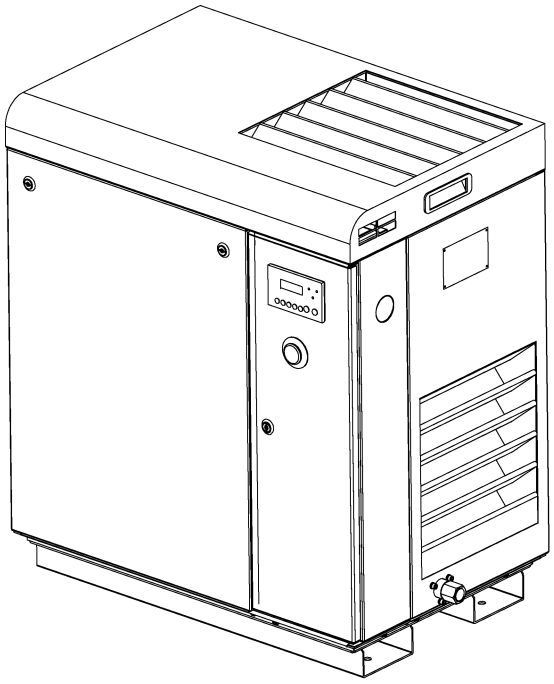
SULLAIR®

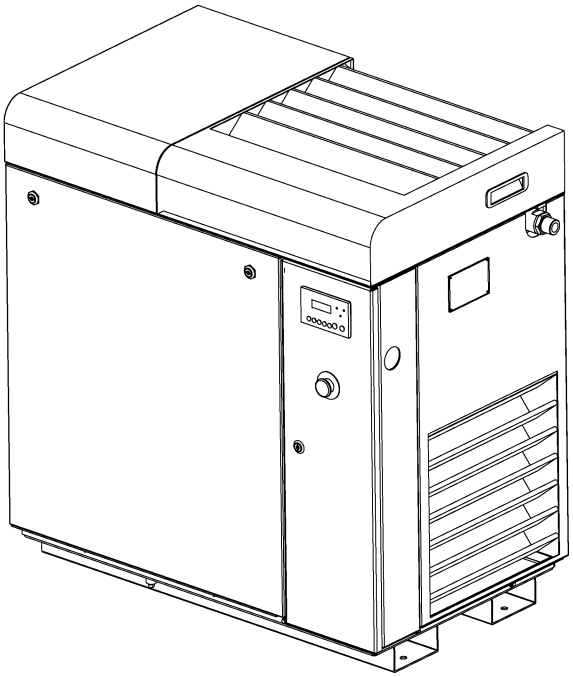
USER MANUAL

ShopTek™

ST4, ST5, ST7, ST11, ST15

4 – 15 kW (5 – 20 hp)
Three-phase 60 Hz





⚠ SAFETY WARNING

Users are required to read the entire User Manual before handling or using the product. Keep the User Manual in a safe place for future reference.

WARRANTY NOTICE

Failure to follow the instructions and procedures in this manual, or misuse of this equipment, will **void** its warranty.

PART NUMBER:
88292018-236 R00

The information in this manual is current as of its publication date and applies to compressor models indicated on this cover with **serial number**:
37216100224
and all subsequent serial numbers until next revision of this manual or release of a replacement manual.

Publication date: 03/31/2017

Air Care Seminar Training

Sullair Air Care Seminars are courses that provide hands-on instruction for the proper operation, maintenance, and servicing of Sullair products. Individual seminars on Stationary compressors and compressor electrical systems are offered at regular intervals throughout the year at Sullair's training facility located at Michigan City, Indiana.

Instruction includes training on the function and installation of Sullair service parts, troubleshooting common faults and malfunctions, and actual equipment operation. These seminars are recommended for maintenance, contractor maintenance, and service personnel.

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SULLAIR®

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Section 1
Safety

NOTE

Operator is required to read entire instruction manual.

1.1 General

Sullair and its subsidiaries design and manufacture all of their products so they can be operated safely. However, the responsibility for safe operation rests with those who use and maintain these products. The following safety precautions are offered as a guide which, if conscientiously followed, will minimize the possibility of accidents throughout the useful life of this equipment.

The compressor should be operated only by those who have been trained and delegated to do so, and who have read and understood this Operator's Manual. Failure to follow the instructions, procedures and safety precautions in this manual may result in accidents and injuries. **NEVER** start the compressor unless it is safe to do so. **DO NOT** attempt to operate the compressor with a known unsafe condition. Tag the compressor and render it inoperative by disconnecting and locking out all power at source or otherwise disabling its prime mover so others who may not know of the unsafe condition cannot attempt to operate it until the condition is corrected.

Install, use and operate the compressor only in full compliance with all pertinent OSHA regulations and/or any applicable Federal, State, and Local codes, standards and regulations. **DO NOT** modify the compressor and/or controls in any way except with written factory approval.

While not specifically applicable to all types of compressors with all types of prime movers, most of the precautionary statements contained herein are applicable to most compressors and the concepts behind these statements are generally applicable to all compressors.

1.2 Personal protective equipment

A. Prior to installing or operating the compressor, owners, employers and users should become familiar with, and comply with, all applicable OSHA regulations and/or any applicable Federal, State and Local codes, standards, and regulations relative to personal protective equipment, such as eye and face protective equipment, respiratory protective equipment, equipment intended to protect the extremities, protective clothing, protective shields and barriers and electrical protective equipment, as well as noise exposure administrative and/or engineering controls and/or personal hearing protective equipment.

1.3 Pressure release

A. Install an appropriate flow-limiting valve between the service air outlet and the shut-off (throttle) valve, either at the compressor or at any other point along the air line, when an air hose exceeding ½″ (13 mm) inside diameter is to be connected to the shut-off (throttle) valve, to reduce pressure in case of hose failure, per OSHA Standard 29 CFR 1926.302(b)(7) and/or any applicable Federal, State and Local codes, standards and regulations.

B. When the hose is to be used to supply a manifold, install an additional appropriate flow-limiting valve between the manifold and each air hose exceeding ½″ (13 mm) inside diameter that is to be connected to the manifold to reduce pressure in case of hose failure.

C. Provide an appropriate flow-limiting valve at the beginning of each additional 75 feet (23 m) of hose in runs of air hose exceeding ½″ (13 mm) inside diameter to reduce pressure in case of hose failure.

D. Flow-limiting valves are listed by pipe size and flow-rated. Select appropriate valves accordingly, in

accordance with their manufacturer's recommendations.

E. **DO NOT** use air tools that are rated below the maximum rating of the compressor. Select air tools, air hoses, pipes, valves, filters and other fittings accordingly. **DO NOT** exceed manufacturer's rated safe operating pressures for these items.

F. Secure all hose connections by wire, chain or other suitable retaining device to prevent tools or hose ends from being accidentally disconnected and expelled.

G. Open fluid filler cap only when compressor is not running and is not pressurized. Shut down the compressor and bleed the receiver tank to zero internal pressure before removing the cap.

H. Vent all internal pressure prior to opening any line, fitting, hose, valve, drain plug, connection or other component, such as filters and line oilers, and before attempting to refill optional air line anti-icer systems with antifreeze compound.

I. Keep personnel out of line with and away from the discharge opening of hoses or tools or other points of compressed air discharge.

J. **DO NOT** use air at pressures higher than 2.1 bar for cleaning purposes, and then only with effective chip guarding and personal protective equipment per OSHA Standard 29 CFR 1910.242(b) and/or any applicable Federal, State, and Local codes, standards and regulations.

K. **DO NOT** engage in horseplay with air hoses as death or serious injury may result.

1.4 Fire and explosion

A. Clean up spills of lubricant or other combustible substances immediately, if such spills occur.

B. Shut off the compressor and allow it to cool. Then keep sparks, flames and other sources of ignition away and **DO NOT** permit smoking in the vicinity when checking or adding lubricant or when refilling air line anti-icer systems with antifreeze compound.

C. **DO NOT** permit fluids, including air line anti-icer system antifreeze compound or fluid film, to accumulate on, under or around acoustical material, or on any external surfaces of the air compressor. Wipe down using an aqueous industrial cleaner or steam clean as required. If necessary, remove acoustical material, clean all surfaces and then replace acoustical material. Any acoustical material with a protective covering that has been torn or punctured should be replaced immediately to prevent accumulation of liquids or fluid film within the material. **DO NOT** use flammable solvents for cleaning purposes.

D. Disconnect and lock out all power at source prior to attempting any repairs or cleaning of the compressor or of the inside of the enclosure, if any.

E. Keep electrical wiring, including all terminals and pressure connectors in good condition. Replace any wiring that has cracked, cut, abraded or otherwise degraded insulation, or terminals that are worn, discolored or corroded. Keep all terminals and pressure connectors clean and tight.

F. Keep grounded and/or conductive objects such as tools away from exposed live electrical parts such as terminals to avoid arcing which might serve as a source of ignition.

G. Remove any acoustical material or other material that may be damaged by heat or that may support combustion and is in close proximity, prior to attempting weld repairs.

H. Keep suitable fully charged Class BC or ABC fire extinguisher or extinguishers nearby when servicing and operating the compressor.

I. Keep oily rags, trash, leaves, litter or other combustibles out of and away from the compressor.

J. **DO NOT** operate the compressor without proper flow of cooling air or water or with inadequate flow of lubricant or with degraded lubricant.

K. **DO NOT** attempt to operate the compressor in any classification of hazardous environment unless the compressor has been specially designed and manufactured for that duty.

1.5 Moving parts

A. Keep hands, arms and other parts of the body and clothing away from couplings, belts, pulleys, fans and other moving parts.

B. **DO NOT** attempt to operate the compressor with the fan, coupling or other guards removed.

C. Wear snug-fitting clothing and confine long hair when working around this compressor, especially when exposed to hot or moving parts.

D. Keep access doors, if any, closed except when making repairs or adjustments.

E. Make sure all personnel are out of and/or clear of the compressor prior to attempting to start or operate it.

F. Disconnect and lock out all power at source and verify at the compressor that all circuits are de-energized to minimize the possibility of accidental start-up, or operation, prior to attempting repairs or adjustments. This is especially important when compressors are remotely controlled.

G. Keep hands, feet, floors, controls and walking surfaces clean and free of fluid, water or other liquids to minimize the possibility of slips and falls.

1.6 Hot surfaces, sharp edges and sharp corners

A. Avoid bodily contact with hot fluid, hot coolant, hot surfaces and sharp edges and corners.

B. Keep all parts of the body away from all points of air discharge.

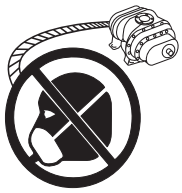
C. Wear personal protective equipment including gloves and head covering when working in, on or around the compressor.

D. Keep a first aid kit handy. Seek medical assistance promptly in case of injury. DO NOT ignore small cuts and burns as they may lead to infection

1.7 Toxic and irritating substances

A. **DO NOT** use air from this compressor for respiration (breathing) except in full compliance with OSHA Standards 29 CFR 1910 and/or any applicable Federal, State or Local codes or regulations.

DANGER



Death or serious injury can result from inhaling compressed air without using proper safety equipment. See OSHA standards and/or any applicable Federal, State, and Local codes, standards and regulations on safety equipment.

B. **DO NOT** use air line anti-icer systems in air lines supplying respirators or other breathing air utilization equipment and **DO NOT** discharge air from these systems into unventilated or other confined areas.

C. Operate the compressor only in open or adequately ventilated areas.

D. Locate the compressor or provide a remote inlet so that it is not likely to ingest exhaust fumes or other toxic, noxious or corrosive fumes or substances.

E. Coolants and lubricants used in this compressor are typical of the industry. Care should be taken to avoid accidental ingestion and/or skin contact. In the event of ingestion, seek medical treatment promptly. Wash with soap and water in the event of skin contact. Consult Material Safety Data Sheet for information pertaining to fluid of fill.

F. Wear goggles or a full face shield when adding antifreeze compound to air line anti-icer systems.

G. If air line anti-icer system antifreeze compound enters the eyes or if fumes irritate the eyes, they should be washed with large quantities of clean water for fifteen minutes. A physician, preferably an eye specialist, should be contacted immediately.

H. **DO NOT** store air line anti-icer system antifreeze compound in confined areas.

I. The antifreeze compound used in air line antifreeze systems contains methanol and is toxic, harmful or fatal if swallowed. Avoid contact with the skin or eyes and avoid breathing the fumes. If swallowed, induce vomiting by administering a tablespoon of salt, in each glass of clean, warm water until vomit is clear, then administer two teaspoons of baking soda in a glass of clean water. Have patient lay down and

cover eyes to exclude light. Call a physician immediately.

1.8 Electrical shock

A. This compressor should be installed and maintained in full compliance with all applicable Federal, State and Local codes, standards and regulations, including those of the National Electrical Code, and also including those relative to equipment grounding conductors, and only by personnel that are trained, qualified and delegated to do so.

B. Keep all parts of the body and any hand-held tools or other conductive objects away from exposed live parts of electrical system. Maintain dry footing, stand on insulating surfaces and **DO NOT** contact any other portion of the compressor when making adjustments or repairs to exposed live parts of the electrical system. Make all such adjustments or repairs with one hand only, so as to minimize the possibility of creating a current path through the heart.

C. Attempt repairs in clean, dry and well lighted and ventilated areas only.

D. **DO NOT** leave the compressor unattended with open electrical enclosures. If necessary to do so, then disconnect, lock out and tag all power at source so others will not inadvertently restore power.

E. Disconnect, lock out, and tag all power at source prior to attempting repairs or adjustments to rotating machinery and prior to handling any ungrounded conductors.

DANGER

All field equipment must be tested for electrostatic fields prior to servicing or making contact with the machine using the following or equivalent test equipment:

- 90 – 600 VAC: Volt detector such as Fluke Model 1AC-A
- 600 – 7000 VAC: Voltage detector such as Fluke Networks Model C9970

It is the responsibility of each organization to provide/arrange training for all their associates expected to test for electrostatic fields.

1.9 Lifting

A. If the compressor is provided with a lifting bail, then lift by the bail provided. If no bail is provided, then lift by sling. Compressors to be air-lifted by helicopter must not be supported by the lifting bail but by slings instead. In any event, lift and/or handle only in full compliance with OSHA standards 29 CFR 1910 subpart N and/or any applicable Federal, State, and Local codes, standards and regulations.

B. Inspect points of attachment for cracked welds and for cracked, bent, corroded or otherwise degraded members and for loose bolts or nuts prior to lifting.

C. Make sure entire lifting, rigging and supporting structure has been inspected, is in good condition and has a rated capacity of at least the weight of the compressor. If you are unsure of the weight, then weigh compressor before lifting.

D. Make sure lifting hook has a functional safety latch or equivalent, and is fully engaged and latched on the bail or slings.

E. Use guide ropes or equivalent to prevent twisting or swinging of the compressor once it has been lifted clear of the ground.

F. **DO NOT** attempt to lift in high winds.

G. Keep all personnel out from under and away from the compressor whenever it is suspended.

H. Lift compressor no higher than necessary.

I. Keep lift operator in constant attendance whenever compressor is suspended.

J. Set compressor down only on a level surface capable of safely supporting at least its weight and its loading unit.

K. When moving the compressor by forklift truck, utilize fork pockets if provided. Otherwise, utilize pallet if provided. If neither fork pockets or pallet are provided, then make sure compressor is secure and well balanced on forks before attempting to raise or transport it any significant distance.

L. Make sure forklift truck forks are fully engaged and tipped back prior to lifting or transporting the compressor.

M. Forklift no higher than necessary to clear obstacles at floor level and transport and corner at minimum practical speeds.

N. Make sure pallet-mounted compressors are firmly bolted or otherwise secured to the pallet prior to attempting to forklift or transport them. **NEVER** attempt to forklift a compressor that is not secured to its pallet, as uneven floors or sudden stops may cause the compressor to tumble off, possibly causing serious injury or property damage in the process.

1.10 Entrapment

A. If the compressor enclosure, if any, is large enough to hold a man and if it is necessary to enter it to perform service adjustments, inform other personnel before doing so, or else secure and tag the access door in the open position to avoid the possibility of others closing and possibly latching the door with personnel inside.

B. Make sure all personnel are out of compressor before closing and latching enclosure doors.

1.11 Implementation of lockout/tagout

The energy control procedure defines actions necessary to lockout a power source of any machine to be repaired, serviced or set-up, where unexpected motion, or an electrical or other energy source, would cause personal injury or equipment damage. The power source on any machine shall be locked out by each employee doing the work except when motion is necessary during setup, adjustment or trouble-shooting.

A. The established procedures for the application of energy control shall cover the following elements and actions and shall be initiated only by Authorized Persons and done in the following sequence:

1. Review the equipment or machine to be locked and tagged out.
2. Alert operator and supervisor of which machine is to be worked on, and that power and utilities will be turned off.
3. Check to make certain no one is operating the machine before turning off the power.
4. Turn off the equipment using normal shutdown procedure.
5. Disconnect the energy sources:
   a. Air and hydraulic lines should be bled, drained and cleaned out. There should be no pressure in these lines or in the reservoir tanks. Lockout or tag lines or valves.
   b. Any mechanism under tension or pressure, such as springs, should be released and locked out or tagged.
   c. Block any load or machine part prior to working under it.
   d. Electrical circuits should be checked with calibrated electrical testing equipment and stored energy and electrical capacitors should be safely discharged.
6. Lockout and/or Tagout each energy source using the proper energy isolating devices and tags. Place lockout hasp and padlock or tag at the point of power disconnect where lockout is required by each person performing work. Each person shall be provided with their own padlock and have possession of the only key. If more than one person is working on a machine *each* person *shall* affix personal lock and tag using a multi-lock device.
7. Tagout devices shall be used only when power sources are not capable of being locked out by use of padlocks and lockout hasp devices. The name of the person affixing tag to power source must be on tag along with date tag was placed on power source.
8. Release stored energy and bring the equipment to a “zero mechanical state”.
9. Verify Isolation: Before work is started, test equipment to ensure power is disconnected.

B. General Security

1. The lock shall be removed by the “Authorized” person who put the lock on the energy-isolating device. No one other than the person/persons placing padlocks and

lockout hasps on power shall remove padlock and lockout hasps and restore power. However, when the authorized person who applied the lock is unavailable to remove it his/her Supervisor may remove padlock/padlocks and lockout hasps and restore power only if it is first:

a. verified that no person will be exposed to danger.
b. verified that the “Authorized” person who applied the device is not in the facility.
c. noted that all reasonable efforts to contact the “Authorized” person have been made to inform him or her that the lockout or tagout device has been removed.
d. ensured that the “Authorized” person is notified of lock removal before returning to work.

2. Tagout System—Tags are warning devices affixed at points of power disconnect and are not to be removed by anyone other that the person placing tag on power lockout. Tags shall never be by-passed, ignored, or otherwise defeated.

1.12 Safety warnings

The following special instructions apply to VSD packages provided with electronic adjustable speed motor drives. These cautions that apply to VSD operation.

WARNING

Ground the unit following the instructions in this manual. Ungrounded units may cause electric shock and/or fire. The variable speed drive has a large capacitive leakage current during operation, which can cause enclosure parts to be above ground potential. Proper grounding, as described in this manual, is required. Failure to observe this precaution could result in death or severe injury.

WARNING

Before applying power to the variable speed drive, make sure that the front and cable covers are closed and fastened to prevent exposure to potential electrical fault conditions. Failure to observe this precaution could result in death or severe injury.

WARNING

Refer all drive service to trained technicians. This equipment should be installed, adjusted, and serviced by qualified electrical maintenance personnel familiar with the construction and operation of this type of equipment and the hazards involved and in accordance with published service manuals. Failure to observe this precaution could result in death or severe injury.

WARNING

Line terminals (L1, L2, L3), motor terminals (U, V, W) and the DC link/brake resistor terminals (-/+) are live when the drive is connected to power, even if the motor is not running. Contact with this voltage is extremely dangerous and may cause death or severe injury.

WARNING

Before opening the variable speed drive covers:

- Disconnect all power to the variable speed drive.
- Wait a minimum of 5 (five) minutes after all the lights on the keypad are off. This allows time for the DC bus capacitors to discharge.
- A hazard voltage may still remain in the DC bus capacitors even if the power has been turned off. Confirm that the capacitors have fully discharged by measuring their voltage using a multimeter set to measure DC voltage. Failure to follow the above precautions may cause death or severe injury.

CAUTION

Do not perform any megger or voltage withstand tests on any part of the variable speed drive or its components. Improper testing may result in damage. Prior to any tests or measurements of the motor or the motor cable, disconnect the motor cable at the variable speed drive output terminals (U, V, W) to avoid damaging the variable speed drive during motor or cable testing.

CAUTION

Do not touch any components on the circuit boards. Static voltage discharge may damage the components.

CAUTION

Install the variable speed drive in a well ventilated room that is not subject to temperature extremes, high humidity, or condensation, and avoid locations that are directly exposed to sunlight, or have high concentrations of dust, corrosive gas, explosive gas, inflammable gas, grinding fluid mist, etc. Improper installation may result in a fire hazard.

CAUTION

Make sure that no power correction capacitors are connected to the variable speed drive output or the motor terminals to prevent variable speed drive malfunction and potential damage.

CAUTION

Make sure that the variable speed drive output terminals (U, V, W) are not connected to the utility line power as severe damage to the VSD may occur.

NOTE

Interior electrical wiring is performed at the factory. Required customer wiring is minimal, but should be done by a qualified electrician in compliance with OSHA, National Electrical Code, and/or any other applicable State, Federal, and local electrical codes concerning isolation switches, fused disconnects, etc. Sullair provides a wiring diagram for use by the installer.

NOTE

Customer must provide electrical supply power disconnect within sight of machine.

Notes:

Section 2
Description

2.1 Introduction

The design of the Sullair ShopTek line of compressor units is a single stage, positive displacement, flooded rotary screw. A complete package includes the:

- Compressor unit
- Electric motor
- Starter
- Compressor inlet and discharge systems
- Compressor lubrication and cooling system
- Controller
- Aftercooler (ST11 and ST15 only)
- Heavy gauge steel mounting frame

⚠ CAUTION

Use only one type of a recommended compressor lubricant. Adding a different one, or mixing lubricants can cause damage and/or malfunctions, and will void the compressor's warranty.

New compressors are shipped from the factory fully charged with Sullube® lubrication fluid. *Section 3.2* and *Section 3.3* describe lubrication requirements and recommendations for each compressor package.

NOTE

The compressor air end requires no internal inspections or maintenance actions. Opening the compressor air end's housing may void its warranty. (This does not apply to the shaft seal or inlet valve which are replaceable.)

External piping, connectors, and the enclosure should be inspected and maintained in accordance with the procedures and recommendations in this manual.

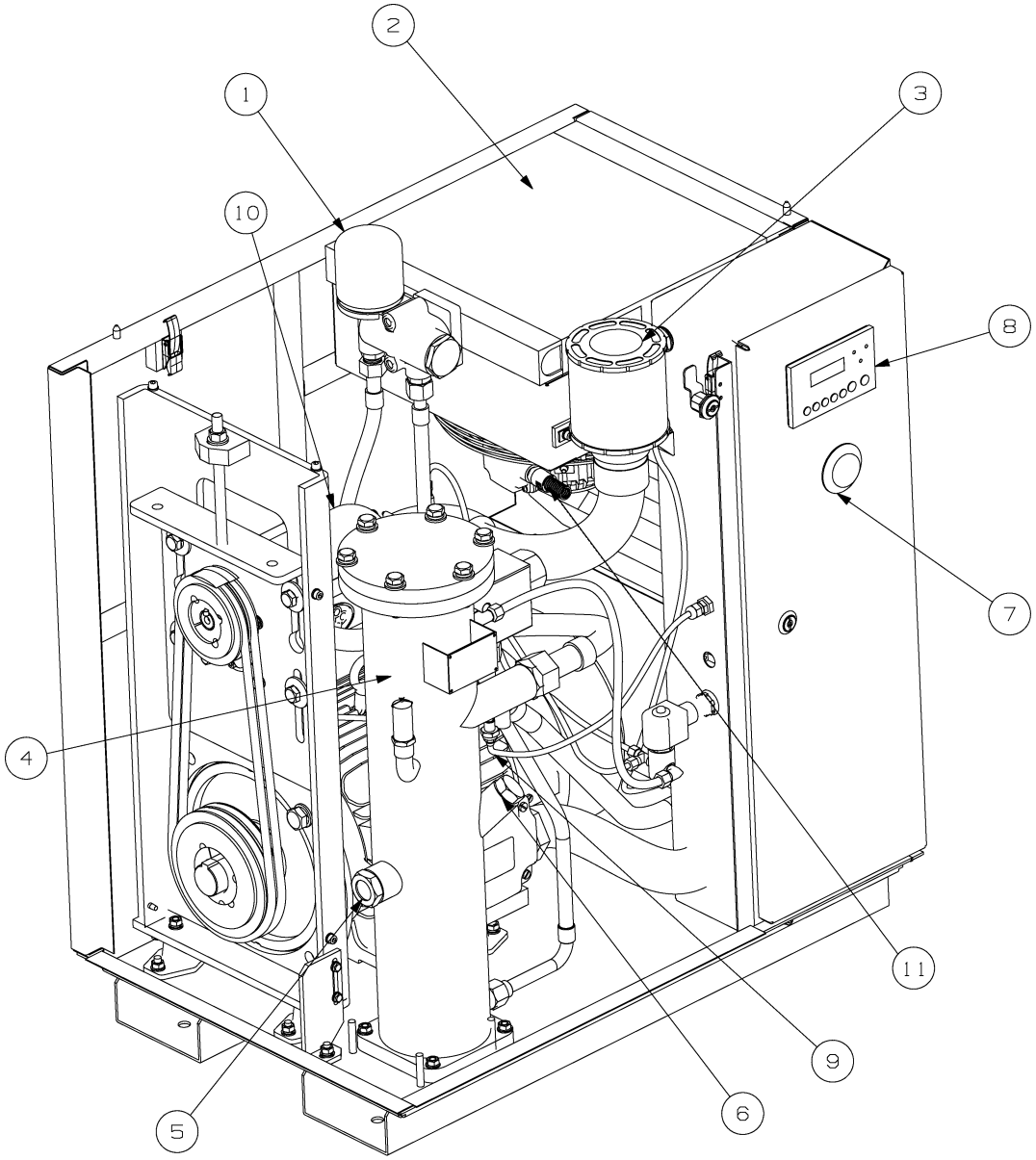
2.2 Compressor component description

The ShopTek compressor (*Figure 2-1* and *Figure 2-2*) uses a fan to draw outside air into the enclosure, cooling the motors, the combined radiator fluid cooler, and air aftercooler. This hot air is then vented out of the top of the enclosure.

Fluid is injected into the compressor, and mixes directly with the air as the rotors turn which compresses the air. The fluid flow has three basic functions:

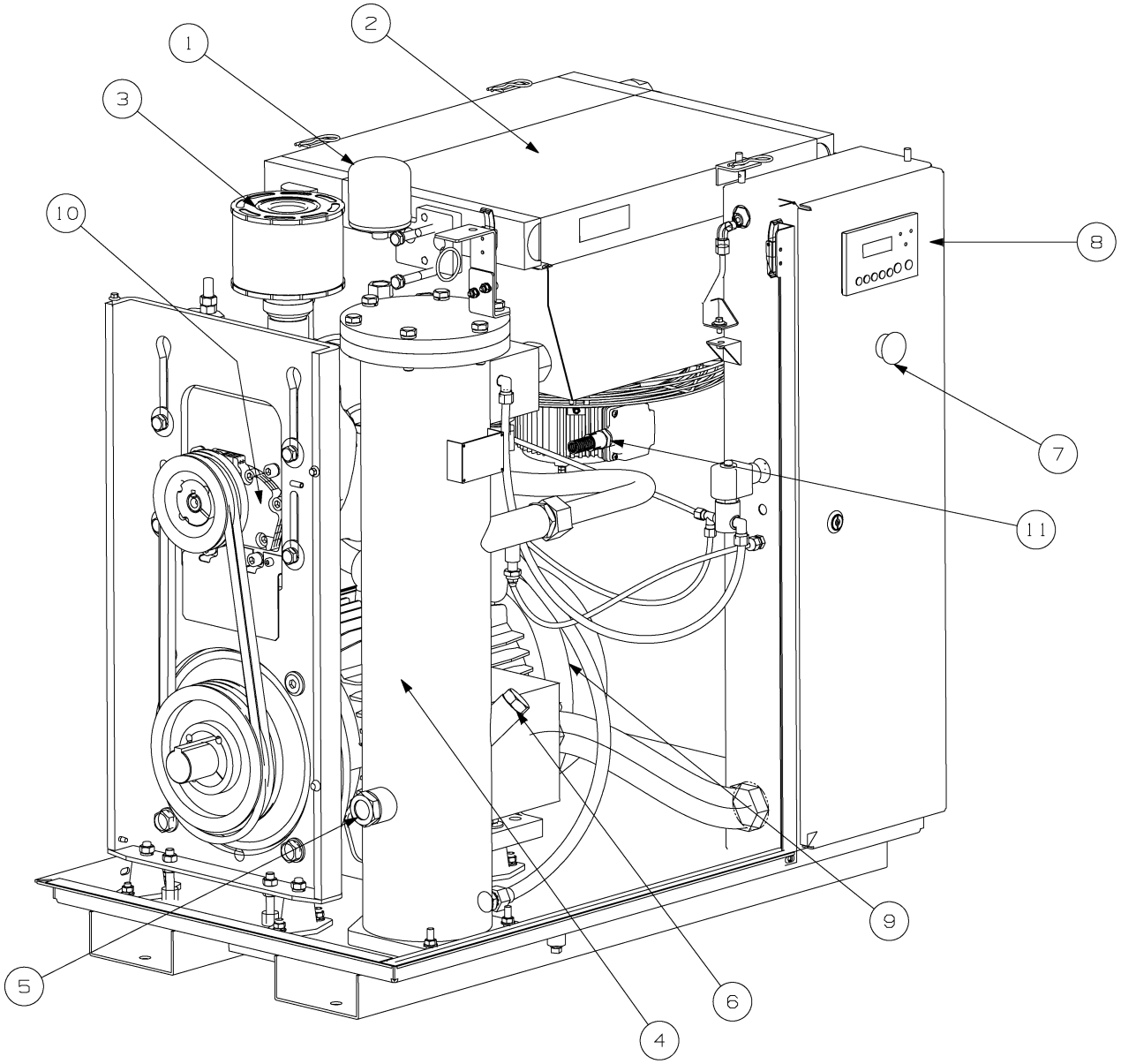
- As a coolant, it controls the air temperature rise normally associated with the heat of compression.
- Seals the clearance paths between the rotors and the stator, and also between the two rotors.
- Provides a lubricating film between the rotors allowing one rotor to directly drive the other, which is an idler, and also lubricates the bearings.

After the air/fluid mixture is discharged from the compressor unit, the fluid is separated from the air. At this time, the air flows through an aftercooler and separator, and then to the service line while the fluid is cooled and filtered in preparation for reinjection.



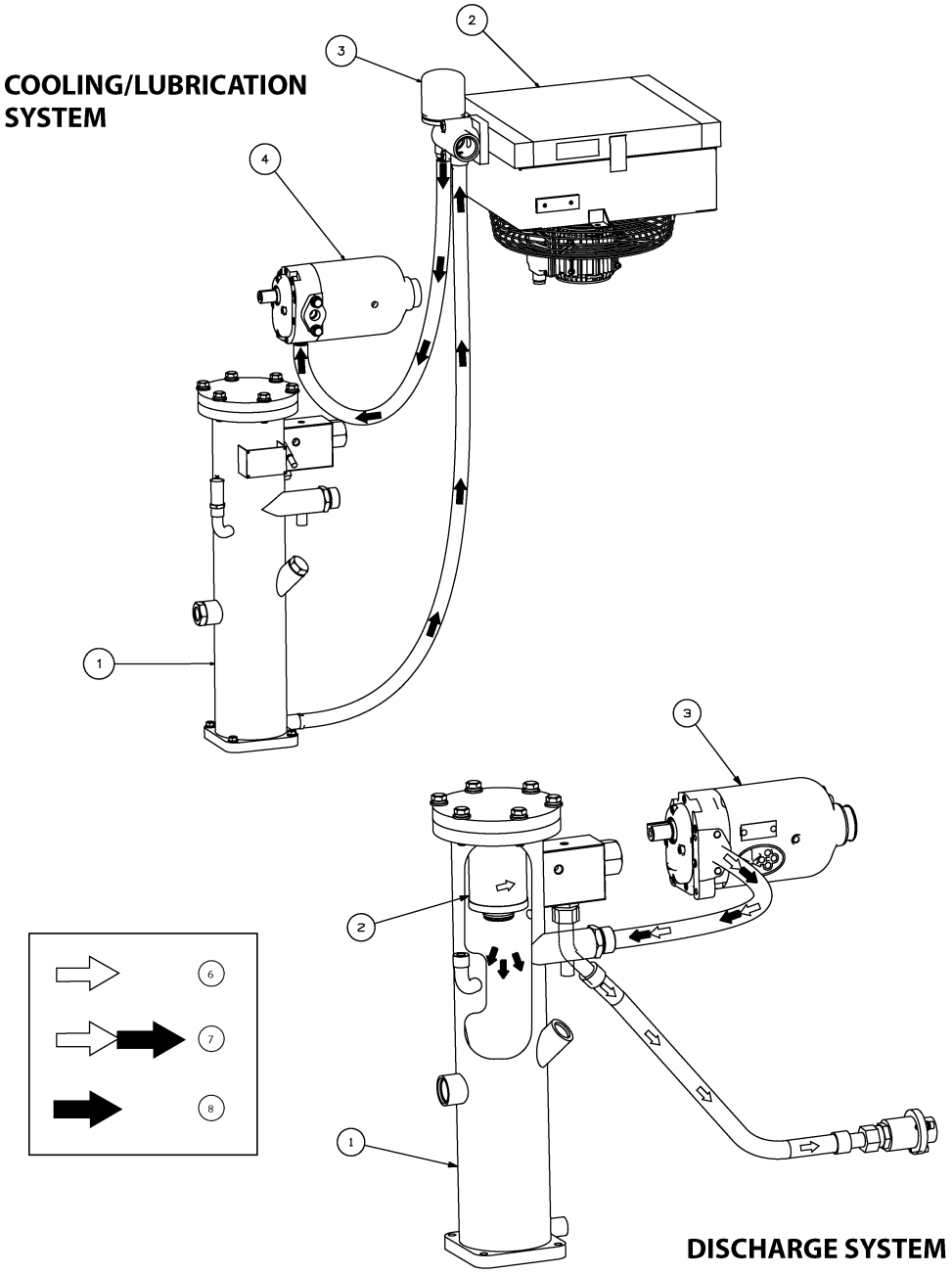
1. Fluid filter	7. E-stop button
2. Fluid cooler	8. Controller
3. Air inlet filter	9. Main motor
4. Separator tube	10. Compressor unit
5. Fluid fill sight glass	11. Cooler fan motor
6. Fluid fill	

Figure 2-1: Main components—ST4, ST5, ST7



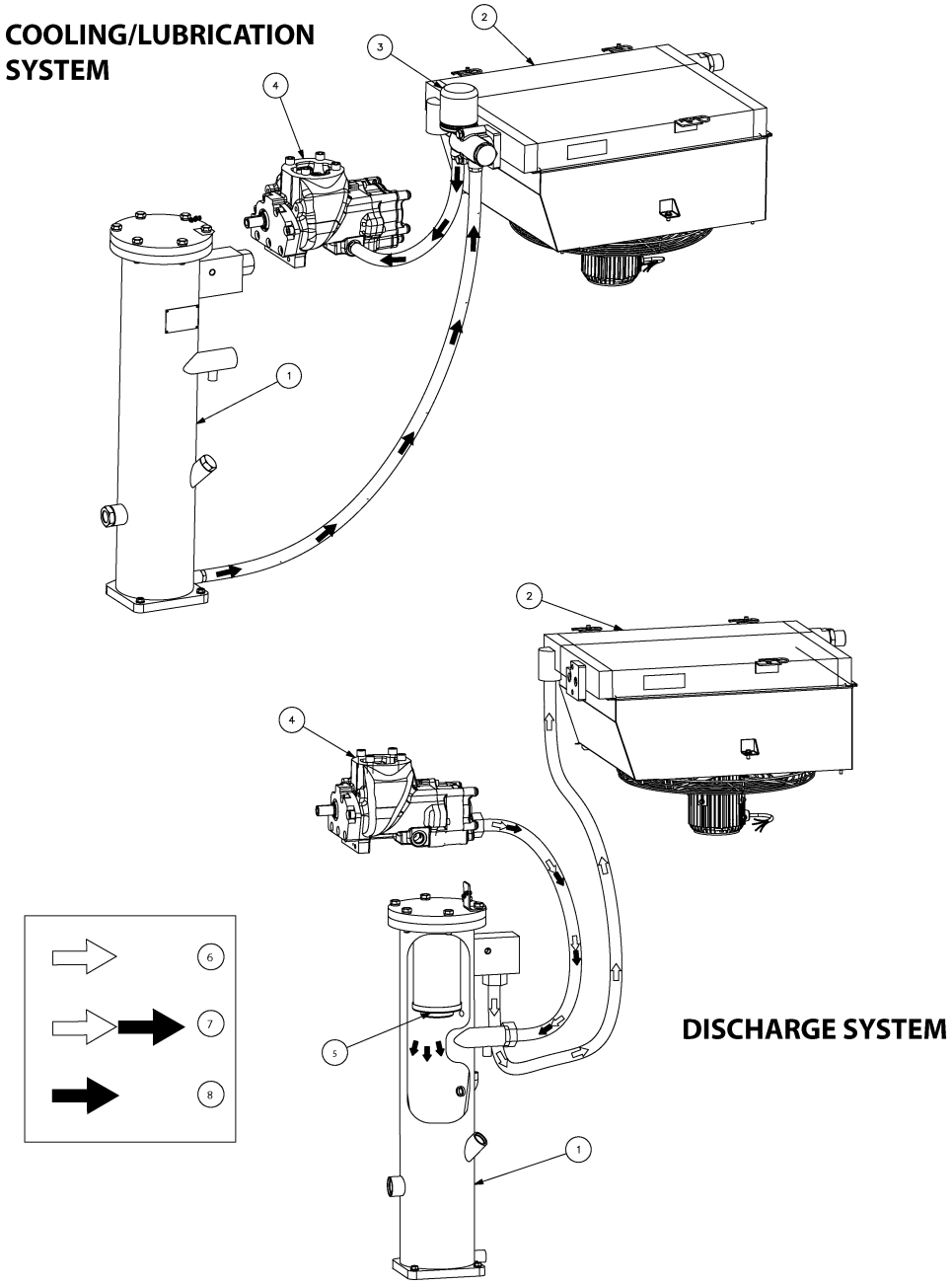
1. Fluid filter	7. E-stop button
2. Aftercooler/fluid cooler	8. Controller
3. Air inlet filter	9. Main motor
4. Separator tube	10. Compressor unit
5. Fluid fill sight glass	11. Cooler fan motor
6. Fluid fill	

Figure 2-2: Main components—ST11, ST15



1.	Separator tube	5.	Separator element
2.	Cooler	6.	Air
3.	Fluid filter	7.	Air/fluid mix
4.	Compressor unit	8.	Fluid

Figure 2-3: Cooling/lubrication and discharge system—ST4, ST5, ST7



1.	Separator tube	5.	Separator element
2.	Cooler	6.	Air
3.	Fluid filter	7.	Air/fluid mix
4.	Compressor unit	8.	Fluid

Figure 2-4: Cooling/lubrication and discharge system—ST11, ST15

2.3 Compressor cooling and lubrication system—functional description

Refer to *Figure 2-3* and *Figure 2-4*. The cooling and lubrication system consists of a fan, fan motor, aftercooler (ST11/ST15 only) / fluid cooler, full flow fluid filter, thermal valve, interconnecting hoses and separator tube.

The pressure in the separator tube starts the fluid flow by forcing the fluid from the high pressure area of the tube to an area of lower pressure in the compressor unit. Fluid flows from the bottom of the separator/tube to the thermal valve that is fully open when the fluid temperature is below 185°F (85°C) [195°F (91°C) for pressures rated above 150 psig]. The fluid passes through the thermal valve, the fluid filter, and directly to the compressor where it lubricates, cools and seals the rotors, and the compression chamber.

As the discharge temperature rises above 185°F (85°C) [195°F (91°C) for pressures rated above 150 psig], due to the heat of compression, the thermal valve begins to adjust and a portion of the fluid then flows through the cooler. From the cooler the fluid flows to the fluid filter and on to the compressor. A portion of the fluid flow to the compressor is routed to the anti-friction bearings which support the compressor rotors.

The fluid filter must be replaced. Refer to *Section 3.4: Lubrication change recommendations and fluid filter and separator maintenance* on page 22.

2.4 Compressor discharge system—functional description

Refer to *Figure 2-3* and *Figure 2-4*. The compressor discharges the compressed air/fluid mixture into the separator/tube. The separator/tube has three basic functions:

- It acts as a primary fluid separator.
- Serves as the compressor fluid sump.
- Houses the final fluid separator.

The compressed air/fluid mixture enters the separator/tube and flows through an internal baffle system that changes the flow's direction and velocity, which causes most of the fluid to fall to the bottom of the separator tube. A small amount of fluid remaining in the compressed air collects on the surface of the separator element as the air flows through the separator.

A return line (or scavenge tube) leads from the dry side of the separator tube to the medium pressure region. Scavenged fluid is returned by a pressure differential between the separator tube and compressor.

The separator system reduces the fluid carry-over to less than 2 ppm at nominal rated pressures.

The controller will shut down the compressor if the discharge temperature reaches 235°F (113°C).

A minimum pressure/check valve located downstream from the separator maintains the separator tube pressure at 50 psig (3.4 bar) during load conditions. This pressure level is necessary for proper air/fluid separation and sufficient fluid circulation.

A terminal check valve is a sub-component of the minimum pressure/check valve that prevents compressed air in the service line from back-flowing into the separator tube on shutdown or when the compressor is operating in an unload condition. Also, a pressure relief valve on the compressor's wet side opens if the separator tube pressure exceeds its rating.

WARNING

Stop the compressor and relieve all internal pressure before removing caps, plugs, and/or other components when the compressor is running or pressurized.

Add fluid to the separator tube through the capped fluid fill port. There is also a sight glass that enables the user to check the separator tube fluid level. See *Section 4.5: Fluid level check* on page 37.

2.5 Control system—functional description

Refer to *Figure 2-5* and *Figure 2-6*. The compressor control system regulates its output to match the demand. This system consists of a solenoid valve and an inlet valve that control the compressor's operational modes. The following descriptions of operational modes apply to a compressor whose rated operating pressure is 125 psig (8.6 bar).

NOTE

Other pressure settings can be selected depending on compressor application or rating.

Start mode—0 to 50 psig (0 to 3.5 bar)

There is no load on the compressor at startup, the solenoid valve is open and the inlet valve is closed. When the compressor ⓘ (START) pad is pressed, the separator tube pressure rises from 0 to 50 psig (0 to 3.4 bar). When it reaches its full operating speed (maximum rpm), the compressor switches to the **full load** mode.

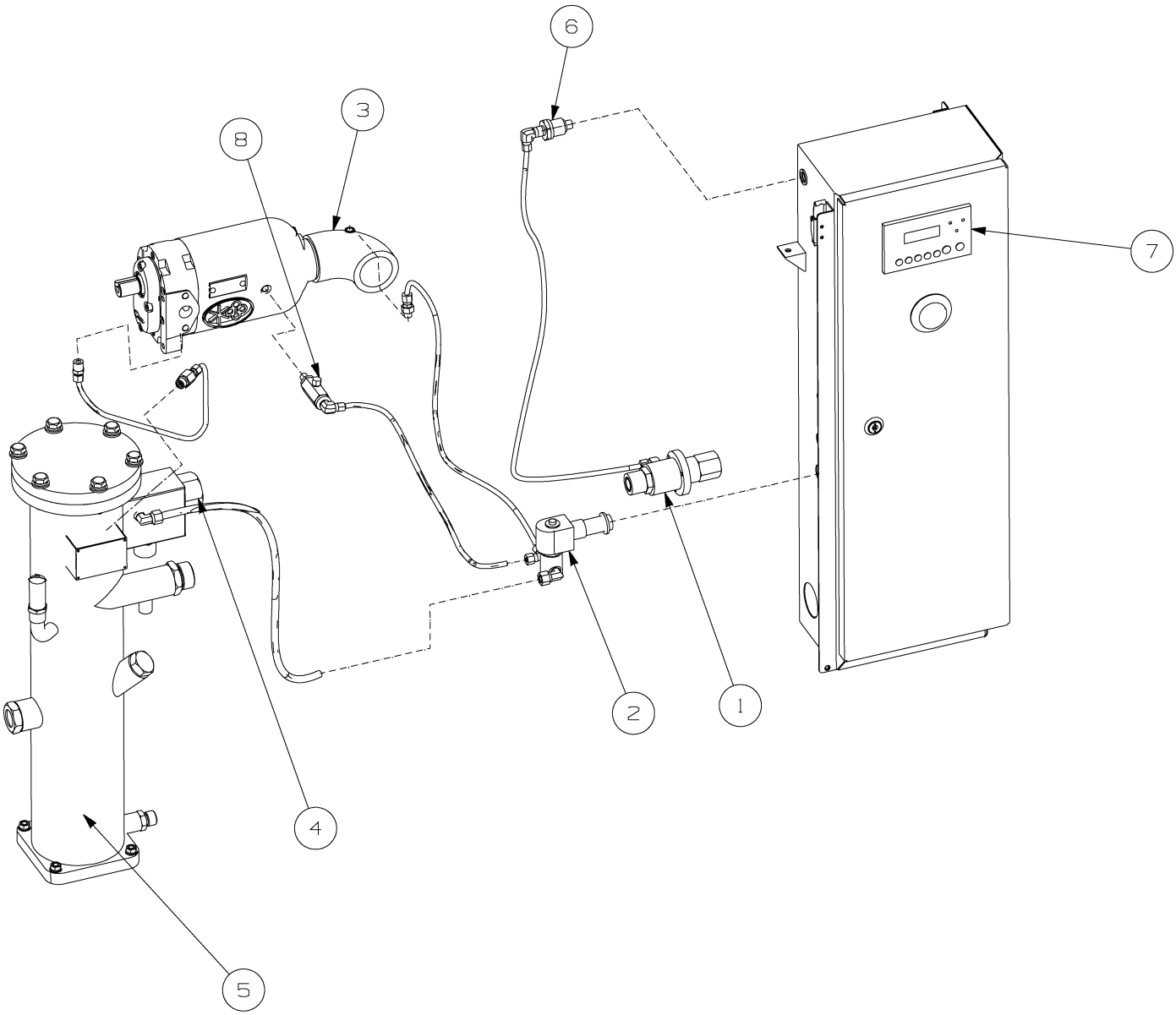
Full load mode—50 to 127 psig (3.4 to 8.8 bar)

When the compressed air pressure rises above 50 psig (3.4 bar), the minimum pressure valve opens allowing compressed air to flow into the service line. From this point on, the Controller continuously monitors the line air pressure. The solenoid valve remains closed in this mode. As long as the compressor is running at 127 psig (8.8 bar) or lower, the inlet valve is fully open.

Unload mode—greater than 127 psig (8.8 bar)

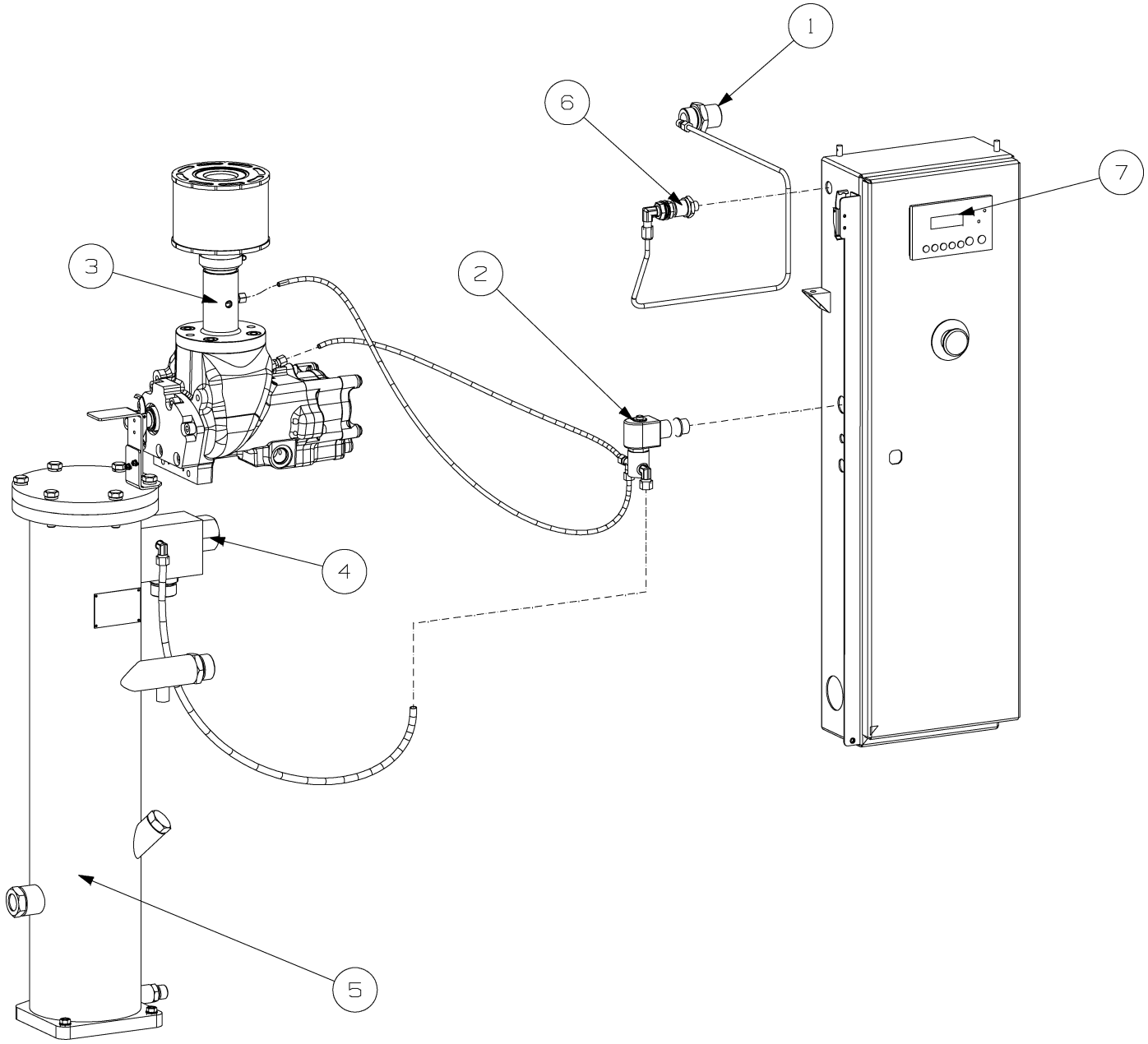
When there is no, or only a small demand, the service line pressure will rise. The controller de-energizes the solenoid valve when the pressure exceeds 127 psig (8.8 bar) allowing the separator tube air pressure to be supplied directly which closes the inlet valve. At the same time the solenoid valve exhausts the system pressure to the atmosphere and lowers the separator tube pressure to approximately 29 psig (2.0 bar). A check valve in the air service line prevents air from back-flowing to the separator tube.

When the pressure drops to the low setting: (cut-in pressure) usually 112 psig (7.7 bar) for high pressure (9 bar) compressors, 137 psig (9.4 bar) for (10 bar) compressors, 161 psig (11.1 bar) for (12 bar) compressors: the controller energizes the solenoid valve and prevents line pressure from reaching the inlet control valve.



1. Air outlet	5. Separator tube
2. Unload solenoid valve	6. Pressure transducer
3. Air inlet	7. Controller
4. Minimum pressure/check valve	8. Check valve

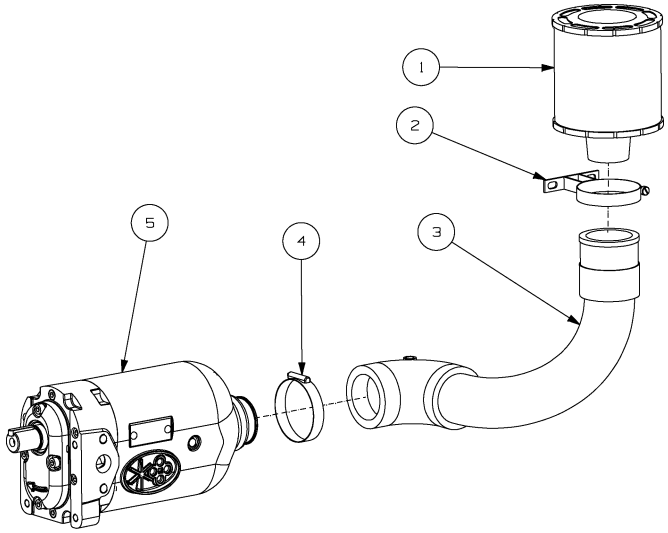
Figure 2-5: Control system—ST4, ST5, ST7



1. Air outlet	5. Separator tube
2. Unload solenoid valve	6. Pressure transducer
3. Air inlet	7. Controller
4. Minimum pressure/check valve	

Figure 2-6: Control system—ST11, ST15

2.6 Air inlet system, functional description

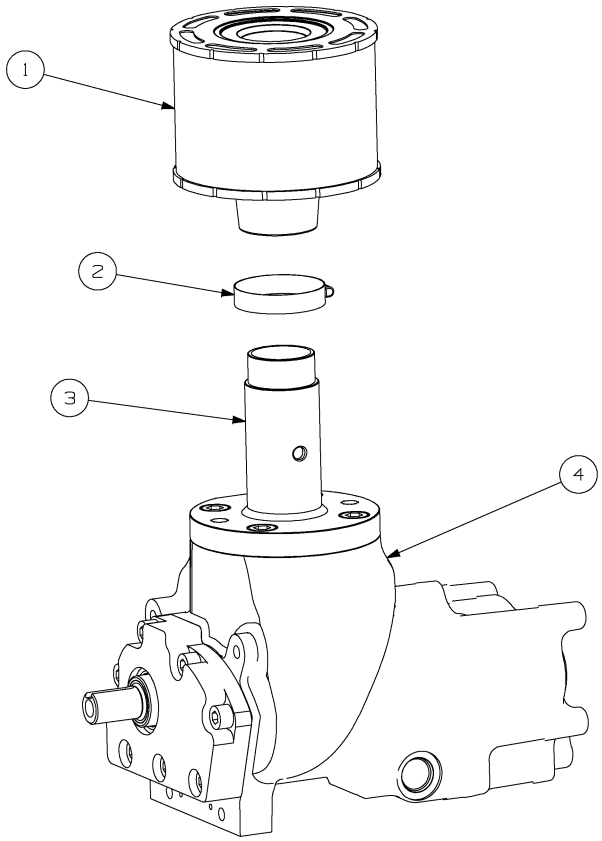


1.	Air inlet filter	4.	Clamp
2.	Clamp	5.	Compressor unit
3.	Inlet tube		

Figure 2-7: Air inlet system—ST4, ST5, ST7

Refer to *Figure 2-7* and *Figure 2-8*. The compressor inlet system consists of a dry-type air filter and an air inlet valve.

The poppet-type air inlet valve controls the compressor's air intake volume. Refer to *Full load mode—50 to 127 psig (3.4 to 8.8 bar)* on page 15. The air inlet valve also acts as a check valve to prevent reverse rotation when the compressor is shut down.



1.	Air inlet filter	3.	Inlet adaptor
2.	Clamp	4.	Compressor unit

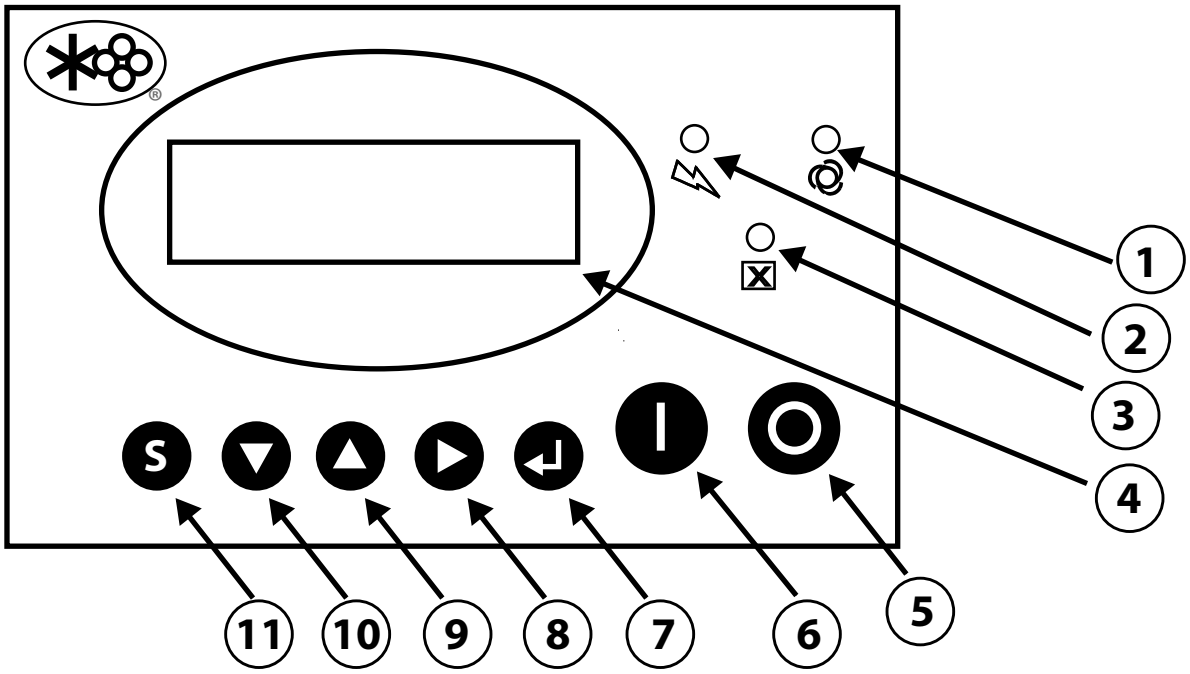
Figure 2-8: Air inlet system—ST11, ST15

WARNING

"The Plastic Pipe Institute recommends against the use of thermoplastic pipe to transport compressed air or other compressed gases in exposed above ground locations, e.g. in exposed plant piping."[1]

Sullube® should not be used with PVC piping systems. It may affect the bond at cemented joints. Certain other plastic materials may also be affected.

[1]*Plastic Pipe Institute, Recommendation B, Adopted January 19, 1972.*



1. Run mode indicator light (green)	7. Return/reset button
2. Power on indicator light (red)	8. Cursor/confirm button
3. Fault warning indicator light (red)	9. Up button
4. Display panel	10. Down button
5. Stop button	11. Set/load/unload button
6. Start button	

Figure 2-9: Control system—ST4, ST5, ST7

2.7 Controller/keypad

Refer to *Figure 2-9*. The controller keypad has two main pads for compressor control. To start the compressor operation, press the green Start pad ⓘ.

To stop compressor operation, press the red Stop pad ◎. The Run mode indicator ◌ lights up whenever the control is in an operating mode.

2.8 LCD display

The display's normal view shows the compressor package's discharge pressure, internal temperature, operating mode, and load status. The modes are MANUAL, STOP, AUTOMATIC, or FAULT.

Refer to *Figure 2-10*. If a machine fault occurs, the red fault ☒ indicator will light up, and the display will indicate that a fault has occurred.

Figure 2-10: RTD fault

The lower line will display the cause of the fault. Refer to service instructions to correct the cause. Press and hold the Return/Reset pad ⏎ to reset the controller.

Refer to *Figure 2-11*. Press the Down arrow ▼ to display additional information about the compressor. The upper line will indicate the name of the temperature, pressure, or other measurement. The lower line indicates the present reading.

Figure 2-11: Total run time

Refer to *Figure 2-12*. When you continue beyond the status information, the display will show a list of control settings. There are customer and factory settings. The upper line will indicate the name of the setting. The lower line displays the present value.

Figure 2-12: Load pressure

Refer to *Figure 2-13* and *Figure 2-14*. To change a selected setting press ▶ and an interface will display where a password is needed. Use ▲ and ▼ to change values of each digit. Use ▶ to move to next digit. After all digits of the password have been accepted, press Ⓢ. Upon acceptance of password, the setting can be modified. Use buttons as above to change values. Press Ⓢ to accept changes.

Figure 2-13: Password entry

Figure 2-14: Load pressure setting

Refer to *Figure 2-14*. If there is no keypad activity, the display will return to normal view in about one minute. If the Start Ⓘ, Stop ◎ or Return/Reset ↵ buttons are pressed, the display also returns to normal view. If any of these occur, the setting will not be altered.

If there are any warnings or recommended service instructions, these will be periodically displayed on the normal view.

The list of displays may be navigated from either direction by using the Up ▲ or Down ▼ arrow keys.

The Emergency Stop button located near the controller overrides all electronic functions to turn off the control devices. The controller senses this and will display **E-stop**. To reset, twist and pull out the Emergency Stop button.

2.9 LED lights

The three LED lights indicate the general conditions of the machine.

- The Power indicator ↯ indicates power is supplied to the controller.
- The Run mode indicator ◎ indicates compressor operation is enabled. It lights steadily if the motor is running.
- The red Fault indicator ☒ indicates that a compressor fault has occurred and needs to be repaired before further operation. The text display will indicate the cause of the fault.

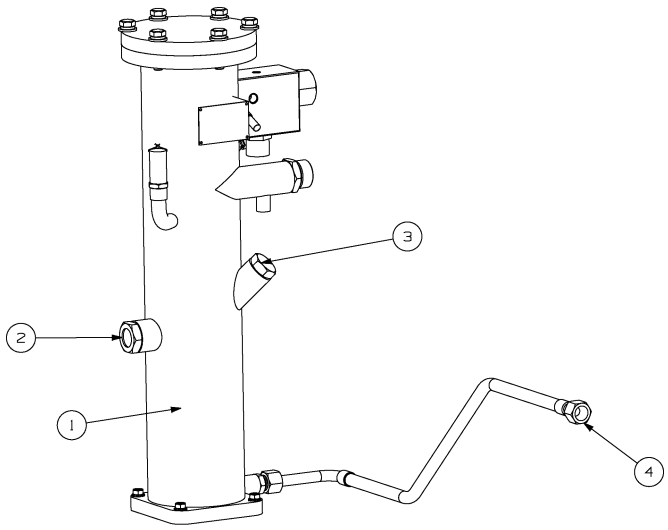
Section 3
Specifications

3.1 Tables of specifications—ShopTek 5 – 20 hp three-phase

Table 3-1: Compressor specifications—60 Hz

Model	ST4	ST5	ST7	ST11	ST15
Rated pressure	10.3 bar (150 psi)	10.3 bar (150 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)
Maximum working pressure	10.3 bar (150 psi)	10.3 bar (150 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)	8.6 bar (125 psi)/ 12 bar (175 psi)
Relief valve setpoint	14.8 bar (215 psi)				
Voltage & frequency	208/230/460V 60 Hz or 575V 60 Hz				
Air end type	Single stage, oil injected rotary screw				
Configuration	Belt driven				
Motor type	TEFC (IP55)				
Motor rating	3.7 kW (5 hp)	5.5 kW (7.5 hp)	7.5 kW (10 hp)	11 kW (15 hp)	15 kW (20 hp)
Motor nominal speed	3520 rpm				
Starting mode	Full voltage				
Service factor	1.25				
Ambient temperature	Between 4° and 40°C (40° and 104°F)				
Lubricant	Sullube®				
Lubricant volume	4 L (1 gal)			5 L (1.3 gal)	
Service connector	NPT ¾″			NPT 1″	
Machine weight	238 kg (524 lbs)	248 kg (546 lbs)	258 kg (567 lbs)	298 kg (657 lbs)	308 kg (679 lbs)
Machine dimensions (L × W × H)	826 × 546 × 938 mm (32.5 × 21.5 × 36.9 in)			998 × 618 × 1035 mm (39.2 × 24.3 × 40.7 in)	
Package dimensions (L × W × H)	1100 × 630 × 1105 mm (43.3 × 24.8 × 43.5 in)			1130 × 700 × 1215 mm (44.5 × 27.6 × 47.8 in)	

3.2 Lubrication guide



1.	Separator tube	3.	Fluid fill port
2.	Sight glass	4.	To drain†

†Disconnect oil line from cooler

Figure 3-1: Fluid fill location

Refer to *Figure 3-1* for the fluid fill port location. Sullair's ShopTek series compressors are filled and tested at the factory with Sullube® lubricant.

CAUTION

Do not mix different types of lubricants. Mixing lubricants can cause malfunctions or compressor damage and will void the compressor's warranty.

CAUTION

Contamination of compressor fluids with mineral oil or other fluids can cause foaming, filter plugging, or orifice line obstruction.

NOTE

When performing a fluid change or topping off: With machine off, fill to the bottom of the fill port. Sight glass will be completely full.

Mixing, changing or adding other lubricants within the compressor unit may void the air end warranty.

3.3 Application guide

Sullair encourages its customers to participate in a fluid analysis program with the fluid suppliers. In some cases the analysis results suggest a fluid change interval which differs from the *User Manual*. Contact a Sullair representative for details.

3.4 Lubrication change recommendations and fluid filter and separator maintenance

Lubricant	Fluid change	Filter change	Separator change
Sullube†	A	B	C
Key:			
A—1 year			
B—2,000 hours			
C—4,000 hours			

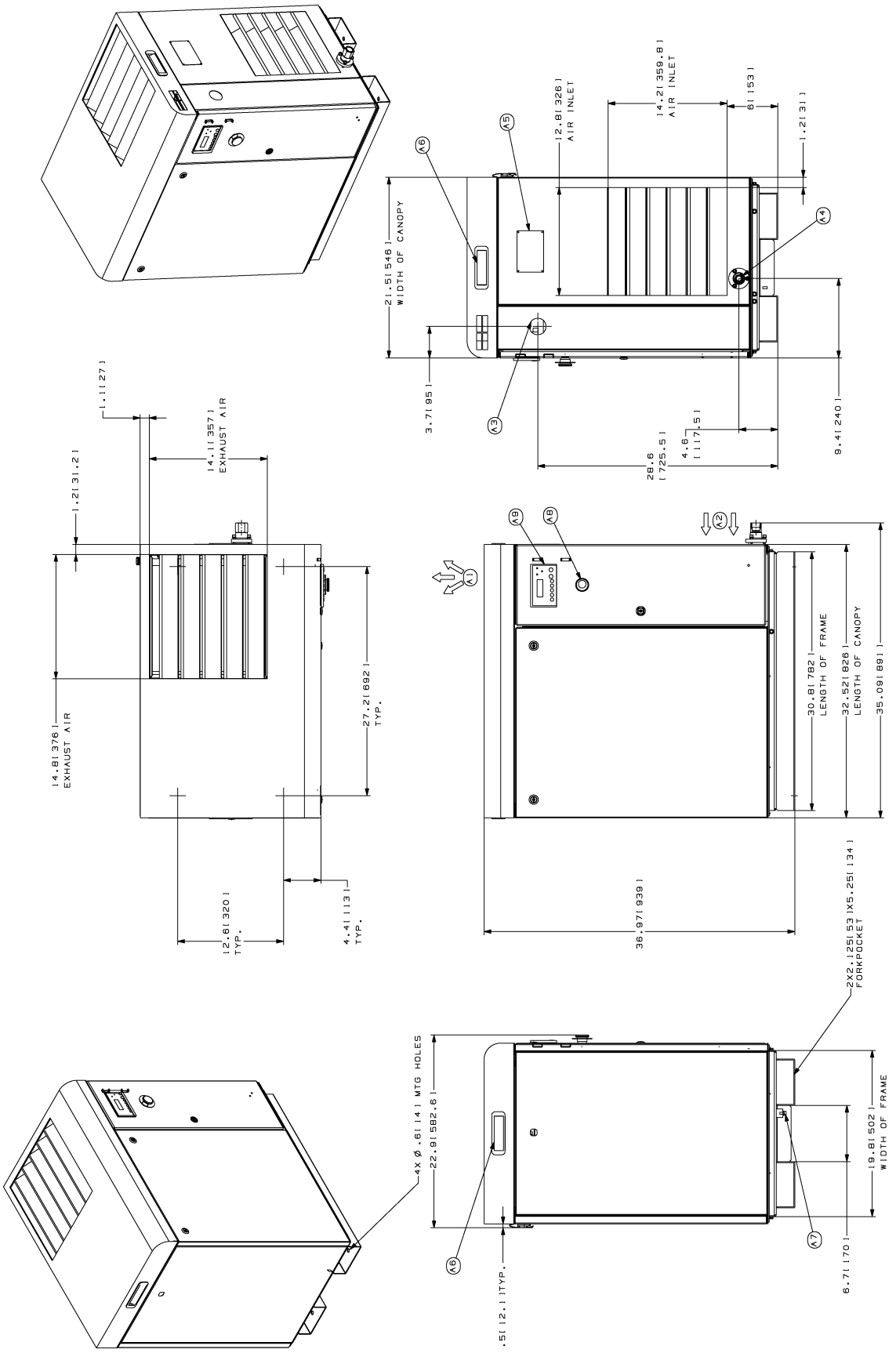
†ST4, ST5, ST7: 1 gallon (4 liters)
ST11, ST15: 1.3 gallons (5 liters)

3.5 Installation drawings (ID), piping & instrumentation diagrams (P&I), and wiring diagrams (WD)

Printed copies of your installation drawings (ID), piping & instrumentation diagrams (P&I), and wiring diagrams (WDs) for your compressor are included in the packet of printed documentation included with your compressor. PDFs of these drawings are included on the documentation CD included with our compressor.

Notes:

3.6 ID—ST4, ST5, ST7



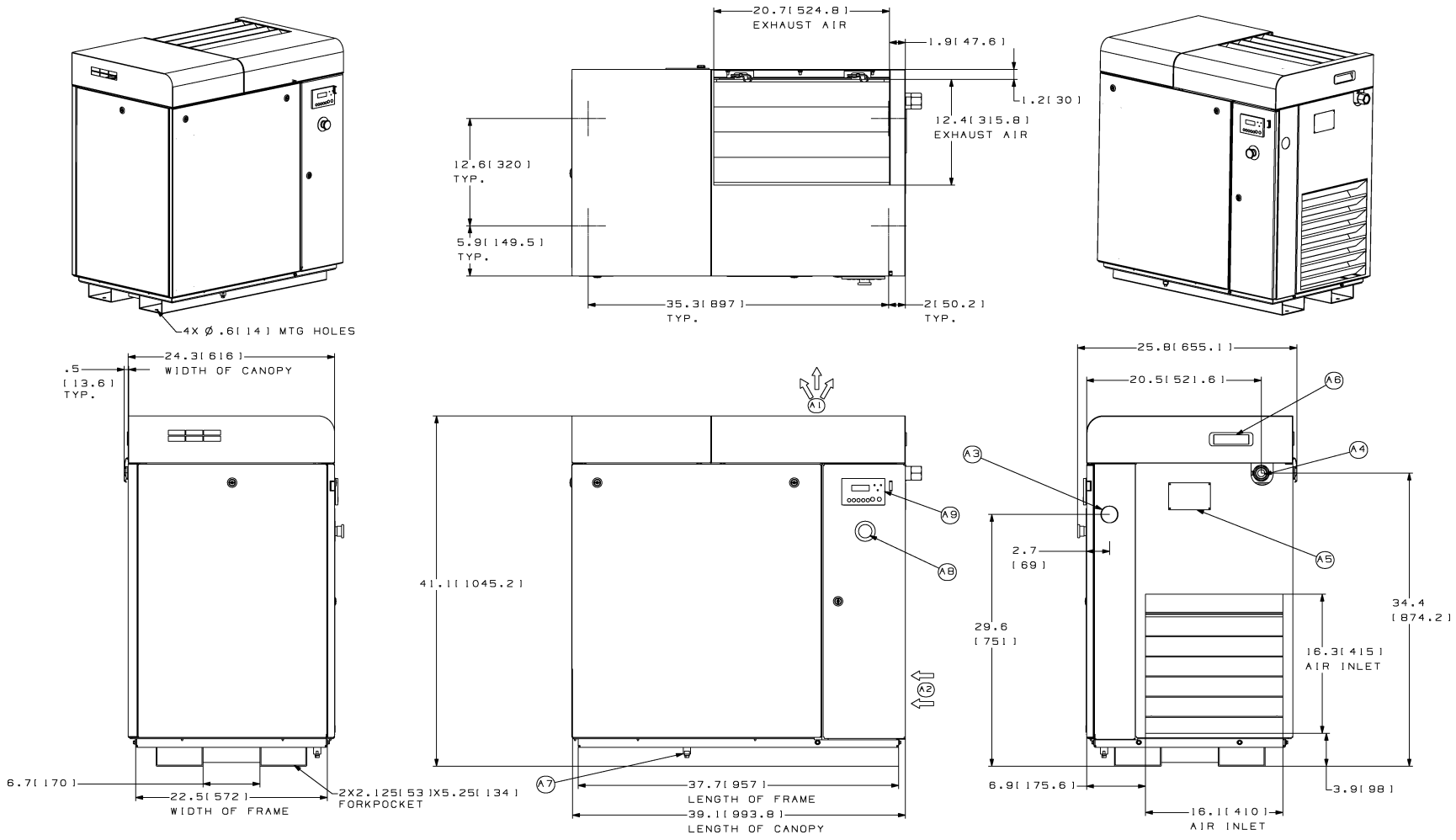
88290017-299 R01

SULLAIR

3.6 ID—ST4, ST5, ST7

Drawing notes	
A1	EXHAUST AIR OUT
A2	AIR INLET
A3	INCOMING CUSTOMER POWER SUPPLY 1.96[50]DIA
A4	AIR OUT CONNECTION 3/4"NPT
A5	SERIAL PLATE
A6	HAND HOLD
A7	CONTAINMENT PAN DRAIN
A8	E-STOP
A9	CONTROLLER
1	ALLOW 4.00 FEET [1.25 METERS] MINIMUM CLEARANCE AROUND MACHINE FOR ACCESS AND FREE CIRCULATION OF AIR.
2	A FOUNDATION OR MOUNTING PACKAGE CAPABLE OF SUPPORTING THE WEIGHT OF THE PACKAGE, AND RIGID ENOUGH TO MAINTAIN THE COMPRESSOR FRAME LEVEL IS REQUIRED.
3	ALL DIMENSIONS ARE +/-.50"[12.7MM]
4	RECOMMENDED INCOMING CUSTOMER POWER SUPPLY IS SHOWN ON DRAWING.
5	DOORS ARE REMOVABLE USING LIFT-OFF PINS.
6	ALL DIMENSIONS SHOWN IN INCHES WITH MILLIMETER DIMENSIONS IN BRACKETS.

3.7 ID—ST11, ST15

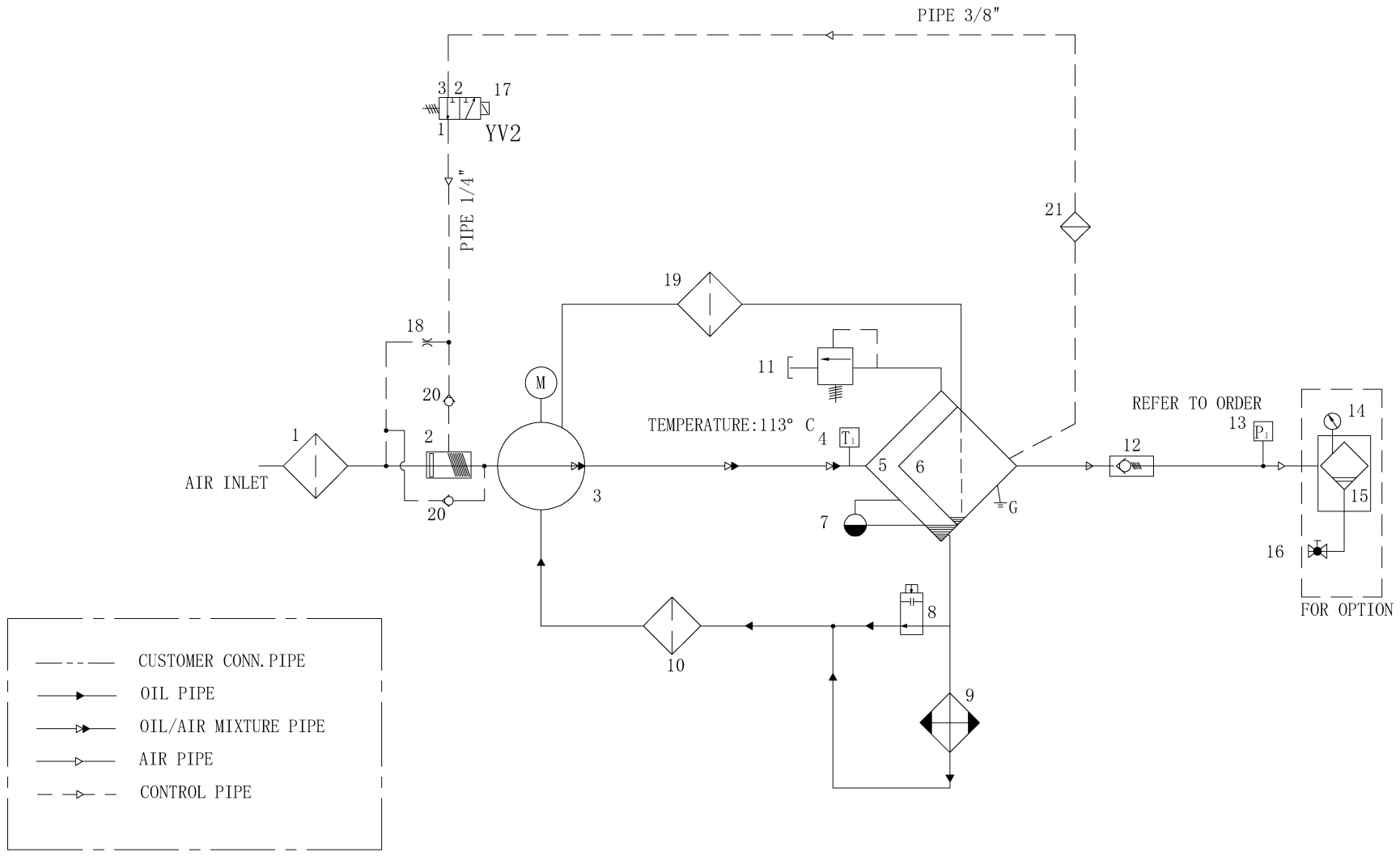


SULLAIR

3.7 ID—ST11, ST15

Drawing notes	
A1	EXHAUST AIR OUT
A2	AIR INLET
A3	INCOMING CUSTOMER POWER SUPPLY 1.96[50]DIA
A4	AIR OUT CONNECTION 3/4"NPT
A5	SERIAL PLATE
A6	HAND HOLD
A7	CONTAINMENT PAN DRAIN
A8	E-STOP
A9	CONTROLLER
1	ALLOW 4.00 FEET [1.25 METERS] MINIMUM CLEARANCE AROUND MACHINE FOR ACCESS AND FREE CIRCULATION OF AIR.
2	A FOUNDATION OR MOUNTING PACKAGE CAPABLE OF SUPPORTING THE WEIGHT OF THE PACKAGE, AND RIGID ENOUGH TO MAINTAIN THE COMPRESSOR FRAME LEVEL IS REQUIRED.
3	ALL DIMENSIONS ARE +/-.50"[12.7MM]
4	RECOMMENDED INCOMING CUSTOMER POWER SUPPLY IS SHOWN ON DRAWING.
5	DOORS ARE REMOVABLE USING LIFT-OFF PINS.
6	ALL DIMENSIONS SHOWN IN INCHES WITH MILLIMETER DIMENSIONS IN BRACKETS.

3.8 Piping and instrumentation—ST4, ST5, ST7



88290016-646 R04

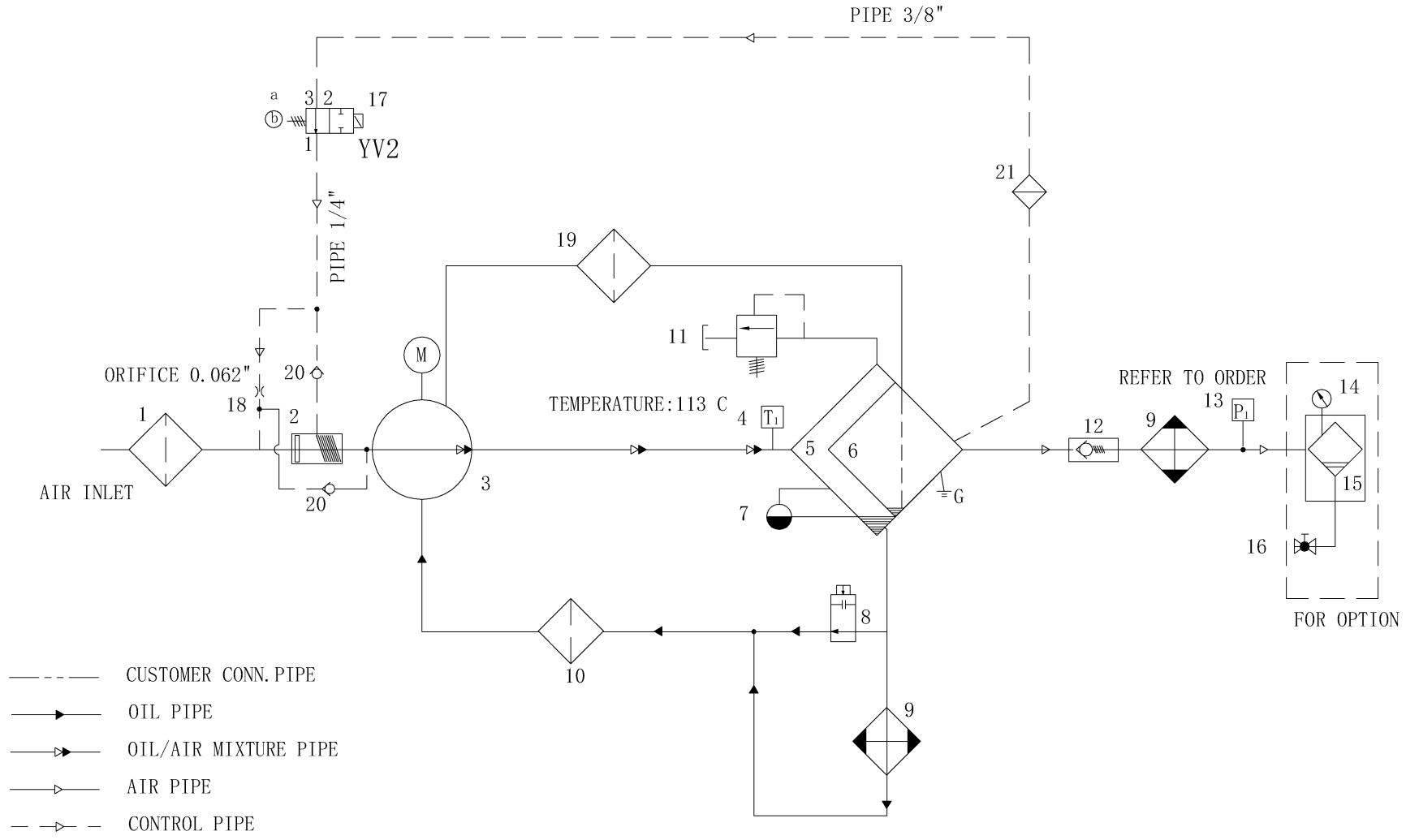
3.8 Piping and instrumentation—ST4, ST5, ST7

Key	Part number	Qty	Description	Notes
1	88290014-486	1	FILTER,AIR 80 CFM	
2	-	1	VALVE INLET	
3	02250171-669	1	COMPRESSOR & PARTS,DXX063140A10ME50AB	
4	88290014-534	1	TRANSDUCER,PT1000 GW100 PLT	
5	88290015-814	1	TANK,WS4/5/7	
6	88290015-049	1	ELEMENT,SEP WS708	
7	88290014-222	1	GLASS,SIGHT M33	
8	-	1	VALVE,THERMAL 185 DEG. F. ES11	
9	88290015-765	1	COOLER,OIL WS4/5/7	
10	88290014-484	1	ELEMENT,LUBE FLTR 5-20 HP	
11	-	1	SAFE VALVE	
12	02250046-338	1	VALVE,MINIMUM PRESSURE GROUP E08E	
13	88290014-514	1	SENSOR,PRESSURE 250PSI 4-20MA	
14	88290015-548	1	GAUGE,CTL AIR PRESS WS11/15	
15	-	1	TANK	
16	88290002-432	1	VALVE,BALLDN6 Q11MP-25P SSAIP	
17	88290015-219	1	VALVE,SOLENOID 1/4"WS1500	
18	-	1	ORIFICE,PLUG 1/8"NPT	
19	88290015-890	1	STRANER OIL	
20	02250110-557	2	VALVE,CHECK 1/4"	
21	241771	1	STRAINER, V-TYPE	

Drawing notes

1	PARTS NUMBERS ARE FOR REFERENCE ONLY. REFER TO BILL OF MATERIAL AND/OR FACE OF ORDER FOR ACTUAL PARTS.

3.9 Piping and instrumentation—ST11, ST15



88290015-826 R03

3.9 Piping and instrumentation—ST11, ST15

Key	Part number	Qty	Description	Notes
1	88290014-485	1	FILTER,AIR 80 CFM	
2	-	1	VALVE INLET	
3	02250170-021	1	COMPRESSOR & PARTS,DXX087140E10M	
4	88290014-534	1	TRANSDUCER,PT1000 GW100 PLT	
5	88290014-226	1	TUBE,SEP WS11/15	
6	88290015-567	1	ELEMENT, AIR/OIL SEP WS11/15+	
7	88290014-222	1	GLASS,SIGHT M33	
8	02250078-204	1	VALVE,THERMAL 185 DEG. F. ES11	
9	88290014-225	1	COOLER,COMB AC/OC WS11/WS15	
10	88290014-484	1	ELEMENT,LUBE FLTR 5-20 HP	
11	-	1	SAFE VALVE	
12	02250046-338	1	VALVE,MINIMUM PRESSURE GROUP E08E	
13	88290014-514	1	SENSOR,PRESSURE 250PSI 4-20MA	
14	88290015-548	1	GAUGE,CTL AIR PRESS WS11/15	
15	-	1	TANK	
16	88290002-432	1	VALVE,BALLDN6 Q11MP-25P SSAIP	
17	88290015-219	1	VALVE,SOLENOID 1/4"WS1500	
18	040127	1	ORIFICE,.062 .125M X .125F HRS	
19	88290015-890	1	STRANER OIL	
20	02250110-557	2	VALVE,CHECK 1/4"	
21	241771	1	STRAINER, V-TYPE	

Drawing notes

1	PARTS NUMBERS ARE FOR REFERENCE ONLY. REFER TO BILL OF MATERIAL AND/OR FACE OF ORDER FOR ACTUAL PARTS.

Notes:

Section 4
Installation

4.1 Compressor mounting—support and location

The compressor must have a stable firm foundation, or mounting structure that is rigid enough to keep the compressor frame level, and maintain the alignment of the compressor and motor. Tie-down bolts of sufficient size must be used to ensure that the compressor frame is firmly anchored to its foundation. Rubber, cork, or other pliable materials can be inserted between the foundation and compressor frame to provide a uniform contact surface.

- Use flex connectors to prevent piping loads from being transmitted to the compressor.
- National and local electrical codes specifying the required clearances for the area around the electrical panel must be complied with.
- Ensure the lighting at the compressor's location is sufficient for safe operation and maintenance.
- The compressor's location should be one that allows access for maintenance vehicles and lifting equipment.
- The clearances around the compressor should permit easy access to all compressor components.
- Walls and ceilings with soft or porous surfaces absorb sound and reduce ambient noise levels. Hard surfaces reflect noise and have little effect on ambient noise levels.

NOTE

Do not install compressors where the machine will be exposed to temperatures lower than 32°F (0°C). Contact Sullair Customer Care regarding operation in sub-freezing temperatures.

4.1.1 Outdoor installation (sheltered)

ShopTek packages are equipped with TEFC motors and have water tight controls that are IP54 rated and are suitable for sheltered outdoor installation.

The compressor should be mounted on a concrete pad. If the pad is not level, the compressor must be mounted in such a manner that its base or skid is level in relation to the pad's surface and fully supported.

If the compressor will be exposed to blowing rain or snow, it should be housed in a covered, four-walled enclosure.

- Sheltered air-cooled machines must have their exhaust air vented outside of the enclosure.
- Installations consisting of more than one compressor should be done in such a manner that each compressor's exhaust is directed away from the air intakes of other compressors or air dryers.
- A standard compressor should not be started if the ambient temperature is 35°F (1.7°C) or lower.

Compressor must not be operated in sub-freezing conditions.

4.2 Ventilation and cooling

Table 4-1: Ventilation requirements

Model	Ventilation air required	
	cfm	m^3/hr
ST4	612	1040
ST5	612	1040
ST7	612	1040
ST11	1471	2500
ST15	1471	2500

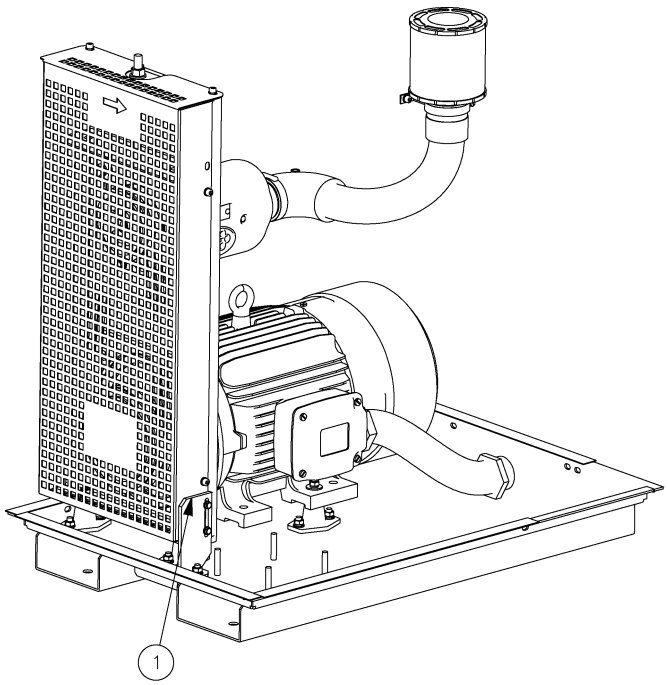
- ShopTek compressors require a three foot (one meter) clearance around their perimeter.
- The location should be free from standing water.
- Clean air should be supplied to the compressor, free from exhaust and paint fumes, dust, metal particles, or caustic chemical vapors.
- Hot exhaust air should be vented out of the area to prevent its recirculation back into the compressor's cooling system.
- Ducting or some other means must be used to ensure that hot exhaust air is vented away from the compressor if the compressor's housing has minimal overhead clearance.

NOTE

Remove the red shipping straps/shipping studs before operating the drive assembly. See *Figure 4-1* and *Figure 4-2*.

NOTE

Housing the compressor in an inadequately ventilated enclosure will cause higher compressor operating temperatures.



1. Shipping strap

Figure 4-1: Shipping strap—ST4, ST5, ST7

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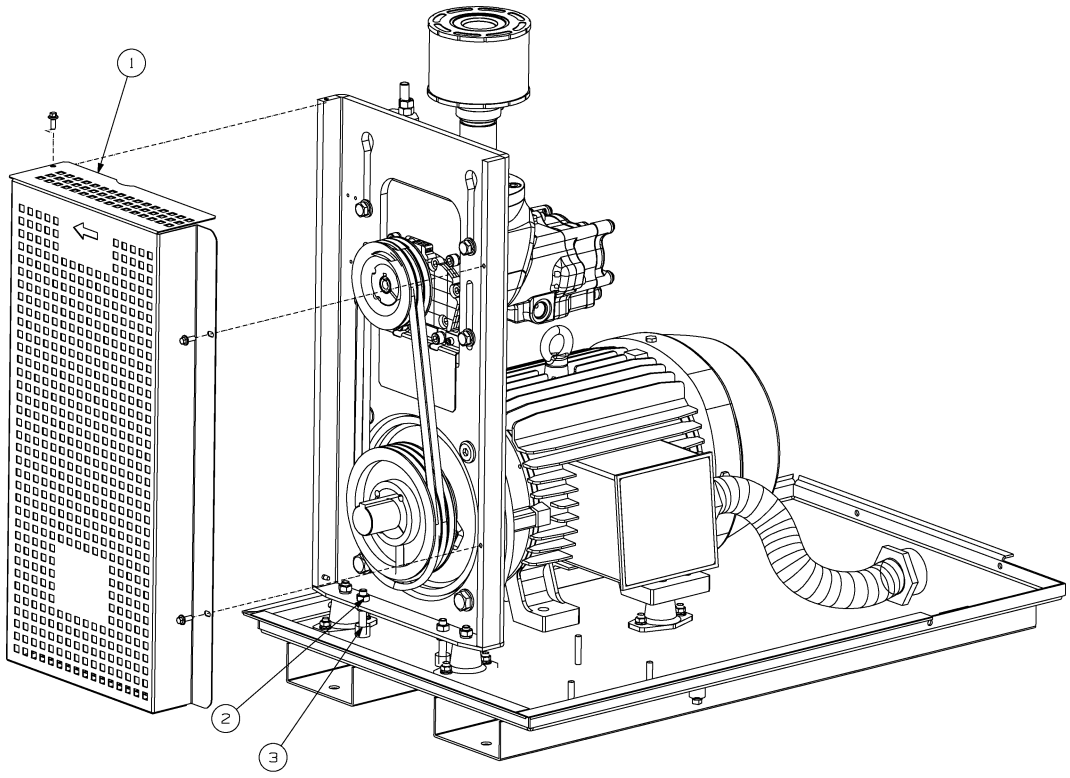


1. Belt guard	3. Shipping studs (2)
2. Nut (2)	

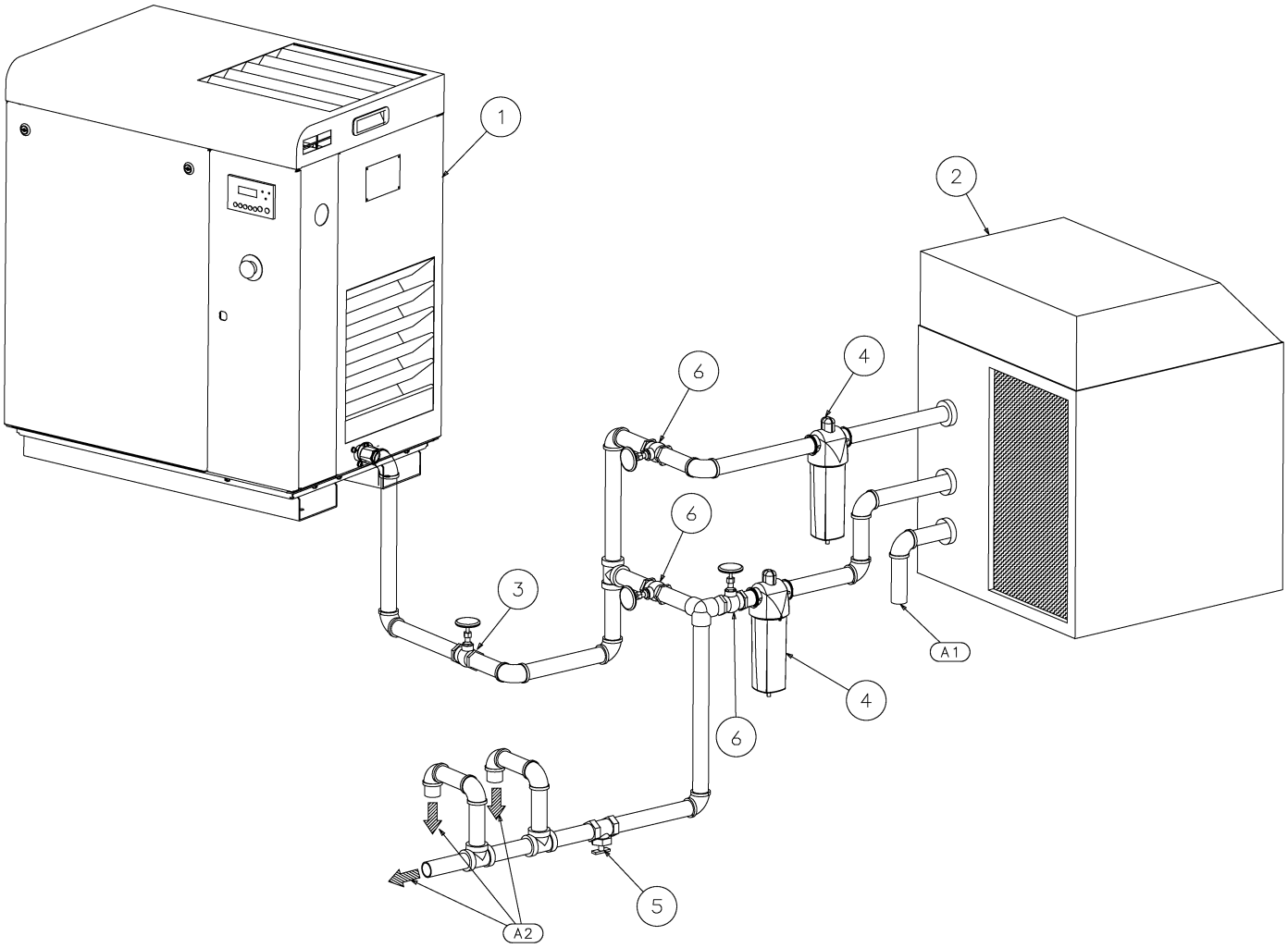
Figure 4-2: Shipping studs—ST11, ST15

4.3 Service air piping

Before installing the compressor, review the service air system's layout including: pipe sizes, auxiliary separator tube, drip legs, line filter(s), and isolation valves (see *Figure 4-3* on page 36).

NOTE

Systems using both reciprocating and rotary screw compressors must isolate the two types from each other through the use of a common receiver tank. Air lines from each individual compressor should be connected directly to the common receiver tank.



1.	Sullair compressor	5.	Standard gate valve
2.	Sullair dryer	6.	By-pass gate valve
3.	Shut-off gate valve	A1.	Condensate drain
4.	Sullair filter	A2.	Air outlets

Figure 4-3: Typical service air piping

88292018-236 R00

4.3.1 Pipe sizing

Pipes should be sized as a minimum to match the dimensions of the compressor's discharge connection. All piping and fittings should be rated for the discharge pressure.

4.3.2 Auxiliary receiver tank

An auxiliary receiver tank should be installed in systems where large demand fluctuations will occur.

4.3.3 Isolation valves

Install isolation valves where isolation of the compressor from the service lines is required. These valves should have drip legs that drain at an angle downward from the base. A vent to the piping should be installed downstream of the compressor outlet connection.

When two compressors are installed to operate in parallel with a common receiver tank, an isolation valve and drain trap for each compressor should be installed before the common separator/sump.

NOTE

Compressors not equipped with a receiver tank may need to have their response times adjusted. Contact Sullair Customer Care for assistance.

4.3.4 Fluid containment

Compressors have a fluid containment pan to collect fluid leaks or spills. The pan has a drain located on the front side of the machine.

4.4 Belt check

Tension of drive belts should be checked upon installation and after ½ to 2 hours of run time. This is essential to proper performance of the compressor unit as well as to ensure long belt life. In addition, belt tension should be checked every 2000 hours and adjusted if necessary.

Refer to *Section 6.8: Belt maintenance* on page 45 for detailed instructions.

4.5 Fluid level check

The compressor is shipped fully charged with the proper amount of fluid. However, it is necessary to check the fluid level at the time of installation and during compressor operation. Check the fluid level by looking at the sight glass on the separator tube when the compressor is in the SHUT DOWN MODE (fluid level may not be visible when operating). In this condition the sight glass should be completely full. Add fluid if the level is visible or if no fluid is visible at all.

4.6 Electrical preparation

Interior electrical wiring is installed at the factory. Required customer wiring should be done by a qualified electrician in compliance with OSHA, National Electric Code and/or any applicable local electrical codes applying to isolation switches, fused disconnects, etc. Sullair provides a wiring diagram for use by the installer. An electrical check should be made to ensure that the first start-up will be successful. The compressor and drive should be properly grounded/earthed in accordance with applicable codes, regulations, and requirements.

Feeder cables should be sized by the customer/electrical contractor to ensure that the circuit is balanced and not overloaded by other electrical equipment. The length of wiring from a suitable electrical power source is critical because voltage drops can adversely effect the performance of the compressor. Cable sizes may vary considerably so the mains terminals will accept up to 120 mm^2 (4/0 awg) (75 kw) cable.

Feeder cable connections to incoming terminals L1-L2-L3 should be tight and clean.

The applied voltage must conform to the motor and compressor data plate ratings.

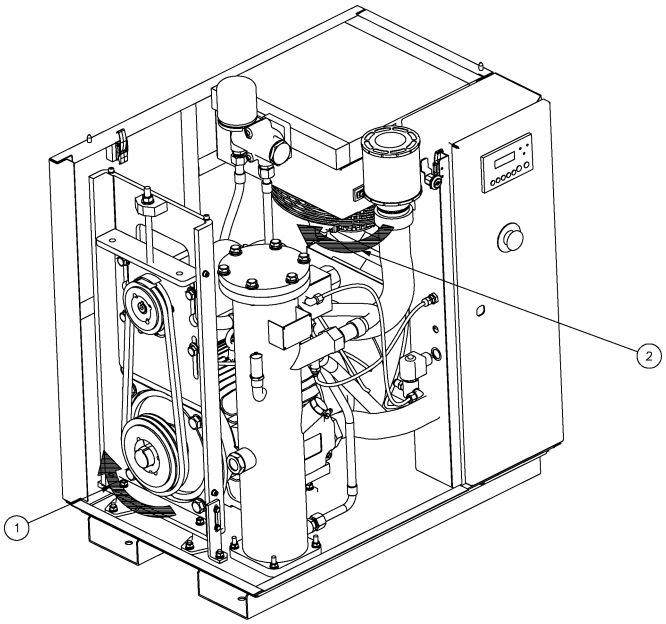
A starter hole is provided for an incoming power connection. If it is necessary to make a hole in the control box in a different location, care should be taken to not allow metal shavings to enter the starter and other electrical components within the box. If another hole is used, the original hole must be blocked off with a sealed plug.

⚠ WARNING

Energized internal components are a potentially fatal shock hazard. Disconnect all power before performing any work on the compressor's electrical system.

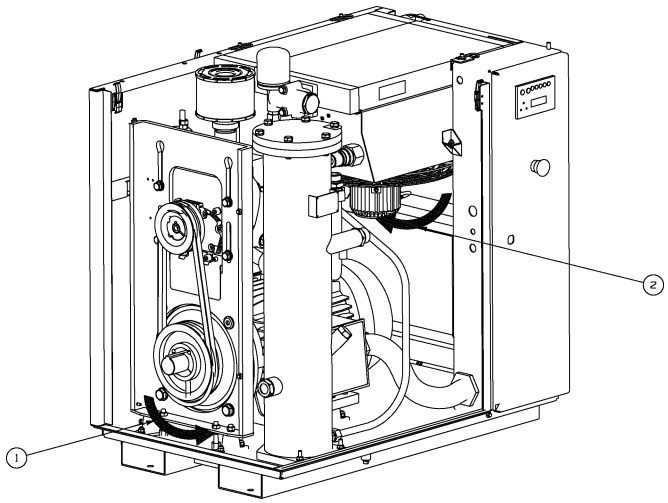
1. Check incoming voltage. The incoming voltage must match the compressor's wire rating/specifications.
2. Check motor starter and overload heater sizes.
3. Check all electrical connections for tightness.

4.7 Motor rotation direction check



1. Main motor direction of rotation
2. Fan motor direction of rotation

Figure 4-4: Main motor/fan motor direction of rotation—ST4, ST5, ST7



1. Main motor direction of rotation
2. Fan motor direction of rotation

Figure 4-5: Main motor/fan motor direction of rotation—ST11, ST15

Motor rotation check must be done at compressor start-up after the wiring has been installed. See *Figure 4-4* and *Figure 4-5*. The compressor can be damaged if it runs in the wrong direction for more than a few seconds. Motor rotation can be viewed through the openings in the belt guard. Pull out the EMERGENCY STOP button and press once, quickly and in succession, the ⏽ (START) pad and ◎ (STOP) pad. This action will bump start the motor. When looking at the motor from the compressor unit, the shaft should turn clockwise for ST4, ST5 and ST7 and counterclockwise for ST11 and ST15. If reverse rotation occurs, disconnect the power to the starter and exchange any two of the three power input leads, then re-check rotation. A “Direction of Rotation” decal is located on the motor drive housing to show proper motor/compressor rotation.

Fan motor rotation should also be checked. It should rotate counter-clockwise when viewing the fan motor from the backside of the motor.

Section 5
Operation

5.1 Routine operation

Before starting the compressor, check the fluid level in the separator tube. If sight glass is not completely full, add the required amount of fluid to bring it to its proper level. Frequent addition of fluid indicates the presence of a leak or a condition causing excessive fluid consumption. See the *Section 6.12: Troubleshooting* on page 51 under “Excessive compressor fluid consumption” for a probable cause and corrective action.

WARNING

High pressure hazard

Removing caps, plugs, and/or other components when compressor is running or pressurized could result in death or serious injury.

Do not remove caps, plugs, and/or other components when compressor is running or pressurized. Stop compressor and relieve all internal pressure before removing caps, plugs, and/or other components.

After a routine start, observe the controller display for the proper indications for this phase of operation. After the compressor has warmed up, check all compressor operation indications to ensure that it is running properly.

Notes:

Section 6
Maintenance

WARNING

Before any repairs are attempted, refer to *Section 1: Safety* before proceeding.

6.1 General

This compressor requires a minimal amount of inspections and maintenance. The controller and other indicators alert the operator to situations requiring maintenance, or fault conditions.

6.2 Maintenance after initial 50 hours of operation

After the initial 50 hours of operation, maintenance is required to clean the system of any foreign materials.

At this time the return line strainer should be cleaned. Refer to *Figure 6-1* and *Figure 6-2*.

6.3 Maintenance schedule

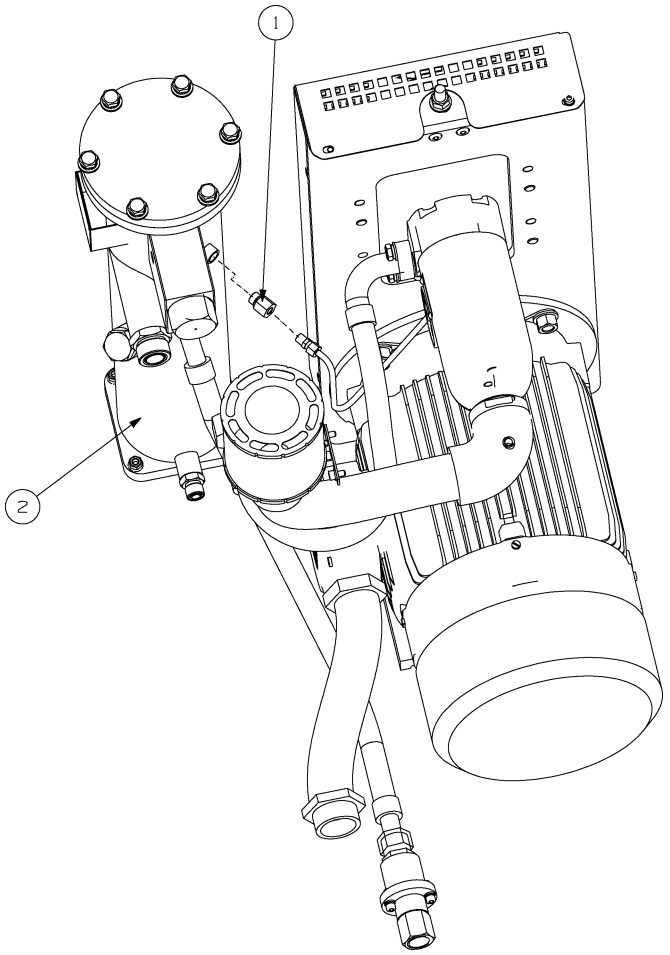
You should perform maintenance according to the following schedule.

6.3.1 Every 2000 hours of operation or six months (whichever occurs first)

- Clean the return line strainer. Refer to *Figure 6-1* and *Figure 6-2*.
- Pull fluid sample from fluid sample valve for analysis. Refer to *Figure 6-3*.

6.3.2 Every 2000 hours of operation or one year (whichever occurs first)

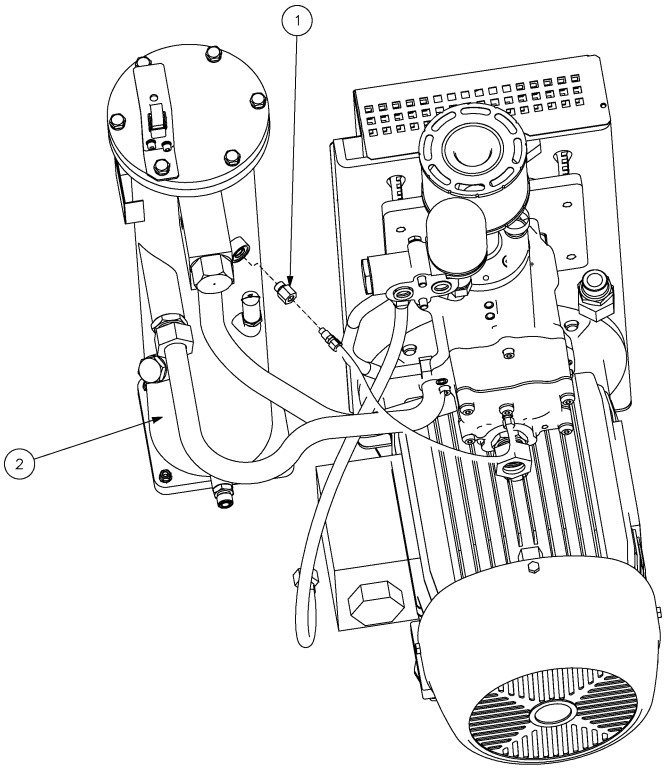
- Replace the fluid filter. Refer to *Section 6.5: Fluid filter maintenance* on page 42.
- Replace air filter. Refer to *Section 6.6: Air filter maintenance* on page 43.



1. Strainer
2. Separator tube

Figure 6-1: Return line strainer—ST4, ST5, ST7

- Check belt tension. Re-tension or replace as necessary. Refer to *Section 6.8: Belt maintenance* on page 45.



1. Strainer
2. Separator tube

Figure 6-2: Return line strainer—ST11, ST15

6.3.3 Every 4000 hours of operation or one year (whichever occurs first)

- Replace the separator element. Refer to *Section 6.7*.

6.3.4 Every one year

- Change the fluid. Refer to *Section 6.4*.

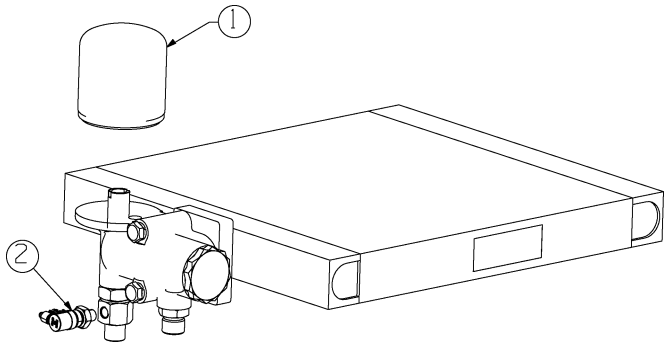
6.3.5 Every two years

- Replace the hoses. Refer to *Section 6.10*.

6.4 Fluid maintenance

Drain the separator tube and change the compressor fluid using instructions shown in *Section 3.2: Lubrication guide* on page 22.

6.5 Fluid filter maintenance



1. Fluid filter
2. Fluid sample valve

Figure 6-3: Fluid filter assembly

Refer to *Figure 6-3*. Replace the fluid filter under any of the following conditions, or whichever occurs first:

- Every 2000 hours a display on the controller indicates the need for replacement
- Every fluid change.

6.5.1 Fluid filter replacement

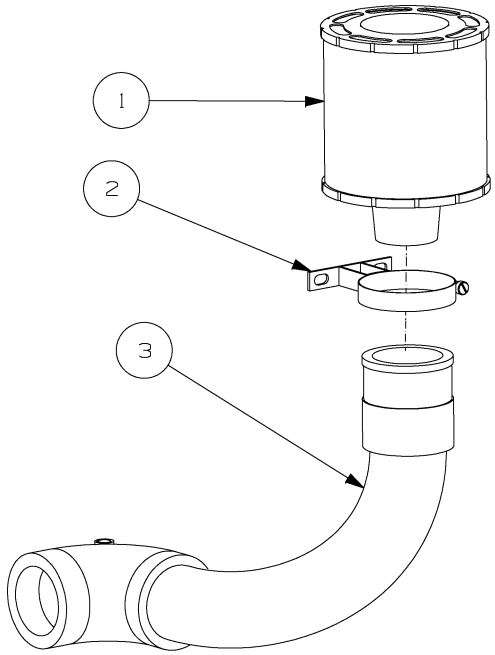
Refer to *Figure 6-3*.

1. Use a strap wrench to remove the fluid filter and gasket.
2. Dispose of the old filter according to applicable federal, state and local regulations.
3. Clean gasket seating surface.
4. Apply a light film of fluid to the filter gasket of a new fluid filter.
5. Hand tighten the filter until the gasket is seated.
6. Continue tightening filter an additional ½ to ¾ turn.
7. Replace any lost fluid. Do not overfill.
8. Restart compressor and check for leaks.

NOTE

Dispose of fluids in accordance with applicable federal, state and local regulations.

6.6 Air filter maintenance



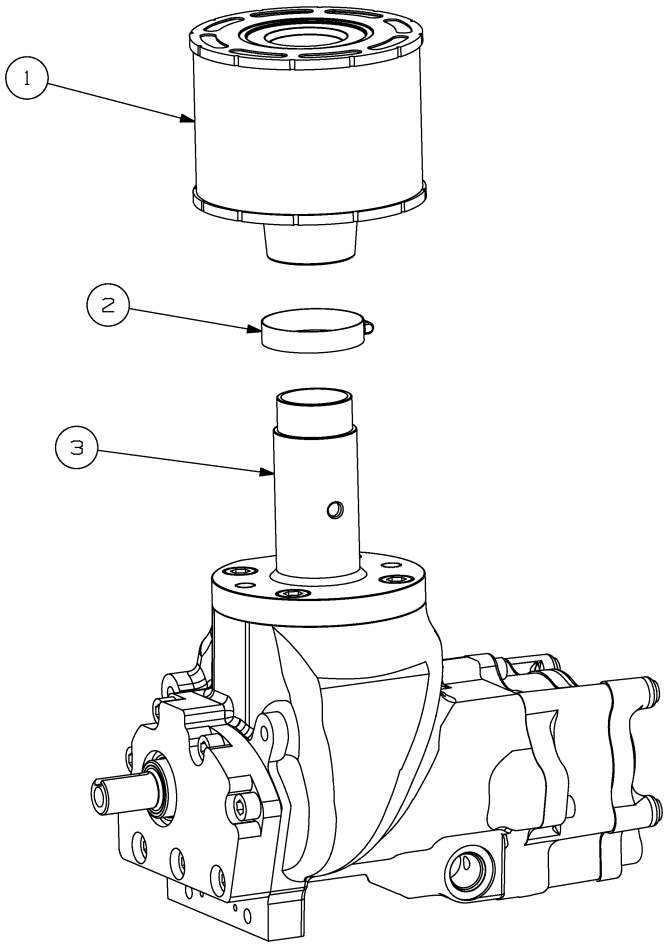
1. Air filter element
2. Clamp
3. Hose

Figure 6-4: Air filter assembly—ST4, ST5, ST7

Refer to *Figure 6-4* and *Figure 6-5*. Air filter maintenance should be performed every 2000 hours or sooner if necessary.

6.6.1 Air filter element replacement

1. Remove enclosure panels to gain access to filter.
2. Loosen hose clamp and remove filter.
3. Install new filter and tighten hose clamp.

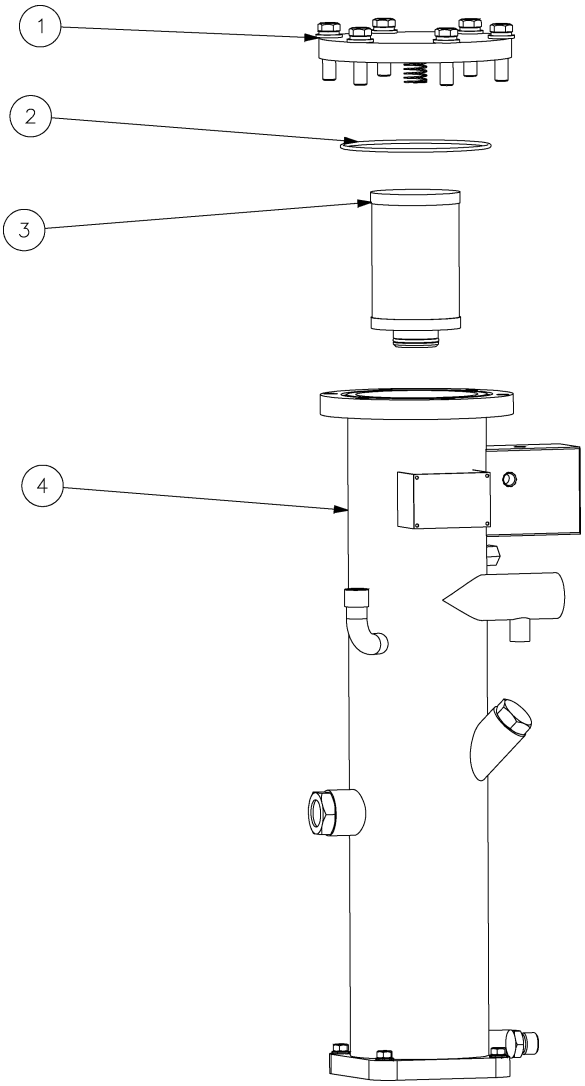


1. Air filter element
2. Clamp
3. Hose

Figure 6-5: Air filter assembly—ST11, ST15

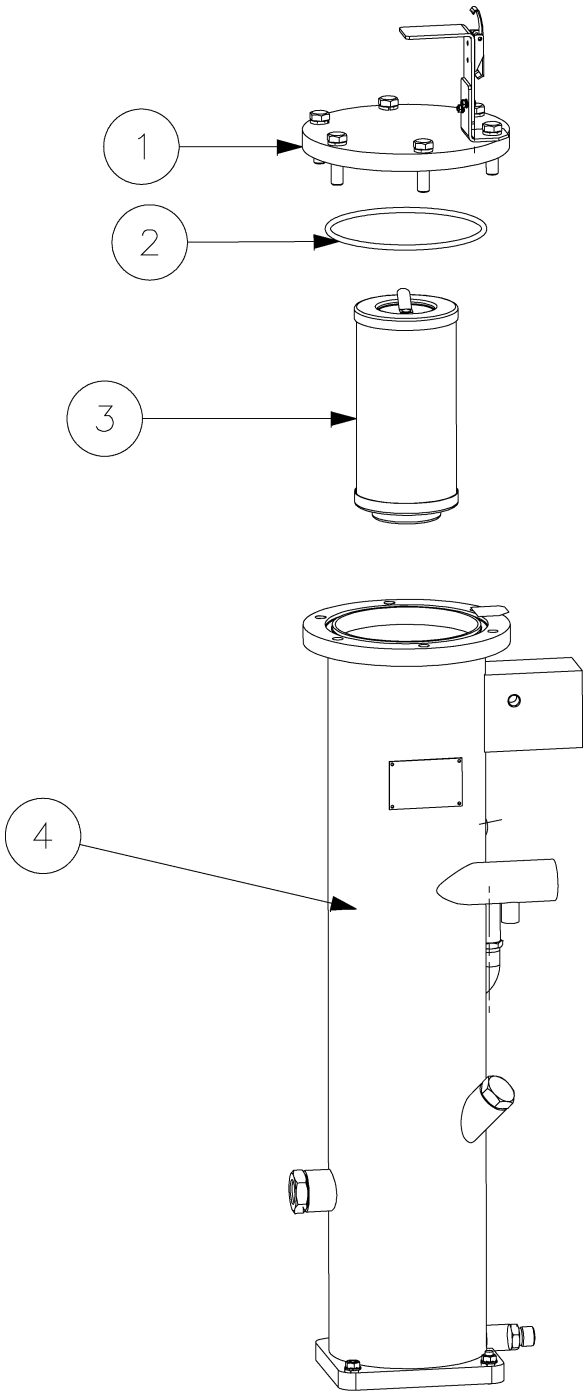
6.7 Separator maintenance

Replace the separator elements every 1 year or 4000 hours, whichever occurs first. The separator elements must be replaced. **Do not** attempt to clean and reinstall the separator elements.



1.	Cover	3.	Separator element
2.	Cover gasket	4.	Separator tube

Figure 6-6: Separator element assembly—ST4, ST5, ST7



1.	Cover	3.	Separator element
2.	Cover gasket	4.	Separator tube

Figure 6-7: Separator element assembly—ST11, ST15

6.7.1 Separator element replacement

Refer to *Figure 6-6* and *Figure 6-7*. Use the following procedure below to change the separator:

CAUTION

Relieve all pressure from the separator/sump tank and all compressor lines.

1. Loosen and remove the six (6) hex head capscrews (M12 x 45 mm) from the cover plate.
2. Lift the cover plate from the separator tube.
3. Remove the separator element.
4. Inspect the separator tube for rust, contamination, or damage.
5. Reinsert the separator elements into the separator tube taking care not to dent the element against the tank opening.
6. Install a new lubricated O-ring in the O-ring groove on the underside of the separator/ tube cover.
7. Replace the cover plate, washers and capscrews. Torque to 28 ft·lbs. (38 N·m).
8. Clean the return line strainer before restarting the compressor. Refer to *Figure 6-1* and *Figure 6-2*.
9. Check condition of grounding spring on lid, ensure it is clean and provides good contact.

6.8 Belt maintenance

The correct drive belt tension is essential to ensure that full motor power is transmitted to the compressor unit. The belt tension is achieved by raising the compressor unit which has the effect of increasing belt tension. Refer to *Figure 6-10* and *Figure 6-11*.

Belt tension must be re-adjusted ½ to 2 hours after a new set of belts are fitted. This will ensure that the belts have completed their initial stretch. Subsequent to this, belt tension needs to be checked and adjusted if necessary every 2000 hours for the duration of the belt life.

There are two recommended methods for checking the belt tension. The test methods will be detailed as follows.

6.8.1 Belt tension measurement with Optikrik tension meter

Refer to *Figure 6-8*. Follow instructions as follows:

1. Ensure the indicator arm is pushed down prior to starting.
2. Gently place the meter on the flat side of one belt at the midpoint between the motor and compressor unit pulleys.
3. Slowly press on the push pad. Avoid contacting the meter with other fingers as this may affect the reading.
4. Once a definite click is detected, immediately release pressure and the indication arm will remain in the measuring position.
5. Carefully lift the meter without moving indicating arm.
6. Read the measurement at the exact point where the top surface of the indicator arm crosses the scale.
7. Rotate the motor pulley through at least one complete revolution and measure the tension again, recording the results.
8. Repeat step 7 for a total of 3 measurements.

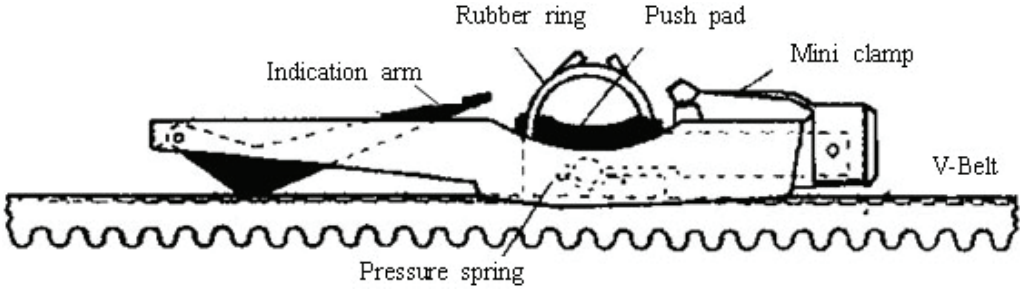


Figure 6-8: Optikrik belt tension meter

9. Average the three measurements to obtain the true belt tension.
10. Repeat for remaining belts.
11. Compare the results to the belt tension specification in *Table 6-1* and adjust if necessary.

6.8.2 Belt tension measurement with frequency meter

Figure 6-9: Belt tension frequency meter

Refer to *Figure 6-9*. Follow instructions as follows:

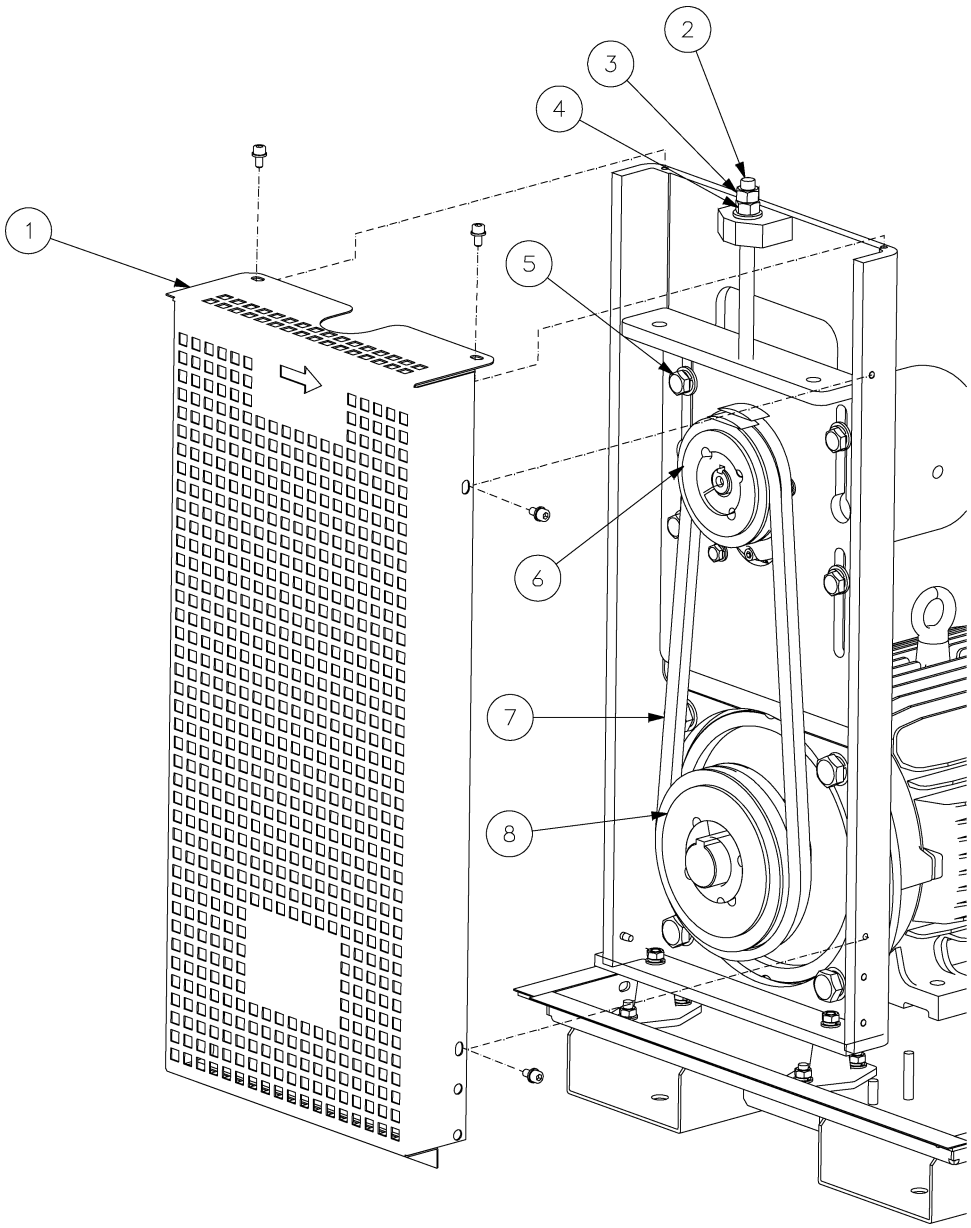
1. Turn on the meter.
2. Hold the meter so that the probe is > 10 mm (⅜") away from the belt being tested. Do not touch the belt with tester probe.
3. Pluck a single belt at the midpoint between the motor and compressor unit pulleys. Try not to disturb any adjacent belts, as this will give a false reading. As the probe detects a vibration, the meter will display the frequency. Record data.
4. Rotate the motor pulley through at least one complete revolution and measure the belts again, recording the results.
5. Repeat step 4 for a total of 3 measurements.
6. Average the three measurements to obtain the true belt tension.
7. Repeat for remaining belts.
8. Compare the results to the belt tension specification in *Table 6-1* and adjust if necessary.

6.8.3 Belt tension adjustment

Refer to *Figure 6-10* and *Figure 6-11*.

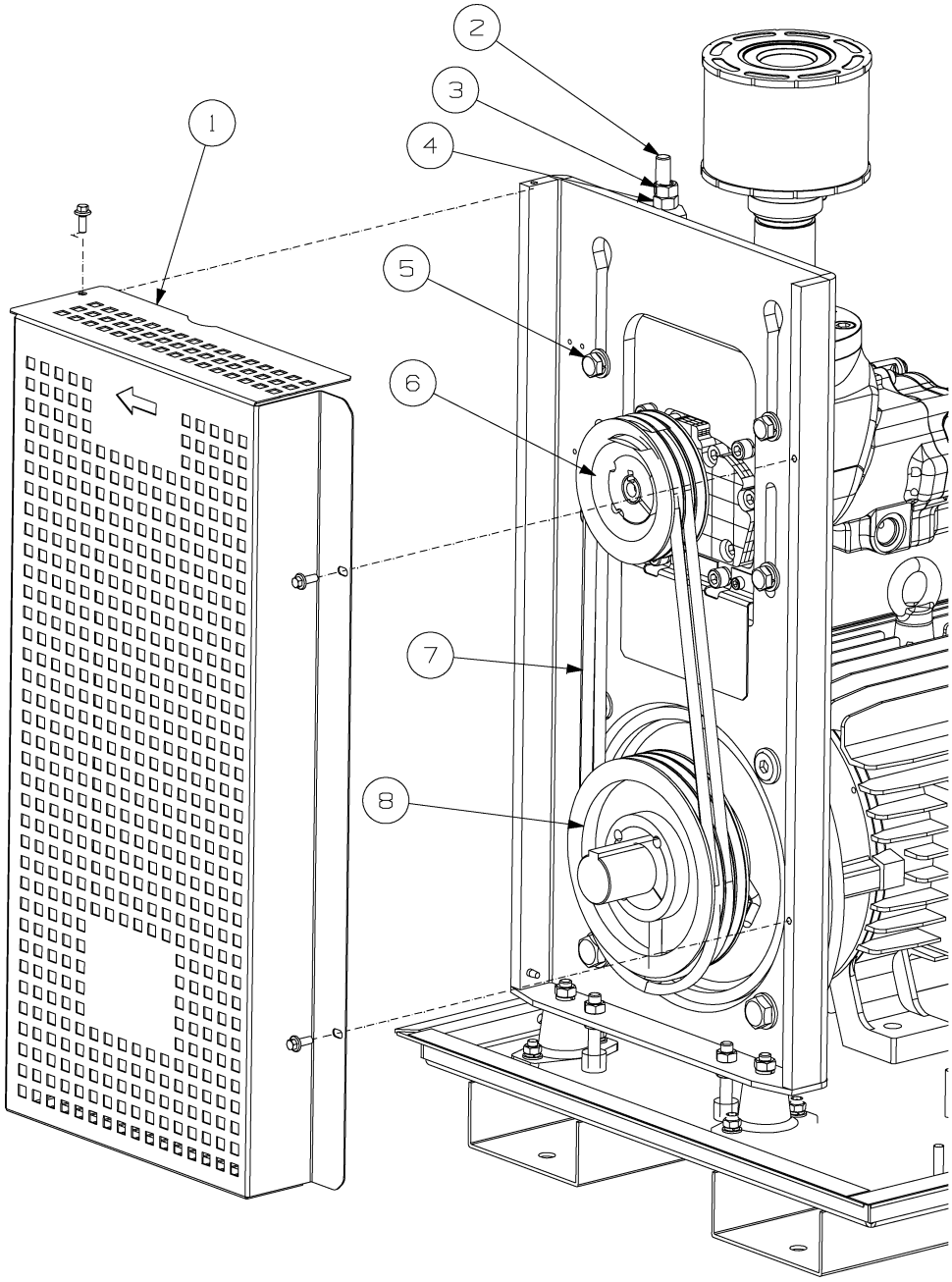
Adjust the belt tension according to the following procedure:

1. Shut down the compressor and isolate all electric power.
2. Open the side panel and remove belt guard.
3. Loosen the locking nut.
4. Loosen the four compressor unit mounting plate bolts ¾ of a turn.
5. Adjust the belt tension by turning the jacking nut clockwise to tighten or counterclockwise to loosen.
6. Measure belt tension and ensure it meets the specifications in *Table 6-1*.
7. Tighten the locking nut.
8. Tighten the four compressor unit mounting plate adjusting bolts.
9. Ensure that the discharge hose is not kinked, bent, or has been placed under undue stress or strain.
10. Replace the belt guard and the side panel.



1. Belt guard	5. Comp. unit mounting plate bolts (4)
2. Belt tension adjustment screw	6. Comp. unit pulley
3. Locking nut	7. Belts
4. Jacking nut	8. Motor pulley

Figure 6-10: Belt tension adjustment—ST4, ST5, ST7



1. Belt guard	5. Comp. unit mounting plate bolts (4)
2. Belt tension adjustment screw	6. Comp. unit pulley
3. Locking nut	7. Belts
4. Jacking nut	8. Motor pulley

Figure 6-11: Belt tension adjustment—ST11, ST15

Table 6-1: Belt tension requirements

	Compressor			TT Mini		Optikrik	
				First time	Re-tension	First time	Re-tension
Model	hp	kw	Hz	Frequency (Hz)	Frequency (Hz)	Force (N)	Force (N)
ST4 series							
ST410	5		60	80	70	233	180
ST410	5		50	82	72	232	178
ST5 series							
ST510	7.5		60	78	68	214	165
ST510	7.5		50	84	74	215	165
ST7 series							
ST709	10		60	87	76	250	192
ST712	10		60	81	71	242	186
ST708	10		50	90	79	237	182
ST713	10		50	85	79	230	191
ST11 series							
ST1109	15		60	85	75	245	189
ST1112	15		60	85	74	254	195
ST1108	15		50	92	81	248	191
ST1113	15		50	89	78	255	196
ST15 series							
ST1509	20		60	92	80	283	217
ST1512	20		60	101	88	276	212
ST1508	20		50	92	81	261	201
ST1513	20		50	91	80	274	210

6.9 Replacement and alignment of belt pulleys

In the event of the motor or compressor unit having been removed and replaced, pulley alignment will have to be checked and adjusted.

Misalignment of pulleys can cause rapid wear of the V-belt form, considerably shortening the service life of both belts and pulleys. Due to Sullair's innovative design, only parallel alignment of the drive pulleys needs to be checked.

Parallel alignment can be checked by two methods.

1. Placing a straight edge against the pulleys near their centers. For correct alignment, the straight edge must be sitting flat against both pulleys, i.e. full face contact. There should be no more than 0.5 mm misalignment.
2. Using a laser, ensure misalignment is no greater than 0.5°.

To correct parallel misalignment, first check that the rear face of the compressor unit pulley is positioned 0.3 in (7.5 mm) off the mounting face. This is required to ensure that the belts clear all mounting bolt heads. With the compressor unit pulley correctly positioned, move the motor pulley on the shaft to achieve correct alignment.

6.9.1 Instructions for installing a pulley

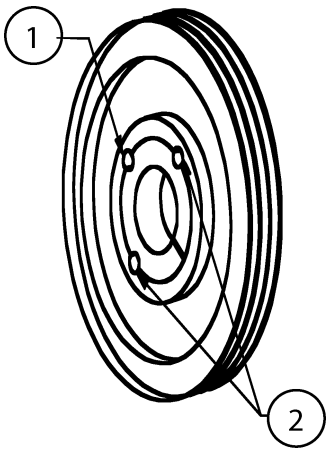
1. Clean all surfaces of shaft, pulley and taper lock bushing.
2. Fit taper lock bushing inside pulley.
3. Spray oil or anti-seize compound on the grub screw threads and gently screw in.
4. Slide the pulley/bushing assembly on to the shaft to the correct position, aligning the keyway.
5. Tighten the grub screws in stages to the specification in *Table 6-2*.

Table 6-2: Pulley tightening torque specification

Tapered hub	Size of Hex Key (mm)	Number of grub screws	Tightening torque	
			ft lbs	N m
1210/1610	5	2	14.8	20.0
2012	6	2	22.1	30.0

6. Check pulley alignment.
7. Install belts and tension as outlined in the belt tensioning procedure.
8. Run machine for ½ to 1 hour and check the tightening torque of the grub screws. Tighten if necessary;

6.9.2 Instructions for removing a pulley



1. Jacking/disassembly hole
2. Installation hole

Figure 6-12: Diagram of belt pulley and taper lock bushing assembly

1. Loosen and remove both grub screws.
2. Install one grub screw into the jacking/disassembly hole. Refer to *Figure 6-12*.
3. Tighten grub screw to release taper lock hub from pulley.
4. Slide pulley and bushing from shaft.

6.10 Hose maintenance

Fluid and air hose replacement is recommended after two (2) years.

6.11 Tank mount package maintenance

Receiver tank should be drained daily. Change SCF filters when indicated by gauge on housing. Refer to dryer documentation for maintenance requirements.

6.12 Troubleshooting

The information in the Troubleshooting Guide describes symptoms and usual causes for the listed discrepancies. However, **do not** assume that these are the only malfunctions or fault conditions that may occur.

NOTE

For additional troubleshooting guidelines, consult the controller's User Manual.

Table 6-3: Troubleshooting guide

Symptom	Probable cause	Remedy
Compressor will not start	Main disconnect switch open	Close switch.
	Line fuse blown	Replace fuse.
	Motor starter overload tripped	Reset - if fault persists, check motor contacts for proper function.
	Low incoming line voltage	Check voltage - in the case of low voltage, check power source, or contact local power company.
Compressor shuts down under service load conditions	Loss of control voltage	Check 110V AC power supply.
	Low incoming line voltage	Check voltage - in the case of low voltage, check power source, or contact local power company.
	High operating pressure	Reset - if fault persists, check line pressure and ensure that it does not exceed the compressor's maximum operating pressure.
Compressor shuts down under service load conditions - High Pressure Fault	Compressor pressure setting incorrect	Change setting in Controller.
	Control line strainer clogged	Clean or replace strainer.
	Minimum pressure valve malfunction	Repair or replace minimum pressure valve.
	Control line air leak	Repair leak
	Defective unload solenoid valve	Check valve – if it does not operate when energized, replace the valve coil or the entire valve if defective.
Compressor shuts down under service load conditions - High Temperature Fault	Cooling air flow restricted	Clean cooler and check for proper ventilation.
	Ambient temperature too high	Check ventilation and increase if too low.
	Low fluid level	Add fluid.
	Clogged fluid filter	Change the fluid filter element.
	Thermal valve malfunction	Replace thermal valve element.
	Temperature sensor RTD malfunction	Check connection and sensor – replace if sensor is defective.
	Cooling fan rotational direction is reversed.	Reconnect fan motor cables for proper rotational direction.

Table 6-3: Troubleshooting guide

Symptom	Probable cause	Remedy
Compressor cannot produce full discharge pressure	Air demand too high	Check service lines for leaks or open valves.
	Dirty air filter	Replace filter.
	Inlet valve bleed orifice obstructed/ plugged	Check the control line bleed orifice inside the inlet valve for blockage or obstructions.
	Defective unload solenoid valve	Check the valve - if it does not operate when energized, replace the valve coil or the entire valve if defective.
	Minimum pressure valve malfunction	Repair or replace minimum pressure valve
	Pressure sensor malfunction	Check connection and sensor – replace if sensor is defective.
	Belts slipping due to lack of tension	Check belts. Re-tension or replace as necessary.
Line pressure rises above unload pressure set-point	Control system leak causing loss of pressure signals	Check for leaks.
	Inlet valve stuck open	Remove the intake hose and check the inlet valve for proper operation.
	Defective unload solenoid valve	Check the valve for proper operation - open when energized - replace if necessary
	Plugged/obstructed control line strainer	Clean or replace strainer
	Pressure sensor malfunction	Check connection and sensor – replace if sensor is defective.
High compressor fluid consumption	Clogged return line or orifice	Clean or replace the strainer.
	Separator element damaged or malfunctioning	Change separator.
	Lubrication system leak	Check all pipes, connections, and components.
	Excess fluid foaming	Drain fluid and change.
	Fluid level too high	Drain and change - check that the compressor temperature has not dropped below 170ºF (76.7ºC).
Pressure relief valve opens frequently	Pressure relief valve defective	Replace.
	Plugged/obstructed separator	Check separator differential.
	Pressure sensor malfunction	Check connection and sensor - replace if sensor is defective.

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