

A detailed, close-up photograph of the internal scroll compressor mechanism, showing the interlocking scrolls and various mechanical parts in a metallic finish. The image is partially obscured by a blue overlay on the right side of the page.

Copeland Scroll Condensing Units *for Outdoor Use*

Application Guidelines

APPLICATION GUIDELINES FOR OUTDOOR SCROLL CONDENSING UNITS

INDEX

Contents

Page

| | |
|--|----|
| Application Guidelines For Outdoor Scroll Condensing Units | 1 |
| 1 Introduction | 2 |
| 2 Safety Information | 2 |
| 3 Nomenclature | 2 |
| 4 Delivery | 3 |
| 4.1 Packaging | 3 |
| 4.2 Transport | 3 |
| 4.3 Standard delivery | 3 |
| 4.3.1 Compressor | 3 |
| 4.3.2 Sound Blanket | 4 |
| 4.3.3 Air condenser | 4 |
| 4.3.4 Fan | 5 |
| 4.3.5 Liquid receiver | 6 |
| 4.3.6 Automatic reset HP/LP pressure switch Alco PS2-W7A | 6 |
| 4.3.7 Liquid line equipment | 7 |
| 4.3.8 Pre-wired electrical panel | 7 |
| 4.4 Additional accessories | 8 |
| 4.4.1 Fan speed control | 8 |
| 4.4.2 Manual reset HP/LP pressure switch Alco PS2 B7A | 9 |
| 4.4.3 Oil separator : Alco OSH-405 | 9 |
| 5 Installation | 10 |
| 5.1 Location & fixing | 10 |
| 5.2 Refrigeration connections | 10 |
| 5.3 Electrical connection | 11 |
| 6 Electrical Diagrams | 11 |
| 6.1 Legend for the electrical diagrams | 11 |
| 6.2 Electrical diagram OM and OL Units compressor in 1 phase (PFJ) | 12 |
| 6.3 Electrical diagram OM and OL Units compressor in 3 phase (TFD) | 13 |
| 6.4 Electrical diagram OMQ and OLQ Units compressor in 1 phase (PFJ) | 14 |
| 6.5 Electrical diagram OMQ and OLQ Units compressor in 3 phase (TFD) | 15 |
| 7 Sound Data | 16 |
| 8 PED Compliance | 16 |
| 9 Protection class | 16 |
| 10 Installation and Service | 16 |

Application Guidelines for Outdoor Scroll Condensing Units

1 Introduction

Copeland has developed a new range of Copeland Scroll Condensing Units for outdoor use.

This range equipped with Copeland Scroll compressors is a new concept of the condensing unit that ensures quick installation, uses fully recyclable materials and has totally new design.

The selection of the units can be done thanks to the product catalogues and/or the Copeland Selection Software (Select).

2 Safety Information



- Refrigerating condensing units must be employed only for the use they are made for.
- Approved refrigerants and refrigerating 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 it in the environment, use specific equipment to collect the refrigerant.
- 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

The nameplate of the condensing units shows the mains characteristics of the units.

The compressor also has its own nameplate.

Each model is existing in 2 versions: normal version and "Low sound" version.

The medium temperature range features ZB Scroll compressors.

The low temperature range features ZF Scroll compressors.

The designation of the units includes the application range of the unit, the compressor capacity and the motor version:

OM-15-PFJ

1 2 3 4

OLQ-09-TFD

1 2 3 4

1 O = Outdoor unit

2 M = Medium temperature

MQ = Medium temperature Quiet version

L = Low temperature

LQ = Low temperature Quiet version

3 Compressor nominal capacity at certain operating conditions

4 Motor version PFJ = 220 – 240 V / 1Ph / 50 Hz

265 V / 1Ph / 60 Hz

TFD = 380 - 420 V / 3Ph / 50 Hz

460 V / 3Ph / 50 Hz



4 Delivery

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

Standard Scope of Delivery:

The units are provided with all necessary components:

- Weather housing made with an ultra-resistant synthetic resin material
- High efficiency condenser with fan.
- Liquid receiver with valve on outlet and relief valve connection.
- Combined and adjustable high and low pressure switch.
- Filter/drier, sight glass and solenoid valve in the liquid line.
- Pre-wired electrical panel with contactor, fuse, terminal blocks etc. and space for additional components
- Insulated copper suction and liquid line tubing extending outside the unit.
- Sound jacket on the OMQ and OLQ models.

All protection systems and electrical components are pre-installed inside the unit.
Components are easily accessible in a large pre-wired electrical panel.

Copper suction and liquid line connections extend outside the unit.

4.1 Packaging

If the packaging box is damaged, the condenser might be damaged.
Condensing units are individually packed on a baseboard and a carton is fitted over.
Accessories are mounted.

4.2 Transport

It is recommended to keep the unit packaged until final installation.
The unit, when boxed, must be handled by a fork lift or pallet truck.
The unit without the packaging must be handled by a fork lift truck or similar.

4.3 Standard delivery

4.3.1 Compressor

The units are equipped with Copeland refrigeration Scroll compressors which are able to operate with R404A, R507, R134a, R407C and R22 (see Compressors Product Selection Catalogue for Refrigeration Scroll compressors C2.2.4).

These compressors have the following equipment:

- Ester oil charge.
- Rotalock valves on suction and discharge side.
- Crankcase heater.
- Oil service valve.
- Oil sight glass.

Specific equipment for low temperature models (ZF):

- Discharge temperature thermostat
- Liquid injection system (DTC)

The compressor type is included in the outdoor unit designation (see following table).

| Unit | | Compressor |
|-----------|------------|---------------|
| OM-15-TFD | OMQ-15-TFD | ZB-15-TFD-551 |
| OM-21-PFJ | OMQ-21-PFJ | ZB-21-PFJ-551 |
| OM-21-TFD | OMQ-21-TFD | ZB-21-TFD-551 |
| OM-26-PFJ | OMQ-26-PFJ | ZB-26-PFJ-551 |
| OM-26-TFD | OMQ-26-TFD | ZB-26-TFD-551 |
| OM-30-TFD | OMQ-30-TFD | ZB-30-TFD-551 |
| OM-38-TFD | OMQ-38-TFD | ZB-38-TFD-551 |
| OM-45-TFD | OMQ-45-TFD | ZB-45-TFD-551 |

| Unit | | Compressor |
|-----------|------------|---------------|
| OL-09-TFD | OLQ-09-TFD | ZF-09-TFD-556 |
| OL-11-TFD | OLQ-11-TFD | ZF-11-TFD-556 |
| OL-13-TFD | OLQ-13-TFD | ZF-13-TFD-556 |
| OL-15-TFD | OLQ-15-TFD | ZF-15-TFD-556 |
| OL-18-TFD | OLQ-18-TFD | ZF-18-TFD-556 |

4.3.2 Sound Blanket

The OMQ and OLQ units include a compressor equipped with a sound jacket.

The sound jacket developed by Copeland Europe is designed for indoor use and has no impact with the performance of the compressor and is suitable for all scroll compressors.

The design consists of a top cap cover and compressor shell cover with adjustable Velcro system.

It also has good characteristics in case of fire and is resistant to:

- Mineral and Polyolester oil
- Refrigerants R22/R404A/R134a/R410A/R407C
- Temperature up to 150°C
- Water



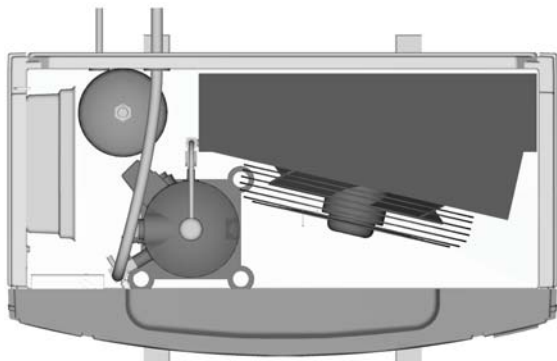
The sound jacket provides an attenuation of the compressor sound level by 5 to 7 dBA

4.3.3 Air condenser

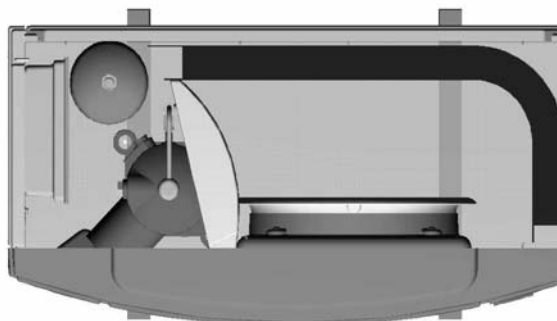
Condenser are using a modern technology with:

- "Rifle-bore" tubes
- L-shape on 6 HP models

Models with compressors up to 5 HP
OM 15 to OM38
OL 09 to OL15



Models with 6 HP compressors
OM 45
OL 18



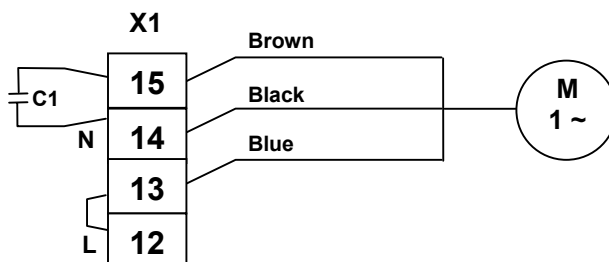
VARIANTE: GENERIOCH

4.3.4 Fan

The condensers of the OM, OMQ, OL and OLQ units are equipped with 1 single phase fan.

The OM and OL units are fitted with a single phase fan since the beginning of 2003.

The OMQ and OLQ have a low speed (910 rpm 6 pole) single-phase motor and a sickle shaped 5 blades fan in order to reduce the sound level.



Fan technical data

| | | OM-15 | OM-21 | OM-26 | OM-30 | OM-38 | OM-45 |
|------------------------|----------|--------------|-------|--------------|-------|-------|-------|
| | | OL-09 | OL-11 | OL-13 | OL-15 | OL-18 | |
| Fan model | Model | 121 | 271 | | | | |
| Capacitor | Capacity | 4 μF - 450 V | | 5 μF - 420 V | | | |
| Fan kit with capacitor | Ident Nb | 3128096 | | 3128109 | | | |

| | | OMQ-15 | OMQ-21 | OMQ-26 | OMQ-30 | OMQ-38 | OMQ-45 |
|-----------|------------------|-------------------|-------------------|--------|--------|--------|--------|
| | | OLQ-09 | OLQ-11 | OLQ-13 | OLQ-15 | OLQ-18 | |
| Fan model | Model | 45 | 90 | | | | |
| | Ident Nb | 3117252 | 3117263 | | | | |
| Capacitor | Capacity μ F | 2 μ F - 450 V | 4 μ F - 450 V | | | | |
| | Ident Nb | 3118506 | 3118517 | | | | |

| | Model 45 | Model 121 | Old Model 120 | | | Model 90 | Model 271 | Old Model 270 | | |
|-----------------------------|----------|-----------|---------------|---------|---------|----------|-----------|---------------|---------|---------|
| Voltage | 220-240 | | 220-240 | 220-240 | 380-420 | 220-240 | | 220-240 | 220-240 | 380-420 |
| Phase | 1PH | | 1PH | 3 Ph | 3 Ph | 1PH | | 1PH | 3 Ph | 3 Ph |
| Diameter mm | 350 | | 350 | | | 420 | | 420 | | |
| Power input W | 65 W | 117 W | 135 W | | | 145 W | 300W | 280 W | | |
| Current input in 50 Hz A | 0,31 | 0.63 | 0,63 A | 0,55 A | 0,32 A | 0,67 | 1.3 | 1,3 A | 1,1 A | 0,65 A |
| Winding resistance Ω | 152 | 108 | 54.1 | 57 | 172 | 70 | 88 | 20 | 20 | 60 |

A single-phase fan can be used equipped with a speed controller connected to the condensing pressure.

The ALCO fan speed regulator FSF 42S can be ordered with the unit (as an option) or can be delivered separately (see chapter 4.4.1).

4.3.5 Liquid receiver

The outdoor condensing units are equipped with CE liquid receivers.

The liquid receivers are equipped with:

- a Rotolock service valve
- a 3/8"-14 NPTF connection for relief valve.

The fitting of a pressure relief device according to the norm EN378-2 is the responsibility of the installer.

Receiver capacity:

- 3,7 liters vertical liquid receivers on OM-15, OMQ-15, OL-09 and OLQ-09
- 8,0 liters CE vertical liquid receivers on other Units



4.3.6 Automatic reset HP/LP pressure switch Alco PS2-W7A

All the condensing units are presently equipped with a dual pressure switch (high and low pressure) with an automatic reset: ALCO PS2 W7A.

A manual reset HP-LP pressure switch is available as an option. (see chapter 5.4.2).

In these systems, pressure controls serve various functions, which may be divided into control and protection functions. Examples for control functions are compressor cycling, pump-down or defrost control. Protection functions include, pressure limiting and cut out against excessive pressures, against loss of charge or for freeze protection.

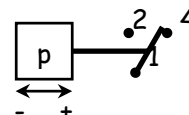
The control is equipped with display scale and pointers to indicate the approximate settings. The display scales are printed in relative pressure units "bar" and "psi".

For precise setting of the control, external gauges must be used.



The PS2 W7A has the following characteristics:

- Automatic reset Dual Pressure Controls
Combined Pressure Limiter for low pressure / high pressure protection.
On pressure rise above the upper setpoint, contacts 1-2 open and contacts 1-4 close.
On decreasing pressure below lower setpoint contacts 1-4 open and contacts 1-2 close.
- Adjustable dual pressure switch
Set-point adjustment range: LP(left) = -0.5 to 7 bar and HP(right) = 6 to 31 bar.
Differential adjustment range: LP = 0,5 to 5 bar, HP = 4 bar.
ALCO Factory Setting: LP = 3,5 / 4,5 bar, HP = 20 bar.
- Electrical contacts
Type of contacts: 2 x SPDT contacts
Contact material: CuAg3
Heating load (AC1): 24 A / 230 V AC
Motor rating UL (FLA): 24 V AC
Locked rotor UL (LRA)/Startup (AC3): 144 A / 230 V AC
- Environmental conditions
Ambient temperatures and medium temperature range at pressure connector: -50 °C to +70 °C.
Dust and water protection EN 60529 / IEC 529: IP44.
Vibration resistance: 4 g @ 10 ... 1000 Hz
- Approvals
PED approved: category 4
DIN and TÜV approved: TÜV DIN 32733(EN 12263) required by DIN 8901 and DIN 8975(EN 378).
Low Voltage Directive 73/23/EWG 93/68/EWG: EN 60947-1, EN 60947-5-1, CE-Label.
Germanic Lloyd
UL / CSA
- Pressure Connector: 7/16"-20 UNF male.
Pressure Connector bellows: brass /bronze
- Leakage Test Pressure: LP = 25 bar, HP = 36 bar.
- Housing materials cover: Polycarbonate (PC)
 frame: Steel, yellow chromated



4.3.7 Liquid line equipment

Filter drier Alco ADK 164

ADK Liquid line filter-driers are for new installation or after service.

- Optimum blend of molecular sieve and activated alumina
- High water and acid capacity
 - Water adsorption capacity with R404A/507 = 23,1 gram at 24°C, 13,8 gram. at 52°C
 - Acid absorption capacity = 4,5 gram
- Filtration down to 25 micron
- Temperature range -45°C to +65°C
- Max. operating pressure: 31 bar
- Maximum working pressure: 34 bar
- Maximum proof pressure: 34 bar
- Compatibility: CFCs, HCFCs, HFCs, mineral, Alkyl benzene and ester lubricants
- Flare (SAE) connection 1/2" (12 mm)
- PED category I



Liquid sight glass Alco AMI 1SS4 1/2S

The **AMI** series of Moisture Indicators are designed to monitor the moisture content within the liquid line of a Refrigeration system. When the line is empty of liquid, circles may be seen in the glass. However, when the liquid refrigerant touches the glass, the circles disappear indicating the system is fully charged.

- High accuracy of moisture indication
- Fused glass - no leakage
- Long lifetime of indicators by utilization of crystals
- Indicator with high resistance against acid and water
- Wide angle view for exact distinction of vapour and liquid
- Maximum operating pressure 35 bar
- Medium temperature : -40 to 100 °C
- Female Solder x Female Solder, 1/2" ODF x ODF 1/2"
- Compatibility with Refrigerants: R22, R404A, R507, R134a, R407C, R502, and R12.
- PED category I



Solenoid valve Alco 200 RB 6 T4

- Compact size
- Snap-on clip for attaching solenoid coils
- No disassembly necessary for soldering
- 1/2" flare Connection
- Nominal Capacity Qn = 18,9 kW with R404A
- Δp minimum = 0,05 bar
- Pressure drop coefficient; kv = 1,6 m³/h



4.3.8 Pre-wired electrical panel

All electrical components are pre-wired on the panel:

- Compressor contactor
- Fuse
- Terminal blocks
- DIN rail mounted terminals
- Cable bushing fitting
- Space for additional components



4.4 Additional accessories

4.4.1 Fan speed control

An electronic speed control is available to control the speed of the fans based on condenser pressure. One or two fans can be controlled at the same time. The control operates with single-phase motors.

The electrical connection is made in the terminal box of the condensing unit and the control is mounted on the liquid valve with a Schrader fitting.

Using a variable fan speed controller offers the following benefits for your application:

- The head pressure can be kept high enough to ensure proper operation of the expansion valve, and hence, sufficient mass flow through the expansion valve to feed the evaporator. This maintains the required cooling capacity and avoids a drop of evaporator temperature.
- The noise level of fan motors can be kept at a minimum by avoiding the permanent on/off cycling of the fan motor. The ALCO fan speed control can be delivered with the Copeland units or as a separated accessory.

The fan speed controller selection depends on the fan motor maximum current, the fan quantity and the refrigerant pressure range.

The fan speed controller **FSF42S** = nominal current between 0.25 A and **4 A** for R404A, R507, R407C, R22

Single fans: model 45, 90, 120 and 270

The fan speed controller **FSF41S** = nominal current between 0.25 A and **4 A** for R134a

Single fans: model 45, 90, 120 and 270

Fan speed controller FSF 4..

In order to ensure compliance with the latest electromagnetic compatibility requirements of the European Community the fan speed controller we are using have a filter installed. With this filter the FSF fulfils the requirement of the European standards EN 55022, EN 50081 and EN 50082 and is conform to the EC-Directive 89/336/EC

Description of control behavior of the FSF 4..

The FS control behavior can be described by dividing it into *maximum range*, *proportional range* and *minimum range*, depending on the input pressure (see figure on the right side).

In the *maximum range* the FS provides a constant output voltage of approximately 1% below the supply voltage. The fan runs at maximum speed.

Along the *proportional range* the output voltage varies between maximum and minimum voltage. The minimum voltage is approximately 50% of the supply voltage.

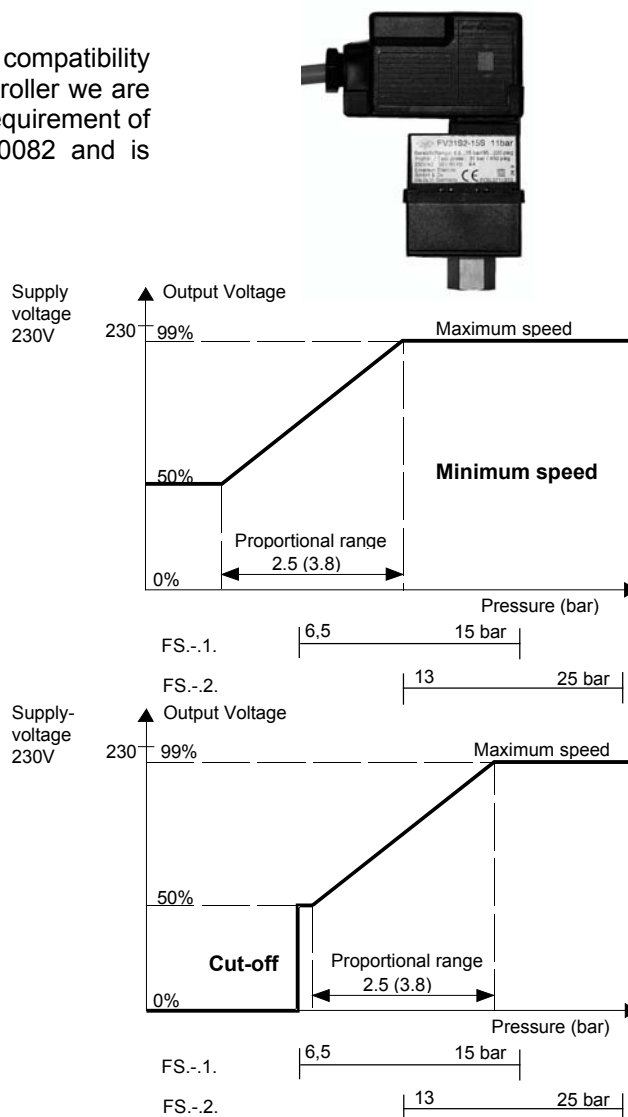
This means that with decreasing pressure the fan slows down from maximum speed to minimum speed.

For the *minimum range* the FS has two operating modes:

- **Minimum speed mode:** for pressure values below the minimum speed setting the fan runs according to the minimum output Voltage of appr. 50% of the supply Voltage (speed depends on the motor characteristics).
- **Cut-off mode:** for pressure values below the minimum speed setting the fan motor is switched off.

The fan speed controller is originally delivered set for the cut-off mode (position "0").

The pressure from which the FS operates in maximum range is adjustable and depends also on the model. The proportional range is fixed at approximately 2.5 bar or 3.8 bar, depending on the model. The minimum range is determined by the setting for the maximum range and the proportional range.



Technical data of the FSF 4..

Supply voltage: 230V/AC +15%, -20%

Temperature range:

Nominal current: 0,5 - 4 (3) Amp.

Starting current: max. 8 Amp./5 sec

Storage and transportation -30 °C to 70 °C

Ambient -20 °C to 55 (40) °C

Medium -20° C to 70°

| Pressure range (bar) | Pressure changes per turn of adjusting screw | | Proportionnal band | Factory setting | Max. proof pressure |
|----------------------|--|-------------------|--------------------|-----------------|---------------------|
| | clockwise | counter clockwise | | | |
| 1 6,5 ... 15 | ~ +1,4 bar | ~ -1,4 bar | 2,5 bar | 11,0 bar | 31,0 bar |
| 2 13 ... 25 | ~ +2,5 bar | ~ -2,5 bar | 3,8 bar | 16,2 bar | 36,0 bar |

4.4.2 Manual reset HP/LP pressure switch Alco PS2 B7A

The PS2 B7A pressure switch has the same characteristics has the PS2 W7A (see page 6) except that it is a manual reset version.

- Automatic reset Dual Pressure Controls

Manual reset on low pressure side

On decreasing pressure below the lower setpoint, contacts 1-4 open, contacts 1-2 close and latch. Only on pressure rise above upper setpoint and after pressing the manual reset button contacts 1-2 will open and contacts 1-4 will close again.

Manual reset on high pressure side

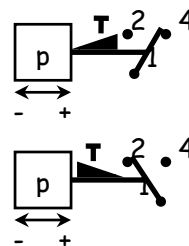
On increasing pressure above the upper setpoint, contacts 1-2 open, contacts 1-4 close and latch. Only on falling pressure below lower setpoint and after pressing the manual reset button, contacts 1-4 will open and contacts 1-2 will close again.

- Adjustable dual pressure switch

Set-point adjustment range: LP(left) = -0.5 to 7 bar and HP(right) = 6 to 31 bar.

Differential adjustment range: LP = 1 bar, HP = 4 bar.

Factory Setting: LP = 3,5 / 4,5 bar, HP = 20 bar.



4.4.3 Oil separator : Alco OSH-405

The Alco OSH-405 oil separator is an option, it can be delivered mounted in the units.

The oil separator has the following characteristics:

- Hermetic construction
- Comply with UL standard and HP German pressurised vessel regulations (**CE** standard effective Nov. 1999)
- PED catagory I
- Copper ODF connection
- Stainless steel needle valve and floater
- Permanent magnet to filter microscopic particles out of the system
- Corrosion resistant epoxy powder painting
- Diameter $\cong 10$ cm
- ODF connection : $\frac{5}{8}$ " (16mm)
- Max. working pressure = 31 Bar
- Volume = 2.14 litres
- Nominal capacity (To +4°C, Tc +38°C, Tsuc 18°C) = 7,3 kW with R404A

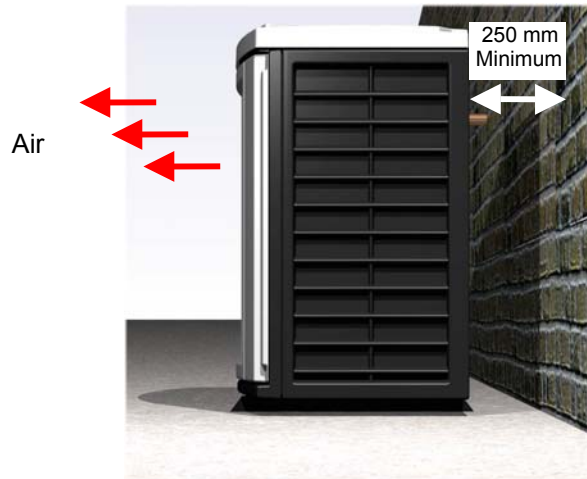
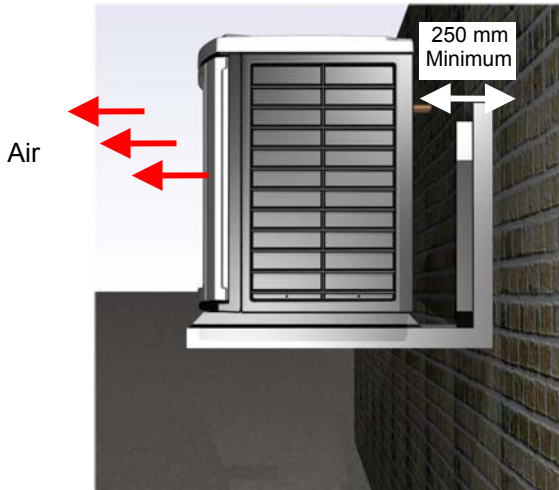


5 Installation

5.1 Location & fixing

The condensing unit should be located in such a place to prevent any dirt, plastic bag, leaves or papers from covering the condenser and its fins. A clogged condenser will increase the condensing temperature, thus reduce the cooling capacity, and lead to a high pressure switch tripping.

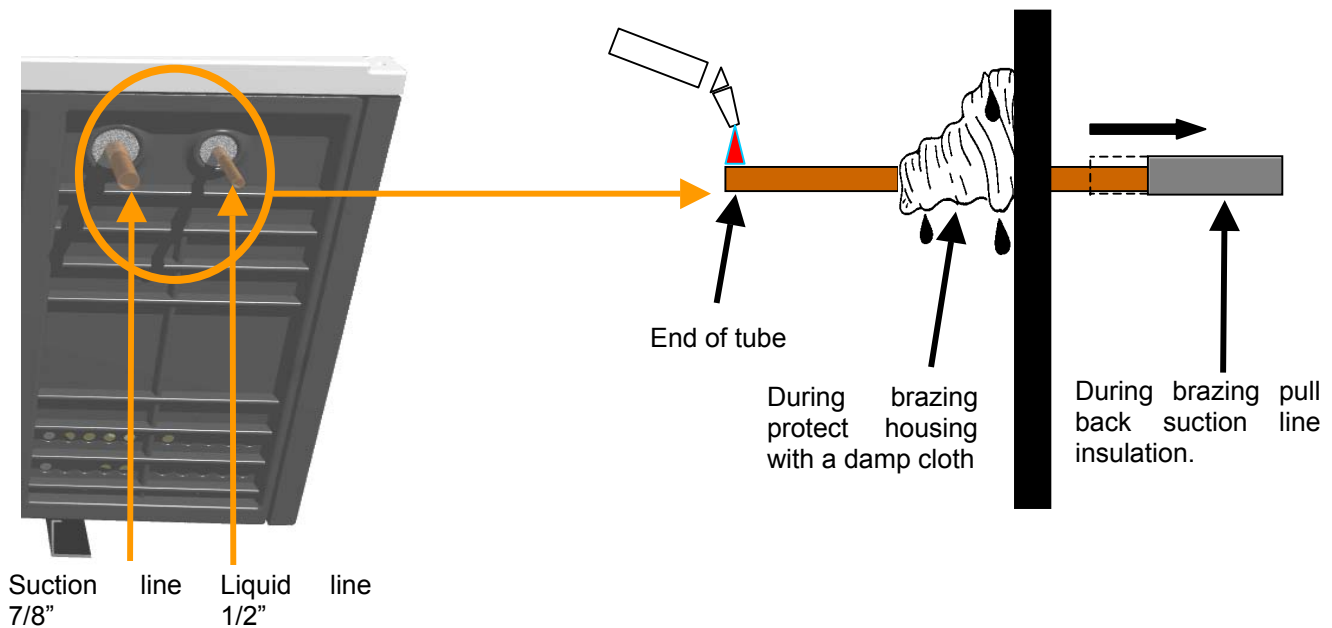
The unit must be located without restricting the airflow, do it has to be installed at a 250 mm (at least) from a wall.



Wall mounting brackets are not included.

5.2 Refrigeration connections

The suction and liquid lines (copper tubes) extend out of the unit, in such a way that brazing the connecting lines to the refrigeration circuit can be done quickly and easily (see below).



5.3 Electrical connection

Use the supplied key to open and close the access door.



Once opened, the door gives an access to the refrigeration components. Sliding the cover upwards gives an access to the electrical components.

The following chapter is showing the electrical drawings and recommended control circuits for the different condensing units.

6 Electrical Diagrams

The wiring diagram is located on the electrical box door.

6.1 Legend for the electrical diagrams

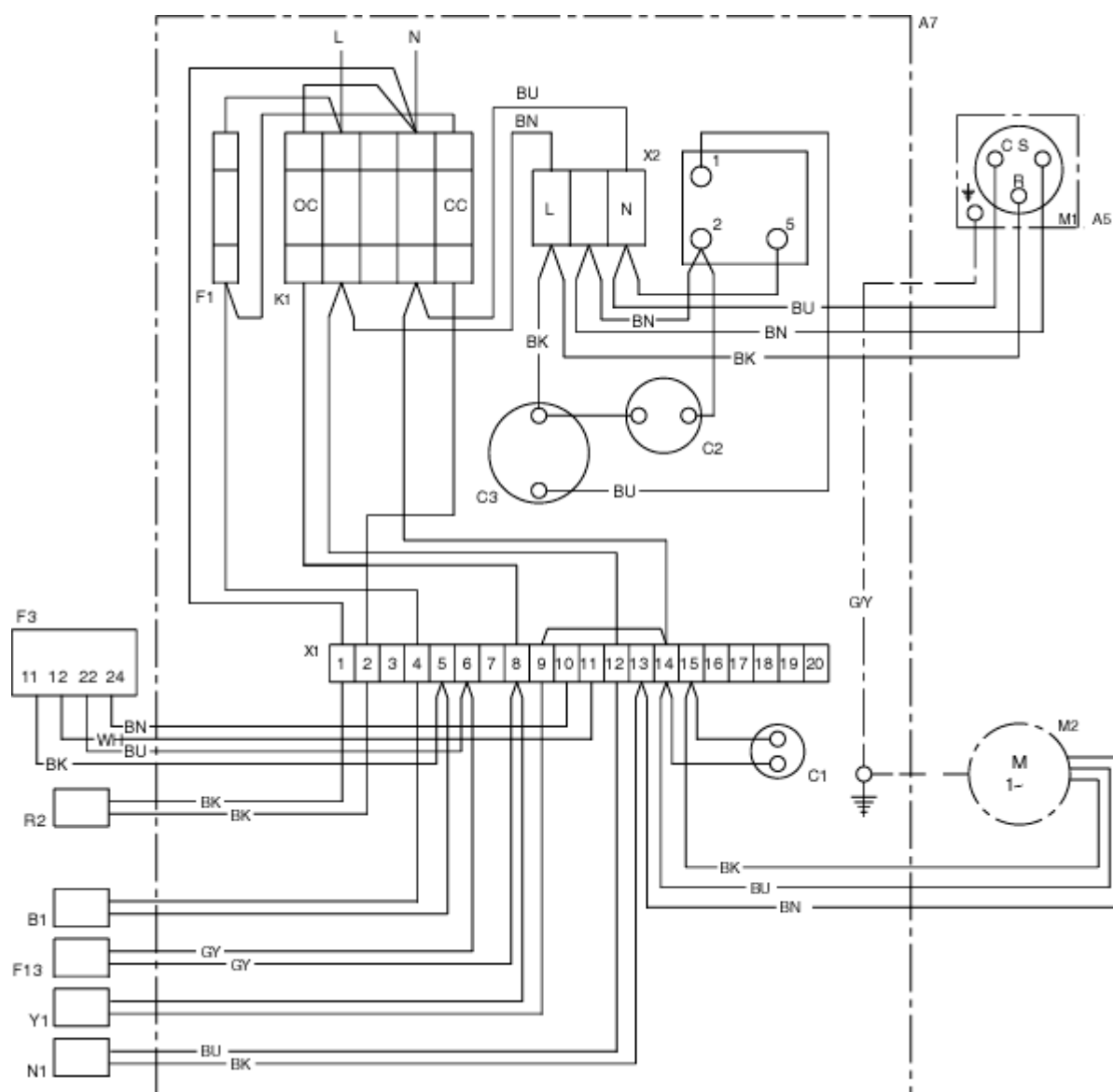
Cable colours

| | | |
|------------|-----------|--------------------|
| WH = white | GY = grey | BK = black |
| BN = brown | BU = blue | G/Y = green/yellow |

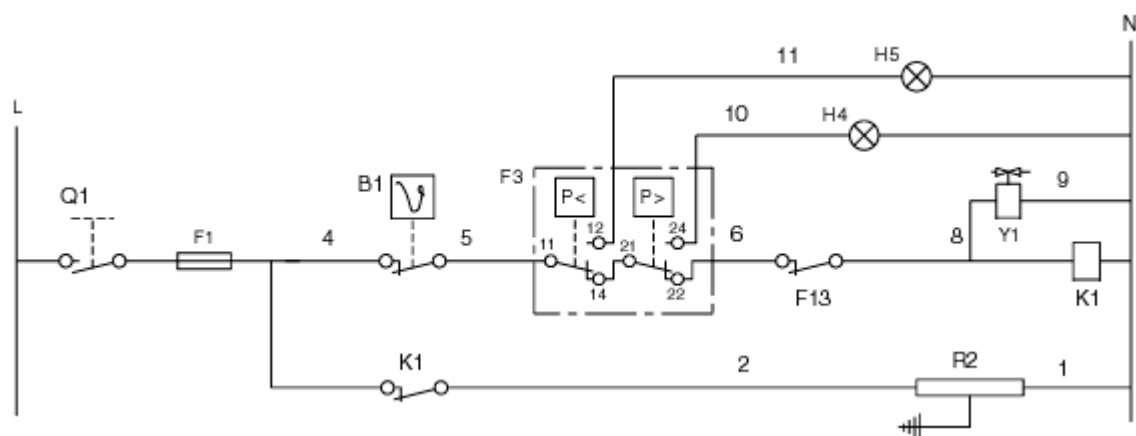
Nomenclature

| | |
|--|--|
| A3 = Capacitor and relay assembly | H4 = Signal lamp F3. Discharge pressure to high (if fitted). |
| A5 = Compressor terminal box | H5 = Signal lamp F3. Suction pressure to low (if fitted). |
| A7 = Condensing unit terminal box | K1 = Contactor M1 |
| B1 = Room thermostat | K51 = Contactor M21 |
| C1 = Fan run capacitor | M1 = Compressor motor |
| C2 = Compressor run capacitor M1 | M2 = Fan motor (condenser) |
| C3 = Compressor start capacitor M1 | N1 = Speed control fan (if fitted) |
| F1 = Fuse for control circuit | Q1 = Main switch |
| F3 = HP/LP pressure switch | R2 = Crankcase heater |
| F11 = Over-current Thermal protector | X2 = Terminal block |
| F13 = Discharge gas thermostat (if fitted) | Y5 = Solenoid valve for liquid injection (if fitted). |

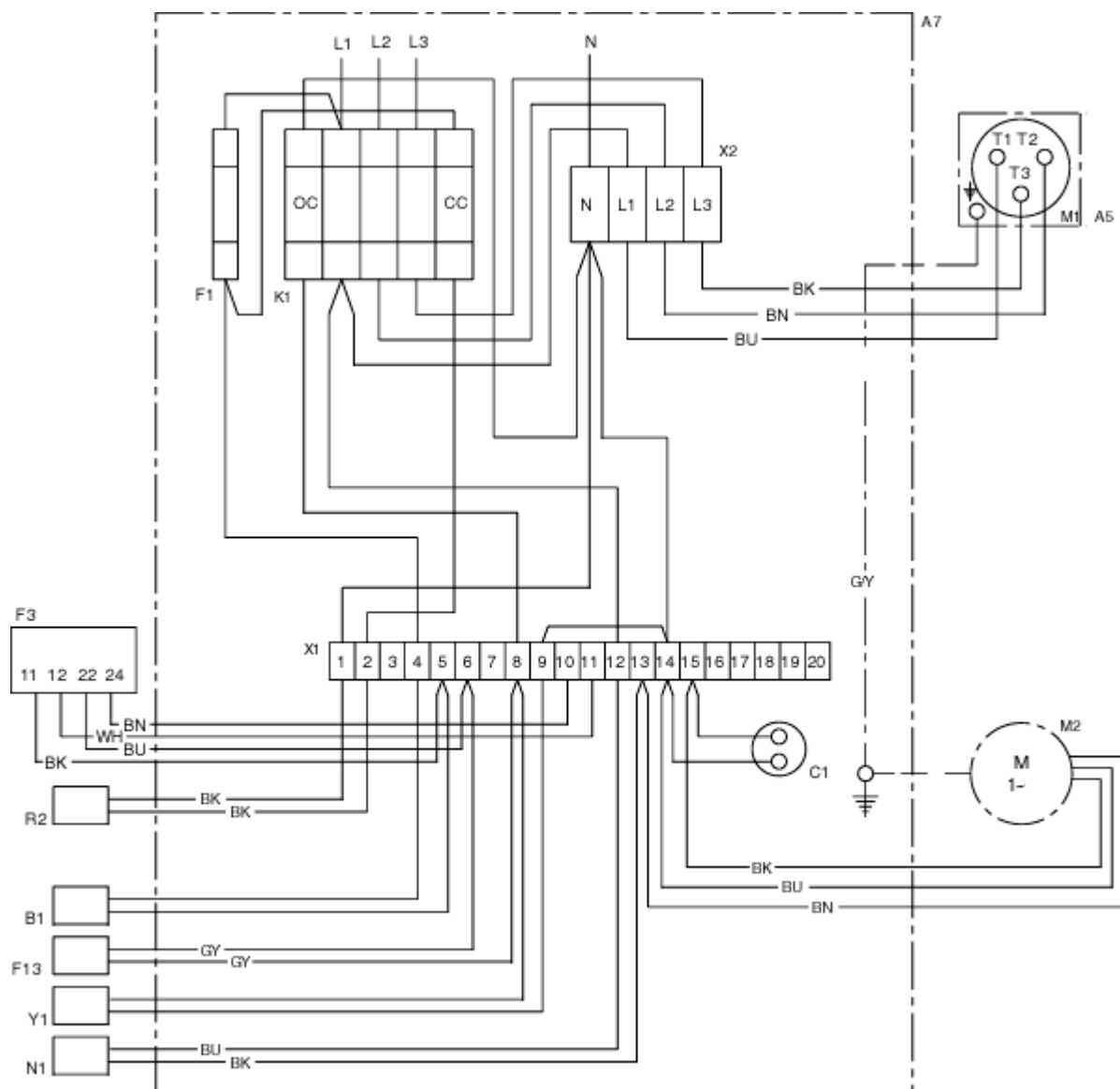
6.2 Electrical diagram OM and OL Units compressor in 1 phase (PFJ)



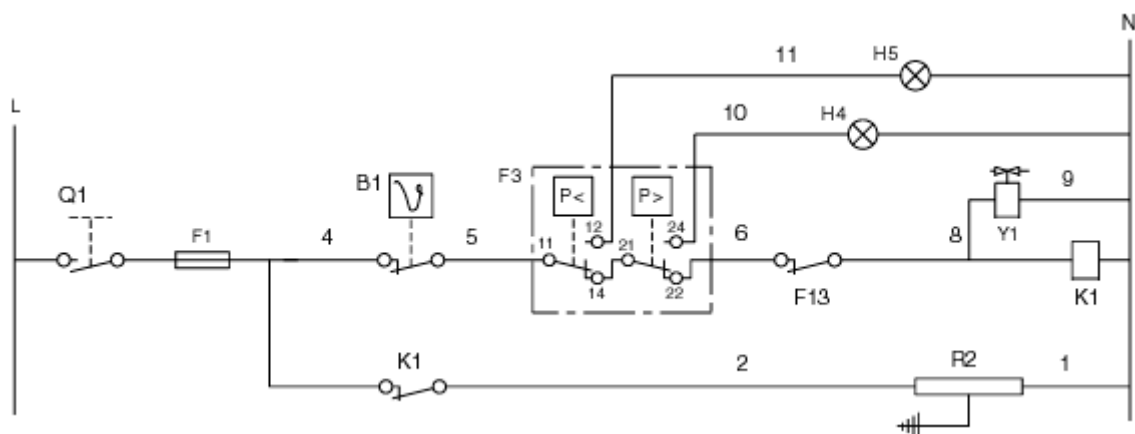
Recommended control circuit



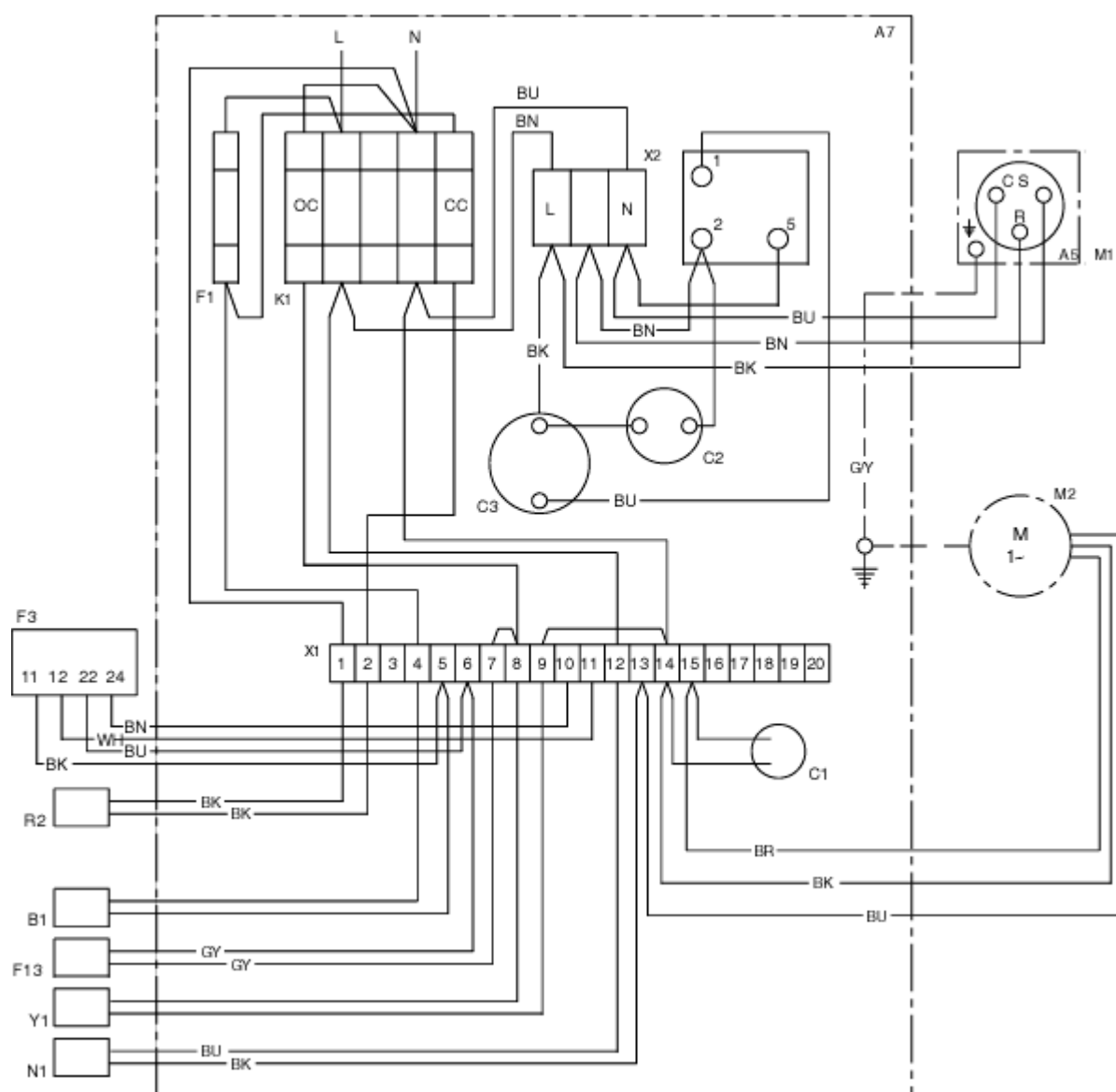
6.3 Electrical diagram OM and OL Units compressor in 3 phase (TFD)



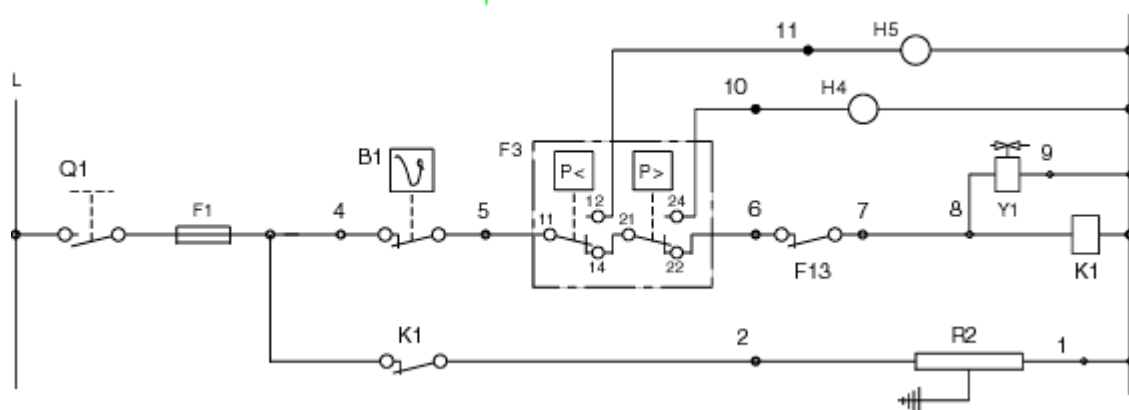
Recommended control circuit



6.4 Electrical diagram OMQ and OLQ Units compressor in 1 phase (PFJ)



Recommended control circuit



7 Sound Data

Sound data is given in our Selection software: SELECT.

The value published is the A-Weighted average Sound Pressure Level at 1 meter, with a free sound propagation under availability of a firm floor and for a defined operating point (ref./evap./amb./superheat).

You can calculate the Sound pressure for a further distance by using the following formula:

$$LPA_d = LPA_{1m} - 20 \log(d)$$

LPA_d = A-Weighted Sound Pressure Level at a "d" distance
 LPA_{1m} = A-Weighted Sound Pressure Level at 1 meter
D = distance

The sound pressure values measured on the field might be lightly different from the published value due to the surrounding, different room characteristics, reverberating object or walls...

8 PED Compliance

- The piping is in compliance with the Pressure Equipment Directive 97/23/EEC (Art.3§3 - sound Engineering Practice)
- Components of the Condensing units carry a CE mark as far as required, and thereby establish Conformity with the relevant directives.
- Conformity Declarations for components are available as far as required.
- The units are in conformity with the low voltage directive? The applied harmonized standard is En 60335-1 (Safety Household and Similar Electrical Appliance, Part 1: General Requirements)
- To incorporate these products into a machine the Manufacturer's declaration of incorporation has to be respected.

9 Protection class

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

- Scroll compressors are IP 21 according to IEC 34:
- Fan is IP54 according to IEC 34
- HP-LP safety pressure switch ALCO PS2 W7A is IP44 according to IEC 529/EN 60529
- Fan seep controller FSF are IP 65 according to IEC529/DIN 40050

10 Installation and Service

The condensing unit should be located in such a place to prevent any dirt, plastic bag, leaves or papers from covering the condenser and its fins.

A clogged condenser will increase the condensing temperature, thus reduce the cooling capacity, and lead to a high pressure switch tripping.

The condensing units are delivered with a holding charge of neutral gas.

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