MARSTAIR
REFRIGERATION AND SPECIALIST AIR CONDITIONING

INSTALLATION & TECHNICAL MANUAL

GENERAL

1. TEV LTD recommend that personnel working on this equipment be skilled and fully conversant with the appropriate Refrigeration and Electrical practices and have sound knowledge of current Industrial Safe Working practices.

2. These units are supplied with a holding charge of oxygen free nitrogen and polyolester oil. Do not mix oils or refrigerants.

3. These units when installed contain live electrical components, moving parts and refrigerant under pressure. Always site out of reach of children and protect from vandalism.

4. The data plate only gives information for the outdoor unit.

5. FUSES - for recommended fuse size see page 9.

6. The refrigerant used should be identified by locating the R404A label (if appropriate) on the unit case

MARSTAIR DUCTED REFRIGERATION CONDENSING UNITS (DRC+)

INDEX

NOTE

IF MECHANICAL PUMP DOWN OPERATION IS REQUIRED CONNECT A LINK WIRE BETWEEN TERMINALS L1 & 3.

IF THIS LINK IS USED THEN TERMINAL 5 CAN NOT BE USED AS AN ALARM FACILITY

SPECIFICATION DETAILS

DRC+		20	30	40	50	60	80
Nominal cooling capacity (-5°C evaporating temp & 32°C ambient temp)	kW 1Ph 3Ph	 1.80 1.80	 2.48 2.48	 3.52 3.52	 4.05 4.05	 4.86 4.86	 5.87 5.87
Operating weight kg		70	70	72	81	81	84
1Ph (230V 50Hz) compresser load only (at nominal cooling capacity)							
Power (nominal)	kW	1.16	1.46	1.87	2.20	2.56	2.95
Starting current LRA	A	28	36	50	51	60	71
Nominal current FLA	A	5.9	7.2	9.3	10.0	12.0	14.1
3Ph (400V 50Hz) compresser load only (at nominal cooling capacity)							
Power (nominal)	kW	-	1.45	1.90	2.12	2.52	2.80
Starting current LRA	A	-	18	22	24	24	27
Nominal current FLA	A	-	2.7	3.9	4.0	4.2	4.8
Sound Pressure Levels (SPL) at 3m distance free field conditions (Reference 2x10-5N/M²)							
Fan Speed Min	dBA	35	35	35	44	44	44
	NR	29	29	29	32	32	32
Fan Speed Max	dBA	52	52	52	54	54	54
	NR	46	46	46	48	48	48
Condenser fan (1Ph 230V 50Hz)							
Airflow (max speed)	m³/s	0.44	0.42	0.38	0.53	0.53	0.48
Fan Motor rating	kW	0.34	0.34	0.34	0.34	0.34	0.34
Nominal current FLA	A	2.6	2.6	2.6	2.6	2.6	2.6
Starting Current	A	6.0	6.0	6.0	6.0	6.0	6.0

Maximum external resistance 100Pa

DRC+ 20 - 80 CAPACITIES

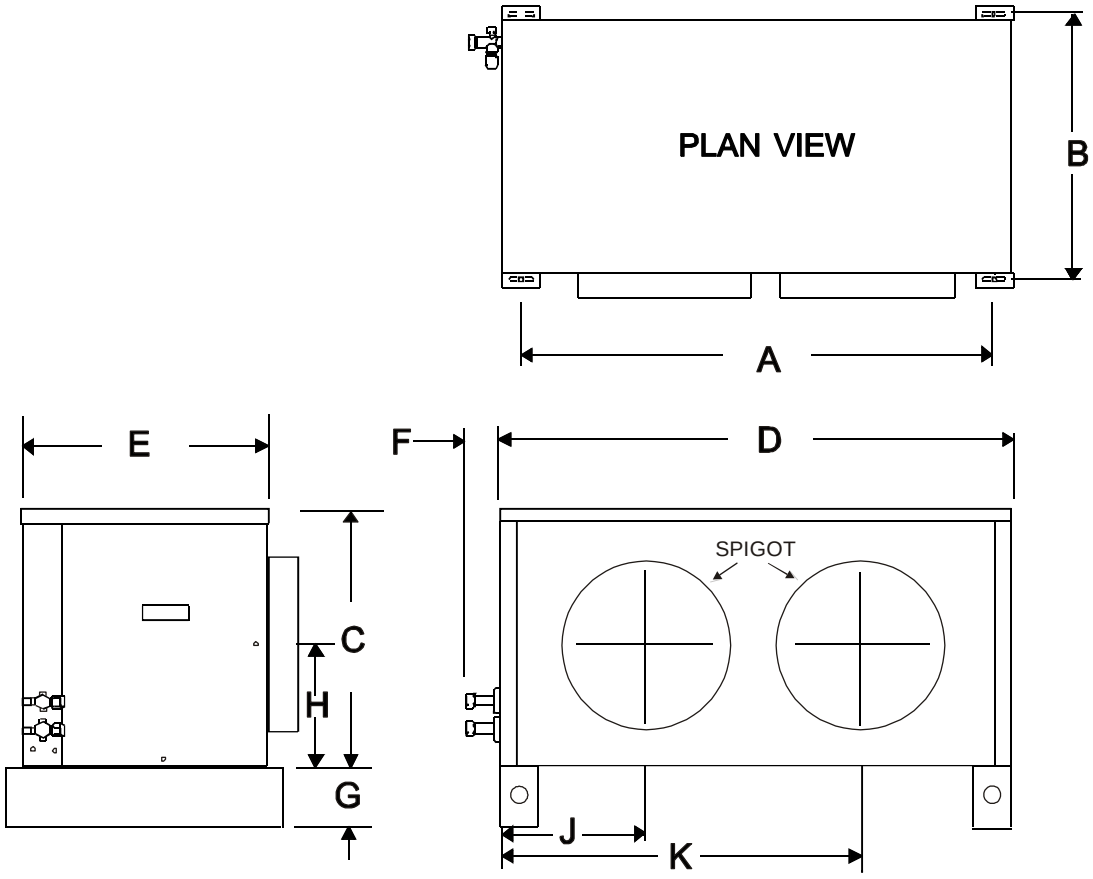
MODEL	Ambient Temp °C	EVAPORATING TEMPERATURE °C					
		-15		-10		-5	
		COOLING CAPACITY AND POWER INPUT kW					
		CAP.	POWER	CAP.	POWER	CAP.	POWER
DRC+ 20	27	1.23	0.85	1.59	0.93	2.00	1.01
	32	1.09	0.85	1.43	0.94	1.80	1.03
	40	0.90	0.85	1.27	0.96	1.49	1.07
DRC+ 30	27	1.84	1.09	2.27	1.19	2.75	1.29
	32	1.64	1.09	2.04	1.20	2.48	1.31
	40	1.35	1.09	1.82	1.23	2.06	1.37
DRC+ 40	27	2.66	1.64	3.24	1.74	3.89	1.85
	32	2.40	1.66	2.94	1.77	3.52	1.91
	40	1.98	1.68	2.44	1.84	2.92	2.01
DRC+ 50	27	2.86	1.84	3.60	1.95	4.47	2.08
	32	2.58	1.86	3.27	1.99	4.05	2.15
	40	2.13	1.88	2.71	2.06	3.36	2.26
DRC+ 60	27	3.43	2.07	4.33	2.18	5.37	2.31
	32	3.10	2.09	3.92	2.22	4.86	2.38
	40	2.56	2.11	3.25	2.29	4.03	2.49
DRC+ 80	27	4.15	2.44	5.23	2.55	6.48	2.68
	32	3.75	2.46	4.74	2.59	5.87	2.75
	40	3.09	2.48	3.93	2.66	4.87	2.86

CONTENTS

ITEM	DESCRIPTION	QUANTITY
1	Stabilizing brackets	4
2	No10 Screws	8
3	Cable glands	2

NOTE: Units are supplied with a packing piece supporting the blower assembly, this **MUST** be removed prior to commissioning.

DIMENSION & WEIGHTS



Model	A	B	C	D	E	F	G	H	J	K	Spigot Ø	Weight (kg)
DRC+ 20	930	510	495	1004	490	65	65	210	317	757	354	70
DRC+ 30	930	510	495	1004	490	65	65	210	317	757	354	70
DRC+ 40	930	510	495	1004	490	65	65	210	317	757	354	72
DRC+ 50	1100	510	560	1174	490	65	65	240	392	865	404	81
DRC+ 60	1100	510	560	1174	490	65	65	240	392	865	404	81
DRC+ 80	1100	510	560	1174	490	65	65	240	392	865	404	84

MOUNTING

Ducted units are designed to be hung on a wall (brackets available as a kit), suspended from a ceiling (installer supplied fittings), or to stand on a flat surface. Whichever method is used it is essential that the mounting surface is capable of supporting the unit's weight. Leave space around the unit for air circulation and access for installation and maintenance.

FLOOR MOUNTING

Using the appropriate side of the packing carton as a template, (centres marked A), mark out and drill 4 holes to suit maximum M8 bolts (also see Fig. 1). Secure the unit to the floor. Discard the 4 stabilizing brackets and 8 screws.

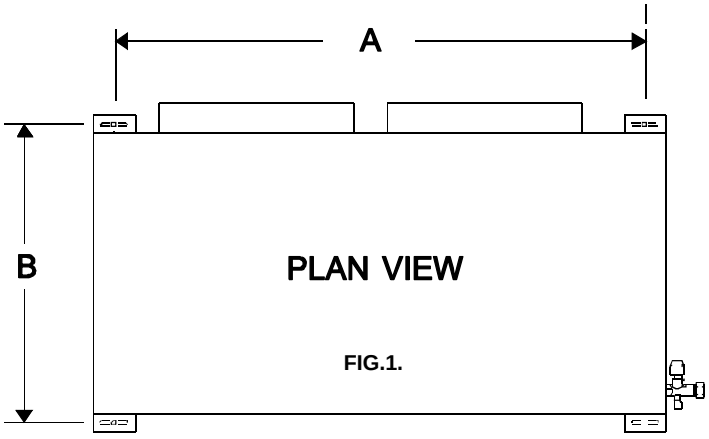
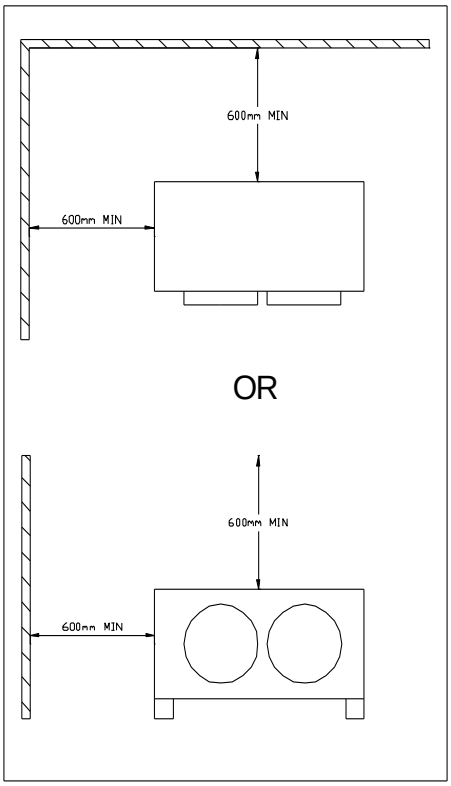


FIG.1.

DRC+	**A** (mm)	**B** (mm)
15 to 40	930	510
50 to 80	1100	510



SUSPENSION MOUNTING

The installer must supply 4 x M8 threaded rods with 16 nuts and washers to suit.

IMPORTANT: The stabilizing brackets provided **MUST** be used when suspending a unit.

Fit the stabilizing brackets to the top corners of the backpanel and front face using the No. 10 screws provided, (2 per bracket).

If these brackets are omitted the unit will be subject to unacceptable movement on compressor start (Fig. 2).

Where long drops of M8 rod are used, it is advisable to incorporate flexible pipes in the suction and expansion lines.

Using the template printed on the side of the packing carton, (centres marked A), mark out the ceiling and drill 4 holes to suit M8 screwed rod, (see Fig. 1). Raise the unit to the required height and pass the screwed rods through the mounting holes in the units feet and stabilizing brackets. Secure the unit with a nut and washer on either side of each stabilizing bracket and two nuts and washers underneath each foot mounting hole, (Fig. 2).

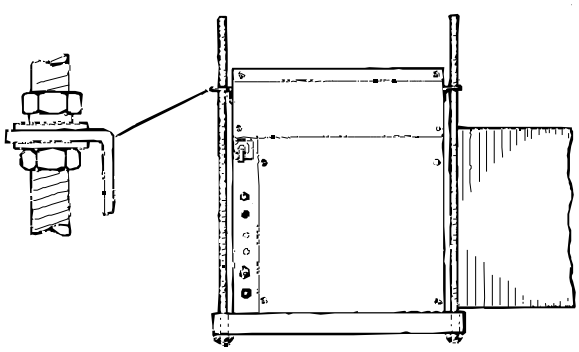


FIG.2.

WALL MOUNTING

Wall mounting brackets are available as an optional Kit (53200407)

DUCTWORK

Each unit is supplied with air inlet and discharge spigots.(see page 2 for sizes)

These may be used for connecting installers ducting or used with the optional duct, plenum and grille kits (refer to kit instructions for installation)

NOTE: It is essential that ducting is adequately insulated to prevent sweating. An insulation thickness of at least 45mm is recommended.

PIPEWORK

Size	**20**	**30**	**40**	**50**	**60**	**80**
Liquid	3/8	3/8	3/8	3/8	3/8	1/2
Suction	3/8	1/2	1/2	1/2	5/8	5/8

MAXIMUM PIPE RUNS

45m maximum including 6m lift. There will be no significant loss of capacity for extended pipe runs provided pipes are correctly sized.

CALCULATING EQUIVALENT LENGTHS

The effects of bends and fittings must be taken into account.

Pipe sizes are based on:
Minimum of 2.5 m/s (500 fpm) suction gas velocity for horizontal or downflow.
Minimum of 5.0 m/s (1000 fpm) suction gas velocity for upflow.
Maximum of 20.0 m/s (4000 fpm) suction gas.
Where vertical risers exceed 3m, oil traps must be formed in the pipe. This will help ensure that oil returns to the compressor. Typically fit an oil trap every 3m with a trap at the bottom of the riser.

GOOD PRACTICE

- Keep pipe runs as short as possible.
- Avoid sharp bends
- Fully insulate both suction and liquid including mechanical connections
- Try to avoid running pipes through hot areas.

The maximum pipe lengths to be used for each pipe size and outdoor unit are shown in the table below. Use of these sizes and lengths is recommended in order to achieve optimum system performance. Smaller suction line sizes may be used but will impose a loss in performance of approximately 2% per 1K additional suction line pressure drop on total cooling and approximately 1% on sensible cooling.

PIPE SIZE

UNIT SIZE	MAXIMUM LENGTH OF EQUIVALENT SUCTION LINE PIPE SIZES (m)							LIQUID LINE			
	⅜	½	⅝	¾	⅞	1⅛	1⅜	⅜	½	⅝	¾
20	7.5	23	45					45			
30		15	45					45			
40		10	36	45				7.5	45		
45		10	36	45				7.5	45		
50		7.5	18	45				7.5	45		
60			14	36	45			7.5	45		
80			11	30	45				45		

In calculating equivalent lengths of pipe runs, the effect of bends and fittings must be taken into account. The table below covers fittings most likely to be encountered in this type of installation. The equivalent lengths of all fittings in a particular pipe run must be added together and the total added to the actual length of pipe in the run, in order to calculate its total equivalent length.

Use the shortest possible route, avoiding sharp bends.

Fully insulate both the suction and expansion lines, including the expansion device, since both lines may sweat.

FITTING LOSSES, in equivalent straight lengths of pipe (m)						
	Pipe Size (outside diameter in inches)					
Fitting	⅜	½	⅝	¾	⅞	1⅛
45° Bend	0.12	0.15	0.18	0.21	0.24	0.3
90° Bend R/d = 1	0.37	0.43	0.49	0.55	0.61	0.79
90° Bend R/d = 1.5	0.24	0.27	0.30	0.37	0.43	0.52
180° Bend C/d = 1.5	0.73	0.91	1.10	1.28	1.46	1.83
180° Bend C/d = 2.5	0.46	0.55	0.64	0.76	0.85	1.07
90° Elbow	0.67	0.85	1.04	1.25	1.46	1.89
R = Radius of bend		d = Diameter of tube			C = Centres of bend	

CONNECTING THE UNITS

1. Connecting the pipework:
   a. Remove the flare nuts from the service valves and release the nitrogen holding charge by slowly opening the valves using a 5mm or 8mm allen key.
   b. Ensure the suction line is fully insulated.
   c. Place the flare nuts over the incoming pipework and flare the pipe ends.
   d. Connect the pipework between the units. Do not leave pipes ends, valves etc open to the atmosphere. Always use 2 spanners when tightening the flare nuts to avoid twisting the pipes. Use a small amount of refrigerant oil on the mating surfaces.

EVACUATING

With the valves open, connect a vacuum pump to the service ports on the outdoor unit valves. Evacuate the interconnecting pipework and indoor unit to 1000 microns (1 Torr) or better. Allow this to be held for a minimum of 15 minutes.

ELECTRICAL

The installer supplies mains, control and interconnecting cables: equipment must be earthed.
Wiring must be carried out in accordance with local and national codes.
Mains supply cables must be size compatible with the recommended fuse.
Cable clamps for use with stranded cables are supplied in units 30 - 90 and should be used to secure incoming/outgoing cables. Installers must supply a method of securing solid sheathed cables.

FUSES: The system and its supply/interconnecting wiring must be protected by fuses, preferably High Rupture Current (HRC) motor rated types (to BS EN60269) or miniature circuit breakers to (BS EN60898) or local codes having similar time lag characteristics, that allow starting of the compressor yet still afford close overcurrent protection under running conditions. The ratings below are for HRC motor rated fuses.

1PH FUSE SIZE						
DRC+	20	30	40	50	60	80
FUSE	16	16	20	25	25	32

3PH FUSE SIZE					
DRC+	30	40	50	60	80
FUSE	10	10	10	10	16

Charging the System:

1. Evacuate the system and interconnecting pipework as page 8 ensuring the service valves are fully open.

2. Allow the evacuated system to draw in the majority of the refrigerant charge.

3. The final charge should be adjusted with the system running.

4. All units are fitted with head pressure control. The link wire across the orange terminals allows the fan to operate at full speed. **THIS SHOULD BE REMOVED AFTER CHARGING**

5. A random start delay of up to 1 minute occurs when mains is first applied. A 3 minute delay occurs between successive compressor operations on all systems.

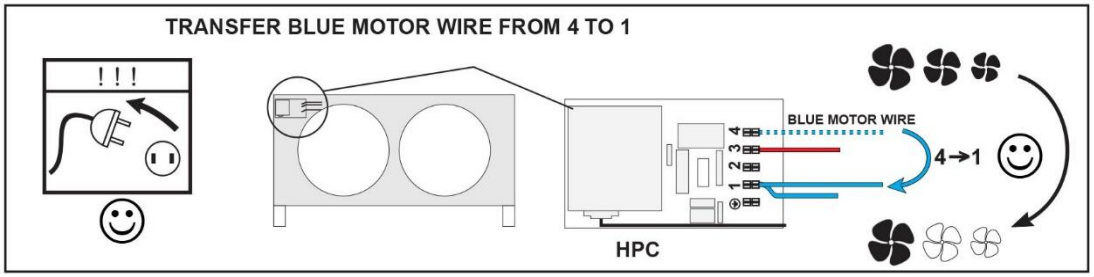
6. Refrigerant and polyolester oil should be introduced through the Schrader valve the service port on the suction service valve on the outdoor unit. **Ensure the refrigerant is the correct type, as shown on the rating plate**. R404A must always be added in the liquid state.

7. Run the system for a few minutes to allow it to stabilize. Where possible, charge to a sweat line on the evaporator. Typical suction pressures on short lines at UK conditions, with high speed evaporator fan, high speed condenser fan, should be; low temperature system approx 4.4 bar (65 psig).

8. **Systems should not be overcharged, to avoid liquid return to the compressor**.

9. **HEAD PRESSURE CONTROL SAGINOMIYA (RGE – ZIN4 – SH)**

The head pressure controller is factory set to suit the refrigerant. It may be necessary to adjust this to suit site conditions, to raise or lower the nominal head pressure.



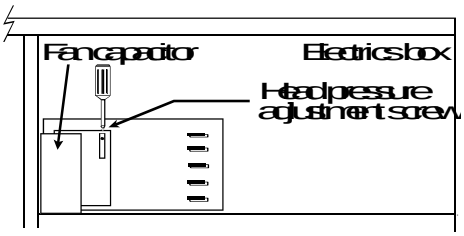
a. With the system switched off, connect a high pressure gauge to the liquid line service valve.

b. Switch on the system, and run for a few minutes to stabilise.

c. The head pressure should be approximately:

R404A: 210-220 psig (14.5-15.2barg) to achieve this adjust the screw clockwise to increase pressure or anticlockwise to decrease. Each ½ turn will alter the pressure by approx 5 psig (0.5 barg)

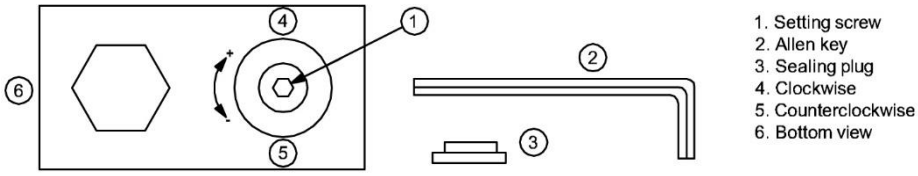
Min fan speed (0 rpm) and fan cut in pressure 200 psig (13.8 barg) are factory set and not adjustable.



NOTE: The condenser fan may stop if the operating pressure drops below 200 psig (13.8 barg)

10. HEAD PRESSURE CONTROL ALCO (FSY-42S)

The head pressure controller is factory set to suit the refrigerant. It may be necessary to adjust this to suit site conditions, to raise or lower the nominal head pressure.



a. With the system switched off, connect a high pressure gauge to the liquid line service valve.

b. Switch on the system, and run for a few minutes to stabilise.

c. The head pressure should be approximately:

R404A: 210-220 psig (14.5-15.2barg) to achieve this remove sealing plug and insert 2mm or 5/64" allen key into setting screw. Turn allen key clockwise (+) or counter clockwise (-) to readjust the setting. Do not turn setting screw **more than 3 turns clockwise** (+3). Use following table as a quick guideline for setting:

Pressure changes per turn of adjusting screw:
Pressure change 1: 4.0 … 12.5 bar:
Clockwise ~ +1,2 bar, counter clockwise ~ -1,2 bar

Pressure change 2: 9.2 … 21.2 bar:
Clockwise ~ +2,5 bar, counter clockwise ~ -2,5 bar

Pressure change 3: 12.4 … 28.4 bar:
Clockwise ~ +3,3 bar, counter clockwise ~ -3,3 bar

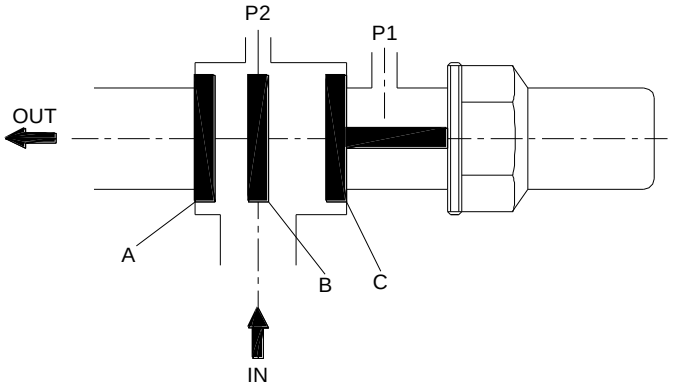
After adjustment, re-insert sealing plug and make sure that it is properly fitted. IP65 protection requires firmly sealed plug

NOTES:
Tolerances for condensing temperatures setpoint: ±2K

Min fan speed (0 rpm) and fan cut in pressure 200 psig (13.8 barg) are factory set and not adjustable.

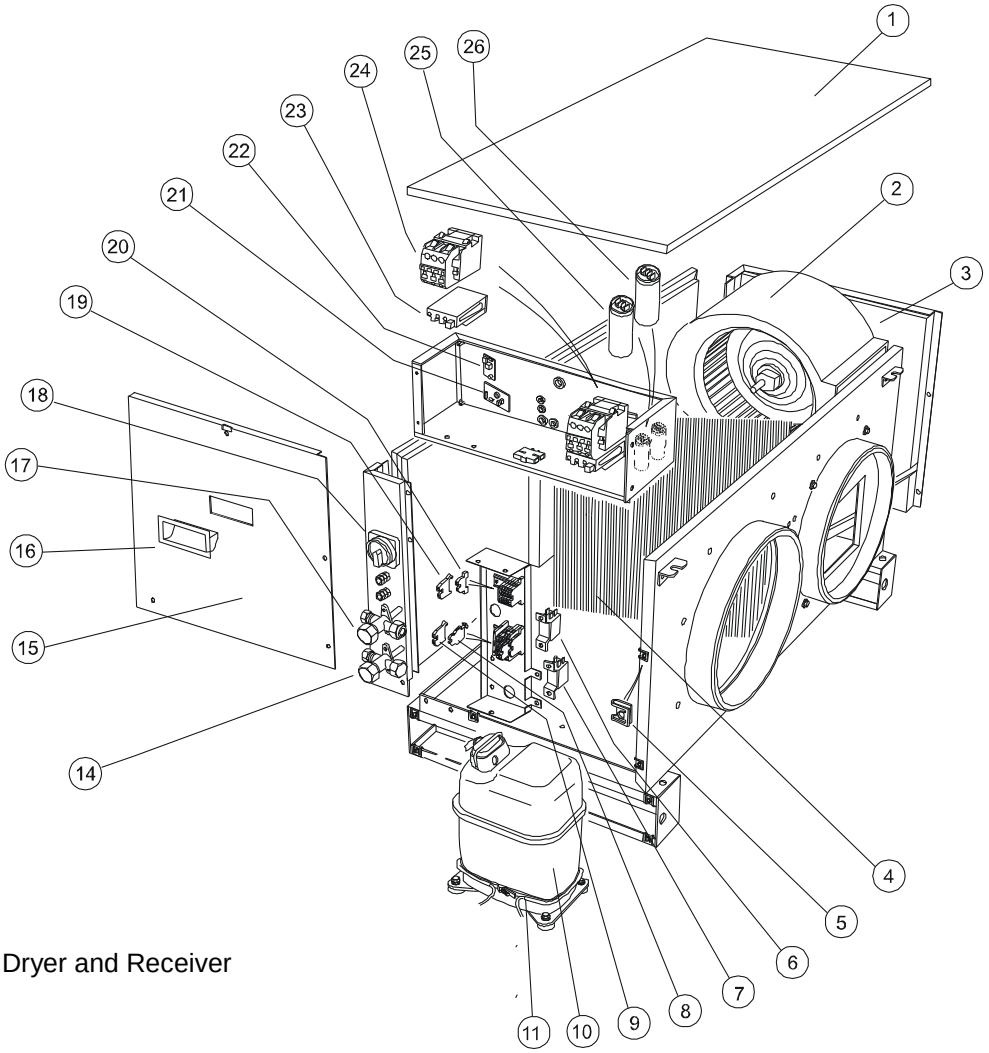
NOTE: The condenser fan may stop if the operating pressure drops below 200 psig (13.8 barg)

ROTA-LOCKED VALVES FITTED TO RECIEVER



POSITION SPINDLE	FUNCTION
A	OUT CLOSED
B	ALL OPEN
C	P1 CLOSED

Pay attention
- P1, P2: optional gages ports.
- The positions IN - OUT could be inverted according to the employment of client.
- The spindle must be positioned in the position B when the valve will be connected to the unit.



Sight Glass, Dryer and Receiver not shown

1	LID	**15**	PANEL ELECTRICS ACCESS
2	FAN ASSEMBLY	**16**	HANDLE
3	PANEL RIGHT HAND ACCESS	**17**	SERVICE VALVE
4	HEAT EXCHANGER COIL	**18**	ISOLATOR
5	SPIRE CLIP	**19**	END CLAMP
6	SWITCH LP AUTO	**20**	TERMINAL
7	SWITCH HP AUTO	**21**	HEAD PRESSURE CONTROL pcb
8	TERMINAL (4 WAY)	**22**	3 MIN TIMER
9	TERMINAL FUSED	**23**	OVER LOAD (3ph)
10	COMPRESSOR	**24**	CONTACTOR
11	CRANK CASE HEATER	**25**	FAN CAPACITOR
14	SERVICE VALVE	**26**	COMPRESSOR CAPACITOR (1ph)

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