ENGINEERING
TOMORROW

Application guidelines

Optyma™
iCO₂ condensing units

R744 | 50 Hz

www.danfoss.com

Optyma™ iCO₂

OP-UPAC015COP04E

WARNING	This indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
CAUTION	This indicates a hazardous situation which, if not avoided, could result in injury to operator or material loss only.

Indicates Prohibition.

Indicates a compulsory matter.
It indicates an instruction on general act of user, which is not specified.

Indicates a compulsory matter.
Indicates that it must be earthed

To facilities designer and installer
- Read the "Safety precautions" carefully before installation.
- After reading the manual, keep it at a place where you can refer to whenever it is necessary.

Installation, electrical work and test run	
WARNING	Have the unit installed by your agent or specialized contractor. Electrical work needs to be done by a qualified electrical work contractor. Improper installation made by yourself may cause electric shock, or fire.
	Installation should be made properly according to this manual. Otherwise it may cause electric shock, or fire.
	Install the condensing unit (CDU) on a sturdy foundation that can bear its weight sufficiently. Imperfect installation may cause injury if it collapses or crumbles.
	Where it is installed in a small room, take measures to prevent the refrigerant from accumulating beyond the critical concentration. For the measures, consult with your dealer. When the refrigerant has leaked in the room, and accumulated beyond the critical concentration, it could cause suffocation if the space in the room is limited.
	Implement the electrical work according to this manual, and use always dedicated circuits. If it fails to observe descriptions in the manual, the capacity of circuits becomes insufficient, or the work is done improperly, it could cause electric shock, or fire.
	Implement the class D grounding by professional electrical work contractor. Do not connect the grounding cable to the gas pipe, water work pipe, lightning rod, or grounding cable of telephone. Imperfect grounding could cause electric shock, or fire.
	Be sure to install the earth leakage breaker according to appropriate local standard where the unit is installed. Unless it is installed, it could cause fire, or electric shock, owing to ground fault.
	Tighten wire terminals securely to specified torque. If they are not tightened securely, it could cause fire, or electric shock, owing to overheat on the terminal.
	Use specified cables for wiring, and connect them securely, avoiding external force. If they are not connected, or fixed, securely, it could cause fire.
WARNING	When wiring at site, take care to avoid wires being bit, by small animals like rat. If they are damaged, it could cause fire.
	To wash refrigerant pipes, use cleaning solution which is not combustible, or toxic. Use of combustible material like alcohol or ether could cause explosion, or fire.
	Wash refrigerant pipes at outdoor, or where it can be ventilated sufficiently. There is risk of oxygen shortage. If open flame is present nearby, it could generate toxic gas.
	If fluorocarbons are used to wash refrigerant pipes, collect them after use. It is prohibited by laws to release fluorocarbons carelessly.
	When using a burner, take care not to burn nearby parts, oil return pipe, or sound insulation cover. If the oil return cover is burned, oil under high pressure will burst out, causing fire, or injury.

Installation, electrical work and test run		
WARNING	Before starting brazing work, evacuate combustible matters from around the site. It could cause fire. Provide a fire extinguisher at the work place.	
	Implement the airtight test. If refrigerant leaks, it could cause oxygen shortage.	
	Open, and close, all valves according to instructions given on nameplates, or this manual. If the valves are opened or closed incorrectly, there is a risk of injury due to refrigerant spouting or the internal pressure of the equipment increasing, causing the refrigerant system to burst.	
	When handling refrigerant, put on leather gloves. Direct contact with hand could cause frostbite, or injury.	
	Always use nitrogen gas for airtight test. If oxygen gas, acetylene gas, fluorocarbon gas, is used by mistake, it could cause explosion, or poisoning.	
	This condensing unit is specially designed for use of R744. It is strictly prohibited to mix any material other than R744 during installation, repair, or relocation. If other refrigerant, or other combustible materials like air, oxygen, propane, or alcohol, are mixed, it could cause explosion, fire, or injury.	
CAUTION	During installation, connect the refrigerant pipe securely before operating the compressor. During repair, relocation, or disposal, remove the refrigerant pipe after stopping the compressor. If it is operated while the refrigerant pipe is removed and the gate valve is opened, it could inhale air, or other, and raise the pressure in the refrigerating cycle excessively, causing explosion, fire, or injury.	
	Avoid installing at a place where combustible gas may leak. If the gas leaks, and accumulates around the condensing unit, it could catch fire.	
	Ventilate effectively. If refrigerant leaks accidentally, it could cause oxygen shortage. If it touches open flame, it may generate toxic gas.	
	Be sure to provide suitable sewer. If frost adhered to the surface of equipment melts, and flows out, it could wet around the equipment.	
	Place a sign board prohibiting people other than operating personnel from touching the condensing unit, or enclose it with protective fence. If it is mishandled, it could cause injury.	
	Produce the refrigerant cycle within the range of specifications. If it is produced beyond the range, it could cause rupture, smoke, fire, or electric shock.	
	Turn off the source power supply before starting maintenance in the condensing unit.	
	Use a circuit breaker with the contact gap of category 3, or higher, at the source power supply.	
	Shield communication cables used for communication with and remote monitoring of the indoor unit.	

To personnel for daily operation and control

- Please read this "Safety precautions" carefully beforehand to use the unit properly.
- Servicing needs to be performed by qualified personnel, who are approved by us, or specialized personnel, who are specified by us.

During operation		
WARNING	Do not operate with covers removed from the condensing unit. If you touch live internal electric parts, it could cause electric shock.	
	None but qualified personnel is allowed to unfasten, or remove, wiring connection. Inside of pipes on the condensing unit is highly pressurized. Handling by unqualified person could result in serious accident.	
	Do not modify, or change, the main unit of condensing unit. It could cause serious accident.	
	Do not remove the protective net from the air blow outlet. Do not poke at the inside with fingers or stick. You could get hurt by the fan running at high speed.	
	When the condensing unit will not stop after taking proper steps for stop, shut down all power supplies immediately. It could cause electric shock, fire, or explosion. In such occasion, consult immediately with your dealer or customer service desk specified by maker.	
	If refrigerant has leaked, stop operation immediately, extinguish flame on a stove. Ventilate the place with care to sweep over the floor, and consult with your dealer or customer service desk specified by maker. Since the refrigerant is heavier than air, it tends to accumulate over the floor, which could cause oxygen shortage. Report the accident to your dealer, or customer service desk of maker.	
	When any abnormal condition (burning smell) is encountered, stop operation immediately, and turn off the source power supply. If operation is continued without repair, it could cause failure, electric shock, or fire. Consult with your dealer or customer service desk specified by maker.	
	When a protective device trips repeatedly or operation of "ON/OFF" switch is not reliable, shut down the source power supply immediately. Since earth leakage, or over-current, is suspected, it could cause electric shock, fire, or rupture.	
CAUTION	**Consideration for children** Children shall not play with the appliance. <In the European Market> Children should be supervised to ensure that they do not play with the appliance. <In the Australian and New Zealand market>	
	Restriction on use of equipment This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. <In the European Market>	
	Refrain from placing something on mechanical sections or insert hand at the inside. It could overheat, you could get hurt by the fan running at high speed.	
	Refrain from using inflammable spray, or placing combustible materials, nearby. If it ignite with sparks from switch, it could cause fire.	

Others		
WARNING	Do not damage, process, bend forcibly, pull, or bundle the power cable. If it is damaged under heavy object, or by being pinched, it could cause fire, or electric shock.	
	When disconnecting a wire connector, hold the plug at the end. If it is pulled forcibly holding the wire, part of core wires may be broken, causing fire by overheat.	
	In the event of fire, "stop oparation command from the equipment" shut down all power supplies. It could cause electric shock, or explosion. To extinguish fire, use "Oil fire extinguisher or electrical fire extinguisher".	
	Provide a secure foothold during servicing. Otherwise, it could cause injury if it collapses.	
	Check regularly the foundation frame for damage after using for a long period of time. If it is used without repair, it could cause injury if the condensing unit drops off.	
	Before cleaning or inspecting the equipment, turn the "ON/OFF" switch to "OFF" to shut down the power supply. Otherwise, you could get injured by the fan, or it could cause electric shock.	

Others		
CAUTION	Do not mount or place something on the condensing unit. It could cause injury if you fall, damage the machine, or drop the object.	
	Refrain from touching hands on the gas cooler fin directly. You could get hurt.	
CAUTION	When washing the gas cooler, take care not to splash water directly over electric parts. It could cause failure on devices.	
	After washing the gas cooler, collect cleaning solution, and dispose after treating appropriately, or have it consigned to a specialized contractor for disposal.	
	Avoid touching exposed pipes, or wires. It could cause burns and electric shock.	
	Avoid touching highly heated sections. Compressor, condenser, or wiring could be heated up beyond 100 °C locally, which could cause burns if touched.	
	Avoid touching electric parts, or operating switches, with wet hands. It could cause electric shock.	
	Regularly inspect the earth leakage breaker for proper operation. If it is defective and fails to trip when current leaks, it could cause electric shock, or fire.	
	When the unit is not used for a long period of time, turn off the source power supply. It may generate heat, resulting in fire accident.	

Repair, relocation and disposal		
WARNING	No person other than repair personnel or specialized contractor should attempt to disassemble, repair, or modify the unit. Improper practice in disassembly, repair, or modification, could cause injury, electric shock, or fire, if it operates abnormally.	
	When it becomes necessary to relocate the unit, ask the work to your dealer, or specialized contractor. Imperfect installation could cause electric shock, or fire.	
	When releasing R744 refrigerant, choke the valve to release little by little, and direct it where no person is present. If it gets into eyes, you could lose eyesight. R744 refrigerant itself is harmless but inhaling highly concentrated R744 could cause various influences over human body. In the solid state, R744 is called generally as dry ice, which is very cold at -75 °C under the atmospheric pressure. If it is touched by bare hand, it could cause frostbite.	

2.1 Outline of refrigerant R744

R744 is an environmentally friendly refrigerant with the ozone depleting coefficent at "0" and a smaller global warming potential. Refrigerant R410A is comparable with this in terms of the ozone depleting coefficient but has a higher global warming potential. R744 has a higher pressure of 64 bar at the same temperature, it is approximately 4 times higher than 16.5 bar of R410A.

Caution of refrigerant R744

1. Refrigeration cycle operates at higher pressures.

As a result, it becomes necessary to change the airtight test pressure and setting pressures, including the airtight pressure, withstanding test pressure, operating pressure, etc., for devices that constitute the refrigerating, and measuring instruments and tools. It is necessary to change also the material and wall thickness of refrigerant pipe (Using K64 class standard pipe).

Refrigerant leak detector needs to have a higher sensitivity.

2. Only use Condensing unit oils recommended by Danfoss.

Synthetic oil (ester oil) compatible with R744 is used.

2.2 Optyma™ iCO2 condensing unit

Scroll-rotary type compressor		
WARNING	**Scroll-rotary compressor is prohibited to turn in reverse.** Contrary to conventional reciprocal type compressor which can rotate in both directions, it can rotate in one direction only with the scroll-rotary compressor.	
	Scroll-rotary compressor becomes very hot It is highly heated during and immediately after stop of operation. Special care must be taken during maintenance and service.	
	Oil is retained at the high pressure side of scroll-rotary compressor. Care must be taken particularly when charging or discharging oil during maintenance, service, or test run.	

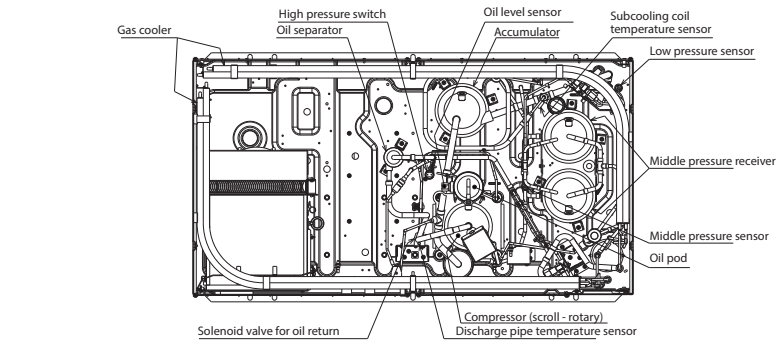
Optyma™ iCO2 combines our market leading expertise in condensing unit design with the unique benefits of stepless inverter Scroll+Rotary technology. The result is 20-30% higher energy efficiency in a flexible plug-and-play package.
The condensing unit includes following:

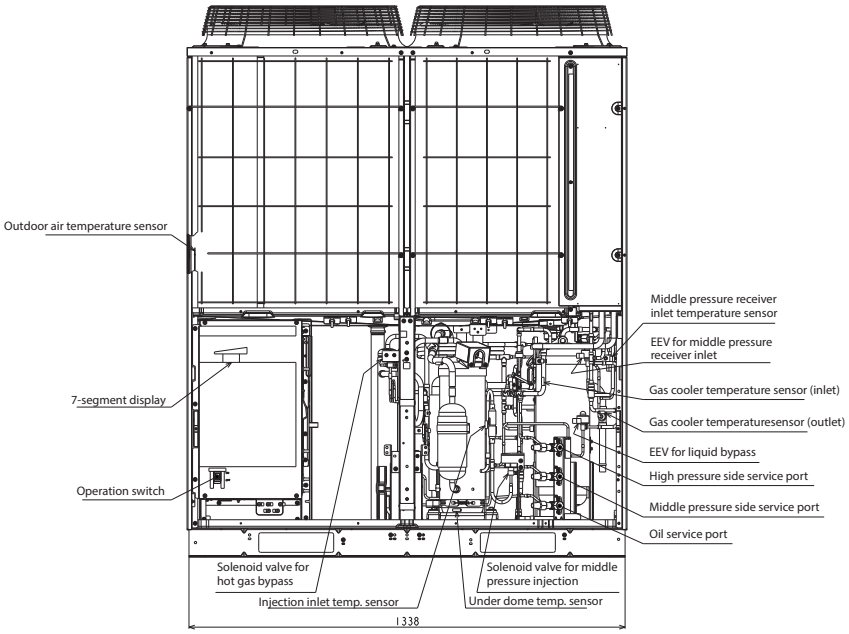
- Inverter Compressor (Scroll + Rotary)
- 2 parallel gas cooler (Coated fin and tube Heat exchanger)
- Unit controller
- 2 DC fan Assembly
- Receiver
- The condensing unit assembly is CE, PED certified CAT II
- This condensing unit controls its capacity by the speed control by means of inverter
- Compressor is connected to the inverter, and operated at variable speed. The inverter changes the power supply frequency supplied to the compressor of which speed changes nearly proportional to this frequency. The capacity is controlled in this way.
- Whether the load is high or low it is judged by detecting the low pressure (LP) of compressor. If the low pressure (LP) is high, it is judged that the load is high so that the output capacity of condensing unit is increased.
- The speed control by inverter features that it allows to change the capacity more finely than the unit number control of compressor. For this reason, it is better to install a plural number of evaporators, as much as possible, so as to control respective liquid solenoid valves individually, for effective operation.
- Since the inverter is in the advancing phase, if an advancing capacitor is installed, the power factor drops in reverse. Never install an advancing capacitor, because it may be broken.

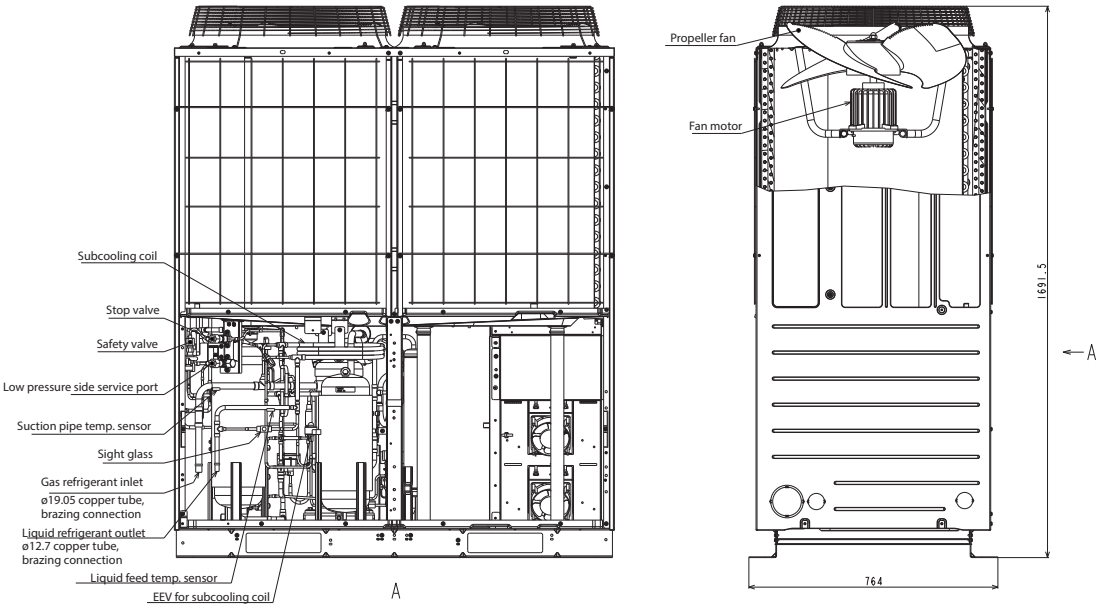
2.3 Specification

Features			Description
Condensing unit	Code number		114X6003
	Model designation		OP-UPAC015COP04E
	Power source		380~400V/3 Ph/50 Hz
	Refrigerant		R744 (CO2)
	Enclosure protection		IP24
	Evaporating temperature range		-45 °C ~ +5°C
	Ambient temperature range		-20 °C ~ +43°C
	Design pressure	High pressure	140 bar
		Low pressure	80 bar
	Capacity modulation		Inverter control by low-pressure sensor
	Unit exterior dimension in mm (Width X Depth X Height)		1350 x 764 x 1691.5 mm
	Accumulator	Volume	7.2 L
	Receiver (Medium pressure)	Volume	7.6L x 2
	Oil separator	Volume	0.87 L
	Connection	Suction connection	Ø19.05 mm (Brazing)
		Liquid connection	Ø12.7 mm (Brazing)
	Net weight		340 Kg
	Sound pressure at 1 m distance		62.0 dB(A)
	Enclosure painting specification		Stucco white
	PED catagory		II
	Approval		CE, UKCA
Compressor	Type		Hermetic inverter Type
	Oil		Diamond freeze MA68
	Displacement		15 CC
	Technology		Scroll + Rotary
	Nominal output		6.4 kW
	Crank case heater		24W
Gas cooler and fan assembly	Type		Axial flow type (Top discharge)
	Fan blade diameter		572 mm
	Power source		DC
	Motor output		386 W
	No. of fans		2
Electrical specifications	Starting current		5A (Inverter Start)
	MCC		19A
	Power input		10.54 kW
	Earth leakage breaker - rated current		30 A
	Earth leakage breaker - sensitivity	Class B	30mA at 0.1sec
	Power cord specification		10 mm² X 4(5) core X 70 m Max.
	Main switch rating		30 A
	Fuse rating		25 A
Module controller assembly	Dimension in mm		182 x 180 x 90
	Enclosure protection		IP64
	Gateway power input		12VDC

2.4 Structural drawing

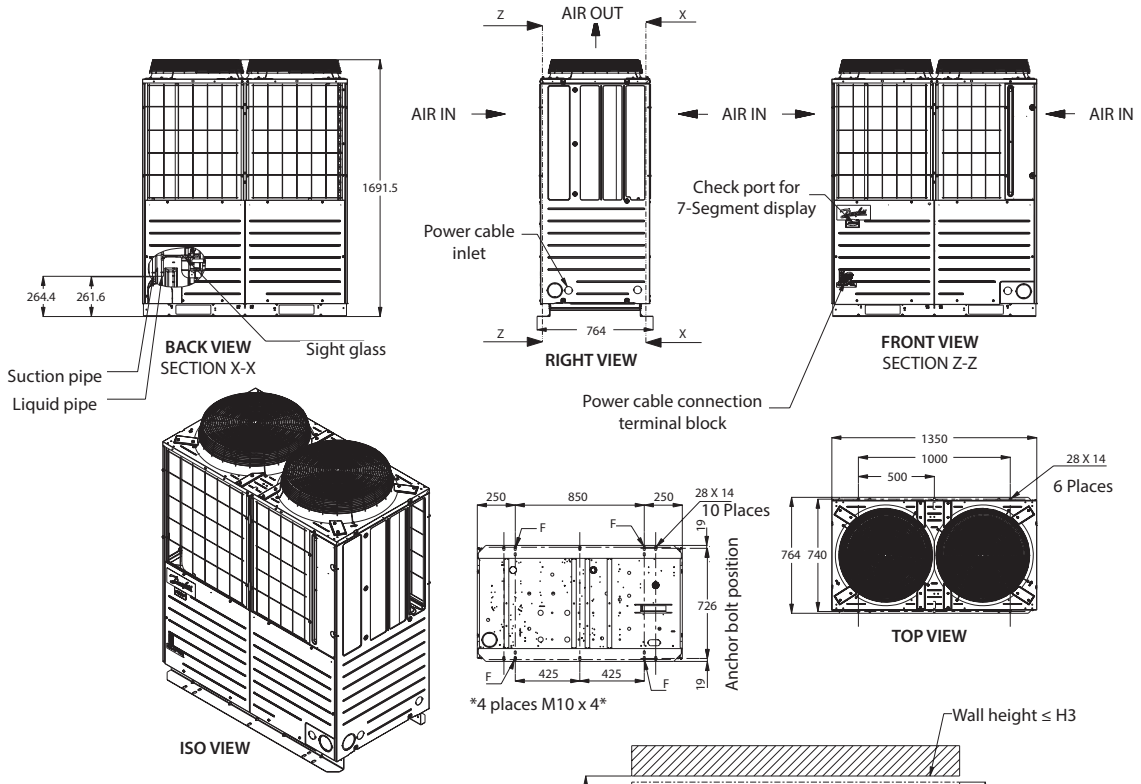






All dimensions in mm

2.5 Dimensions



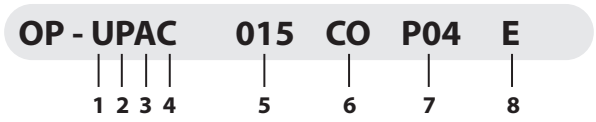
Installation Example	I	II
L1	800	800
L2	10	10
L3	800	800
L4	100(*)	500
H1	1500	1500
H2	Not limited	Not limited
H3	1000	1000
H4	Not limited	Not limited

* Be sure to keep more than 100mm spaces when the unit contacts with a wall. If the unit installed in succession, 10mm spaces is enough.

1. All dimensions are in mm
2. Dimensions are not to scale

2.6 Nomenclature

Designation system for the Optyma™ **iCO2 range**

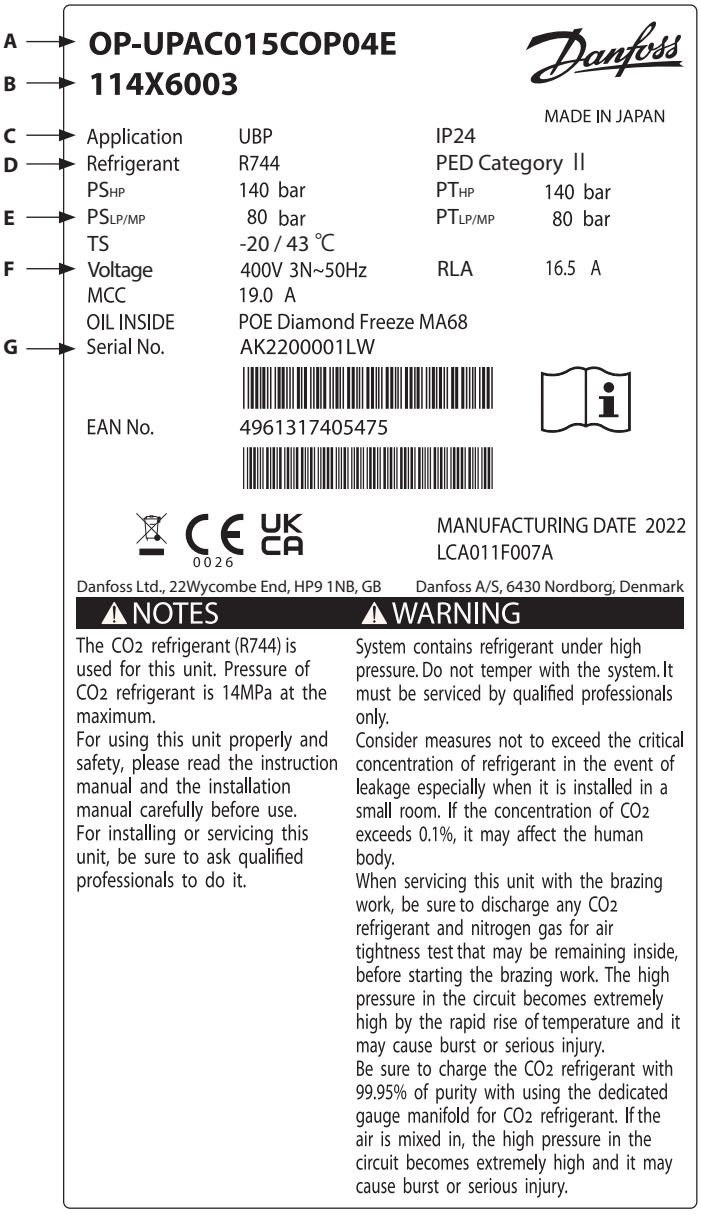


1	**Application:** U = Universal (MBP & LBP)
2	**Condensing unit family:** P = Optyma™ iCO2
3	**Refrigerant:** A = R744 (CO2)
4	**Gas cooler type** C = Fin and tube heat exchanger
5	**Compressor Displacement in cm^3:** Example 015 = 15 cm3
6	**Compressor platform** CO = Two stage Rotary & Scroll compressor
7	**Version:** P04: Optyma™ Plus iCO2 standard version with dedicated accessories for CO2 refrigerant.
8	**Electrical code:** E = Compressor 133–308V 3-phase & fan DC 280/339V

Version control

Model	Optyma™ iCO_2
Version	(P04)
Condensing unit: IP level	IP24
Refrigerant	R744 / CO_2
Compressor technology	2 stage – Scroll+Rotary
Control box (pre-wired E-panel)	Yes
Fin and Tube condenser	Yes
Fan speed controller	Yes
Main switch (circuit breaker)	Yes
Filter drier	Yes
Sight glass	Yes
Crankcase heater	Yes
HP Switch	Auto/Manual reset mode
Acoustic insulation	Yes
Condensing unit electronic controller	Yes
Network connectivity	Yes
Stack mounting	Not possible
Oil separator	Yes
Discharge gas Temperature Sensor	Yes
Suction gas Temperature Sensor	Yes
Ambient Temperature Sensor	Yes
HP/LP Alarm	Yes
Injection kit	Premounted
Adjustable time delay (Compressor)	Yes (available in Controller)
Electronic Expansion Valve	Yes
Solenoid valve	Yes
Receiver	Yes
Service valves	Yes
Accumulator	Yes
Oil separator	Yes
Subcooling coil	Yes
Pressure relief valve	Yes
Stop valve	Yes
Check Valve	Yes

2.7 Nameplate

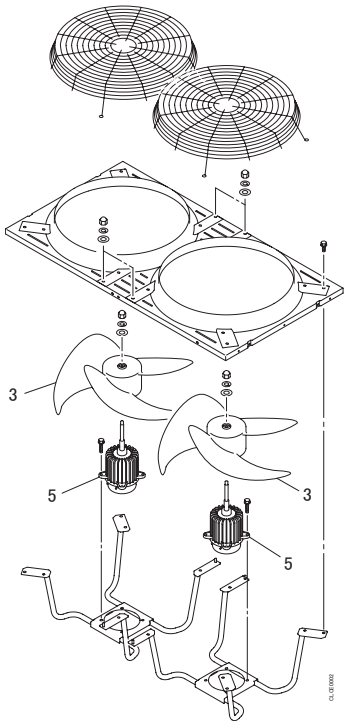
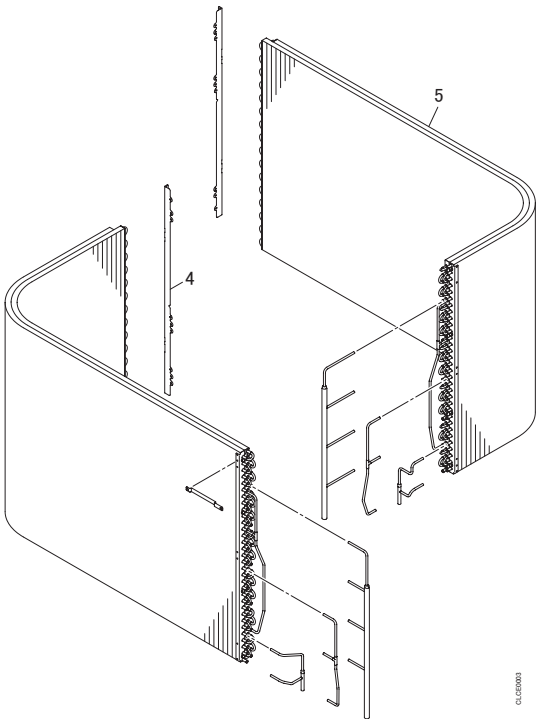


A: Model
B: Code number
C: Application, Protection
D: Refrigerant
E: Housing Service Pressure (Maximum working pressure)
F: Supply voltage, Rated Load Ampere, Maximum Continuous Current
G: Serial Number and bar code

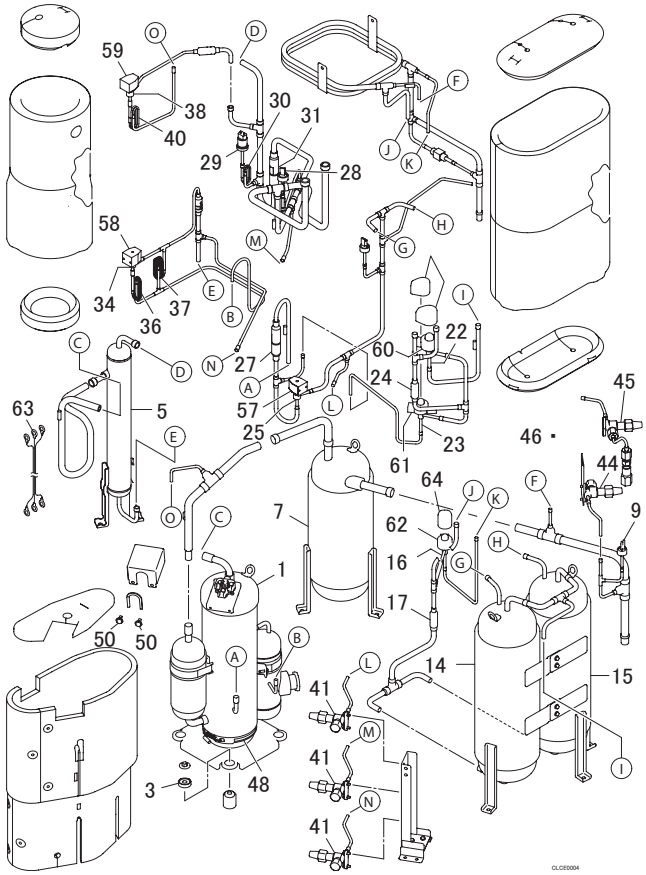
2.8 Approvals and certificates

PED	OP-UPAC015COP04E
CE	OP-UPAC015COP04E
UKCA	OP-UPAC015COP04E
Other	Contact Danfoss

2.9 Spare part

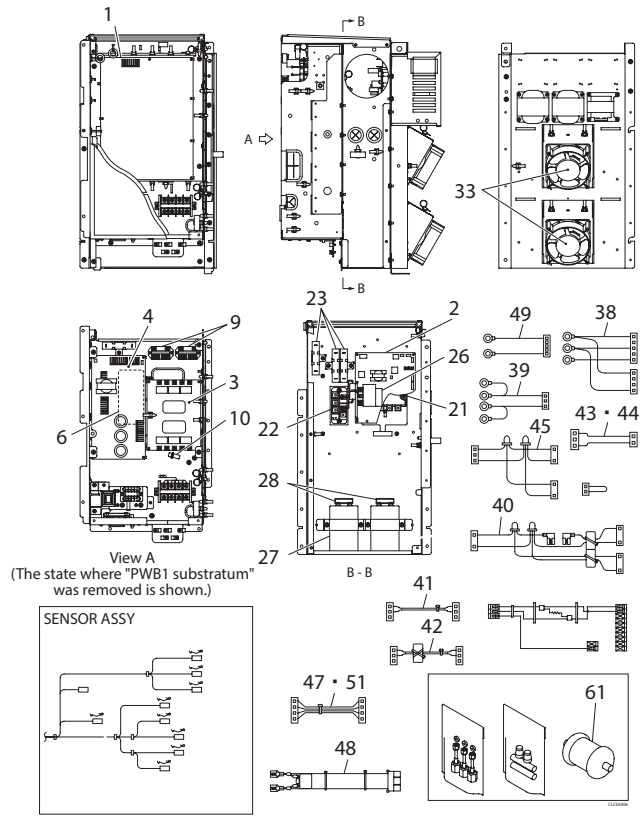
No.	Parts Name	Parts No	Danfoss Requirements				Packing Style	Remarks
			Gross weight	Unit Dimension (mm)				
			Kg	Length	Width	Height		
Fan Assembly								
								
3	FAN,PROPELLER	SSA431B242B	4.600	630	630	290	Carton box	Fan, D570mm
5	MOTOR,DC	SSA512T155	8.200	450	250	240	Carton box	Fan motor, UGBTEF-12MMHI08, Rated output:386W, Rated voltage:DC280/339V
Heat Exchange Assembly								
								
4	Front heat exchanger	LCA301A005	60.600	1420	960	750	Wood crate	SPARE PART, HEAT EXCH ASSY(AIR)
5	Rear heat exchanger	LCA301A007	60.600	1420	960	750	Wood crate	SPARE PART, HEAT EXCH ASSY(AIR)

No.	Parts Name	Parts No	Danfoss Requirements				Packing Style	Remarks
			Gross weight	Unit Dimension (mm)				
			Kg	Length	Width	Height		
Piping								



1	COMPRESSOR ASSY	LCA201A003B	49.000	510	440	760	Wood crate	Compressor, GSR2115AD2, Rated voltage:133-308V 3 phase
3, 5	SEPARATOR,OIL	LCA354A010	4.000	760	230	150	Carton box	Oil separator, Connection size:inlet Φ12.7 outlet Φ9.52
2, 7	ACCUMULATOR	SSA351A268	21.300	420	380	700	Wood crate	Accumulator, Volume:7.2L, Connection size:inlet Φ19.05 outlet Φ19.05
29, 9	SENSOR,LP	SSA551D031	0.093	105	85	55	Carton box	Low presure sensor PSL, HSK-BC-016, Range:0 to 100bar, Connection size:Φ6.0
7, 14	RECEIVER (Front)	SSA352A150	24.200	720	330	310	Wood crate	Middle pressure receiver 1, Volume:7.6L, Connection size:inlet Φ12.7outlet Φ12.7 and Φ9.52
7, 15	RECEIVER (Rear)	SSA352A150A	24.100	720	330	310	Wood crate	Middle pressure receiver 2, Volume:7.6L, Connection size:inlet Φ12.7outlet Φ12.7 and Φ9.52
10, 16	VALVE,EXP	SSA387F071	0.068	150	125	20	Vinyl bag	EEV for subcooling coil EEVSC, CPM-B06YCSM-1, Connection size:inlet Φ6.35 outlet Φ6.35
16D, 17	STRAINER	SSA357A050	0.055	150	85	20	Vinyl bag	Stainer, Connection size:inlet Φ12.7 outlet Φ8.0
9, 22	VALVE,EXP	SSA387F058	0.108	175	150	25	Vinyl bag	EEV for middle pressure receiver inlet EEVG, HPM-BD24SM-1, Connection size:inlet Φ7.94 outlet Φ7.94
8, 23	VALVE,EXP	SSA387F070	0.067	150	125	20	Vinyl bag	EEV for liquid bypass EEV-LB1, CPM-B04YCSM-1, Connection size:inlet Φ6.35 outlet Φ6.35
6A, 24	STRAINER	SSA357A050C	0.049	150	85	20	Vinyl bag	Stainer, Connection size:nlet Φ9.52 outlet Φ9.52
25	VALVE,S(2WAY)	SSA382A278A	0.070	150	85	20	Vinyl bag	Solenoid valve for gas injection SV-INJ1, ALS-BCY2SM-2, Connection size:inlet Φ6.35 outlet Φ6.35
29, 9	SENSOR,LP	SSA551D031	0.093	105	85	55	Carton box	Middle pressure sensor PSM, HSK-BC-016, Range:0 to 100bar, Connection size:Φ6.0
12A, 27	VALVE,CHECK	SSA385A053	0.185	150	125	25	Vinyl bag	Check valve, CAV-10Y3CSM-1, Connection size:inlet Φ9.6 outlet Φ9.6
27, 28	SENSOR,HP	SSA551D030	0.094	105	85	55	Carton box	High pressure sensor PSH, HSK-BC150D-016, Range:0 to 150bar, Connection size:Φ6.0
28, 29	SWITCH,HP	SSA532A086A	0.162	145	70	70	Carton box	High pressure switch 63H1-1, CCB-4UB08W, PED certified CE 0035, ON;140bar/OFF:90bar, Connection size:Φ6.35
28, 30	CAPILLARY	PCM315B005	0.011	150	85	15	Vinyl bag	Capillary, Length:250mm, Connection size:inlet Φ3.2 outlet Φ3.2

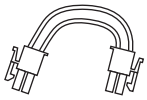
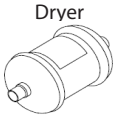
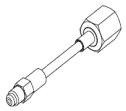
No.	Parts Name	Parts No	Danfoss Requirements				Packing Style	Remarks
			Gross weight	Unit Dimension (mm)				
			Kg	Length	Width	Height		
12B, 31	VALVE,CHECK	SSA385A053A	0.189	150	125	25	Vinyl bag	Check valve, CAV-10Y4CSM-1, Connection size:inlet Φ12.8 outlet Φ12.8
25	VALVE,S(2WAY)	SSA382A278A	0.070	150	85	20	Vinyl bag	Solenoid valve for gas bypass SV-HG1, ALS-BCY2SM-2, Connection size:inlet Φ6.35 outlet Φ6.35
16B, 41L	SPARE PART, HP SERVICE VALVE ASSY	LCA381A004	0.469	195	125	60	Carton box	Service valve for high pressure side service port or middle pressure side service port or oil servise port, FCV-B2CSM-1, Connection size:inlet Φ6.35 outlet Φ6.35
16A, 44	SPARE PART, LP SIDE SERVICE VALVE ASSY	LCA381A023	0.434	125	125	70	Carton box	Service valve for low pressure side service port, FCV-B2CSM-1, Connection size:inlet Φ6.35 outlet Φ6.35
17, 45	VALVE ASSY,SERVICE	LCA381A024	0.460	195	125	60	Carton box	Service valve for safety valve, FCV-B2CSM-1, Connection size:inlet Φ6.35 outlet Φ6.35
18, 46	VALVE,SAFETY	SSA388P001	0.112	150	85	30	Vinyl bag	Safety valve, CS-001-2, Setting:8.7MPa, Connection size:M16
	PACKING	SSA932A046	0.003	150	85	5	Vinyl bag	Packing, CSM-1, inner Φ3.5 outside Φ14.6
32, 48	HEATER ASSY(CRANK)	PCA541B016L	0.066	300	175	20	Vinyl bag	Crankcase heater, Rated output 23.8W, Rated voltage:240V 1 phase
14C, 57	COIL ASSY,SOLENOID	LCA382F007B	0.185	105	85	55	Carton box	Coli for SV-INJ1, A22-1B28BSM-1, Rated voltage:AC220~240V 1 phase 50/60Hz
14B, 58	COIL ASSY,SOLENOID	LCA382F006F	0.168	105	85	55	Carton box	Coil for SV-OIL1, SR10D-79B-9, Rated voltage:AC220V 1 phase 50/60Hz
14A, 59	COIL ASSY,SOLENOID	LCA382F007C	0.175	105	85	55	Carton box	Coil for SV-HG1, A22-1B17BSM-1, Rated voltage:AC220~240V 1 phase 50/60Hz
8-10, 60	COIL,SOLENOID	SSA382F224B	0.184	110	90	65	Carton box	Coil for EEVG, HPM-MD12SM-6, Rated voltage:DC12V
8-10, 61	COIL,SOLENOID	SSA382F230	0.152	105	85	55	Carton box	Coil for EEVLB, CPM-MD12SM-1, Rated voltage:DC12V
8-10, 62	COIL,SOLENOID	SSA382F230A	0.157	105	85	55	Carton box	Coil for EEVSC, CPM-MD12SM-2, Rated voltage:DC12V
63	WIRING ASSY	PCM504A018AV	0.300	225	300	40	Vinyl bag	Wiring for compressor
14B, 34-37	VALVE ASSY,S(OIL)	LCA382A018	1.400	400	340	270	Carton box	Valve ASSY of SV-OIL1-2, Connection size:inlet Φ6.35 outlet Φ6.35
14A, 38-40	VALVE ASSY,S(HG)	LCA382A002	0.474	370	220	100	Carton box	Valve ASSY of SVHG1, Connection size:inlet Φ6.35 outlet Φ9.52
Control								



1	PWB ASSY(CONTROL)	PCM505A011BD	0.900	370	285	85	Carton box	Only for supply parts PWB1
2	PWB ASSY(INV.)	PCB505A107CB	0.468	220	200	80	Carton box	Only for supply parts PWB2
3	PWB ASSY(N.F)	PCB505A035H	1.100	250	180	70	Carton box	PWB3

No.	Parts Name	Parts No	Danfoss Requirements				Packing Style	Remarks
			Gross weight	Unit Dimension (mm)				
			Kg	Length	Width	Height		
4	PWB ASSY(POWER)	PCB505A114A	0.989	305	175	100	Carton box	Only for supply parts PWB5
5	PWB ASSY	LCA505A003D	0.145	170	150	70	Carton box	Only for supply parts PWB6
6	PWB ASSY(REMOTE)	PCM505A009A	0.130	195	125	60	Carton box	PWB7
10	TRANSFORMER ASSY	PCB554A021	0.030	300	175	10	Vinyl bag	Current transformer, GJ-4-X, 4.1V±3%/50A(50/60Hz, 150Ω)
21	TRANSISTOR(POWER)	PCB008A177B	0.429	160	95	65	Carton box	Only for supply parts TM, PM50CL1A120
22	DIODE(MODULE)	PCB008A121A	0.231	125	80	55	Carton box	Only for supply parts DM, PGH75N16
23	RESISTOR	SSA553A536	0.124	105	85	55	Carton box	R1-1,2,3, 26500-0600, 7.5Ω
26	CAPACITOR	SSA552F694	0.125	105	85	55	Carton box	Capacitor, PC78D125-225K, Capacitance 2.2μF
27	CAPACITOR	SSA552F427AK	0.811	165	90	85	Carton box	Capacitor, LNX2G472MSEBMZ, Capacitance 4700μF
28	RESISTOR	SSA553A380	0.049	150	80	15	Vinyl bag	R3, 32500-1070, 30kΩ
33	MOTOR ASSY,AC	PCB511A006F	0.725	160	160	80	Carton box	Fan motor, UP12D23-GTEW, Rated output 16W, Rated voltage:230V 1 phase 50/60Hz
34	SENSOR ASSY	LCA551A002	0.052	300	175	10	Vinyl bag	THO-G1,G2
35	SENSOR ASSY	LCA551A002A	0.058	300	175	10	Vinyl bag	THO-M1,INJ1
36	SENSOR ASSY	LCA551A005	0.073	300	175	10	Vinyl bag	THO-D1,S,C1
37	SENSOR ASSY	LCA551A003	0.115	300	225	10	Vinyl bag	THO-SC,R,A
38	WIRING ASSY	PCM504A018AP	0.038	300	175	15	Vinyl bag	PWB3-1 L1 ,PWB3-1 N ,PWB3-1 L2 - PWB1 CNW1,PWB1 CNW2
39	WIRING ASSY	PCM504A006J	0.025	175	150	15	Vinyl bag	52X1-1 5,52X1-2 5,52X1-2 6,52X1-1 6- PWB1 CNM1
40	WIRING ASSY	PCM504A006L	0.084	105	85	55	Carton box	PWB5 CN13-2- PWB1 CNDR,PWB1 CN13V
41	WIRING ASSY	PCM504A006M	0.007	150	125	10	Vinyl bag	PWB1 CN15V- PWB5 CN15V-2
42	WIRING ASSY	PCM504A006N	0.034	175	150	30	Vinyl bag	PWB1 CN18V- PWB5 CN18V-2
43	WIRING ASSY	PCM504A018K	0.055	105	85	55	Carton box	PWB5 CNA1-2- FM1 CNDC1
44	WIRING ASSY	PCM504A018L	0.053	105	85	55	Carton box	PWB5 CNA2-2- FM2 CNDC2
45	WIRING ASSY	PCM504A018AC	0.020	175	150	15	Vinyl bag	PWB1 CNN3- FMC1,FMC2
46	WIRING ASSY	LCA504A004	0.002	150	85	10	Vinyl bag	PWB1 CNS1
47	WIRING ASSY	PCM504A006Z	0.039	300	175	10	Vinyl bag	PWB1 CNI1- PWB2-1 CNI2
48	WIRING ASSY	PCA504A273	0.016	250	175	10	Vinyl bag	DM1 G,DM1 K- PWB2-1 CNR
49	WIRING ASSY	PCM504A018AJ	0.018	175	150	15	Vinyl bag	C2 -,C1 +- PWB2-1 CAN
50	HARNESS ASSY	LCA504A001	0.038	105	85	55	Carton box	OLS1- CNTH7,CNZ
51	WIRING ASSY	PCM504A023	0.022	300	175	10	Vinyl bag	CN1- CNV1
71	DRYER	SSA356A004	1.500	200	110	110	Carton box	Filter dryer, DCY-P8 165 S/MMS, Connection size:inlet Φ16.1 outlet Φ16.1
74	OIL(DF-MA68-0.5L)	DF-MA68-0.5L	1.500	90	90	260	Carton box	Oil, 1PCS/1pack carton
75	OIL(DF-MA68-4.0L)	DF-MA68-4.0L	27	420	410	290	Carton box	Oil, 1PCS/1pack carton
CO2 MODULE CONTROLLER UNIVERSAL GATEWAY								
76	MODULE CONTROLLER	118U5498	2.600	182	90	180	Carton box	Module Controller Assy ICO_2

Accessories

Name	Q'ty	Location of use	
Wiring 	3	Connect these to CNG1, 2 or CNS3 on the outdoor unit PCB when external inputs are used.	These are fixed in the control box with tapes. When using the wiring, refer to the "External input harness installation manual", page 47
Wiring 	2	When using external outputs, cut the harness at the center to produce a pair of connectors, and connect them to CNH, CNY, CNZ1 and CNZ2 on the outdoor unit PCB.	These are fixed in the control box with tapes. When using the wiring, refer to the "External input harness installation manual", page 48
Dryer 	1	Install in liquid pipe. Dryer pipe diameter need to reduce with reducer to connect liquid pipe.	This is fixed to unit base plate with tapes.
Reducer (for dryer) 	2	Connect to dryer pipe.	These are fixed to unit base plate with tapes.
Reducer (for service port) 	3	Using for airtight test and vacuuming. Connect to service port.	"These are fixed to unit base plate with tapes. When using the reducer, refer to the page 12-13 of Instructions "Leak detection" and "Vacuum dehydration"."

2.10 Refrigeration capacity

Refrigeration capacity list

Unit: kW

Model		OP-UPAC015COP04E
Outdoor air temperature		32 °C
Refrigerant		R744(CO_2)
Evaporation temperature (°C)	-45	7.09
	-40	8.32
	-35	10.2
	-30	12.1
	-25	13.9
	-20	15.8
	-15	17.7
	-10	19.6
	-5	20.9
	0	20.0
	5	19.8

Notes:

1. This shows the case of refrigerant R744, power source voltage 400V, and gas cooler outdoor air temperature 32 °C.
2. The evaporating temperature is the saturated temperature of the suction pressure, and shows the value when the suction gas superheat degree is 10K.
3. When evaporating temperature exceeds -5°C, rated capacity decreases due to the operation of the protection control, and rated capacity decreases as the evaporation temperature increases.

Refrigeration capacity curve and power consumption curve

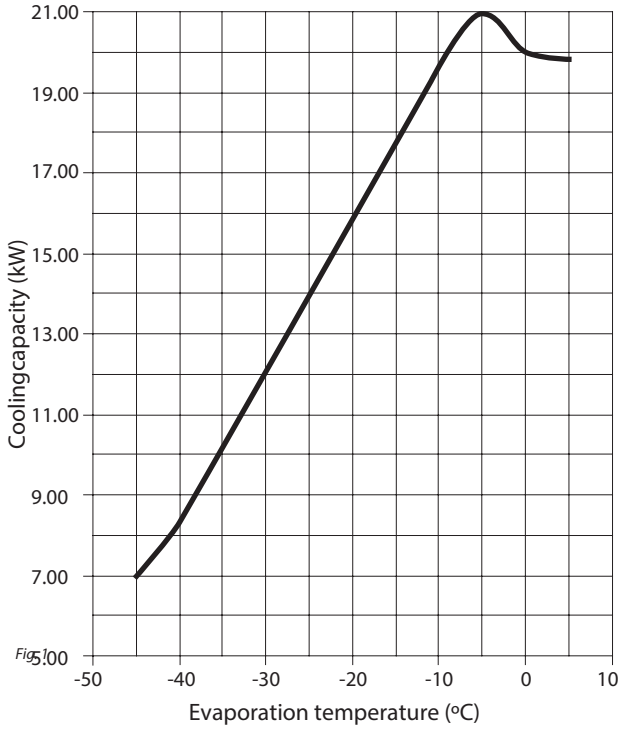


Fig. 1

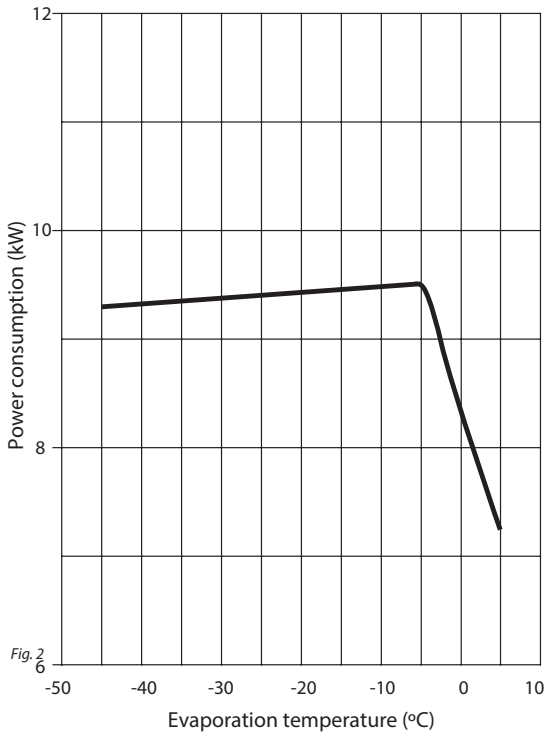


Fig. 2

Notes:

1. When evaporating temperature exceeds -5°C, power consumption decreases due to the operation of the protection control, and power consumption decreases as the evaporation temperature increases.

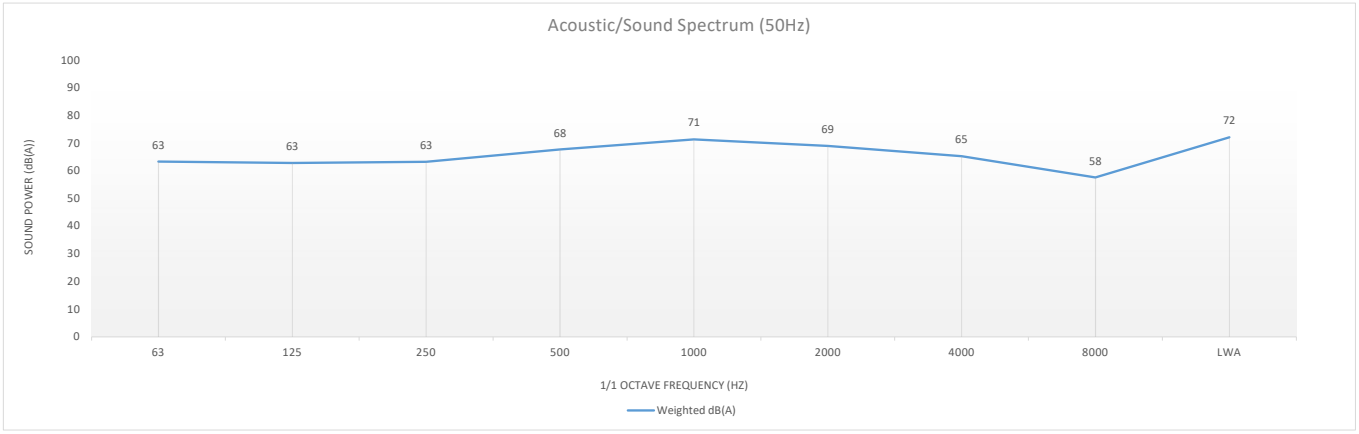
2.11 Noise level

Cooling mode

Model	Sound Power Spectrum	Sound Power Spectrum, 1/1 Octave									
		63	125	250	500	1000	2000	4000	8000	16k	L_{WA}
OP-UPAC015COP04E	1/1 Octave dB(A)	63	63	63	68	71	69	65	58	-	72

EN13215 Conditions - MBP				
Evaporation temperature (°C)	Ambient temperature (°C)	Superheat (K)	Compressor speed (rps)	Fan Speed (rps)
-10	32	10	104	2 fans x 16.67

Calculated Sound Pressure (Free Field) (dB(A))			
Distance (in Meters)	1m	3m	10m
Sound Pressure (dB(A))	62	52.5	42



Acoustic spectrum data are calculated and validated at addition of sound power levels of compressor and fan motor at full speed according to EN13215 conditions.
As compressor and fan motor are placed in a packaged unit, effect of noise reduction due to enclosure and insulation was considered for evaluation of sound power
The values are declared according to EN13215 at MBP conditions at full speed of compressor (104 rps) and full speed of fan motors (2 fans X 16.67 rps)

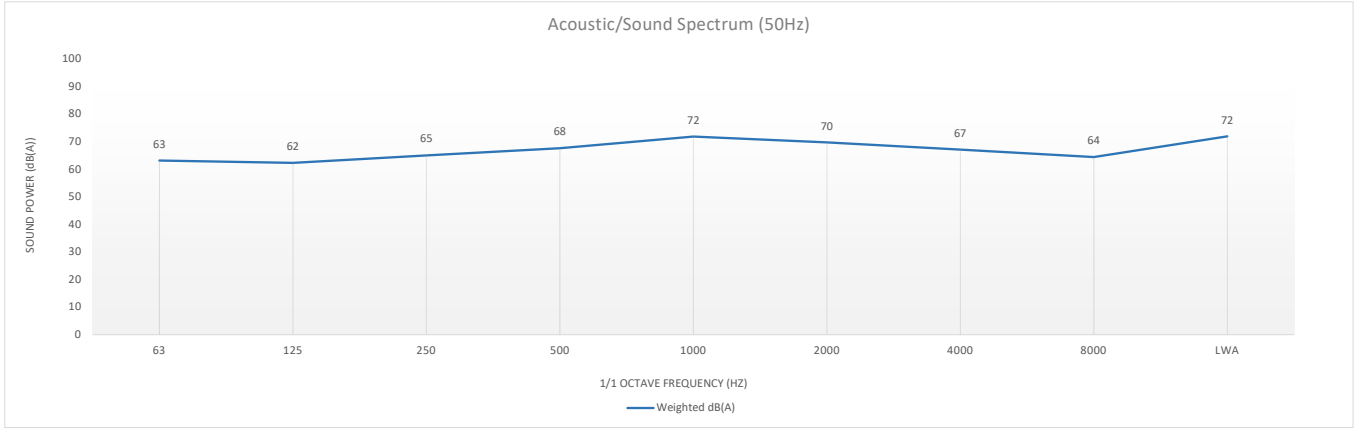
Fig. 3

Freezing mode

Model	Sound Power Spectrum	Sound Power Spectrum, 1/1 Octave									
		63	125	250	500	1000	2000	4000	8000	16k	L_{WA}
OP-UPAC015COP04E	1/1 Octave dB(A)	63	62	65	68	72	70	67	64	-	72

EN13215 Conditions - LBP				
Evaporation temperature (°C)	Ambient temperature (°C)	Superheat (K)	Compressor speed (rps)	Fan Speed (rps)
-35	32	10	104	2 fans x 16.67

Calculated Sound Pressure (Free Field) (dB(A))			
Distance (in Meters)	1m	3m	10m
Sound Pressure (dB(A))	62	52.1	42



Acoustic spectrum data are calculated and validated at addition of sound power levels of compressor and fan motor at full speed according to EN13215 conditions.
As compressor and fan motor are placed in a packaged unit, effect of noise reduction due to enclosure and insulation was considered for evaluation of sound power
The values are declared according to EN13215 at LBP conditions at full speed of compressor (104 rps) and full speed of fan motors (2 fans X 16.67 rps)

Fig. 4

2.12 Reference data for anti-vibration design

Position of the center of gravity

Model / Item	Product external dimensions W × D × H (mm)	Product weight (kg)	Position of center (mm)[1]								
			W direction				D direction				Height
			X	X_1	X_2	L_1	Y	Y_1	Y_2	L_2	Z
OP-UPAC015COP04E	1350 x 764 x 1691.5	340	590	340	510	850	375	345	381	726	697

[1] **Note:** Dimensions L_1 (X_1, X_2) and L_2 (Y_1, Y_2) indicate the position of installation bolts.

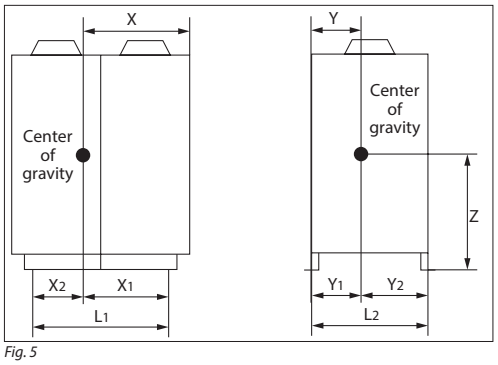


Fig. 5

Anti-vibration data

Model / Item	Compressor speed (min^{-1})	Fan speed (min^{-1})
OP-UPAC015COP04E	6240	1000

3.1 Operation range

Use this condensing unit within the following operation ranges.

Item	Unit	Specifications
Refrigerant	-	R744
Evaporation temperature	°C	-45 ~ 5
Low pressure (LP)	bar abs	8.3 ~ 30.5
Suction gas temperature(Ts)	°C	Evaporating temperature +40°C
Discharge temperature(Td)	°C	125 or under
Ambient temperature	°C	-20 ~ 43
Power supply voltage	-	Within ±10% of rated voltage (380/400/415 V)
Voltage unbalance rate	-	Within ±2% of rated voltage

Note:

1. Install sufficient insulation on liquid feed piping and suction gas piping. (Refer to the insulation (*) thickness in the following table.)

Type	OP-UPAC015COP04E	
Pipe section	Liquid feed	Suction
For cooling	20mm	30mm
For freezing	30mm	40mm

Note:

Where the thermal conductivity of insulator is 0.035W/m-K, if the liquid feed pipe and the suction gas pipe touch each other, it could cause a superheat as a result of heat transfer between these pipes. Separate these pipes effectively.

2. Do not use the unit in a corrosive atmosphere.

3. Arrange at site such that the degree of superheat of suction gas will fall within a range of 5 deg to 40 deg.

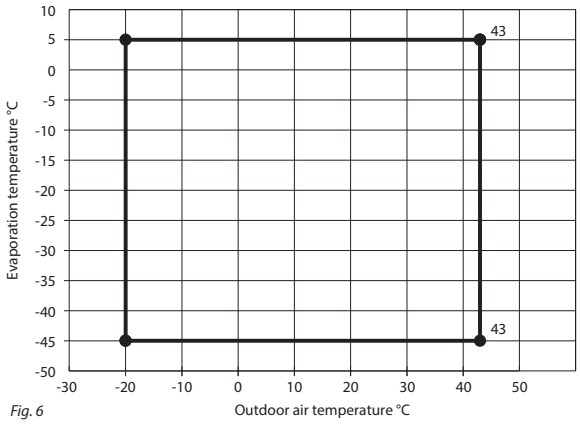


Fig. 6

3.2 Device to be connected to low pressure side

Select and connect devices (show case, etc.) to be connected to the low pressure side of condensing unit according to the following table.

Item	Specifications
Number of connectable units	1 - 16 units
Load capacity	Determine the capacity such that the total rated nominal capacities of these units, is below 100 % of the condensing unit rated capacity. (Maximum ambient: +43°C) Min. load during operation need further investigation for single and multi-evaporator(see dedicated slide) : the minimum demand asked by the cold rooms / Display cabinets will be higher than 50% of the minimum cooling load of the condensing unit. For Single evaporator, an additional rule is requested : 58% of the maximum cooling load of the condensing unit
Evaporator volume and specification	Select specifications with which the refrigerant flow speed from 8 to 12m/s on liquid line and 0,6to 1,2m/s on vapour suction line. Suggested PS =80bars All total evaporator volume above 58 Liters should get specific validation

Item	Specifications
System controller (Gateway)	Use AK-CC55 single coil controllers (084B4082 or 084B4083) and all appropriate sensors
Expansion valve	Select appropriate AKVP and orifice diameter on Coolselector Danfoss Software
Basics	• Module controller must be connected to ensure oil return (118U5498) • Pipe insulation should be schedule 20/30mm MT, 30/40mm LT • Inlet and outlet ball valve as well and sight glass on farest evaporator is good to have • PED certification must be completed → easy with Danfoss PED certif. and pre mounted PRV • Proximity main switch and Circuit breaker (30A with B curve,30mA)

Please use the oil and refrigerant charge calculation sheet before starting you comissioning

(Some additional oil quantities might be requested)

Minimum load in one to one and multiple cold room system

The minimum capacity of the unit is obtained with Coolselector. Minimum compressor speed (2400rpm) at the lower ambient temperature. Then 2 rules need to be considered to ensure best in class unit behavior.

1. For one-to-one system:

- We advise to take a margin of 30% above minimum cooling capacity at low ambient temperature.
- This value will prevent with ambient temperature variation, reduction of demand, reduced number of start and stop of the unit.
- For higher ambient temperature, the unit will increase the frequency to maintain the capacity to deliver to the evaporator.

Example:

Evaporating temperature	One to one minimum cooling capacity
0°C	13,9 kW
-10°C	11,5 kW
-25°C	7,8 kW
-35°C	5,7 kW

2. In all cases, including multi evaporator ones:

The minimum demand of the system might be low during a period such as Night, close store, wintertime. You need to take care that the lowest load mustn't be lower than 50% of the minimum load the following one for one time. (The unit will be block on alarm (E88) mode if you have more than 10 stop and star for on hour running time)

Example:

Evaporating temperature	Minimum cooling capacity demand
From -35 to -45°C	1,9 kW
From -20 to -34°C	3,0 kW
From -5 to -19°C	4,1 kW
From 5 to -4°C	5,1 kW

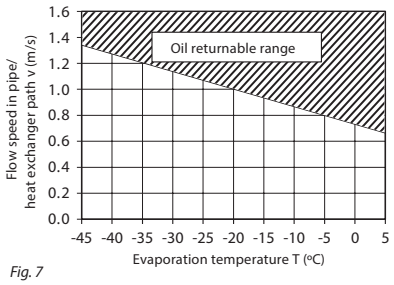
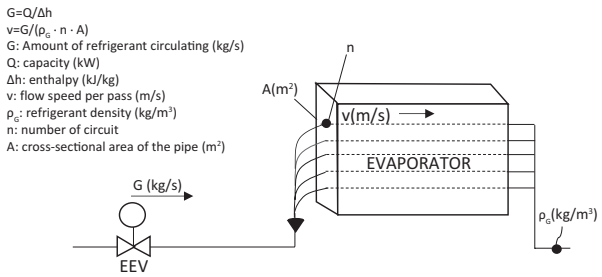


Fig. 7



⚠	Install the earth leakage breaker on the electric circuit to provide more safe protective function. It will prevent electric shock in the event of earth leakage.
	Cleaning solution of gas cooler, or antifreeze solution, should not be disposed in a sewer, but disposed according to provisions of applicable laws. For details, consult your dealer or the customer service desk of maker.

3.3 Location & fixings

Be sure to secure installation spaces.
It could cause failures on the compressor or electric equipment owing to short-circuit in air flow

Install the equipment in a plane surface where air circulates around the equipment and the equipment operates correctly.

So not install in the following locations:

- A dusty place
- Place with flammable gas atmosphere
- Place where water or oil (contain machine oil) is scattered or where there is a lot of steamPlace exposed to direct sunlight for a long time.
- Area with high corrosive atmosphere
- Install the unit in areas with a lot of snow, wind, and lightning so that it does not interfere with the operation of the unit. If snow accumulates on its feet, it will cause problems with outside air temperature measurement.
- Areas with large voltage fluctuations
- Place where there is a machine that generates electromagnetic waves
- Place where not blocking or expose an obstacle for walking areas, doors, windows etc.

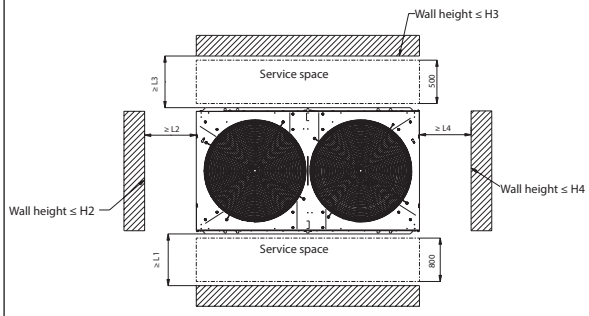


Fig. 8

Installation Example	I	II
L1	800	800
L2	10	10
L3	800	800
L4	100(*)	500
H1	1500	1500
H2	Not limited	Not limited
H3	1000	1000
H4	Not limited	Not limited

(*) A service space of 800mm minimum is necessary if installed in series. More than 800 mm is nice to have to inspect or replace parts of the condensing unit.

Take care not to interfere with the service space during piping work. Where the necessary space is not available, install a stand to run the piping under the unit.

(*1) Be sure to keep more than 100mm spaces when the unit contacts with a wall. If the unit installed in succession, 10mm spaces is enough.

(*2) A space of 330mm is necessary when the power cable is taken in from L2 side, where units are installed in series.

4.1 Outline of installation

Flow of installation work and points to note during installation
<Refrigerant piping work, airtight test, vacuum drying and additional refrigerant charge>

Note :
1. Conventional R410A application products are absolutely incompatible with R744 application products.
2. Replace all measuring instruments and tools directly in contact with the refrigerant with those special to R744.

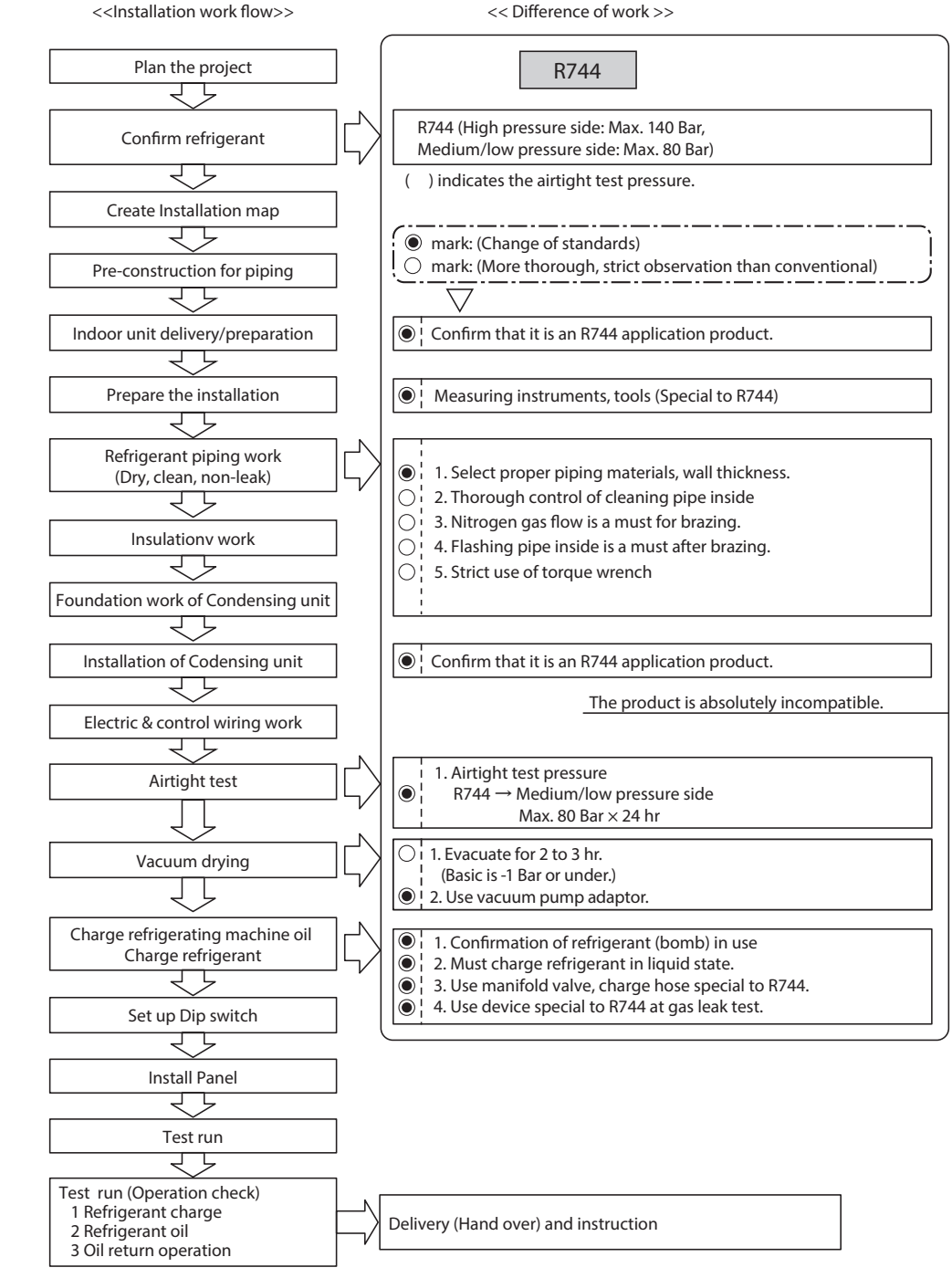


Fig. 9

4.2 Caution for installation work

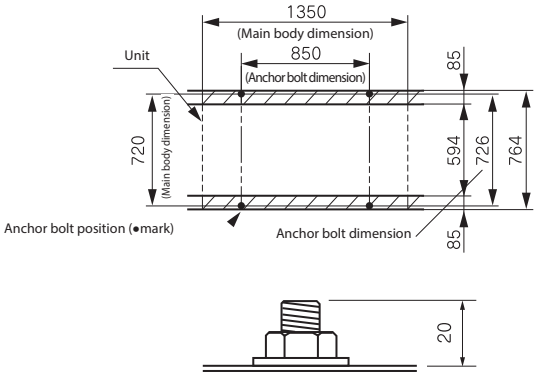
- Install the unit on the leeward of building, or under the eaves.
- When installing the unit at coastal area, protect it from briny air with a windshield plate, or the like.
- Provide measures to wash off salt particles adhered to external panels of the unit. Take care not to cover the unit with a sun shield, etc.
- Standing water over the bottom plate of outdoor unit accelerates corrosion badly. Tilt the plate, or take other means to drain water effectively.
- Secure a better draining capacity at the foundation.
- When installing the unit at coastal area, wash off with water adhered salt or fouling at regular intervals from the surface.

Caution for maintenance:
When the unit is not operated for a long time after the season, or other, protect it unit with a cover, etc.

4.3 Delivery and installation of the condensing unit

Anchor bolt position

- Make sure to fix the fixing legs of refrigerating machine with 4 pieces of anchor bolt (M10). Optimum height of bolt above the surface is 20 mm.



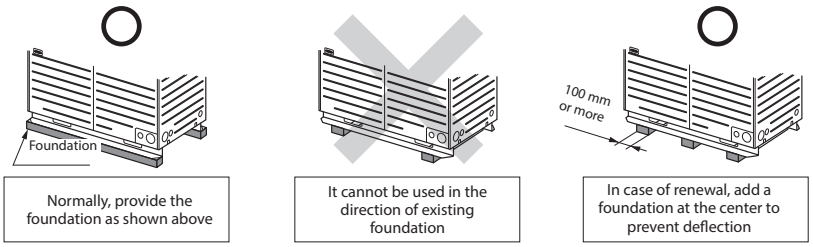


Fig. 10

Foundation

- Confirm that the strength and levelness of foundation can prevent vibration and noise.
- The foundation must be larger than the shadowed areas in the above figures (larger than the front of the fixing legs of condensing unit).
- The foundation must run in the lateral direction of condensing unit as shown above (in the direction of the width of 1,350 mm).
- Fix the unit securely so that it will not be toppled by earthquake, or sudden gust.

Rubber cushion

- Size of rubber cushion must be able to support the entire bottom area of fixing leg. (See following figure.)

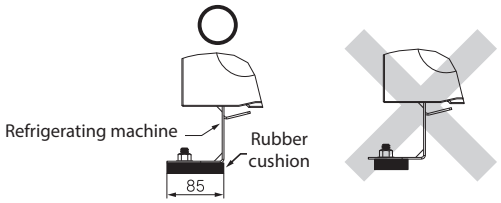


Fig. 11

NOTE:
a) Install the cushion rubber such that it will support the entire bottom area of the fixing leg of condensing unit.
b) It is prohibited that the bottom area of the fixing leg runs out the cushion rubber partially, or it is supported partially only by the cushion rubber.

Provision at snowy region

Provide following measures at snowy region not to bury the suction inlet, blow outlet, or the bottom of base plate, under snow.

1. Install the outdoor unit on a stand that is higher than expected surface of snow.
2. Install the unit under the eaves, or a snow roof (provided at site).

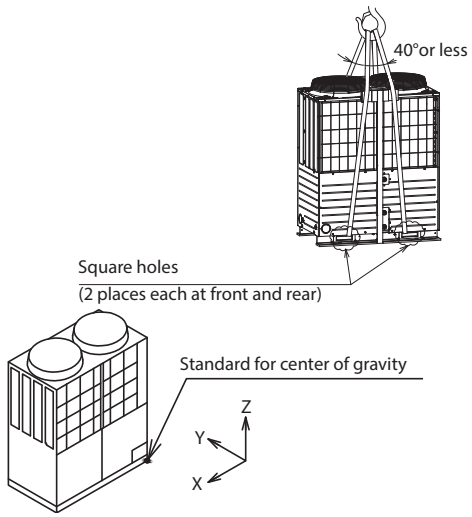
⚠	When the condensing unit is hoisted with ropes for delivery, take care to maintain the centre of gravity. It could drop off if the stability is lost.

Delivery

Determine the delivery route, and deliver the unit to the installation place without removing the packing.
When hoisting the unit, use a pair of ropes and cushions to protect sections chafed by the ropes.

NOTE:

Make sure to pass the ropes through square holes on the fixing legs of condensing unit.
Protect surfaces of the condensing unit where the ropes are applied with wear plates or cushions.



Center of gravity position

Type	OP-UPAC015COP04E
Weight (kg)	340
X (mm)	608
Y (mm)	342
Z (mm)	620

Fig. 12

4.4 Caution for piping work

1. General caution

How well designed and practiced the refrigerant piping work plays a critical influence over the capacity, life, or failures, on the refrigerating unit. Design and practice the piping work as instructed below.

Design and practice the piping work as instructed below.

- Sufficiently wash the inside of low pressure device, pipes, etc., to remove dirt or moisture, and dry them before use. Use always a pipe cutter to cut refrigerant pipes, and blow off dirt with nitrogen, or air, before connection. (Avoid to use a saw, or grinder, because it could produce a lot of chips.)
- Use the nitrogen gas blow when brazing pipes to prevent oxide scale.
- Where the condensing units is positioned lower than the low pressure device, limit the level difference between them no larger than 5 m or, if it is positioned higher, no larger than 22 m. Length of piping between them needs to be no longer than 100 m. (When the level difference, or piping length, exceeds these standards, special measures may be required, such as the enlargement of pipe diameter.)

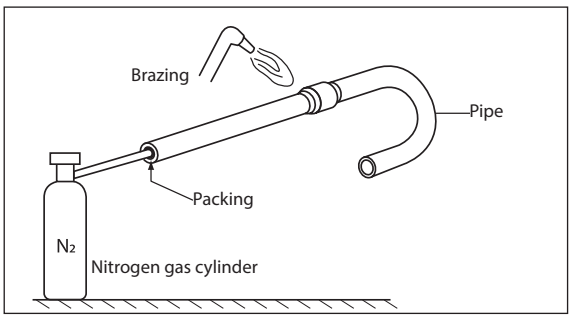


Fig. 13

Typical instillation

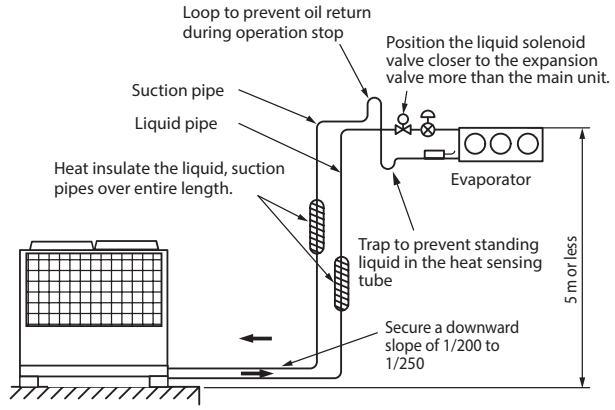


Fig. 14

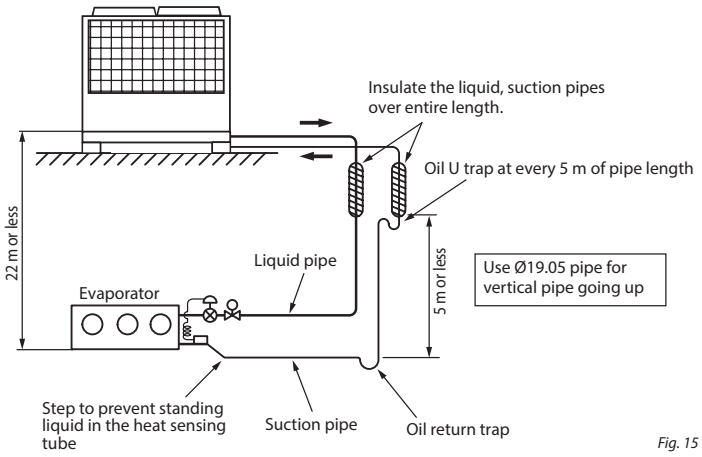


Fig. 15

- The suction piping connected to the compressor must be flexible in 3 dimensions to dampen vibrations. Furthermore piping has to 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.
- Take care to avoid direct contact between suction and liquid pipes without insulation material too large temperature difference.
- The condensing unit is charged with Nitrogen gas at approx. 0.1 bar at shipping from the factory. Make sure to keep the seal intact till just before connecting pipes in order to keep out dirt or moisture. Release to the atmosphere must be made through service ports at the high, medium and low sides.

*Dryer (accessory of refrigerant machine) is recommended to install in liquid pipe. Also strainer is recommended to install before the low pressure expansion valve.

Note on R744

⚠	Refrigeration cycle pressures (airtight test pressure, operation pressure, etc.) become approx. 4 times larger than the same of R410A.
	Wall thickness of refrigerant pipes varies depending on the refrigerant and pipe size. Check if specified thickness is observed, and correct if necessary. It could vary depending on pipe materials as well.
	Ester oil is used as the condensing unit oil for the refrigeration cycle of R744. In order to avoid contamination with impurities such as moisture, dirt, etc., as much as possible, the same fundamental control as Freon is required at the installation of refrigerant piping.
	Practice thorough control on the storage and curing of pipes to protect them from dirt or moisture.
	Make sure to practice the nitrogen blowing before brazing to prevent oxide scale.

Piping work at site

1. Pipe diameter
Prepare refrigerant pipes at site. Pipe joints are as shown below.

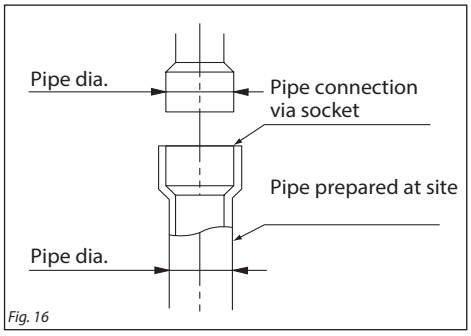


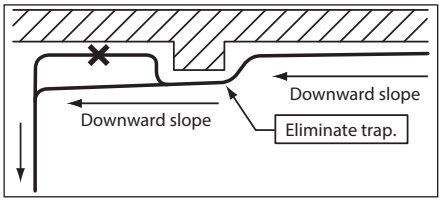
Fig. 16

Dimension

Type	Connecting pipe dia. (Example) (mm)	
	Suction pipe	Liquid pipe
OP-UPAC015COP04E	Ø19.05 (Brazing)	Ø12.7 (Brazing)

*Pipe wall thickness shows that of C1220T 1/2H.

2. Suction pipe
- Normally, adjust the pipe size to the end diameter of copper pipe at the joint of condensing unit.
- Provide a downward slope (1/200 to 1/250) at the sidewise run of suction pipe. To return lubrication oil smoothly, do not provide a trap at the sidewise run section. Where heights differ larger than 5 m between the condensing unit and the low pressure device, provide a small trap.



3. Liquid piping
- Install the liquid solenoid valve just before the expansion valve.
- If the liquid feed piping is overheated by the effect of other heat source, it generates flash gas, reducing the cooling capacity. Run the liquid feed piping at a place as cool as possible. Where it passes at a place at high temperature by any chance, insulate it.

4. Pipe bending
When bending a pipe, it is necessary to compensate for possible thinning of pipe wall by bending, where the bending radius R is 4 times of pipe O.D., or less, at the center line of pipe being bent.
When a pipe is bent, it could cause creases, reduced wall thickness, or increased resistance in refrigerant flow. It is recommended to make the pipe bending radius R to be 3 times of pipe O.D., or more, at the center line of pipe being bent.

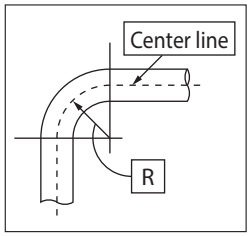


Fig. 17

Pipe O.D.(mm)	Wall thickness (mm)	
	With bend	Without bend
Ø12.7	1.0, or more	0.8, or more
Ø15.88	1.2, or more	1.0, or more
Ø19.05	1.4, or more	1.2, or more
Ø 25.4	1.8, or more	1.8, or more

** In case of pipe material: C1220T 1/2H.*

4.5 Caution for electric wiring work

- Switch off and isolate the main power supply.
- Ensure that power supply can not be switched on during installation.
- All electrical components must be selected as per local standards and unit requirements.
- Refer to wiring diagram for electrical connections details.
- Ensure that the power supply corresponds to the unit characteristics and that the power supply is stable (nominal voltage ±10% and nominal frequency ±2,5 Hz).
- Dimension the power supply cables according to unit data for voltage and current.
- Make the power supply according to local standards and legal requirements.
- The unit is equipped with high and low pressure switches, which directly cut the power supply to the compressor in case of activation. Parameters for high and low pressure cut outs are preset in the controller, adapted to the compressor installed in the unit.

Wiring capacity
Electrical installation work must be performed by an electrical installation service provider qualified by a power provider of the country.
Electrical installation work must be executed according to the technical standards and other regulations applicable to electrical installations in the country.

Please install an earth leakage breaker without fail. The installation of an earth leakage breaker is compulsory in order to prevent electric shocks or fire accidents. (Since this condensing unit employs inverter control, please use an impulse withstanding type one to prevent the earth leakage breaker from false activation.)

Note

a) Use only copper wire.
Do not use any supply cord other than the one specified in parenthesis for each type of cord mentioned below.
- *Braided cord (Cord designation 60245 IEC 51), if allowed in the relevant part 2.*
- *Ordinary tough rubber sheathed cord (Cord designation 60245 IEC 53)*
- *Flat twin tinsel cord (Cord designation 60227 IEC 41)*
- *Ordinary polyvinyl chloride sheathed cord (Cord designation 60227 IEC 53)*

Please do not use any cord other than polychloroprene sheathed flexible cord (Cord designation 60245 IEC 57) for condensing unit use.

b) A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.

c) Ground the unit. Do not connect the ground wire to a gas pipe, lighting rod or telephone grounding wire.
If improperly grounded, an electric shock or malfunction may result.
Never connect the grounding wire to a gas pipe because if gas leaks, it could cause explosion or ignition.

d) The installation of an impulse withstanding type earth leakage breaker is necessary. A failure to install an earth leakage breaker can result in an accident such as an electric shock or fire. Do not turn on the power until the electrical work is completed. Be sure to turn off the power when servicing.

e) Please do not use a phase advance capacitor for power factor improvement under any circumstances. (It does not improve power factor, while it can cause an anomalous overheat accident.)

f) For power supply cables, use conduits.

g) Please do not lay electronic control wires (remote controller and signal wires) and other high current cables together outside the unit. Laying them together can result in malfunction or failure of the unit due to electric noise.

h) Power cables and signal wires must always be connected to the terminal blocks respectively and secured them with cable fastening clamps provided in the unit.

i) Clamp cables so that they may not touch the pipe, etc.

j) When cables are connected, please make sure to check no loose connection or disconnection at connecting coupling of all electrical components in the control box and then attach the cover to control box securely. (Improper cover attachment can result in malfunction or a failure of the unit, if water penetrates into the control box.)

k) Make sure to use circuit breakers (earth leakage breaker and circuit breaker) of proper capacity.
Use of breakers of larger capacity could result in trouble on components or fire accident.
The circuit breaker should isolate all poles under over current.

l) Install an isolator or a cut-off switch on the power supply line in accordance with the local codes and regulations. The isolator shall be locked to keep the power supply line in OFF state in conformity with EN60204-1.

m) After maintenance service, be sure to restore all wiring, bundling wire and wiring route to their original state in order for them not to touch to the metal parts.

n) When tightening electric wires and operation circuit wires to the terminal block, tighten the screws at torques as shown in the table at right.

Screw size	Tightening torque (Nm)
M4	1.0 ~ 1.3
M5	2.0 ~ 2.5
M6	4.0 ~ 5.0
M8	9.0 ~ 11.0
M10	18.0 ~ 23.0

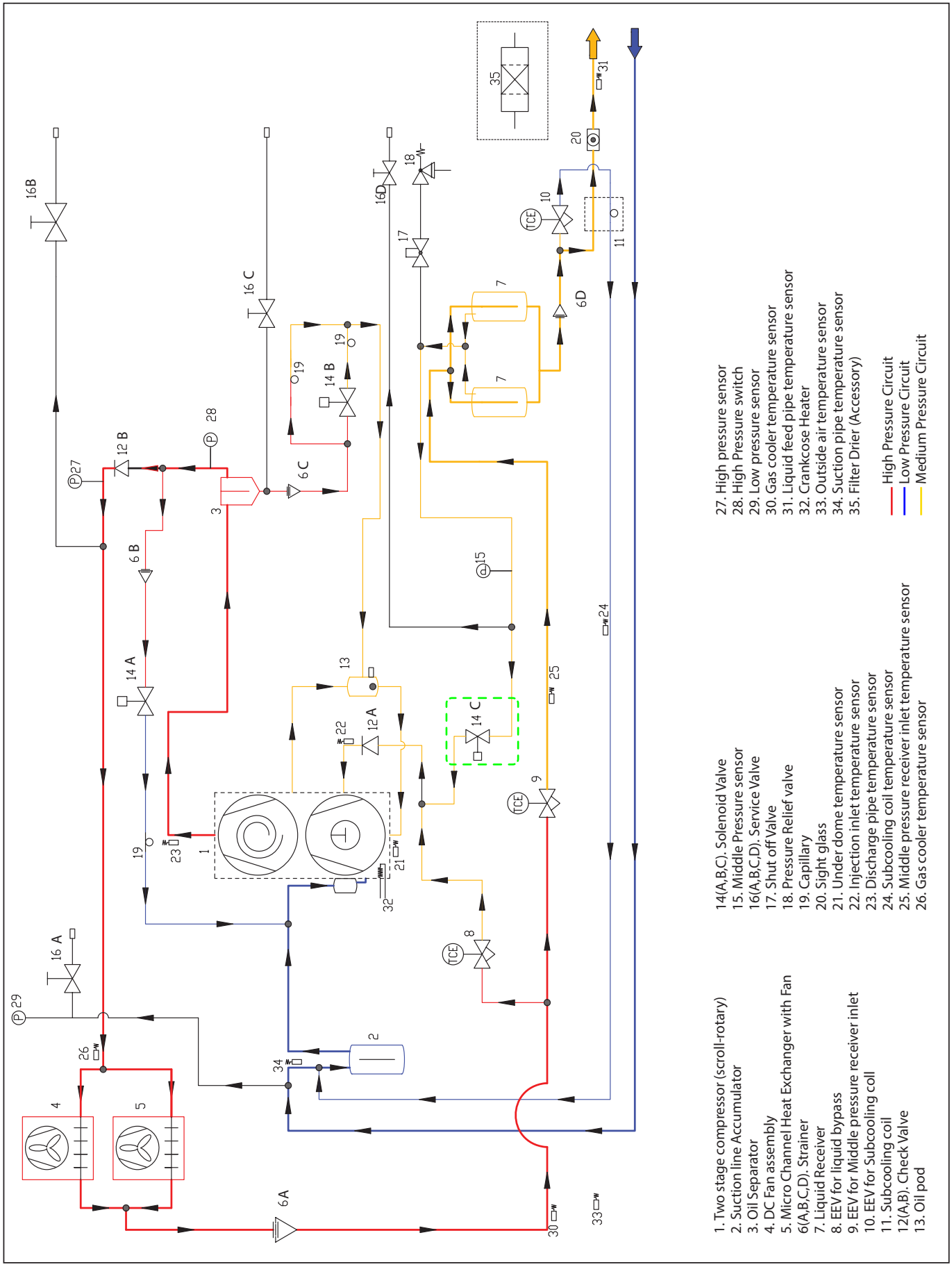
Electric characteristics for (50Hz)

Item		(Unit)	OP-UPAC015COP04E
Nominal output		(kW)	6.4
Power supply			3P, 380/400/415 V, 50 Hz
Electric characteristics	Power consumption	(kW)	10.54/10.54/10.54
	Operation current	(A)	17.4/16.5/15.9
Min. wire size		(mm^2)	10 mm^2 × 4(5) (Max. length: 70m)
Operation circuit wire size		(mm^2)	2.0
Earth cable size		(mm^2)	3.5
Earth leakage breaker	Rated current	(A)	30
	Rated sensitivity current	(mA)	30 (Release time 0.1 sec. or less)(Class B)

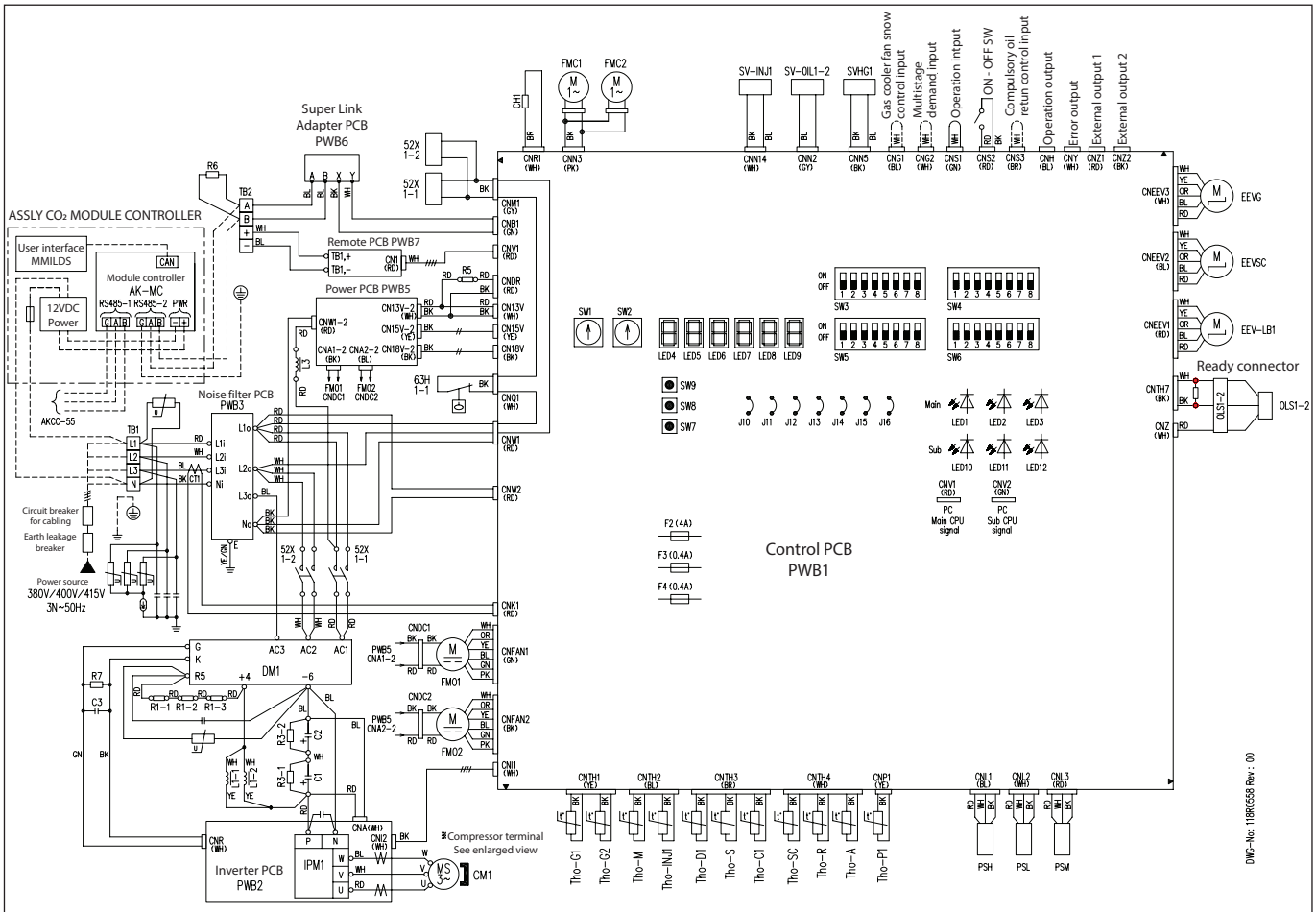
Note:

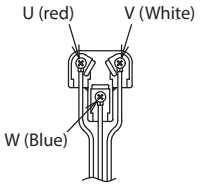
1. *Electric characteristics are based on the condenser suction air temperature at 32°C, evaporation temperature -10°C and condensing unit inlet superheat degree 10 deg.*
2. *Figure in [ ] of the minimum wire size shows the maximum wire length (m) with the voltage drop at 2 V.*

PID



Wiring Diagram





※Enlarged drawing of compress terminals

Notes

1. This drawing shows the electrical circuit of CO_2 condensing unit.
2. Dotted line (-----) shows the wiring on site.
   Long dashed double-short dashed line (-----) shows installation on site.
3. Separate signal line from power line.
4. CNG1,CNG2,CNS1,CNS2 and CNS3 are no voltage contact inputs.
   If they will be used, use the attached harness for level input.
5. Output of CNH,CNY,CNZ1 and CNZ2 is 12V. Maximum current is less than 20mA (+ side (1 PIN side) is common) .
   If they will be used, use the attached harness and be sure to connect to unit relay (Coil resistance of 7502 or more provided on site).

Symbol	Name
C1,2	Electrolytic capacitor
C3	Filter capacitor
CH1	Crankcase heater
CM1	Compressor motor
CNA-Z	Connector
CT1	Compressor current
DM1	Diode module
EEVG	EEV for middle pressure receiver inlet
EEV-LB1	JEEV for liquid bypass
EEVSC	EEV for subcooling coil
F	Fuse
FMC1,2	Inverter cooling fan
FMO1,2	Fan motor
IPM1	intelligent power module
J10	Spare
J11,12	Power supply, voltage switching
J13	External input signal type switching
J14~16	Spare
L1-1,2	DC reactor
L3	Reactor
LED1	Main, inspection (red)
LED2	Main, normal (green)
LED3	Main, service (green)
LED4~6	7-segment LED (function display)
LED7~9	7-segment LED (data display)
LED10	Sub, normal (green)
LED 11	Sub, inspection (red)

Symbol	Name
LED 12	Sub, service (green)
OLS1-2	Oil level sensor
PSH	High pressure sensor
PSL	Low pressure sensor
PSM	Middle pressure sensor
PWB1~3,5~7	Printed wiring board
R1-1,2,3	Inrush suppression resistance
R3-1,2	Discharge resistance
R5	Drop resistance
R6	Termination resistance
R7	Filter resistance
SVHG1	Solenoid valve for hot gas bypass
SV-INJ1	Solenoid valve for gas injection
SV-OIL1-2	Solenoid valve for oil return
SW1	Compressor low pressure control setting (10s)
SW2	Compressor low pressure control setting (1s)
SW3-1~3	Spare
SW3-4	Protection start II cancel
SW3-5	Gas cooler fan control
SW3-6	Spare
SW3-7	Compressor total operation time reset
SW3-8	Spare
SW4-1~4	Model selection
SW4-5~8	Spare
SW5-1~3	For target middle pressure adjustment
SW5-4,5	Spare
SW5-6~8	Pressure check operation mode

Symbol	Name
SW6-1~3	Spare
SW6-4	Presence of subcooling suppression control
SW6-5	Oil level error/oPE display switching
SW6-6	Presence of regular inspection and maintenance contract
SW6-7	Oil level error
Sw6-8	Spare
SW7	Data erase/write
SW8	7-segment display (1s)
SW9	7-segment display (10s)
TB1,2	Terminal block
Tho-A	Outdoor air temp. sensor
Tho-C1	Under dome temp. sensor
Tho-D1	Discharge pipe temp. sensor
Tho-G1	Gas cooler temp. sensor 1 (inlet)
Tho-G2	Gas cooler temp. sensor 2 (outlet)
Tho-INJ1	Gas injection inlet temp. sensor 1
Tho-M	Middle pressure receiver inlet temp. sensor
Tho-P1	Power transistor temp. sensor
Tho-R	Liquid feed pipe temp. sensor
Tho-SC	Subcooling coil temp. sensor
Tho-S	Suction pipe temp. sensor
ON-OFF SW	Operation switch
52X1-1,2	Magnetic contactor for CM
63H1-1	High pressure switch

5.1 Airtight Method

	Do not pressurize to specified pressure all at once, but raise it gradually.
	Stop the pressurizing at each step of 10 bar, 30 bar and 70 bar, and leave it alone to see if the pressure drops.
	Raise then the pressure to the design pressure, and record the ambient temperature and the pressure.

Apply a foam liquid over the surface. If no foam generates, it passes the test. It passes the test also if the pressure does not drop after leaving it alone for approx. a day under the specified pressure.

It is necessary to apply correction for ambient temperature variation.
Example for 1 K (Kelvin) Ambient Temperature difference:
T1=20°C
=293K; (20 +273K)

T2=21°C
= 294K; (21 +273K)

PT1=80,0 bar; PT2=?
PT2 = PT1*T2/T1
= 80,0bar*294K/293K
= 80,3bar

Therefore, 1K temperature difference can cause a 0.3 bar pressure difference.

$$\text{Absolute pressure at measurement} = \text{Absolute pressure at pressuring} \times \frac{(273°C + \text{Temperature at measurement})}{(273°C + \text{Temperature at pressurizing})}$$

Absolute pressure = Gauge pressure + 1.0133 (bar)
(Gauge pressure is the pressure indicated on the manifold.)
If the pressure drops, it leaks at some places. Find and repair the leak spots.
When it leaks, check welded section and screwed section using foaming liquid.

Work sequence

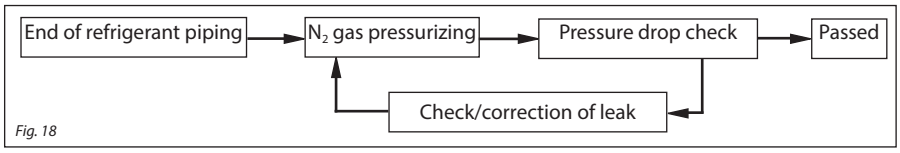


Fig. 18

Recommended bubble leak test liquid

Bubble leak test liquid	Maker
Gupoflex	Yokogawa & Co., Ltd.

Note
High, medium and low pressures of this unit are displayed at the 7-segment indicator on the control PCB. They are not displayed when the power supply is turned off. In such occasion, check them by installing a gauge manifold at the service ports of high, medium and low pressure sides. (For the location of service ports, see the following figure.)
When venting the gas, start from the low pressure side. (Take care not to make the low pressure side of compressor higher than the high pressure side.)

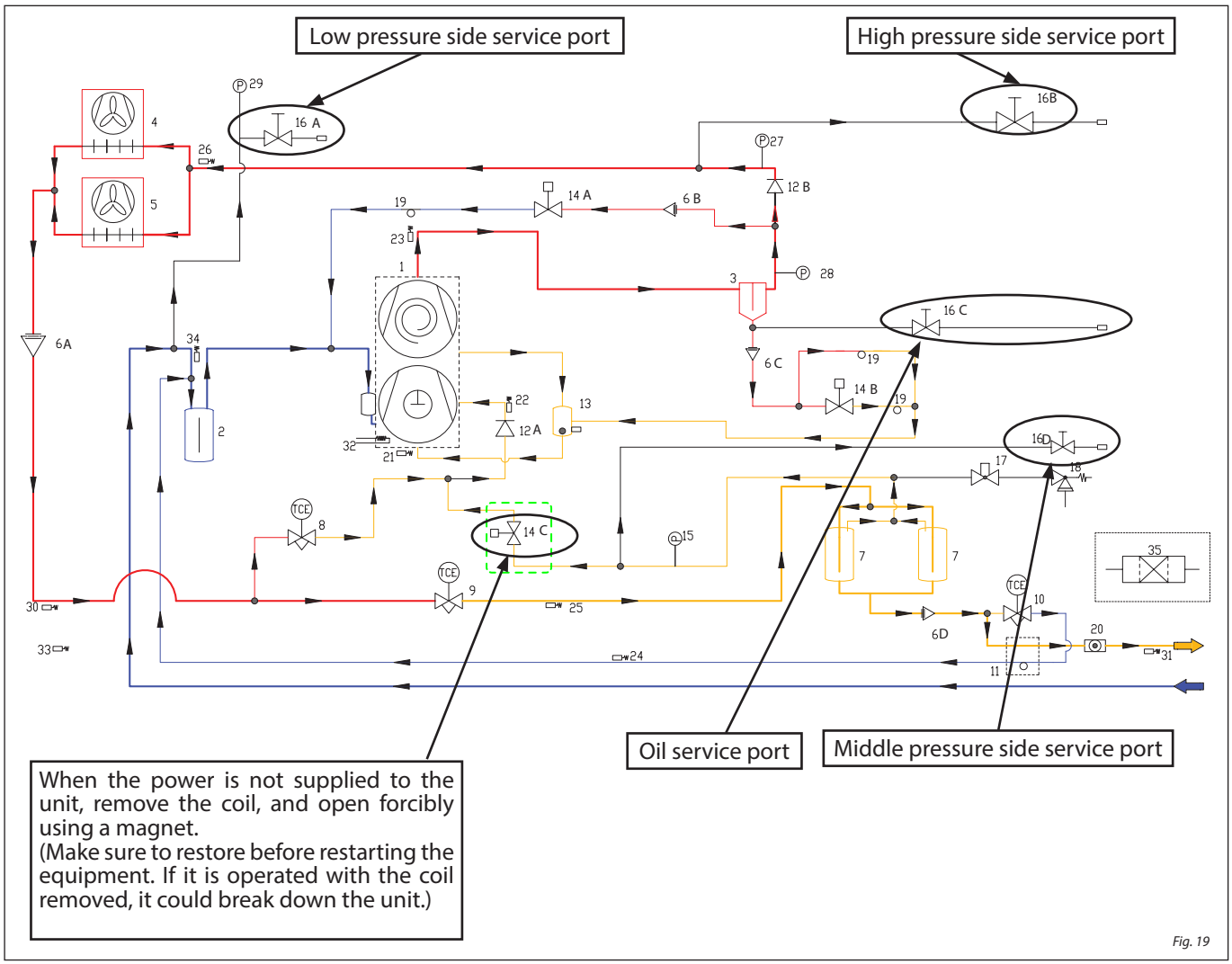

Low pressure side service port
High pressure side service port
Oil service port
Middle pressure side service port
When the power is not supplied to the unit, remove the coil, and open forcibly using a magnet.
(Make sure to restore before restarting the equipment. If it is operated with the coil removed, it could break down the unit.)

Fig. 19

5.2 Vacuuming

- After the airtight test, connect the vacuum pump to the low pressure side service port and high pressure side service port, and evacuate.
- Use always a vacuum pump to the equipment. Never attempt to evacuate by its own in any event.
- This unit displays the low pressure digitally on the controller. If the unit is not energized during the evacuation, the controller does not display the low pressure. Check the low pressure with the gauge manifold or vacuum gauge.
- When the unit is not energized, remove the coil from the medium pressure suction solenoid valve, and open it forcibly using a special magnet.
- When the unit is energized, turn the DIP switch SW5-7 to ON (Up) to turn on the unit's power source. The electronic expansion valve and solenoid valve in the unit open. The vacuum pump is connected to the low pressure side only at that time.

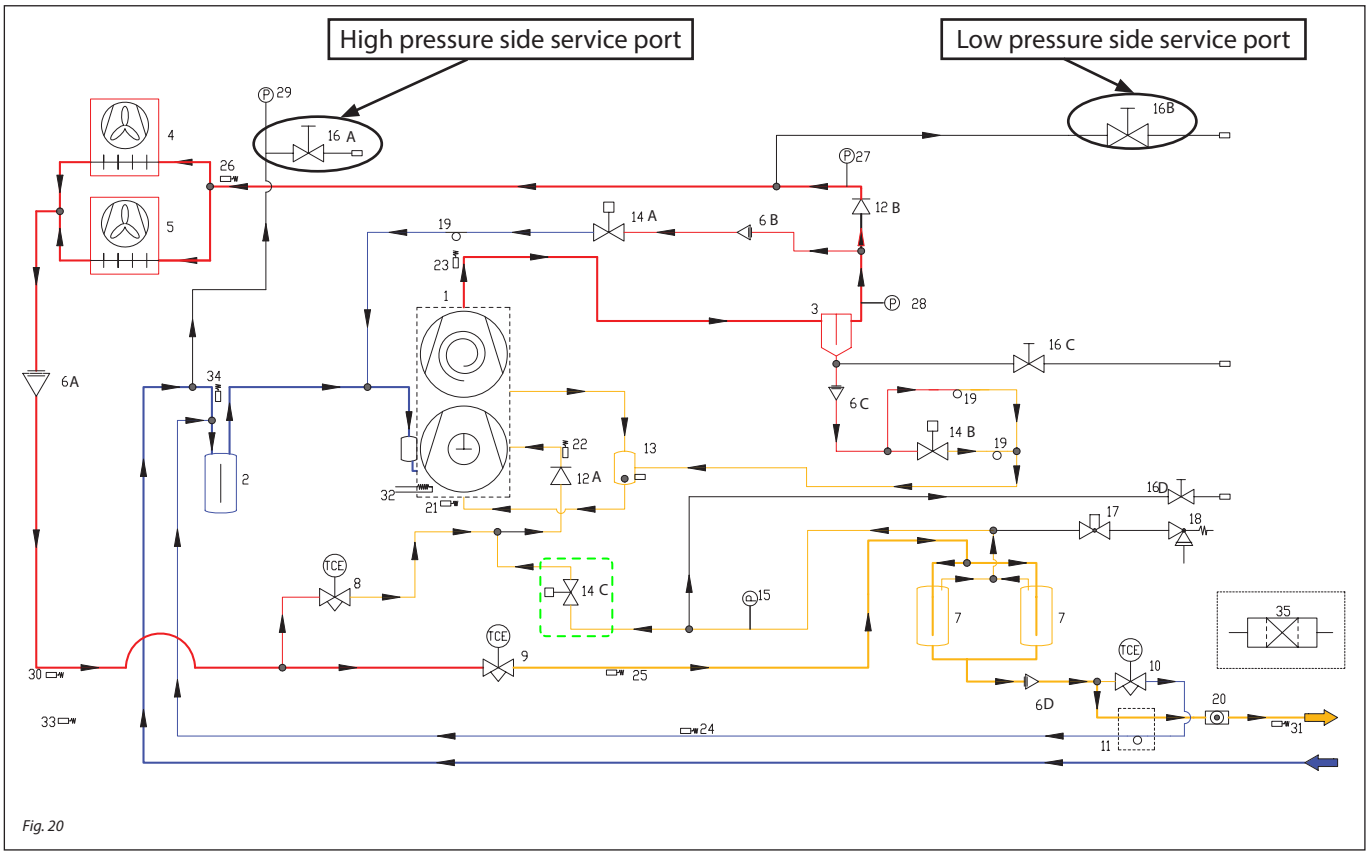


Fig. 20

Note on R744 (CO_2) :

Since R744 (CO_2) may corrode metals if it solves into water, becoming weakly acidic, it is necessary to dry sufficiently by the vacuum drying.

⚠	Start evacuation from the low pressure side to prevent the reverse phase on the compressor.
	Vacuum sufficiently for 2 to 3 hours after reaching a degree of vacuum at lower than -1 bar.
	Use a vacuum pump with a higher exhaust speed. (Conventional small pumps with exhaust speed of 20 to 30 l/min, which are in use widely, will take too much time.)
	Install a vacuum pump adaptor to prevent oil from returning from the pump to the refrigeration cycle.
	Use a manifold valve and a charge hose special to R744 (CO2).
	A joint (Reducer) to install on the service valve is included in the accessories. When performing the airtight test or vacuuming, finish the connection form of the joint according to purposes.
	When the degree of vacuum rises, presence of moisture, or leaks, is suspected. Check for moisture, or leaks. (Special vacuum dry) i. Vacuum dry (1st). ii. Vacuum dry (1st). : Pressurize nitrogen gas to 0.5 bar, and charge. Use nitrogen always. iii. Vacuum dry (2nd). iv. Ultimate vacuum must be maintained at -1 bar after letting it alone. If it is not, repeat the vacuum dry and vacuum break.

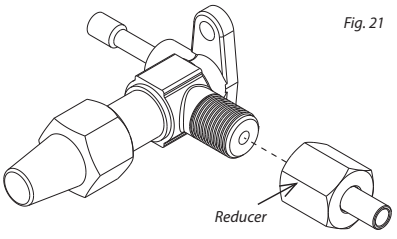


Fig. 21

5.3 Charge of condensing unit oil

- On the way of vacuuming, refill condensing unit oil from the service port.
- When the unit is not energized, remove coils from the hot gas bypass solenoid valve and oil return solenoid valve, and open the solenoid valve forcibly using a special magnet.
- When the unit is energized, turn off the unit's power supply, turn the dip switch SW5-7 to ON (Up), and turn the power ON. The electronic expansion valve and solenoid valve in the unit open. Make sure to turn SW5-7 to OFF (Down) when the work is over. The vacuum pump is connected to the service port at the low pressure side only at that time.
- In the event that the pipe is long or there is an oil sump in the evaporator, the condensing unit oil retained in the compressor becomes insufficient. Charge additional condensing unit oil according to 5.4 Calculation of the charge quantity of condensing unit oil.
- After charging the additional oil, confirm that 7-segment display "C32 (Level switch)" indicates "1 (With oil)". When the oil is insufficient, it indicates "0". (After stopping the freezing operation, for example, the oil level may turn to "0" temporarily because of the pressure difference in the compressor. If it indicates "0" continually while the compressor is running, refill additional oil.) When the left 3 of 7-segment shows C32, the third digit from the right indicates the OLS1-2 status.
- If the condensing unit oil becomes insufficient during operation, tripping OLS1-2, the oil level alarm "oPE88-1" or oil level error "E88-1" is indicated on 7-segment display. (Dip switch SW6-5 OFF is for Alarm or ON for Error.) When the alarm or error occurs, refill additional condensing unit oil. This error need to be taken quickly, if we prioritize the safety of goods it's mandatory to solve this quickly because you can damage quickly or broke the compressor.
- Time of oil level low with OLS1-2 during compressor running can be summed and checked with 7-segment display "C42", which displays "Accumulated time of CM1 ON and OLS1-2 OFF"

5.4 Calculation of the charge quantity of condensing unit oil

Use the following equation.

Condensing unit oil quantity (cc) = Standard condensing unit oil quantity*1 (cm^3) + Piping condensing unit oil quantity *2 (cc)

As to the standard condensing unit oil quantity of condensing unit and piping condensing unit oil quantity for the above equation, refer to 1 and 2.
Since the standard condensing unit oil of 1 is charged at the shipment from factory, calculate the charge quantity of oil from the piping condensing unit oil of 1.

1. Standard condensing unit oil quantity of condensing unit (Charged at the shipment from factory.)

	Diamond Freeze MA68
Condensing unit oil initial charge quantity	1,830cc

2. Piping condensing unit oil quantity

•This is calculated based on the specifications of connecting gas pipe (pipe size) and the length of each pipe. Where no branching pipe is used, take the length of pipe to the farthest low pressure device as the pipe length. Where it is used, take the sum of the length of pipe to the pipe joint of farthest low pressure device from first branching and the length of pipe to the pipe joint of second farthest device as the pipe length. Example of calculation where there are branch pipes is as shown below.

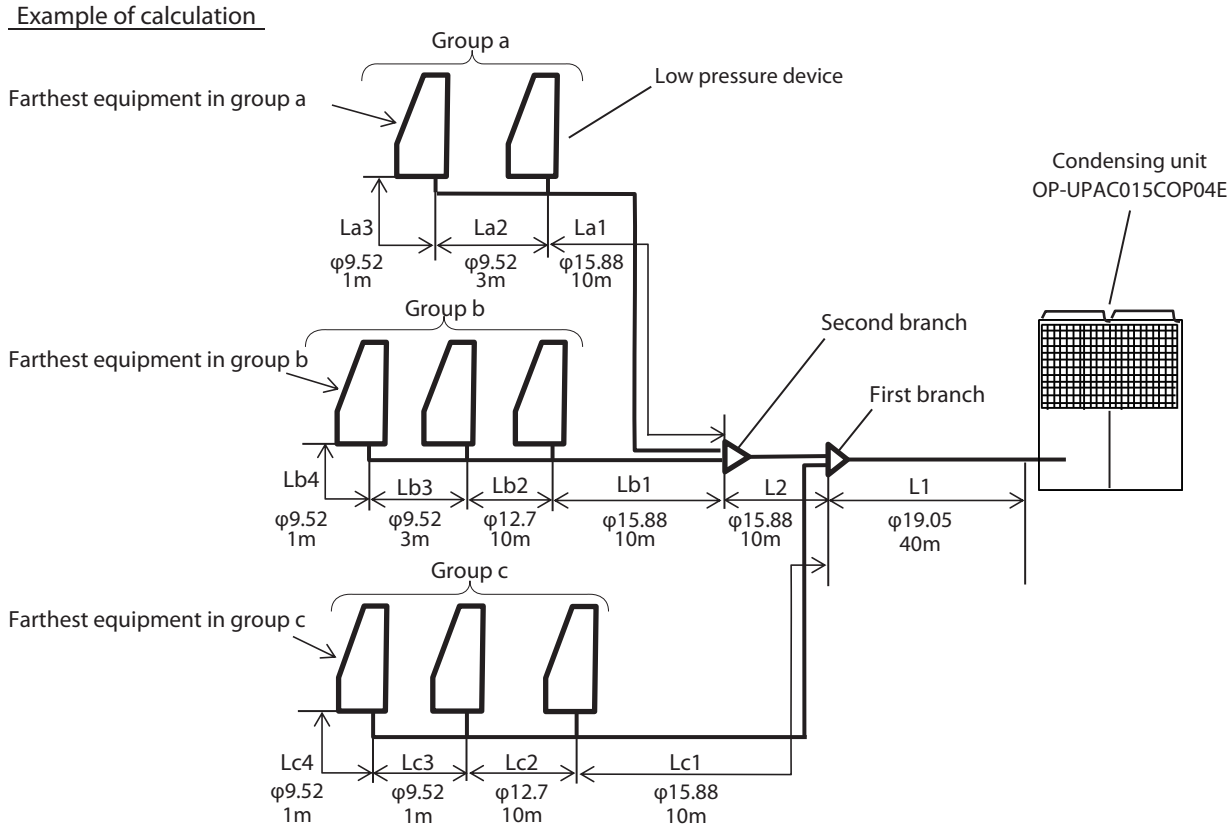


Fig. 22

•Items necessary to calculate the oil quantity vary depending on the distance to the farthest length from first branch.
Farthest in group a: LA = L2 + La1 + La2 + La3
Farthest in group b: LB= L2 + Lb1 + Lb2 + Lb3 + Lb4
Farthest in group c: LC= Lc1 + Lc2 + Lc3 + Lc4
Where LB > LC > LA, calculate the piping oil quantity from LB and LC.

•Piping condensing unit oil quantity = (Oil quantity/unit length of L1 pipe) x L1 (m) + (Oil quantity/unit length of L2 pipe) x L2 (m)
+ (Oil quantity/unit length of Lb1 pipe) x Lb1 (m) + (Oil quantity/unit length of Lb2 pipe) x Lb2 (m)
+ (Oil quantity/unit length of Lb3 pipe) x Lb3 (m) + (Oil quantity/unit length of Lb4 pipe) x Lb4 (m)
+ (Oil quantity/unit length of Lc1 pipe) x Lc1 (m) + (Oil quantity/unit length of Lc2 pipe) x Lc2 (m)
+ (Oil quantity/unit length of Lc3 pipe) x Lc3 (m) + (Oil quantity/unit length of Lc4 pipe) x Lc4 (m) …… (a)

Oil quantity/m of refrigerant pipe (gas pipe)					
Refrigerant pipe size x Wall thickness (For material: C1220 1/2H)	Ø6.35×t0.5	Ø9.52×t0.8	Ø12.7×t1.0	Ø15.88×t1.2	Ø19.05×t1.4
Charge quantity (cc/m)	3	5	7	11	16

- Calculate the piping condensing unit oil quantity from the equation (a) above.
  Piping refrigerating oil quantity = 16 x 40 + 11 x 10 + 11 x 10 + 7 x 10 + 5 x 3 + 5 x 1 + 11 x 10 + 7 x 10 + 5 x 1 + 5 x 1 = **1,140 cc**

3 Additional condensing unit oil quantity

Additional condensing unit oil is calculated to be 1,140 cc from 2. Round up the oil quantity calculated with 2 by the unit of 100 cc.
If the piping condensing unit oil calculated with 2 is less than 640 cc, it is not necessary to add the piping oil quantity.
Total condensing unit oil in the system becomes 1,830 cc + 1,140 cc = 2,970 cc from 1 and 2.

4. Maximum refrigerant machine oil quantity

Φ19.05 equivalent pipe length = Piping refrigerating oil quantity(cc)/16(cc/m)

Maximum refrigerant machine oil quantity is different by equivalent pipe length. Below equation shows calculation of Φ19.05 equivalent pipe length and bellow graph shows maximum refrigerant machine oil quantity for each Φ19.05 equivalent pipe length

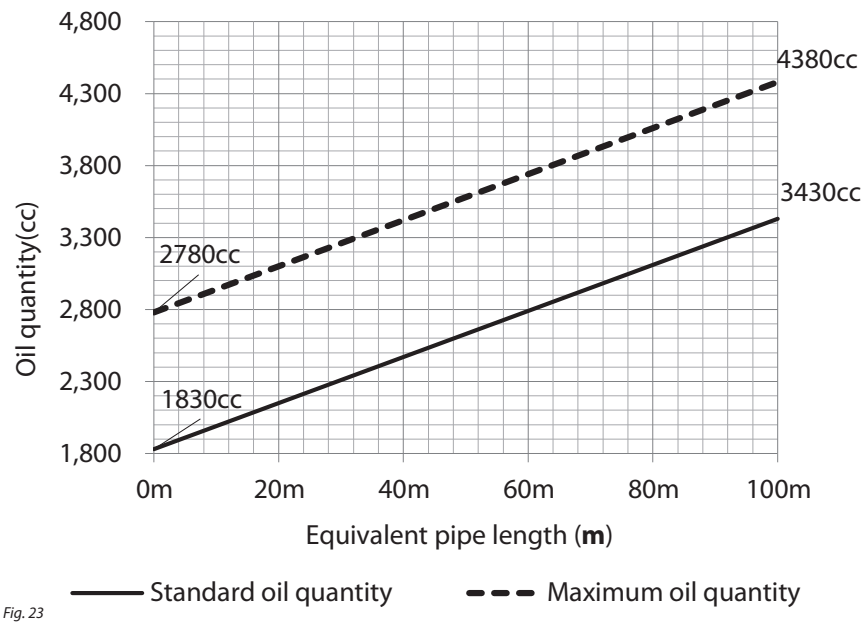


Fig. 23

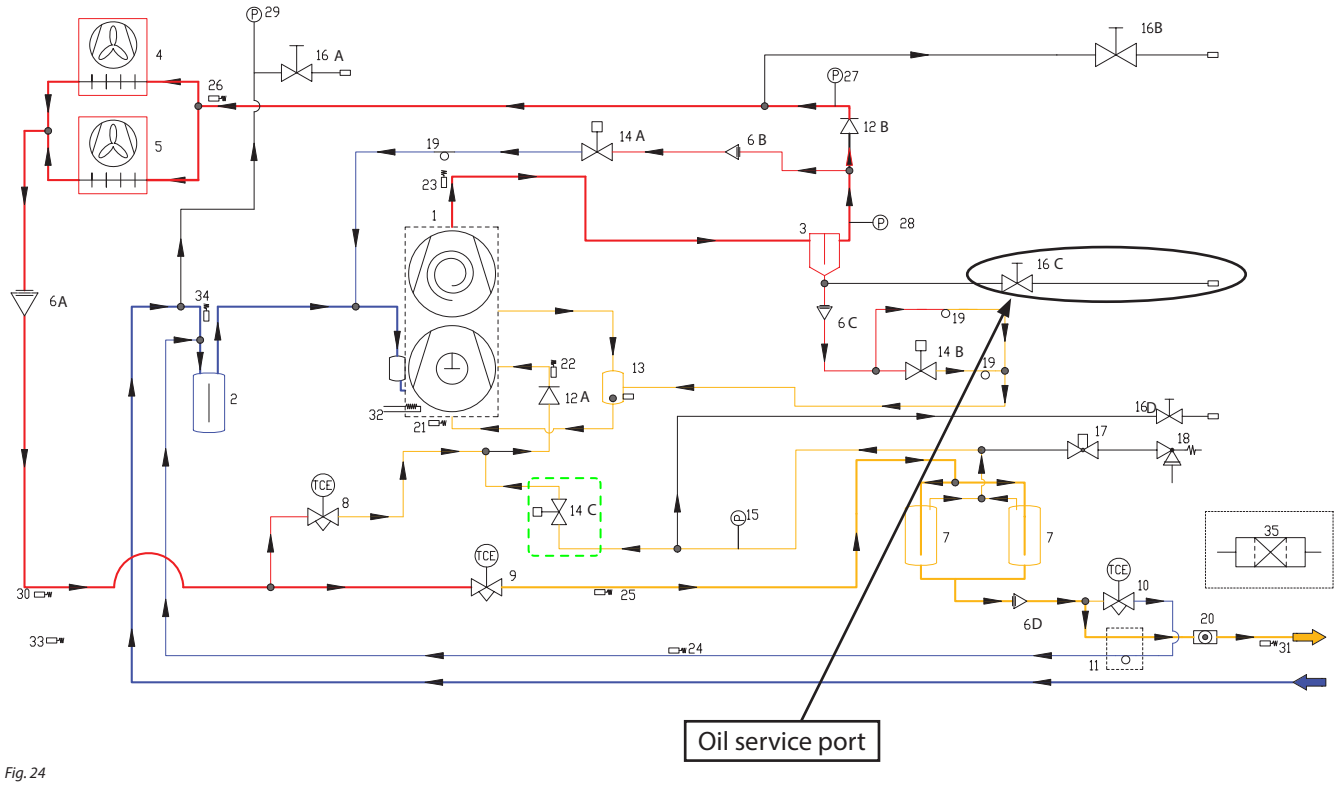


Fig. 24

Caution for installation

1. Time to open up the condensing unit oil to the atmosphere should be as short as possible.
2. Use up the condensing unit oil for replenishment. Once oil container is opened, it should be used entirely and should not be stored for future use.
3. Ambient temperature at storage should be no higher than 40 °C, and avoid places where it is exposed to direct sunlight or temperatures change widely.
4. The oil become colorless and transparent.
5. Since the unit inside becomes in the state of vacuum during the replenishment of condensing unit oil, pay utmost attention not to introduce air.
6. Please note that a special device (manual pump) is required when condensing unit oil is charged after operating the unit,
7. Dispose of the condensing unit oil and container after opening according to the regulations of each country.

5.5 Replenishment of condensing unit oil after operation

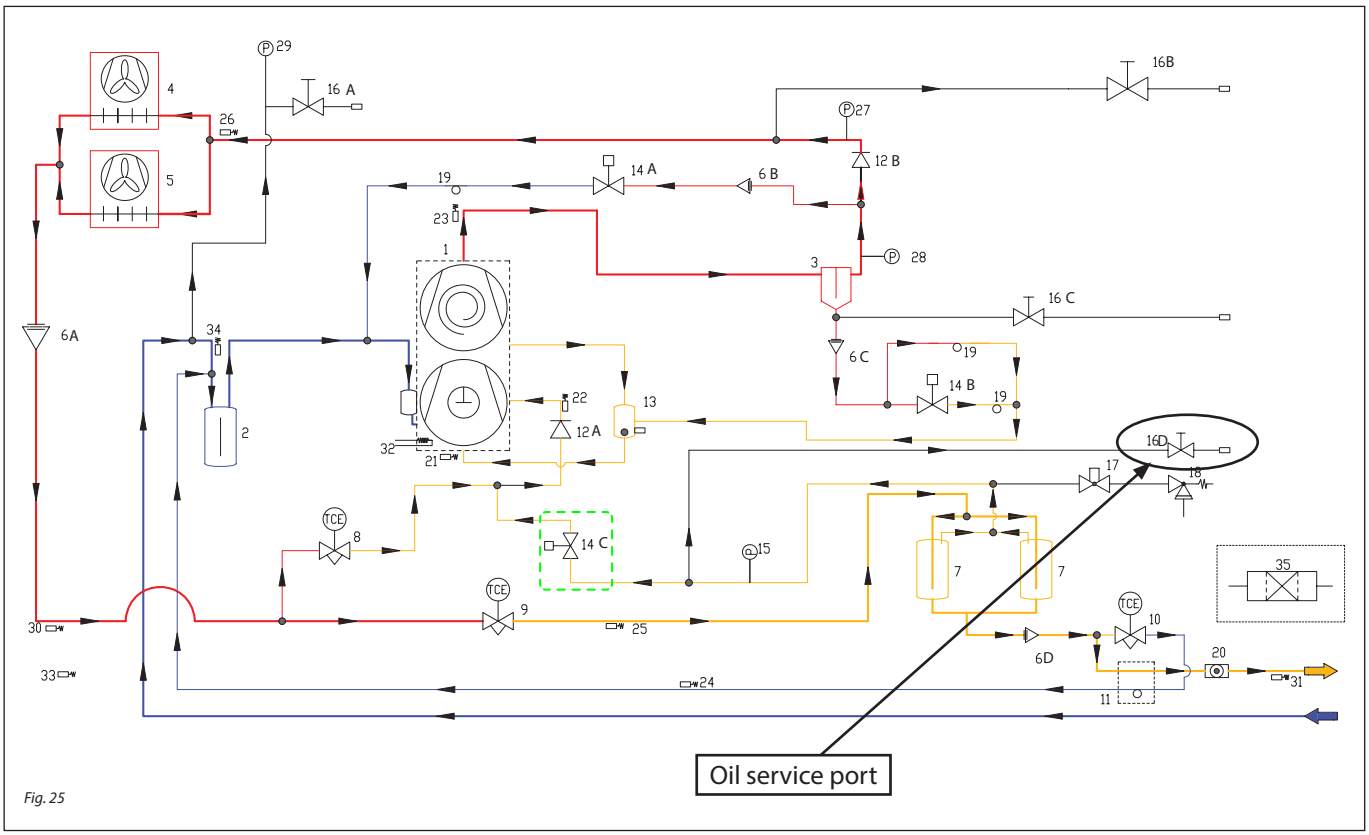


Fig. 25

Note:
Entire compressor becomes very hot and under high pressure immediately after operation. Handle it with utmost care.

1. Stop the unit.
2. Connect the manual pump and the unit with a charging pressure hose (for CO_2).
   * Before connecting the pressure hose, confirm that the valve at the oil service port is closed.
3. Compress condensing unit oil with the manual pump. When the pressure becomes higher than the balance pressure, open the valve at the oil service port, and charge the condensing unit oil.
4. After charging oil, close the valve at the oil service port, and remove the charging pressure hose (for CO_2).
5. Operating the unit, check the oil level in the oil pod.

5.6 Refrigerant charge

After vacuuming and charging the condensing unit oil, charge the refrigerant as follows.

5.6.1 Confirmation of refrigerant bomb

- Bombs are designated by color depending on kinds of refrigerant. Bomb containing CO_2 is painted in green.
- Kind of refrigerant is also stamped on the bomb according to the provision of container inspection.
- Use a refrigerant that satisfies the conditions "Purity > 99.95 (vol%), Moisture < 0.005 (vol%)".

5.6.2 Weight check of refrigerant bomb

- Use a weight whenever the refrigerant is charged, and charge in the specified quantity as calculated with the following equation.

5.6.3 Calculation of refrigerant charge quantity

Calculate the charge quantity with the following equation.

Refrigerant charge quantity (kg) = Standard refrigerant quantity of condensing unit + Refrigerant quantity for show case or unit cooler + Piping refrigerant quantity.

Regarding these refrigerant quantities, refer to 1, 2 and 3.

1. Standard refrigerant quantity of condensing unit

Standard refrigerant quantity of condensing unit (kg)	
Evaporation temperature setting ≤ -5°C	Evaporation temperature setting > -5°C
10.2	12.2

2. Refrigerant quantity for connected show case or unit cooler

Check the total capacity (ℓ) of show cases and unit coolers to be connected. Calculate the charge quantity by multiplying the refrigerant charge rate.

Refrigerant of show cases or unit coolers to be connected = Total capacity of show cases or unit coolers to be connected (ℓ) x Refrigerant charge rate[1)]

[1)] Refrigerant charge rate of show cases or unit coolers: 0.2 (kg/ℓ)
If the connected showcase total volume ≥ 27.5L, refrigerant charge rate of show cases or unit coolers: 0.15 (kg/ℓ)

Max connected number	Max Evaporator volume (L)
16	58.0 L* (-10°C ≤ ET ≤ -5°C)

** -5 < ET ≤ +5: Max evaporator volume is 40.0L under the high ET condition.*
These connected 58.0L or 40.0L case such as >27.5L, it should be secured minimum total volume under operation (13L).
-45 ≤ ET < -10: Max evaporator volume is no change 27.5L under the low ET condition.

When increasing the number and volume of evaporators connected to the condensing unit, be sure to observe the following.
Maximum connectable evaporator (showcase) volume:
-10°C ≤ ET< - 5°C : 58.0L
-5°C < ET ≤ + 5°C : 40.0L

3. Piping refrigerant quantity

Piping refrigerant charge quantity is calculated from the specifications of liquid pipe of connecting pipe (pipe size) and the length of each pipe.

Piping refrigerant charge quantity (kg) = Additional charge quantity/m of Ø6.35 (kg/m)Ø x L1 + Additional charge quantity/m of Ø9.52 (kg/m) x L2 + Additional charge quantity/m of Ø12.7 (kg/m) x L3 + Additional charge quantity/m of Ø15.88 (kg/m) x L4 + Additional charge quantity/m of Ø19.05 (kg/m) x L5

L1: Total length of Ø6.35 (m), L2: Total length of Ø9.52 (m), L3: Total length of Ø12.7 (m), L4: Total length of Ø15.88 (m), L5: Total length of ***Ø19.05 (m)***

5.6.4 Maximum refrigerant charge quantity

Confirm that the refrigerant charge quantity as calculated in the step 5.6.3 is not larger than the maximum refrigerant charge quantity.
Get the maximum refrigerant charge quantity from the Ø12.7 equivalent pipe length and the Fig. 26. Calculate the Ø12.7 equivalent pipe length of Fig. 26 with the following equation.
Maximum refrigerant charge quantity is not changed as Evaporation temperature setting.
Ø12.7 equivalent pipe length (m) = Piping refrigerant quantity (kg)/Additional charge quantity/m of Ø12.7 (kg/m)

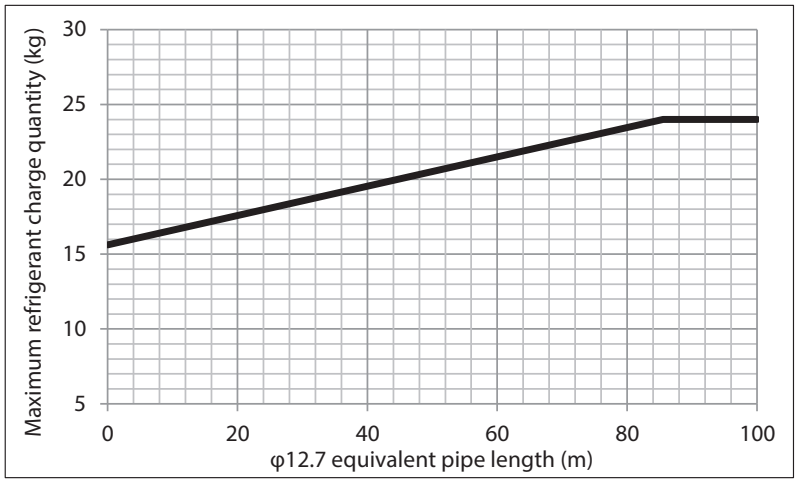


Fig. 26 Maximum refrigerant charge quantity

When Refrigerant charge quantity calculated in the step 5.6.3 < Maximum refrigerant quantity, charge the refrigerant in the quantity calculated in the step 5.6.3.
When Refrigerant charge quantity calculated in the step 5.6.3 ≥ Maximum refrigerant charge quantity, charge the refrigerant in the maximum refrigerant charge quantity.

5.6.5 Example of calculation – Determination of refrigerant charge quantity

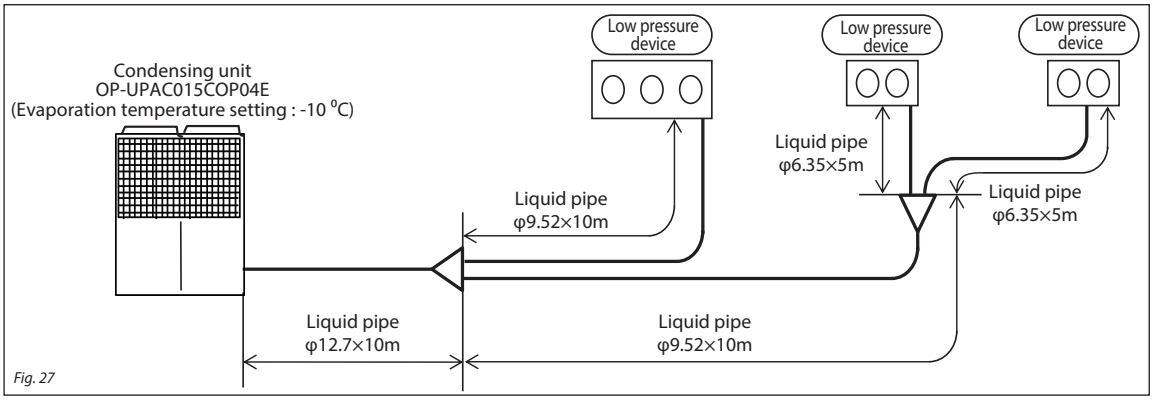


Fig. 27

In case of the piping system as above, the piping refrigerant charge quantity becomes 6.3 kg from the following calculation.
Piping refrigerant quantity = 0.098 (kg/m) x 10 (m) + 0.054 (kg/m) + (10 (m) + 10 (m)) + 0.025 (kg/m) x (5 (m) + 5 (m)) = 2.3 kg..... (a)

Additional charge quantity/m of refrigerant pipe (Liquid feed pipe)					
Refrigerant pipe size x Wall thickness (For material: C1220 1/2H)	Ø6.35×t0.5	Ø9.52×t0.8	Ø12.7×t1.0	Ø15.88×t1.2	Ø19.05×t1.4
Additional charge quantity (kg/m)	0.025	0.054	0.098	0.155	0.225

In addition, Ø12.7 equivalent pipe length is calculated to confirm that the refrigerant charge quantity is smaller than the maximum refrigerant charge quantity.

Ø12.7 equivalent pipe length = Piping refrigerant quantity (ℓ)/0.098 = 23.6 (m) ..... (b)

Calculate the refrigerant charge quantity for when total capacity of connected unit coolers is 16 (ℓ).

Refrigerant charge quantity = 10.2 (kg) + 16 (ℓ) x 0.2 (kg/ℓ) + 2.3 (kg) = 15.7 (kg) ..... (c)

There is the relationship as shown by Fig. 28 among the Ø12.7 equivalent pipe length (b), refrigerant charge quantity (c) and maximum refrigerant charge quantity. Since the refrigerant charge quantity: 15.7 kg is smaller than the maximum refrigerant quantity: 24 kg, 15.7 kg is taken as the refrigerant charge quantity. (When Calculated refrigerant charge quantity ≥ Maximum refrigerant quantity, charge in the maximum refrigerant quantity.)

The total volume and length of the evaporator (showcase) connected to the condensing unit must be within the range of Fig. 28.

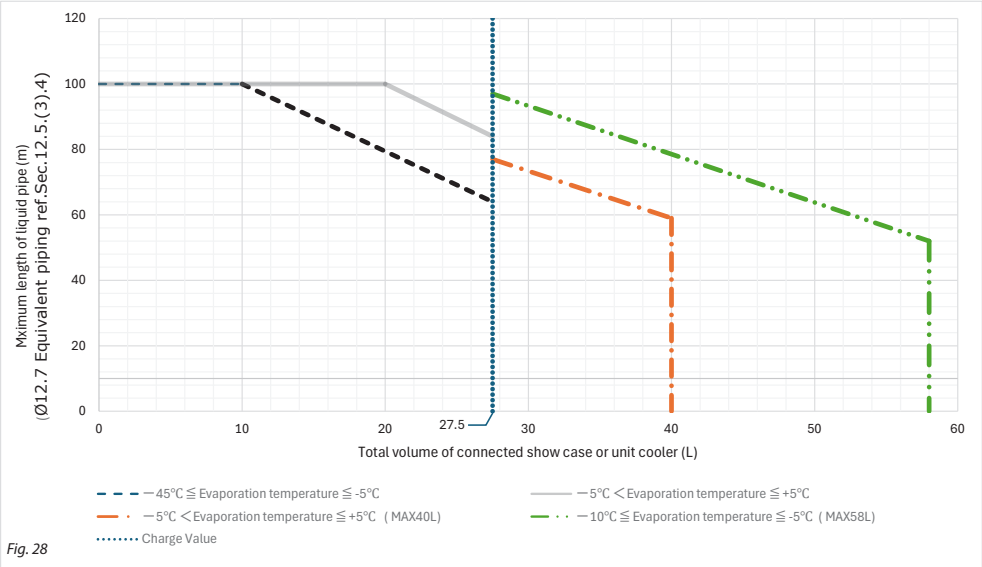


Fig. 28

Total volume of evaporator (showcase) connected to condensing unit and liquid pipe length

5.6.6 Refrigerant charge to stopped compressor

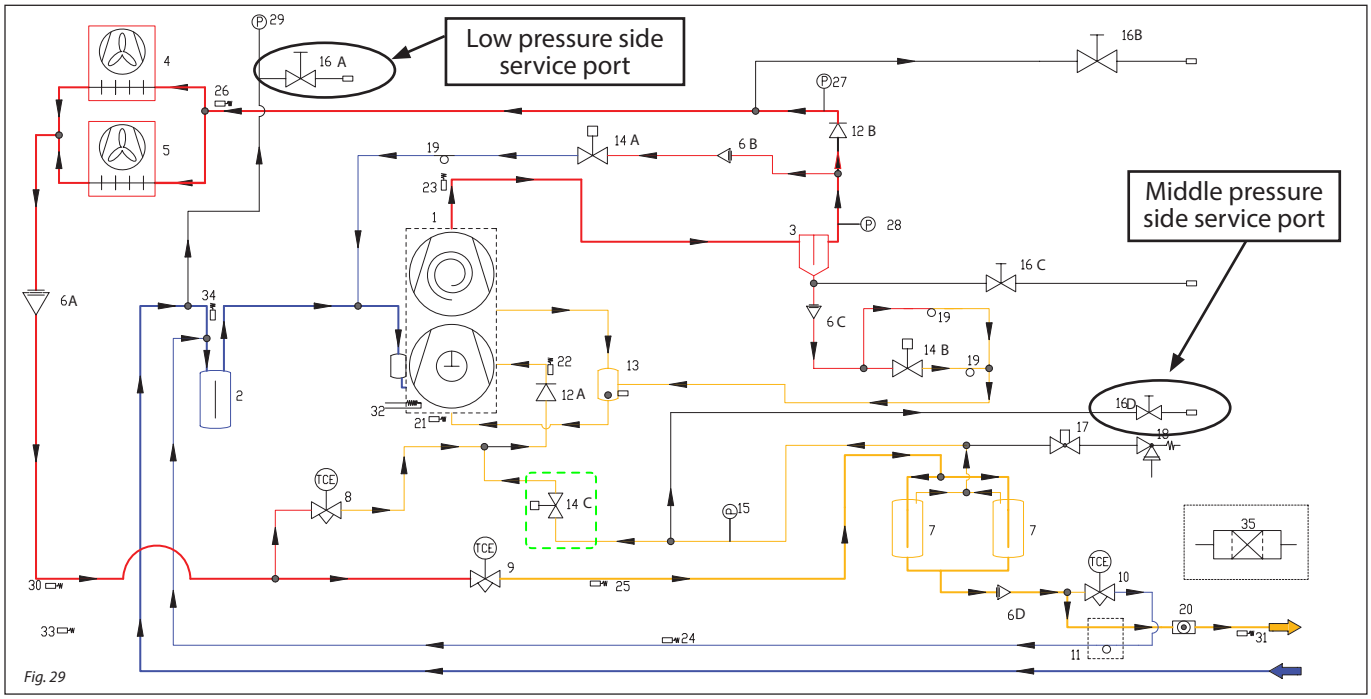
- Charge liquid refrigerant from the medium pressure service port of vessel unit.
- When the unit is energized, turn off the unit's power supply. Turn the dip switch SW5-7 to ON (Up) and turn ON the unit's power supply. Electronic expansion valves and solenoid valves (SVHG1, SV-OIL1-2, SV-INJ1, EEVG, EEVSC and EEV-LB1) in the unit open. When the work is over, turn the dip switch SW5-7 to OFF (Down).

5.6.7 Refrigerant charge in the cycle when the compressor is running

- While the compressor is running, charge liquid refrigerant from the low pressure side service port. Open the valve on the bomb gradually after operating the compressor. (Don't open the valve quickly. It could cause liquid back, resulting in failures on the unit.)

Note:

Overcharge of refrigerant could cause the liquid back from the medium pressure receiver. While the condensing unit is operating, take care to avoid the degree of superheat of under-dome (under-dome temperature - saturation temperature of medium pressure sensor) becomes lower than 10 deg.



Note on R744 (CO_2) :

R744 (CO_2) uses pressures higher than equipment based on Freon. Sufficient care must be taken when charging the gas.

Caution for work

1. Charge in liquid phase after breaking the vacuum at 7 or 10 bar.
2. Confirm that it is contained in a cylinder special to R744 (CO2).
3. Use the manifold valve and the charge hose special to R744 (CO_2).
4. Show a warning sign board stating "High pressure gas charge" at a place where it can be seen by people. (When the charging place can be approached from more than one place, show the board at respective places.)
5. Even when the charge pressure dropped in the cylinder, never heat the cylinder higher than 40°C for reason of security.
6. Do not lay flat the cylinder during charging.
7. Before disconnecting the charge hose, open the blow valve of gauge manifold to release CO_2 refrigerant. Take care to prevent frostbite because the liquid refrigerant may be released.

5.7 External signal output

Part of operating states can be output from the controller of condensing unit.

1. Alarm signal :

If the condensing unit stops under abnormal condition, an alarm signal is released.

2. Compressor operation signal :

Signals of compressor operation and stop can be extracted.

- Extract signals via a relay.

Where the power for the relay contacts is taken from a terminal box, connect the wires as shown by the electric wiring in the next section.

List of external output

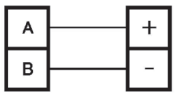
Name		Purpose (Factory default)	Specifications	Point of caution	
External input	CNS1(Green)	no use	Non-voltage contact (DC12V)	Stops when open.	
	CNS2(Red)	ON-OFF SW		Valid when short-circuited.	
	CNS3(Brown)	Compulsory oil return control input		Valid when short-circuited.	Use connectors fixed with tapes on the outer wall of the control box.
	CNG1(Blue)	Gas cooler fan snow control input		Valid when short-circuited	
	CNG2(White)	Multistep demand input		Valid when short-circuited.	
External output	CNH(Blue)	Operation output	12 VDC output (10 mA)	-	
	CNY(White)	Error output		-	
	CNZ1, CNZ2 (Red) (Black)	Set with 7-segment (*)		(Molex: Provide 5557-2R, 5556T at site.)	

*(*) **0**: Operation output **1**: Error output **2**: Compressor ON output **3**: Fan ON output **4**: Oil return operation output **5**: High pressure control output*
***6**: Compressor operation time (Maintenance time) time-over output*

For the default output, see Instruction manual page 48

3. Signal cable connection procedures for connecting Module controller

•Signal cables use DC 5 V. Never connect wires for 400 V. It trips the protective fuse on the PCB.
-Confirm that it is so arranged that 400 V power will not be applied to signal cables.
-Check the resistance of signal cable terminal board before turning power on . If the resistance is 100Ω, or less, a power cable may be connected to the signal cable terminal board.
•Communication method is based on RS485.
•Connect signal cable to A, B on the terminal board.
•Signal cables has the polarity. Connect them as shown in fig. 30.



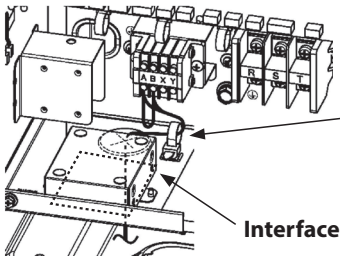


Fig. 30

Rotary switch setting (SW1:0, SW2:1) on interface board is "01" from factory sipping. This is slave address number.
Set dip switch SW3-4 of interface board to ON.

Signal cable fixing band
-Fix the signal cable with care to protect the connection to the terminal board from external force.
-Give an adequate allowance to the signal cable before fixing.

•Connect it to the terminal board using M3.5 crimp terminal as shown in the sketch below.

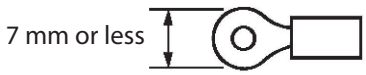


Fig. 31

•Use an adequate screwdriver to tighten terminal screws. If it is tightened too much, it could destroy screws. For the tightening torque of screw, see the table below.

Tightening torque (N·m)		
M3.5	Power cable/signal cable terminal board	0.68 ~ 0.82

5.8 Checking before turning on the power supply

1. Reconfirm that wires are connected correctly.
2. Check the power terminal board and installation face with a 500 V megger to see if it is 1 MΩ, or more.
3. Charge specified condensing unit oil and specified quantity of refrigerant after evacuation. (Refer to Instruction Mnaual 6.1. Charge of condensing unit oil, 6.2. Calculation of the charge quantity of condensing unit oil, 6.3. Replenishment of condensing unit oil after operation, 6.4. Refrigerant charge)
4. Confirm that the operation switch (CNS2) at the bottom of controller is turned OFF. Remove the cartons and the bracket before operation.
5. Anti-vibration shipping washers are not used on the compressor. Since this product does not use anti-vibration shipping washers, it is not necessary to remove them before operation.
6. Turn on the source power supply 6 hours or more before starting the compressor to energize the crankcase without turning on the operation switch (CNS2).

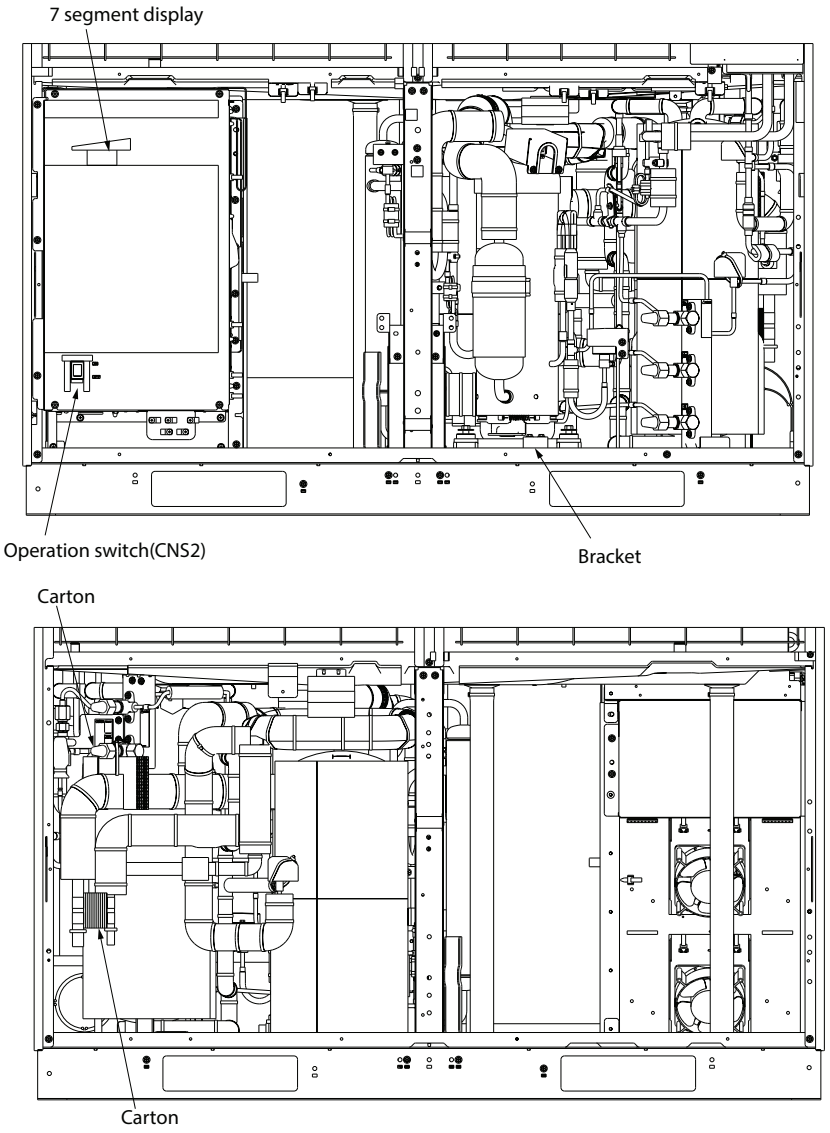


Fig. 32

5.9 Check after Start: after a couple of hours of stable operation following has to be checked

1. Unit current consumption.
2. Rotation of fan (suction through condenser).
3. Check for leakages in refrigerant system.
4. Check superheat.
5. Check oil level.
6. Check for abnormal noises.
7. Check for abnormal vibrations.
8. Suction and discharge pressures

6.1 General recommendations

	Even if main switch of condensing unit is in position OFF power still available at income terminals of main switch.
	In case of any service related to electrical components inside condensing unit it is recommended to disconnect condensing unit from the power by switch located before condensing unit.

It is recommend to check the unit for leakages minimum once a year and in accordance with national requirements.
Furthermore following should be checked:
1. Electrical and refrigerant connections for damages, corrosion etc.
2. The mounting devices (bolts, nuts, etc) of the unit.
3. Vibrations: if it is on the same level as after installation or any signs of abnormal vibration.
4. Operation conditions.
5. Airflow across the condenser.
6. Oil level.
7. Tightness of electrical connections.
8. Operation of the crankcase and oil separator heaters.

Compressor must always be warmer than any other component in the circuit, even if the circuit is switched off for seasonal stop.

6.2 Service and safety advice

If the refrigerant system has been opened the system has to be flushed with dry air or nitrogen to remove moisture and a new filter dryer has to be installed. If evacuation of refrigerant has to be done, it shall be done in such a way that no refrigerant can escape to the environment. Beware of hot and cold components in the refrigeration system. The components in the refrigeration system are pressurized; as a consequence special attention has to be paid during operation on these components.

	Do not operate condensing unit without refrigerant charge or without being connected to the system.
	Safety goggles, gloves, protective clothing, safety boots, hard hats or another safety equipment should be worn when necessary.
	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.
	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.
	Before Starting Repair Work - Disconnect from mains - Wait as stated before for discharge of the DC-link. - Remove compressor cable.

7.1 Unpacking

When unit reaches your warehouse, inspect the packing for any visible damage and make sure it is in good condition. In the event you detect any damage, please contact your forwarder immediately: send a registered letter to the shipping company claiming the suffered damage, a copy of which should be sent responsible contact in Danfoss.

7.2 Transportation and handling

Move the condensing unit only with appropriate mechanical or handling equipment according to weight. 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 an upright position. After unpacking, check that the unit is complete and undamaged.

7.3 Disposal Instruction

Equipment containing electrical components must not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

Always transmit the model number and serial number with any claim filed regarding this product.

The product warranty may be invalied 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 and serial number transmitted with the warranty claim.

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is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

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Danfoss Inverter Scrolls

Danfoss Scrolls

Danfoss Optyma™ Condensing Units

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