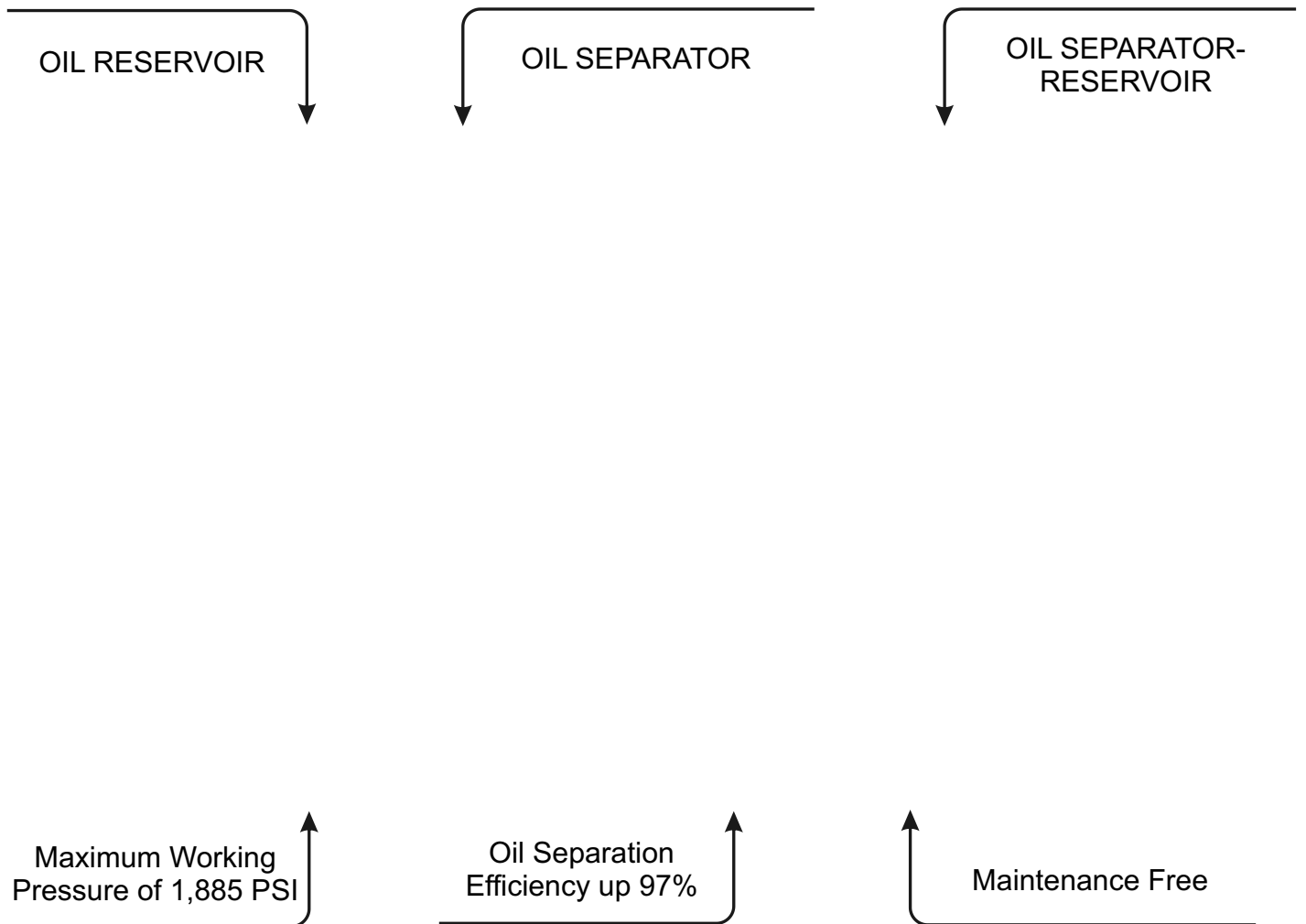




Oil Management Controls



Oil Management Controls

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.

The function of an Oil Reservoir is to provide a holding charge of oil. The amount of oil circulating in a system varies depending on the operating conditions and the oil reservoir caters for these fluctuations by providing additional storage capacity.

Efficiency

To establish the oil separator efficiency when used on transcritical CO₂ applications Henry Technologies commissioned independent testing. The tests showed the resultant oil separator efficiency at capacities of 25% to 103%. Efficiency levels of up to 97% were recorded. The tests utilised a semi-hermetic compressor with a variable speed drive motor to enable the capacity to be adjusted.

There are many factors that affect oil separator efficiency such as; discharge gas temperature and pressure; compressor oil carry-over and the density of the discharge gas and oil. Consequently oil separator efficiency varies on each system.

Main Features

Separator/Separator-Reservoir

- High oil separation efficiency - up to 97%
- Consistent low pressure drop
- No clogging elements due to excessive oil in the system
- No oil blow-out at start up from oil left in a coalescing element
- Maintenance-free
- Oil level sensor port (except STH-5392)

Oil Reservoir

- Two sizes available; 1.59 US gallons and 2.91 US gallons
- Clear sight glasses
- Oil level sensor port



Materials of Construction

The main components; shell, end caps and connections are made from carbon steel.

Technical Specifications

Allowable operating pressure= 0 to 1,885 PSI (130 Bar)

Allowable operating temperature = +32°F to +284°F (0°C to +140°C)

Henry Technologies' Oil Management Components are UL and C-UL Listed by Underwriters Laboratories, Inc.



Oil Separator

Part No	ODS (inch)	Dimensions (inch)								Mounting Details	Fig No	Pre-charge qty (gal)	Weight (lbs)
		ØA	B	C	D	ØE	F	G	H				
STH-5193	1/2NPT	6.63	25.12	7.52	7.95	9.10	7.95	N/A	1.77	3 x 0.55" slots	1	0.16	68.34
STH-5196	3/4 NPT	6.63	27.44	7.52	10.28	9.10	10.28	N/A	1.77	3 x 0.55" slots	1	0.16	68.34
STH-5198	1 NPT	6.63	29.41	7.52	10.28	9.10	10.28	N/A	1.77	3 x 0.55" slots	1	0.16	74.96
STH-5410	1 1/4 NPT	6.63	29.61	7.72	10.28	9.10	10.28	N/A	1.54	3 x 0.55" slots	1	0.16	76.06
STH-5411	1 1/2 NPT	8.63	32.32	8.03	10.28	11.14	10.28	N/A	2.36	3 x 0.55" slots	1	0.16	125.66
STH-5412	2 NPT	8.63	35.47	8.27	10.28	11.14	10.28	N/A	2.17	3 x 0.55" slots	1	0.16	141.10

Oil Separator-Reservoir

Part No	ODS (inch)	Dimensions (inch)								Mounting Details	Fig No	Pre-charge qty (gal)	Weight (lbs)
		ØA	B	C	D	ØE	F	G	H				
STH-5392	1/4 NPT	2.87	27.36	23.82	5.39	N/A	N/A	N/A	N/A	2 x 0.55" slots	2	0.29	13.67
STH-5398	1 NPT	6.63	39.06	7.52	10.28	9.10	10.67	10.43	1.77	3 x 0.55" slots	3	1.77	99.65

*Indicates reservoir capacity

Oil Reservoir

Part No	ODS (inch)	Dimensions (inch)								Mounting Details	Fig No	Pre-charge qty (gal)	Weight (lbs)
		ØA	B	C	D	ØE	F	G	H				
STH-9109	3/8 NPT	6.63	24.53	7.84	9.45	9.10	8.23	4.72	4.72	3 x 0.55" slots	4	1.59	61.73
STH-9108	3/8 NPT	6.63	36.61	7.84	21.54	9.10	8.23	10.59	10.95	3 x 0.55" slots	4	2.91	91.49

*Indicates reservoir capacity

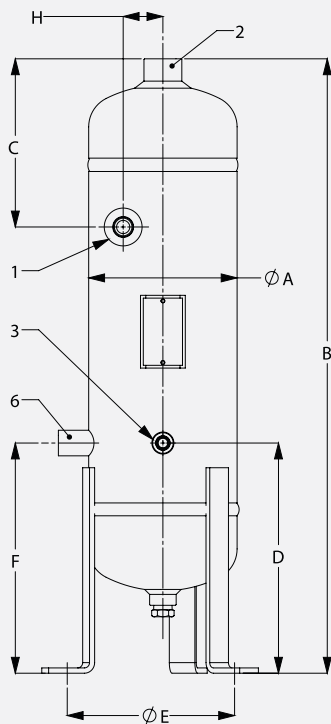


Fig. 1

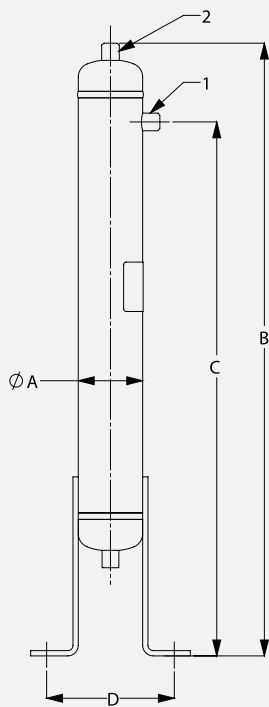


Fig. 2

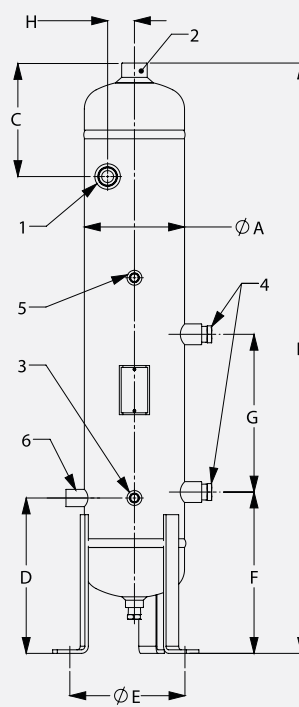


Fig. 3

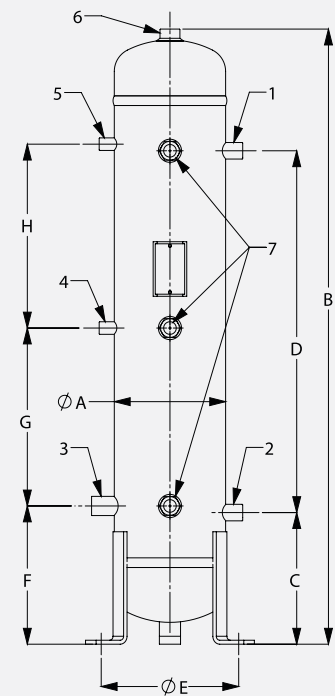


Fig. 4

- ① Inlet
- ② Outlet
- ③ Oil return, 3/8 NPT
- ④ Sight glass
- ⑤ Port, 3/8 NPT
- ⑥ Level control conn, 1/2NPT (except STH-5392)

- ① Inlet
- ② Outlet
- ③ Level control conn, 1/2NPT
- ④ Charging conn, 1/4 NPT
- ⑤ Vent valve conn, 1/4 NPT
- ⑥ Relief valve conn, 1/2NPT
- ⑦ Sight glass (centre sight glass on STH-9108 only)

Performance Data

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

Separator Performance Data

Part No	Capacity in tonnage of refrigeration at nominal evaporator temperature (°F)						Vol discharge (CFM)
	-22	-4	14	32	50	59	
STH-5193	3.98	4.35	4.72	5.09	5.43	5.60	1.53
STH-5196	10.41	11.35	12.34	13.28	14.19	14.62	4.00
STH-5198	15.61	17.03	18.51	19.93	21.30	21.92	6.00
STH-5410	36.40	39.08	43.22	46.35	49.76	51.18	14.00
STH-5411	57.15	62.27	67.96	73.08	77.91	80.47	22.01
STH-5412	75.35	82.18	89.57	96.39	102.93	106.06	29.01

All data is based on 1,305 PSI high pressure, 95°F gas cooler, 46.4°F suction gas superheat and 41°F useful superheat.

Separator-Reservoir Performance Data

Part No	Capacity in tonnage of refrigeration at nominal evaporator temperature (°F)						Vol discharge (CFM)
	-22	-4	14	32	50	59	
STH-5392	2.62	2.84	3.10	3.33	3.55	3.67	1.00
STH-5398	15.61	17.03	18.51	19.93	21.30	21.92	6.00

All data is based on 1,305 PSI high pressure, 95°F gas cooler, 46.4°F suction gas superheat and 41°F useful superheat.

Selection Guidelines

The most important parameter for selection is the discharge volumetric flow rate, expressed in CFM. 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.

To calculate the discharge volumetric flow rate, the maximum and minimum system mass flow rates are required along with the density of the gas at the inlet to the separator.

These mass flow rates can either be calculated from first principles or by using refrigeration cycle analysis software. In this way, superheating (useful and un-useful) can be accounted for in the mass flow rate calculation.

The gas density at inlet to the separator is a function of both pressure and temperature. The inlet gas temperature is dictated by a number of system design factors including compressor performance. The gas will be in a superheated state.

Example:-

Refrigerant CO₂ (R744)

Maximum refrigeration capacity = 11.94 tons

Minimum refrigeration capacity = 7.39 tons

Evaporating temperature = 14°F

Gas cooler outlet = 95°F

High pressure = 1,305 PSI (a)

Suction gas superheat = 9°F

Useful superheat = 9°F

From analysis software:-

Maximum mass flow rate = 2319.26 lbs/hr

Minimum mass flow rate = 1435.21 lbs/hr

Gas density, superheated, at inlet to separator = 10.11lb/ft³

Note: Mass flow rate = [(Tons of refrigeration/ refrigerating effect) x 3600]

Use the equation:-

$$\text{Discharge volume flow rate} = \frac{\text{Mass flow rate}}{\text{Gas density}}$$

Hence for this example:-

$$\text{Calculated maximum discharge volume flow rate} = \frac{2319.26}{10.11} = 229.4 \text{ ft}^3/\text{hr}$$

$$\text{Calculated minimum discharge volume flow rate} = \frac{1435.21}{10.11} = 141.96 \text{ ft}^3/\text{hr}$$

Using these ft³/hr figures, the recommended helical separator selection is model STH-5196 (reference additional note 3 for guidance on minimal under-sizing).

Additional notes on selection:-

1. It is recommended that the separator is not operated below 25% of its rated maximum capacity. This is to optimise efficiency. 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.

Installation – Notes

1. Oil separators are not 100% efficient, so installing an oil separator should not be viewed as a replacement for oil traps, suction line accumulators or good oil return piping practices.
2. An initial oil pre-charge of 1.59 US gallons is required.
3. Install the oil separator/separator-reservoir vertically and reasonably close to the compressor. Proper piping practice should be adopted to prevent excessive loads or vibration at the inlet and outlet connections. The separator/separator-reservoir must be properly supported at the bottom mounting feet interface.
4. A check valve should be located downstream of the separator/separator-reservoir outlet connection. This check valve is to prevent liquid refrigerant migrating from the condenser/gas cooler.