THE DUPLEX® 2000psi Botanical Oil Extraction System
Installation Manual
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1. Critical Safety Overview

Please read these IMPORTANT SAFEGUARDS carefully before installing, operating or performing any user-maintenance activities on the system, and SAVE THESE INSTRUCTIONS to refer to them as needed to ensure continued safe operation. These instructions are critically important to your safety and proper operation of the system. Failure to follow these instructions may result in damage to equipment and/or bodily injury.

- Ensure that a qualified safety officer oversees all installation, operation and user-maintenance activities in accordance with this instruction manual.

- Ensure that only qualified personnel perform all installation, operation and user-maintenance activities in accordance with this instruction manual.

**Note:** Qualified personnel are given documented training and should be qualified by the extractor manufacturer or its designee, or as otherwise required by the Authority Having Jurisdiction (AHJ), prior to performing any installation, operation or user-maintenance activities. Qualified personnel are to be experienced in such work and must be aware of and take all safety precautions.

- Our subcritical and supercritical CO₂ extraction systems operate under high pressure. Operators must be fully trained and familiar with the systems. Failure to operate these systems correctly can result in a rapid release of high-pressure CO₂ and may cause equipment damage and/or bodily injury.

- Our subcritical and supercritical CO₂ extraction systems use large amounts of CO₂ during operation. These systems should be installed in a well-ventilated area to prevent buildup of CO₂, which can cause asphyxiation. Always use a CO₂ monitor to ensure safe operations.

**WARNING – RISK OF INJURY:** Opening a vessel under pressure can result in a rapid release of pressure and ejection of material from inside the vessel. **DO NOT ATTEMPT TO OPEN A VESSEL UNDER PRESSURE!** Always make sure a vent path for the vessel is opened and the corresponding pressure gauge reads zero prior to loosening the vessel closure. If the handles are difficult to open, this may indicate that the pressure vessel is still pressurized. Do not force it open. Any pressure in the pressure vessel can be hazardous.

**WARNING – MAY CAUSE BURNS:** Liquified gases are normally stored under pressure. When these liquids are released to atmospheric pressure, rapid evaporation occurs resulting in reduced temperatures at the point of evaporation. Exposure of tissue to evaporating liquid can result in freezing and tissue damage. Precautions should be taken to avoid contact of liquid with eyes, skin, or respiratory system. Tissue damaged by exposure to evaporating liquid should be treated as frozen tissue (i.e., frostbite). Reference the Safety Data Sheet (SDS) for more detailed information.

**WARNING – RISK OF INJURY:** Check that all components are secured before operating the extraction system.

- Our subcritical and supercritical CO₂ extraction systems are designed to operate indoors in a temperature-controlled environment. Extreme temperatures (below 60°F and above 80°F) will negatively impact the functionality of the system, chiller, pump and CO₂ bottles.

- For indoor chiller and cooling system applications, only use propylene glycol and distilled water. **Never use deionized water in the chiller or cooling system for indoor applications.** For outdoor chiller and cooling system applications, use propylene glycol and clean tap water.
• Extraction system components can weigh in excess of 2,000 lb. and must be moved carefully. **Do not attempt to move system pieces without the proper equipment, as this could result in serious injury or death.**

• Personal Protective Equipment (PPE) is recommended for persons during setup, operation, disassembly, and clean-up of the equipment. It is recommended that operators wear the following PPE:
  - Chemical-resistant safety goggles;
  - Gloves;
  - Ear protection devices;
  - Flame-resistant clothing (when working with flammable solvents or in an otherwise hazardous location);
  - Close-toed foot protection; and
  - Respirator mask.

• For CE Code-based installations and NEC-based installations, please refer to the following instructions, as applicable:
  - For CE Code-based installations: “Installations shall be in accordance with the manufacturer’s installation instructions and CSA C22.1, Canadian Electrical Code, Part 1 (CE Code), National Fire Code of Canada (NFC), and CSA B149.1, Natural Gas and Propane Installation Code.”
  - For NEC-based installations: “Installation shall be in accordance with the manufacturer’s installation instructions and NFPA 70, National Electrical Code (NEC), International Fire Code (IFC), NFPA 1, Fire Code, and NFPA 58, Liquified Petroleum Gas Code.”

• It is the responsibility of the AHJ to verify the suitability of the extractors in the end installation in accordance with all applicable codes, together with these installation instructions.

**FAILURES TO FOLLOW THE INSTALLATION AND OPERATION PROCEDURES PROVIDED IN THIS MANUAL MAY VOID THE EXTRACTION SYSTEM’S WARRANTY.**
2. Facility Requirements

Temperature

The Duplex® system is designed to run in a climate-controlled facility where the temperature is maintained between 60°F and 80°F. System performance will decrease outside this temperature range, getting progressively worse as temperatures deviate farther from the recommended range.

Ventilation and Dust Control

The Duplex® system should be placed in a well-ventilated environment that is free from excess dust from other manufacturing operations.

Foundation

The Duplex® system is designed to be installed on a concrete (or similarly stable) flat floor.

Custom Layout

The Duplex® system is designed to be able to be located in different rooms or areas to isolate different portions of the process. This modulation should be stated during the purchase process, otherwise additional costs and delays may occur.
3. When the System Arrives

Verifying Apeks System Contents List

Every Apeks machine is sent with a system contents list that contains a quality control checklist and a packing slip, such as the one shown in Figure 3-1.

**VERIFY THAT ALL ITEMS ON THE PACKING SLIP HAVE BEEN RECEIVED BEFORE CONTINUING WITH UNPACKING AND INSTALLATION. CONTACT US IF ANY ITEMS ARE MISSING.**

---

**Figure 3-1: Packing Slip**
Receiving the Crates

Apeks Labeling

An Apeks sticker (such as the one shown in Figure 3-2) should be displayed on the outside of each crate. If the crate delivered to you does not have an Apeks sticker, please contact us to ensure the crate came directly from Apeks.

<table>
<thead>
<tr>
<th>THE DUPLEX®</th>
<th>MODEL</th>
<th>SERIAL #</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiller</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Box _____________ of _____________

Figure 3-2: Shipping Label
TiltWatch and ShockWatch

Each crate should have TiltWatch Plus sensors and ShockWatch stickers (such as those shown in Figure 3-3) affixed on the outside. The TiltWatch Plus Sensors indicate the degree to which the crate may have tilted to the right or left or if the crate overturned completely during shipping. If the sensors show the crate tilted beyond 30° to the right or left or overturned completely, please contact us. The ShockWatch sticker is an additional sticker that indicates if the crate has been mishandled. If the indicator on the ShockWatch sticker is red, please contact us.

![TiltWatch Label and ShockWatch Sticker](image)

Figure 3-3: TiltWatch Label and ShockWatch Sticker

Inspecting Crates for Damage

Prior to opening any crate, you should verify that there is no visible external damage. If you notice your crate has been damaged, be sure to note the damage on the applicable Proof of Delivery, and please contact us to report the damage.
System Layouts

The Duplex® 2000psi 20Lx20L Standard Layout
Unpacking Instructions

⚠️ **WARNING**: Each crate contains heavy components. Do not attempt to lift without the proper equipment.

Uncrating Extractor and Separator Stands

To uncrate the extractor and separator stands, first, remove the sides and top of the shipping crates. Then, remove the wooden tie downs that keep the system attached to the skid. See Figure 3-4.

![Separator Stand Wood Tie-Downs Shown](image)

**Figure 3-4**: Separator Stand Wood Tie-Downs Shown
Carefully use a forklift to remove the extractors and separators from the skids. The stands have features designed specifically to be used with a forklift to properly remove the system from the skid. See Figure 3-5. **WARNING:** Lifting the extractors and separators from anywhere but the labeled pickup locations can lead to equipment damage and/or serious injury or death.

Attach the four leveling feet to each stand before lowering the stand. Once the system is on the ground, use the leveling feet to level the system and then snug the jam nut against the stand to secure the feet. See Figure 3-6.
Uncrating Diaphragm Compressor

To uncrate the diaphragm compressor, first, remove the sides and top of the shipping crate. Then, remove the lag screw/bolts that keep the diaphragm pump attached to the skid. See Figure 3-7.

![Diaphragm pump on skid](image)

**Figure 3-7: Diaphragm pump on skid**

Carefully use a forklift to remove the diaphragm compressor from the shipping crate. The diaphragm compressor stand is labeled with proper forklift pickup locations. **WARNING:** Lifting the diaphragm compressor from anywhere but the labeled pickup locations can lead to equipment damage and/or serious injury or death.

Once the diaphragm compressor is off the shipping crate, attach the four rubber vibration dampening feet to the four corners of the pump. See Figure 3-8. Anchor the diaphragm compressor to the floor with concrete lags or other suitable hardware.

![Vibration Dampening Feet](image)

**Figure 3-8: Vibration Dampening Feet**
Uncrating Chiller

To uncrate the chiller, first, remove the sides and top of the chiller shipping crate. Then, remove the wooden blocks holding the chiller to the base. Using a forklift or the provided ramp, remove the chiller from the base. When the chiller is in its final location, lock the wheels.

Setup and Assembly

Coolant Line and Chiller Setup

The separator coolant loop will incorporate the Separator Temperature Control Unit (TCU), the diaphragm compressor, and the separator vessel/control stand.

The hose on the separator TCU delivery will connect to the water flow switch on the separator stand. See Figure 3-9.

![Separator TCU Delivery to Water Flow Switch](image-url)
The hose from the back of the separator stand will connect to the pump inlet on the base of the diaphragm compressor stand. See Figure 3-10.
The hose from the pump outlet on the base of the diaphragm compressor will connect to the process return line on the separator TCU. The return line connection to the TCU will depend on the installed TCU. See Figure 3-11.

Figure 3-11: Pump Outlet to Separator TCU Return
The extractor coolant loop will incorporate the extractor TCU and the extractor vessel stand. The hose on the extractor TCU delivery will connect to the temperature control heat exchanger on the extractor stand. The hose from the flow switch on the extractor stand will connect to the process return line on the extractor TCU. The return line connection to the TCU will depend on the installed TCU. See Figure 3-12.

*Figure 3-12: Extractor TCU Coolant Line Setup*

Water supply and drain lines for outdoor chiller setups should be connected via the connections shown in Figure 3-13. Connections will differ based on the installed TCU.

![Diagram of Delta T TCU and Advantage TCU with labels for water drain and water supply]

**Figure 3-13:** Outdoor Chiller TCU Coolant Line Setup

Water drain and supply hoses require additional setup instructions for installation onto the extractor and separator TCUs. Please refer to the installation procedures outlined below.

**Tools and supplies recommended for installation:**
- Tube cutters
- Silicone lubricating grease
- Hose clamp for 1.07” outer diameter hose
- Clamp tool for tightening clamp *(Note: Tool will depend on clamp applied.)*

**Water drain and supply hose installation steps:**
1. Cut hose to necessary length for facility.
2. Place clamp over hose. DO NOT TIGHTEN CLAMP UNTIL YOU REACH STEP 6.
3. Apply silicone lubricant on the inner diameter of hose.
4. Insert hose over barb fitting on TCU.
5. Slide clamp up tube until it is situated over barbed fitting.
6. Tighten clamp.

Installed hose connection will look like that shown in Figure 3-14.

![Photo of installed water drain and supply hose]

**Figure 3-14:** TCU Water Drain and Supply Hose Connection
CO₂ Connections

Use supplied CO₂ bottle valve gaskets when connecting bottles to the system. There are five CO₂ lines to be connected on The Duplex® system. Avoid kinks and abrasion when routing the CO₂ hoses.

There is one nylon line that runs from the separator stand to the diaphragm compressor suction line. This connection is a 48" long nylon flexible line with ¼" compression fittings and a minimum bend radius of 6". Installing the hose with a bend radius less than the required minimum can result in a kink or blockage. See Figure 3-15.

There is one nylon line that runs from the diaphragm compressor to the extractor stand. The 20Lx20L has a 48" long black nylon flexible line with ½" compression fittings, and the 4x20L has a 60" long black nylon flexible line with ½" compression fittings. This line has a minimum bend radius of 4" in both systems. Installing the hose with a bend radius less than the required minimum can result in a kink or blockage. See Figure 3-16.

Figure 3-15: Separator Stand to Compressor

Figure 3-16: Diaphragm Compressor to Extractor Stand
There are three lines connecting the extractor stand to the separator stand. These are 18" black flexible lines with 3/8" compression fittings and a minimum bend radius of 3 ½ ". Installing the hose with a bend radius less than the required minimum can result in a kink or blockage. Connect 1, 2, and 3 on the extractor stand to their respective connections on the separator stand. See Figure 3-17.
CO₂ Vent Connections

There is one vent line connection point located on the back of the separator stand at valve 0. See Figure 3-18. The connection is a $\frac{3}{8}$" Swagelok compression fitting.

You are responsible for running each vent line to a safe vent location outside the building. Vent lines should be rated to the pressure of the system. We recommend $\frac{3}{8}$" x .049" or $\frac{1}{2}$" x .065" stainless steel tubing. Note that an adapter fitting will be necessary if you are not using $\frac{3}{8}$" tubing.

Figure 3-18: Vent line connection
Air Connections

There are over 25 air operated ball valves that are used to control the CO₂ flow path throughout the system. These valves are controlled by an air manifold on the back of the control panel mount. The air manifold receives electrical signals from the controller and uses compressed air to open valves. The air outputs for the air manifold can be seen in Figure 3-19.

An air compressor is provided to supply the system with the necessary air pressure to actuate the air operated ball valves. The air tube connection to supply the system with air can be seen in Figure 3-20.
There are 16 \( \frac{3}{4} \)" red airlines that run between the separator vessel stands and extractor vessel stands. These lines are connected with push-to-connect 12-port connectors. The numbers in Figure 3-21 represent valve numbers.

![Figure 3-21: Airline connections](image)

**Ensure all 12 O-Rings are in place before coupling the connectors.** The airline connectors must be attached to the extractors before connecting the 12-port connector. There is a tab and slot that only allow the connector to be oriented in one way. Turn the locking ring to secure in place.

There is one \( \frac{3}{4} \)" red airline that runs between the separator stand and valve 17 on the diaphragm compressor. This line is connected with a push-to-connect coupling and is labeled on both sides. Insert the tubing into the coupling to connect. See Figure 3-22.

![Figure 3-22: Airline connection to Compressor](image)
### Electrical Requirements

**WARNING**: Do not modify power connections.

#### Electrical Specifications:

Unless otherwise noted, all voltage for all components of all systems 60Hz

<table>
<thead>
<tr>
<th>Compressor Motor HP*</th>
<th>Phase</th>
<th>Voltage</th>
<th>Motor FLA</th>
<th>Recommended Fuses where field wired</th>
<th>Compressor mfg and model</th>
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</thead>
<tbody>
<tr>
<td>15</td>
<td>3</td>
<td>208V***</td>
<td>21A***</td>
<td>AJT40</td>
<td>PDC4</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>230V***</td>
<td>21A***</td>
<td>AJT40</td>
<td>PDC4</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>460V</td>
<td>21A</td>
<td>AJT40</td>
<td>PDC4</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>575V</td>
<td>17A</td>
<td>AJT30</td>
<td>PDC4</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>380V (50hz)</td>
<td>27A</td>
<td>AJT50</td>
<td>PDC4</td>
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</table>

***150kVA Step-Up Transformer

***All 208/230VAC Systems will be manufactured as 480VAC and shipped with 150kVA step up transformer.

<table>
<thead>
<tr>
<th>Recommended Transformer Primary Fuses</th>
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</thead>
<tbody>
<tr>
<td>208V: AJT225</td>
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<tr>
<td>230V: AJT200</td>
</tr>
</tbody>
</table>

*Motor overload will be set @Apeks to nameplate FLA. Recommended motor branch circuit fuse protection is 175% of NEC FLA from Table 430-250 per 430.52. Explanation here: http://www.cooperindustries.com/content/dam/public/bussmann/Electrical/Resources/solution-center/technical_library/BUS_Ele_Tech_Lib_Motor_Circuit_Notes.pdf

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<th>Voltage</th>
<th>Phase</th>
<th>Main Fuse or breaker size</th>
<th>Recommended connection</th>
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<td></td>
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<td>10A</td>
<td>NEMA 5-15R wall receptacle with surge protector</td>
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<th>FLA</th>
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<td>1</td>
<td>10</td>
<td>NEMA 5-15R wall receptacle NO GFI</td>
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</tbody>
</table>

continued on page 2...
## The Duplex®

### Outdoor Cooling Units

<table>
<thead>
<tr>
<th>Outdoor cooling unit</th>
<th>Goes with</th>
<th>Voltage</th>
<th>Phase</th>
<th>Full Load Amps from Advantage</th>
<th>Recommended connection</th>
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</thead>
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<td>OACS10-Low Voltage</td>
<td>Single Duplex System</td>
<td>208-230VAC</td>
<td>3</td>
<td>50</td>
<td>Field Wired- 6Ga THHN (90C) to Fused disconnect @90A type J fuses</td>
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<tr>
<td>OACS 10- High voltage</td>
<td>Single Duplex System</td>
<td>460VAC</td>
<td>3</td>
<td>26</td>
<td>Field Wired- 10Ga THHN (90C) to Fused disconnect @40A type J fuses</td>
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<tr>
<td>OACS 10- Higher Voltage</td>
<td>Single Duplex System</td>
<td>575VAC</td>
<td>3</td>
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<td>Field Wired- 10Ga THHN (90C) to Fused disconnect @40A type J fuses</td>
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### Indoor Temperature Control Units

<table>
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<tr>
<th>Indoor Temperature Control Units</th>
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<th>Phase</th>
<th>Full Load Amps from Advantage</th>
<th>Recommended connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentra SK-1035-Low voltage</td>
<td>2 per Duplex system</td>
<td>208-230VAC</td>
<td>3</td>
<td>28</td>
<td>Field wired- 10Ga THHN (90C) to Fused disconnect @40A Type J fuses</td>
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<tr>
<td>Sentra SK-1035-High voltage</td>
<td>2 per Duplex system</td>
<td>460VAC</td>
<td>3</td>
<td>14</td>
<td>Field wired- 14Ga THHN (90C) to Fused disconnect @20A type J fuses</td>
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<tr>
<td>Sentra SK-1035-Higher voltage</td>
<td>2 per Duplex system</td>
<td>575VAC</td>
<td>3</td>
<td>11.6</td>
<td>Field wired- 14Ga THHN (90C) to Fused disconnect @20A type J fuses</td>
</tr>
</tbody>
</table>
Electrical Connections

HARTING connector

The HARTING connector carries the signals from the pressure transducers, flow switches, etc. back to the main control enclosure (excluding the thermocouples). These are quick-connecting electrical connections that plug in and are secured with snaps on each side. See Figure 3-23.

⚠️ WARNING: Ensure the power is off before connecting or disconnecting the HARTING connector. Confirm the cable numbers match on the male and female connectors before connecting them. For example, 1209CBL1 should be connected to 1209CBL1.

Thermocouple Connector

The thermocouple connector carries the signal from the thermocouples back to the main control enclosure. The thermocouple connectors will be like those shown in Figure 3-24.
Separator Vessel Stand to Extractor Vessel Stand

There are three junction boxes located on the system that require connecting HARTING and thermocouple connectors.

Junction box 1 is located on the diaphragm compressor and junction boxes 2 and 3 are located on the back side of Extractor Stand. See Figure 3-25.

Figure 3-25: Junction Box HARTING and Thermocouple Connections
Diaphragm Compressor Motor Wiring

The wiring for the motor on the diaphragm compressor terminates in the overload on the bottom of the motor starter assembly in the motor enclosure. See Figure 3-26. These three wires are labeled T1, T2, and T3 and should be terminated in their respective locations on the bottom of the overload portion of the motor starter. The wiring coming to the top of the motor starter contactor will be terminated to the facility power.

The combination of the contactor and the overload constitutes the motor starter assembly.

Figure 3-26: Motor starter assembly in Motor Enclosure on back of separator stand
Temperature Control Units

Each TCU connector is connected to the main control enclosure by a HARTING connector. The extractor TCU connector is 1408CBL1. The separator TCU connector is 1409CBL1.

The TCU is terminated to the facility power by customer-supplied wiring. This wiring connection location is dependent on the TCU installed. See Figure 3-27.

The Separator TCU requires the connection of a thermocouple at the water delivery port. The thermocouple to be connected is labeled “Sep Chiller 2 Water Outlet Temp.” See Figure 3-28.
Verify both TCU and diaphragm compressor motor directions after wiring connections are complete. Motor direction is labeled on the TCU pump and on the diaphragm compressor housing. See Figure 3-29. If the motor is spinning in the wrong direction, a certified electrical professional will be needed to correct the issue.

E-mail Alerts and Software Updates

To receive software updates and e-mail alerts, connect your system to the Internet by attaching an Ethernet cable to the Ethernet connection located on the side of the electrical control box. After you have connected your system to the Internet, you can sign up for e-mail alerts. To do so, please visit https://www.apekssupercritical.com/service-request/ and submit a ticket with your system’s information. One of our representatives will contact you once e-mail messaging has been set up, and you can then decide which notifications you wish to receive via the “Message Selection” screen. When setting up e-mail messaging, you can also choose to set up daily data logs.
4. General Overview and Nomenclature

System Overview

This section is intended to provide a general overview of the system and to showcase the various components. Figures 4-1 and 4-3 provide an overhead view of the various systems. Figures 4-2 and 4-4 provide a front view of the various systems (diaphragm compressor and TCUs not shown).

Figure 4-1: Overhead view of standard layout (The Duplex® 20Lx20L)

Figure 4-2: Front view of standard layout (The Duplex® 20Lx20L)
Figure 4-3: Overhead view of standard layout (The Duplex® 4x20L Standard Layout)

Figure 4-4: Front view of standard layout (The Duplex® 4x20L)
General System Specifications

<table>
<thead>
<tr>
<th></th>
<th>Extraction Stand</th>
<th>Separation/Control Stand</th>
<th>Diaphragm Compressor</th>
<th>Extractor TCU</th>
<th>Separator TCU</th>
<th>Air Compressor</th>
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<tbody>
<tr>
<td>Max Pressure (psi)</td>
<td>2000psi</td>
<td>2000psi</td>
<td>2000psi</td>
<td>100psi</td>
<td>100psi</td>
<td>125psi</td>
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<tr>
<td>Operating Temperature (°F)</td>
<td>40°F - 160°F</td>
<td>40°F - 160°F</td>
<td>75°F - 250°F</td>
<td>20°F - 150°F</td>
<td>20°F - 150°F</td>
<td>60°F - 80°F</td>
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<td>Dimensions (in) WxDxH</td>
<td>58x42x77</td>
<td>53x36x84</td>
<td>74x37x68</td>
<td>13x19x29</td>
<td>13x19x29</td>
<td>14x24x18</td>
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<tr>
<td>Weight (lb.)</td>
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<td>750 lb.</td>
<td>4,500 lb.</td>
<td>500 lb.</td>
<td>500 lb.</td>
<td>80 lb.</td>
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</table>

5. References

- Visit and subscribe to our YouTube channel for instructional videos: [https://www.youtube.com/user/ApeksSupercritical](https://www.youtube.com/user/ApeksSupercritical).
- Visit the Apeks online store for parts related to your system: [https://www.apekssupercritical.com/shop/](https://www.apekssupercritical.com/shop/).
- For more information regarding software updates and to sign up for e-mail alerts, visit: [https://www.apekssupercritical.com/service-request/](https://www.apekssupercritical.com/service-request/).
## 6. Appendices

### Appendix A – Torque Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Torque (lb-in)</th>
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</thead>
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<td>Fuse Holders (1492-H6)</td>
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<td>Fuse Holders (3046401)</td>
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<td>Terminal Blocks (1492-J4)</td>
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<td>Ground Blocks (1492-JG4)</td>
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<td>Overload Relay (T1/T2/T3) Phillip Screws</td>
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Questions?

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