Copeland™
brand products

Application Guidelines

Semi-Hermetic Stream CO_2 Compressors
4MTL-05_to 4MTL-30_
4MSL-03_ to 4MSL-15_

EMERSON™
Climate Technologies

1 Safety instructions

Copeland™ brand semi-hermetic compressors are manufactured according to the latest European safety standards. Particular emphasis has been placed on the user's safety.

These compressors are intended for installation in systems according to the Machinery Directive MD 2006/42/EC. They may be put to service only if they have been installed in these systems according to instructions and conform to the corresponding provisions of legislation. For relevant standards please refer to the Manufacturer's Declaration, available on request.

These instructions should be retained throughout the lifetime of the compressor.

You are strongly advised to follow these safety instructions.

1.1 Icon explanation

	**WARNING** This icon indicates instructions to avoid personal injury and material damage.		**CAUTION** This icon indicates instructions to avoid property damage and possible personal injury.
	**High voltage** This icon indicates operations with a danger of electric shock.		**IMPORTANT** This icon indicates instructions to avoid malfunction of the compressor.
	**Danger of burning or frostbite** This icon indicates operations with a danger of burning or frostbite.	***NOTE***	This word indicates a recommendation for easier operation.
	**Explosion hazard** This icon indicates operations with a danger of explosion.		

1.2 Safety statements

- **Refrigerant compressors must be employed only for their intended use.**
- **Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.**
- **Electrical connections must be made by qualified electrical personnel.**
- **All valid standards for connecting electrical and refrigeration equipment must be observed.**
- **The national legislation and regulations regarding personnel protection must be observed.**

Use personal safety equipment. Safety goggles, gloves, protective clothing, safety boots and hard hats should be worn where necessary.

1.3 General instructions

WARNING
System breakdown! Personal injuries! Never install a system in the field and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.
System breakdown! Personal injuries! Only approved refrigerants and refrigeration oils must be used.

WARNING
CO_2 refrigerant! Danger of suffocation! Never release significant volumes of CO_2 or the entire contents of the system into closed rooms. In case of closed room, if possible, keep the room well ventilated and/or install a CO_2 detection device. CO_2 is odourless and colourless, so it cannot be perceived directly in case of emission.

WARNING
High shell temperature! Burning! Do not touch the compressor until it has cooled down. Ensure that other materials in the area of the compressor do not get in touch with it. Lock and mark accessible sections.

CAUTION
Overheating! Bearing damage! Do not operate compressor without refrigerant charge or without being connected to the system.

CAUTION
Contact with POE! Material damage! POE lubricant must be handled carefully and proper protective equipment (gloves, eye protection, etc.) must be used at all times. POE must not come into contact with any surface or material that it might damage, including without limitation, certain polymers, eg,. PVC/CPVC and polycarbonate.

IMPORTANT
Transit damage! Compressor malfunction! Use original packaging. Avoid collisions and tilting.

2 Product description

2.1 Common information about Copeland Stream™ semi-hermetic compressors for CO_2 transcritical and subcritical applications

These guidelines cover Stream CO_2 semi-hermetic compressors. The Stream CO_2 series of transcritical 4MTL models ranges from 5 to 30 hp; the series of subcritical 4MSL models ranges from 3 to 15 hp.

The performance values shown in **Table 1** are valid for 50 Hz supply frequency.

Compressor	Displacement (m^3/h)	Cooling capacity Qo* (kW)	COP	Net weight (kg)	Footprint (mm x mm)
4MTL-05_	4.6	8.72[1)]	1.57	124	368 x 256
4MTL-07_	6.2	11.81[1)]	1.62		
4MTL-09_	7.4	14.65[1)]	1.67		
4MTL-12_	9.5	19.24[1)]	1.70	170	368 x 256
4MTL-15_	12.5	25.16[1)]	1.75		
4MTL-30_	17.9	37.00[1)]	1.80		
4MSL-03_	4.6	7.51[2)]	3.41	124	368 x 256
4MSL-04_	6.2	10.38[2)]	3.68		
4MSL-06_	7.4	12.38[2)]	3.76		
4MSL-08_	9.5	15.87[2)]	3.60	170	368 x 256
4MSL-10_	12.5	20.98[2)]	3.72		
4MSL-15_	17.9	31.01[2)]	3.84		

[1)] Evaporating -10°C; gas cooler outlet temp 35°C; high pressure 90 bar; superheat 10K; subcooling 0K
[2)] Evaporating -35°C; condensing -5°C; superheat 10K; subcooling 0K

Table 1: Stream CO_2 compressors range and performance for full load (100%)

Table 2 shows the key pressure values that are relevant to the use of Stream CO_2 compressors.

Compressor	Motor	Maximum operating pressure (MOP) [bar(a)]	Standstill pressure (nameplate) Ps / Pss [bar(a)]	Burst pressure [bar(a)]
4MTL-05_	**EWL** FWM/D FWE / FWC	120 / 42	135 / 90	420 / 330
4MTL-07_				
4MTL-09_				
4MTL-12_	**AWM/D** EWL AWE	120 / 42	135 / 90	420 / 330
4MTL-15_				
4MTL-30_				
4MSL-03_	**EWL** FWM/D FEW / FWC	60 / 23	135 / 90	420 / 330
4MSL-04_				
4MSL-06_				
4MSL-08_	**AWM/D** EWL AWE	60 / 23	135 / 90	420 / 330
4MSL-10_				
4MSL-15_				

Table 2: Stream CO_2 compressor pressures

NOTE: **Throughout these guidelines, pressure values shown with the [bar(a)] or [bar] unit are absolute pressures. For values in relative (gauge) pressure, [bar(g)] will be used.**

The line-up of 4-cylinder semi-hermetic Stream compressors for CO_2-transcritical applications is the ideal solution for R744 medium temperature section of booster systems. This range is designed for maximum standstill pressures of 135 bar at high side and 90 bar at low side (see

Chapter 3.2.1 "Safety relief valves"). Refrigerant flow and heat transfer have been optimized for best performance.

The compressor is only one component which must be combined with many others to build a functional and efficient refrigeration system.

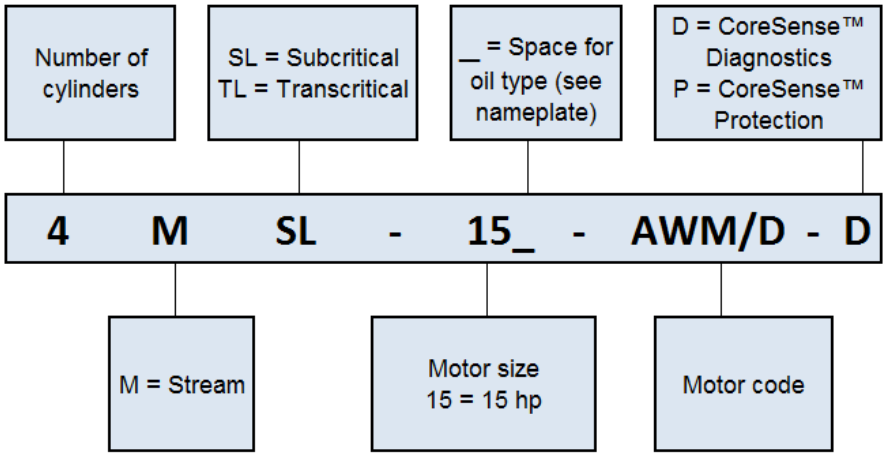
Therefore the information in this manual relates to Copeland Stream semi-hermetic compressors for CO_2 transcritical and subcritical applications with standard equipment and accessories only.

2.2 About these guidelines

These guidelines are intended to enable users to ensure the safe installation, start-up, operation and maintenance of Stream CO_2 semi-hermetic compressors. They are not intended to replace the system expertise available from system manufacturers.

2.3 Nomenclature

The model designation contains the following technical information about Stream CO_2 compressors:



The oil type is mentioned on the nameplate (see Chapter 2.4 "Nameplate information"). Different oils are qualified (see Chapter 2.5.1 "Qualified refrigerant and oils").

2.4 Nameplate information

All important information for identification of the compressor is printed on the nameplate located below the left cylinder bank:

- The year and month of production are shown as part of the serial number (Jan = A, Feb = B, … Dec = L).
- Type of refrigerant (R744).
- Type of lubricant: POE or PAG type.

15L = Produced in December 2015

PAG68 = Oil type

R744 = CO_2 refrigerant

Figure 1: Nameplate information

2.5 Application range

2.5.1 Qualified refrigerant and oils

Stream CO_2 compressors can be delivered with either PAG or POE oil.

Oil recharge values can be taken from Copeland™ brand products Select software available at www.emersonclimate.eu.

Qualified refrigerant	CO_2 (R744)
Copeland brand products standard oil	Emkarate RL 68 HB (POE1)
Alternative (optional): PAG instead of POE	Zerol RFL 68 EP (PAG1)

Table 3: Qualified refrigerant and oils for recharging and topping up

To recharge:

- When the compressor is completely empty of oil, the amount of oil to be "recharged" is typically 0.12 litre less than the original oil charge (oil will already be present in the system).

To top up:

- During commissioning, planned maintenance or servicing, add oil so that the compressor oil level is between min ¼ and max ¾ of side sight glasses and full in the housing cover sight glass.
- Recommended purity rate for carbon dioxide purity class: 4.0 [(≥ 99.99%) H_2O ≤ 10 ppm, O_2 ≤ 10 ppm, N_2 ≤ 50 ppm] or higher.

2.5.2 Application limits

CAUTION
Oil dilution! Bearing malfunction! A minimum superheat of 5K at the compressor suction is required at all operating conditions to avoid oil dilution with CO_2 (R744).

The operating envelopes of transcritical and subcritical Stream CO_2 compressors are shown below.

Operating envelopes for transcritical applications

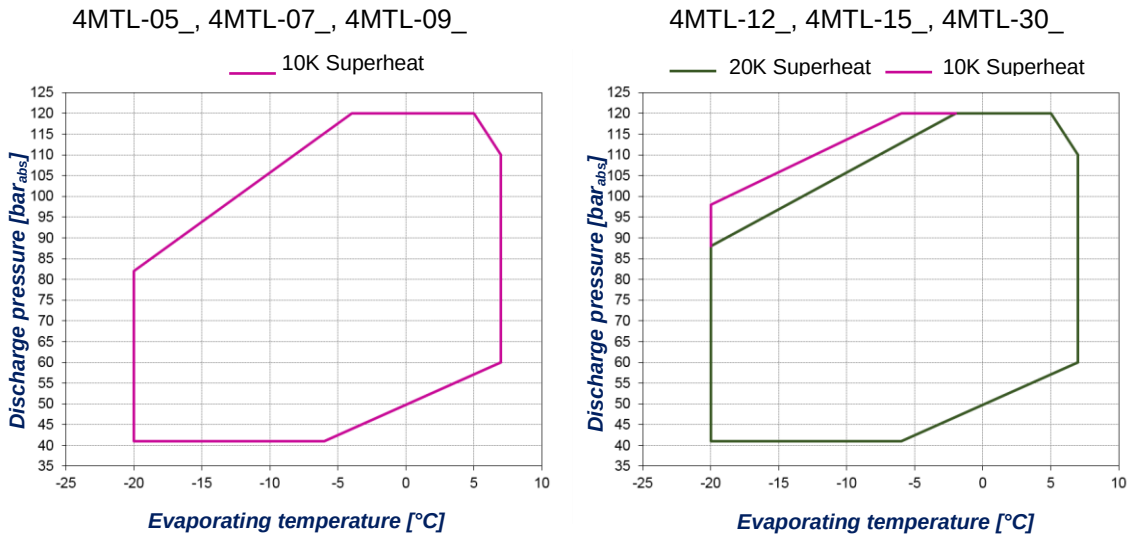


Figure 2: Operating envelopes for transcritical applications with R744

Operating envelope for subcritical applications

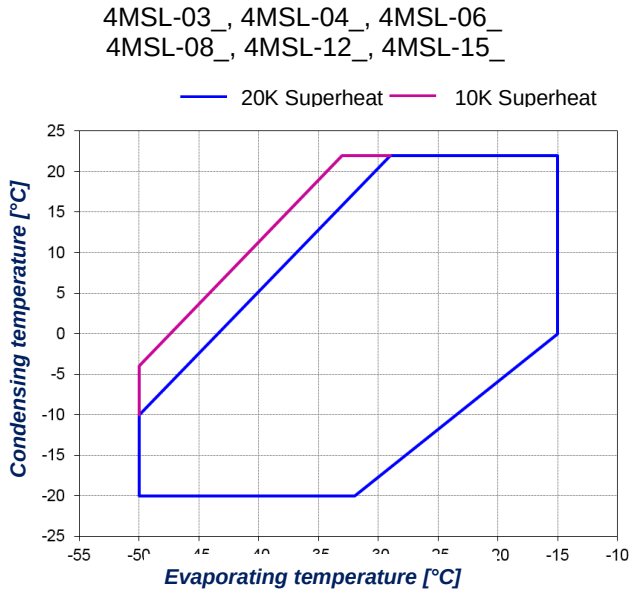


Figure 3: Operating envelope for subcritical applications with R744

The compressor suction superheat should be controlled so that it is always above 5K to avoid oil dilution in the compressor, but low enough to keep the compressor discharge temperature below 155°C, especially at high pressure ratios (high discharge and low suction pressures).

2.6 Design features

2.6.1 Compressor construction

Stream CO_2 compressors have a large discharge chamber to eliminate pulsations. The cylinder heads and the discharge plenum are designed to minimize the heat transfer to suction side.

Each cylinder head has a plugged 1/8" - 27 NPTF tapped hole on the high pressure.

Figure 4: Compressor external view

2.6.2 Compressor cooling

Compressor motor cooling must be ensured in all circumstances.

All Stream CO_2 compressors are suction gas-cooled. With suction gas-cooled compressors, the motor is cooled by refrigerant gas that flows through the motor. Depending on operating conditions, the maximum allowed suction gas superheat shall not exceed the values shown in the envelopes.

2.6.3 Oil lubrication

An oil splasher system ensures proper lubrication at constant or variable speed.

2.6.4 Oil level

All Stream CO_2 compressors are equipped with three identical sight glasses, one at each side of the compressor and one at the front.

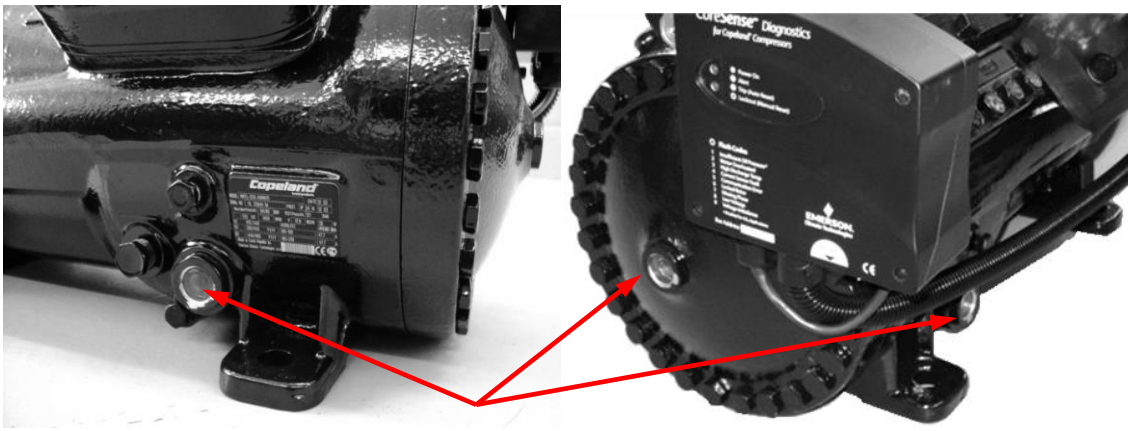


Figure 5: Sight glasses location

All compressors are delivered with sufficient oil for normal operation. The optimum oil level should be checked by operating the compressor until the system is stable and then comparing the sight glass reading with the appropriate diagram below. The oil level should be between ¼ and ¾ of side sight glasses and full in the housing cover sight glass.

The housing cover sight glass serves only as a means of checking the oil level in the compressor crankcase and cannot be used for its control.

When an oil regulator is used, it has to be installed in place of one of the side sight glasses. The oil level controller should be min ¼ and max ¾ of the sight glass. The level can also be checked within 10 seconds of compressor shutdown.

For 4MTL and 4MSL compressors a higher oil level may be accepted when an oil regulator is used as the oil separator will reduce excessive oil circulation.

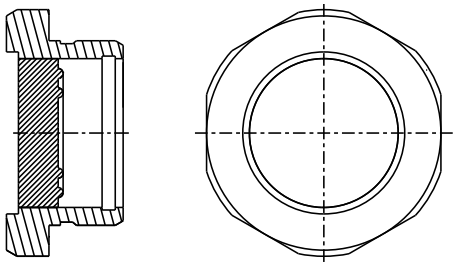


Figure 6: Sight glass design

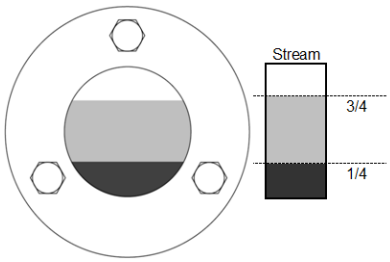


Figure 7: Sight glass reading

The sight glass thread is 1 1/8"-18 UNEF, and the tightening torque is 50 to 60 Nm.

Stream CO_2 compressors do not have an oil pump. An oil pressure safety control cannot be used to protect the compressor against lubrication problems. However, a float level switch for oil can be used to protect the compressor against oil loss.

2.6.4.1 TraxOil electronic oil level management system

TraxOil uses a Hall-sensor to measure the oil level. A magnetic float changes its position according to the oil level. The Hall sensor converts these magnetic field changes into an equivalent signal, which is used by the internal integrated electronics to evaluate the oil level.

Maintaining proper oil level is of primary importance for a long compressor lifetime.

Particularly in refrigeration applications with varying operating conditions and defrost cycles an active oil level management is a must in order to ensure reliable compressor operation.

An additional benefit of active systems is that, in addition to oil balancing, they normally also monitor the oil level and provide alarm capabilities.

The OM5 TraxOil provides both functions: oil level monitoring and oil level balancing for active oil level management systems, especially for CO_2 applications.

The OM5 TraxOil has been developed and specially optimized for CO_2 systems, where maximum working pressures above 60 bar and up to 130 bar are required.

The OM5 TraxOil is designed to feed oil in subcritical or transcritical CO_2 compressors when necessary.

The oil level control is divided into 3 zones: normal, warning and alarm.

Figure 8: TraxOil OM5 with sight glass & coil

More information about this product can be found at www.emersonclimate.eu.

2.6.4.2 Oil level monitoring system

The OW4 and OW5 TraxOil are intended for systems which only require oil level monitoring and alarming and do not need active oil level balancing.

- OW4 is designed for CO_2 subcritical applications
- OW5 is designed or CO_2 transcritical applications

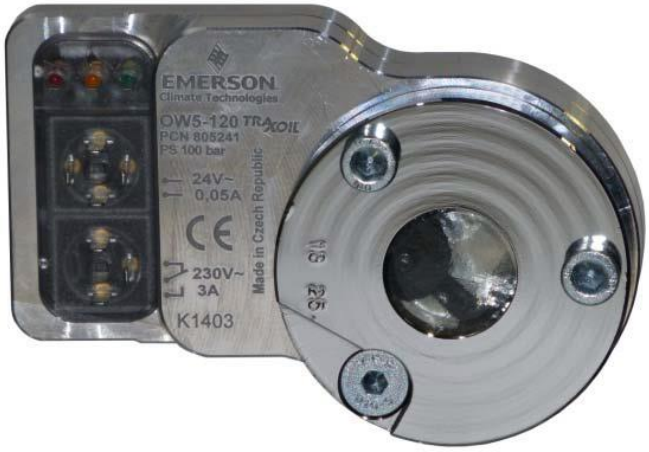


Figure 9: OW4/OX5 for oil level monitoring

The level control is divided into 3 zones: normal, warning and alarm.

If the oil level drops into the red zone, the OW4/OW5 generates an alarm signal and the alarm contact (SPDT) changes into alarm state. The alarm contact may be used to shut down the compressor. The alarm will be reset when the oil level comes back to normal.

More information about this product can be found at www.emersonclimate.eu.

3 Installation

WARNING
High pressure! Injury to skin and eyes possible! Be careful when opening connections on a pressurized item.

3.1 Compressor handling

3.1.1 Delivery

Please check whether the delivery is correct and complete. Any deficiency should be reported immediately in writing.

Standard delivery:

- Suction and discharge shut-off valves
- Pressure relief valve on discharge
- Oil charge, oil sight glasses
- Crankcase heater 230V
- Mounting part kit (rubber)
- CoreSense™ Diagnostics or CoreSense™ Protection module
- Holding charge up to 2.5 bar(g) (dry air)
- Electrical terminals

3.1.2 Transport and storage

WARNING
Risk of collapse! Personal injuries! Move compressors only with appropriate mechanical or handling equipment according to weight. Keep in the upright position. Do not stack pallets on top of each other. Keep the packaging dry at all times.

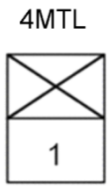


Figure 10: Storage of packaging

Compressors are delivered on pallets. Accessories may be mounted or delivered loose.

3.1.3 Positioning and securing

IMPORTANT
Handling damage! Compressor malfunction! Only use the lifting eyes whenever the compressor requires positioning. Using discharge or suction connections for lifting may cause damage or leaks.

If possible, the compressor should be kept horizontal during handling.

For safety reasons two lifting eyes should be fitted before moving a compressor (½" - 13 UNC, ident number 2932854). Otherwise refer to drawing in **Figure 11** to see how to apply another lifting method.

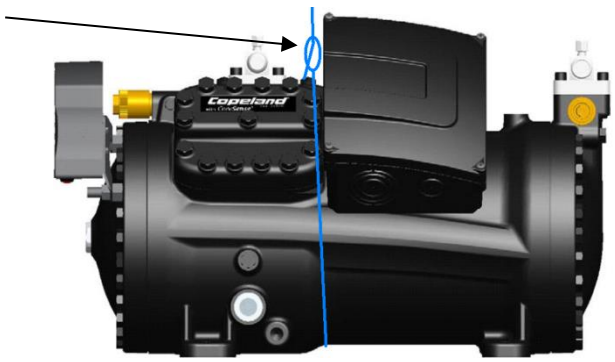


Figure 11

In order to avoid refrigerant leaks or other damage the compressors should never be lifted by the service valves or other accessories.

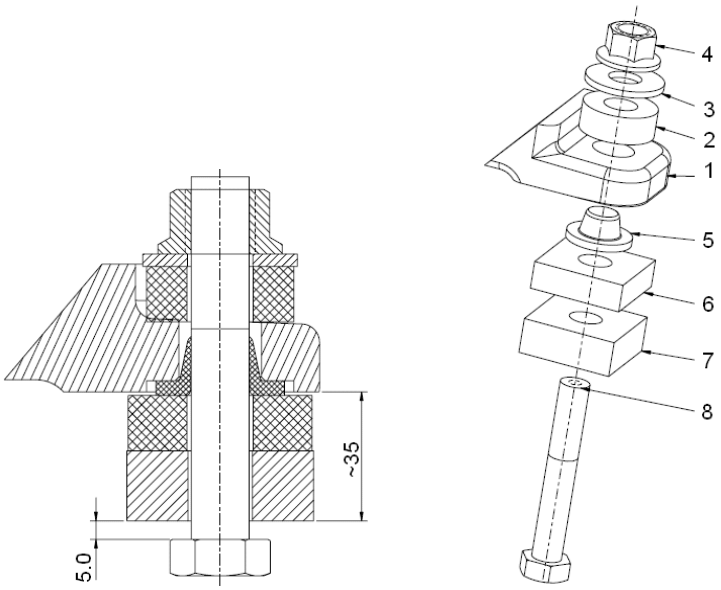
3.1.4 Installation location

Ensure the compressors are installed on a solid level base. Horizontal installation is recommended.

Temperatures around the compressor should not exceed 65°C in order to avoid suction gas temperature increase and malfunctioning of electronics.

3.1.5 Mounting parts

To minimize vibration and start/stop impulses flexible mounting should be used. For this purpose one set of rubber mounting parts for each of the Stream models is delivered with each 4MTL and 4MSL compressor. The mounting kit can be used for single and parallel operation.



1 ..... Body mounting foot
2 ..... Spacer – Rubber
3 ..... Washer – Standard
4 ..... Locknut – Prev torque type
5 ..... Spacer – Rubber mounting
6 ..... Rubber pad twin
7 ..... Spacer
8 ..... Screw hex hd cap

Figure 12: Compressor mounting parts

A compressor may be rigidly mounted, ie, without mounting parts. In this case more shock and vibration loading will be transmitted to the frame. Use only the compressor foot for fixation and avoid direct contact of other parts of the compressor housing with bordering components or base frame.

Unevenness in the mounting surface will have to be compensated by the rack and/or the compressor bottom plate/feet. Excessive unevenness can result in too high mechanical stress to the system and could damage the compressor or rack. Therefore, the flatness of the mounting location is essential. In addition, both vibration/shock and mechanical stress to compressor can be avoided by using rubber mounting parts.

If the installation requires a very high level of vibration absorption, additional vibration absorbers – available on the market – can be fitted between the rails and the foundation.

3.2 Pressure safety controls

3.2.1 Safety relief valves

CAUTION
High pressure! System leak! In the event that a pressure relief valve activates repeatedly, check and replace it as needed in order to avoid a permanent leak. Always check system for CO_2 loss after activation of the pressure relief valve.

The compressor is fitted with a pressure relief valve on the discharge side (factory mounted). If excessive pressures are reached, the valve opens and prevents further pressure increase. CO_2 is then blown off to the ambient.

An optional pressure relief valve (90 bar) is available for the suction side. Typically the suction side of the system is anyhow protected by an additional pressure relief valve. This system pressure relief valve is also acceptable for compressor protection.

The pressure relief valve does not replace pressure switches or additional safety valves in the system.

- High pressure side (HP) 135 bar

Typically after a blow-off, pressure relief valves are never perfectly tight. It is therefore recommended to replace the pressure relief valves after any blow-off.

The following pictures show the position of the pressure relief valve (high side) and the position of the plug (low side):

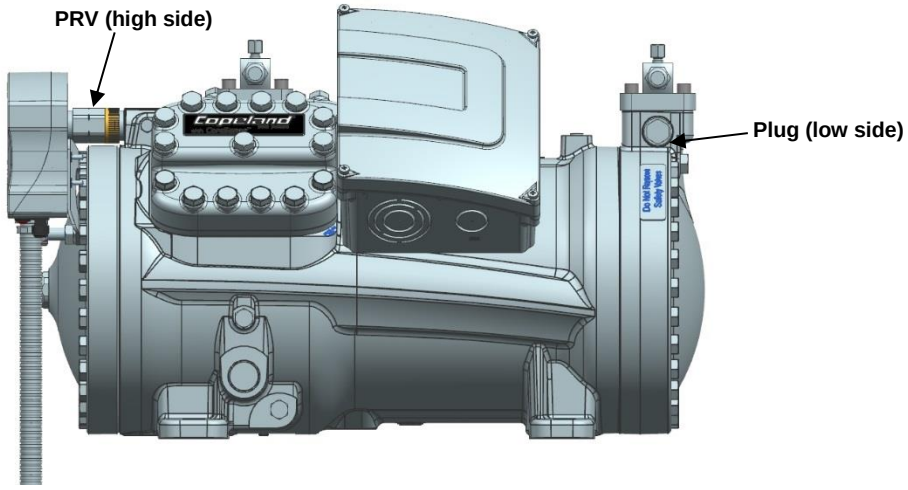


Figure 13: Position of the pressure relief valve – Models 4MTL12/15/30 & 4MSL08/12/15

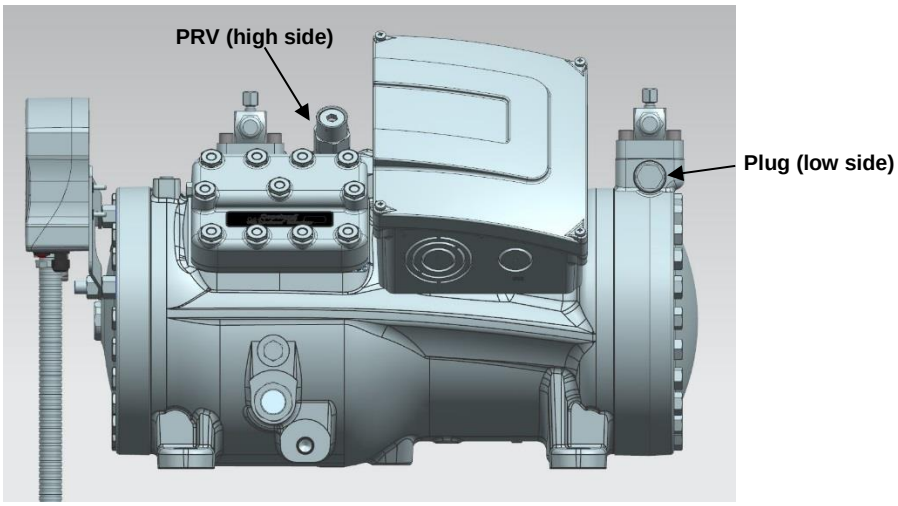


Figure 14: Position of the pressure relief valves – Models 4MTL05/07/09 & 4MSL03/04/06

3.2.2 Maximum allowable pressures Ps

The maximum allowable pressures Ps according to EN 12693 shown on the compressor nameplate are obligatory and must not be exceeded.

- For transcritical applications: High-pressure side (HP): 135 bar
  Low-pressure side (LP): 90 bar
- For subcritical applications: High-pressure side (HP): 135 bar
  Low-pressure side (LP): 90 bar

All pressures are expressed in [bar(a)] (absolute).

3.2.3 Maximum operating pressures

The maximum operating pressures according to the envelopes shown in Chapter 2.5.2 "Application limits" have to be respected during compressor operation. Running a compressor outside the envelope could lead to compressor breakdown and/or system failure.

The position of the HP and LP connections is shown in **Appendix 1** "Stream compressor connections". It is recommended to connect the pressure cut-out devices directly to the compressor housing. For the high pressure cut-out switch, one of the connection ports "4" can be used (see **Appendix 1**). For the low pressure cut-out connection, port "6" on the right-hand side of the compressor (which is the side where the electrical box is installed) above the oil level is recommended.

NOTE: **The compressor operating range may be restricted for various reasons. Check the application range limitations in Copeland brand products Select software at www.emersonclimate.eu.**

3.3 Shut-off valves

Stream CO_2 compressors are factory-equipped with shut-off valves both for suction and discharge sides. The shut-off valves are suitable for welding and brazing.

	Compressor		Displacement	Flange size suction & discharge	Suction connection (inner diameter) brazing	Drawing number	Short description	Discharge connection (inner diameter)	Drawing number	Short description
			m³/h	[mm]	["]	Suction		["]	Discharge	
Transcritical	4MTL-05_	5 hp	4.60	45 x 45	5/8	510-0823-00	W22 / ODS 5/8	1/2	510-0809-00	W17.2 / ODS 1/2
	4MTL-07_	7 hp	6.20		5/8		W22 / ODS 5/8	1/2		W17.2 / ODS 1/2
	4MTL-09_	9 hp	7.40		5/8		W22 / ODS 5/8	1/2		W17.2 / ODS 1/2
	4MTL-12_	12 hp	9.54	52 x 52	7/8	510-0844-00	W30 / ODS 7/8	5/8	510-0842-00	W22 / ODS 5/8
	4MTL-15_	15 hp	12.50		7/8		W30 / ODS 7/8	5/8		W22 / ODS 5/8
	4MTL-30_	30 hp	17.90		7/8		W30 / ODS 7/8	5/8		W22 / ODS 5/8

Table 4: General overview of transcritical models

	Compressor		Displacement	Flange size suction & discharge	Suction connection (inner diameter) brazing	Drawing number	Short description	Discharge connection (inner diameter)	Drawing number	Short description
			m³/h	[mm]	["]	Suction		["]	Discharge	
Subcritical	4MSL-03_	3 hp	4.60	45 x 45	5/8	510-0823-00	W22 / ODS 5/8	1/2	510-0809-00	W17.2 / ODS 1/2
	4MSL-04_	4 hp	6.20		5/8		W22 / ODS 5/8	1/2		W17.2 / ODS 1/2
	4MSL-06_	6 hp	7.40		5/8		W22 / ODS 5/8	1/2		W17.2 / ODS 1/2
	4MSL-08_	8 hp	9.54	52 x 52	7/8	510-0844-00	W30 / ODS 7/8	5/8	510-0842-00	W22 / ODS 5/8
	4MSL-12_	12 hp	12.50		7/8		W30 / ODS 7/8	5/8		W22 / ODS 5/8
	4MSL-15_	15 hp	17.90		7/8		W30 / ODS 7/8	5/8		W22 / ODS 5/8

Table 5: General overview of subcritical models

3.3.1 Shut-off valves design

The standard shut-off valves on Stream CO_2 compressors are flange valves with one flare connection port (lockable) for service. The service connection port is a 7/16" – 20UNF, with a blind cap SAE 1/4" (material of blind cap is stainless steel 1.4301). The valves are universal, ie, suitable for brazing or welding (butt weld and fillet weld connections are possible).

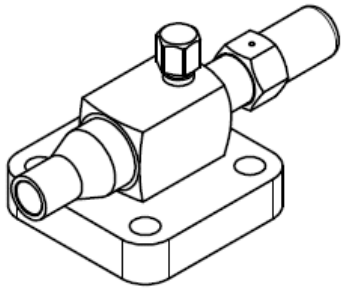
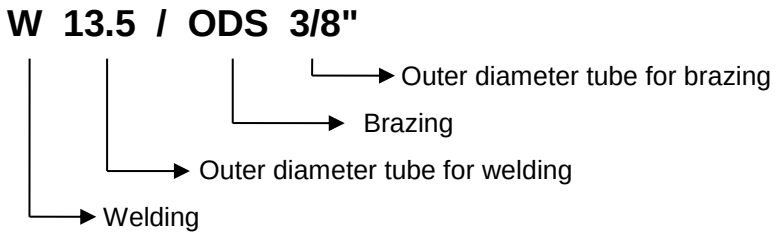


Figure 15: 3D-view of shut-off valve

For proper tightening torques for bolts, spindle cap, blind cap and gland seal, please refer to table in **Appendix 2** "Tightening torques in Nm".

The spindle is front seated (close to piping system) when the compressor is delivered.

3.3.2 Explanation of supplier description



3.3.3 Additional information about the use of shut-off valves

CAUTION
High operating pressures! Risk of leakage! High operating pressures must be taken into account when welding and brazing connections. Use materials and follow procedures according to the relevant standards in order to prevent any risk of leakage when operating the compressor.

The shut-off valves are made of a fine-grained mild steel (S235JRG2C - EN 10025) suitable for both welding and brazing. Plating is Fe/Cu5Sn5 material.

The use of standard steel tubes (S235, P235, etc.) is possible.

When using stainless steel tubes (SS) the welding consumable has to be selected for dissimilar materials (stainless steel to mild steel).

For the brazing of the connection, brazing material with a minimum silver content of 34% (or higher) in combination with flux material is required, eg, Fontargen A319, A320. The description of the brazing material according to European standard EN1044 is: AG106 and AG104 respectively.

In any case the connection area after welding or brazing has to be cleaned and protected against corrosion.

Drawing number	Flange fixing pitch dimensions	Brazing inner diameter	"z" - dimension (thickness)	"a" - dimension	"D" Outer diameter butt welding	Depth for tube insertion
PCN	[mm]	["]	[mm]	[mm]	[mm]	[mm]
510-0809-00	45 x 45	1/2	2.20	3.11	17.2	11.0
510-0823-00	45 x 45	5/8	2.95	4.17	22.0	11.0
510-0842-00	52 x 52	5/8	2.95	4.17	22.0	11.0
510-0844-00	52 x 52	7/8	3.83	5.41	30.0	16.0
510-0845-00	52 x 52	1 1/8	3.15	4.45	35.0	19.0
510-0847-00	70 x 70	1 3/8	4.20	5.94	42.4	23.0

Table 6: Dimensions for welding and brazing

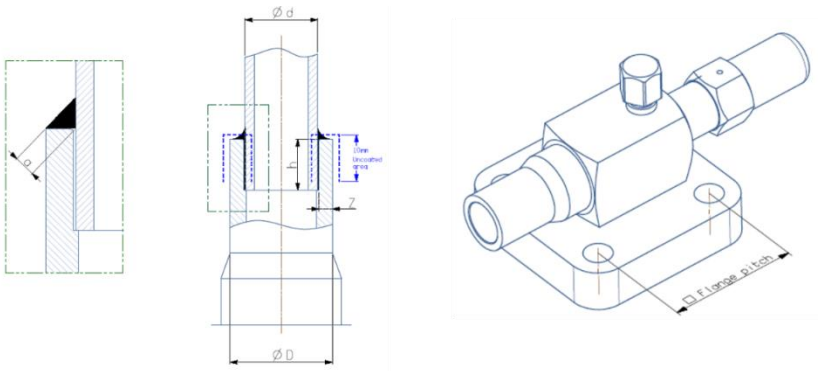


Figure 16: Dimension references for welding and brazing

3.3.4 Variations for shut-off valves

Compressors can be ordered without valves on request. In that case the valves will be removed and a blind flange with gasket will be used for suction and discharge to guarantee the tightness of the compressor during transport.

For Stream CO_2 compressors, Emerson Climate Technologies also offers variations for connection sizes. Additionally, a compression fitting can be used for the discharge part of Stream CO_2 compressors. Compressors can be ordered with "variation discharge shut-off valve with Hy-Lok fitting at the discharge part". The tube diameter for the discharge line must be defined by the customer.

NOTE: **For details about variations, see Tables 7 & 8 below and refer to Technical Information "Shut-off valves for CO_2 Stream compressors" at www.emersonclimate.eu.**

				Variation bigger Ø			
	Compressor	Displacement	Flange size	Suction connection (inner diameter)	Short description	Discharge connection (inner diameter)	Short description
		m³/h	S & D	["]		["]	
Transcritical	4MTL-05_	4.60	45 x 45mm	3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-07_	6.20		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-09_	7.40		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-12_	9.54	52 x 52mm	1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MTL-15_	12.50		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MTL-30_	17.90		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
Subcritical	4MSL-03_	4.60	45 x 45mm	3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-04_	6.20		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-06_	7.40		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-08_	9.54	52 x 52mm	1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MSL-12_	12.50		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MSL-15_	17.90		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4

Table 7: Variations with larger tube connections

				Variation bigger Ø			
	Compressor	Displacement	Flange size	Suction connection (inner diameter)	Short description	Discharge connection (inner diameter)	Short description
		m³/h	S & D	["]		["]	
Transcritical	4MTL-05_	4.60	45 x 45mm	3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-07_	6.20		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-09_	7.40		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MTL-12_	9.54	52 x 52mm	1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MTL-15_	12.50		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MTL-30_	17.90		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
Subcritical	4MSL-03_	4.60	45 x 45mm	3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-04_	6.20		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-06_	7.40		3/4	W25.4 / ODS 3/4	5/8	W22 / ODS 5/8
	4MSL-08_	9.54	52 x 52mm	1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MSL-12_	12.50		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4
	4MSL-15_	17.90		1 1/8	W35 / ODS 1 1/8	3/4	W25.4 / ODS 3/4

Table 8: Variations with smaller tube connections

3.4 Screens

CAUTION
Screen blocking! Compressor breakdown! Use screens with at least 0.6 mm openings.

The use of screens finer than 30 x 30 meshes (0.6 mm openings) anywhere in the system should be avoided with these compressors. Field experience has shown that finer mesh screens used to protect thermal expansion valves, capillary tubes or accumulators can become temporarily or permanently plugged with normal system debris and block the flow of either oil or refrigerant to the compressor. Such blockage can result in compressor failure.

4 Electrical connection

4.1 General recommendations

The compressor terminal box has a wiring diagram on the inside of its cover. Before connecting the compressor, ensure that the supply voltage, the phases and the frequency match the nameplate data.

The knockouts have to be removed before the electrical glands can be installed. First make sure that the terminal box is closed with the terminal box cover. We recommend to use a subland twist driller to avoid any damage to the box while removing the knockouts.

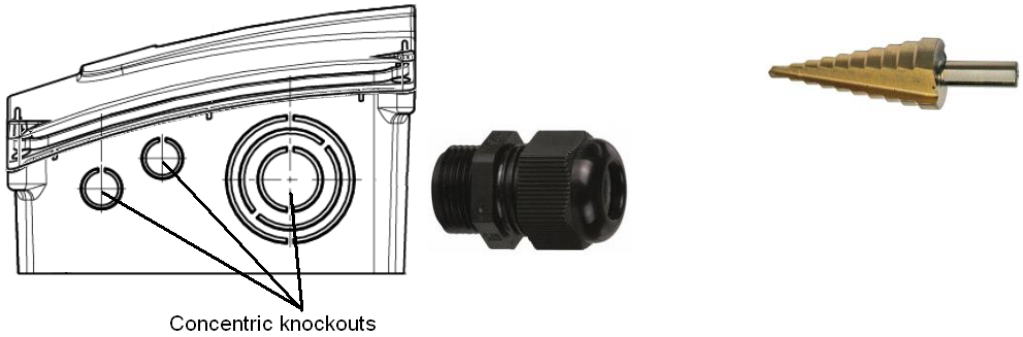


Figure 17: Terminal box knockouts

4.2 Electrical installation

All compressors can be started Direct-On-Line.

The position of bridges required for Direct-On-Line start (depending on type of motor and/or mains voltage) is shown in Chapter 4.4 "Wiring diagrams".

4.2.1 Direct-On-Line > Star / Delta motors (Y/Δ) – Code E

On this three-phase motor, the 6 ends of the three windings are led into the terminal box of the compressor via cable bushings.

The required star or delta connection is achieved by means of connection bars in the terminal box or via controlled contactors. Thus, the motor can be run at the operating voltage.

The voltage version L (motor code EWL) of this motor allows operation at two voltages, a lower voltage, eg, 230V in delta connection, and a higher voltage, eg, 400V in star connection.

The voltage version M or D (motor code EWM for 50 Hz or EWD for 60Hz) of this motor shall be used for full load in delta connection. The star connection is primarily used here for starting procedure (Star-Delta-Start).

However, the EWM motor could also be used for power supply with voltages of 690V/3~/50Hz in star connection (only on the M version).

4.2.2 Part winding motors (YY/Y) – Code A

Part-winding motors contain two separate windings (2/3 + 1/3) which are internally connected in star and operated in parallel. The voltage cannot be modified by changing the electrical connections as the motor is only suitable for one voltage.

The first part-winding, ie, the 2/3 winding on terminals 1-2-3, can be used for part-winding start (remove the bridges!). After a time delay of 1 ± 0.1 seconds the second part winding, ie, the 1/3 winding on terminals 7-8-9, must be brought on line.

4.2.3 Part-winding motors (YY/Y) – Code F

Part-winding motors contain two separate windings (Code F motors always split by 1/2 + 1/2) which are internally connected in star and operated in parallel. The voltage cannot be modified by changing the electrical connections as the motor is only suitable for one voltage.

The first part-winding, ie, the 1/2 winding on terminals 1-2-3, can be used for part-winding start (remove the bridges!). After a time delay of 1 ± 0.1 seconds the second part-winding, ie, the second half winding on terminals 7-8-9, must be brought on line.

4.3 Terminal box isolators and jumpers position

The position of the jumpers in the terminal box is shown in **Tables 9 & 10**.

4.3.1 Star / Delta motors (EW)*

Star / Delta motors can be connected Direct-On-Line or Star / Delta start.

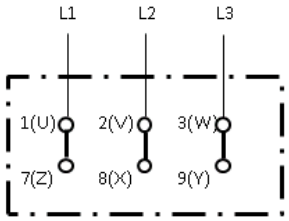
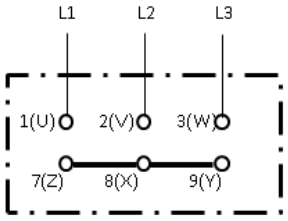
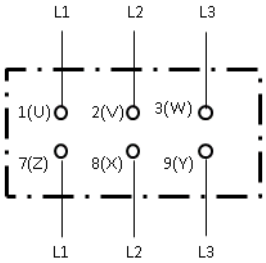
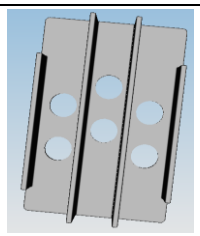
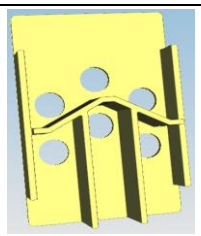
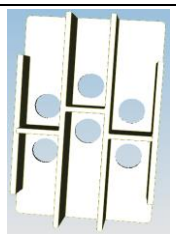
	Direct-On-Line start Δ	Direct-On-Line start Y	Star / Delta start Y - Δ
Star / Delta motor Y - Δ **Code E**			
Recommended isolator (packed in T-Box)			

Table 9: Terminal box isolators & jumpers position for star/delta winding motors

4.3.2 Part-winding motors (AW or FW*)*

Part-winding motors can be connected Direct-On-Line or part-winding start.

Make sure that the 2 wires (L2) which are guided through the current sensor are in the same direction. The black wire (voltage sensing) from the sensor module must be connected to the same terminal as the wires that are guided through the current sensor.

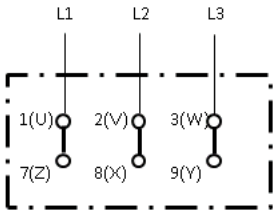
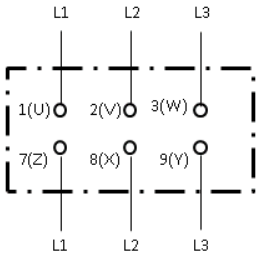
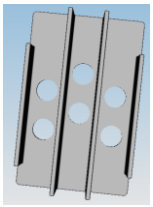
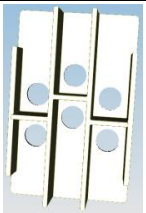
	Direct-On-Line start YY - Y	Part-winding start YY - Y First start step 1–2-3
Part-winding motor: YY – Y **Code A** **Code F**		
Recommended isolator (packed in T-Box)		

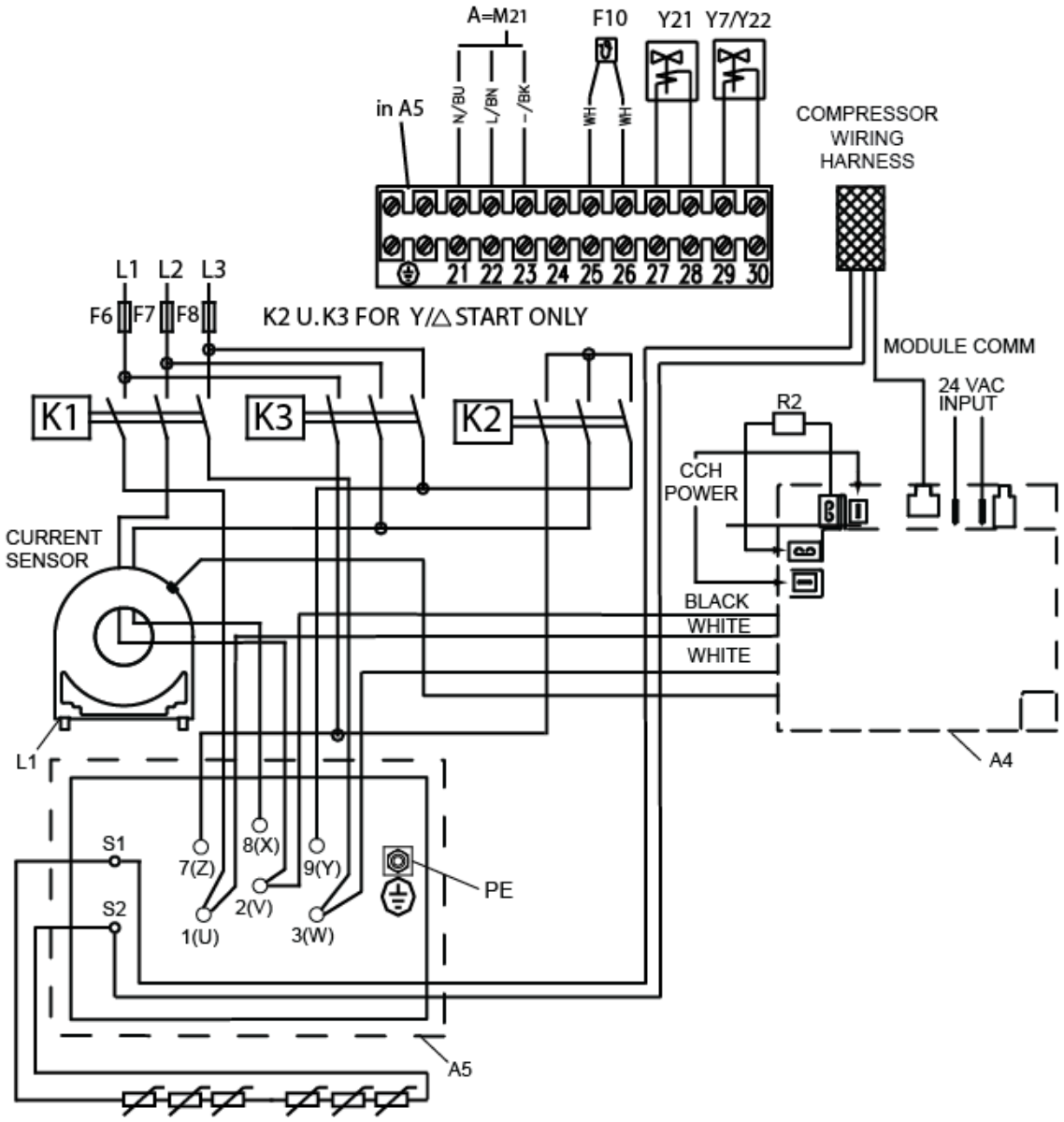
Table 10: Terminal box isolators & jumpers position for part-winding motors

***NOTE:* The isolators are not factory-mounted; they are packed and shipped loose in the terminal box.**

4.4 Wiring diagrams

4.4.1 Wiring diagrams for Star / Delta Direct-On-Line motors (EW)*

4.4.1.1 Compressors with CoreSense Diagnostics module

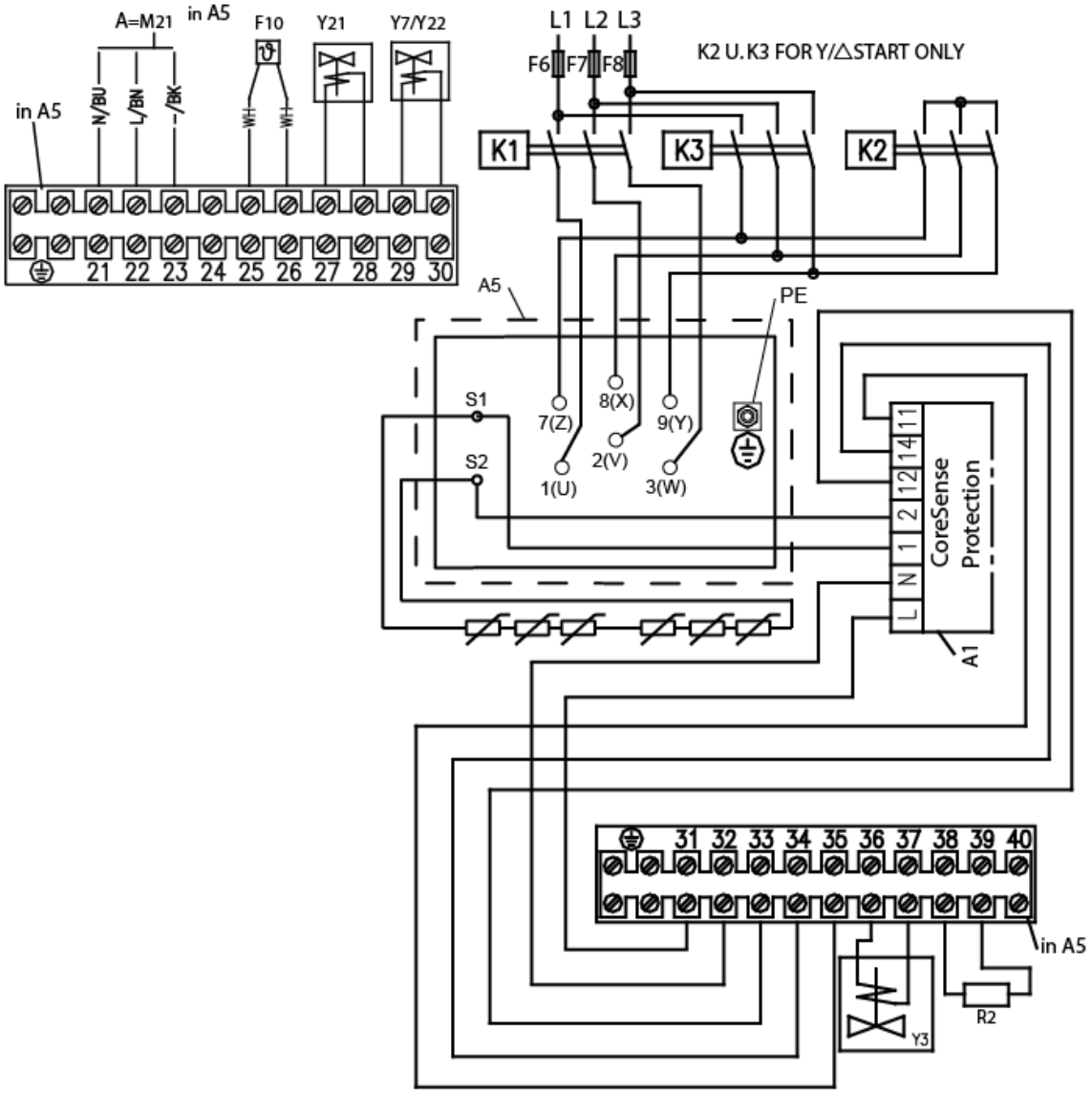


Legend

A4 ..... Sensor module
A5 ..... Terminal box compressor
F6 ..... Fuse for control circuit
F7 ..... Fuse for control circuit
F8 ..... Fuse for control circuit
F10 ..... Thermal protection switch M21
K1 ..... Contactor M1
K2 ..... Contactor M1 Y-connection
K3 ..... Contactor M1 Δ-connection
L1 ..... Current transducer CoreSense
M21 ..... Fan motor / condenser
R2..... Crankcase heater
Y7..... Solenoid valve pumpdown
Y21..... Solenoid valve
Y22..... Solenoid valve
S1..... Thermistor chain motor temperature
S2..... Thermistor chain motor temperature

Figure 18: Electrical diagram for EW* Direct-On-Line motor versions with CoreSense Diagnostics

4.4.1.2 Compressors with CoreSense Protection module



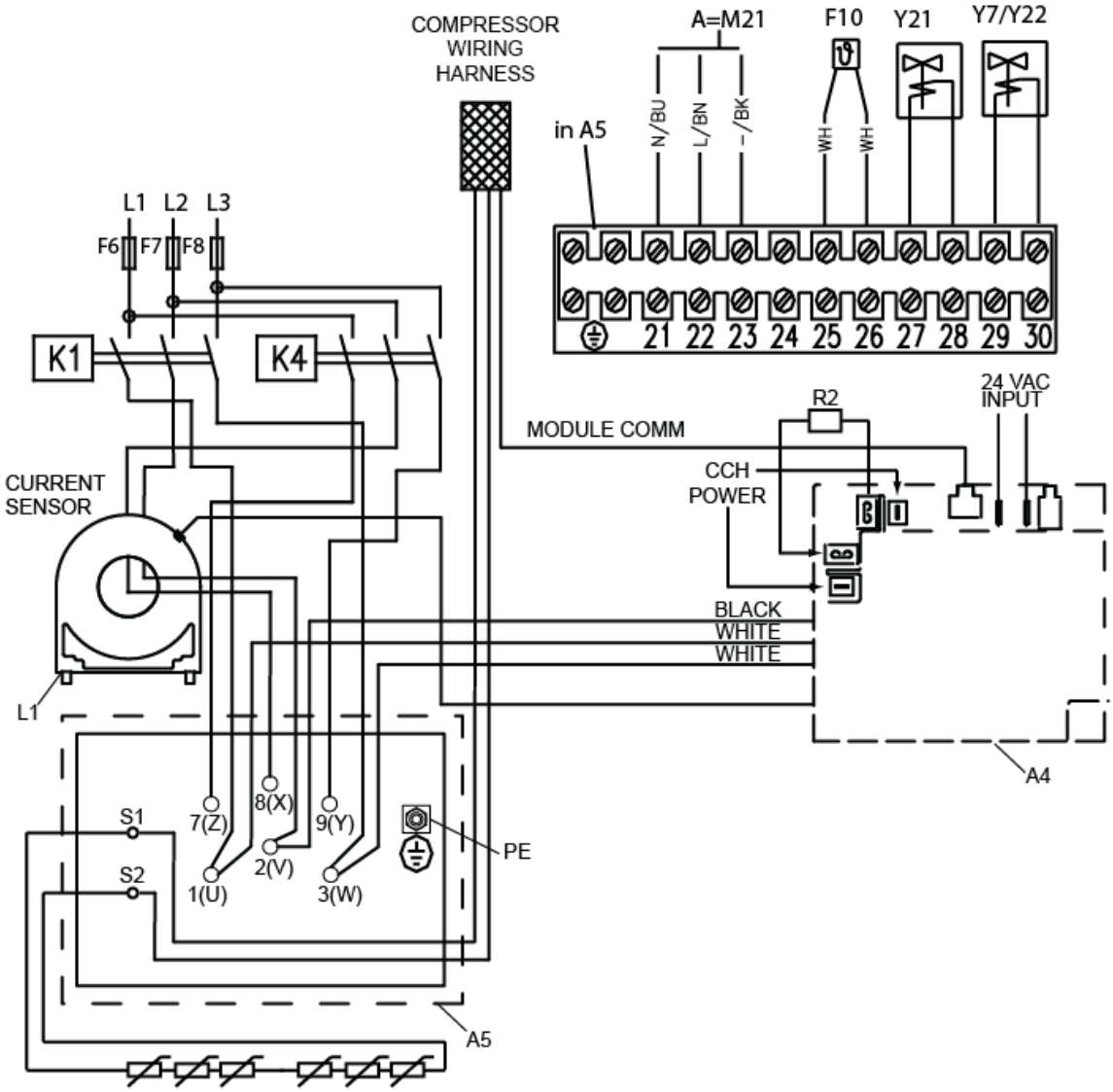
Legend

A1 ..... CoreSense Protection module
A5 ..... Terminal box compressor
F6 ..... Fuse for control circuit
F7 ..... Fuse for control circuit
F8 ..... Fuse for control circuit
F10 ..... Thermal protection switch M21
K1 ..... Contactor M1
K2..... Contactor M1 Y-connection
K3..... Contactor M1 Δ-connection
M21 ..... Fan motor / condenser
R2..... Crankcase heater
S1..... Thermistor chain motor temperature
S2..... Thermistor chain motor temperature
Y3..... Solenoid valve unloaded start

Figure 19: Electrical diagram for EW* Direct-On-Line motor versions with CoreSense Protection

4.4.2 Wiring diagrams for part-winding motors (AW / FW*)*

4.4.2.1 Compressors with CoreSense Diagnostics module

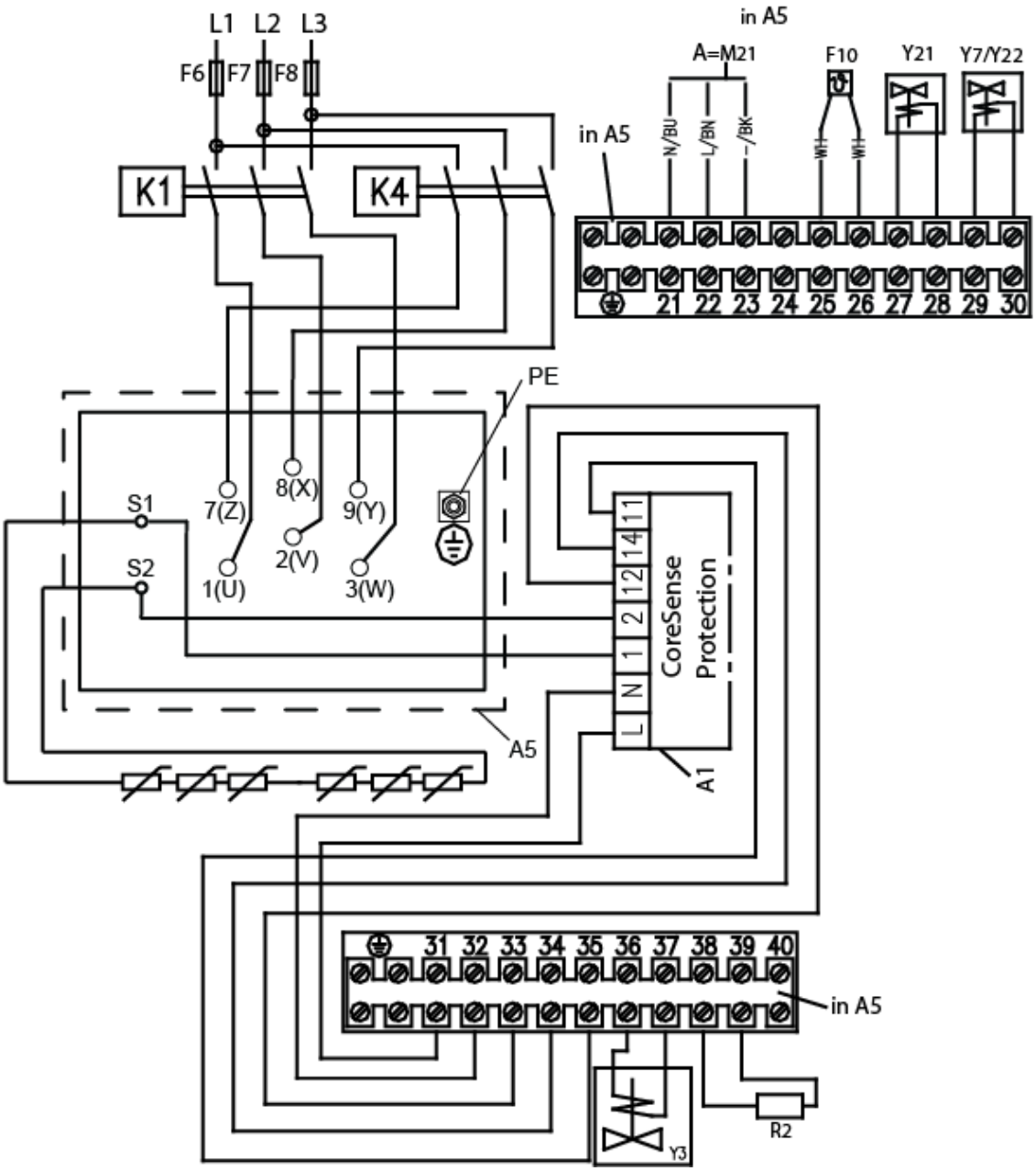


Legend

A4 ..... Sensor module
A5 ..... Terminal box compressor
CCH.... Crankcase heater
F6 ..... Fuse for control circuit
F7 ..... Fuse for control circuit
F8 ..... Fuse for control circuit
F10 ..... Thermal protection switch M21
K1.....Contactor M1 Y-connection
K4.....Contactor M1 YY-connection
L1 .....Current transducer CoreSense
M21 .....Fan motor / condenser
S1.....Thermistor chain motor temperature
S2.....Thermistor chain motor temperature

Figure 20: Electrical diagram for AW* & FW* part-winding motor versions with CoreSense Diagnostics

4.4.2.2 Compressors with CoreSense Protection module



Legend

A1 ..... CoreSense Protection module
A5 ..... Terminal box compressor
F6 ..... Fuse for control circuit
F7 ..... Fuse for control circuit
F8 ..... Fuse for control circuit
F10 ..... Thermal protection switch M21
K1 ..... Contactor M1
K4.....Contactor M1 for second part-winding
M21 .....Fan motor / condenser
R2.....Crankcase heater
S1.....Thermistor chain motor temperature
S2.....Thermistor chain motor temperature
Y3.....Solenoid valve unloaded start

Figure 21: Electrical diagram for AW* & FW* part-winding motor versions with CoreSense Protection

4.5 Protection devices

Independently from the internal motor protection, fuses must be installed before compressor start-up. The selection of fuses has to be carried out according to VDE 0635, DIN 57635, IEC 269-1 or EN 60-269-1.

4.6 CoreSense™ Diagnostics

CoreSense™ Diagnostics is used for all 4MTL and 4MSL Stream semi-hermetic compressors. It provides advanced protection against faults such as high discharge temperature, locked rotor, single/missing phase, voltage imbalance and low voltage. The module is capable of communication via Modbus® protocol. An external overload protection is not necessary.

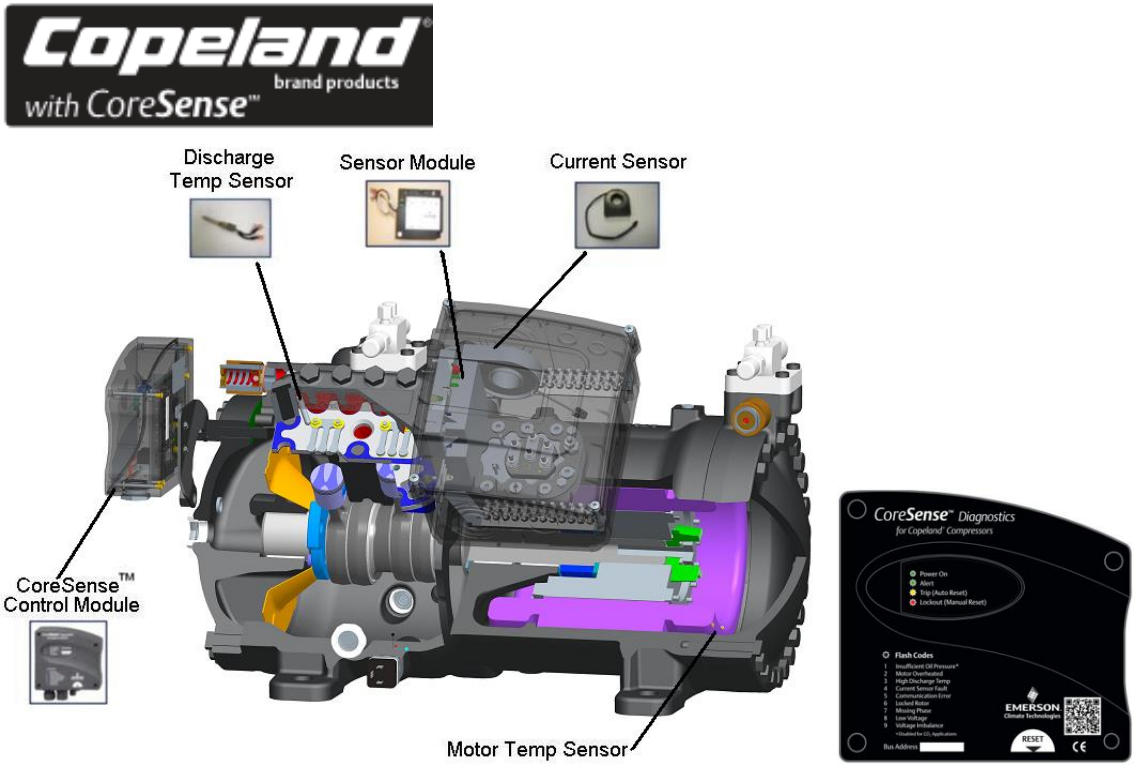


Figure 22: Compressor internal view with sensors and CoreSense Diagnostics module

For the electrical connection of the CoreSense Diagnostics module, refer to the wiring diagram below:

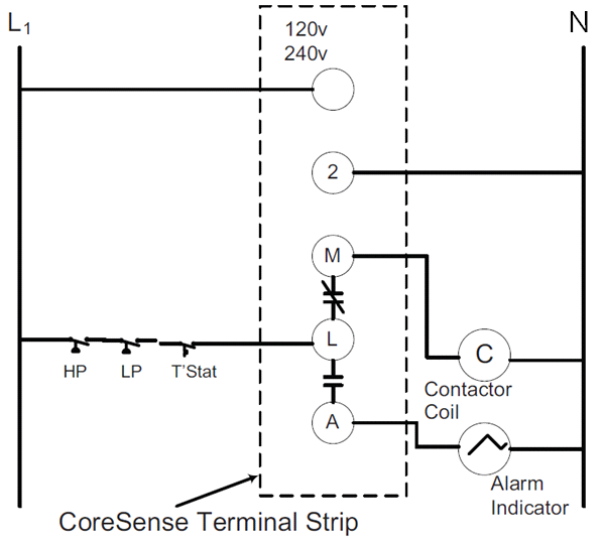


Figure 23: CoreSense Diagnostics module wiring diagram

NOTE: **For more information please refer to Technical Information D7.8.4 "CoreSense™ Diagnostics for Stream refrigeration compressors".**

4.6.1 Dip-switch settings on CoreSense Diagnostics module

There is a Dip-switch terminal located in the front module which has to be adjusted.

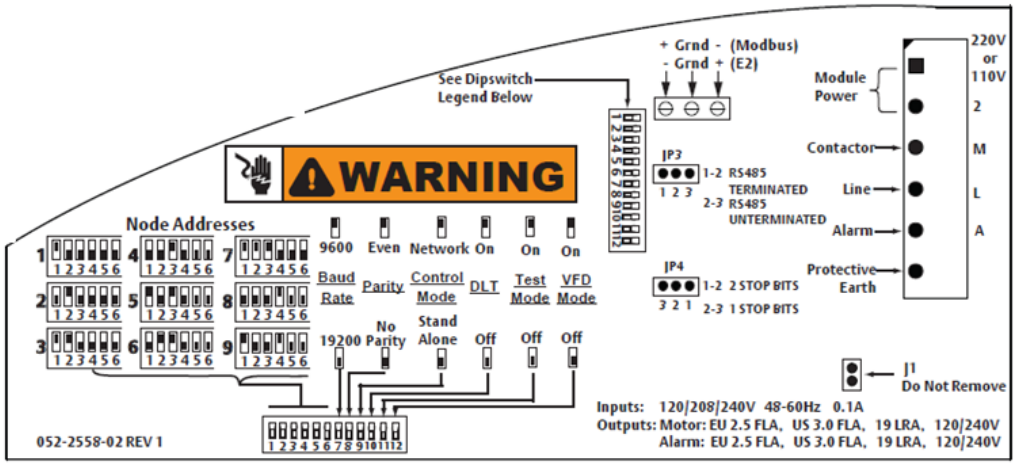


Figure 24: Dip-switch setting on CoreSense Diagnostics

4.7 CoreSense™ Protection

4.7.1 Motor protection

Stream compressors with "-P" at the end of the description are equipped with a CoreSense Protection device. The temperature-dependent resistance of the thermistor (also PTC-resistance) is used to sense the winding temperature. Two chains of three thermistors each connected in series are embedded in the motor windings in such a manner that the temperature of the thermistors can follow with little inertia.

The CoreSense Protection module switches a control relay depending on the thermistor resistance. It is installed in the terminal box to which the thermistors are connected.

Caution: The maximum test voltage for thermistors is 3V.

The total resistance of the thermistor chains on a cold compressor should be ≤ 1800Ω.

Protection class of the module: IP20.

IMPORTANT
Different sources for power supply and contact 11-14! Module malfunction! Use the same potential for the power supply (L) and the switch contact of the control loop (11-14).

Control circuit wiring:

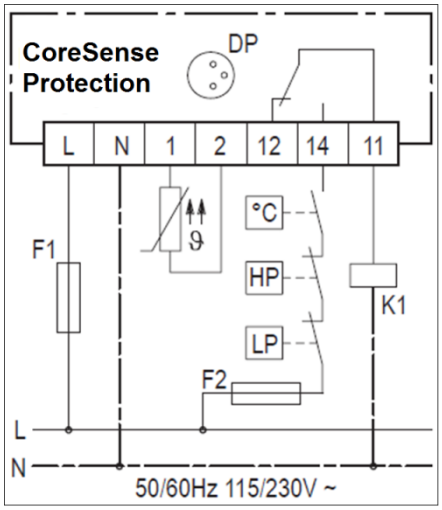


Figure 25: CoreSense Protection module wiring diagram

4.8 Crankcase heaters

IMPORTANT
Oil dilution! Bearing malfunction! Turn the crankcase heater on 12 hours before starting the compressor.

A crankcase heater is always required for 4MTL and 4MSL Stream compressors and is used to prevent refrigerant from migrating into the compressor during standstill periods.

4MTL and 4MSL Stream compressors use a 100-Watt crankcase heater available in 230V only. The crankcase heater is delivered as a kit together with the compressor. This "easy-to-install" kit consists of 3 parts:

- 1 crankcase heater
- 1 heat-conductive paste tube
- 1 mounting ring

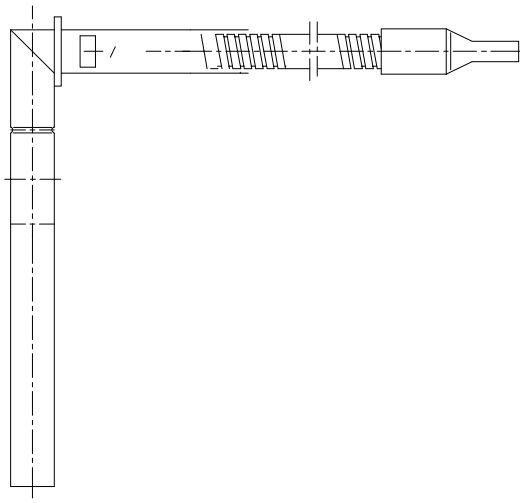
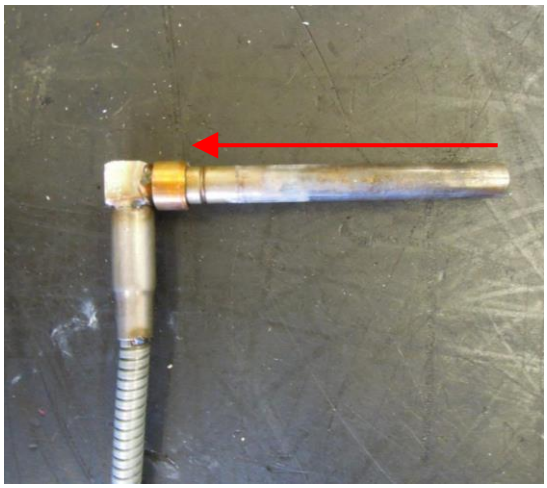


Figure 26: 100 Watt crankcase heater element

Figure 27: Crankcase heater kit

The crankcase heater has to be inserted in a special chamber. Please follow the procedure below for installation:

Insert the mounting ring along the heating part until it blocks.



Spread a thick layer of conductive paste around the heating part.

Remove the plug before heater installation.
Insert the heater in the hole.
The mounting ring (preassembled on the heater before insertion) has to be pressed into the hole.

The crankcase heater is secured into position.
It is also possible to secure the heater more firmly by using a rubber hammer on the flat surface.

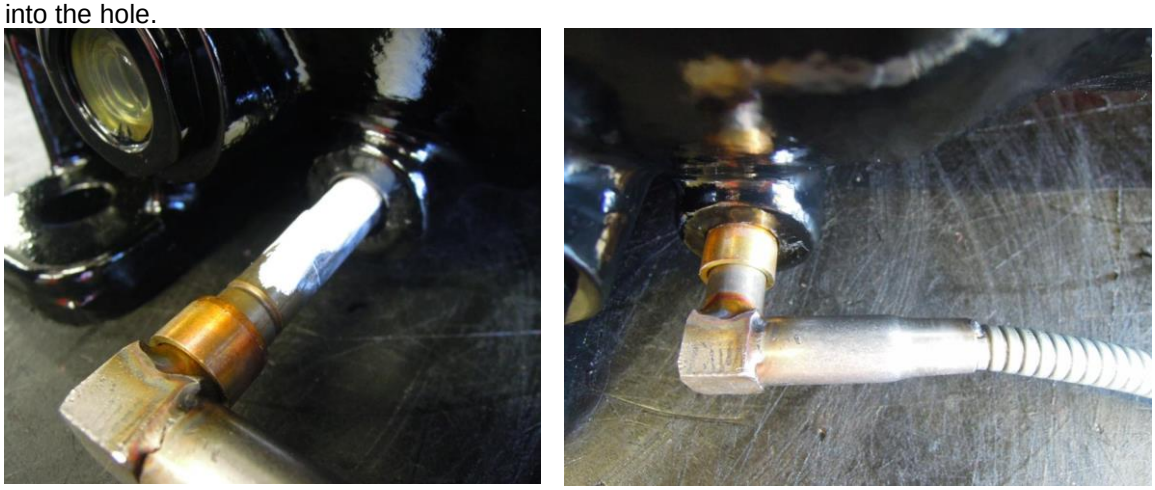


Figure 28: Crankcase heater installation procedure

5 Starting up & operation

WARNING
Diesel effect! Compressor destruction! The mixture of air and oil at high temperature can lead to an explosion. Avoid operating with air.

5.1 Leak test

As a general rule, the reduction of leaks is a legal obligation. Refrigeration systems must be checked for leakage before they get into operation. The rules for tightness tests when building a CO_2 system are the same as for systems using other refrigerants. Typically leakage tests are performed by means of inert gases, eg, dried nitrogen or helium.

Leak test frequency is covered by legislation. CO_2 is not in the scope of the F-gas-regulation (EU) No 517/2014 (repealing Regulation (EC) No 842/2006). In principle refrigeration equipment with a refrigerant charge of 3 kg or more shall be tested for tightness once per year. Repeated inspection might be required.

Leak detection spray and electronic leak detectors can be used. Electronic leak detectors shall have certain sensitivity according to local standards and need to be checked regularly.

Fluorescent additives must be approved by equipment manufacturer.

Copeland brand compressors are leak-tested during manufacturing. Never apply higher pressures than allowed Ps to the compressor. If the pressure / tightness test of the connected piping system requires higher pressures, the compressor shut-off valves must remain closed during the test. It is legally allowed to test parts of the system separately.

5.2 System evacuation

Before commissioning, remove the holding charge then evacuate with a vacuum pump. Proper evacuation reduces residual moisture to 50 ppm. The installation of adequately sized access valves at the furthest point from the compressor in the suction and liquid lines is advisable. To achieve undisturbed operation the compressor valves are closed and the system is evacuated down to 0.3 mbar / 0.225 Torr. Pressure must be measured using a vacuum pressure (Torr) gauge on the access valves and not on the vacuum pump; this serves to avoid incorrect measurements resulting from the pressure gradient along the connecting lines to the pump. Then the compressor must be evacuated.

Due to the factory holding charge of dry air the compressor is under pressure (about 1 to 2.5 bar); this is to indicate that the compressor does not leak.

When removing plugs from the compressor in order to connect a pressure gauge or to fill in oil, the plug may pop out under pressure and oil can spurt out.

5.3 Preliminary checks – Pre-starting

Discuss details of the installation with the installer. If possible, obtain drawings, wiring diagrams, etc. It is ideal to use a check-list but always check the following:

- Visual check of the electrics, wiring, fuses etc.
- Visual check of the plant for leaks, loose fittings such as TXV bulbs etc.
- Compressor oil level
- Calibration of HP & LP switches and any pressure actuated valves
- Check setting and operation of all safety features and protection devices
- All valves in the correct running position
- Pressure and compound gauges fitted
- Compressor pre-charged with refrigerant
- Compressor electrical isolator location & position

5.4 Charging procedure

CAUTION
Low suction pressure operation! Compressor Damage! Do not operate with a restricted suction. Do not operate with the low-pressure cut-out bridged. Do not operate compressor without enough system charge to maintain at least 6 bar absolute suction pressure. Allowing the absolute pressure to drop below 6 bar for more than a few seconds might cause CO_2 solidification which would block valves or pipes.

CAUTION
Low moisture content! Corrosive impact on refrigeration system! Use only high-dried CO_2 quality.

Charge the system with vapour CO_2 up to a minimum absolute pressure of 6 bar to prevent dry ice formation. Then continue charging with liquid CO_2. The system should be charged through the liquid-receiver shut-off valve or through a valve in the liquid line. The use of a filter drier in the charging line is highly recommended.

As there may be several valves in the system it is recommended to charge on both the high and low sides simultaneously to ensure a sufficient pressure is present in the compressor before it runs. The majority of the charge should be placed in the high side of the system to prevent bearing washout during first-time start.

5.5 Initial start-up

CAUTION
Oil dilution! Bearing malfunction! It is important to ensure that new compressors are not subjected to liquid abuse. Turn the crankcase heater on 12 hours before starting the compressor.

CAUTION
High discharge pressure operation! Compressor damage! Do not use compressors to test opening set point of high-pressure cut-out.

The compressor must be equipped according to our technical documentation considering the application intended. Make sure this requirement is met before start-up.

For brazing connections where dissimilar or ferric metals are joined a silver alloy rod with a minimum silver content of 34% shall be used being either flux-coated or with a separate flux.

Bolt torque settings are listed in **Appendix 2**.

With the exception of rubber-coated metallic gaskets (Wolverine) all gaskets should be oiled before fitting. O-rings should also be oiled.

NOTE: **A compressor should never be operated beyond its approved application range! Check by consulting the appropriate data sheet. To avoid motor damage the compressor MUST NOT be started, nor may high-potential testing be carried out under vacuum.**

5.6 Minimum run time

Emerson Climate Technologies recommends a maximum of 10 starts per hour. The most critical consideration is the minimum run time required to return oil to the compressor after start-up.

5.7 Recommended inverter range

Stream compressors are released for inverter applications from Control Techniques or other brands available on the market.

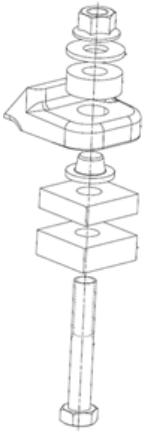
Application	Family	Type	Nominal power	Displacement @ 50Hz	Approved frequency range [Hz]	Recommended mounting parts	Exploded view # 3189744
Subcritical	S	4MSL-03_	3HP	4,60	Planned early 2016	Hard rubber # 3189744	
		4MSL-04_	4HP	6.20			
		4MSL-06_	6HP	7.40			
	M	4MSL-08_	8HP	9.54	25 - 70	Hard rubber # 3189744	
		4MSL-12_	12HP	12.50			
		4MSL-15_	15HP	17.90			
Transcritical	S	4MTL-05_	5HP	4.60	25 - 60 Preliminary	Hard rubber # 3189744	
		4MTL-07_	7HP	6.20			
		4MTL-09_	9HP	7.40			
	M	4MTL-12_	12HP	9.54	25 - 70	Hard rubber # 3189744	
		4MTL-15_	15HP	12.50			
		4MTL-30_	30HP	17.90			

Table 11: Inverter operation - Released frequencies

5.8 Recommendations for use with an inverter

Running the Stream CO_2 compressor with an inverter is a reliable application. Resonances might occur in the lower frequency ranges. This phenomenon strongly depends on the system design and operating conditions.

Emerson Climate Technologies performed extensive tests to investigate compressor behaviour in terms of resonances. The testing indicates that the following hardware variables have a significant impact on possible resonances:

- **Mounting parts:** The rubber mounting parts supplied with Stream compressors are suitable for the whole frequency range from 25 to 70 Hz.
- **Piping design:** It is recommended to pay particular attention to the discharge line design. A discharge pipe parallel to the compressor axis normally gives a positive effect to reduce resonances at low frequencies.
- **Base frame design:** The framework structure should be stiff enough to ensure that its resonance frequencies are above the maximum 70 Hz frequency. A design with natural frequencies below the minimum 25 Hz speed may lead to high vibrations during start-up.
- Performance data and envelopes are published in Copeland brand products Select software at www.emersonclimate.eu.

6 Maintenance & repair

6.1 Exchanging the refrigerant

4MTL and 4MSL compressors are released only for use with CO_2 refrigerant.

The replacement of CO_2 with any other refrigerant is not allowed.

In the event that the refrigerant needs replacing, the CO_2 charge does not need to be recovered and can be blown off into the environment. Ensure that no oil is blown off (use filter drier). It is essential to ensure a good ventilation or evacuation of the CO_2 refrigerant to avoid a risk of suffocation.

6.2 Replacing a compressor

CAUTION
Inadequate lubrication! Bearing destruction! Exchange the accumulator after replacing a compressor with a burned out motor. The accumulator oil return orifice or screen may be plugged with debris or may become plugged. This will result in starvation of oil to the new compressor and a second failure.

In the case of a motor burnout, the majority of contaminated oil will be removed with the compressor. The rest of the oil is cleaned through the use of suction and liquid line filter driers. A 100% activated alumina suction line filter drier is recommended but must be removed after 72 hours. **It is highly recommended that the suction accumulator be replaced if the system contains one.** This is because the accumulator oil-return orifice or screen may be plugged with debris or may become plugged shortly after a compressor failure. This will result in starvation of oil to the replacement compressor and a second failure. When a single compressor or tandem is exchanged in the field, it is possible that a major portion of the oil may still be in the system. While this may not affect the reliability of the replacement compressor, the extra oil will add to rotor drag and increase power usage.

6.3 Lubrication and oil removal

CAUTION
Chemical reaction! Compressor destruction! Do not mix up ester oils with mineral oil and/or alkyl benzene.

The compressor is supplied with an initial oil charge. The standard oil charge for use with R744 refrigerant is a polyolester (POE) lubricant Emkarate RL 68 HB.

One disadvantage of POE is that it is far more hygroscopic than mineral oil (see **Figure 29**). Only brief exposure to ambient air is needed for POE to absorb sufficient moisture to make it unacceptable for use in a refrigeration system. Since POE holds moisture more readily than mineral oil it is more difficult to remove it through the use of vacuum. Compressors supplied by Emerson Climate Technologies contain oil with low moisture content, and it may rise during the system assembling process. Therefore it is recommended that a properly sized filter-drier is installed in all POE systems. This will maintain the moisture level in the oil to less than 50 ppm. If oil is charged into a system, it is recommended to use POE with moisture content no higher than 50 ppm.

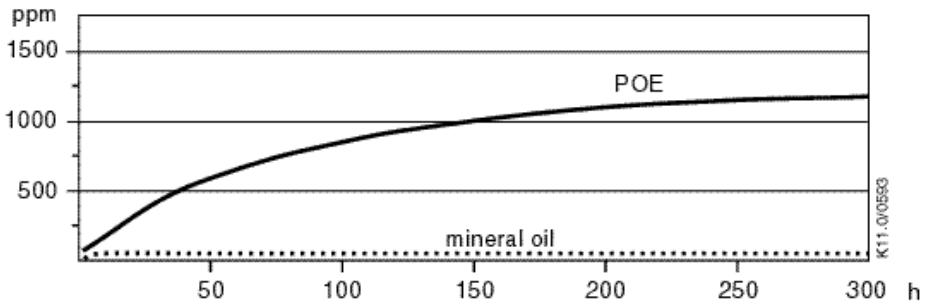


Figure 29: Absorption of moisture in ester oil in comparison to mineral oil in ppm by weight at 25°C and 50% relative humidity (h=hours)

The diagram in **Figure 29** compares the hygroscopic characteristics of POE oil with mineral oil (moisture absorption in PPM at 25°C and 50% relative humidity). If the moisture content of the oil in a refrigeration system reaches unacceptably high levels, corrosion and copper plating may occur. The system should be evacuated down to an absolute pressure of 0.3 mbar or lower.

If there is uncertainty as to the moisture content in the system, an oil sample should be taken and tested for moisture. Sight glass/moisture indicators currently available can be used with the natural refrigerants and lubricants. However, the moisture indicator will just show the moisture content of the refrigerant. The actual moisture level of POE would be higher than what the sight glass indicates. This is due to the high hygroscopicity of the POE oil. To determine the actual moisture content of the lubricant, samples have to be taken from the system and analysed. The plug (1/4"-18 NPTF) that should be used for oil removal is shown in **Figure 30** below:

Figure 30: Oil removal plug position

6.4 Oil additives

Although Emerson Climate Technologies cannot comment on any specific product, from our own testing and past experience, we do not recommend the use of any additive to reduce compressor bearing losses or for any other purpose. Furthermore, the long-term chemical stability of any additive in the presence of refrigerant, low and high temperatures, and materials commonly found in refrigeration systems is complex and difficult to evaluate without rigorously controlled chemical laboratory testing. The use of additives without adequate testing may result in malfunction or premature failure of components in the system and, in specific cases, in voiding the warranty on the component.

6.5 Unbrazing system components

WARNING
Explosive flame! Burning! Oil-refrigerant mixtures are highly flammable. Remove all refrigerant before opening the system. Avoid working with an unshielded flame in a refrigerant charged system.

Before opening up a system it is important to remove all refrigerant from both the high and low sides of the system. If a brazing torch is then applied to the low side while the low side shell and suction line contain pressure, the pressurized refrigerant and oil mixture could ignite when it escapes and contacts the brazing flame. To prevent this occurrence, it is important to check both the high and low sides with manifold gauges before unbrazing. Instructions should be provided in appropriate product literature and assembly (line repair) areas. If compressor removal is required, the compressor should be cut out of system rather than unbrazed.

7 Dismantling & disposal

Removing oil and refrigerant:
Do not disperse in the environment.
Use the correct equipment and method of removal.
Dispose of oil and refrigerant properly.
Dispose of compressor properly.

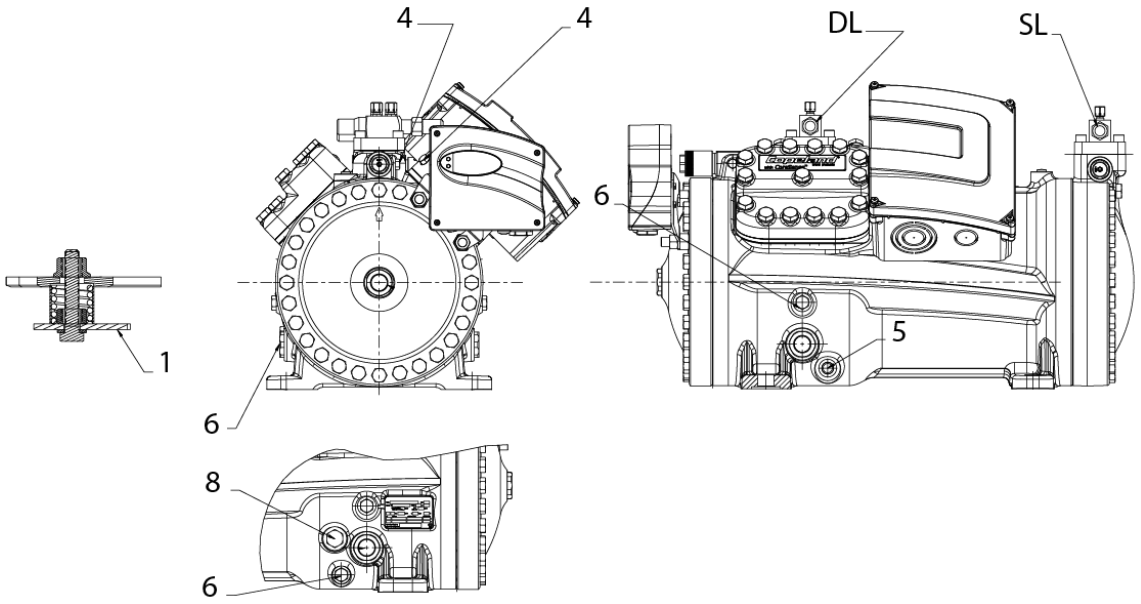
Appendix 1: Stream compressor connections

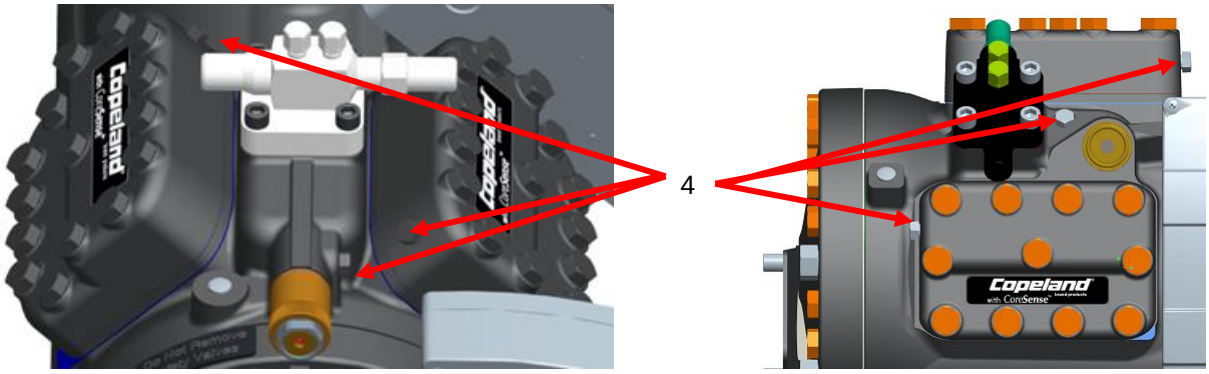
4MTL

4MTL-05X	4MTL-07X	4MTL-09X
4MTL-12X	4MTL-15X	4MTL-30X

4MSL

4MSL-03X	4MSL-04X	4MSL-06X
4MSL-08X	4MSL-12X	4MSL-15X

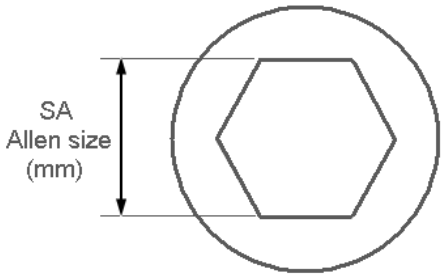


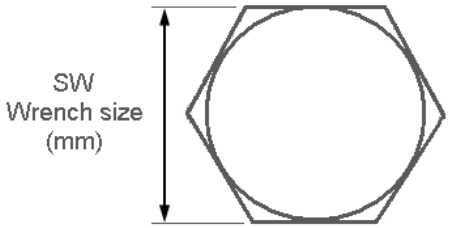


SL	Suction line size (sweat) 4MSL-03_, 4MSL-04_, 4MSL-06_ 4MTL-05_, 4MTL-07_, 4MTL-09_	ID 5/8" OD 22 mm	DL	Discharge line size (sweat) 4MSL-03_, 4MSL-04_, 4MSL-06_ 4MTL-05_, 4MTL-07_, 4MTL-09_	ID 7/8" OD 30 mm
SL	Suction line size (sweat) 4MSL-08_, 4MSL-12_, 4MSL-15_ 4MTL-12_, 4MTL-15_, 4MTL-30_	ID 1/2" OD 17.2 mm	DL	Discharge line size (sweat) 4MSL-08_, 4MSL-12_, 4MSL-15_ 4MTL-12_, 4MTL-15_, 4MTL-30_	ID 5/8" OD 22 mm
1	Base mountings	Ø 22 mm	4	Plug high pressure connection	1/8" 27 NPTF
5	Crankcase heater	1/2" 14 NPTF	6	Plug low pressure connection / Oil removal plug	1/4" 18 NPTF
8	Plug low pressure connection	1/2" 14 NPTF			

Appendix 2: Tightening torques in Nm

Suction shut-off valve screws	3/8"-16 UNC 36 - 44 Nm SA 8 mm	Discharge shut-off valve screws	3/8"-16 UNC 36 - 44 Nm SA 8 mm
Shut-off valve cap (spindle)	3/4"-16 UNF 4 - 5 Nm	Shut-off valve pressure cap	7/16"-20 UNF 24 - 35 Nm
Stator cover	1/2"-13 UNC 119 - 159 Nm SW 19	Housing cover	1/2"-13 UNC 119 - 159 Nm SW 19
Safety valve LP side	M24 X 1.5 90 - 110 Nm SW 24	Safety valve HP side	M24 X 1.5 90 - 110 Nm SW 24
Oil sight glass	1 1/8"-18 UNEF 50 - 60 Nm SW 35	Oil drain plug	1/4"-18 NPTF 30 - 40 Nm
Cylinder head	1/2"-13 UNC 102 - 138 Nm SW 19	Head temperature sensor	1/8"-27 NPTF 30 - 35 Nm
Terminal studs	M5 8.5 - 9.6 Nm SW 8	Terminal plate mounting screws	3/8"-16 UNC 36 - 44 Nm SA 3/16"
Plug for pressure relief valve	M24 X 1.5 90 - 110 Nm SW 22		





The ranges of torque values given in this specification are assembly torques. Torque after joint relaxation must be within 15% of the minimum assembly torque unless re-torque is called for and must not be above 10% of the maximum assembly torque.

Disclaimer

1. The contents of this publication are presented for informational purposes only and are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability.
2. Emerson Climate Technologies GmbH and/or its affiliates (collectively "Emerson"), as applicable, reserve the right to modify the design or specifications of such products at any time without notice.
3. Emerson does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Emerson product remains solely with the purchaser or end user.
4. Emerson does not assume responsibility for possible typographic errors contained in this publication.

BENELUX
Josephinastraat 19
NL-6462 EL Kerkrade
Tel. +31 77 324 02 34
Fax +31 77 324 02 35
benelux.sales@emerson.com

UK & IRELAND
Unit 17, Theale Lakes Business Park
Reading, Berkshire RG7 4GB
Tel: +44 1189 83 80 00
Fax: +44 1189 83 80 01
uk.sales@emerson.com

BALKAN
Selska cesta 93
HR-10 000 Zagreb
Tel. +385 1 560 38 75
Fax +385 1 560 38 79
balkan.sales@emerson.com

GERMANY, AUSTRIA & SWITZERLAND
Senefelder Str. 3
DE-63477 Maintal
Tel. +49 6109 605 90
Fax +49 6109 60 59 40
ECTGermany.sales@emerson.com

SWEDEN, DENMARK, NORWAY & FINLAND
Norra Koxåsvägen 7
SW-443 38 Lerum
Tel. +46 725 386486

nordic.sales@emerson.com

ROMANIA

Tel. +40 374 13 23 50
Fax +40 374 13 28 11
Ancuta.Ionescu@Emerson.com

FRANCE, GREECE & MAGHREB
8, Allée du Moulin Berger
FR-69134 Ecully Cédex
Tel. +33 4 78 66 85 70
Fax +33 4 78 66 85 71
mediterranean.sales@emerson.com

EASTERN EUROPE & TURKEY
Pascalstr. 65
DE-52076 Aachen
Tel. +49 2408 929 0
Fax +49 2408 929 525
easterneurope.sales@emerson.com

ASIA PACIFIC
Suite 2503-8, 25/F, Exchange Tower
33 Wang Chiu Road, Kowloon Bay
Kowloon, Hong Kong
Tel. +852 2866 3108
Fax +852 2520 6227

ITALY
Via Ramazzotti, 26
IT-21047 Saronno (VA)
Tel. +39 02 96 17 81
Fax +39 02 96 17 88 88
italy.sales@emerson.com

POLAND
Szturmowa 2
PL-02678 Warsaw
Tel. +48 22 458 92 05
Fax +48 22 458 92 55
poland.sales@emerson.com

MIDDLE EAST & AFRICA
PO Box 26382
Jebel Ali Free Zone - South, Dubai - UAE
Tel. +971 4 811 81 00
Fax +971 4 886 54 65
mea.sales@emerson.com

SPAIN & PORTUGAL
C/ LLull, 321 (Edifici CINC)
ES-08019 Barcelona
Tel. +34 93 412 37 52
Fax +34 93 412 42 15
iberica.sales@emerson.com

RUSSIA & CIS
Emerson LLC
Dubininskaya str. 53, build. 5, 4th floor
115054 Moscow, Russia
Phone: +7 (495) 995 95 59
Fax: +7 (495) 424 88 50

C6.3.3/1212-0116/E

For more details, see www.emersonclimate.eu

Connect with us: facebook.com/EmersonClimateEurope

Emerson Climate Technologies - European Headquarters - Pascalstrasse 65 - 52076 Aachen, Germany
Tel. +49 (0) 2408 929 0 - Fax: +49 (0) 2408 929 570 - Internet: www.emersonclimate.eu

EMERSON
Climate Technologies

EMERSON. CONSIDER IT SOLVED.™