HELICAL OIL SEPARATORS

The function of a Helical Oil Separator is to efficiently remove oil from the discharge gas and return it to the compressor, either directly or indirectly. This helps maintain the compressor crankcase oil level and raises the efficiency of the system by preventing excessive oil circulation.

A higher level of efficiency is to be expected compared to a conventional type oil separator.

Applications

Helical oil separators can be used in a wide variety of applications. Common applications include multi-compressor racks and remote condensing units.

Helical oil separators are intended for Low Pressure Oil Management Systems. These products are designed for use with scroll and reciprocating type compressors. They are not recommended for screw or rotary vane compressors.

The standard product range is designed for use with HCFC, HFC, R290 & A2L gases and their associated oils, compatible with the vessel materials. Note that the S-5411 and S-5414 models are not currently suitable for use with R290 and A2L gases. The SN range is additionally suitable for use with ammonia. The SH high pressure range is intended for use with R410A, sub-critical CO_2 and A2L gases compatible with the vessel materials.

Please contact Henry Technologies for new or special applications.

How it works

Upon separator entry, refrigerant gas containing oil in aerosol form encounters the leading edge of the helical flighting. The gas/oil mixture is centrifugally forced along the spiral path of the helix causing heavier oil particles to spin to the perimeter, where impingement with a screen layer occurs. The screen layer functions as both an oil stripping and draining medium. Separated oil flows downward along the boundary of the shell through a baffle and into an oil collection chamber at the bottom of the separator.

The specially engineered baffle isolates the oil chamber and eliminates oil re-entrapment by preventing turbulence. The virtually oil free refrigerant gas then exits through a second screen fitting just below the lower edge of the helical flighting. A float activated oil return needle valve allows the separated oil to return to the compressor crankcase or oil reservoir. There is a permanent magnet positioned at the bottom of the oil collection chamber to capture any system metal debris, which could impair the operation of the needle valve. With proper selection, an oil separation efficiency of up to 99% can be achieved.

Main Features

- High oil separation efficiency - up to 99%
- Low pressure drop
- No blocked elements because of too much oil in the system
- No oil blow-out at start up from oil left in a coalescing element
- Cleanable/replaceable oil float assemblies for S-5288, SN-52* and S-54* models

Outlet Connection

Helical Flighting

Inlet Connection

Mesh Screen

Second Mesh Screen

Oil Drain Baffle

Ball Float

Oil Return Connection

Needle Valve Assembly

Magnet

Technical Specification

For all models excluding SH series:
Allowable operating pressure = 0 to 31 barg
Allowable operating temperature = -10°C to +130°C

For SH models:
Allowable operating pressure = 0 to 48 barg
Allowable operating temperature = -10°C to +130°C

Materials of Construction

The main components; shell, end caps and connections are made from carbon steel. The oil float is made from stainless steel. The needle valve seat is made from either brass or steel, dependent on model.

STANDARD RANGE

Part No	Conn Size (inch)	Dimensions (mm)							Mounting details	Drawing reference	Weight (kg)	Pre-charge qty (l)	CE Cat
		Ø A	B	C	D	E	F	Ø G					
S-5180	1/4 ODS	64	162	44	43	N/A	17.5	N/A	3/8"	fig.1	1.3	0.11	SEP
S-5181	3/8 ODS	64	191	44	71	N/A	16.5	N/A	3/8"	fig.1	1.4	0.11	SEP
S-5182	1/2 ODS	102	330	70	64	N/A	60	N/A	M10	fig.2	3.6	0.6	Cat II
S-5185	5/8 ODS	102	381	70	64	N/A	60	N/A	M10	fig.2	4.1	0.6	Cat II
S-5187	7/8 ODS	102	433	76	77	N/A	60	N/A	M10	fig.2	4	0.6	Cat II
S-5188	1 1/8 ODS	102	483	76	78	N/A	60	N/A	M10	fig.2	4	0.6	Cat II
S-5190	1 3/8 ODS	152	385	107	91	N/A	60	N/A	M10	fig.2	8.8	1.45	Cat II
S-5192	1 5/8 ODS	152	429	109	97	N/A	60	N/A	M10	fig.2	9	1.45	Cat II
S-5194	2 1/8 ODS	152	437	111	105	N/A	60	N/A	M10	fig.2	9	1.45	Cat III
S-5288	1 1/8 ODS	102	614	76	78	97	N/A	120.7	2 x Ø14mm holes	fig.3	7.4	0.71	Cat II
SN-5290	1 3/8 ODS	152	510	108	92	101	N/A	111	2 x Ø14mm slots	fig.3	10.8	0.71	Cat II
SN-5292	1 5/8 ODS	152	556	108	99	101	N/A	111	2 x Ø14mm slots	fig.3	11.7	0.71	Cat II
SN-5294	2 1/8 ODS	152	566	111	107	101	N/A	111	2 x Ø14mm slots	fig.3	11.9	0.71	Cat II
S-5411-CE	1 5/8 ODS	219	650	148	164	100	N/A	168	3 x Ø14mm slots	fig.4	26	0.7	Cat II
S-5412	2 1/8 ODS	203	650	137	164	102	N/A	162	3 x Ø14mm slots	fig.4	20	0.71	Cat III
S-5413	2 5/8 ODS	256	758	166	202	102	N/A	210	3 x Ø14mm slots	fig.4	30	0.71	Cat III
S-5414-CE	3 1/8 ODS	324	831	215	229	100	N/A	273	3 x Ø14mm slots	fig.4	56	0.7	Cat III

HIGH PRESSURE RANGE

Part No	Conn Size (inch)	Dimensions (mm)							Mounting details	Drawing reference	Weight (kg)	Pre-charge qty (l)	CE Cat
		Ø A	B	C	D	E	F	Ø G					
SH-5182	1/2 ODS	102	352	70	81	N/A	60	N/A	M10	fig.2	5.7	0.6	Cat II
SH-5185/P	5/8 ODS	102	402	70	81	N/A	60	N/A	M10	fig.2	6.5	0.6	Cat II
SH-5187/P	7/8 ODS	102	453	76	94	N/A	60	N/A	M10	fig.2	7.1	0.6	Cat II
SH-5188/P	1 1/8 ODS	102	500	76	93	N/A	60	N/A	M10	fig.2	7.4	0.6	Cat II
SH-5190/P	1 3/8 ODS	152	570	108	135	98	N/A	112	3 x Ø14mm slots	fig.5	14.5	1.45	Cat III
SH-5192	1 5/8 ODS	152	615	108	140	99	N/A	112	3 x Ø14mm slots	fig.5	15	1.45	Cat III
SH-5194	2 1/8 ODS	152	623	111	145	99	N/A	112	3 x Ø14mm slots	fig.5	16	1.45	Cat III

Note: 'P' Models include a 3/8" NPT fitting for PRV. 'P' models are the standard stock models.
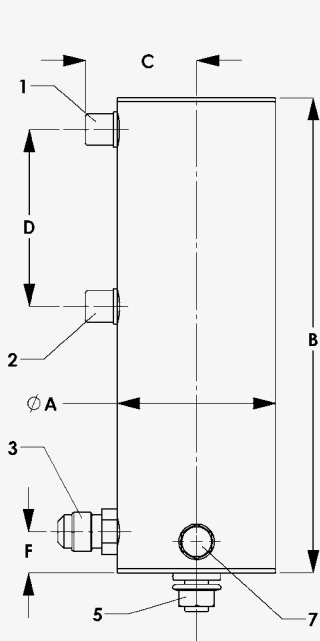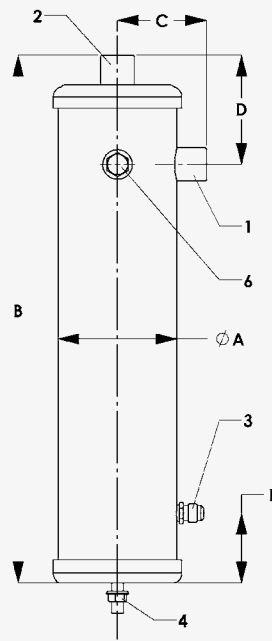
Fig. 1

Fig. 2

1 Inlet

2 Outlet

3 Oil return, 3/8 SAE Flare

4 M10 stud and nut

5 3/8 NPT stud and nut

6 3/8 NPT fitting
('P' models only)

7 1/8 NPT drain port & plug
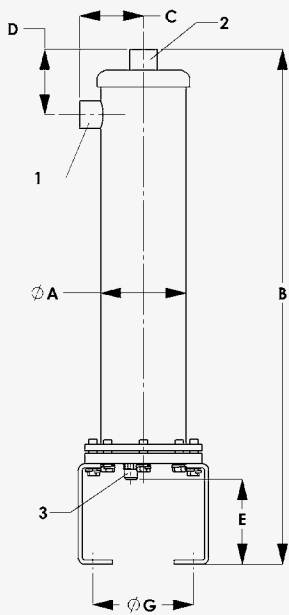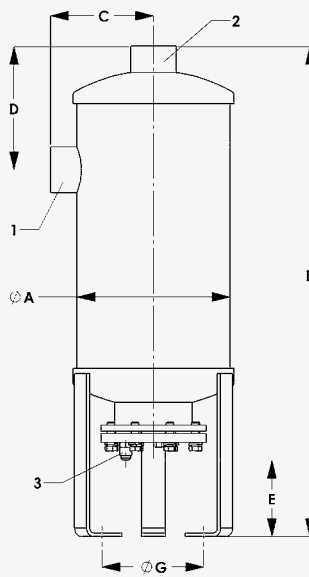(protrudes 19mm from
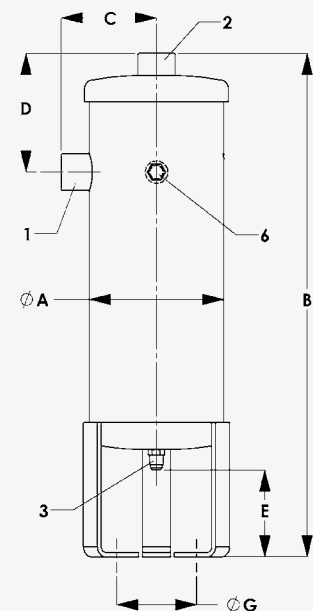side of shell)

Fig. 3

Fig. 4

Fig. 5

Performance data

This table provides a summary of the kW capacity of each separator for fixed evaporating and condensing temperatures. This table can be used as a quick reference guide. However, the Selection Guidelines are recommended for helical separator sizing.

Selection Guidelines

The most important parameter for şelection is the discharge volumetric flow rate, expressed in m³/hr. This is the calculated volume flow rate at entry to the oil separator. It is not to be confused with the compressor displacement or swept volume.

A quick method is to use the selection graphs. These graphs have been compiled for the common refrigerants R404A/R507A, R134a, R407F, R448A/R449A, R450A, R407A and R407C.

Graphs for other refrigerants are available on request.

The graphs are based on a simplified refrigeration cycle and hence the corresponding calculation of discharge volume flow rate is approximate. Although approximate, this method of selection has been used successfully for many years for standard refrigeration systems.

Where a higher degree of accuracy is required to calculate the m³/hr, the flow rate calculation method is recommended. The flow rate calculation method is also recommended for CO_2 cascade and special applications.

HELICAL OIL SEPARATORS

Part No	Capacity in kW of refrigeration at nominal evaporator temperature						Maximum discharge volume (m³/hr)
	R404A/507A		R134a		R407F		
	-40°C	5°C	-40°C	5°C	-40°C	5°C	
S-5180	2.6	3.5	1.8	2.6	3.4	4	1.3
S-5181	3.5	5.3	2.6	3.5	4.5	5.2	1.7
S-5182, SH-5182	5.3	7	3.5	5.3	6.8	8	2.6
S-5185, SH-5185P	14.1	19.4	10.6	14.1	17.8	20.8	6.8
S-5187, SH-5187P	23	30	15.8	19.4	26.7	31.3	10.2
S-5188, S-5288, SH-5188P	29.8	38.7	21.1	26.4	35.6	41.7	13.6
S-5190, SN-5290 & SH-5190P	42.2	52.8	28.2	35.2	49	57.3	18.7
S-5192, SN-5292 & SH-5192	52.8	66.9	38.7	45.8	62.4	72.9	23.8
S-5194, SN-5294, S-5411-CE & SH-5194	84.4	109	63.4	73.8	98	115	37.4
S-5412	109	144	77.4	95	129	151	49.3
S-5413	225	292	162	197	267	312	102
S-5414-CE	352	461	253	310	419	490	159.8

Notes: All data is for a 38°C condensing temperature, 18°C suction temperature and on connection size being the same as the compressor discharge valve

Helical Separator Selection

Using the Graphs

To use the selection graphs, the refrigerant type, maximum refrigeration capacity, minimum refrigeration capacity, evaporating temperature and the condensing temperature is required.

Example

Refrigerant R404A
Maximum refrigeration capacity = 40 kW
Minimum refrigeration capacity = 25 kW
Evaporating temperature = -35˚C
Condensing temperature = +40˚C

From the R404A graph, follow the -35˚C evaporator temperature line to the intersection of the 40˚C condensing temperature line. Extend a line horizontally from this point to the m³/hr/kW factor. Multiply this factor by the maximum and minimum refrigeration capacities to compute the maximum and minimum discharge volume flow rates.

From the R404A graph, the [m³/hr/kW factor] = 0.42

Therefore:
Maximum discharge volume flow rates = (0.42 x 40) = 16.8 m³/hr
Minimum discharge volume flow rates = (0.42 x 25) = 10.5 m³/hr

The maximum and minimum m³/hr figures should be compared with the rated capacity of the helical separator. Refer to the Performance Data Table for the rated capacities.

The general recommendation is that the calculated maximum flow should not exceed the rated capacity of the separator. Also, the minimum flow should not be below 25% of the rated capacity. Using these m³/hr figures, the recommended helical separator selection is either model S-5190 or SN-5290, both with a rated capacity of 18.7 m³/hr. The final selection depends on whether or not the user requires a separator model with a removable/cleanable oil float assembly.

Additional notes on selection:

1. The 25% of minimum rated recommendation capacity rule is to optimise efficiency. Below this load factor, the efficiency of the separator will decrease. On systems with extreme unloading conditions, one separator per compressor should be used rather than one separator for a common discharge line.

2. Understanding the system refrigeration capacity and the percentage of full and low load run times can also be helpful in selecting the separator.

3. In cases where the maximum discharge has been exceeded by only a minimal amount and the system has unloading characteristics, select the smaller separator. It is not recommended to oversize.

Discharge (m³/hr)
Chart-R404A/R507A

m³/hr/kW

Evaporator Temp (°C)

Condensing Temp (°C)

25
30
35
40
45
50
55

Discharge (m³/hr)
Chart-R134a

m³/hr/kW

Evaporator Temp (°C)

Condensing Temp (°C)

25
30
35
40
45
50
65

Discharge (m³/hr)
Chart-R407F

m³/hr/kW

Evaporator Temp (°C)

Condensing Temp (°C)

25
30
35
40
45
50
55

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Discharge (m³/hr)
Chart-R448A/R449A

Condensing Temp (°C)

m³/hr/kW

Evaporator Temp (°C)

Discharge (m³/hr)
Chart-R450A

Condensing Temp (°C)

m³/hr/kW

Evaporator Temp (°C)

Discharge (m³/hr)
Chart-R407A

Condensing Temp (°C)

m³/hr/kW

Evaporator Temp (°C)

Discharge (m³/hr)
Chart-R407C

Discharge (m³/hr)
Chart-R513A

Discharge (m³/hr)
Chart-R32

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