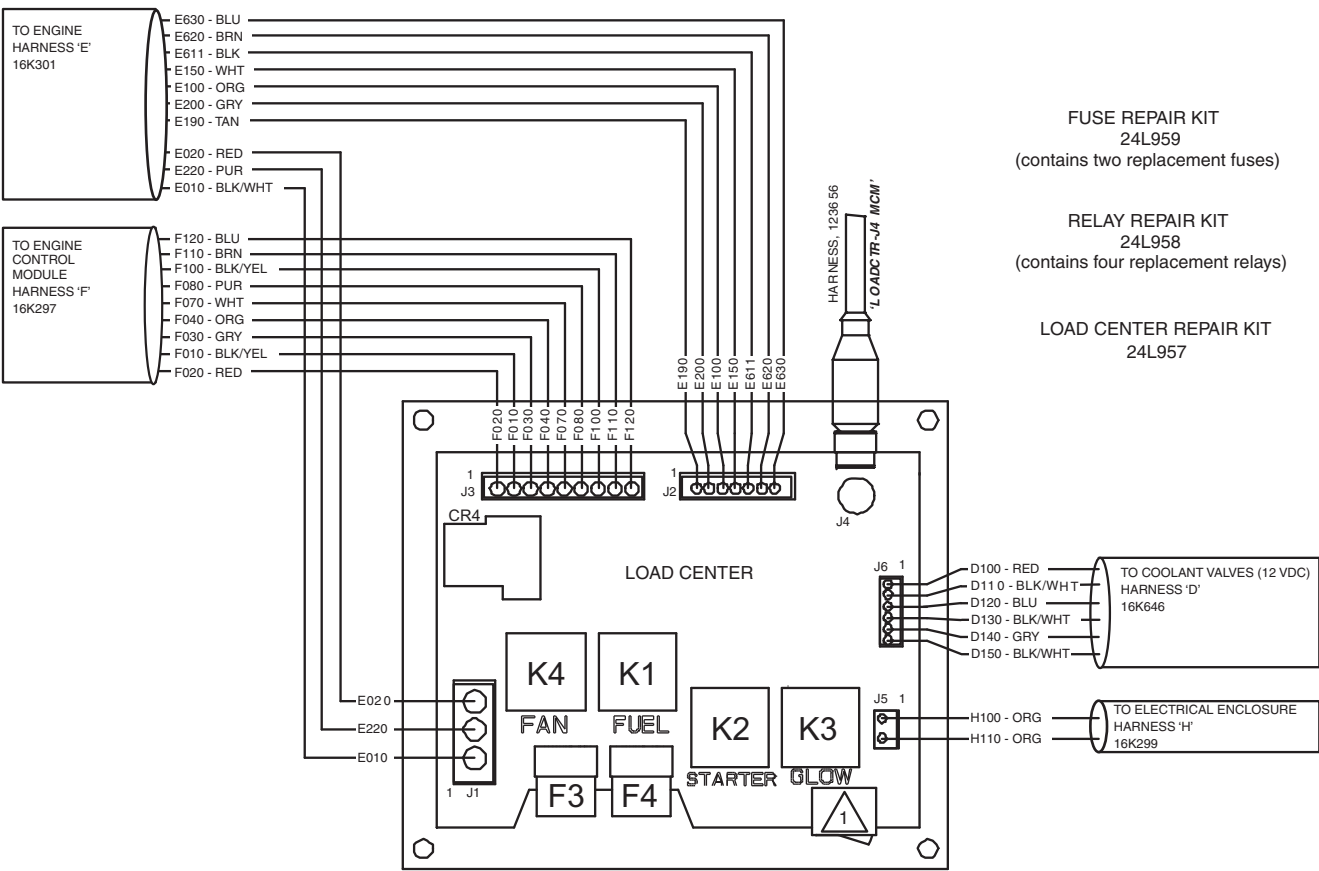


# Reactor Cabinet Wiring Diagram



DETAIL A  
CIRCUIT BREAKER AND TERMINAL BLOCK DESIGNATION

# Load Center Wiring Diagram



Manual Valve Switch:  
O — OFF: Automatic Operation  
1 — ON: Manual Operation

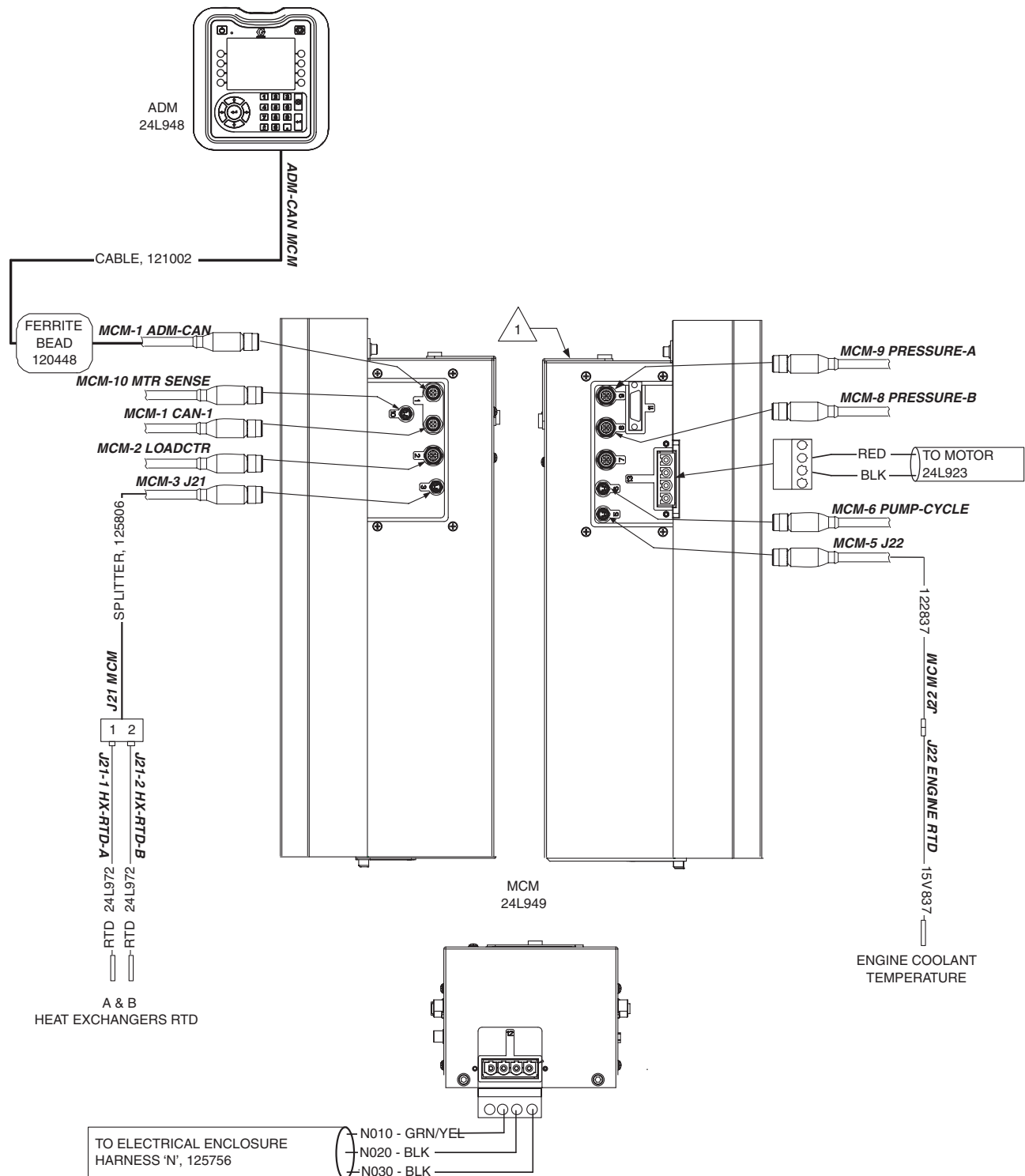
# Coolant Valve (12 VDC) Wiring Diagram

Load Center	Harness D (16K646)	Connection Description	Coolant Valve Coil Terminal
J6-1	D150 — BLK/WHT	Bypass valve return	J18-2
J6-2	D140 — GRY	Bypass valve signal	J18-1
J6-3	D130 — BLK/WHT	B valve return	J17-2
J6-4	D120 — BLU	B valve signal	J17-1
J6-5	D110 — BLK/WHT	A valve return	J16-2
J6-6	D100 — RED	A valve signal	J16-1

The diagram shows a square terminal block with four pins. PIN 1 is at the top right, and PIN 2 is at the top left. The wiring connections from the table are shown entering the terminal block from the bottom.



# Reactor Wiring Diagram



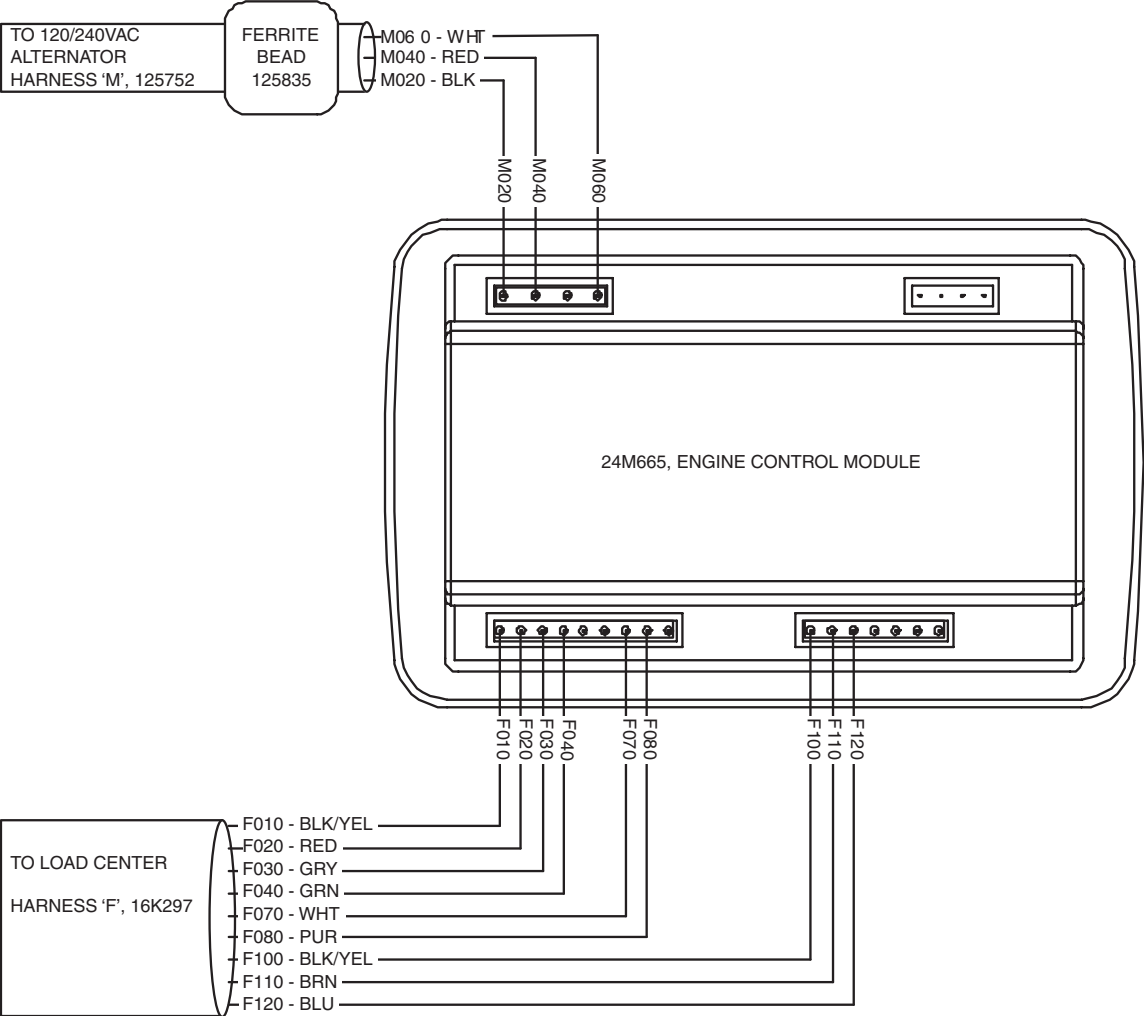
**Rotary switch setting:** E-30i = 0 E-XP2i = 1  
See Cable Routing Table on next page.

Reactor Cable Routing

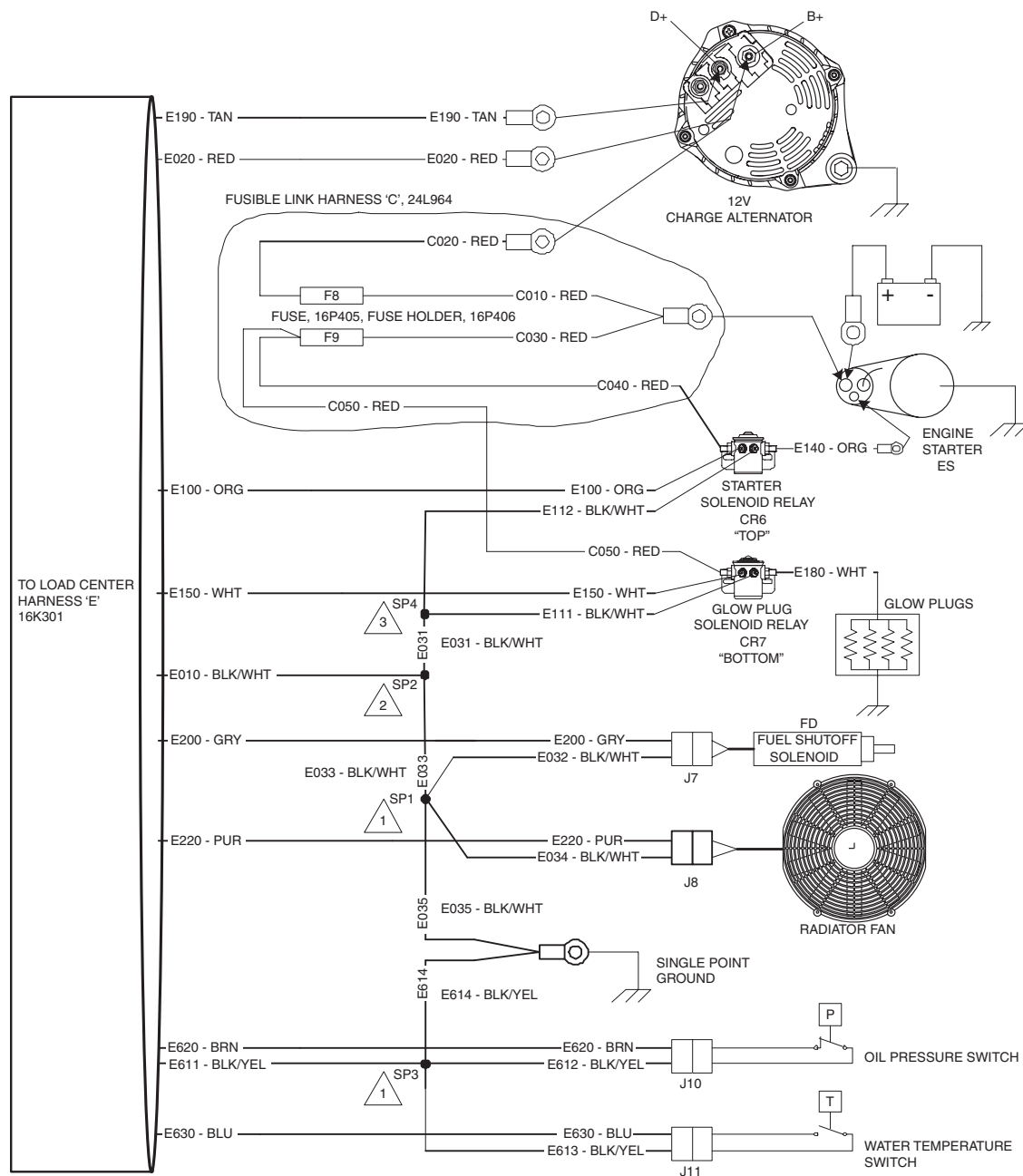
Item	End 1	End 2	Part
MCM-1 ADM-CAN	MCM-1	ADM-CAN	121002
MCM-10 MTR SENSE	MCM-10	MOTOR	24K393
MCM-1 CAN-1	MCM-1	ELECT. ENCL.	123652
MCM-2 LOADCTR	MCM-2	LOAD CENTER	123656
MCM-3J21	MCM-3	J21	125806
MCM-5J22	MCM-5	J22	122837
MCM-6 PUMP — CYCLE	MCM-6	PUMP CYCLE SWITCH	125757

Item	End 1	End 2	Part
MCM-8 PRES- SURE B	MCM-8	B PRES- SURE	15M669
MCM-9 PRES- SURE A	MCM-9	A PRES- SURE	15M669
HARNESS 'N'	MCM-12	ELECT. ENCL.	125756
TO MOTOR	MCM-13	MOTOR	24K393

Engine Control Module Wiring Diagram

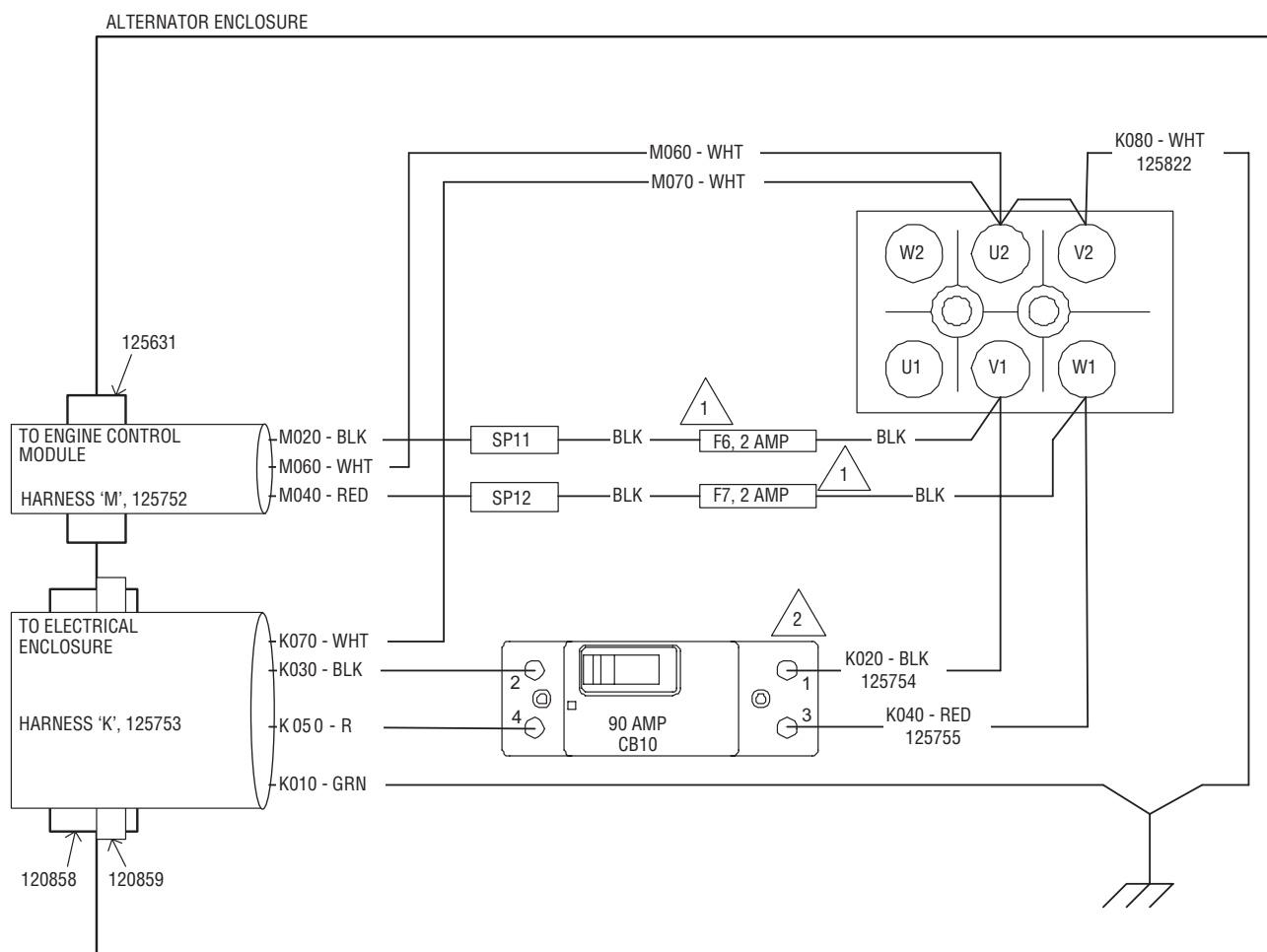


## Engine Wiring Diagram



- 1 Splice located inside the 3/4 in. loom above the starter.
- 2 Splice located inside the 3/4 in. loom above the panel holding CR6 and CR7, near the white cable tie.
- 3 Splice located inside the 3/4 in. loom bottom of the loop, under CR6 and CR7, approximately 6 in. from the main trunk, Engine Harness (E).
- 4 See [Repair Fusible Link Harness, page 80](#), for fuse or fuse holder repair.

## Alternator Enclosure Wiring Diagram



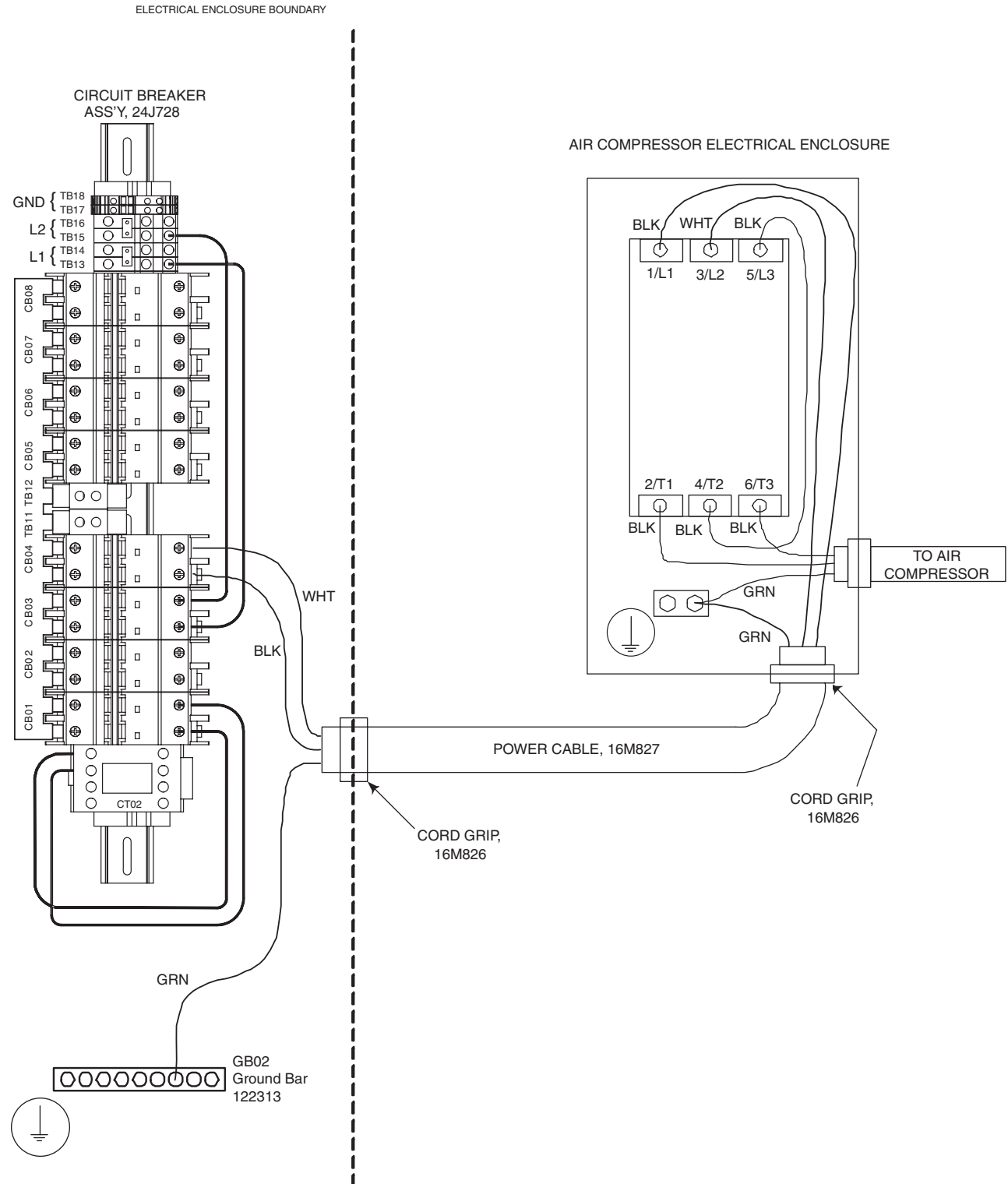
F6 and F7 Fuse replacement kit, 24M723.  
(contains two fuses)



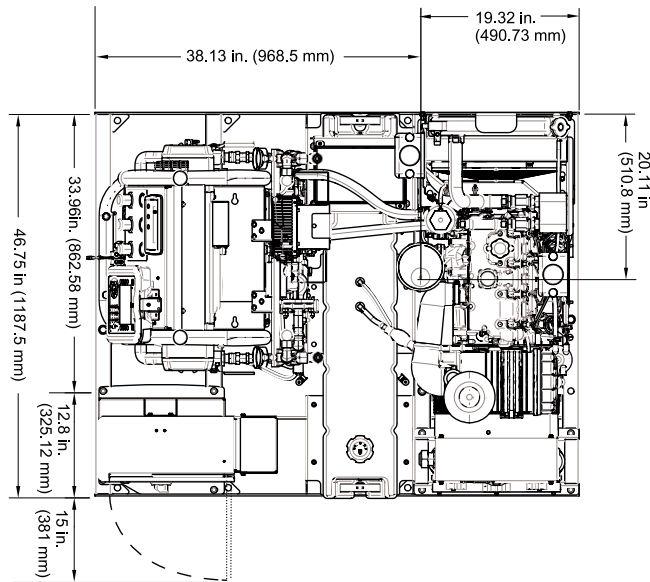
CB10 circuit breaker replacement kit, 24L965.

3. Two ferrite beads (125835), not shown, are located on two bundles of wires from the alternator to the circuit board. These are installed to eliminate electrical interferences and are needed to ensure proper operations.

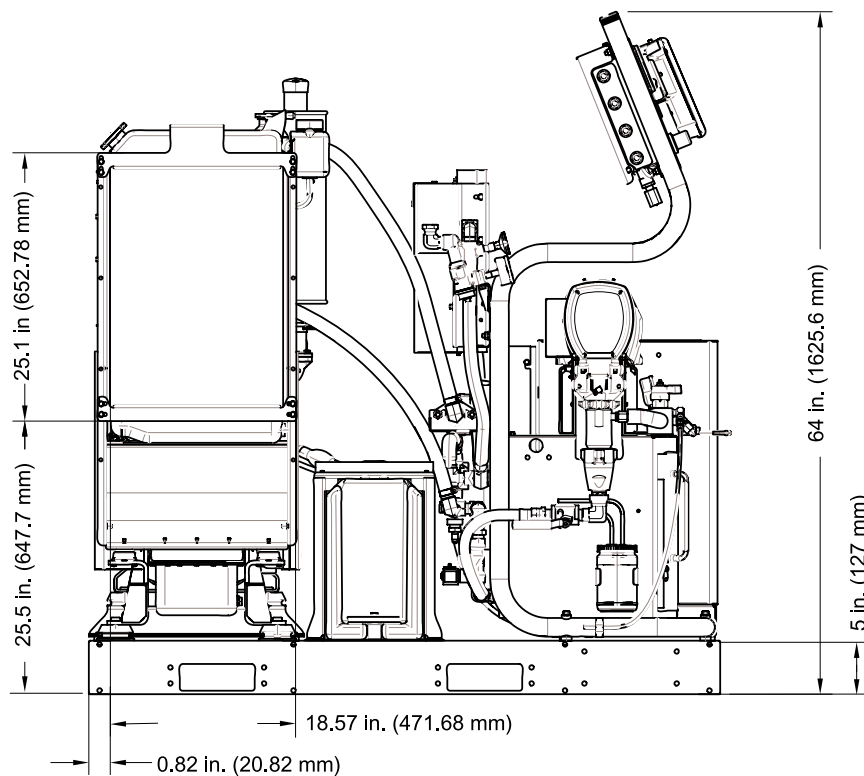
# Air Compressor Wiring Diagram



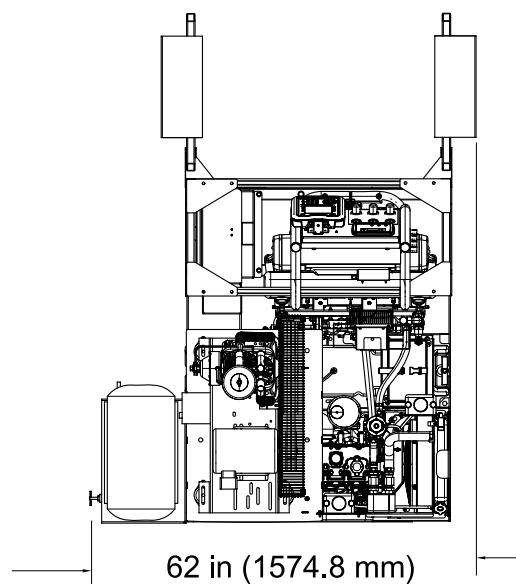
## Dimensions



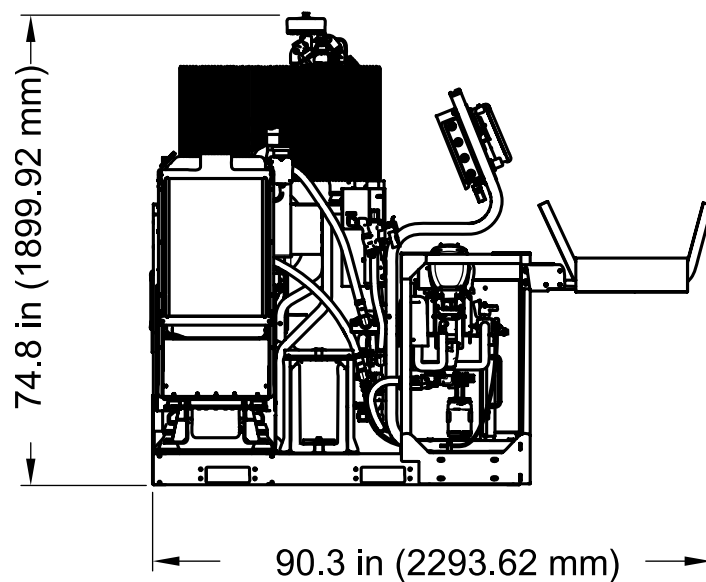
Top View  
Figure 51



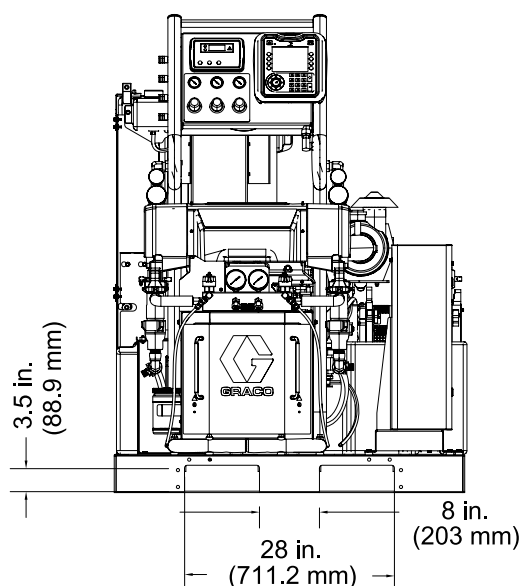
Side View  
Figure 52



Top View: System with Compressor and Hose Rack Accessories  
Figure 53

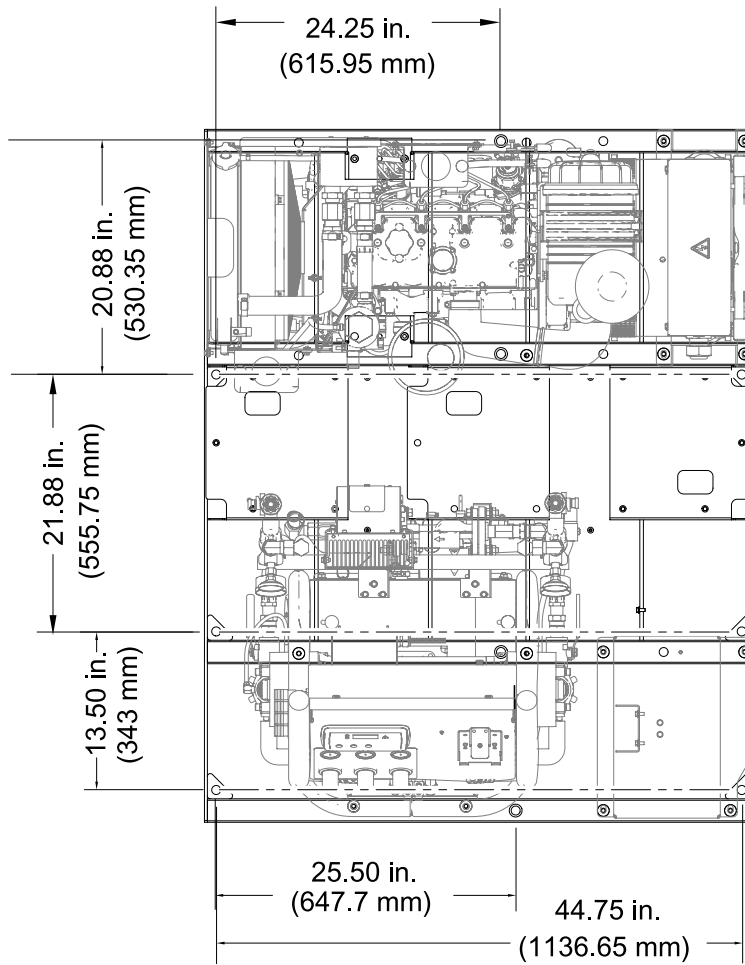


Side View: System with Compressor and Hose Rack Accessories  
Figure 55



Front View  
Figure 54

## Dimensions



Pallet Mounting Dimensions  
Figure 56



# Technical Specifications

E-30i Models		
	U.S.	Metric
Maximum Fluid Working Pressure		
Pressure	2000 psi	14 MPa, 140 bar
Maximum Fluid Temperature		
E-30i	140°F	60°C
E-30i with booster heater	180°F	82°C
Maximum Output		
Output	30 lb/min	13.5 kg/min
Maximum Heated Hose Length		
Length	310 ft	94 m
Output per Cycle		
A and B	0.0272 gal.	0.1034 liter
Operating Ambient Temperature Range		
Temperature	20° to 120°F	-7° to 49°C
Auxiliary Power Available		
Voltage	120 Vac or 240 Vac, 60 Hz	
Engine		
Model	Perkins 404-22G, 2.2 L, 29 HP	
Alternator		
Model	Mecc Alte 22 kW, 240 V, 1 PH, 60 Hz, pancake style	
Battery Requirements		
Voltage	12 Vdc	
Minimum Cold Cranking Amps	800 CCA	
Connection Type	Post Style	
Recommended Battery Size		
BC Group Number	34	
Length	10.25 in.	260 mm
Width	6.81 in.	173 mm
Height	7.88 in.	200 mm
Booster Heater Power		
E-30i	None	
E-30i with booster heat	4000 Watts	

Recommended Air Compressors		
Champion® BR-5, Base Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 21 cfm	
Required Features	Belt guard aftercooler	
	Pilot valve unloader	
Quincy QP–5–5B, Base Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 17.2 cfm	
Required Features	Belt guard aftercooler	
	Pilot valve unloader	
Champion® HR5-3, 30 Gallon Tank Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 21 cfm	
Required Features	Pilot valve unloader	
Noise		
Sound Pressure measured from 3.1 ft (1 m), at 1500 psi (10 MPa, 103 bar), 2 gpm (7.6 lpm)	91.0 dBA	
Fluid Inlets		
Component A (ISO) and Component B (RES)	3/4 NPT(f) with 3/4 NPSM(f) union	
Fluid Outlets		
Component A (ISO)	#8 (1/2 in.) JIC, with #5 (5/16 in.) JIC adapter	
Component B (RES)	#10 (5/8 in.) JIC, with #6 (3/8 in.) JIC adapter	
Fluid Circulation Ports		
Size	1/4 NPSM(m), with plastic tubing	
Maximum Pressure	250 psi	1.75 MPa, 17.5 bar
Weight		
E-30i	1750 lb	794 kg
E-30i with booster heat	1800 lb	816 kg
E–30i with compressor	2250 lb	1020 kg
E–30i with booster heat and compressor	2300 lb	1043 kg
Wetted Parts		
Material	Aluminum, stainless steel, zinc plated carbon steel, brass, carbide, chrome, chemically resistant o-rings, PTFE, ultra-high molecular weight polyethylene	

E-XP2i Models		
	U.S.	Metric
Maximum Fluid Working Pressure		
Pressure	3500 psi	24.1 MPa, 241 bar
Maximum Fluid Temperature		
E-XP2i	180°F	82°C
Maximum Output		
Output	2 gpm	7.6 lpm
Maximum Heated Hose Length		
Length	310 ft	94 m
Output per Cycle		
A and B	0.0203 gal.	0.0771 liter
Operating Ambient Temperature Range		
Temperature	20° to 120°F	-7° to 49°C
Auxiliary Power Available		
Voltage	120 Vac or 240 Vac, 60 Hz	
Engine		
Model	Perkins 404–22G, 2.2 L, 29 HP	
Alternator		
Model	Mecc Alte 22 kW, 240 V, 1 PH, 60 Hz, pancake style	
Battery Requirements		
Voltage	12 Vdc	
Minimum Cold Cranking Amps	800 CCA	
Connection Type	Post Style	
Recommended Battery Size		
BC Group Number	34	
Length	10.25 in.	260 mm
Width	6.81 in.	173 mm
Height	7.88 in.	200 mm
Booster Heater Power		
Wattage	4000 Watts	

Recommended Air Compressors		
Champion® BR-5, Base Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 21 cfm	
Required Features	Belt guard aftercooler	
	Pilot valve unloader	
Quincy QP-5-5B, Base Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 17.2 cfm	
Required Features	Belt guard aftercooler	
	Pilot valve unloader	
Champion® HR5-3, 30 Gallon Tank Mount		
Specifications	5 HP, 240 V, 1 Phase, 60 Hz, 21 cfm	
Required Features	Pilot valve unloader	
Noise		
Sound Pressure measured from 3.1 ft (1 m), at 2000 psi (14 MPa, 138 bar), 1.0 gpm (3.8 lpm)	91.0 dBA	
Fluid Inlets		
Component A (ISO) and Component B (RES)	3/4 NPT(f) with 3/4 NPSM(f) union	
Fluid Outlets		
Component A (ISO)	#8 (1/2 in.) JIC, with #5 (5/16 in.) JIC adapter	
Component B (RES)	#10 (5/8 in.) JIC, with #6 (3/8 in.) JIC adapter	
Fluid Circulation Ports		
Size	1/4 NPSM(m), with plastic tubing	
Maximum Pressure	250 psi	1.75 MPa, 17.5 bar
Weight		
E-XP2i	1800 lb	816 kg
E-XP2i with compressor	2500 lb	1043 kg
Wetted Parts		
Material	Aluminum, stainless steel, zinc plated carbon steel, brass, carbide, chrome, chemically resistant o-rings, PTFE, ultra-high molecular weight polyethylene	

## Notes

[illegible]

# 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

The Parties acknowledge that they have required that the present document, as well as all documents, notices and legal proceedings entered into, given or instituted pursuant hereto or relating directly or indirectly hereto, be drawn up in English. Les parties reconnaissent avoir convenu que la rédaction du présente document sera en Anglais, ainsi que tous documents, avis et procédures judiciaires exécutés, donnés ou intentés, à la suite de ou en rapport, directement ou indirectement, avec les procédures concernées.

## Graco Information

For the latest information about Graco products, visit [www.graco.com](http://www.graco.com).

**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

All written and visual data contained in this document reflects the latest product information available at the time of publication.

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

For patent information, see [www.graco.com/patents](http://www.graco.com/patents).

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**Graco Headquarters:** Minneapolis

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