MARSTAIR
REFRIGERATION AND SPECIALIST AIR CONDITIONING

SMCD TECHNICAL MANUAL

CONTENTS

1 – GENERAL INFORMATION

1A GENERAL INFORMATION

Installation must be carried out in accordance with the Marstair installation manual, EN 378 and national codes and guidance.

1. Installation work on this equipment to be completed by F Gas certified Technicians who are fully conversant with the appropriate Refrigeration and Electrical practices and have sound knowledge of current Industrial Safe Working practices. It is also advisable that technicians hold the ACRIB Understanding the properties of flammable refrigerants (A2L, A2 and A3) qualification.

   NOTE: it is the responsibility of the operator to ensure the technician is certified to the correct standard (EN13313 or equivalent).

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 individual indoor or outdoor unit.

5. The refrigerant used should be identified on the unit case

6. A suitable risk assessment of the installation must be carried out. This ensures a safe working environment is maintained in accordance with The Dangerous Substances and Explosive Atmosphere Regulations and the Management of Health and Safety at Work Regulations. A step by step guidance template is provided within these instructions.

7. The condensing unit must be installed outside.

8. Systems can use R454A, R454C & R455A refrigerant which are classed as A2L flammable gases

1B GENERAL INSTALLATION PROCEDURE

- Carry out “step by step” or full risk assessment
- Ensure that no sources of ignition are present during installation
- Only certified natural persons should be present during the installation
- Correct selection of tools and equipment compatible with A2L refrigerants. This should include the following:
  - Flammable gas leak detector placed at a low level next to the service valves of the condensing unit.
  - If adequate natural ventilation is not present throughout the installation process, then forced ventilation should be employed via an A2L compatible or ATEX rated fan and motor.
  - When pressure testing through a refrigerant manifold, ensure that it is suitable for the pressure (no sight glass fitted).
  - A2L compatible 2 stage vacuum pump, exhausted to a safe well ventilated area and away from any source of ignition (check exhaust fumes with flammable gas leak detector).
  - R454C bottle adaptor (left handed female and right handed male connections DIN477-1 21.8mm LH, External, 14 T.P.I).
  - All refrigerant hoses should be as short as possible and have self-closing or ball valve connections in accordance with BS EN 378.
  - If additional refrigerant is to be added, charge in liquid state and ensure a flammable gas leak detector is positioned at a low level near the connections. (If the flammable gas leak detector indicates the presence of a flammable atmosphere, do not energise or de-energise any electrical components until a safe environment has been ensured.)
- Leak checking the system in accordance with EN 1516/2017 directly after installation.
- If a leak is discovered, energise the flammable gas leak detector and place at a low level near connections to the recovery machine and cylinder. Connect an A2L compatible recovery machine and recover into a suitable recovery cylinder (red painted cylinder valve guard and shoulder) in accordance with BS EN 378.

2 - SMCD CONDENSING UNITS

2A SPECIFICATION.

SMCD Medium Temperature		50	90	100	130	150	180
Nominal cooling capacity (-10°C evaporating temp & 32°C ambient temp) R454C	kW	4.5	6	7.5	N/A	8.8	11
3Ph (400v 50Hz) compressor load only (at nominal cooling capacity)							
Power (nominal)	kW	2.2	2.8	3.5	N/A	4.13	5.17
Starting current LRA	A	40	48	64	N/A	74	102
Nominal current FLA	A	6.7	10	11.3	N/A	12.3	15.9
Sound Pressure Levels (SPL) at 10m distance in free field conditions @ 27°C external ambient.							
dBA		33	37	38	N/A	37	39
NR		27	30	31	N/A	30	32
Condenser fan (1Ph 230V 50Hz)							
Airflow (max speed)	m^3/s	0.91	0.91	1.85	N/A	1.85	1.85
Airflow motor rating	kW	0.13	0.13	2x0.13	N/A	2x0.13	2x0.13
Nominal current FLA	A	0.6	0.6	2x0.6	N/A	2x0.6	2x0.6
Fans: No. x diameter	#x mm	1x457	1x457	2x457	N/A	2x457	2x457
Fans max speed	r.p.m	940	940	940	N/A	940	940

SMCD Low Temperature		50	90	100	130	150	180
Nominal cooling capacity (-30°C evaporating temp & 32°C ambient temp) R454C	kW	N/A	4	N/A	5.8	N/A	7.3
3Ph (400v 50Hz) compressor load only (at nominal cooling capacity)							
Power (nominal)	kW	N/A	2.3	N/A	3.4	N/A	4.3
Starting current LRA	A	N/A	64	N/A	74	N/A	102
Nominal current FLA	A	N/A	9	N/A	13.7	N/A	16
Sound Pressure Levels (SPL) at 10m distance in free field conditions @ 27°C external ambient.							
dBA		N/A	37	N/A	37	N/A	39
NR		N/A	30	N/A	30	N/A	32
Condenser fan (1Ph 230V 50Hz)							
Airflow (max speed)	m^3/s	N/A	0.91	N/A	1.85	N/A	1.85
Airflow motor rating	kW	N/A	0.13	N/A	2x0.13	N/A	2x0.13
Nominal current FLA	A	N/A	0.6	N/A	2x0.6	N/A	2x0.6
Fans: No. x diameter	#x mm	N/A	1x457	N/A	2x457	N/A	2x457
Fans max speed	r.p.m	N/A	940	N/A	940	N/A	940

2B PERFORMANCE DATA.

R454C

		Evaporating temperature				
SMCD 50		-20	-15	-10	-5	0
Ambient temperature YBD17K1E	27	3.10	3.90	4.83	5.93	7.22
	30	2.98	3.75	4.65	5.72	6.96
	32	2.91	3.64	4.53	5.57	6.79
	35	2.77	3.49	4.34	5.35	6.51
	38	2.63	3.33	4.14	5.12	6.25
	40	2.55	3.23	4.02	4.97	6.07
		Evaporating temperature				
SMCD 90		-20	-15	-10	-5	0
Ambient temperature YBD24K1E	27	4.09	5.13	6.36	7.81	9.50
	30	3.92	4.93	6.12	7.53	9.16
	32	3.82	4.79	5.96	7.33	8.94
	35	3.64	4.59	5.72	7.04	8.57
	38	3.46	4.39	5.45	6.74	8.23
	40	3.36	4.25	5.29	6.54	7.99
		Evaporating temperature				
SMCD 100		-20	-15	-10	-5	0
Ambient temperature YBD31K1E	27	5.11	6.42	7.95	9.76	11.88
	30	4.91	6.17	7.65	9.41	11.45
	32	4.78	5.99	7.45	9.16	11.17
	35	4.55	5.74	7.15	8.81	10.72
	38	4.33	5.49	6.82	8.43	10.29
	40	4.20	5.31	6.62	8.18	9.99
		Evaporating temperature				
SMCD 150		-20	-15	-10	-5	0
Ambient temperature YBD36K1E	27	6.06	7.61	9.43	11.58	14.09
	30	5.82	7.31	9.07	11.16	13.58
	32	5.67	7.10	8.84	10.86	13.25
	35	5.40	6.81	8.48	10.45	12.72
	38	5.13	6.51	8.09	10.00	12.21
	40	4.98	6.30	7.85	9.70	11.85
		Evaporating temperature				
SMCD 180		-20	-15	-10	-5	0
Ambient temperature YBD45K1E	27	7.54	9.47	11.74	14.42	17.54
	30	7.24	9.10	11.29	13.90	16.90
	32	7.06	8.84	11.00	13.52	16.50
	35	6.72	8.47	10.55	13.00	15.83
	38	6.39	8.10	10.07	12.45	15.20
	40	6.20	7.84	9.77	12.07	14.75

		Evaporating temperature				
SMCD 90 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ10K1E	27		2.58	3.27	4.04	4.99
	30		2.56	3.23	4.00	4.96
	32		2.52	3.21	3.97	4.91
	35		2.49	3.17	3.95	4.86
	38			3.13	3.91	4.80
	40			3.10	3.87	4.76
		Evaporating temperature				
SMCD 130 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ15K1E	27		3.77	4.78	5.91	7.30
	30		3.74	4.72	5.85	7.25
	32		3.68	4.69	5.80	7.18
	35		3.64	4.64	5.78	7.11
	38			4.58	5.72	7.02
	40			4.53	5.66	6.96
		Evaporating temperature				
SMCD 180 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ19K1E	27		4.72	5.98	7.39	9.13
	30		4.68	5.91	7.32	9.08
	32		4.61	5.87	7.26	8.98
	35		4.56	5.80	7.23	8.89
	38			5.73	7.15	8.78
	40			5.67	7.08	8.71

R455A

		Evaporating temperature				
SMCD 50		-20	-15	-10	-5	0
Ambient temperature YBD17K1E	27	3.31	4.15	5.15	6.32	7.69
	30	3.18	3.99	4.95	6.09	7.41
	32	3.09	3.88	4.82	5.93	7.23
	35	2.95	3.71	4.62	5.70	6.94
	38	2.80	3.55	4.41	5.46	6.66
	40	2.72	3.44	4.28	5.29	6.46
		Evaporating temperature				
SMCD 90		-20	-15	-10	-5	0
Ambient temperature YBD24K1E	27	4.25	5.34	6.62	8.13	9.89
	30	4.08	5.13	6.37	7.83	9.53
	32	3.98	4.99	6.20	7.62	9.30
	35	3.79	4.78	5.95	7.33	8.92
	38	3.60	4.57	5.68	7.02	8.57
	40	3.50	4.42	5.51	6.81	8.32
		Evaporating temperature				
SMCD 100		-20	-15	-10	-5	0
Ambient temperature YBD31K1E	27	5.38	6.76	8.38	10.29	12.52
	30	5.17	6.50	8.06	9.92	12.07
	32	5.04	6.31	7.85	9.65	11.78
	35	4.80	6.05	7.53	9.28	11.30
	38	4.56	5.78	7.19	8.88	10.85
	40	4.43	5.60	6.97	8.62	10.53
		Evaporating temperature				
SMCD 150		-20	-15	-10	-5	0
Ambient temperature YBD36K1E	27	6.47	8.13	10.08	12.37	15.05
	30	6.22	7.81	9.70	11.93	14.51
	32	6.06	7.59	9.44	11.61	14.16
	35	5.77	7.27	9.06	11.16	13.59
	38	5.49	6.95	8.64	10.68	13.04
	40	5.33	6.73	8.39	10.36	12.66
		Evaporating temperature				
SMCD 180		-20	-15	-10	-5	0
Ambient temperature YBD45K1E	27	8.02	10.08	12.49	15.34	18.66
	30	7.71	9.68	12.02	14.78	17.98
	32	7.51	9.41	11.70	14.39	17.55
	35	7.15	9.01	11.23	13.83	16.84
	38	6.80	8.62	10.71	13.24	16.17
	40	6.60	8.34	10.40	12.85	15.69

		Evaporating temperature				
SMCD 90 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ10K1E	27		2.77	3.51	4.34	5.36
	30		2.75	3.47	4.30	5.33
	32		2.71	3.45	4.27	5.28
	35		2.68	3.41	4.25	5.22
	38			3.36	4.20	5.16
	40			3.33	4.16	5.12
		Evaporating temperature				
SMCD 130 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ15K1E	27		4.05	5.13	6.34	7.83
	30		4.02	5.07	6.28	7.79
	32		3.96	5.04	6.23	7.71
	35		3.91	4.98	6.20	7.63
	38			4.91	6.14	7.54
	40			4.87	6.08	7.47
		Evaporating temperature				
SMCD 180 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ19K1E	27		5.07	6.43	7.94	9.81
	30		5.03	6.35	7.86	9.75
	32		4.95	6.31	7.80	9.65
	35		4.89	6.23	7.76	9.55
	38			6.15	7.69	9.44
	40			6.09	7.61	9.36

R454A

		Evaporating temperature				
SMCD 50		-20	-15	-10	-5	0
Ambient temperature YBD17K1E	27	3.70	4.65	5.76	7.08	8.61
	30	3.56	4.47	5.55	6.82	8.30
	32	3.47	4.34	5.40	6.64	8.10
	35	3.30	4.16	5.18	6.39	7.77
	38	3.14	3.98	4.94	6.11	7.46
	40	3.05	3.85	4.80	5.93	7.24
		Evaporating temperature				
SMCD 90		-20	-15	-10	-5	0
Ambient temperature YBD24K1E	27	4.79	6.02	7.46	9.16	11.15
	30	4.60	5.79	7.18	8.83	10.74
	32	4.49	5.62	6.99	8.60	10.49
	35	4.27	5.38	6.71	8.27	10.06
	38	4.06	5.15	6.40	7.91	9.66
	40	3.94	4.98	6.21	7.67	9.38
		Evaporating temperature				
SMCD 100		-20	-15	-10	-5	0
Ambient temperature YBD31K1E	27	6.08	7.64	9.47	11.63	14.14
	30	5.84	7.34	9.11	11.21	13.63
	32	5.69	7.13	8.87	10.91	13.31
	35	5.42	6.83	8.51	10.49	12.77
	38	5.15	6.53	8.12	10.04	12.26
	40	5.00	6.32	7.88	9.74	11.90
		Evaporating temperature				
SMCD 150		-20	-15	-10	-5	0
Ambient temperature YBD36K1E	27	7.34	9.22	11.42	14.03	17.06
	30	7.05	8.86	10.99	13.52	16.45
	32	6.87	8.60	10.70	13.16	16.05
	35	6.54	8.24	10.27	12.65	15.40
	38	6.22	7.88	9.80	12.11	14.78
	40	6.04	7.63	9.51	11.75	14.35
		Evaporating temperature				
SMCD 180		-20	-15	-10	-5	0
Ambient temperature YBD45K1E	27	9.05	11.37	14.09	17.30	21.05
	30	8.70	10.93	13.56	16.68	20.29
	32	8.47	10.61	13.20	16.23	19.80
	35	8.07	10.17	12.66	15.61	19.00
	38	7.67	9.72	12.09	14.94	18.24
	40	7.45	9.41	11.73	14.49	17.70

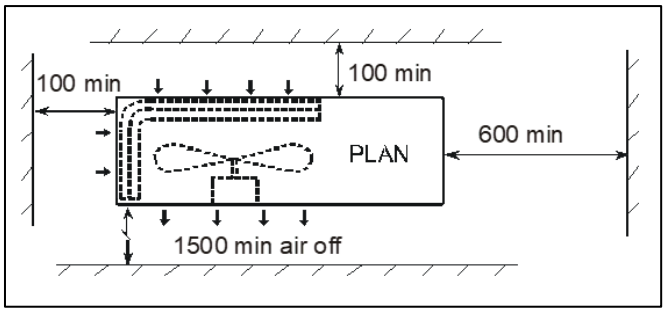
		Evaporating temperature				
SMCD 90 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ10K1E	27		3.16	4.00	4.95	6.11
	30		3.13	3.95	4.90	6.07
	32		3.09	3.93	4.86	6.01
	35		3.05	3.88	4.84	5.95
	38			3.83	4.79	5.88
	40			3.80	4.74	5.83
		Evaporating temperature				
SMCD 130 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ15K1E	27		4.62	5.86	7.24	8.94
	30		4.59	5.79	7.17	8.88
	32		4.51	5.75	7.11	8.80
	35		4.46	5.68	7.08	8.71
	38			5.61	7.00	8.60
	40			5.55	6.93	8.53
		Evaporating temperature				
SMCD 180 LT		-45	-40	-35	-30	-25
Ambient temperature YFJ19K1E	27		5.78	7.32	9.05	11.18
	30		5.73	7.23	8.96	11.11
	32		5.64	7.19	8.89	11.00
	35		5.58	7.10	8.85	10.89
	38			7.01	8.76	10.75
	40			6.94	8.67	10.66

2C MOUNTING, DIMENSIONS & WEIGHTS.

These units are designed to stand on a flat surface. If the unit is to be wall mounted the following kits are available.

KIT	SMCD 90-180
Mounting Bracket	55021101

Whether floor or wall mounted, it is essential that the mounting surface is capable of supporting the unit weight**.** Leave space around the unit for air circulation and access for installation and maintenance.

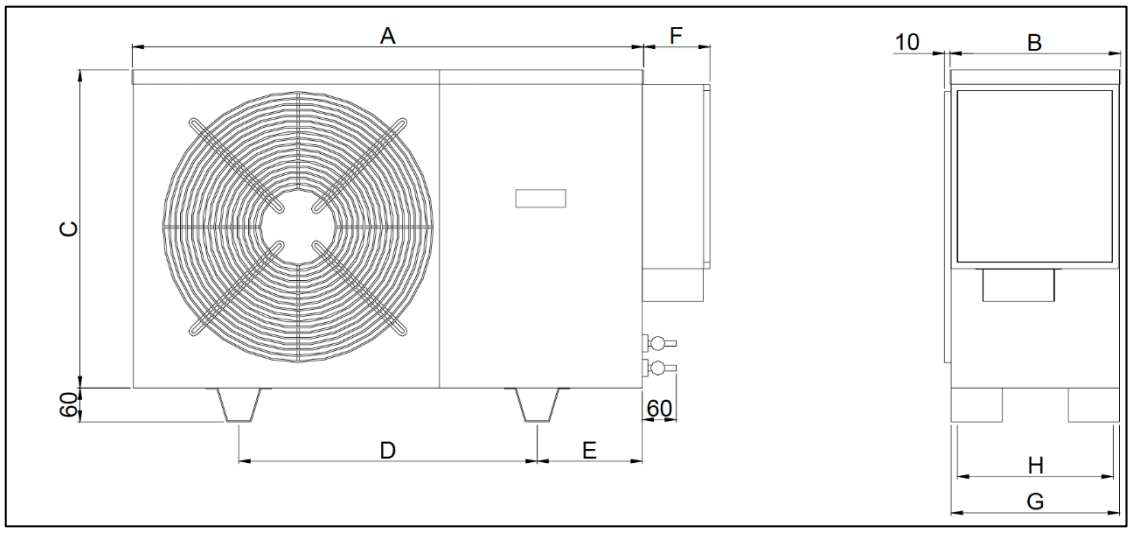


Dimensions in mm.

Condensing unit to be installed outside and not in an enclosed area.
Smoking and naked flames should be prohibited around the area around the condensing unit.

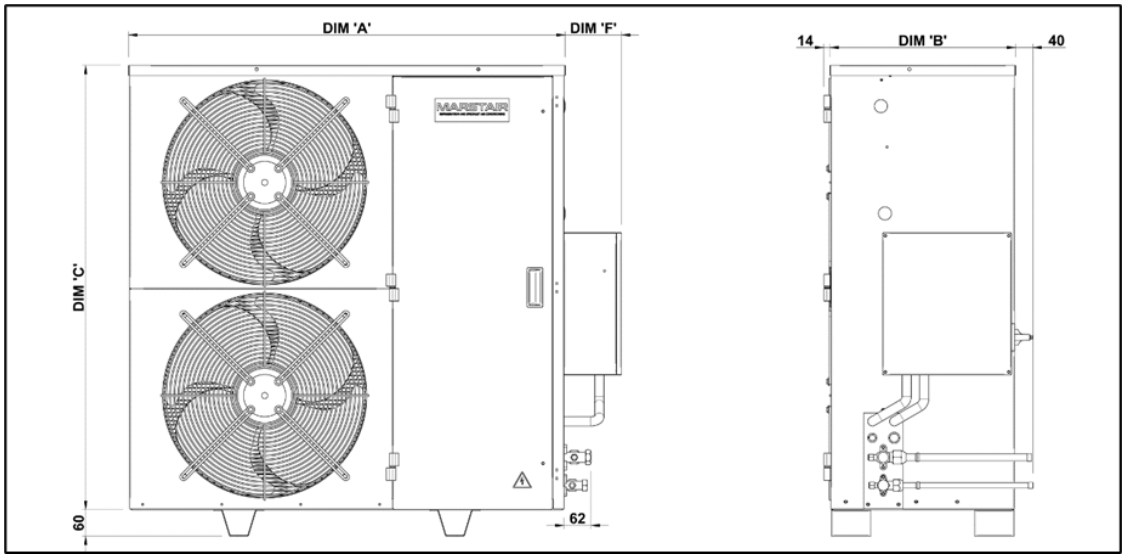
Packed weights					
Model	Dimensions			Weight	
SMCD	Width	Depth	Height	MT	LT
50	1160	390	720	74	N/A
90	1160	465	820	86	88
100	1160	465	1080	100	N/A
130	1160	465	1080	N/A	113
150	1160	465	1080	113	N/A
180	1160	465	1275	128	130

SMCD 50-90 (Dimensions in mm.)



Model									Weight	
SMCD	A	B	C	D	E	F	G	H	MT	LT
50	1000	350	660	495	250	117	346	324	72	N/A
90	1000	425	760	495	250	117	417	397	84	86

SMCD 100-180 (Dimensions in mm.)



Model									Weight	
SMCD	A	B	C	D	E	F	G	H	MT	LT
100	1000	425	1020	495	250	117	417	397	98	N/A
130	1000	425	1020	495	250	117	417	397	N/A	111
150	1000	425	1020	495	250	117	417	397	111	N/A
180	1000	425	1215	675	211	117	417	397	126	128

2D GENERAL.

Supplied Sweat connections						
Model	SMCD					
Size	50	90	100	130	150	180
Liquid	1/2	1/2	1/2	1/2	1/2	1/2
Suction	1/2	5/8	3/4	3/4	3/4	7/8

The installation section of the risk assessment template or equivalent should be carried out before commencing installation.
When installing a split refrigeration system, all interconnecting refrigeration pipework must be manufactured, jointed, tested, insulated and installed in such a way as to ensure that damage cannot occur during normal, service and maintenance operations that may cause a rupture and subsequent leakage.
It is advisable, wherever possible, that brazed or permanent mechanical joints are used when jointing refrigeration pipework designed for an A2L refrigerant.

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 expansion lines including mechanical connections
Try to avoid running pipes through hot areas.

Connecting the pipework:

a. 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. Connect the pipework between the units. Do not leave pipes ends, valves etc open to the atmosphere.
d. Use a protective shield to avoid scorching the side panel.

2D3 – MULTI SPLIT SYSTEMS RUNNING ON LIQUID LINES WITH RECEIVER FITTED AND NO EEV IN CONDENSING UNIT.

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.

Suction Line					
SMCD	1/2"	5/8"	3/4"	7/8"	1-1/8
50	7.5	18	45		
90		10	25	45	
100		7.5	22	45	
130			15	30	45
150			12	27	45
180			7.5	16	45

Liquid Line				
SMCD	3/8"	1/2"	5/8"	7/8
50	7.5	45		
90		20	45	
100		15	45	
130		12	45	
150		8	45	
180		7.5	35	45

2E PRESSURE TESTING

The pressure testing section of the risk assessment template or equivalent should be carried out before commencing pressure testing.

Pressure and leak testing of the system should be completed in accordance with EN 378.

Note for split systems with receiver in the condensing unit and EEV before cabinet evaporator: Interconnecting lines are high pressure

The maximum allowable pressure of the cabinet needs to be assessed when determining the testing pressure.

The condensing unit is fitted with a high-pressure limiting device
SMCD 50-180 = 26Bar

The condensing unit has a pressure relief valve is set to 29.5Bar which is equal to the condensing unit maximum allowable pressure do not exceed this pressure if testing the condensing unit.

2F EVACUATING

The Evacuation section of the risk assessment template or equivalent should be carried out before commencing Evacuation.
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.

2G ELECTRICAL & FUSES

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 50-90 and should be used to secure incoming/outgoing cables. Installers must supply a method of securing solid sheathed cables.

THREE PHASE UNITS WITH SCROLL COMPRESSORS:
On 3 Ph units sizes it is possible for the scroll compressor to run backwards.
This becomes obvious on start up - the compressor will not develop a normal running pressure differential and the top will not become warm: it may be excessively noisy. If this happens, switch off the mains power and exchange the two supply phases **not** connected to the indoor unit. This will correct the rotation.
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.

3PH Fuse							
SMCD	unit	50	90	100	130	150	180
Fuse	MT	10	16	16	N/A	16	20
	LT	N/A	16	N/A	20	N/A	20

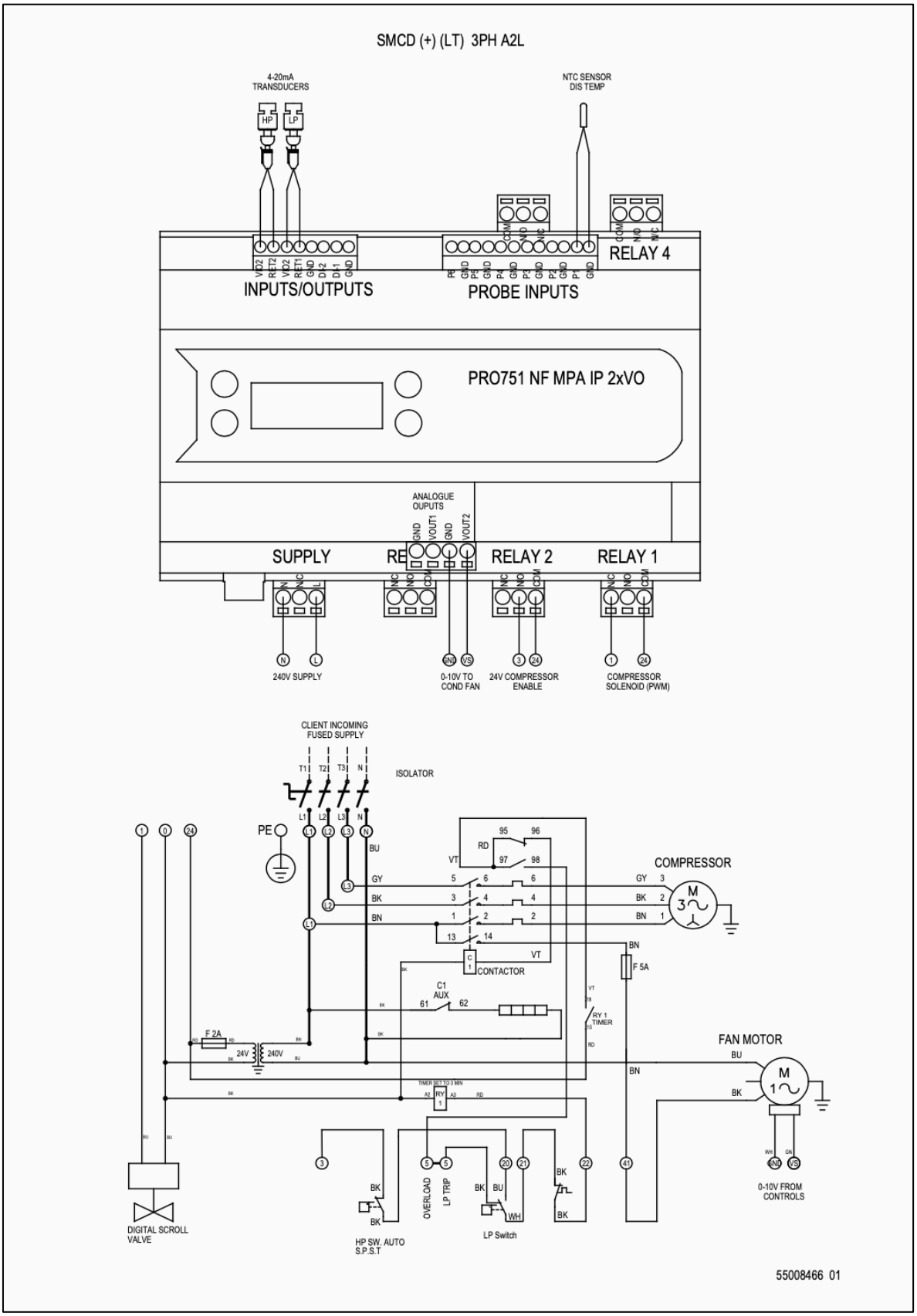
The ratings are for the outdoor unit only. Currents for the indoor units including heaters if applicable should be noted and the fuse size increased pro-rata if using same supply.

2H REFRIGERANT
Charging the system

The charging of refrigerant section of the risk assessment template or equivalent should be carried out before commencing refrigerant charging.

1. Evacuate the system and interconnecting pipework 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 have head pressure control within the controller.
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. Refrigerant must always be added in the liquid state.
7. Run the system for a few minutes to allow it to stabilize. Check suction and head pressures and use the sight glass as a guide. Note that A2L refrigerants have high levels of glide, and overcharging can occur when trying to achieve a completely clear sight glass.
8. Systems should not be overcharged, to avoid liquid return to the compressor

2I CONDENSING UNIT WIRING DIAGRAMS



2J RDM CONTROLLER PARAMETERS

Number	Parameter	Range Bar (Psi)	RDM Factory Settings	SMCD Factory Settings	Units
P-01	Transducer 1 Span*	-3.4 -180.0 (-49.3 -2610)	21	21	Bar/Psi
P-02	Transducer 2 Span	-3.4 -180.0 (-49.3 -2610)	66	66	Bar/Psi
P-03	Transducer 1 Offset*	-3.4 -180.0 (-49.3 -2610)	-1	-1	Bar/Psi
P-04	Transducer 2 Offset	-3.4 -180.0 (-49.3 -2610)	-1	-1	Bar/Psi
P-05	Section 1 Target	-3.4 -180.0 (-49.3 -2610)	2.2	3	Bar/Psi
P-06	Section 2 Target	-3.4 -180.0 (-49.3 -2610)	17	12	Bar/Psi
P-07	Section 1 Target Above	-3.4 -180.0 (-49.3 -2610)	0.4	0.4	Bar/Psi
P-08	Section 2 Target Above	-3.4 -180.0 (-49.3 -2610)	0.8	0.8	Bar/Psi
P-09	Section 1 Target Below	-3.4 -180.0 (-49.3 -2610)	0.4	0.4	Bar/Psi
P-10	Section 2 Target Below	-3.4 -180.0 (-49.3 -2610)	0	0	Bar/Psi
P-11	Section 1 Response On	1 – 60	-	-	-
P-12	Section 2 Response On	1 – 60	-	-	-
P-13	Section 1 Response Off	1 – 60	-	-	-
P-14	Section 2 Response Off	1 – 60	-	-	-
P-15	Section 1 Stages	0 – 5	1	1	-
P-16	Section 2 Stages	0 – 5	1	1	-
P-17	Section 1 Stage On Delay	00:00 – 60:00	10	10	mm:ss
P-18	Section 2 Stage On Delay	00:00 – 60:00	10	10	mm:ss
P-19	Section 1 Stage Off Delay	00:00 – 60:00	10	10	mm:ss
P-20	Section 2 Stage Off Delay	00:00 – 60:00	10	10	mm:ss
P-21	Section 1 Inverter	0 = Off, 1 = On	1	1	-
P-22	Section 2 Inverter	0 = Off, 1 = On	1	1	-
P-23	Section 1 Inverter Min	0 - 100	10	10	%
P-24	Section 2 Inverter Min	0 - 100	70	20	%
P-25	Section 1 Inverter Max	0 - 100	100	100	%
P-26	Section 2 Inverter Max	0 - 100	100	60	%
P-27	Section 1 Transducer Fail	0 = Off, 1 = On	1	1	-
P-28	Section 2 Transducer Fail	0 = Off, 1 = On	1	1	-
P-31	Section 1 Run Last	0 = Off, 1 = On	-	-	-
P-32	Section 2 Run Last	0 = Off, 1 = On	-	-	-
P-33	Section 1 Pwm	0 = Off, 1 = On	1	1	-
P-35	Section 1 Pwm Cycle Time	00:10 - 00:30	20	20	mm:ss
P-87	Section 1 Optimisation Limit	-3.4 -180.0 (-49.3 -2610)	2	2	Bar/Psi
P-51	Section 2 Do Trip	0 = Off, 1 = On	1	1	
P-53	Section 2 Discharge Trip	-3.4 -180.0 (-49.3 -2610)	25	25	Bar/Psi
P-54	Section 2 Discharge Stop	-3.4 -180.0 (-49.3 -2610)	23	23	Bar/Psi
P-55	Section 2 Discharge Diff	-3.4 -180.0 (-49.3 -2610)	6	6	Bar/Psi
P-56	Section 1 Pwm Stop	-49 - 128 (-56.2 - 262.4)	120	120	°C/°F
P-58	Section 1 Pwm Diff	-49 - 128 (-56.2 - 262.4)	20	20	°C/°F
P-60	Section 2 Control Type	0 = Fixed, 1 = Floating	0	0	-
P-62	Section 2 Refrigerant	3 = R134A, 11 = R404A, 12 = R407A, 14 = R407C, 22 = R407F, 24 = R449A & R448A, 25 = R513A, 26 = R454C, 27 = R455A For alternative refrigerant options please contact Marstair Technical	0	0	-
P-64	Section 2 Low Limit	-3.4 -180.0 (-49.3 -2610)	8.2	8.2	Bar/Psi
P-66	Section 2 High Limit	-3.4 -180.0 (-49.3 -2610)	23	23	Bar/Psi

Number	Parameter	Range Bar (Psi)	RDM Factory Settings	SMCD Factory Settings	Units
P-68	Section 2 Condenser Offset	-49 - 128 (-56.2 - 262.4)			°C/°F
P-70	Input 1	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	1	1	-
P-71	Input 2	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	-	-	-
P-72	Input 3	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	-	-	-
P-73	Input 4	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	-	-	-
P-74	Input 5	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	-	-	-
P-75	Input 6	0=Off, 1=Probe, 2=Ambient, 3=Status N/O, 4=Status N/C, 5=General N/O, 6=Gen N/C, 7=Standby N/O, 8=Standby N/C, 9=Standby 2 N/O, 10=Standby 2 N/C	-	-	-
P-78	Display Pin	1 - 999	-	-	-
P-80	Section 1 Alarm Delay	00:00 – 99:00	00.60	00.60	mm:ss
P-81	Section 2 Alarm Delay	00:00 – 99:00	00.60	00.60	mm:ss
P-82	Section 1 Low Alarm Delay	00:00 – 99:00	00.60	00.60	mm:ss
P-83	Section 2 Low Alarm Delay	00:00 – 99:00	00.60	00.60	mm:ss
P-84	Section 1 HP Alarm	-3.4 -180.0 (-49.3 -2610)	6	6	Bar/Psi
P-85	Section 2 HP Alarm	-3.4 -180.0 (-49.3 -2610)	22	22	Bar/Psi
P-86	Section 1 LP Alarm	-3.4 -180.0 (-49.3 -2610)	10	0.5	Bar/Psi
P-87	Section 2 LP Alarm	-3.4 -180.0 (-49.3 -2610)	0.1	0.1	Bar/Psi
P-88	Section 1 LP Shutdown	-3.4 -180.0 (-49.3 -2610)	0.1	0.1	Bar/Psi
P-89	Section 2 LP Shutdown	-3.4 -180.0 (-49.3 -2610)	14	1	Bar/Psi
P-90	Status Alarm Delay	00:00 – 60:00	10.00	10.00	mm:ss
P-91	General Alarm Delay	00:00 – 60:00	10.00	10.00	mm:ss
P-92	Refrigerant Weight	0 – 100	0	0	%
P-94	Refrigerant Glide	0 – 100	0	0	%
P-101	Section 1 Stage 1	0 -31	3	3	-
P-102	Section 1 Stage 2	0 -31	-	-	-
P-103	Section 1 Stage 3	0 -31	-	-	-
P-104	Section 1 Stage 4	0 -31	-	-	-
P-105	Section 1 Stage 5	0 -31	-	-	-
P-150	Custom A1	If refrigerant type (P-62) is set to Custom then curve fitting data for a particular gas type can be entered here. Please contact RDM Technical Support for more details.	-	-	-
P-151	Custom B1 High		-	-	-
P-152	Custom B1 Low		-	-	-
P-153	Custom C1		-	-	-
P-154	Custom A2		-	-	-
P-155	Custom B2 High		-	-	-
P-156	Custom B2 Low		-	-	-
P-157	Custom C2		-	-	-
dFLt	Restore default values		-	-	-

2K ECO DESIGN INFORMATION TABLES

Model(s): SMCD 50			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-10°C	°C
Parameters at full load and ambient temperature 32°C			
Rated cooling capacity	P_A	4.53	kW
Rated power input	D_A	1.82	kW
Rated COP	COP_A	**2.49**	
Parameters at full load and ambient temperature 25°C			
Cooling capacity	P_2	4.88	kW
Power input	D_2	1.64	kW
Rated COP	COP_2	**2.98**	
Other items			
Capacity control	Fixed		
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD 90			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-10°C	°C
Annual electricty consumption	*Q*	10292	kWh/a
Seasonal engery performance ratio	*SEPR*	3.55	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	5.950	kW
Rated power input	D_A	2.340	kW
Rated COP	COP_A	**2.54**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	6.40	kW
Declared power input	D_B	2.11	kW
Rated COP	COP_B	**3.03**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	7.08	kW
Declared power input	D_C	1.84	kW
Rated COP	COP_C	**3.85**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	7.71	kW
Declared power input	D_D	1.66	kW
Rated COP	COP_D	**4.64**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD 100			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-10°C	°C
Annual electricty consumption	*Q*	12741	kWh/a
Seasonal engery performance ratio	*SEPR*	3.57	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	7.400	kW
Rated power input	D_A	2.910	kW
Rated COP	COP_A	**2.54**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	7.99	kW
Declared power input	D_B	2.63	kW
Rated COP	COP_B	**3.04**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	8.83	kW
Declared power input	D_C	2.29	kW
Rated COP	COP_C	**3.86**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	9.62	kW
Declared power input	D_D	2.05	kW
Rated COP	COP_D	**4.69**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD 150			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-10°C	°C
Annual electricty consumption	*Q*	15142	kWh/a
Seasonal engery performance ratio	*SEPR*	3.59	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	8.840	kW
Rated power input	D_A	3.460	kW
Rated COP	COP_A	**2.55**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	9.61	kW
Declared power input	D_B	3.14	kW
Rated COP	COP_B	**3.06**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	10.65	kW
Declared power input	D_C	2.74	kW
Rated COP	COP_C	**3.89**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	11.60	kW
Declared power input	D_D	2.46	kW
Rated COP	COP_D	**4.72**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

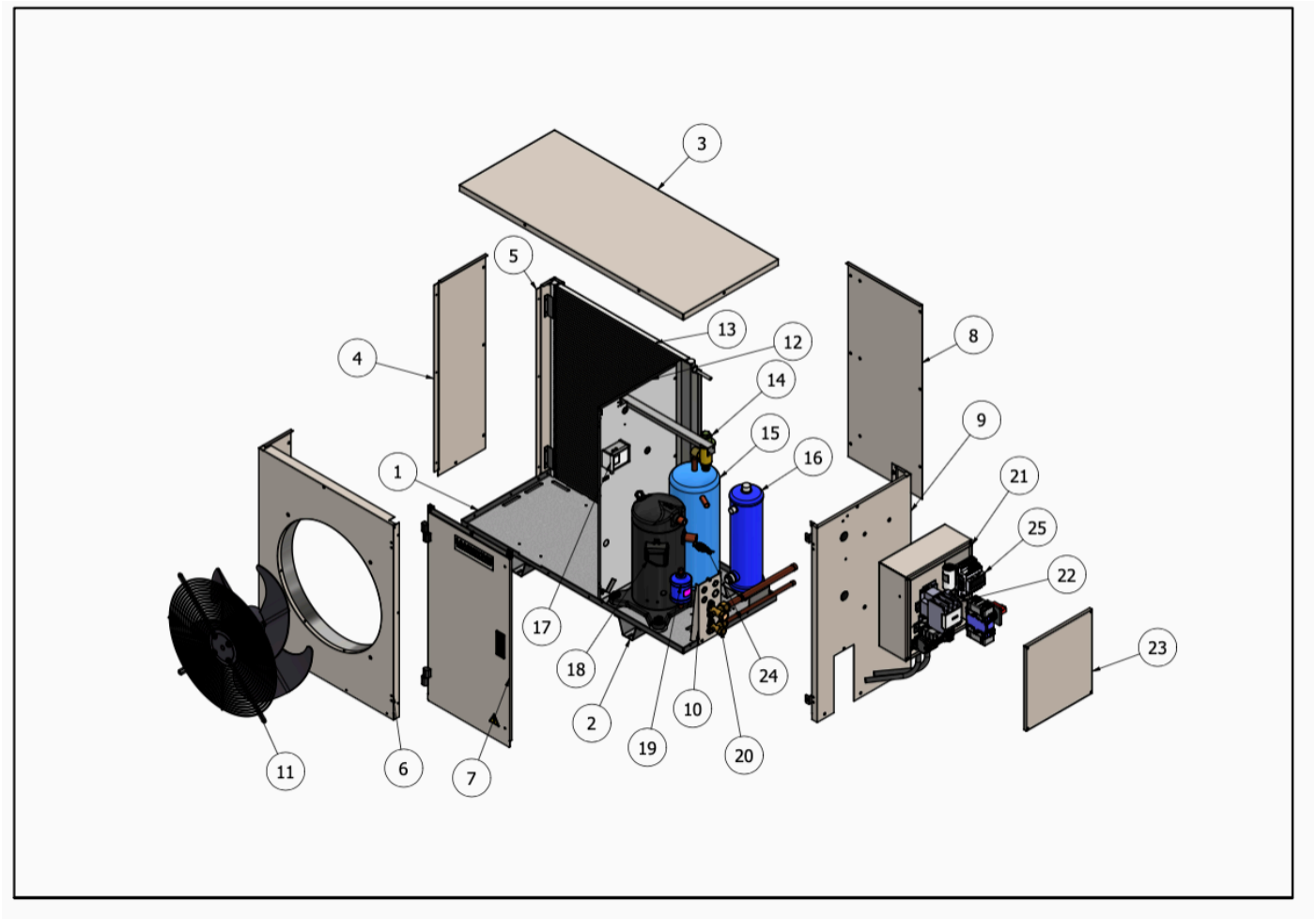
Model(s): SMCD 180			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-10°C	°C
Annual electricty consumption	*Q*	18930	kWh/a
Seasonal engery performance ratio	*SEPR*	3.57	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	11.000	kW
Rated power input	D_A	4.340	kW
Rated COP	COP_A	**2.53**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	11.90	kW
Declared power input	D_B	3.92	kW
Rated COP	COP_B	**3.04**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	13.15	kW
Declared power input	D_C	3.41	kW
Rated COP	COP_C	**3.86**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	14.35	kW
Declared power input	D_D	3.05	kW
Rated COP	COP_D	**4.70**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD LT 90			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-35°C	°C
Annual electricty consumption	*Q*	11792	kWh/a
Seasonal engery performance ratio	*SEPR*	2.03	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	3.210	kW
Rated power input	D_A	2.130	kW
Rated COP	COP_A	**1.51**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	3.28	kW
Declared power input	D_B	1.92	kW
Rated COP	COP_B	**1.71**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	3.38	kW
Declared power input	D_C	1.66	kW
Rated COP	COP_C	**2.04**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	3.46	kW
Declared power input	D_D	1.42	kW
Rated COP	COP_D	**2.44**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD LT 130			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-35°C	°C
Annual electricty consumption	*Q*	17235	kWh/a
Seasonal engery performance ratio	*SEPR*	2.03	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	4.690	kW
Rated power input	D_A	3.110	kW
Rated COP	COP_A	**1.51**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	4.79	kW
Declared power input	D_B	2.81	kW
Rated COP	COP_B	**1.70**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	4.94	kW
Declared power input	D_C	2.43	kW
Rated COP	COP_C	**2.03**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	5.05	kW
Declared power input	D_D	2.07	kW
Rated COP	COP_D	**2.44**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

Model(s): SMCD LT 180			
Refrigerant fluid(s): R454C			
Item	**Symbol**	**Value**	**Unit**
Evaporating temperature	*t*	-35°C	°C
Annual electricty consumption	*Q*	21559	kWh/a
Seasonal engery performance ratio	*SEPR*	2.03	
Parameters at full load and ambient temperature 32°C (Point A)			
Rated cooling capacity	P_A	5.870	kW
Rated power input	D_A	3.890	kW
Rated COP	COP_A	**1.51**	
Parameters at part load and ambient temperature 25°C (Point B)			
Declared cooling capacity	P_B	6.00	kW
Declared power input	D_B	3.51	kW
Rated COP	COP_B	**1.71**	
Parameters at part load and ambient temperature 15°C (Point C)			
Declared cooling capacity	P_C	6.18	kW
Declared power input	D_C	3.04	kW
Rated COP	COP_C	**2.03**	
Parameters at part load and ambient temperature 5°C (Point D)			
Declared cooling capacity	P_D	6.32	kW
Declared power input	D_D	2.59	kW
Rated COP	COP_D	**2.44**	
Other items			
Capacity control	Fixed		
Degradation coefficient for fixed and staged capacity units	*Cdc*	0.25	
Contact details	TEV Limited Armytage Road Brighouse HD61QF		

2L COMPONENT IDENTIFICATION SMC+



Item	Description	Item	Description
1	BASE PANEL	14	PRESSURE RELIEF VALVE (PRV)
2	MOUNTING FEET	15	LIQUID RECEIVER
3	LID	16	OIL SEPERATOR
4	SIDE PANEL	17	PRESSURE SWITCH
5	CORNER PANEL	18	DIGITAL COMPRESSOR
6	FASCIA PANEL	19	FILTER DRIER
7	HINGED DOOR AND HANDLE	20	SERVICE VALVES
8	REAR ACCESS PLATE	21	ELECTRICS BOX
9	REAR ACCESS PANEL	22	ELECTRICAL COMPONENTS
10	VALVE PANEL	23	COVER ELECTRICS BOX
11	FAN ASSEMBLY AND FAN GUARD	24	PRESSURE SWITCH HP/LP
12	BULKHEAD PANEL	25	CONTROLLER
13	MICROCHANNEL HEAT EXCHANGER (COIL)		

2M CONDENSING UNIT MAINTENANCE

The refrigerant recovery section of the risk assessment template or equivalent should be carried out before commencing refrigerant recovery.

Before engaging in any maintenance or repairs ensure

- Use of trained certified natural persons*.
- Well ventilated working environment.
- Use of a flammable gas leak detector.
- Correct selection of tools and equipment compatible with A2L refrigerants.
- Recovery of remaining refrigerant.
- Purging pipework with a suitable inert gas, prior to, during and for a suitable period after carrying out flame brazing to ensure that a flammable mixture cannot be formed.
- Adequate fire watch.
- Pressure testing of repair in accordance with EN378.
- Evacuation and dehydration in accordance with EN 378.
- Charging of the system in accordance with EN 378.
- Leak checking of the repair and system in accordance with EN 1516/2017.

Any other information identified within the site-specific risk assessment is available and taking into account.

***NOTE: it is the responsibility of the operator to ensure the technician is certified to the correct standard (EN13313 or equivalent).**

IMPORTANT
ISOLATE THE UNIT PRIOR TO COMMENCING ANY MAINTENANCE OR REPAIR WORK

GENERAL

1. Ensure unit is not blocked or enclosed and there is adequate free airflow in and round the condensing unit.
2. Visually inspect the unit for wear and tear.
3. Remove the access panels (retain the screws).
4. Clean the base and insides of the unit.
5. Check all electrical connections are secure.
6. Check the face of the coil for cleanliness. Comb the fins if necessary.
7. Check the tightness of the compressor fixing bolts.
8. Check the fan rotates freely.
9. Check the pipework insulation condition.
10. Suction and discharge pressure.
11. Operation of head pressure control.
12. Visually check for oil patches.
13. Check safety labels are clear

3 – REFRIGERATED DISPLAY CABINET

3A GENERAL

Ensure a Cabinet suitable for flammable refrigerants is used. Instructions for use with that cabinet must be followed, paying special attention the requirements of leak detection, alarms, and the procedures to follow should such a leak event occur.
If the leak is identified as occurring outside the cold room, but inside a building or enclosure ensure adequate ventilation. No source of ignition shall be energised or brought into the area until the environment is proven to be safe.
Smoking and naked flames should be prohibited in area around the condensing (outdoor) unit.

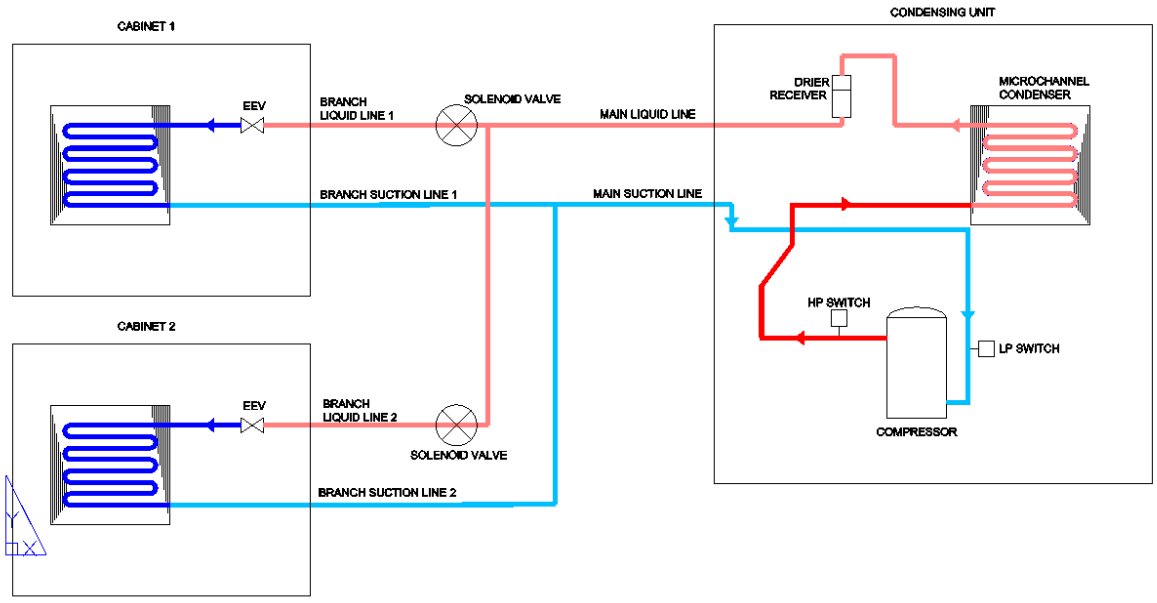
3B MAINTENANCE

The refrigerant recovery section of the risk assessment template or equivalent should be carried out before commencing refrigerant recovery.
Before engaging in any maintenance or repairs ensure

o Use of trained certified natural persons*.
o Well ventilated working environment.
o Use of a flammable gas leak detector.
o Correct selection of tools and equipment compatible with A2L refrigerants.
o Recovery of remaining refrigerant.
o Purging pipework with a suitable inert gas, prior to, during and for a suitable period after carrying out flame brazing to ensure that a flammable mixture cannot be formed.
o Adequate fire watch.
o Pressure testing of repair in accordance with EN378.
o Evacuation and dehydration in accordance with EN 378.
o Charging of the system in accordance with EN 378.
o Leak checking of the repair and system in accordance with EN 1516/2017.

Any other information identified within the site specific risk assessment is available and taking into account.
***NOTE: it is the responsibility of the operator to ensure the technician is certified to the correct standard (EN13313 or equivalent).**
System is to be switched off and isolated during any repairs.

3C REFRIGERANT SYSTEM SCHEMATIC DIAGRAMS



4– SPARES

Products for spare parts, please ensure the use of official Marstair spares. Any spare parts taken from other companies, Marstair will not be responsible in case of any damage and will be out of warranty.

5 – END OF LIFE REQUIRMENTS

Refrigerant must be recovered by a certificated technician before the plant is dismantled. Modern refrigerant recovery machines should be able to remove well over 95% of the refrigerant in an old system.
All recovered refrigerants can either be:
a) Sent for destruction by incineration at a licenced waste facility

b) Sent to a specialist plant that can re-process the old refrigerant into a gas with properties identical to virgin refrigerant, to create “reclaimed refrigerant”

c) Given a basic cleaning process, to create “recycled refrigerant”

Given the refrigerant supply shortage that will be created by the phase down process, it is worth trying to send the old refrigerant for reclamation as it may have a good residual value. If the old refrigerant is too contaminated it cannot be reclaimed and must be sent for destruction. It is important not to mix different gases in the same recovery cylinder – as this would render them unsuitable for reclamation.
Reclaimed refrigerant can be used in any refrigeration equipment. Recycled refrigerant must always be used with care as it may be contaminated or of unknown composition.

6 – INSTALLATION RISK ASSESSMENT

Installation of an A2L SMCD System
Prior to installation, it is important to ensure that the location is suitable for this type of system and that the instructions have been followed with regard to the minimum room volume for the maximum charge weight. This assessment process is designed to augment a detailed risk assessment not replace it.

INSTALLATION

Question	N/A	YES	NO	Comments
1. Has correct PPE been selected?				If yes go to question 2 If no stop assessment
2. Are suitable first aid facilities available?				If yes go to question 3 If no stop assessment
3. Has the electrical supply been suitably isolated?				If yes go to question 4 If no rectify and reassess
4. Are hot works required for jointing of the refrigeration pipework?				If yes go to question 7 If no go to question 5
5. Are permanent mechanical joints required?				If yes go to question 20 If no go to question 6
6. Have the flare connections been made to a suitable standard?				If yes go to question 20 If no rectify and reassess
7. Are you competent to carry out brazing tasks?				If yes go to question 8 If no stop assessment
8. Brazing certificate number				
9. Has a suitable fire extinguisher been selected and a hot work permit been issued?				If yes go to question 10 If no stop assessment
10. Is the area adequately ventilated?				If yes go to question 11 If no stop assessment
11. Are the pressure regulators in date?				If yes go to question 12 If no rectify and reassess
12. Are the flash back arrestors in date?				If yes go to question 13 If no rectify and reassess
13. Has the oxyfuel equipment been leak tested?				If yes go to question 14 If no rectify and reassess
14. Has the Oxygen Free Nitrogen equipment been leak tested?				If yes go to question 15 If no rectify and reassess
15. Are all the cylinders upright and secure?				If yes go to question 16 If no rectify and reassess
16. Is Oxygen Free Nitrogen purging at the correct flow rate through the pipework?				If yes go to question 17 If no rectify and reassess
17. Has a full shutdown of equipment been completed upon conclusion of hot works				If yes go to question 18 If no rectify and reassess
18. Is a fire watch to be undertaken?				If yes go to question 19 If no rectify and reassess
19. Duration of fire watch				

PRESSURE TESTING

20. F Gas certificate number				
21. Is the system to be pressure tested with Oxygen Free Nitrogen?				If yes go to question 22 If no rectify and reassess
22. What is the required strength pressure test?				

23. What is the required tightness pressure test?				
24. Has the pressure been incrementally increased in a safe manner?				If yes go to question 25 If no rectify and reassess
25. Has the system passed the strength test?				If yes go to question 26 If no rectify and reassess
26. Has the system passed the tightness test?				If yes go to question 27 If no rectify and reassess
27. What was the duration of the tightness test?				
28. Has the system been safely de-pressurised into a well ventilated environment?				If yes go to question 29 If no rectify and reassess

EVACUATION

29. Has a flammable gas leak detector been energised and placed in a suitable location?				If yes go to question 30 If no rectify and reassess
30. Have all possible ignition sources been removed from the work area?				If yes go to question 31 If no rectify and reassess
31. Has a suitable vacuum pump been fitted to the system?				If yes go to question 32 If no rectify and reassess
32. Is the oil level satisfactory?				If yes go to question 33 If no rectify and reassess
33. Is the exhaust able to be discharged into a safe environment away from ignition source?				If yes go to question 34 If no rectify and reassess
34. Has a vacuum gauge been connected to the system?				If yes go to question 35 If no rectify and reassess
35. Has a suitable vacuum been achieved and held for a suitable period of time?				If yes go to question 36 If no rectify and reassess

CHARGING OF REFRIGERANT

36. Is additional refrigerant charge required?				If yes go to question 37 If no go to question 44
37. Is a suitable charging cylinder available fitted with the correct bottle adaptor?				If yes go to question 38 If no rectify and reassess
38. Have you selected a calibrated weighing platform?				If yes go to question 39 If no rectify and reassess
39. Calibration certificate number				
40. Has the charging hose been evacuated of air?				If yes go to question 41 If no rectify and reassess
41. Will the system be charged in liquid or vapour form?				
42. Has the correct additional charge been added in accordance with the manufacturers instructions?				If yes go to question 43 If no rectify and reassess
43. Can the equipment be energised to remove refrigerant from the charging hoses?				If yes go to question 44 If no rectify and reassess

44. Have the isolation valves been opened correctly?				If yes go to question 45 If no rectify and reassess
45. Has the system been leak checked with a suitable leak detector for A2L refrigerant?				If yes go to question 46 If no rectify and reassess
46. Have the running conditions of the system been checked/recorded?				If yes go to question 47 If no rectify and reassess
47. Have the charging hoses been removed safely and with minimum loss of refrigerant?				If yes go to question 48 If no rectify and reassess
48. Is the service valve leak free and cap replaced?				If yes go to question 49 If no go to question 50

REFRIGERANT RECOVERY

49. Have all of the tools, refrigerant and equipment been removed from site?				If yes end assessment If no rectify and reassess
50. Is the area adequately ventilated?				If yes go to question 51 If no rectify and reassess
51. Has a suitable flammable gas leak detector been energised and placed at a low level?				If yes go to question 52 If no rectify and reassess
52. Has a suitable recovery unit been fitted?				If yes go to question 53 If no rectify and reassess
53. Do you have a suitable recovery cylinder with adequate capacity?				If yes go to question 54 If no rectify and reassess
54. Have you placed it on to a suitable calibrated weighing platform?				If yes go to question 55 If no rectify and reassess
55. Calibration certificate number				
56. Have you documented the amount of refrigerant recovered and filled out the appropriate paperwork?				If yes go to question 57 If no rectify and reassess
57. Identify source of leakage and recommence assessment procedure.				

This information is to be given to the end user along with any other risks identified.