MAKING MODERN LIVING POSSIBLE

Residential and light commercial scroll compressors

50 - 60 Hz

R407C / R22 / R410A

REFRIGERATION &
AIR CONDITIONING DIVISION

SELECTION &
APPLICATION GUIDELINES

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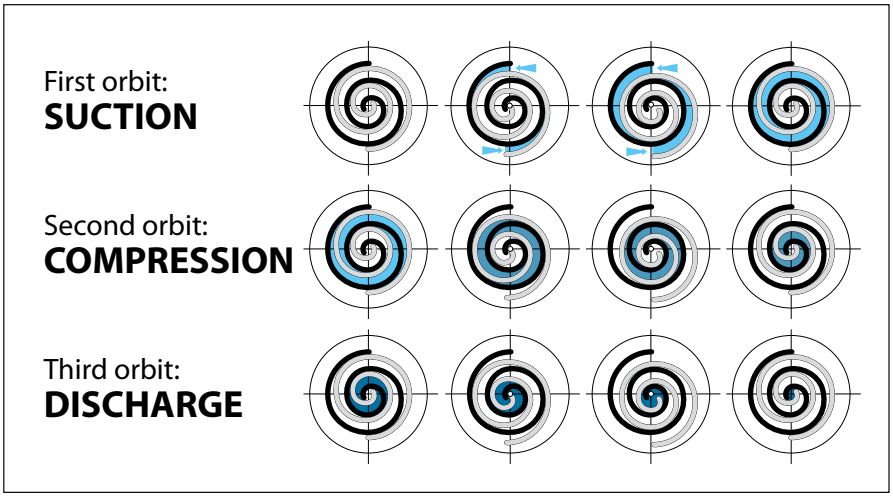
The scroll compression process

The entire scroll compression process is illustrated below. The center of the orbiting scroll traces a circular path around the center of the fixed scroll. This movement creates symmetrical compression pockets between the two scroll elements.

Low pressure suction gas is trapped within each crescent-shaped pocket as it forms; continuous motion of the orbiting scroll serves to seal the pocket, which decreases in volume as the pocket moves towards the center of the scroll set, with corresponding increase in gas pressure. Maximum compression is achieved after three complete orbits, as the pocket reaches the discharge port at the center.

Scroll compression is a continuous process: when one pocket of gas is being compressed during the second orbit, another gas enters a new pocket formed at the periphery, and simultaneously, another is being discharged.

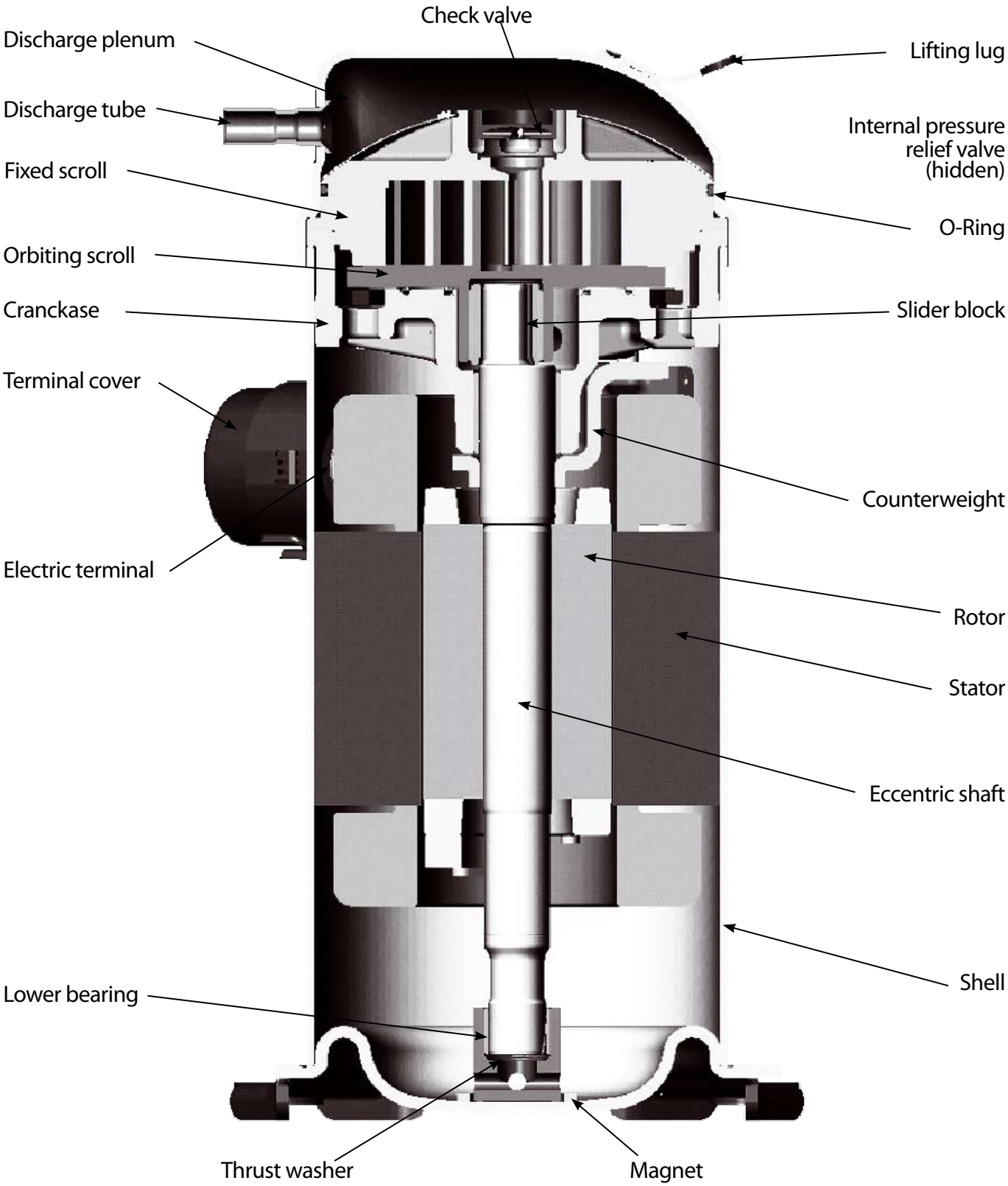


Danfoss scroll compressors are manufactured using the most advanced machining, assembly, and process control techniques. In design of both the compressor and the factory, very high standards of reliability and process control were first priority. The result is a highly efficient product with the highest reliability obtainable, and a low sound level.

SCROLL COMPRESSION PRINCIPLE

Scroll Compressor Components

The motor stator is rigidly attached to the shell. The rotor is shrink-fit onto the eccentric shaft. The shaft is supported by two bearings, one in the crankcase and the second below the motor.



COMPRESSOR MODEL DESIGNATION

Nomenclature

Type	Size	Motor	Features
HRH	036	U1L	P6

Application:
H: high temperature / air conditioning

Family:
C: light commercial scroll
R: residential scroll (new platform)
L: light commercial scroll (new platform)

Refrigerant & lubricant:
M: R22, alkylbenzene lubricant
P: R407C, POE lubricant
H: R410A, POE lubricant
J: R410A, PVE lubricant

Nominal capacity:
In thousand Btu/h at 60 Hz,
ARI conditions

Model variation
T: design optimized for 7.2/54.4°C (45/130°F)
U: design optimized for 7.2/37.8°C (45/100°F)

Other features

	Oil sight glass	Oil equali-sation	Oil drain	LP gauge port	Gaz equali-sation port
6	None	None	None	None	None
7	Threaded	None	None	None	None
8	None	Brazed	None	None	Brazed

Tubing and electrical connections
P: brazed connections, spade terminals
C: brazed connections, screw terminals

Motor protection
L: internal motor protection

Motor voltage code
1: 208-230V/1~/60 Hz
2: 208-230V/3~/60 Hz
4: 380-400V/3~/50 Hz & 460V/3~/60 Hz
5: 220-240V/1~/50 Hz
7: 500V/3~/50 Hz & 575V/ 3~/60 Hz
9: 380V/3~/60 Hz

Operating envelopes

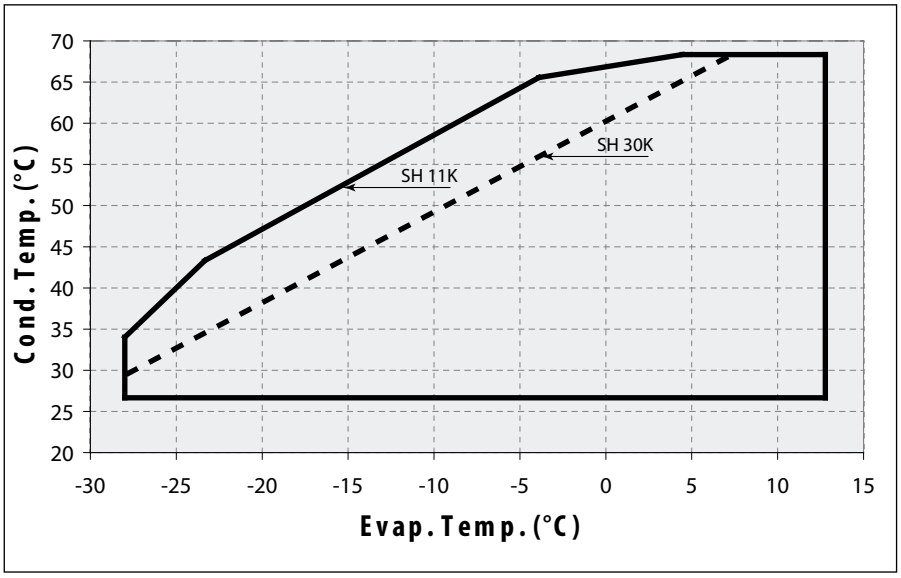
The operating envelopes for Danfoss scroll compressors are given in the figures below, where the condensing and evaporating temperatures represent the range for steady-state operation. Under transient conditions, such as start-up and defrost for heat pump applications, the compressor may operate outside this envelope for short periods.

The figures below show the operating envelopes for HR / HL / HC compressors with refrigerants R22, R407C and R410A with model variation related to T or U design optimization. The operating limits serve to define the envelope within which reliable operations of the compressor are guaranteed:

- Maximum discharge gas temperature: +135°C
- A suction superheat below 5 K is not recommended due to the risk of liquid floodback
- Maximum superheat of 30 K
- Minimum and maximum evaporating and condensing temperatures as per the operating envelopes.

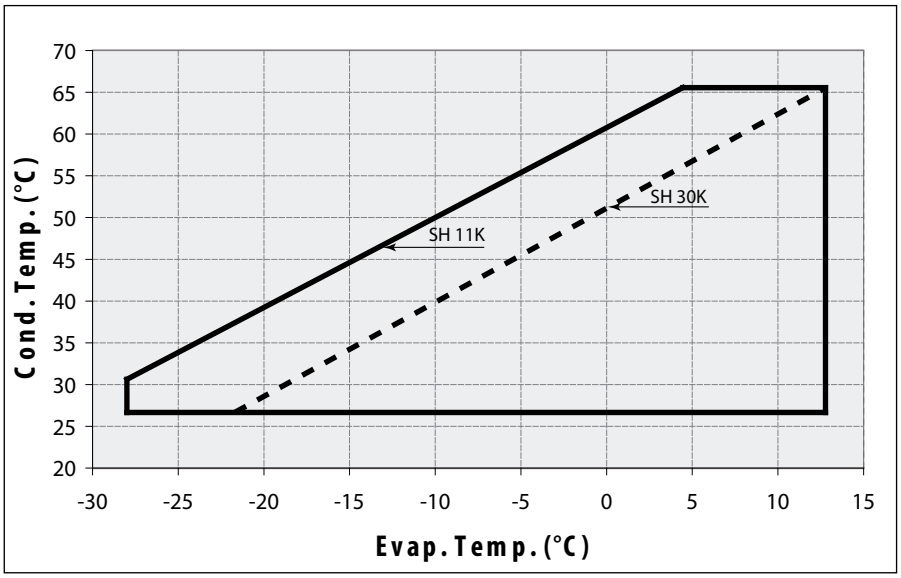
R22, R407C and R410A Model variation T

(optimized for 7.2/54.4°C)



R22 and R410A Model variation U

(optimized for 7.2/37.8°C)



SPECIFICATIONS

Oil type

Danfoss scroll compressors are charged with oil at the factory with the oils indicated, in the table below.

Compressor range	Oil type
HRM / HLM / HCM	Alkylbenzene
HRP / HLP / HCP	Polyolester
HRH / HLH	Polyolester
HLJ	Polyvinylether

Residual moisture

Prior to shipment from the factory, every compressor is dehydrated, evacuated, and charged with dry nitrogen. Maximum residual moisture levels are 232 mg for models capacities up to HRM/HRP047 and HRH040 and 340 mg for larger compressors.

TECHNICAL SPECIFICATIONS

50-Hz data *

	Model	Nominal Cap 60 Hz	Nominal cooling capacity		Power input	A max	Efficiency		Swept volume	Displace-ment	Oil charge	Net weight
		TR	W	Btu/h	kW	A	COP W/W	EER Btu/h/W	cm3/rev	m3/h	dm3	kg
R22	HRM032U4	2.7	7850	26790	2.55	-	3.08	10.5	43.6	7.60	1.06	31
	HRM034U4	2.8	8350	28490	2.66	-	3.14	10.7	46.2	8.03	1.06	31
	HRM038U4	3.2	9240	31520	2.94	10.0	3.14	10.7	46.2	8.03	1.06	31
	HRM040U4	3.3	9710	33120	2.98	10.0	3.26	11.1	54.4	9.47	1.06	31
	HRM042U4	3.5	10190	34770	3.13	11.0	3.26	11.1	57.2	9.95	1.06	31
	HRM045U4	3.8	10940	37310	3.45	12.0	3.17	10.8	61.5	10.69	1.33	31
	HRM047U4	3.9	11500	39250	3.57	12.0	3.23	11.0	64.1	11.15	1.33	31
	HRM048U4	4.0	11510	39270	3.57	12.5	3.23	11.0	64.4	11.21	1.57	37
	HRM051T4	4.3	12390	42280	3.67	13.0	3.37	11.5	68.8	11.98	1.57	37
	HRM051U4	4.3	12800	43690	3.83	13.0	3.34	11.4	68.8	11.98	1.57	37
	HRM054U4	4.5	13390	45680	3.97	13.1	3.37	11.5	72.9	12.69	1.57	37
	HRM058U4	4.8	14340	48930	4.25	15.0	3.37	11.5	78.2	13.60	1.57	37
	HRM060T4	5.0	14570	49720	4.28	15.0	3.40	11.6	81.0	14.09	1.57	37
	HRM060U4	5.0	14820	50580	4.40	15.0	3.37	11.5	81.0	14.09	1.57	37
	HLM068T4	5.7	16880	57580	5.00	-	3.37	11.5	93.1	16.20	1.57	37
	HLM072T4	6.0	17840	60870	5.29	-	3.37	11.5	98.7	17.20	1.57	37
	HLM075T4	6.3	18430	62880	5.37	16.0	3.43	11.7	102.8	17.88	1.57	37
	HLM081T4	6.8	19890	67880	5.80	17.0	3.43	11.7	110.9	19.30	1.57	37
	HCM094T4	7.8	23060	78670	6.80	21.0	3.39	11.6	126.0	21.93	2.66	44
	HCM109T4	9.1	26690	91070	7.77	24.0	3.43	11.7	148.8	25.89	2.66	44
	HCM120T4	10.0	29130	99390	8.51	25.0	3.42	11.7	162.4	28.26	2.66	44
R407C	HRP034T4	2.8	7940	27080	2.68	-	2.96	10.1	-	-	1.06	31
	HRP038T4	3.2	8840	30150	2.82	-	3.14	10.7	51.6	8.98	1.06	31
	HRP040T4	3.3	9110	31080	3.14	11.5	2.90	9.9	54.4	9.47	1.06	31
	HRP042T4	3.5	9580	32680	3.30	10.0	2.90	9.9	57.2	9.95	1.06	31
	HRP045T4	3.8	10810	36890	3.58	12.0	3.02	10.3	61.5	10.69	1.33	31
	HRP047T4	3.9	11130	37980	3.69	12.0	3.02	10.3	64.1	11.15	1.33	31
	HRP048T4	4.0	11100	37880	3.35	12.0	3.31	11.3	64.4	11.21	1.57	37
	HRP051T4	4.3	12120	41370	3.83	13.0	3.17	10.8	68.8	11.98	1.57	37
	HRP054T4	4.5	12570	42880	3.97	12.5	3.17	10.8	72.8	12.66	1.57	37
	HRP058T4	4.8	13470	45970	4.25	14.0	3.17	10.8	78.2	13.60	1.57	37
	HRP060T4	5.0	13860	47280	4.26	15.0	3.25	11.1	81.0	14.09	1.57	37
	HLP068T4	5.7	15700	53560	5.10	-	3.08	10.5	93.1	16.20	1.57	37
	HLP072T4	6.0	16810	57350	5.16	15.0	3.26	11.1	98.7	17.17	1.57	37
	HLP075T4	6.3	18040	61550	5.54	16.0	3.26	11.1	102.8	17.88	1.57	37
	HLP081T4	6.8	18600	63470	5.66	17.0	3.28	11.2	110.9	19.30	1.57	37
	HCP094T4	7.8	21590	73660	6.63	21.0	3.26	11.1	126.0	21.93	2.66	44
	HCP109T4	9.1	25070	85550	7.77	24.0	3.23	11.0	148.8	25.89	2.66	44
	HCP120T4	10.0	27370	93400	8.47	25.0	3.23	11.0	162.4	28.26	2.66	44
R410A	HRH031U4	2.6	7 530	25 710	2.67	10.0	2.82	9.62	29.8	5.19	1.06	31
	HRH032U4	2.7	7 670	26 170	2.75	10.0	2.79	9.51	30.6	5.33	1.06	31
	HRH034U4	2.8	-	-	-	-	-	-	-	-	1.06	31
	HRH036U4	3.0	8 820	30 110	3.13	10.0	2.82	9.62	34.7	6.04	1.06	31
	HRH038U4	3.2	9 250	31 560	3.35	12.0	2.76	9.41	36.5	6.36	1.06	32
	HRH040U4	3.3	10 200	34 810	3.58	12.0	2.85	9.72	-	-	1.33	32
	HRH044U4	3.7	10 830	36 940	3.92	13.5	2.76	9.41	42.6	7.41	1.57	37
	HRH049U4	4.1	12 110	41 320	4.04	13.5	2.99	10.22	47.4	8.24	1.57	37
	HRH051U4	4.3	12 860	43 890	4.21	13.0	3.05	10.42	49.3	8.58	1.57	37
	HRH054U4	4.5	13 340	45 510	4.41	15.0	3.02	10.32	52.1	9.07	1.57	37
	HRH056U4	4.7	13 830	47 200	4.58	15.0	3.02	10.31	54.1	9.42	1.57	37
	HLH061T4	5.1	15 210	51 880	4.89	-	3.11	10.61	57.8	10.10	1.57	37
	HLH068T4	5.7	16 880	57 610	5.26	19.0	3.21	10.96	64.4	11.21	1.57	37
	HLJ072T5①	6.0	17 130	58 450	6.09	-	2.81	9.60	-	-	1.57	-
	HLJ075T5①	6.3	-	-	-	-	-	-	-	-	1.57	-
	HLJ083T5①	6.9	19 120	65 230	7.02	-	2.72	9.30	-	-	1.57	-

TR = Ton of Refrigeration
COP = Coefficient Of Performance
EER = Energy Efficiency Ratio

*: ARI standard rating conditions, 400V / 3ph / 50Hz
①: 220-240V / 1ph / 50Hz

Evaporating temperature : 7.2 °C
Condensing temperature: 54.4 °C
Superheat: 11.1 K
Sub-cooling: 8.3 K

Subject to modification without prior notification
For full data details and capacity tables refer to Online Datasheet Generator : **www.danfoss.com/odsg**

TECHNICAL SPECIFICATIONS

60-Hz data *

	Model	Nominal Cap 60 Hz	Nominal cooling capacity		Power input	A max	Efficiency		Swept volume	Displace-ment	Oil charge	Net weight
							COP	EER				
		TR	W	Btu/h	kW	A	W/W	Btu/h/W	cm3/rev	m3/h	dm3	kg
R22	HRM032U4	2.7	9 320	31 790	2.94	-	3.17	10.8	43.6	9.15	1.06	31
	HRM034U4	2.8	9 810	33 480	3.07	-	3.20	10.9	46.2	9.70	1.06	31
	HRM038U4	3.2	11 130	37 980	3.39	10.0	3.28	11.2	46.2	9.70	1.06	31
	HRM040U4	3.3	11 720	39 980	3.57	10.0	3.28	11.2	54.4	11.42	1.06	31
	HRM042U4	3.5	12 300	41 980	3.75	11.0	3.28	11.2	57.2	12.01	1.06	31
	HRM045U4	3.8	13 180	44 980	4.01	12.0	3.28	11.2	61.5	12.90	1.33	31
	HRM047U4	3.9	13 920	47 490	4.22	12.0	3.30	11.3	64.1	13.45	1.33	31
	HRM048U4	4.0	13 830	47 180	4.25	12.5	3.25	11.1	64.4	13.52	1.57	37
	HRM051T4	4.3	15 030	51 270	4.46	13.0	3.37	11.5	68.8	14.45	1.57	37
	HRM051U4	4.3	15 030	51 280	4.46	13.0	3.37	11.5	68.8	14.45	1.57	37
	HRM054U4	4.5	15 730	53 680	4.62	13.1	3.40	11.6	72.9	15.31	1.57	37
	HRM058U4	4.8	16 930	57 780	5.02	15.0	3.37	11.5	78.2	16.42	1.57	37
	HRM060T4	5.0	17 490	59 670	5.14	15.0	3.40	11.6	81.0	17.00	1.57	37
	HRM060U4	5.0	17 490	59 680	5.19	15.0	3.37	11.5	81.0	17.00	1.57	37
	HLM068T4	5.7	20 190	68 880	5.94	-	3.40	11.6	93.1	19.55	1.57	37
	HLM072T4	6.0	21 330	72 770	6.27	-	3.40	11.6	98.7	20.72	1.57	37
	HLM075T4	6.3	22 120	75 480	6.45	16.0	3.43	11.7	102.8	21.58	1.57	37
	HLM081T4	6.8	23 880	81 470	6.96	17.0	3.43	11.7	110.9	23.30	1.57	37
	HCM094T4	7.8	27 690	94 470	8.07	21.0	3.43	11.7	126.0	26.46	2.66	44
	HCM109T4	9.1	32 020	109 270	9.33	24.0	3.43	11.7	148.8	31.25	2.66	44
	HCM120T4	10.0	34 950	119 260	10.22	25.0	3.42	11.7	162.4	34.10	2.66	44
R407C	HRP051T4	4.3	14380	49080	4.46	13.0	3.23	11.0	68.8	14.45	1.57	37
R410A	HRH031U4	2.6	9 080	30 990	3.04	10.0	2.99	10.2	29.8	6.26	1.06	31
	HRH032U4	2.7	9 380	31 990	3.10	10.0	3.02	10.3	30.6	6.43	1.06	31
	HRH034U4	2.8	-	-	-	-	-	-	-	-	1.06	31
	HRH036U4	3.0	10 370	35 390	3.47	10.0	2.99	10.2	34.7	7.30	1.06	31
	HRH038U4	3.2	11 100	37 890	3.79	12.0	2.93	10.0	36.5	7.67	1.06	32
	HRH040U4	3.3	12 160	41 490	4.03	12.0	3.02	10.3	-	-	1.33	32
	HRH044U4	3.7	13 010	44 390	4.31	13.5	3.02	10.3	42.6	8.95	1.57	37
	HRH049U4	4.1	14 360	48 990	4.66	13.5	3.08	10.5	47.4	9.95	1.57	37
	HRH051U4	4.3	15 180	51 780	4.84	13.0	3.14	10.7	49.3	10.36	1.57	37
	HRH054U4	4.5	15 970	54 480	5.14	15.0	3.11	10.6	52.1	10.94	1.57	37
	HRH056U4	4.7	16 670	56 880	5.36	15.0	3.11	10.6	54.1	11.36	1.57	37
	HLH061T4	5.1	18 050	61 580	5.70	-	3.17	10.8	57.8	12.13	1.57	37
	HLH068T4	5.7	20 130	68 670	6.30	19.0	3.20	10.9	64.4	13.52	1.57	37
	HLJ072T4	6.0	-	-	-	-	-	-	-	-	1.57	-
	HLJ075T4	6.3	-	-	-	-	-	-	-	-	1.57	-
	HLJ083T4	6.9	-	-	-	-	-	-	-	-	1.57	-

TR = Ton of Refrigeration
COP = Coefficient Of Performance
EER = Energy Efficiency Ratio

***:** ARI standard rating conditions , 460V / 3ph / 60Hz

Evaporating temperature : 7.2 °C
Condensing temperature: 54.4 °C
Superheat: 11.1 K
Sub-cooling: 8.3 K

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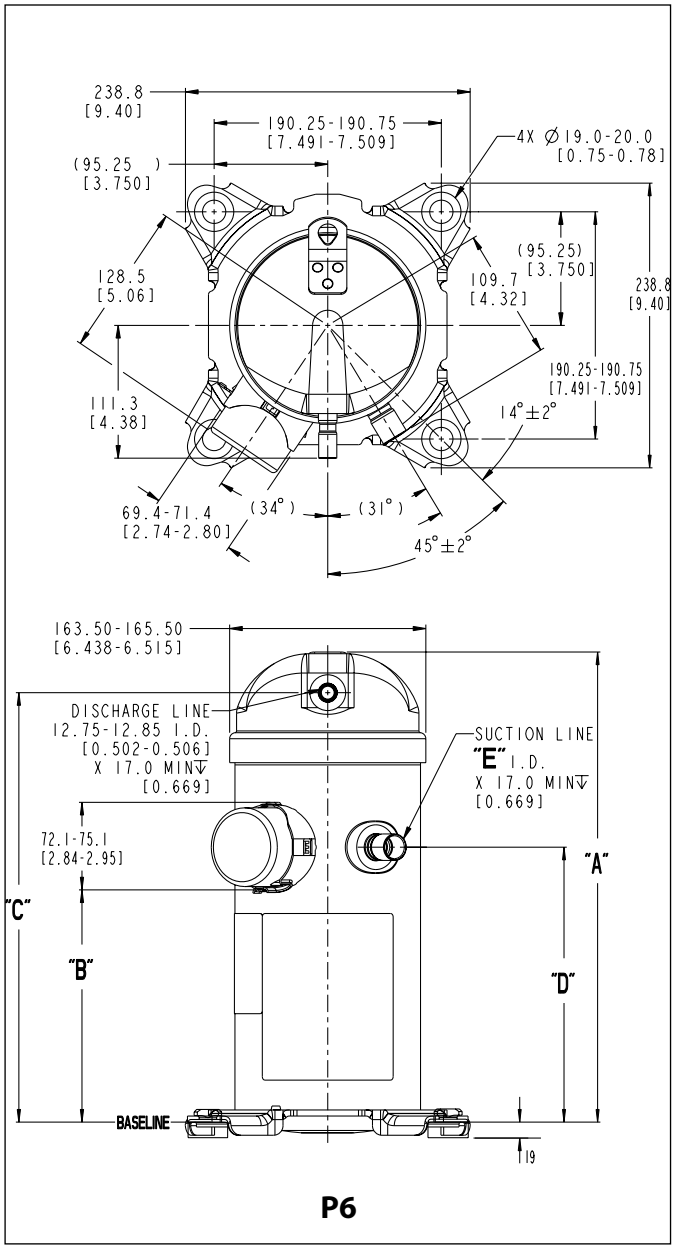
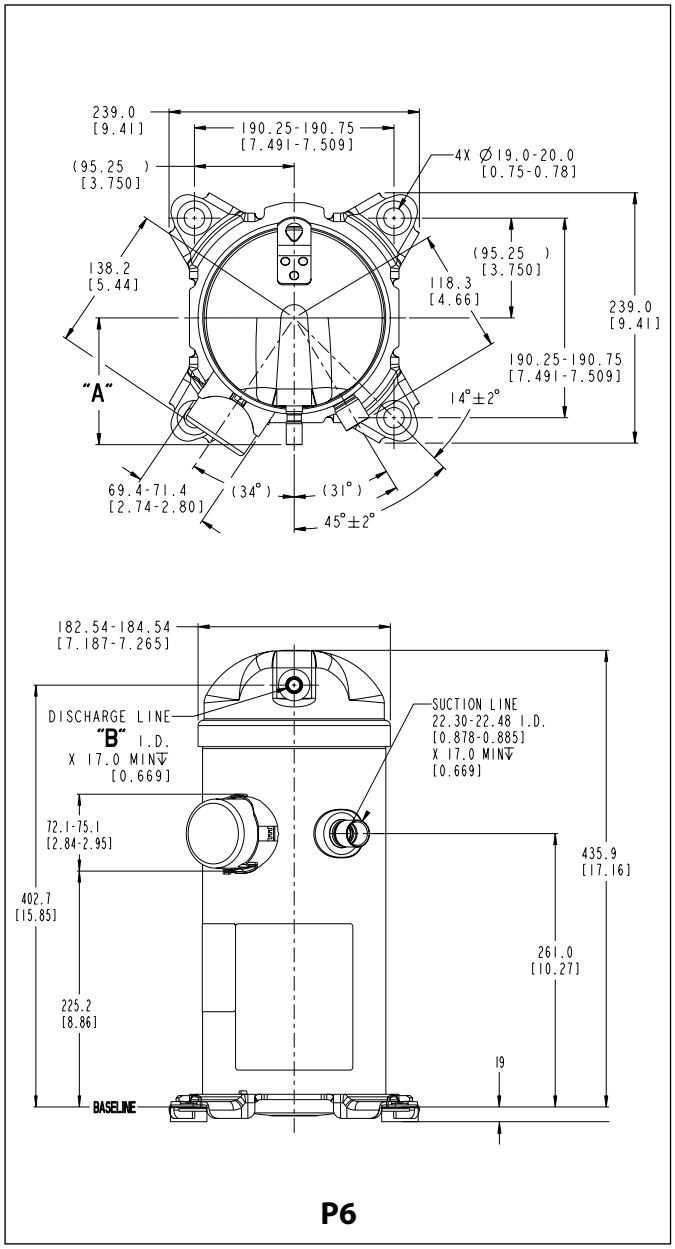
DIMENSIONS



Compressor models			"A"	"B"	"C"	"D"	"E"
HRM032 HRM034 HRM038 HRM040 HRM042	HRP034 HRP038 HRP040 HRP042	HRH031 HRH032 HRH034 HRH036 HRH038	394.4 mm (15.53 in.)	194.9 mm (7.67 in.)	360.4 mm (14.19 in.)	230.8 mm (9.09 in.)	19.13-19.23 mm (0.753 - 0.757 in.)
HRM045 HRM047	HRP045 HRP047	HRH040	419.9 mm (16.53 in.)	220.2 mm (8.67 in.)	385.8 mm (15.19 in.)	256.3 mm (10.09 in.)	22.30-22.48 mm (0.878 - 885 in.)

DIMENSIONS



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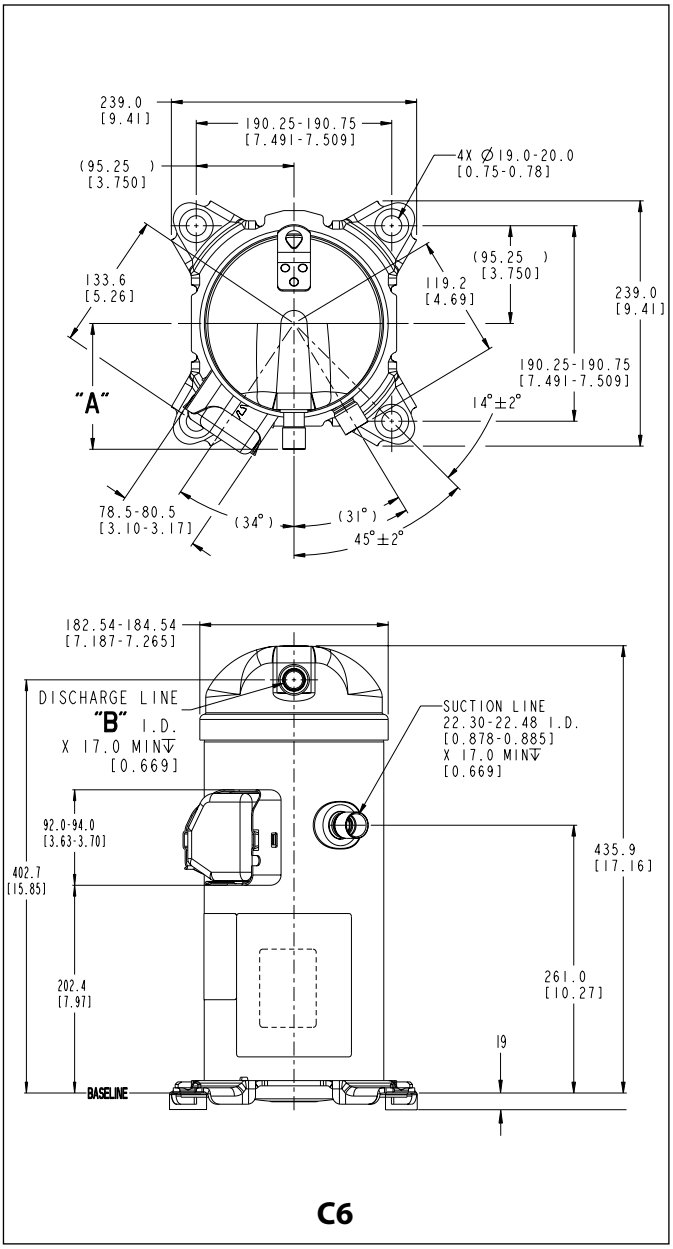

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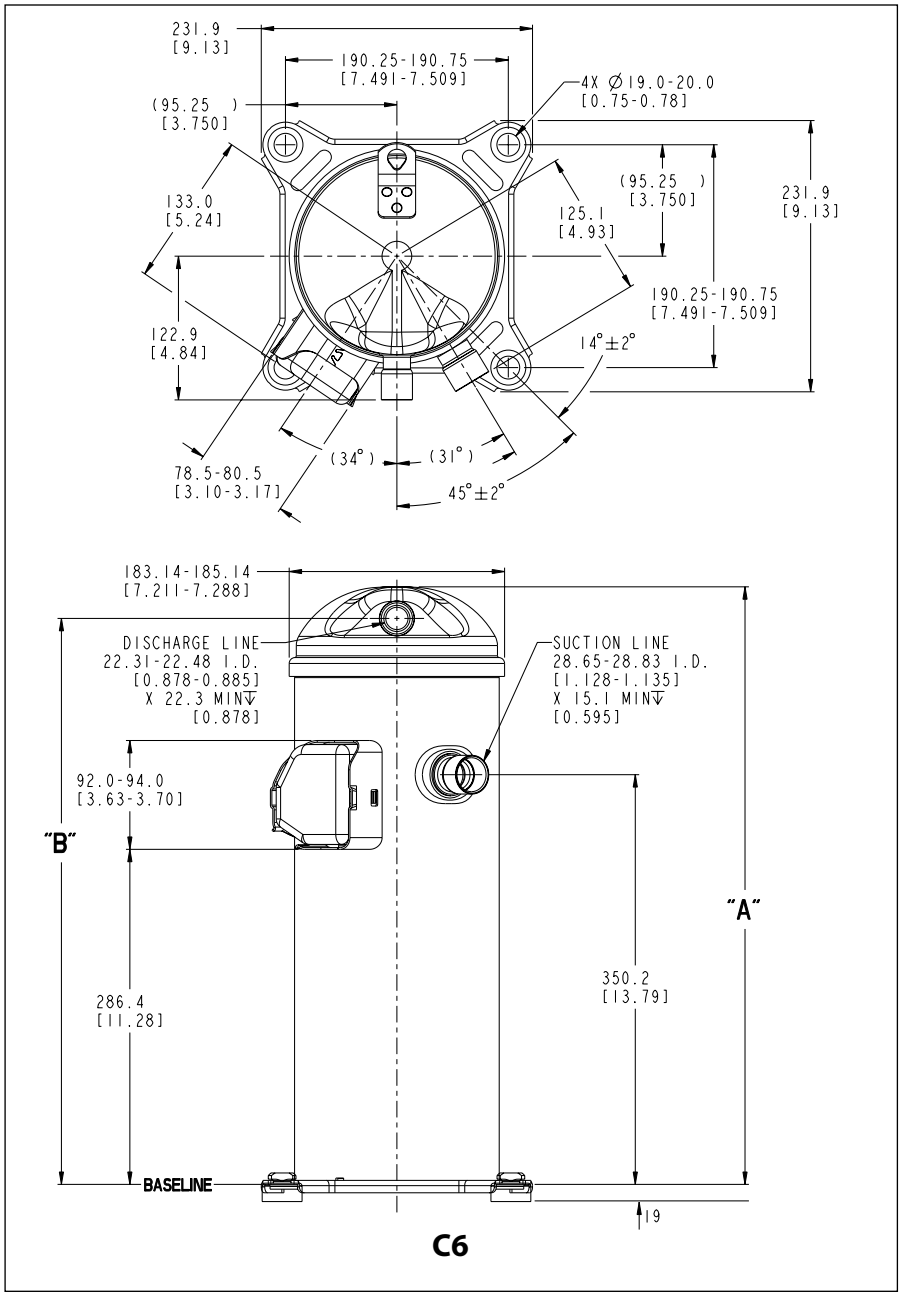
Compressor models			"A"	"B"
HRM048 HRM051 HRM054 HRM058 HRM060 HLM068 HLM072 HLM075	HRP048 HRP051 HRP054 HRP058 HRP060 HLP068 HLP072 HLP075	HRH044 HRH049 HRH051 HRH054 HRH056 HLH061 HLH068 HLJ072 HLJ083	121.0 mm (4.76 in.)	12.75 - 12.85 mm (0.502 - 0.506 in.)
HLM078 HLM081	HLP081		121.9 mm (4.80 in.)	19.12 - 19.24 mm (0.752 - 0.757 in.)

DIMENSIONS



Compressor models		"A"	"B"
HCM094	HCP094	"516.8 mm (20.34 in.)"	"490.1 mm (19.29 in.)"
HCM109 HCM120	HCP109 HCP120	"526.2 mm (20.72 in.)"	"499.5 mm (19.67 in.)"

ELECTRICAL CONNECTIONS AND WIRING

Motor voltage

Scroll compressors are available in six different motor voltages

	Motor voltage code 1	Motor voltage code 2	Motor voltage code 4	Motor voltage code 5	Motor voltage code 7	Motor voltage code 9
Nominal voltage 50 Hz	-	-	380-400V-3-50 Hz	220-240V-1-50 Hz	500V-3-50 Hz	-
Voltage range 50 Hz	-	-	340 - 440	198 - 264	450 - 550	-
Nominal voltage 60 Hz	208-230V-1-60 Hz	208-230V-3-60 Hz	460V-3-60 Hz	-	575V-3-60 Hz	380V-3-60 Hz
Voltage range 60 Hz	187 - 253	187 - 253	414 - 506	-	517 - 632	342 - 418

Prior to energizing, verify that leads and terminal connectors are in proper working condition.

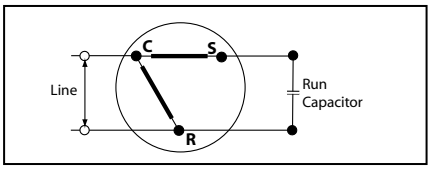
Warning: For safety reasons, make voltage measurements at the unit contactor, not at compressor terminals. Always keep the terminal cover in place when the compressor is energized.

Electrical connections

Danfoss scroll compressors are designed to operate without any assistance if running within the defined nominal voltage. PSC wiring is sufficient (see below).

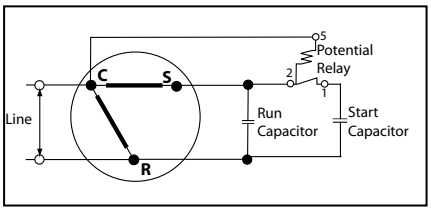
PSC starting device

The start winding (C-S) of the motor remains in circuit through a permanent (run) capacitor.
This permanent (run) capacitor is connected between the start winding (C-S) and the run winding (C-R).



CSR starting device

If start assist is required, in case of operating below the nominal voltage, a CSR starting device is required.
During start-up, the start winding (C-S) is energised through an electromagnetic potential relay and a start capacitor.
A permanent (run) capacitor is wired between the start winding (C-S) and the run winding (C-R).



Nominal capacitor value and relays

	Compressor Models ①	PSC wiring	CSR wiring	
		Run capacitor	Start capacitor	Relay
R22	HRM032-034-038-040-042	70µF	145-175µF	3ARR3*3AL*
	HRM045-047	60µF	145-175µF	3ARR3*3AL*
	HRM054	55µF	161-193µF	3ARR3*24AP*
	HRM058-060	55µF	88-108µF	3ARR3*25AS*
	HLM068-072-075-081	55µF	88-108µF	3ARR3*25AS*
R407C	HRP034-038-040-042	70µF	145-175µF	3ARR3*3AL*
	HRP045-047	60µF	145-175µF	3ARR3*3AL*
	HRP054	55µF	161-193µF	3ARR3*24AP*
	HRP058-060	55µF	88-108µF	3ARR3*25AS*
	HLP068-072-075-081	55µF	88-108µF	3ARR3*25AS*
R410A	HRH031-032-036	70µF	145-175µF	3ARR3*3AL*
	HRH038-040	60µF	145-175µF	3ARR3*3AL*
	HRH051-054-056	55µF	88-108µF	3ARR3*25AS*
	HLH068	55µF	88-108µF	3ARR3*25AS*
	HLJ072-083	55µF	88-108µF	3ARR3*25AS*

① Motor voltage code 5

ELECTRICAL CONNECTIONS AND WIRING

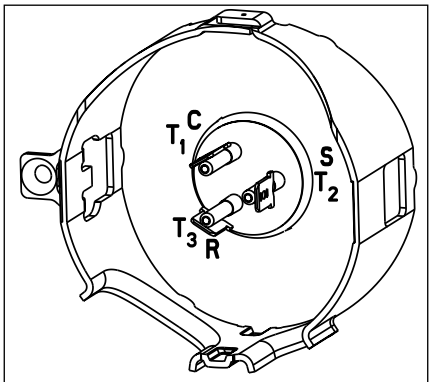
Wiring connections

Danfoss scroll compressors will only compress gas while rotating counter-clockwise (when viewed from the compressor top). Since single-phase motors will start and run in only one direction, reverse rotation is not a major consideration. Three-phase motors, however, will start and run in either direction, depending on the phase angles of the supplied power. Care must be taken during installation to ensure that the compressor operates in the correct direction.

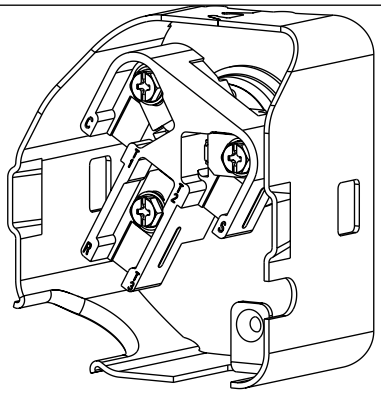
Proper rotation is verified by observing suction and discharge pressures with the compressor operating. A decrease in discharge pressure and an increase in suction pressure indicates reverse rotation. After several minutes of operation, if a compressor is rotating in the wrong direction, the compressor line break motor protector will de-energize the compressor. As corrective action, disconnect power and switch any two power leads at the unit contactor. Never switch leads directly at the compressor.

Internal wiring of Danfoss three-phase scroll compressors is consistent with the direction of rotation. Correct phasing, once determined for a specific system or installation, should maintain proper rotation direction. A phase monitor will ensure correct rotation when power is applied

The drawings below show electrical terminal labeling and should be used as a reference when wiring the compressor. For three phase applications, the terminals are labeled T1, T2, and T3. For single-phase applications the terminals are labeled C (common), S (start), and R (run).



Quick connect spade terminals
P terminal box type



Ring connect screw terminals
C terminal box type

Terminal cover and gasket

The terminal cover and gasket should be installed prior to operation of the compressor. The terminal cover has two outside tabs, 180 degrees apart, that engage the terminal fence. When installing the cover, check that it is not pinching the lead wires. Both the inside of the terminal cover and the gasket have labels for the terminal pins: C (common), R (run), and S (start).

IP rating

The compressor terminal boxes IP rating according to CEI 529 is IP22 for all models.

IP ratings is only valid when correctly sized cable glands of the IP rating is applied.

IP 2 2

First numeral, level of protection against contact and foreign objects
2 Protection against objects size over 12.5 mm (fingers or similar)

Second numeral, level of protection against water
2 Protection against dripping water when tilted up to 15°

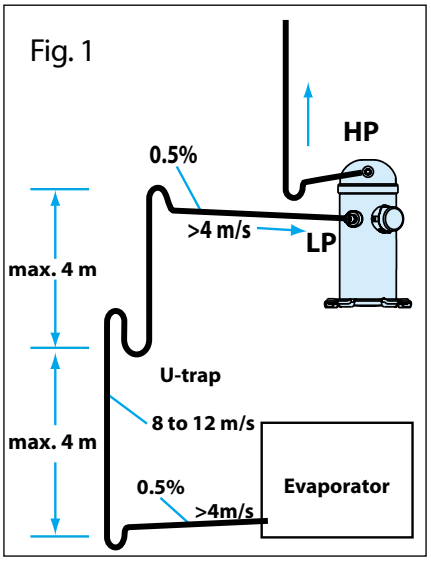
General

Successful application of scroll compressors is dependent on careful selection of the compressor for the application. If the compressor is not correct for the system, it will operate beyond the limits given in this manual. Poor performance, reduced reliability, or both may result.

Essential piping design considerations

Proper piping practices should be employed to ensure adequate oil return, even under minimum load conditions with special consideration given to the size and slope of the tubing coming from the evaporator. Tubing returns from the evaporator should be designed so as not to trap oil and to prevent oil and refrigerant migration back to the compressor during off-cycles.
If the evaporator lies above the compressor, as is often the case in split or remote condenser systems, the addition of a pump-down cycle is strongly recommended. If a pump-down cycle were to be omitted, the suction line must have a loop at the evaporator outlet to prevent refrigerant from draining into the compressor during off-cycles.
If the evaporator were situated below the compressor, the suction riser must be trapped so as to prevent liquid refrigerant from collecting at the thermal bulb location (see fig. 1).
When the condenser is mounted at a higher position than the compressor, a suitably sized «U»-shaped trap close to the compressor is necessary to prevent oil leaving the compressor from draining back to the discharge side of the compressor during off cycle. The upper loop also helps avoid condensed liquid refrigerant from draining back to the compressor when stopped (see fig. 2). The maximum elevation difference between the indoor and outdoor section cannot exceed 8 m. System manufacturers should specify precautions for any applications that exceed these limits to ensure compressor reliability.
Piping should be designed with adequate three-dimensional flexibility. It should not be in contact with the surrounding structure, unless a proper tubing mount has been installed. This protection proves necessary to avoid excess vibration, which can ultimately result in connection or tube failure due to fatigue or wear from abrasion. Aside from tubing and connection damage, excess vibration may be transmitted to the surrounding structure and generate an unacceptable noise level within that structure as well (for more information on noise and vibration, see the section on: "Sound and vibration management" p.24).

Fig. 1



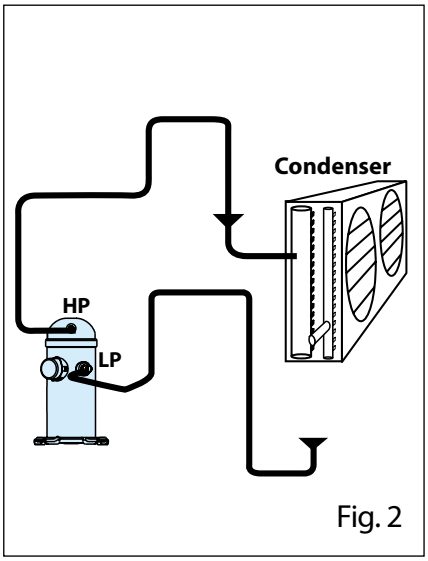


Fig. 2

Oil level checking and top-up

In installations with good oil return and line runs up to 15 m, no additional oil is required. If installation lines exceed 15 m, additional oil may be needed. 1 or 2% of the total system refrigerant charge (in weight) can be used to roughly define the required oil top-up quantity.

Always use oil from new cans.

Top-up the oil while the compressor is idle. Use any accessible connector on the compressor suction line and a suitable pump.

Refrigerant charge limits

The refrigerant charge limits listed in the table below will help evaluate the required compressor protection in relation with the system charge and the application.

Notes: for reversible heat pump systems and other specific applications, please refer to section "Specific Application Recommendations".

Compressor models	Refrigerant charge limit (kg)
HRM032-034-038-040-042-045-047 HRP034-038-040-042-045-047 HRH031-032-034-036-038-040	3.6
HRM048-051-054-058-060 / HLM068-072-075-078-081 HRP048-051-054-058-060 / HLP068-072-075-081 HRH044-049-051-054-056 / HLH061-068 - HLJ072-083	5.4
HCM094-109-120 HCP094-109-120	7.2

Minimum sump superheat

The minimum sump temperature is in the range from 6K to 17K above saturated suction temperature. Refer to the floodback test criteria on pages 21 and 22.

High pressure ratio

Scroll compressors are machines with fixed volume ratio, and operate more efficiently near the design pressure ratio. In the extreme, do not exceed a 7.5:1 pressure ratio (absolute discharge pressure to absolute suction pressure) for extended periods. The Danfoss scroll compressor is equipped with an internal pressure relief valve for protection against blocked condenser and fan failure conditions.

High and low pressure protection

High pressure

A high-pressure (HP) safety switch is recommended to shut down the compressor should the discharge pressure exceed the values shown in the table below. The high-pressure switch can be set to lower values depending on the application and ambient conditions. The HP switch must either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated.

Note: because power consumption of scroll compressors is almost directly proportional to discharge pressure, the high-pressure control can be used to indirectly limit the maximum current draw. A high-pressure control used in this manner however can never replace an external overload protector.

Danfoss HCM/HCP 094 - 109 - 120 scroll compressors are not equipped with an internal pressure relief valve; therefore a high pressure switch is required, set no higher than the limits given in the table below.

Low pressure

A low pressure (LP) safety switch is recommended. Deep vacuum operations of a scroll compressor can cause internal electrical arcing and scroll instability. Danfoss scroll compressors exhibit high volumetric efficiency and may draw very low vacuum levels, which could induce such a problem. The minimum low-pressure safety switch (loss of charge safety switch) setting is given in the following table. For systems without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor. LP switch settings for pump-down cycles with automatic reset are also listed in the table below:

		R22	R407C	R410A
Working pressure range high side	bar (g)	10.9 - 27.7 ③	10.5 - 29.1 ③	15.8 - 44.5 ③
Working pressure range low side	bar (g)	1.4 - 6.9 ③	1.1 - 6.4 ③	1.9 - 10.8 ③
Maximum high pressure safety switch setting	bar (g)	29	30	45
Minimum low pressure safety switch setting ①	bar (g)	0.5	0.5	1.5
Minimum low pressure pump-down switch setting ②	bar (g)	1.3	1.0	2.3

① LP safety switch shall never be bypassed.

② Recommended pump-down switch settings: 1.5 bar (R22, R407C) and 2.5 bar (R410A) below nominal evaporating pressure.

③ Depends on the models, check on the nameplate

Maximum discharge gas temperature

The discharge temperature depends on the combination of evaporating temperature, condensing temperature and suction gas superheat. Discharge gas temperature should be controlled with an isolated thermocouple or thermostat attached to the discharge line 15 cm (6 inches) from the compressor shell. Maximum discharge gas temperature must not exceed 135°C (275°F) when the compressor is running within the approved operating envelope.

Phase sequence and reverse rotation protection

Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively. The compressor will only operate properly in a single direction, and the motor is wound so that if the connections are correct, the rotation will also be correct. This is particularly important with three-phase compressors since the motor will run equally well in both directions. Reverse rotation results in excessive noise; no pressure differential between suction and discharge; and suction line warming rather than immediate cooling. A service technician should be present at initial start-up to verify that supply power is properly phased and that compressor and blowers are rotating in the correct direction. Danfoss Scroll compressors are designed to operate for a maximum of 150 cycles (hours) in reverse, but as a reverse rotation situation can go unnoticed for longer periods, phase monitors are recommended.

For compressors HLM078, HLP081, HLJ083 and larger, phase monitors are required for all applications. Danfoss recommends phase protection for residential compressors. The selected phase sensing device should lock out the compressor from operation in reverse.

SYSTEM DESIGN RECOMMENDATIONS

Internal motor protection

Danfoss scroll compressors are equipped with internal line break protectors mounted on their motor windings. The protectors are automatic reset devices, each containing a snap action bimetal switch.

Internal protectors respond to over-current and to high temperature. They are designed to interrupt motor current under a variety of fault conditions, such as failure to start, running overload, and fan failure. In single-phase compressors, internal protectors guard against external miswiring, such as reversing electrical connections to the Run (R) and Start (S) terminals. In three-phase compressors the internal protectors provide protection during secondary single-phase conditions (loss of phase).

On/off cycling (cycle rate limit)

Danfoss recommends a restart delay timer to limit compressor cycling. The timer prevents reverse compressor rotation, which may occur during brief power interruptions.

The system must be designed in a way that guarantees a minimum compressor running time of 2 minutes so as to provide for sufficient motor cooling after start-up along with proper oil return. Note that the oil return may vary since it depends upon system design.
There must be no more than 12 starts per hour, a number higher than 12 reduces the service life of the motor-compressor unit. A three-minute (180-sec) time out is recommended.

Voltage imbalance

For three-phase applications the voltage measured at the compressor terminals for each phase should be within ± 2% of the average for all phases.

Preventing liquid floodback

Danfoss recommends the use of a thermostatic expansion valve for all air conditioning and heat pump applications. A TXV has two key benefits: it provides modulating control of the system under varying load conditions, and it protects the compressors from floodback during adverse running conditions.

Excessive liquid refrigerant floodback during steady state operation is a major system design consideration for all types of compressors. Oil dilution that occurs with excessive floodback can have a significant adverse effect on bearing reliability. Suction accumulators may be required in some applications to prevent floodback.

Testing for excessive liquid floodback

When the use of fixed orifice devices is specified in the system design, and when a TXV is applied at the limit of its control range, the following tests should be conducted to determine if a suction accumulator is needed. Refer to the flowcharts on pages 21 and 22 to determine when to apply the excessive liquid floodback test.

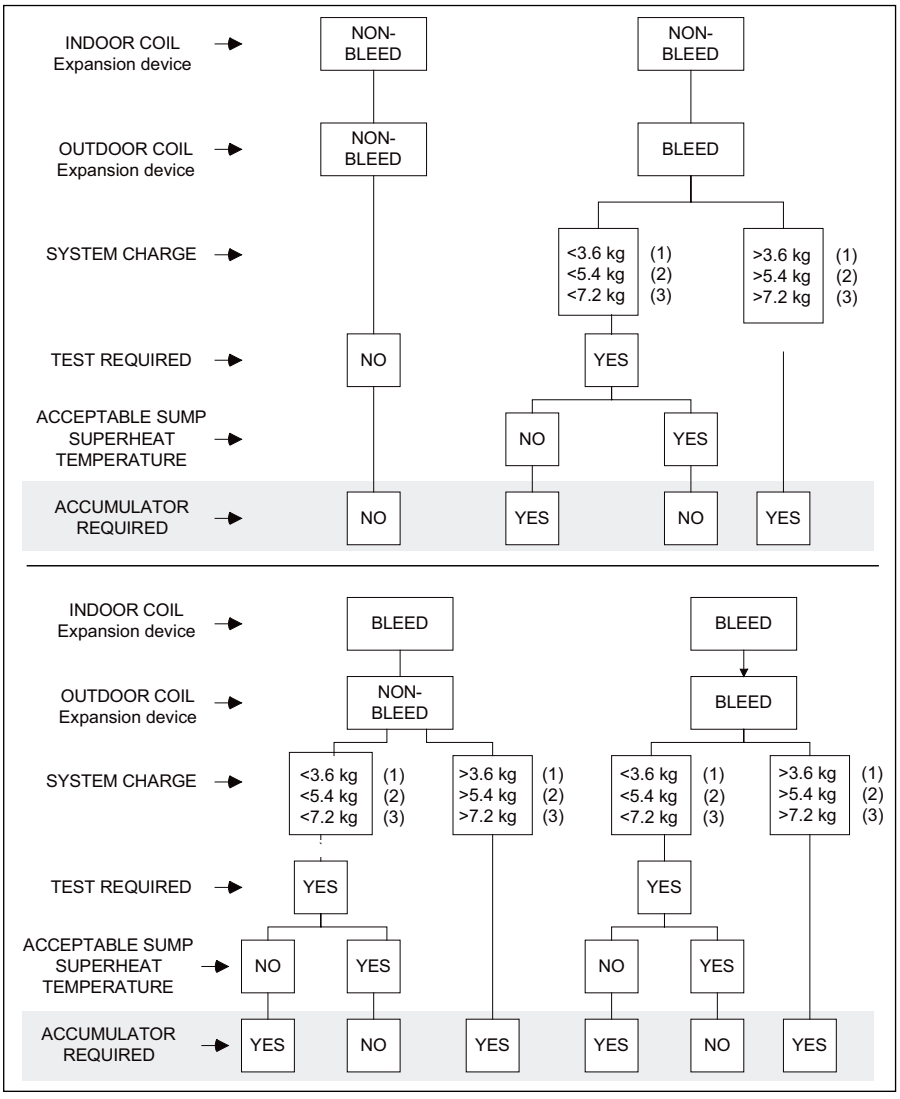
Split unit cooling mode

Set up a system with the smallest rated indoor section for the tested outdoor section. Charge the system with 120% of the system nameplate charge using 7.62 m (25 ft.) of interconnecting tubing. Ensure that both indoor and outdoor sections have full airflow. Apply voltage to the compressor. Operate the system at 46.1°C (115°F) dry bulb outdoor and 19.4°C (67°F) dry bulb and 13.9°C (57°F) wet bulb indoor for a minimum of one hour. Unless the sump superheat is in the area designated "Acceptable Zone" in the chart on page 22, a suction accumulator is required. (Sump superheat is found by subtracting saturated suction temperature from compressor base temperature.)

Split unit heating mode

Repeat the test, but with the system in heating mode and the outdoor temperature at -17.8°C (0°F) dry bulb. If the sump superheat is not in the "ACCEPTABLE ZONE" shown in the Floodback Requirement graph on the next page, a suction accumulator is required.

Heat pumps



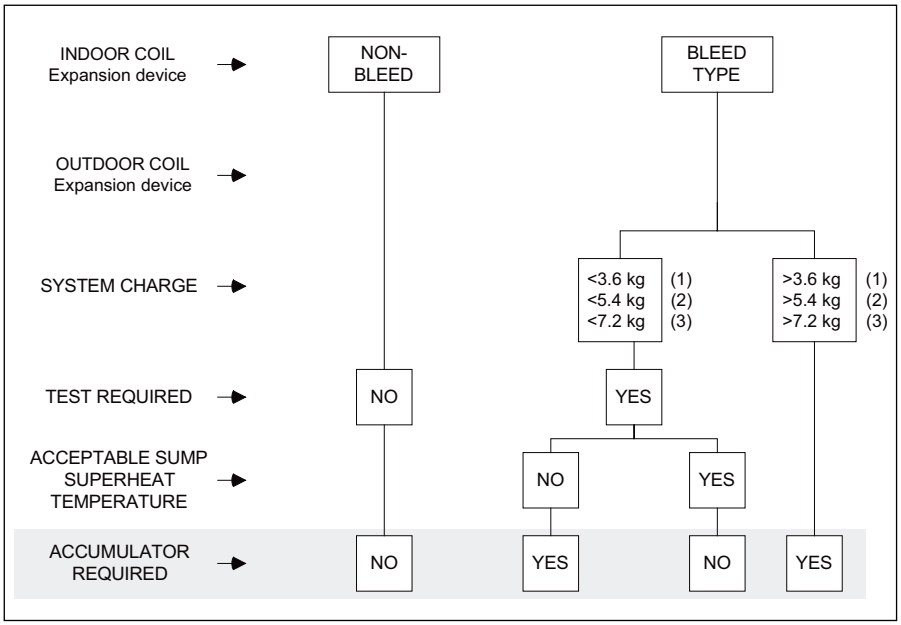
(1) HRM032-034-038-040-042-045-047
HRP034-038-040-042-045-047
HRH031-032-034-036-038-040

(2) HRM048-051-054-058-060 / HLM068-072-075-078-081
HRP048-051-054-058-060 / HLP068-072-075-081
HRH044-049-051-054-056 / HLH061-068 / HLJ072-083

(3) HCM094-109-120
HCP094-109-120

SYSTEM DESIGN RECOMMENDATIONS

Air-conditioning

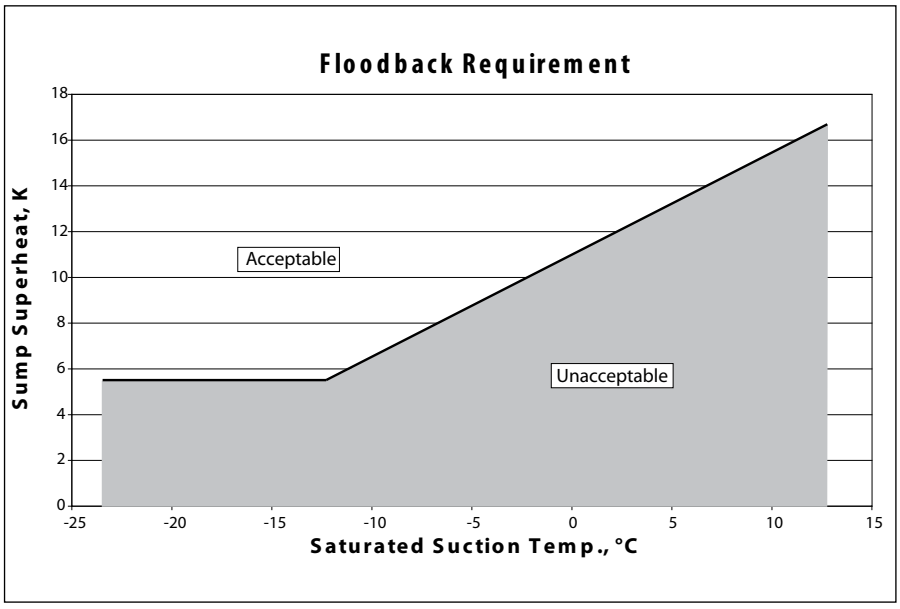


(1) HRM032-034-038-040-042-045-047
HRP034-038-040-042-045-047
HRH031-032-034-036-038-040

(2) HRM048-051-054-058-060 / HLM068-072-075-078-081
HRP048-051-054-058-060 / HLP068-072-075-081
HRH044-049-051-054-056 / HLH061-068 / HLJ072-083

(3) HCM094-109-120
HCP094-109-120

Floodback requirement



SPECIFIC APPLICATION RECOMMENDATIONS

Crankcase heater

Crankcase heaters provide extra compressor protection, and should be considered for all applications. For HCM/HCP 094 - 109 - 120, to prevent excessive refrigerant migration during off cycles, a crankcase heater is required.

For initial installation of precharged systems and for any extended power interruptions, the crankcase heater should be energized for 24 hours prior to compressor startup.

Reversible heat pump systems

Transients are likely to occur in reversible heat pump systems, i.e. a changeover cycle from cooling to heating, defrost or low-load short cycles. These transient modes of operation may lead to liquid refrigerant carryover (or floodback) or excessively wet refrigerant return conditions. As such, reversible cycle applications require specific precautions for ensuring a long compressor life and satisfactory operating characteristics. Regardless of the refrigerant charge in the system, specific tests for repetitive floodback are required to confirm whether or not a suction accumulator needs to be installed. A crankcase heater and discharge gas thermostat are required for reversible heat pump applications.

These considerations cover the most important issues in the realm of common applications. Each application design however should be thoroughly tested to ensure acceptable operating characteristics.

Loss of charge protection

Danfoss HCM/HCP 094 - 109 - 120 scroll compressors do not include a thermal valve protection; therefore, all applications require loss of charge protection :

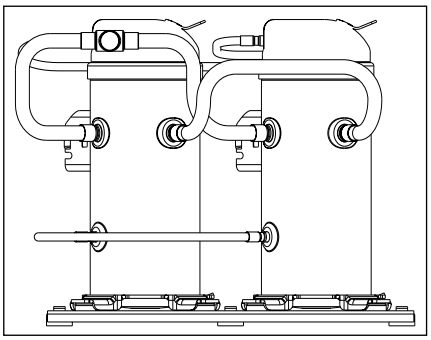
• For Air Conditionning, a low pressure switch in the low pressure side of the system is required.

• For Heat pump applications a discharge line thermostat set no higher than 135°C is required. The thermostat must be a manual lockout type device (or electrical lockout circuit) and be located within 150 mm of the compressor discharge connection. The discharge line thermostat must be insulated to insure proper sensing and operation.

Tandem

Danfoss scroll compressors in C8 version can be mounted in tandem assemblies.

Such manifolding applications require special design considerations that go beyond the scope of this document. Please contact Danfoss CC for further information.



Starting sound level

During start-up transients it is natural for compressor sound levels to be slightly higher than during normal running. Danfoss scroll compressor models exhibit very little increased start-up transient sound. If a 3-phase model is miswired, the compressor will run in reverse. Reverse compressor rotation is characterized by an objectionable sound. To correct reverse rotation, disconnect power and switch any two of the three power leads at the unit contactor. *Never switch leads at the compressor terminals*.

Running sound level

Danfoss scroll compressors are designed with optimized discharge ports and wrap geometry to reduce the sound level when a compressor is running.

Stopping sound level

Danfoss scrolls have very low shutdown sound due to minimal volume of discharge volume to push scrolls in reverse at shutdown. Due to this small reexpansion there is no internal break mechanism required to prevent reverse spin of the scroll set.

Sound generation in a refrigeration / air conditioning system

Typical sound and vibration in Refrigeration and Air-Conditioning systems encountered by design and service engineers may be broken down into the following three source categories.

Sound radiation:
This generally takes an airborne path.

Mechanical vibrations:
These generally extend along the parts of the unit and structure.

Gas pulsation:
This tends to travel through the cooling medium, i.e. the refrigerant.
The following sections will focus on the causes and methods of mitigation for each of the above sources.

Compressor sound radiation

For sound radiating from the compressor, the emission path is airborne and the sound waves are traveling directly from the machine in all directions.
The Danfoss scroll compressor is designed to be quiet and the frequency of the sound generated is pushed into the higher ranges, which not only are easier to reduce but also do not generate the penetrating power of lower-frequency sound.
Use of sound-insulation materials on the inside of unit panels is an effective means of substantially reducing the sound being transmitted to the outside. Ensure that no components capable of transmitting sound/vibration within the unit come into direct contact with any non-insulated parts on the walls of the unit.
Because of the Danfoss's unique design of a full-suction gas & oil cooled motor, compressor body insulation across its entire operating range is possible.

Mechanical vibrations

Vibration isolation constitutes the primary method for controlling structural vibration. Danfoss scroll compressors are designed to produce minimal vibration during operations. The use of rubber isolaters on the compressor base plate or on the frame of a manifolded unit is very effective in reducing vibration being transmitted from the compressor(s) to the unit. Rubber grommets are supplied with all Danfoss compressors. Once the supplied rubber grommets have been properly mounted, vibration transmitted from the compressor base plate to the unit are held to a strict minimum. In addition, it is extremely important that the frame supporting the mounted compressor be of sufficient mass and stiffness to help dampen any residual vibration potentially transmitted to the frame. The tubing should be designed so as to both reduce the transmission of vibrations to other structures and withstand vibration without incurring any damage. Tubing should also be designed for three-dimensional flexibility. For more information on piping design, please see the section entitled "Essential piping design considerations" p 17 .

Gas pulsation

The Danfoss scroll compressor has been designed and tested to ensure that gas pulsation has been optimized for the most commonly encountered air conditioning pressure ratio. On heat pump installations and other installations where the pressure ratio lies beyond the typical range, testing should be conducted under all expected conditions and operating configurations to ensure that minimum gas pulsation is present. If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass should be installed. This information can be obtained from the component manufacturer.

INSTALLATION

System cleanliness

The refrigerant compression system, regardless of the type of compressor used, will only provide high efficiency and good reliability, along with a long operating life, if the system contains solely the refrigerant and oil it was designed for. Any other substances within the system will not improve performance and, in most cases, will be highly detrimental to system operations.
The presence of non-condensable substances and system contaminants, such as metal shavings, solder and flux, have a negative impact on compressor service life. Many of these contaminants are small enough to pass through a mesh screen and can cause considerable damage within a bearing assembly. The use of highly hygroscopic POE and PVE oils in R407C and R410A compressors requires that the oil be exposed to the atmosphere just as little as possible.
System contamination is one of main factors affecting equipment reliability and compressor service life. It is important therefore to take system cleanliness into account when assembling a refrigeration system.
During the manufacturing process, circuit contamination may be caused by:

- Brazing and welding oxides,
- Filings and particles from the removal of burrs in pipe-work,
- Brazing flux,
- Moisture and air.

Consequently, when building equipment and assemblies, the following precautions must be taken: never drill holes into the pipe-work after installation.

Insulation resistance and dielectric strength

Insulation resistance must be greater than 1 megohm when measured with a 500 volt direct current megohm tester.

Each compressor motor is tested at the factory with a high potential voltage (hi-pot) that exceeds the UL requirement both in potential and in duration. Leakage current is less than 0.5 mA.

Danfoss scroll compressors are configured with the pump assembly at the top of the shell, and the motor below. As a result, the motor can be partially immersed in refrigerant and oil. The presence of refrigerant around the motor windings will result in lower resistance values to ground and higher leakage current readings. Such readings do not indicate a faulty compressor, and should not be cause for concern.

In testing insulation resistance, Danfoss recommends that the system be first operated briefly to distribute refrigerant throughout the system. Following this brief operation, retest the compressor for insulation resistance or current leakage.

Compressor holding charge

Each compressor is shipped with a nominal dry nitrogen holding charge between 0.4 bar and 0.7 bar, and is sealed with elastomer plugs. The plugs should be removed with care to avoid oil loss when the holding charge is released. Remove the suction plug first and the discharge plug afterwards. The plugs shall be removed only just before connecting the compressor to the installation in order to avoid moisture entering the compressor. When the plugs are removed, it is essential to keep the compressor in an upright position so as to avoid oil spillage.

Liquid line filter driers

A properly sized filter drier is required for all Danfoss scroll applications. Danfoss recommends DCL (solid core) driers for HCFC refrigerants with mineral oil, and DML (100% molecular seives) driers for HFC refrigerants R407C and R410A with POE or PVE oil. For servicing of existing installations where acid formation is present the Danfoss DCL solid core filter driers containing activated alumina are recommended. The drier is to be oversized rather than undersized. When selecting a drier, always take into account its capacity

(water content capacity), the system refrigeration capacity and the system refrigerant charge.

Compressor replacement after motor burn out

If there has been a motor burnout follow the evacuation procedure described on page 28. Remove and replace the liquid line filter drier and install a Danfoss type DAS burnout drier of appropriate capacity.

Refer to the DAS drier instructions and technical information on correct use and monitoring of the burnout drier and the liquid line and suction line filter driers.

Tube brazing procedure

Do not bend the compressor discharge or suction lines or force system piping into the compressor connections, because this will increase stresses that are a potential cause of failure. Recommended brazing procedures and material, are described below:

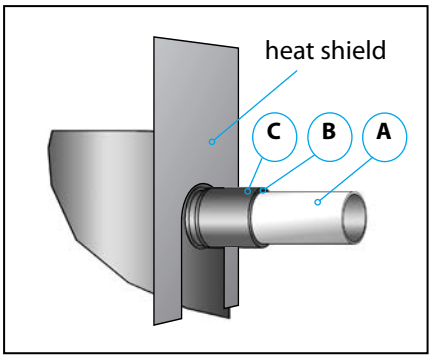
Brazing material

For copper suction and discharge fittings, use copper-phosphorus brazing material. Sil-Fos® and other silver brazing materials are also acceptable. If flux is required for the brazing operation, use coated rod or flux core wire. To avoid system contamination, do not brush flux on.

Compressor connection

When brazing the compressor fittings, do not overheat the compressor shell, which could severely damage certain internal components due to excessive heating. Use of a heat shield and/or a heat-absorbent compound is highly recommended. For brazing the suction and discharge connections, the following procedure is advised:

- Make sure that no electrical wiring is connected to the compressor.
- Protect the terminal box and compressor painted surfaces from torch heat damage (see diagram).
- Use only clean refrigeration-grade copper tubing and clean all connections.
- Purge nitrogen or CO_2 through the compressor in order to prevent against oxidation and flammable conditions. The compressor should not be exposed to the open air for extended periods.
- Use of a double-tipped torch is recommended.
- Apply heat evenly to Area (A) until the brazing temperature is reached. Move the torch to Area (B) and apply heat evenly until the brazing temperature has been reached there as well, and then begin adding the brazing material. Move the torch evenly around the joint, in applying only enough brazing material to flow the full circumference of the joint.



- Move the torch to area (C) only long enough to draw the brazing material into the joint, but not into the compressor.
- Remove all remaining flux once the joint has been soldered with a wire brush or a wet cloth. Remaining flux would cause corrosion of the tubing.

Ensure that no flux is allowed to enter into the tubing or compressor. Flux is acidic and can cause substantial damage to the internal parts of the system and compressor.

The POE and PVE oils used in compressors are highly hygroscopic and will rapidly absorb moisture from the air. The compressor must therefore not be left open to the atmosphere for a long period of time. The compressor fitting plugs shall be removed just before brazing the compressor.

⚠ **Before eventual unbrazing the compressor or any system component, the refrigerant charge must be removed from both the high and low pressure sides. Failure to do so may result in serious personal injury. Pressure gauges must be used to ensure all pressures are at atmospheric level.**

For more detailed information on the appropriate materials required for brazing or soldering, please contact the product manufacturer or distributor. For specific applications not covered herein, please contact Danfoss Commercial Compressors for further information.

Vacuum pump-down and moisture removal

Moisture obstructs the proper functioning of both the compressor and the refrigeration system. Air and moisture reduce service life and increase condensing pressure, which causes abnormally high discharge temperatures that are then capable of degrading the lubricating properties of the oil. The risk of acid formation is also increased by air and moisture, and this condition can also lead to copper plating. All these phenomena may cause both mechanical and electrical compressor failures. The typical method for avoiding such problems is a vacuum pump-down executed with a vacuum pump, thus creating a minimum vacuum of 500 microns (0.67 mbar). Please refer to Bulletin "Vaccum pump down and dehydration procedure".

Be sure to follow all government regulations regarding refrigerant reclamation and storage.

Refrigerant charging

It is recommended that system charging be done using the weighed charge method, adding refrigerant to the high side of the system. Charging the high and low sides of a system with gas simultaneously at a controlled rate is also an acceptable method. Do not exceed the recommended unit charge, and never charge liquid to the low side.

Maximum inclination

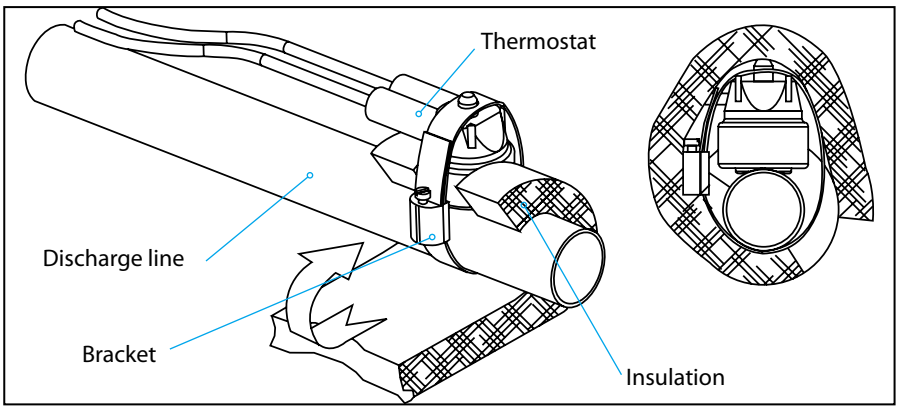
Maximum inclination from the vertical plane, while operating must not exceed 7 degrees.

Discharge temperature protection

The discharge gas temperature must not exceed 135°C.

The discharge gas thermostat accessory kit includes all components required for installation, as shown below. The thermostat must be attached to the discharge line within 150 mm from the compressor discharge port.

Discharge thermostat kit code number: 7750009.



Crankcase heater

Compressor models	Code no.	Voltage	Power	Certification
HRM032-034-038-040-042-045-047 HRP034-038-040-042-045-047 HRH031-032-034-036-038-040	120Z0055	230	40W	CE
	120Z0056	400	40W	CE
HRM048-051-054-058-060 / HLM068-072-075 HRP048-051-054-058-060 / HLP068-072-075 HRH044-049-051-054-056 / HLH061-068 / HLJ072	120Z0057	230	50W	CE
	120Z0058	400	50W	CE
HLM078-081 / HCM094-109-120 HLP081 / HCP094-109-120 HLJ083	120Z5011	230	70W	UL
	120Z0059	230	70W	CE
	120Z0060	400	70W	CE
	120Z5012	460	70W	UL
	120Z5013	575	70W	UL

Mounting hardware

Compressor models	Code no.	Description
All models	120Z5017	Mounting grommet
	120Z5014	Mounting sleeve
	120Z5031	Bolt / sleeve / washer
	120Z5005	Bolt / sleeve / washer + grommet (service kit)

Lubricants

Compressor models	Code no.	Description
HRM / HLM / HCM	7754009	Alkylbenzene 2 liter can
HRP / HLP / HCP	120Z5033	POE 1 liter can
HRH / HLH	120Z5033	POE 1 liter can
HLJ	*	PVE

* contact Danfoss for product availability

Capacitors for single phase

Compressor models*	Code no.	Description
HRM032-034-038-040-042 HRP034-038-040-042 HRH031-032-036	120Z0051	Run capacitor 70µF
HRM045-047 HRP045-047 HRH038-040	120Z0050	Run capacitor 60µF
HRM054-058-060 / HLM068-072-075-081 HRP054-058-060 / HLP068-072-075-081 HRH051-054-056 / HLH068 / HLJ072-083	8173234	Run capacitor 55µF

*Motor voltage code 5

ORDERING INFORMATION AND PACKAGING

R22 Single pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRM032	U	P	6	120U0921		120U0996	120U0956		
HRM034	U	P	6	120U0926	120U1081	120U1001			
HRM038	U	P	6	120U0931	120U1091	120U1011	120U0966	120U1056	
HRM040	U	P	6	120U0936	120U1101	120U1021		120U1061	
HRM042	U	P	6	120U0941	120U1111	120U1031	120U0971	120U1066	
HRM045	U	P	6	120U0946	120U1121	120U1041	120U0981	120U1071	
HRM047	U	P	6	120U0951	120U1131	120U1051	120U0991	120U1076	
HRM048	U	C	8			120U1671			
HRM048	U	P	6	120U1496		120U1666		120U1791	
HRM051	T	P	6			120U1676			
HRM051	U	P	6	120U1506	120U1866	120U1686		120U1801	
HRM054	U	C	6	120U1516					
HRM054	U	P	6	120U1511	120U1871	120U1696		120U1811	
HRM058	T	C	6	120U1526					
HRM058	T	P	6	120U1521					
HRM058	U	C	6	120U1536					
HRM058	U	C	8			120U1716			
HRM058	U	P	6	120U1531	120U1876	120U1711	120U1601	120U1821	
HRM060	T	P	6	120U1541		120U1721			
HRM060	U	C	6	120U1551					
HRM060	U	C	8		120U1886	120U1741			
HRM060	U	P	6	120U1546	120U1881	120U1736	120U1611	120U1831	
HLM068	T	C	6		120U1891	120U1746			
HLM068	T	P	6	120U1556			120U1616		
HLM072	T	C	6		120U1896	120U1751			120U1856
HLM072	T	P	6	120U1566			120U1626		
HLM075	T	C	6		120U1901	120U1761		120U1836	
HLM075	T	P	6	120U1576			120U1636		
HLM078	T	C	6		120U1906	120U1771			
HLM081	T	C	6		120U1911	120U1776		120U1846	
HLM081	T	P	6	120U1586			120U1646		
HCM094	T	C	2		120U0896	120U0591		120U0716	120U0751
HCM094	T	C	6		120U0891	120U0581		120U0711	120U0746
HCM094	T	C	7			120U0586			
HCM094	T	C	8		120U0901	120U0596		120U0721	120U0756
HCM109	T	C	6			120U0366			
HCM109	T	C	7			120U0371			
HCM120	T	C	6		120U0761	120U0391			
HCM120	T	C	7			120U0396			

R22 Industrial pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRM032	U	P	6	120U0918		120U0993	120U0953		
HRM034	U	P	6	120U0923	120U1078	120U0998			
HRM038	U	P	6	120U0928	120U1088	120U1008	120U0963	120U1053	
HRM040	U	P	6	120U0933	120U1098	120U1018		120U1058	
HRM042	U	P	6	120U0938	120U1108	120U1028	120U0968	120U1063	
HRM045	U	P	6	120U0943	120U1118	120U1038	120U0978	120U1068	
HRM047	U	P	6	120U0948	120U1128	120U1048	120U0988	120U1073	
HRM048	U	C	8			120U1668			
HRM048	U	P	6	120U1493		120U1663		120U1788	
HRM051	T	P	6			120U1673			
HRM051	U	P	6	120U1503	120U1863	120U1683		120U1798	
HRM054	U	C	6	120U1513					
HRM054	U	P	6	120U1508	120U1868	120U1693		120U1808	
HRM058	T	C	6	120U1523					
HRM058	T	P	6	120U1518					
HRM058	U	C	6	120U1533					
HRM058	U	C	8			120U1713			
HRM058	U	P	6	120U1528	120U1873	120U1708	120U1598	120U1818	
HRM060	T	P	6	120U1538		120U1718			
HRM060	U	C	6	120U1548					
HRM060	U	C	8		120U1883	120U1738			
HRM060	U	P	6	120U1543	120U1878	120U1733	120U1608	120U1828	
HLM068	T	C	6		120U1888	120U1743			
HLM068	T	P	6	120U1553			120U1613		
HLM072	T	C	6		120U1893	120U1748			120U1853
HLM072	T	P	6	120U1563			120U1623		
HLM075	T	C	6		120U1898	120U1758		120U1833	
HLM075	T	P	6	120U1573			120U1633		
HLM078	T	C	6		120U1903	120U1768			
HLM081	T	C	6		120U1908	120U1773		120U1843	
HLM081	T	P	6	120U1583			120U1643		
HCM094	T	C	2		120U0893	120U0588		120U0713	120U0748
HCM094	T	C	6		120U0888	120U0578		120U0708	120U0743
HCM094	T	C	7			120U0583			
HCM094	T	C	8		120U0898	120U0593		120U0718	120U0753
HCM109	T	C	6			120U0363			
HCM109	T	C	7			120U0368			
HCM120	T	C	6		120U0758	120U0388			
HCM120	T	C	7			120U0393			

ORDERING INFORMATION AND PACKAGING

R407C Single pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRP034	T	P	6			120U2024	120U2019		
HRP038	T	P	6		120U1086	120U1006	120U0961		
HRP040	T	P	6		120U1096	120U1016	120U1929		
HRP042	T	P	6		120U1106	120U1026			
HRP045	T	P	6		120U1116	120U1036	120U0976		
HRP047	T	P	6		120U1126	120U1046	120U0986		
HRP048	T	C	8			120U1661			
HRP048	T	P	6			120U1656			
HRP051	T	P	6	120U1501	120U1861	120U1681		120U1796	
HRP054	T	P	6			120U1691		120U1806	
HRP058	T	C	8			120U1706			
HRP058	T	P	6			120U1701	120U1596	120U1816	
HRP060	T	C	8			120U1731			
HRP060	T	P	6			120U1726	120U1606	120U1826	
HLP068	T	C	6			120U2014			
HLP068	T	P	6	120U1561			120U1621		
HLP072	T	C	6			120U1756			
HLP072	T	P	6	120U1571			120U1631		
HLP075	T	C	6			120U1766		120U1841	
HLP075	T	P	6	120U1581			120U1641		
HLP081	T	C	6		120U1916	120U1781		120U1851	
HLP081	T	C	8			120U1786			
HLP081	T	P	6	120U1591			120U1651		
HCP094	T	C	6		120U0906	120U0601			
HCP094	T	C	7		120U0911	120U0606			
HCP094	T	C	8		120U0916	120U0611			
HCP109	T	C	6			120U0376			
HCP109	T	C	7			120U0381			
HCP109	T	C	8			120U0386			
HCP120	T	C	6		120U0766	120U0401			
HCP120	T	C	7			120U0406			
HCP120	T	C	8			120U0411			

R407C Industrial pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRP034	T	P	6			120U2021	120U2016		
HRP038	T	P	6		120U1083	120U1003	120U0958		
HRP040	T	P	6		120U1093	120U1013	120U1926		
HRP042	T	P	6		120U1103	120U1023			
HRP045	T	P	6		120U1113	120U1033	120U0973		
HRP047	T	P	6		120U1123	120U1043	120U0983		
HRP048	T	C	8			120U1658			
HRP048	T	P	6			120U1653			
HRP051	T	P	6	120U1498	120U1858	120U1678		120U1793	
HRP054	T	P	6			120U1688		120U1803	
HRP058	T	C	8			120U1703			
HRP058	T	P	6			120U1698	120U1593	120U1813	
HRP060	T	C	8			120U1728			
HRP060	T	P	6			120U1723	120U1603	120U1823	
HLP068	T	C	6			120U2011			
HLP068	T	P	6	120U1558			120U1618		
HLP072	T	C	6			120U1753			
HLP072	T	P	6	120U1568			120U1628		
HLP075	T	C	6			120U1763		120U1838	
HLP075	T	P	6	120U1578			120U1638		
HLP081	T	C	6		120U1913	120U1778		120U1848	
HLP081	T	C	8			120U1783			
HLP081	T	P	6	120U1588			120U1648		
HCP094	T	C	6		120U0903	120U0598			
HCP094	T	C	7		120U0908	120U0603			
HCP094	T	C	8		120U0913	120U0608			
HCP109	T	C	6			120U0373			
HCP109	T	C	7			120U0378			
HCP109	T	C	8			120U0383			
HCP120	T	C	6		120U0763	120U0398			
HCP120	T	C	7			120U0403			
HCP120	T	C	8			120U0408			

ORDERING INFORMATION AND PACKAGING

R410A Single pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRH031	U	P	6	120U1136	120U1251	120U1191	120U1166	120U1216	
HRH032	U	P	6	120U1141	120U1256	120U1196	120U1171	120U1221	
HRH034	U	P	6	120U1146	120U1261			120U1226	
HRH036	U	P	6	120U1151	120U1266	120U1201	120U1176	120U1231	
HRH038	U	P	6	120U1156	120U1271	120U1206	120U1181	120U1236	
HRH040	U	P	6	120U1161	120U1276	120U1211	120U1186	120U1241	
HRH044	U	P	6	120U1286	120U1456	120U1361		120U1411	
HRH049	U	P	6	120U1291	120U1461	120U1366		120U1416	
HRH051	U	P	6	120U1296	120U1466	120U1371	120U1326	120U1421	
HRH054	U	P	6	120U1301	120U1471	120U1376	120U1331	120U1426	
HRH056	U	C	6			120U1386			
HRH056	U	P	6	120U1306	120U1476	120U1381	120U1336	120U1431	
HLH061	T	C	6			120U2052			
HLH068	T	C	6		120U1481	120U1391		120U1436	
HLH068	T	P	6	120U1311			120U1341		
HLJ072	T	C	6		120U1486	120U1396			
HLJ072	T	P	6	120U1316			120U1346		
HLJ075	T	C	6						120U1446
HLJ083	T	C	6		120U1491	120U1401		120U1441	
HLJ083	T	P	6	120U1321			120U1351		

R410A Industrial pack

Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRH031	U	P	6	120U1133	120U1248	120U1188	120U1163	120U1213	
HRH032	U	P	6	120U1138	120U1253	120U1193	120U1168	120U1218	
HRH034	U	P	6	120U1143	120U1258			120U1223	
HRH036	U	P	6	120U1148	120U1263	120U1198	120U1173	120U1228	
HRH038	U	P	6	120U1153	120U1268	120U1203	120U1178	120U1233	
HRH040	U	P	6	120U1158	120U1273	120U1208	120U1183	120U1238	
HRH044	U	P	6	120U1283	120U1453	120U1358		120U1408	
HRH049	U	P	6	120U1288	120U1458	120U1363		120U1413	
HRH051	U	P	6	120U1293	120U1463	120U1368	120U1323	120U1418	
HRH054	U	P	6	120U1298	120U1468	120U1373	120U1328	120U1423	
HRH056	U	C	6			120U1383			
HRH056	U	P	6	120U1303	120U1473	120U1378	120U1333	120U1428	
HLH061	T	C	6			120U2049			
HLH068	T	C	6		120U1478	120U1388		120U1433	
HLH068	T	P	6	120U1308			120U1338		
HLJ072	T	C	6		120U1483	120U1393			
HLJ072	T	P	6	120U1313			120U1343		
HLJ075	T	C	6						120U1443
HLJ083	T	C	6		120U1488	120U1398		120U1438	
HLJ083	T	P	6	120U1318			120U1348		

ORDERING INFORMATION AND PACKAGING

Packaging

Single pack

Compressors are packaged individually in a cardboard box.
One service kit is included in each cardboard box.

A service kit consists of 4 grommets and 4 bolts / washers / sleeve assemblies, for one compressor.

Industrial pack

Compressors are not packaged individually but are delivered all together on one pallet. They can't be ordered individually.

One mounting kit per compressor is included. A mounting kit consists of 4 grommets and 4 sleeves, for one compressor.

Packaging regions details

According to delivery region, packaging dimensions and compressor quantities are different.

See below for details.

Delivered region	Packaging	Nbr	Pallet type	Comments
Americas Asia Pacific Middle East	Single pack	16	US Pallet	Optimised for overseas container loading
	Industrial pack	16	US Pallet	
Europe	Single pack	8	Euro Pallet	-
	Industrial pack	12	Euro Pallet	

* Nbr : number of compressors/pallet

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Danfoss Refrigeration & Air Conditioning is a worldwide manufacturer with a leading position in industrial, commercial and supermarket refrigeration as well as air conditioning and climate solutions.

We focus on our core business of making quality products, components and systems that enhance performance and reduce total life cycle costs – the key to major savings.

Controls for Commercial Refrigeration

Controls for Industrial Refrigeration

Electronic Controls & Sensors

Industrial Automation

Household Compressors

Commercial Compressors

Sub-Assemblies

Thermostats

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