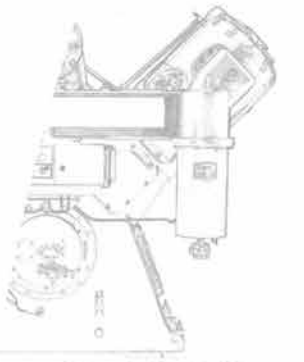
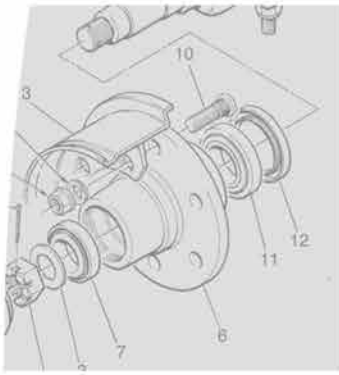
Gardner Denver





User manual

Screw compressor

L160 - L290 V2
L160RS- L290RS V2

America ZS1149274 / 03 - January 2017

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1 FOREWORD

Gardner Denver screw compressors are the product of years of research and development. Together with high quality requirements, these conditions guarantee that the screw compressors are manufactured for long service life, high reliability, and economical operation.

Of course they also meet high environmental protection standards.

1.1 About these operating instructions

This operating instruction applies to the following compressors:

- L160 110A V2
- L160 130A V2
- L160 190A V2
- L200 110A V2
- L200 130A V2
- L200 190A V2
- L250 110A V2
- L250 130A V2
- L250 190A V2
- L290 110A V2
- L290 130A V2
- L290 190A V2
- L160 RS 190A V2
- L200 RS 190A V2
- L250 RS 190A V2
- L290 RS 190A V2

These operating instructions are written for operating and maintenance personnel.

These operating instructions are part of the compressor and must be stored near the compressor such that they are available at all times.

These operating instructions contain all of the documentation required for safe operation and maintenance of the compressor. These include:

- Installing and connecting the compressor
- Commissioning and operating the compressor
- Replacing wear parts and consumable materials, such as filters and oil
- Identifying faults and clearing system malfunctions
- Performing regular visual inspections for damage
- Cleaning, maintenance, and repair of the compressor

The dealer's or manufacturer's shop, with its qualified and experienced personnel, is responsible for all repair work that exceeds typical maintenance and requires specialized technical knowledge.

All pressure values in these operating instructions are gage pressures (positive pressure).

Target groups

The target groups for these operating instructions are the operators, maintenance personnel, and electrical technicians.

After training, the **operator** is permitted to start up and shut down the compressor and activate the emergency-stop.

Maintenance personnel may, in conjunction with the information in these operating instructions, maintain the compressor, repair it, start it up and shut it down and activate the emergency-stop.

Electricians may electrically install the compressor, carry out direction of rotation checks and carry out electrical maintenance work.

Safety requirements

In addition to all the other information in these operating instructions, the general safety instructions in the Chapter “Safety Requirements” must absolutely be read.

1.2 Notes

General notes

The operating instructions must be read and applied by any person assigned to work with and on the compressor.

Regardless of these operating instructions, the laws, regulations, directives, and standards in force in the installed location and the country of use must be followed.

Training

Operator training at site is performed by authorized service technicians. These operating instructions serve as training documents, along with the repair instructions, which are provided only in conjunction with service training.

These measures ensure that the assigned work can be completed reliably.

Guarantee

Gardner Denver is not liable for the functional safety of the compressor if any actions are taken that are contrary to the intended use, or if used for any other purpose than those listed in the operating instructions.

Gardner Denver refuses any guarantee or liability for cases of:

- Operating errors.
- Use of the compressor other than as intended.
- Damages resulting from foreseeable misuse or failure to follow the operating instructions.
- Damages or injuries caused by third party components.
- Use of replacement or wear parts or consumable materials that are not provided or recommended by Gardner Denver.
- Inadequate maintenance.
- Modifications to the compressor.

The guarantee and liability conditions of the general terms and conditions of Gardner Denver are not expanded by the notes above.

Warranty

Conditions and exclusions to the warranty by Gardner Denver are indicated in our general terms and conditions, which were provided with the compressor. The document can also be sent again upon request.

Copyright

These operating instructions are subject to copyright law and may be used solely for the agreed purpose, that is, as a reference for internal purposes.

Propagation or reproduction of this document, or the sale and impartation of its contents, are prohibited unless expressly allowed. Infringement is liable to compensation. All rights are reserved with respect to registration of a patent, utility patent, or design patent.

Resale

If the compressor is resold, these operating instructions must be provided to the new operator along with the compressor. If necessary, the operating instructions must be reordered from Gardner Denver by providing the order confirmation number. The compressor may not be resold without these operating instructions in any case.

1.3 Intended use

The compressor uses the best available technology and meets applicable safety requirements at the time of sale, in the context of correct usage.

The design cannot prevent foreseeable misuse, nor all other residual risks, without limiting the functionality of correct usage.

The compressor is designed for the compression of atmospheric air (compressed air for driving pressure equipment). The compressor is not suitable for the compression of other gases.

The compressor is considered to be used correctly if the following points are also covered:

- The compressor is used in accordance with these operating instructions.
- The operator’s work procedures and operating instructions are followed.

Any other use, or use exceeding these limits, is considered to be improper. The manufacturer is not liable for any resulting damages. The user alone bears the entire risk.

Correct usage also includes following the operating instructions and complying with the inspection and maintenance instructions.

Other provisions

The use of the compressor can cause hazards to life and limb of the user or third parties, or damage to the compressor or other property, if the compressor:

- Is not used properly.
- Is operated by untrained personnel.
- Is modified or altered.
- The safety instructions are not followed.

The following apply in addition to these operating instructions:

- Applicable accident prevention regulations.
- Generally recognized safety rules.
- Country-specific regulations.

Installation site / altitude

The compressor is intended to be installed in a suitable compressor room. The compressor is not suitable for outdoor installation.

Depending on the operating pressure, ambient humidity, and ambient temperature at which the compressor is operated, the permissible altitude of the installation site is limited. The permissible site altitude is determined by Gardner Denver for each individual case in consultation with the customer.

Work environment

The lighting intensity in the area of the compressor must be ≥ 200 lx in normal operation.

The lighting intensity must be ≥ 500 lx for inspection and maintenance work.

The ambient temperature for operation: See “Technical data”

Pressure equipment

A pressure safeguard (pressure relief or the like) that conforms to the applicable specifications must be provided for the pressure equipment and systems installed in the compressed air supply network, considering the weakest pressurized component.

1.4 Foreseeable misuse

Incorrect usage and abuse

The following rationally foreseeable applications (incorrect usage) do not comply with the intended use:

- Compressing gases other than atmospheric air.
- Operation outside of the permissible operating limits, even if exceeded for only a short time, or if not immediately detectable.
- Operation outside of the permissible ambient temperatures.
- Intake of non-atmospheric air (overpressure or underpressure).
- Use as a respiratory air compressor.
- Manipulation of sensor signals.
- Changing signals from sensors.
- Operation without protective and safety devices.
- Operation with defective, deactivated, or manipulated protective and safety devices, or safety values, or operation with other safety-related defects.
- Use by private users or users without technical training.
- Operation outside of industrial premises.
- Failure to comply with maintenance intervals.
- Failure to perform maintenance and repairs.
- Incorrectly executed maintenance and repairs.

Limitations on use

Operation of the compressor is not permitted:

- Outside of the permissible ambient temperatures.
- Above the permissible elevation of the installation site.
- On a foundation that does not have sufficient load capacity.
- In areas with explosive atmosphere.

1.5 Service

In case of questions or problems with compressor, consult your Gardner Denver representative.

Trained technicians provide fast, technically accurate assistance.

For questions

In case of questions or spare parts orders, please provide the model, identification, and year built, as indicated on the model rating plate. Providing these data ensures that you will receive the correct information or spare parts.

Your Gardner Denver representative

Use the following table to record data about your local Gardner Denver representative.

Name:	
Contact person:	
Address:	
Telephone	
Fax	
Email:	

Chart 1-1: Local Gardner Denver representative

1.6 Rating plate

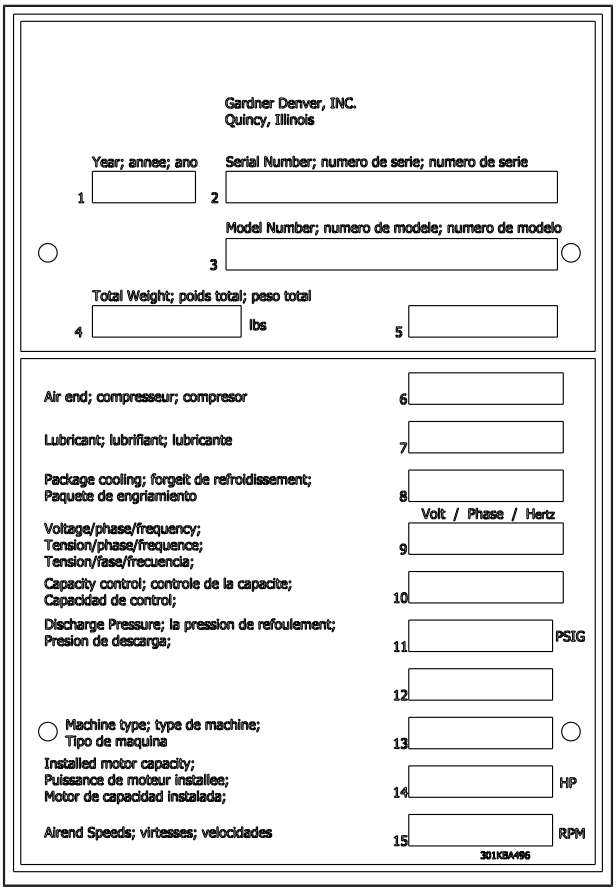


Fig. 1-1: Rating plate

2 SAFETY REQUIREMENTS

Every person involved with the operation, maintenance, and repair of the compressor must read and follow the safety requirements.

Gardner Denver accepts no responsibility for material damage or injuries that arise from non-observation of safety conditions or the failure to observe normal levels of care and attention, even where this is not expressly stated in these operating instructions.

2.1 General safety instructions

Organizational measures

The following organizational measures support the safe operation of the compressor:

- Only assigned personnel may work on the compressor. Personnel are trained and instructed on the compressor.
- Personnel must have read the operating instructions and particularly the Chapter “Safety requirements”. During the assignment is too late. This applies in particular to personnel who are in action only occasionally, such as for maintenance.
- The responsibilities of personnel for operation, maintenance, and repair must be clearly defined.
- Personnel should be checked regular to ensure they are conscious of safety and hazards when working.
- Personnel in training, under instruction, being taught, or taking part in a general training program may work with the compressor only under the continuous supervision of an authorized person.
- For safety-related changes to the compressor or its operating behavior, the compressor must be stopped immediately and the fault must be reported to the responsible area or person.
- Faults, especially those that can compromise safety, must be corrected immediately. Otherwise the compressor must not be operated.
- All hazard warning signs on and near the compressor must be checked regularly for completeness and legibility. Missing hazard warning signs must be replaced immediately.
- The time frames from tests and inspections must be adhered to.
- The operating instructions must be updated to include instructions for supervisory or reporting obligations in reaction to special operating conditions, such as with respect to work organization, process flows, responsibilities, etc.

2.2 Warnings about Special Types of Hazard

Electricity

⚠ DANGER	
	**Electric shock** Deadly electrical voltage ⇨ Exercise extreme caution when working with electrical equipment.
	⇨ Before starting maintenance work, disconnect the compressor and lock it out to prevent restarting.

For all work on the compressor’s electrical equipment, the 5 safety rules for working on electrical systems must be followed.

The following instructions must also be followed:

- Work on the electrical equipment of the compressor may be done only by an electrician in accordance with electrical rules.
- The electrical equipment of the compressor must be inspected regularly. Defects, such as loose connections or scorched cables, must be corrected immediately.
- Only original fuses with the specified current rating may be used.

Only for RS compressors:

Due to residual voltage in the capacitors, the electrical enclosure must not be opened until at least 10 minutes after disconnecting (main disconnect switch OFF). Follow the hazard warning sign on the electrical enclosure! See the “safety symbols” table.

Noise

The sound pressure level without the sound-proofing enclosure is approx. 95 dB(A). Remaining for long periods alongside the compressor without its sound-proofing enclosure can result in irreversible hearing impairment.
Only operate the compressor without the sound-proofing enclosure during test runs. Wear personal hearing protection.

The sound pressure level with sound-dampening enclosure is about: (See "Technical data".)
During normal operation the compressor may only be operated with a closed acoustic hood.

Oil, grease, and other chemical substances

Follow the applicable safety requirements when handling oils, greases, and other chemical substances.

Use caution when handling hot materials, as there is a risk of burning or scalding.

Explosive hazard areas

⚠ DANGER

Explosion hazard

The compressor is not designed for operation in explosion hazard areas.

⇨ Operation of the compressor in explosion hazard areas is not permitted!

2.3 Protective and safety devices

The compressor is equipped with the following protective and safety equipment.

Prior to commissioning, particularly after maintenance and repair work, all protective and safety devices must be installed and checked for proper function.

In addition, the inspection intervals required in the country of use must be complied with.

NOTE

Operation of the compressor is permitted only with complete, functional protective and safety devices in place.

Emergency stop

The emergency stop button can be used to bring the compressor to a safe condition in dangerous situations.

Emergency stop buttons are mounted:

- On the control panel of the compressor
- Optionally in a pedestal (control console)

Using the emergency stop

1 Press the <Emergency stop> pushbutton.
The compressor is placed in a safe condition.

2 Rectify the fault that was the cause of the emergency-stop.
See the "Troubleshooting" chapter.

3 Unlock <Emergency-Stop> button.
Turn the pushbutton anticlockwise.

4 Start up the compressor.
See section "Commissioning after a fault" in the chapter "Commissioning and operation".

Safety valve / non-return valve

The compressor is protected from exceeding the permissible operating pressure by a safety valve. The safety valve opens at 15 bar / 218 psi.

The compressor is protected against backpressure from the compressed air network by means of a check valve on the pressure side.

Protective covers and enclosure panels

The cooling air fans are covered with protective mesh.

The coupling between the drive and the compressor is protected by a mesh guard.

The housing of the compressor is designed so that any broken parts that may be thrown off are retained within the compressor.

The compressor housing serves as a sound protection cover.

2.4 Residual risks

Hot surfaces

Some parts of the compressor become hot in operation (up to 120 °C / 248 °F). A hazard warning sign on the compressor enclosure warns of this danger.

Before beginning maintenance and repair work, the compressor must have cooled off sufficiently.

Personal protective equipment

We recommend wearing the following personal protective equipment:

- Safety shoes
- Safety glasses whenever working with compressed air and open enclosure
- Hearing protection when the sound protection cover is open

2.5 Labeling of safety instructions

Safety instructions are used as special warning notices in the operating instructions, using the following names and symbols.

These special warning notices serve to protect against hazards and are close to the potential hazard in space and time:

- On the system, near the source of hazard
- In the operating instructions, before a sequence of actions or activities to be performed is described

Structure of safety instructions

The special warning notices in the operating instructions are structured as follows:

ALERT WORD	
Safety symbol	**Hazard (consequences of hazard)** Description of the hazard (source) Protective measure (protection against hazard)

Components of safety instructions

Hazard (consequences of hazard): The hazard sequence tells the type of hazard.

Description of the hazard (hazard source): The hazard source indicates the cause of the hazard.

Protective measure (protection against hazard): The protection against the hazard describes the measures for preventing the hazard.

Alert word: The alert word classifies the severity of the hazard into four levels, emphasized graphically with different colors. The alert word is used in the safety instructions as described below.

DANGER Indicates an immediate dangerous situation that, if not prevented, will result in death or extreme (irreversible) injury.

WARNING Indicates a potential dangerous situation that, if not prevented, can result in death or extreme (irreversible) injury.

CAUTION Indicates a potential dangerous situation that, if not prevented, can result in slight or minor (reversible) injury.

CAUTION Indicates information or recommendations that directly or indirectly relate to the safety of persons or equipment protection.

2.6 Safety symbol

The safety symbols (hazard warning signs) can be used in the operating instructions and in the environment around the compressor.

Safety symbol	Meaning	Application / behavior
	General hazard	Warning of a general hazard. Follow the warning and proceed with the required caution (e.g., protective clothing) and care.
	Slip hazard	Warning of a slip hazard. Use caution when walking, stepping, or climbing.
	Component or system under pressure	Labeling of devices or areas in which the air pressure is substantially higher than in the normal atmosphere. Do not open devices or chambers until the pressure has been equalized.
	Do not operate with open doors or loose clothing.	It is not permitted to run the compressor with open doors or loose clothing, except for test runs. High sound pressure level, risk of injury! Normal operation requires the enclosure to be closed.
	Do not breathe in the compressed air from this unit	It is not permitted to use the compressed air produced by this compressor for breathing. Indrawn materials can be dangerous to health. Do not use compressed air as breathing air.

Chart 2-1: Safety symbol

Safety symbol	Meaning	Application / behavior
	Electrical voltage	Warning against dangerous electrical voltage. Work on the electrical equipment of the compressor may be done only by an electrician in accordance with electrical rules.
	System continues to run	The compressor continues to run for 30 second after the stop button <O> is pressed. Do not open the compressor enclosure until the compressor has stopped.
	Follow the instructions for use	Labeling of instructions to the user that additional information can be found in the (manufacturer's) operating instructions. Before the machine is operated, the user (operator) must have read and understood the instructions for use (manufacturer's instructions for use).
	Secure against being switched on again	• Secure against being switched back on again during electrical work • Secure against being switched back on again when working on rotating parts • Secure against being switched back on again during repair work
	Use hearing protection	Label for areas with elevated sound pressure level. Enter the area only with suitable hearing protection.
	Warning about industrial trucks	Warning of industrial trucks traveling within the plant (e.g., forklifts) when transporting. Do not perform any work in traffic lanes with limited visibility that are not secured or blocked off. Use or crossing of this traffic lane requires great caution.
	Warning of suspended loads	Warning of suspended loads during transport. During transport, no persons may be present in the hazard area. In particular, do not reach in or allow the feet to pass beneath the suspended compressor.
	Warning of moving machine parts.	When performing maintenance work, it is necessary to check some functions with the enclosure open. Injury hazard due to rotational or translational motion. Maintenance work may be performed only by specially trained technicians.
	Warning against hand injuries	Hazard that the hands may be crushed, drawn in, or otherwise injured. Keep clear.

Chart 2-1: Safety symbol

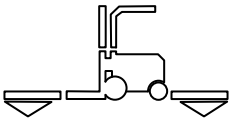
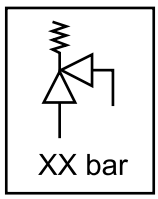
Safety symbol	Meaning	Application / behavior
	Warning of automatic start	In normal operation the compressor can start automatically at any time. Operational readiness of the compressor is indicated by the green LED on the control panel. Do not perform any work on the compressor when the green LED is lit.
	Warning of hot surfaces	Parts of the compressor become very hot when in operation (up to 235 °C / 455 °F). Risk of injury from hot surfaces. Before beginning maintenance and repair work, the compressor must have cooled off sufficiently.
	Suffocation warning	Suffocation hazard due to insufficient ventilation and exhaust of the compressor space. The operator must provide sufficient ventilation and exhaust of the compressor room.
	Warning of a crushing hazard	Warning of crush hazards on a piece of equipment (e.g., a machine) or structural components (e.g., covers, enclosures, guards, fences) during transport. Working at the labeled workstations requires increased vigilance.
	Do not go beneath the load	Do not go beneath a suspended load. The driver is not allowed to drive the industrial truck if a person is located beneath the load. The driver must also make sure that no one stands or walks under the load. The load must be transported so that it is sufficiently clear of the ground (max. 0.5 m / 20 in above the ground). (In Germany also refer to the law BGV D27 “Industrial trucks”). The driver is responsible for all travel and load movements of an industrial truck.
	Lifting point	Labeling of lifting points. Only the labeled lifting points may be used for transport.
	Safety valve	Opening pressure of the safety valve (for value “xx” see the sticker on the control panel).
	Check connection terminals and retighten if needed. For additional instructions, see the operating instructions.	Warning of loosened clamp connections. Clamping pressure can fade after some time. Check the clamps regularly according to the safety guidelines and tighten as needed.

Chart 2-1: Safety symbol

Safety symbol	Meaning	Application / behavior
	Electrical voltage Residual voltage on the capacitors	Warning against dangerous electrical voltage. Warning of stored energy in the form of capacitors. They carry deadly electrical voltage. Do not open the electrical switch cabinet (RS compressor or **ARV**) for 10 minutes after disconnecting the compressor. Work on the electrical equipment of the compressor may be done only by an electrician in accordance with electrical rules. **The following section only applies for the frequency converter of the manufacturer Allen Bradley:** Check the DC bus voltage of the frequency inverter at the grid terminal strip of the frequency inverter. The exact position of the “DC+” and “DC-” terminals can be found in the included operating instructions for the frequency inverter.
	Spring tension	Warning of springs under tension in the interior of the intake regulator. Before opening the intake regulator, read the repair manual.
	Bacterial contamination hazard	Warning of the presence of Legionella in the cooling water in an open-loop cooling water circuit Continuous monitoring of the cooling water by maintenance personnel.
	Caution: hot liquid	Warning of hot oil or hot coolant. Allow the compressor to cool before opening the fluid circuit lines.

Chart 2-1: Safety symbol

NOTE

All hazard warning signs must be present and in legible condition.

Check regularly and replace when needed.

2.7 Transport and installation

Transport

A suitable forklift with sufficiently long forks must be used to transport the compressor. Dependent on type, the compressor weighs up to 4,700 kg / 10362 lbs.

Insert the forks only at the lifting points provided.

The compressor, even in its packed state, may not be transported by crane.

During transport, no person may be present in the hazard area. In particular, do not reach in or allow the feet to pass beneath the suspended compressor.

Installation / installation site

The compressor must be installed with full contact on a foundation with sufficient structural strength.

The installation site (compressor room) must be sized so that the compressor is sufficiently accessible and the required cooling is ensured.

No flammable or explosive materials may be stored near the compressor.

2.8 Normal operation

The compressor may be used only if it is in a technically pristine state, and it must be used as intended, with awareness of safety and hazards, by following the operating instructions.

Operate the compressor only if all protective and safety devices, sound dampeners, ventilation and exhaust devices, and cooling water supply (for water-cooled compressors only) are present and functional.

Check regularly that:

- All hoses and pipelines are in good condition and securely attached.
- there are no leaks (oil, coolant, or cooling water).
- The electrical connection lines are in good condition.
- cooling water supply is provided (for water-cooled compressors only).

Behavioral rules for using compressed air.

- Do not use any method that involves questionable safety.
- Never play around with compressed air.
- Never direct compressed air at the skin or at other person.
- Never use compressed air to clean clothing.
- When using compressed air to clean equipment, use great care and also wear safety glasses as eye protection.

Safety measures

Operate the compressor only when the enclosure is closed.

Check the compressor at least once per shift for externally visible damage and defects. Report any changes (including to the operating performance) to the responsible location or person immediately. Stop and secure the compressor immediately, if needed. Have faults repaired immediately.

Do not switch off or remove the exhaust and vacuum devices when the compressor is running.

Remote control

If there is a remote control, the compressor must bear a clearly visible sign with the following inscription: “Caution! The compressor is remotely controlled and could start without warning.”

In addition, safety precautions must be taken to ensure that no one is working on the compressor when it is remotely controlled.

2.9 Special work

Organizational

The maintenance work and intervals are specified in the operating manual, including information about replacing parts/partial equipment.

Maintenance and repair work may be performed only under supervision, or by a person qualified for this work.

Secure an ample working area, if needed.

Workshop equipment suitable for the work is absolutely required to perform maintenance and repair work.

Safety measures

Personnel must not wear open, long hair, loose clothing, or jewelry, including rings. When the compressor is running, there is an injury hazard, such as due to jamming or drawing in. If needed or required by regulations, use personal protective equipment!

Perform only those maintenance and repair works for which you have sufficient training and where you feel comfortably sure of your ability.

Do not use machine parts as climbing aids. For maintenance work at greater heights, use fall protection.

Maintenance/fault clearing

Perform any maintenance and repair work only when the compressor is switched off and the power grid supply is disconnected. Secure the compressor against being turned on accidentally.

Before opening the compressor enclosure:

- Allow the compressor to come to a stop.
- Wait for automatic pressure relief.
- Wait until the residual energy from the capacitors has dissipated.
- Cool the compressor down to room temperature.

Cleanliness

Always pay attention to cleanliness during maintenance and repair work. Keep dirt away by covering parts and exposed openings with a clean cloth, paper, or tape.

Oil loss causes the floor to be slippery. Clean the work area thoroughly after completing the maintenance and repair work.

Cleaning agents

Never use solvents or cleaning agentsthat can corrode the materials to clean the parts.

Take preventive action against vapors of solvents or cleaning agents that are hazardous to health.

Weight / lifting gear

Carefully attach and secure heavy individual components and assemblies when replacing, so that they do not present a hazard. Use only suitable lifting gear that is in technically perfect condition, and a load handling device with sufficient load capacity. Do not stand or work beneath suspended loads.

Spare parts

Use only original spare parts.

Spare parts must comply with the technical requirements stipulated by the manufacturer. This is guaranteed only when original spare parts are used.

After completing maintenance and repair work

After maintenance and repair work is completed, ensure that no tools, loose parts, or rags have been left behind in the compressor (particularly in the drive motor or the drivetrain).
Rotate the drive several times in order to make sure that there is no mechanical fault in the compressor or the drivetrain.

Tighten all bolt connections that were loosened for the maintenance and repair work. Also check all the other bolt connections.

Before releasing the compressor for operation after maintenance and repair work, ensure that the operating pressures, temperatures, and time settings are correct, and that the control and shutoff device work perfectly.

If safety or protective devices must be removed, then they must be re-installed and checked for perfect function immediately after completing the work.

2.10 Modifications and changes to the machine

Do not make any modifications, additions, or reconfigurations of the compressor without prior consultation with Gardner Denver.

Unauthorized changes to the machine are not allowed for safety reasons.

Original parts are specially conceived for the machine. We explicitly give notice that parts and special equipment not provided by us are also not approved by us. The installation and/or use of such products can therefore degrade active and/or passive safety.

Damage arising from the use of non-original parts or special equipment precludes the liability of the manufacturer. This also applies to the installation and adjustment of safety devices and valves, and for the welding of load-bearing or pressurized parts.

3 DESIGN AND FUNCTION

3.1 General description

The compressor is an oil-lubricated, compressing, single-stage screw compressor with one sound-proofed enclosure.

The main components are the drive motor, the compressor stage, the oil circuit and the electronic control.

Oil is injected into the compressor stage for lubrication, sealing and cooling.

The rolling bearings and gearbox are lubricated with oil.

Principle of compression

The compressor stages consist of a main rotor and a secondary rotor with spiral teeth that mesh with each other. Compression chambers bounded by the flanks of the teeth and by the compressor housing are formed. By rotating the rotors, the volume of the chambers is continuously reduced, until the compressed air is forced out the outlet port of the staged housing. Screw compressors are rotary forced displacement compressors, with no oscillating mass but with pulsating output.

Electronic controls

The main components of the electronic control system are a microprocessor, a touch screen, flat panel keys, and LEDs.

Detailed description operating manual for electronic controls

3.2 Construction of the compressor

Air-cooled

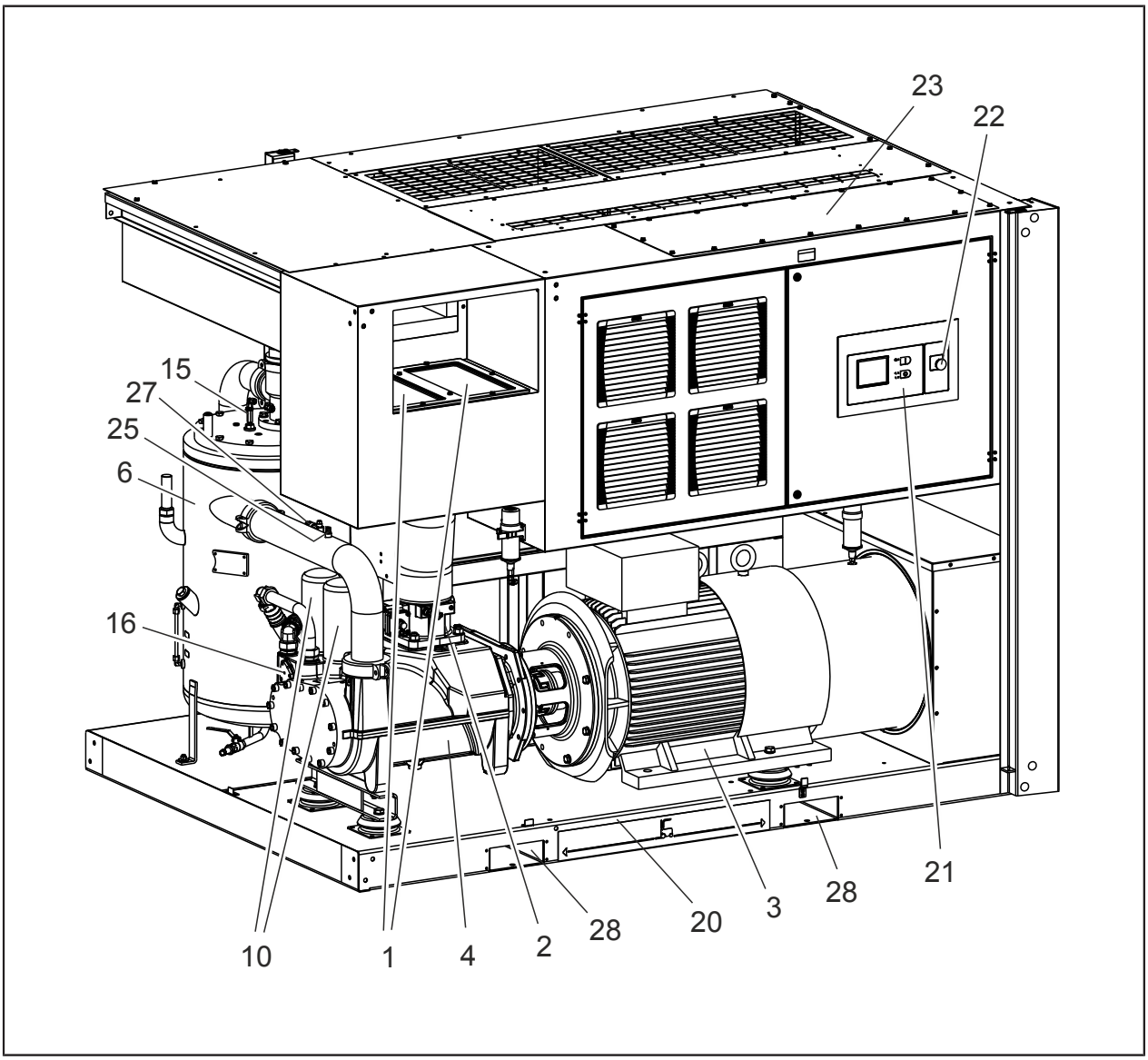


Fig. 3-1: Overview Part 1

[1] Suction filter
[2] Intake regulator
[3] Electric motor
[4] Screw compressor
[6] Fine precipitator
[10] Oil filter
[15] Fine separator, suction
[16] Oil temperature regulator
[20] Base frame
[21] Control system control panel
[22] EMERGENCY-Off button
[23] Electrical enclosure
[25] Compression temperature sensor
[27] Final compression pressure sensor
[28] Opening for lifting tool

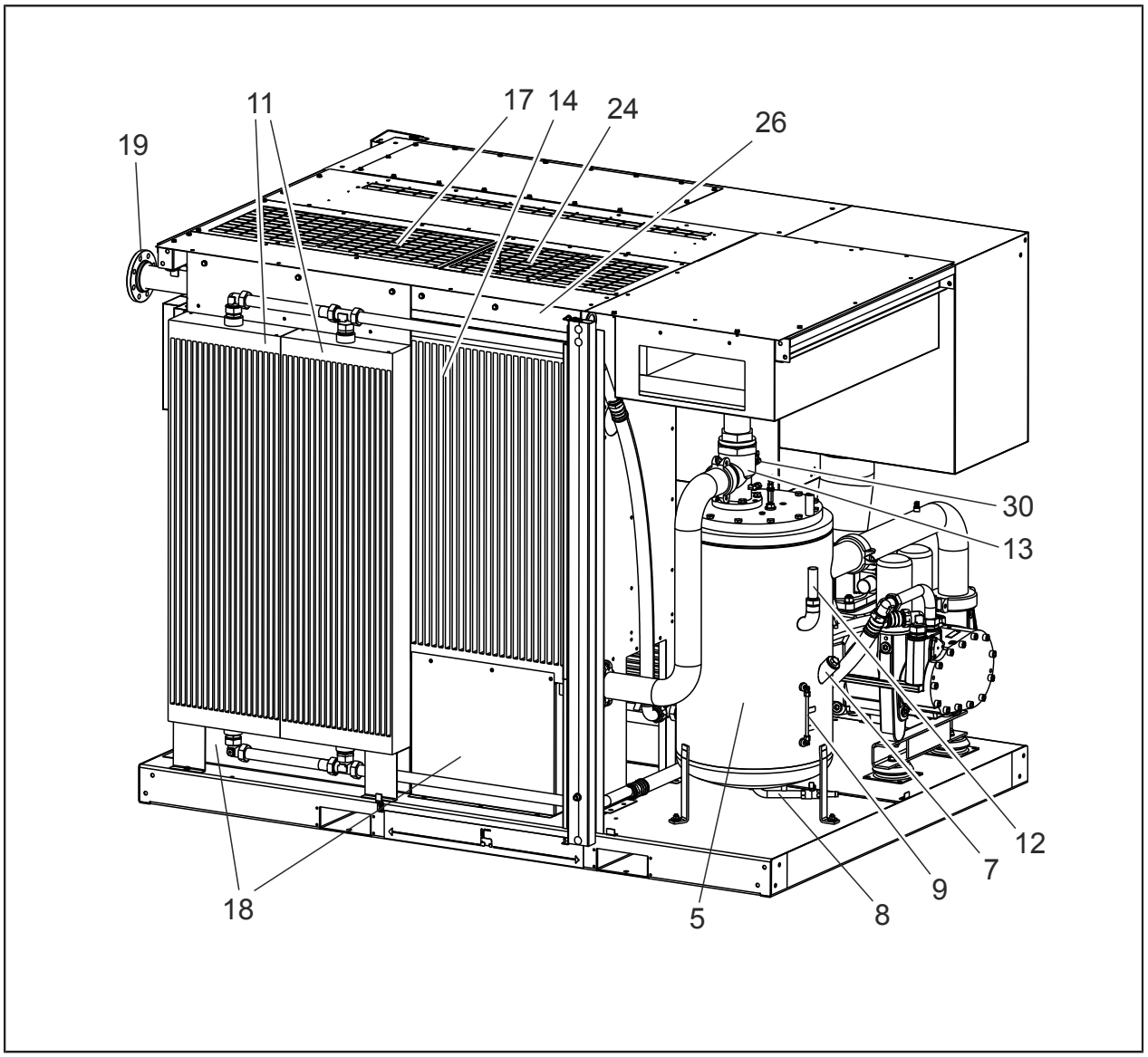


Fig. 3-2: Overview Part 2 (air-cooled)

[5] Pressure vessel
[7] Oil fill
[8] Oil drain
[9] Oil level indicator
[11] Oil cooler
[12] Safety valve
[13] Pressure retention and check valve
[14] Air cooler
[17] Oil cooler cooling air fan
[18] Cooling air inlet filter pad
[19] Compressed air outlet
[24] Aftercooler cooling air fan
[26] Line pressure sensor
[30] Cooler pressure relief

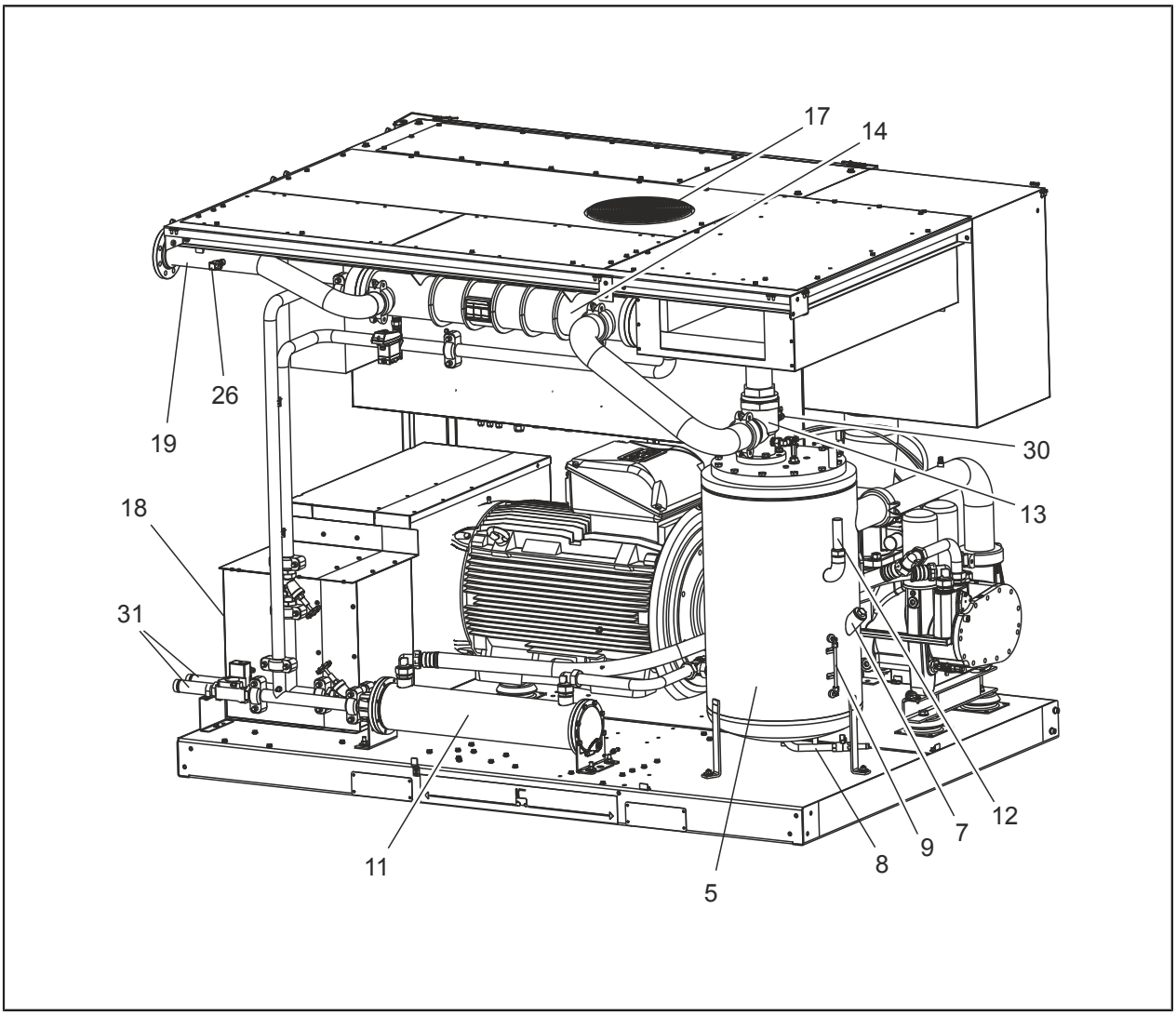


Fig. 3-3: Overview Part 2 (water-cooled)

[5] Pressure vessel
[7] Oil fill
[8] Oil drain
[9] Oil level indicator
[11] Oil cooler
[12] Safety valve
[13] Pressure retention and check valve
[14] Air cooler
[17] Cooling air fan
[18] Cooling air inlet filter fleece
[19] Compressed air outlet
[26] Line pressure sensor
[30] Cooler pressure relief
[31] Cooling water connection

3.3 System schematic for air-cooled compressor

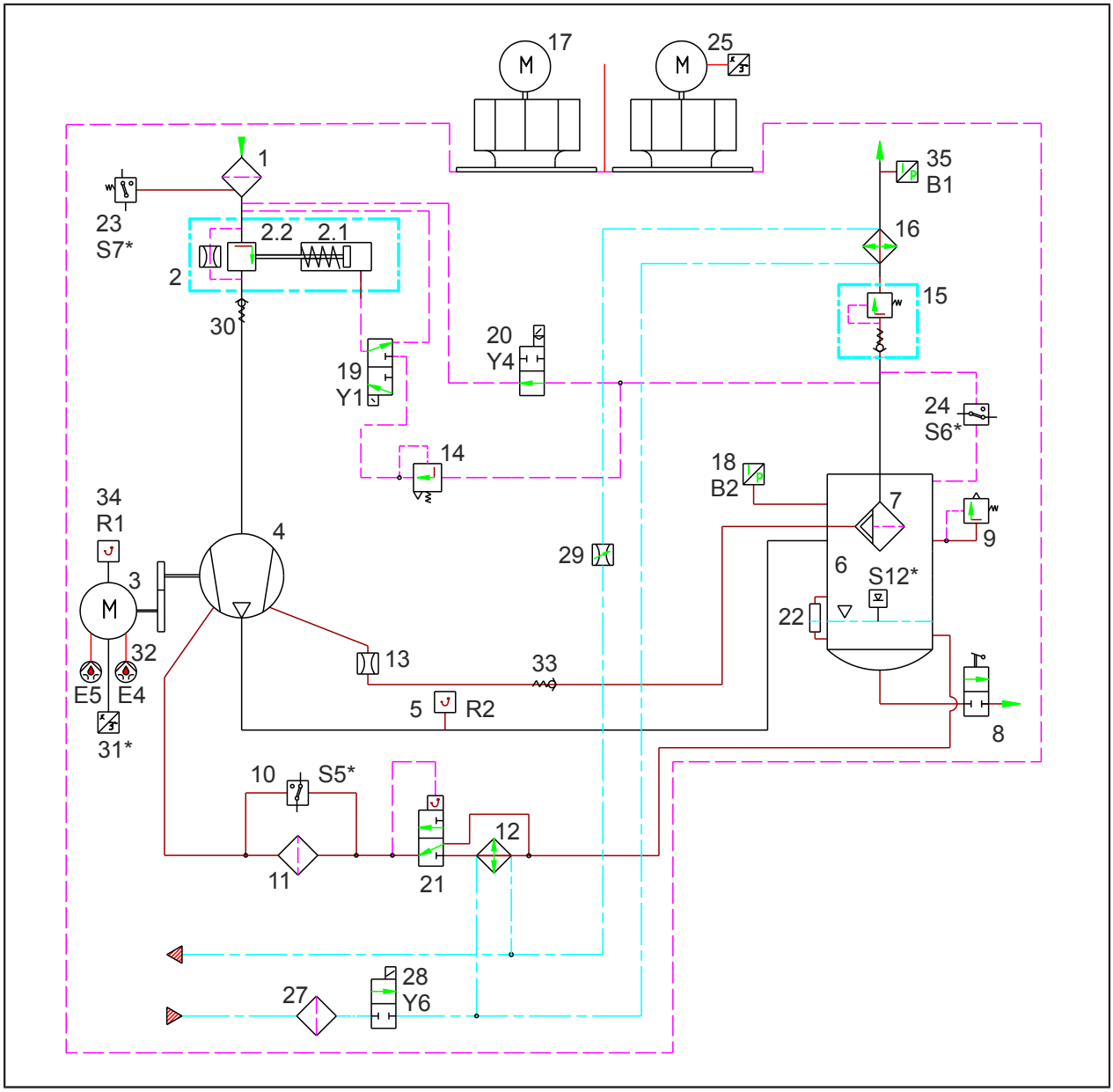


Fig. 3-4: Functional schematic

	Compressed air		Oil
	Control air		Cooling water

Chart 3-1: Lines

Components

No.	Designation	No.	Designation	No.	Designation
1	Intake air filter	13	Throttle; orifice diameter 1.2 mm / 0.047 "	27	Dirt trap (only LxxxW)

Chart 3-2: Components

No.	Designation	No.	Designation	No.	Designation
2	Suction regulator; residual pressure 1 - 1.5 bar / 15 - 22 psi	14	Pressure reducing valve	28	Cooling water solenoid valve (Y) (only L xxxW)
2.1	Adjusting cylinder	15	Pressure retention and check valve Opening pressure 4 - 4.5 bar / 58 - 65 psi	29	Adjustable throttle valve (only L xxxW)
2.2	Throttle	16	Aftercooler compressed air	30	Check valve
3	Electric motor	17	Cooling air fan (aftercooler)	31	Frequency converter L160RS - L290RS; Optional
4	Screw compressor	18	Final compression pressure sensor (B2)	32	Motor lubrication system E4/E5
5	Final compression temperature sensor (R2)	19	3/2-way solenoid valve (regulator valve) (Y1)	33	Oil suction non-return valve
6	Pressure vessel	20	Blow-off valve (Y4)	34	Motor temperature monitoring (R1)
7	Fine precipitator	21	Oil temperature regulator; opening starts at 55 °C / 131 °F	35	Line pressure sensor (B1)
8	Oil drain	22	Oil level indicator		
9	Safety valve	23	Suction filter monitoring (S7); optional Switching point 50mbar / 20 in H_2O		
10	Oil filter monitoring (S5); optional Switching point 2.2 bar / 32 psi	24	Fine separator monitoring (S6); optional Switching point 1.2 bar / 17 psi		
11	Oil filter	25	Speed-controlled cooling air fan (oil cooler)		
12	Oil cooler				

Chart 3-2: Components

3.4 Oil circuit

At oil temperatures below 55°C / 131°F, the oil flows from the pressure vessel (-6-) through the cooler bypass pipe directly to the oil filters (-11-) and is then injected into the screw compressor (-4-).

If the oil temperature reaches between 55°C / 131°F and 70°C / 158°F, the oil flow is divided between oil cooler (-12-) and bypass pipe.

At oil temperatures upwards of 70°C / 158°F, the entire oil flow flows through the oil cooler (-12-).

The oil separated in the oil fine separator (-7-) is fed back to the compressor through the oil suction pipe.

The entire oil circuit is based on differential pressure in the system. If you account for differential pressure within the oil circuit of approx. 2 bar / 29 PSI, then the oil is injected in the screw compressor with approx. 8bar / 116PSI at a vessel pressure of, for example, 10bar / 145PSI.

During screw compressor off-load operation, a sufficiently large drop in pressure, and thus the required oil injection volume, is achieved so that negative pressure is produced at the intake port and at the injection point when the suction regulator is shut (-2-).

Excess pressure of approx. 1.5 bar/ 22PSI (off-load pressure) is produced in the pressure vessel at the same time.

3.5 Air circuit

The air drawn in reaches the screw compressor (-4-) via the suction filter (-1-) and the suction regulator (-2-). It is cooled by the injected oil during the compression process. The ensuing compressed air-oil mixture flows tangentially into the pressure vessel (-6-). After the pre-separation and the subsequent fine separation in the fine separator (-7-), the low-oil compressed air reaches the load network via the pressure-retaining and non-return valve (-15-) and the air cooler (-16-).

3.6 Regulation

(Also refer to the operating instructions for the compressor controller GD Pilot TS)

Unit standstill

- During unit standstill times, the suction regulator (-2-) is shut by a pressure string on the adjusting cylinder (-2.1-).
- The solenoid valve (-19-(Y1)) is currentless.
- The pressure vessel is depressurised through the blow-off valve (-20-) to atmospheric pressure.
- The cooling water solenoid valve (-xx-(Y6)) is shut in a currentless state (only L xxx W – water-cooled systems).

Starting the unit

- The motor starts up in Y-operation.
- The cooling water solenoid valve (-xx-(Y6)) is supplied with current and opens (only L xxx W).
- The suction regulator is shut.
- The compressor draws in air by means of an adjustable throttle. Pressure builds up in the pressure vessel.
- Oil is supplied to the screw compressor due to the drop in pressure between the pressure vessel and the injection point in the screw compressor.
- When switching the drive motor to Δ-operation, the solenoid valve (-19-(Y1)) switches, as it is being supplied with current.
- The air circulated in the system flows through the solenoid valve (-19-(Y1)) into the upper control space of the adjusting cylinder (-2.1-). The blow-off valve (-20-(Y4)) shuts.
- The throttle (-2.2-) in the suction regulator (-2-) is opened.
- At a vessel pressure of 4.5 bar / 65psi, the pressure-retaining and non-return valve (-15-) opens.
- The supply of compressed air to the load network begins.
- The unit is in on-load operation.

Shutting the unit down

- After pressing the OFF button on the control panel of the GD Pilot TS compressor control, the solenoid valve (-19-(Y1)) is switched to a currentless state.
- The upper control space of the adjusting cylinder (2.1) is ventilated by the solenoid valve (-19-(Y1)). The pressure spring in the adjusting cylinder causes the throttle (-2.2-) in the intake regulator to close.
- After 30 sec. have lapsed, the drive motor (-3-) and the cooling air fans (-17 and 25-) are shut down. The cooling water solenoid valve (-xx-(Y6)) is shut in a currentless state (only L xxx W).

Automatic operation (OPEN-CLOSED operation)

- If the pressure at the line pressure sensor (-35-(B1)) reaches the set upper switching point, the solenoid valve (-19-(Y1)) is switched to a currentless state.
- The upper control space of the adjusting cylinder (2.1) is ventilated by the solenoid valve (-19-(Y1)). The pressure spring in the adjusting cylinder causes the throttle (-2.2-) in the intake regulator to close.
- The pressure vessel is depressurised through the blow-off valve (-20-) to off-load operation pressure (residual pressure).
- The screw compressor now runs in off-load operation.
- The cooling air fan (-25-) is switched on and off based on the final compression temperature (only L xxx fixed fan speed A – air-cooled units).

- The cooling air fan (-25-) is speed-controlled based on the final compression temperature (only L xxx RS with fan speed control A – air-cooled units).
- The cooling water solenoid valve (-xx-(Y6)) is opened and closed based on the final compression temperature (only L xxx W – water-cooled units).
- If the pressure at the line pressure sensor (-35-(B1)) does not drop to the set lower switching point within the set run-on time (e.g. 120 seconds), the drive motor (-3-) and the cooling air fan (-25-) are shut down and the unit is depressurised to atmospheric pressure. The cooling water solenoid valve (-xx-(Y6)) is shut in a currentless state (only L xx W).
- The unit is now in stand-by mode and can restart at any time once the line pressure drops to the set lower switching point (see section “Starting the unit”).
- If the line pressure drops to the preset lower switching point within the set motor run-on time, the solenoid valve (-19-(Y1)) is supplied with current again and the blow-off valve (-20-(Y4) is shut.
- The unit goes back to on-load operation.

3.7 Lubricant system

The screw compressor unit’s drive motor is fitted with an automatic motor lubrication system.

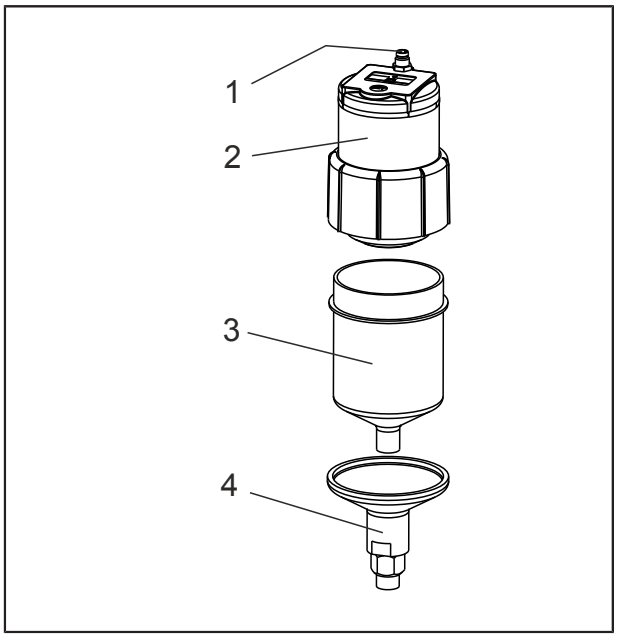
Function of the motor lubrication system

The automatic motor lubrication system guarantees permanent lubrication of the motor bearings. When the drive motor is active, the lubricators are supplied with voltage (24 VDC) via the compressor controller. The grease quantity set at the lubricator is distributed during several cycles depending on the motor service life measured.

An empty grease cartridge or a fault on the lubricator is indicated on the compressor control by means of a message [Warning: Mot.lubr. sys] (also refer to the operating instructions for the compressor control GD Pilot TS).

Structure of the lubricators

(2x per drive motor)



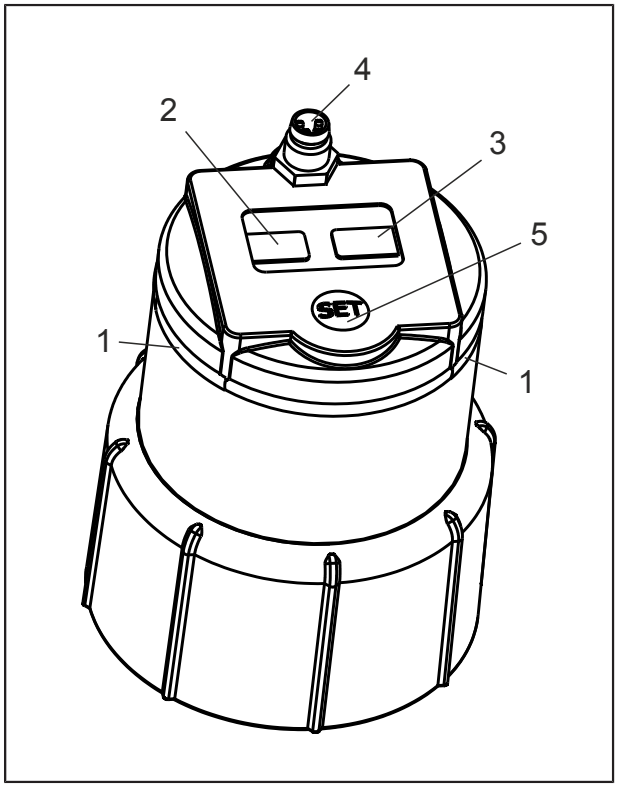
[1] Socket for connection cable

[2] Lubricator drive

[3] Grease cartridge (not refillable)

[4] Support bracket

Function display on lubricator



[1] Function display (LED)

[2] Min. lubrication period from the vessel change and count display of the last 100 operating hours of the lubricant vessel.

[3] Lubricant quantity for 100 operating hours

[4] Plug connector

[5] “SET” key

The function display is only active if the screw air compressor unit’s drive motor is running.

The lubricators are fitted with one red and one green LED. These LEDs indicate the following operating conditions or faults to the operator.

LED	Signal	Explanation
Green	Constant signal	OK. “System running”
Green	Continuous signal <30sec.	Dispensing cycle
Red	Continuous signal >30sec.(*)	Fault/error
Red	Continuous signal (*)	Grease cartridge empty, please change

(*) When the lubricator issues this signal, the following message is output on the compressor control: [Warning: Mot.lubr. sys] (also refer to the operating instructions for the compressor control GD Pilot TS).

If the lubricant pipe is blocked, the drive unit increases the pressure to 6bar / 87psi. If the max. pressure is reached, the lubricator switches to a special programme and attempts to open the lubrication duct with three additional lubrications within 48 hours. If this remains unsuccessful, the unit reports a fault.

Special lubrication

If you push the “SET” key for 10 seconds, a special lubrication takes place; e.g. for prefilling or flushing a soiled lubrication point.

Lubricator operating parameters

The following setting applies to the screw air compressor range L160-L290 / 50Hz + 60 Hz with a standard electric motor:

Description	Value
Grease dispensing volume / 100 operating hours	2.7 cm³ / 0.17 in³
Pause time between two dispensing processes	approx. 9 operating hours
Grease cartridge service life	approx. 4,000 operating hours

3.8 Heat recovery L160-L290

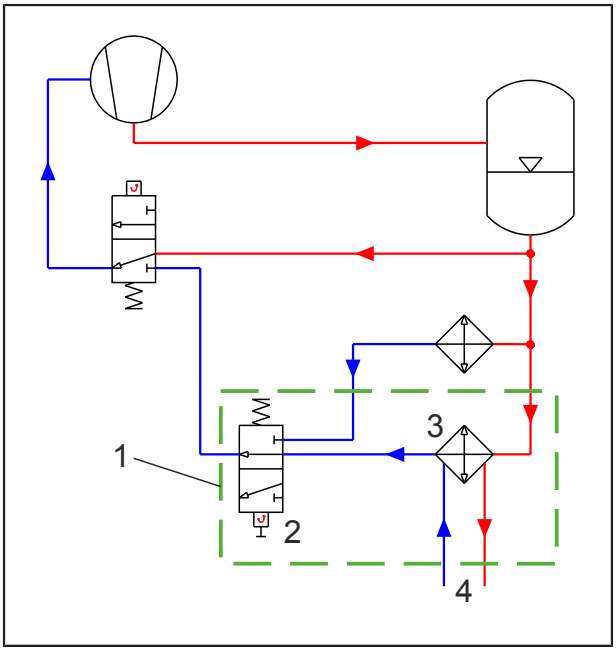
⚠ WARNING

Contamination with Legionella

Health hazard with open-loop cooling systems.

⇨ Continuous monitoring of water quality and germ count in the cooling circuit.

Heat recovery function schematic



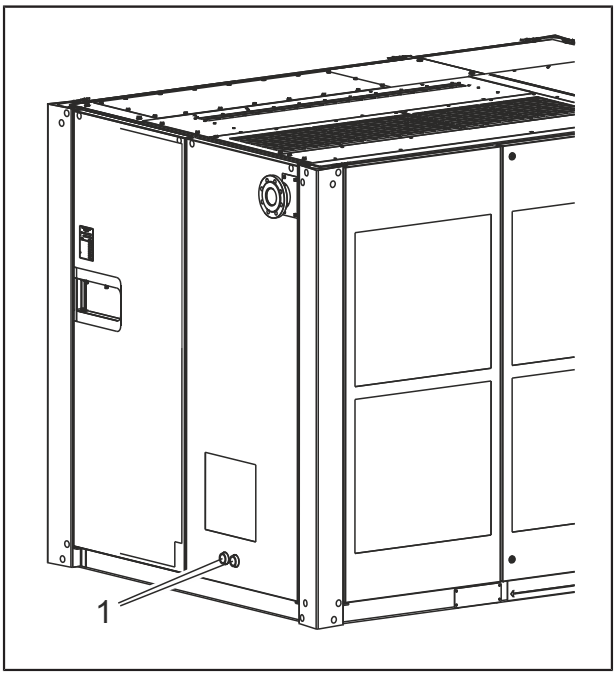
[1] Heat recovery

[2] Temperature regulator with switch-off function

[3] Heat exchanger

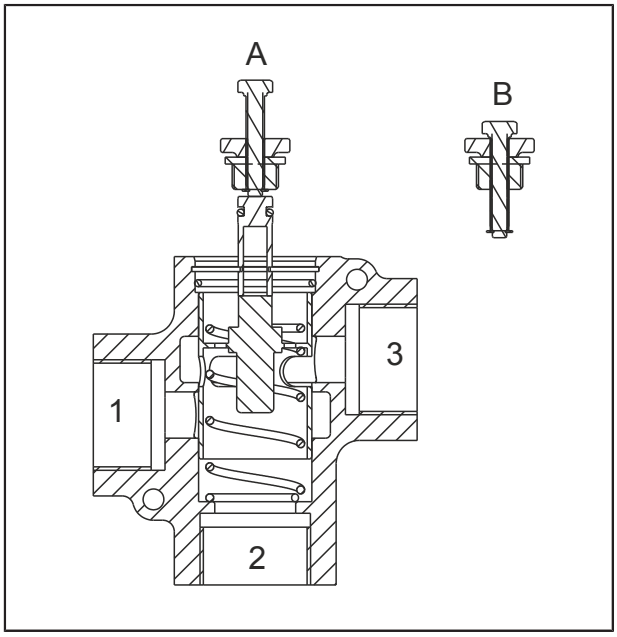
[4] Cooling water connection

External connections



[1] Cooling water connection

Switching heat recovery on and off



[1] Connection from oil cooler

[2] Connection to compressor

[3] Connection from heat exchanger (WRG)

[A] Heat recovery switched on

[B] Heat recovery switched off

Turning the hex screw clockwise to the stop (max. torque 3 Nm) switches the heat recovery off. Turning the hex screw counter-clockwise to the stop (max. torque 3 Nm) switches the heat recovery on.

4 TRANSPORT AND INSTALLATION

4.1 Transport

Delivery

The compressor is bolted down to a shipping pallet and covered in plastic sheet packaging.

The center of gravity and lifting points are marked on the packaging.

Receiving

When received, check for shipping damage.

1 Check the delivery for visible damage.

2 Use the packing list to check the delivery for completeness.

3 Immediately inform the freight forwarder, insurance, and Gardner Denver of any missing parts or damage.

Weight

Dependent on type, the compressor weighs up to 4,700 kg / 10362 lbs (gross). The weight is stated on the nameplate and is visible from the outside.

Transport

⚠ DANGER

Danger to life

Danger to life from tipping or falling parts.

⇨ A suitable forklift with sufficiently long forks must be used to transport the compressor.

⇨ Use forks only at the labeled lifting points.

⇨ The compressor, even in its packed state, may not be transported by crane.

⇨ During transport, no persons may be present in the hazard area. In particular, do not reach in or allow the feet to pass beneath the suspended compressor.

NOTICE

Property damage

Do not lift up or lash the compressor system by its enclosure.

Note fork length of forklift.

Transporting the compressor

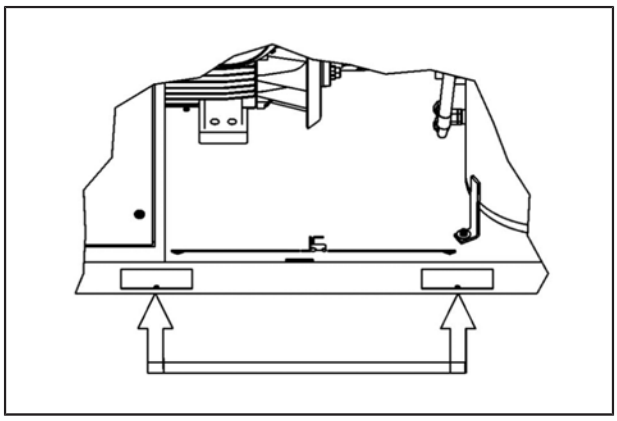
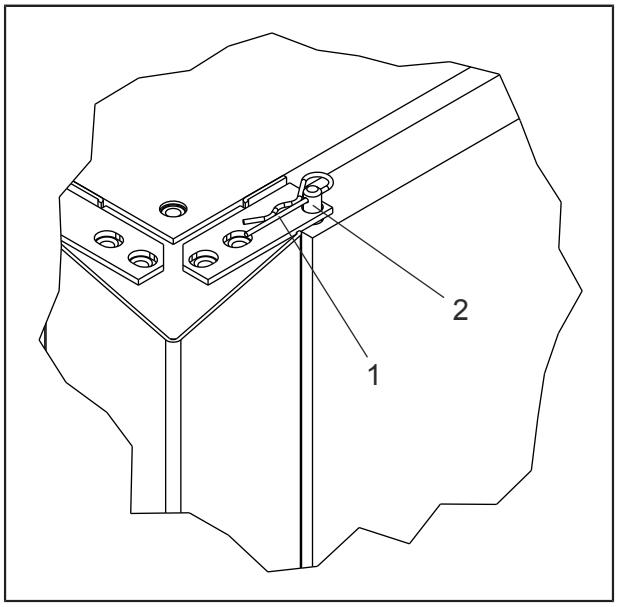


Fig. 4-1: Lifting points



[1] Wire pin

[2] Hinge pin

1 Remove bolts from the transport pallet.

2 Pull wire pin

3 Remove doors

4 Lift the compressor off of the transport pallet.

5 Transport the compressor to the destination area.

6 Align the compressor and place it down.

Weights

The following values are approximate. They apply to the screw compressor unit, including oil charge:

Air-cooled systems	50 Hz	60 Hz
L160	4186 kg / 9229 lbs	4186 kg / 9229 lbs
L200	4415 kg / 9733 lbs	4415 kg / 9733 lbs
L250	4625 kg / 10196 lbs	4625 kg / 10196 lbs
L290 110 (direct drive)	4500 kg / 9921 lbs	4500 kg / 9921 lbs
L290	4650 kg / 10251 lbs	4650 kg / 10251 lbs
L160RS	4378 kg / 9652 lbs	4378 kg / 9652 lbs
L200RS	4573 kg / 10082 lbs	4573 kg / 10082 lbs
L250RS	4669 kg / 10293 lbs	4669 kg / 10293 lbs
L290RS	4684 kg / 10326 lbs	4684 kg / 10326 lbs
Water-cooled systems		
L160	4120 kg / 9083 lbs	4120 kg / 9083 lbs
L200	4330 kg / 9456 lbs	4330 kg / 9456 lbs
L250	4490 kg / 9899 lbs	4490 kg / 9899 lbs
L290 110 (direct drive)	4340 kg / 9568 lbs	4340 kg / 9568 lbs
L290	4490 kg / 9899 lbs	4490 kg / 9899 lbs
L160RS	4270 kg / 9414 lbs	4270 kg / 9414 lbs
L200RS	4460 kg / 9832 lbs	4460 kg / 9832 lbs
L250RS	4520 kg / 9965 lbs	4490 kg / 9899 lbs
L290RS	4520 kg / 9965 lbs	4490 kg / 9899 lbs

4.2 Storage

Storing compressors.

The compressor should be stored in a dry area, heated if possible. This applies especially to the winter months.

NOTICE

Damage to property

Damage to property due to exceeding the permissible temperature range

⇨ Where there is a risk that the permissible temperature limits of +2 ...+65 °C / +36 ... +149 °F could be exceed or underrun, contact Gardner Denver.

Corrosion protection

All compressors are protected at the factory against corrosion for shipping and short-term storage prior to commissioning. If compressors are stored for longer than 6 months, additional preventive measures must be taken.

Compressors that will be out of service for an extended period of time must also be protected against corrosion.

4.3 Installation

Requirements for the installation site

The compressor must be installed with full contact on a foundation with sufficient structural strength. The bearing surface must be level to within 3 mm / 0.12 ".

The installation site (compressor room) should be of sufficient size that on side ("A") a clearance of 1 m/39 “ and on side ("B") a clearance of 1.5/59 “ may not be undershot. The clearance above the compressor should be 1.50 m/59” at least. There should also be appropriate access space for maintenance work.

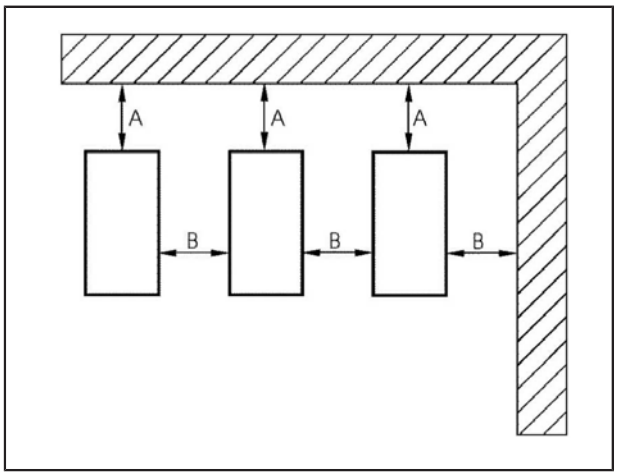


Fig. 4-2: Installation / clearances

- Set up the compressor so that there is sufficient access and that the required cooling is ensured.
- Do not block the air inlet.
- Avoid moisture.

Ventilation and exhaust

⚠ DANGER

Danger of asphyxiation

Danger from asphyxiation due to insufficient ventilation and exhaust.

⇨ The operator must provide sufficient ventilation and exhaust of the compressor room.

In order to be able to dissipate the heat produced during operation, the compressor room must have sufficient volume and good ventilation.
The recommended minimum size of the compressor room is 60 m^3 / 646 ft^3.
The air inlet and outlet openings should have a minimum area of 1,8 m^2 / 19 sq ft (for air-cooled compressors) or x,xx m^2 / xx sq ft (for water-cooled compressors).

The fresh air opening should be located as low as possible. The exhaust opening should be located as high as possible.

Cover ventilation openings with screens in order to prevent dirt from entering the compressor room.

The design of ventilation system is based primarily on the required amount of cooling air. (See "Technical data").

If local conditions are unfavorable, install air ducting. The flow speed of the cooling air should not exceed 5 m/s / 16.5 ft/sec. We recommend a minimum channel cross section of 1.8 m^2/19 sq ft (air-cooled compressor) and x,xx m^2/ xx sq ft (water-cooled compressor).

NOTE

In order to ensure good heat dissipation, the installed auxiliary fans should be designed for air volume about 15 to 20% greater than the required cooling air volume for the compressor.

When installing several compressors in one compressor room, use the sum of the required cooling air volumes for all the compressors in the room.

The following illustration shows the recommended ventilation requirements.

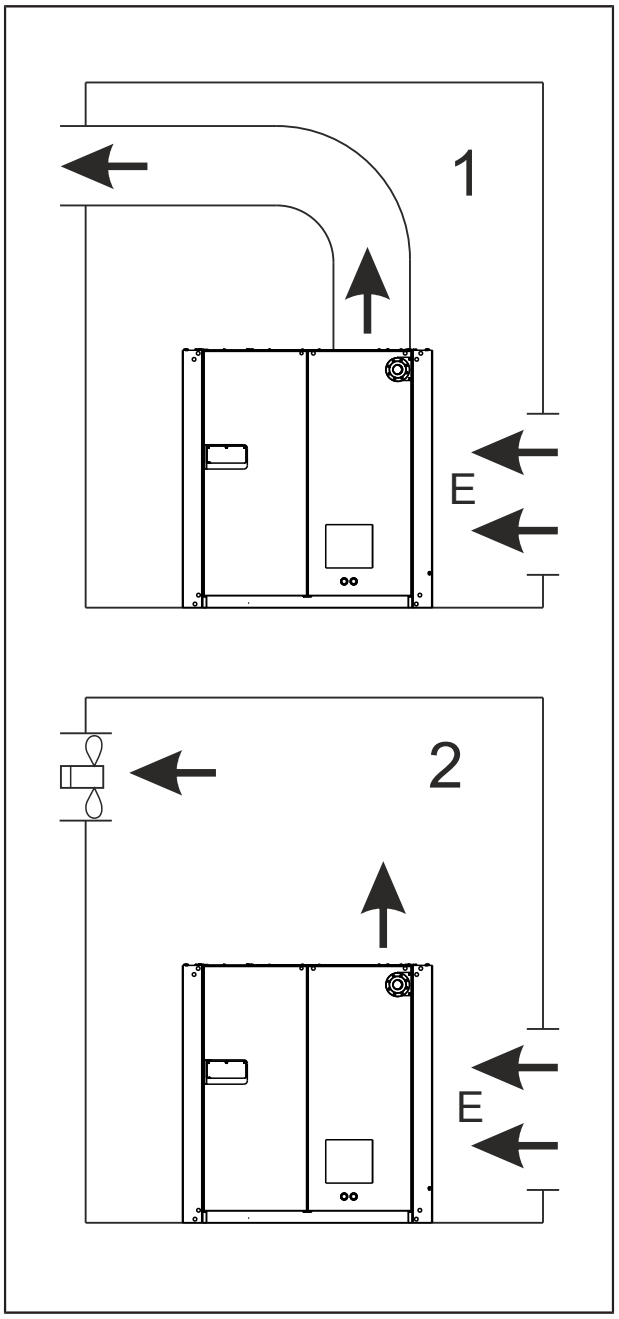


Fig. 4-3: Compressor room ventilation

Install compressor

⚠ DANGER

Risk of injury

Danger from improper installation

- ⇨ Consider the permissible load capacity of the foundation.
- ⇨ Make sure the foundation is solid and flat.
- ⇨ The compressor must be installed with full contact on a foundation with sufficient structural strength.
- ⇨ The compressor must not be operated on the transport pallet.
- ⇨ No flammable or explosive materials may be stored near the compressor.

1. Place the compressor down at the correct location.
2. Ensure that the bearing surface is even to within 3 mm / 0.12 ". (The compressor does not have any levelling means fitted on it)

5 PREPARING FOR COMMISSIONING

5.1 Piping

Remove all blank flanges, stoppers, caps, and desiccant bags before installing the piping.

Distributor piping and pipe connections must be the correct size and designed for the operating temperatures and pressures.

Label the compressed air and water lines according to local requirements.

Support all piping appropriately. Pipes must not bear any loads.

If compressed air hoses are used, they must be of the correct size and must be suitable for the operating pressure and temperature. Do not use worn, damaged, or substandard hoses.

A shutoff valve should be installed in the supply line, so that the compressor can be isolated for maintenance purposes.

The drain line running away from the condensate connection must be pitched at no greater than 5 / 16.4 ft m.

An air tank of sufficient volume should be installed (as a buffer) between the compressor and the compressed air network. As a guideline for the tank capacity, select a size that is 10 % of the supply volume. For example, a compressor with a supply volume of 10m³/min / 353 ft³/min requires a tank with a volume of 1 m³ / 35 ft³.

5.2 Compressed air connection

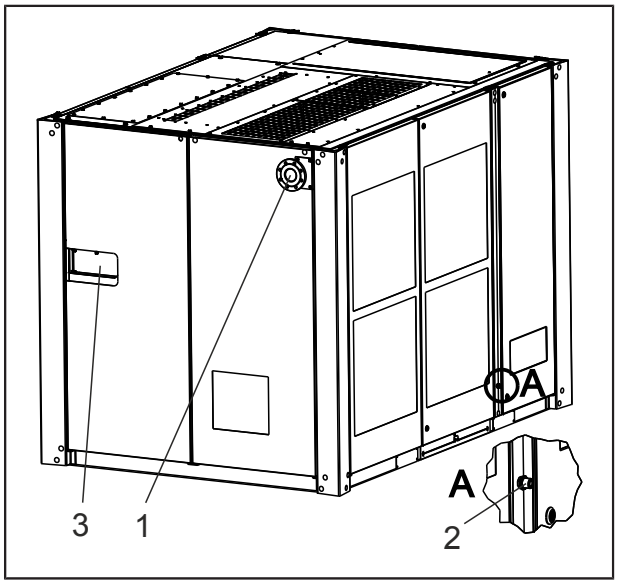


Fig. 5-1: Compressed air and condensate connection

[1] Compressed air connection

[2] Condensate connection

[3] Electrical connection

⚠ WARNING

Risk of injury

If incorrectly connected, the connection can come loose and the open connection can cause severe personal injury.

⇨ When connecting the compressor to the compressed air network, in addition to the operating temperatures and pressures, the connection flange requires special inspection.

⇨ When connecting hoses, suitable measures must be taken to prevent dangerous "whipping" of a free end.

Check the connection flange

The pressure connection comprises a DIN / ANSI B16.5 flange.

The connection is indentified by a stamp on the outside of the flange plate:

DN80, PN16 / 3" 150lbs

1 Read the connection ID.

2 Ensure that the connection and the flange match each other.

Connect the compressor to the compressed air network.

The compressor is fully assembled at the factory. The connection to the compressed air network should be made with a flexible line, that is, a compressed air hose or compensator.

Use only hose couplings and connectors of the correct type and size.

1 Ensure that the supply line can be connected with no tension.

2 Connect the connection line to the compressed air connection of the compressor.

3 Secure hose lines.

5.3 Electrical connection

NOTICE

Disturbances in the electrical supply grid

Speed-controlled **(RS)** compressor systems can cause disturbances in low-voltage grids. For this reason, this drive system is not intended for use on the public low-voltage grid that feeds residential areas.

The compressor system is completely finished at the factory according to EN 60204 (Industrial Machinery).

- The power supply to the compressor must be suitable for industrial equipment and must meet all requirements of EN60204-1/IEC60204-1. If the installation conditions deviate from the conditions as described in EN 60204, consult Gardner Denver.
- Provide the electrical connection and protective measures according to VDE, BS, or local requirements. As a rule, additional regulations from the corresponding power company must also be complied with.
- A main switch must be fitted on-site upstream of the compressor (DIN EN 1012 - 1) insofar that such a switch has not already been fitted in the factory as a special accessory. The main disconnect switch must meet the requirements of the safety standard EN 60 204-1 (Electrical Equipment for Machinery) and EN 60947-2 (Low Voltage Equipment).
- The compressor must be protected by suitable line fuses according to EN 60269-1 (Low Voltage Directive).
- If other electrical circuits are run to the electronic controller afterward, such as lighting, heating, or the like, that are not disconnected by the main disconnect switch, then these excepted electrical circuits must be labeled and run separately per EN 60204. Warning labels must also be installed near the main disconnect switch and near these circuits.
- Should an electrical connection to an unearthed AC electrical circuit (IT network) be made, observe the instructions in the supplied documentation of the frequency converter (only RS compressors).

Electrically connect the compressor

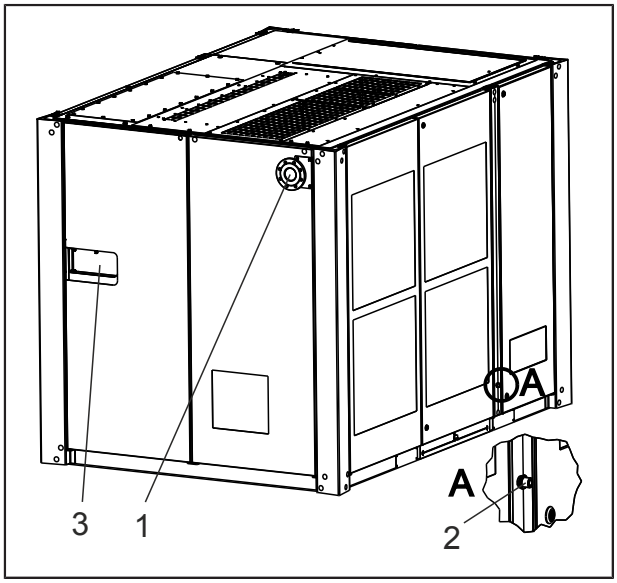


Fig. 5-2: Supply line openings

[1] Compressed air connection

[2] Condensate connection

[3] Electrical connection

⚠ DANGER

Electric shock

Deadly electrical voltage

⇨ Work on the electrical equipment may be performed only by authorized electrical technicians.

1. Remove the factory cover.
2. Install a customer supply line cover.
3. Run the supply lines through the openings in the electrical enclosure.
4. Connect the supply lines; see wiring diagram.
5. Tighten the cable screws.

Check the setting of the fan circuit breaker.

⚠ DANGER

Electric shock

Deadly electrical voltage

⇨ Work on the electrical equipment may be performed only by authorized electrical technicians.

1. Check the setting of the circuit breakers for the two fan motors; see wiring diagram.
2. Set the circuit breakers for the correct grid voltage and frequency; see wiring diagram.

Check the settings of the control transformer

⚠ DANGER

Electric shock

Dangerous electrical voltage

⇨ Work on the electrical equipment may be performed by specialized electrical technicians only.

⇨ With the speed-controlled types (RS) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage.

- The control transformer is preset to the rated voltage at the factory.
- In practice, it has been found that the actual supply voltage can deviate from the rated voltage.
- In order to adapt to local conditions, the correct setting must be made on the control transformer when the compressor is under load, by measuring the control transformer output voltages and adjusting them as needed.
- Several taps are provided for this purpose (see wiring diagram).

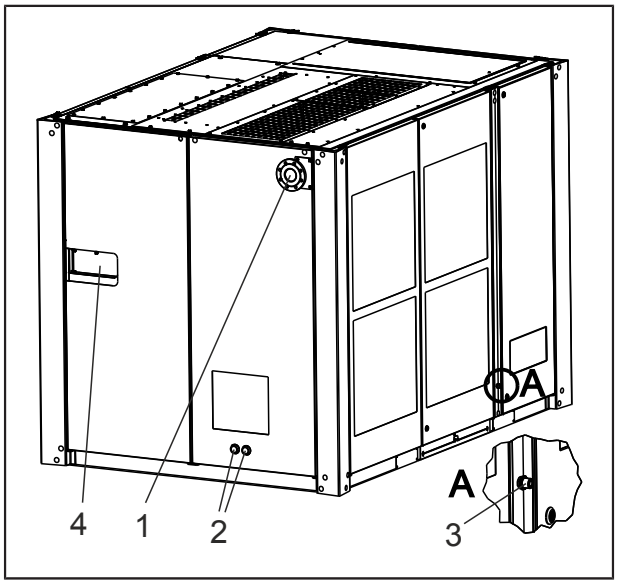
NOTICE

Property damage

Incorrect control transformer settings can cause problems in operation.

⇨ Checking the control transformer settings is part of commissioning and periodic inspection and maintenance, because grid voltage conditions can change.

5.4 Cooling water connection



[1] Compressed air connection

[2] Cooling water connection

[3] Condensate connection

[4] Electrical connection

⚠ WARNING

Contamination with Legionella

Health hazard with open-loop cooling systems.

⇨ Continuous monitoring of water quality and germ count in the cooling circuit.

Connect the compressor to the cooling water network

The compressor is fully assembled at the factory. The connection to the cooling water network should be made with a flexible line, that is, a compressed air hose or compensator.

Use only connections that are the correct size.

1 Ensure that the lines can be connected with no tension.

2 Connect the connection line to the cooling water inlet and outlet of the compressor.

3 Shut-off valves must be installed at the cooling water inlet and cooling water outlet.

4 Secure hose lines.

Cooling water inlet and cooling water outlet

- European version: EN 10226-1 Rp 1 1/2
- USA/CANADA version: 1 1/2 NPT

Permissible cooling water data

- Max. cooling water pressure:
  10 bar / 145 psi
- Min. cooling water inlet temperature:
  5 °C / 41 °F
- Max. cooling water inlet temperature:
  42 °C / 107 °F
- Max. cooling water outlet temperature:
  57 °C / 134 °F

P [KW]	Δp [psi]	V [gal/min]
160	13	39.6
200	16	47.5
250	19	52.8
290	34	60.7

*Chart 5-1: Cooling water requirement at maximum power and (**ΔT** = 10K)*

ΔT:

Cooling water outlet temperature =

Cooling water inlet temperature + ΔT

Δp:

Cooling water outlet pressure =

Cooling water inlet pressure - Δp

The values are based on freshwater quality without additives (e.g., antifreeze). If the cooling water quality deviates from this, please consult Gardner Denver.

Adjust the volume of cooling water according to the description "Cooling water adjustment for water-cooled compressor systems".

NOTE

The cooling water outlet temperature should be below 57 °C / 135 °F, if possible, in order to prevent excessive lime sediment.

6 COMMISSIONING AND OPERATION

6.1 Initial commissioning

NOTICE

Property damage

Although every compressor has already undergone a test run at the factory, and has been checked thoroughly again prior to shipping, the possibility of transport damage cannot be eliminated.

⇨ Check the compressor again for damage before commissioning and observe it during the first few hours of operation.

⇨ If the compressor is connected to the power grid again and started, the direction of rotation of the drive motor and/or the fan absolutely must be checked, depending on the version.

– Drive motor for non-RS compressors

– Fans for RS compressors

Preparations

- Check all electrical and electronic components and devices for water that may have penetrated or condensed. If any is found, contact Gardner Denver.
- If the compressor has been stored for an extended period of time (up to 2 years), then switch on the main disconnect switch at least one hour prior to starting. This ensures that the capacitors are functional and prevents them from being damaged.
- If the compressor has been stored for longer than 2 years, consult Gardner Denver.

Perform initial commissioning as follows

1 Check the oil level.

2 Check the settings of the fan motor protection switch.

3 Check the settings of the control transformer.

4 Check all connection terminals on the electronic controller, and tighten if needed.

5 Switch on the main disconnect switch.

– All three LEDs on the control panel light up.

6 Set the display language.

7 Acknowledge the faults shown on the display.

– The message [Ready to start] appears on the display.

8 Check the factory settings for target pressure (minimum network pressure [min. network pressure] and maximum network pressure [max. network pressure]) and adjust if necessary.

9 Switch on the cooling water supply (for water-cooled compressors only).

10 Press start button < I >.

11 Check the direction of rotation of the drive motor (not RS compressors) or the fans (RS compressors). See the following descriptions.

12 Check the output voltages of the control transformer under load.

Check the direction of rotation of the drive motor (not RS compressors)

⚠ DANGER

Risk of injury

The direction of rotation of the drive motor can be checked only if the coupling cover is removed.

⇨ Before switching on, ensure that there is no one in the hazard zone.

⇨ Keep a safe distance away from rotating parts of the machine.

⇨ Wear hearing protection.

⇨ Operate the compressor only when the enclosure is closed, except for test runs.

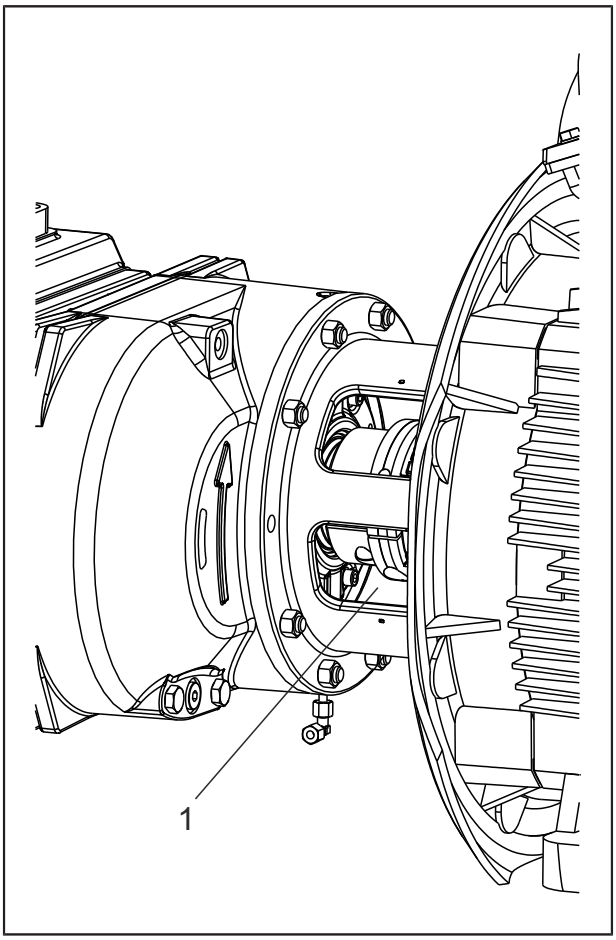


Fig. 6-1: Check the direction of rotation of the drive motor

[1] Protective cover (removed)

1 Switch off the main disconnect switch.

2 Open the enclosure.

3 Remove the protective cover from the coupling.

4 Switch the main switch ON.

5 Press start button < I >.

6 Check the direction of rotation.

7 If the direction of rotation is incorrect: Immediately switch the compressor off with the emergency-stop pushbutton and not with stop button < O >; otherwise damage to the compressor may occur, even if it only operates very briefly.

8 Switch off the main disconnect switch.

9 Correct the direction of rotation. Change the rotating field on the compressor.

10 Mount the protective cover on the coupling.

11 Close the enclosure.

Check the direction of rotation of the fan motors (for RS compressors)

⚠ CAUTION

Falling hazard

The direction of rotation of the fan motors can be checked only "from above."

⇨ Provide a safe means of climbing up.

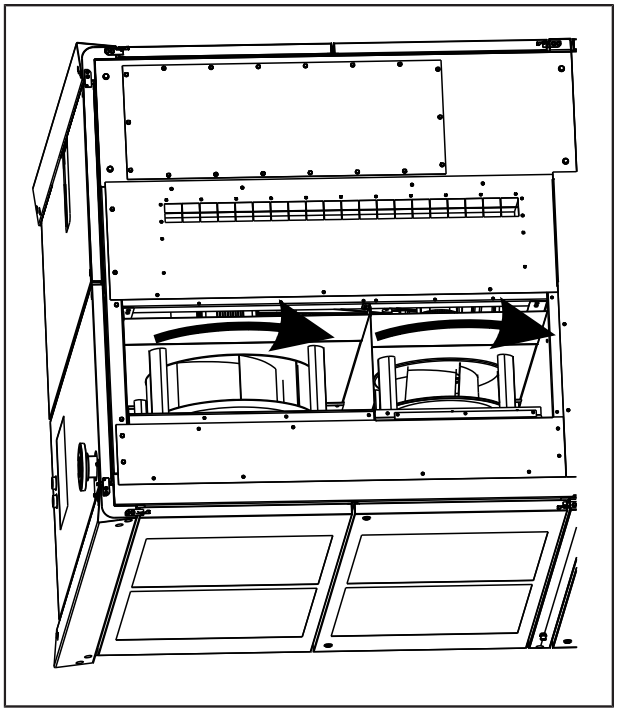


Fig. 6-2: Check the direction of rotation of the fan motors (air-cooled systems)

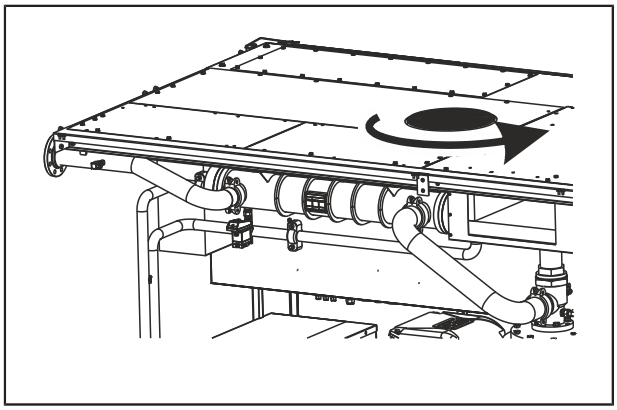


Fig. 6-3: Check the direction of rotation of the fan motor (water-cooled system)

The direction of rotation of the fan motors can be checked while the enclosure is closed.

1 Place a suitable ladder next to the compressor and climb up.
2 Check the direction of rotation.
The rotational direction arrow is visible through the protective cover.
3 If the direction of rotation is incorrect: Switch off the compressor.
4 Switch off the main disconnect switch.
5 Correct the direction of rotation. Change the rotating field on the compressor.

Start-up temperature safety device

The compressor does not start up at ambient temperatures less than + 2 °C / 36 °F.

6.2 Normal operation

Electronic controls

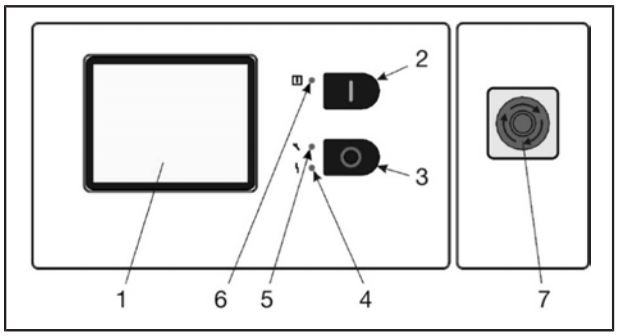


Fig. 6-4: Control panel

[1] Touchscreen Display
[2] Start button < I >
[3] Stop button < O >
[4] red LED
flashing slowly: Warning or maintenance
flashing rapidly: Fault
[5] yellow LED
flashing slowly: Maintenance necessary
[6] green LED
lit up permanentaly: System in operation
flashing: Sytem in standby
[7] Pushbutton <Emergency-stop>

⚠ DANGER

Risk of injury

When the compressor is in standby mode, the green LED flashes, and the compressor can start automatically at any time.

⇨ Do not perform any work on the compressor when the green LED is blinking.

Switching on

1 Press start button < I > on the control panel.
– The compressor switches on.
– The compressor runs automatically (automatic mode). See the sequence description in the "Sequence" section of the chapter "Structure and function."

Operating states

During automatic mode, the compressor can be in one of the following operating states:

- Ready to start (Standby) [Ready to start]
- Loaded operation [On-Load]
- Partial load operation (on-load operation at reduced speed only RS compressors) [On-Load]
- Idle [Off-Load]

Observations during operations

During operation the compressor must be regularly checked to ensure leak-tightness of the oil circuit. With water-cooled systems, this inspection is extended to the cooling water circuit.

Condensate Drain

The condensate drain on the aftercooler is actuated via sensor control.

Switching off

1 Press stop button < O > on the control panel.
– The compressor continues running for 30 seconds (soft stop).

Emergency stop

The emergency stop button can be used to bring the compressor to a safe condition in dangerous situations.

Emergency stop buttons are mounted:

- On the control panel of the compressor
- Optionally in a pedestal (control console)

Using the emergency stop

1 Press the <E-stop> button.
The compressor is brought to a safe condition.
2 Correct the fault that was the reason for the emergency stop.
See the “fault correction” chapter.

3 Unlock the <E-stop> button.
Turn the button counterclockwise.

4 Start up the compressor.
See the paragraph “Commissioning after a fault” in the chapter “Commissioning and operation.”

6.3 Routine commissioning

Routine commissioning includes commissioning after maintenance.

1 Open the shutoff valves between the compressor and the compressed air network.

2 Then proceed as described in the "Initial commissioning" section.

6.4 Commissioning after extended downtime

For commissioning after an extended idle period, consult Gardner Denver.

6.5 Commissioning after a fault

NOTICE

Property damage

Avoid switching on the compressor multiple times without clearing the fault, as this can lead to significant machine damage.

⇨ Switch on the compressor only after the fault has been cleared.

Recommissioning after a fault (automatic shutoff)

Faults are shown in the "Fault memory" display memory.

1 Switch off the main disconnect switch and secure it against switching on again.

2 Clear the fault.
See the “fault correction” chapter.

3 Switch on the main disconnect switch.

4 Acknowledge the fault in the Fault memory menu.

5 After acknowledgement, the message [Ready to start] appears on the display, as long as no other fault is present.

6 Press the start button < I > on the control panel.

– The compressor switches on.

– The compressor runs in automatic mode.
See the sequence description in the "Sequence (automatic operation)" section of the chapter "Structure and function."

7 CLEARING A FAULT

Instructions for clearing a fault

Potential causes and solutions are listed in the following tables.

The measures listed in these operating instructions for clearing faults may be performed only by specially trained personnel. Any other work beyond this must be performed by the manufacturer's service personnel! Work on the electrical equipment may be performed only by authorized electrical technicians.

Solutions are described in detail in repair instructions, which are transmitted as part of the operator training.

NOTICE

Property damage

Property damage due to incorrect/unsuitable measures for fault clearing.

⇨ If the solutions listed here are not sufficient to clear the fault. Contact Gardner Denver.

⇨ For fault and warning messages that are displayed on the display of the electronic controller, follow the instructions in the chapter "Fault clearing" in the operating instructions for the electronic controller.

Fault: Unit will not start

Potential root cause	Remedy
Missing operating or control voltage	Check fuses, main disconnect switch, and supply lines.
Fault not acknowledged	Acknowledge a fault in the electronic controller.
Pressure vessel not depressurised.	Wait for depressurisation. Screw compressor does not start up when the vessel pressure is greater than the preset value. See factory setting “Start protection” GD Pilot TS.
Drive motor defective	Check connections, windings, etc.
Compressor defective	Rotate compressor by hand, replace if needed.
Ambient temperature < +1 °C / 33.8 °F	Ensure that the ambient temperature is at least +1 °C / 33.8°F if necessary provide stationary heating
The remote control/timer control via terminal strip is activated	Deactivate remote control/timer control
Line pressure is above the lower switching point (L160-L290) or the nominal pressure (L160RS-L290RS)	Wait until the line pressure has fallen below the switching point / nominal pressure

Chart 7-1: Fault cleared by: Unit will not start

Fault: Unit remains stopped during the run-up phase.

Potential root cause	Remedy
Short circuit in the compressor	Determine and correct the cause of the short circuit. Replace defective fuses.
Loose terminal connections	Check terminal connections and tighten if needed.
Switching on and off by hand has exceed the maximum number of motor switching cycles.	Avoid switching on and off frequently by hand. Allow the electric motor to cool down.

Chart 7-2: Fault cleared by: Unit remains stopped during the run-up phase.

Potential root cause	Remedy
Intake regulator does not close completely	Make the intake regulator moveable, replace if needed. Check solenoid valves (Y1) and pressure reducing valve (14).

Chart 7-2: Fault cleared by: Unit remains stopped during the run-up phase.

Fault: Unit does not reach the set network pressure.

Potential root cause	Remedy
Network pressure sensor defective	Check the network pressure sensor, replace if needed.
Too much air captured	Throttle the removal, or switch on and use additional compressors.
Oil fine separator soiled	Replace oil fine separator cartridge
Air filter dirty	Replace air filter cartridge
Severe leaking	Check compressor. For example: ● Check for leaks. ● Safety valve after checking is defective or open. ● Condensate drain on test function.
Intake regulator does not open completely	Make the intake regulator moveable, replace if needed. Check solenoid valves (Y1) and pressure reducing valve (14) and replace if necessary.

Chart 7-3: Fault cleared by: Unit does not reach the set network pressure.

Fault: Unit switches off.

Potential root cause	Remedy
Water inlet temperature too high (for water-cooled compressors only)	Check cooling water feed.
Ambient temperature too high	Ventilate the compressor room.
Electric motor defective	Check the electric motor and posistor.
Fan is defective	Check fans, replace if needed.
Sensor, connections, or lines defective	Check sensors, connections, and lines.
Supply cable cross section too small for electrical lines	Measure current draw; replace lines if needed.
Oil level too low	Top up oil in the pressure vessel
Oil injection pressure too low	Replace oil filter cartridge. Clean oil system
Oil temperature too high	Check oil cooler and fan / check oil temperature, check cooling water circuit (only for Lxxx W water-cooled systems)
Compressor defective	Replace compressor

Chart 7-4: Fault cleared by: Unit switches off.

Fault: Idle pressure too high

Potential root cause	Remedy
Compressor does not give relief	Check suction regulator, blow-off solenoid valve (Y4) and pressure-retaining and non-return valve, and replace if necessary.
Intake regulator does not close completely	Make the intake regulator moveable, replace if needed. Check solenoid valves (Y1) and pressure reducing valve (14).

Chart 7-5: Fault cleared by: Idle pressure too high

Fault: Oil in the air filter

Potential root cause	Remedy
Suction regulator non-return function defective	Check non-return valve; replace if necessary.
Continuous Emergency-Off deactivation	Emergency-Off may only be used for safety-related function problems

Fault: Safety valve opens

Potential root cause	Remedy
Safety valve defective	Replace safety valve.
Network pressure sensor defective	Replace network pressure sensor.
Final compression pressure sensor defective	Replace final compression pressure sensor
Electronic controls defective	Replace electronic controller.
Oil fine separator soiled	Replace oil fine separator cartridge
Intake regulator does not close completely	Check solenoid valves (Y1) and pressure reducing valve (14); replace if necessary. Make the intake regulator moveable, replace if needed.

Chart 7-6: Fault cleared by: Safety valve opens

Clearing the fault: Lubricator

If faults occur during operation of the lubricator, check for potential root causes using the following table.

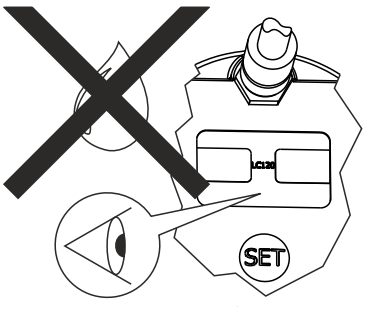
Fault	Potential root cause	Remedy
Lubrication system not dispensing, despite voltage being supplied. 	• Cable connected incorrectly • Cable broken	• Check whether the plug icon is being shown in the display.

Chart 7-7: Troubleshooting and clearing faults on the lubricator

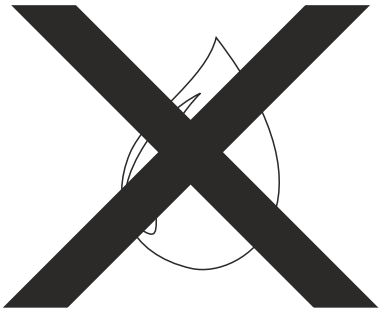
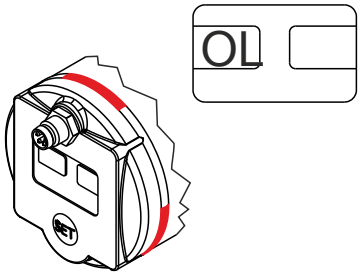
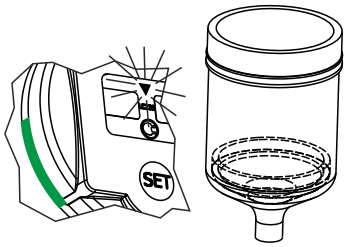
Fault	Potential root cause	Remedy
Lubrication system not dispensing, despite voltage being supplied. The plug icon appears on the display. 	● Drive and LC not screwed together properly.	Screw the drive and LC together until the white triangle on the drive is fully visible.
Lubrication system is in pressure cut-off. 	● Counter-pressure to lubrication point > 87 psi.	• Flush lubrication point (manually or special dispensing PURGE I) • Pressure check if necessary • Acknowledge fault by pressing the SET key.
Lubricant cartridge empty, but no “LC” message. 	● LC unit too small for the drive.	Use the original LC unit MLS 120 of Gardner Denver.

Chart 7-7: Troubleshooting and clearing faults on the lubricator

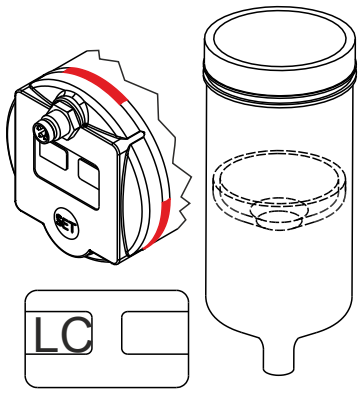
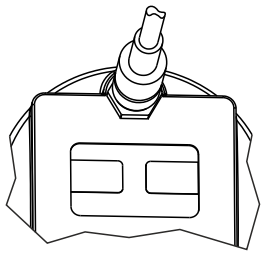
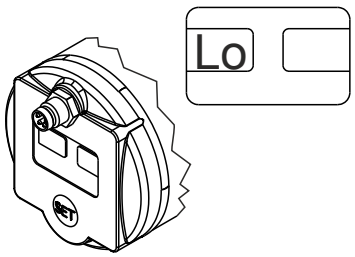
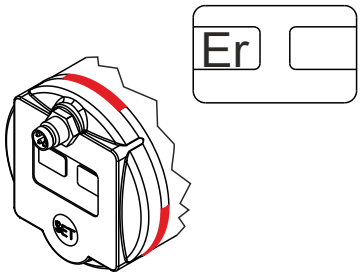
Fault	Potential root cause	Remedy
Message “LC” even though lubricant cartridge is not completely emptied. 	LC unit too big for the drive.	Use the original LC unit MLS 120 of Gardner Denver.
Display not working despite voltage being supplied. 	Internal drive fault.	Replace entire lubrication system
“Lo” message on the display. 	Weak backup battery of the drive.	Change the CR2450 (3V) backup battery. **May only be changed by trained personnel.**
“Er” message on the display. 	Internal drive fault	Replace entire lubrication system

Chart 7-7: Troubleshooting and clearing faults on the lubricator

NOTE

Also note the fault messages on the display of the operator panel.
The corresponding actions to clear the faults are described in the operating instructions for the electronic controls.

8 MAINTENANCE AND SERVICE

Maintenance and service are decisive factors for the compressor to be able to meet the challenges of trouble-free operation and service life that it faces. Compliance with the specified maintenance interval and the careful performance of maintenance and care tasks are therefore mandatory.

Help is available from your responsible Gardner Denver representative, who can create an individualized maintenance plan.

8.1 General notes

Target group

The measures listed in these operating instructions for clearing faults may be performed only by specially trained personnel.

Any other work beyond this must be performed by the manufacturer's service personnel!

Safety

Follow the safety instructions in the safety requirements chapter.

⚠ DANGER

Electric shock

Deadly electrical voltage

⇨ Exercise extreme caution when working with electrical equipment.

⇨ Before starting maintenance work, disconnect the compressor and lock it out to prevent restarting.

⚠ WARNING

Risk of injury from hot bleeder valve

The outlet temperature of the compressed air can be as high as 90°C / 194 °F.

⇨ Allow the compressor system to cool down before opening the bleeder valve.

⇨ Do not work on the compressor system when it is hot

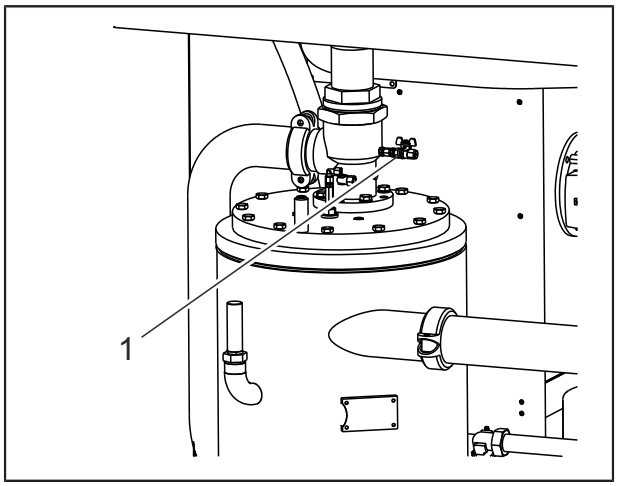


Fig. 8-1: Bleeder valve position for air-cooled compressor systems

[1] Bleeder valve

Protection measures for safe maintenance (Safety routine)

For all maintenance work, if not expressly otherwise stated:

1. Lockout and Tagout.
2. Allow the compressor to come to a stop.
3. Wait for automatic pressure relief.
4. Close the shutoff valve (customer provided) in the supply line.
5. Wait until the residual electrical energy in the capacitors has dissipated (only RS compressors).
6. Cool the compressor down to room temperature.
7. Wear personal protective equipment.
8. Follow instructions regarding hazardous materials.

Manual pressure relief

⚠ WARNING

Pressurized components

Even when the compressor is relieved of pressure, the aftercooler remains pressurized.

⇨ Perform pressure relief manually, before maintenance work is performed near the aftercooler.

1. Close the shutoff valve (customer provided) in the supply line.
2. Lockout and Tagout.
3. Open the enclosure, create access.

4 Undo the lock screw on the closed air vent valve (ball valve at the pressure-retaining valve).

5 Relieve the pressure in the aftercooler by carefully opening the pressure relief valve.

6 Close the vent valve and screw in the sealing screw.

7 After maintenance work is complete, open the shutoff valve in the supply line.

Test run

After any maintenance work, a test run should be performed to locate any leaks, among other things. For each test run, proper and quiet performance of the compressor should also be ensured.

Electrical components

⚠ DANGER

Electric shock

Dangerous electrical voltage

⇨ Work on the electrical equipment may be performed by specialized electrical technicians only.

⇨ With the speed-controlled types there is a risk of electric shocks due to charged capacitors!
Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage.

Checking the DC bus voltage of the frequency inverter

The DC bus voltage is measured at the grid terminal of the frequency inverter. The exact position of the “DC+” and “DC-” terminals can be found in the included operating instructions for the frequency converter.

1 Measure the voltage between terminals DC+ and DC-.

2 Measure the voltage between the terminal DC+ and the chassis.

3 Measure the voltage between the terminal DC- and the chassis.

The voltage must be zero for all three measurements.

Water-cooled compressors

When operating water-cooled screw compressor units please observe the following points.

- In case of leakage a part of the oil in oil/water coolers may penetrate into the cooling water circuit. Cooling water must not be discharged into public sewage systems in an uncontrolled manner. Exclude ucontrolled overflow of oil from separating basins into public sewage systems. Carefully comply with the sewage regulations and guidelines.
- Carefully perform maintenance and repairs. Removed tube bundles must be checked for damage before reinstallation (and replaced even in case of minor damage). When assembling alwas use new seals.

8.2 Service

For any spare parts needed, the local Gardner Denver branch or representative retailer is available.
The local Gardner Denver subsidiary or the responsible dealer is available for any spare parts requirements.

It is important to provide the model name and serial number of the compressor in all communications.

NOTE

Order spare parts on the basis of the separately provided spare parts list.

8.3 Inspection of protective and safety devices

Protective covers and enclosure panels

Ensure that all protective covers and enclosures of the compressor are installed correctly.

- Protective cover for cooling air fans
- Protective cover of the coupling between the drive and compressor
- Compressor housing; here especially the openings (doors)

Safety valve must be in perfect condition. For example, it must not be blocked by dirt or paint.

Emergency-Stop pushbutton /Emergency-Stop function

The switching function of the contacts can be checked by an electrician.

NOTE

The emergency stop function may be actuated only in dangerous situations. Otherwise increased wear, up to and including damage to the compressor, can be expected.

The switching function of the contacts can be checked by an electrician.

Functional check of the safety valves

The functional checking of the safety valve must be carried out by a safety specialist. The result of the functional check must be documented.

1 Lockout and Tagout.

2 Open the enclosure, create access.

3 Press start button < I >
to allow the compressor to run under load.

NOTICE

Hearing damage

Increased sound pressure level when operated without noise-reducing enclosure.

⇨ Wear hearing protection.

⚠ WARNING

Risk of burns/scalding

Risk of burns/scalding due to escaping hot oil (oil mist) / hot compressed air.

⇨ Wear suitable protective clothing.

⇨ Slowly unscrew the knurled cap.

⇨ Do not unscrew the knurled cap too far out of the housing.

⇨ Tighten the knurled cap to the stop again after every functional test.

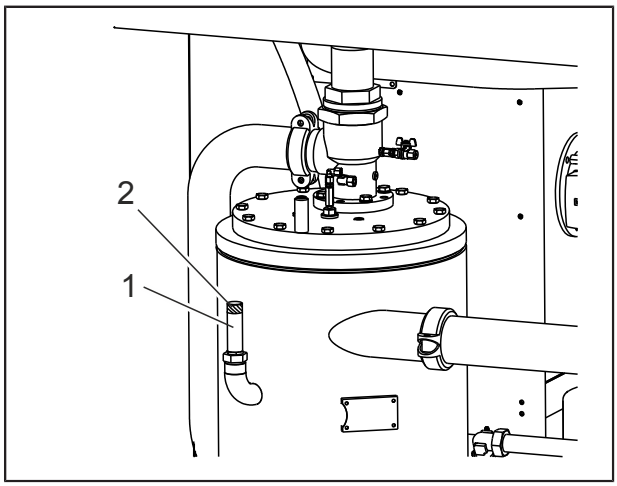


Fig. 8-2: Safety valves

[1] Safety valve

[2] Valve cap

4 Rotate the valve cap counter-clockwise until a clear blow-off is heard.

5 Turn the valve cap clockwise up to the stop.
The valve must shut fully again.

8.4 Routine maintenance

All maintenance work and testing listed in the maintenance plan must be performed and documented at the intervals listed.

All maintenance, repairs, and service work performed on the compressor must be documented.

Service and maintenance work should be performed by the local Gardner Denver representative.

Cleanliness

The compressor room and the environment of the compressor must always be kept clean.

The compressor must be checked regularly for damage and excessive wear.

Spilled oil must be wiped up immediately. Oil traces must be removed immediately.

Electrical connections

The condition of cables and terminals must be checked regularly.

- Watch for loose connections or worn wires.
- All connections must be clean and tight.
- Replace worn or damaged wires or cables immediately.

Leak points

⚠ WARNING

Risk of injury due to high pressure

⇨ Do not use the hand to search for leaking points in the system.

⇨ Always use paper or cardboard for this purpose.

- If a leak is suspected, check the appropriate area for leaks.
- Immediately repair or replace damaged or leaking pipe and hose connections.

Emission or leakage of consumable materials

The following consumables are used in the compressor:

- Compressor oil AEON 9000SP
- POLYREX EM lubricating grease

In case of accident or extended contact with consumable materials, follow the instructions on the material safety data sheets.

Prevent leakage of operating fluids.
Carefully clear up any operating fluids that escape.
Observe the information in the hazardous substance data sheets!

Oil coking in the lubricating oil system.

High oil temperatures reduce the service life of the oil, which can lead to oil coking in the oil lubrication system. Deposits of oil coke can cause damage to bearings and gearboxes.

8.5 Maintenance plan

Maintenance work should be performed regularly, as recommended in the following maintenance plan. The maintenance plan is suitable for most cases, but some detail changes may be needed under certain conditions. The maintenance plan should always be used as a guideline, but if a change is needed on the basis of experience, this should be discussed with Gardner Denver.

Maintenance plan: Maintenance every 8 operating hours

Components	Measure	Required qualification	Completed
Oil tank level check	Check and top up if necessary	Maintenance personnel	
On-load/off-load machine function	Check and report if necessary	User	
Outlet pressure and temperature	Check	User	
Control Panel	Check for fault messages (report if any)	User	

Chart 8-1: Maintenance plan every 8 operating hours

Maintenance plan: Maintenance every 125 operating hours

Components	Measure	Required qualification	Completed
Cooler / fan	Check and clean if necessary	Maintenance personnel	

Chart 8-2: Maintenance plan every 125 operating hours

Maintenance plan: Maintenance every 3,000 operating hours, but at least every 6 months

Components	Measure	Required qualification	Completed
Filter mats cooling air inlet	Inspect, clean, and replace as needed.	Maintenance personnel	
Air filter	Replace air filter	Maintenance personnel	
Oil filter	Replace oil filter	Maintenance personnel	
Motor lubrication	Replace MLS cartridge (grease cartridge)	Maintenance personnel	
Compressor oil AEON9000SP	Conduct oil analysis	Maintenance personnel	
Inlet filter, electrical enclosure cooling air	Replace.	Maintenance personnel	
Frequency converter cooling air inlet filter (VS)	Replace.	Maintenance personnel	
Condensate Drain	Aftercooler, functional check.	Maintenance personnel	
Electronic controls	Check for displayed maintenance reminders.	User	

Chart 8-3: Maintenance plan: Maintenance 2,000 hours

Maintenance plan: Maintenance every 4,000 hours, but at least once a year

Components	Measure	Required qualification	Completed
Customer operating log	Check and preserve operating parameters.	User	
Electronic controls	Check error statistics.	User	
General	Maintenance / cleaning	Maintenance personnel	
Air filter	Replace	Maintenance personnel	
Oil filter	Replace	Maintenance personnel	
Filter mats cooling air inlet	Inspect, clean, and replace as needed.	Maintenance personnel	
Oil fine separator	Replace	Maintenance personnel	
Inlet filter, electrical enclosure cooling air	Replace.	Maintenance personnel	
Frequency converter cooling air inlet filter (RS)	Replace.	Maintenance personnel	
Compressor oil AEON9000SP	Replace	Maintenance personnel	
Motor bearing lubrication	Replace MLS cartridge (grease cartridge)	Maintenance personnel	
Safety valve	Function test at least once a year	Maintenance personnel	
Hoses and piping	Check for leaks or any damage.	Maintenance personnel	
Condensate Drain	Aftercooler, functional check.	Maintenance personnel	
Electrical wiring	Check connections and condition.	Electrician	
Compressor	Keep the compressor room and surrounding area clean.	User	
Dirt catcher (for water-cooled compressors only)	Remove and clean the screen	Maintenance personnel	

Chart 8-4: Maintenance plan: Maintenance 4,000 hours

Maintenance plan: Maintenance Every 8,000 hours, but at least every two years

Components	Measure	Required qualification	Completed
Pressure-retaining valve	Replace.	Maintenance personnel	
Suction regulator non-return valve	Replace.	Maintenance personnel	
Suction regulator pressure regulator	Replace.	Maintenance personnel	
Blow-off valve diaphragm	Replace	Maintenance personnel	

Chart 8-5: Maintenance plan: Service D

Inspection every 4 years:

Have electrical installation inspected by an electrician.

Inspection every 5 years:

Internal inspection of the pressure vessel by a competent individual

Inspection every 10 years:

Strength test of the pressure vessel by appointed body

Notes

Operating parameters: The current settings, e.g. maximum line pressure [Line Pressure max.] and minimum line pressure [Line Pressure min.] should be documented in the customer operations log. The operating log should also contain records and results of maintenance work and inspections. This will enable Gardner Denver to determine the specific service that your compressor needs.

Maintenance work: The individual maintenance tasks that the service personnel can carry out, are detailed in the following chapter. All other maintenance work must be performed by trained service personnel using the repair manual.

Service cycles: The earliest date always applies; i.e. if the operating hours are reached before the calendar date, then the service in question must be carried out.

Servicing kits: To identify the correct servicing kit, see the following table "Part numbers for servicing kits".

Model number	Service	Part number
L160 - L290	2000 + 4000 operating hours	302KGA6032
L160 RS - L290 RS	2000 + 4000 operating hours	302VGA6032

Chart 8-6: Part numbers for maintenance kits

Electronic controls

Information regarding maintenance points for the electronic controller are found in the operating instructions for the electronic controller.

8.6 Maintenance work

8.6.1 Filter mats

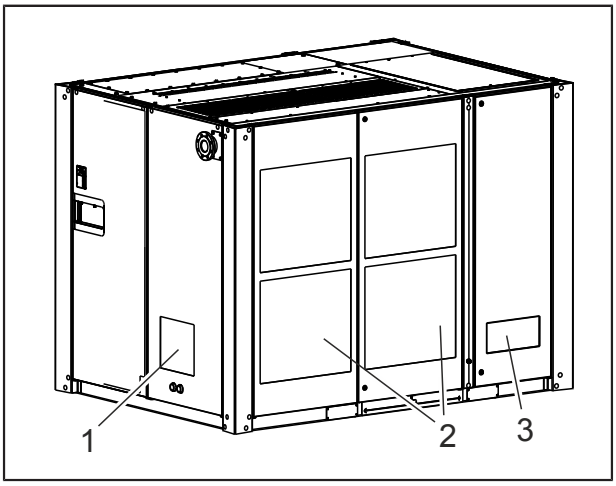


Fig. 8-3: Filter mats

[1] Motor cooling air inlet

[2] Oil cooler and aftercooler cooling air inlet

[3] Suction air compressor inlet

Replacement times for the filter pad

The operating modes and the quality of the suction air (e.g. dust content) have a significant impact on the service life of the filter pad.

The filter pad should be inspected for dust accumulation at least weekly; daily if possible.

In these usage scenarios, shorter replacement intervals are possible.

As soon as one of the filter pads shows a defect, it must be replaced.

8.6.2 Switch cabinet inlet filter

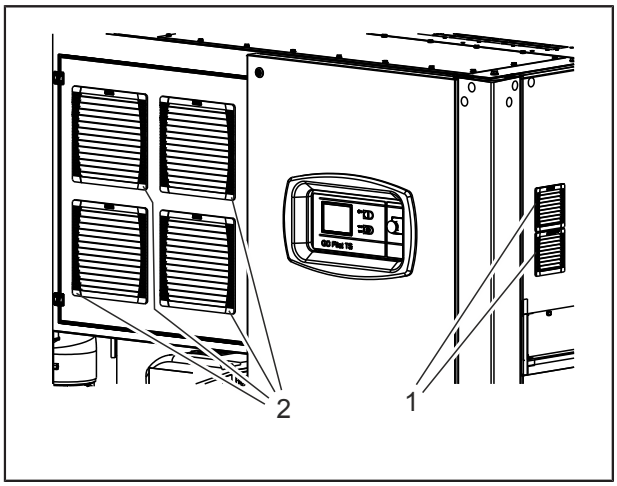


Fig. 8-4: Switch cabinet inlet filter, air-cooled system

[1] Control system inlet filter

[2] Frequency converter inlet filter

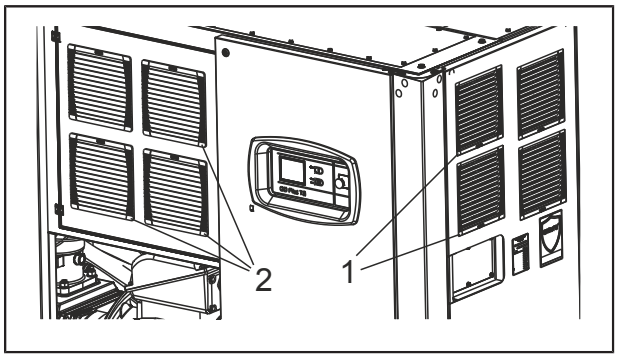


Fig. 8-5: Inlet filter and switch cabinet filter fan, water-cooled system

[1] Filter fan control

[2] Inlet filter controller

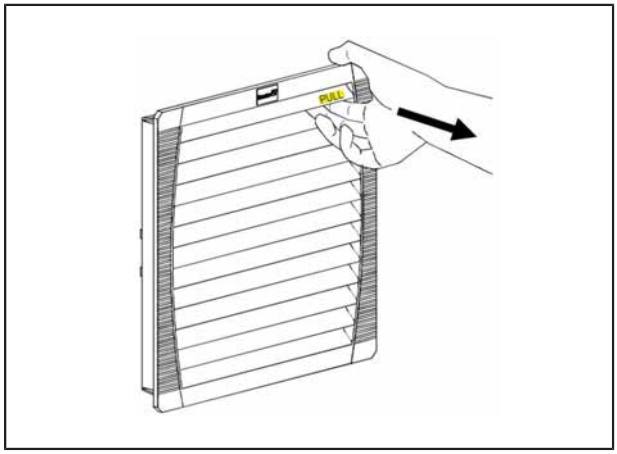


Fig. 8-6: Louvred grille

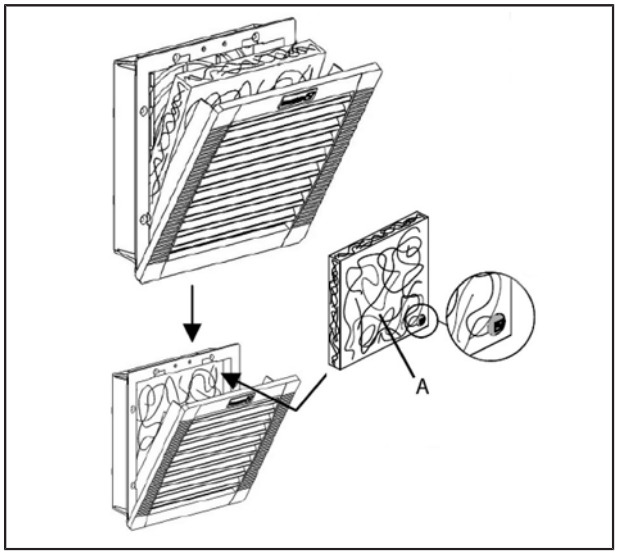


Fig. 8-7: Filter element replacement

Change inlet filter

1 Open the mesh cover on the intake filter.

2 Remove dirty filter.

3 Insert new filter.

4 Close louvred grille.

Replacement times for the inlet filter elements

The operating modes and the quality of the suction air (e.g. dust content) have a significant impact on the service life of the filter elements.

The filter elements should be inspected for dust accumulation at least weekly; daily if possible.

If usage scenarios transpire with, for example, a high rate of dust accumulation, the replacement intervals must be shortened in relation to the maintenance plan.

8.6.3 Oil change

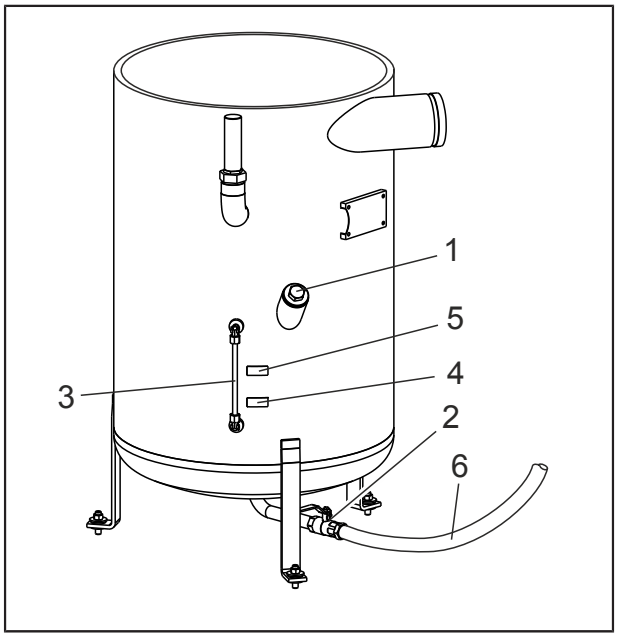


Fig. 8-8: Oil filter

[1] Oil filler neck

[2] Oil drain

[3] Oil level indicator

[4] Min. oil level marking

[5] Max. oil level marking

[6] Oil outlet hose

⚠ WARNING

Scalding hazard

Scalding hazard from hot oil.

⇨ Change the oil only when the compressor is stopped and not pressurized.

⇨ Use caution when draining out the hot oil.

Oil must be changed if the message [Service due] is displayed on the electronic control unit.

With these compressors, the time for changing oil is heavily dependent on the degree of soiling of the circulating oil. It is vital you ensure that no oil-harming foreign substances (dust, vapour, gas) get into the oil circuit of the compressor system through the air suction filter with the suction air. Also, heavy moisture content in the suction air and condensation build-up within the machine have an impact on the service life of the lubrication oil, meaning shortening the oil replacement times may be necessary. The replacement intervals specified are based on suction air which is normally present and no large ratios of foreign substances (dust, vapour, gas) arising.

When changing oil, drain used oil as completely as possible, as used oil greatly reduces the service life of the new oil charge.

You must refrain from mixing different lubrication oils. When changing oil types, the oil must be completely drained from the oil circuit.

You can find the maintenance intervals in the maintenance plan.

Replacement times for the lubrication oil

Operating conditions (e.g. cooling medium temperatures), the type of operation and the quality of the suction air (e.g. dust content, content of gaseous foreign substances such as SO2, solvent vapours, etc.) have a significant impact on oil change intervals.

In such instances of usage, the permitted duration of use of the oil must be checked with the help of an oil analysis.

NOTE

Collect the used oil. Do not let it drain into the soil.

Dispose of the oil in accordance with regulations. Do not discard any oil. Immediately capture any used oil! Ensure leak-tightness!

Changing oil

1 Lockout and Tagout.
2 Wait for compressor to cool down
3 Open the enclosure, create access.
4 Open oil filler neck carefully. Allow any **residual pressure** to be released.
5 Provide an oil collecting vessel.
6 Place oil drain hose over the collecting vessel.
7 Open oil drain valve.
8 Drain oil completely.
9 Close oil drain valve.
10 Top up with oil until the max. mark is reached.
11 Shut oil filler neck.
12 Close the enclosure.
13 Switch on the main disconnect switch.
14 Switch on screw compressor for approx. 2 min.
15 Switch off screw compressor.
16 Switch OFF the main disconnect switch and secure it against switching on again.
17 Open the enclosure.
18 Check the oil level. If necessary, correct oil level.
19 Close the enclosure.

8.6.4 Oil filter

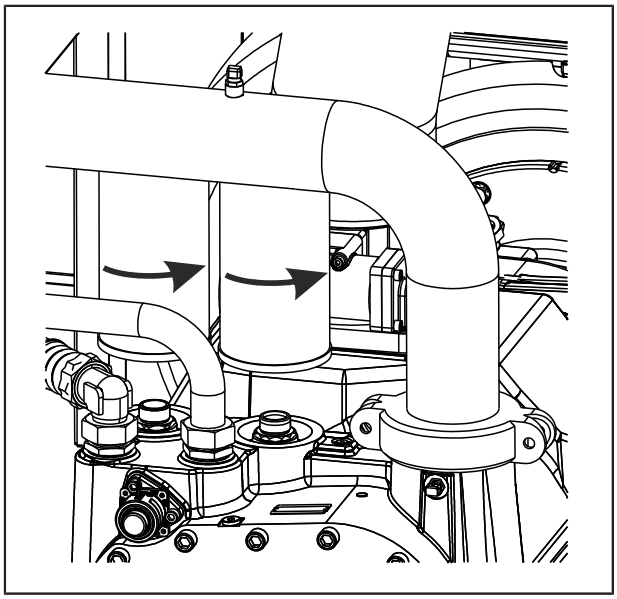


Fig. 8-9: Oil filter

WARNING

Scalding hazard

Scalding hazard from hot oil.

⇨ Change the oil only when the compressor is stopped and not pressurized.

⇨ Use caution when draining out the hot oil.

The compressor is equipped with two oil filters. The oil filter elements must be changed, if the message [Service due] or [Oil filter] is displayed on the electronic control unit.

Replacing oil filter elements

1 Switch OFF the main disconnect switch and secure it against switching on again.
2 Wait for compressor to cool down
3 Open the enclosure, create access.

4 Release the filter elements (for direction of rotation see illustration).
5 Insert new filter elements.
6 Close the enclosure.

8.6.5 Oil fine separator

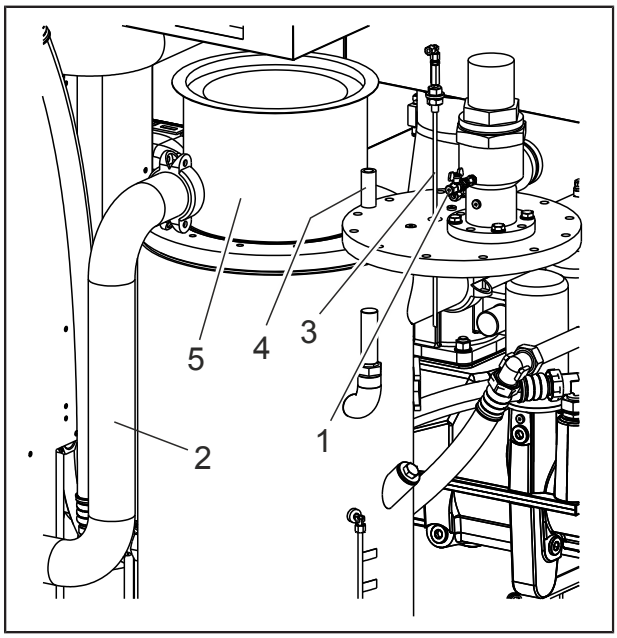


Fig. 8-10: Air filter

[1] Pressure relief
[2] Pressure pipe
[3] Suction pipe
[4] Vessel cover lifting device
[5] Oil fine separator

The compressor is equipped with an internal oil fine separator. The oil fine separator separates compressed air and oil, with the oil then being injected in the compressor stage for lubrication, cooling and sealing.

The oil fine separator must be changed if the message [Service due] or [Fine separator] is displayed on the electronic control unit.

Changing the oil fine separator

⚠ WARNING

Pressure components

Even when the compressor is relieved of pressure, the aftercooler remains pressurized.

⇨ Release pressure manually prior to performing maintenance work in the aftercooler and pressure-retaining valve area.

1 Switch OFF the main disconnect switch and secure it against switching on again.
2 Open the enclosure, create access.
3 Open valve (1) for pressure relief.
4 Detach pressure pipe (2).
5 Detach suction pipe (3).
6 Remove vessel cover screws.
7 Raise vessel cover using the lifting device (4).
8 Turn vessel cover by 180°.
9 Lift oil fine separator (5) out of the vessel.
10 Replace sealing rings.
11 Lift new oil fine separator (5) in the vessel.
12 Swivel vessel cover into the exit position.
13 Release lifting device (4).
14 Attach vessel cover screws
- Torque screw 8.8 - **214Nm ; 158 lbf-ft**
- Torque screw 5.6 - **95Nm ; 70 lbf-ft**

15 Attach suction pipe (3)
16 Attach pressure pipe (2).
17 Shut valve (1).
18 Shut enclosure.

8.6.6 Air filter

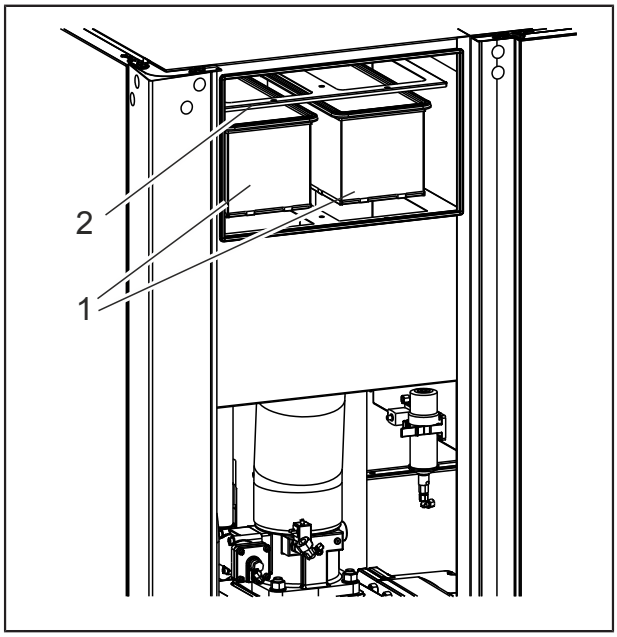


Fig. 8-11: Air filter

[1] Air filter
[2] Pressing frame

The compressor is equipped with two air filters. The air filter serves to filter the intake air. The condition of the air filter must be checked through regular visual inspections.

The air filter elements must be changed, if the message [Service due] or [Air filter] is displayed on the electronic control unit.

Check the air filter

1 Switch OFF the main disconnect switch and secure it against switching on again.
2 Open the enclosure, create access.
3 Check filter elements.
   – Replace filter elements if heavily soiled.
4 Close the enclosure.

Change the air filter element

NOTICE

Property damage

Operating the compressor without an air filter, even for a short time, can cause severe damage to the compressor.

⇨ Never operate the compressor without an air filter.

⇨ Dirt must not be allowed to enter the clean air side of the air filter!

1 Switch off the main disconnect switch.
2 Open the enclosure, create access.
3 Release pressing frame.
4 Replace filter elements.
5 Attach pressing frame (hexagon screw tightening torque **< = 8 Nm / 71 ft-lbs**)
6 Close the enclosure.

8.6.7 Connection terminals in the switch cabinet / control transformer setting

DANGER

Electric shock

Deadly electrical voltage

⇨ Exercise extreme caution when working with electrical equipment.

⇨ Before starting maintenance work, disconnect the compressor and lock it out to prevent restarting.

DANGER

Electric shock

Dangerous electrical voltage

⇨ Work on the electrical equipment may be performed by specialized electrical technicians only.

⇨ With the speed-controlled types (RS) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage.

NOTICE

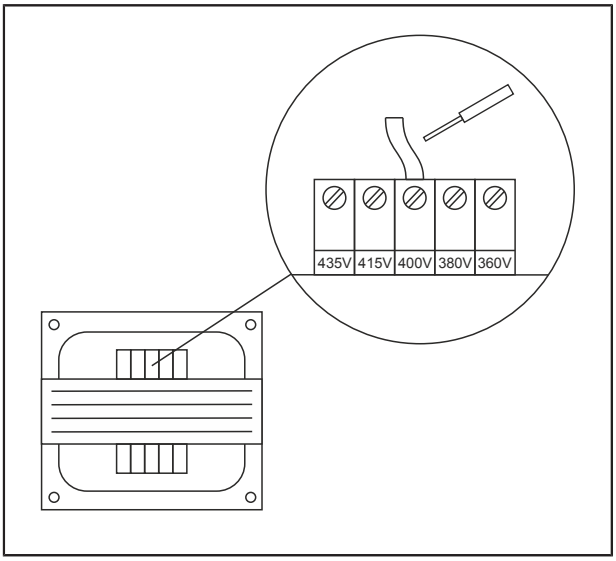
Property damage

Incorrect control transformer settings can cause problems in operation.

⇨ Checking the control transformer settings is part of commissioning and periodic inspection and maintenance, because grid voltage conditions can change.

Checking the setting of the control transformer forms part of commissioning and periodic inspection/maintenance, as the mains voltage conditions may have changed.

The connection terminals in the switch cabinet are to be checked during the first commissioning and thereafter in accordance with the maintenance plan and re-tighten if necessary.



Check the setting of the control transformer as follows:

- Switch on system as in chapter “Routine commissioning”.
- In on-load operation check the control transformer’s output voltages. Several taps are provided for this purpose (see wiring diagram).

If the output voltage is not correct, check the setting of the control transformer as follows:

- Switch off the main disconnect switch and secure it against switching on again.
- With speed-controlled systems or fans (RS), wait for 10 minutes. This the time it takes the power capacitors to discharge.
- Modify the setting of the control transformer accordingly (control transformer tap illustration shows an example of this).
- Then check setting once more.

8.6.8 Drive motor / lubricator

The drive motor is equipped with an automatic motor lubrication system.

Maintenance of the motor lubrication system is limited to replacing the grease cartridges. Empty grease cartridges or a fault in the lubricator are indicated on the electronic controls with the message [Warning: Mot.Lubricator] (see also the operating instructions for the electronic controller).

Replacing the grease cartridge

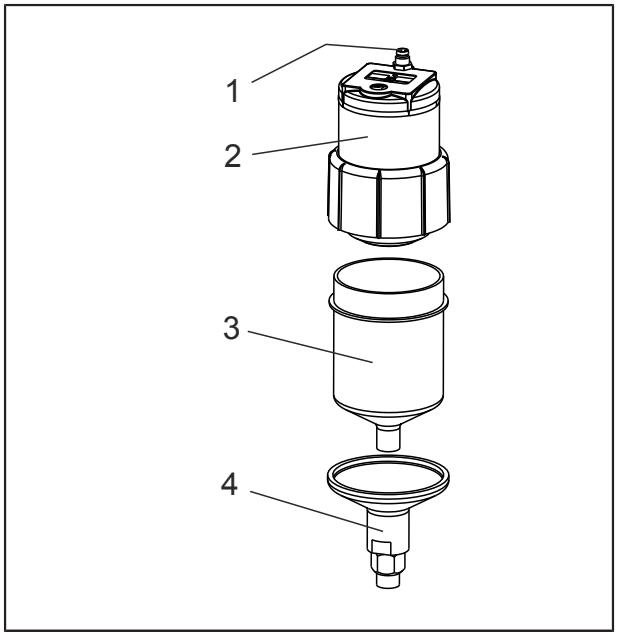


Fig. 8-12: Lubricator

[1] Socket for connection cable

[2] Lubricator drive

[3] Grease cartridge (not refillable)

[4] Support bracket

Changing the grease cartridge

An empty grease cartridge or a fault on the lubricator is indicated on the compressor control by means of a message [Warning: Mot.lubr. sys] (also refer to the operating instructions for the compressor control GD Pilot TS).

Procedure for changing the grease cartridge

1 Switch OFF the main disconnect switch and secure it against switching on again.

2 Open the enclosure, create access.

3 Pull the plug from the lubricator as follows.

- ° Completely unscrew union nut.
- ° Pull out plug.

4 Release drive union nut from the grease cartridge fully and lift off.

5 Release grease cartridge from the support bracket by turning anticlockwise.

6 Unscrew cap of the new grease cartridge.

7 screw new grease cartridge into the support bracket. (Max. torque 2–3 Nm / 18 - 27 ft-lbs)

8 Place the drive on the new grease cartridge. The toothing of the two parts must intermesh.

9 Apply drive union nut without tool. (Max. torque 2 - 3 Nm / 18 - 27 ft-lbs)

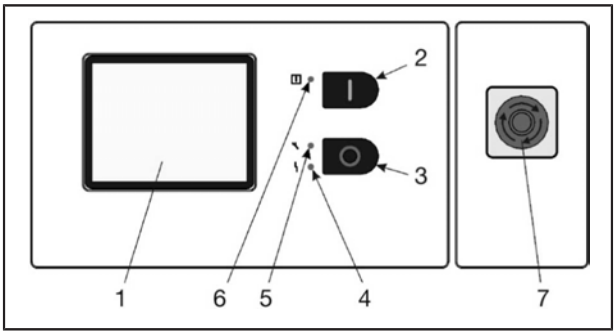
- ° You must ensure that the triangular marks on the drive housing are fully visible.
- ° If these marks are not fully visible, release the union nut and put the drive back on again.

10 Insert plug in the drive and apply union nut again so it is finger-tight.

11 Shut enclosure.

8.6.9 Control system

Test emergency stop button



[1] Touchscreen Display

[2] Start button < I >

[3] Stop button < O >

[4] red LED
flashing slowly: Warning or maintenance
flashing rapidly: Fault

[5] yellow LED
flashing slowly: Maintenance necessary

[6] green LED
lit up permanentaly: System in operation
flashing: Sytem in standby

[7] Pushbutton <Emergency-stop>

NOTE

The emergency stop function may be actuated only in dangerous situations. Otherwise increased wear, up to and including damage to the compressor, can be expected.

Test the emergency stop button only when the compressor is stopped.

1 Press the stop button < O >.
- – The status message of the electronic controls is [Ready to start].

1 Press the <E-stop> button.
- – The electronic controller displays the fault message [Emergency Stop Activated].
- – The "Fault memory" register card blinks.

2 Unlock the <E-stop> button.
Turn the button counterclockwise.

3 Reset fault message.
To do so, press the [RESET] button on the “Fault memory” register card in the electronic controller.
- – The "Fault memory" register card stops blinking.

8.6.10 Checking intervals for pressure vessel and electrical installation

Pressure vessel

The checking intervals for the compressed-air vessel and the safety valve have to be coordinated with the local approval bodies.

Electrical installation

After four years, or after each instance of interference, the electrical installation is to be subjected to an inspection by an electrical specialist.

If shorter checking intervals apply in your territory, please adhere to them.

8.6.11 Maintenance instructions and lubricant recommendations for fixed compressors

Lubricant recommendation

Please note that proper lubrication significantly increases the service life of your compressor system.

In accordance with applicable accident prevention regulations, lubrication oils whose properties meet the intended operating conditions are to be used.

Please refrain from mixing different lubrication oils. This also means oil must be completely drained from the oil circuit when changing oil types.

The oil change intervals stated in the maintenance plan are to be halved when final compression temperatures are continuously higher than 90°C/195°F.

A precise specification of the oil change intervals should be defined according to the operating conditions that actually exist through oil examinations.

The following types of oil are to be used:

USA version:

- AEON9000SP
- AEON9000TH (optional)
- AEON6000FG-46 (optional)
- AEON9000FG (optional)
- For further information, please contact your local CompAir Distributor or Gardner Denver-USA at 866-440-6241.

9 APPENDIX

9.1 Decommissioning

Routine decommissioning

Routine decommissioning includes, for example, decommissioning for maintenance work.

1 Lockout and Tagout.

2 Close the shutoff valves between the compressor and the compressed air network.

3 Relieve the pressure in the aftercooler by carefully opening the pressure relief valve.

Decommissioning for an extended period of time.

For decommissioning for more than six months, contact Gardner Denver.

Final decommissioning

In order to prevent renewed commissioning of the compressor or misuse by unknown persons, the compressor must be rendered unusable.

The compressor is made unusable by removing the electronic controller. Consult Gardner Denver.

9.2 Consumables and auxiliary materials

The compressor contains approximately 120 litres / 31.7 gal of oil.

There are two grease cartridges in the lubricator of the drive motor.

Material safety data sheets

When handling consumables and auxiliary materials, the associated material safety data sheets must be adhered to.

- Lubricating oil: AEON 9000SP
- Lubricating grease: MOBIL POLYREX EM

9.3 Disassembly

⚠ WARNING

Damage to health

Risk of damage to health from consumables and auxiliary materials

Consumables and auxiliary materials can cause irreparable damage to health, induce allergies, or irritate mucous membranes.

⇨ Follow the locally applicable operating instructions and hazardous material safety data sheets when handling consumables and auxiliary materials.

⇨ Avoid direct contact with consumables and auxiliary materials. Wear personal protective equipment.

⇨ In case of injuries associated with consumables and auxiliary materials, consult a physician and indicate the material involved. Keep the safety data sheet for the causative material available.

⚠ CAUTION

Slip hazard

Slip hazard due to spilled consumables

⇨ Clean up escaped consumable materials immediately.

⇨ Avoid direct contact with consumables. Wear personal protective equipment.

Prerequisites

- The compressor is shut down.
  - The compressor is electrically disconnected.
  - The main disconnect switch is switched to OFF and secured against restarting.
  - The compressor is not pressurized.
  - Liquids and greases are removed to the greatest extent possible.

Remove the electrical connection

⚠ DANGER

Electric shock

Deadly electrical voltage

⇨ Work on the electrical equipment may be performed only by authorized electrical technicians.

1 Disconnect the feed cables. See wiring diagram.
2 Remove the feed cables.
3 Apply seal plugs to the feed line openings.

Removing the pipework

1 Disconnect the compressed air connection.
2 Disconnect the condensate drain lines.
3 Allow the condensate to drain out completely.
4 Clean up any escaped condensate immediately.

Draining the lubricating oil

1 Open the enclosure, create access.
2 Place a suitable container below the oil drain.
3 Open the drain valve and allow oil to drain out completely. Dispose of the lubricating oil.
4 Close the drain valve.
5 Close the enclosure.

Remove the oil filter

1 Remove all oil filters in the lubrication system. Dispose of the filters.
   – Oil filter
   – Oil fine separator

Remove the drive motor lubricator grease cartridges

1 Open the enclosure, create access.
2 Pull the plug from the lubrication system.
3 Unscrew the lubricator (grease cartridge with drive and cover) from the lubrication point.
4 Seal off the lubrication point.
5 Close the enclosure.

Remove the air filter

1 Remove all filter elements and filter mats. Dispose of filter elements and filter mats.
   – Air filter cartridge
   – Filter mat
   – Switch cabinet cooling air inlet filter (only RS compressors)
   – Control air filter

9.4 Disposal

General

The compressor must be dismantled and removed by technicians. The applicable local safety and environmental protection regulations must be complied with.

When disposing of materials that are hazardous to health, the instructions on the corresponding material safety data sheets must be followed.

Packaging materials, cleaning agents, and used or residual consumables must be fed to recycling in accordance with the regulations applicable at the installation site.

9.5 Limit values of dissolved matter

NOTE

The data listed below are guidelines that may deviate under certain operating conditions. The overall composition and operating temperature are the critical factors. This cannot be used to justify a warranty claim.

Dissolved matter / key values		Circulating water	Flow-through water
pH value (at 25 °C / 77 °F)		6 - 9	6 - 9
Carbonate hardness	$CaCO_3$	< 0.0008 lb/gal	< 0.0004 lb/gal
Overall hardness		< 36 mg/dl < 200 ppm < 11.5 °dH < 20 °fH	< 9 mg/dl < 50 ppm < 2.8 °dH < 5 °fH
Chloride	Cl^-	< 0.0016 lb/gal	< 0.0004 lb/gal

Chart 9-1: Limit values of dissolved matter

Dissolved matter / key values		Circulating water	Flow-through water
Sulfate	SO_4^{2-}	< 0.0016 lb/gal	< 0.0004 lb/gal
Nitrate	NO_3^-	< 0.0008 lb/gal	< 0.0008 lb/gal
Organic materials ($KMnO_4$ absorption)		< 0.0002 lb/gal	< 0.00008 lb/gal
Free aggressive carbolic acid	CO_2	< 0.00017 lb/gal	< 0.00017 lb/gal
Silicon oxide	SiO_2	< 0.00008 lb/gal	< 0.00008 lb/gal
Free chlorine	Cl_2	< 0.00003 lb/gal	< 0.000017 lb/gal
Oxygen	O_2	< 0.000017 lb/gal	< 0.000017 lb/gal
Ammonia	NH_4^+	< 0.000008 lb/gal	< 0.000008 lb/gal
Iron	Fe	< 0.0000017 lb/gal	< 0.0000017 lb/gal
Manganese	Mn	< 0.0000008 lb/gal	< 0.1 mg/l 0.00000008 lb/gal
Sulfide	S^{2-}	0	0
Ammonia	NH_3	0	0
Conductivity		> 50 < 800 µS/cm	> 50 < 200 µS/cm

Chart 9-1: Limit values of dissolved matter

9.6 Technical data

9.6.1 L160-L200, 60Hz, air-cooled "A", water-cooled "W"

L160-L200 60Hz, air-cooled "A" + water-cooled "W"		L160			L200		
Maximum operating pressure	[psig]	110	130	190	110	130	190
Minimum operating pressure	[psig]	75					
Ambient temperature	[°F]	34 to 113					
Volume flow	[cfm]	1128.5	1040	819.5	1338	1266.9	1010.1
Aftercooler outlet temperature above ambient temperature	"A" = [°F] "W" = [°F]	14 18	13 18	13 18	14 18	13 18	13 18
Sound pressure level (ISO 2151)	"A" [dB(A)] "W" [dB(A)]	78 75			79 76		
Nominal power of drive motor	[hp / kW]	217.5 / 160			272 / 200		
Total power consumption during load operation (460V / 575V)	[A]	307 / 249			394 / 320		
Electric motor		IP55 (IE3) - IEC 60034-2-1 ECA Qualifying					
Nominal speed of drive motor	[rpm]	3600					
Rated capacity of fan motor (460V / 575V)	"A" [hp / kW] "W" [hp / kW]	Air cooler = 3.0 / 2.2 / oil cooler = 5.4 / 4.0 (IE 3) 0.4 + 0.34 / 0.3 + 0.25 (IE 3)					

Chart 9-2: Technical data; L160-L200 ESM160 + ESM200, 60Hz, air-cooled "A", water-cooled "W"

L160-L200 60Hz, air-cooled "A" + water-cooled "W"		L160	L200
Recommended cable cross section (460V / 575V)		2 x 3 x AWG4/0 / 2 x 3 x AWG3/0	2 x 3 x MCM350 2 x 3 x MCM250
Recommended fuse size (time-delay)	[A]	2 x 3 x 200	2 x 3 x 250
Cooling air volumetric flow rate	"A" [cfm] "W" [cfm]	Air cooler = 3531 / oil cooler = 7769 2754	
Cooling air outlet temperature above ambient temperature	"A" [°F]	32	40
Residual pressure at ambient temperature	"A" [Torr]	0.68 / 0.3 [95 °F / 113 °F]	0.53 / 0.15 [95 °F / 113 °F]
Cooling water quantity (ΔT = 10 K)	"W" [gal/min]	39.6 @ Δp = 13 [psi]	47.5 @ Δp = 16 psi
Cooling water inlet temperature	"W" [°F]	min. 41 / max. 95	
Cooling water outlet temperature	"W" [°F]	max. 131	
Cooling water pressure	"W" [psig]	max. 145	
Cooling water connections	"W"	1 1/2-11 1/2 NPT	
Total oil volume	[gal]	31.7	
Compressed air connection		Flange ANSI B16.5 3" 125lbs	
Weight	[lb]	"A"= 9229 "W" = 9083	"A"= 9733 "W" = 9456
Dimensions L x W x H	[in]	114.5 x 81.5 x 86.3	

Chart 9-2: Technical data; L160-L200 ESM160 + ESM200, 60Hz, air-cooled "A", water-cooled "W"

9.6.2 L250-L290, 60Hz, air-cooled "A", water-cooled "W"

L250-L290 60Hz, air-cooled "A" + water-cooled "W"		L250			L290		
Maximum operating pressure	[psig]	110	130	190	110	130	190
Minimum operating pressure	[psig]	75					
Ambient temperature	[°F]	34 to 113					
Volume flow	[cfm]	1464.3	1398.4	1160.7	1616.7	1546.9	1244.3
Aftercooler outlet temperature above ambient temperature	"A" = [°F] "W" = [°F]	18 18	16 18	16 18	18 18	16 18	16 18
Sound pressure level (ISO 2151)	"A" [dB(A)] "W" [dB(A)]	80 77			81 78		
Nominal power of drive motor	[hp / kW]	340 / 250			340 / 250		
Total power consumption during load operation (460V / 575V)	[A]	424 / 343			505 / 408		

Chart 9-3: Technical data; L250-L290 ESM250 + ESM290, 60Hz, air-cooled "A", water-cooled "W"

L250-L290 **60Hz, air-cooled "A" + water-cooled "W"**		**L250**	**L290**
Electric motor		IP55 (IE3) - IEC 60034-2-1 ECA Qualifying	
Nominal speed of drive motor	[rpm]	3600	
Nominal power of fan motor	"A" [hp / kW]	Air cooler = 3.0 / 2.2 / oil cooler = 5.4 / 4.0 (IE 3)	Air cooler = 3.0 / 2.2 / oil cooler = 10.1 / 7.5 (IE 3)
Rated capacity of fan motor	"W" [hp / kW]	0.4 + 0.34 / 0.3 + 0.25 (IE 3)	
Recommended cable cross section (460V / 575V)	[mm^2]	2 x 3 x MCM350 2 x 3 x MCM250	2 x 3 x MCM500 2 x 3 x MCM350
Recommended fuse size (time-delay)	[A]	2 x 3 x 300	2 x 3 x 350
Cooling air volumetric flow rate	"A" [cfm]	Air cooler = 4414 / oil cooler = 7769	Air cooler = 4767 / oil cooler = 10948
Cooling air volumetric flow rate	"W" [cfm]	2754	
Cooling air outlet temperature above ambient temperature	"A" [°F]	32	34
Residual pressure at ambient temperature	"A" [Torr]	0.38 / 0.08 [95 °F / 113 °F]	0.53 / 0.15 [95 °F / 113 °F]
Cooling water quantity (ΔT = 10 K)	"W" [gal/min]	52.8 @ Δp = 19 psi	60.7 @ Δp = 34 psi
Cooling water inlet temperature	"W" [°F]	min. 41 / max. 95	
Cooling water outlet temperature	"W" [°F]	max. 131	
Cooling water pressure	"W" [psig]	max. 145	
Cooling water connections	"W"	1 1/2-11 1/2 NPT	
Total oil volume	[gal]	31.7	
Compressed air connection		Flange ANSI B16.5 3" 125lbs	
Weight	[lb]	"A"= 10196 "W" = 9899	"A"= 10251 "W" = 9899
Dimensions L x W x H	[in]	114.5 x 81.5 x 86.3	

Chart 9-3: Technical data; L250-L290 ESM250 + ESM290, 60Hz, air-cooled "A", water-cooled "W"

9.6.3 L160 RS, 60Hz, air-cooled "A", water-cooled "W"

L160 RS, **60Hz, air-cooled "A" + water-cooled "W"**		**L160 RS**	
Maximum operating pressure	[psig]	190	
Minimum operating pressure	[psig]	75	
Ambient temperature	[°F]	34 / 113	
		Min. speed	Max. speed
Volume flow rate / Final pressure [bar]	[cfm]	228.7 / 110	1113.9 / 110

Chart 9-4: Technical data; L160 RSVS160, 60Hz, air-cooled "A", water-cooled "W"

L160 RS, 60Hz, air-cooled "A" + water-cooled "W"		**L160 RS**	
Volume flow rate / Final pressure [bar]	[cfm]	294.7 / 130	1026.4 / 130
Volume flow rate / Final pressure [bar]	[cfm]	341.3 / 145	969.9 / 145
Volume flow rate / Final pressure [bar]	[cfm]	490 / 190	836.8 / 190
Aftercooler outlet temperature above ambient temperature	"A" = [°F] "W" = [°F]	8 18	
Sound pressure level (ISO 2151)	"A" [dB(A)] "W" [dB(A)]	76 / 78 76 / 77	
Nominal power of drive motor	[hp / kW]	217.5 / 160	
Total current consumption during load operation (460V)	[A]	318	
Electric motor		TEFC IP55, EISA 2007 (IE-3)	
Nominal speed of drive motor	[rpm]	500 / 1986	
Nominal power of fan motor	"A" [hp / kW]	Air cooler = 2.0 / 1.5 (IE3) / oil cooler = 4.0 / 3.0 (IE3)	
Rated capacity of fan motor	"W" [hp / kW]	0.4 / 0.3 (IE 3)	
Recommended cable cross-section (460V)		2 x 3 x AWG3/0	
Recommended fuse size (time-delay) (460V)	[A]	2 x 3 x 175	
Air cooler/oil cooler cooling air volume	"A" [cfm]	3531 / 7769	
Cooling air volumetric flow rate	"W" [cfm]	2754	
Cooling air outlet temperature above ambient temperature	"A" [°F]	32	
Residual pressure at ambient temperature	"A" [Torr]	0.83 / 0.45 [95 °F / 113 °F]	
Cooling water quantity (ΔT = 10 K)	"W" [gal/min]	39.6 @ Δp = 13 [psi]	
Cooling water inlet temperature	"W" [°F]	min. 41 / max. 95	
Cooling water outlet temperature	"W" [°F]	max. 131	
Cooling water pressure	"W" [psig]	max. 145	
Cooling water connections	"W"	1 1/2-11 1/2 NPT	
Total oil volume	[gal]	31.7	
Compressed air connection		Flange ANSI B16.5 3" 125lbs	
Weight	[lbs]	"A" = 9652 "W" = 9414	
Dimensions L x W x H	[in]	114.5 x 81.5 x 86.3	

Chart 9-4: Technical data; L160 RSVS160, 60Hz, air-cooled "A", water-cooled "W"

9.6.4 L200 RS, 60Hz, air-cooled "A", water-cooled "W"

L200 RS, 60Hz, air-cooled "A" + water-cooled "W"		**L200 RS**	
Maximum operating pressure	[psig]	190	
Minimum operating pressure	[psig]	75	
Ambient temperature	[°F]	34 / 113	
		Min. speed	Max. speed
Volume flow rate / Final pressure [bar]	[cfm]	228.7 / 110	1365.7 / 110
Volume flow rate / Final pressure [bar]	[cfm]	219.8 / 130	1280.2 / 130
Volume flow rate / Final pressure [bar]	[cfm]	215.6 / 145	1224.8 / 145
Volume flow rate / Final pressure [bar]	[cfm]	209.3 / 190	1051.9 / 190
Aftercooler outlet temperature above ambient temperature	"A" = [°F] "W" = [°F]	8 18	
Sound pressure level (ISO 2151)	"A" [dB(A)] "W" [dB(A)]	78 / 80 77 / 78	
Nominal power of drive motor	[hp / kW]	272 / 200	
Total current consumption during load operation (460V)	[A]	390	
Electric motor		TEFC IP55, EISA 2007 (IE-3)	
Nominal speed of drive motor	[rpm]	500 / 2419	
Nominal power of fan motor	"A" [hp / kW]	Air cooler = 3.0 / 2.2 (IE3) / oil cooler = 4.0 / 3.0 (IE3)	
Rated capacity of fan motor	"W" [hp / kW]	0.4 / 0.3 (IE 3)	
Recommended cable cross-section (460V)		2 x 3 x MCM250	
Recommended fuse size (time-delay) (460V)	[A]	2 x 3 x 225	
Air cooler/oil cooler cooling air volume	"A" [cfm]	3531 / 8476	
Cooling air volumetric flow rate	"W" [cfm]	2754	
Cooling air outlet temperature above ambient temperature	"A"[°F]	40	
Residual pressure at ambient temperature	"A" [Torr]	0.83 / 0.45 [95 °F / 113 °F]	
Cooling water quantity (ΔT = 10 K)	"W" [gal/ min]	47.5 @ Δp = 16 psi	
Cooling water inlet temperature	"W" [°F]	min. 41 / max. 95	
Cooling water outlet temperature	"W" [°F]	max. 131	
Cooling water pressure	"W" [psig]	max. 145	
Cooling water connections	"W"	1 1/2-11 1/2 NPT	
Total oil volume	[gal]	31.7	
Compressed air connection		Flange ANSI B16.5 3" 125lbs	

Chart 9-5: Technical data; L200 RSVS200, 60Hz, air-cooled "A", water-cooled "W"

L200 RS, 60Hz, air-cooled "A" + water-cooled "W"		L200 RS
Weight	[lbs]	"A" = 10082 "W" = 9983
Dimensions L x W x H	[in]	114.5 x 81.5 x 86.3

Chart 9-5: Technical data; L200 RSVS200, 60Hz, air-cooled "A", water-cooled "W"

9.6.5 L290 RS, 60Hz, air-cooled "A", water-cooled "W"

L290 RS, 60Hz, air-cooled "A" + water-cooled "W"		L290 RS	
Maximum operating pressure	[psig]	190	
Minimum operating pressure	[psig]	75	
Ambient temperature	[°F]	34 / 113	
		Min. speed	Max. speed
Volume flow rate / Final pressure [bar]	[cfm]	229.5 / 110	1620.1 / 110
Volume flow rate / Final pressure [bar]	[cfm]	223.1 / 130	1520.6 / 130
Volume flow rate / Final pressure [bar]	[cfm]	219.6 / 145	1449.5 / 145
Volume flow rate / Final pressure [bar]	[cfm]	204.2 / 190	1250.4 / 190
Aftercooler outlet temperature above ambient temperature	"A" = [°F] "W" = [°F]	10 18	
Sound pressure level (ISO 2151)	"A" [dB(A)] "W" [dB(A)]	81 / 83 79 / 80	
Nominal power of drive motor	[hp / kW]	340 / 250	
Total current consumption during load operation (460V)	[A]	480	
Electric motor		TEFC IP55, EISA 2007 (IE-3)	
Nominal speed of drive motor	[rpm]	500 / 2910	
Nominal power of fan motor	"A" [hp / kW]	Air cooler = 3.0 / 2.2 (IE3) / oil cooler = 10.1 / 7.5 (IE3)	
Rated capacity of fan motor	"W" [hp / kW]	0.4 / 0.3 (IE 3)	
Recommended cable cross-section (460V)		2 x 3 x MCM350	
Recommended fuse size (time-delay) (460V)	[A]	2 x 3 x 300	
Air cooler/oil cooler cooling air volume	"A" [cfm]	4767 / 10948	
Cooling air volumetric flow rate	"A" [cfm]	2754	
Cooling air outlet temperature above ambient temperature	"A" [°F]	34	
Residual pressure at ambient temperature	"A" [Torr]	0.38 / 0.08 [95 °F / 113 °F]	
Cooling water quantity (ΔT = 10 K)	"W" [gal/ min]	60.7 @ Δp = 13 psi	

Chart 9-6: Technical data; L290 RSVS290, 60Hz, air-cooled "A", water-cooled "W"

L290 RS, 60Hz, air-cooled "A" + water-cooled "W"		L290 RS
Cooling water inlet temperature	"W" [°F]	min. 41 / max. 95
Cooling water outlet temperature	"W" [°F]	x. 131
Cooling water pressure	"W" [psig]	max. 145
Cooling water connections	"W"	1 1/2-11 1/2 NPT
Total oil volume	[gal]	31.7
Compressed air connection		Flange ANSI B16.5 3" 125lbs
Weight	[lbs]	"A" = 10326 "W" = 9965
Dimensions L x W x H	[in]	114.5 x 81.5 x 86.3

Chart 9-6: Technical data; L290 RSVS290, 60Hz, air-cooled "A", water-cooled "W"

⚠ CAUTION

The NEC requires that wire sizes be determined by using the appropriate multiplier for the conductor temperature rating at ambient temperatures other than 30 ºC (86 °F) and then selecting the wire that has sufficient ampacity, after correction, to meet the load requirements shown in the "NEC Package Amps @ 30 ºC" column above.

Wire ampacity is to be corrected, not "Package Amps". Additional correction multipliers apply based on more than three conductors in one conduit.

The appropriate installation and use of 75 ºC (167 °F) and 90 ºC (203 °F) wire is the responsibility of the electrical professional(s) performing the installation and must be per NEC, local and state regulations as allowed.

All of the above recommended minimum wire sizes are based on all terminal connections being rated at 75 ºC (167 °F) minimum temperature rating and copper wire run lengths of 30 m (100 ft) or less.

Please note that all UL-508A listed control panels are rated for 40 ºC (104 °F) ambient conditions.

9.7 Installation plan

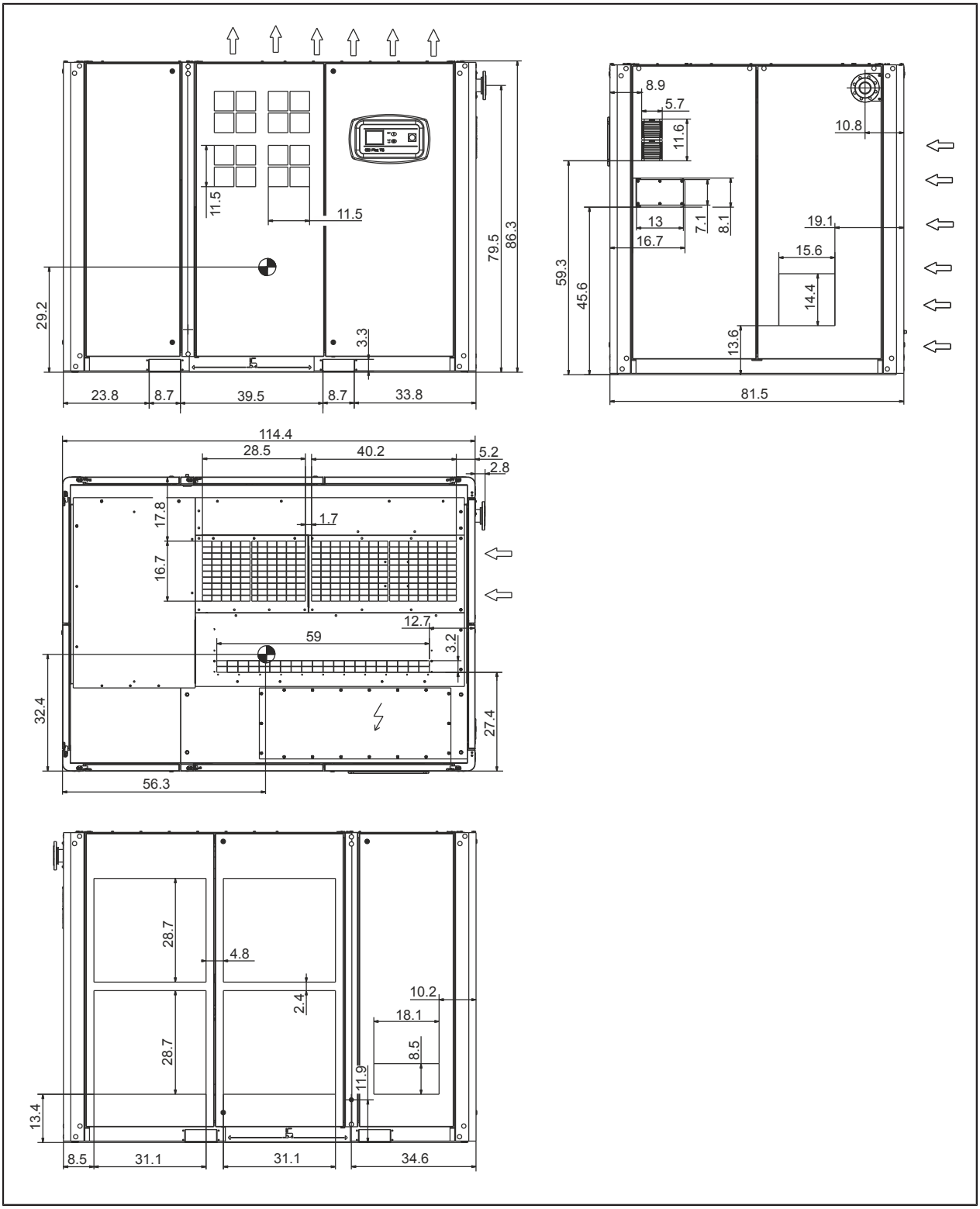


Fig. 9-1: L160 - L290 RS air-cooled

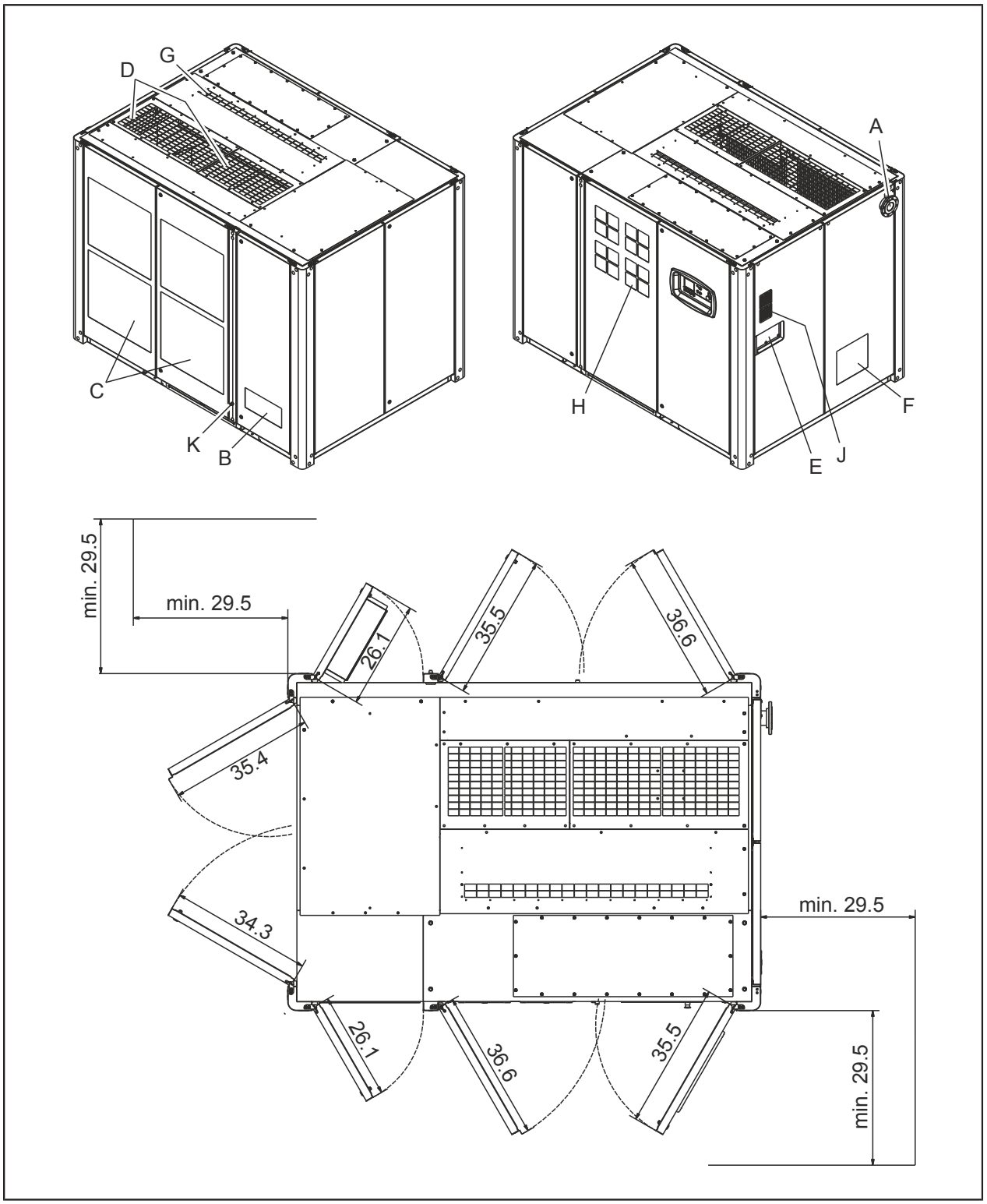


Fig. 9-2: L160 - L290 RS air-cooled

[A] Compressed air connection

[B] Compressor suction shaft

[C] Air and oil cooler cooling air inlet

[USA] Air and oil cooler cooling air outlet

[E] Cover for supply cable

[F] Motor cooling air inlet

[G] Motor cooling air outlet

[H] Frequency converter cooling air inlet (only speed-controlled system)

[J] Switch cabinet cooling air inlet

[K] Discharge for condensate drain

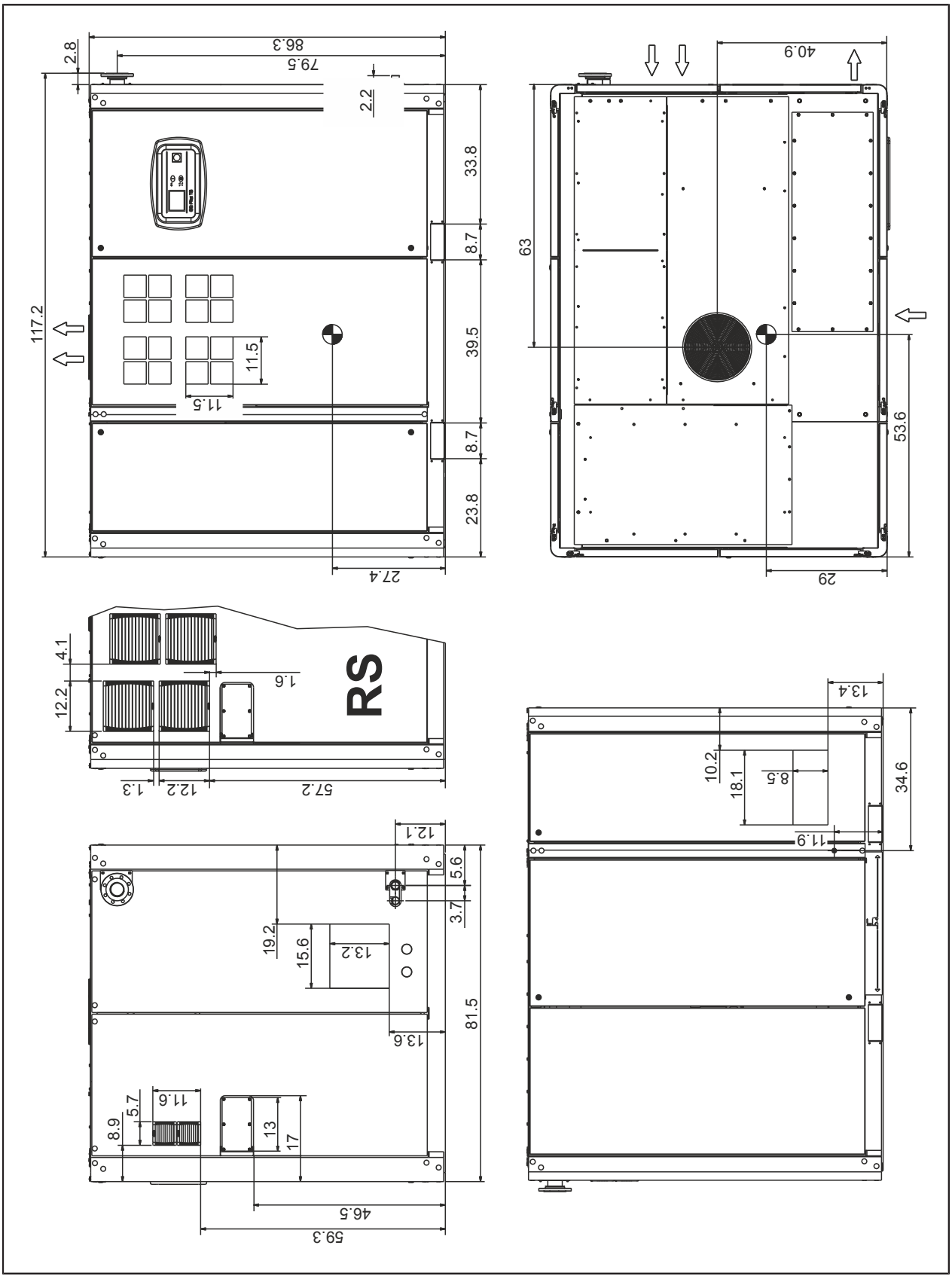


Fig. 9-3: L160 - L290 RS water-cooled

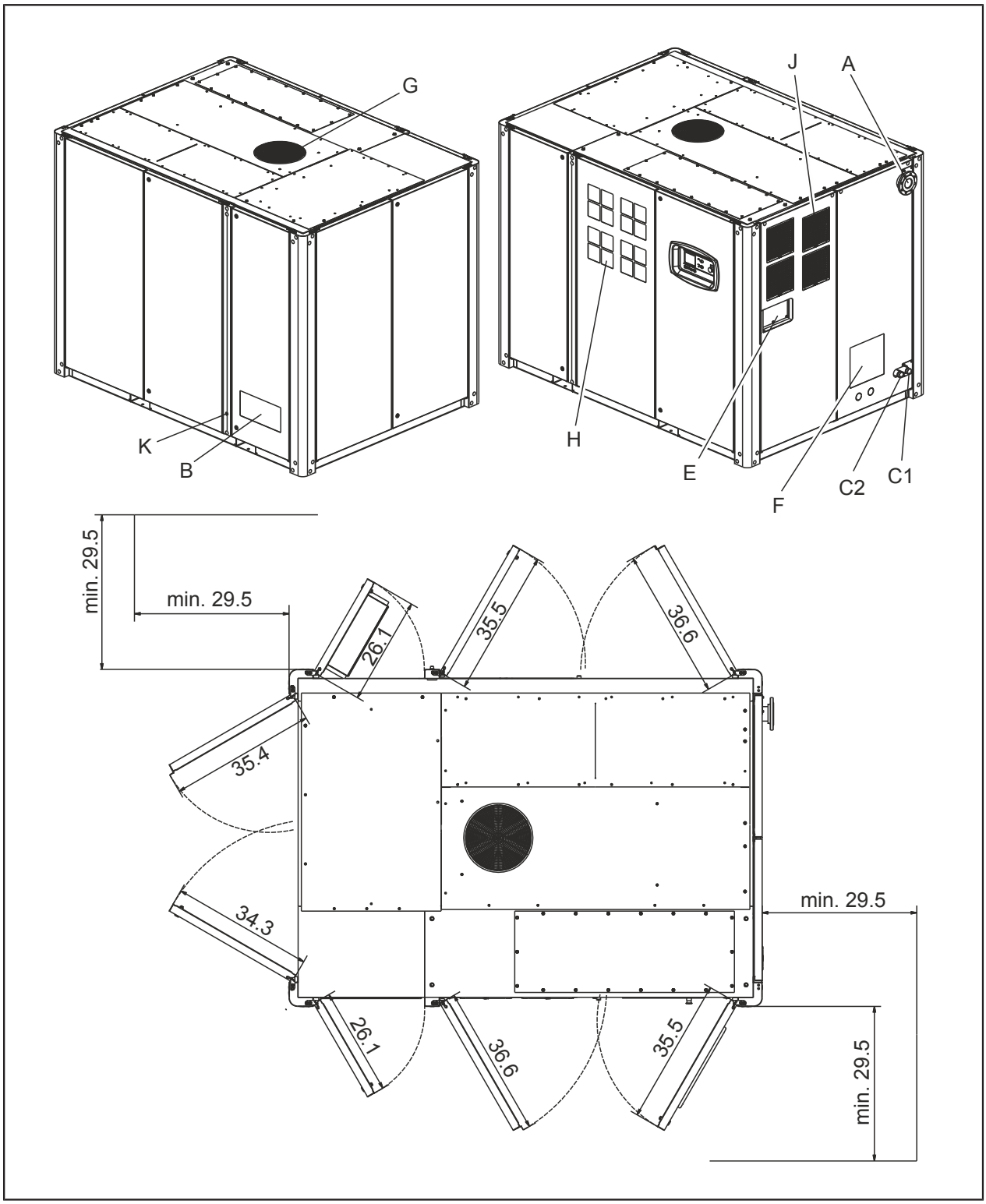


Fig. 9-4: L160 - L290 RS water-cooled

[A] Compressed air connection
[B] Compressor suction duct
[C1] Cooling water inlet
[C2] Cooling water outlet
[E] Cover for supply cable
[F] Motor cooling air inlet
[G] Motor cooling air outlet
[H] Switch cabinet cooling air inlet
[J] Switch cabinet cooling air outlet
[K] Condensate drain outlet

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