

Reactor® E-30i and E-XP2i

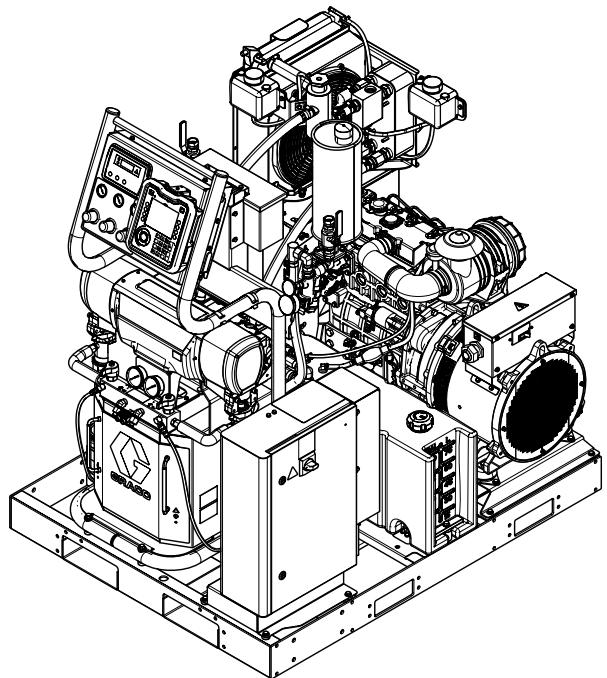
3A1706K
EN

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 |
| Important Two-Component Material Information | 7 |
| Proportioner Models | 9 |
| Systems..... | 11 |
| Accessories..... | 12 |
| Supplied Manuals | 13 |
| Related Manuals | 13 |
| Troubleshooting..... | 14 |
| Error Codes and Troubleshooting..... | 14 |
| Load Center Diagnostics | 37 |
| Repair..... | 46 |
| Before Beginning Repair..... | 46 |
| Pressure Relief Procedure..... | 46 |
| Flushing | 47 |
| Flush Inlet Strainer Screen | 48 |
| Shutdown | 49 |
| Drain Coolant | 50 |
| Refill Proportioner Coolant Loop | 51 |
| Refill Engine Coolant Loop | 52 |
| Coolant Specifications..... | 53 |
| Change Pump Lubricant..... | 53 |
| Remove Pump..... | 54 |
| Install Pump | 56 |
| Repair Drive Housing | 56 |
| Repair Motor Brushes | 59 |
| Repair Electric Motor..... | 61 |
| Repair Circuit Breaker Module | 62 |
| Replace Relays and Fuses | 64 |
| Replace Transducers | 65 |
| Replace Fans | 66 |
| Repair Booster Heater..... | 68 |
| Repair Heated Hose..... | 71 |
| Repair Fluid Temperature Sensor (FTS) | 72 |
| Replace Heat Exchangers | 74 |
| Replace Power Supply | 77 |
| Replace Circulation Pump | 78 |
| Repair Sight Glass Filter..... | 79 |
| Repair Filter Housing Filter | 80 |
| Remove Fuel Tank..... | 81 |
| Replace Battery | 81 |
| Repair Fusible Link Harness | 82 |
| Remove Radiator..... | 84 |
| Repair Advanced Display Module (ADM)..... | 85 |
| Repair Engine Control Module | 85 |
| Replace Motor Control Module (MCM) | 86 |
| Replace High Power Temperature Control Module (HPTCM)..... | 86 |
| Replace Low Power Temperature Control Module (LPTCM) | 86 |
| Remove Proportioner | 88 |
| Repair Engine..... | 90 |
| 12V Charge Alternator..... | 90 |
| Notes | 91 |
| Parts..... | 92 |
| Electrical Schematics..... | 134 |
| Repair and Spare Parts Reference | 149 |
| Dimensions | 151 |
| Technical Specifications..... | 154 |
| Graco Standard Warranty..... | 158 |

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.

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

Warnings

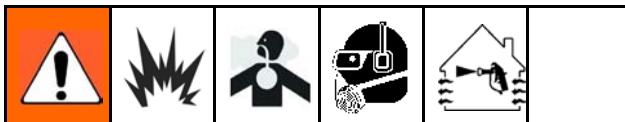
|  WARNING | |
|--|--|
|    | SKIN INJECTION HAZARD <p>High-pressure fluid from dispensing device, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. Get immediate surgical treatment.</p> <ul style="list-style-type: none">Engage trigger lock when not dispensing.Do not point dispensing device at anyone or at any part of the body.Do not put your hand over the fluid outlet.Do not stop or deflect leaks with your hand, body, glove, or rag.Follow the Pressure Relief Procedure when you stop dispensing and before cleaning, checking, or servicing equipment.Tighten all fluid connections before operating the equipment.Check hoses and couplings daily. Replace worn or damaged parts immediately. |
|     | FIRE AND EXPLOSION HAZARD <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">Use equipment only in well ventilated area.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.Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc).Keep work area free of debris, including solvent, rags and gasoline.Do not plug or unplug power cords, or turn light switches on or off when flammable fumes are present.Ground all equipment in the work area. See Grounding instructions.Use only grounded hoses.Hold gun firmly to side of grounded pail when triggering into pail.If there is static sparking or you feel a shock, stop operation immediately. Do not use equipment until you identify and correct the problem.Keep a working fire extinguisher in the work area. |
|    | THERMAL EXPANSION HAZARD <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">Open a valve to relieve the fluid expansion during heating.Replace hoses proactively at regular intervals based on your operating conditions. |

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

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

Important Two-Component Material Information

Isocyanate Conditions



Spraying or dispensing materials containing isocyanates creates potentially harmful mists, vapors, and atomized particulates.

Read material manufacturer's warnings and material MSDS to know specific hazards and precautions related to isocyanates.

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.

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.

Moisture Sensitivity of Isocyanates



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, **never** interchange component A (isocyanate) and component B (resin) parts.

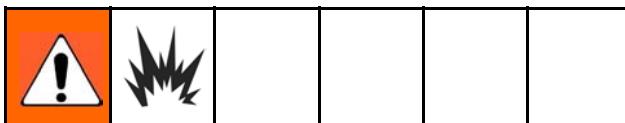
Isocyanates (ISO) are catalysts used in two component foam and polyurea coatings. ISO will react with moisture (such as humidity) to form small, hard, abrasive crystals, which become suspended in the fluid. Eventually a film will form on the surface and the ISO will begin to gel, increasing in viscosity. 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



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

Keep Components A and B Separate



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, **never** interchange component A (isocyanate) and component B (resin) parts.

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 |  Conforms to ANSI/UL Std. 73 Certified to CAN/CSA Std. C22.2 No. 68 |
| 259080 259081 |  Conforms to ANSI/UL Std. 499 Certified to CAN/CSA Std. C22.2 No. 88 |

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.

| 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 |
| SEBU8311-02 | <p>Perkins® Engine, Repair-Parts Access at www.perkins.com. Go to Service and Support/manuals. Select engine family and type code "GN".</p> <p><i>Contact Perkins for engine warranty and service.</i></p> |
| - | <p>Mecc Alte Self-Regulating Alternator Series NPE, Repair-Parts Access at www.meccalte.com. Select "meccalte" logo / Download / Instruction Manuals. Select NPE instruction manual on page 5. Go to Support and enter serial number for Parts List and Help Videos.</p> <p><i>Contact Mecc Alte for warranty and service.</i></p> |
| F3231, ver 16 | <p>Champion Air Compressor, Operation/Maintenance & Parts list. For warranty and service call Gardner-Denver Customer Service (866) 276-3440 or Champion (815) 875-3321.</p> |

Related Manuals

Manuals are available at 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 Repair Motor Brushes, page 59 . |
| | | | | Motor brushes completely worn down. | Check motor brushes and replace if needed. |
| | | | | Bad MCM. | Replace MCM. See Replace Motor Control Module (MCM), page 86 . |

| 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 Replace Motor Control Module (MCM), page 86 . |
| A4DA A4DB | Boost A | ALARM | High Heater Current | Short circuit in booster heater wiring. | Check wiring for touching wires. |
| | Boost B | | | Bad heater. | Measure resistance of heater(s), replace if needed. See Repair Booster Heater, page 68 . |
| 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. |

Troubleshooting

| 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 Repair Electric Motor, page 61 . |
| | | | | Chemical pump is stuck | Repair or replace chemical pump. See Remove Pump, page 54 . |
| A7CH | Hose | ALARM | Unexpected Relay Current | Shorted HPTCM. | Replace Module. See Replace High Power Temperature Control Module (HPTCM), page 86 . |
| A7DA | Boost A | ALARM | Unexpected Heater Current | Shorted LPTCM. | Replace Module. See Replace Low Power Temperature Control Module (LPTCM), page 86 . |
| 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 Replace High Power Temperature Control Module (HPTCM), page 86 . |
| 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 | Boost A | 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. |
| CACB | Boost B | | | 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. |
| CACH | Hose | | | 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. |
| CACM | MCM | | | Bad module | (CACA or CACB) Replace LPTCM. See Replace Low Power Temperature Control Module (LPTCM) , page 86. (CACH) Replace HPTCM. See Replace High Power Temperature Control Module (HPTCM) , page 86. (CACM) Replace MCM. See Replace Motor Control Module (MCM) , page 86. (CACP) Replace Remote Display Module. See Remote Display Module manual for instructions. |
| CACP | Remote Display Module | | | | |

Troubleshooting

| 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 Repair Electric Motor, page 61 . |
| | | | | Chemical pump is stuck. | Repair or replace pump. See Remove Pump, page 54 . |
| 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 | ADVI-SORY | Motor Brush Wear | Brushes have worn down and need replacing. | Replace Brushes. See Repair Motor Brushes, page 59 . |
| MMUX | USB | ADVI-SORY | 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 | 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. |
| | | | Over Pressure B | Bad pressure transducer. | Verify the ADM pressure reading the analog gauges at the manifold. Replace transducers if they do not match. See Replace Transducers, page 65 . |
| P6AX P6BX | MCM | ALARM | Pressure Transducer Fault A | Loose/bad connection. | Check to ensure the pressure transducer is properly installed and all wires are properly connected. |
| | | | Pressure Transducer Fault B | 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 Replace Transducers, page 65 . If the error does not follow, replace MCM. See Replace Motor Control Module (MCM), page 86 . |

Troubleshooting

| Error Code | Error Location | Type | Name | Cause | Solution |
|--------------|-----------------------|----------|---|---|---|
| P7AX P7BX | MCM | ALARM | Pressure Imbalance A High (P7AX) | 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 B High (P7BX) | 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 Replace Load Center Relays and Fuses, page 64 . |
| | | | | Engine thermostat is stuck open. | Replace thermostat. See Perkins dealer. |

| Error Code | Error Location | Type | Name | Cause | Solution |
|------------|----------------|-----------|----------------------|---|--|
| T2AE | Heat Exchanger | DEVIATION | Low Temperature Hx A | Recirculating material to heat with drum feed pumps only. | Recirculate material using Jog mode for heat exchanger heating. |
| T2BE | | | 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 Replace Circulation Pump, page 78 . |
| | | | | Air lock in circulation pump. | Check for coolant flow in sight glass. |
| | | | | Loose or incorrect wiring connections. | Verify coolant valve connections, see Electrical Schematics, page 134 . Check coolant valve harness (D). See Harness Identification, page 134 . Verify voltage is 11–13 volts at coolant valve connectors. |
| | | | | No voltage to coil of valve. | <p>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 (242) and ensure the LEDs are on. See Load Center, page 143.</p> <p>Follow Load Center Diagnostics, page 37. If necessary, replace the load center board. See Replace Load Center, page 64.</p> <p>If voltage is present, measure the resistance of the coil, it should be approximately 12.5 Ω, if coil is open replace coil.</p> <p>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 Replace Control Valve, page 77.</p> |

Troubleshooting

| 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. | Use a smaller mix chamber that is rated for the unit in use. |
| | | | | Bad heater(s) | 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. | Replace fan relay. See Replace Load Center Relays and Fuses, page 64 . |
| | | | | Engine thermostat is stuck open. | 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) | Manual override switch on load center board is in the on position. | Open cabinet cover and turn switch to the off position. |
| | | | High Chemical Temperature Hx B (T4BE) | A or B side control valve solenoid is stuck in the open position. Debris in valve diaphragm or plunger preventing spring-loaded closed function. | Disconnect connector from solenoid coil. If temperature does not decrease, rebuild solenoid. See Replace Control Valve, page 77 . |
| | | | | 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. | Follow Load Center Diagnostics, page 37 . If necessary, replace load center board. See Replace Load Center, page 64 . |
| | | | | (T4BE only) J6 connector on load center "Heat Valves" location is not centered. | Reconnect J6 connector on load center in centered location. |
| | | | | A and B heat exchanger RTD cables cross-connected to splitter cable. | Swap RTD connections to splitter 1 an 2 markings. See Reactor Wiring Diagram, page 144 . |

| Error Code | Error Location | Type | Name | Cause | Solution |
|------------|----------------|-------|---------------------------------------|--|--|
| T4CA | Boost A | ALARM | (T4CA or T4CB) LPTCM Over Temperature | Cooling fan not operating. | If fan is not working check wiring between CB03 and fan. If wiring is good, replace fan. See Replace Electrical Enclosure Fan, page 67 . |
| T4CB | Boost B | | (T4CH) HPTCM Over Temperature | Overheated module. | Turn controller off. Wait a few minutes. If the condition does not clear or regenerates consistently, replace module. See Replace High Power Temperature Control Module (HPTCM), page 86 , or Replace Low Power Temperature Control Module (LPTCM), page 86 . |
| T4CH | Hose | | | | |
| | | | | | |
| T4CM | MCM | ALARM | High MCM Temperature | High ambient temperature. | Ensure ambient temperature is below 120°F(48°C) before using the system. |
| | | | | Overheated control module. | Stop the pumps. Wait a few minutes. If the condition does not clear or regenerates consistently, replace MCM. See Replace Motor Control Module (MCM), page 86 . |
| T4DA | Boost A | ALARM | High Chemical Temperature | Bad RTD or bad RTD placement against heater rod. | Swap A and B heater power cables and RTD cables and see if issue follows. If so, replace RTD. See Replace RTD, page 69 . |
| | Boost B | | | Bad Low Power Temperature Control Module. | Swap the A and B LPTCMs and see if the issue follows the module. If so replace LPTCM. See Replace Low Power Temperature Control Module (LPTCM), page 86 . |
| T4DE | Heat Exchanger | | High Temperature Coolant Outlet | Radiator fan not functioning properly. | Check fan relay (K4) and fuse (30 Amp ATO "F3") on load center board. Replace if needed. See Replace Load Center Relays and Fuses, page 64 . |
| | | | | Plugged radiator. | Replace if needed. See Remove Radiator, page 84 . |
| | | | | High ambient temperature. | 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 Replace High Power Temperature Control Module (HPTCM), page 86. |
| 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 Repair Electric Motor, page 61. |

| 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. | <p>Expose each hose RTD connection to check and retighten any loose connector. Measure hose RTD cable and FTS continuity. See Check RTD Cables and FTS, page 71. Order RTD Test Kit 24N365 for measurement.</p> <p>See Temporary Manual Hose Temperature Control instructions, in the operation manual, to finish the job until repair can be completed.</p> |

Troubleshooting

| 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) | Low chemical supply temperature. System stored below 20°F(-7°C) causing slow control valve operation. | Use Jog Mode to recirculate heated chemical back to drum in cold conditions before spraying. Chemical below 32°F(0°C) at startup. Ensure ambient temperature is above 20°F(-7°C). |
| | | | | Plugged filter in sight glass. Indicated by consistent low A and B temperature alarms. | Clean or replace filter. To replace filter in sight glass, see Repair Sight Glass Filter, page 79 and order replacement filter kit 24L922. To replace filter in filter housing, see Repair Filter Housing Filter, page 80 and order replacement filter kit 24T028. |
| | | | | Coolant debris stuck in valve pilot hole or passages. | Inspect and clean control valve. Repair or replace if necessary. See Replace Control Valve, page 77 . |
| | | | | 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 Replace Circulation Pump, page 78 . |
| | | | | (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 coil. | Turn on the manual valve switch, on the load center, and see if the solenoid shifts. For coolant valve LED identification, see Load Center Diagnostics, page 37 . If solenoid does not shift, replace solenoid coil. See Replace Control Valve, page 77 . |
| | | | | Valve solenoid not getting 12 VDC electrical signal. | Verify 12 VDC signal is at the valve solenoid coil connector. All three valves are normally closed with power removed. See Electrical Schematics, page 134 for valve wiring harness identification diagram. |
| | | | | Bad load center. | Follow Load Center Diagnostics, page 37 . If necessary, replace load center. See Replace Load Center, page 64 . |

Continued on next page.

| 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) | A and B heat exchanger RTD cables cross-connected to splitter cable. | Swap RTD connections to splitter 1 an 2 markings. See Reactor Wiring Diagram, page 144 . |
| 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 Ω, of heater rod, replace if reading open. See Replace Heater Element, page 68 . Recirculate heated chemical back to drum in cold conditions before spraying chemical below 32°F(0°C) at startup. Use Jog Mode for heat exchanger heating. 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 MCM circuit breaker (CB02). | Visually check circuit breaker for a tripped condition. If Diagnostic screen is enabled, MCM Bus 14 V indicates normal voltage and 1 V indicates failed MCM. |
| 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 dryer are setup to be continuous run and sized according to manual. |

Troubleshooting

| Error Code | Error Location | Type | Name | Cause | Solution |
|------------|----------------|----------|---------------------------|---|---|
| V4CM | MCM | ALARM | Bus Overvoltage | 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. |
| V4MH | HPTCM | ALARM | High Line Voltage | | |
| 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 Replace Motor Control Module (MCM), page 86 . |
| 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 Replace Load Center, page 64 . |
| 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 Repair Advanced Display Module (ADM), page 85 . |
| 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

For air compressor service or warranty, contact the Champion division of Gardner-Denver. See [Supplied Manuals, page 13](#), for contacts.



Before performing any troubleshooting procedures:

1. Relieve Pressure. See [Pressure Relief Procedure, page 46](#).
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 Repair Circuit Breaker Module, page 62 . Check circuit breaker (CB10). See Repair Circuit Breaker Module, page 62 . |
| Electric motor does not operate. | Loose connections. | Check MCM connection 13. |
| | Tripped circuit breaker (CB02). | Reset breaker, see Repair Circuit Breaker Module, page 62 . Check 240VAC at output of breaker. |
| | Worn brushes. | Check both sides. Length must be 0.7 in. (17 mm) minimum. To replace, see Repair Motor Brushes, page 59 . |
| | Broken or misaligned brush springs. | Realign or replace, see Repair Motor Brushes, page 59 . |
| | Brushes or springs binding in brush holder. | Clean brush holder and align brush leads for free movement. |
| | Shorted armature. | Replace motor, see Repair Electric Motor, page 61 . |
| | Check motor commutator for burn spots or other damage. | Remove motor. Have motor shop resurface commutator, if possible. |

Troubleshooting

| 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 Electrical Schematics, page 134 . |
| | Fan blade obstructed. | Remove obstruction. |
| | Defective fan. | Replace. See Replace Motor Fan, page 66 . |
| 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 Electrical Schematics, page 134 . |
| | 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 Systems with Air Compressors, page 100 . |

Coolant System



| Problem | Cause | Solution |
|--|--|--|
| Proportioner Coolant Loop | | |
| Air bubbles in sight glass. | Air trapped in heat exchanger coolant. | See Refill Proportioner Coolant Loop, page 51. |
| | Coolant hoses between the proportioner coolant loop and engine coolant loop were modified and created a high point air pocket. | Ensure coolant hoses have a constant rise in elevation. |
| | Proportioner coolant loop expansion bottle is empty. | See Refill Proportioner Coolant Loop, page 51. |
| 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 Replace Control Valve, page 77 . |
| Material slowly heats up. | Coolant filter plugged. | Clean or replace filter. To replace filter in sight glass, see Repair Sight Glass Filter, page 79 and order replacement filter kit 24L922. To replace filter in filter housing, see Repair Filter Housing Filter, page 80 and order replacement filter kit 24T028. |
| | A and B control valves are not opening fully. | Repair or replace valve. See Replace Control Valve, page 77 . |
| | 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 Drain Coolant, page 50 . 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 Replace Control Valve, page 77 . |
| | 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 Replace Control Valve, page 77 . |
| 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 Replace Control Valve, page 77 . |
| | Control valve stuck in open position. | Repair valve. See Replace Control Valve, page 77 . |
| | Bad load center. | Replace the load center board. See Replace Load Center, page 64 . |

Troubleshooting

| Problem | Cause | Solution |
|---|---|---|
| Engine Coolant Loop | | |
| Engine coolant does not reach full temperature. | Radiator fan does not shut off. Radiator core becoming plugged. Engine thermostat not opening. | Check fan relay. Check fan wiring. Replace radiator. See Remove Radiator, page 84. Replace engine thermostat. |
| Engine temperature normal, but heat exchanger temperature is low or slowly increases. | Coolant level is low in expansion bottle. No coolant flow in engine coolant loop. Heat exchanger in the engine coolant loop is plugged. | Refill Engine Coolant Loop, page 52. |
| 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. Spring loaded gasket inside radiator cap does not seal. | Switch radiator caps. Radiator cap is marked 16 lbs and expansion bottle is marked 8 lbs. 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. |
| Coolant level dropping in overflow bottle but no visible leaks. | Cap not fully tightened. | Push down and tighten cap past safety latch position. |

Hose Heat System



Before performing any troubleshooting procedures:

1. Relieve Pressure. See [Pressure Relief Procedure, page 46](#).
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 Repair Fluid Temperature Sensor (FTS), page 72 . |
| 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 Electrical Schematics, page 134 . |
| | 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. |

Troubleshooting

| 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 Repair Fluid Temperature Sensor (FTS), page 72 . |
| Hose does not heat. | FTS failed. | Check FTS, see Repair Fluid Temperature Sensor (FTS), page 72 . |
| | FTS not installed correctly. | FTS should be installed close to end of hose in same environment as gun. Verify FTS installation, see Repair Fluid Temperature Sensor (FTS), page 72 . |
| | Loose hose electrical connections. | Check connections. Repair as necessary. |
| | Circuit breakers tripped. | Reset breakers (CB20 and CB02), see Repair Circuit Breaker Module, page 62 . |
| | 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 Check Hose Heat Connectors, page 71 . |
| 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 to 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 46](#).
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 Replace Heater Element, page 68 . |
| | Signal failure from RTD. | See (T4DA, T4DB), Error Codes and Troubleshooting, page 14 . |

Load Center Diagnostics

Reference [Replace Relays and Fuses, page 64](#), and [Load Center Wiring Diagram, page 143](#). The LEDs on the load center board are helpful diagnostic tools when troubleshooting problems with the engine. Before referencing the [Engine Troubleshooting, page 40](#), 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 40](#).

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

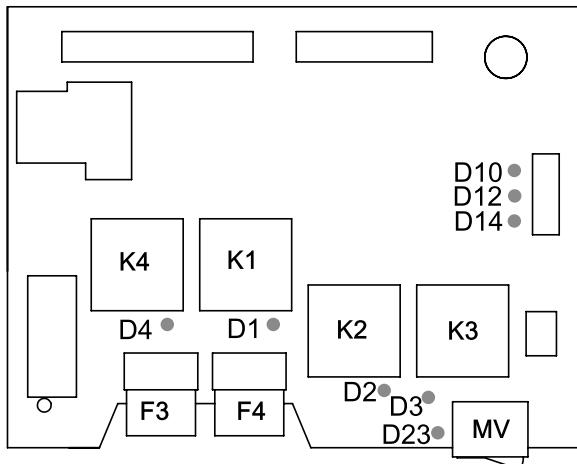
| | Fuel (D1) | Starter (D2) | Glow Plugs (D3) | Radiator Fan (D4) |
|---|---|---------------------------------------|--|-------------------------|
| 1 | Engine Harness (E) and its connections | | | |
| 2 | Engine Fuel Shutoff Solenoid Solenoid (FD) | Starter Solenoid Relay (CR6) | Glow Plugs Solenoid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

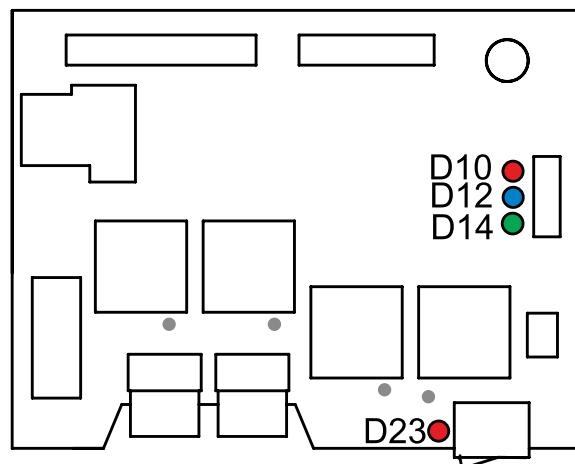
| | Fuel (D1) | Starter (D2) | Glow Plugs (D3) | Radiator Fan (D4) |
|----|--|---|--------------------------------------|---|
| 1 | Battery | | | |
| 2 | Battery cables and its connections | | | |
| 3 | | No D2 LED Disconnect switch ON | | |
| 4 | Load Center Fuse F4 ("PWR - ATO 20A") | | | Load Center Fuse F3 ("FAN - ATO 30A") |
| 5 | Fusible Link Harness (C) and its connections | | | |
| 6 | Engine Harness (E) and its connections | | | |
| 7 | Engine Control Module Harness (F) and its connections | | | |
| 8 | Load Center Fuel Relay (K1) | Load Center Starter Relay (K2) | Load Center Glow Relay (K3) | Load Center Fan Relay (K4) |
| 9 | Load Center Board | | | |
| 10 | Engine Control Module | | | |

Troubleshooting



Load Center Component Identification
Figure 1

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



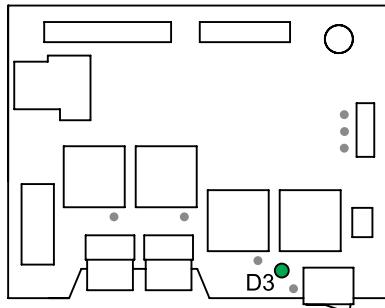
Manual Valve Switch ON (engine off)
Figure 2

| 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. |

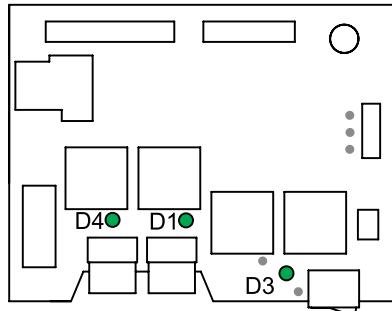
| LED | Description |
|--------------|-------------|
| ● | Off |
| ● (solid) | On |
| ● (flashing) | Flashing |

LED Sequence for Engine Startup and Operation

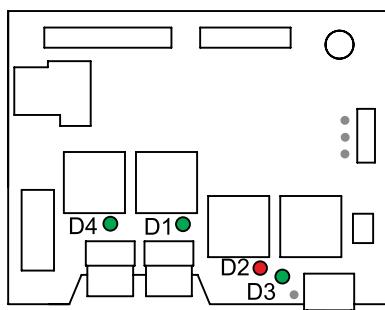
- After pressing green start button on Engine Control Module, glow plugs start warming engine.



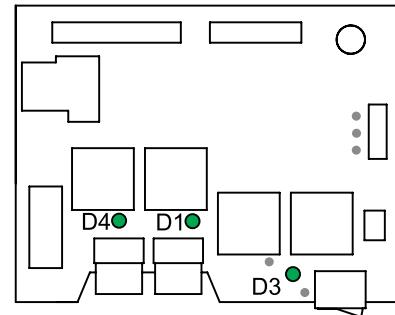
- Fuel and radiator fan turn on shortly before engine starting; glow plugs continue to warm engine.



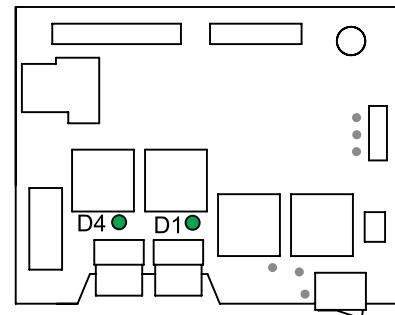
- Engine starting; fuel, fan, and glow plugs continue to operate.



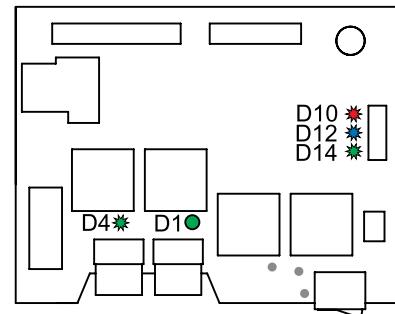
- Engine starting; glow plugs continue to warm engine.



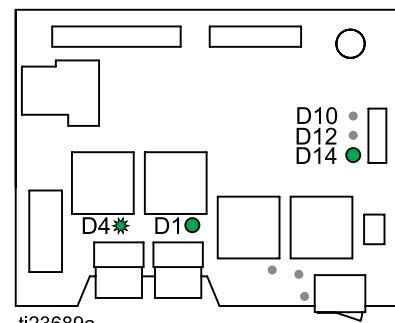
- Engine is running; with main power switch off, the radiator fan runs continuously.



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



- Ensure engine is running; proportioner idle before any heat zone is turned on.



Engine

Contact Perkins for diesel engine service or warranty. See [Supplied Manuals, page 13](#).



| 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 Replace Battery, page 81 . |
| | 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 Harness Identification, page 134 . 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 Replace Relays and Fuses, page 64 . |
| | Blown fusible link. | Verify continuity through fusible link harness from starter to 12V charge alternator. If required, replace Fusible Link Harness (C). See Harness Identification, page 134 . See Repair Fusible Link Harness, page 82 . |
| | Failed Engine Control Module. | Replace module. See Repair Engine Control Module, page 85 . |
| | Failed Load Center board. | Replace board. See Replace Load Center, page 64 . |

| Problem | Cause | Solution |
|---|--|---|
| Reference Load Center Diagnostics, page 37. | | |
| 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 Replace Battery, page 81 . |
| | Loose or corroded battery cable connector. | Verify cable connectors. See Replace Battery, page 81 . |
| | 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 Harness Identification, page 134 . 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 Replace Relays and Fuses, page 64 . |
| | Failed starter relay. | Replace relay K2 located on Load Center board. See Replace Relays and Fuses, page 64 . |
| | Failed starter solenoid relay. | Replace solenoid relay CR6 located on side of engine. See Replace Engine Solenoid Relays, page 65 . |
| | Blown fusible link. | Verify continuity through fusible link harness from starter to solenoid relay CR6. If required, replace Fusible Link Harness (C). See Harness Identification, page 134 . |
| | Failed load center board (242). | Replace board. See Replace Load Center, page 64 . |
| | Failed engine control module (428). | Replace module. See Repair Engine Control Module, page 85 . |
| | Failed engine starter (ES). | Contact local Perkins distributor for service. |

Troubleshooting

| Problem | Cause | Solution |
|---|--|---|
| Reference Load Center Diagnostics, page 37. | | |
| 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 Harness Identification, page 134. |
| | 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 Replace Relays and Fuses, page 64. |
| | Solenoid valve rod stuck in extended position. | Remove valve rod and clean with WD-40. |
| | 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 Replace Engine Solenoid Relays, page 65. |
| | Failed glow plug solenoid relay. | Replace solenoid relay CR7 located on side of engine. See Replace Engine Solenoid Relays, page 65. |
| | 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 Load Center Diagnostics, page 37 . | | |
| 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 Harness Identification, page 134 . |
| | Failed fuel relay. | Replace relay K1 located on Load Center board. See Replace Relays and Fuses, page 64 . |
| | 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. |

Troubleshooting

| Problem | Cause | Solution |
|---|--|--|
| Reference Load Center Diagnostics, page 37. | | |
| 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. |
| | Engine water temperature switch failed or shorted out. | Check for shorts to switch wiring. See Electrical Schematics, page 134. |
| | 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 Harness Identification, page 134. |
| | Blown radiator fan fuse. | Determine cause of blown fuse F3 "FAN - ATO 30A". Repair issue then replace fuse. See Replace Relays and Fuses, page 64 |
| | Failed radiator fan relay. | Replace relay K4 located on Load Center board. See Replace Relays and Fuses, page 64 . |
| | Obstructed radiator fan. | Remove obstructions. |
| | Failed radiator fan. | Replace fan. See Replace Radiator Fan, page 67 . |
| | Failed engine coolant temperature sensor. | Replace engine coolant temperature sensor located behind radiator connected to MCM port 5. See Replace Engine RTD, page 90 . |
| | Plugged radiator or coolant system. | Clean or replace radiator. See Remove Radiator, page 84 . 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 Harness Identification, page 134 . |
| | 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 Harness Identification, page 134 . |
| | 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



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.

Before Beginning Repair

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. Flush if necessary. See [Flushing, page 47](#).
2. See [Shutdown, page 49](#).

Pressure Relief Procedure

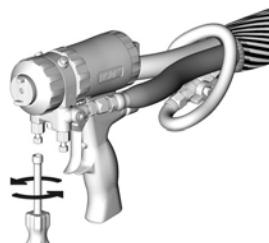


This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection, splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop spraying and before cleaning, checking, or servicing equipment.

The Fusion AP gun is shown.

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

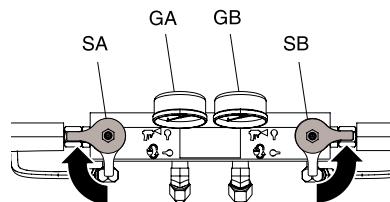
2. Close gun fluid inlet valves A and B.



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



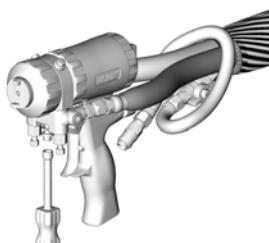
. Ensure gauges drop to 0.



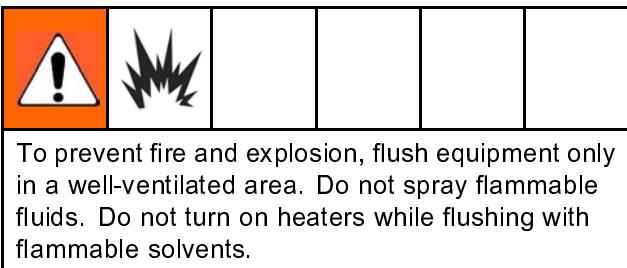
5. Engage gun piston safety lock.



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



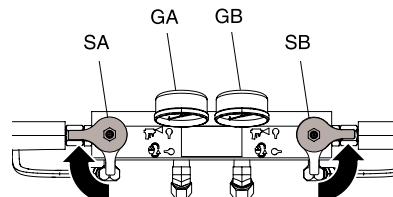
Flushing



- 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.

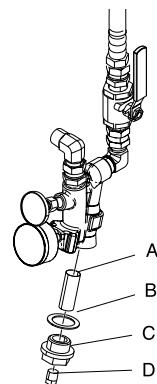


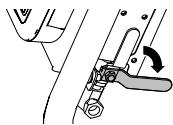
Figure 3

Shutdown

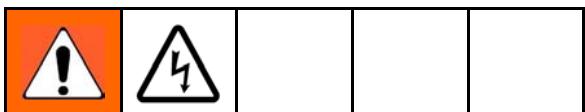
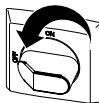
NOTICE

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 46](#).
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.



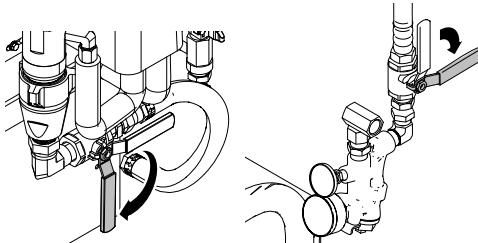
To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.

9. Allow engine dwell time.

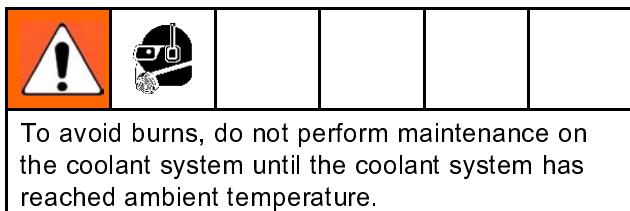
NOTICE

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. Close all fluid supply valves.



Drain Coolant



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 49](#).
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.

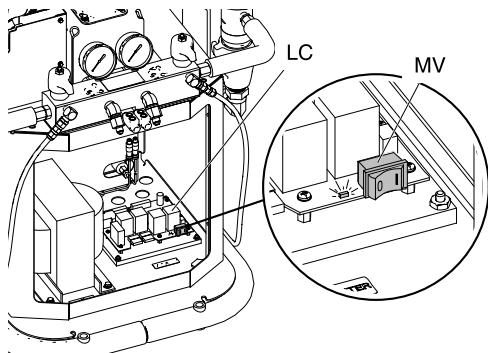
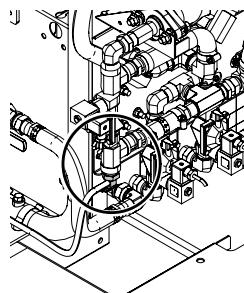


Figure 4

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

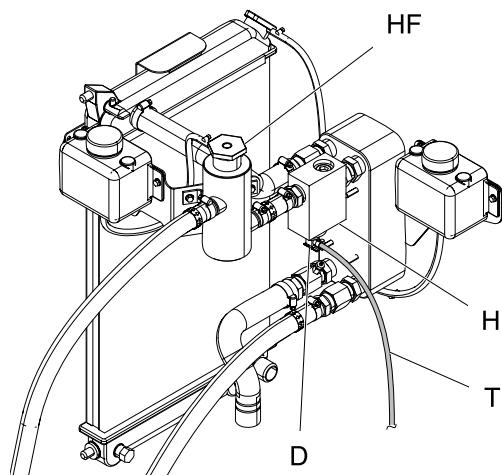
4. To drain proportioner coolant loop:
 - a. Remove the proportioner coolant loop fill bottle (HF) cap. See [Fig. 8](#).

- 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 51](#).
5. To drain proportioner coolant loop from filter housing. Only available on Series B systems.
 - a. Remove the proportioner coolant loop fill bottle cap (HF).

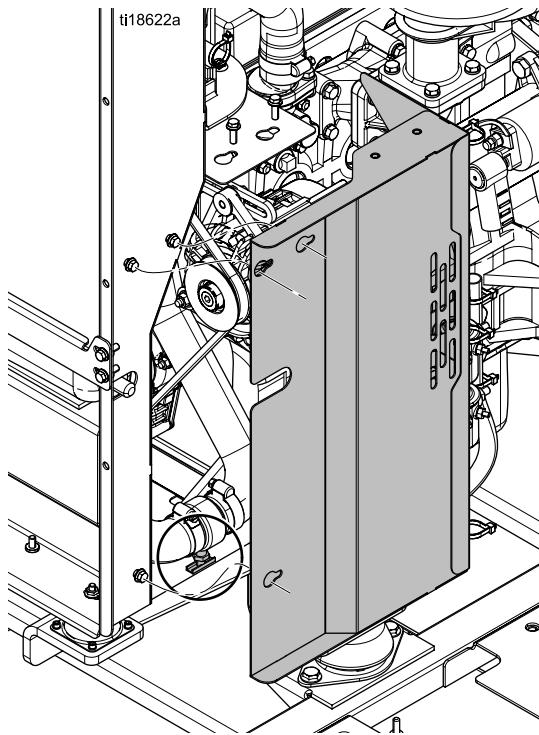


ti21730a

Filter Housing Drain Valve (D)
Figure 6

- b. Place the other end of the filter housing drain tube (T) in a waste container. Open the drain valve (D).
- c. To refill coolant loop, see [Refill Proportioner Coolant Loop, page 51](#).

6. To drain engine coolant loop:
 - a. Remove the engine coolant loop (RC) cap. See Fig. 8.
 - b. Remove engine guards as shown. Let the guards rest on the engine to access the drain valve.



Engine Coolant Loop Drain Valve
Figure 7

- 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 52](#).
- 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.

| | | | | | | |
|---|--|--|--|--|--|--|
| | | | | | | |
| <p>To avoid burns, do not perform maintenance on the coolant system until the coolant system has reached ambient temperature.</p> | | | | | | |

Only use coolant solutions that are compatible with the system. See [Coolant Specifications, page 53](#).

1. Before refilling coolant loop, perform steps 1–3 from [Drain Coolant, page 50](#). Drain coolant loop if necessary.

NOTICE

Do not refill with drained coolant. Use only fresh, new coolant to avoid contaminants.

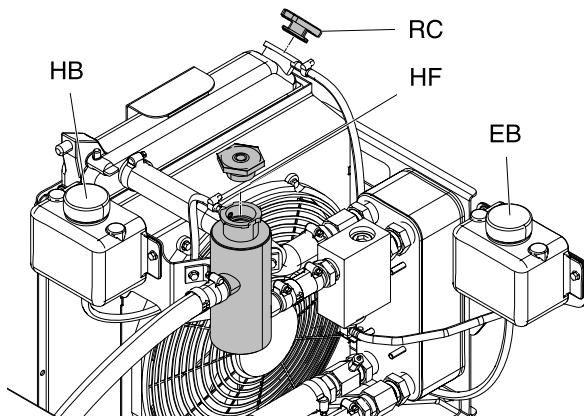
NOTICE

Do not use any “stop leak” additives to prevent plugged filters and small orifices.

NOTICE

Do not interchange the two caps between the radiator and coolant bottle. The caps have different pressure ratings that affect the overflow.

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 53](#).



Coolant System Bottles
Figure 8

3. Replace cap and tighten past the safety latch position.



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 8](#).

Refill Engine Coolant Loop

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

| | | | | |
|--|--|--|--|--|
| | | | | |
| 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 53](#).

1. Perform [Shutdown, page 49](#).

NOTICE

Do not refill with drained coolant. Use only fresh, new coolant to avoid contaminants.

NOTICE

Do not use any "stop leak" additives to prevent plugged filters and small orifices.

NOTICE

Do not interchange the two caps between the radiator and coolant bottle. The caps have different pressure ratings that affect the overflow.

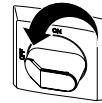
2. Remove the engine radiator coolant cap (RC) and fill until the coolant reaches the bottom of the neck. See [Fig 8](#). Replace cap. See [Coolant Specifications, page 53](#).
3. Remove the cap from the engine coolant loop bottle (EB) and fill until the coolant is at the hot level. Replace cap.



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

NOTICE

Do not refill with straight water or tap water. Changing the 50% mix ratio use of tap water will allow fittings to rust.

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. Do not use any stop leak products. The additives in these products will clog the heat exchanger and fluid valves, decreasing system performance. 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

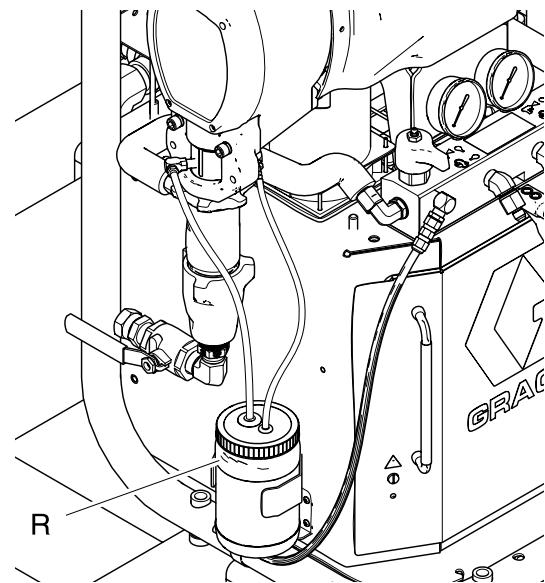
Check the condition of the ISO pump lubricant daily. Change the lubricant if it becomes a gel, its color darkens, or it becomes diluted with isocyanate.

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 46.
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 9

Remove Pump

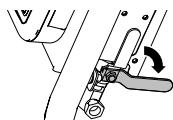


Pump rod and connecting rod move during operation. Moving parts can cause serious injury such as pinching or amputation. Keep hands and fingers away from connecting rod during operation.

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.



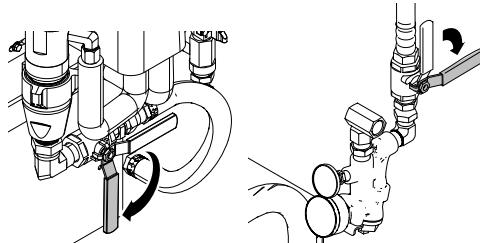
To prevent electric shock do not remove any shrouds or open the electrical enclosure door. 240 V is still present in the system until the engine has stopped.

9. Allow engine dwell time.

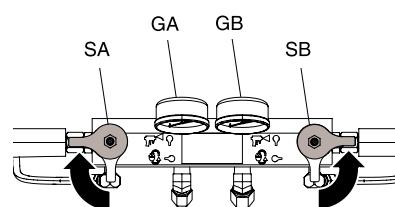
NOTICE

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. 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.



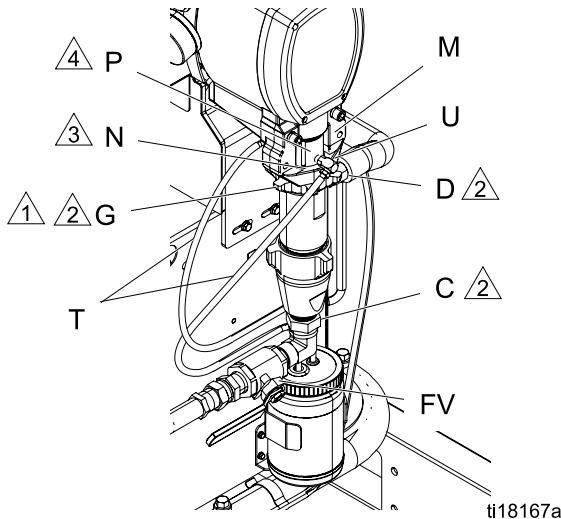
Note

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

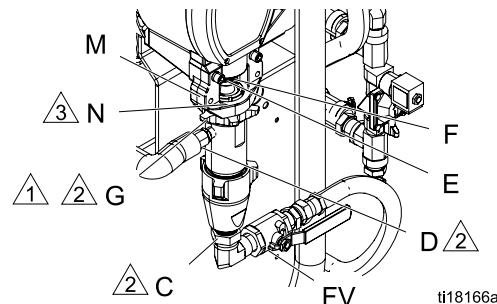
Figure 10

- Flat side faces up.
- Lubricate threads with ISO oil or grease.
- Pump top threads must be nearly flush with bearing face (N).
- 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 11

- Flat side faces up.
- Lubricate threads with ISO oil or grease.
- 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. 11, 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. 10, 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.

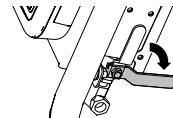
8. Seat finger guard (P) on wet-cup. Continue threading pump into bearing housing (M) until top threads are +/- 1/16 in. (2 mm) of bearing face (N). Ensure that barbed fittings at wet-cup flush ports are accessible.
9. Connect component A outlet tube loosely at pump and at heater. Line up tube, then 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.

- 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.

- Press  on the engine control module.
- Open air compressor bleed valve to relieve pressure and remove water from tank.
- Perform [Pressure Relief Procedure, page 46](#).
- Remove screws (61) and motor shield (56), see [Fig. 12](#).

Note

Examine bearing housing (303) and connecting rod (305). If these parts need replacing, first remove the pump (306), see [Remove Pump, page 54](#).

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

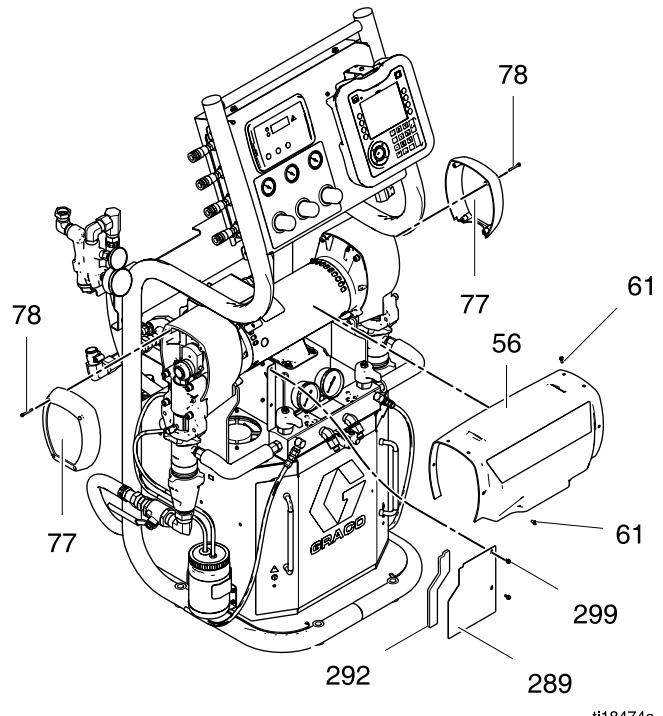
NOTICE

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.

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

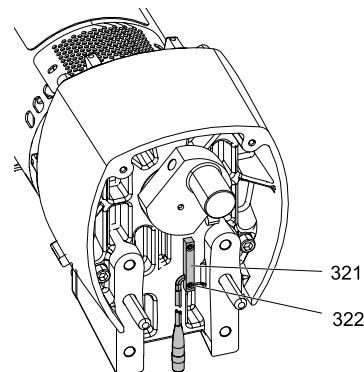
Note

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.



#18474a

Figure 12



#18169a

Figure 13

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. 13, 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 56](#).

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](#).

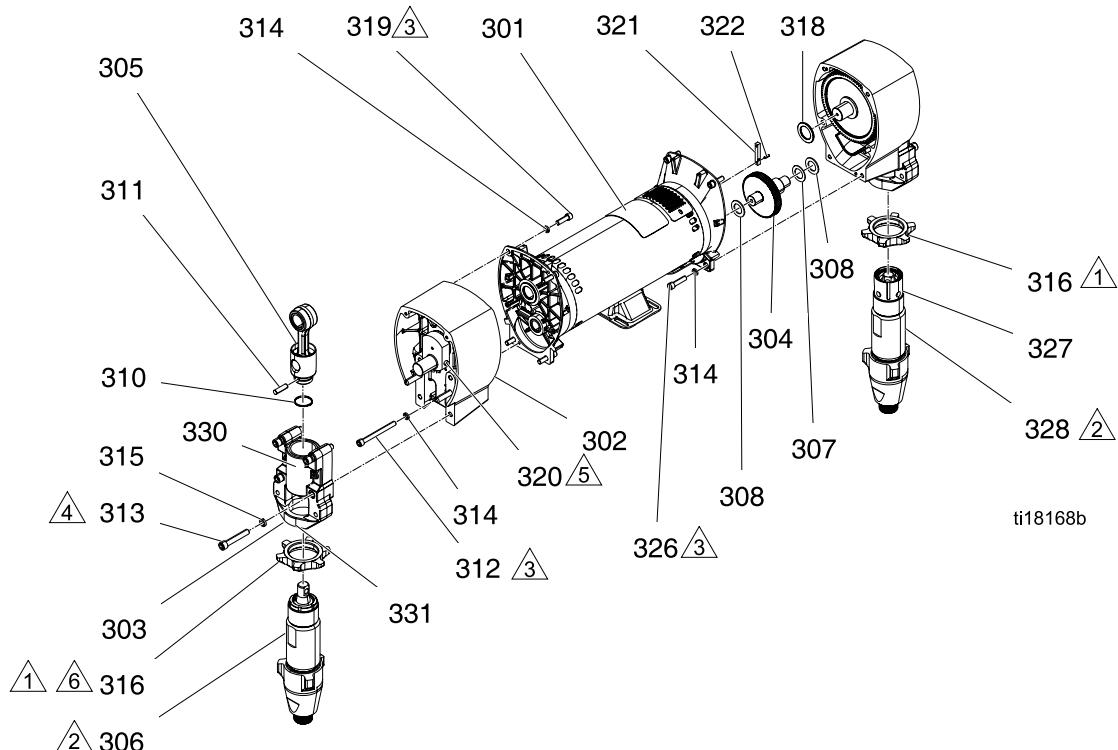


Figure 14

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 46](#).
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

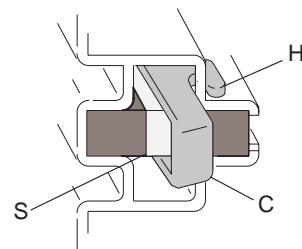
Allow engine dwell time, per manufacturer recommendations, prior to shutdown. Dwell time will help engine cool down after running at operating temperature for any period of time.

8. Press  on the engine controller.



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

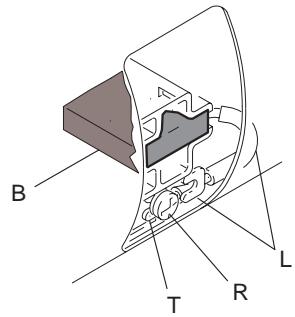
9. Remove motor cover, screws. Remove brush inspection covers, and screws from top and bottom of motor.
10. Remove two screws (299) and front plate (289). See [Fig. 20, page 65](#).
11. Remove two screws (299) from back plate (290). Rest fan and back plate (290) behind motor. See [Fig. 20, page 65](#).
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

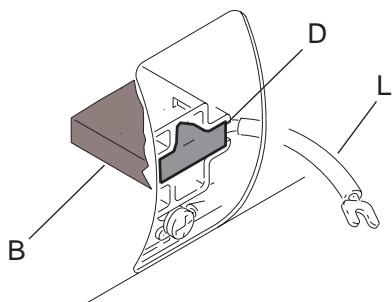
NOTICE

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

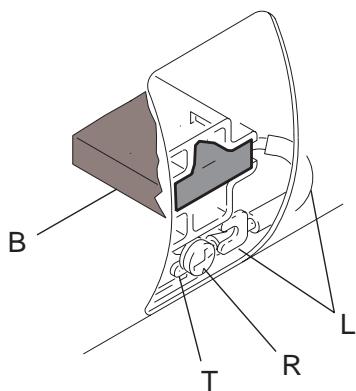
Note

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

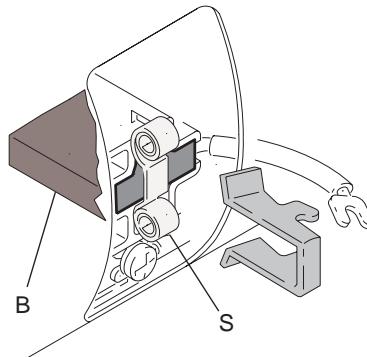
1. Install new brush (B) so lead (L) is in long slot (D) of holder.



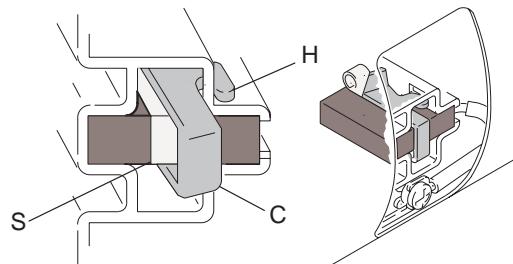
2. Slide terminal (L) under terminal screw (R). Make sure motor lead terminal (T) is still connected at screw. Tighten screw.



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..

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 56](#).
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. 20, page 65](#).
4. Remove screws (326) and washers (314). Test brushes with both pump pins (F) disconnected. See [Fig. 14, 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

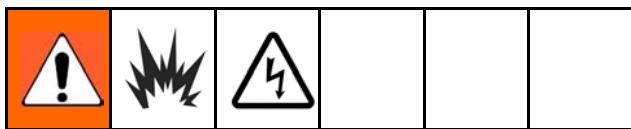
1. Place motor on unit. Thread motor cables into conduit as before. See [Electrical Schematics, page 134](#).
2. Fasten motor with screws (273) until screws are fully threaded in mounting bracket. Do not tighten screws until drive housing and pumps are connected to the motor.

Note

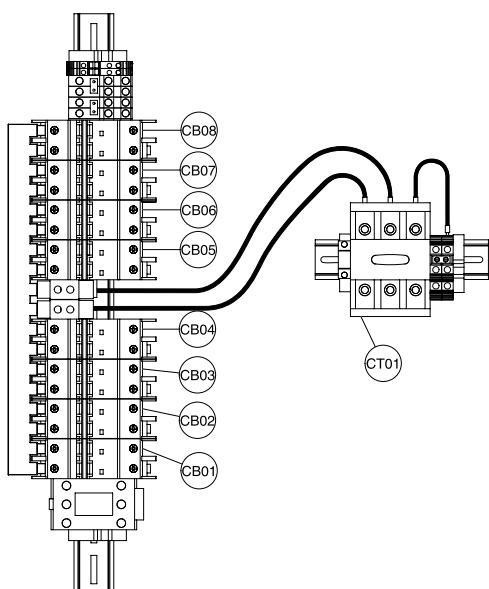
If necessary, loosen screws (273) to align the motor (301) with side brackets.

3. Install drive housing and pump assemblies, see [Installation, page 58](#).
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. 20, page 62](#).
7. Install front bracket.
8. Install drive housing covers and motor cover.
9. Return to service.

Repair Circuit Breaker Module

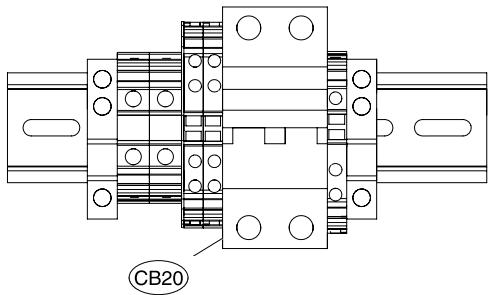


1. See [Before Beginning Repair, page 46](#).
2. Using an ohmmeter, check for continuity across circuit breaker (left to right). If no continuity, trip breaker, reset, and retest. If still no continuity, replace breaker as follows:
 - a. Refer to [Electrical Schematics, page 134](#), and tables on next page.
 - b. Install new breaker and reconnect wires.



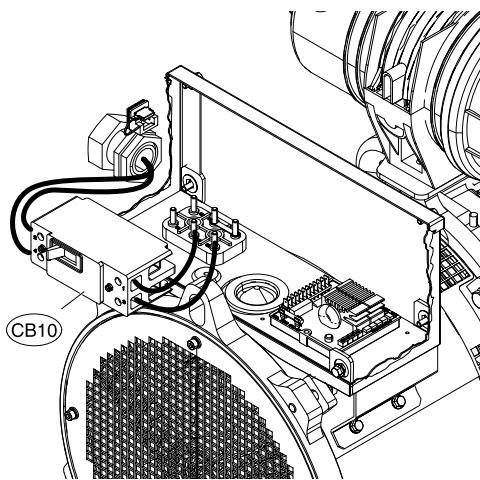
Circuit Breakers
Figure 15

| 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 16

| Ref. | Size | Component |
|------|------|-------------|
| CB20 | 50 A | Heated Hose |

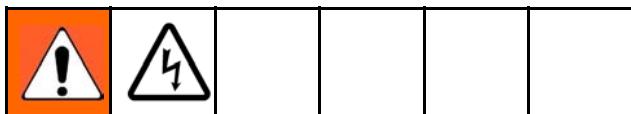


Circuit Breakers Inside Alternator Assembly
Figure 17

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

Replace Relays and Fuses

Replace Load Center Relays and Fuses

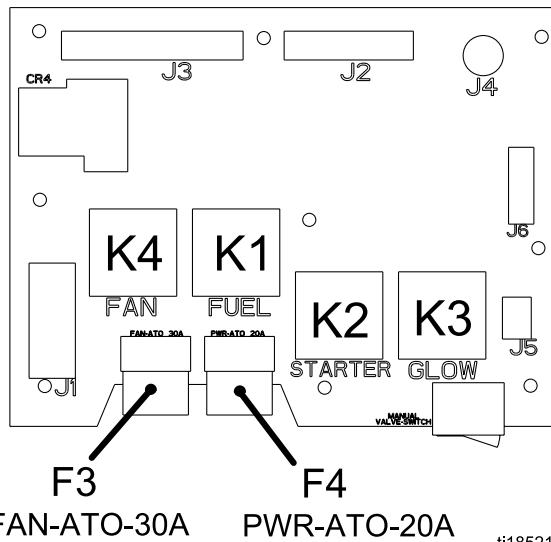


1. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 81](#).
2. Remove the bad relay or fuse from the load center (242) and install a new relay or fuse. See [Fig. 18](#).
3. Connect battery cable. See [Replace Battery, page 81](#).

Relay and Fuse Identification Table

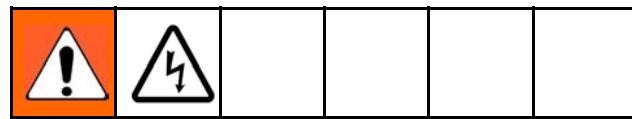
See [Load Center Wiring Diagram, page 143](#).

| 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. |



Load Center Relay and Fuse Identification
Figure 18

Replace Load Center

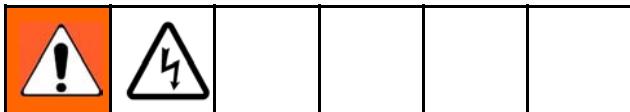


NOTICE

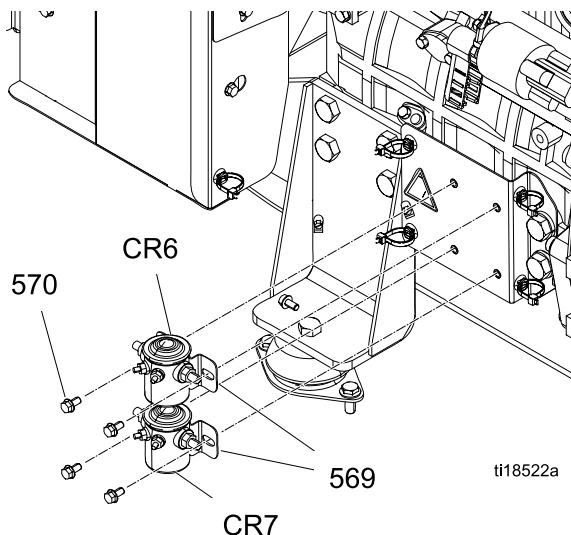
Before handling board, put on a static conductive wrist strap to protect against static discharge which can damage board. Follow instructions provided with wrist strap.

1. Perform [Shutdown, page 49](#).
2. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 81](#).
3. Disconnect all connectors. See [Load Center Wiring Diagram, page 143](#)
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 143](#)
6. Connect battery cable. See [Replace Battery, page 81](#).

Replace Engine Solenoid Relays



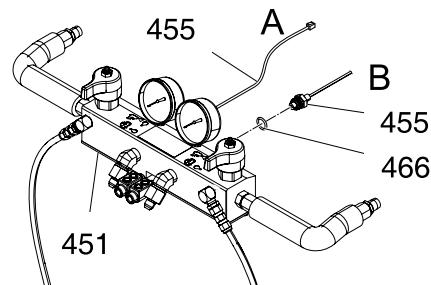
1. Perform [Shutdown, page 49](#).
2. Disconnect the negative lug from the negative post of the battery. See [Replace Battery, page 81](#).
3. Remove two bolts (570) and solenoid relay (569). The starter solenoid relay (CR6) is above the glow plug solenoid relay (CR7).
4. Disconnect cables from the old relay and connect to the new relay. See [Load Center Wiring Diagram, page 143](#).



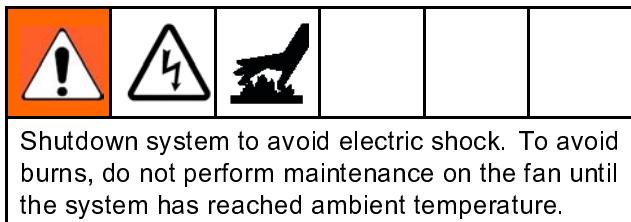
Starter (top) and Glow Plug (bottom) Solenoid Relays
Figure 19

Replace Transducers

1. Perform [Shutdown, page 49](#).
2. Perform [Pressure Relief Procedure, page 46](#).
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 49](#).
2. Remove two screws (299) and front plate (289).
3. Remove three screws (299) from back plate (290).
4. Refer to [Electrical Schematics, page 134](#). 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 62](#).
5. Remove bolts (251) and fan (212).
6. Install new fan (212) in reverse order.

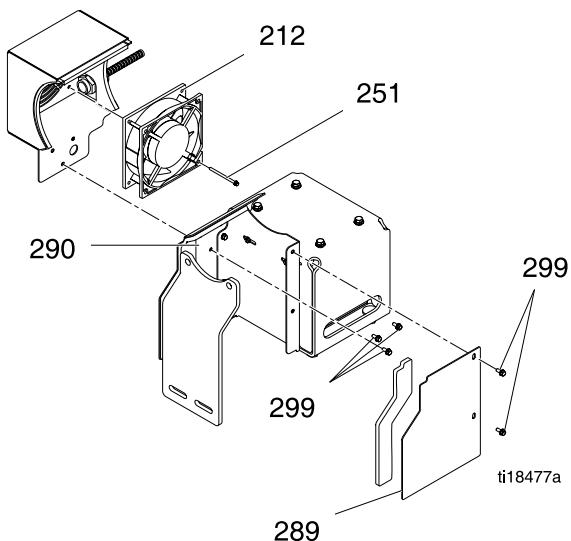


Figure 20

Replace Proportioner Module Fan



1. Perform [Shutdown, page 49](#).
2. Remove cabinet panel (70).
3. See [Electrical Schematics, page 134](#). 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 62](#).
4. Remove fan (212).
5. Install new fan (212) in reverse order of disassembly.

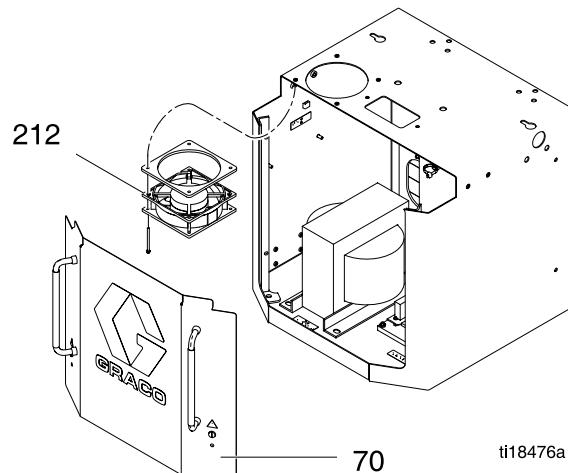


Figure 21

Replace Radiator Fan



1. Perform [Shutdown, page 49](#).
2. Remove four screws (605) and disconnect power cable (PC).
3. Install new fan (605) to radiator bracket (601) with screws (605).

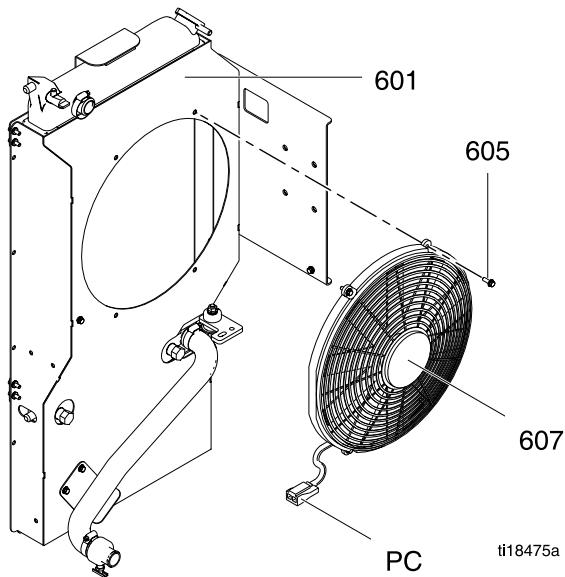


Figure 22

Replace Electrical Enclosure Fan



1. Perform [Shutdown, page 49](#).
2. Open electrical enclosure door (502). Loosen four nuts (558) and remove fan (561).
3. Refer to [Electrical Schematics, page 134](#). 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 62](#).
4. Install new fan (561) in reverse order of disassembly so that the fan blows out of the electrical enclosure.

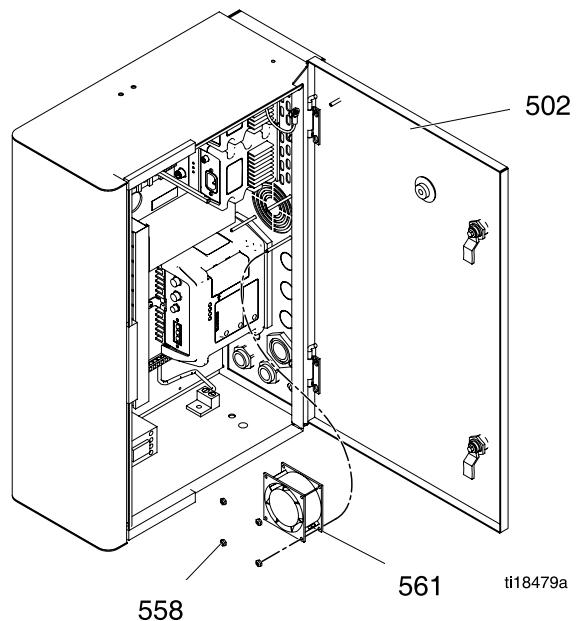


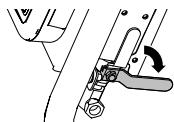
Figure 23

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 46](#).
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.

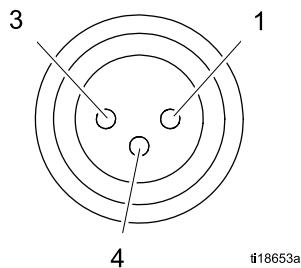
16. To remove heater element, first remove RTD (360) to avoid damage. See step 7, [Replace RTD, page 69](#)
17. Remove heater element (357) from housing (351). Be careful not to spill any fluid left in housing. See [Fig. 23, page 66](#).
18. Inspect element. It should be relatively smooth and shiny. 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 69](#).
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 49](#).
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 134](#).
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 49](#).
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 134](#).
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 134](#).
 - 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).

Repair

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).

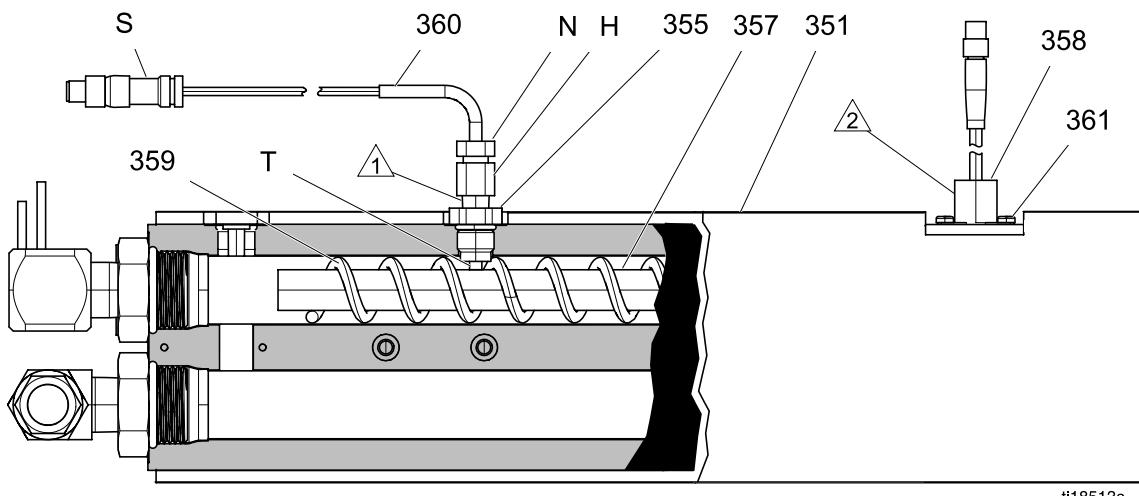


Figure 24

Repair Heated Hose

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

Check Hose Heat Connectors

1. Perform [Shutdown, page 49](#).

Note

Whip hose must be connected.

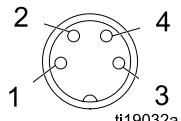
2. Disconnect hose connector (V) at Reactor, see [Fig. 25](#).
3. Using an ohmmeter, check between the connectors (V). There should be continuity.
4. If hose fails test, retest at each length of hose, including whip hose, until failure is isolated.

Check RTD Cables and FTS

1. Perform [Shutdown, page 49](#).
2. Disconnect RTD cable (C) at Reactor.
3. Test with an ohmmeter between pins of cable connector C.

Note

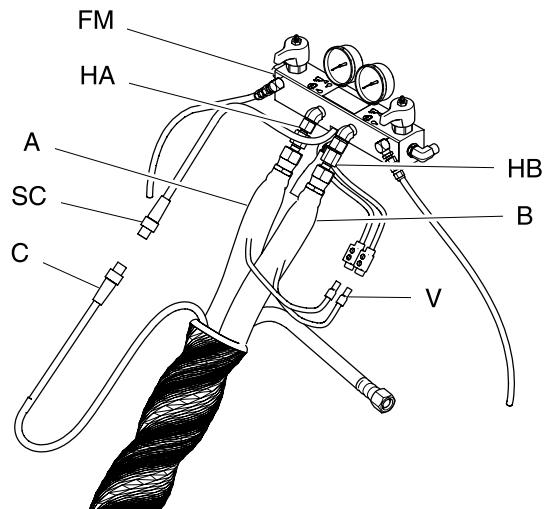
Do not touch outer ring with test probe.



| 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 25

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.

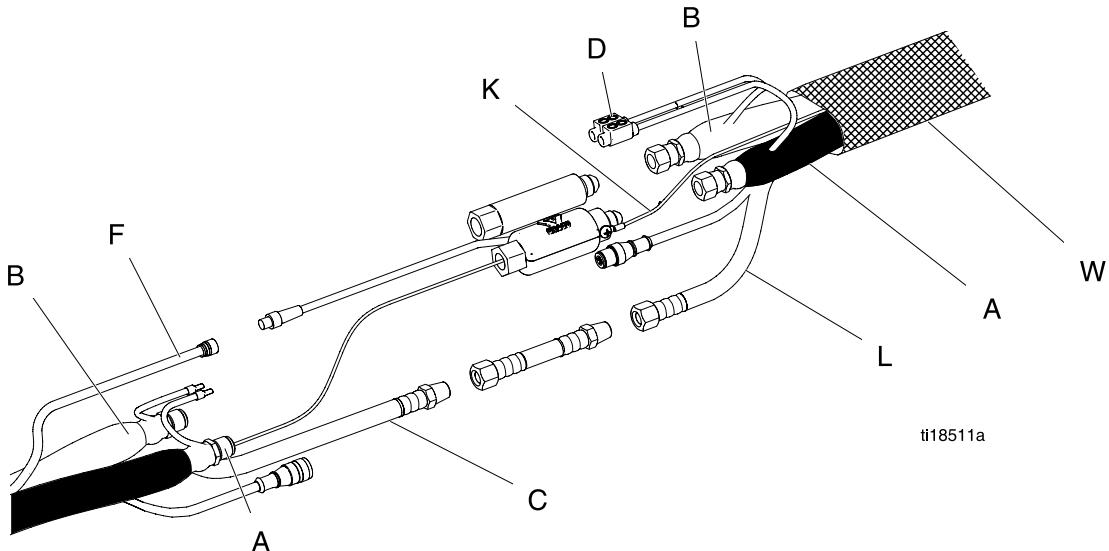


Figure 26

Test/Removal

1. Perform [Shutdown, page 49](#).
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 71](#).
4. If FTS fails, replace FTS.

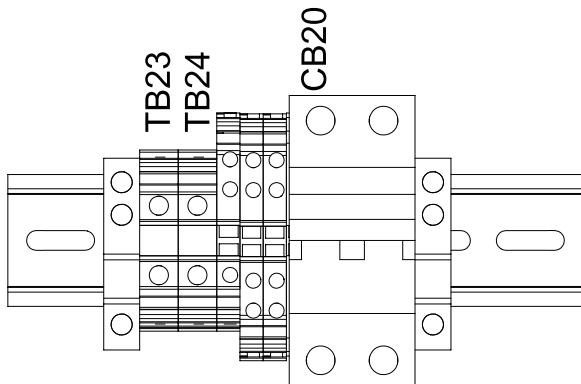
- a. Disconnect air hoses (C,L) and electrical connectors (D).
- b. Disconnect FTS from whip hose (W) and fluid hoses (A, B).
- c. Remove ground wire (K) from ground screw on underside of FTS.
- d. Remove FTS probe (H) from component A (ISO) side of hose.

Transformer Primary Check

1. See [Shutdown, page 49](#).
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 49](#).
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).



ti18544a

Figure 27

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.



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

- Do not touch hot fluid or equipment.
- Allow equipment to cool completely before touching it.
- Wear gloves if fluid temperature exceeds 110°F (43°C).
- Do not turn on hose heat without fluid in hoses.



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

Repair

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.

| Diagnostic | | |
|------------------------|--------------------------|---------------------|
| Recipes | | |
| E-30i Active | | |
| 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 |

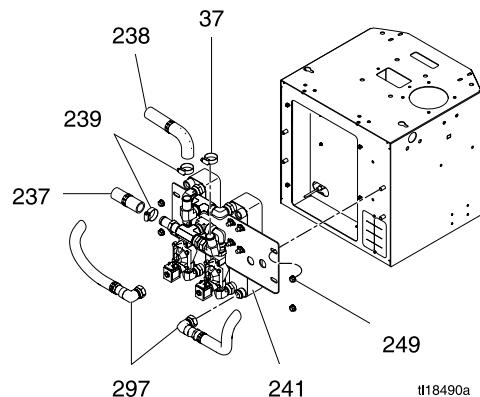
Replace Transformer

1. Perform [Shutdown, page 49](#).
2. Open Reactor cabinet.
3. Remove bolts holding transformer (226) to cabinet floor.
4. Disconnect the transformer wires. See [Reactor Cabinet Wiring Diagram, page 142](#)
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 88](#).

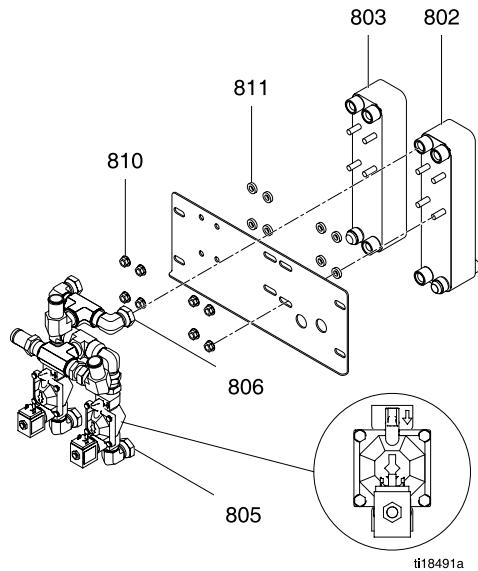
2. Perform [Flushing, page 47](#).
3. Perform [Shutdown, page 49](#).
4. Perform [Drain Coolant, page 50](#).
5. For proportioner heat exchangers:
 - a. Remove fuel tank. See [Remove Fuel Tank, page 81](#).
 - b. Disconnect both RTD connectors (284). See [Replace Proportioner RTD, page 76](#).
 - c. Disconnect A and B material lines from swivel fittings (297).



Proportioner Heat Exchangers
Figure 28

- 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).

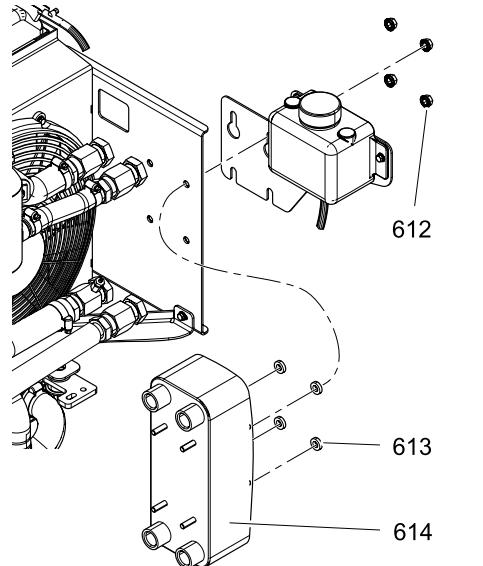


Proportioner Heat Exchangers
Figure 29

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

6. For the engine heat exchanger:

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



Engine Heat Exchanger
Figure 30

Replace Proportioner RTD

1. Perform [Shutdown, page 49](#).
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.

4. Remove compression fitting (283) from the back of the heat exchanger with RTD (284) attached.

The RTD probe cannot be removed from the compression nut.

NOTICE

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

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).

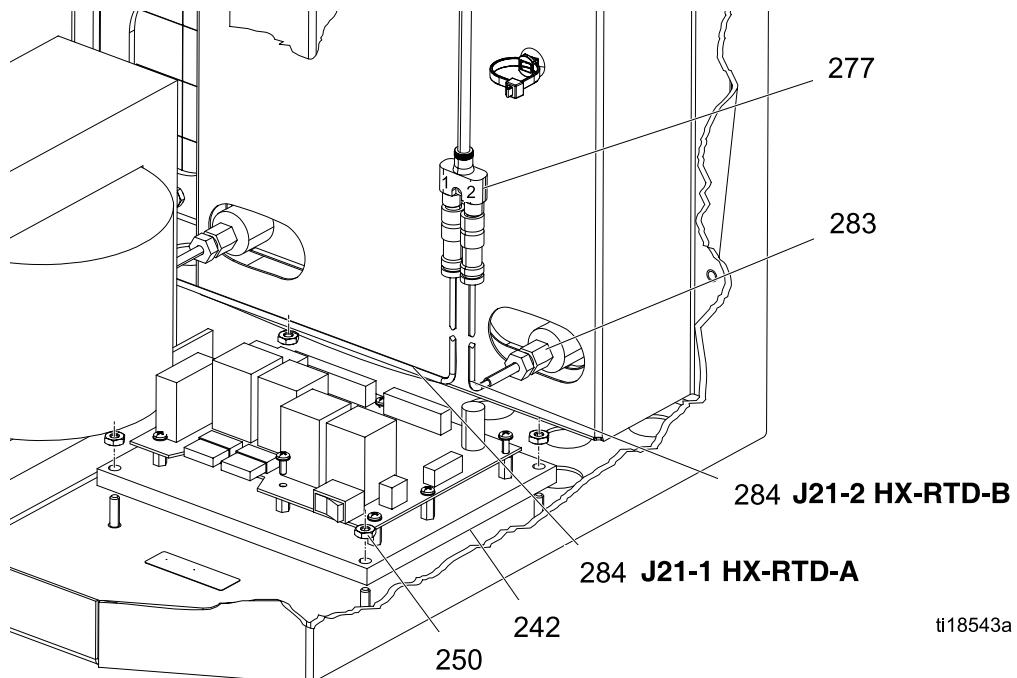


Figure 31

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 49](#).
2. Drain coolant from the proportioner coolant loop. See [Drain Coolant, page 50](#).
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.

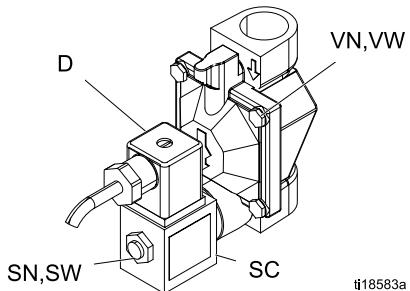
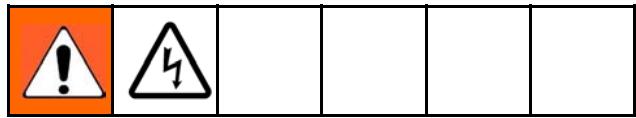
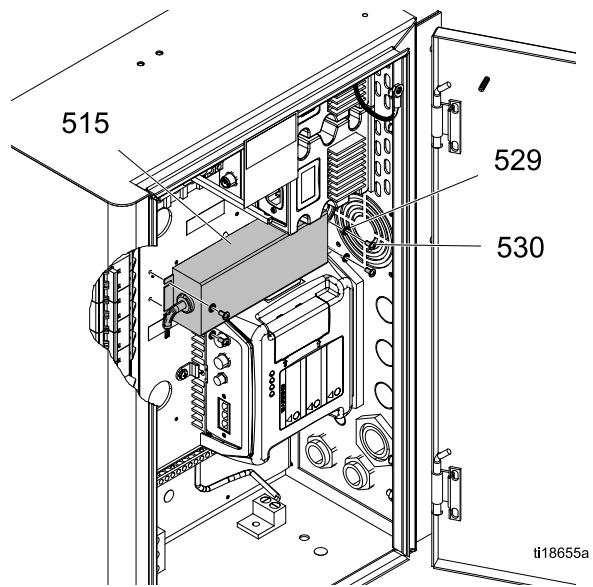


Figure 32

Replace Power Supply

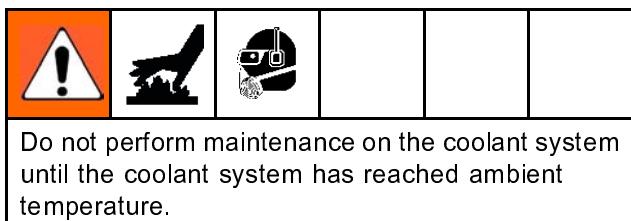


1. Perform [Shutdown, page 49](#).
2. Disconnect power supply cables (515) from HPTCM and terminal blocks. See [Electrical Schematics, page 134](#).
3. Remove fan assembly, screws (530), washers (529), and power supply (515).
4. Install new power supply (515) in reverse order.

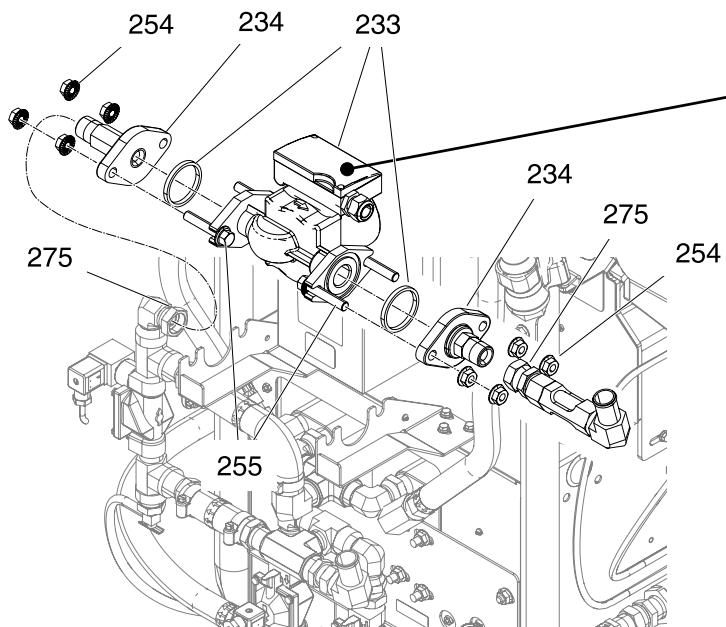


24 VDC Power Supply
Figure 33

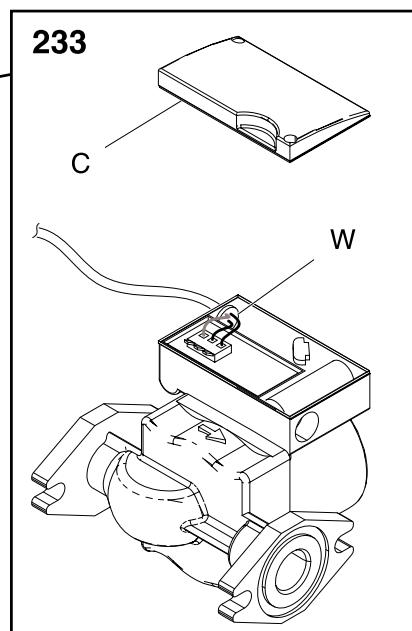
Replace Circulation Pump



1. Perform [Shutdown, page 49](#).
2. Perform [Drain Coolant, page 50](#).
3. If a wall is installed and the circulation pump can not be accessed, remove the proportioner. See [Remove Proportioner, page 88](#).
4. Disconnect pump fittings (234) from swivel fitting (275).
5. Remove pump cover (C).



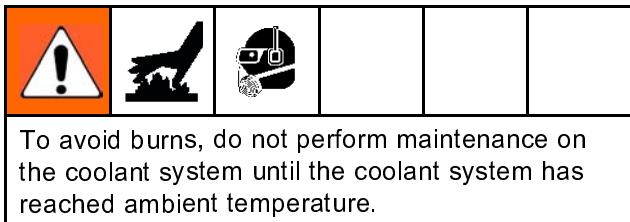
6. Press in tabs to disconnect power wires (W).
7. Remove four outside nuts (254). Hold on to the pump flanges (234) and remove the circulation pump (233). Remove four inside nuts (254) to remove flanges from the pump.
8. Place o-rings, supplied with the new circulation pump (233), between the pump and 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 142](#).
11. Connect flange fittings (234) to swivel on the elbow flange fitting (234) and fitting (275).



ti18518a

Figure 34

Repair Sight Glass Filter



Note

For Series B systems: the filter was removed from the sight glass and a larger filter was added near the coolant loop fill bottle. Remove filter from sight glass and replace if necessary, or use Filter Housing Kit 24T027. See manual 332510 for installation instructions.

To replace the filter in the filter housing, see [Repair Filter Housing Filter, page 80](#).

1. Drain the proportioner coolant loop. See [Drain Coolant, page 50](#).
2. Loosen hose clamp (37) and pull coolant hose (112) off of elbow fitting (248).

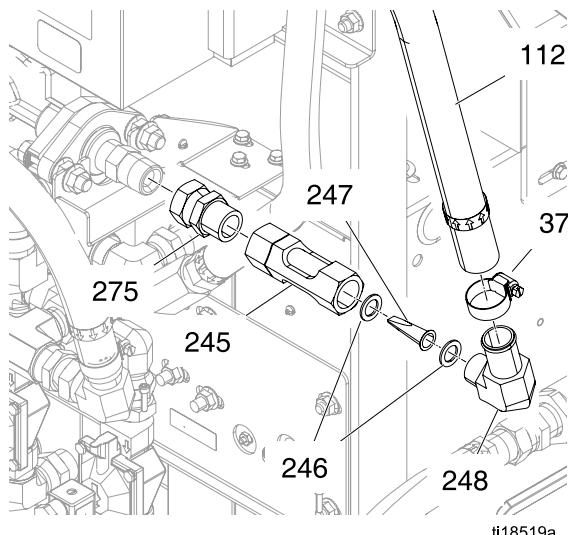


Figure 35

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.

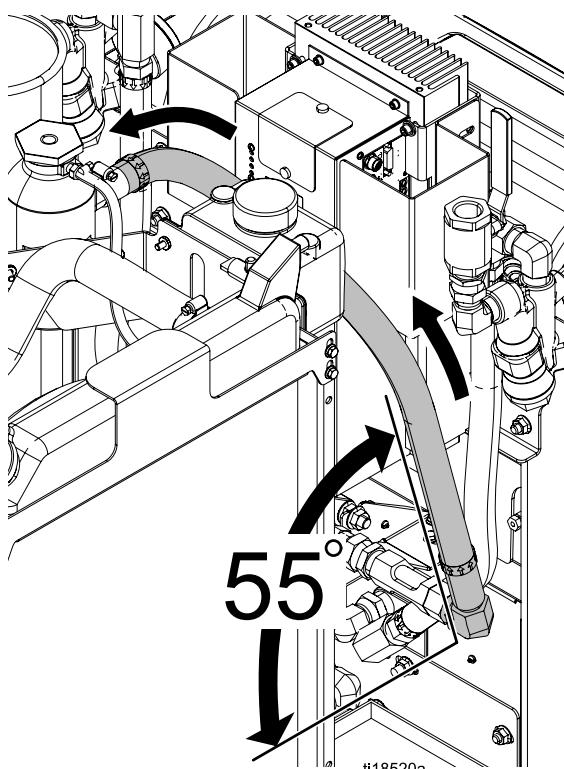


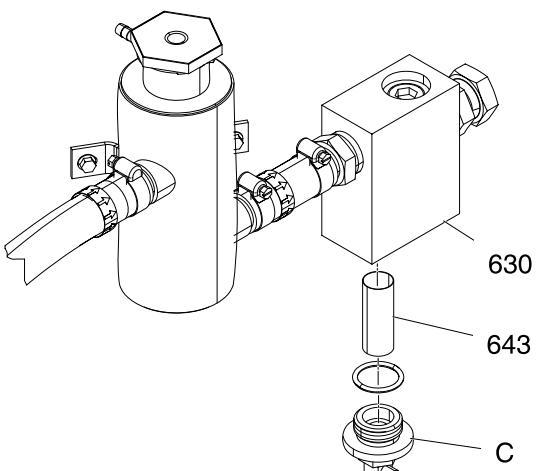
Figure 36

Repair Filter Housing Filter

Note

On Series B systems, the filter was removed from the sight glass and a larger filter was added near the coolant loop fill bottle.

1. Drain the proportioner coolant loop. See [Drain Coolant, page 50](#).
2. Remove cap (C) and filter (643) from filter housing (630).
3. Pull out filter (643). Brush out filter and replace if necessary.
4. Insert filter (643) into cap (C) and tighten cap into filter housing (630).



ti21731a

Remove Fuel Tank

1. Perform [Shutdown, page 49](#).
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.

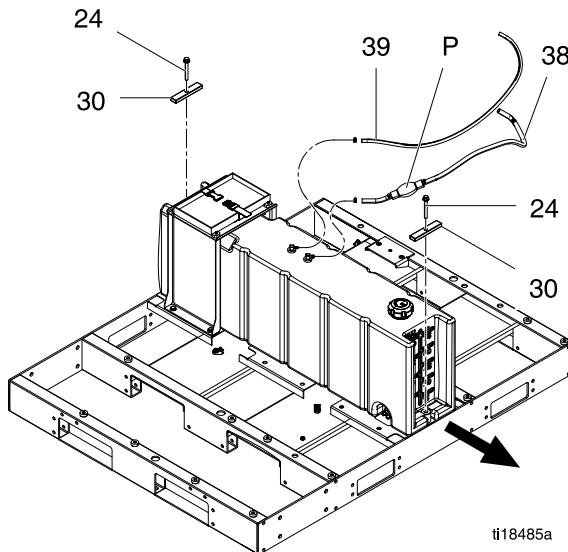


Figure 37

See [Technical Specifications, page 154](#) 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.

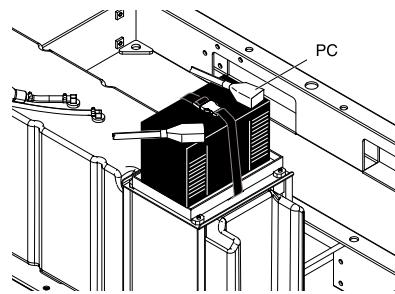


Figure 38

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.

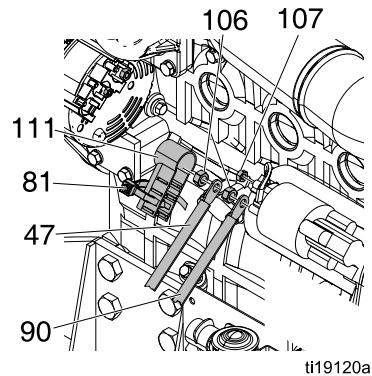
Replace Battery

| | | | | | |
|---|--|--|--|--|--|
| | | | | | |
| <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

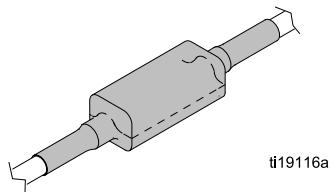
Follow this procedure to replace fuses inside the fusible link harness (90). See [Electrical Schematics, page 134](#), for fusible link harness connections and wire identification.

1. Perform [Shutdown, page 49](#).
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.



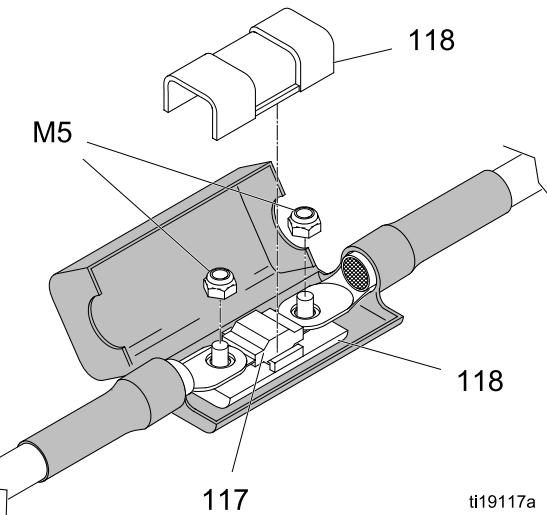
- b. Using a multimeter, measure continuity through the harness ring terminals. See Table 1.
- c. If one of the two wire paths measures "open", then the fuse (F8, F9) in that path is blown and needs to be replaced.

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



ti19116a

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.



ti19117a

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 50](#).
2. Remove radiator air exhaust duct, if used.
3. Remove screws (17) and back panel (8).

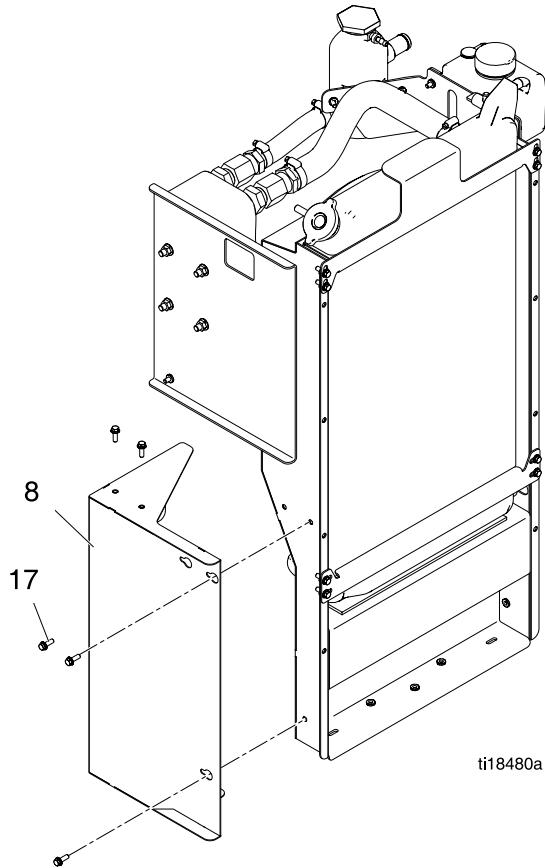


Figure 39

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).

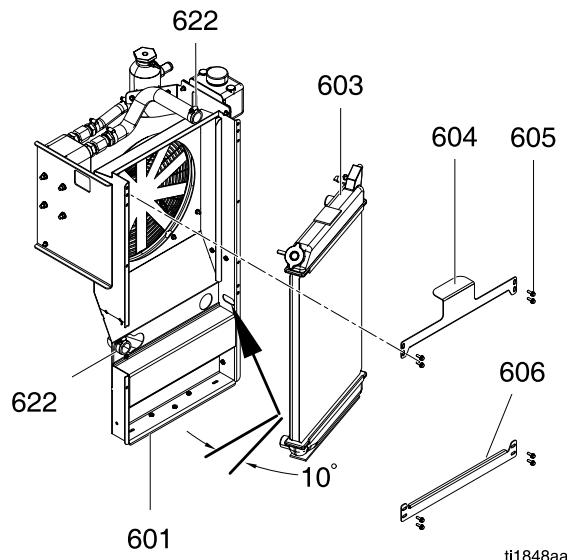


Figure 40

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 52](#).

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.

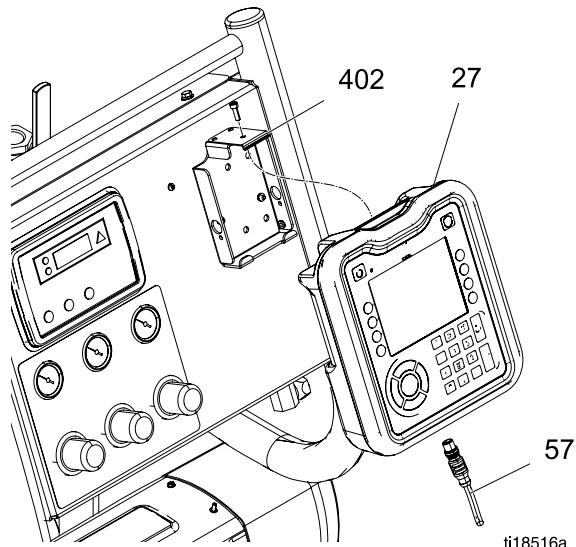


Figure 41

Repair Engine Control Module

1. Perform [Shutdown, page 49](#).
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 145](#)
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).

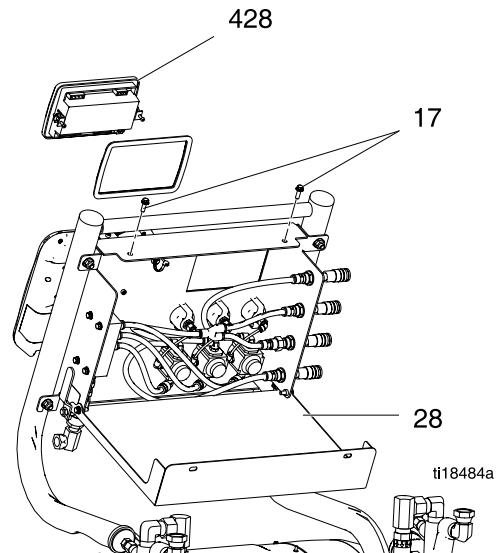


Figure 42

Replace Motor Control Module (MCM)

See [Fig. 43, page 86](#).

1. Perform [Shutdown, page 49](#).
2. Remove four screws (73, 74) and two guards (68).
3. Disconnect connectors from MCM (205). Disconnect two power cables. See [Electrical Schematics, page 134](#).
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 134](#).

Replace High Power Temperature Control Module (HPTCM)

See [Fig. 45, page 86](#).

1. Perform [Shutdown, page 49](#).

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)

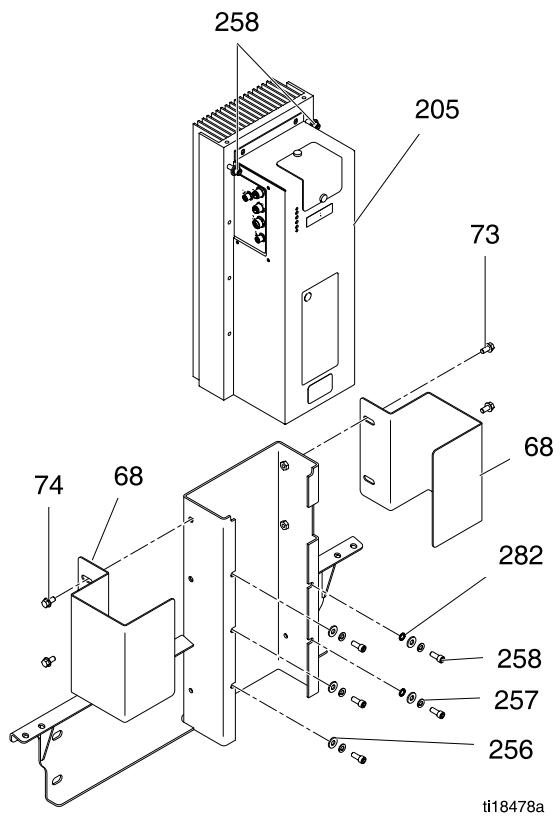
See [Fig. 44, page 86](#).

1. Perform [Shutdown, page 49](#).
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).

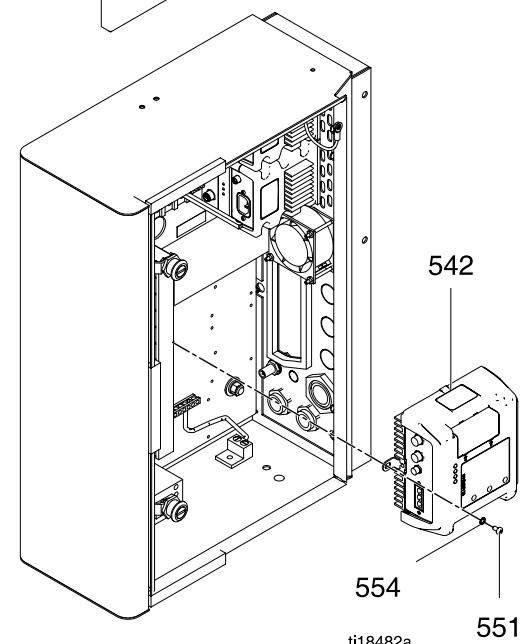
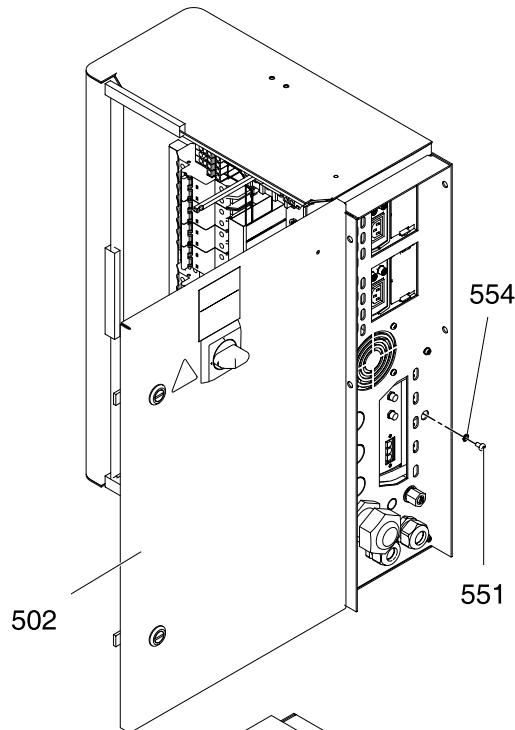
Note

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

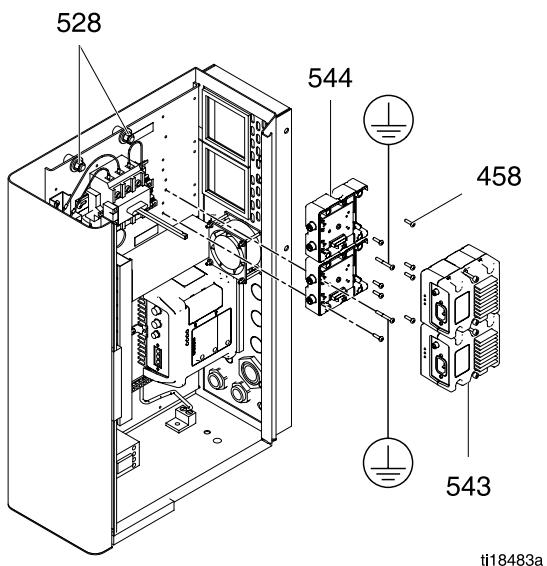
5. If the base needs to be replaced, disconnect CAN cables, remove four mounting screws (458), and remove ground screw in base (544).
6. Reassemble parts in reverse order.



MCM Repair
Figure 43



HPTCM Repair
Figure 45



LPTCM 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.



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.

1. Perform [Shutdown, page 49](#).
2. Drain the proportioner coolant loop. See [Drain Coolant, page 50](#).
3. Place an empty pallet in front of the proportioner (23) and center the pallet cross beam with the proportioner.

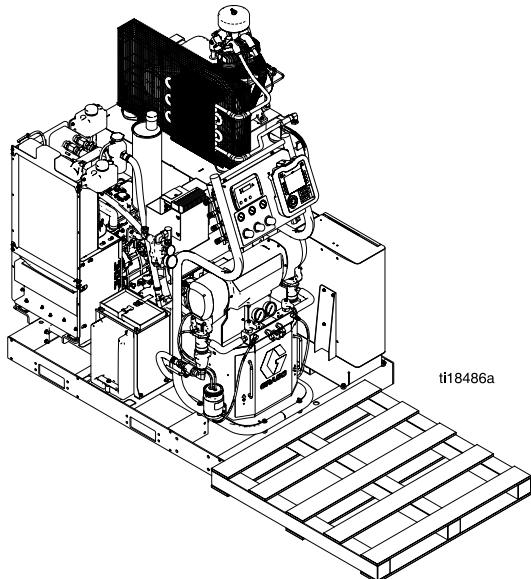


Figure 46

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

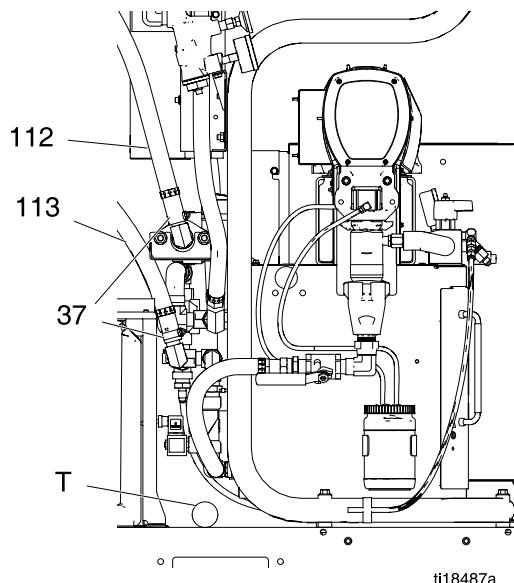


Figure 47

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 143](#). 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 81](#), if the fuel tank (29) is mounted on the pallet (1).

- 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.

- 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.

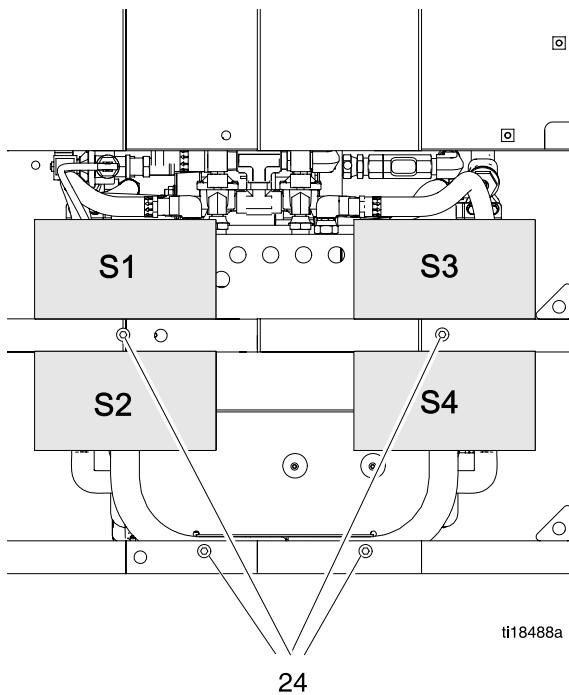


Figure 48

- 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.

- 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.

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

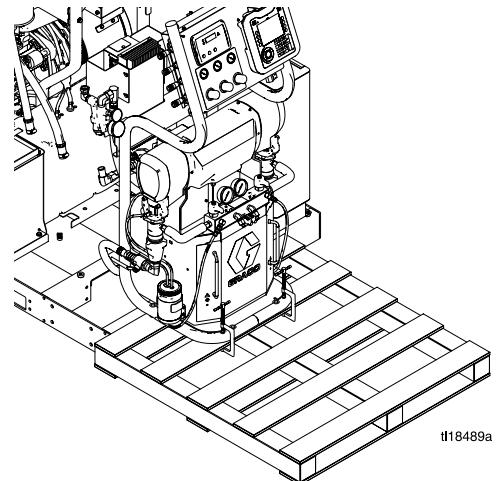


Figure 49

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 49](#).
2. Drain the engine coolant loop. See [Drain Coolant, page 50](#).
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 52](#).

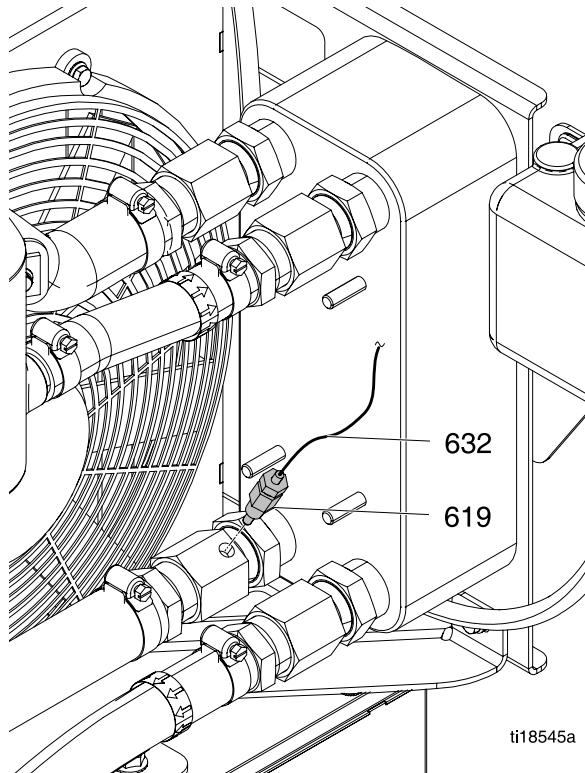


Figure 50

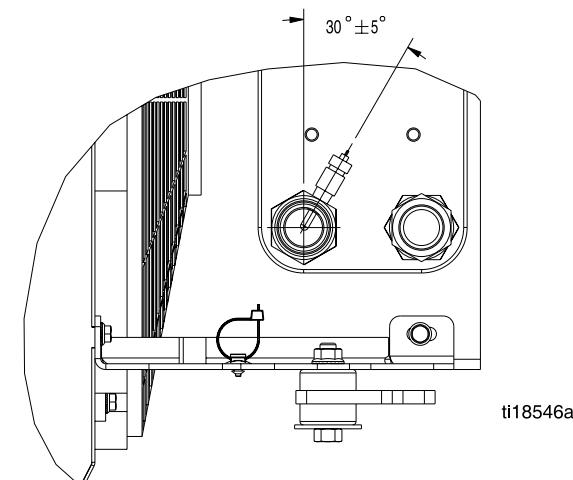


Figure 51

12V Charge Alternator

Contact your nearest Perkins distributor for repair and maintenance.

Notes

Parts

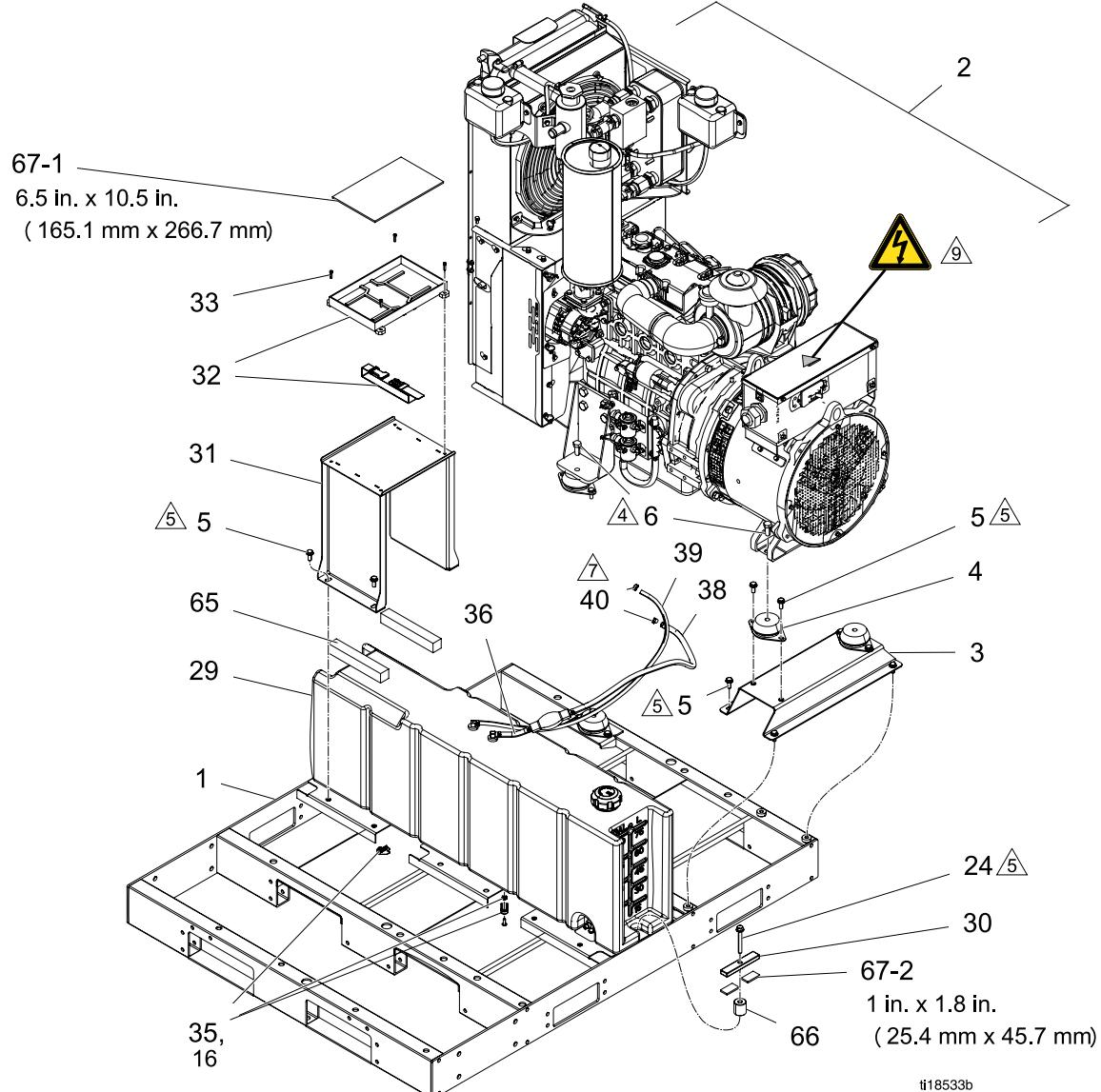
Systems

259079, E-30i

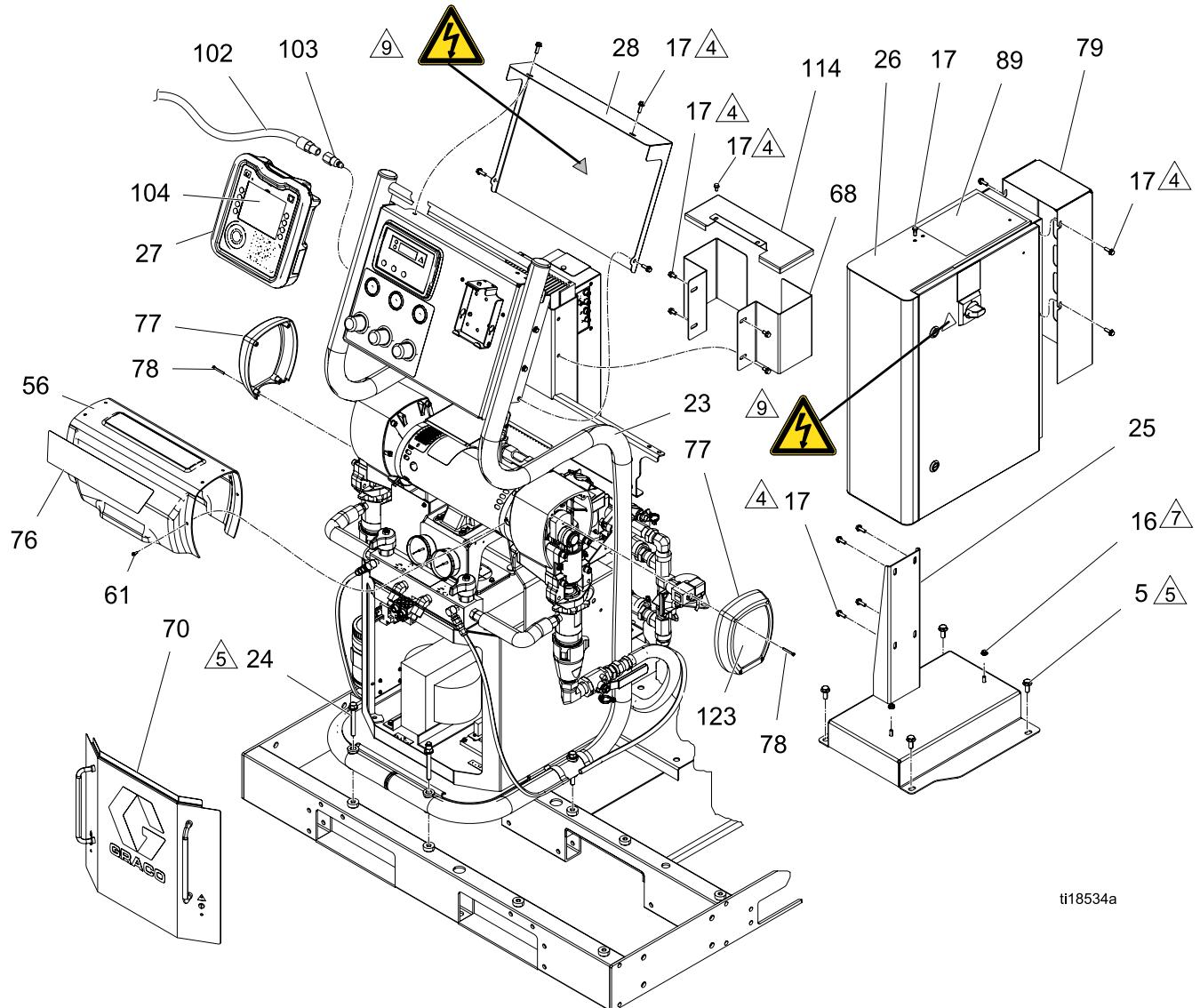
259080, E-30i with Booster Heat

259081, E-XP2i with Booster Heat

For systems with an air compressor, see [259089, 259090, and 259091, page 100](#).

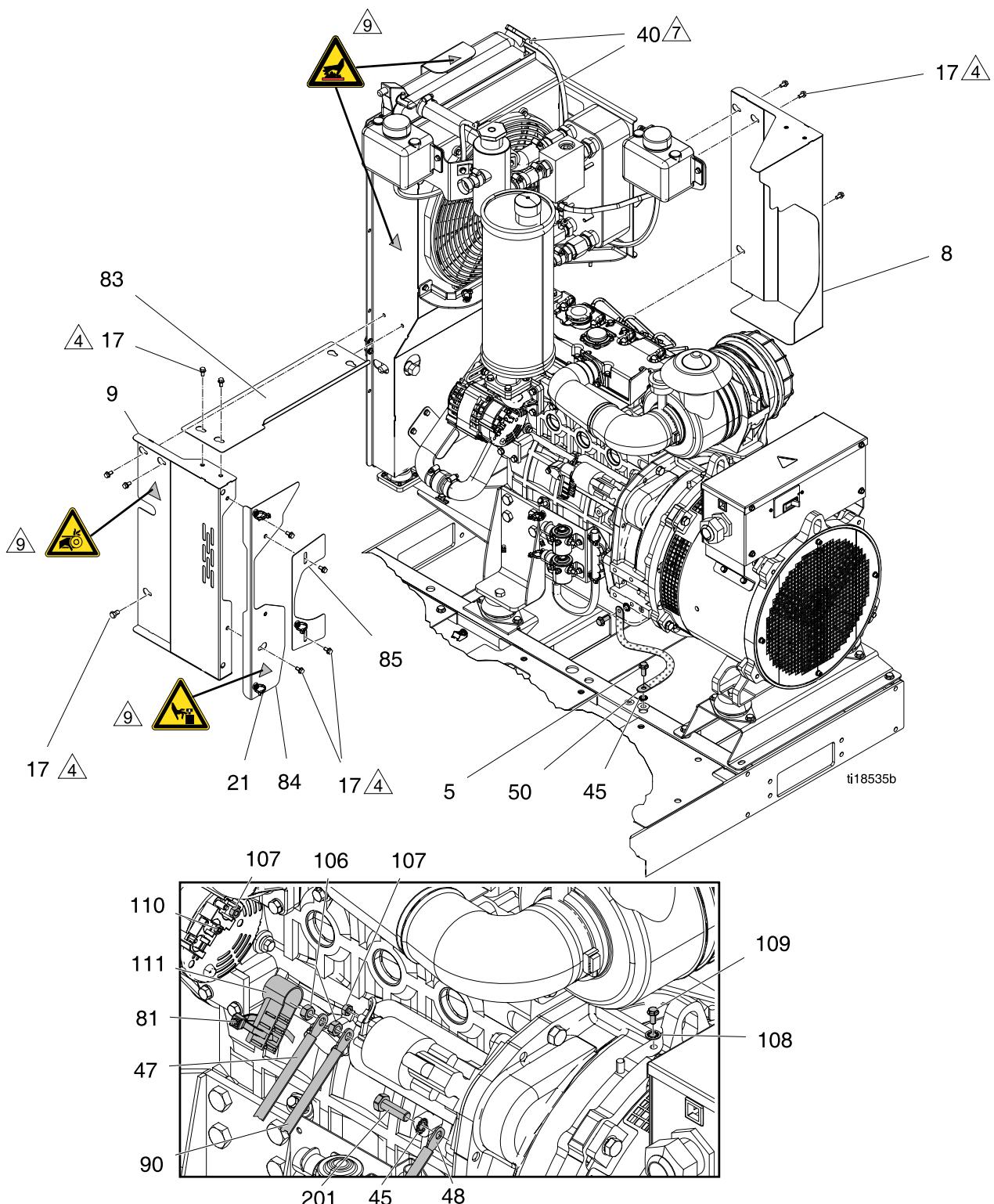


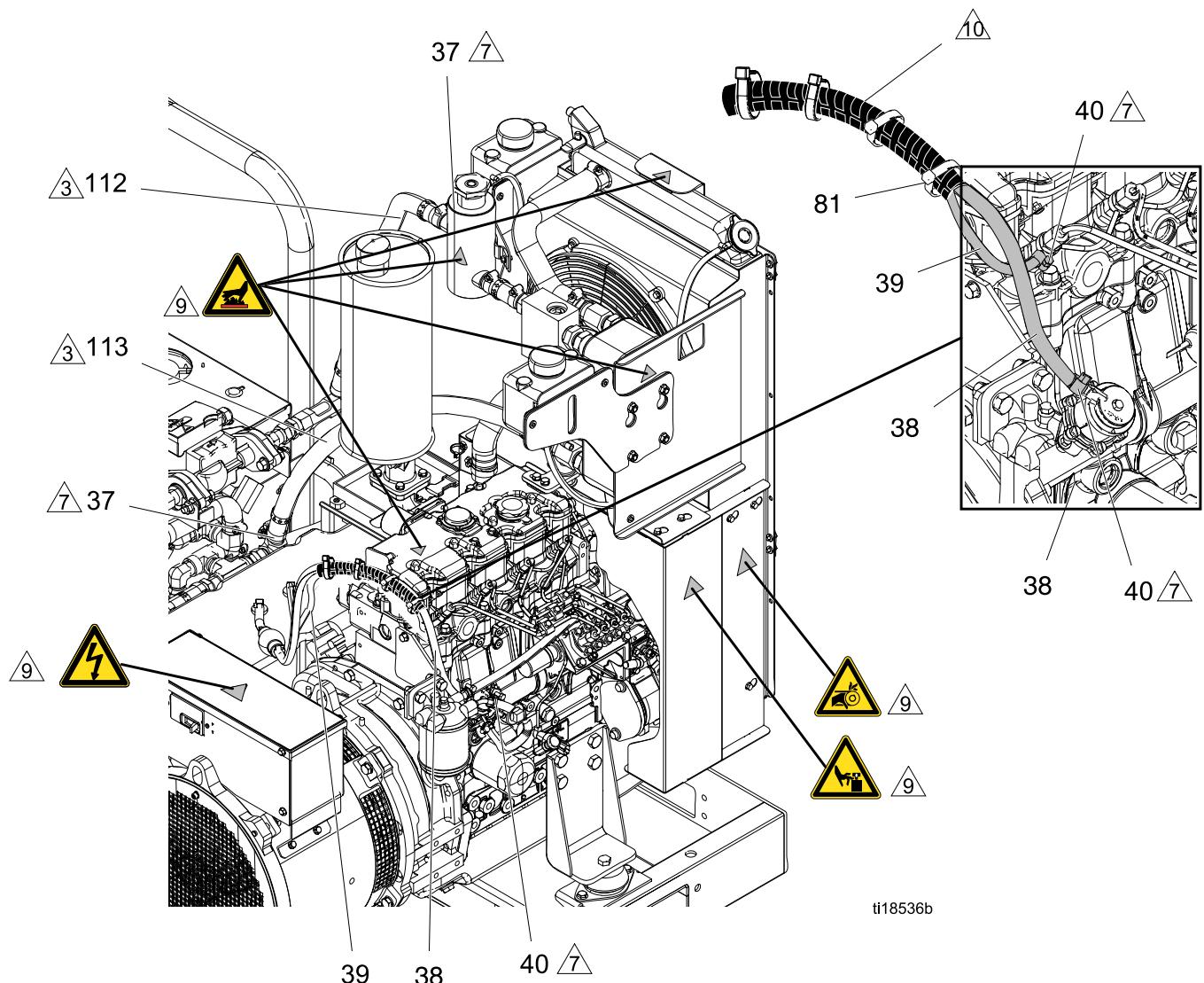
ti18533b



ti18534a

Parts





ti18536b

- 2 Apply anaerobic sealant to all non-swiveling pipe threads.
- 3 Apply lubrication to all push—on hoses prior to assembly.
- 4 Torque to 25 ft-lbs (33.8 N•m).
- 5 Torque to 40 ft-lbs (54 N•m).
- 6 Torque to 15–20 in.-lbs (1.7–2 N•m).
- 7 Torque to 25 in-lbs (2.8 N•m).
- 9 Safety and warning labels are from label sheet (55).
- 10 Bundle fuel lines above engine, inside flexible plastic split conduit, with cable ties (81) to avoid direct contact.

Parts

| Ref | Part | Description | Quantity | | |
|-----|--------|--|----------|--------|--------|
| | | | 259079 | 259080 | 259081 |
| 1 | 24J658 | BASE, pallet | 1 | 1 | 1 |
| 2 | — | GENERATOR, diesel, 22kw, see 22kW Diesel Generator, page 124 | 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 Proportioners, page 104 | 1 | | |
| | — | PROPORTIONER, E-30i, (4.0kw, 230v, 1ph), see Proportioners, page 104 | | 1 | |
| | — | PROPORTIONER, E-xp2i, (4.0kw, 230v, 1ph), see Proportioners, page 104 | | | 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 Electrical Enclosure, page 121 | | 1 | 1 |
| | — | ENCLOSURE, electrical, non-heat, see Electrical Enclosure, page 121 | 1 | | |
| 27 | 24L948 | MODULE, ADM | 1 | 1 | 1 |
| 28 | 16H880 | COVER, air panel | 1 | 1 | 1 |
| 29 | 24K390 | TANK, fuel, see Fuel Tank, page 131 | 1 | 1 | 1 |
| 30 | 16J889 | BRACKET, support, fuel tank | 2 | 2 | 2 |

| 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 |

Parts

| 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 |

| 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* | 16T798 | HOSE, coolant, 1 in. ID, 2.66 ft (0.81 m) | 1 | 1 | 1 |
| 113* | 16T799 | 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 134.

❖ Included in [Battery Cable Kit 24L962](#).

* Included in [Complete Coolant Hose Kit 24L939](#).
See [Complete Coolant Hose Kit, page 113](#).

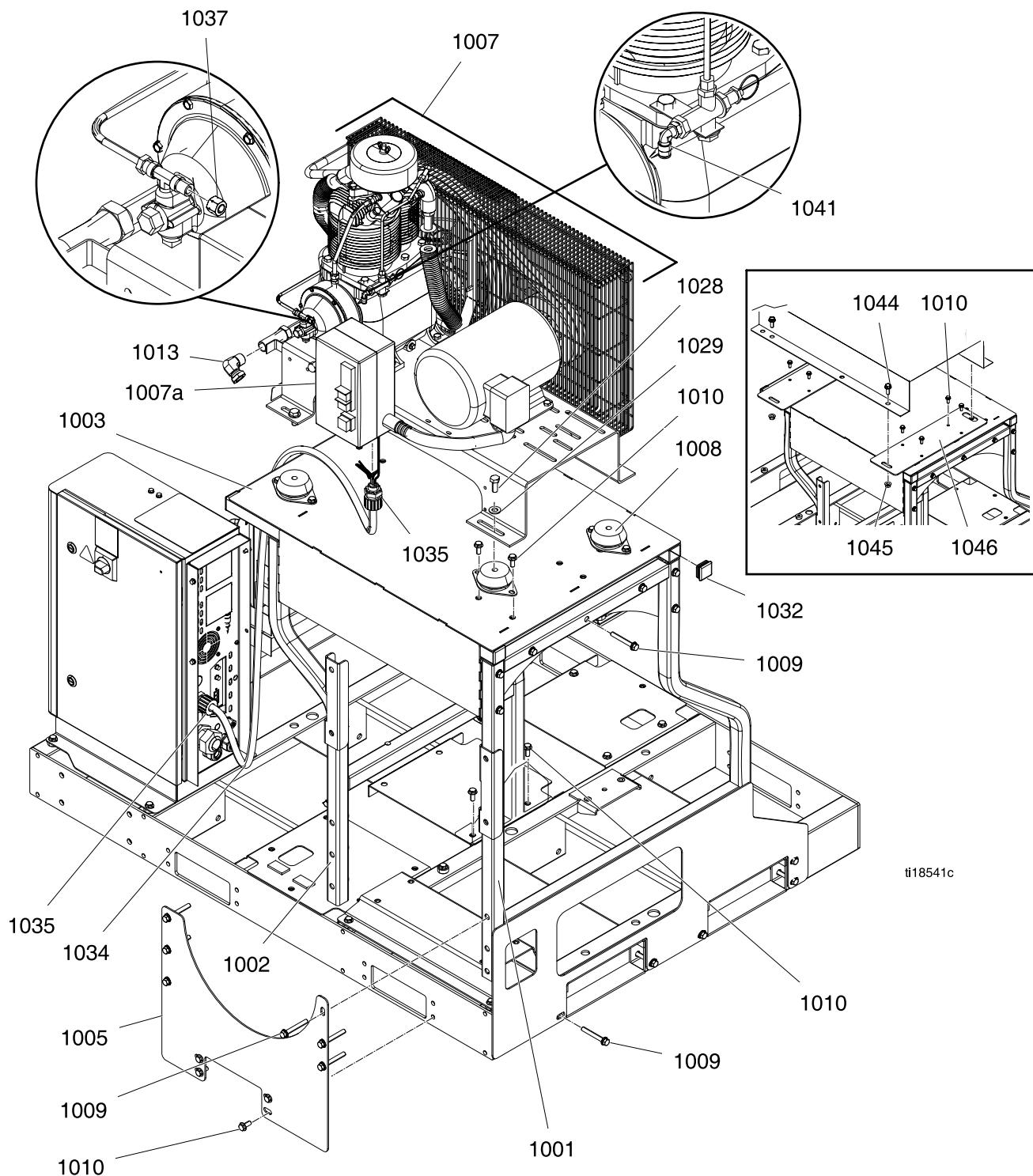
* Not shown.

Parts

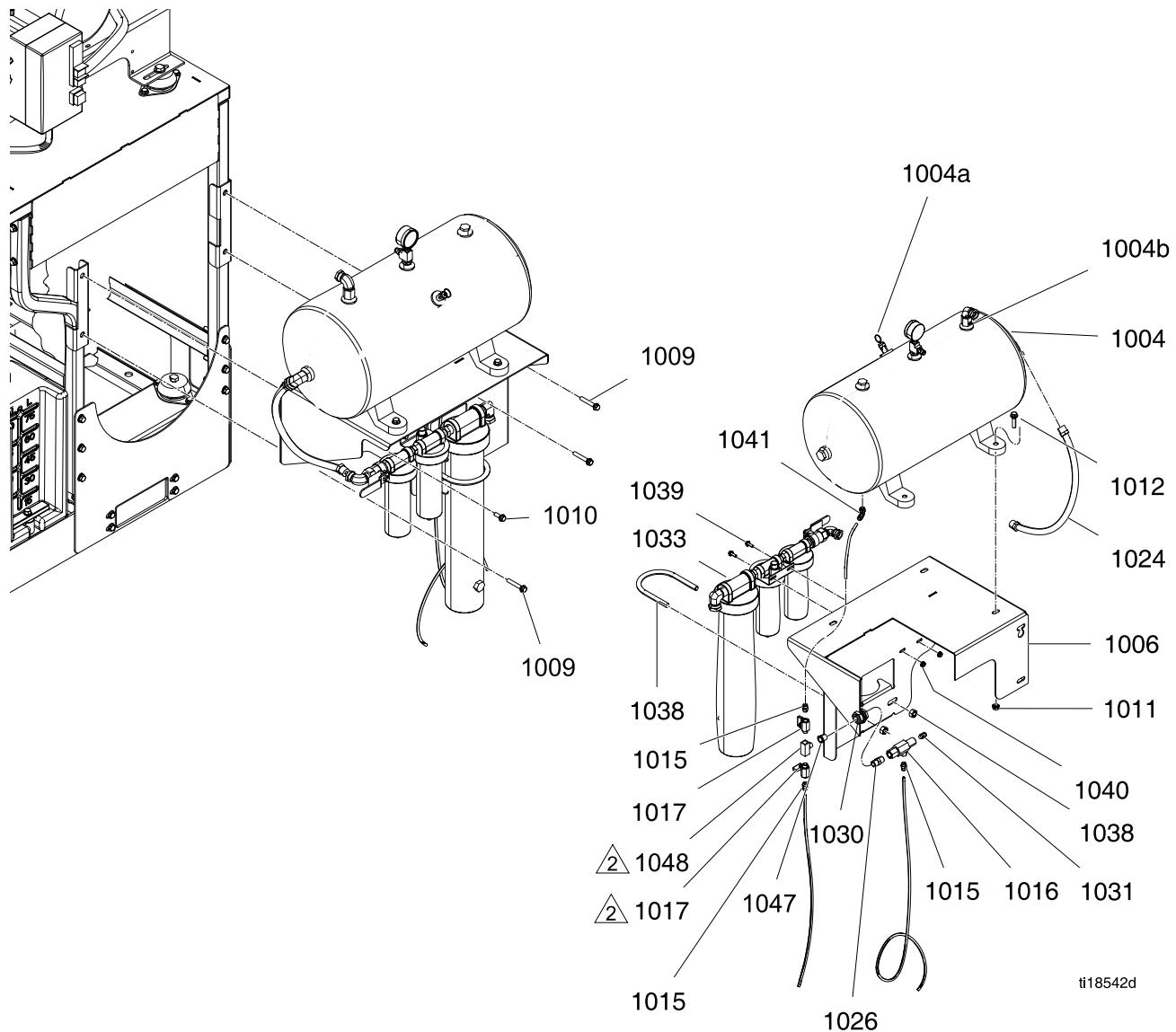
259089, E-30i with Air Compressor

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.

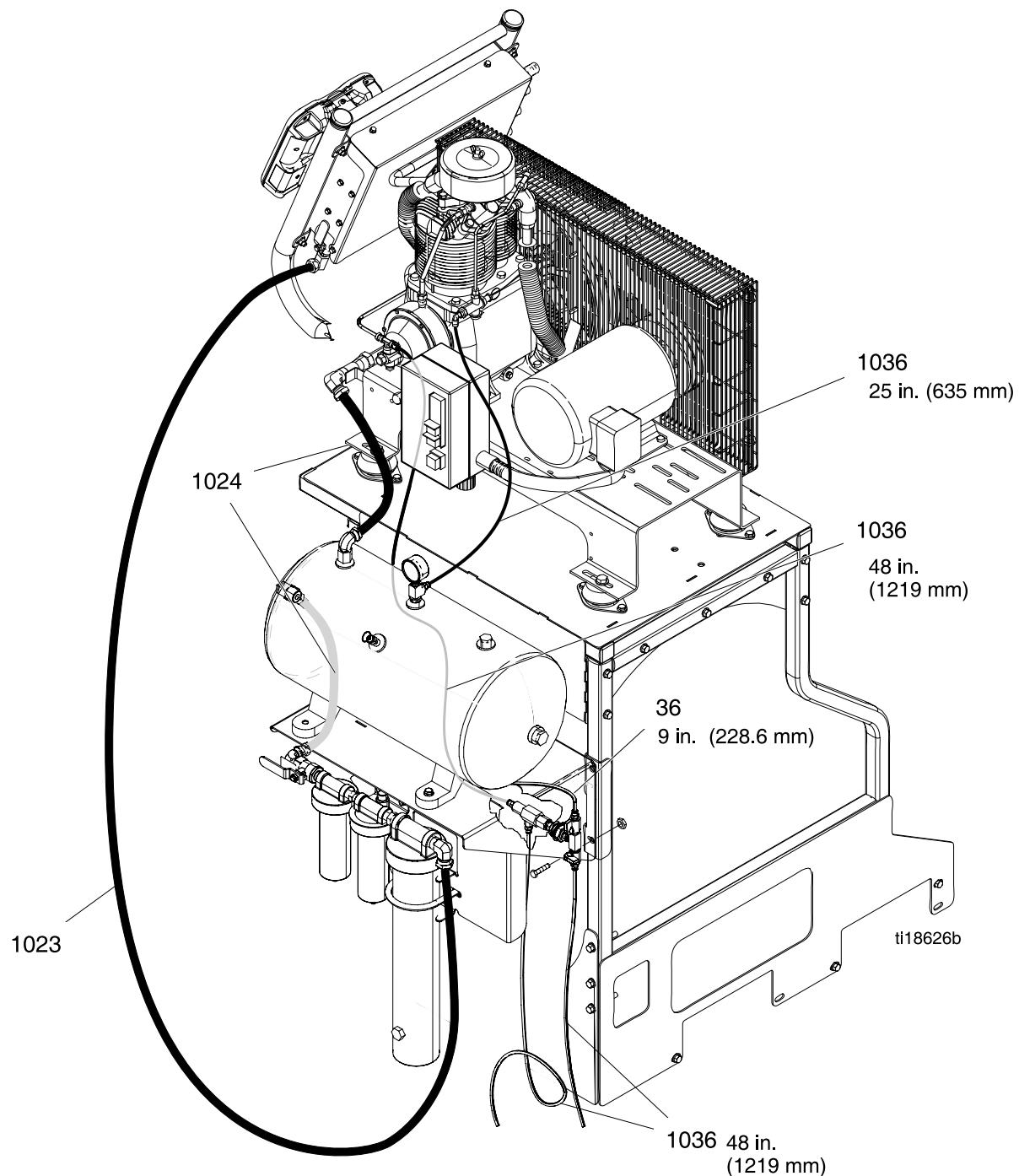


Apply anaerobic sealant to all non-swiveling pipe threads.



For additional automatic water drain capability, order Hankinson automatic electric timed drain (part no. 531-02-175-1). Install between tee fitting and lower ball valve.

Parts



| 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 92.

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 | 1024 | 218093 | HOSE, coupled; 1/2-14 NPT | 2 |
| 1002* | 24M146 | RACK, compressor, front | 1 | 1026 | 297436 | STRAIGHT, nipple, hex. 3/8 | 1 |
| 1003* | 24M145 | RACK, compressor, top | 1 | 1028 | 105324 | SCREW, cap, hex hd; 1.18 in. (30 mm), M12 x 1.75 | 4 |
| 1004 | 24M125 | TANK, ASM, 12 gal, air receiver (includes 1004a and 1004b) | 1 | 1029 | 109570 | WASHER, plain | 4 |
| 1004a | 125967 | VALVE, safety relief, 200 psi (1.4 MPa, 14 bar) | 1 | 1030 | 16N177 | BULKHEAD, brass, 3/8 | 1 |
| 1004b | 16N185 | VALVE, check, 1/2 m x f | 1 | 1031 | 115671 | CONNECTOR, male; 1/4 OD x 1/8 NPT 9(f) | 1 |
| 1005* | 16K133 | GUSSET, compressor, support, side | 1 | 1032* | 111218 | CAP, tube, square | 4 |
| 1006* | 24M150 | BRACKET, air tank/dryer | 1 | 1033 | 24M178 | SYSTEM, desiccant air dryer; see manual 309921 | 1 |
| 1007 | 125970 | COMPRESSOR, air, 5 HP | 1 | 1034 | 16M827 | HARNESS, wire, 3 pole, 8/3 | 1 |
| 1007a | 24T192 | KIT, repair, compressor control box | 1 | 1035 | 16M826 | CORD, grip, 3/4 in. | 2 |
| 1008 | 24L953 | KIT, isolator (4 pack) | 1 | 1036 | 24M675 | KIT, tube, nylon, rd; 1/4 in. OD, 16 ft (4.8 m) | 1 |
| 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 |
| 1011* | 112958 | NUT, hex, flanged; 3/8-16 | 4 | 1039 | 113796 | SCREW, flanged, hex hd | 2 |
| 1012 | 112785 | SCREW, hex hd, flanged; 1.5 in. (38 mm), 3/8-16 | 4 | 1040 | 115942 | NUT, hex, flange head | 2 |
| 1013 | 120375 | ADAPTER, elbow, 3/4-14 NPTF X 1/142 NPSM | 1 | 1041 | 114109 | ELBOW, male, swivel | 2 |
| 1014 | — | PROPORTIONER, see table for part number | ★ | 1044* | 111195 | SCREW, cap, flange hd; 1.25 in. (31.75 mm), 1/2-13 | 4 |
| | | | ★ | 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 | 1048 | 126110 | FITTING, tee, male branch, 1/4-18 NPT | 1 |
| 1023 | 214656 | HOSE, coupled, 61209, 10 ft (3 m) | 1 | | | | |

* Included in Compressor Frame Kit 24M258.

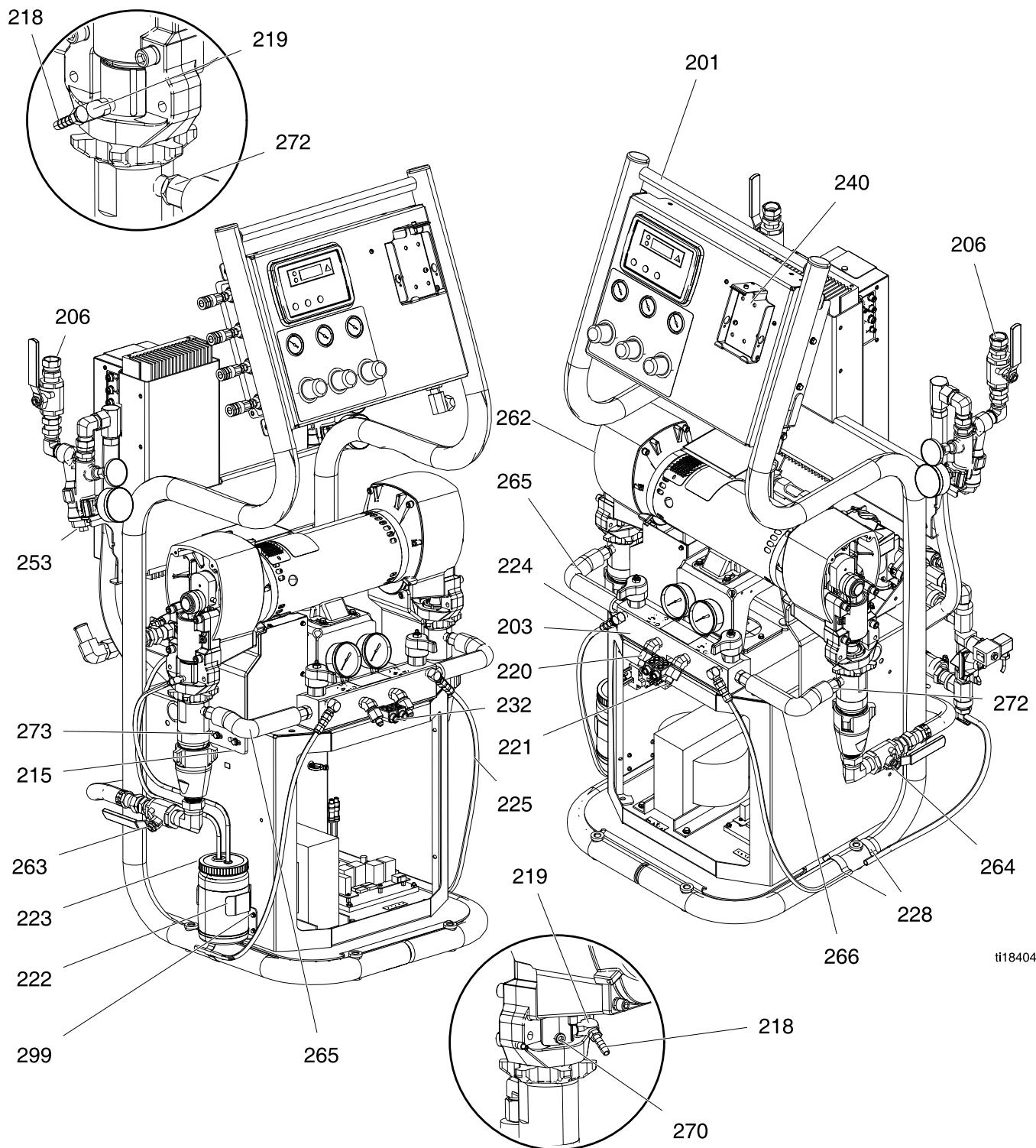
★ Parts for adapting to the mounting feet of the optional Quincy PTL5-5B air compressor.

Proportioners

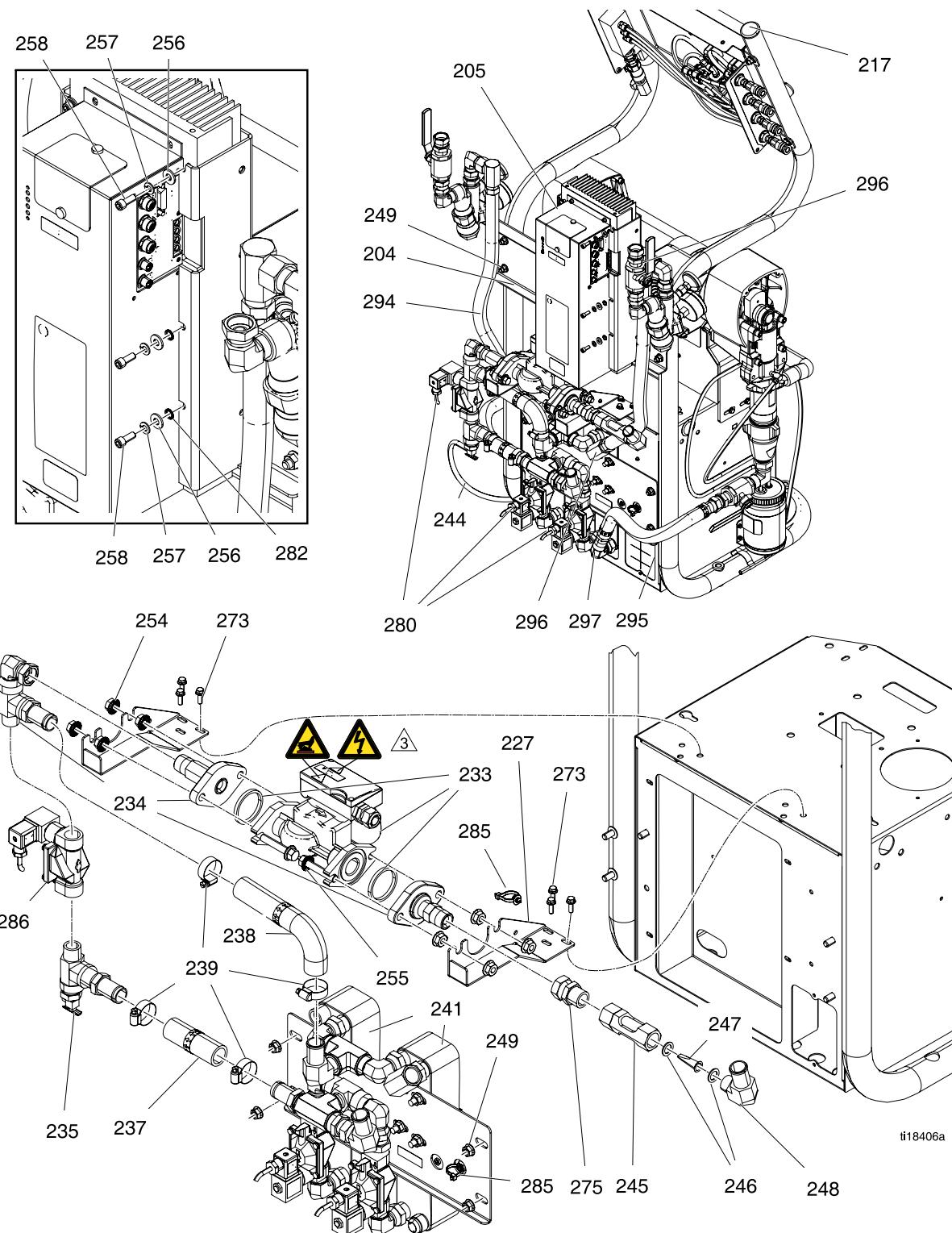
E-30i

E-30i with Booster Heat

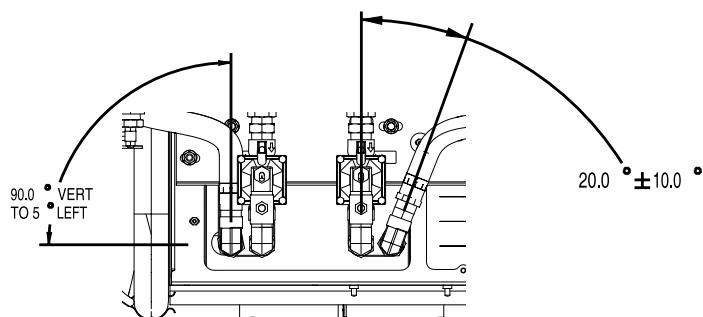
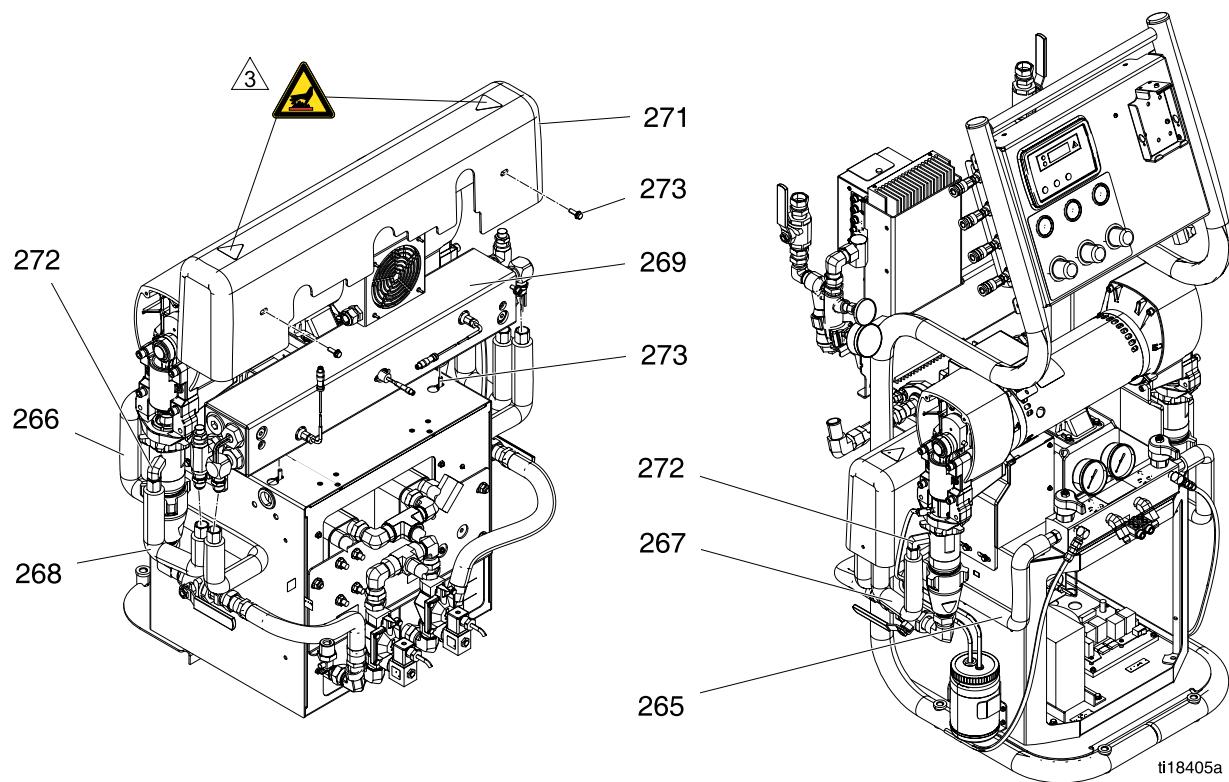
E-XP2i with Booster Heat

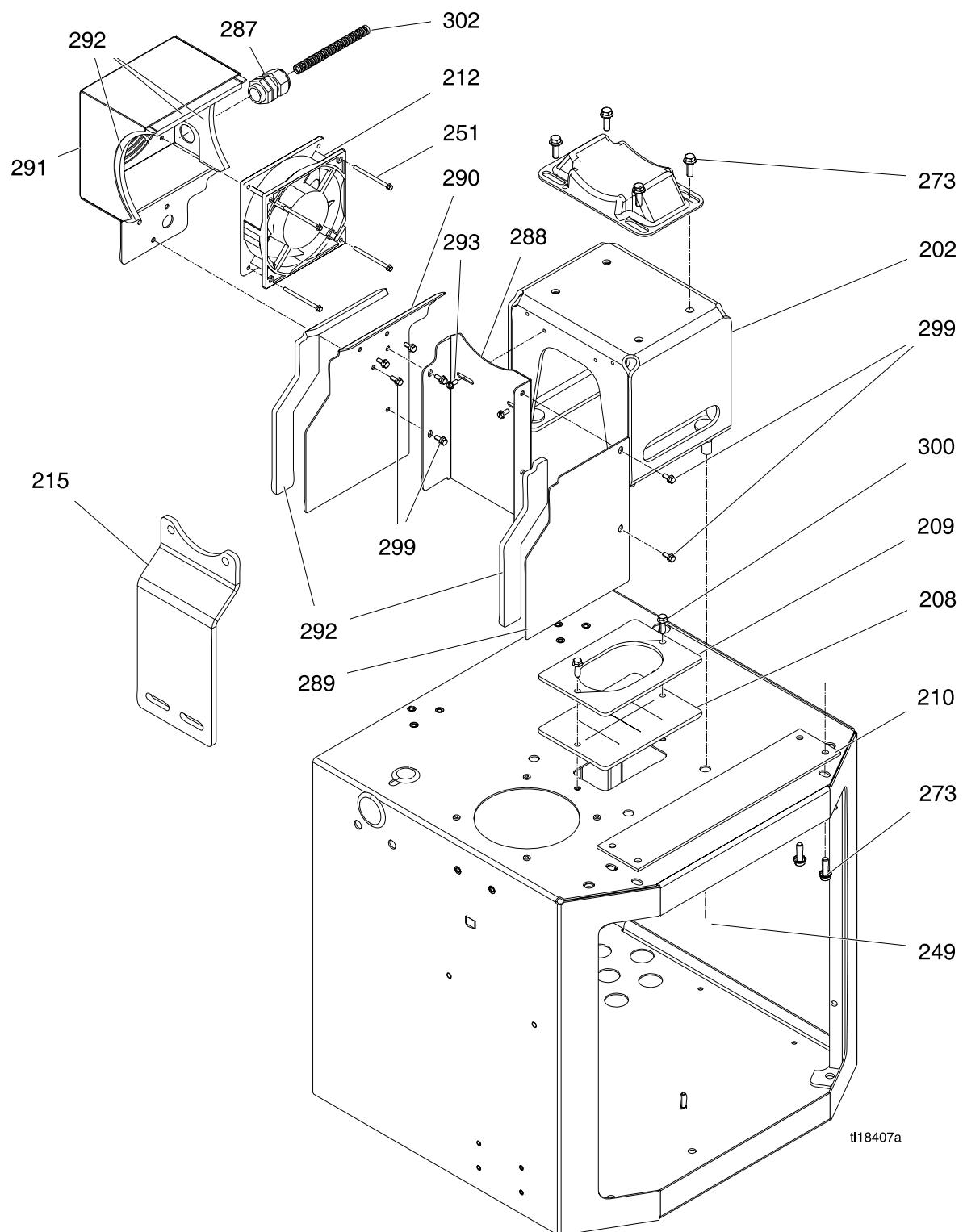


ti18404a

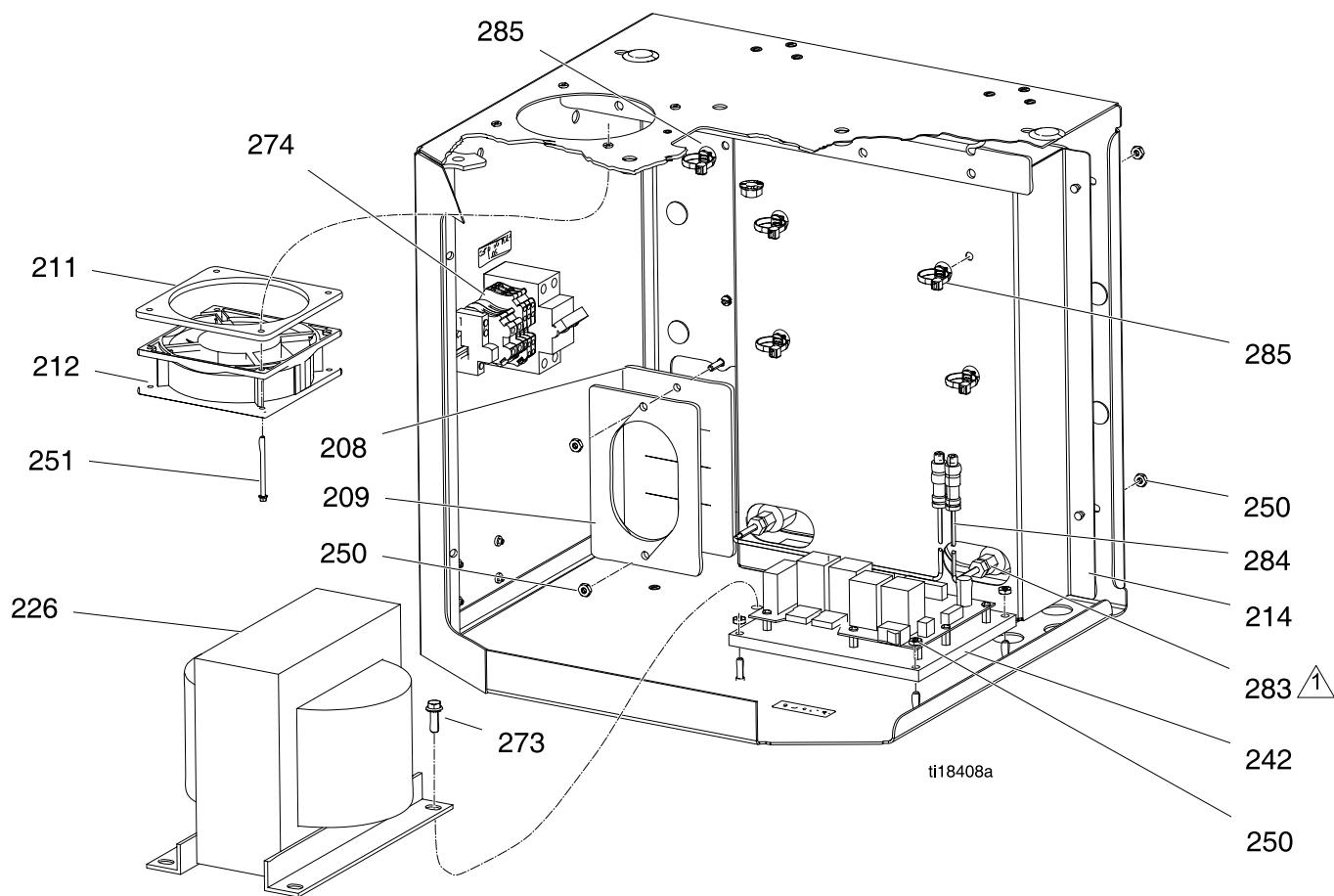


Parts





Parts



- 1 Apply anaerobic polyacrylate pipe sealant to all non-swiveling pipe threads.
- 2 Apply grease to tube fitting threads. Torque to 43 ft-lbs (58 N·m).
- 3 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 Fluid Manifold, page 120 | 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 Fluid Inlet Kit, page 133 | 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 |

Parts

| Ref | Part | Description | Quantity | | |
|--------|--------|--|----------|-------------------------------|-----------------------------------|
| | | | E-30i | E-30i with Booster Heat | E-XP2i with Booster Heat |
| 237 | 16T797 | 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 Air Control Panel, page 118 | 1 | 1 | 1 |
| 241 | — | EXCHANGER, heat, assembly; see Heat Exchanger Assembly, page 132 | 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 Proportioner Module, page 114 | 1 | 1 | |
| | 24L925 | PROPORTIONER, module, E-XP2i; see Proportioner Module, page 114 | | | 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 Dual Zone 4.0 Kw Fluid Heater, page 116 | | 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, 4.25 in. | 2 | 2 | 2 |

Parts

| 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 113](#)
- ❖ Included in Pump Inlet Assembly Kit. See [Pump Inlet Assembly Kits, page 113](#).
- + See [Electrical Schematics, page 134](#).
- ✖ Parts used with Series A systems only.

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 |

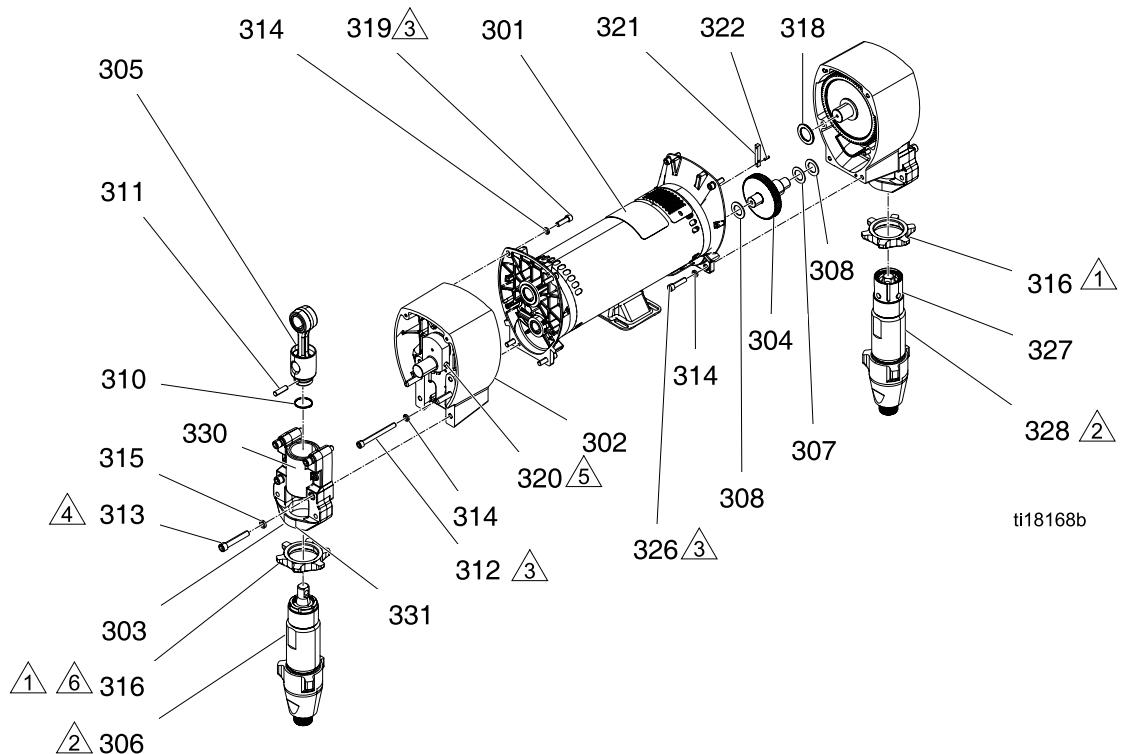
Complete Coolant Hose Kit, 24L939

| Ref | Description | Qty. |
|---|---|------|
| Systems, page 92 | | |
| 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 |
| Proportioners, page 104 | | |
| 244 | HOSE, rubber, 5/16 in., 1 ft (0.3 m) | 1 |
| 298 | HOSE, coolant, 1 in. ID, 0.33 ft (0.1 m) | 1 |
| 22 kW Diesel Generator, page 124 | | |
| 562 | CLAMP, hose, dia. 3/4-1-3/4 in. | 1 |
| Radiator, page 126 | | |
| 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 |
| 628 | HOSE, 1 in. ID; 0.271 ft (0.08 m) | 1 |
| 629 | HOSE, 5/16 in. ID; 1.5 ft (0.5 m) | 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).

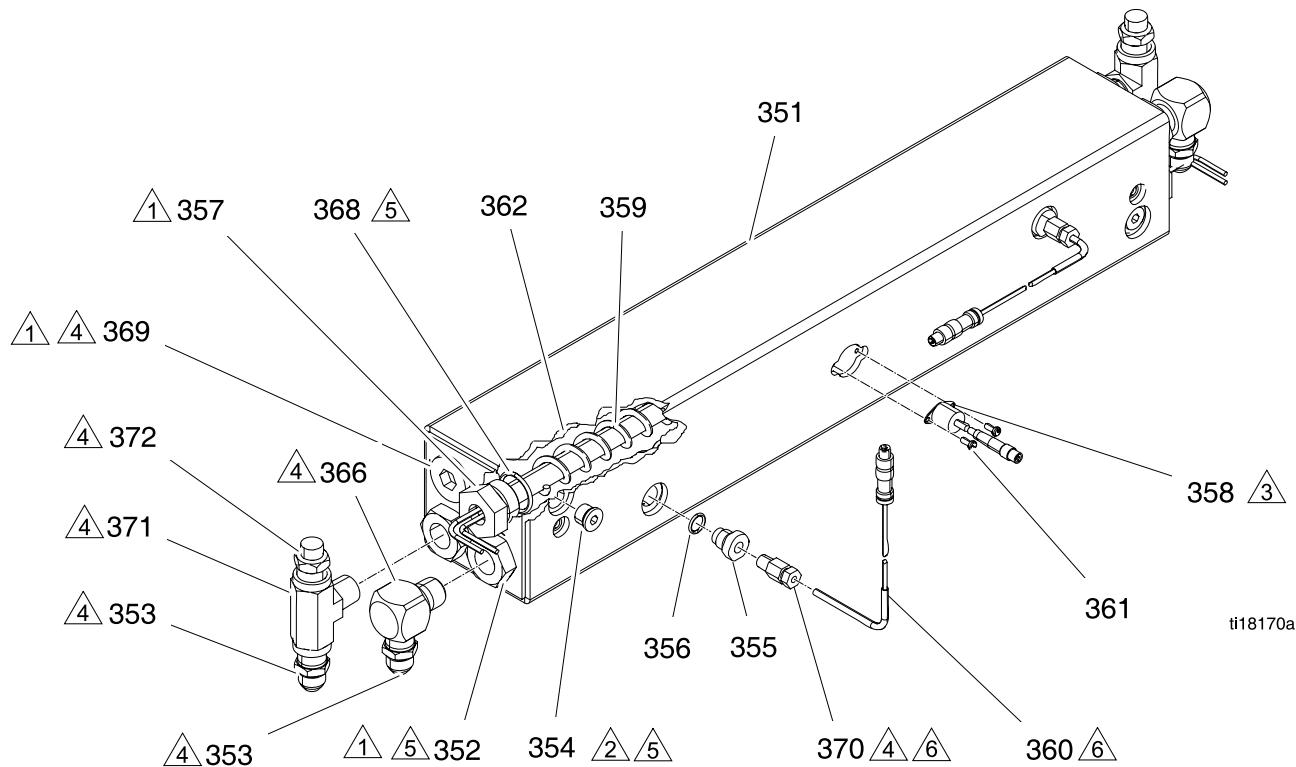
| Ref | Part | Description | Quantity | |
|------|--------|--|----------|--------|
| | | | 24L924 | 24L925 |
| 301 | 24L923 | MOTOR, electric | 1 | 1 |
| 302 | 245969 | HOUSING, drive | 2 | 2 |
| 303 | 257355 | HOUSING, bearing | | 2 |
| | 245927 | HOUSING, bearing | 2 | |
| 304 | 243951 | GEAR, combination | 2 | 2 |
| 305 | 241279 | ROD, connecting; includes spring (310) | 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.

Parts

Dual Zone 4.0 Kw Fluid Heater

24L936



- 1 Torque to 120 ft-lbs (163 N·m).
- 2 Torque to 23 ft-lbs (31 N·m).
- 3 Apply thermal paste.
- 4 Apply pipe sealant and PTFE tape to all non-swiveling threads and threads without o-rings.
- 5 Apply lithium grease lubricant to o-rings before assembling in block (1).
- 6 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.

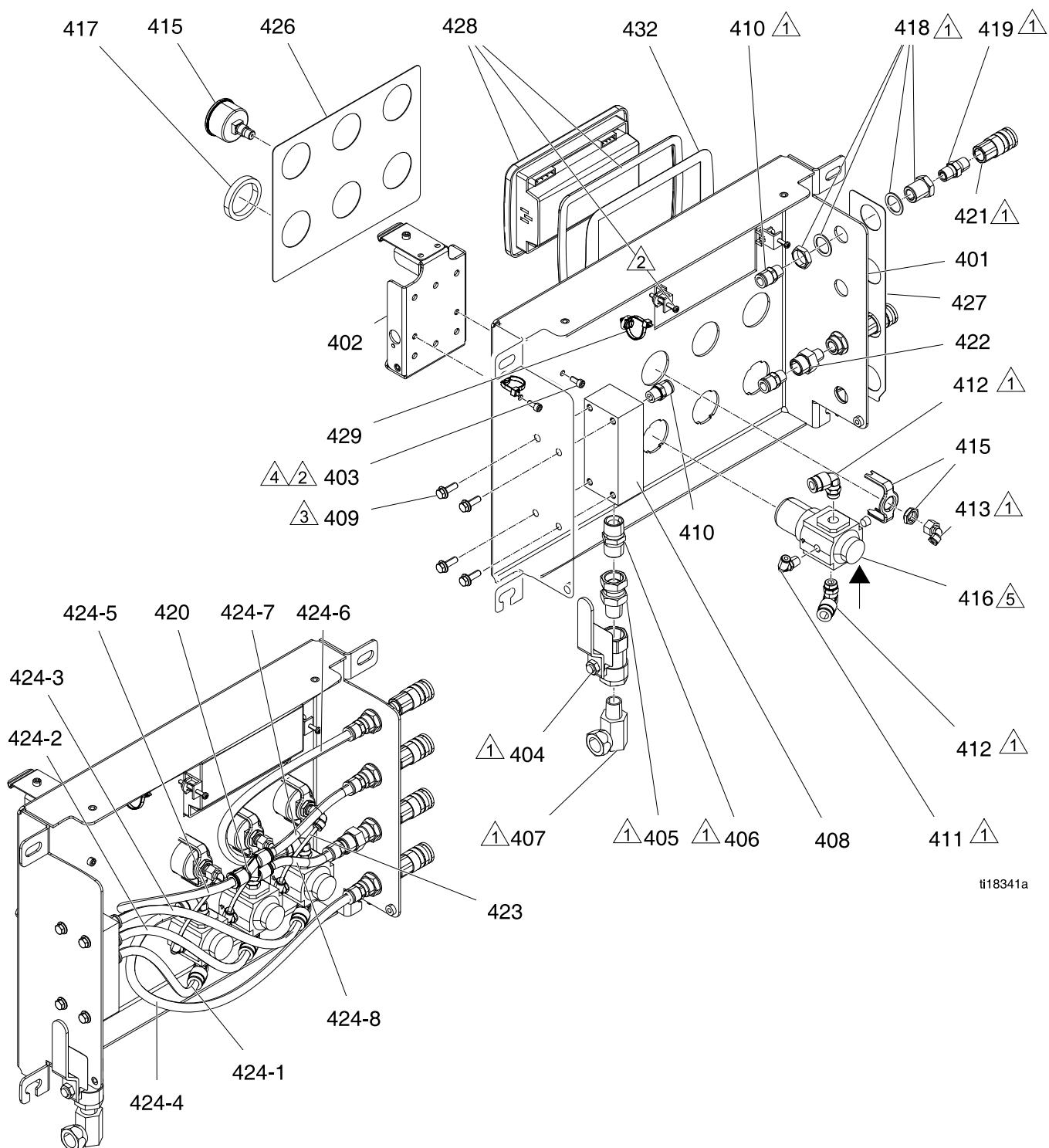
24L936

| 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 | 248187 | KIT, rupture, disc assy | 2 |

* Included in 24L973 Heater RTD Repair Kit.

Parts

Air Control Panel



-  Apply pipe sealant to all non-swiveling pipe threads.
-  Apply anaerobic thread 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 | 424 | ★ | HOSE, nylon, 250 psi; see identification table | 9 |
| 411 | 198171 | FITTING, elbow, 1/8 NPT x 5/32 OD | 3 | 424 | ★ | LABEL, instructions | 1 |
| 412 | 115841 | FITTING, elbow, 1/4 NPT(f) x 3/8 OD | 6 | 426 | 16K325 | LABEL, instructions | 1 |
| 413 | 15T498 | FITTING, 90°, swivel, 5/32 OD x 1/8 NPT(f) | 3 | 427 | 16K326 | MODULE, engine controller | 1 |
| | | | | 428 | 24M665 | TIE, cable, fir tree | 2 |
| | | | | 429 | 125625 | LABEL, safety | 1 |
| | | | | 432▲ | 16K940 | | |

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

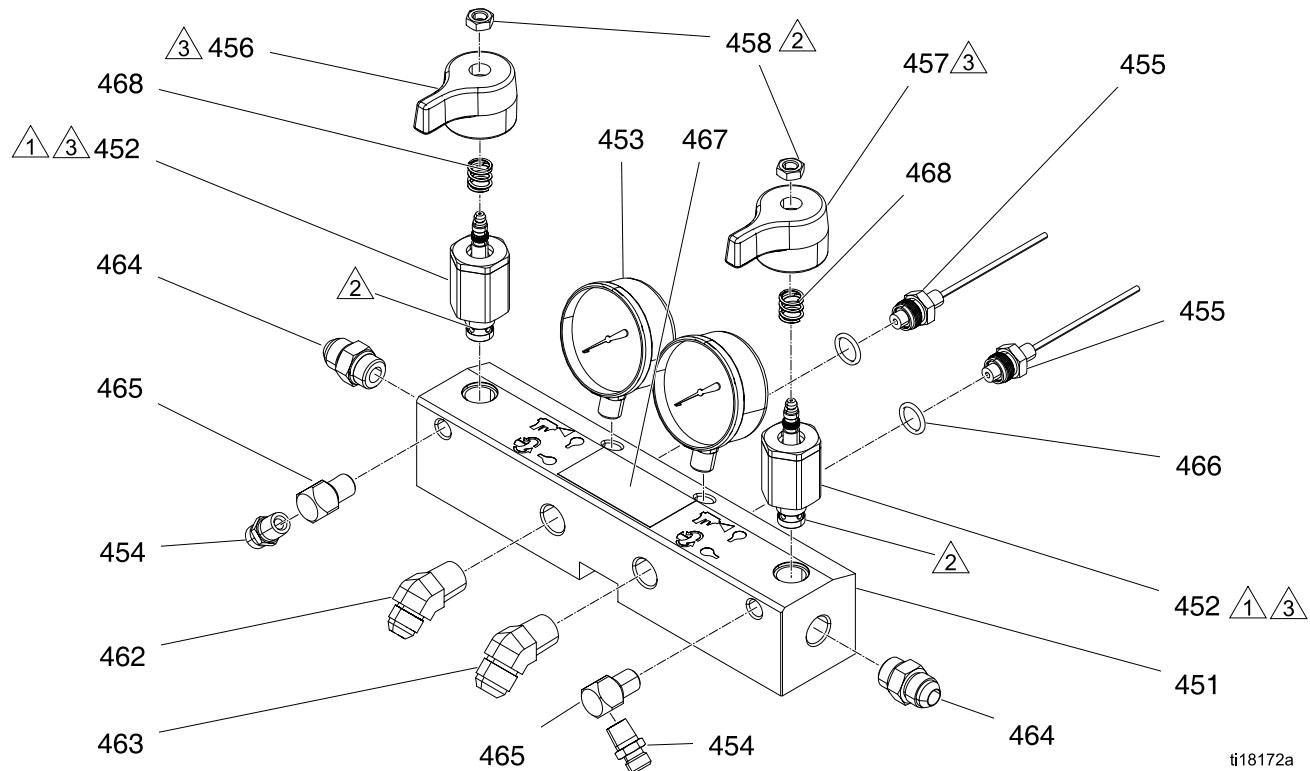
★ Included in Tubing Repair Kit 24M650.

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



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

 Apply sealant (113500) to threads.

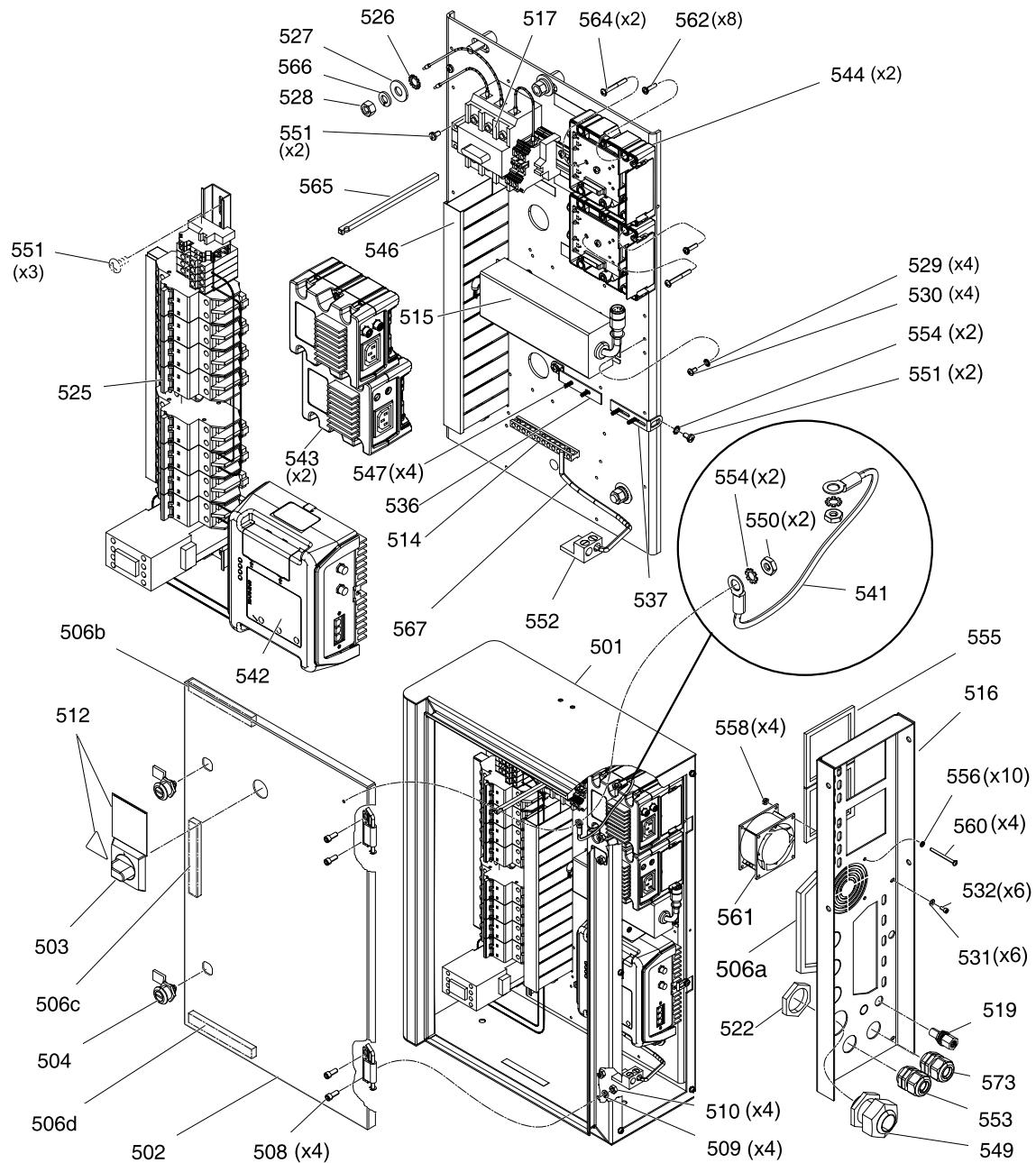
 3 Valve must be closed with handle position as shown on drawing.

** 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★ | 247824 | KIT, valve, cartridge, drain | 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



Parts

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 |

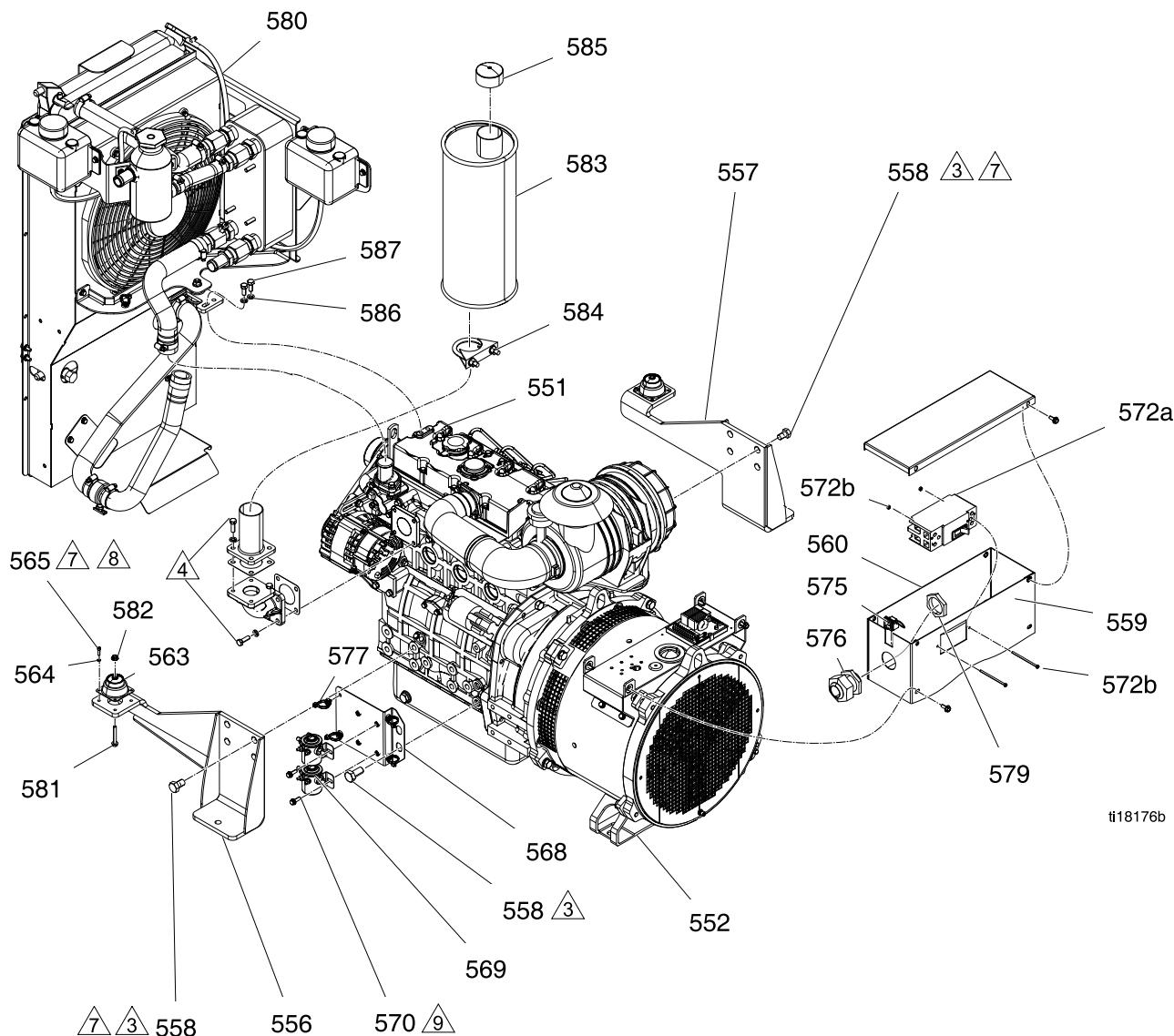
| Ref | Part | Description | Quantity | |
|------|--------|---|-----------|--------------|
| | | | With Heat | Without Heat |
| 541 | 194337 | WIRE, grounding, door | 1 | 1 |
| 542 | 24L950 | MODULE, HPTCM | 1 | 1 |
| 543 | 24L951 | MODULE, LPTCM | 2 | |
| 544 | 289697 | MODULE, GCA, cube, base | 2 | |
| 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 134](#).

* Not shown.

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

22kW Diesel Generator



ti18176b

- | | | | |
|---|----------------------------------|----|--|
| 1 | Torque to 26 ft-lbs (35.25 N•m) | 7 | Apply sealant (blue) to threads. |
| 2 | Torque to 15 ft-lbs (20 N•m) | 8 | Torque to 15 ft-lbs (20 N•m) |
| 3 | Torque to 100 ft-lbs (135.6 N•m) | 9 | Torque to 15–20 in.-lbs (1.7–2 N•m) |
| 4 | Torque to 40 ft-lbs (54 N•m) | 10 | Apply lubrication to engine end of hose prior to assembly. |
| 6 | Apply sealant (red) to threads. | | |

22kW Diesel Generator

| Ref | Part | Description | Qty. | Ref | Part | Description | Qty. |
|-----|--------|---|------|-----|---|--|------|
| 551 | — | ENGINE, diesel, Perkins | 1 | 572 | | SCREW | 2 |
| 552 | 24R079 | ALTERNATOR, 22 kw, diesel engine | 1 | a | 572 | WASHER | 2 |
| 556 | 16J883 | BRACKET, engine mount, left | 1 | b | 572 | NUT | 2 |
| 557 | 16J884 | BRACKET, engine mount, right | 1 | c | 575 | 125631 BUSHING, cable, lay-in strain relief | 1 |
| 558 | 125532 | SCREW, M14 hex head x 30 mm | 10 | 576 | 120858 | BUSHING, strain relief, M40 thread | 1 |
| 559 | 16H904 | ENCLOSURE, alternator, front | 1 | 577 | 125625 | TIE, cable, fir tree | 4 |
| 560 | 16H906 | ENCLOSURE, alternator, front | 1 | 579 | 120859 | NUT, strain relief, M40 thread | 1 |
| 562 | 125371 | CLAMP, hose, dia. 3/4-1-3/4 in. | 1 | 580 | — | See Radiator, page 126 | 1 |
| * | 563 | 125394 ISOLATOR, mount, radiator, bottom | 2 | 581 | 120736 | SCREW, hex flange hd, M6 x 1 | 2 |
| 564 | 100079 | WASHER, lock, spring | 8 | 582 | 115942 | NUT, hex, flange head | 2 |
| 565 | 106245 | SCREW, cap, sch, 0.625 in. (16 mm) x #8-32 | 8 | 583 | — | MUFFLER, 2 in. (50.8 mm) exhaust | 1 |
| 568 | 16J799 | BRACKET, engine relay | 1 | ■ | 584 | 125161 MUFFLER, clamp | 1 |
| 569 | 24L963 | KIT, relay, solenoid, 12v, intermittent | 2 | ■ | 585 | 125685 CAP, exhaust | 1 |
| 570 | 113161 | SCREW, flanged, hex hd, 1/2 in. x 1/4-20 | 4 | ■ | 586 | 104572 WASHER, lock spring | 2 |
| 572 | 24L965 | CIRCUIT, breaker, 90A | 1 | 587 | 105328 SCREW, cap, hex hd, M8 x 1.25 | 2 | |

■ Included in Muffler Kit 24L943.

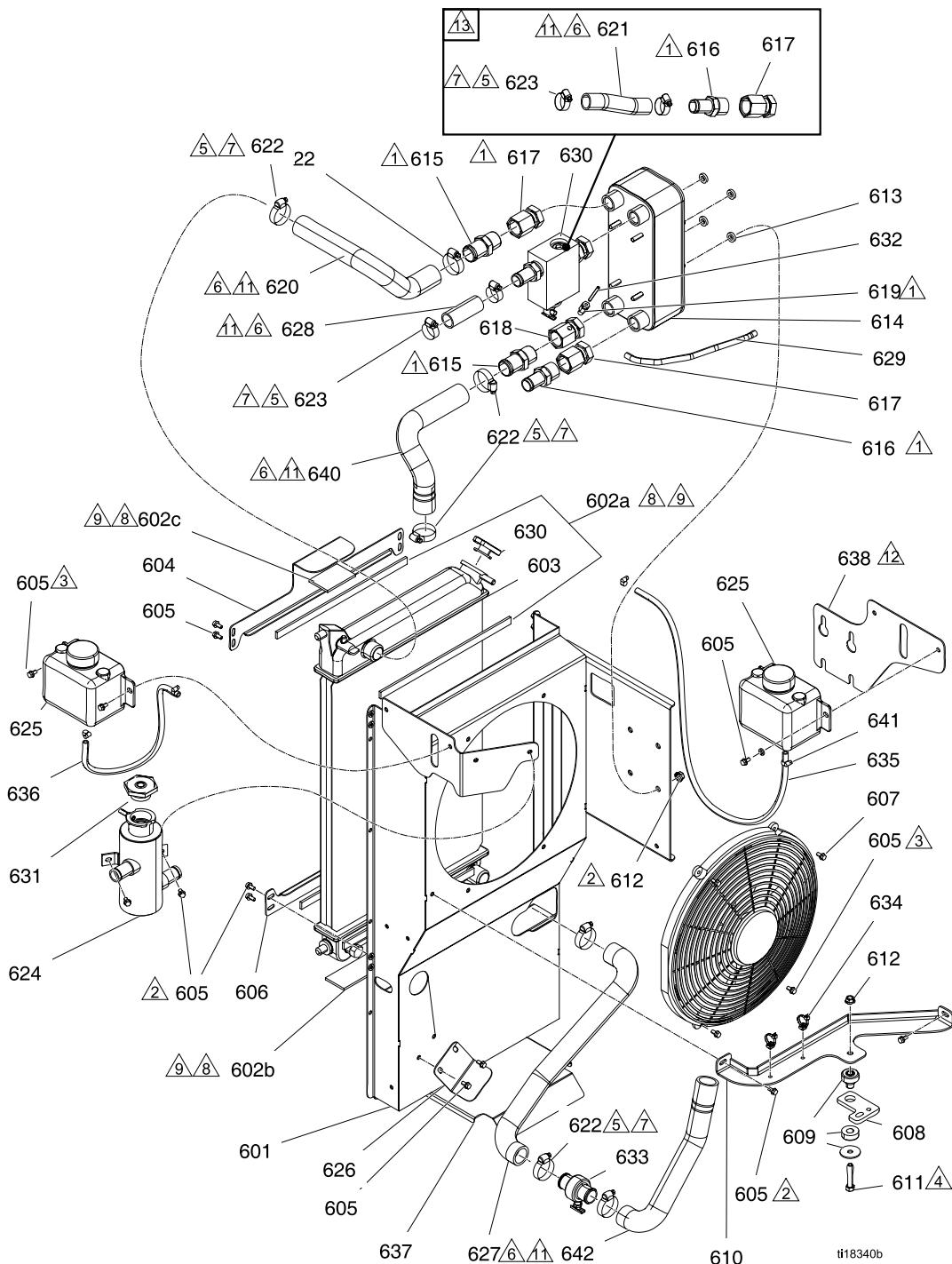
* Included in Complete Coolant Hose Kit 24L939.

See [Complete Coolant Hose Kit, page 113](#).

Replace fuses F6 and F7 located in the junction
box above the 120/240 V alternator. Use Fuse
Replacement Kit 24M723.

Radiator

See assembly notes on next page.



- Apply pipe sealant to all non-swiveling pipe threads.
- Torque to 25 +/- 2 ft-lbs (34 N•m).
- Torque to 10 +/- 2 ft-lbs (14 N•m).
- Torque to 40 +/- 2 ft-lbs (54 N•m).
- Torque to 15–20 in.-lbs (1.7–2 N•m).
- Install rubber hose onto bead barb fitting to 0.13 in. (3.3 mm) maximum from hex.
- Locate and install edge of hose clamp 0.38 in. (9.6 mm) maximum from the end of rubber hose.
- Secure adhesive side of gasket to parts opposing radiator, not radiator.
- See parts list for length.
- Torque to 23 +/- 2 ft-lbs (31 N•m).
- Apply lubrication to all press-on hoses prior to assembly.
- 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).
- For Series A systems only.

| Ref | Part | Description | Qty | Ref | Part | Description | Qty | |
|------|--------|--|-----|-----|--------|----------------------------|--|---|
| 601 | 16H872 | COVER, radiator mount | 1 | 616 | 125139 | FITTING, barb, beaded hose | 2 | |
| 602 | 16H910 | GASKET, radiator isolation; see 602a-602c | 1 | ◆ | 617 | 158383 | FITTING, union, adapter, straight | 3 |
| 602a | — | GASKET, radiator isolation; 14 in. (355.6 mm), 0.63 in. dia. | 4 | ◆ | 618 | 125171 | FITTING, modified, union | 1 |
| 602b | — | GASKET, radiator isolation; 14 in. (355.6 mm), 2 in. dia. | 1 | ◆ | 619* | — | FITTING, compression, 1/8 NPT, SST | 1 |
| 602c | — | GASKET, radiator isolation; 3 in. (76.2 mm), 2 in. dia. | 1 | * | 620 | 125359 | HOSE, formed, 1 1/4 upper radiator | 1 |
| 603 | — | RADIATOR | 1 | * | 621 | 16T800 | HOSE, coolant, 1 in. ID; 6 in. (152.4 mm) | 1 |
| ❖ | | | | * | 622 | 125371 | CLAMP, hose, dia. 3/4-1-3/4 in. | 4 |
| 604 | 16H868 | BRACKET, top | 1 | * | 623 | 125370 | CLAMP ,hose, dia. 11/16-1-1/2 in. | 2 |
| 605 | 113161 | SCREW, flanged, hex hd; 1/4-20 x 1/2 in. (13 mm) | 20 | * | ● | — | TANK, aluminum, coolant | 1 |
| 606 | 16H870 | BRACKET, bottom | 1 | * | 624 | — | ● | 1 |
| 607 | 16H717 | FAN, 16 in., 12V | 1 | * | 625 | 125204 | BOTTLE, overflow | 2 |
| 608 | 16K156 | BRACKET, plate | 1 | * | 626 | 16H901 | BRACKET, hose support | 1 |
| 609 | 125579 | ISOLATOR, mount, radiator, top | 1 | * | 627 | 125360 | HOSE, formed, 1 1/4 lower radiator | 1 |
| 610 | 16H876 | BRACKET, support | 1 | * | 628 | 16W156 | HOSE, coolant, 1 in. ID; 0.271 ft (0.08 m) | 1 |
| 611 | 111803 | SCREW, cap, hex hd; 3/8-16 x 2 in. (50.8 mm) | 1 | ★ | 629 | 16W155 | HOSE, rubber, 5/16 in. 1.5 ft (0.5 m) | 1 |
| 612 | 112958 | NUT, hex, flanged | 5 | ★ | 630 | — | HOUSING, filter | 1 |
| ■ | | | | ★ | | | | |
| 613 | 16J741 | WASHER, nylon, 30% glass .750 OD | 4 | | | | | |
| 614 | — | EXCHANGER, heat | 1 | | | | | |
| ◆ | | | | | | | | |
| 615 | 125356 | FITTING, 1 in. NPT X 1.25 barbed hose | 2 | | | | | |

Parts

| 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 | 643 | — | STRAINER, 40 mesh; not shown | 1 |
| | | | | ★ | | Included in Filter Housing Kit 24T027. | |

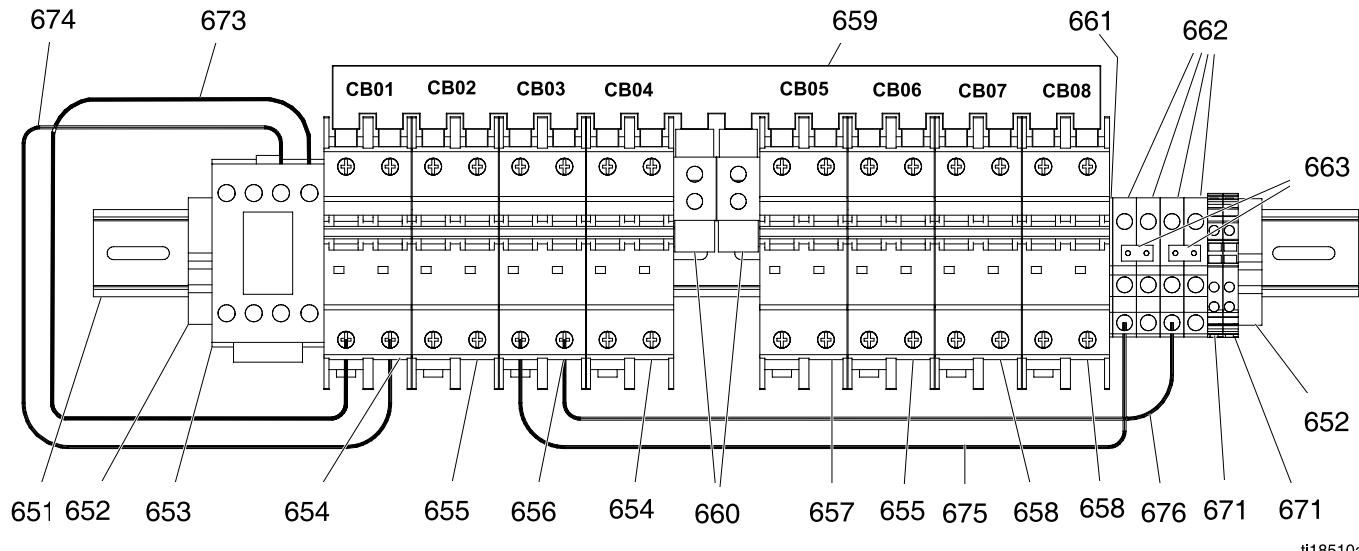
- ◆ *included in Heat Exchanger Kit 24L946.*
- ❖ *Included in Radiator Repair Kit 24L937.*
- *Included in Coolant Bottle Repair Kit 24L942.*
- *Included in Radiator Isolator Kit 24L945.*

- ★ *Included in Filter Housing Kit 24T027.*
- * *Included in RTD Sensor Kit 24L974.*
- * *Included in Complete Coolant Hose Kit 24L939.
See Complete Coolant Hose Kit, page 113.*

Circuit Breaker Modules

24J728, Din Rail Circuit Breaker Assembly

See [Electrical Schematics](#), page 134.



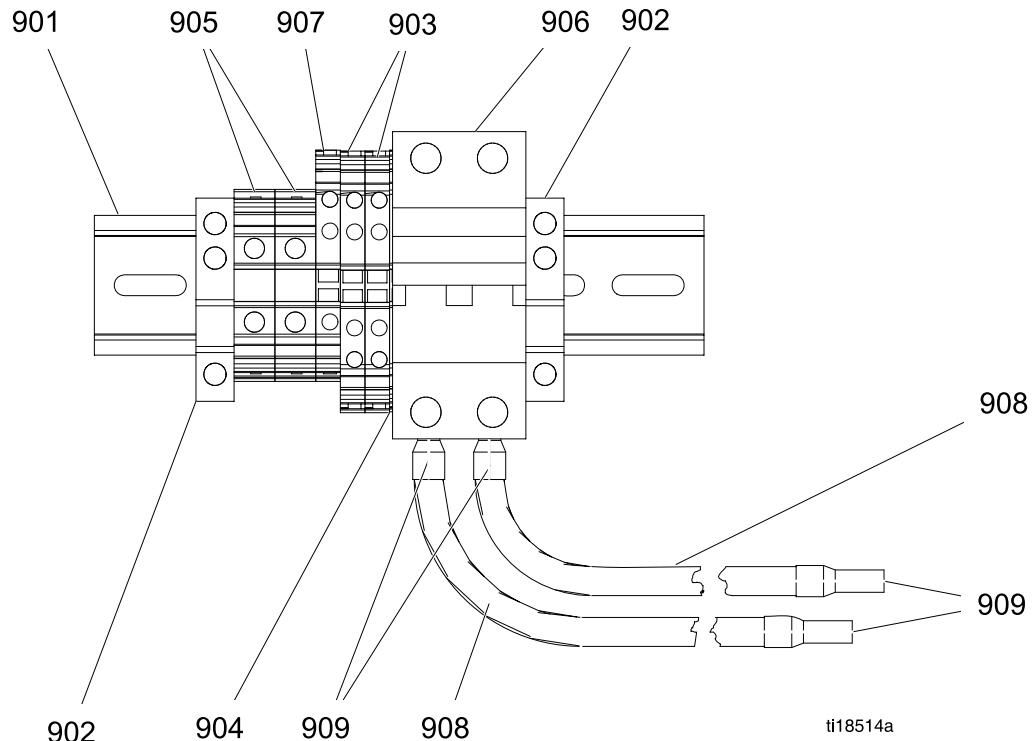
ti18510a

| Ref | Part | Description | Qty | Ref | Part | Description | Qty |
|-----|--------|----------------------------------|-----|-----|--------|--|-----|
| 651 | 125666 | RAIL, DIN, 18 in. (457.2 mm) | 1 | 662 | 125671 | TERMINAL, block, three wire | 4 |
| 652 | 125667 | TERMINAL, stop, end | 2 | 663 | 125672 | TERMINAL, block, bridge jumper | 2 |
| 653 | 126015 | RELAY, contactor | 1 | 671 | 125767 | TERMINAL, block, three wire ground | 2 |
| 654 | 126130 | CIRCUIT, breaker, 2P, 30A, UL489 | 2 | 673 | — | WIRE, black , 10 AWG, UL 1015, 14 in. (355.6 mm). K130 | 2 |
| 655 | 126128 | CIRCUIT, breaker, 2P, 20A, UL489 | 2 | 674 | — | WIRE, red , 10 AWG, UL 1015, 14 in. (355.6 mm). K140 | 2 |
| 656 | 126125 | CIRCUIT, breaker, 2P, 5A, UL489 | 1 | 675 | — | WIRE, black , 16 AWG, UL 1015, 14 in. (355.6 mm). K150 | 2 |
| 657 | 126126 | CIRCUIT, breaker, 2P, 10A, UL489 | 1 | 676 | — | WIRE, red , 16 AWG, UL 1015, 14 in. (355.6 mm). K160 | 2 |
| 658 | 126127 | CIRCUIT, breaker, 2P, 15A, UL489 | 2 | | | | |
| 659 | 125668 | BAR,18 pos, power buss | 1 | | | | |
| 660 | 125669 | BAR, bus, connector | 2 | | | | |
| 661 | 125670 | TERMINAL, block, end cover | 1 | | | | |

Parts

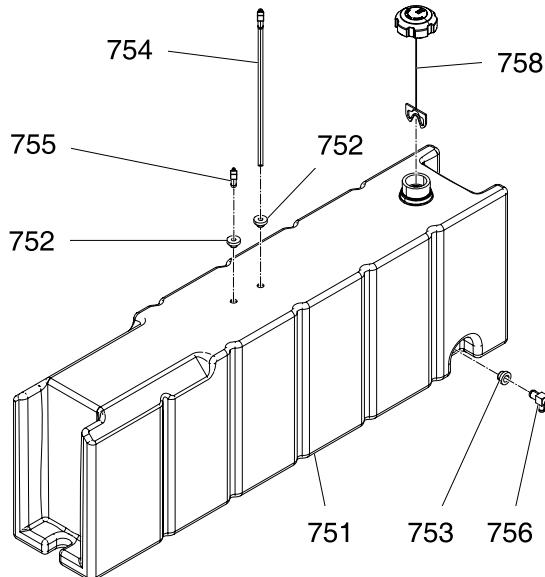
24J721, Transformer and Fan Circuit Breaker Module

See [Electrical Schematics, page 134](#).



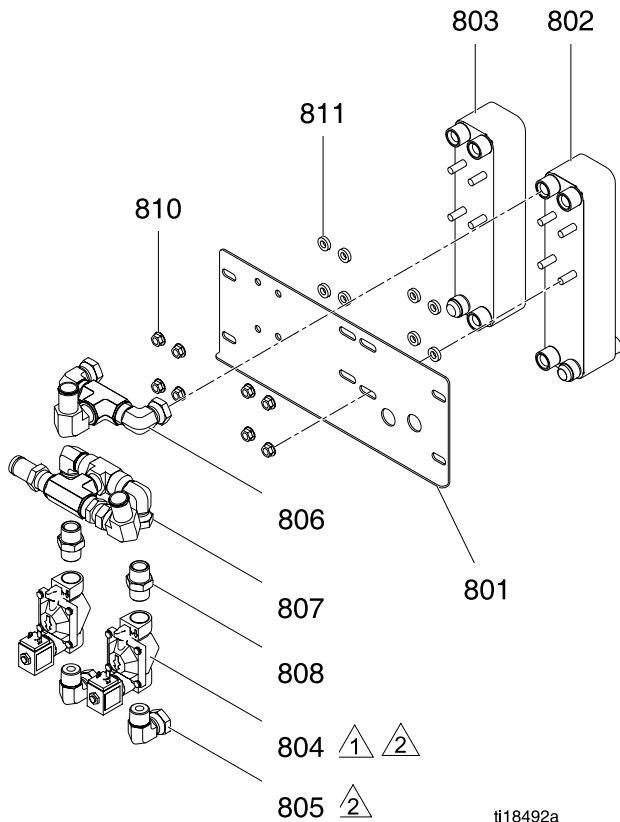
ti18514a

| 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 | 758 | 24L955 | CAP, fuel | 1 |
| 754 | 125647 | FITTING, suction, assy | 1 | | | | |

Heat Exchanger Assembly



ti18492a

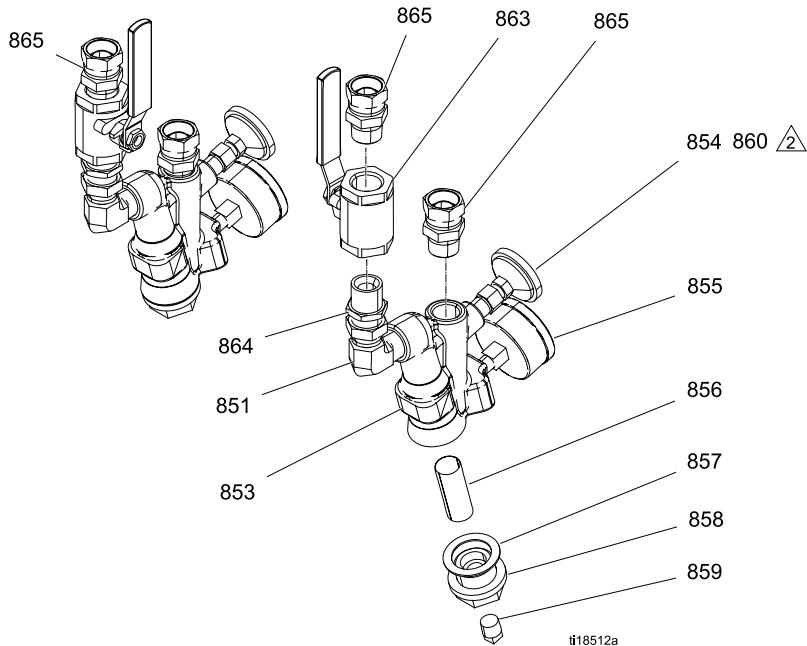
- 1 Ensure flow direction arrows on solenoids valves (804) are pointing down.
- 2 Apply anaerobic pipe sealant to all non-swiveling fittings before assembling.

| 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, y-strainer, inlet; series A | 2 |
| 853 | 247503 | ★ MANIFOLD, y-strainer, inlet; series A | 2 | ★ | 16V879 | CAP, filter; series B | 2 |
| ★ | 16W714 | MANIFOLD, y-strainer, inlet; series B | | 859 | 104813 | PLUG, pipe; series A | 2 |
| 854 | 102124 | THERMOMETER, dial | 2 | ★ | 555808 | PLUG, pipe; series B | 2 |
| 855 | 120300 | GAUGE, pressure, fluid | 2 | 860 | 15D757 | HOUSING, thermometer, VISCON HP | 2 |
| 856* | 180199 | FILTER, replacement, 20 mesh | 2 | 863 | 109077 | VALVE, BALL 3/4 NPT | 2 |
| 857 | 15H200 | ★ GASKET, y-strainer, inlet; series A | 2 | 864 | 160032 | NIPPLE, 1-1/4 in. x 2 in. 3/4 NPT | 2 |
| ★ | C20203 | O-RING, fluoroelastomer, y-strainer, inlet; series B | 2 | 865 | 157785 | FITTING, swivel | 4 |

* Optional 80 mesh filter 255082 (2 pack)

★ Series A y-strainers use a flat gasket (857) and can be identified by a thin white seal. The gasket material was upgraded for improved sealing. The new material has a light gray color.

Series B y-strainers use an o-ring (857) with manifold (853) and strainer plug (858). There is no visible seal when fully assembled.

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 | Engine, page 146 |
| D | (280) | 16K646 | Load Center Coolant Valves | Load Center, page 143 Coolant Valve Wiring Diagram, page 143 |
| E | (49) | 16K301 | Engine Load center | Engine, page 146 Load Center, page 143 |
| F | (94) | 16K297 | Load Center Engine Engine Control Module | Load Center, page 143 Engine, page 146 Engine Control Module, page 145 |
| H | (53) | 16K299 | Load Center Electrical Enclosure | Load Center, page 143 Electrical Enclosure, page 136 |
| K | (52) | 125753 | Alternator Enclosure Electrical Enclosure | Alternator Enclosure, page 147 Electrical Enclosure, page 136 |
| M | (51) | 125752 | Alternator Enclosure Engine Control Module | Alternator Enclosure, page 147 Engine Control Module, page 145 |
| N | (54) | 125756 | Reactor Electrical Enclosure MCM | Reactor, page 142, 135 Electrical Enclosure, page 136 |

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 |

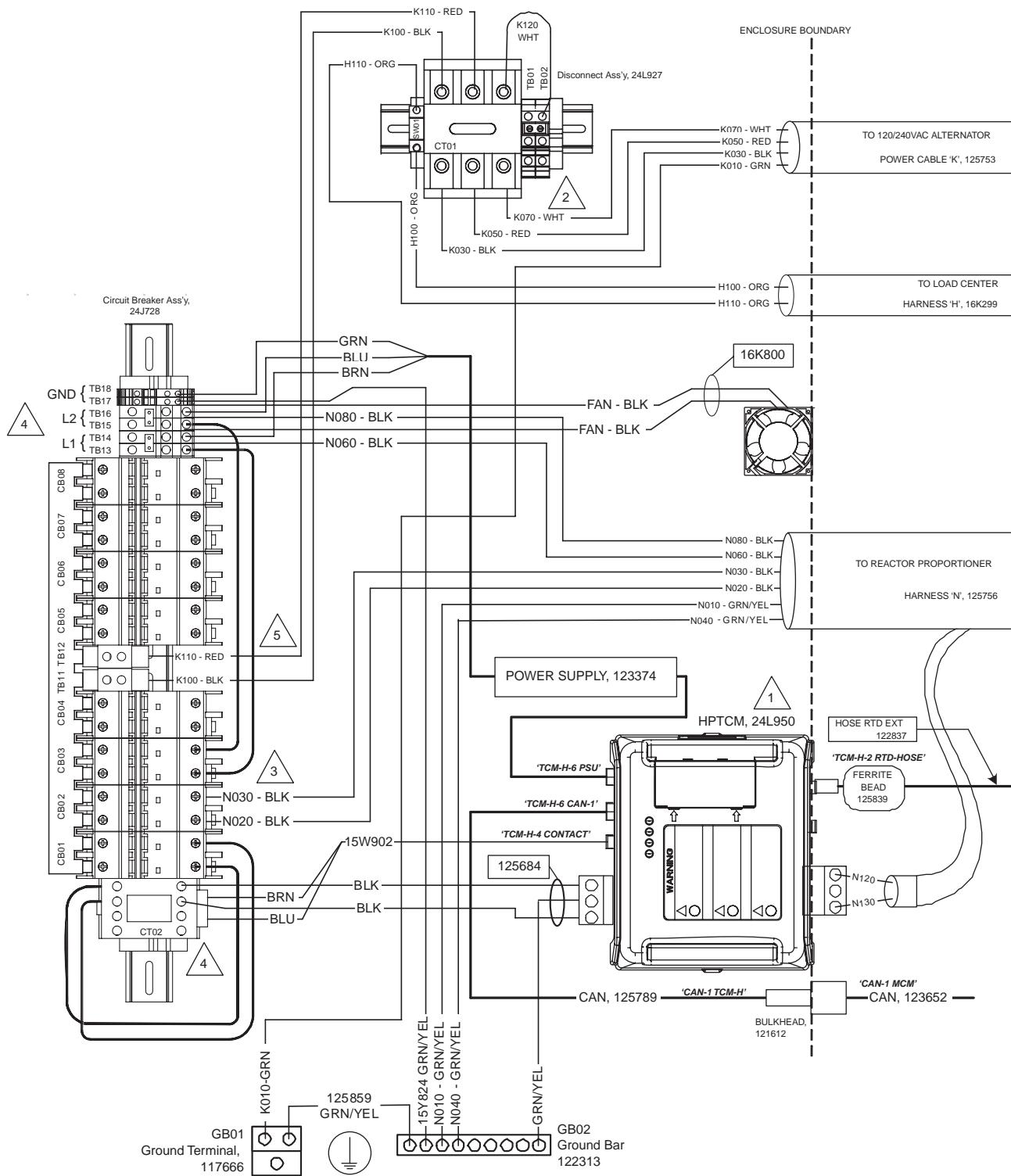
| Ref. | Size | Component |
|------|------|--|
| CB07 | 15 A | E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) A |
| | | E-30i: Auxiliary |
| CB08 | 15 A | E-XP2i and E-30i With Heat: Low Power Temperature Control Module (LPTCM) B |
| | | E-30i: Auxiliary |

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 |

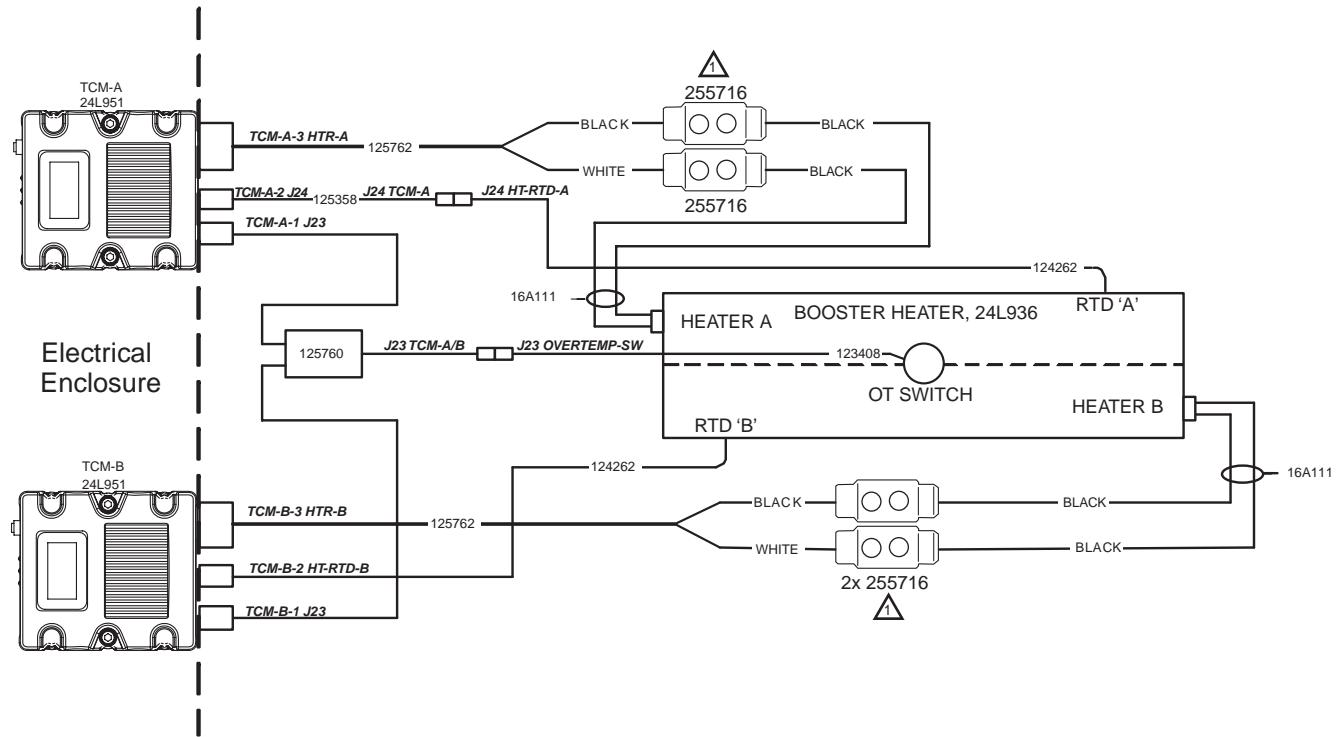
Electrical Enclosure Wiring Diagram



See assembly notes on next page.

- 1** Rotary switch set to "0".
See [Circuit Breaker Identification, page 135](#), for circuit breaker identification table.
- 2** Torque power wire connections to 55–62 in.–lbs (6.2–7 N•m).
- 3** Torque circuit breaker contactor connections to 23–25 in.–lbs (2.5–2.8 N•m).
- 4** Torque terminal blocks to 5–7 in.–lbs (0.5–0.8 N•m).
- 5** Torque din rail power leads to 30–32 in.–lbs (3.3–3.6 N•m).

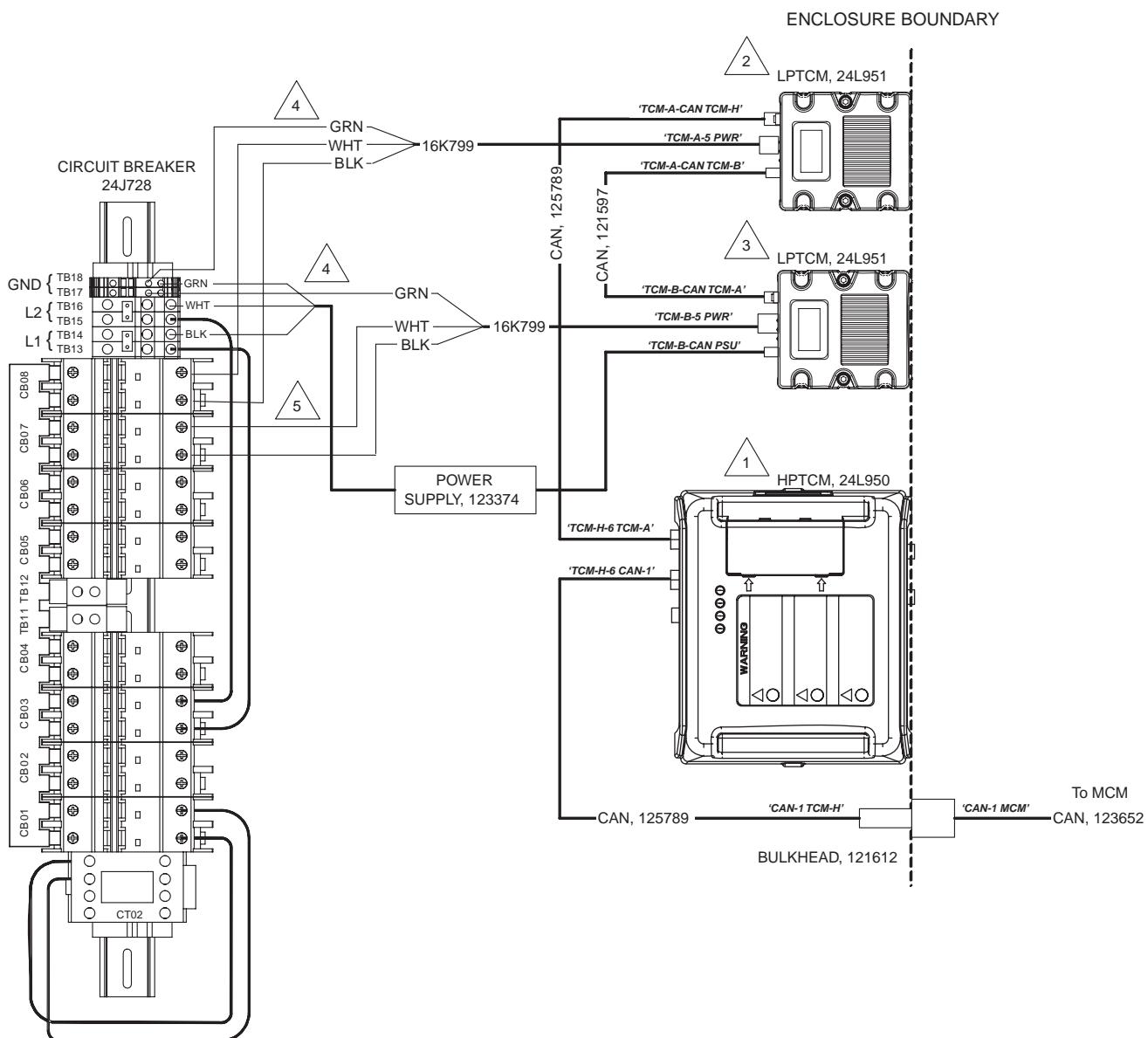
Outside Electrical Enclosure With Optional Heater Wiring Diagram



Heater viewed from the back of the proportioner.

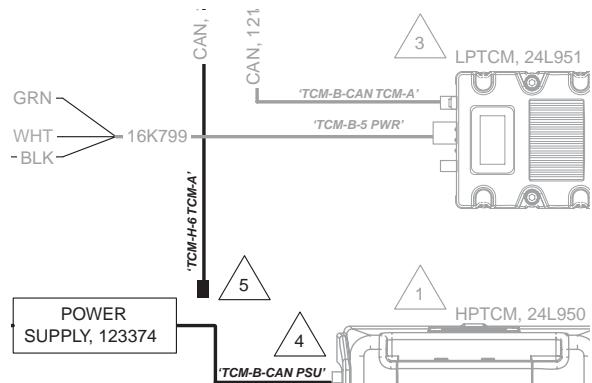
- 1** Torque power wire connections to 55–62 in.–lbs (6.2–7 N•m).

Booster Heater Wiring Diagram



- 1** △ Rotary switch set to “0”.
- 2** △ Rotary switch set to “A”.
- 3** △ Rotary switch set to “B”.
- 4** △ Torque terminal blocks to 5–7 in.–lbs (0.5–0.8 N•m).
- 5** △ Torque circuit breaker connections to 23–25 in.–lbs (2.5–2.8 N•m).
See Disable Optional Booster Heater Wiring Diagram on next page.

Disable Optional Booster Heater Wiring Diagram

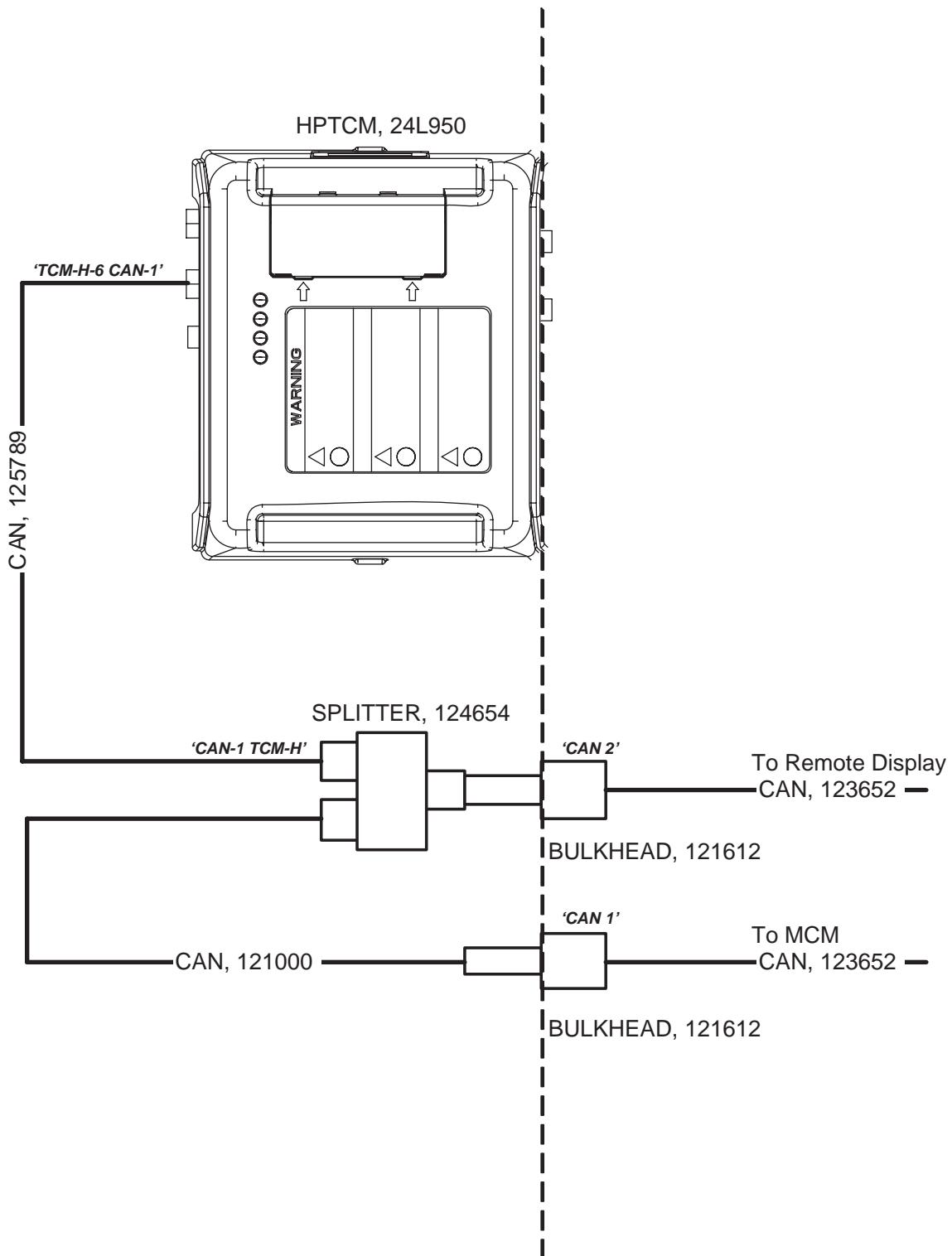


New power supply connection in port #6.

Unterminated

Optional Remote Display Module Wiring Diagram

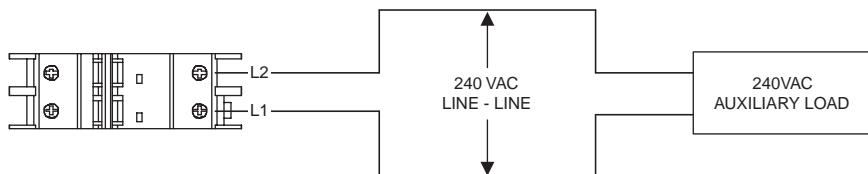
ENCLOSURE BOUNDARY



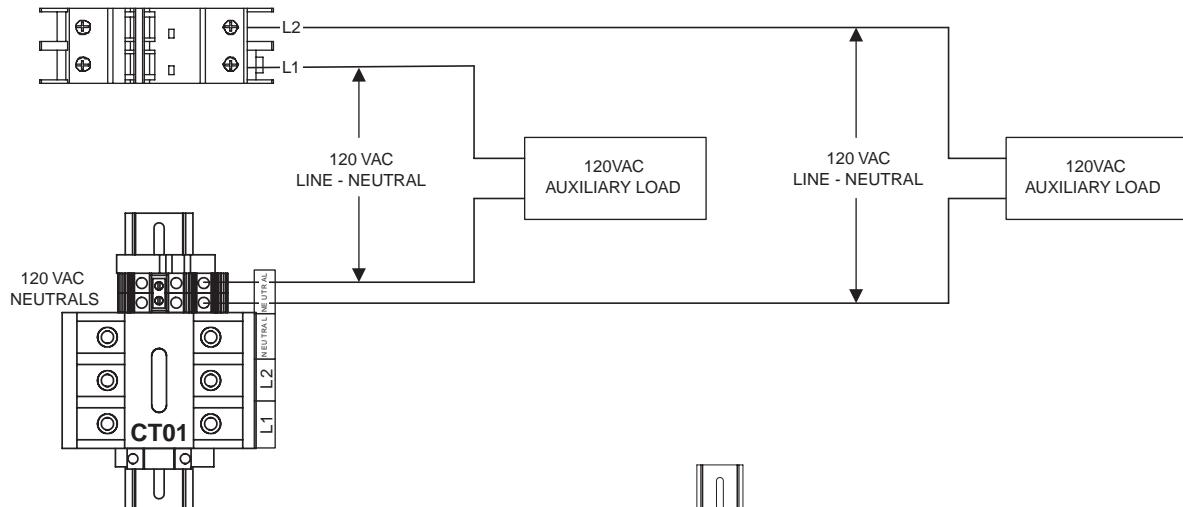
Optional Customer Auxiliary Power Wiring Diagram

See [Circuit Breaker Identification, page 135](#), 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.

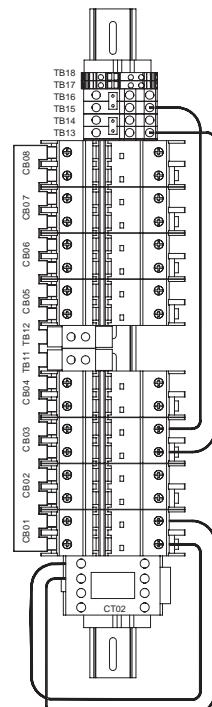
240 VAC AUXILIARY LOAD



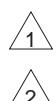
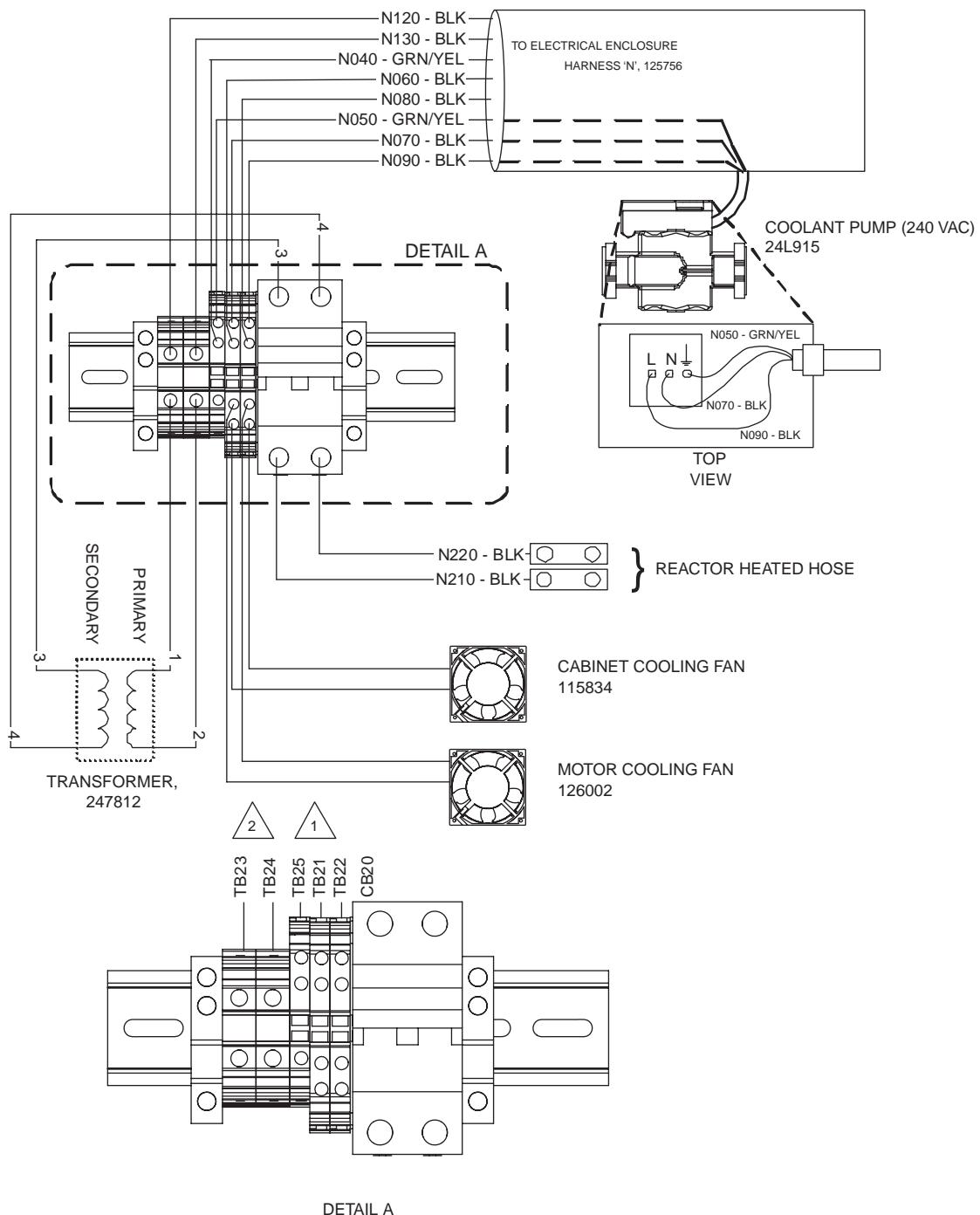
120 VAC AUXILIARY LOAD



MAIN POWER SWITCH

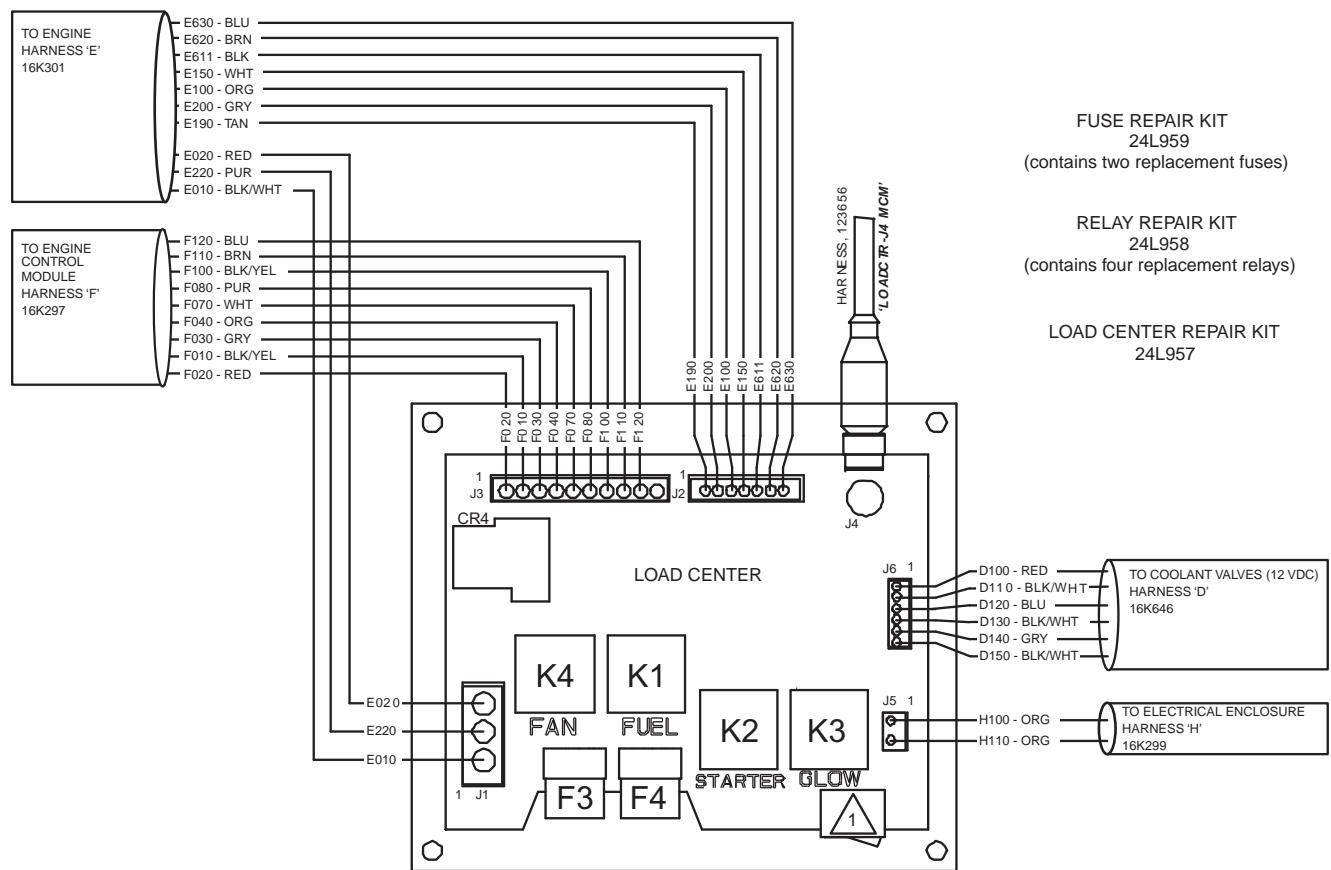


Reactor Cabinet Wiring Diagram



- Torque thin terminal block connections to 5–7 in.-lbs (0.5–0.8 N•m).
- Torque large terminal block connections to 13–15 in.-lbs (1.4–1.7 N•m).

Load Center Wiring Diagram



Manual Valve Switch:

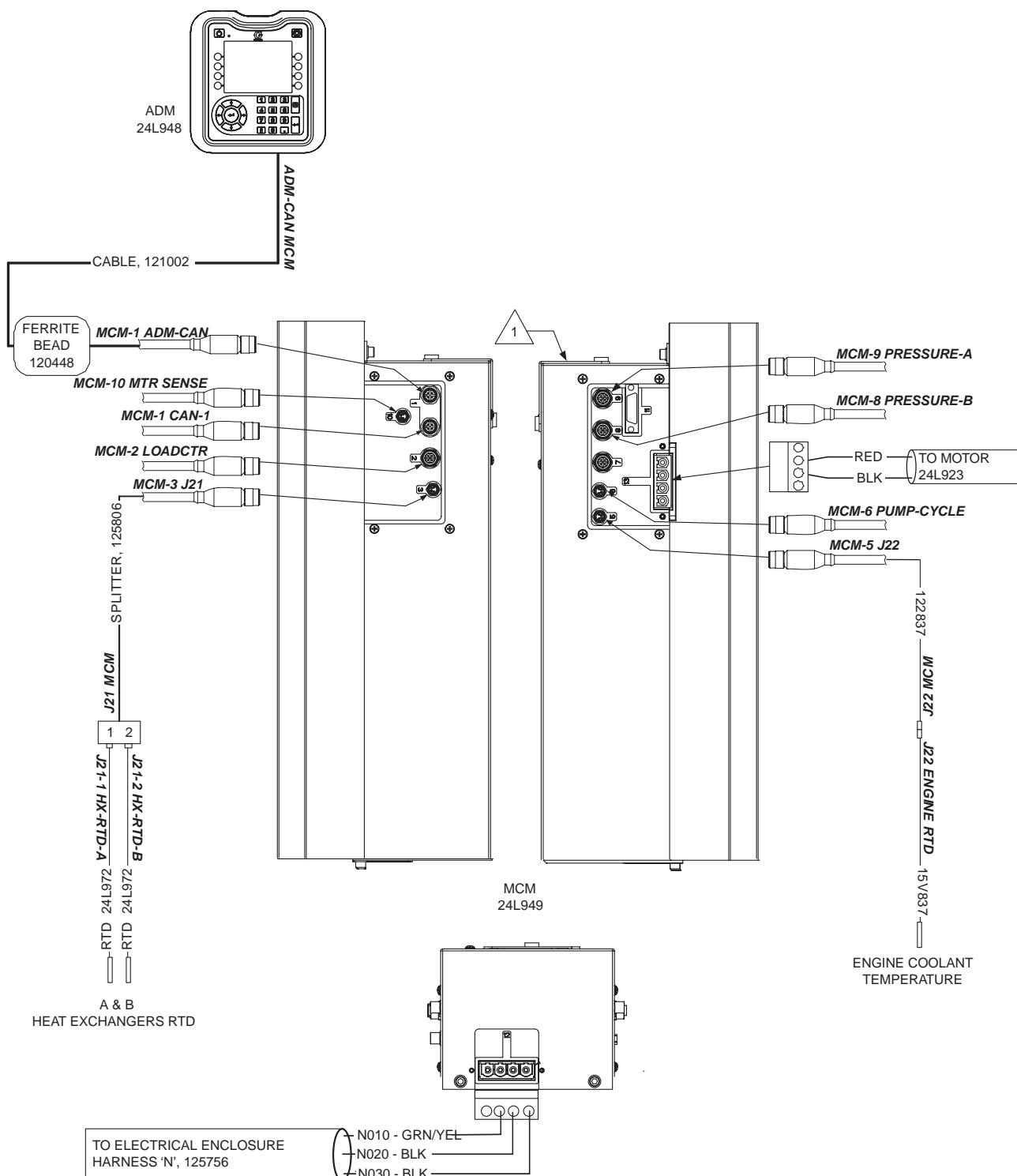
0 — OFF: Automatic Operation

1 – ON: Manual Operation

Coolant Valve (12 VDC) Wiring Diagram

| Load Center | Harness D (16K646) | Connection Description | Pin No. | Coolant Valve Connector Pin Designations |
|-------------|--------------------|------------------------|---------|--|
| J6-6 | D150 — BLK/WHT | Bypass valve return | J18-2 | |
| J6-5 | D140 — GRY | Bypass valve signal | J18-1 | |
| J6-4 | D130 — BLK/WHT | B valve return | J17-2 | |
| J6-3 | D120 — BLU | B valve signal | J17-1 | |
| J6-2 | D110 — BLK/WHT | A valve return | J16-2 | |
| J6-1 | D100 — RED | A valve signal | J16-1 | |

Reactor Wiring Diagram



Rotary switch setting:
E-30i = 0 E-XP2i = 1

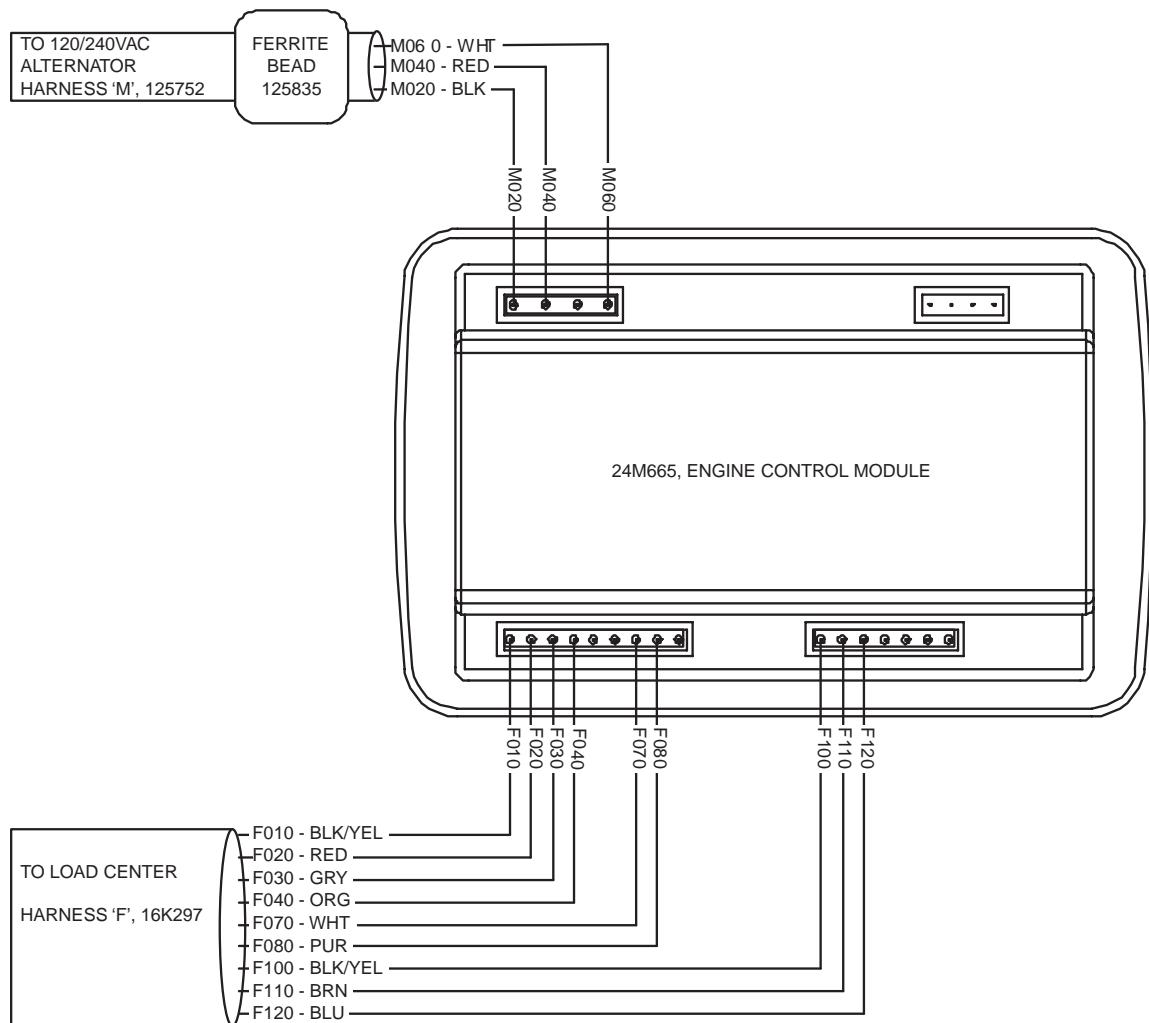
See Cable Routing Table on next page.

Reactor Cable Routing

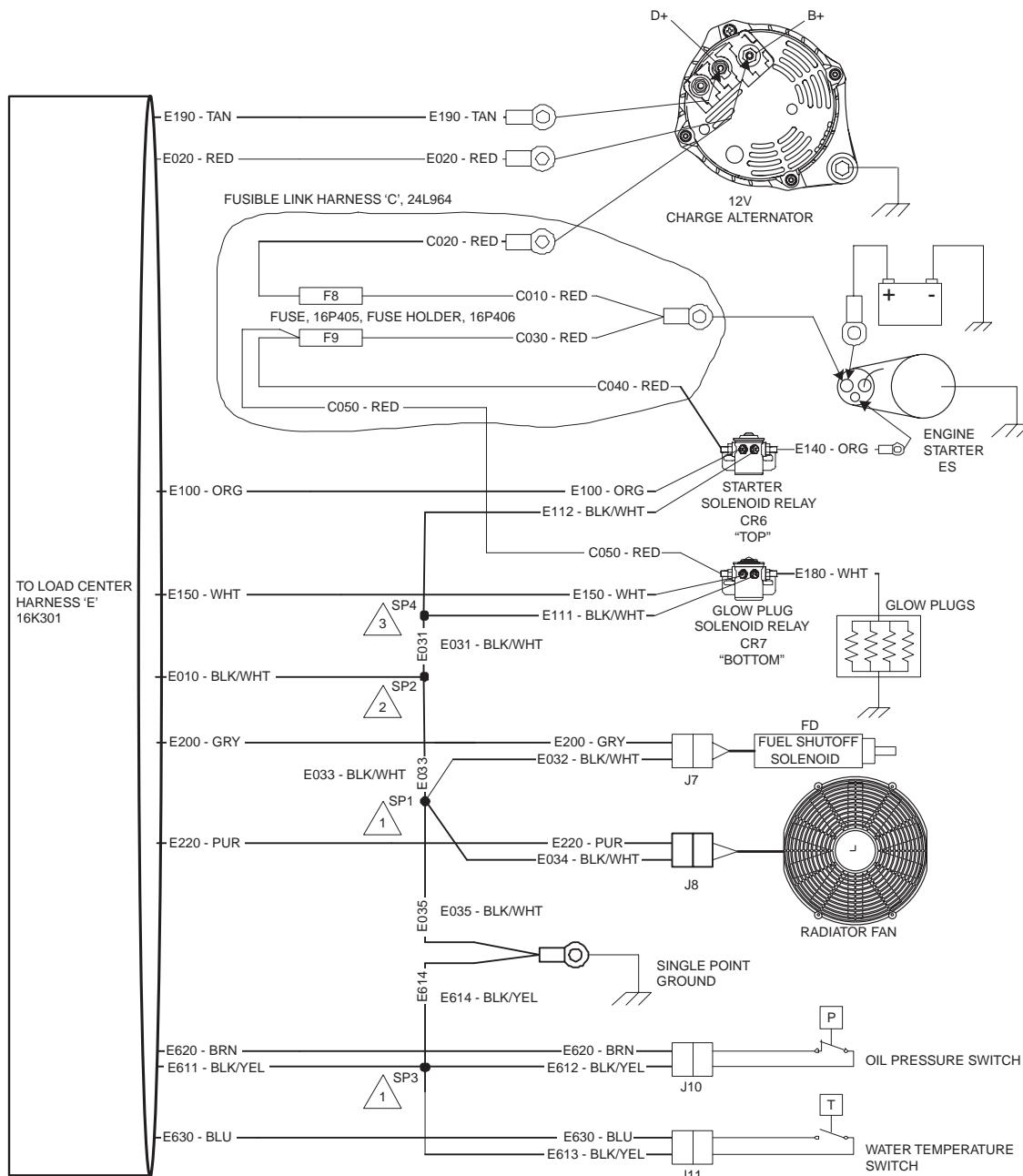
| Item | End 1 | End 2 | Part |
|--------------------------|--------|-------------------------|--------|
| MCM-1 ADM-CAN | MCM-1 | ADM-CAN | 121002 |
| MCM-10 MTR SENSE | MCM-10 | MOTOR | 24K393 |
| MCM-1 CAN-1 | MCM-1 | ELECT. ENCL | 123652 |
| MCM-2 LOADCTR | MCM-2 | LOAD CENTER | 123656 |
| MCM-3J21 | 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

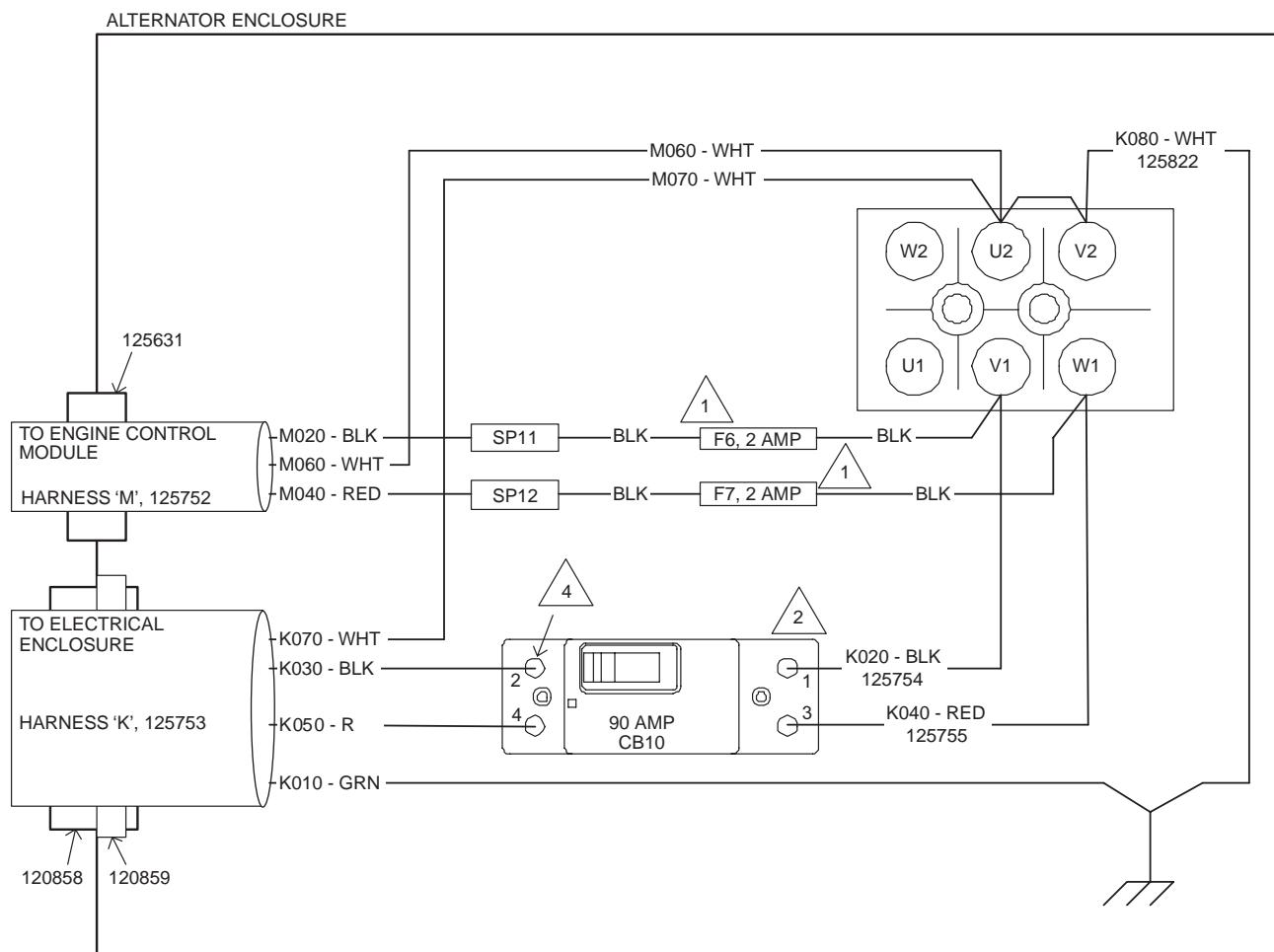


Engine Wiring Diagram



- 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 82](#), 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.

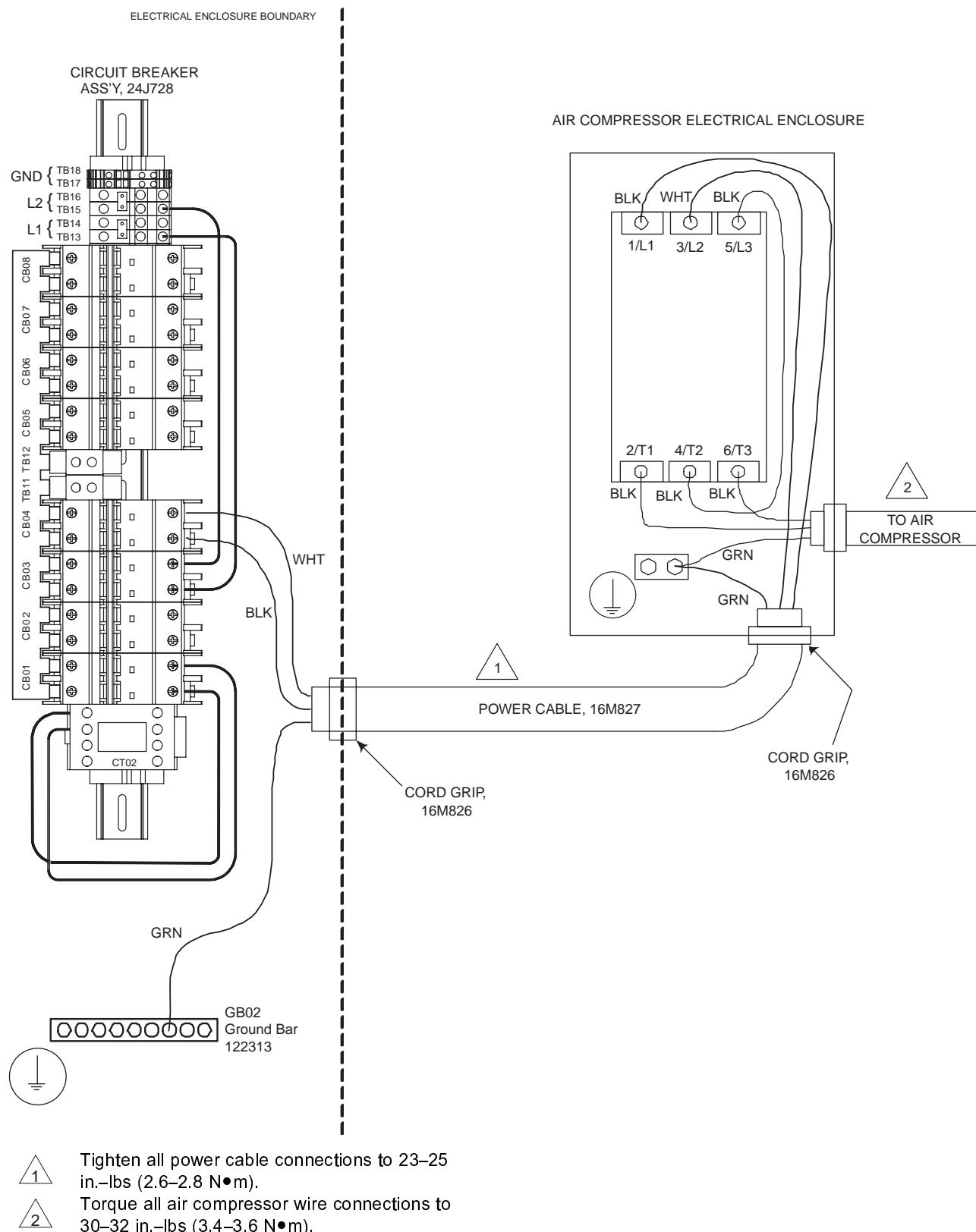
3.

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.



Torque all four wire connections to 40–42 in.-lbs (4.5–4.7 N•m).

Air Compressor Wiring Diagram



Repair and Spare Parts Reference

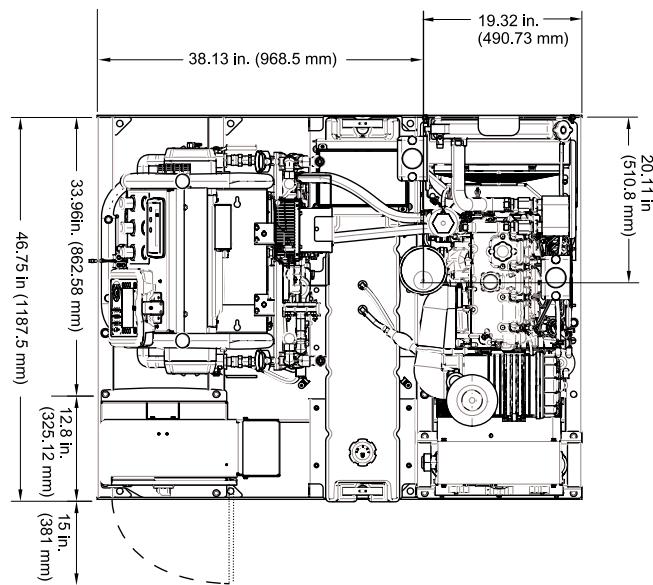
Recommended Common Spare Parts

| Ref | Part | Description | Part of Assembly |
|------|--------|---|---|
| 71 | 24K207 | Hose FTS (Fluid Temperature Sensor) | Systems |
| 117 | 16P405 | Fusible Link Fuse (Replacement For Fusible Link Harness) | Systems |
| 118 | 16P406 | Fusible Link Fuse Holder (Replacement For Fusible Link Harness) | Systems |
| 242 | 24L958 | Load Center Relay Repair Kit, for load center | Proportioner |
| 242 | 24L959 | Load Center Fuse Repair Kit | Proportioner |
| 246 | 24L922 | Sight Glass Filter Repair Kit (5 pack) | Proportioner |
| 247 | | | |
| 283 | 24L972 | RTD Repair Kit (A or B Heat Exchangers) | Proportioner |
| 284 | | | |
| 286 | 125774 | Coolant Valve Repair Kit (includes diaphragm, seals, and plunger) | Proportioner Heat Exchanger Assembly |
| 804 | | | |
| 286 | 125787 | Coolant Valve Solenoid Coil Repair Kit | Proportioner Heat Exchanger Assembly |
| 804 | | | |
| 306 | 15C852 | E-30i Pump Repair Kit | Proportioner Module |
| 306 | 15C851 | E-XP2i Pump Repair Kit | Proportioner Module |
| 306 | 246963 | E-XP2i Wet Cup Repair Kit | Proportioner Module |
| 306 | 246964 | E-30i Wet Cup Repair Kit | Proportioner Module |
| 360 | 24L973 | RTD Repair Kit (Engine Heat Exchanger) | Heater |
| 370 | | | |
| 452 | 247824 | Drain Valve Cartridge | Fluid Manifold |
| 453 | 102814 | Air Pressure Gauge | Fluid Manifold |
| 455 | 15M669 | Pressure Sensor | Fluid Manifold |
| 569 | 24L963 | Engine Solenoid Relay Kit | Diesel Generator |
| 572 | 24L965 | 90 A Circuit Breaker Kit (For Generator Junction Box) | Diesel Generator |
| 619 | 24L974 | RTD Repair Kit (Booster Heaters) | Radiator |
| 632 | | | |
| 643 | 24T028 | Filter Housing Kit | Radiator |
| 856 | 180199 | Y-Strainer Filter, 20 mesh (2 pack) | Fluid Inlet Kit |
| 857 | 15H200 | Y-Strainer Gasket (2 pack) | Fluid Inlet Kit |
| - | 24M723 | Fuse Replacement Kit (For Generator Junction Box) | Diesel Generator |
| - | 24N365 | RTD Cable Test Kit (To assist measuring RTDs and RTD cable resistances) | Heated Hose and FTS |
| 1033 | 288810 | Desiccant Gel Pellets Kit (For three stage air dryer) | Air Compressor Systems |

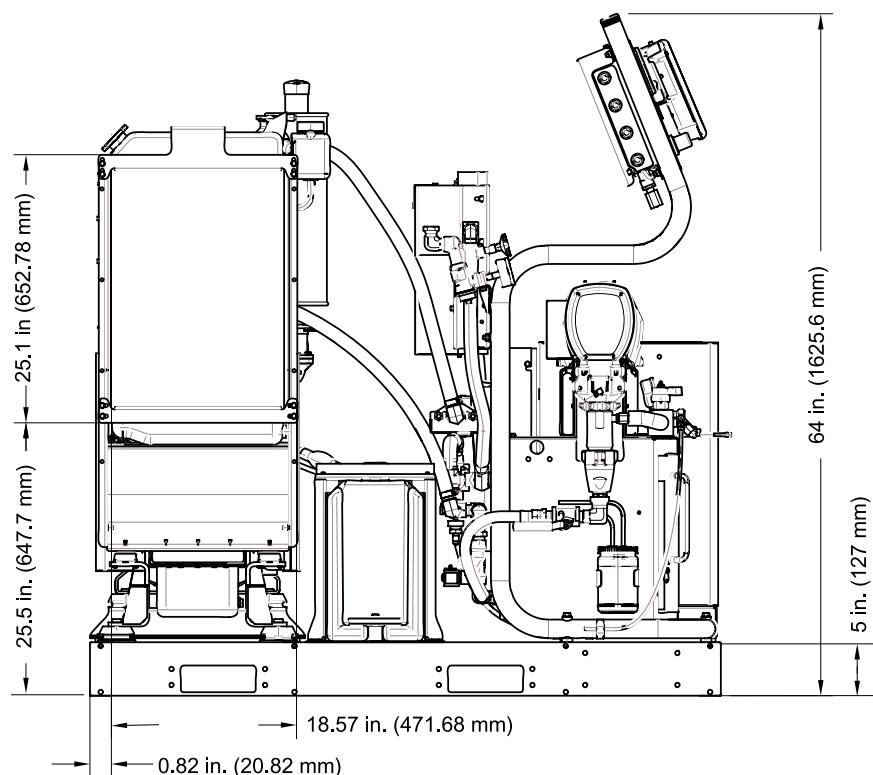
Recommended Rebuild Spare Parts

| Ref. | Part | Description | Part of Assembly |
|-------------------|--------|--|---|
| 27 | 24L948 | Advanced Display Module (ADM) | System |
| 205 | 24L949 | Motor Control Module (MCM) | Proportioner |
| 212 | 115834 | Cooling Fan, Proportioner | Proportioner |
| 233 | 24L915 | Coolant Circulation Pump | Proportioner |
| 242 | 24L957 | Load Center Repair Kit | Proportioner |
| 245 246 247 | 24L921 | Sight Glass Repair Kit (includes sight glass, filter, and washer) | Proportioner |
| 286 804 | 24L916 | Coolant Valve (complete) | Proportioner Heat Exchanger Assembly |
| 416 | 116513 | Air Regulator | Air Control Panel |
| 423 424 | 24M650 | Air Control Tubing Repair Kit (includes full length of air control tubing) | Air Control Panel |
| 542 | 24L950 | High Power Temperature Control Module (HPTCM for hose heat) | Electrical Enclosure |
| 543 | 24L951 | Low Power Temperature Control Module (LPTCM for booster heaters) | Electrical Enclosure |
| 561 | 125784 | Cooling Fan | Electrical Enclosure |
| 654 | 126130 | 30A Circuit Breaker | Electrical Enclosure |
| 655 | 126128 | 20A Circuit Breaker | Electrical Enclosure |
| 656 | 126125 | 5A Circuit Breaker | Electrical Enclosure |
| 657 | 126126 | 10A Circuit Breaker | Electrical Enclosure |
| 658 | 126127 | 15A Circuit Breaker | Electrical Enclosure |
| 906 | 24L960 | 50A Circuit Breaker | Transfer and Fan Circuit Breaker Module |
| – | 24L939 | Complete Coolant Hose Kit (includes all coolant hoses) | See Complete Coolant Hose Kit, page 113 . |

Dimensions

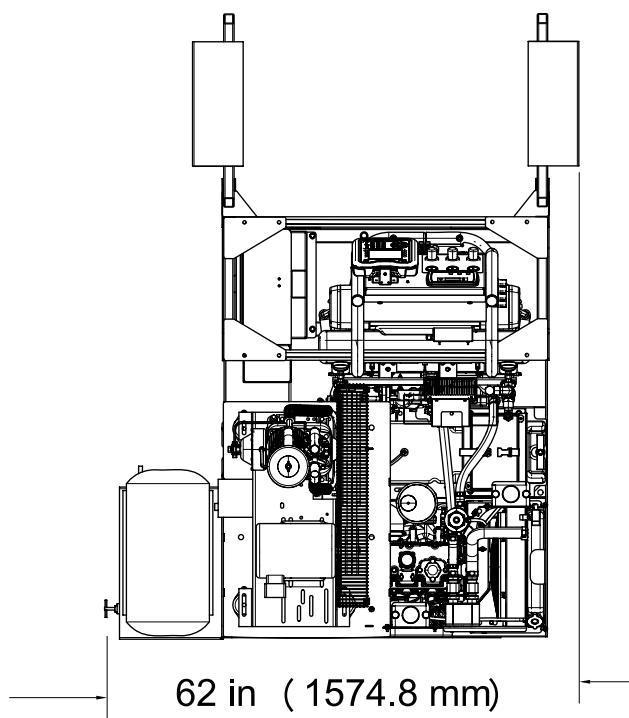


Top View
Figure 52

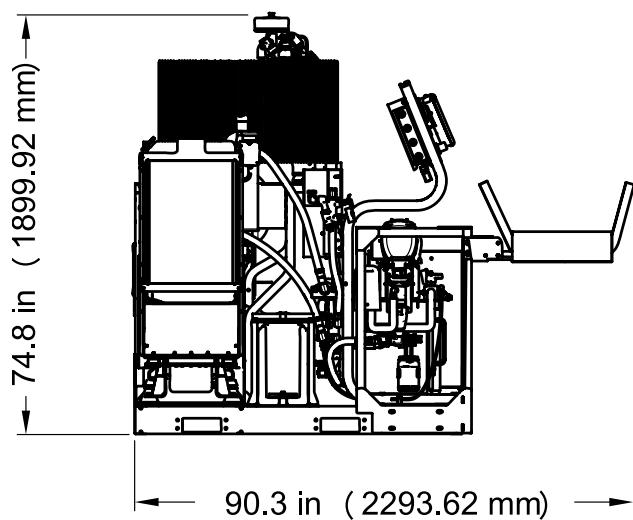


Side View
Figure 53

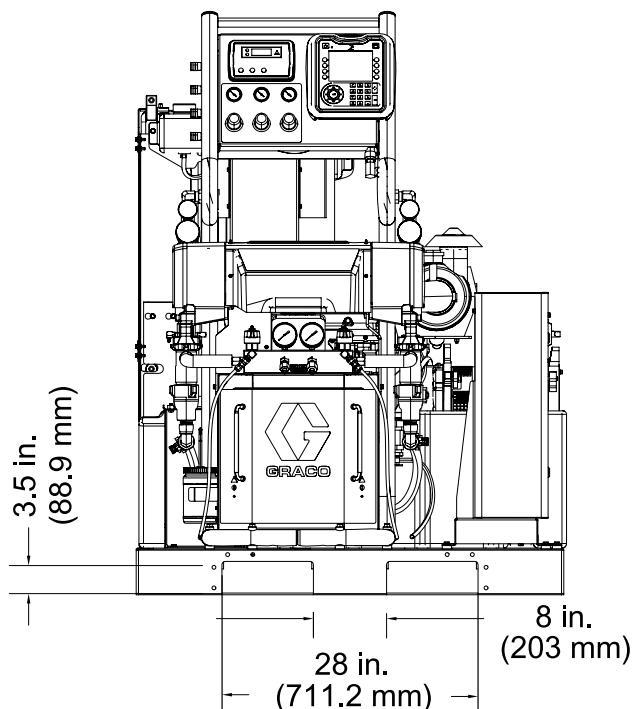
Dimensions



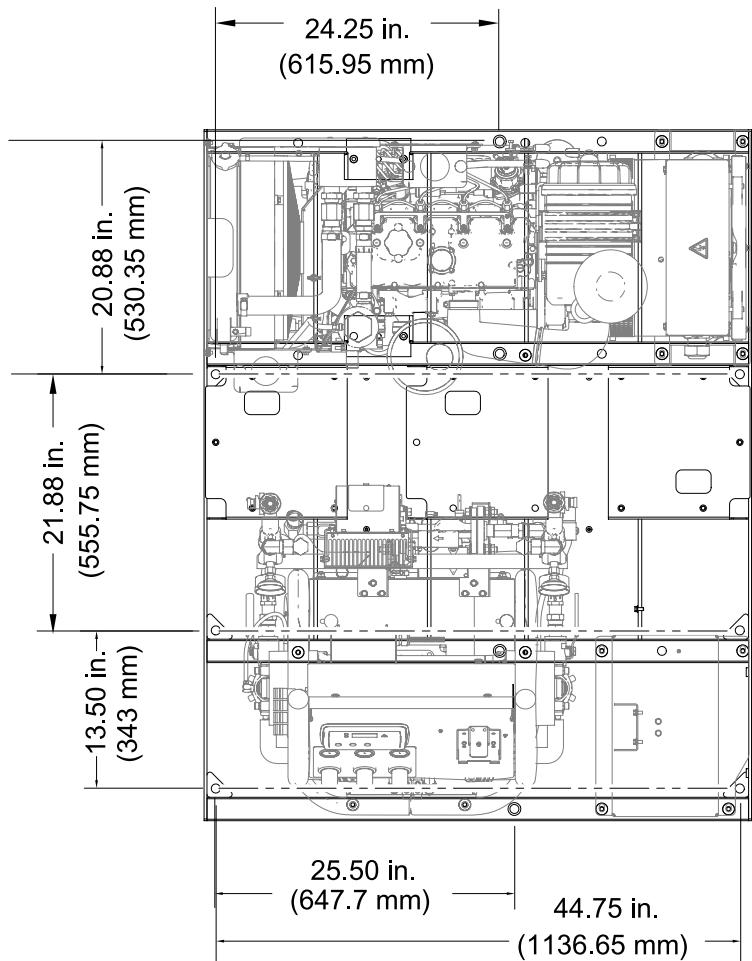
Top View: System with Compressor and Hose Rack Accessories
Figure 54



Side View: System with Compressor and Hose Rack Accessories
Figure 56



Front View
Figure 55



Pallet Mounting Dimensions

Figure 57

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 | |

Technical Specifications

| 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 | |

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 présent 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.

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.

Original Instructions. This manual contains English. MM 3A1706

Graco Headquarters: Minneapolis

International Offices: Belgium, China, Japan, Korea

GRACO INC. AND SUBSIDIARIES • P.O. BOX 1441 • MINNEAPOLIS MN 55440-1441 • USA

Copyright 2012, Graco Inc. All Graco manufacturing locations are registered to ISO 9001.

www.graco.com

Revision K, April 2014