APPLICATION GUIDELINES

Copeland semi-hermetic condensing units

COPELAND

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1. Introduction

This guideline deals with air-cooled condensing units equipped with semi-hermetic reciprocating compressors. The selection of the units can be done with the help of the product catalogues and/or the Copeland Selection Software (Select). The software is available for download at www.copeland.com/mea under the 'Quick Links for Tools' header, tagged as Product Selection software (Europe Products).

2. Safety Information

- Refrigerating condensing units must be employed only for their intended use.
- Approved refrigerants and refrigerant oils may only be used.
- Do not start the unit until it is charged with refrigerant.
- Correctly used, the compressor and the pressure line piping may reach temperatures that may cause burning if touched.

- In case of leak of refrigerant avoid eye contact.
- If the refrigerant needs to be removed from the system, do not disperse into the environment, use specific recovery equipment.
- For storage, use original packaging and avoid collisions and tilting.

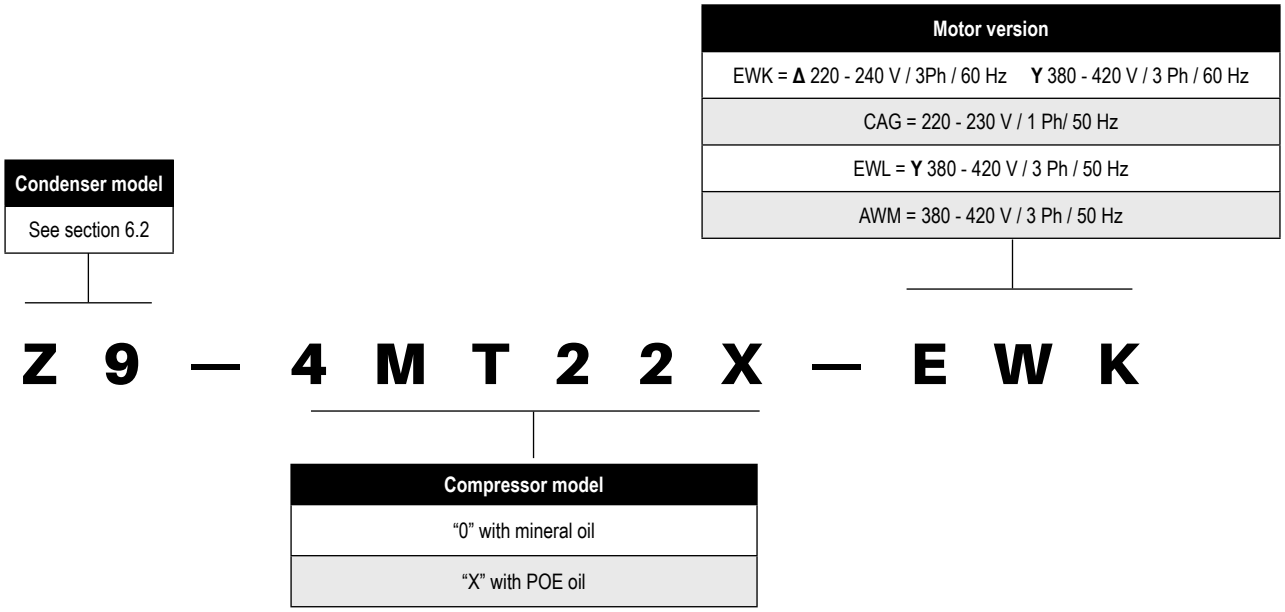
- Trained electrical personnel must connect the unit and its accessories.
- All valid standards for connecting electrical and refrigeration equipment must be observed.
- Limit values for the supply voltage of the unit may not be exceeded.

Only qualified personnel should install and intervene on Copeland condensing units. The compressor and the tubing can reach temperatures high enough to induce burns.

It is not allowed to run a test without the compressor being connected to the system and without refrigerant.

It is of vital importance that the discharge stop valve has been fully opened before the compressor is started. If the discharge stop valve is closed or partly closed an unacceptable pressure with accordingly high temperatures may develop in the cylinder head. When operating with air the so-called Diesel effect may occur, i.e. the air sucked in is mixed with oil gas and can explode due to the high temperature in the cylinder head, and thereby destroy the compressor.

3. Nomenclature



4. Delivery

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

Standard scope of delivery

- Compressor
- Condenser
- Single phase condenser fans
- Receiver with rotalock valve
- Pipe connections
- LP/HP pressure switch
- Differential oil pressure switch when required
- Terminal connection box for fans and LP/HP pressure switch
- Neutral gas holding charge

5. Packaging and transport

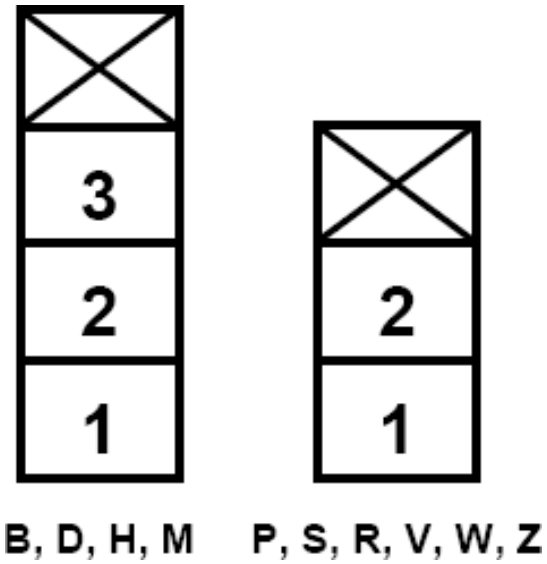
Condensing units are packed on a baseboard and a carton fitted over. Accessories are mounted. B8 to zg and W99-6T (2-stage) units are supplied as a single piece.

W99 condensing units with 4 and 6 S, D and M compressors are delivered in 2 pieces. One box contains the condenser and associated mounting frame while the other box contains the compressor/ horizontal receiver assembly.

In the unlikely event that the packaging box is damaged, inspect the condenser for possible damage.

Condensing units should only be moved with the appropriate rigging equipment. In order to avoid damage, the condensing unit should not be lifted by the compressor service valves, the tubing or other accessories.

Condensing units starting with letters B, D, H or M can be stacked three high. Other condensing units can be stacked two high. It is recommended to keep the unit packaged until final installation. The condensing unit, when boxed, can be handled by forklift or pallet truck. The condensing unit without packaging must be handled by a forklift truck or similar.



6. Standard Delivery

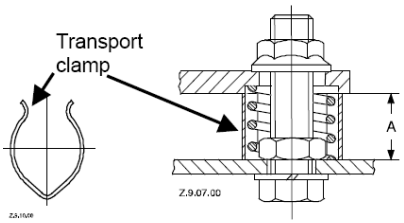
6.1 Compressor

Single phase compressors are equipped with starting equipment (start capacitor, run capacitor and a relay).
Semi-hermetic compressors are equipped with motor protection:

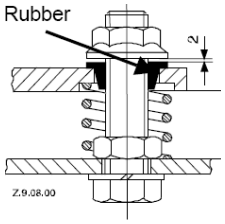
- Klixon over-current thermal protection for single phase, K compressors
- Kriwan thermistor protection module for three phase K,L,2,3,4,6 S/D compressors
- Coresense diagnostics for 4M and 6M compressors

K and L compressors with mineral oil, are lubricated by a splasher, while the POE model incorporates an internal oil pump (designated by Pin the compressor nomenclature) that does not need an oil pressure switch. All other compressors are lubricated by an external oil pump and are equipped with a compact, electronic oil pressure safety switch. Compressor models 2, 3, 4 and 6 S/D are fitted with an OPS2 switch. 4M and 6M compressor models use a dedicated oil pressure safety switch incorporated with the coresense diagnostic module.

Each compressor is delivered with four colored mounting springs that are already installed between the feet and the condensing unit base plate. These are clamped to avoid transport damage. It is necessary to remove the transportation clamps and to adjust the mounting spring height before starting up the condensing unit. The adjustment is described on the right.



Transport position



Operational position

Compressor		Size A	Size B	Spring color	
		mm	mm	Motor end	Compressor end
KM, KJ, KSJ	7X.10X	22	25	2 x Blue	2 x Maroon
KSJ,KL,KSL	15X.20X			2 x Maroon	2 x Green
LE, LF, LJ	20X	30	35	2 x Blue	2 x Blue
LF, LJ, LL	30X				
LL, LSG	40X		44	2 x Maroon	2 x Maroon
LHA					
2S					
2DC, 20D, 2DL, 2DB,3DA,3SA			35		
3DC,3SC	75X				
3DC,3DS,3SC,3SS	100X				2 x White
3DS,3SS,4DL,4SL	150X	34	44	2 x Yellow	2 x Green
4DA,4SA					
4DH,4DJ,4DT,6DL,4SH,4SJ,4ST,6SL				2 x Black	
6TA,6TH					
6DH,6SH				2 x Blue	
6TJ					2 x Red
6DJ,6DT,6SJ,6ST		48			
4M,6M		34		2 X Violet	2 x Orange

Further technical information can be found in the following application guidelines:
Discus, K, L and S series semi-hermetic compressors D6.3.4/0412-0912//E
Discus III4M/6M semi-hermetic compressors C6.3.1/0312-0712/E

6.2 Condenser

6.4The condensers are constructed with copper tubes and aluminium fins, steel-sheet housing with a fan opening. The main characteristics of the condensers are shown below:

Condenser designation	Rows	Tubes	Finned length	Finned height	Fin spacing	Number of fans	Fan model	Fan diameter
B8	3	14	430	350	2.1	1	71	300
D8	4	16	430	400	2.1	1	121	350
H8	3	19	625	475	2.1	1	271	420
M8	5	26	625	650	2.1	1	271	420
M9	5	26	625	650	2.1	1	611	500
P8	4	23	820	575	2.1	2	121	350
R7	3	23	1000	575	2.1	2	271	420
S9	4	26	1000	650	2.1	2	271	420
V9	4	31	1200	775	2.1	2	271	420
V6	5	31	1200	775	2.1	2	611	500
W9	5	33	1500	825	2.1	2	611	500
Z9	5	48	1500	1200	2.1	4	611	500

W99 = 2 X W9

6.3 Condenser fan(s)

Condensing units are equipped with 1, 2 or 4 single phase fans and dual rated for 50 and 60 Hz operation. The complete fan is made of an external rotor motor with the fan blades permanently fixed to the rotor. The fan guard has 4 mounting feet. The fan is positioned in order to blow the air from the condenser to the compressor. The fan motors are thermally protected by a thermostatic switch. A single pole bimetallic element protects the motor against motor overload, excess voltage and inadequate cooling. On start up, check the rotational direction of the fan. The fan must blow from the condenser to the compressor.

Fan motor code	Fan diameter	Voltage V (± 10 %) / Ph	Run capacitor µF/ V	Power input (50Hz/60Hz) W	Motor current (50Hz/60Hz) A
71	300	230V/1Ph	2.5 / 450	85 / 105	0.38 / 0.45
121	350	230V / 1Ph	4 / 450	110 / 145	0.45 / 0.65
271	420	230V/1Ph	7 I 400	280 / 350	1.25 / 1.68
611	500	230V/1Ph	10 / 450	570 / 730	2.48 / 3.20

Protection class IP54F
Insulation class F

6.4 Liquid receiver

Copeland condensing units are equipped with CE labeled liquid receivers. The receivers are equipped with:

- rotalock service valve on top of the receiver for the liquid outlet line
  - 1/2 "for 3.25,3.89, 7.85 l
  - 5/8 " for 11.7 l
  - 3/4 "for 15.8 l
  - 7/8 "for 18.9, 23.5 and 47.9 l
- plugged 3/8" - 14 NPTF connection, for relief valve
- sight glass, mounted on receivers 11.7 land larger for max liquid level

The fitting of a pressure relief device according to standard EN 378-2 or equivalent country specific standard is the responsibility of the installer. It is recommended to charge the system with refrigerant via the rotalock service valve.

6.5 Safety pressure switch

Copeland semi hermetic condensing units are supplied with a dual HP/ LP, auto reset, safety switch. Pressure switches are used for control or protective functions. Examples of control functions are compressor cycling, pump down or defrost control. Protection functions include, pressure limiting and cutout against excessive pressures, against loss of charge or for freeze protection. The control is equipped with a display scale and pointers to indicate the approximate settings. The display scales are printed in relative pressure units "bar" and "psi". External gauges must be used for precise setting of the control.

Characteristics

- Combined pressure limiter for low / high pressure protection
- Adjustable settings
  - Set-point adjustment range: LP(left) = -0.3 to 7 bar, HP(right) = 6 to 31 bar
  - Differential adjustment range: LP= 1 to 5 bar, HP fixed
  - Factory setting: LP = 3.4 / 4.5 bar, HP = 20 bar
- Electrical contacts
  - 2 x SPDT contacts
  - Motor rating (FLA): 12A / 240V AC
  - Locked Rotor (LRA): 72A / 240V AC
- Environmental conditions
  - Dust and water protection EN60529 / IEC529 : IP44
- Approvals
  - EN12263
  - UL873 file number E85974
  - CE low voltage directive
- Pressure connector
  - 7/16"-20 UNF male (1/4" SAE male flare)

6.6 Oil pressure switch

As indicated in section 6.1, compressors with an external oil pump are equipped with oil pressure safety. The safety device monitors the oil pressure differential, protecting the compressor against damage, if the differential is too low. A brass mechanical sensor is screwed directly into the housing of the oil pump. Internal channels link the sensor to the inlet and outlet ports of the oil pump.

Depending on the compressor model, an OPS2 or the integrated coresense diagnostic module will provide the electronic protection.

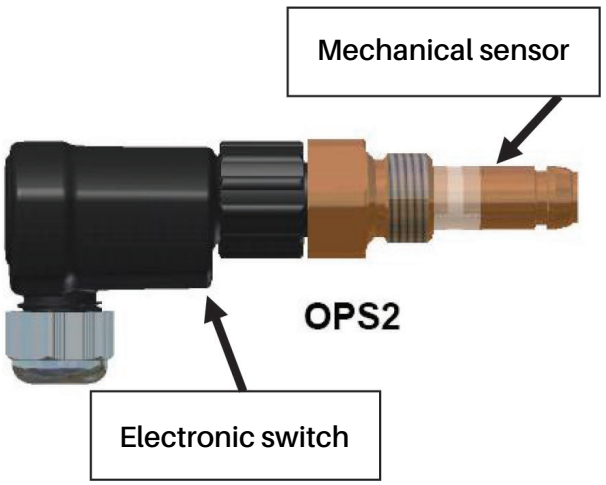
OPS2

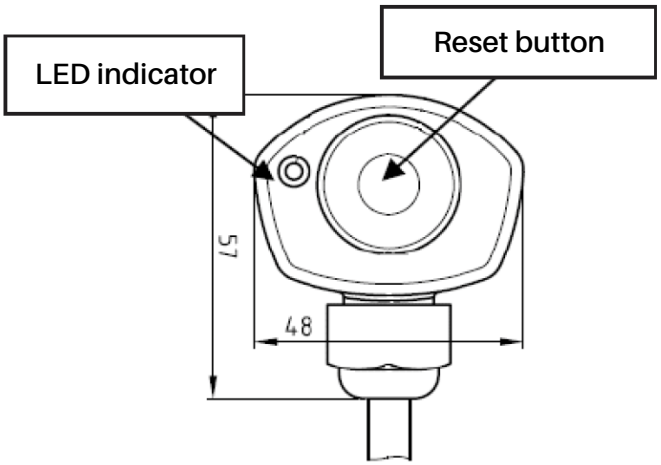
The black electronic switch is screwed onto the brass mechanical sensor. The OPS2 is activated by the running signal of the compressor contactor. The differential pressure monitoring will only start when the running recognition signal, D1, is present.

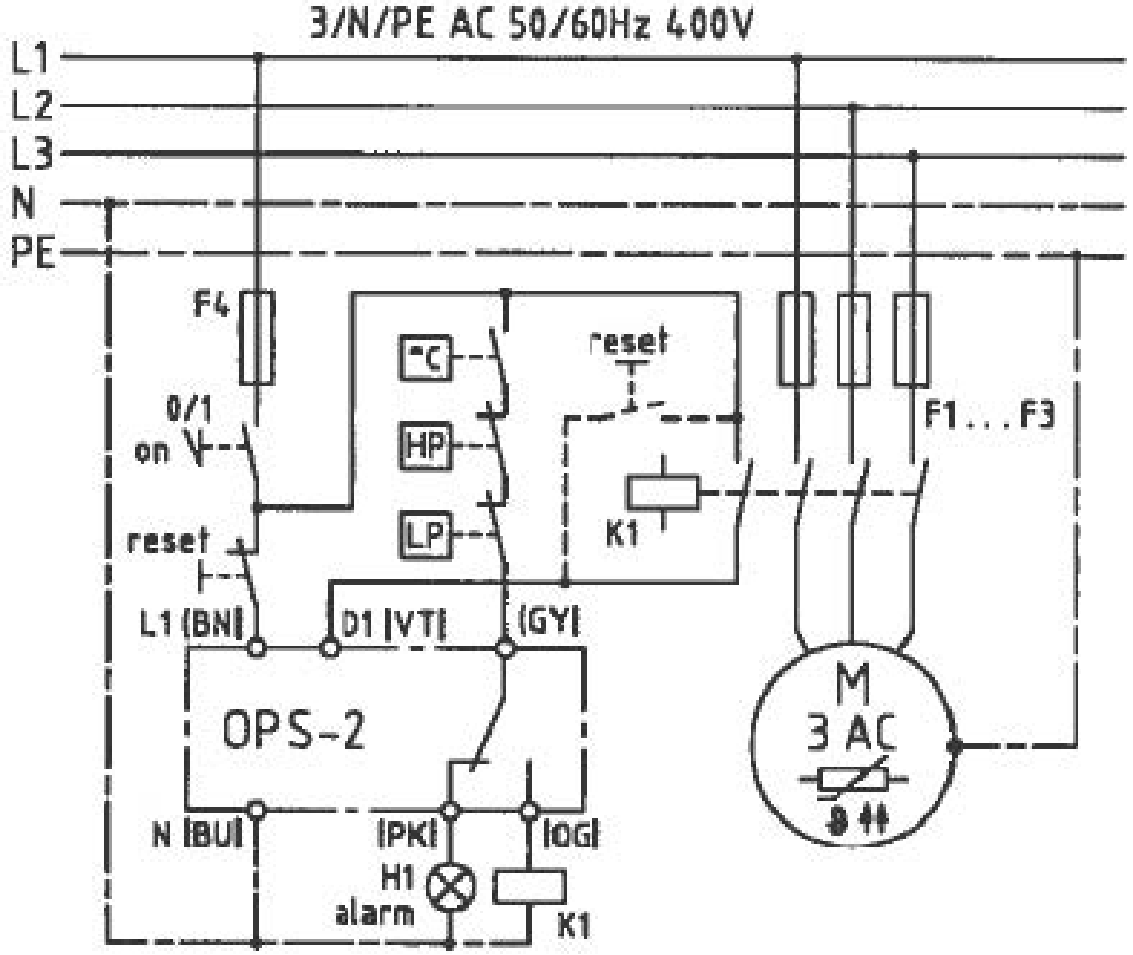
If a failure (i.e. incorrect mounting) registers for more than 5s, the relay will trip and lockout.

If the oil pressure differential drops below a preset value for longer than the 120s, fixed time delay, then the output contact of the switch will open to stop the compressor. Repeated shorter periods of insufficient oil pressure are also recognized and will shut off the compressor after an appropriate time delay. A manual reset is required to restart the compressor. The relay will switch to running mode after a 120s delay.

Power supply	115-230V AC, -15%..+10%, 3VA 50/60 Hz
Ambient temperature range	-30...+70°C
Restart relay after tripping	120 sec ± 5 sec
Start up delay	3 sec± 1 sec
Differential pressure	0.95 ± 0.15 bar
Connection cables	6 x AWG18 (0.75 mm2), L=1m color coded
Maximum Pressure	30 bar
Refrigerant compatibility	Yes (Brass)
Protection class according to EN60529	IP54
Reset	Manual
LED status : 2 x flashes at start up	Software version
LED status : 1 x flash after 2 x flashes above	Standby function
LED status : Continuous red light	No differential pressure
LED status : 10 Hz flashing - 10 times per second	Malfunction – internal malfunction – internal power supply too low – switch not mounted correctly into sensor – running signal on, but relay out
Led status : 1 Hz flashing - 1 time per second	Restart delay
LED status : LED off	Correct operation

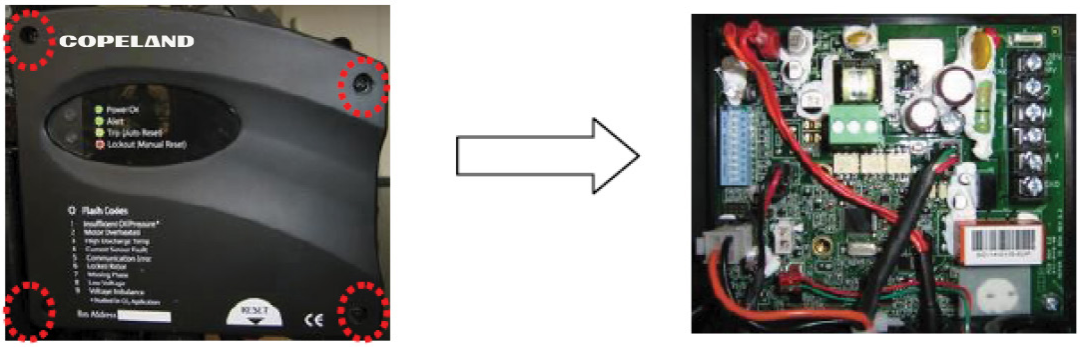

Mechanical sensor
OPS2
Electronic switch


LED indicator
Reset button
57
48


3/N/PE AC 50/60Hz 400V
L1
L2
L3
N
PE
F4
°C
HP
LP
reset
0/1
on
reset
K1
F1...F3
L1 (BN)
D1 (VT)
(GY)
OPS-2
M
3 AC
N (BU)
(PK)
(OG)
H1
alarm
K1

6.7 Coresense diagnostics

1. Remove coresense front module cover by unscrewing 4 screws in the corners.

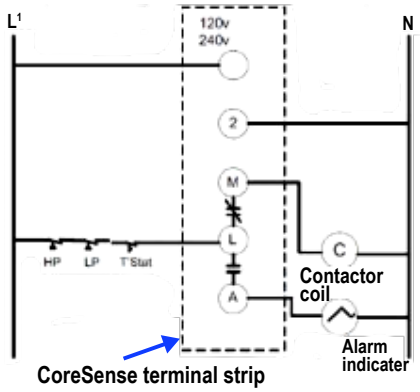


2. Verify DIP-switch settings.

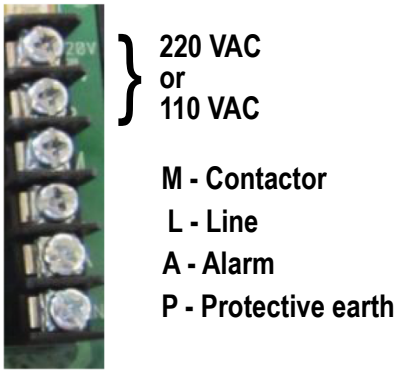
Dip-switch	DIP-switch meaning	Default	Comment
1	Node address	On	Change it only if communication with pack controller is used
2	Node address	Off	Change it only if communication with pack controller is used
3	Node address	Off	Change it only if communication with pack controller is used
4	Node address	Off	Change it only if communication with pack controller is used
5	Node address	Off	Change it only if communication with pack controller is used
6	Enable frequency inverter	Off	Change it only if frequency inverter is used (On: Frequency inverter is enabled)
7	Communication Baud rate	Off	Change it only if communication with pack controller is used (Off: 19200; On: 9600)
8	Communication parity	Off	Change it only if communication with pack controller is used (off: no parity; on: even parity)
9	Communication with pack controller or service laptop	Off	Change it only if communication with pack controller or service laptop is used (off: stand-alone mode; on: communication mode)
10	DLT probe	F/S	Default on - factory set off for compressor with demand cooling module

3. Check the jumper settings (only if communication with pack controller is used). Please refer to label inside the module or guidelines for more details.

4. Supply 110/220 VAC power to the front module. Make wiring to contactor, line, alarm and protective earth (grounding). For cables use the opening at the bottom right of the module.



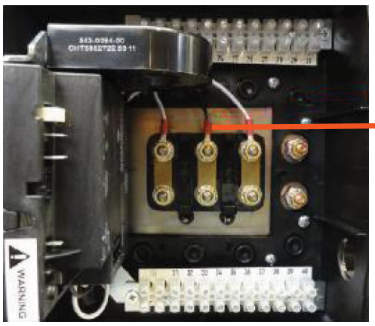
Sensor module wiring diagram



CoreSense terminal strip

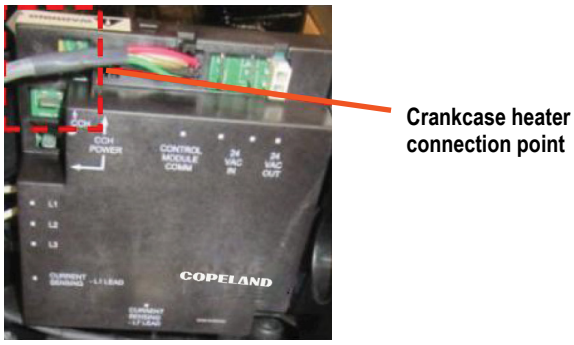
5. In case of direct-start connection, L2 power supply lead; in case of part winding connection, L2 and L8 power leads from the customer should go through the current sensor opening in the same direction.

6. Make sure that the black lead from the sensor module is always connected to terminal 2 (factory-installed). The black lead from the sensor module must always be connected to that terminal off which the power supply cable is lead through current sensor.



7. Supply 24 VAC power to the sensor module. Any class II transformer with 24 VAC output can be used. The sensor module needs 3 VA power input. The transformer is factory fitted and wired (MEA production units only).

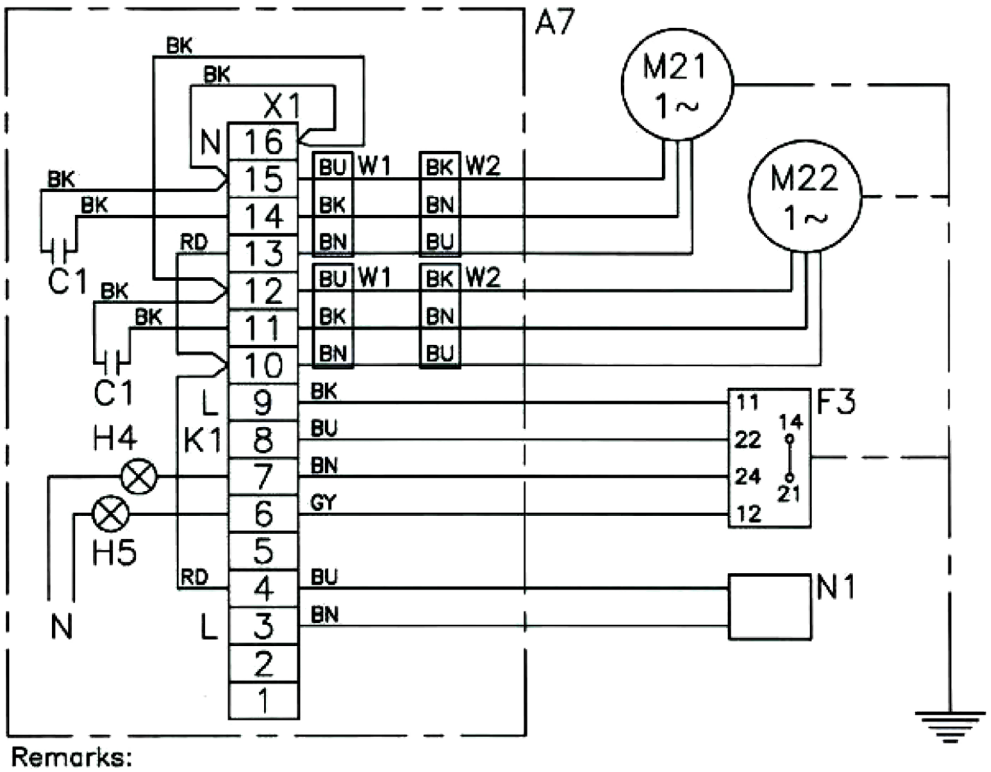
8. Connect the crankcase heater to the sensor module (optional). The sensor module has a relay to control the crankcase heater (only 120/240 VAC).



Further technical information on CoreSense Diagnostics can be found in application guideline D7.8.4/0112-0912/E.

7. Electrical Diagrams

Fans for Condensing unit with Semihermetic Compressor L–N. 220–240±10%V/1/50Hz	DU3–101S–00



Remarks:

A7 = Terminal box Condensing unit
C1 = Run capacitor M21/M22
F3 = Pressure control switch
H4 = Signal lamp F3 High discharge pressure (if fitted)
H5 = Signal lamp F3 Low suction pressure (if fitted)
K1 = Contactor M1
M21 = Fan motor/ condenser
M22 = Fan motor/ condenser
N1 = Speed control fan (if fitted)
X1 = Terminal block

W1 = Fan Wiring for:
71 Fan – PN 3124538
121 Fan– PN 3124549
271 Fan– PN 3124550
611 Fan– PN 3124561
271 Fan– PN 50137
611 Fan– PN 41503

W2 = Fan Wiring for:
71 Fan – PN 3152682
121 Fan– PN 3152693

Cable colours

WH = white
GY = grey
BK = black
BN = brown
BU = blue
RD = red
OG = orange
G/Y = green/yellow

8. Sound data

Sound data is given in our selection software: SELECT
Sound pressure values are published at a distance of 10 meters.

The sound pressure values measured in the field may differ slightly from the published value due to surrounding reverberating objects or walls.

9. Compliance

- The piping is in compliance with the Pressure Equipment Directive 97/23/EEC. (Art 3 Sound Engineering Practice)
- Components of the condensing unit carry a CE mark as far as required, and thereby establish conformity with the relevant directives.
- Conformity declarations for components are available.
- The units are in conformity with the low voltage directive. The applied harmonized standard is EN60335-1. (Safety household and similar electrical appliance, Part1: General requirements)
- To incorporate these products into a machine the Manufacturers declaration of incorporation has to be respected.

10. Protection class

Please find under the protection class of the different components of the unit.

- Compressors are IP54 according to IEC34
- OPS2 oil pressure safety switch is IP54 according to EN60529
- Condenser fan(s) are IP54 according to IEC34
- HP/LP safety pressure switch is IP44 according to IEC529 / EN60529
- CoreSense diagnostic module, IP54

11. Installation and service

The condensing unit should be located in such a place so as to prevent dirt, plastic bags, leaves or papers from covering the condenser and its fins. A clogged condenser will increase the saturated condensing temperature, thus reducing cooling capacity and may lead to high pressure switch tripping. Respect the published operating envelope of the condensing unit. In order to limit out of envelope start up pressures after standstill or defrost, a MOP expansion valve or a CPR/OPR valve is highly recommended. Compressor models supplied with Discharge Temperature Control (OTC) or Demand Cooling (DC) require a full bore of liquid to the expansion device for adequate compressor cooling. To ensure reliable operation with liquid injection, limit compressor superheat to a maximum value of 20K.

If top up oil is required in field installations, oil charging can be done via the appropriate ports with the following approved oils:

- Mineral oil: Suniso 3G
- POE oil: Emkarate RL 32 3MAF
  Mobil EAL Arctic 22 C

About Copeland

Copeland is a global leader in sustainable heating, cooling, refrigeration and industrial solutions. We help commercial, industrial, refrigeration and residential customers reduce their carbon emissions and improve energy efficiency. We address issues like climate change, growing populations, electricity demands and complex global supply chains with innovations that advance the energy transition, accelerate the adoption of climate friendly low GWP (Global Warming Potential) and natural refrigerants, and safeguard the world's most critical goods through an efficient and sustainable cold chain. We have over 18,000 employees, with feet on the ground in 50 countries - a global presence that makes it possible to serve customers wherever they are in the world and meet challenges with scale and speed. Our industry-leading brands and diversified portfolio deliver innovation and technology proven in over 200 million installations worldwide. Together, we create sustainable solutions that improve lives and protect the planet today and for future generations. For more information, visit copeland.com.

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