

Optyma™ iCO₂

Condensing Units OP-MPAM005COP04G

Name plate

A	OP-MPAM005COP04G		
B	114X6001		MADE IN ITALY
C	Application	MBP	IP54
D	Refrigerant	R744	
E	PS-HP	140bar	
F	PS-MP	80bar	
G	PS-LP	80bar	
H	Voltage	230V 1N	~50Hz
I	LRA	Inverter driven	MCC 15 A
J	OIL INSIDE	PAG ND8 268cc (268cc=158cc compressor + 110 suction accumulator)	
K	Serial No.	000102DT1821	
L	EAN No.	5702424493981	
M	MR117403-6570		Only for Norway

Danfoss A/S, 6430 Nordborg, Denmark

* For exact values please refer name plate in unit

- A:** Model
- B:** Code number
- C:** Application, IP protection level
- D:** Refrigerant (R744=CO₂)
- E:** Maximum working pressure
- F:** Middle working pressure
- G:** Minimum working pressure
- H:** Supply voltage
- I:** Maximum Current Consumption
- J:** Oil type
- K:** CDU serial number
- L:** European Article Number
- M:** Condensing unit Label PN (Factory)



This unit contains frequency converter and EMI filter with capacitors. Disconnect the AC mains and wait for at least 4 min to de-Energize all Electrical parts before opening the door for performing any service or repair work. Failure to wait the specified time after power has been removed could result in death or serious injury

Installation and servicing of the condensing units by qualified personnel only. Follow these instructions and sound refrigeration engineering practice relating to installation, commissioning, maintenance, and service.

This product is not subject to the UK PSTI regulation, as it is for supply to and use only by professionals with the necessary expertise and qualifications. Any misuse or improper handling may result in unintended consequences. By purchasing or using this product, you acknowledge and accept the professional-use-only nature of its application. Danfoss does not assume any liability for damages, injuries, or adverse consequences ("damage") resulting from the incorrect or improper use of the product and you agree to indemnify Danfoss for any such damage resulting from your incorrect or improper use of the product.

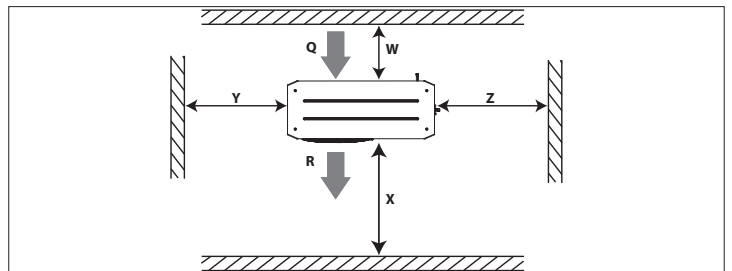
The condensing unit must only be used for its designed purpose(s) and within its scope of application.

Under all circumstances, the EN378 (or other applicable local safety regulation) requirements must be fulfilled.

The condensing unit is delivered under nitrogen gas pressure (1 bar) and hence it cannot be connected as it is; refer to the «installation» section for further details.

The condensing unit must be handled with caution in the vertical position (maximum offset from the vertical: 15°)

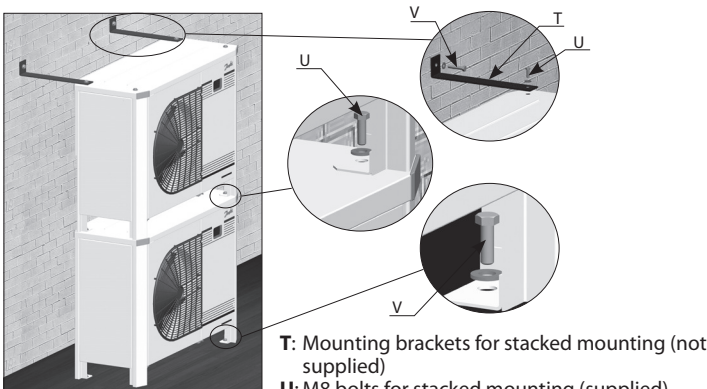
Compressor of condensing unit cannot be connected directly to the network in any case, only via original drive from Danfoss.



Picture 1 : Minimum mounting distances

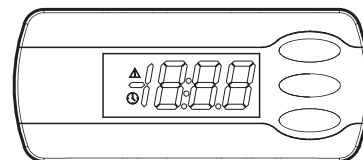
Q: Air in **R:** Air out

Unit	W [mm]	X [mm]	Y [mm]	Z [mm]
Housing	250	760	581	581



Picture 2 : Stacked mounting

- T:** Mounting brackets for stacked mounting (not supplied)
- U:** M8 bolts for stacked mounting (supplied)
- V:** Mounting bolts (not supplied)



Picture 3 : Electronic controller display

- Active alarm
- Night mode

Display shows temperature value for suction pressure. Push middle button to switch to Evaporating temp. setpoint.

Instructions

1- Introduction

These instructions pertain to Optyma™ iCO₂ condensing units OP-MPAM005COP04G used for refrigeration systems. They provide necessary information regarding safety and proper usage of this product.

The condensing unit includes following:

- Microchannel heat exchanger
- Variable speed scroll compressor
- Receiver
- Pressure relief valve (PRV)
- Suction accumulator
- Oil separator integrated to the compressor
- Ball valves
- Sight glass in liquid line
- Filter drier
- High pressure switch
- Electronic controller
- High and medium pressure valves
- Compressor drive with EMC filter
- Motor protection
- Main switch with overload protection
- Pressure and temperature sensors
- DC Fan
- Robust weatherproof housing

2 - Handling and storage

- It is recommended not to open the packaging before the unit is at the final place for installation.
- Handle the unit with care. The packaging allows for the use of a forklift or pallet jack. Use appropriate and safe lifting equipment.
- Store and transport the unit in upright position.
- Store the unit between -35°C and 50°C.
- Don't expose the packaging to rain or corrosive atmosphere.
- After unpacking, check that the unit is complete and undamaged.

3 - Installation precautions

	Never place the unit in a flammable atmosphere.
	Place the unit in such a way that it is not blocking or hindering walking areas, doors, windows or similar.

- Ensure adequate space around the unit for air circulation and to open doors. Refer to picture 1 for minimal distance to walls.
- Avoid installing the unit in locations exposed to direct sun.
- The unit ambient temperature must not exceed 46°C.
- Avoid installing the unit in aggressive and dusty environments.

- Ensure a foundation with horizontal surface (less than 3° slope), strong and stable enough to carry the entire unit weight and to eliminate vibrations and interference.
- Ensure that the power supply corresponds to the unit characteristics (see nameplate).
- Use clean and dehydrated refrigeration-grade copper tubes.
- Use clean and dehydrated system components.
- The suction piping connected to the compressor must be flexible in 3 dimensions to dampen vibrations.
- Piping must be done in such a way that oil return for the compressor is ensured and the risk of liquid slug over in compressor is eliminated.
- Maximum pipe run one way is 20 meters.
- Maximum height difference between condensing unit and evaporators is ± 5 meters.
- Smallest evaporator internal volume should not be less than 2 Liters.
- Maximum total evaporator internal volumes is 10 Liters for evaporating temperature equal or less than -5°C and 6 Liters for evaporating temperature +10°C.
- Liquid line and receiver are protected by a pressure relieve valve connected to the receiver. Pressure limit set at 80 barg.
- Liquid line must be rated PS 80 barg.
- Evaporator and suction line can be rated 60 barg or 80 barg.
- Suction line must be protected by a PRV set to the max working pressure of suction line and evaporator.
- All section of system which can be close by isolation valve must be protected by a PRV or a check valve to allow flow in the direction of a PRV.
- Pressure relieve valve must be place where no risk for people or goods
- Piping must be supported and clamped.
- The machine room if any and cold room must be equipped with a CO₂ detector according to EN378.

4 - Installation

- The installation in which the condensing unit is installed must comply to European community Pressure directive (PED) and European standard EN 378.
- The condensing unit itself is a partly completed machine, which is not in the scope the PED directive.
- It is recommended to install the unit on rubber grommets or vibration dampers (not supplied).

- It is possible to stack one unit on top of another. Maximum stacking number is 2.
- When stacking, the topmost unit must be secured to the wall as shown on figure 2.
- Slowly release the nitrogen holding charge through the Shrader port.
- Connect the unit to the system as soon as possible to avoid oil contamination from ambient moisture.
- Avoid material entering the system while cutting tubes. Never drill holes where burrs cannot be removed.
- Braze with great care using state-of-the-art technique and vent piping with nitrogen gas flow.
- Connect the required safety and control devices.
- Liquid line and return line must be thermally insulated. A badly insulated liquid line can generate flash gas during operation and receiver over pressure during standstill. Receiver overpressure can eventually result in the release of refrigerant through the receiver PRV.

5 - Leak and pressure test



Never pressurize the circuit with oxygen or dry air. This could cause fire or explosion.

Do not use dye for leak detection.

- Pressure tests:
 - Pressure test the system at 1.1 x PS
 - Test separately suction and liquid line if PS are different.
 - Remove suction line PRV before test
 - Close condensing unit ball valve to avoid to pressurize the unit itself. This would force open the condensing unit PRV, when testing liquid line at 88 barg.
 - Once pressure test completed, do not forget to put the suction line PRV before proceeding to leak test.
- Leak test:
 - Perform a leak detection test on the complete system at pressure $P = 0,25 \times PS = 20$ bar.
 - When a leak is discovered, repair the leak, and repeat the leak detection.
- After completion of test, vent nitrogen to atmosphere and open condensing unit service valve.

6 - Electrical connections

- Switch off and isolate the main power supply.
- Ensure that power supply cannot be switched on during electrical connection.
- All electrical components must be selected as per local standards and unit

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requirements.

- Refer to wiring diagram for electrical connections details.
- Ensure that the power supply corresponds to the unit characteristics and that the it is stable (nominal voltage $\pm 10\%$ and nominal frequency $\pm 2,5$ Hz).
- Dimension the power supply cables according to unit data for voltage and current, ambient temperature and cable grouping.
- Protect the power supply against overload, mechanical stress, and damage, and ensure correct earthing.
- Make the power supply according to local standards and legal requirements.
- The unit is equipped with an electronic controller.
- The unit is equipped with high pressure switch, which directly cut the power supply to the compressor in case of activation. PS = 140 bar.

7 - Setting the electronic controller

- The unit is equipped with an electronic controller which is factory programmed with parameters for use with the actual unit. Refer to application guideline for details.
- Energize the unit.
- The electronic controller display shows the temperature value for the suction pressure.
- A short push on middle button show evaporating temperature setpoint r23. Factory setting of r23 = -10°C .
- Controller main switch parameter r12 should be set to 0 = stop (factory setting).
- To change controller parameter,
 - Push the upper button for a couple of seconds. The first parameter code r05 appears.
 - Push the upper or lower button to find parameter.
 - Push the middle button until the value for this parameter is shown.
 - Push the upper or lower button to select the new value.
 - Push the middle button to confirm the selected value.
 - Select next parameter with upper or lower button or simply wait 20s to return to main display.
- If necessary, change parameter r23 to desired suction pressure ($^{\circ}\text{C}/^{\circ}\text{F}$).
- Check that evaporator expansion valve type (o09) and pump down limits (c75.. c80) fit your needs.

- Refer to guideline for detailed list of parameters and their definitions.

8 - Vacuum dehydration

- Before vacuuming the system, you need to open fully high pressure and bypass valve. Unit must be connected to power supply and controller main switch r12 must be set to value 2 = Vacuum mode.
- If you are using the suction shradr port to add some oil, connect vacuum pump to liquid line shradr port only.
- Pull down the system under a vacuum of 500 μm Hg (0.67 mbar) absolute.
- Do not use a megohmmeter nor apply power to the compressor while it is under vacuum as this may cause internal damage.

9 - Oil addition

- Make calculation of oil charge addition with the provided excel sheet, available on Danfoss selection software, CoolSelector™.
- The condensing unit is supply with Idemitsu PAG ND8 oil. Be sure to use same oil type
- Oil can 250 ml can be ordered at Danfoss with article code 118U4144
- Oil addition must be done through the suction shradr port. Vacuum should be enough to drain oil inside the circuit. You can also use a stirrup pump.

10 - Filling the system

- Use only R744 refrigerant grade 4.5 (99,995%).
- Make calculation of refrigerant charge with the provided excel sheet before charging.
- Use a scale to measure the refrigerant charge you put in the system.
- Several charging method are possible. We describe below the most practical method that should fit most situation.
- Open condensing unit ball valves.
- Set condensing unit main switch r12 in vacuum mode (value 2).
- Charge suction line in vapor phase till you reach a pressure below the suction line PS.
- Set condensing unit main switch r12 to automatic (value 1).
- Condensing unit should start
- Complete the charge on suction line in vapor phase till you reach the target charge.
- In case suction line PS is 60 bar, this method ensure you do not exceed the PS even during summer time.
- Do not fill with liquid on suction line. It

risks damaging the compressor.

- Do not fill on liquid line when system is running. It will disturb the control of the unit leading to chaotic behavior. And there is high risk of overfilling the receiver with liquid.

11 - Check with running unit

- Check the fan rotation direction. Air must flow from the condenser towards the fan.
- Check current draw and voltage.
- Check suction superheat to reduce risk of slugging. The optimum unit return gas superheat is around 6K. The maximum allowed superheat is 30K.
- Respect the operating limits.
- Check all tubes for abnormal vibration. Movements more than 1.5 mm require corrective measures such as tube brackets or balance weight.
- In case of problem see Trouble shooting section

12 - Check for charge correctness

- CO2 condensing unit must be charge with a scale.
- Sight glass is not a reliable indication of charge correctness.
- Sight glass will shown a large amount of flash gas. Depending on running condition, liquid level can fill only 50% of the sight glass. It does not mean you miss charge.
- Do not overcharge the system. Overcharging the system risk to damage compressor with liquid return and can cause overpressure at standstill.
- Overcharge will show very low compressor suction super heat
- Low charge will give low evaporating temperature, high superheat, largely open evaporator expansion valve.
- If charge is not correct, double check system volume (piping and evaporator), check charge calculation, empty the system and re-do the charging.
- Simulate high ambient by covering the gascooler and check system run correctly.
- Make a pump down to control the correct charge: with too low charge, system may have difficulty to recover after a pump down.
- Never leave the filling cylinder connected to the circuit.
- Record type and amount of refrigerant charge as well as operating conditions as a reference for future inspections.
- Before leaving the installation site, carry

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out a general installation inspection regarding cleanliness, noise, and leak detection.

13 - Trouble shooting

- Compressor failure to build up pressure: Check all bypass valves in the system to ensure that none of these has been opened. Also check that all solenoid valves are in their proper position.
- Abnormal running noise: Ensure the absence of any liquid flood-back to the compressor by means of measuring the return gas. Superheat should be at least 6K above the saturated suction temperature under steady-state operating conditions.
- The high-pressure switch trips: Check condenser operation (condenser cleanliness, fan operation). If all these are OK, the problem may be due to either refrigerant overcharging or the presence of a non-condensable (e.g. air, moisture) in the circuit.
- The low-pressure switch trips: Check evaporator operation (coil cleanliness, fan operation, defrost, water flow, water filter, etc.), liquid refrigerant flow and pressure drops (solenoid valve, filter dryer, expansion valve, etc.), refrigerant charge.

14 - Maintenance

	<p>Always switch off the unit switch and wait 4 minutes (capacitor discharge time) before opening the condensing unit to avoid electric shock. Even when main switch is OFF, voltage is available on the income terminals of main switch and this should be considered during maintenance and service repair.</p>
	<p>Internal pressure and surface temperature are dangerous and may cause injury. Maintenance operators and installers require appropriate skills and tools. Tubing temperature may exceed 100°C and can cause severe burns.</p>
	<p>Ensure that periodic inspections are performed according to EN378 and local regulations for system safe and reliability.</p>

Before working on pressurized component, shut down the unit and wait until equipment is at the ambient temperature.

To prevent system related problems, following periodic maintenance is recommended:

- Verify that safety devices are operational and properly set.

- Ensure that the system is leak tight.
- Check the compressor current draw.
- Confirm that the system is operating in a way consistent with previous maintenance records and ambient conditions.
- Check that all electrical connections are still adequately fastened.
- Keep the unit clean and verify the absence of rust and oxidation on the unit components, tubes, and electrical connections.
- The condenser must be checked at least once a year for clogging and be cleaned if deemed necessary. Access to the internal side of the condenser takes place through the fan door. Microchannel coils tend to accumulate dirt on the outer surface rather than inside, which makes them easier to clean than fin-&-tube coils.
- Switch off the unit at main switch before removing the fan panel.
- Remove surface dirt, leaves, fibers, etc. with a vacuum cleaner, equipped with a brush or other soft attachment. Alternatively, blow compressed air through the coil from the inside out, and brush with a soft bristle. Do not use a wire brush. Do not impact or scratch the coil with vacuum cleaner tube or air nozzle.
- If the refrigerant system has been opened, the system must be flushed with dry air or nitrogen to remove moisture and a new filter drier must be installed.

15 - Summer vacation

- In case the condensing unit run in pressure control mode (stand alone mode), If the evaporator is switch OFF, the unit could still make pump down from time to time. Those start and stop could be frequent in summer time to maintain receiver pressure to an acceptable limit.
- In case suction line and evaporator are PS 80 bar. we recommend to switch OFF the condensing unit during summer vacation : set controller main switch r12 to value 0 to force open receiver valve then turn OFF the power supply. Refrigerant charge limit guarantee that pressure in system will be less than 80 bar as long as evaporator temperature is less than 38°C.
- In case evaporator and suction line are PS 60 bars. Depending on specific situation, the best option could be to keep the system running during summer vacation to be sure evaporator remains at temperature below 22°C (corresponding

to 60 bar saturated pressure).

16 - Empty the system

- Set controller main switch r12 to value 2 = vacuum mode. This will stop compressor and force bypass valve and high-pressure valve fully open.
- Connect a service pipe equipped with a shutoff valve to suction line Shrader port.
- Open the valve slowly and discharge refrigerant in free atmosphere
- Ensure proper ventilation of location where refrigerant is release.
- Do not discharge refrigerant from liquid line. You will risk dry ice formation inside the pipe. Ice could prevent the flow of refrigerant and generate a sudden burst of CO₂ when it melts.

17 - Warranty

- Always transmit the model number and serial number with any claim filed regarding this product.
- The product warranty may be void in following cases:
 - Absence of nameplate.
 - External modifications, in particular drilling, welding, broken feet, and shock marks.
 - Compressor opened or returned unsealed.
 - Rust, water, or leak detection dye inside the compressor.
 - Use of a refrigerant or lubricant not approved by Danfoss.
 - Any deviation from recommended instructions pertaining to installation, application, or maintenance.
 - Use in mobile applications.
 - Use in explosive atmospheric environment.
 - No model number or serial number transmitted.

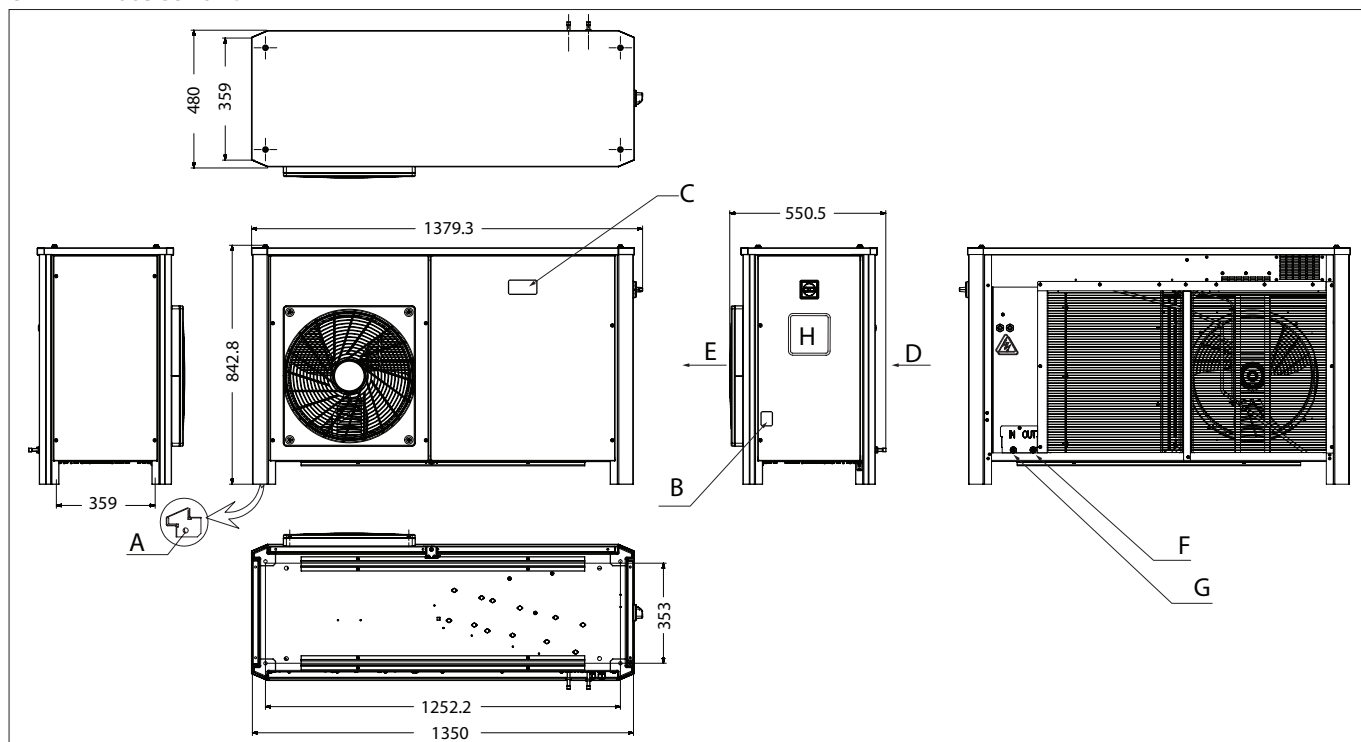
18 - Disposal

- Danfoss recommends that condensing units and oil should be recycled by a suitable company at its site.

Instructions

GA & PID Drawings

OP-MPAM005COP04G



English Legend

- A Ø12 Hole for Mounting
- B Sight Glass
- C Controller Display

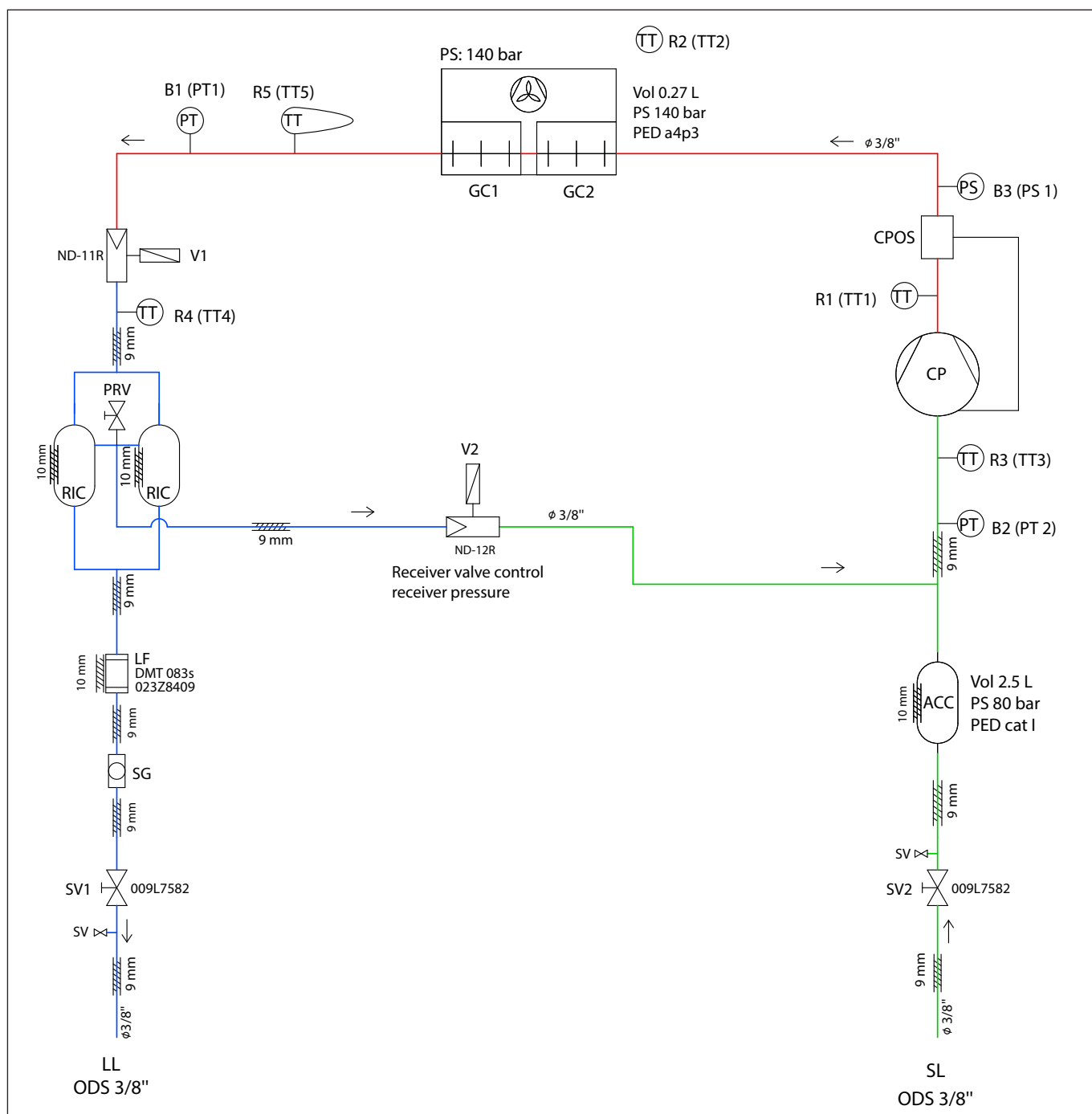
- D Air in
- E Air out
- F Liquid Port

- G Suction Port
- H Nameplate
- ⚠ Electrical Cables

Note: all dimension are in mm

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PID (Piping & Instrumentation Diagram)



English Legend

ACC - Suction accumulator vol. 2.5L PS 80 bar PED cat 1
B1 - High pressure sensor
B2 - Low pressure sensor
B3 - High pressure switch
CP - Inverter driven Scroll compressor with oil separator, Compressor suction vol. 1.2L PS 80 PED cat 1
CPOS - Oil separator build on compressor
R1 - Discharge temperature sensor
R2 - Ambient temperature sensor
R3 - Suction temperature sensor
R4 - Receiver inlet temperature sensor

R5 - Gas cooler outlet temperature sensor
V1 - Expansion valve (main) High pressure valve control gascooler pressure
V2 - Expansion valve (gas by-pass) Receiver valve control receiver pressure
PRV - Pressure Relief valve
GC1 - MCHC Gas cooler 1
GC2 - MCHC Gas cooler 2
LF - Liquid filter dryer
LL - Liquid line
PRV - Pressure relief valve on receiver Pset = 80 bar

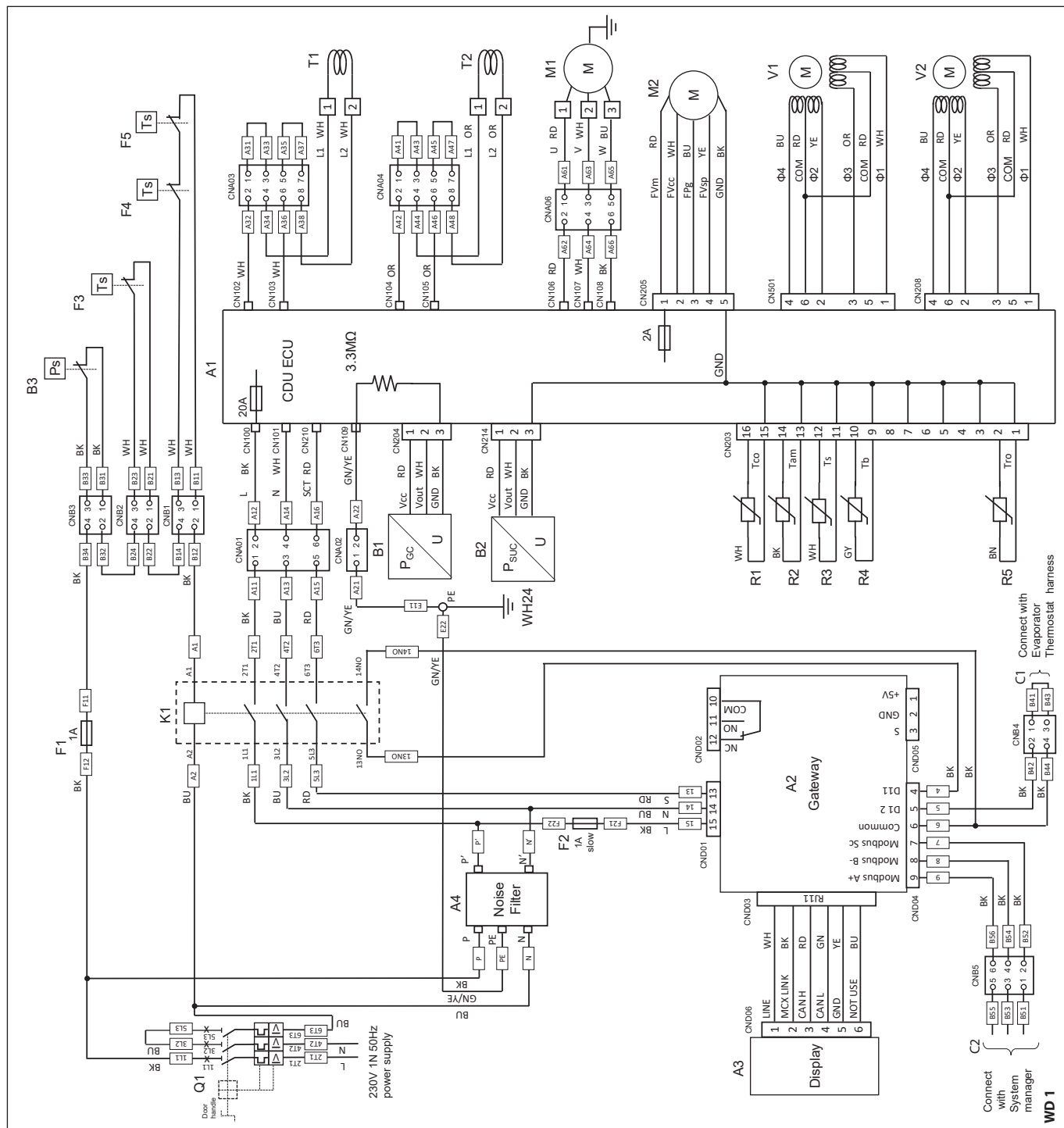
RIC - Receiver Vol. 2.5 L PS 80 bar PED cat I
SG - Sight glass with moisture indicator
SL - Suction line
SV - Schrader valve
SV1 - GBCH Service ball valve 1 (liquid line)
SV2 - GBCH Service ball valve 2 (suction line)

Red line - high pressure line
Blue line - Liquid line
Green line - Suction line
Black line - Oil line

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Wiring Diagram

OP-MPAM005COP04G



English Legend

- A1** : CDU ECU
- A2** : CDU Gateway
- A3** : CDU Display
- A4** : Noise filter
- B1** : High pressure sensor
- B2** : Low pressure sensor
- B3** : High pressure switch
- C1** : Connect with Evaporator Thermostat harness
- C2** : Connect with System manager
- F1** : Fuse (Pressure SW Thermal SW circuit)
- F2** : Fuse (GW circuit)
- F3** : Thermal switch (compressor)
- F4** : Thermal switch (reactor1)
- F5** : Thermal switch (reactor2)

- K1** : Contactor
- M1** : Compressor
- M2** : Fan motor
- Q1** : Main switch
- R1** : Discharge temp. thermistor
- R2** : Ambient air temp. thermistor
- R3** : Suction temp. thermistor
- R4** : Refrigerant inlet temp. thermistor
- R5** : Receiver outlet temp. thermistor
- T1** : Reactor1
- T2** : Reactor2
- V1** : Expansion valve (main)
- V2** : Expansion valve (bypass)

Wire colors

- BK** : black
- BU** : blue
- BN** : brown
- GN** : green
- GY** : grey
- OR** : orange
- RD** : red
- YE** : yellow
- WH** : White



Danfoss A/S

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