

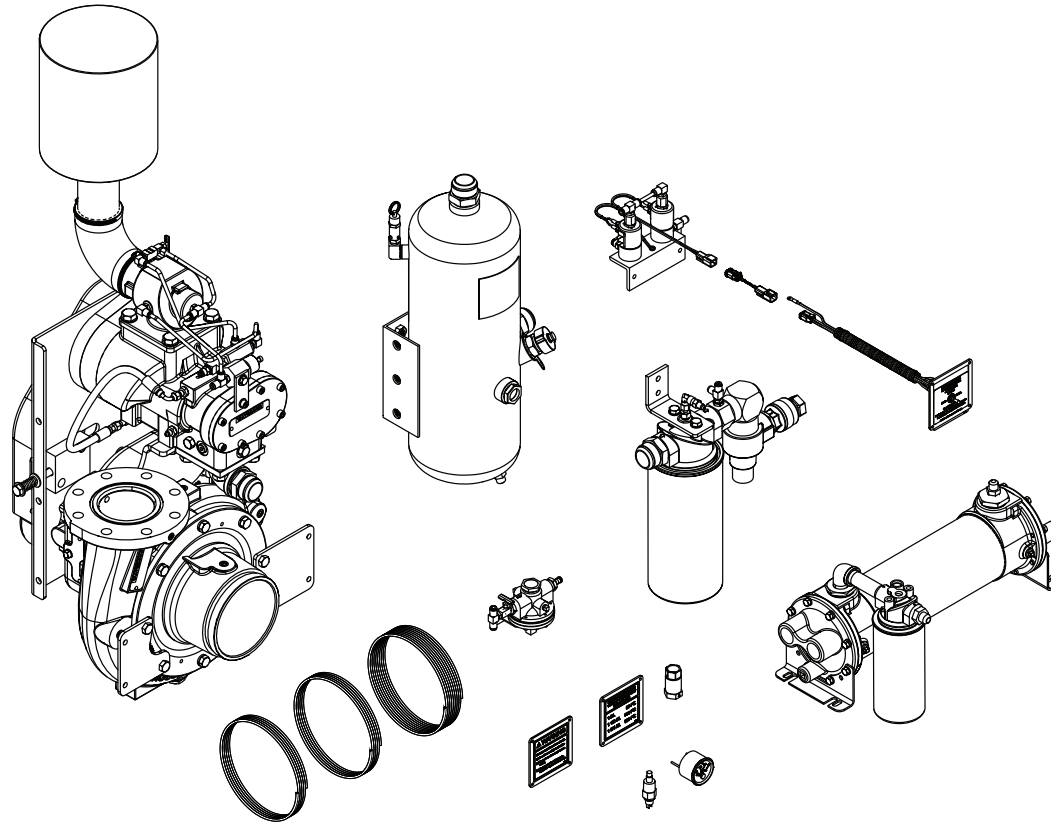
# WATEROUS

Form Number: F-2937

Issue Date: Jan. 18, 2022

## Traditional CAFS—CP-2, CL, CX, HL Series Pumps, and TC20 Series Power Take-Offs

Installation, Operation, and Maintenance



Waterous Company • 125 Hardman Avenue South • South Saint Paul, MN 55075 • (651) 450-5000

[www.waterousco.com](http://www.waterousco.com)

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## Safety Precautions

- Read and understand all the associated documentation before you begin the installation.
- Read and understand all the notices and safety precautions.
- Be aware that these instructions are only guidelines and are not meant to be definitive. Contact Waterous when you have questions about the equipment.
- Do not install the equipment if you are not familiar with the tools and skills needed to safely perform the required procedures—proper installation is the responsibility of the purchaser.
- Do not operate the equipment when safety guards are removed.
- Do not modify the equipment.
- Regularly check for leaks and worn or deteriorated parts.

## NOTICE

### Before Operation

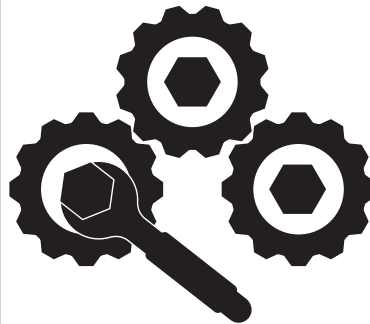
- Read and understand all the instructions provided.
- Check all fluid levels and replenish if necessary.
- Remove all shipping plugs and install the operation plugs or caps.



## NOTICE

### Modification

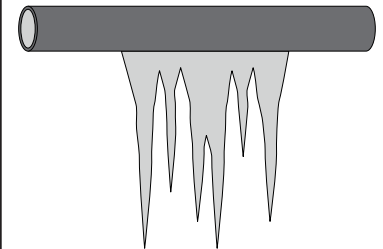
- Modifying the equipment can damage components and void your warranty.
- Do not modify the system or any of its components.



## NOTICE

### Freeze Damage

- Do not allow fluid in the lines to freeze.
- Remove all freezable fluid from the lines before storing the apparatus.





## NOTICE

### High Current

- High current from welding or plasma cutting can damage components.
- Disconnect all ground wire connections before applying high current.



## WARNING

### Hot Surface

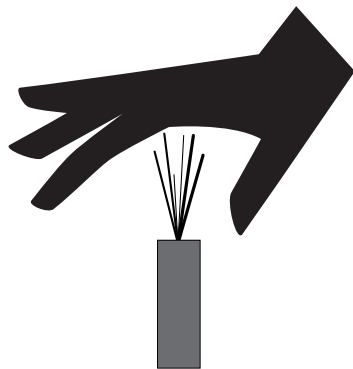
- Hot surfaces can burn you.
- Do not touch the surface during operation—allow it to cool after operating.



## WARNING

### High Pressure

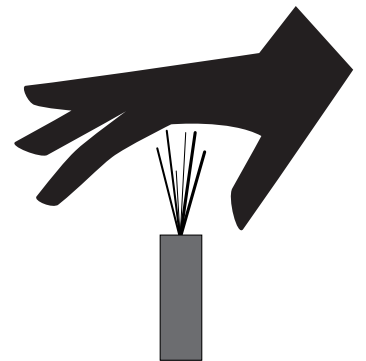
- Liquid ejected at high pressure can cause serious injury.
- Drain the pump after use and before servicing.



## WARNING

### High Pressure

- Liquid ejected at high pressure can cause serious injury.
- Purge all pressure before servicing.

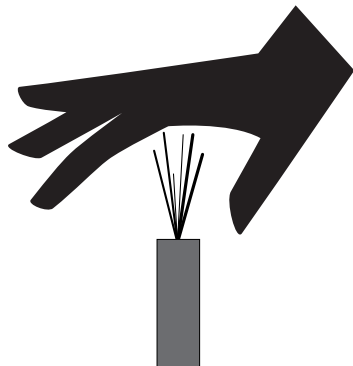




## WARNING

### High Pressure

- Liquid ejected at high pressure can cause serious injury.
- Do not operate beyond recommended pressure.



## WARNING

### Moving Parts

- Rotating parts can cause severe injury or death.
- Do not enter or reach into the compartment when equipment is operating.



Use this document to install and operate your Waterous equipment. Understand the following conditions before continuing with the document:

- The instructions may refer to options or equipment that you have not purchased with your system.
- The illustrations in this document are intended to convey concepts. Do not use the illustrations to determine physical attributes, placement, or proportion.
- Understand that your application may require additional steps, that are not described in the illustrations or instructions, to perform the installation.
- The equipment described in this document is intended to be installed by a person or persons with the necessary skills and knowledge to perform the installation.
- The equipment described in this document is intended to be operated by a person or persons with the basic knowledge of operating similar equipment.
- The information in this document is subject to change without notice.

This document is divided into the following sections:

#### SAFETY

This section describes precautions and alert symbols that are in this document.

#### INTRODUCTION

This section is an overview of the document.

#### PRODUCT OVERVIEW

This section describes the components that make up the system and the various system configurations.

#### INSTALLATION

This section describes the installation and initial setup procedures.

#### OPERATION

This section describes equipment operation.

#### MAINTENANCE

This section describes required maintenance.

#### TROUBLESHOOTING

This section describes how to troubleshoot any issues with the equipment.

## Using this Document

Use the guidelines below when viewing this document.

### Viewing the Document Electronically

- View this document in landscape orientation.
- Use the table of contents to navigate directly to that section.
- Text **with this appearance** is linked to a reference.

### Printing the Document

- The document is viewed the best when printed in color.
- The *print on both sides* and *flip on long edge* features can provide the best results.
- Use a 3-ring binder to store the document.

## Symbols

Symbols are used to illustrate additional tools or operations that are required to complete the instructions.



Drill—This symbol tells you to drill holes in the apparatus.



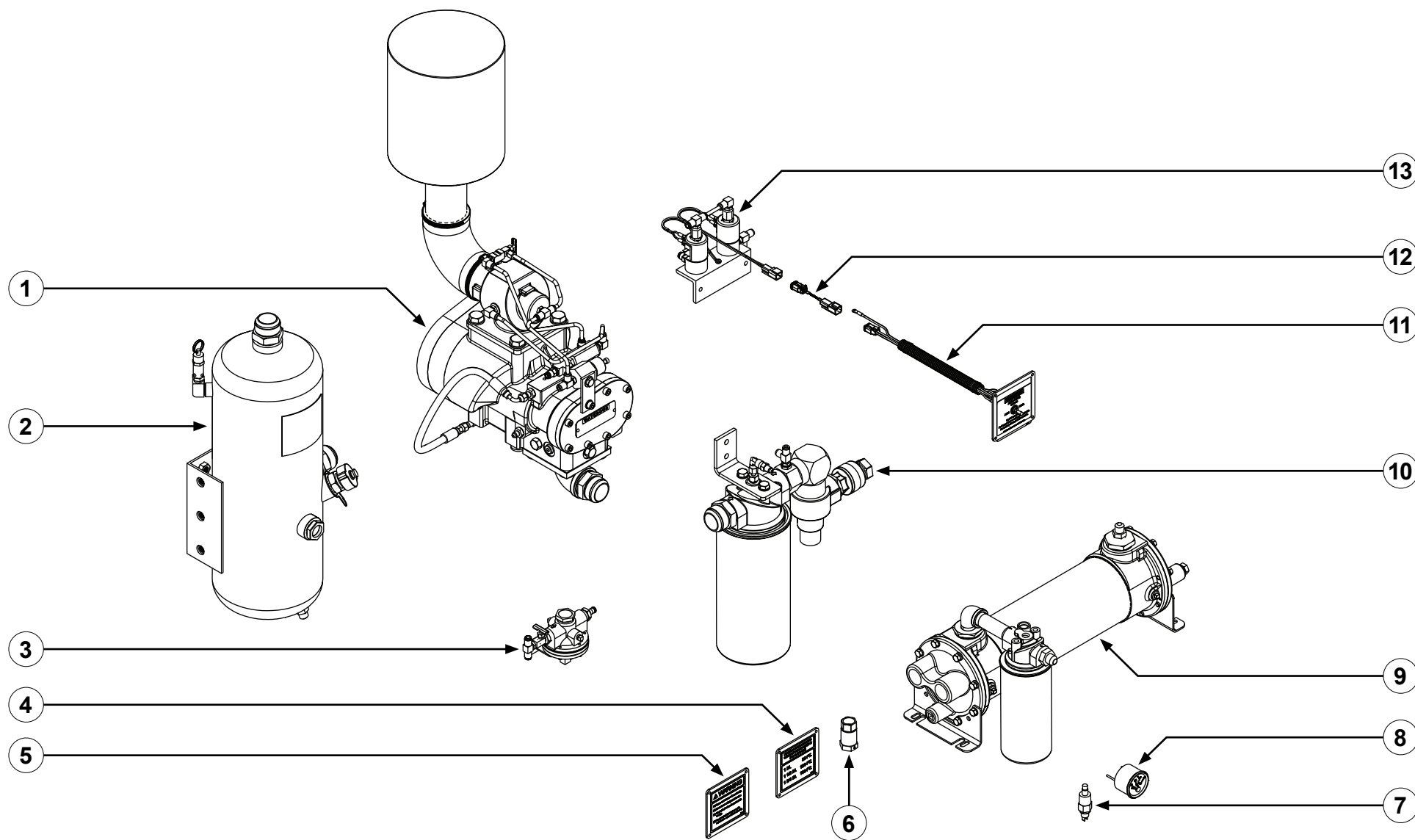
Jig saw—This symbol tells you to make a cutout in the apparatus.



Section reference—This symbol tells you to go to the section reference for additional information.

## System Components

The CAFSystem™ includes the illustrated components. The system is available in 12 V or 24 V. Some components are assembled at the factory, while other components are shipped loose and require installation. The components that require installation depend on the configuration of your system. Additional components such as wire, bulbs, and connectors are sourced by the installer. Contact Watrous for information about available installation kits.

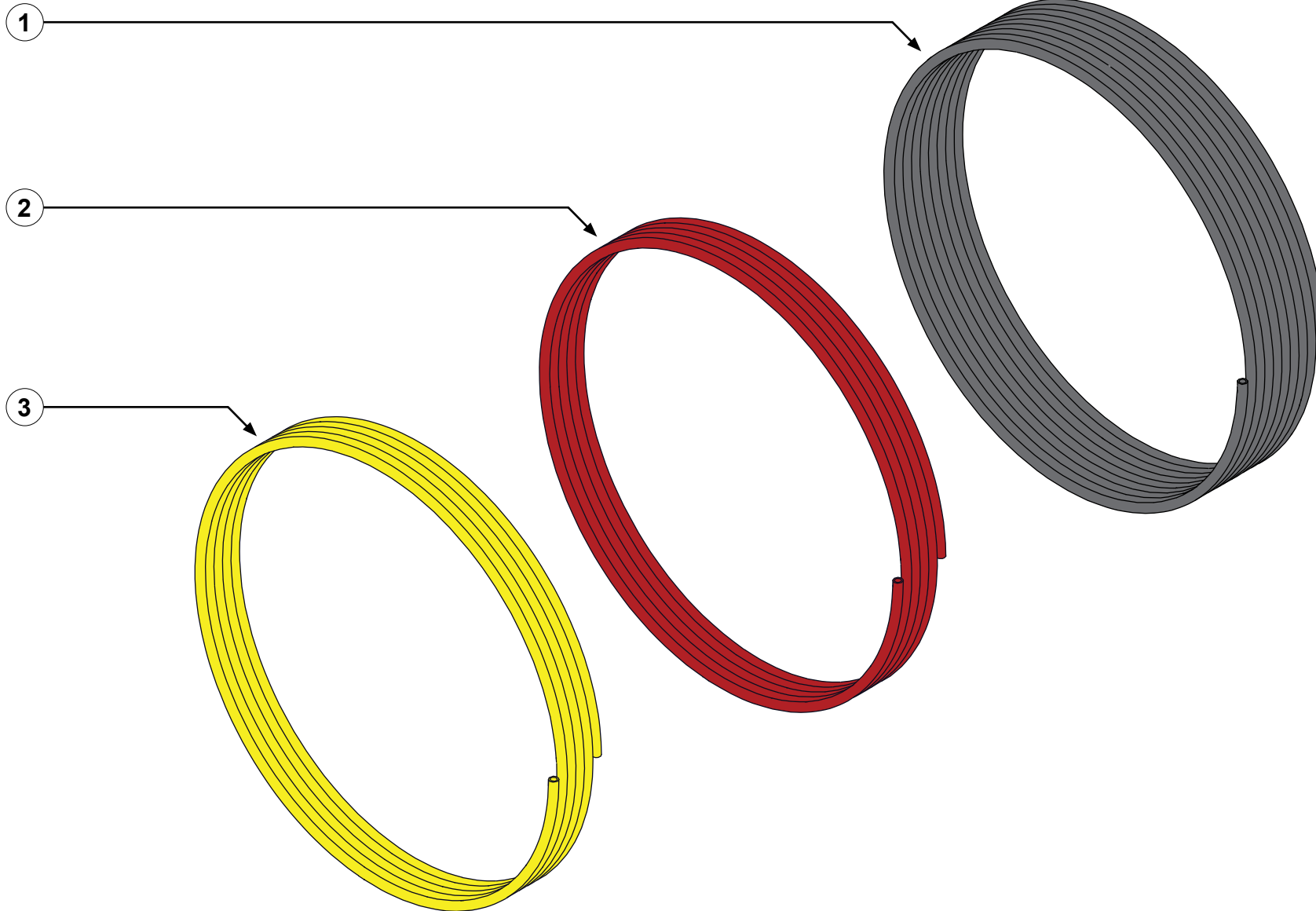


## System Components

Feature		Description
1	Compressor	This creates the compressed air for the system—150-P shown.
2	Sump	This separates the air/oil mixture.
3	Piloted balance valve	This regulates the pressure between the pneumatic and hydraulic parts of the system.
4	Hose length plate	This details the recommended minimum hose length for a given diameter.
5	Compressed air warning plate	This details warnings associated with operating the system.
6	Check valve	This prevents liquid from flowing backwards through the system.
7	Oil temperature sender	This measures the sump oil temperature and triggers a warning when the temperature reaches a predetermined value.
8	Oil temperature gauge	This displays the sump oil temperature.
9	Oil cooler—shell style	This cools the compressor oil.
10	Separator filter	This removes any remaining oil from the air/oil mixture.
11	Auto-sync switch	This selects the mode of operation.
12	Auto-sync extension harness	This is an extension for the auto-sync switch wire harness.
13	Auto-sync solenoid assembly	This implements the operation mode selected by the auto-sync switch.

## System Components

The CAFSystem™ includes the additional illustrated components. The components are color coded for troubleshooting purposes.

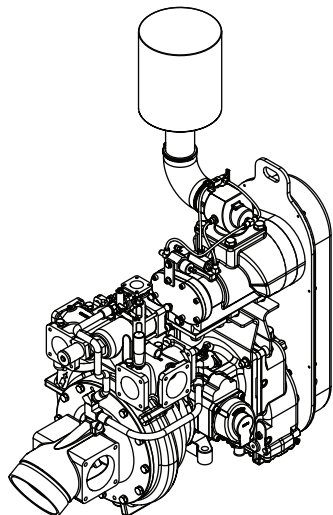


## System Components

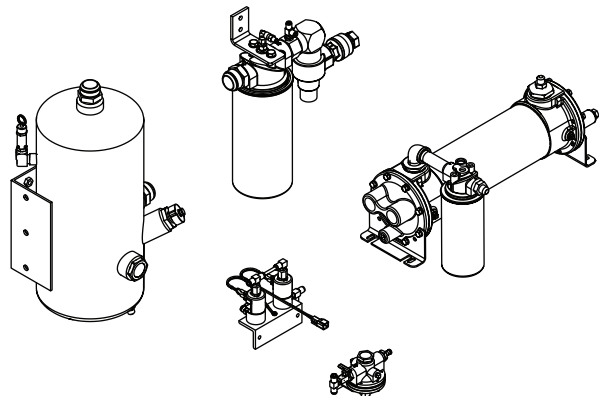
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Feature		Description
1	Black tubing	This 1/4 inch air brake tube connects various components in the system.
2	Red tubing	This 1/4 inch air brake tube connects various components in the system.
3	Yellow tubing	This 1/4 inch air brake tube connects various components in the system.

### 100-D, 120-D and 150-D CAFS— HLK Configurations

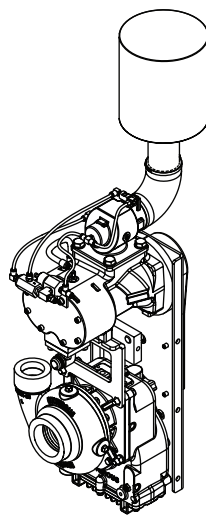


Assembled at the Factory

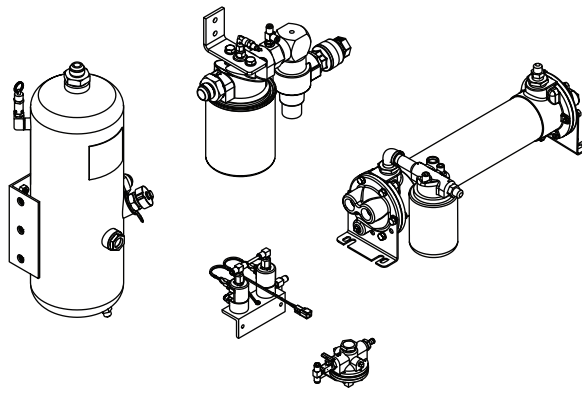


Shipped Loose

### 100-P and 120-P CAFS— CPK-2 Configuration

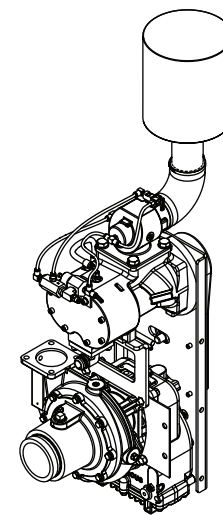


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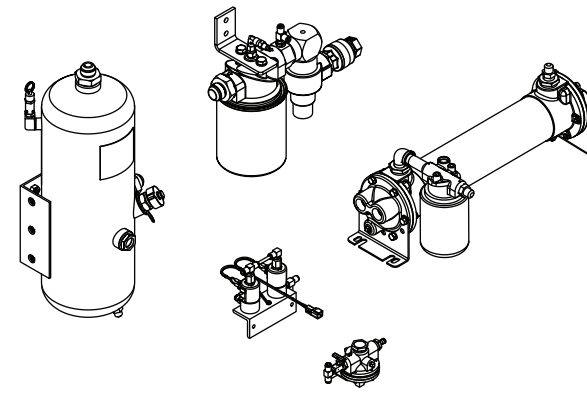


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### 100-P and 120-P CAFS— CLVK Configuration

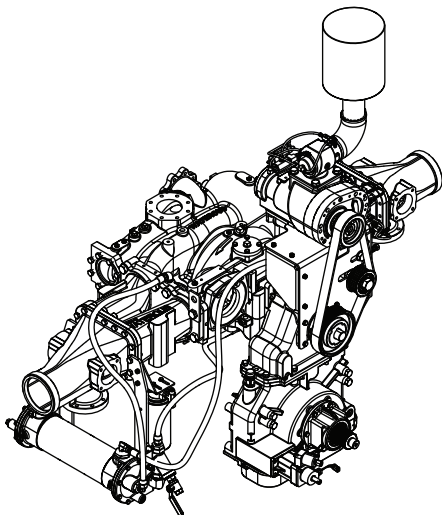


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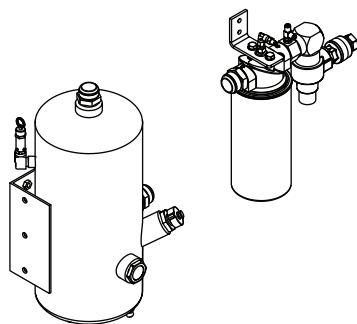


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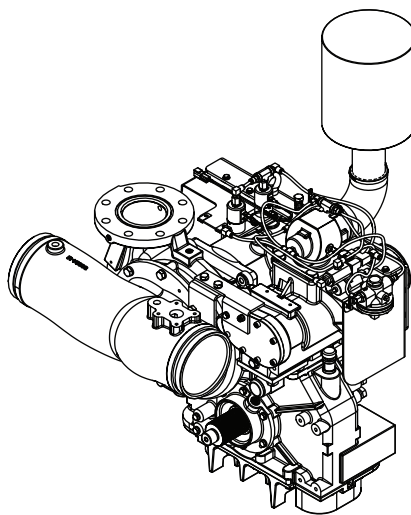


**150-D CAFS—  
CSC20 Configuration**

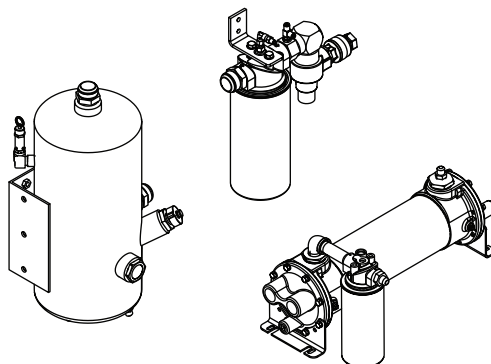
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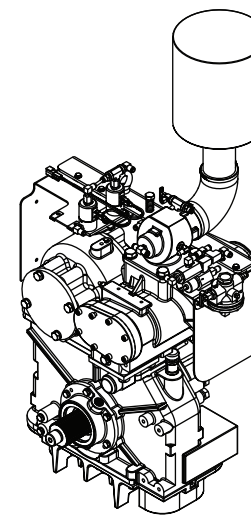
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**150-ESD CAFS—  
CXSC20 Configuration**

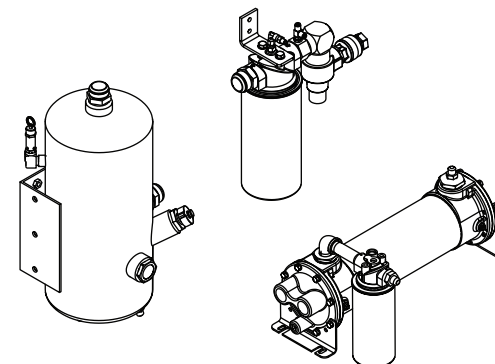
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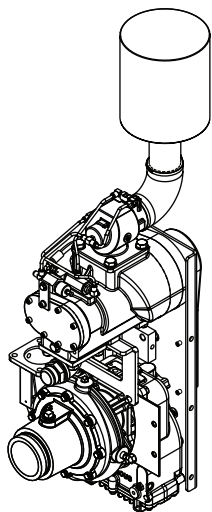
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**150-ESD CAFS—  
TC20 Configuration**

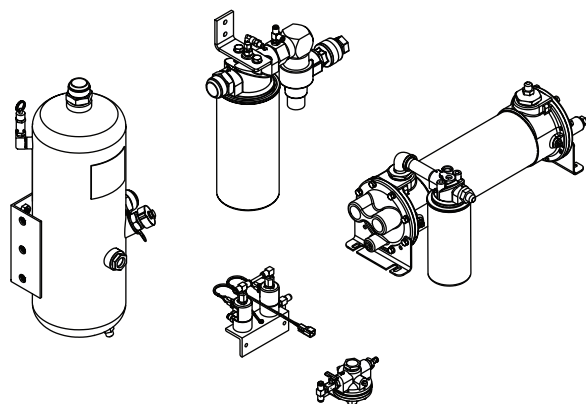
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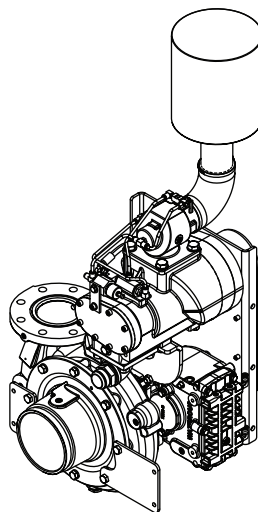
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**150-P CAFS—  
CLVK Configuration**

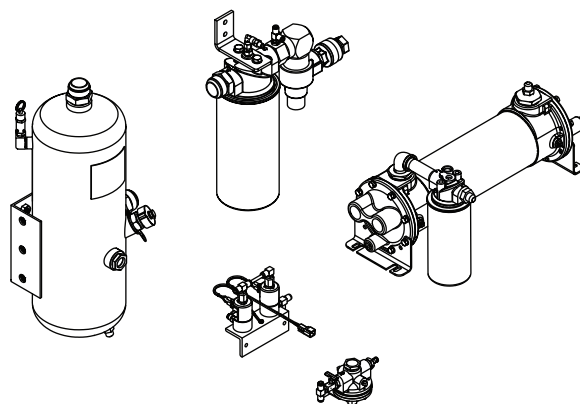
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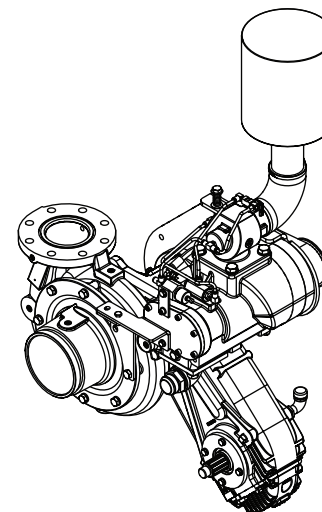
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**150-P CAFS—  
CXVK Configuration**

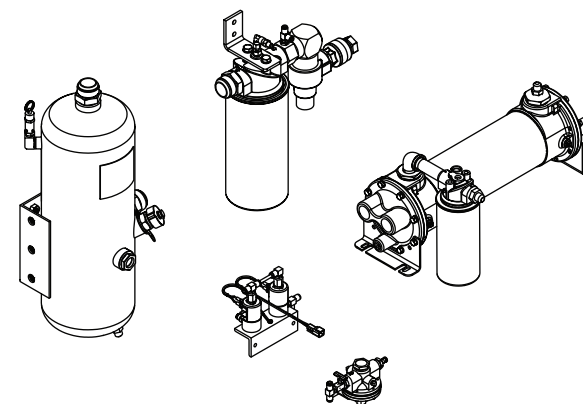
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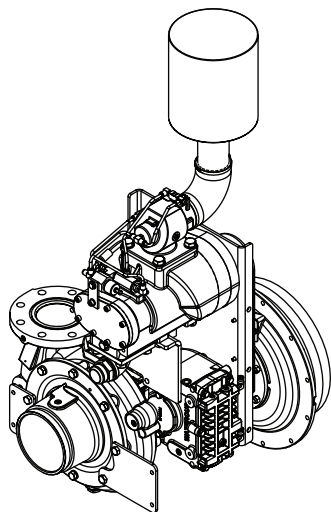
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**150-P CAFS—  
CXVPA Configuration**

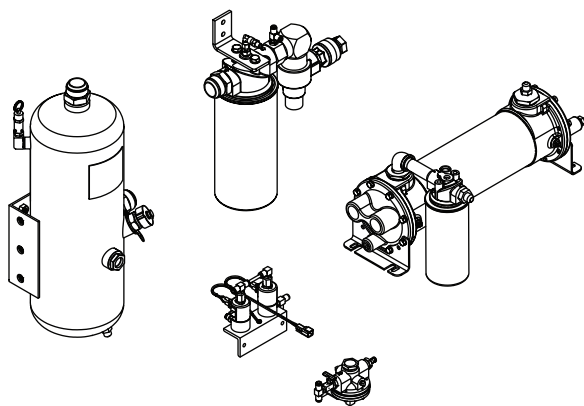
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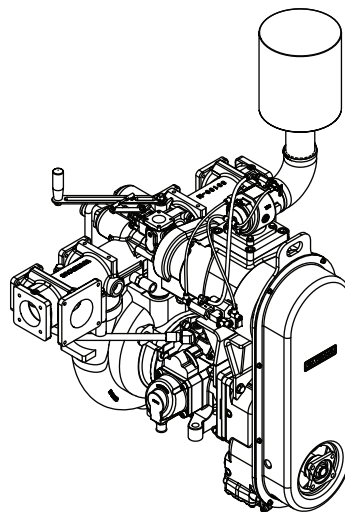
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**150-T CAFS—  
CXVT Configuration**

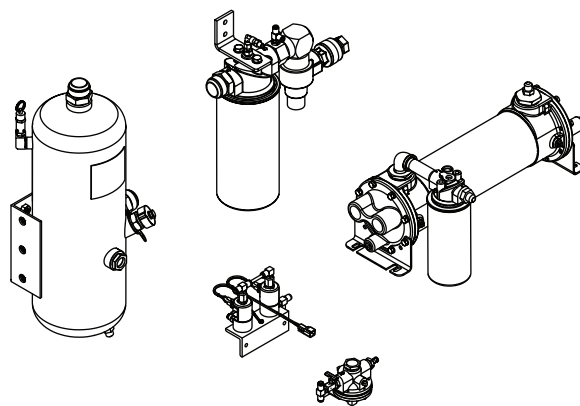
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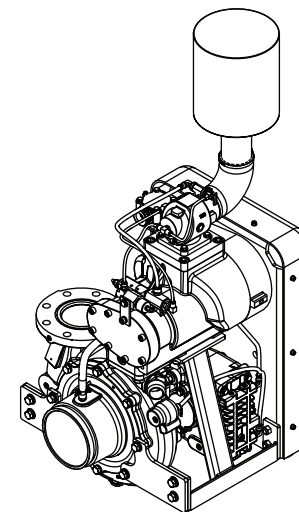
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**200-D CAFS—  
HL400K Configuration**

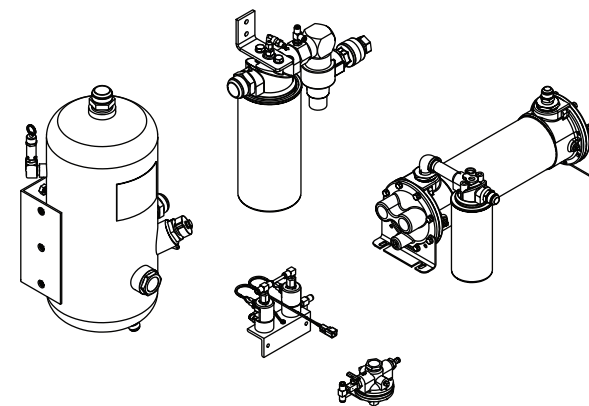
Assembled at the Factory



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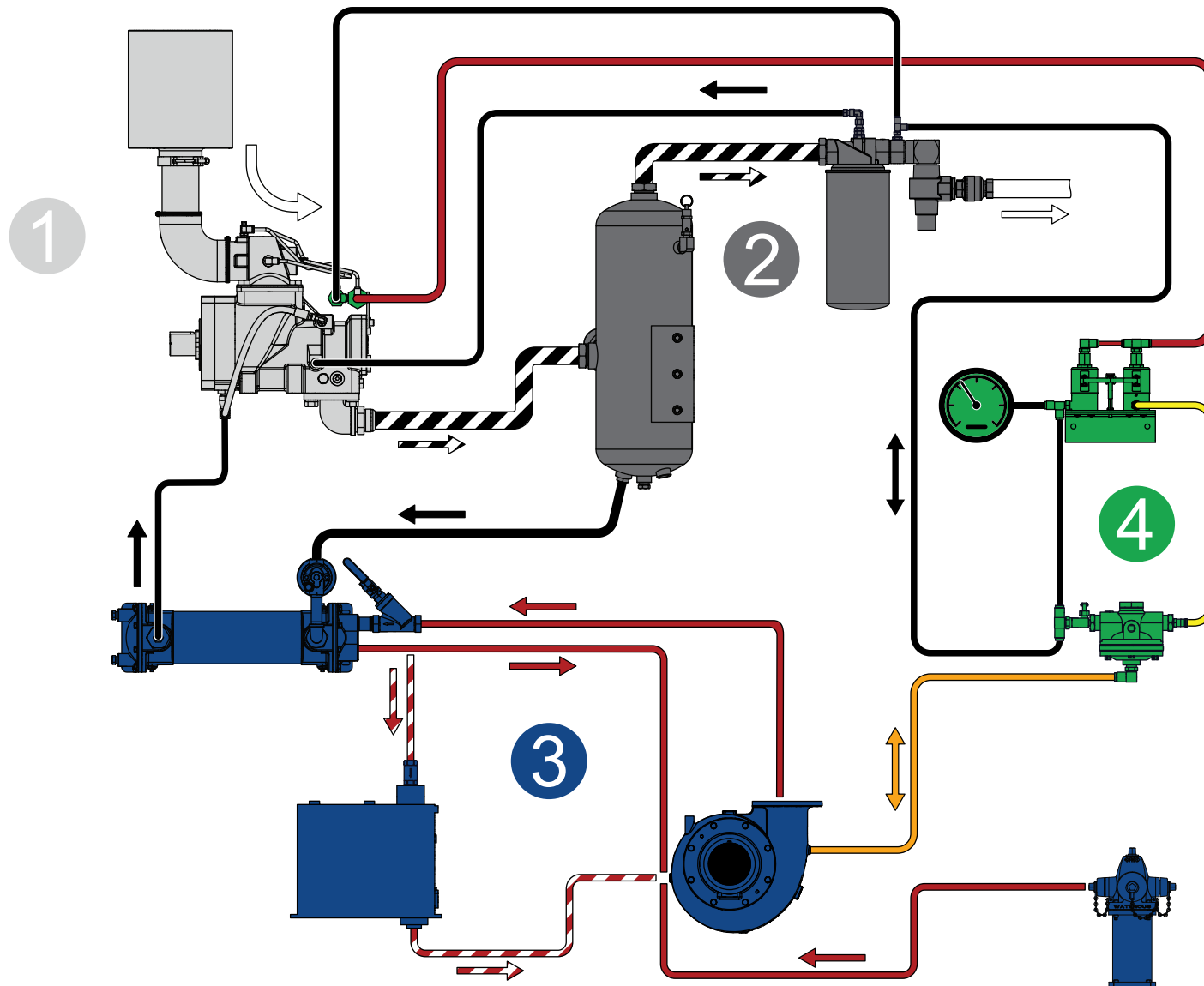
**200-P CAFS—  
CXVK Configuration**

Assembled at the Factory



Shipped Loose

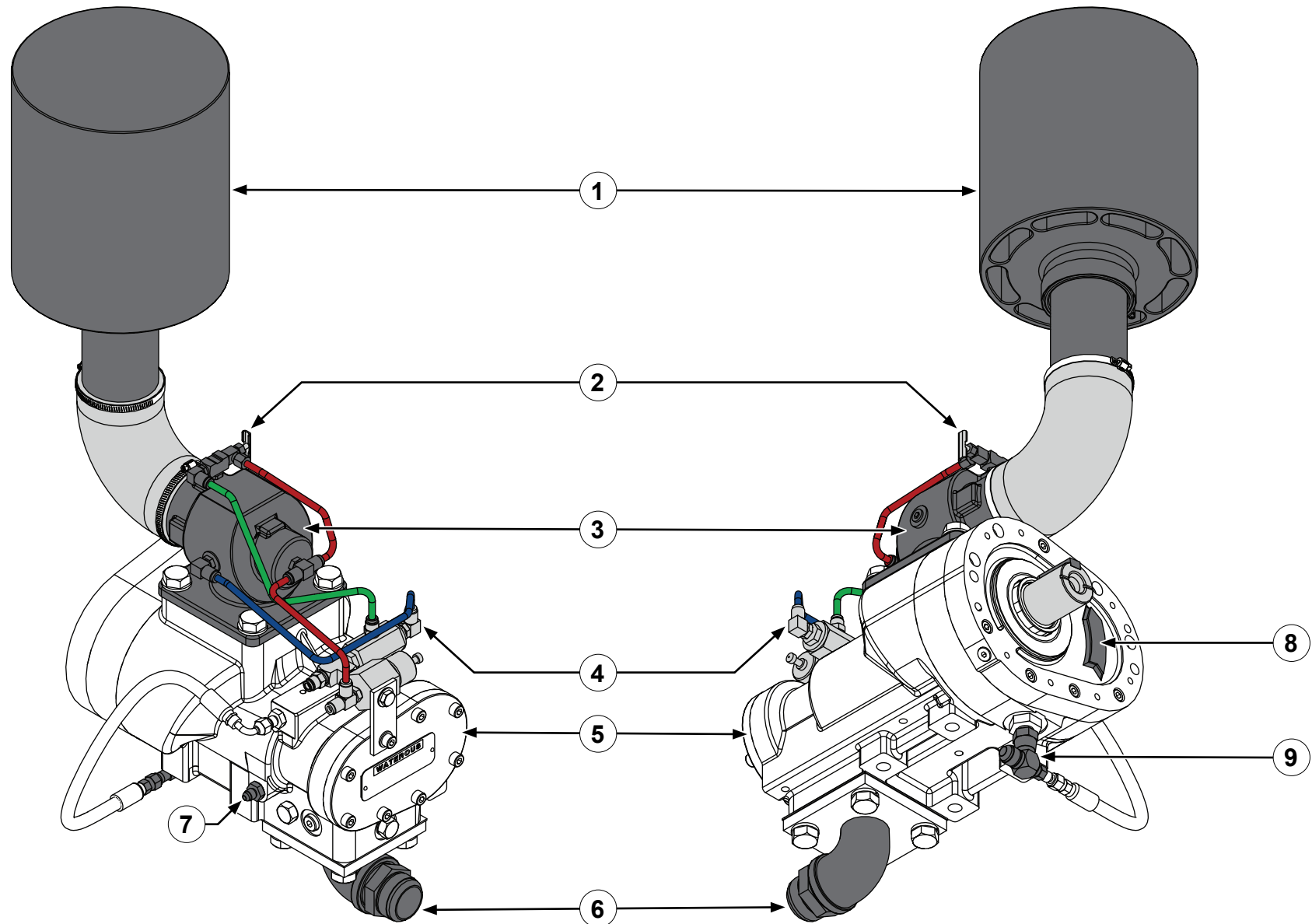
## Operation Overview



## Operation Overview

Description	
1 Compressor	The compressor portion of the system includes the compressor and the components driving the compressor, such as the power take-off (PTO). Air enters the compressor through the air filter. The air is then entrained, or mixed into the oil, and sent to the sump.
2 Compressed air	The compressed air portion of the system includes the sump, separator filter, and supporting hoses. The air/oil mixture moves to the sump and separates. The separated oil collects at the bottom of the sump before being sent to the oil cooler. After the oil is cooled, it is sent back to the compressor to repeat the cycle. The air in the sump is then moved to the separator filter. The separator filter collects any oil remaining in the mixture and sends it back to the compressor. The compressed air is then filtered and moved to the air distribution manifold. A port on the separator filter also sends air (pressure) to the balance valve and pressure modulation control (PMC) assembly, where it is used to synchronize air and water pressure in auto mode.
3 Cooling	The cooling portion of the system includes the oil cooler, supporting hoses, fire pump, and water source. The oil moves from the sump to the oil cooler. Flowing water circulated by the fire pump removes heat from the oil as it flows through the oil cooler. Typical applications use an external water source to cool the compressor oil. Alternatively, an internal water source, such as an on-board water tank, can be used to cool the compressor oil. However, an internal water source can retain heat and become less effective, so the compressor oil temperature must be closely monitored. Depending on your application, an additional fan-style cooler may be available to enhance the cooling capability of the system.
4 Balance	The balance portion of the system includes the balance valve, auto-sync solenoid assembly, PMC assembly, and supporting hoses. When operating in auto mode, the balance valve synchronizes the air pressure produced by the compressor to the water pressure. The balance portion of the system also purges the air from the system when operation is complete.

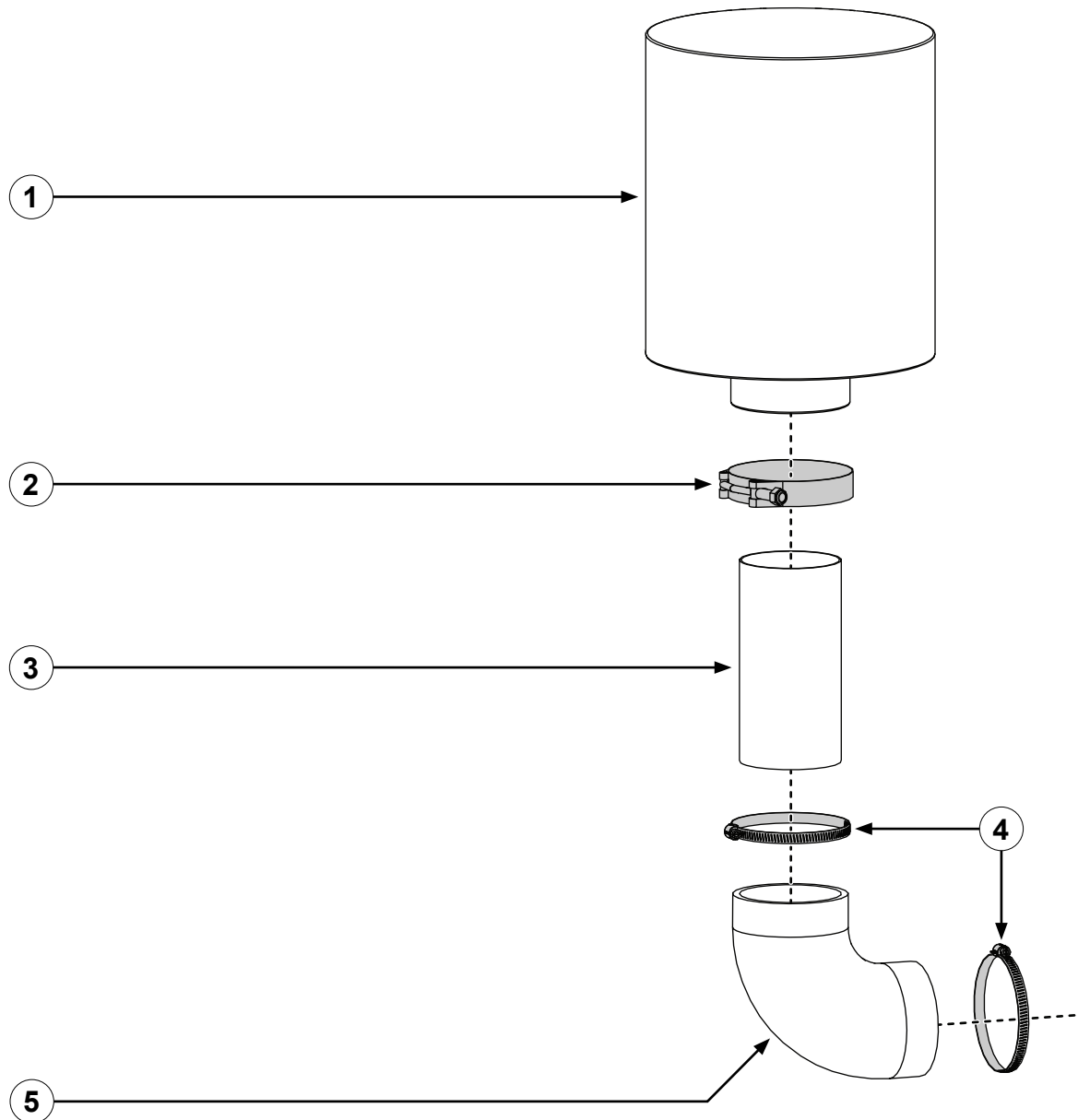
## Compressor Components—150-P



## Compressor—150-P

Feature		Description
1	Air filter assembly	This filters the incoming air supply to the compressor.
2	Air inlet trim valve (AITV)	This calibrates the auto-sync air balance system.
3	Air inlet assembly	This controls the air supply to the compressor.
4	Pressure modulation control (PMC)	This part of the air control circuit sets the fixed pressure during operation and bleed-off during shutdown.
5	Compressor	This pumps the compressed air and oil mixture.
6	Compressed air outlet	The compressed air/oil mixture exits the compressor at this port.
7	Oil return port	The cooled oil enters the compressor at this port.
8	Rotation direction indicator	This indicates the direction of the input rotation entering the compressor.
9	Scavenged oil port	The scavenged oil enters the compressor at this port.

## Air Filtration Components

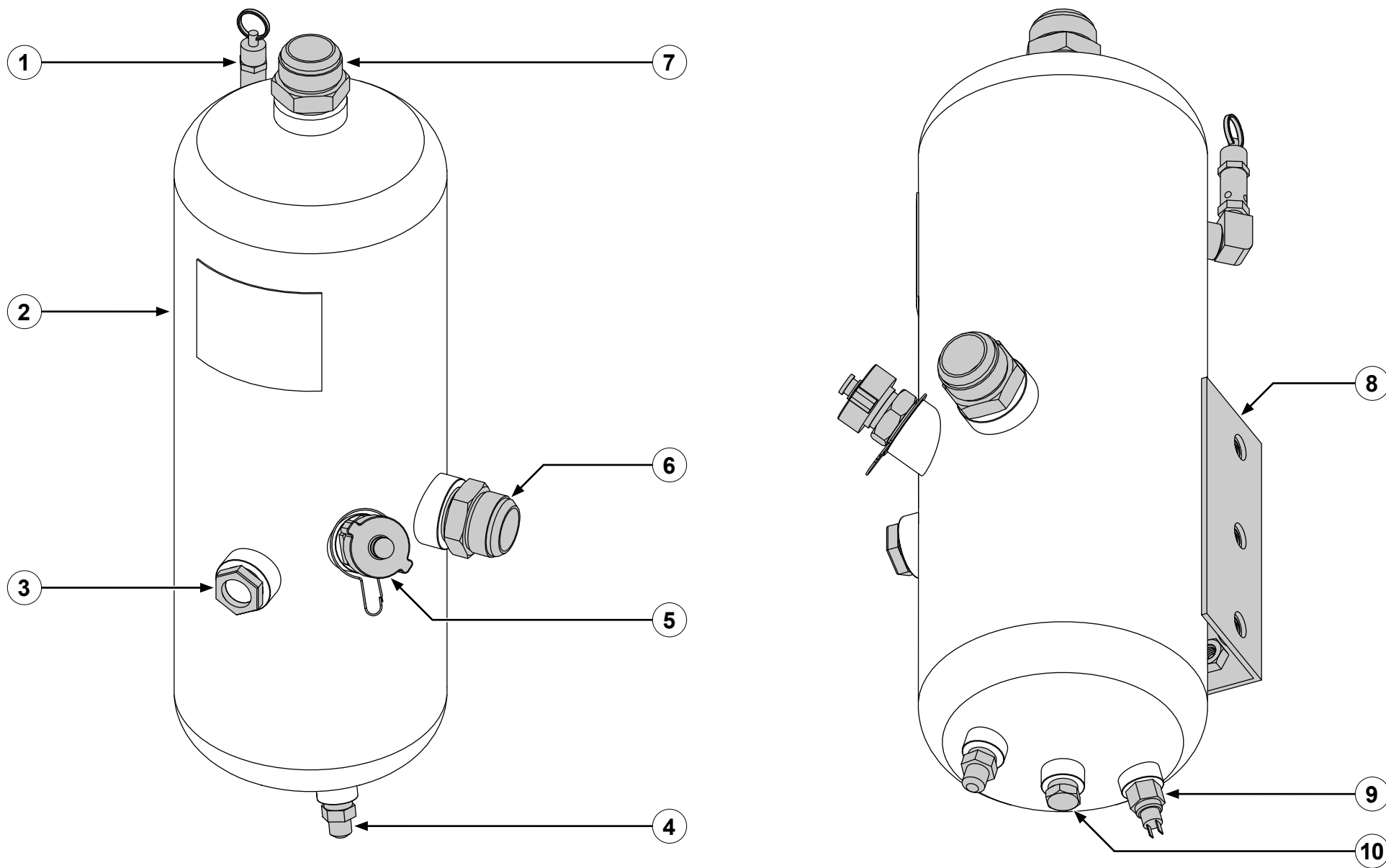




## Air Filtration Components

Feature	Description
1 Air filter	This filters the incoming air—150-P air filter shown.
2 T-bolt clamp	This secures the air filter to the air inlet tube.
3 Air inlet tube	<p>This routes fresh air to the compressor. It is supplied as a 4 foot (1.22 m) aluminum tube that is cut to length as required by your application.</p> <p><b>Note:</b> Always use a tube with a smooth-wall interior. Never use flexible tubing or tubing with irregular walls.</p>
4 Hose clamp	This secures the air filter components together.
5 90° rubber elbow	This routes fresh air to the compressor.

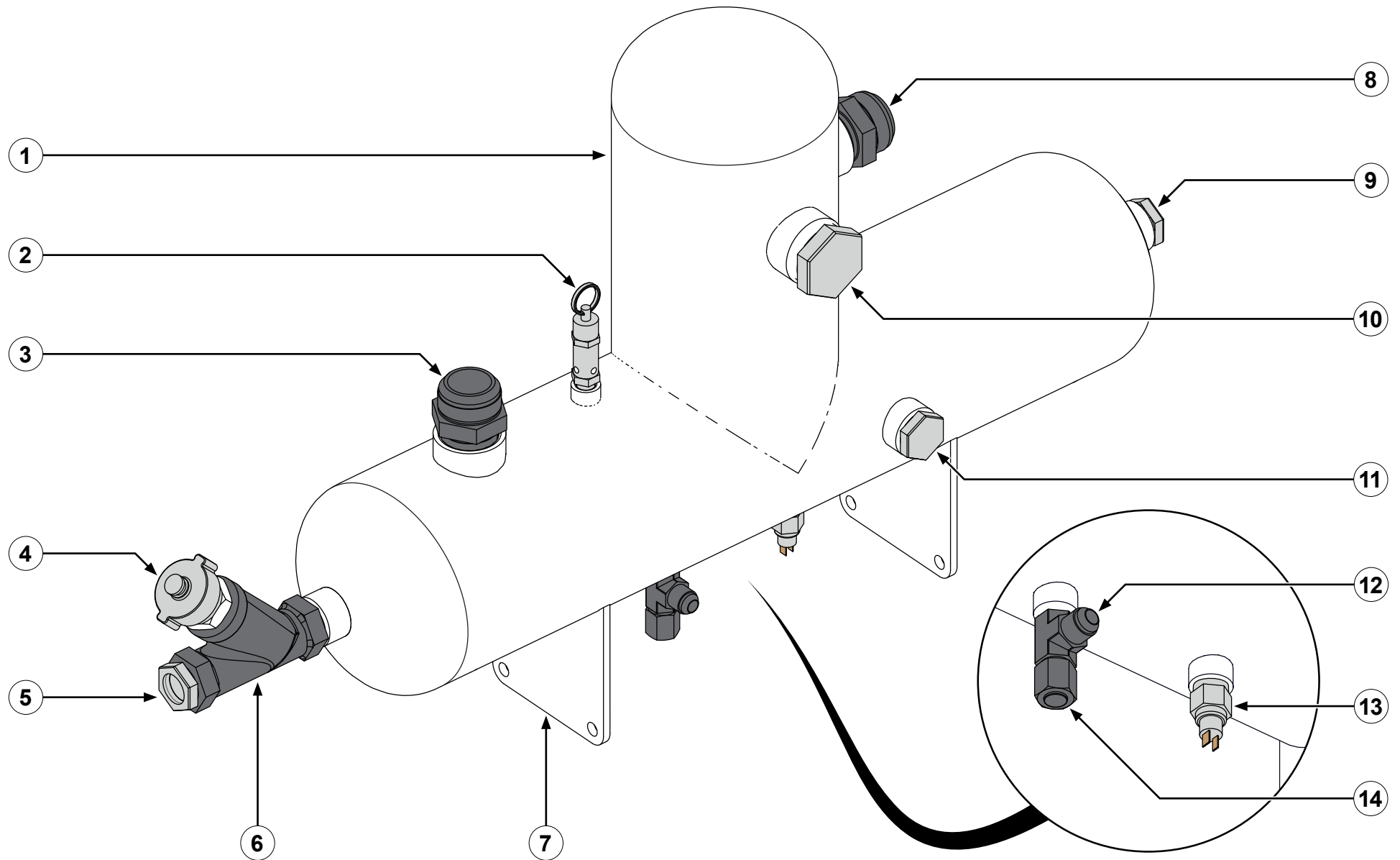
## Oil Sump—Vertical



## Oil Sump—Vertical

Feature		Description
1	Pressure release valve	This limits the amount of pressure contained in the sump to 200 psi.
2	Sump body	This is where the air/oil mixture is initially separated.
3	Sight window	This displays the oil level in the sump.
4	Oil out port	This routes the oil to the compressor.
5	Oil fill port	This is where the oil is added to the sump.
6	Air/oil in port	This receives air/oil from the compressor.
7	Air/oil out port	This is the compressed air output.
8	Mounting bracket	This mounts the sump on the apparatus. The sump can be oriented vertically or horizontally to meet application requirements.
9	Temperature sender	This measures the sump oil temperature—shown installed.
10	Oil drain port	This is where the oil is drained from the sump.

## Oil Sump—Tee

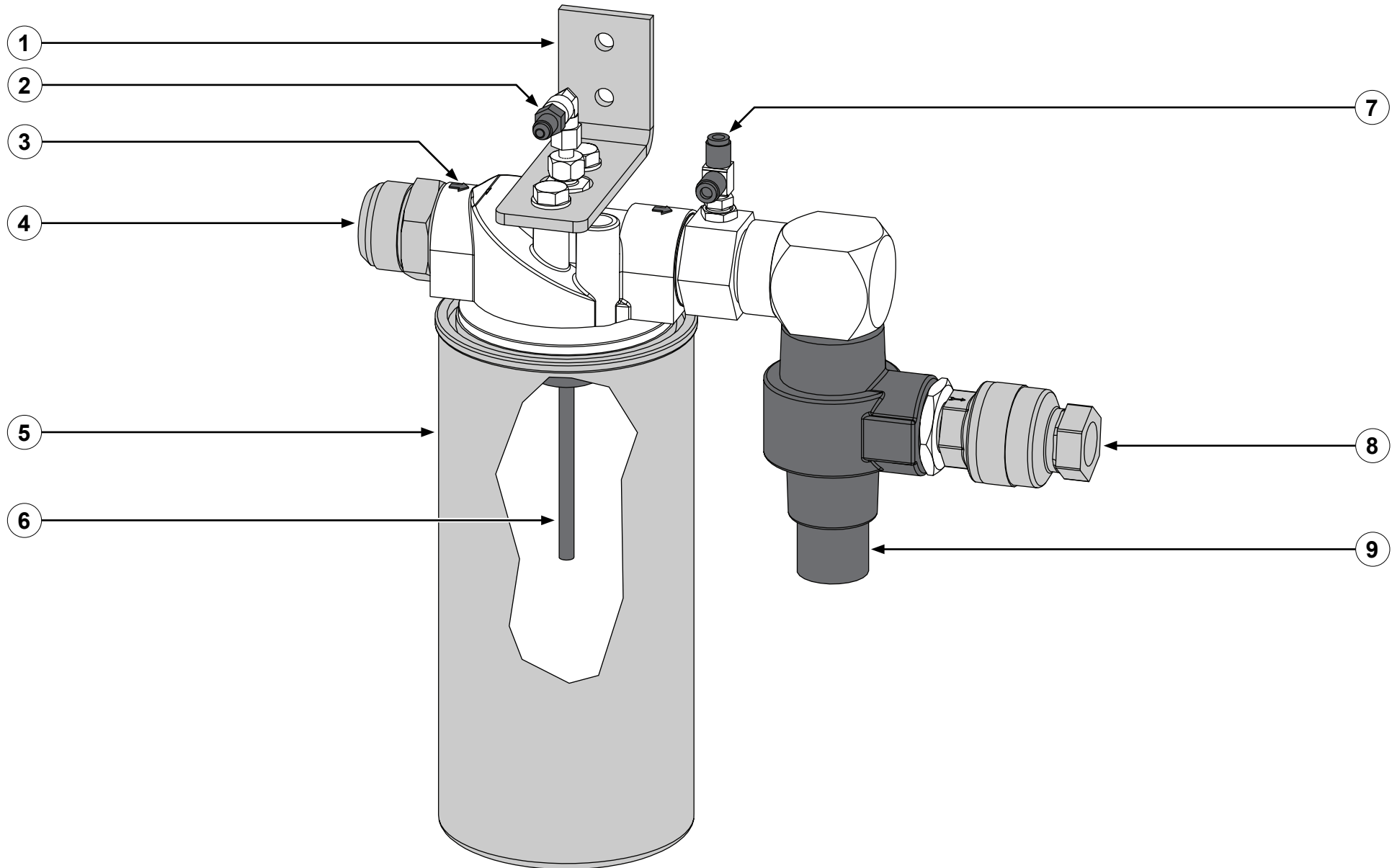


## Oil Sump—Tee

The horizontal oil sump port locations are customizable to meet your application.

	Feature	Description
1	Sump body	This is where the air/oil mixture is initially separated.
2	Pressure release valve	This limits the amount of pressure contained in the sump to 200 psi.
3	Air/oil in port	This receives air/oil from the compressor.
4	Oil fill cap	This seals the oil fill port.
5	Sight window	This displays the oil level in the sump.
6	Wye strainer oil fill port	This is where the oil is added to the sump.
7	Mounting bracket	This mounts the sump on the apparatus. The sump must be oriented vertically with the sump body toward the top.
8	Air/oil out port	This is the compressed air output.
9	Plug	This plug seals the alternate location for the wye strainer, sight window, or wye strainer with sight window.
10	Plug	This plug seals the alternate location for the air/oil out port.
11	Plug	This plug seals the alternate location for the wye strainer, sight window, or wye strainer with sight window.
12	Oil out port	This routes the oil to the compressor.
13	Temperature sender	This measures the sump oil temperature—shown installed.
14	Oil drain port	This is where the oil is removed from the sump.

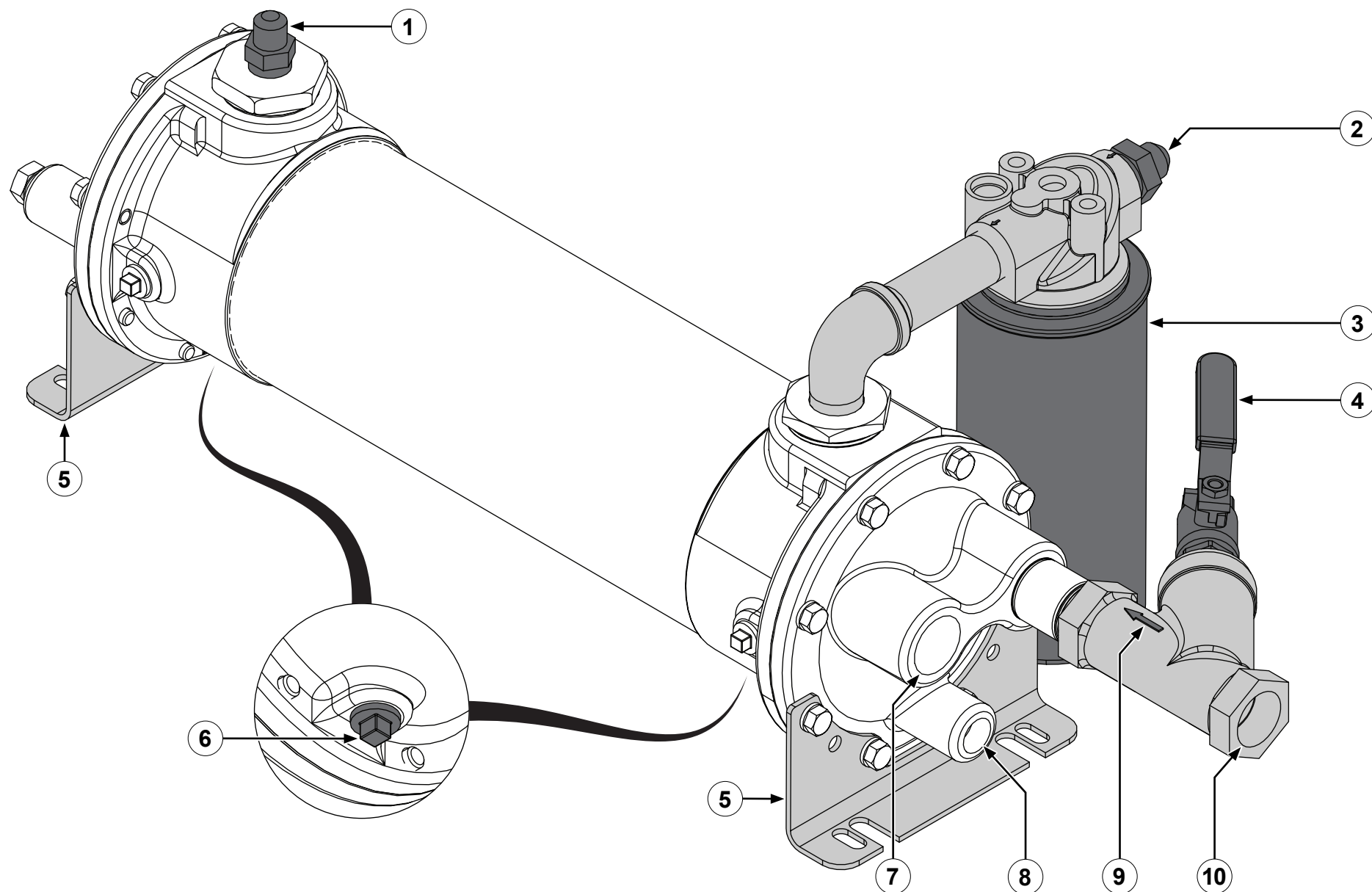
## Separator Filter



## Separator Filter

Feature		Description
1	Mounting bracket	This mounts the separator filter on the apparatus.
2	Scavenge tube check valve	This routes the recovered oil from the air/oil mixture.
3	Direction of flow indicator	This indicates the direction of flow through the separator filter.
4	Air/oil input port	This is where the compressed air/oil mixture enters the separator filter.
5	Separator filter	This is the final stage of air/oil separation when any remaining oil is removed from the air/oil mixture.
6	Oil filter tube	This draws the oil out of the separator filter.
7	Pressure port	This port connects to the pressure control circuit.
8	Air outlet master check valve	This prevents water from flowing backwards through the system.
9	Minimum pressure valve	This sets the minimum pressure allowed to pass through the valve—approximately 40 psi (2.8 bar).

## Oil Cooler

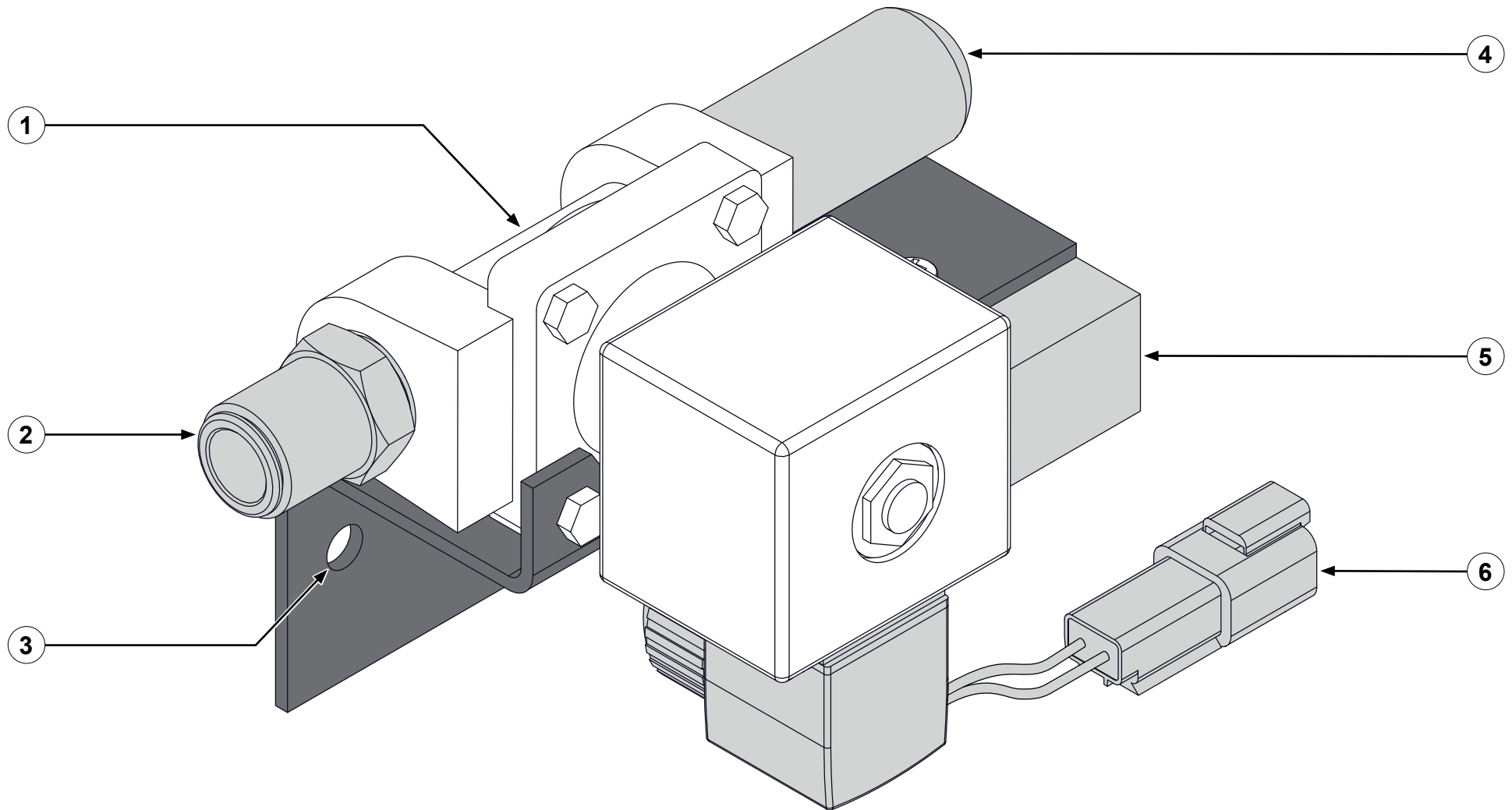




## Oil Cooler

Feature	Description
1 Oil outlet	This is the outlet for the cooled oil. <b>Note:</b> <i>The oil outlet and oil inlet are reversible to suit the needs of your application.</i>
2 Oil inlet	This is the inlet for heated oil. <b>Note:</b> <i>The oil inlet and oil outlet are reversible to suit the needs of your application.</i>
3 Oil filter	This filters the oil before it enters the cooler. The direction of oil flowing through the filter is fixed, but the oil filter can be relocated to another inlet/outlet on the oil cooler to suit the needs of your application.
4 Wye fitting clean-out valve	This allows you to quickly remove accumulated debris from the wye fitting.
5 Mounting bracket	This mounts the oil cooler on the apparatus.
6 Oil drain	This allows you to drain the oil.
7 Water outlet	This is the outlet for the water that cools the oil. <b>Note:</b> <i>The water outlet and water inlet are reversible to suit the needs of your application.</i>
8 Water drain	This allows you to drain the water from the cooler to prevent freezing. The drain components are application-specific and supplied by the installer.
9 Direction of flow indicator	This indicates the direction of water flowing through the oil cooler. Water must flow through the wye strainer before entering the oil cooler.
10 Water inlet	This is the inlet for the water that cools the oil. <b>Note:</b> <i>The water inlet and water outlet are reversible to suit the needs of your application.</i>

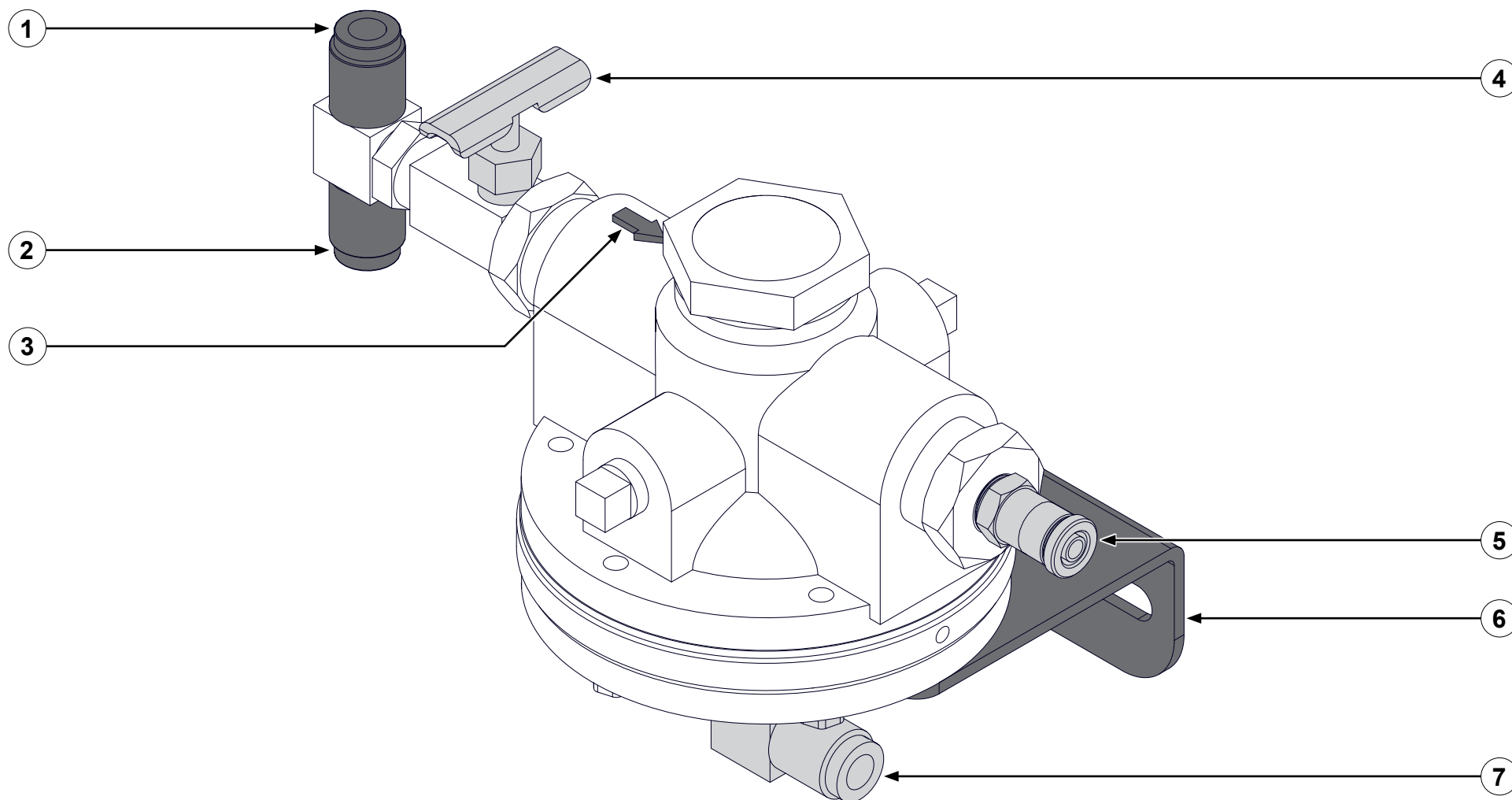
## Sump Vent—Optional



## Sump Vent—Optional

	Feature	Description
1	2-way solenoid valve	This actuates to vent the sump.
2	Vent fitting	This connects to the separator filter.
3	Mounting hole	This secures the assembly to the apparatus.
4	Vent muffler	This reduces vent noise.
5	Time delay relay	This regulates how long the solenoid is open.
6	Wire harness	This connects to the PTO engage switch.

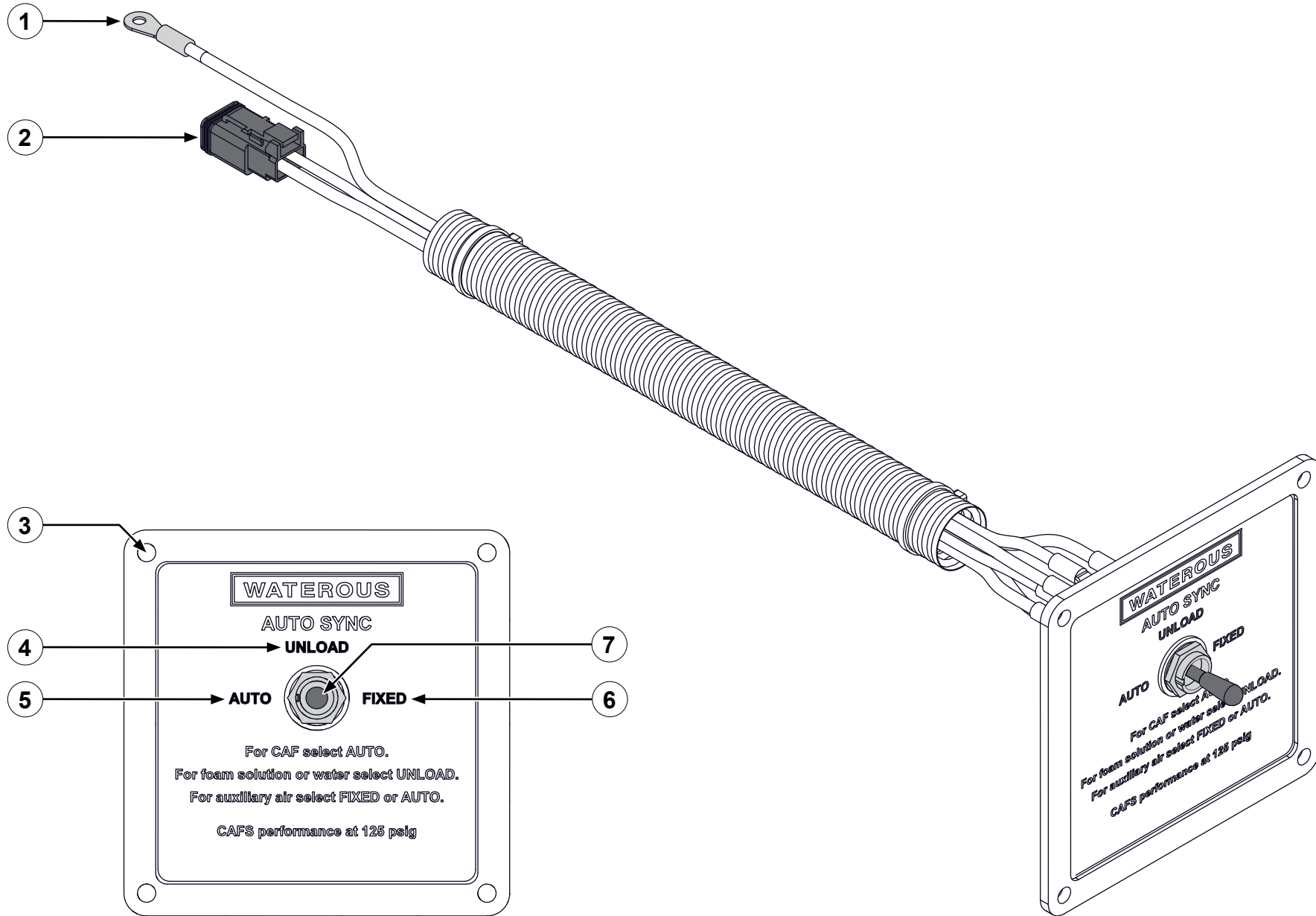
## Balance Valve



## Balance Valve

	Feature	Description
1	Pressure port	This connects to the pressure control circuit.
2	Separator filter output	This connects to the separator filter.
3	Direction of flow indicator	This indicates the direction the air flows through the balance valve.
4	Balance trim valve	This adjusts the balance air circuit.
5	Auto-sync output	This connects to the solenoid assembly.
6	Mounting bracket	This mounts the balance valve on the apparatus.
7	Pump input	This connects to the water pump discharge.

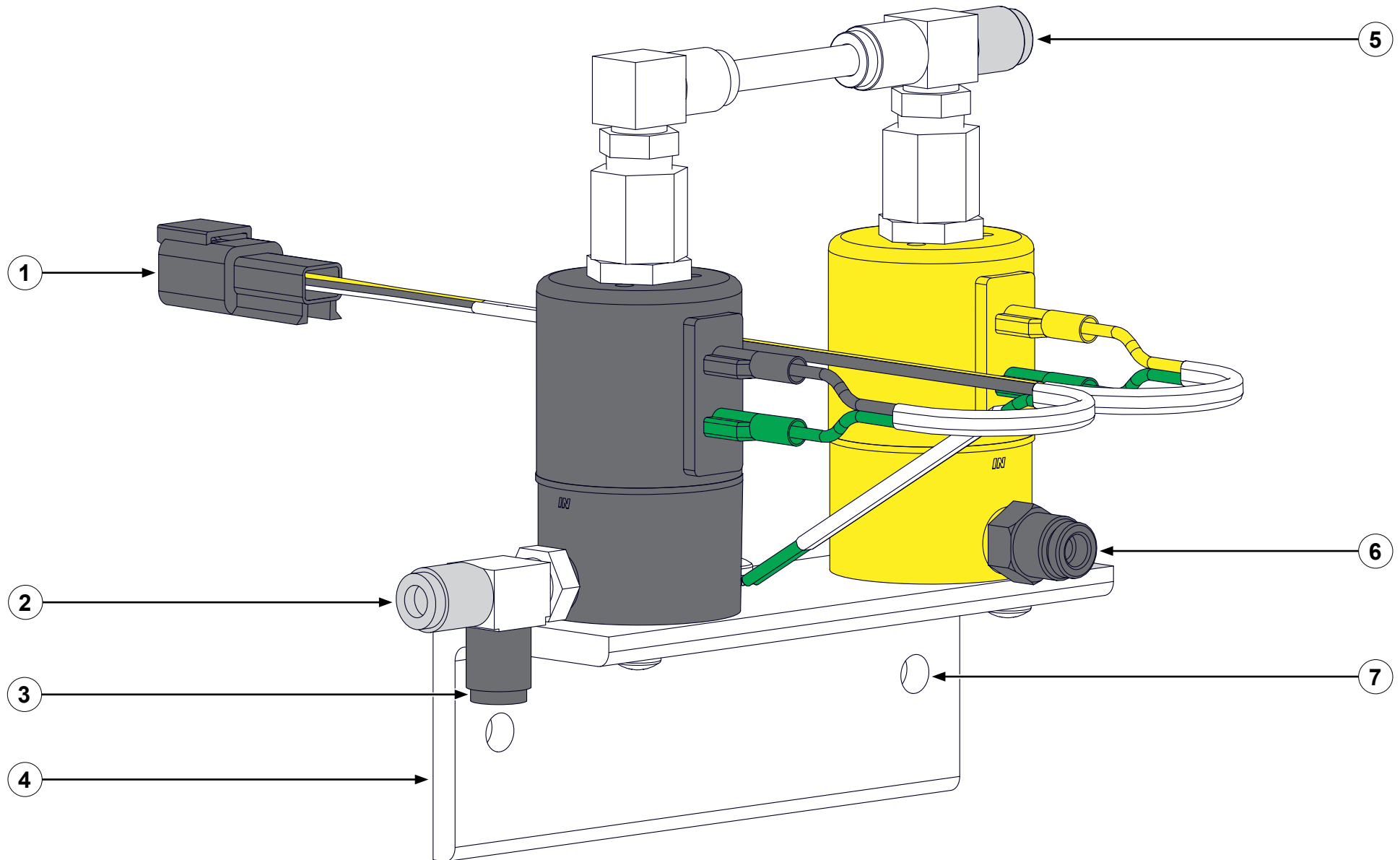
## Auto-Sync Mode Switch



## Auto-Sync Mode Switch

Feature		Description
1	Power wire	This connects to apparatus power.
2	Wire harness connector	This connects to the wire harness on the auto-sync assembly.
3	Mounting hole	This secures the plate to the apparatus.
4	Unload mode	This mode operates the compressor at approximately 40 psi (2.8 bar). The compressor generates a minimum pressure of 40 psi (2.8 bar) to circulate the compressor oil and cool the system. Always start the compressor in this mode or auto mode.
5	Auto mode	This mode operates the compressor at 50 to 150 psi (3.4 to 10.3 bar). The system automatically adjusts the air pressure as you raise and lower the water pressure. Always start the compressor in this mode or unload mode.
6	Fixed mode	This mode operates the compressor at 150 psi (10.3 bar) regardless of water pressure.
7	3-way switch	This toggles between the 3 operation modes.

## Auto-Sync Solenoid Assembly





## Auto-Sync Solenoid Assembly

	Feature	Description
1	Wire harness	This connects to the auto-sync switch.
2	Pressure gauge output	This connects to the optional pressure gauge.
3	Balance valve input	This connects to the balance valve.
4	Mounting bracket	This mounts the auto-sync on the apparatus.
5	PMC input	This connects to the PMC.
6	Balance valve input	This connects to the output side of the balance valve.
7	Mounting hole	This secures the assembly to the apparatus.

## Installation Overview

This equipment is intended to be installed by a person or persons with the basic knowledge of installing similar equipment. Contact Waterous with questions about installing the equipment. The installation may require the following tasks and abilities:

- Locating, drilling, and cutting features into the apparatus.
- Welding.
- Installing the hoses and fittings.
- Routing and securing the hoses.
- Routing and securing the wiring.
- Calibrating the output.
- Calibration and final testing.

## Preparing for the Installation

Use the following guidelines before, during, and after the installation.

- Read and understand all the installation instructions before installing the equipment.
- Prepare a suitable, well-lit area and gather all the necessary tools before you begin the installation.
- Make sure that you remove any shipping plugs or caps before installing components.
- Make sure that you bring all fluids to operating levels before using the equipment.

## NOTICE

### Before Operation

- Read and understand all the instructions provided.
- Check all fluid levels and replenish if necessary.
- Remove all shipping plugs and install the operation plugs or caps.



## Modifying the Equipment

This equipment is intended to operate as designed. Do not remove, modify, or change the components in the system. Doing so will void the warranty.

## NOTICE

### Modification

- Modifying the equipment can damage components and void your warranty.
- Do not modify the system or any of its components.



***Do not modify the system or any of its components. Doing so will void your warranty.***

## Additional Documentation

Additional documentation is available through the MyWaterous login at [www.waterousco.com](http://www.waterousco.com). Use your serial number to gain access to the service parts lists associated with your system. Dimensional drawings are available through the Waterous Service department.

## Determining Panel and Plate Locations

Use the following guidelines to determine a location to mount the control panel and instruction plate:

- Consider the wire harness and hose routing.
- Consider accessibility during operation and maintenance.
- Install instruction plates near their applicable operator panels.

## Determining Hose Routing

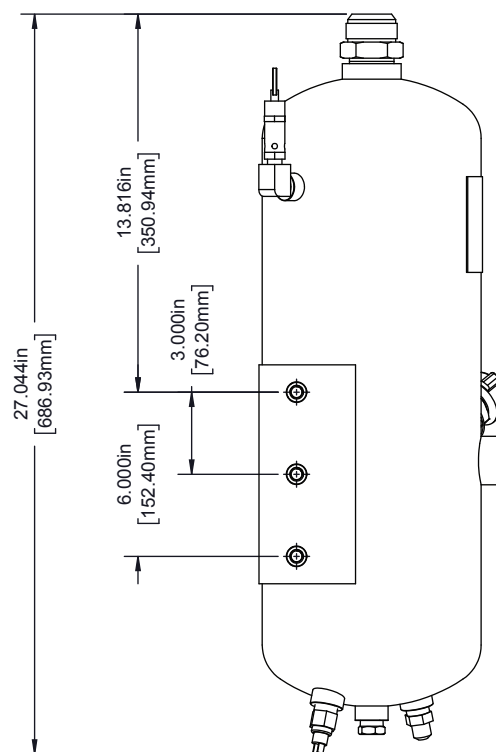
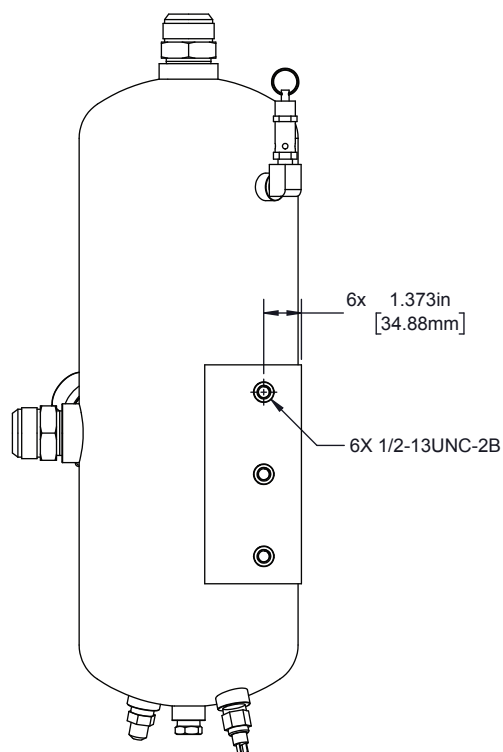
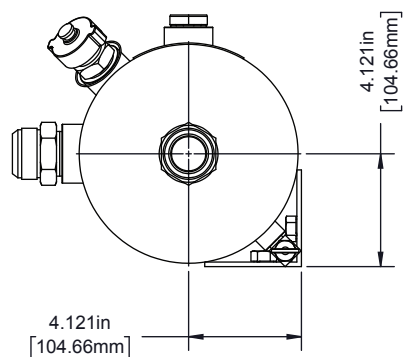
Use the following guidelines when routing the hoses:

- Route hoses in a straight line whenever possible.
- Do not pinch or kink hoses.
- Do not secure hoses to moving parts.
- Do not secure hoses near excessive heat.

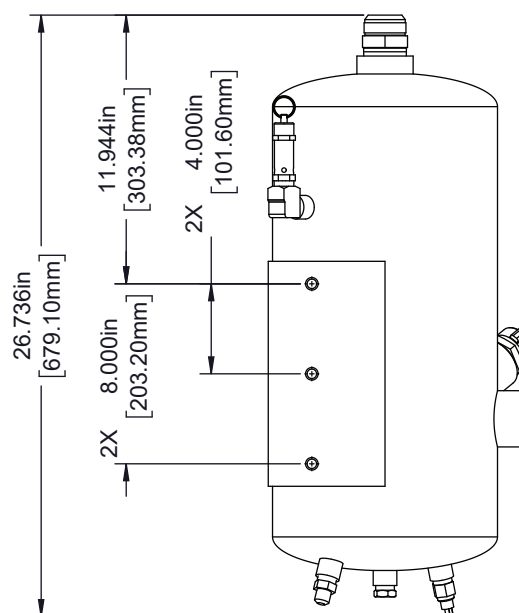
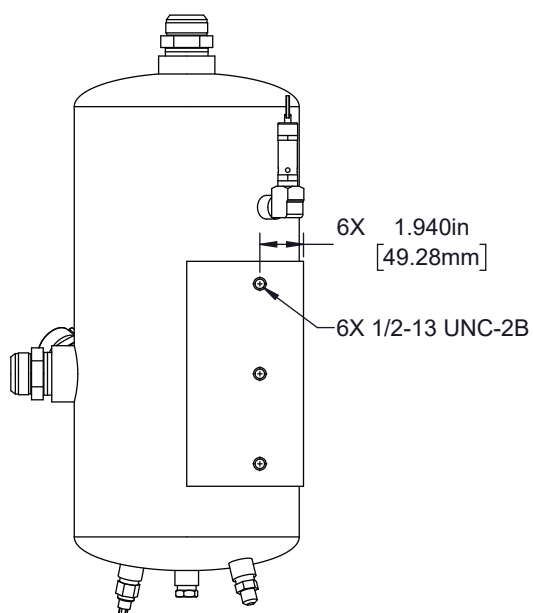
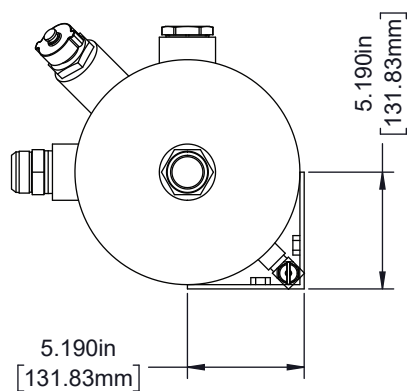
## Determining Cable and Wire Routing

Use the *Wiring Best Practices* document, available at [www.waterousco.com](http://www.waterousco.com), as a guide to select and route wiring for your application.

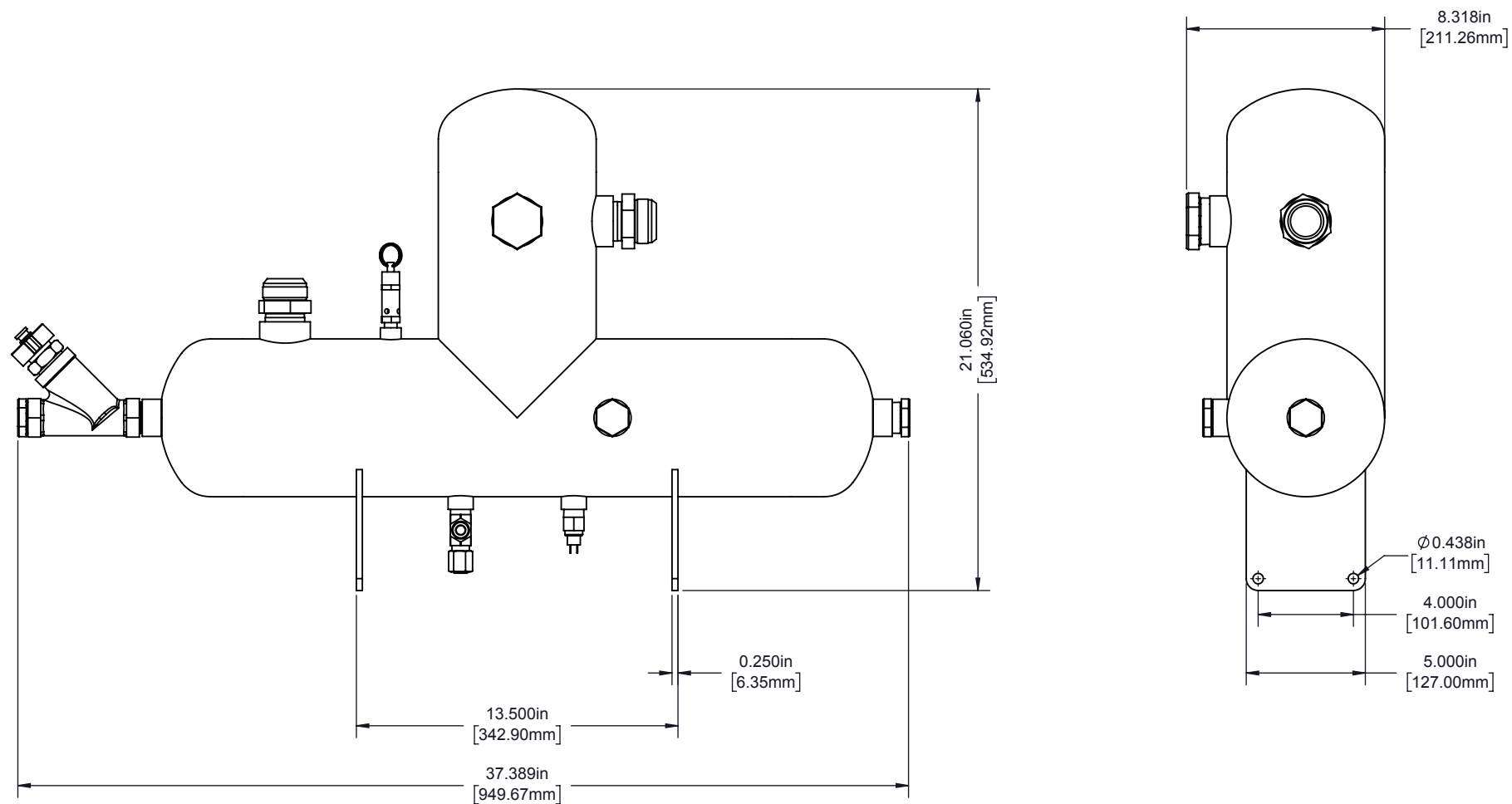
## Dimensions—Sump, 8-Inch Long Version



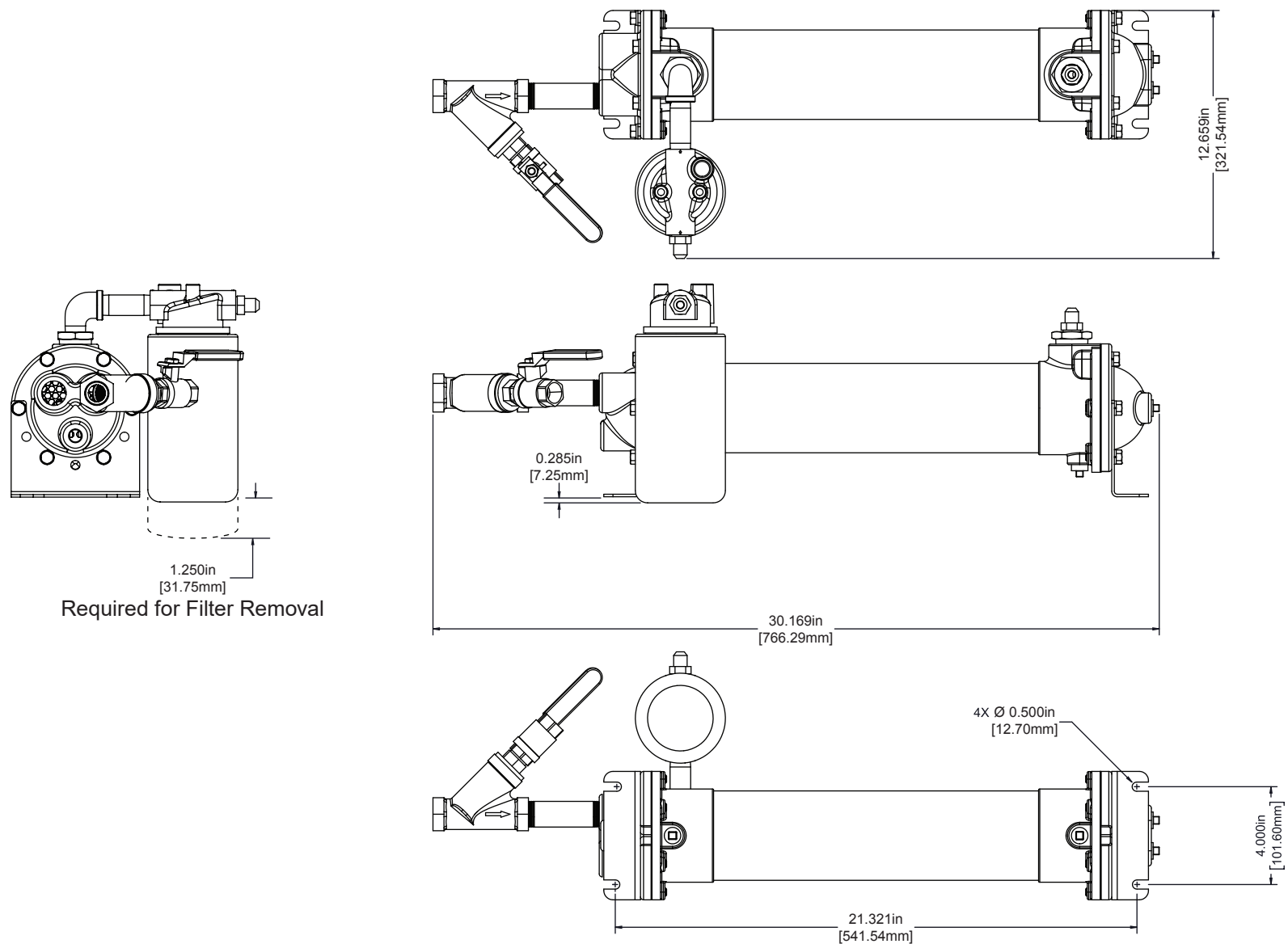
## Dimensions—Sump, 10-Inch Version



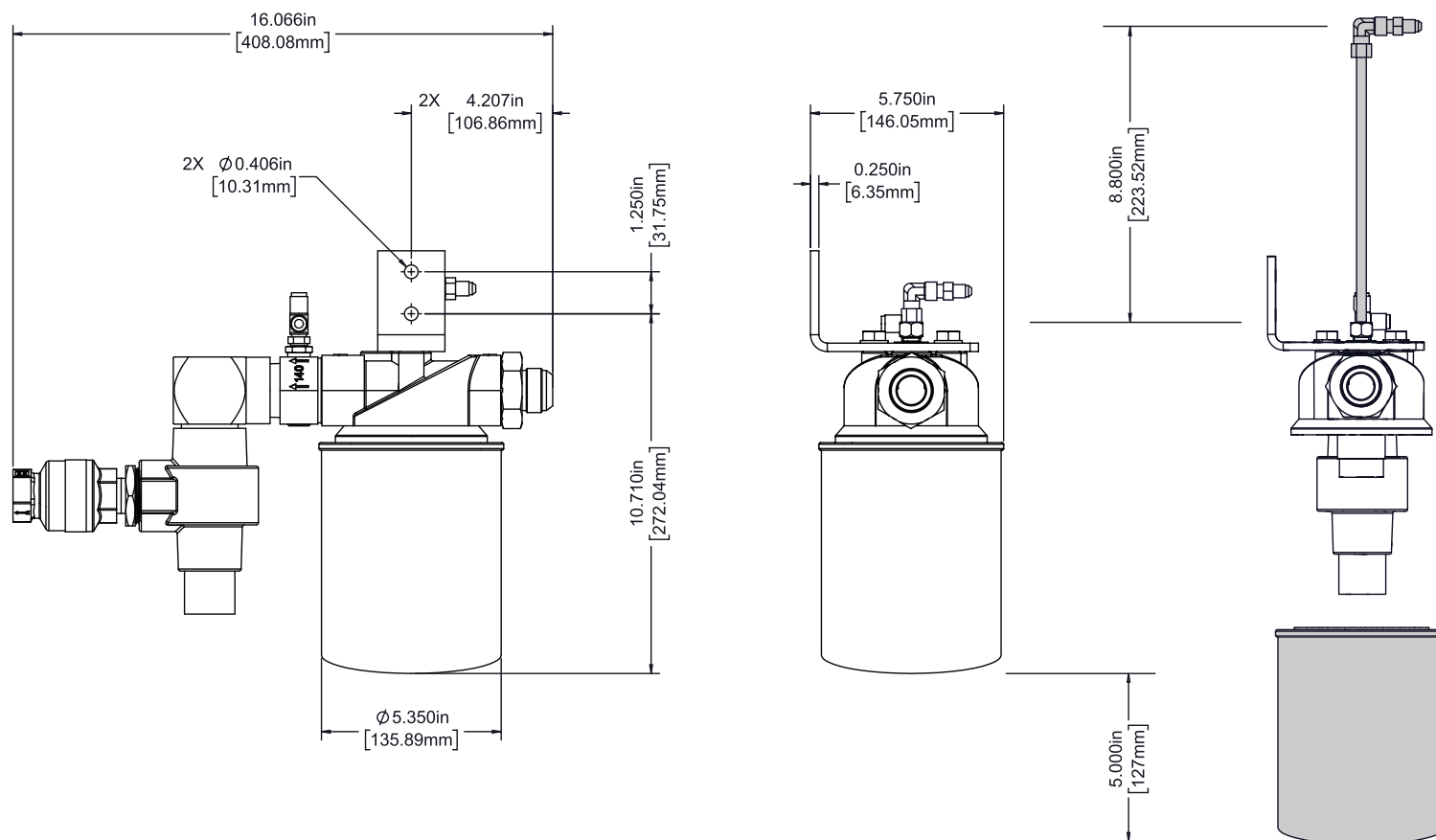
## Dimensions—Tee Sump



## Dimensions—Oil Cooler, 150-P

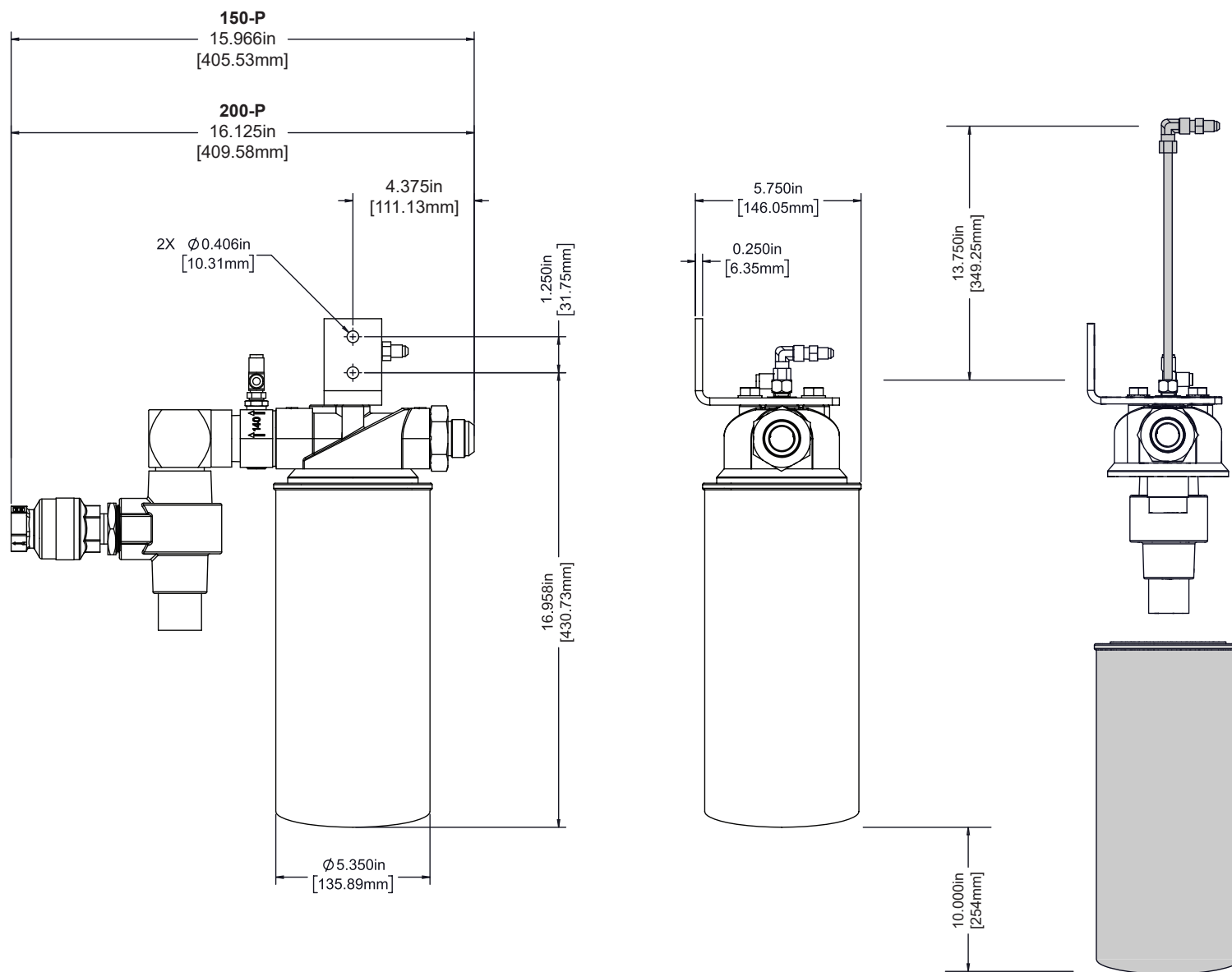


## Dimensions—Separator Filter, 100-P and 120-P

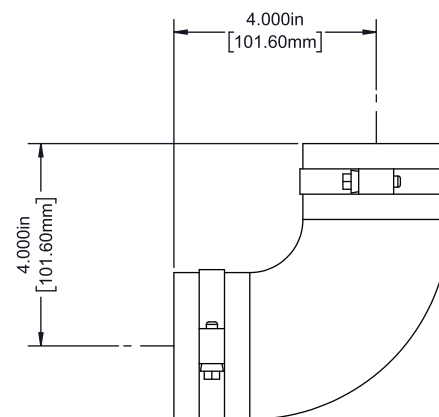
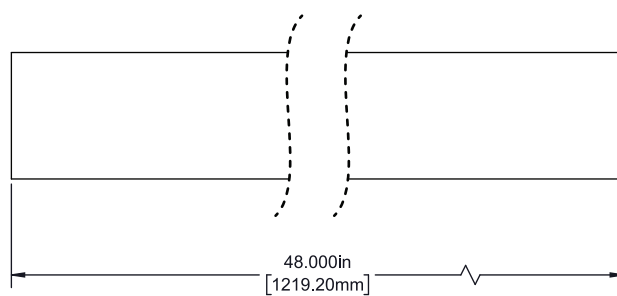
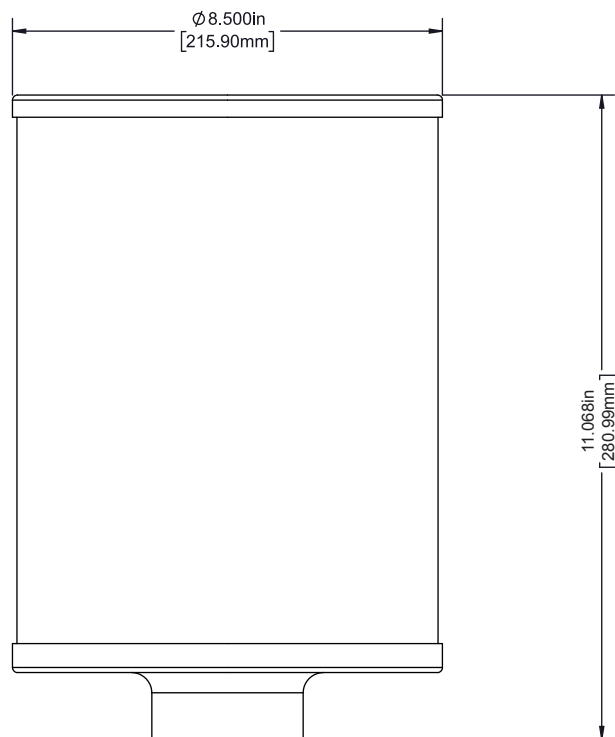




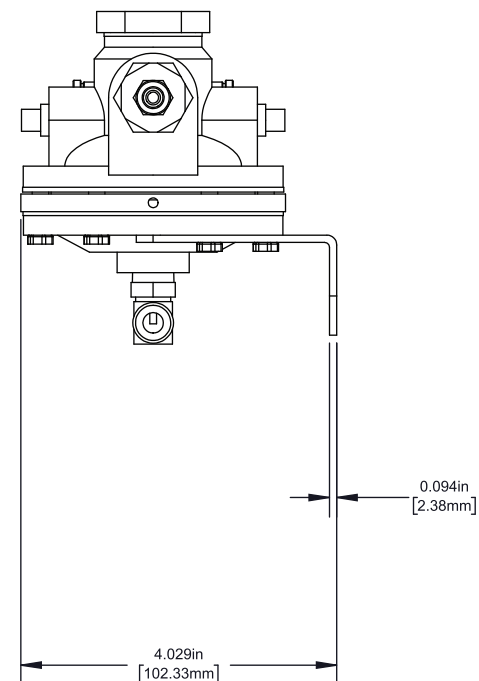
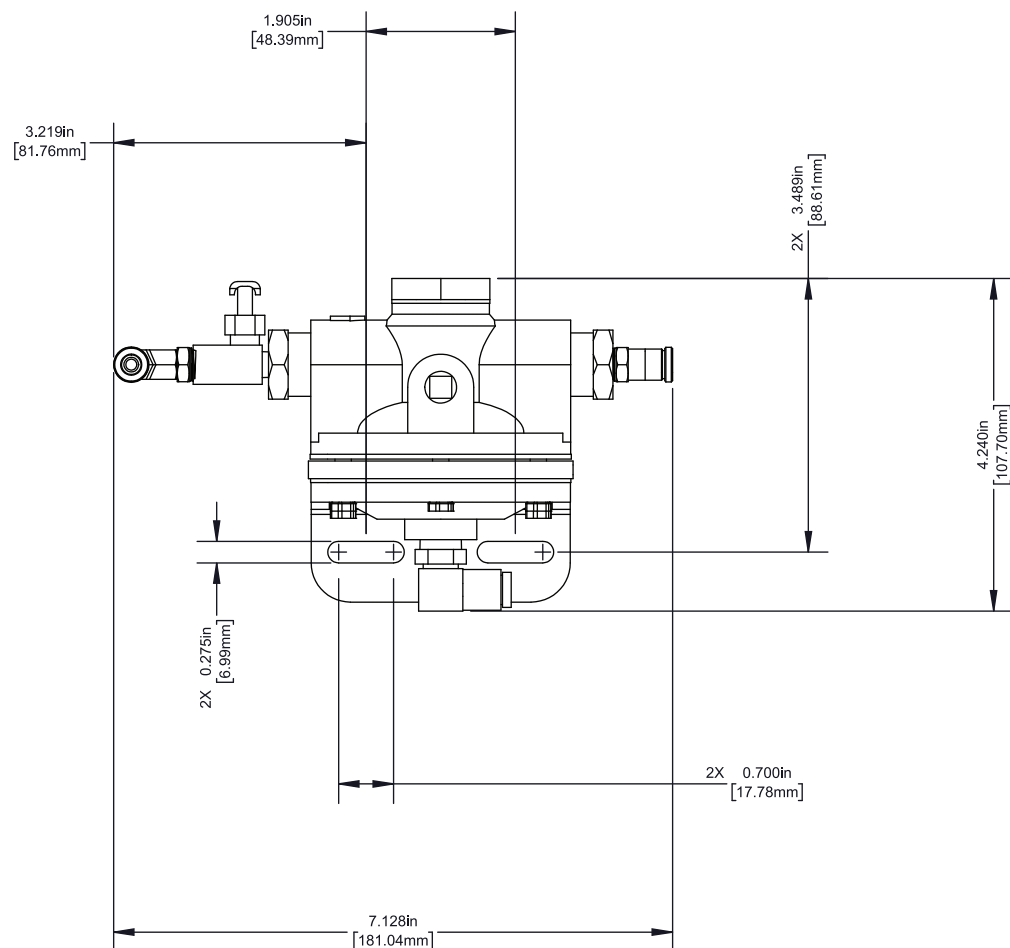
## Dimensions—Separator Filter, 150-P and 200-P



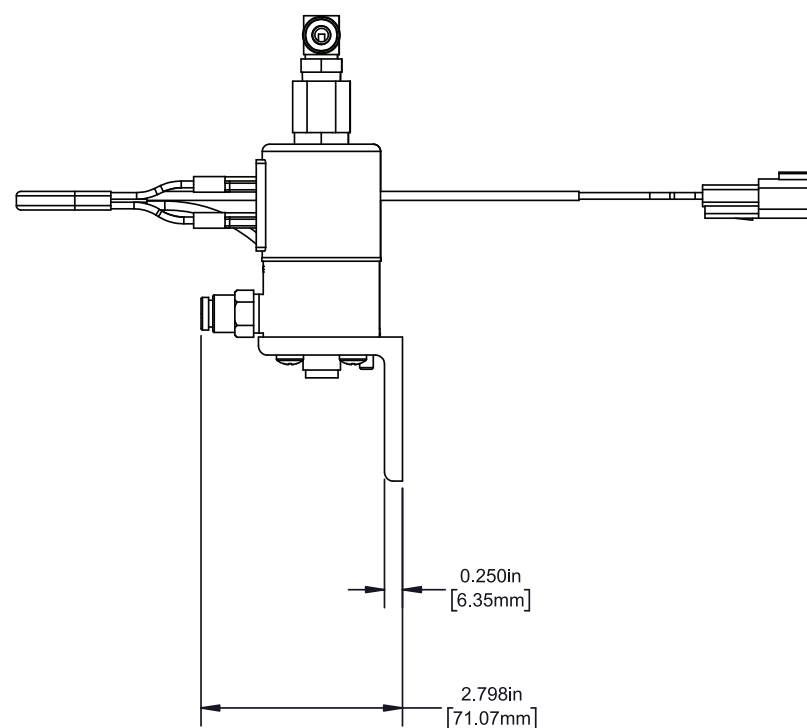
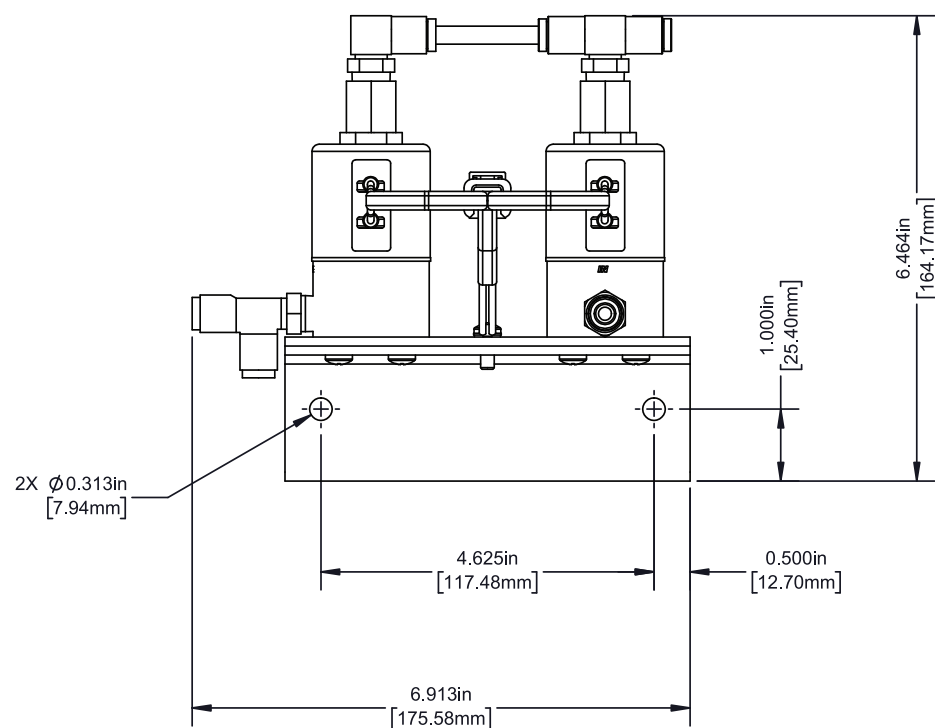
## Dimensions—Air Intake Components; 100-P, 150-P, and 200-P



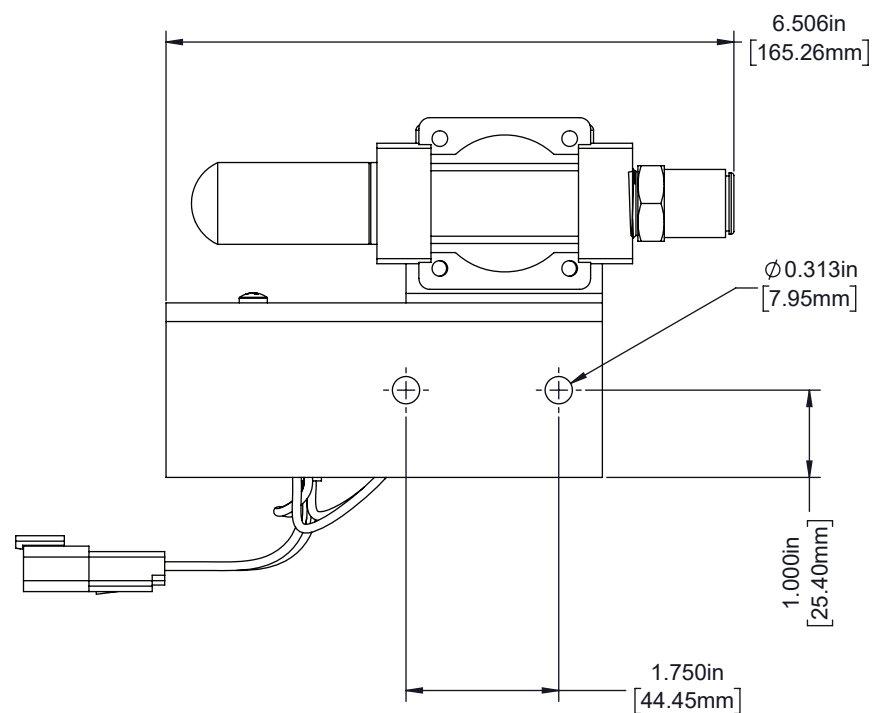
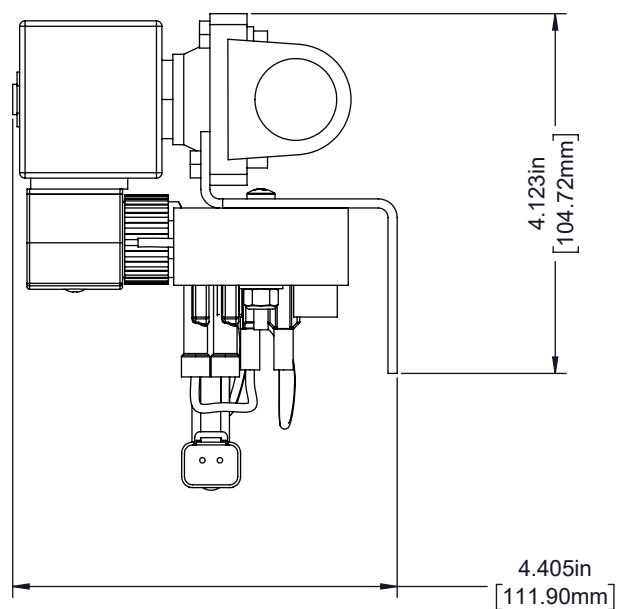
## Dimensions—Balance Valve



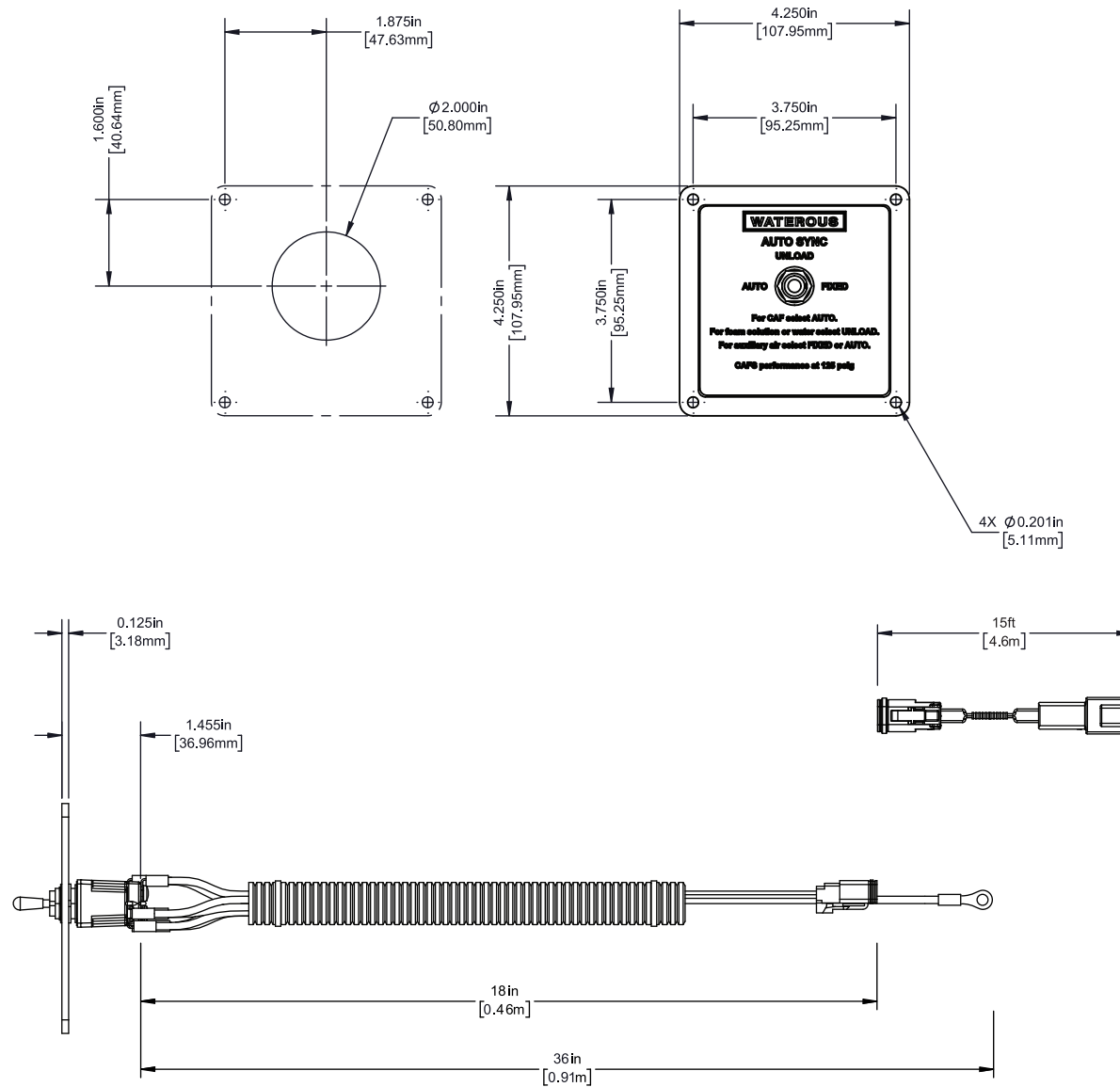
## Dimensions—Auto-Sync Solenoid Assembly



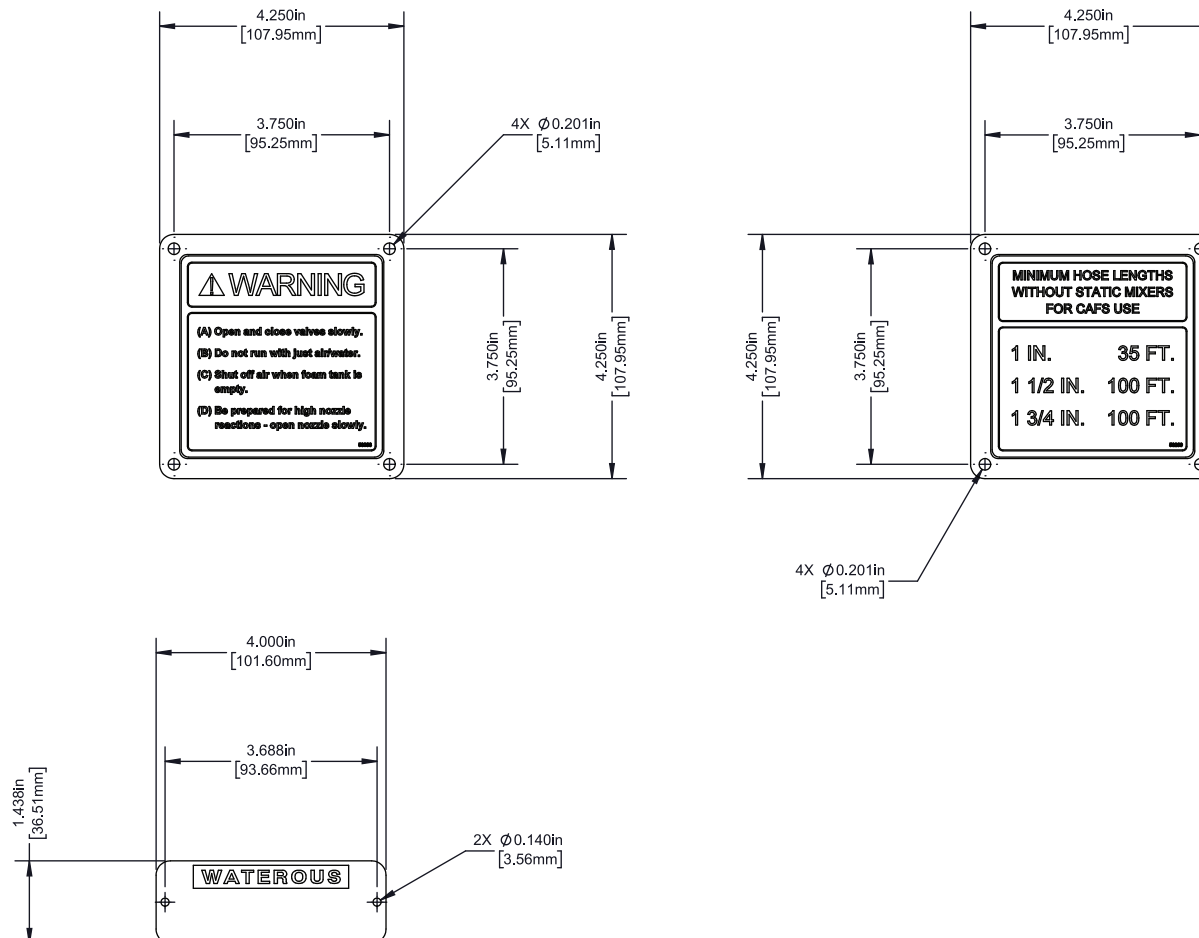
## Dimensions—Optional Sump Vent Assembly



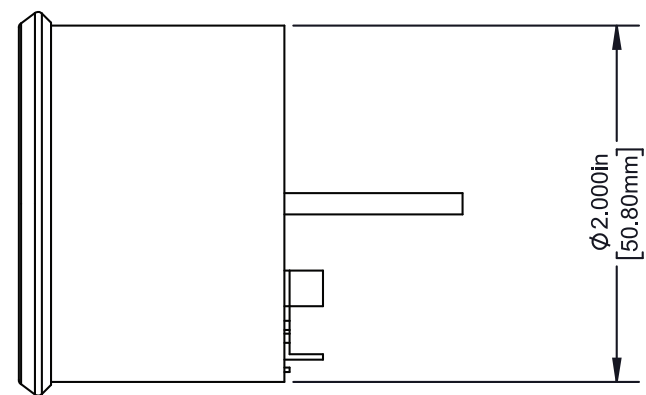
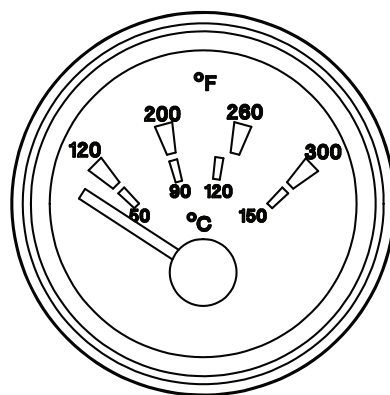
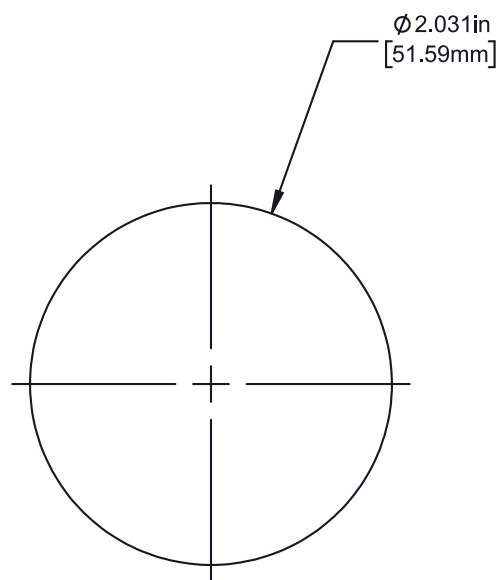
## Dimensions—Auto-Sync Switch



## Dimensions—Warning, Instruction, and Serial Plates



## Dimensions—Temperature Gauge





## Notes

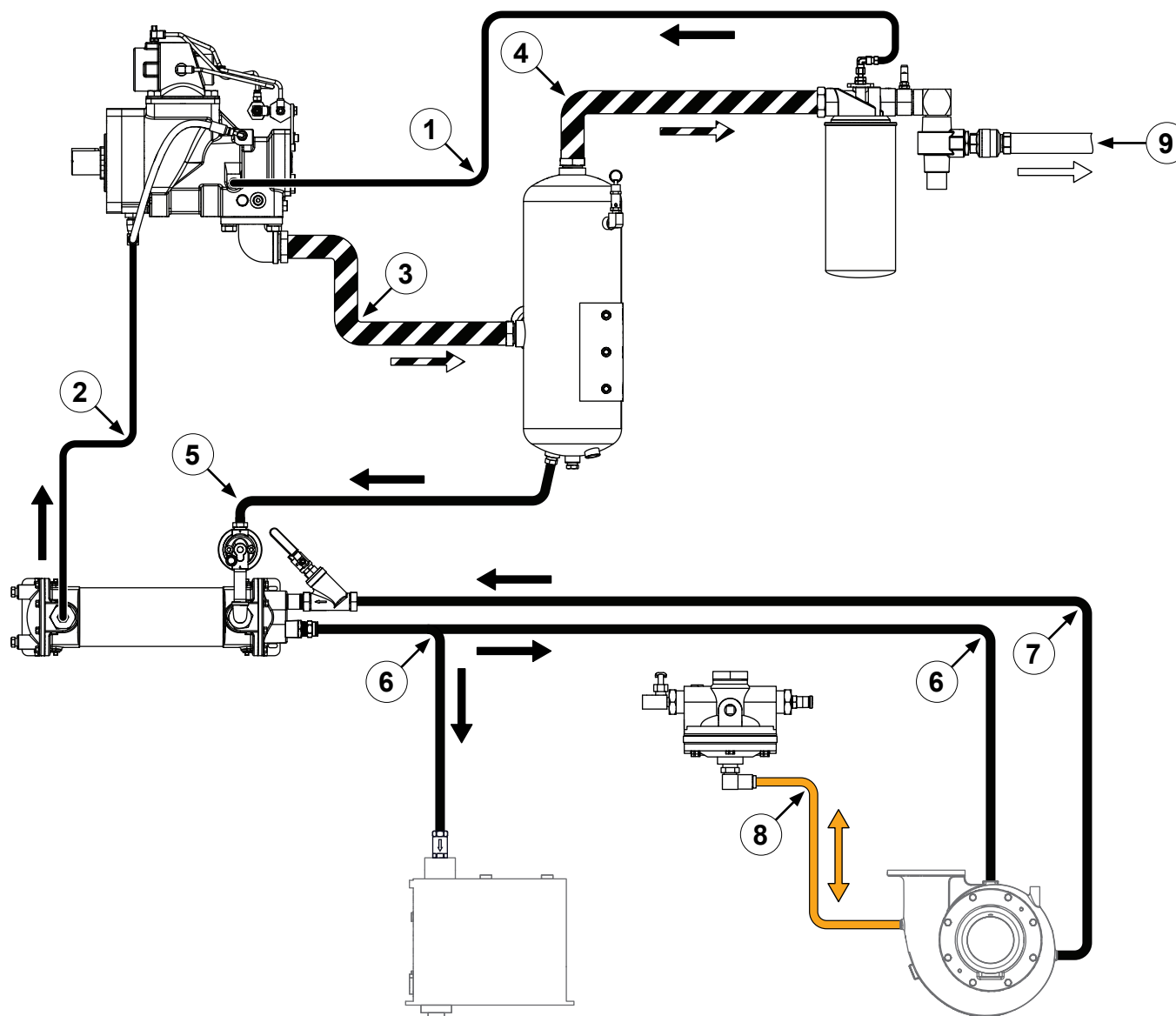


## Pneumatic Connections—Overview

	Feature	Description
1	Compressed air line	This line is a black air brake tube that routes compressed air from the auto-sync solenoid assembly to the pressure gauge.
2	Compressed air line	This line is a black air brake tube that routes compressed air from the balance valve to the auto-sync solenoid assembly.
3	Compressed air line	This line is a black air brake tube that routes compressed air from the air/oil separator filter to the balance valve.
4	Balanced air line	This line is a yellow air brake tube that routes balanced air from the balance valve to the auto-sync solenoid assembly.
5	Regulated air line	This line is a red air brake tube that routes regulated air from the auto-sync solenoid assembly to the PMC.
6	Compressed air line	This line is a black air brake tube that routes compressed air from the air/oil separator filter to the PMC.
7	Regulated air line	This line is a red air brake tube that routes regulated air from the PMC to the air inlet assembly.
8	Bleed-off line	This line is a green air brake tube that routes air from the PMC to the air inlet assembly.
9	Regulated air line	This line is a red air brake tube that routes regulated air from the PMC to the air inlet trim valve.
10	Blow-down line	This line is a blue air brake tube that routes compressed air from the PMC to the air inlet assembly.

## Hose Connections Overview—150-P

Use the illustration to plan the hose routing for the apparatus. Contact Watrous for more information about available hose and fitting kits.

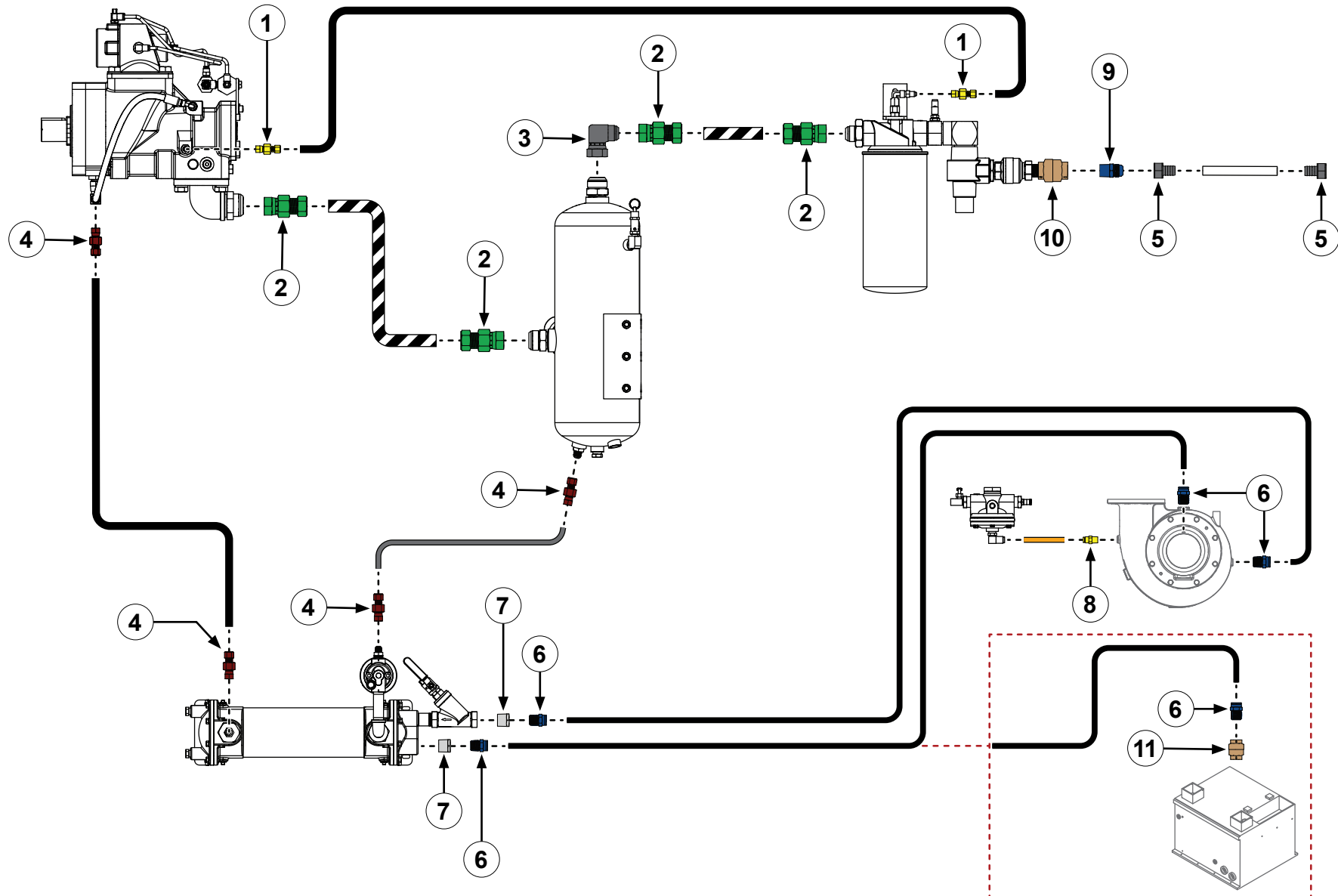


## Hose Connections Overview—150-P

Feature		Description
1	Oil scavenger return hose	This routes oil from the scavenger port on the separator filter to the compressor—1/4 inch hydraulic hose.
2	Oil cooler hose	This routes oil from the oil cooler to the compressor—1/2 inch hydraulic hose.
3	Compressed air hose	This routes compressed air from the compressor to the sump—1-3/8 inch hydraulic hose.
4	Compressed air hose	This routes compressed air from the sump to the separator filter—1-3/8 inch hydraulic hose.
5	Oil cooler hose	This routes oil from the sump to the oil cooler—1/2 inch hydraulic hose.
6	Cooler return hose	This routes water from the oil cooler to the pump inlet or water tank—5/8 inch black air brake tubing.
7	Cooler supply hose	This routes water from the pump to the oil cooler—5/8 inch black air brake tubing.
8	Balance valve hose	This routes water between the pump discharge and the balance valve—1/4 inch orange air brake tubing.
9	Compressed air output	This routes compressed air to the air manifold—3/4 inch push-on hose.

## Fittings Overview—150-P

Use the illustration to plan the hose routing for the apparatus. Contact Watrous for more information about available hose and fitting kits.



## Fittings Overview—150-P

Feature		Description
1	Hose fitting	This is for a 1/4 inch hose—#4 FJIC.
2	Hose fitting	This is for a 1-3/8 inch hose—#24 FJIC.
3	90° adapter fitting	This is a #24 MJIC x #24 FJIC.
4	Hose fitting	This is for a 1/2 inch hose—#8 FJIC.
5	Push-on hose fitting	This is for a 3/4 inch hose—#12 FJIC.
6	Hose fitting	This is for a 5/8 inch hose—1/2 MNPT.
7	Reducer bushing	This is a 1 MNPT x 1/2 FNPT.
8	Hose fitting	This is a 1/4 MNPT x 1/4 AB.
9	Straight adapter	This is a 3/4 MNPT x #12 MJIC.
10	Check valve	This prevents compressed air from flowing backwards—3/4 inch.
11	Check valve	This prevents water from flowing backwards—the check valve is installer-supplied and the size is dependent on your application.

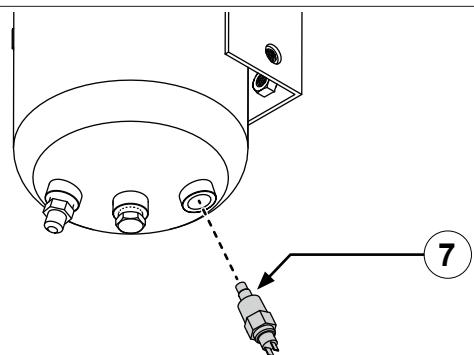
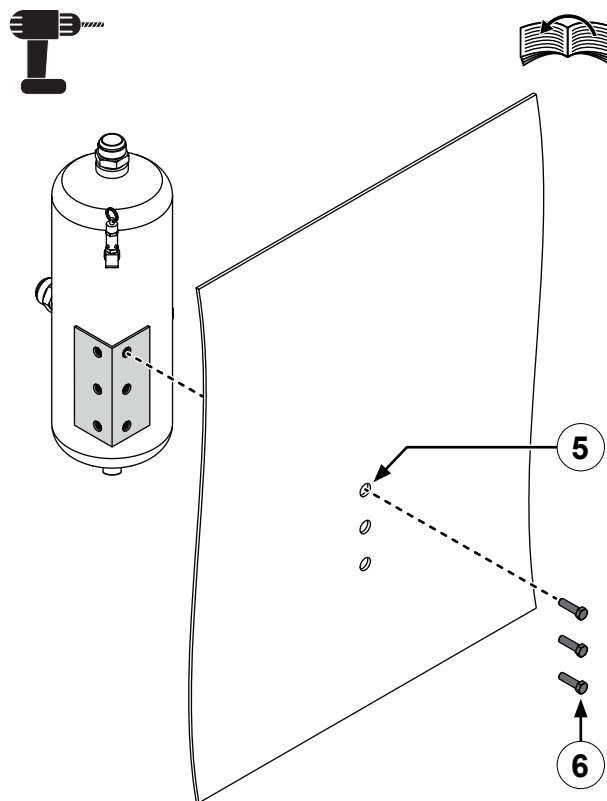
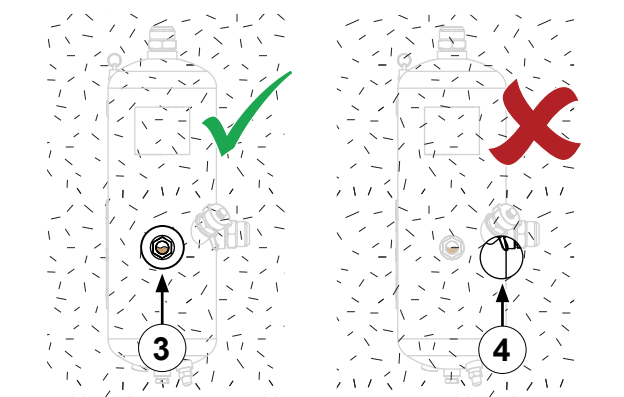
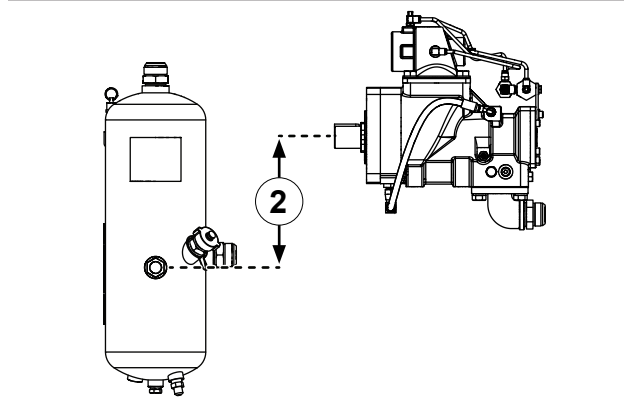
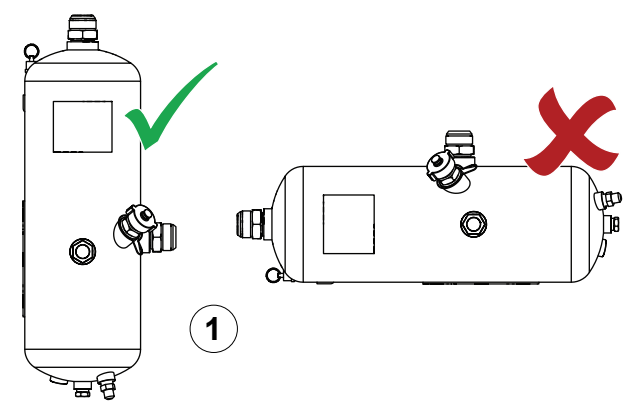




## Temperature Gauge and Sender Connections Overview

Feature	Description
1 Power and ignition	The temperature gauge and sender are powered by the apparatus and enabled by the ignition.
2 Warning light	This is installed on the operator panel and illuminates when the oil in the sump reaches a predetermined temperature—the light and wiring are installer-supplied.
3 Temperature sender wire	This connects the small tab on the temperature sender to the warning light.
4 Temperature sender	This reacts when the oil temperature in the sump reaches a predetermined temperature.
5 Bulb-power wire	This wire connects the light bulb in the temperature gauge to power.
6 Bulb-ground wire	This wire connects the light bulb in the temperature gauge to frame ground.
7 Resistor—24 V only	This and a light bulb are provided and used with the 24 V system.
8 Temperature gauge power wire	This wire connects the temperature gauge to power.
9 Temperature gauge ground wire	This wire connects the temperature gauge to frame ground.
10 Temperature gauge	This displays the sump oil temperature.

## Installing the Oil Sump



Use the illustrations and instructions to install the oil sump.

**Note:** Make sure to install the sump so that it is easy to access. You must be able to perform regular maintenance and see into the sight window.

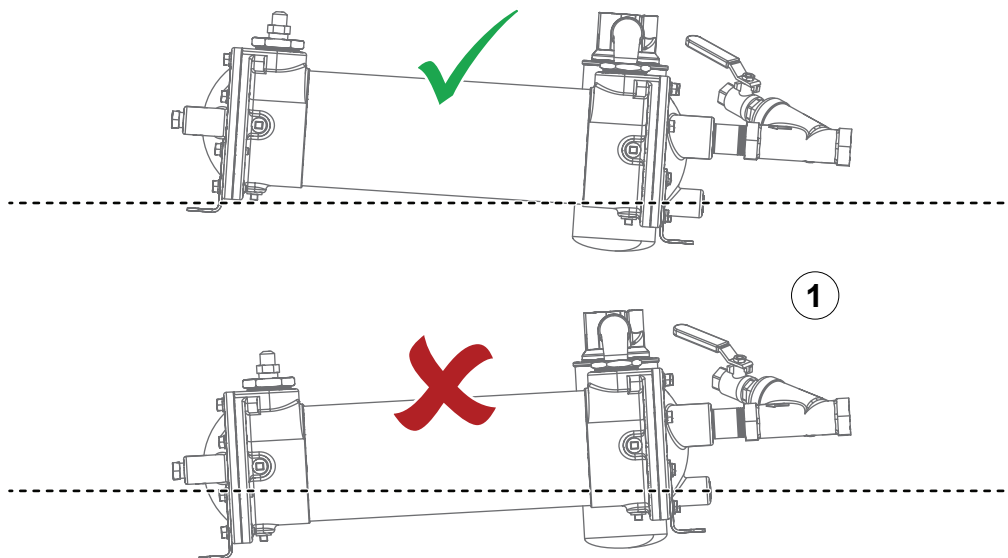
- 1 Install the sump with the oil drain toward the bottom to facilitate drainage.
- 2 Install the oil sump so that the sight window is below the top of the compressor.
- 3 Install the sump so that the sight window is clearly visible.
- 4 Make sure that the sight window is visible.

**Note:** If the sight window is not visible, premature damage can occur and will void your warranty.

- 5 Drill the mounting holes for the sump. Refer to: **"Dimensions—Sump, 8-Inch Long Version" on page 40.**
- 6 Use locally sourced hardware to secure the sump to the apparatus.
- 7 Install the temperature sender.

**Note:** The threads of the temperature sender are the ground connection for the sensor. Do not use thread tape on the threads. There must be continuity between the temperature sender and frame ground to complete installation.

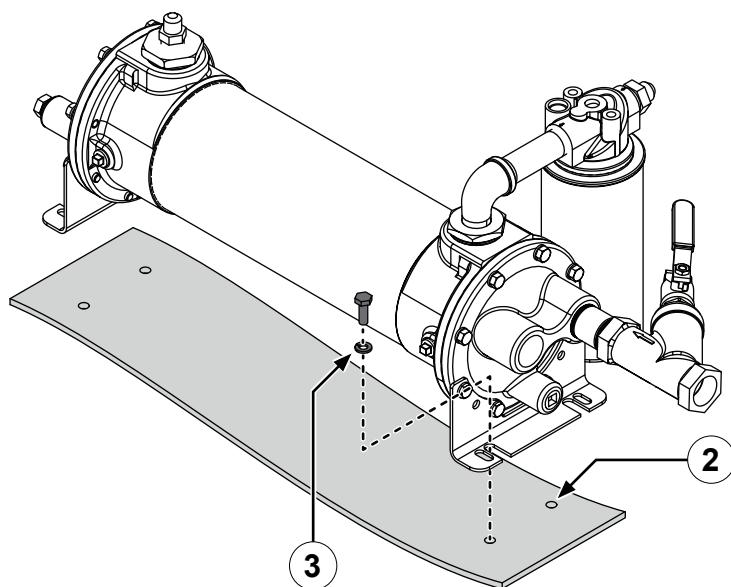
## Installing the Oil Cooler



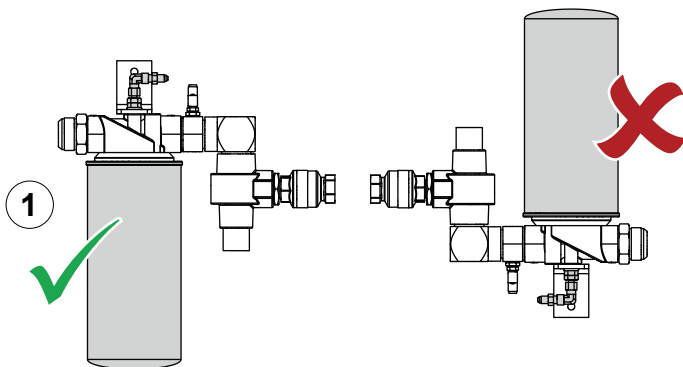
Use the illustrations and instructions to install the oil cooler.

**Note:** Make sure to install the oil cooler so that it is easy to access. You must be able to perform regular maintenance and drain the oil cooler to prevent freeze damage.

- 1 Install the oil cooler with the drain tilted slightly downward.
- 2 Drill the mounting holes for the oil cooler. Refer to: **"Dimensions—Oil Cooler, 150-P" on page 43.**
- 3 Use locally sourced hardware to secure the oil cooler to the apparatus.



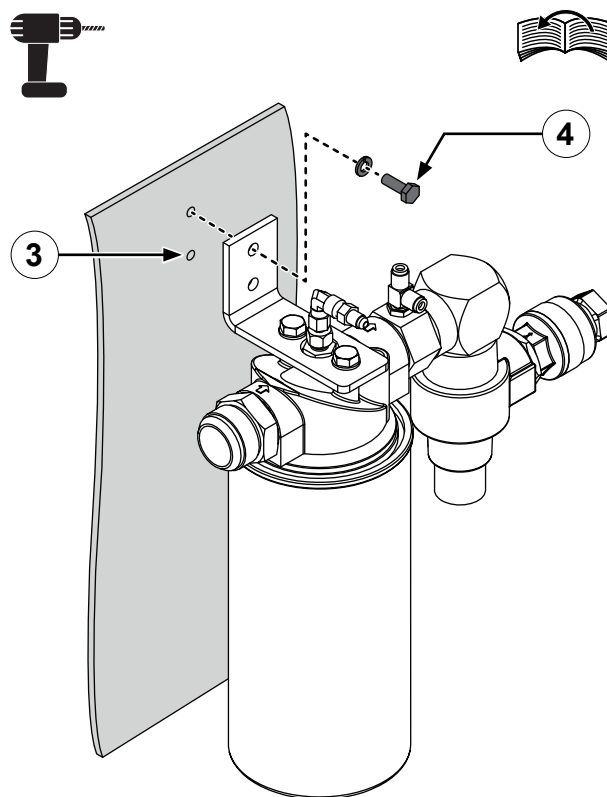
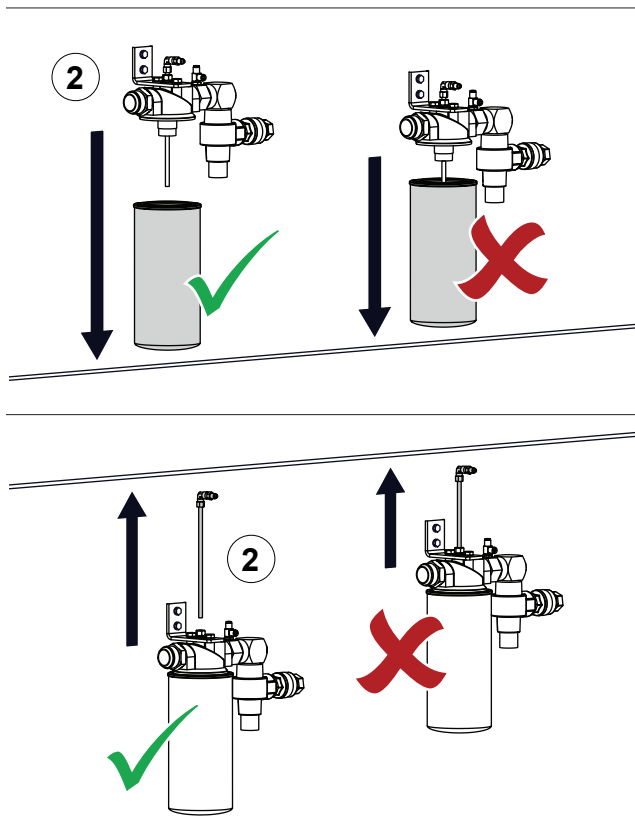
## Installing the Separator Filter



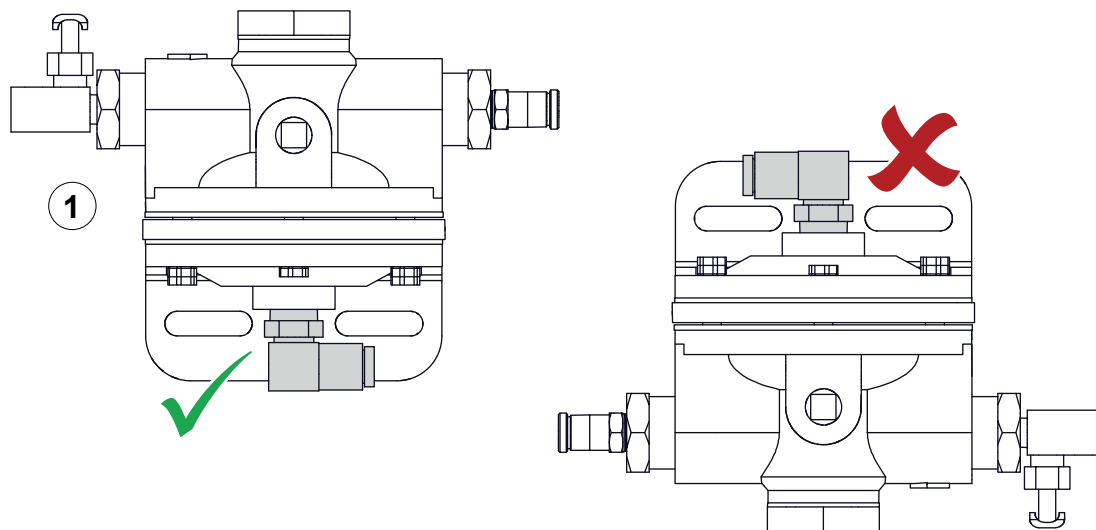
Use the illustrations and instructions to install the air/oil separator.

**Note:** Make sure to install the separator filter so that it is easy to access.

- 1 Install the separator filter with the filter toward the bottom.
- 2 For maintenance purposes, make sure that you can either remove the filter or remove the scavenger tube and then the filter.
- 3 Drill the mounting holes for the separator filter. Refer to: **"Dimensions—Separator Filter, 150-P and 200-P" on page 45.**
- 4 Use locally sourced hardware to secure the separator filter to the apparatus.



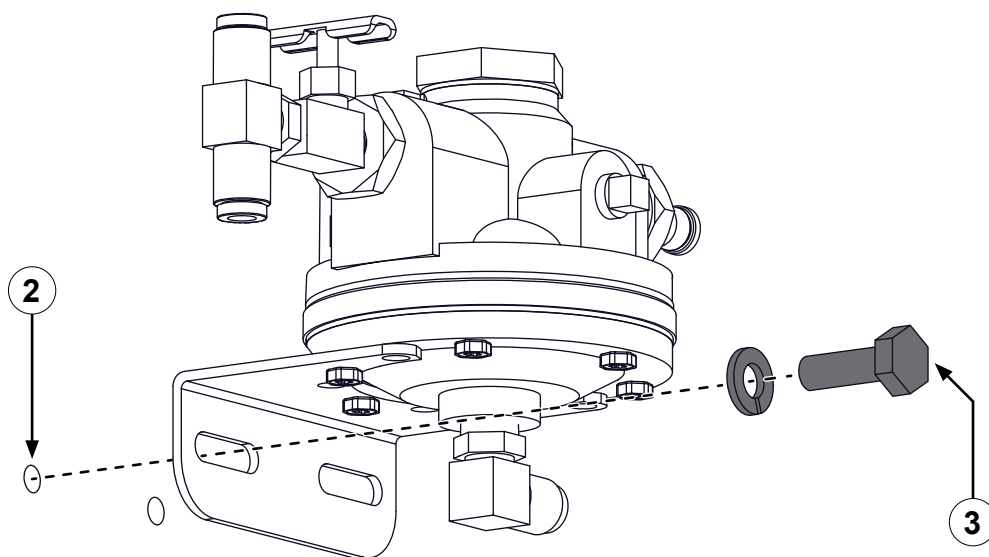
## Installing the Balance Valve



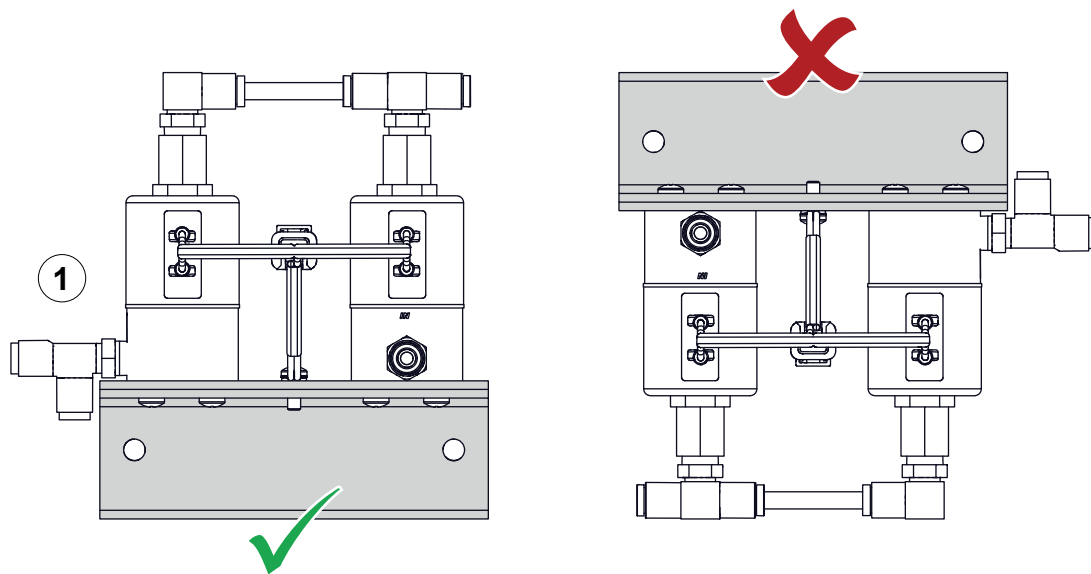
Use the illustrations and instructions to install the balance valve.

**Note:** Make sure to install the balance valve so that it is easy to access. Installing the balance valve where it is not able to be adjusted will void your warranty.

- 1 Install the balance valve with the trim valve handle toward the top.
- 2 Drill the mounting holes for the balance valve. Refer to: **"Dimensions—Balance Valve" on page 47.**
- 3 Use locally sourced hardware to secure the balance valve to the apparatus.

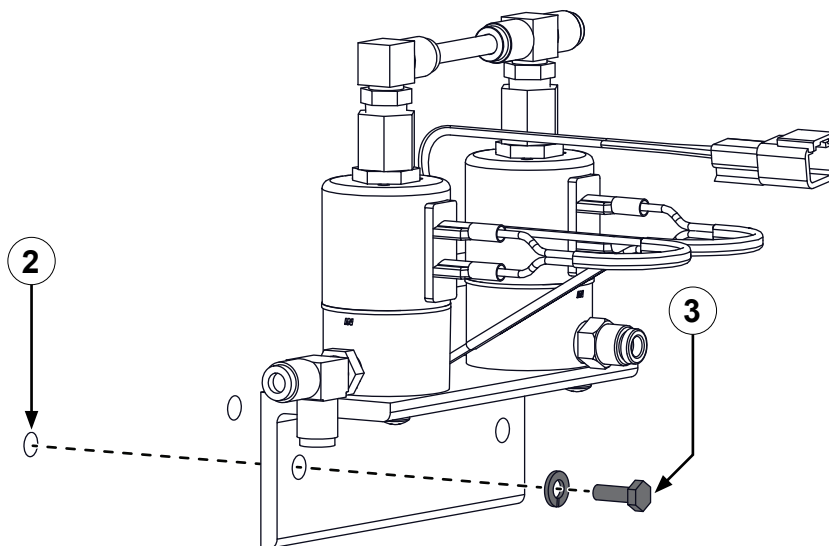


## Installing the Auto-Sync Solenoid Assembly

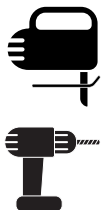


Use the illustrations and instructions to install the auto-sync solenoid assembly.

- 1 Install the auto-sync solenoid assembly with the mounting bracket toward the bottom.
- 2 Drill the mounting holes for the auto-sync solenoid assembly. Refer to: **"Dimensions—Auto-Sync Solenoid Assembly" on page 48.**
- 3 Use locally sourced hardware to secure the auto-sync solenoid assembly to the apparatus.



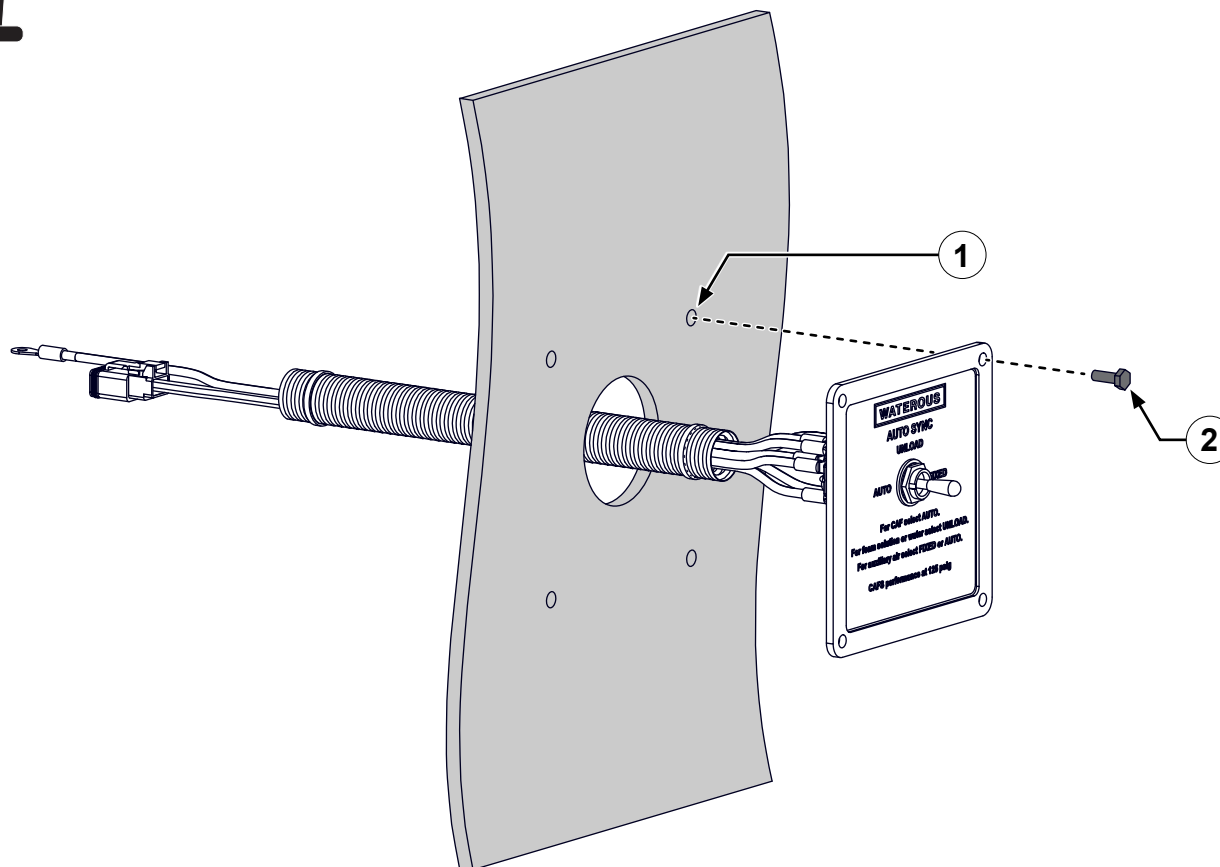
## Mounting the Auto-Sync Switch



Use the illustration and instructions to mount the auto-sync switch on the apparatus.

**Note:** Make sure to install the auto-sync switch so that it is easy to access.

- 1 Create the cutout and drill the mounting holes for the auto-sync switch. Refer to: **"Dimensions—Auto-Sync Switch" on page 50.**
- 2 Use locally sourced hardware to secure the auto-sync switch to the apparatus.







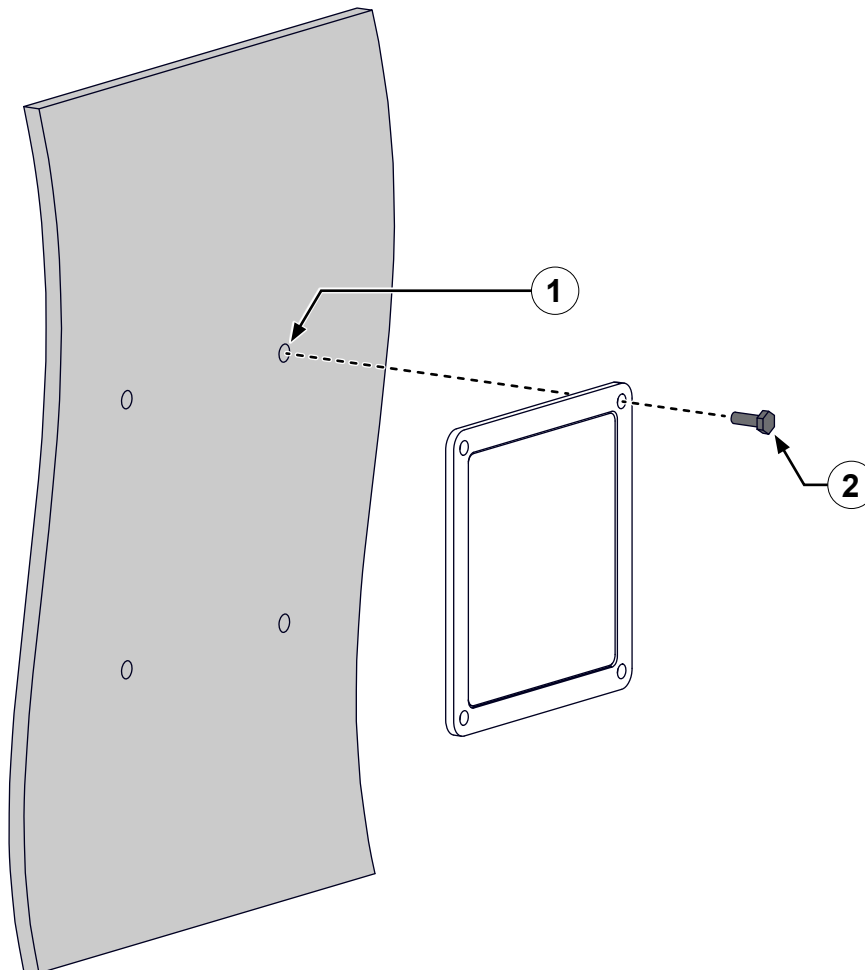
## Installing the Warning, Instruction, or Serial Plate



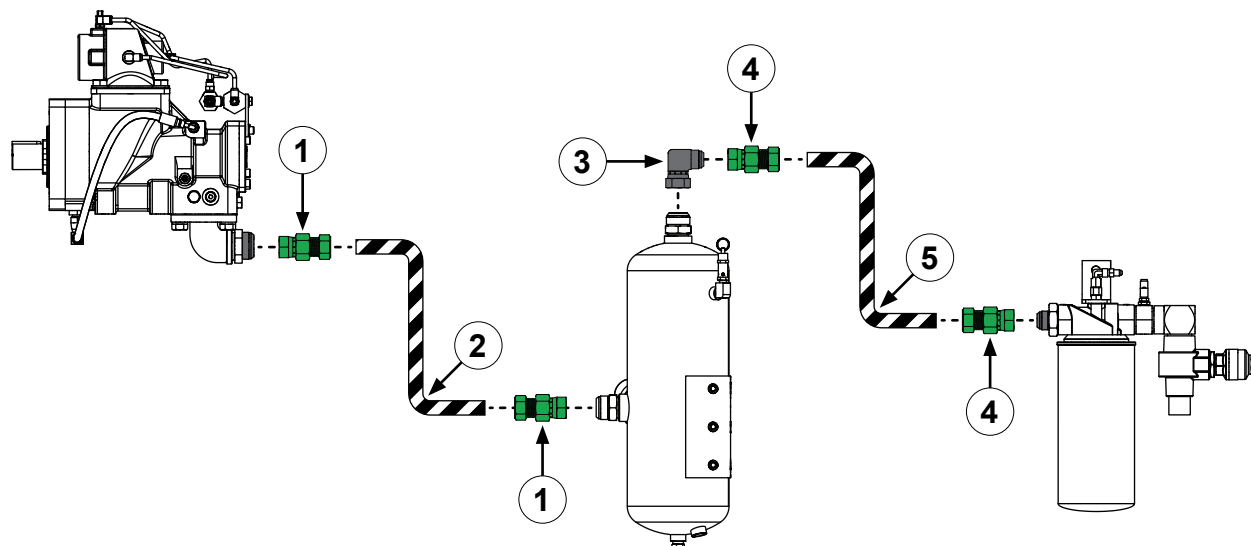
Use the illustration and instructions to mount the warning, instruction, and serial plates on the apparatus.

**Note:** Make sure to install the plates near the auto-sync switch.

- 1 Drill the mounting holes for the warning, instruction, and serial plates (when applicable) to the apparatus. Refer to: **"Dimensions—Warning, Instruction, and Serial Plates" on page 51.**
- 2 Use locally sourced hardware to secure the plates to the apparatus.



## Installing the Compressed Air Hoses—150-P



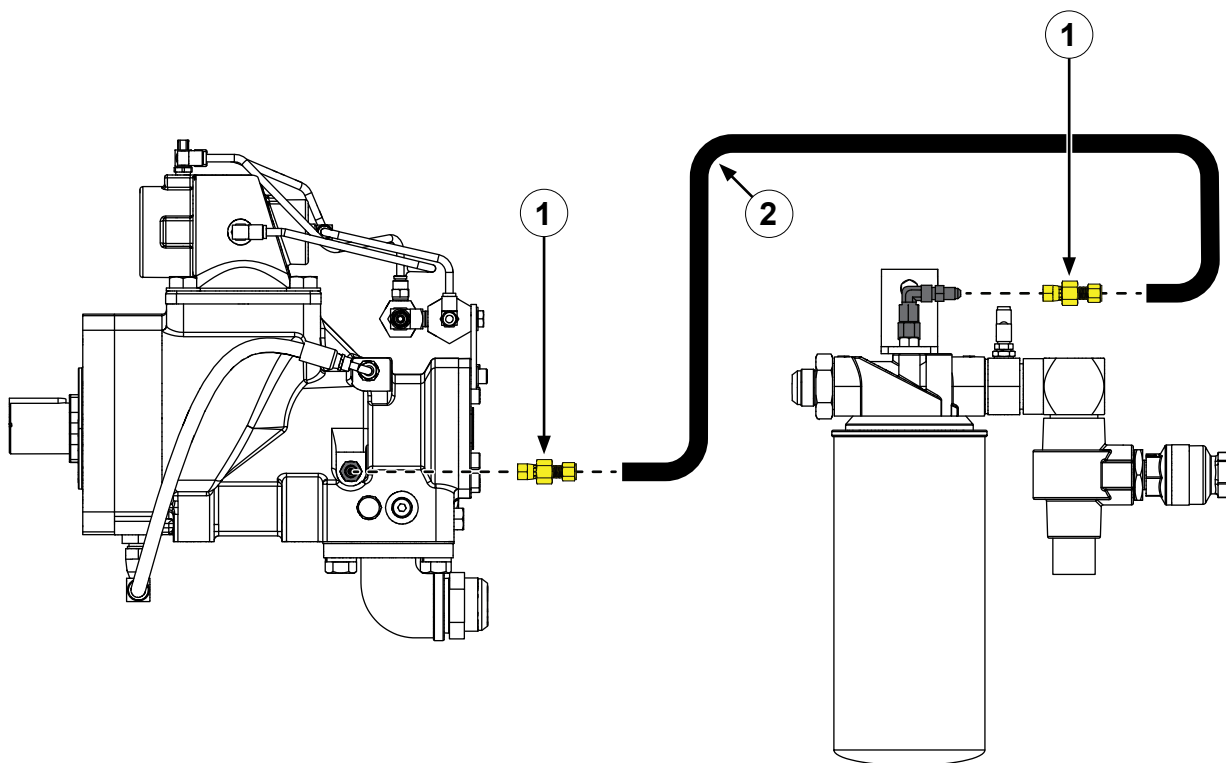
Use the illustration and instructions to install the compressed air hoses.

- 1 Install the fitting (#24 FJIC) onto the compressor and sump.
- 2 Install the 1-3/8 inch hydraulic hose into the fittings (#24 FJIC).
- 3 Install the 90° adapter (#24 MJIC x #24 FJIC) onto the sump.
- 4 Install the fitting (#24 FJIC) onto the sump and separator filter.
- 5 Install the 1-3/8 inch hydraulic hose into the fittings (#24 FJIC).

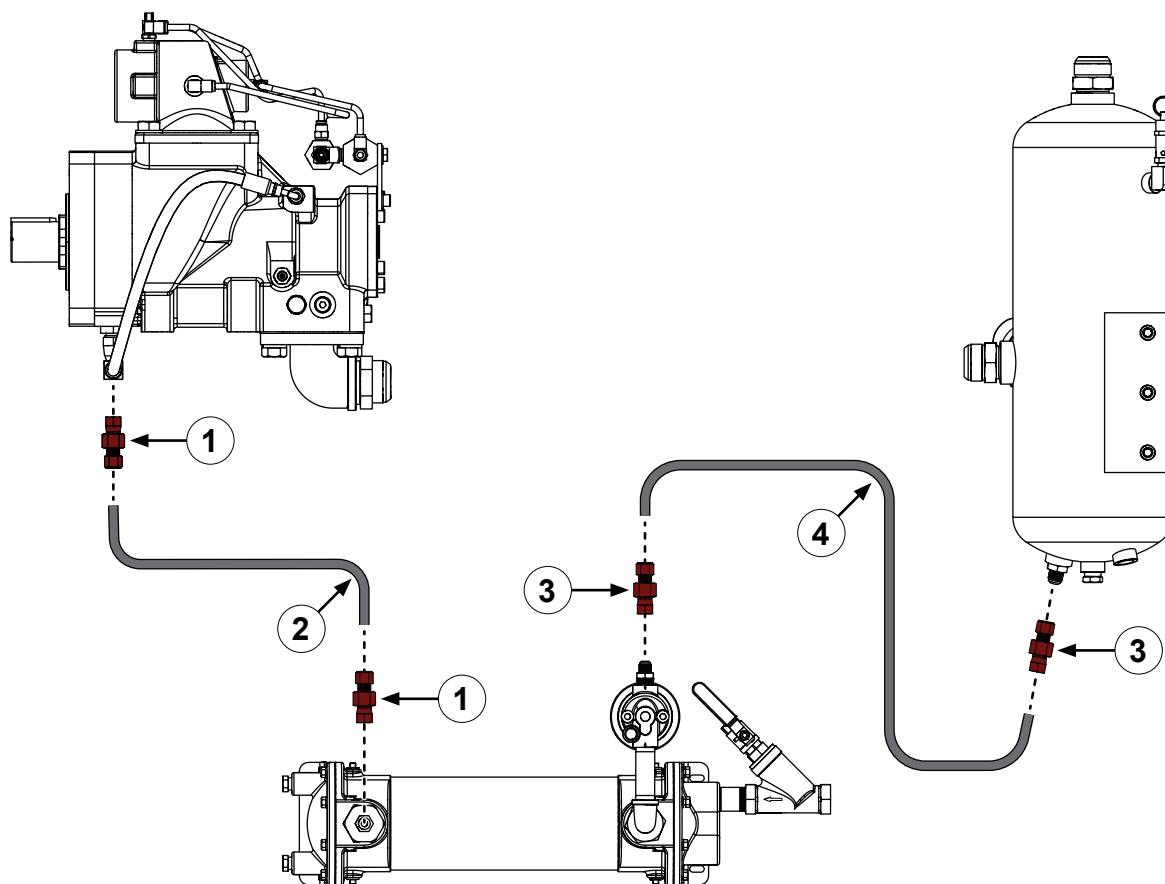
## Installing the Scavenge Oil Hose—150-P

Use the illustration and instructions to install the scavenge oil hose.

- 1 Install the fittings (#4 FJIC) onto the air compressor and separator filter.
- 2 Install the 1/4 inch hydraulic hose into the fittings (#4 FJIC).



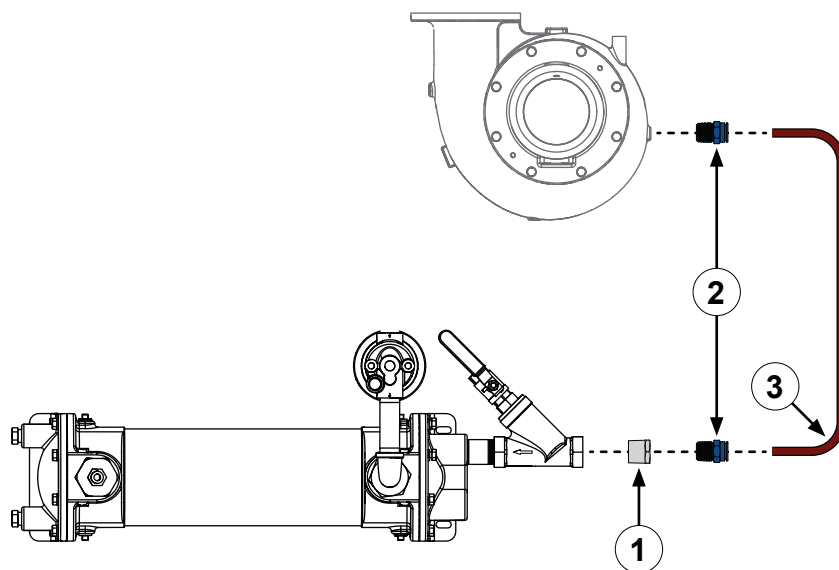
## Installing the Oil Cooler Hoses—Oil Hoses, 150-P



Use the illustration and instructions to install the oil hoses for the oil cooler.

- 1 Install the fittings (#8 FJIC) onto the compressor and oil cooler.
- 2 Install the 1/2 inch hydraulic hose into the fittings (#8 FJIC).
- 3 Install the fittings (#8 FJIC) onto the oil cooler and sump.
- 4 Install the 1/2 inch hydraulic hose into the fittings (#8 FJIC).

## Installing the Oil Cooler Hoses—Water Lines, 150-P



Use the illustrations and instructions to install the water lines for the oil cooler.

- 1 Install the reducer bushing (1 MNPT x 1/2 FNPT) into the wye fitting.
- 2 Install the straight fitting (1/2 MNPT x 5/8 AB) into the reducer bushings (1 MNPT x 1/2 FNPT) on the wye fitting and pump discharge port.

**Note:** Always connect to the first stage of a multistage pump or the low pressure outlet of an HL Series pump.

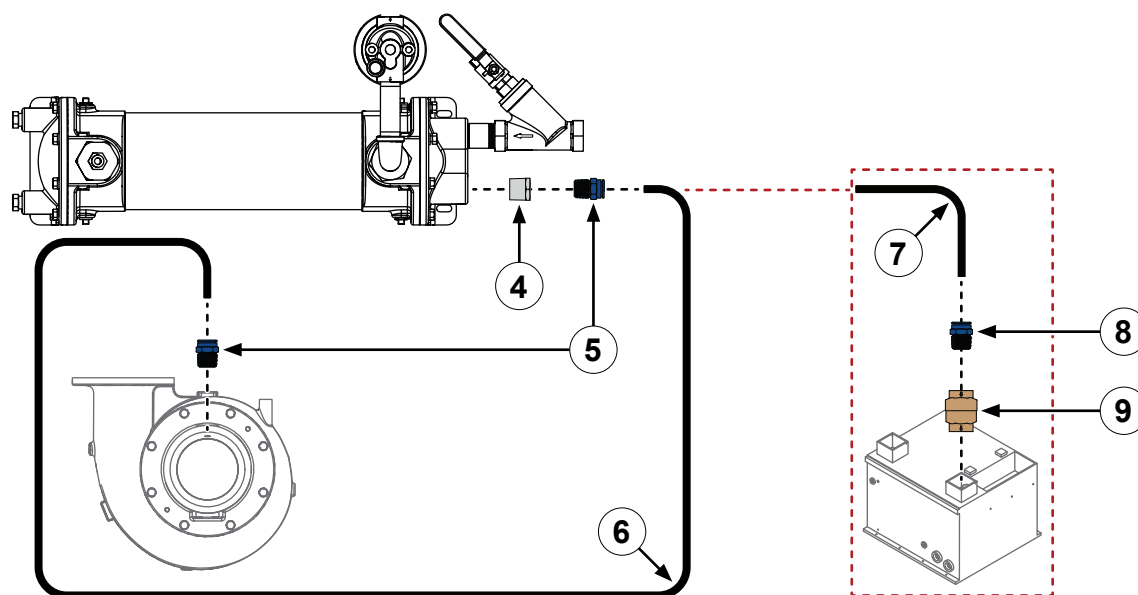
- 3 Install the air brake hose (5/8 inch, black) into the straight fittings (1/2 MNPT x 5/8 AB).
- 4 Install the reducer bushing (1 MNPT x 1/2 FNPT) into the oil cooler outlet port.
- 5 Install the straight fittings (1/2 MNPT x 5/8 AB) into the reducer bushing (1 MNPT x 1/2 FNPT) on the oil cooler outlet port and low-pressure port on the pump inlet.

- 6 Install the air brake hose (5/8 inch, black) into the straight fittings (1/2 MNPT x 5/8 AB).

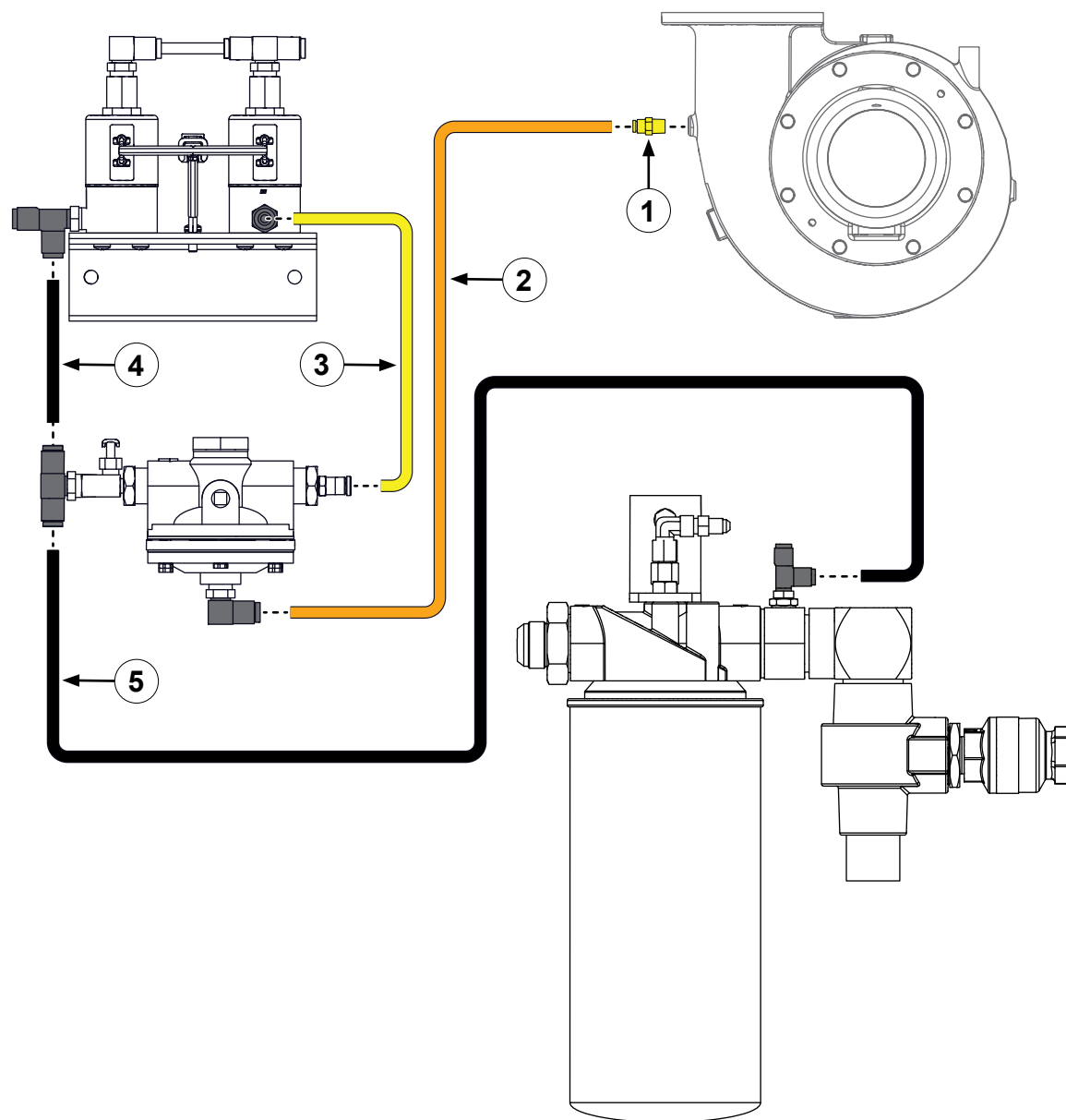
- 7 Alternatively, the hose can be routed to the main tank.

- 8 Install the straight fitting (1/2 MNPT x 5/8 AB) onto the air brake hose (5/8 inch, black).

- 9 Install the check valve (1/2 inch) onto the straight fitting (1/2 MNPT x 5/8 AB).



## Installing the Balance Valve Hoses



Use the illustration and instructions to install the balance valve hoses.

- 1 Install the fitting (1/4 MNPT x 1/4 AB) into a port on the high-pressure side of the pump.
- 2 Connect the orange air brake hose to the balance valve and a discharge port on the pump.

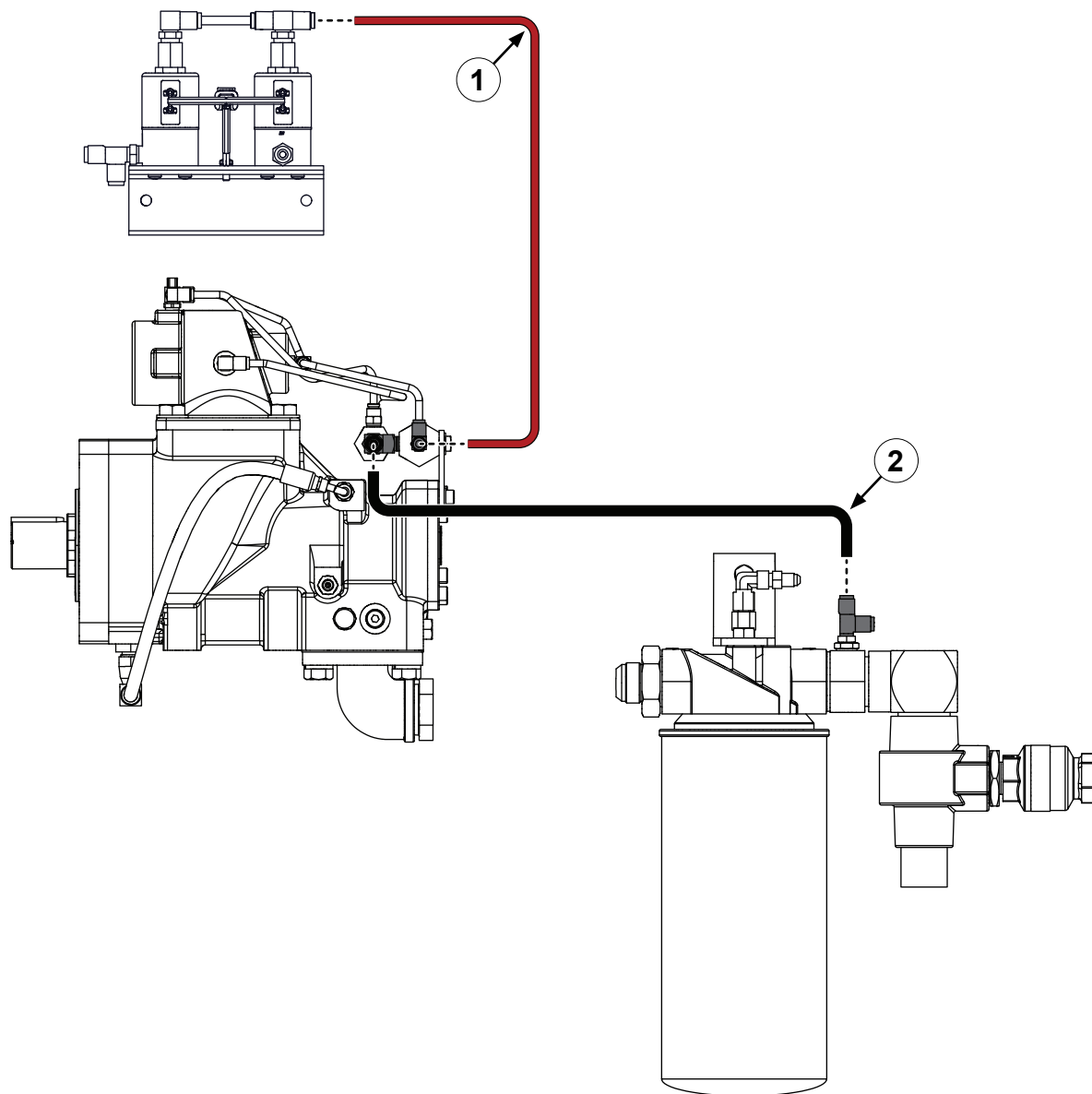
**Note:** Always connect to the first stage of a multistage pump or the low-pressure outlet of an HL Series pump.

- 3 Connect the yellow air brake hose to the balance valve and auto-sync solenoid assembly.
- 4 Connect the black air brake hose to the balance valve and auto-sync solenoid assembly.
- 5 Connect the black air brake hose to the balance valve and separator filter.

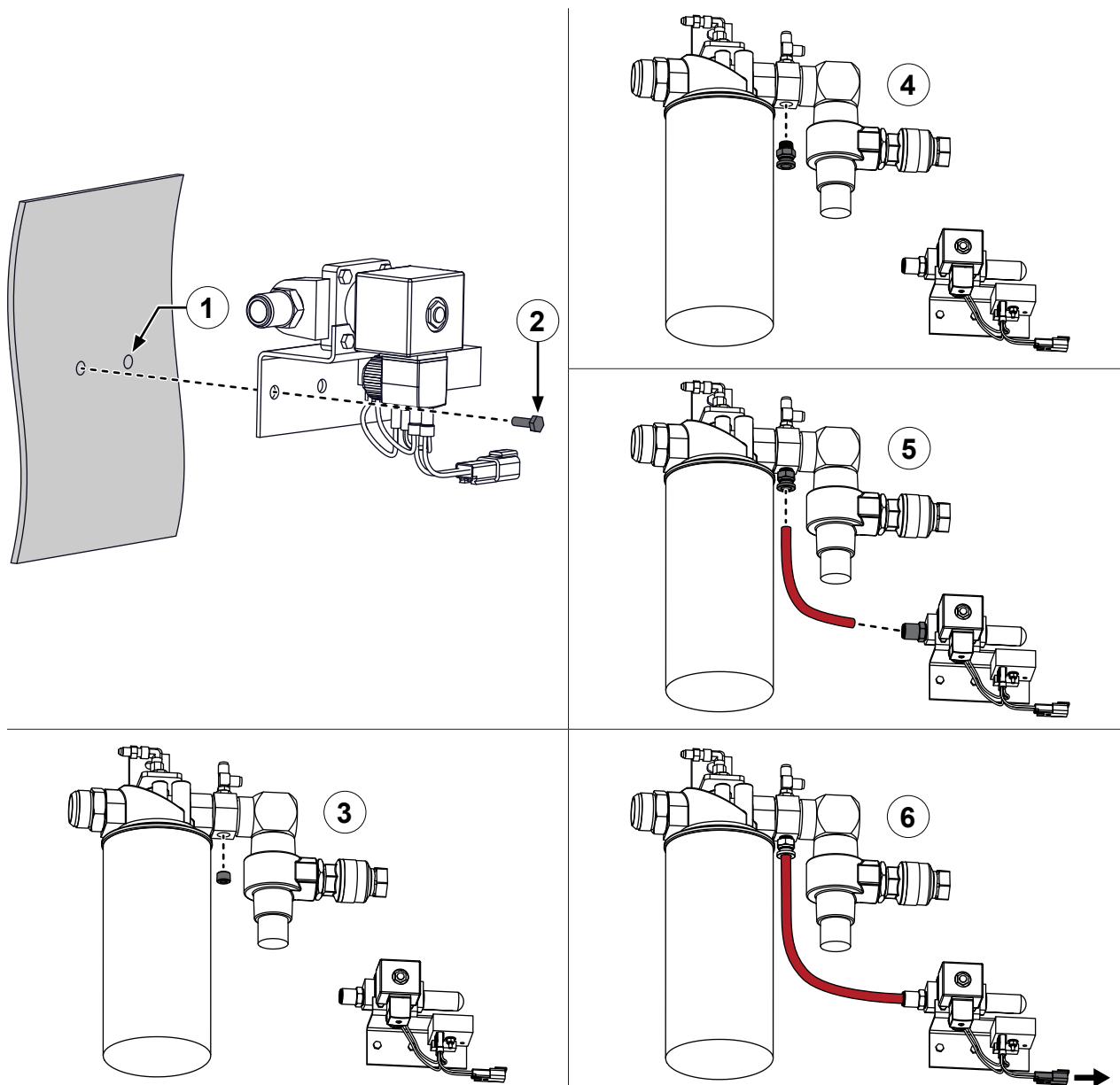
## Installing the PMC Hoses—150-P

Use the illustration and instructions to install the PMC hoses.

- 1 Connect the red air brake hose to the auto-sync solenoid assembly and PMC assembly.
- 2 Connect the black air brake hose to the separator filter and PMC assembly.



## Installing the Sump Vent Assembly

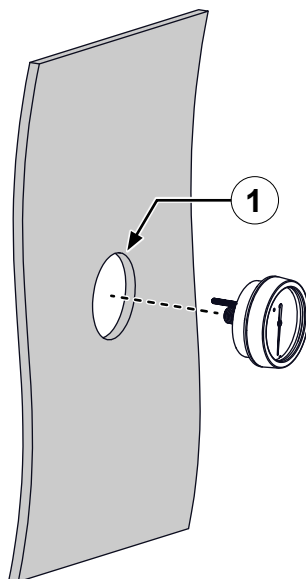


Use the illustrations and instructions to install the optional sump vent assembly. In some applications, the sump vent solenoid opens for 10 seconds at engine startup to prevent engine stall.

- 1 Drill the mounting holes for the mounting bracket. Refer to: **"Dimensions—Optional Sump Vent Assembly" on page 49.**
- 2 Use locally sourced hardware to secure the sump vent to the apparatus.
- 3 Remove the plug from the vent port.
- 4 Install the quick connect fitting into the vent port.
- 5 Cut the air brake tubing to the appropriate length, then use it to connect the separator filter and sump vent assembly.
- 6 Connect the wire harness to the PTO engage switch.

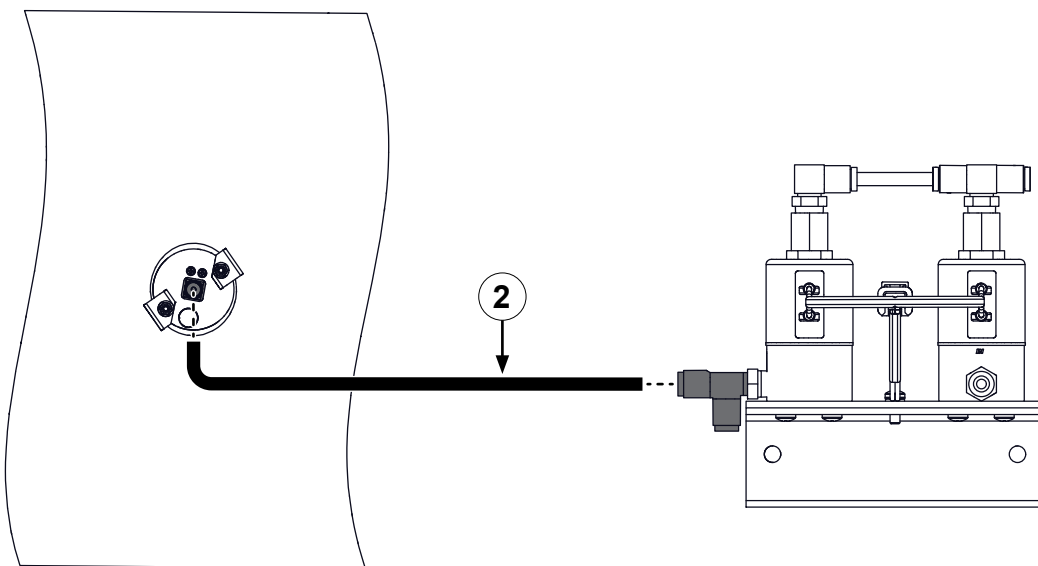


## Installing the Pressure Gauge

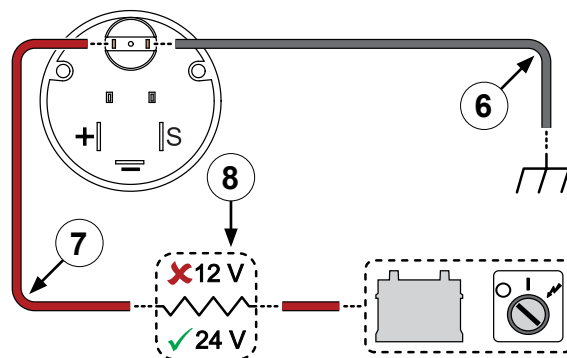
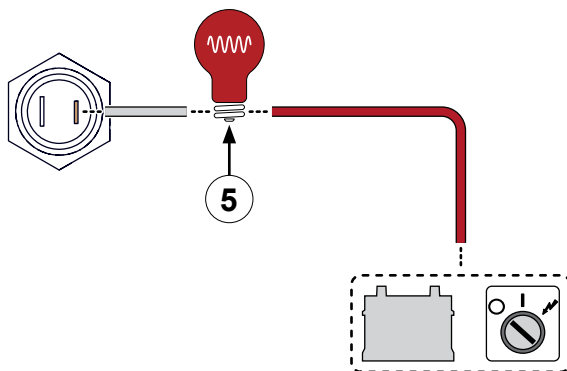
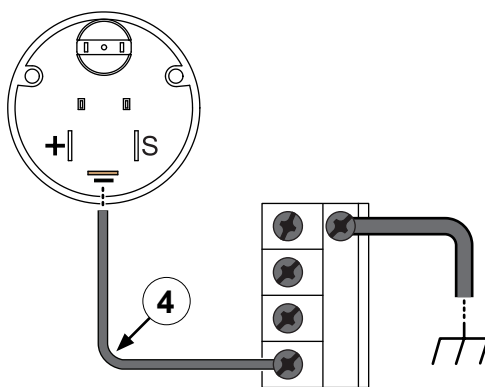
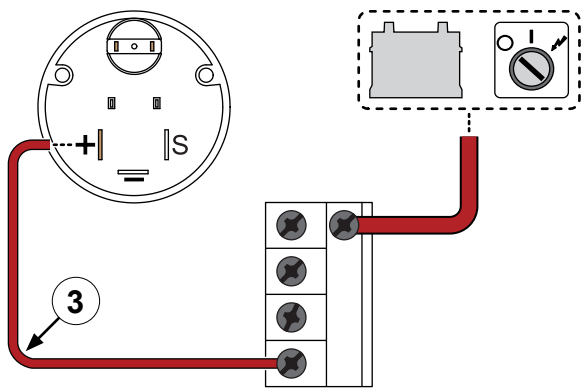
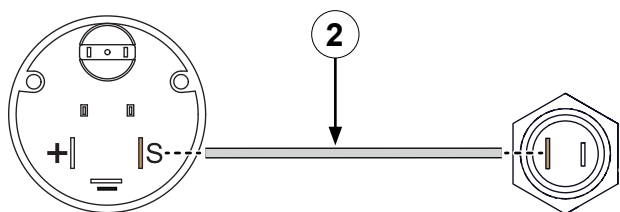
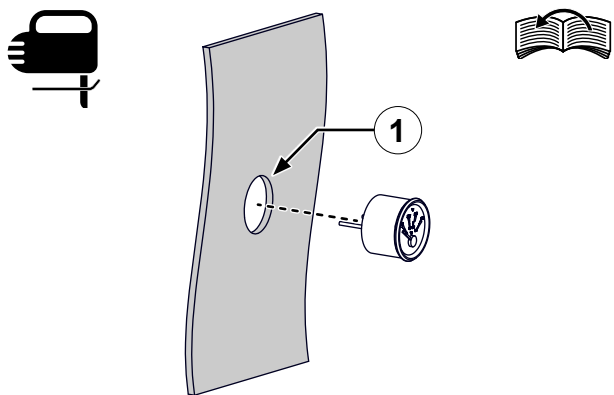


Use the illustrations and instructions to install the pressure gauge. The pressure gauge is required by NFPA standards and locally sourced by the installer.

- 1 Create the cutout for the pressure gauge. For dimensions, refer to the specifications provided by the manufacturer.
- 2 Use a portion of the black air brake tubing to connect the pressure gauge and auto-sync solenoid assembly.



## Installing the Temperature Gauge

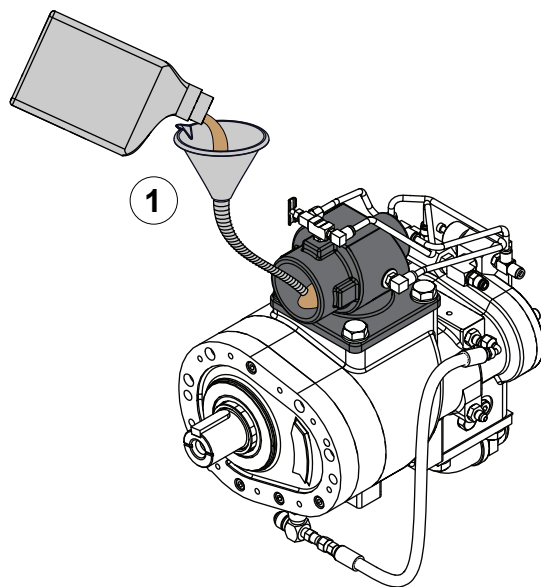


Use the illustrations and instructions to install the temperature gauge.

**Note:** Locally source the appropriate wire and connectors for the gauge.

- 1 Create the cutout for the temperature gauge. Refer to: **"Dimensions—Temperature Gauge" on page 52**. Use the provided hardware to secure the temperature gauge to the apparatus.
- 2 Connect the temperature gauge signal terminal to the larger spade on the temperature sender.
- 3 Connect the temperature gauge positive terminal to the appropriate power distribution circuit.
- 4 Connect the temperature gauge negative terminal to frame ground.
- 5 Connect the smaller spade on the temperature sender to the appropriate power distribution circuit. Install a locally sourced warning light into the circuit, then mount the light on the operator's panel.
- 6 Connect one temperature gauge light terminal to chassis ground.
- 7 Connect the other temperature gauge light terminal to the positive side of the power supply.
- 8 Use the provided resistor and bulb with a 24 V power source.

## Preparing for Operation



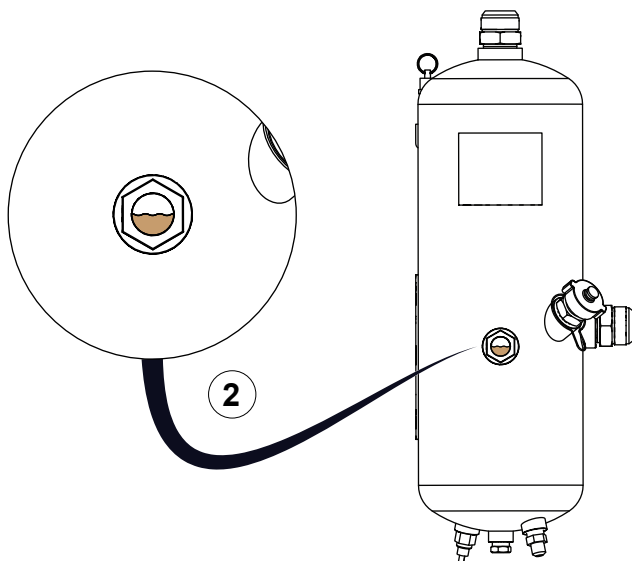
Use the illustrations and instructions to prepare the system for operation. This procedure distributes the oil in the sump to the hoses, oil cooler, and other system components.

Before you begin the procedure:

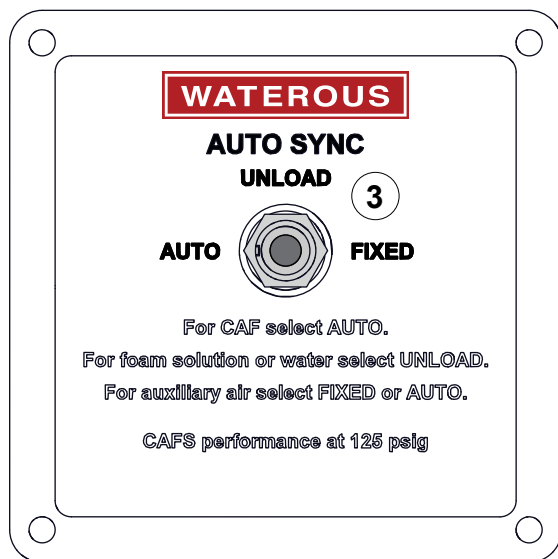
- Make sure that all tools, towels, and debris are removed from the apparatus.
- Make sure that the hardware and connections are properly tightened.
- Make sure that the drain valves are closed.
- Make sure to flow water through the oil cooler.
- Make sure that all associated equipment is operating properly.

1 Remove the air filter assembly to access the air intake. Pour 8 to 16 oz (267 to 474 ml) of sump oil into the air inlet, then install the air filter.

2 Make sure that the sump oil level reaches halfway up the sight window. Refer to: **"Checking the Sump Oil Level" on page 93.**



## Preparing for Operation



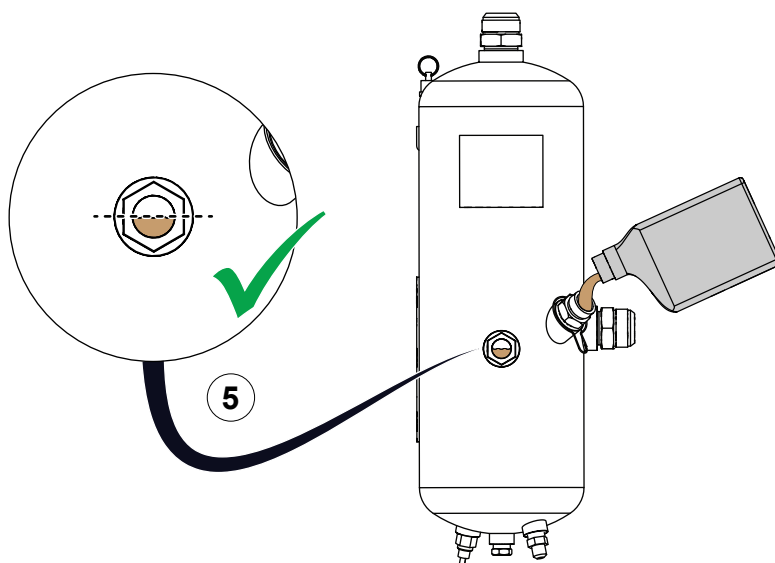
Use the illustrations and instructions to prepare the system for operation.

- 3 Toggle the auto-sync switch to the *UNLOAD* position, then engage the compressor for up to 10 seconds.

**Note:** Do not operate the compressor for more than 10 seconds during this procedure. Doing so will damage the compressor and void your warranty.

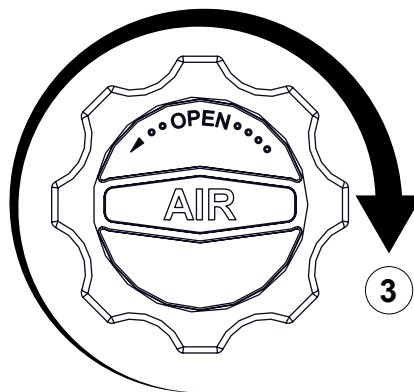
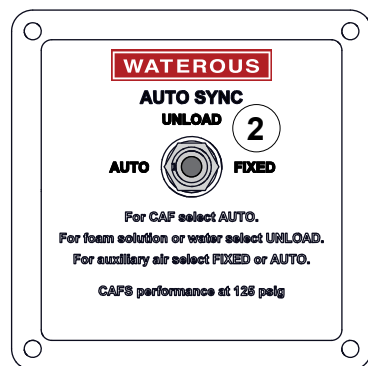
- 4 Allow time for the pressure to be completely purged from the system.

 <b>WARNING</b>	
<p><b>High Pressure</b></p> <ul style="list-style-type: none"> <li>• Liquid ejected at high pressure can cause serious injury.</li> <li>• Purge all pressure before servicing.</li> </ul>	



- 5 Replenish the oil that moved into the system. Refer to: **"Adding Oil to the Sump" on page 94.**
- 6 Repeat the procedure until the oil level remains stable.

## Calibrating the System—Unload Mode



Use the illustrations and instructions to calibrate the system for unload mode.

When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

1 Use caution when performing this procedure.

<b>! WARNING</b>	
<b>Moving Parts</b> <ul style="list-style-type: none"> <li>• Rotating parts can cause severe injury or death.</li> <li>• Do not enter or reach into the compartment when equipment is operating.</li> </ul>	

2 Toggle the auto-sync switch to the *UNLOAD* position.

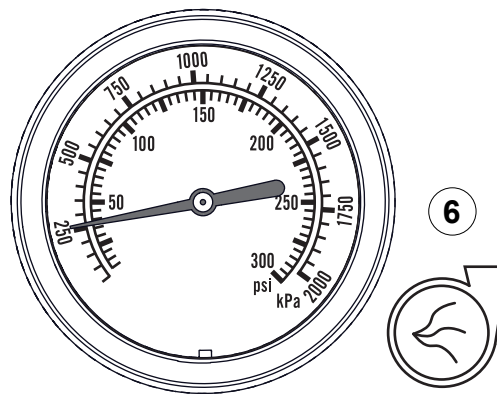
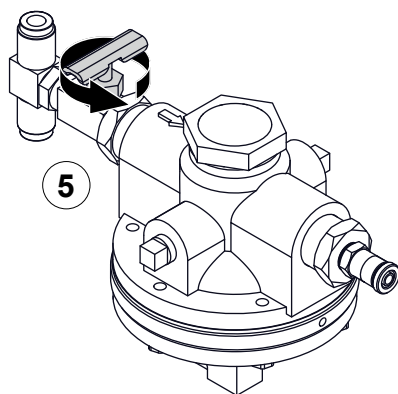
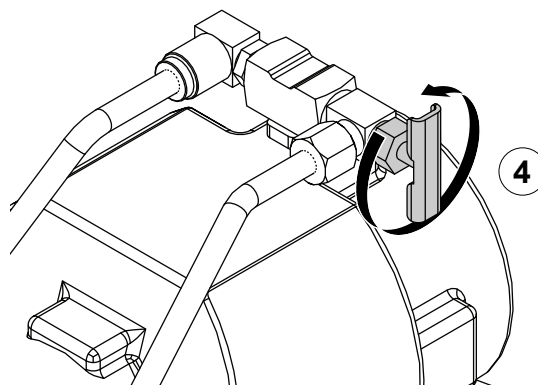
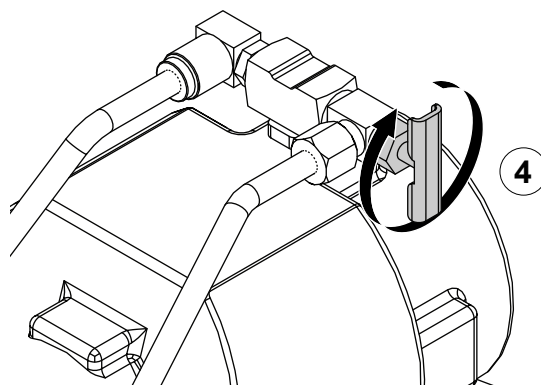
3 Close all air discharges before calibration.

4 Locate the air inlet trim valve on the compressor, then turn it clockwise until fully closed. From the closed position, turn it 3 full turns counterclockwise.

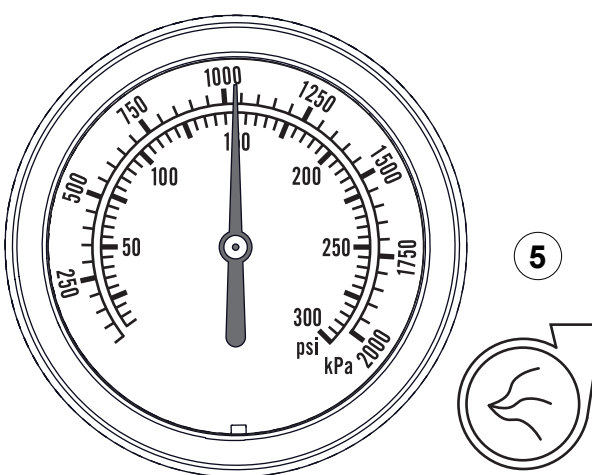
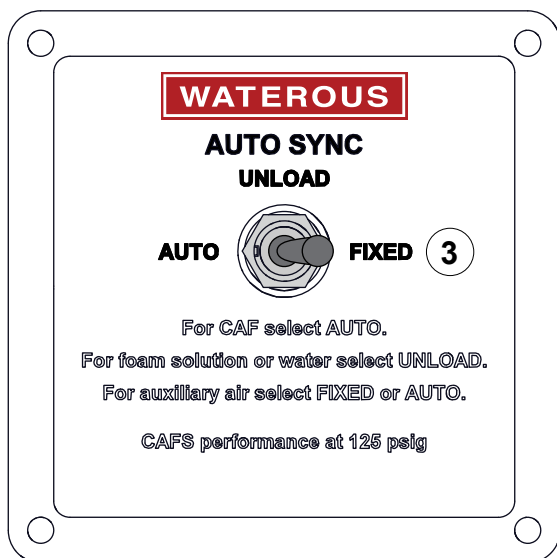
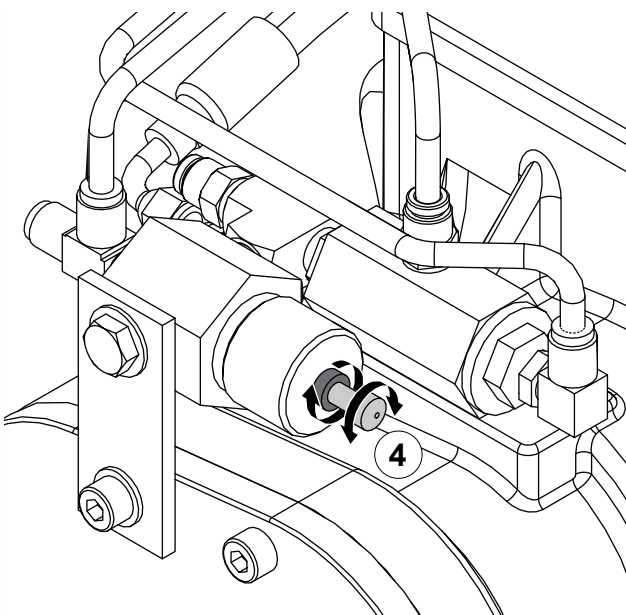
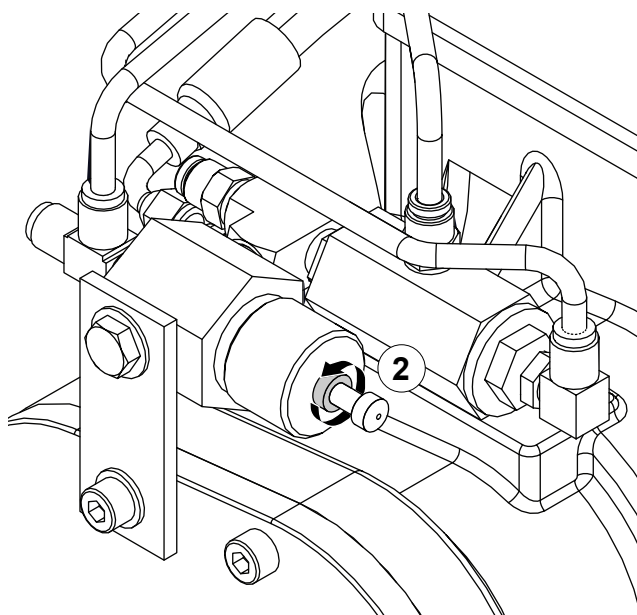
5 Locate the trim valve on the balance valve assembly, then turn it counterclockwise until fully open.

6 Idle the engine and flow water through the pump, then engage the PTO. The gauge should read approximately 40 psi (2.8 bar).

**Note:** Do not engage the PTO when the engine speed is above 1000 rpm.



## Calibrating the System—Fixed Mode



Use the illustrations and instructions to calibrate the system for fixed mode.

When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

- 1 Use caution when performing this procedure.

<b>WARNING</b>	
<p style="text-align: center;"><b>Moving Parts</b></p> <ul style="list-style-type: none"> <li>• Rotating parts can cause severe injury or death.</li> <li>• Do not enter or reach into the compartment when equipment is operating.</li> </ul>	

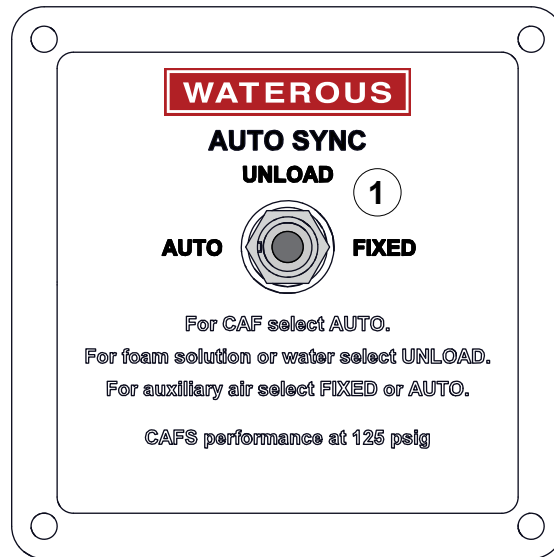
- 2 Loosen the locknut on the manual adjustment screw.

- 3 Toggle the auto-sync switch to the *FIXED* position.

- 4 To adjust the air pressure, do the following:
  - Turn the screw clockwise to increase pressure.
  - Turn the screw counterclockwise to decrease pressure.

- 5 Allow time for the adjustment to take effect, then use the gauge to verify the change. Secure the setting with the locknut.

## Calibrating the System—Fixed Mode

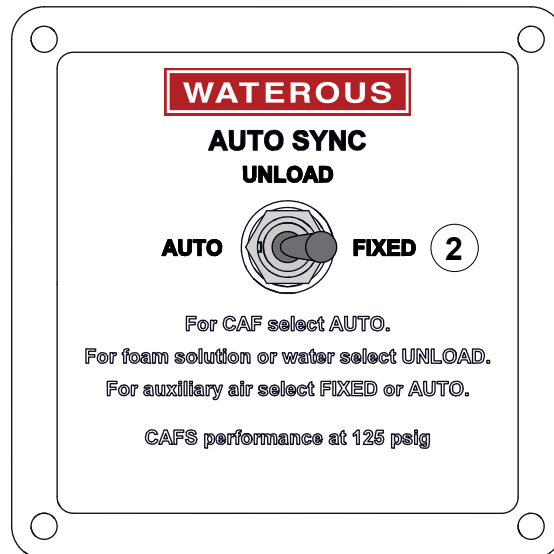


Use the illustrations and instructions to verify that the system is calibrated for fixed mode.

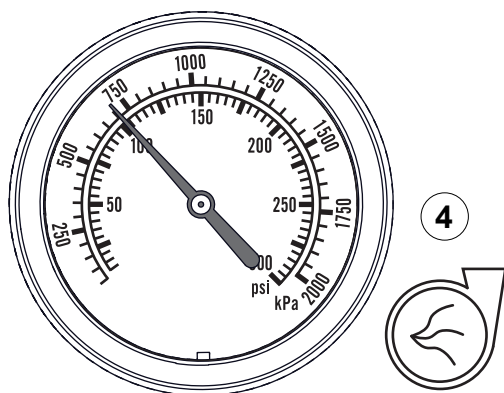
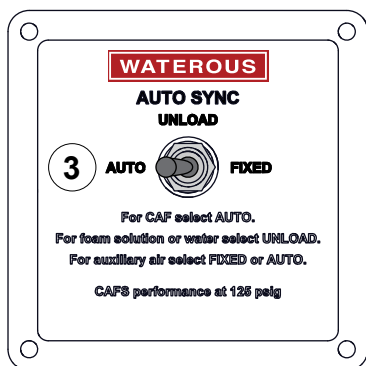
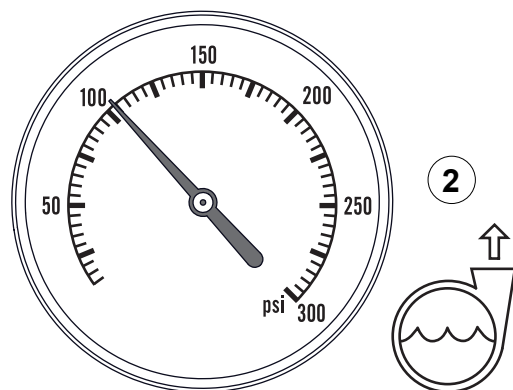
When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

- 1 Toggle the auto-sync switch to the *UNLOAD* position to make sure that the oil pressure decreases to the unload mode value—typically 40 psi (2.8 bar).
- 2 Toggle the auto-sync switch to the *FIXED* position to make sure that the oil pressure increases to the fixed mode value—typically 145 to 150 psi (10 bar).
- 3 Verify that the system operates as expected in both modes when you vary the engine speed.



## Calibrating the System—Auto Mode



Use the illustrations and instructions to adjust the system in auto mode.

When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

1 Use caution when performing this procedure.



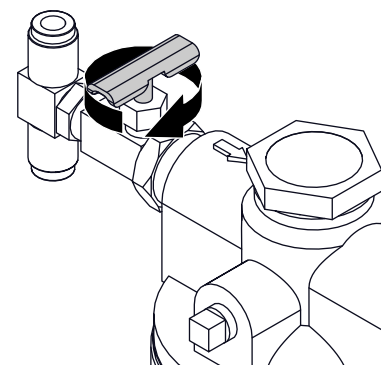
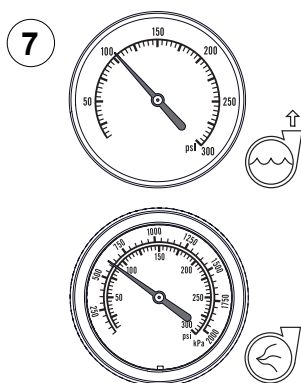
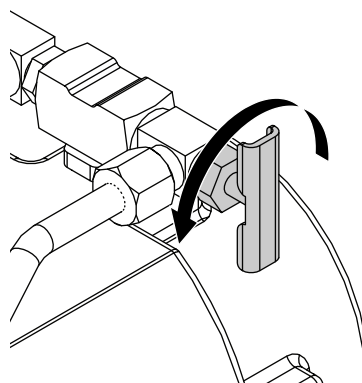
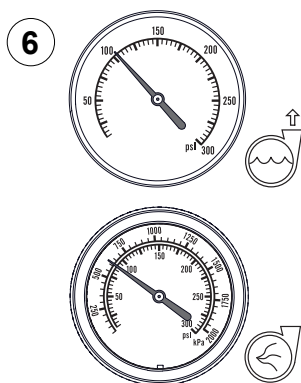
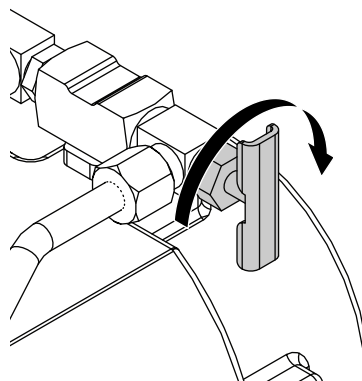
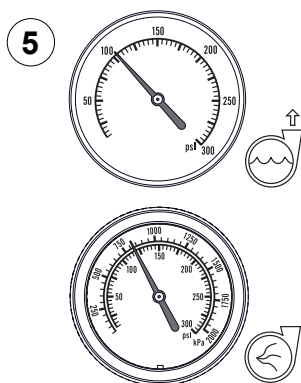
2 Make sure that the pump has 100 psi (10.3 bar) at the main discharge with minimal flow.

3 Toggle the auto-sync switch to the *AUTO* position.

4 Make sure that the air pressure is equal to, or up to 5% higher than, the static water pressure. Raise and lower the static water pressure to make sure that the air pressure follows the static water pressure.



## Calibrating the System—Auto Mode



Use the illustrations and instructions to adjust the system in auto mode.

When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

5 If the air pressure is 5% higher than the water pressure, turn the air inlet trim valve 1/2 turn clockwise. After the adjustment takes effect, compare the air and water pressure.

6 If the air pressure is lower than the water pressure, turn the air inlet trim valve 1/2 turn counterclockwise. After the adjustment takes effect, compare the air and water pressure.

If the air pressure is still lower than the water pressure, turn the air inlet trim valve an additional 1/2 turn counterclockwise.

**Note:** Do not turn the air inlet trim valve more than 1 full turn counterclockwise.

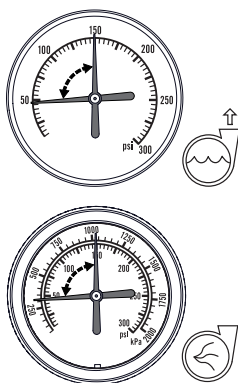
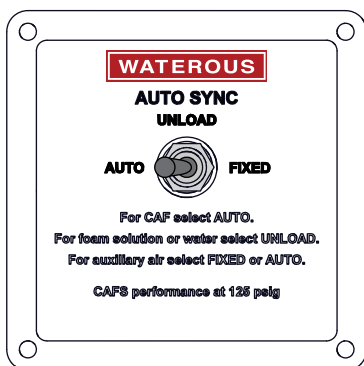
7 If the air pressure is still lower than the water pressure, turn the balance valve assembly trim valve 1 full turn clockwise. After the adjustment takes effect, compare the air and water pressure.

Repeat this step until the air pressure is equal to, or 5% higher than, the water pressure.

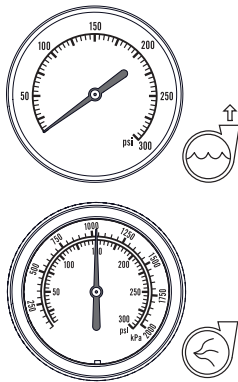
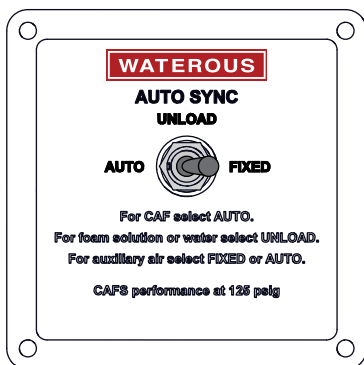
**Note:** Make sure that the air pressure rises and falls automatically as you raise and lower the static water pressure.

## Operating the System

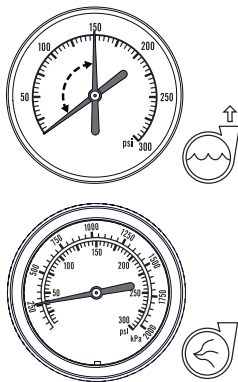
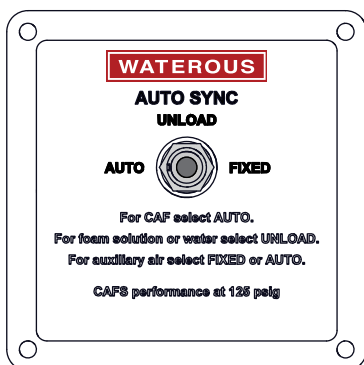
1



2



3



The system operates in 3 modes. Each mode is engaged with the toggle switch on the auto-sync controller.

When operating the system:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation.
- Never operate the system with the compressor oil temperature above 250°F (121°C).

1 To operate in auto mode, toggle the auto-sync switch to the *AUTO* position. In this mode, the system synchronizes the air pressure with the water pressure.

The air pressure rises and falls automatically as you raise and lower the static water pressure. Auto mode operates between approximately 50 to 150 psi.

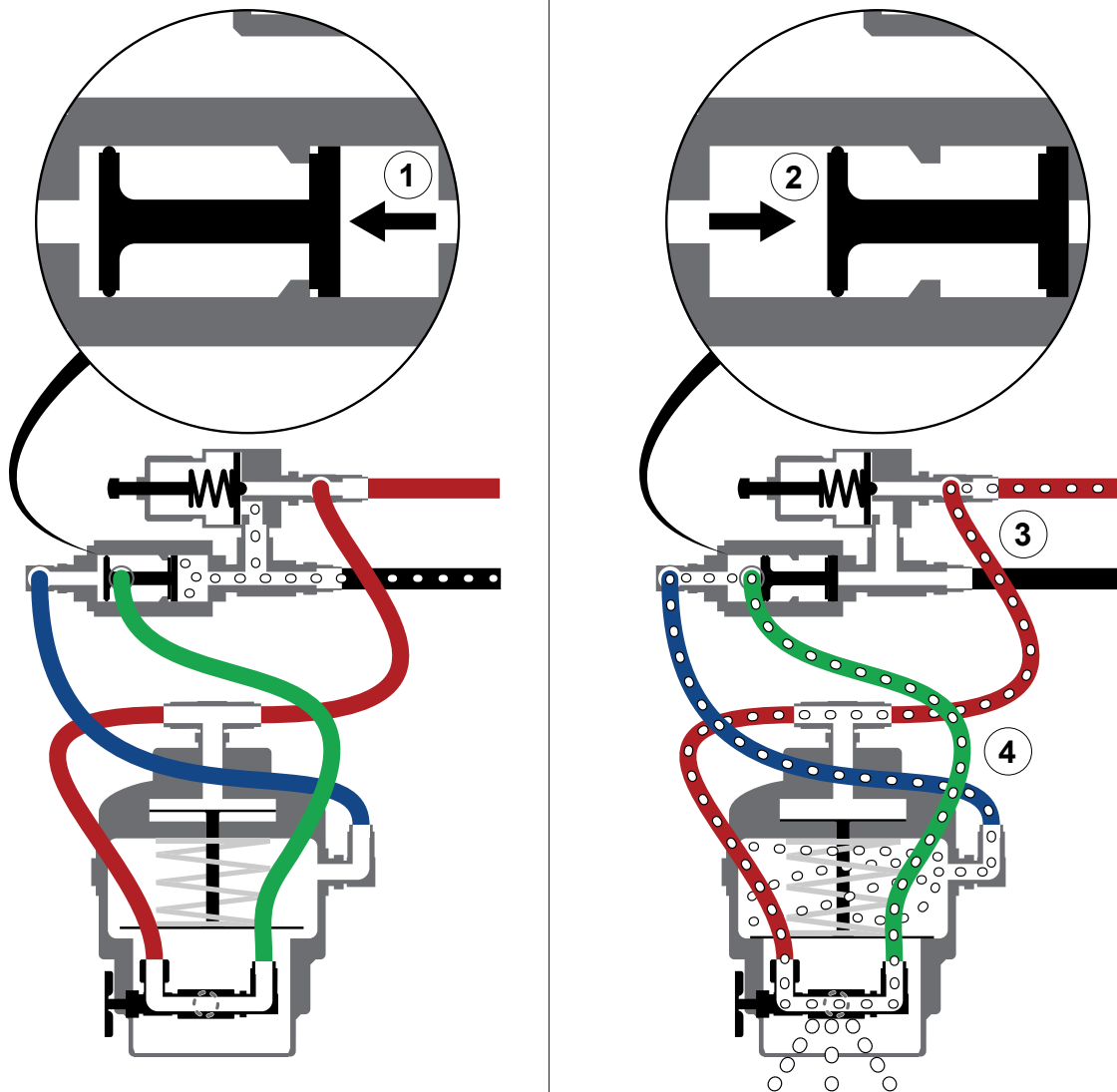
2 To operate in fixed mode, toggle the auto-sync switch to the *FIXED* position. In this mode, the system sets the air pressure to approximately 150 psi.

Fixed mode is used to operate air tools, rescue bags, etc. Operate the compressor in fixed mode once a week for 15 minutes per the maintenance schedule.

3 To operate in unload mode, toggle the switch to the *UNLOAD* position. In this mode, the system operates the compressor in standby.

Approximately 40 psi is produced to circulate the oil and cool the compressor. In unload mode, the air pressure and water pressure work independently.

## Understanding the Shuttle Valve Operation



The shuttle valve engages as the pressure in the system rises. It prevents air from escaping during CAFS operation. When the system shuts down and pressure is no longer applied to the valve, the shuttle returns to its resting position and bleeds off any remaining air in the system to atmosphere.

**Note:** The ○○○ illustrates the main air pressure route described in the instructions.

- 1 The rising pressure in the system moves the shuttle into the operating position.
- 2 When operation ends, the lack of air pressure moves the shuttle into the resting position.
- 3 Air in the lines migrates to atmosphere through the red tubing.
- 4 Air in the compressor migrates to atmosphere through the green tubing.

## Operating in Unload Mode



Unload mode operates the compressor in standby. The compressor generates a minimum pressure of 40 psi (2.8 bar) to circulate the compressor oil and cool the system.

**Note:** The ○○○ illustrates the main air pressure route described in the instructions.

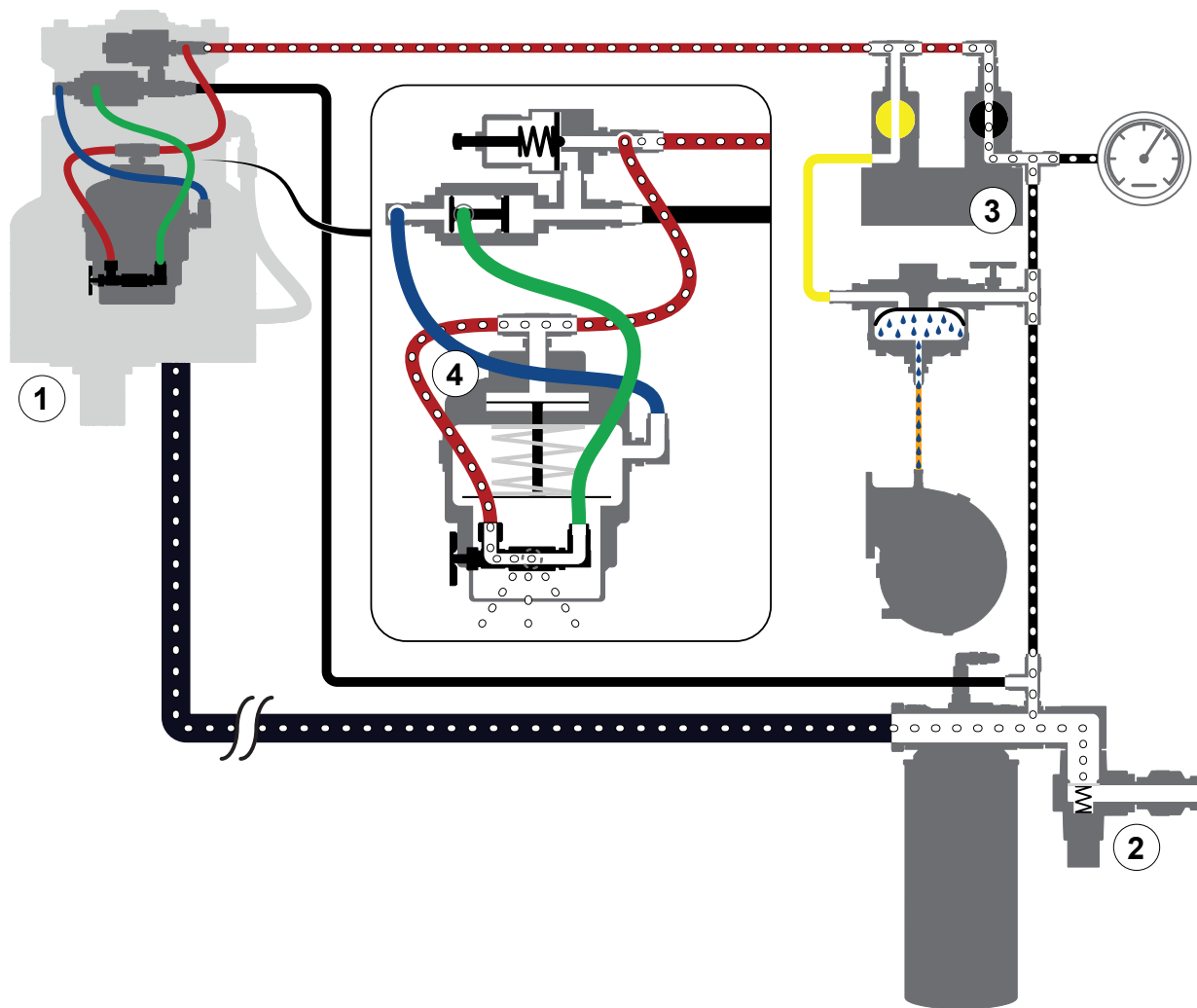
1 The compressor builds air pressure in the system to 40 psi (2.8 bar). To adjust the set point, refer to: **"Calibrating the System—Unload Mode"** on page 81.

2 The minimum pressure valve prevents air pressure below 40 psi (2.8 bar) from entering the manifold.

**Note:** The master air pressure gauge should read 0 psi in unload mode.

3 The open black solenoid allows air to pass through to the PMC.

4 The air (pressure) modulates the air inlet to maintain the 40 psi (2.8 bar) air pressure.

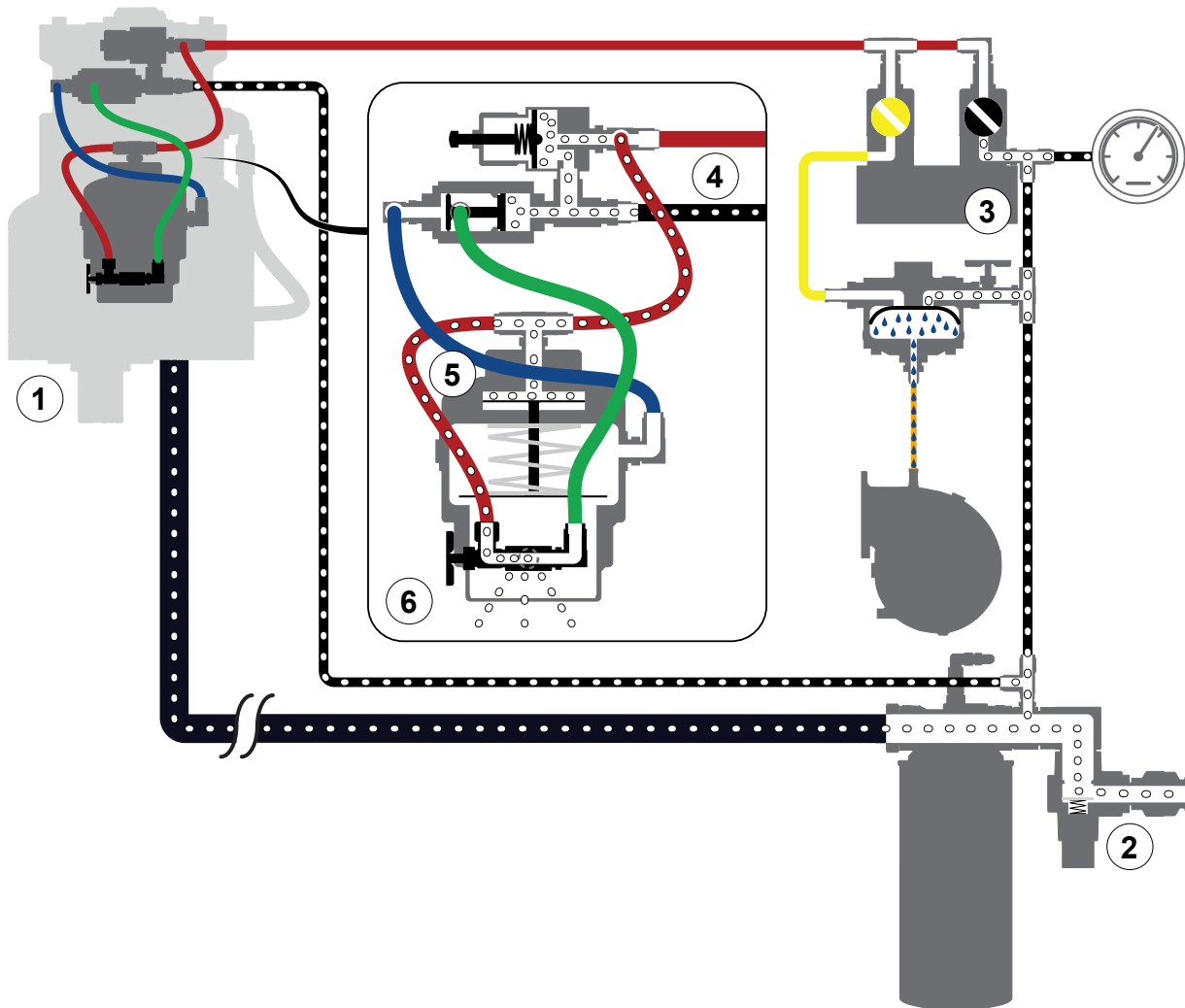


## Operating in Fixed Mode



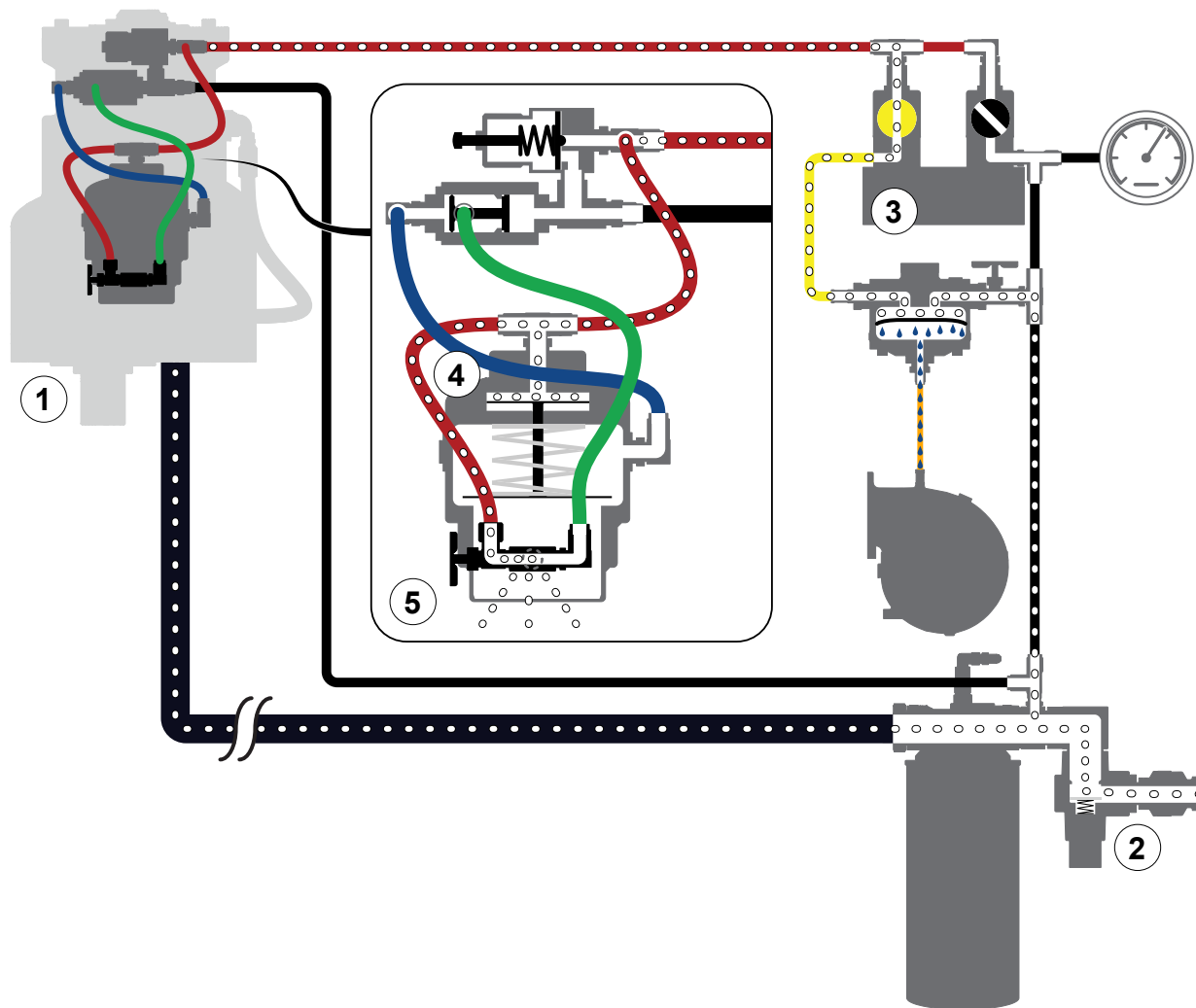
Fixed mode sets the air pressure at a fixed point. The fixed point for typical applications is 150 psi (10.3 bar).

**Note:** The ○○○ illustrates the main air pressure route described in the instructions.



- 1 The compressor builds air pressure in the system.
- 2 Air moves through the system and interacts with the regulator components.
- 3 Both solenoids are closed, which allows the air pressure to operate independently from the water pressure.
- 4 Pressure builds until it reaches the set point when the fixed pressure regulator opens and allows excess air (pressure) to purge to atmosphere. To adjust this setting, refer to: **"Calibrating the System—Fixed Mode" on page 83.**
- 5 As the air (pressure) is purged to atmosphere, it closes the valve in the air inlet.
- 6 As the air (pressure) drops, the fixed pressure regulator closes, the compressor air inlet opens, the system pressure builds, and the cycle repeats.

## Operating in Auto Mode



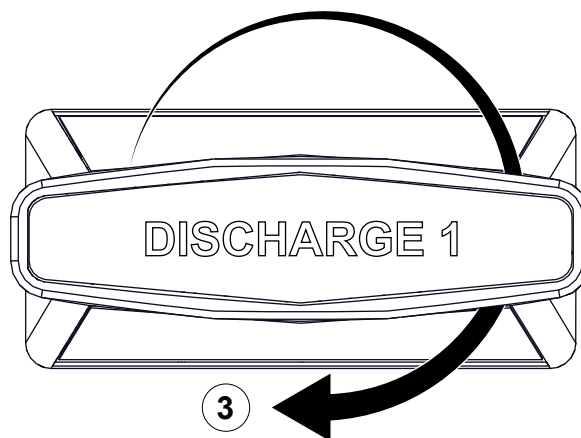
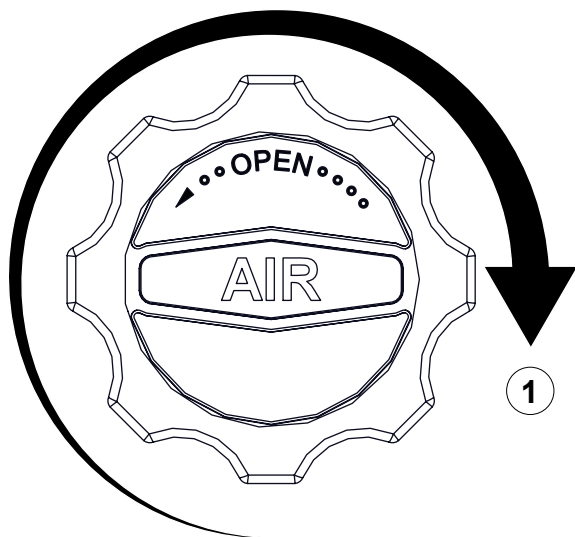
Auto mode synchronizes the air pressure with the water pressure. The air pressure rises and falls automatically as you raise and lower the water pressure. Auto mode operates between 50 to 150 psi (3.4 to 10.3 bar).

**Note:** Only operate multi-stage water pumps in volume mode.

**Note:** The ○○○ illustrates the main air pressure route described in the instructions.

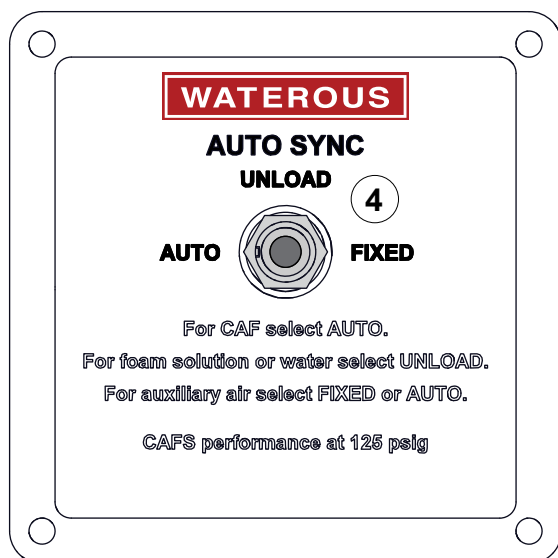
- 1 The compressor builds pressure to match the water pressure. When the water pressure is below 40 psi (2.8 bar), the system operates as if it is in unload mode.
- 2 As the air pressure surpasses 40 psi (2.8 bar), the minimum pressure valve opens, allowing air to move into the manifold.
- 3 Inside the balance valve:
  - The water side of the balance valve closes the path for air to move to the yellow solenoid, forcing air pressure to build.
  - As the air pressure builds, it overtakes the water pressure on the other side of the diaphragm and allows the air to move through the yellow solenoid to the PMC.
- 4 Inside the PMC:
  - Air pressure builds in the PMC until it closes the air intake, which starves the compressor of air and causes the pressure to drop.
  - As the air pressure drops, the water pressure closes the diaphragm and stops the air from moving through the yellow solenoid.
- 5 Air (pressure) in the PMC escapes through the trim valve, opening the air inlet and allowing the pressure to increase.

## Shutting Down the System



Use the illustrations and instructions to create a shutdown procedure for your application.

- 1 Close the air valves.
- 2 Disengage the foam proportioner, then flow water through the discharge hoses until all bubbles are gone.
- 3 Close the discharge valves.
- 4 Toggle the auto-sync switch to the *UNLOAD* position.



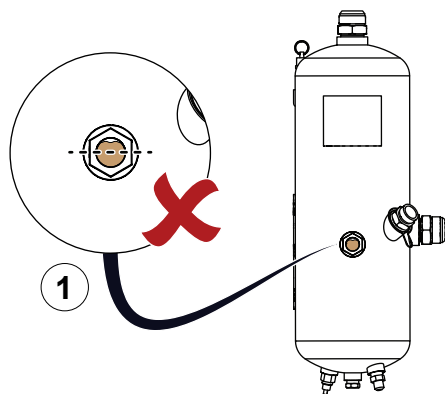
## Maintenance Schedule

Perform the following procedures at the recommended intervals at a minimum. Environmental conditions affect the maintenance requirements. Inspect the components frequently and create a maintenance schedule suitable to your application and environment. Replace wear components with equivalent components. Use your serial number to gain access to the service parts lists associated with your system through the MyWaterous login at [www.waterousco.com](http://www.waterousco.com).

Operation	Initial Operation	Daily	Weekly	12 Months	24 Months	Comment
Check the oil level.	X	X				
Inspect the hoses and fittings.	X	X				
Service operation.			X			Operate the system in air only mode once a week for 15 minutes.
Change the oil.				X		Change the oil after the first 30 hours of operation, then yearly after that.
Change the oil filter.				X		Replace the oil filter when you replace the oil.
Inspect the mounting hardware.				X		
Change the separator filter.					X	Replace the separator filter after a sudden increase in oil consumption.
Change the air filter.	Replace as necessary per environmental conditions.					Replace the air filter more often in dusty or dirty environments.
Clean the wye strainer.	Clean after each use. This is dependent on water quality.					Clean the wye strainer after each use. This is dependent on water quality.

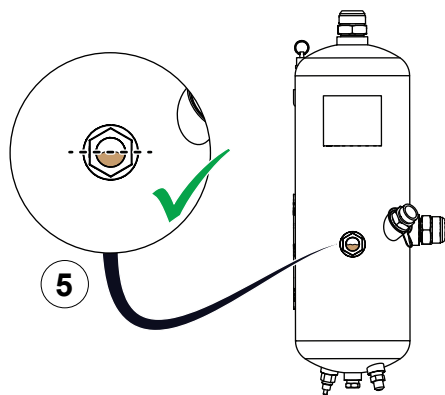
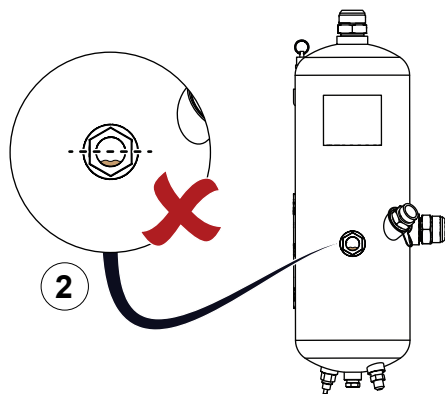


## Checking the Sump Oil Level

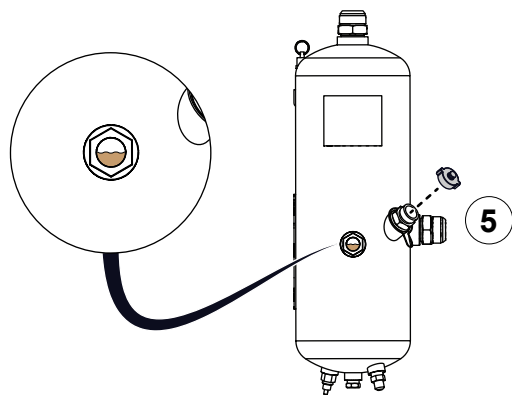
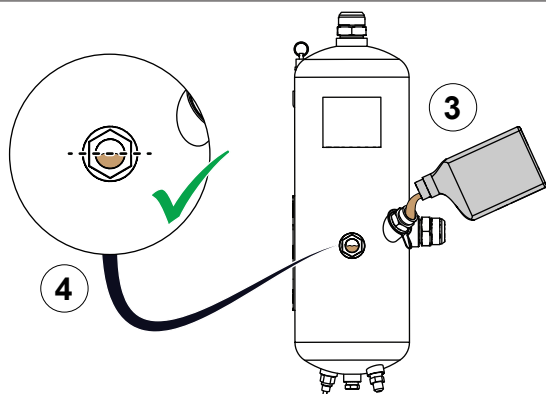
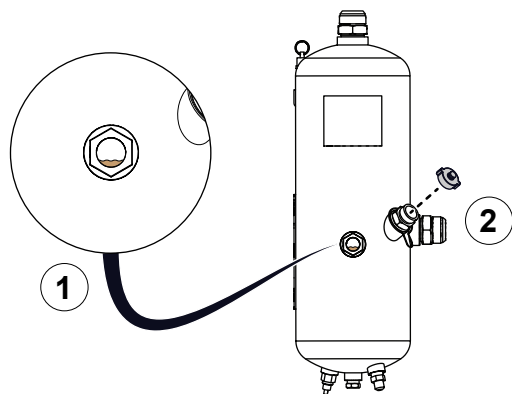


Use the illustration and instructions to check the oil level. Check the compressor oil level daily and replenish the oil accordingly.

- 1 The oil level is too high when it is higher than halfway up the sight window. Drain the appropriate amount of oil. Refer to: **"Changing the Sump Oil" on page 95.**
- 2 The oil level is too low when it is lower than halfway up the sight window. Add the appropriate amount of oil. Refer to: **"Adding Oil to the Sump" on page 94.**
- 3 The appropriate oil level is halfway up the sight window.



## Adding Oil to the Sump



Use the illustrations and instructions to add oil to the sump. Purge the pressure from the system before adding the oil.

 <b>WARNING</b>	
<b>High Pressure</b> <ul style="list-style-type: none"><li>• Liquid ejected at high pressure can cause serious injury.</li><li>• Purge all pressure before servicing.</li></ul>	

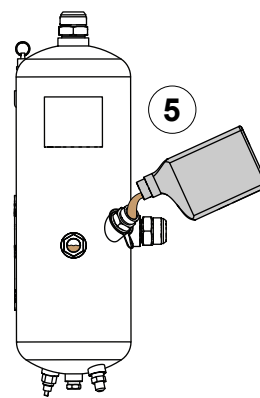
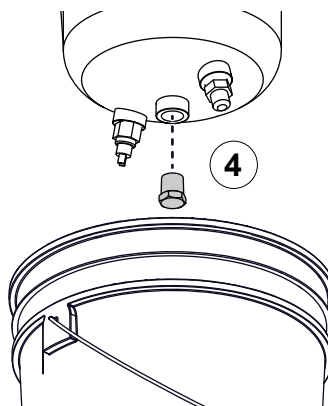
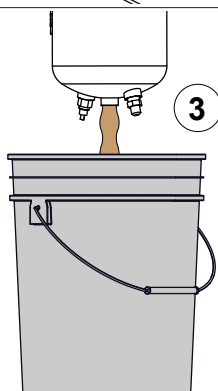
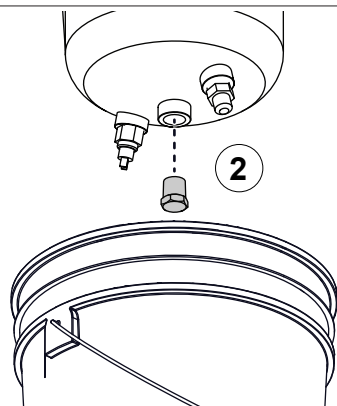
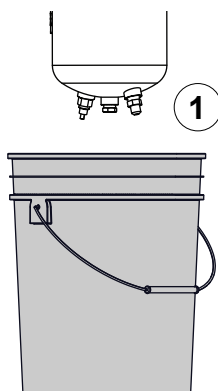
***Open the pressure relief valve to make sure that you purge the pressure from the system before beginning the procedure.***

- 1 Use the sight window to approximate the amount of oil in the sump.
- 2 When all pressure has been purged from the system, remove the oil fill cap.
- 3 Add oil to the sump.

**Note:** After pouring some oil into the sump, allow it to settle before adding more to avoid over-filling.

- 4 Add oil until it reaches halfway up the sight window.
- 5 Install the oil fill cap.

## Changing the Sump Oil



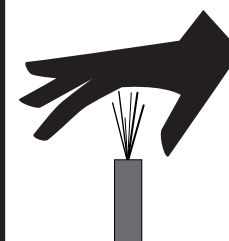
Use the illustrations and instructions to change the oil in the sump. Purge the pressure from the system before changing the sump oil.



### WARNING

#### High Pressure

- Liquid ejected at high pressure can cause serious injury.
- Purge all pressure before servicing.



**Open the pressure relief valve to make sure that you purge the pressure from the system before beginning the procedure.**

- 1 Place a suitable container under the sump to collect the drained oil.

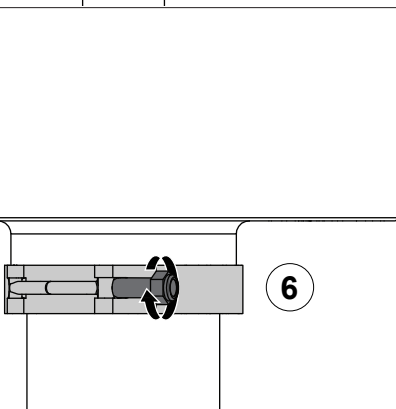
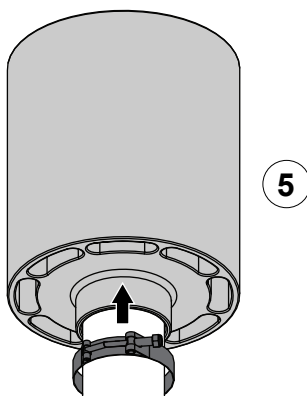
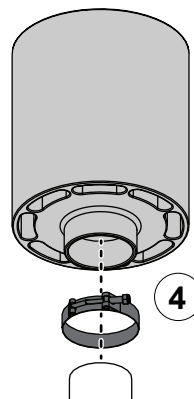
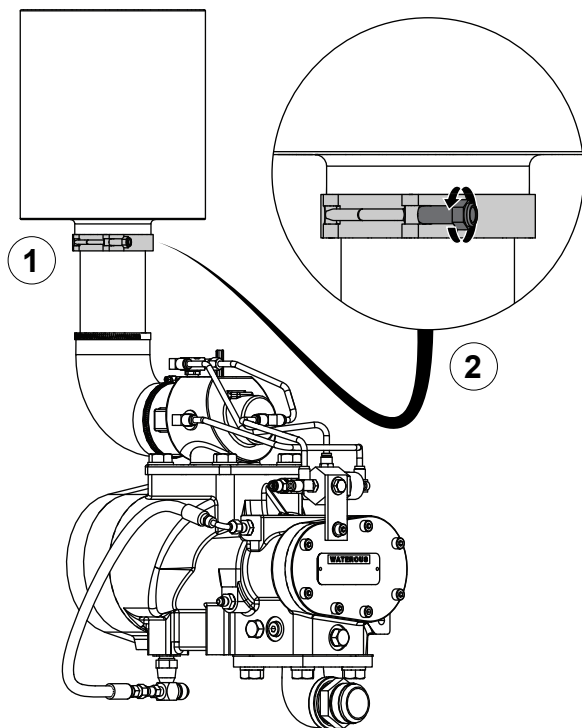
**Note:** Some applications include an oil drain hose to transfer oil into the container.

- 2 Remove the oil drain plug.
- 3 Allow the oil to drain.
- 4 Install the oil drain plug.

**Note:** Disregard the small amount of oil that is left in the lines.

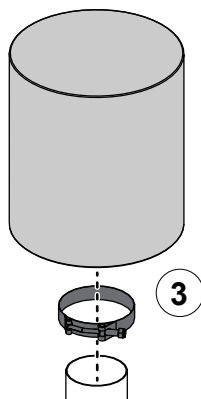
- 5 To add oil to the sump, refer to: **"Adding Oil to the Sump" on page 94.**
- 6 Properly dispose or recycle the oil per your local regulations.

## Changing the Air Filter

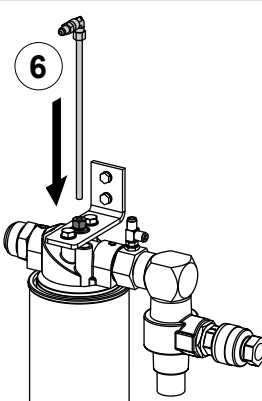
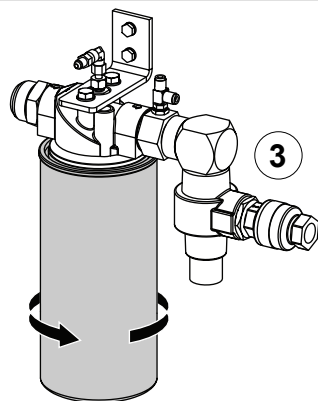
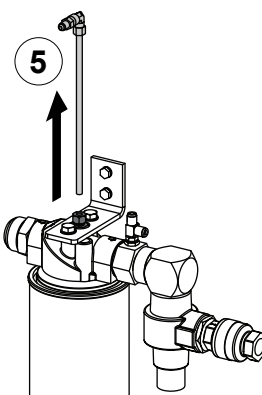
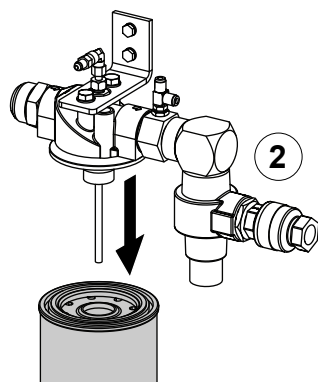
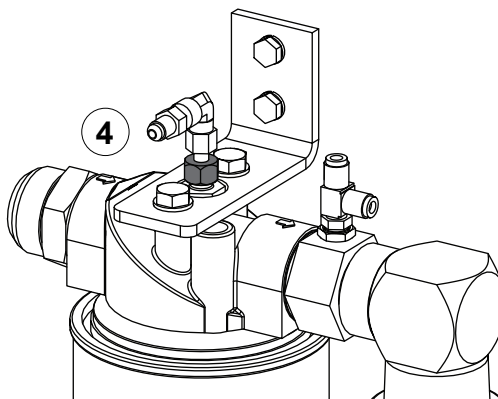
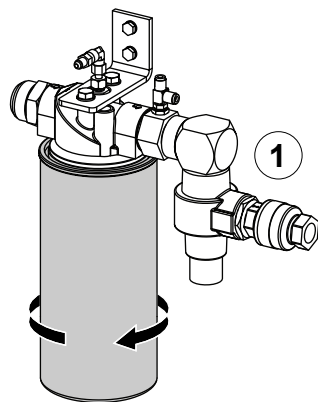


Use the illustrations and instructions to change the air filter.

- 1 Locate the T-bolt clamp that secures the air filter to the air tube.
- 2 Loosen the T-bolt clamp.
- 3 Remove and discard the air filter.
- 4 Position the new air filter over the air tube.
- 5 Install the air filter onto the tube, then position the T-bolt clamp over the air filter.
- 6 Tighten the T-bolt clamp to secure the air filter to the air tube.



## Changing the Separator Filter



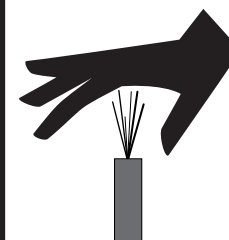
Use the illustrations and instructions to change the separator filter. Space constraints may require you to remove the oil filter tube before changing the filter. Purge the pressure from the system before changing the separator filter.



### WARNING

#### High Pressure

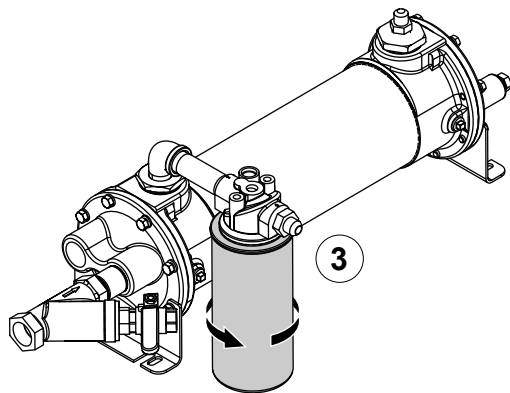
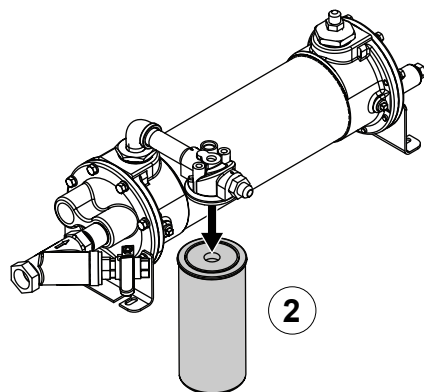
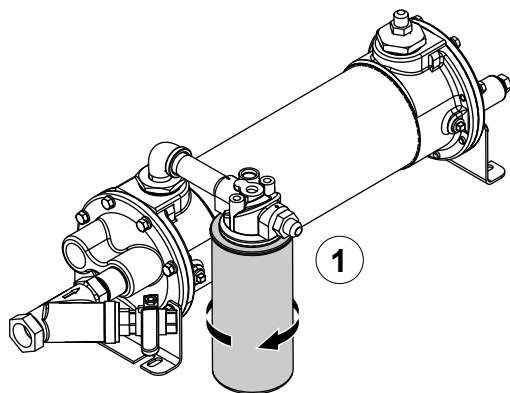
- Liquid ejected at high pressure can cause serious injury.
- Purge all pressure before servicing.



*Open the pressure relief valve to make sure that you purge the pressure from the system before beginning the procedure.*

- 1 Remove the separator filter from the assembly.
- 2 Discard the filter.
- 3 Install the replacement filter onto the assembly.
- 4 If space constraints require you to remove the oil filter tube before changing the filter, loosen the compression fitting securing the oil filter tube to the assembly.
- 5 Raise or remove the tube, then follow the previous steps to install the replacement filter.
- 6 Lower the tube into the assembly, then tighten the compression fitting to secure the tube.

## Changing the Oil Filter



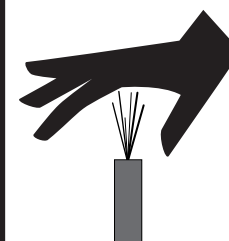
Use the illustrations and instructions to change the oil filter. Purge the pressure from the system before changing the oil filter.



### WARNING

#### High Pressure

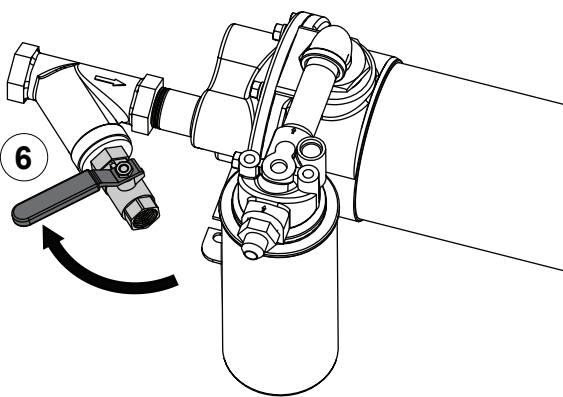
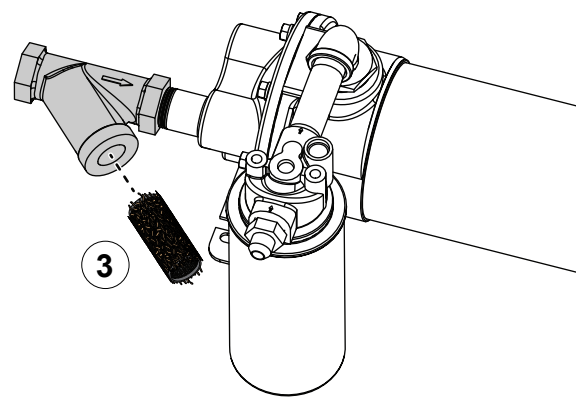
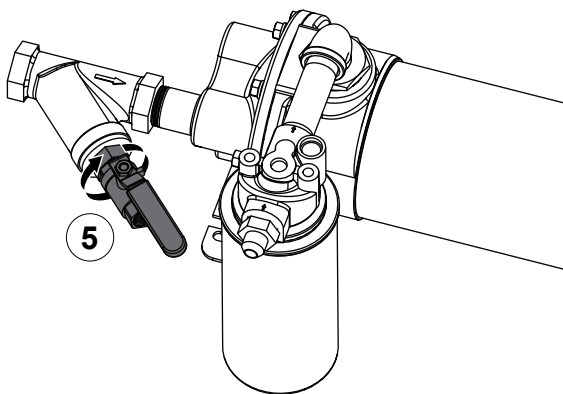
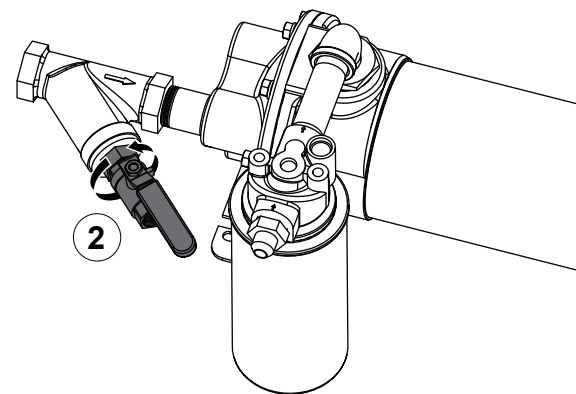
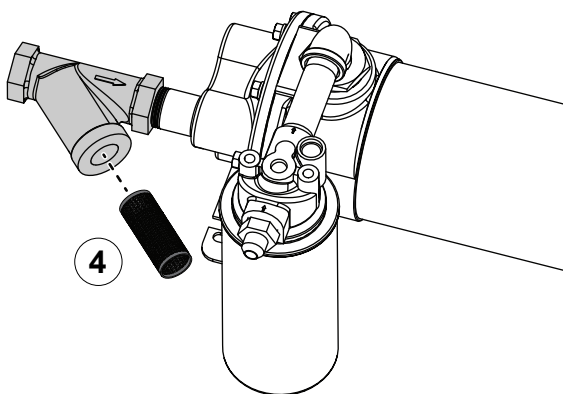
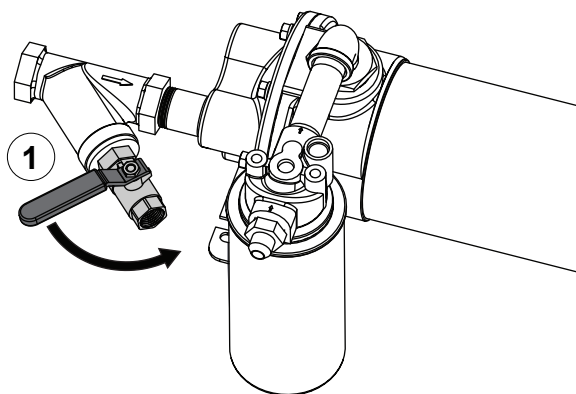
- Liquid ejected at high pressure can cause serious injury.
- Purge all pressure before servicing.



*Open the pressure relief valve to make sure that you purge the pressure from the system before beginning the procedure.*

- 1 Remove the filter from the assembly.
- 2 Discard the filter.
- 3 Install the replacement filter onto the assembly.

## Cleaning the Wye Strainer



Use the illustrations and instructions to clean the wye strainer. Purge the pressure from the system before changing the wye strainer.

 <b>WARNING</b>	
<p><b>High Pressure</b></p> <ul style="list-style-type: none"> <li>• Liquid ejected at high pressure can cause serious injury.</li> <li>• Purge all pressure before servicing.</li> </ul>	

**Open the pressure relief valve to make sure that you purge the pressure from the system before beginning the procedure.**

1 Open the clean-out valve and allow the system drain.

2 Remove the clean-out valve and adapting components.

**Note:** Replace any worn or deteriorated washers or O-rings.

3 Remove the strainer from the assembly, then clean or replace it.

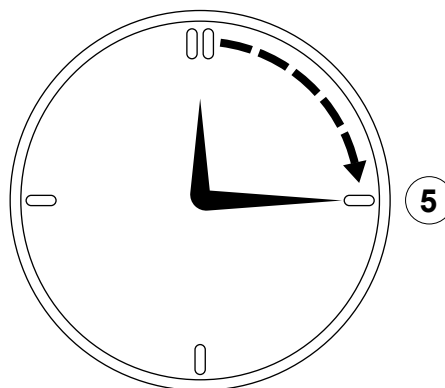
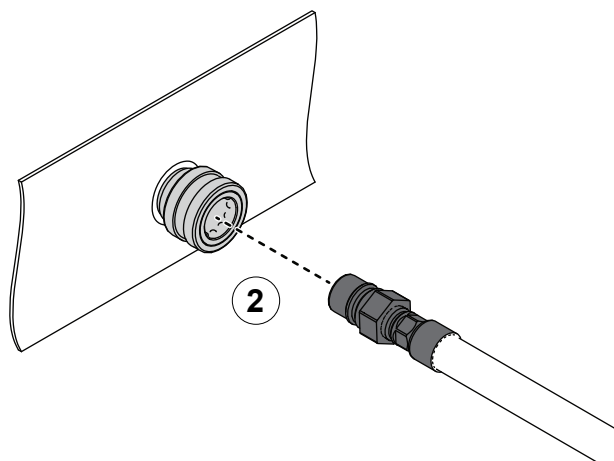
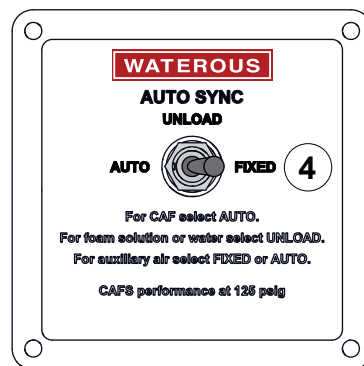
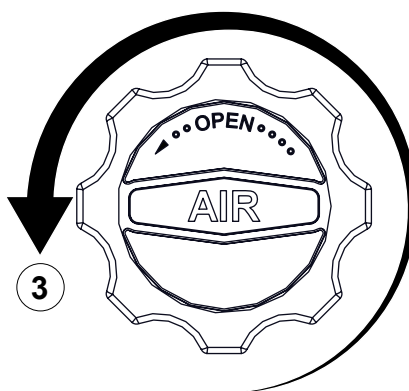
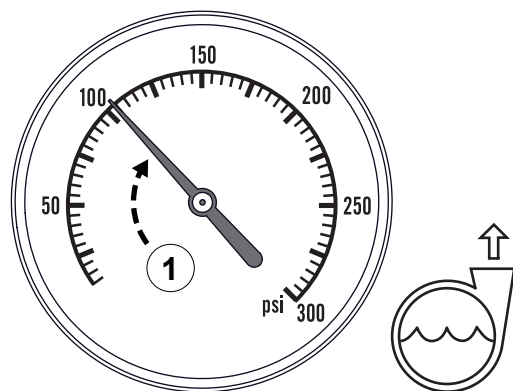
4 Install the strainer into the wye fitting.

**Note:** Operating the cooler without the strainer allows debris from the water supply to damage the system.

5 Install the clean-out valve into the wye fitting.

6 Close the clean-out valve.

## Performing the Weekly Compressor Maintenance



Use the illustrations and instructions to perform the weekly compressor maintenance. Operating the compressor in fixed mode with the air discharge open lubricates and exercises the system.

**Note:** In humid environments, steam can form and escape during this procedure.

When performing this procedure:

- Always start the system in auto or unload mode.
- Always circulate enough cool water to regulate the compressor oil temperature during operation
- Never operate the system with the compressor oil temperature above 250°F (121°C).

1 Engage the water pump, then make sure that the pressure is rising.

2 Connect a hose to the auxiliary air outlet.

3 Open the auxiliary air outlet.

4 Engage the compressor, then toggle the auto-sync switch to the **FIXED** position.

5 Operate the system for 15 minutes.

6 After completing the procedure, shut down the system. Refer to: **"Shutting Down the System"** on page 91.



## Troubleshooting Guide

Symptom	Possible Cause	Solution
The compressor is working, but no air is supplied to the discharges.	The auto-sync switch is not in the correct position.	<ul style="list-style-type: none"> <li>• Make sure that the air pressure produced in unload mode is between 25 to 40 psi.</li> <li>• Make sure that the air pressure produced in auto mode is 50 psi or more and changes with water pressure.</li> <li>• Make sure that the air pressure produced in fixed mode is between 145 to 150 psi.</li> </ul>
	The air discharge solenoid is not working.	Verify that the air discharge solenoid has power and is operational—repair or replace the solenoid.
	There is a leak in the air solenoid or in the tubing between the solenoid and discharge.	Repair or replace the leaking components.
	The air check valve is defective or mounted backwards.	Replace the air check valve or mount it correctly.
	The trim valve is out of adjustment.	Adjust the trim valve.
	The minimum pressure valve is stuck.	<ul style="list-style-type: none"> <li>• Disassemble and clean the minimum pressure valve, then assemble the minimum pressure valve with moly grease.</li> <li>• Replace the minimum pressure valve.</li> </ul>
	The air lines were plumbed prior to the discharge valve seal.	Relocate air lines to the discharge side of discharge valve.
	The compressor speed (rpm) is too low.	Increase the compressor speed (rpm).
The air supply is insufficient.	The air lines are the wrong size.	Replace the lines with the correct size.
	The minimum pressure valve is restricted.	Clear any debris hindering valve operation.
	The throttle valve is closed (if the system uses a throttle valve to control air flow).	Make sure that the throttle valve is open and properly adjusted.
The system is functional, but the pressure gauge is not indicating the correct pressure.	<ul style="list-style-type: none"> <li>• The gauge is malfunctioning.</li> <li>• The air line has detached or is leaking.</li> <li>• The air line is restricted.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the components for air leaks.</li> <li>• Reattach, repair, or replace the malfunctioning components.</li> <li>• Make sure that the air line is not kinked or obstructed—clear any obstructions.</li> </ul>
Air pressure is produced in fixed mode, but no pressure is produced in auto mode.	<ul style="list-style-type: none"> <li>• The balance valve is malfunctioning.</li> <li>• Water is not being supplied to the balance valve.</li> </ul>	<ul style="list-style-type: none"> <li>• Make sure that the balance valve tubing is installed properly.</li> <li>• Make sure that the balance valve tubing is not leaking, kinked, or obstructed—clear any obstructions.</li> </ul>
	The balance trim valve is closed.	Make sure that the trim valve is open and properly adjusted.
Air pressure is produced in auto mode, but it remains at the fixed pressure.	The balance valve is malfunctioning.	<ul style="list-style-type: none"> <li>• Make sure that the balance valve tubing is installed properly.</li> <li>• Make sure that the balance valve tubing is not leaking, kinked, or obstructed—clear any obstructions.</li> </ul>
	The balance trim valve is closed.	<ul style="list-style-type: none"> <li>• Make sure that the trim valve is open and properly adjusted.</li> <li>• If the trim valve is already open, make sure that it is not obstructed—clear any obstructions.</li> </ul>

Symptom	Possible Cause	Solution
The air discharge pressure is too high.	The red auto-sync tube has detached or is leaking.	Reattach, repair, or replace the tubing.
	The trim valve is out of adjustment—the air inlet trim valve is too far open, the balance trim valve is closed.	Adjust the trim valve.
	The PMC valve is out of adjustment.	Adjust the system to approximately 150 psi in fixed mode.
The system is overheating (air/oil cooling).	The electric cooling fan is malfunctioning.	<ul style="list-style-type: none"> <li>• Make sure that the fan control wiring and motor are not damaged—repair or replace damaged components.</li> <li>• Make sure that no fuses or breakers are blown or tripped—replace or reset blown fuses and breakers.</li> </ul>
	Not enough air is flowing through the cooler.	<ul style="list-style-type: none"> <li>• Make sure that there is no debris obstructing the cooling fins on the fan—clear any obstructions.</li> <li>• Make sure that there is adequate space in front of and behind the cooler for air to flow through the fan.</li> <li>• Repair or replace the cooler.</li> </ul>
The system is overheating with adequate flow to the cooler (liquid shell/tube cooling).	The compressor oil level is too low.	<ul style="list-style-type: none"> <li>• Add the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.</li> <li>• Make sure that the lines are not kinked or obstructed—clear any obstructions.</li> <li>• Replace the oil filter.</li> </ul>
	The temperature sending unit and/or temperature gauge is malfunctioning.	<ul style="list-style-type: none"> <li>• Check the wire connections at the sending unit.</li> <li>• Make sure that the wiring is not damaged or corroded—repair or replace any damaged or corroded wiring.</li> <li>• Make sure that the components are not malfunctioning or corroded—repair or replace worn or corroded components.</li> </ul>
	The water being recirculated through the system has become saturated with heat.	Introduce cool water to the tank or stop operation until the system is no longer overheating.
	The cooler is partially restricted.	Check the cooler for debris—clear any debris hindering the flow and determine where debris entered the cooler.
	The wye strainer or panel strainer is plugged with debris.	Clean the wye strainer or panel strainer.
	There is a hole in the wye strainer.	Replace the wye strainer.
	There is a buildup of material in the cooling tubes.	Clean the cooler as needed and clear any obstructions in the tubing.
The air flow meter is not reading correctly (stuck at 0 cfm).	The magnetic coupler has decoupled.	Turn the air flow off and then on to reset the air flow meter.
	There is debris on the magnet.	Disassemble and clean the magnet, then assemble the magnetic coupler.
	The magnet is loose and sliding off of the piston.	Remove the magnet, then securely attach the magnet to the piston.
	The air flow meter is malfunctioning.	Replace the air flow meter.
The air flow meter is not reading correctly (stuck at a high cfm).	The magnetic coupler has decoupled.	Allow excess air (pressure) in the compressor to bleed off, then turn the air flow off and then on to reset the air flow meter.
	The air flow meter is malfunctioning.	Replace the air flow meter.

Symptom	Possible Cause	Solution
The oil consumption is high.	The compressor oil level is too high.	Remove the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.
	The compressor oil is not suitable for your system.	Switch to low- or non-foaming compressor oil.
	The separator filter is damaged.	Replace the separator filter.
	There is water in the separator filter.	Remove the water or replace the separator filter.
	An incompatible separator filter is being used.	Replace the separator filter with another separator filter from the factory-recommended brand.
	Air flow exceeds the system's cfm.	<ul style="list-style-type: none"> <li>• Check the maximum cfm of the system and test again.</li> <li>• Lower the engine speed and flow CAFS to relieve pressure.</li> <li>• Replace the separator filter.</li> </ul>
	The scavenge tube is restricted.	Make sure that the tube is not kinked or obstructed—clear any obstructions.
	The scavenge tube is sitting too high in the separator filter.	Adjust the height of the scavenge tube.
	There is an oil leak in the system.	Repair or replace the leaking components.
The engine stalls when the compressor is engaged.	The compressor was engaged while under load.	Allow the air (pressure) in the compressor to bleed off before engaging the compressor.
	The compressor is flooded with oil.	Allow the air (pressure) in the compressor to bleed off, then start the compressor and flow air.
	The engine horsepower was underrated.	Increase the engine speed (rpm) before engaging the compressor—do not engage the compressor when the engine speed is over 1000 rpm.
	The auto-sync system is in fixed mode.	Engage the compressor in auto or unload mode, then switch to fixed mode.
	The compressor oil level is too low.	Add the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.
	The compressor oil level is too high.	Remove the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.
	The compressor is locked up.	Replace the compressor.
	The sump is positioned too high above the compressor.	Lower the sump or install a check valve into the oil line between the oil cooler and compressor.
	There is a dome on the compressor discharge hose.	Reroute the hose per the requirements of your application.
The compressor is locked up.	The oil level is too high and the compressor is flooded.	Remove the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.
	There was a sump fire.	Check the system and repair the damaged components. Contact Waterous for more information.
	The oil level is low or there is no oil.	<ul style="list-style-type: none"> <li>• Add the appropriate amount of oil—the proper oil level is halfway up the sight window when the apparatus is on level ground.</li> <li>• Check the system and repair the damaged components. Contact Waterous for more information.</li> </ul>

Symptom	Possible Cause	Solution
The air pressure is appropriate but the system produces poor quality foam.	The foam system has not been calibrated or is out of calibration.	Make sure that the foam system has been calibrated—recalibrate the system.
	You are using a wetting agent, not foam concentrate.	Use foam concentrate rated for CAFS.
	The foam proportioning control is too low.	Increase the amount of concentrate to the manufacturer's recommended percentage.
	The air supply is restricted.	Make sure that the lines are not kinked or obstructed—remove any obstructions.
	The air/water volume was not adjusted properly.	Adjust the air/water volume to achieve the proper mixture for foam.
	The air/water pressure is not balanced.	Adjust the trim valve.
	The foam proportioning control is too low or disabled, or the foam tank is empty.	Make sure that the proportioner is turned on, the foam supply valve is open, the foam tank has concentrate, the wye strainer is clear, and the supply line is connected to the injector.
The foam pump is disabled and there is foam in the water system.	Foam concentrate was poured into the on-board water tank.	Flush the tank and pump with clean water, then refill.
	The foam manifold drain line is not isolated from the water drain lines.	Isolate to a separate drain valve.
	The cooler line is plumbed from the foam manifold.	Relocate the cooler line to the discharge side of the fire pump.
	The foam concentrate inject check valve is defective.	Repair or replace the check valve.
	There is a leak between the water and foam tanks.	Repair or replace the tanks.
	The dry vacuum test forces foam concentrate into the foam manifold.	Set the proportioner to flush during the test.
Water is in the compressor oil/air.	The air check valves are malfunctioning.	Repair or replace the check valves.
	Check valves were not installed on the discharges.	Install check valves on the discharges.
	Condensation has built up in the oil/air mixture.	Flow air once per week at a minimum, more often if operating in high humidity.
	The system was exposed to cold temperatures without the oil cooler being drained.	Test the oil cooler for internal leaks from the water side to the oil side—replace the cooler.
The air flow meter is not reading correctly.	The magnetic coupler has decoupled.	Turn the air flow off and then on to reset the air flow meter.
	The meter is malfunctioning.	Replace the air flow meter.

Symptom	Possible Cause	Solution
The safety pop-off valve is opening at a low pressure or opening repeatedly.	The auto-sync system is out of balance.	Adjust the auto-sync system—make sure to not open the compressor trim valve more than 3 turns.
	A sump fire damaged the pop-off valve.	Check the system for other damaged components, then replace the pop-off valve.
	The trim valve or inlet is completely open.	Adjust the trim valve.
	The red tube circuit has detached or is leaking.	Reattach, repair, or replace the red tubing.
	The black tube circuit is restricted.	Make sure that the black tubing is not kinked or obstructed—clear any obstructions.
	Operating in high humidity has trapped water vapor in the compressor oil.	Operating the system at the boiling point of water allows the water vapor to escape as steam.
The bleed-down time seems too long during system operation.	The bleed-down time varies between systems.	If the auto-sync system is working properly and the compressor output is within spec, the bleed-down time is normal.
	The trim valve or inlet is too far closed.	Adjust the trim valve.
	The air inlet trim valve is restricted.	Clear any debris hindering the trim valve operation.
The bleed-down time seems too long during system shutdown.	The bleed-down time varies between systems.	If the auto-sync system is working properly and the compressor output is within spec, the bleed-down time is normal.
	There is a plugged restrictor jet at the air inlet trim valve tee.	Remove and discard the restrictor jet at the tee fitting.
	The green/gray air-brake tube is restricted.	Make sure that the green/gray tubing is not kinked or obstructed—clear any obstructions.
	The shuttle valve is stuck.	Disassemble and clean the shuttle valve, then install it back into the PMC. <b>Note:</b> Because it is easy to reverse the shuttle valve connections, make sure to note how the shuttle valve is connected during disassembly.
The clutch is smoking.	The auto-sync system is engaged in the wrong mode.	Engage the system in auto or unload mode.
	The clutch solenoid has an air leak.	Repair the air leak or replace the solenoid.
	The clutch disc is contaminated.	Clean or replace the clutch disc.
	The clutch is engaged at a high engine speed.	Only engage the clutch at a lower engine speed.
	The clutch is engaging the system when the compressor has not had adequate bleed-down time.	Allow the air (pressure) in the compressor to bleed off before engaging the compressor.
	The air supply for the clutch does not have an isolated air line.	Plumb an air line exclusively for clutch operation.

Symptom	Possible Cause	Solution
The discharge hose is shaking (slug flow).	The foam proportioner is on, the setting is correct, and the tank has concentrate, but it is not providing foam solution.	Refer to foam proportioner instructions for detailed calibration and troubleshooting instructions.
	Foam concentrate is not being injected into the foam manifold.	Make sure that the foam system is turned on.
	The discharge has low water flow and the foam concentrate is not being injected into the foam manifold.	<ul style="list-style-type: none"> <li>• Increase water flow.</li> <li>• Raise the foam percentage.</li> <li>• Make sure that the flow meter is the correct size.</li> <li>• Make sure that the foam system has been calibrated—recalibrate the system.</li> </ul>
	Poor quality foam concentrate is being used.	<ul style="list-style-type: none"> <li>• Make sure that the foam system is calibrated correctly.</li> <li>• Raise the foam percentage until slug flow stops.</li> </ul>
	The wye strainer is plugged with debris.	Clean the foam tank and wye strainer, then open the foam concentrate shut-off valve.
	The foam concentrate shut-off valve is closed.	Open the shut-off valve.
	The foam concentrate inject check valve is in the bypass position.	Move the check valve to the inject position.
The compressor is producing no air pressure.	The clutch is not engaging.	<ul style="list-style-type: none"> <li>• Make sure that the clutch is operating properly—check air clutch systems for leaks.</li> <li>• Make sure that the <i>OK TO PUMP</i> light is illuminated.</li> <li>• Check the wire connections at the clutch or PTO.</li> <li>• Make sure that the wiring is not damaged or corroded—repair or replace any damaged or corroded wiring.</li> <li>• Make sure that the PTO is not malfunctioning—repair or replace any damaged components.</li> </ul>
	The auto-sync system is not engaged in fixed mode.	<ul style="list-style-type: none"> <li>• Make sure that the air pressure produced in unload mode is between 25 to 40 psi.</li> <li>• Make sure that the air pressure produced in auto mode is 50 psi or more and changes with the water pressure.</li> <li>• Make sure that the pressure produced in fixed mode is between 145 to 150 psi.</li> </ul>
The compressor is producing low air pressure.	The clutch is not engaging.	<ul style="list-style-type: none"> <li>• Make sure that the clutch is operating properly—check air clutch systems for leaks.</li> <li>• Make sure that the <i>OK TO PUMP</i> light is illuminated.</li> <li>• Check the wire connections at the clutch or PTO.</li> <li>• Make sure that the wiring is not damaged or corroded—repair or replace any damaged or corroded wiring.</li> <li>• Make sure that the PTO is not malfunctioning—repair or replace any damaged components.</li> </ul>
	The auto-sync system is not engaged in fixed mode.	<ul style="list-style-type: none"> <li>• Make sure that the air pressure produced in unload mode is between 25 to 40 psi.</li> <li>• Make sure that the air pressure produced in auto mode is 50 psi or more and changes with the water pressure.</li> <li>• Make sure that the pressure produced in fixed mode is between 145 to 150 psi.</li> </ul>

# **WATEROUS**

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