CoreDEF Series Submersible DEF Pump

Installation, Service, & Parts Lists
Notice

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Contact Red Jacket Technical Support for additional troubleshooting information at 800-323-1799.

DAMAGE GOODS/LOST EQUIPMENT

Thoroughly examine all components and units as soon as they are received. If any cartons are damaged or missing, write a complete and detailed description of the damage or shortage on the face of the freight bill. The carrier's agent must verify the inspection and sign the description. Refuse only the damaged product, not the entire shipment.

VR must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

VEEDER-ROOT'S PREFERRED CARRIER

1. Fax Bill of Lading to V/R Customer Service at 800-234-5350.
2. Call V/R Customer Service at 800-873-3313 with the specific part numbers and quantities that were received damaged or lost.
3. VR will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

CUSTOMER'S PREFERRED CARRIER

1. Customer files claim with carrier.
2. Customer may submit a replacement purchase order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If “lost” equipment is delivered at a later date and is not needed, VR will allow a Return to Stock without a restocking fee.
4. VR will NOT be responsible for any compensation when a customer chooses their own carrier.

RETURN SHIPPING


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Introduction

Overview

The CoreDEF Series Submersible DEF Pump, herein referred to as Submersible DEF pump, is only intended to be used to pump Diesel Exhaust Fluid (DEF) from underground storage tanks (UST) or above ground totes in retail, commercial, and industrial applications. The submersible DEF pump installs into a threaded opening in the bulk head with a minimum diameter of 8” (203mm) for clearance. The adjustable column pipe is available in a variety of lengths to accommodate various tank diameters and designs.

The submersible DEF pump system is equipped with variable length column pipe, check valve, pressure relief kits, optional pressure gauge and various UMP configurations. Operation in flammable fluids is not allowed. The submersible DEF pump should only be used as described in this manual and is designed for DEF consisting of 32.5% urea and 67.5% de-ionized water.

The submersible DEF pump offers the following features:

- **Liquid Quality Compliance** - the pump and supplied components satisfy the ISO 22241 standard for DEF quality.
- **Continuous Run Capability** - the pressure relief valve will allow the pump to run continuously regardless of dispensing from the fueling nozzle. Fluid is recirculated back to the tank through the pressure relief valve.
- **Start/Stop Capabilities** - the pump and motor are capable of up to 30 motor/pump start and stops per hour regardless of pump flow rates.

![Figure 1. Typical Submersible DEF Pump System Components](image-url)
Notes To Contractor/Installer

Some considerations may be needed prior to specifying the Red Jacket Submersible DEF pump and its accessories/options. The system may be purchased with either an in-tank, fixed pressure relief or the adjustable pressure relief which is installed in the sump.

The installation of the adjustable pressure relief requires plumbing to return the excess product to the tank. The system will also work with DEF recirculation systems which require a separate return port. Please ensure there are proper openings to route the product back into the tank and provision for other options such as vents, thermal relief (adjustable pressure relief system only), remote fill, probes and the electrical cord grip.

**NOTICE** The cord grip shall not be installed in the same opening as a product flow.

**RECOMMENDED BULKHEAD AND MANWAY COVER OPENINGS**

Installer to determine system needs and configuration prior to specification of manway lid and bulkhead (see Figure 2). Typical size requirements for DEF system openings are listed below:

- Strain relief for wiring - 1/2" NPT
- Probe - 4” NPT
- Submersible DEF pump - 2” full coupling
- DEF recirculation - 2” full coupling
- Remote fill - 2” NPT
- Adjustable pressure relief - 1” NPT
- Vent - 2” NPT

![Figure 2. Example Opening Locations In Manway Cover For DEF System](image-url)
Safety Precautions

The following safety symbols are used throughout this manual to alert you to important safety hazards and precautions.

<table>
<thead>
<tr>
<th>EXPLOSIVE</th>
<th>FLAMMABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuels and their vapors are extremely explosive if ignited.</td>
<td>Fuels and their vapors are extremely flammable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELECTRICITY</th>
<th>TURN POWER OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</td>
<td>Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
<th>READ ALL RELATED MANUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
<td>Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEAR EYE PROTECTION</th>
<th>WEAR GLOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear eye protection when working with pressurized systems or epoxy sealant to avoid possible eye injury.</td>
<td>Wear gloves to protect hands from irritation or injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLEAN WORK AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove spilled liquid and dispose of it in an environmentally sound manner.</td>
</tr>
</tbody>
</table>

---

**WARNING**

The Red Jacket Submersible DEF Pump and wiring shall not be installed within a hazardous environment as defined by NFPA 70 (NEC).

**FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.**

1. All installation work must comply with the latest issue of the National Electrical Code (NFPA 70), PEI/RP1100 Recommended Practices For The Storage And Dispensing Of Diesel Exhaust Fluid (DEF), and any European, national, state, and local code requirements that apply.
2. Turn off, tag, and lockout power to the submersible DEF pump before connecting or servicing it.
3. Do not step on DEF plumbing when entering or leaving the sump.
4. Before installing pipe threads apply an adequate amount of fresh DEF compatible, UL listed non-setting thread sealant.
5. Not reading and following all warnings and instructions in this manual can cause damage to property, environment, resulting in serious injury or death.
Warnings and Instructions

⚠️ WARNING ⚠️

This section introduces the hazards and safety precautions associated with installing, inspecting, maintaining or servicing this product. Before performing any task on this product, read this safety information and the applicable sections in this manual, where additional hazards and safety precautions for your task will be found. Fire, explosion, electrical shock or pressure release could occur and cause damage to property, environment, resulting in serious injury or death, if these safe service procedures are not followed.

PRELIMINARY PRECAUTIONS

⚠️ WARNING ⚠️

You are working in a potentially dangerous environment of flammable fuels, vapors, and high voltage or pressures. Only trained or authorized individuals knowledgeable in the related procedures should install, inspect, maintain or service this equipment.

Read The Manual

Read, understand and follow this manual and any other labels or related materials supplied with this equipment. If you do not understand a procedure, call 1-800-323-1799 to locate a qualified technician. It is imperative to your safety and the safety of others to understand the procedures before beginning work. Make sure your employees and any service contractors read and follow the instructions.

Follow The Regulations

Applicable information is available in PEI/RP1100 Recommended Practices For The Storage And Dispensing Of Diesel Exhaust Fluid (DEF)¹, NFPA 70; National Electrical Code (NEC), Occupational Safety and Hazard Association (OSHA) regulations and federal, state, and local codes. All these regulations must be followed. Failure to install, inspect, maintain or service this equipment in accordance with these codes, regulations and standards may lead to legal citations with penalties or affect the safe use and operation of the equipment.

ISO Standard For DEF

The production, handling and transportation of Diesel Exhaust Fluid (DEF) are governed by the ISO 22241 standard. Guidelines require manufacturers to follow clear procedures for the manufacture and distribution of DEF, ensuring that the product meets the requirements of vehicle manufacturers. The ISO standards are available from the ISO website².

REQUIREMENTS FOR USE

يته Notice

Contractors MUST supply additional pressure relief in the DEF system downstream of the check valve to assure the system does not exceed the recommended 50 psi during thermal expansion!

Apply Loctite primer 7090 to all contractor assembled joints for additional residual torque.

• Application of the submersible DEF pump must be consistent with NFPA Code 70/NEC, OSHA regulations, and federal, state and local fire codes, and other applicable local regulations.

• The selection of any Veeder-Root product must be based upon physical specifications and limitations and the product’s compatibility with the materials to be handled. Veeder-Root makes no warranty of fitness for a particular purpose.

• All Veeder-Root products should be used in accordance with applicable federal, state and local laws, ordinances and regulations.

INSTALLATION ENVIRONMENT

The submersible DEF pump is only intended to be used to pump DEF fluid.

CLEANLINESS OF SURFACES IN CONTACT WITH DEF

All surfaces in direct contact with DEF shall be free of foreign matter (fuel, oil, grease, detergent, dust and any other substance).

To avoid any contamination of DEF with trace elements, particles and foreign matter, surfaces of equipment not exclusively used with DEF shall be cleaned with distilled or de-ionized water and DEF in the last cleaning step immediately before the use with the DEF to be handled with the equipment.

The use of tap water should especially be avoided due to the high concentrations of alkali and alkali earth metal ions therein. However, if distilled water or de-ionized water is not readily available, the material may be cleaned with tap water, provided the last rinse is done using DEF.

SAFETY INSTRUCTIONS

• The maximum operating pressure and the operating temperature must be observed.

• High operating pressure may result in the containers, fittings, pipelines or the hoses bursting or becoming loose. Make sure that excessive pressure does not result when filling a container.

• Remove spilled liquid from the floor and dispose of it in an environmentally sound manner.

• Only start three-phase motors with an upstream motor-protection switch.

• Comply with technical requirements of local power supply companies.

• Only use the pump for its intended use.

• Always operate the pump in a vertical position.

• Follow internal instructions.

• Wear protective clothing (face and breathing protection, protective gloves, etc.).
Pump Dimensions

Figure 3 shows reference dimensions/components of a typical submersible DEF pump as installed with a fixed pressure relief. Figure 4 shows reference dimensions/components of a typical submersible DEF pump as installed with adjustable pressure relief.

---

**Figure 3. Submersible DEF Pump Dimensions/Tank Installation W/Fixed Bypass Pressure Relief Assembly**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UMP</td>
</tr>
<tr>
<td>2</td>
<td>1-1/4&quot; Nipple - Hex - SST</td>
</tr>
<tr>
<td>3</td>
<td>1-1/4&quot; to 1-1/2&quot; Bushing</td>
</tr>
<tr>
<td>4</td>
<td>1-1/2&quot; Tee</td>
</tr>
<tr>
<td>5</td>
<td>1-1/2&quot; Nipple</td>
</tr>
<tr>
<td>6</td>
<td>Check Valve (Install W/Flow Arrow UP)</td>
</tr>
<tr>
<td>7</td>
<td>1-1/2&quot; Pipe</td>
</tr>
<tr>
<td>8</td>
<td>Clinch Fitting Ass’y.</td>
</tr>
<tr>
<td>9</td>
<td>2&quot; Pipe</td>
</tr>
<tr>
<td>10</td>
<td>Manway</td>
</tr>
<tr>
<td>11</td>
<td>1/2&quot; NPT Strain Relief w/customer supplied reducing bushing as required</td>
</tr>
<tr>
<td>12</td>
<td>Bypass Relief Valve</td>
</tr>
<tr>
<td>13</td>
<td>UMP Cable</td>
</tr>
<tr>
<td>14</td>
<td>Zip Ties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>RETRACTED</th>
<th>EXTENDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 with 1/2&quot; Pressure Relief - 3/4 HP</td>
<td>66.0&quot; (1676mm)</td>
<td>97.0&quot; (2464mm)</td>
</tr>
<tr>
<td>D2 with 1/2&quot; Pressure Relief - 3/4 HP</td>
<td>96.0&quot; (2438mm)</td>
<td>157.0&quot; (3988mm)</td>
</tr>
<tr>
<td>D1 with 1-1/4&quot; Pressure Relief - 2 HP</td>
<td>73.0&quot; (1854mm)</td>
<td>104.0&quot; (2642mm)</td>
</tr>
<tr>
<td>D2 with 1-1/4&quot; Pressure Relief - 2 HP</td>
<td>103.0&quot; (2616mm)</td>
<td>164.0&quot; (4166mm)</td>
</tr>
</tbody>
</table>
Kits And Accessories

The submersible pump system is designed to operate as a complete solution for UST applications. The tote applications will require custom fabrication and installation of the piping systems by the contractor. The contractors should be aware of material compatibility and use only fittings, sealants and plumbing compatible with DEF per ISO 22241.

Figure 4. Submersible DEF Pump Dimensions/Tank Installation W/Adjustable Bypass Pressure Relief Assembly
1. Select UMP (HP and voltage requirements).

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Model Number</th>
<th>HP</th>
<th>Volts</th>
<th>Hz</th>
<th>Phase</th>
<th>Length ('B' Figure 3)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>410852-001</td>
<td>DP75U1</td>
<td>3/4</td>
<td>230</td>
<td>60</td>
<td>1</td>
<td>16.81&quot; (427mm)</td>
<td>22 lbs. (10kg)</td>
</tr>
<tr>
<td>410852-002</td>
<td>DP75U3</td>
<td>3/4</td>
<td>230</td>
<td>50</td>
<td>1</td>
<td>16.81&quot; (427mm)</td>
<td>22 lbs. (10kg)</td>
</tr>
<tr>
<td>410852-003</td>
<td>DP200U1</td>
<td>2</td>
<td>230</td>
<td>60</td>
<td>1</td>
<td>23.94&quot; (608mm)</td>
<td>34.2 lbs. (15.5kg)</td>
</tr>
<tr>
<td>410852-004</td>
<td>DP200U17</td>
<td>2</td>
<td>400</td>
<td>50</td>
<td>3</td>
<td>23.94&quot; (608mm)</td>
<td>34.2 lbs. (15.5kg)</td>
</tr>
<tr>
<td>410852-005</td>
<td>DP200U4</td>
<td>2</td>
<td>230</td>
<td>60</td>
<td>3</td>
<td>23.94&quot; (608mm)</td>
<td>34.2 lbs. (15.5kg)</td>
</tr>
</tbody>
</table>

2. Select piping kit

**NOTICE** If piping version with No Pressure Relief is chosen, the customer must select the Adjustable Pressure Relief kit (see Item 5 below).

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>410869-001</td>
<td>D1 with 1/2&quot; Pressure Relief - 3/4 HP</td>
</tr>
<tr>
<td>410869-002</td>
<td>D2 with 1/2&quot; Pressure Relief - 3/4 HP</td>
</tr>
<tr>
<td>410869-003</td>
<td>D1 with 1-1/4&quot; Pressure Relief - 2 HP</td>
</tr>
<tr>
<td>410869-004</td>
<td>D2 with 1-1/4&quot; Pressure Relief - 2 HP</td>
</tr>
<tr>
<td>410869-005</td>
<td>D1 with no Pressure Relief - 3/4 or 2 HP</td>
</tr>
<tr>
<td>410869-006</td>
<td>D2 with no Pressure Relief - 3/4 or 2 HP</td>
</tr>
</tbody>
</table>

3. For multiple dispenser applications select the Isotrol box:
   - Isolates the handle signals between each dispenser
   - Isolates and protects individual dispensers from wiring shorts or phasing issues
   - Isolates and protects technicians from dangerous feedback during service
   - Accepts up to eight individual dispenser signals

<table>
<thead>
<tr>
<th>Isotrol Box</th>
<th>Hook Voltage</th>
<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>W/O Relay For Standalone</td>
<td>120V hook</td>
<td>880-049-1</td>
</tr>
<tr>
<td></td>
<td>240V hook</td>
<td>880-050-1</td>
</tr>
<tr>
<td>W/Relay For Manifolded</td>
<td>120V hook</td>
<td>880-047-1</td>
</tr>
<tr>
<td></td>
<td>240V hook</td>
<td>880-048-1</td>
</tr>
</tbody>
</table>
4. Select the Control Box for each pump.

**Table 1: UMP (Capacitor or Heater)**

<table>
<thead>
<tr>
<th>Dispenser Hook Voltage</th>
<th>UMP</th>
<th>Voltage</th>
<th>DP75U1, DP75U3-3 (17.5 μF)</th>
<th>DP200U1 (40 μF)</th>
<th>DP200U17 (CR123C526A)</th>
<th>DP200U4 (CR123C867A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Phase Control Box With Capacitor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120V hook</td>
<td>UMP</td>
<td>880-045-5</td>
<td>410861-001</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>240V hook</td>
<td>UMP</td>
<td>410860-003</td>
<td>410860-001</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Three Phase Starter With (3) Heaters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120V hook</td>
<td>UMP</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>410648-001 (3) 410649-010</td>
<td></td>
</tr>
<tr>
<td>240V hook</td>
<td>UMP</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>410648-002 (3) 410649-010</td>
<td></td>
</tr>
<tr>
<td>Single Phase Control Box and Capacitor Kit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120V hook</td>
<td>UMP</td>
<td>880-041-5 &amp; 410164-001</td>
<td>880-041-5 &amp; 410164-003</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>240V hook</td>
<td>UMP</td>
<td>880-042-5 &amp; 410164-001</td>
<td>880-042-5 &amp; 410164-003</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
</tbody>
</table>

**NOTICE** Existing applications may not require an Isotrol or a Control Box. In these applications capacitors can be purchased as listed in Table 6 on page 35.

5. Select optional accessories.

**Table 2: Item Description**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPT to BSP Adapters - SST</td>
<td>410878-001</td>
<td>Male 1-1/4&quot; NPT to Female 1-1/4&quot; BSP</td>
</tr>
<tr>
<td>(Stated adjustment range of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>column piping in Figure 3 is</td>
<td></td>
<td></td>
</tr>
<tr>
<td>affected by use of adapters)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>410879-001</td>
<td>Female 2&quot; NPT to Male 2&quot; BSP</td>
</tr>
<tr>
<td>Pressure Gauge</td>
<td>410880-001</td>
<td>1/4&quot; NPT fitting- SST 316 components</td>
</tr>
</tbody>
</table>
Introduction

Temperature Data

*DEF will degrade with prolonged storage above 77°F (25°C). Refer to the DEF manufacturer’s guidelines for proper storage.

Operating Data

Table 1. Electrical Service Information

<table>
<thead>
<tr>
<th>Model</th>
<th>HP</th>
<th>KW</th>
<th>Voltage (+6% / -10%)</th>
<th>Hz</th>
<th>PH</th>
<th>Max. Current (A)</th>
<th>Locked Rotor Amps</th>
<th>Capacitor (µF)</th>
<th>UMP Resistance (Including Cable) (Ω)</th>
<th>Min. Transformer Rating (KVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP75U1</td>
<td>3/4</td>
<td>0.56</td>
<td>230</td>
<td>60</td>
<td>1</td>
<td>4.5</td>
<td>13</td>
<td>17.5; 440V</td>
<td>5.9-7.3; 13.2-16.2; 18.9-23.2</td>
<td>1.8</td>
</tr>
<tr>
<td>DP75U3</td>
<td>3/4</td>
<td>0.56</td>
<td>230</td>
<td>50</td>
<td>1</td>
<td>4.6</td>
<td>10</td>
<td>17.5; 440V</td>
<td>8.3-10.2; 17.5-21.5; 25.7-31.5</td>
<td>1.8</td>
</tr>
<tr>
<td>DP200U1</td>
<td>2</td>
<td>1.5</td>
<td>230</td>
<td>60</td>
<td>1</td>
<td>10</td>
<td>35</td>
<td>40.0; 440V</td>
<td>2.1-2.7; 4.3-5.3; 6.2-7.7</td>
<td>3.6</td>
</tr>
<tr>
<td>DP200U17</td>
<td>2</td>
<td>1.5</td>
<td>400</td>
<td>50</td>
<td>3</td>
<td>4.9</td>
<td>21</td>
<td>–</td>
<td>8.7-10.7; 8.7-10.7; 8.7-10.7</td>
<td>3.6</td>
</tr>
<tr>
<td>DP200U4</td>
<td>2</td>
<td>1.5</td>
<td>230</td>
<td>60</td>
<td>3</td>
<td>9.2</td>
<td>40</td>
<td>–</td>
<td>2.4-3.0; 2.4-3.0; 2.4-3.0</td>
<td>3.6</td>
</tr>
</tbody>
</table>

* NOTE: Check valve recommended with use of Adjustable Pressure Relief valve which is not designed to hold system pressure.

Temperature Data

Operating Temperature (Fluid) +12°F to +104°F (-11°C to +40°C)*

*DEF will degrade with prolonged storage above 77°F (25°C). Refer to the DEF manufacturer’s guidelines for proper storage.
Installation

Submersible DEF Pump Assembly

**NOTICE**
If no column pipe assembly or fixed pressure relief valve was purchased it is mandatory the contractor follow the ISO 22241 guidelines. Pressure relief must be used with all systems to limit discharge pressure to 50 psi (344.7 kPa). Any fixed length plumbing needs to allow for proper clearance to bottom of tank per Figure 3. Ensure all sealants are DEF compatible and use only stainless steel plumbing and hardware to avoid any product contamination. It is required that if a fixed pressure relief system is not selected, the optional adjustable pressure relief must be installed in the manway.

**WARNING**
Plastic pipe is not recommended for support of pumps in any applications.

Manway Fittings And Connections

Take caution of fitting and plumbing routing, size and materials to assure adequate performance and material compatibility per ISO 22241.

**NOTICE**
Minimum riser flange diameter recommended for installation of all assemblies is 8” (203mm). Assemblies may fit into a 6” (152mm) riser flange if no fixed pressure relief is used. The 2HP or 3/4HP UMP will not fit through a 4” (102mm) riser.

Installing the Pump

1. Before installing pipe threads apply an adequate amount of fresh, UL classified for DEF, non-setting thread sealant. Loctite 567 sealant is recommended with Loctite 7090 primer for all field serviceable pipe threads. Loctite 8009 is to be used as the DEF compatible anti-seize on the clinch nut threads (see Figure 5).

![Figure 5. Apply Loctite 8009 To Threads And Tapered Fingers Of Clinch Nut](image)

2. Measure the distance from the bottom of the tank to the top of the manway as shown in Figure 6.
3. Apply primer and coat sealant on threads of 1-1/4" SST hex nipple and hand screw UMP onto column pipe assembly. Place a pipe wrench over the rectangular cable holding bracket at the top of the UMP and a wrench on the hex faces of the nipple, tighten to 125 ft-lbs (170 N·m).

4. Apply primer and attach 2" NPT column pipe with sealant to an ISO 22241 compliant manway cover and torque to 150 ft-lbs (203 N·m).

5. Loosen the clinch assembly on the column pipe by unscrewing the three set screws in the side of locking nut, then backing off the locking nut (see Figure 8).
A slight twisting of the UMP will loosen the seals and facilitate adjusting it to the correct length. Do not rotate piping beyond 1/4 turn.

6. Referencing Figure 9, pull the UMP end until the distance between the bottom of the bulk head and the bottom of the UMP is 3 inches (76 mm) shorter than the distance measured in Step 2.

7. Tighten the column pipe locking nut and torque to 150 ft-lbs (203 N\text{m}) minimum, then torque each set screw in the locking nut to 10 ft-lbs. (14 N\text{m}).

8. Feed UMP cable through strain relief (supplied) and tighten cord grip to 3 ft-lbs (4 N\text{m}) after removing excess slack in the tank. Thread sealant is not required between cord grip and bushings. Threads are 1/2” NPT.

9. Secure the UMP cable to the column pipe with tie straps. Locate the tie straps approximately as shown in Figure 10. Ensure the UMP cable is not in front of (blocking) the pressure relief nozzle (if applicable).

10. Gently lower the assembly using manway cover.

Do NOT use the UMP cable as a lowering or restraining device as damage can occur.
TYPICAL FIXED PRESSURE RELIEF INSTALLATION

See example installation in Figure 11.

**NOTICE** No additional thermal relief is needed when using fixed pressure relief when located downstream of check valve.

![Diagram of Fixed Pressure Relief Installation Example](image)

**NOTICE** Ball valve (not supplied) should be installed to contain DEF in lines to dispenser for servicing.

**NOTICE** If DEF recirculation option is selected, return flow, pressure gauge and ball valve are required.

1. Install optional pressure gage if desired.

**NOTICE** Carefully apply sealant to port to avoid contamination of gauge.
ADJUSTABLE PRESSURE RELIEF OPTION

If the fixed pressure relief kits are not ordered it is mandatory to install the adjustable pressure relief valve in the sump. This valve is a 1” NPT fitting and will need to follow the same guidelines for material compatibility and sealant. During installation, the technician will need to plumb this valve’s bypass back into the UST. A check valve is recommended downstream of the optional adjustable pressure relief valve to maintain line pressure to dispensers. See example installation in Figure 12.

**NOTICE** To allow for thermal expansion, ensure line pressure relief is supplied/installed downstream of the check valve.

---

![Diagram of Adjustable Pressure Relief Installation Example](image)

**NOTICE** When routing the return to the tank it may be required to extend the return line near the bottom of the tank to avoid any potential disruptions to the probe’s accuracy.

**NOTICE** Return flow from adjustable relief valve should be separate from recirculation loop if present.

The adjustable pressure relief valve can be used in conjunction with the optional pressure gage to set to system pressure.

1. Install optional pressure gage if desired.

**NOTICE** Carefully apply sealant to port to avoid contamination of gauge.
2. Remove the machined 1-1/8" hex cover from the end of the Adjustable Pressure Relief valve.
3. Adjust the set screw with the 1/4" hex key per Figure 13.

4. Turning screw clockwise increases pressure up to 50 psi (345 kPa) (maximum).
5. Determine desired flow through nozzles.
6. Adjust set screw to set flow through nozzles.
7. Lock down hex jam nut.
8. Replace hex cover and torque to 30 ft-lbs. (41 N•m).

**NOTICE** Do not modify valve to allow for higher pressure! Failure to install the fixed pressure relief valve or the adjustable pressure relief valve can lead to system overpressure and could possibly damage the dispenser and DEF system.

**Electrical Connections**

**WARNING** The DEF pump is NOT designed for use in flammable liquids, or to be installed in locations classified as hazardous per NFPA 70 (NEC)!

**WARNING** Disconnect, lock out, and tag power at the panel before servicing the pump.

In DEF fueling sites that are being upgraded to include a Control Box with capacitor, it is imperative to verify the wiring connections between the pump and the Control Box. Energizing a pump with incorrect connections can cause the thermal overload in the pump to trip open, resulting in a very lengthy wait for the thermal protector to reset.

Resistance tests are always made with the power off and the wires disconnected from the Control Box.

Set up the electrical meter to the ohms (Ω) function. Measure the resistance between each pair of wires that run out to the pump. Consider the three readings as “low”, “medium” and “high”. Ignore actual color of wires.

1. Locate the two wires that give the highest ohmmeter reading. Mark the remaining wire "BLACK".
2. Mark the wire "GREY" that in combination with the "BLACK" wire (as determined in Step 1.) gives the lowest reading.
3. Mark the remaining wire "BROWN".
4. Connect the "GREY" wire to the “M1” terminal of the Control Box.
5. Connect the “BLACK” wire to the “M2” terminal of the Control Box.
6. Connect the “BROWN” wire to the “M3” terminal of the Control Box.
SIMPLIFIED WIRING DIAGRAMS

Wiring Diagrams

SINGLE TANK INSTALLATIONS

Figure 16 through Figure 25 contain example wiring diagrams for various single tank/submersible DEF pump installations.

MANIFOLDED TANK INSTALLATIONS

When greater flow rates are needed, two pumps may be installed in the same piping system by means of a manifold. Tandem systems offer backup support so operations can continue if one pump stops working.

Figure 26 through Figure 29 contain example wiring diagrams for various manifol ded tanks/submersible DEF pump installations featuring Isotrol Control Boxes.

ISOTROL CONTROL BOX WIRING PRECAUTIONS (Apply to Figure 22 through Figure 29):

WARNING The Isotrol Control Box is intended to provide electrical isolation between the dispenser pump enable (Hook) signal and the submersible turbine pump (STP) control relay. Other energized sources of power can still exist within the dispenser even with this device. The neutral connection to the N terminal of TB1 and N terminal of TB2 must be from the service panel and be a permanently connected, unswitched connection.

- The N connection on TB1 and the eight N connections on TB2 may be spliced to a common neutral wire from the service panel described above.
- Make only one ‘wire’ connection on each N terminal on TB2.

NOTICE The phase of L1 (TB1) must match the phase of the power supplying the ATG device to prevent cross phasing which may damage the input on some ATG equipment.

GENERAL WIRING PRECAUTIONS

- Wiring must be rated 90°C minimum.
- Make ground connection in accordance with local codes.
Figure 16. Suggested 208/230 V Wiring Diagram Without Optional Control Box

Figure 17. 240 Vac Remote Control Box With 120 Vac Coil And Capacitor (Models 880-045-5 Or 410861-001)
Figure 18. 240 Vac Remote Control Box With 240 Vac Coil And Capacitor (Models 410860-001 Or 410860-003)

Figure 19. 230 Vac Remote Control Box With 110Vac Coil - Model 880-041-5
Figure 20. 240 Vac Remote Control Box With 240 Vac Coil - Model 880-042-5

WARNING
DISCONNECT, LOCK OUT, AND TAG POWER AT THE POWER PANEL BEFORE WIRING THE PUMP.

LOAD CENTER
220 OR 240 VOLT
1 PHASE, 2 WIRE
15A-2P SWITCHED NEUTRAL BREAKER

PILOT LIGHT
3P.S.T.
TOGGLE SWITCH

LINE STARTER

PILOT LIGHT
LOAD CENTER
220 OR 240 VOLT
1 PHASE, 2 WIRE
15A-2P SWITCHED NEUTRAL BREAKER

15A-2P SWITCHED NEUTRAL BREAKER

OPTIONAL SOLENOID VALVE
(76 VOLT AMPS. MAX.)

EXTERNAL PILOT LIGHT
(240 VOLTS)
25 WATT MAX.

OPTIONAL
OTHER
DISPENSER
(MAX. TOTAL OF 6 DISPENSERS)

DISCONNECT, LOCK OUT,
AND TAG POWER AT THE
POWER PANEL BEFORE
WIRING THE PUMP.

Liquid-Tight Junction Box

Continuous duty capacitor

Cable Strain Relief

Internal overload protector

Submersible DEF pump

Make ground connection in accordance with local codes.

NOTICE

Brown

Grey

Black

Green

Submersible DEF pump

Make ground connection in accordance with local codes.
Figure 21. Three Phase Remote Control Box (Starter)

NOTE: Starter is wired to 208/240V to pump motor, 120 V to dispenser switch.

A

120 V Coil

To 208/240 V Supply

L1 L2 L3

3

L

To UMP

UMP: DP200U4 410852-005
STARTER: 410648-001
HEATERS: (3X) 410649-010

NOTE: Starter is wired to 208/240V to pump motor, 208/240 V to dispenser switch.

B

240 V Coil

To 208/240 V Supply

L1 L2 L3

3

L

To UMP

UMP: DP200U4 410852-005
STARTER: 410648-002
HEATERS: (3X) 410649-010

C

240 V Coil

To 380/415 V Supply

L1 L2 L3

3

L

To UMP

UMP: DP200U4 410852-004
STARTER: 410648-002
HEATERS: (3X) 410649-003

NOTE: Starter is wired to 2380/415V to pump motor, 240 V to dispenser switch.

LEGEND

Overload heater
Normally closed contact
Normally open contact
Screw terminal
Wire added by installer
Wire added by manufacturer

The enclosure is rated NEMA 1 and is to be installed only in a non-hazardous indoor location. Use 75°C copper conductors only. Torque terminals to 20 Lb-in. Refer to installation manual 577014-045 provided with the starter.

Refer to diagram A, B or C for appropriate wiring for the installation requirements.

Discontinue, lock out, and tag power at the power panel before wiring the pump.

WARNING

DISCONNECT, LOCK OUT, AND TAG POWER AT THE POWER PANEL BEFORE WIRING THE PUMP.

NOTICE
Make ground connection in accordance with local codes.

The enclosure is rated NEMA 1 and is to be installed only in a non-hazardous indoor location. Use 75°C copper conductors only. Torque terminals to 20 Lb-in. Refer to installation manual 577014-045 provided with the starter.

Refer to diagram A, B or C for appropriate wiring for the installation requirements.

Discontinue, lock out, and tag power at the power panel before wiring the pump.

WARNING

DISCONNECT, LOCK OUT, AND TAG POWER AT THE POWER PANEL BEFORE WIRING THE PUMP.

NOTICE
Make ground connection in accordance with local codes.
Figure 22. Isotrol To Remote Control Box With 120 Vac Coil And Capacitor (Models 880-045-5 Or 410861-001)
Figure 23. Isotrol To Remote Control Box With 240 Vac Coil And Capacitor (Models 410860-001 Or 410860-003)
Figure 24. Isotrol To 400 Vac Remote Control Box (Starter) W/240 Vac Coil And Three Heaters
(Model 410648-002 Starter And 3x 410649-003 Heaters)
Figure 25. Isotrol To 240 Vac Remote Control Box (Starter) W/120 Vac Coil And Three Heaters (Model 410648-001 Starter And 3x 410649-010 Heaters)
Figure 26. Isotrol W/Relay To Manifolded 240 Vac Remote Control Boxes With 120 Vac Coil And Capacitor (Models 880-045-5 Or 410861-001)
Figure 27. Isotrol W/Relay To Manifolded 240 Vac Remote Control Boxes With 240 Vac Coil And Capacitor (Models 410860-001 Or 410860-003)
Figure 28. Isotrol W/Relay To Manifolded 400 Vac Remote Control Boxes (Starters) W/240 Vac Coil And Three Heaters (Model 410648-002 Starter And 3x 410649-003 Heaters)
Figure 29. Isotrol W/Relay To Manifolded 208/240 Vac Remote Control Boxes (Starters) W/120 Vac Coil And Three Heaters (Model 410648-001 Starter And 3x 410649-010 Heaters)
Operational Precautions

- Pump must be completely submerged in DEF (primed) prior for initial install to avoid a dry start condition.
- Do not allow pump to run dry or damage will occur.
- DEF freezes at approximately 12°F (-11°C).
- Bypass/relief valves (capable of minimum 5 gpm [19 lpm]) are needed for proper pump cooling when no product is flowing through dispensers. These valves are provided by Veeder-Root as part of the plumbing system.
- Do not allow DEF to freeze in plumbing, pump or in any fittings or damage may occur.
- Only skilled contractors may install the submersible DEF pump, accessories and controls.

Initial Start Up of Pump

1. If a ball valve is installed down line from the pump, close it.
2. Turn the pump on and let it run for about 2 minutes to verify or set discharge pressure (50 psi maximum).
3. If applicable, open the ball valve down line from the pump.
4. Purge system of air by pumping at least 15 gallons (57 liters) through each dispenser. Begin with the dispenser furthest from the pump and work back toward the pump.
5. Turn off pump.
6. Pump start-up is now complete.

**NOTICE** For Three Phase Pumps Only!

Where it is not convenient to predetermine the power supply phase rotation, proper rotation can be determined by pump performance. Pump head pressure and capacity will be considerably less than rated when rotating backwards.

Connect the pump leads to terminal T1, T2, and T3 of the magnetic starter observing color code shown in Figure 21, Figure 24, Figure 25, Figure 28 and Figure 29. With ample product in the tank and the system purged of air, start the pump and make a pressure gauge reading of the system pressure with the ball valve closed; or, open valve and calculate pumping rate.

Next, reverse power leads at L1 and L2. Repeat either pressure or capacity tests, as described above. If results are higher than the first test, the rotation of the second test is correct. If the second test gives lower performance than the first, reconnect the power leads to L1 and L2 (as under test 1) for correct rotation.

Where the power supply has been properly marked L1, L2, and L3 in accordance with accepted phase rotation standards, it is possible to predetermine the proper rotation of these units. The pump power leads are color coded brown, grey and black, if connected through the magnetic starter to L1, L2, and L3 respectively, the UMP will rotate in the correct direction. It is recommended, however, that the performance tests always be made whether or not the power supply has been properly ‘phased out’.

Maintenance

- No maintenance of system is required. Service only as needed utilizing the included troubleshooting guide.
- UMP contains no internal serviceable parts.
- Check valves and pressure relief have no internal serviceable parts.
- All replacement parts are to be serviced by a qualified contractor.
## Troubleshooting

### Table 2. Submersible DEF Pump System Troubleshooting

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pump stops and starts</strong></td>
<td>a. Incorrect voltage or voltage drop.</td>
<td>a. Check the voltage during starting. If the wiring cross-section is too small, the voltage drop may be such that the motor cannot function normally. Installation of a voltage boost transformer may be necessary.</td>
</tr>
<tr>
<td></td>
<td>b. Open circuit or incorrect pump wiring.</td>
<td>b. Measure the resistance between pump wires. Check the pump cable and all wiring to the pump and control boxes is per the manuals.</td>
</tr>
<tr>
<td></td>
<td>c. Motor protection trips out.</td>
<td>c. Confirm pump has bypass flow per manual requirements. For 3-phase pumps, verify the heaters in the starter box are the correct size. For single phase pumps, check capacitor for opens or shorts.</td>
</tr>
<tr>
<td><strong>No product flow</strong></td>
<td>a. Pump is not running.</td>
<td>a. See above.</td>
</tr>
<tr>
<td></td>
<td>b. Controller not powered.</td>
<td>b. Check that the circuit breaker and lockout switch on control box are not in the Off or tripped position.</td>
</tr>
<tr>
<td></td>
<td>c. Restriction in piping system.</td>
<td>c. Confirm flow direction of check valve is correct. Confirm ball valves and plumbing in sump is correct.</td>
</tr>
<tr>
<td></td>
<td>d. Insufficient DEF in tank.</td>
<td>d. Check fluid level in tank, Confirm minimum of 6 inches (150mm) above the pump strainer/inlet.</td>
</tr>
<tr>
<td></td>
<td>e. Frozen DEF in piping system.</td>
<td>e. DEF freezes at +12°F (-11°C). Installation of pipe heaters or a DEF recirculation system may be necessary.</td>
</tr>
<tr>
<td></td>
<td>f. Wrong direction of rotation (single phase).</td>
<td>f. Interchange the two pump wires to the capacitor.</td>
</tr>
<tr>
<td><strong>Insufficient product flow</strong></td>
<td>a. Bypass valve is set below desired pressure.</td>
<td>a. Set bypass pressure per requirements stated in manual.</td>
</tr>
<tr>
<td></td>
<td>b. Strainer clogged.</td>
<td>b. Confirm pump strainer is not clogged.</td>
</tr>
<tr>
<td></td>
<td>c. Wrong direction of rotation (3 Phase).</td>
<td>c. Interchange two pump wires at box.</td>
</tr>
<tr>
<td></td>
<td>d. Fixed pressure relief is stuck open.</td>
<td>d. Confirm fixed pressure relief valve is closed and sealed before setting pressure (45 psi [310 kPa]).</td>
</tr>
<tr>
<td></td>
<td>e. Partially frozen DEF in piping system.</td>
<td>e. Continue to dispense DEF to thaw out piping.</td>
</tr>
<tr>
<td><strong>Slow to discharge DEF</strong></td>
<td>a. Confirm system is holding pressure.</td>
<td>a. Check pressure holding of system with pump off and assure check valve does not have any contamination.</td>
</tr>
</tbody>
</table>
### Table 3. Pressure Expectations By Pressure Relief Type

<table>
<thead>
<tr>
<th>UMP</th>
<th>Pump Off</th>
<th>Pump On</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed</td>
<td>Adjustable</td>
</tr>
<tr>
<td>3/4 HP</td>
<td>28 psi (193.1 kPa)</td>
<td>0</td>
</tr>
<tr>
<td>2 HP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTICE** Pump-Off pressure expectations for adjustable pressure relief type are only 0 psi upstream of check valve. Downstream pressure is trapped by check valve.
General Repair

**WARNING** Disconnect, lock out, and tag power at the panel before servicing the pump.

If a system has any issues found during the troubleshooting process follow the steps below:

1. Remove pressure from system. Ensure no DEF fluid is in the lines in the sump.
2. Carefully disconnect all plumbing, gauges and any pressure relief units in manway as is necessary to allow removal of the manway cover.
3. Disconnect electrical connections to UMP cable.
4. Loosen and remove manway cover fasteners from tank.
5. Carefully lift bulk head cover from tank with column pipe and UMP connected.

**NOTICE** Approximate weight of the submersible DEF pump/piping assembly is 75 pounds (34 kg).

6. Determine clean, safe workspace and carefully set down motor assembly/plumbing and manway cover.

**NOTICE** All surfaces in direct contact with DEF shall be free of foreign matter (fuel, oil, grease, detergent, dust and any other substance). See “Cleanliness Of Surfaces In Contact With DEF” on page 5.

7. Remove device that is being replaced (UMP, fixed pressure relief or check valve) from system.

**NOTICE** Ensure check valve’s flow arrow is correctly oriented (towards manway cover) during its replacement.

8. Clean all fittings and reapply thread sealant (Loctite 567 recommended).

9. Replace cord if damaged with kit 410886-001. Remove the two 5/32" hex socket head screws and the 5/16" hex bolt holding the UMP cable/bracket assembly and replace (see Figure 30). Torque to fasteners to 10 ft-lbs. (14 N·m).

---

**Figure 30. UMP Cable Holding Bracket Retaining Screws**
10. See recommended torque settings for fittings in Table 4.

### Table 4. Recommended Torque Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 1-1/4&quot; NPT Fittings</td>
<td>125 ft-lbs (170 N•m)</td>
</tr>
<tr>
<td>2&quot; NPT Column Pipe To Manway Cover Nipple</td>
<td>150 ft-lbs (203 N•m)</td>
</tr>
<tr>
<td>Column Pipe Locking (Clinch) Nut</td>
<td>150 ft-lbs (203 N•m)</td>
</tr>
<tr>
<td>Column Pipe Locking (Clinch) Nut Set Screw</td>
<td>10 ft-lbs (14 N•m)</td>
</tr>
<tr>
<td>UMP to 1-1/4&quot; Nipple</td>
<td>125 ft-lbs (170 N•m)</td>
</tr>
<tr>
<td>1/2&quot; Small Fixed Pressure Relief</td>
<td>65 ft-lbs (88 N•m)</td>
</tr>
<tr>
<td>1-1/4&quot; Large Fixed Pressure Relief</td>
<td>125 ft-lbs (170 N•m)</td>
</tr>
<tr>
<td>1&quot; NPT Adjustable Pressure Relief Valve</td>
<td>100 ft-lbs (136 N•m)</td>
</tr>
<tr>
<td>Adjustable Pressure Relief Valve Hex Cover</td>
<td>30 ft-lbs (41 N•m)</td>
</tr>
<tr>
<td>Cable Cord Grip</td>
<td>3 ft-lbs (4 N•m)</td>
</tr>
<tr>
<td>UMP Cable Holding Bracket Fasteners</td>
<td>10 ft-lbs (14 N•m)</td>
</tr>
</tbody>
</table>
# Parts Lists

## Submersible Pump And Accessories

Table 5. Replacement Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UMP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP75U1</td>
<td></td>
<td>410852-001</td>
</tr>
<tr>
<td>DP75U3</td>
<td></td>
<td>410852-002</td>
</tr>
<tr>
<td>DP200U1</td>
<td></td>
<td>410852-003</td>
</tr>
<tr>
<td>DP200U17</td>
<td></td>
<td>410852-004</td>
</tr>
<tr>
<td>DP200U4</td>
<td></td>
<td>410852-005</td>
</tr>
<tr>
<td>Pressure Relief Kit</td>
<td>Adjustable Pressure Relief Kit</td>
<td>410881-001</td>
</tr>
<tr>
<td>Replacement Cable Kit</td>
<td>Cable Repair Kit</td>
<td>410886-001</td>
</tr>
<tr>
<td><strong>Miscellaneous Accessories</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4 HP Relief Valve Kit, 1/2&quot; NPT</td>
<td></td>
<td>410882-001</td>
</tr>
<tr>
<td>2 HP Relief Valve Kit, 1-1/4&quot; NPT</td>
<td></td>
<td>410883-001</td>
</tr>
<tr>
<td>Check valve kit</td>
<td></td>
<td>410875-001</td>
</tr>
<tr>
<td>1-1/4&quot; Adapter Kit, NPT To BSP</td>
<td></td>
<td>410878-001</td>
</tr>
<tr>
<td>2&quot; Adapter Kit, NPT To BSP</td>
<td></td>
<td>410879-001</td>
</tr>
<tr>
<td>Pressure Gauge Kit</td>
<td></td>
<td>410880-001</td>
</tr>
</tbody>
</table>

*All capacitors contain internal bleed-down resistor and are rated 440 volts.*

## Capacitor Kits

Table 6 lists the capacitor kits parts list.

Table 6. Capacitor Kits*

<table>
<thead>
<tr>
<th>Item (ref. Figure 31)</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>410164-001</td>
<td>17.5 μF Capacitor</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>410164-002</td>
<td>25 μF Capacitor</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>410164-003</td>
<td>40 μF Capacitor</td>
<td>1</td>
</tr>
</tbody>
</table>

*All capacitors contain internal bleed-down resistor and are rated 440 volts.*
## Control Boxes

![Control Box Diagram](image)

**Figure 32. Control Box W/Capacitor**

### Table 7. Control Box W/Capacitor (120V Coil)

<table>
<thead>
<tr>
<th>Item (Refer Figure 32)</th>
<th>Qty. / Part Number</th>
<th>Description</th>
<th>880-045-5</th>
<th>880-046-5</th>
<th>0410861-001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CB-3/4 HP 17.5 µF 120V Coil</td>
<td>CB-1-1/2 HP 25 µF 120V Coil</td>
<td>CB-2 HP 40 µF 120V Coil</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Capacitor Kit</td>
<td>410164-001</td>
<td>410164-002</td>
<td>410164-003</td>
</tr>
<tr>
<td>2</td>
<td>014-723-1</td>
<td>Line Contactor Relay</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>247-001-5</td>
<td>Pilot Light Assy.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>080-858-1</td>
<td>Toggle Switch</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>008-202-1</td>
<td>Terminal Block</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table 8. Control Box W/Capacitor (240V Coil)

<table>
<thead>
<tr>
<th>Item (Refer Figure 32)</th>
<th>Qty./Part Number</th>
<th>Description</th>
<th>0410860-003</th>
<th>0410860-002</th>
<th>0410860-001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CB-3/4 HP 17.5 µF 240V Coil</td>
<td>CB-1-1/2 HP 25 µF 240V Coil</td>
<td>CB-2 HP 40 µF 240V Coil</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Capacitor Kit</td>
<td>410164-001</td>
<td>410164-002</td>
<td>410164-003</td>
</tr>
<tr>
<td>2</td>
<td>014-720-1</td>
<td>Line Contactor Relay</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 8. Control Box W/Capacitor (240V Coil)

<table>
<thead>
<tr>
<th>Item (Refer Figure 32)</th>
<th>Qty./Part Number</th>
<th>Description</th>
<th>0410860-003</th>
<th>0410860-002</th>
<th>0410860-001</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>247-001-5</td>
<td>Pilot Light Assy.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>080-858-1</td>
<td>Toggle Switch</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>008-202-1</td>
<td>Terminal Block</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 33. 880-041-5/880-042-5 Control Box

Table 9. 880-041-5 / 880-042-5 Control Box

<table>
<thead>
<tr>
<th>Item (Ref. Figure 33)</th>
<th>Part No.</th>
<th>Description</th>
<th>880-041-5 Control Box W/115V Coil</th>
<th>880-042-5 Control Box W/230V Coil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>108-572-4</td>
<td>Control box</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>247-001-5</td>
<td>Pilot light ass'y</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Line contactor relay</td>
<td>014-723-1</td>
<td>014-72-1</td>
</tr>
<tr>
<td>4</td>
<td>080-858-1</td>
<td>Toggle switch</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>008-202-1</td>
<td>Terminal block</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>