

OIL SEPARATORS





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APPLICATIONS

The oil separators, shown in this chapter, are classified “Pressure vessels” in the sense of the Pressure Equipment Directive 97/23/EC, Article 1, Section 2.1.1 and are subject of Article 3, Section 1.1 of the same Directive.

They are designed for installation on commercial refrigerating systems and on civil and industrial conditioning plants, which use refrigerant fluids proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

The advantages of the oil separator on the discharge line of a compressor in a refrigeration system are confirmed by many years of experience. The oil separator intercepts the oil mixed with compressed gas and returns it to the crankcase of the compressor thus assuring an efficient lubrication of its moving parts. Furthermore, the oil separator maintains a high coefficient of condenser and evaporator performance by almost completely removing oil deposits from their exchange surfaces. When a very high temperature at the end of the compression stage leads to the formation of oil vapours, a separator with a capacity exceeding the values shown in the table should be used. Moreover, the oil separator, damping the valves pulsations, reduces system noise with an open or semi-hermetic compressor.

Finally, the use of an oil separator leads to:

- a longer life of the compressor;
- a better performance of the whole system with consequent energy saving;
- a quieter operation by reducing pulsations.

Table 1 and 2 show the technical data relating to the working conditions of oil separators.

CONSTRUCTION

Castel manufactures two types of oil separators:

- separators series 5520 can be overhauled for maintenance and can be replaced from the system. They are equipped with threaded connections, which can mate to the connections type 5590 (to be ordered separately)

- separators series 5540 are closed type and they cannot be dismantled from the system, except cutting the piping. The body is manufactured from steel pipe of adequate thickness. Flanges and cover are also made of steel. Either threaded connections of separators series 5520 or solder connections of separators series 5540 are manufactured, machining, with steel bar EN 10277-3 11S Mn Pb 37 + C.

The internal device is simple in order to assure a trouble-free long operation. Appropriate metallic screens, placed on the inlet and outlet, rapidly reduce gas speed, and create the conditions required for the separation of the oil from the refrigerant. A float operated needle valve, set on the bottom of the vessel, return the oil to the crankcase of compressor. The bottom also includes a chamber that collects all metallic debris. A permanent magnet holds these impurities to avoid they stop or damage the operation of needle, moved by floating.



SELECTING THE SIZE OF AN OIL SEPARATOR

The selecting of an oil separator should be done comparing the characteristics of the installed compressor, establishing:

- inlet connection must agree with the discharge diameter of the compressor
- refrigerant flow capacity with fixed working conditions (saturated discharge temperature saturated suction temperature, eventually liquid subcooling, sucked vapour overheating).

This is necessary to define the gas speed referred to the cross section of oil separator, assigned an end compression temperature. It is advisable the above-mentioned speed doesn't exceed 0,5 m/s, to avoid great swirl phenomena.

Table 2 has being written following this principle.

Generally, fixed the following data: refrigerating capacity of compressor, type of refrigerant and working conditions, the volumetric capacity Q, of compressed gas, is given by:

$$Q = \frac{P}{\Delta H} \times v_g \quad [m^3/s] \quad \text{with:}$$

- P = refrigerant flow capacity kW]
- ΔH = heat content differential, see diagram (fig. 1). [kJ/kg]
- v_g = specific volume of compressed gas, separator inlet (fig. 1). [m³/kg].

Check of gas speed, referred to the cross section of oil separator, is given by:

$$v = \frac{Q}{S} \quad [m/s] \quad \text{with:}$$

- S = gross cross section of shell separator [m²]

INSTALLATION

The oil separators type 5520 and 5540 should be installed in the discharge line between the compressor and the condenser mounted securely in a vertical position and reasonably close to the compressor.

To prevent the return of refrigerant from condenser, during the off cycle of the system, it's advisable to install a check valve between the condenser and oil separator outlet connection.

Oil separator performs best when operating at or near the compressor discharge temperature. In location the oil separator, choose a position to avoid, as far as possible, chilling of the shell, which may result in condensing of liquid within the separator. If this is not possible, it is advisable to supply the separator with the better solutions (insulation, strap heater, others) to prevent the refrigerant in the system from condensing in the shell.

Before the oil separator is installed, either one 5520 or one 5540, an initial charge of oil should be added to it. Refer to general characteristics of oil separators or to instruction sheet for the proper amount of oil. Oil pre-charge is very important, failure to pre-charge separator sump may result in damage to the oil return float mechanism. Use the same type of oil that is in the compressor crankcase.

Acting as the lay out of refrigerating system, the return line may be run from the oil fitting to:

- the compressor crankcase;
- the suction line upstream the compressor or upstream the receiver, if present;
- the oil reservoir if oil control system is being used.

A sight glass may be installed in the oil line, in a position that oil is flowing through the tube, to check the correct working of the oil separator.

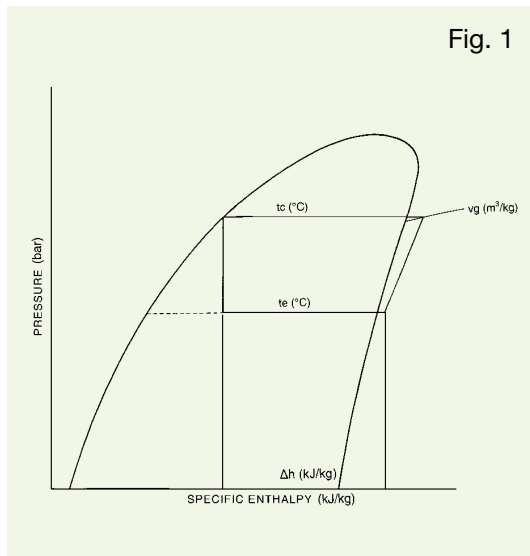
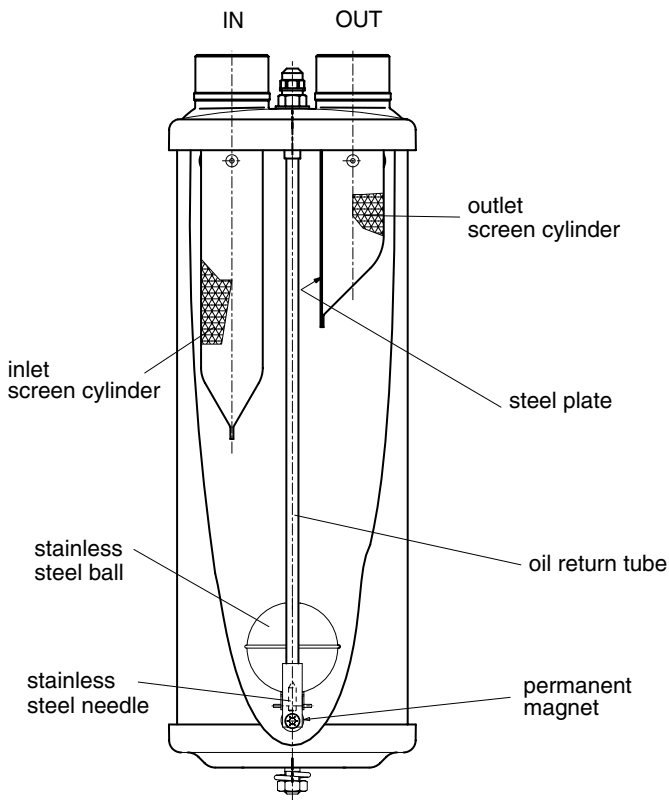
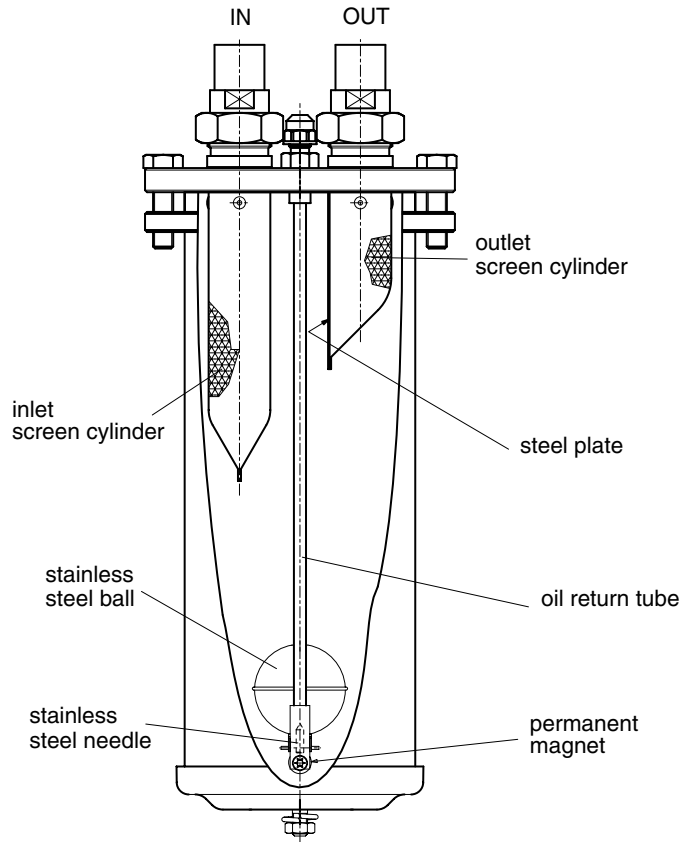


Fig. 1



5540



5520

TABLE 1: General Characteristics

Catalogue Number	Solder Connections				Couple of solder connections IN / OUT			Oil connection [SAE Flare]	Oil addition [kg]	Max. differential pressure [bar]	TS [°C]		PS [bar]	Risk Category according to PED		
	ODS		ODM		Catalogue Number	ODS (1)					min.	max.				
	Ø [in.]	Ø [mm]	Ø [in.]	Ø [mm]		Ø [in.]	Ø [mm]									
5540/4	1/2"	-	5/8"	16	-	-	-	1/4"	0,4 / 0,5	21	- 10	+ 130	32	I		
5540/5	5/8"	16	3/4"	-												
5540/7	7/8"	-	1"	-												
5540/9	1.1/8"	-	1.3/8"	35												
5540/11	1.3/8"	35	1.5/8"	-												
5540/13	1.5/8"	-	-	-												
5540/M42	-	42	-	-												
5540/17	2.1/8"	54	-	-	5590/5	5/8"	16	1/4"	0,4 / 0,5	21	- 10	+ 130	32	II		
5520/C	-	-	-	5590/7											7/8"	-
5520/D	-	-	-	5590/9											1.1/8"	-
				5590/11											1.3/8"	35
5520/E	-	-	-	5590/13											1.5/8"	-
				5590/M42	-	42										

(1) The dimensions of the separator's connections must agree with the discharge diameter of the compressor

TABLE 2: Dimensions and Weights												
Catalogue Number		Soder Connections		Dimensions [mm]						Weight [g]		
Separator	Connections	ODS		Ø D ₁	Ø D ₂	H ₁	H ₂	H ₃	H ₄			
		Ø [in.]	Ø [mm]									
5540/4	-	1/2"	-	123,0	-	17,5	-	-	280,0	4175		
5540/5		5/8"	16						367,0	4910		
5540/7		7/8"	-						5030			
5540/9		1.1/8"	-						5835			
5540/11		1.3/8"	35						5845			
5540/13		1.5/8"	-						471,0	9350		
5540/M42		-	42						481,0	9550		
5540/17		2.1/8"	54						481,0	9550		
5520/C	5590/5	5/8"	16	123,0	154,0	17,5	-	-	339,0	61,0	400,0	6865
	5590/7	7/8"	-						394,0	67,0	461,0	7935
5520/D	5590/9	1.1/8"	-	123,0	154,0	17,5	-	-	394,0	67,0	461,0	7935
	5590/11	1.3/8"	35						92,0	486,0	7675	
5520/E	5590/13	1.5/8"	-	123,0	154,0	17,5	-	-	394,0	92,0	486,0	7675
	5590/M42	-	42						486,0	7675		

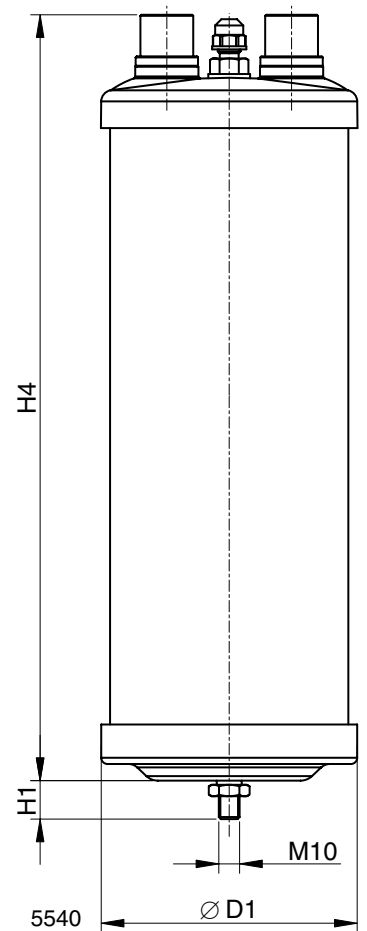
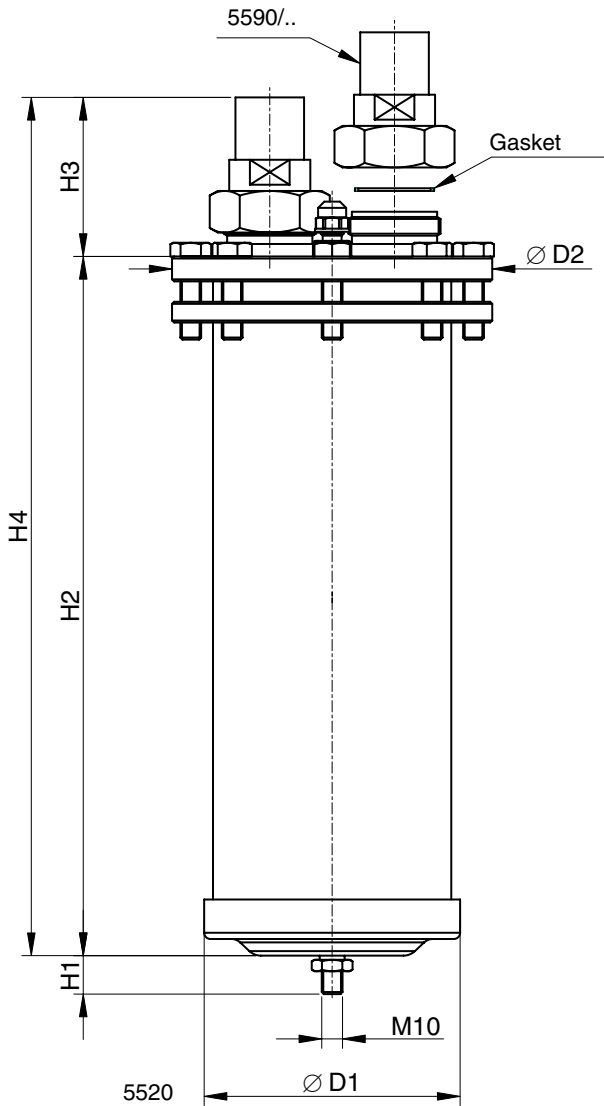




TABLE 3: Refrigerant Flow Capacity									
Catalogue Number	Catalogue Number of solder connections	Refrigerant Capacity (1) [kW]							
		R134a		R22		R404A		R407C	
		Evaporating Temperature [°C]							
		-20	+5	-20	+5	-20	+5	-20	+5
5540/4		5,3	6,1	6,4	7,9	6,4	8,8	6,0	8,0
5540/5		16,4	18,9	19,7	24,5	19,9	27,3	18,6	24,6
5540/7		18,6	21,3	22,2	27,7	22,5	30,8	21,0	27,8
5540/9		21,2	24,3	25,4	31,5	25,7	35,2	24,6	31,8
5540/11		23,9	27,4	28,6	35,6	28,9	39,6	27,0	35,8
5540/13		33,1	38,0	39,6	49,3	40,1	54,9	37,6	49,6
5540/M42									
5540/17		42,5	48,8	50,9	63,4	51,5	70,6	48,3	63,7
5520/C	5590/5	16,4	18,9	19,7	24,5	19,9	27,3	18,6	24,6
	5590/7	18,6	21,3	22,2	27,7	22,5	30,8	21,0	27,8
5520/D	5590/9	21,2	24,3	25,4	31,5	25,7	35,2	24,6	31,8
	5590/11	23,9	27,4	28,6	35,6	28,9	39,6	27,0	35,8
5520/E	5590/13	26,5	30,4	31,8	39,5	32,1	44,0	30,0	40,0
	5590/M42								

(1) Refrigerant flow capacity with a condensing temperature of + 40°C and normal overheating values of vapour sucked by compressor. No liquid subcooling.

Maximum pressure drop of 0,15 bar