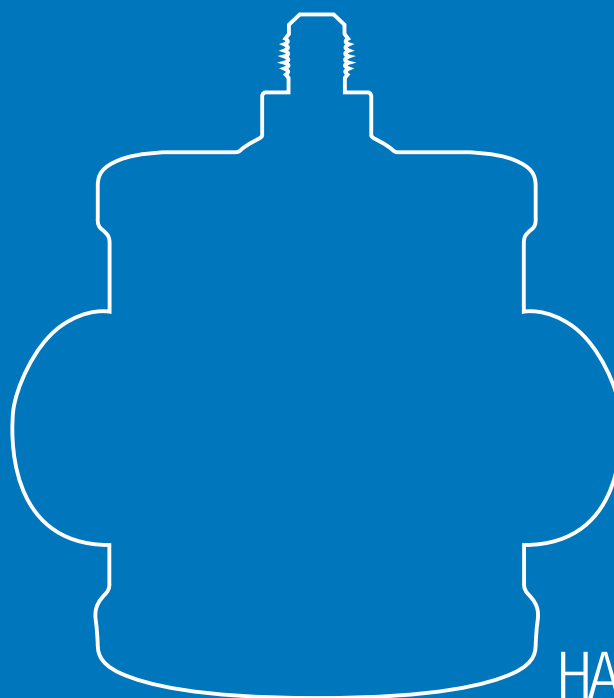




HANDBOOK
OIL CONTROL SYSTEM



APPLICATIONS

The oil separators, shown in this handbook, are classified "Pressure vessels" in the sense of the Pressure Equipment Directive 94/23/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 the following refrigerant fluids: R22, R134a, R404A, R407C, R410A; R507 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). For specific applications with refrigerant fluids not listed above, always proper to the Group II, please contact Castel Technical Department.

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 oil reservoir or directly to the compressor crankcase 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.

Tables 1 and 3 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, returns 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 0,4 m/s, to avoid great swirl phenomena.

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:

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

with:

P = refrigerant flow capacity [kW]

ΔH = heat content differential, see diagram (fig. 1) [kJ/kg]

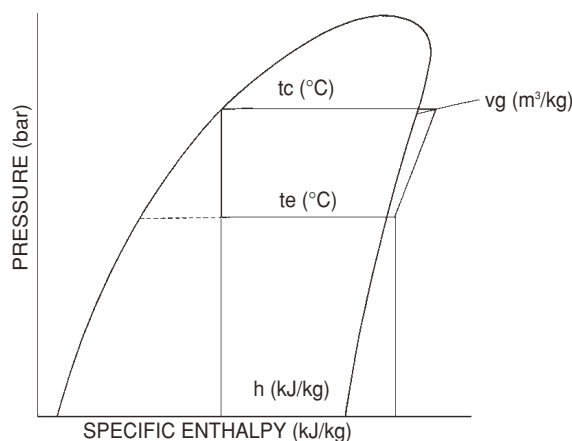
v_g = specific volume of compressed gas, separator inlet (fig. 1). [m³/kg]

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

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

with:

S = gross cross section of shell separator [m²]



■ Fig. 1

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.

TABLE 1: General Characteristics of Oil Separators

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]	Volume [l]	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	30	- 10	+ 130	45	2,40	I
5540/5	5/8"	16	3/4"	—										3,03	
5540/7	7/8"	—	1"	—										3,52	
5540/9	1.1/8"	—	1.3/8"	35											
5540/11	1.3/8"	35	1.5/8"	—				3/8"	0,6 / 0,7	21			32	7,00	II
5540/13	1.5/8"	—	—	—											
5540/M42	—	42	—	—											
5540/17	2.1/8"	54	—	—											
5520/C	—				5590/5	5/8"	16	1/4"	0,4 / 0,5	30			45	2,95	I
					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 of Oil Separators

Catalogue Number		Solder 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	—	17,5	—	—	280	4200
5540/5		5/8"	16						367	4960
5540/7		7/8"	—							5030
5540/9		1.1/8"	—						428	5835
5540/11		1.3/8"	35	5800						
5540/13		1.5/8"	—	471					10000	
5540/M42		—	42							
5540/17		2.1/8"	54	481					10460	
5520/C	5590/5	5/8"	16	121	149	17,5	336	61	397	6980
	5590/7	7/8"	—							
5520/D	5590/9	1.1/8"	—				391	67	458	7760
	5590/11	1.3/8"	35							
5520/E	5590/13	1.5/8"	—					92	483	7680
	5590/M42	—	42							

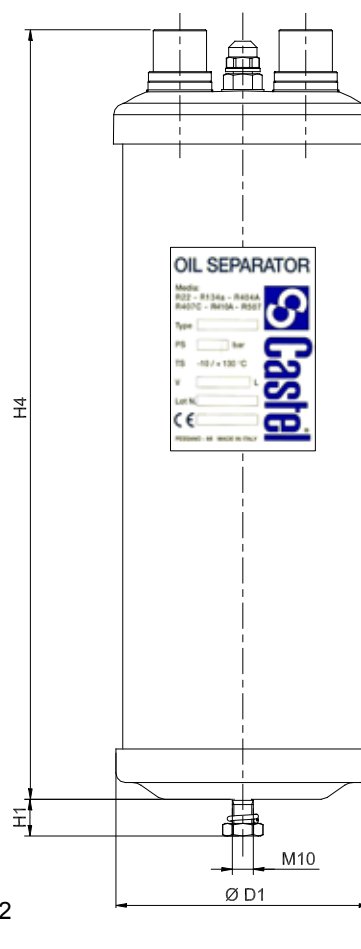
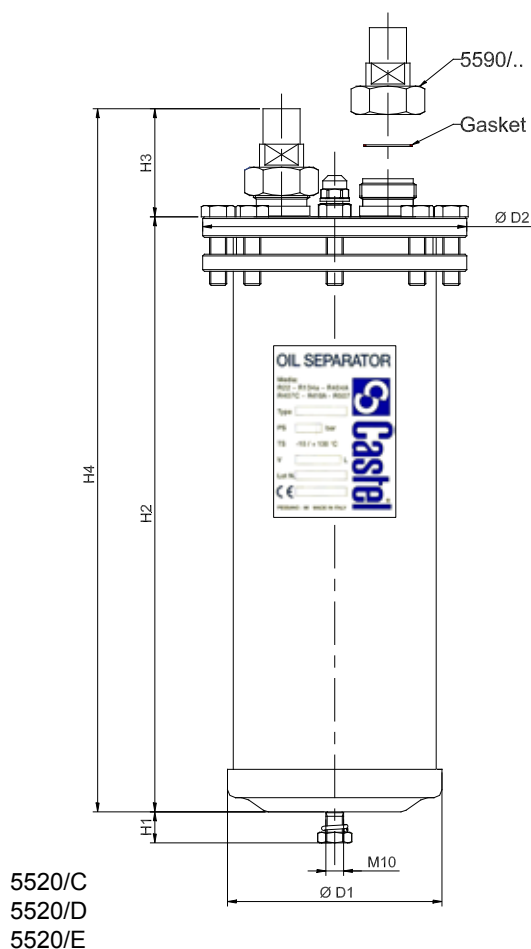


TABLE 3: Refrigerant Flow Capacity (1) [kW]							
Catalogue Number	Catalogue Number of solder connections	R134a					
		Condensing temperature [°C]					
		+40			+50		
		Evaporating temperature [°C]			Evaporating temperature [°C]		
		-20	-10	+5	-20	-10	+5
5540/4	—	5,4	5,7	6,3	6,2	6,7	7,3
5540/5		10,7	11,5	12,6	12,4	13,3	14,7
5540/7		13,4	14,4	15,7	15,5	16,6	18,4
5540/9		16,1	17,2	18,8	18,6	20,0	22,0
5540/11		18,8	20,1	22,0	21,7	23,3	15,7
5540/13		30,6	32,7	35,8	35,3	37,9	41,9
5540/M42		38,3	40,9	44,8	44,1	47,4	52,4
5540/17							
5520/C	5590/5	10,7	11,5	12,6	12,4	13,3	14,7
	5590/7	13,4	14,4	15,7	15,5	16,6	18,4
5520/D	5590/9	16,1	17,2	18,8	18,6	20,0	22,0
	5590/11	18,8	20,1	22,0	21,7	23,3	15,7
5520/E	5590/13	21,5	23,0	25,1	24,7	26,6	29,4
	5590/M42						

TABLE 3: Refrigerant Flow Capacity (1) [kW]											
Catalogue Number	Catalogue Number of solder connections	R22									
		Condensing temperature [°C]									
		+40					+50				
		Evaporating temperature [°C]					Evaporating temperature [°C]				
		-40	-30	-20	-10	+5	-40	-30	-20	-10	+5
5540/4	—	6,0	6,5	7,0	7,5	8,2	6,7	7,3	7,9	8,5	9,3
5540/5		12,0	13,0	13,9	14,9	16,4	13,4	14,6	15,8	16,9	18,6
5540/7		15,0	16,2	17,4	18,6	20,5	16,8	18,2	19,7	21,2	23,3
5540/9		18,0	19,5	20,9	22,4	14,6	20,2	21,9	23,7	25,4	28,0
5540/11		21,0	22,7	24,4	26,1	28,7	23,5	25,5	27,6	29,6	32,6
5540/13		34,2	37,0	39,7	42,5	46,8	38,3	41,6	45,0	48,3	53,1
5540/M42		42,8	46,2	49,6	53,1	58,5	47,9	52,0	56,2	60,4	66,4
5540/17											
5520/C	5590/5	12,0	13,0	13,9	14,9	16,4	13,4	14,6	15,8	16,9	18,6
	5590/7	15,0	16,2	17,4	18,6	20,5	16,8	18,2	19,7	21,2	23,3
5520/D	5590/9	18,0	19,5	20,9	22,4	14,6	20,2	21,9	23,7	25,4	28,0
	5590/11	21,0	22,7	24,4	26,1	28,7	23,5	25,5	27,6	29,6	32,6
5520/E	5590/13	24,0	25,9	27,9	29,8	32,8	26,9	29,2	31,5	33,9	37,3
	5590/M42										

(1): Refrigerant flow capacity with overheating values of vapour sucked by compressor of 10 °C. No liquid subcooling.

Maximum pressure drop of 0,15 bar

Be continued

TABLE 3: Refrigerant Flow Capacity (1) [kW]

Catalogue Number	Catalogue Number of solder connections	R404A									
		Condensing temperature [°C]									
		+40					+50				
		Evaporating temperature [°C]					Evaporating temperature [°C]				
		-40	-30	-20	-10	+5	-40	-30	-20	-10	+5
5540/4	—	6,6	7,2	7,9	8,5	9,4	6,8	7,6	8,3	9,1	10,2
5540/5		13,2	14,5	15,8	17,1	18,8	13,6	15,1	16,7	18,2	20,4
5540/7		16,5	18,1	19,7	21,3	23,5	17,0	18,9	20,8	22,8	25,5
5540/9		19,8	21,7	23,7	25,6	28,2	20,3	22,7	25,0	27,3	30,6
5540/11		23,1	25,3	27,6	29,9	32,9	23,7	26,5	29,1	31,9	35,7
5540/13		37,6	41,2	45,0	18,6	53,6	38,7	43,1	47,5	52,0	58,2
5540/M42		47,0	51,5	56,3	60,8	67,0	48,3	53,9	59,4	65,0	72,7
5520/C	5590/5	13,2	14,5	15,8	17,1	18,8	13,6	15,1	16,7	18,2	20,4
	5590/7	16,5	18,1	19,7	21,3	23,5	17,0	18,9	20,8	22,8	25,5
5520/D	5590/9	19,8	21,7	23,7	25,6	28,2	20,3	22,7	25,0	27,3	30,6
	5590/11	23,1	25,3	27,6	29,9	32,9	23,7	26,5	29,1	31,9	35,7
5520/E	5590/13	26,4	28,9	31,6	34,1	37,6	27,1	30,3	33,3	36,5	40,8
	5590/M42										

TABLE 3: Refrigerant Flow Capacity (1) [kW]

Catalogue Number	Catalogue Number of solder connections	R407C									
		Condensing temperature [°C]									
		+40					+50				
		Evaporating temperature [°C]					Evaporating temperature [°C]				
		-40	-30	-20	-10	+5	-40	-30	-20	-10	+5
5540/4	—	7,0	7,6	8,2	8,8	9,7	7,6	8,4	9,1	9,8	10,9
5540/5		14,0	15,2	16,4	17,6	19,4	15,3	16,7	18,2	19,6	21,8
5540/7		17,5	19,0	20,5	22,0	24,3	19,1	20,9	22,7	24,5	27,3
5540/9		21,0	22,8	24,6	26,4	29,1	22,9	25,1	27,3	29,4	32,7
5540/11		24,4	26,6	28,7	30,8	34,0	26,7	29,3	31,8	34,3	38,2
5540/13		39,8	43,4	46,8	50,2	55,3	43,5	47,7	51,8	55,9	62,2
5540/M42		49,8	54,2	58,5	62,7	69,1	54,4	59,7	64,8	69,9	77,7
5520/C	5590/5	14,0	15,2	16,4	17,6	19,4	15,3	16,7	18,2	19,6	21,8
	5590/7	17,5	19,0	20,5	22,0	24,3	19,1	20,9	22,7	24,5	27,3
5520/D	5590/9	21,0	22,8	24,6	26,4	29,1	22,9	25,1	27,3	29,4	32,7
	5590/11	24,4	26,6	28,7	30,8	34,0	26,7	29,3	31,8	34,3	38,2
5520/E	5590/13	27,9	30,4	32,8	35,2	38,8	30,5	33,5	36,4	39,2	43,6
	5590/M42										

(1): Refrigerant flow capacity with overheating values of vapour sucked by compressor of 10 °C. No liquid subcooling.

Maximum pressure drop of 0,15 bar

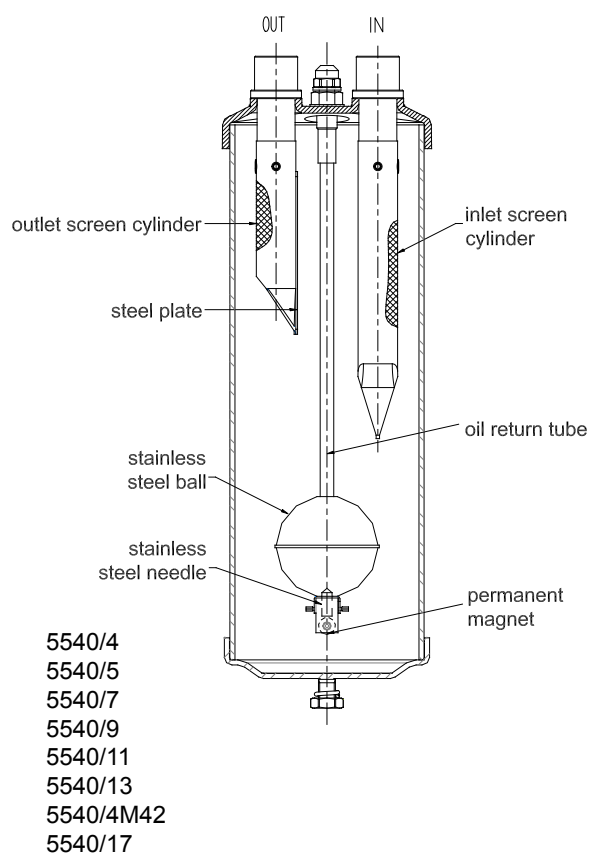
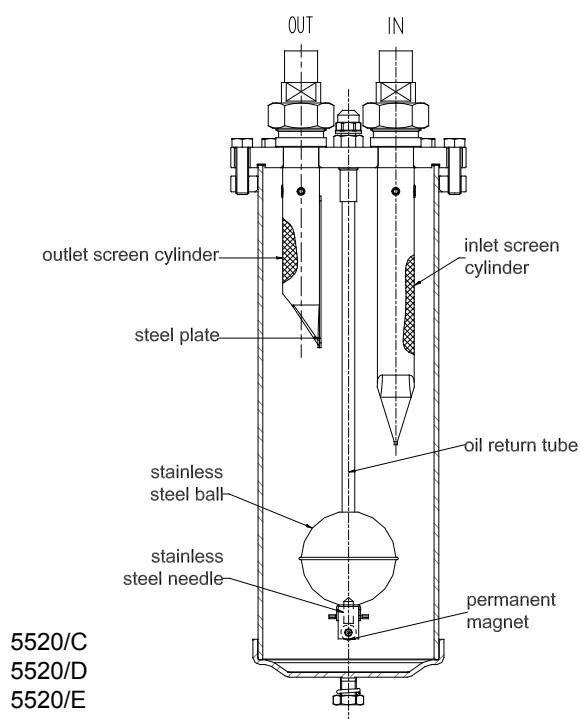
Be continued

TABLE 3: Refrigerant Flow Capacity (1) [kW]

Catalogue Number	Catalogue Number of solder connections	R410A					
		Condensing temperature [°C]					
		+40			+50		
		Evaporating temperature [°C]			Evaporating temperature [°C]		
		-20	-10	+5	-20	-10	+5
5540/4	—	10,1	10,9	12,0	11,0	11,8	13,2
5540/5		20,2	21,7	23,9	22,0	23,6	26,4
5540/7		25,3	27,1	29,9	27,5	29,5	32,9
5540/9		30,3	32,6	35,9	33,0	35,4	39,5
5540/11		35,4	38,0	41,9	38,5	41,3	46,1
5540/13		-	-	-	-	-	-
5540/M42		-	-	-	-	-	-
5540/17		-	-	-	-	-	-
5520/C	5590/5	20,2	21,7	23,9	22,0	23,6	26,4
	5590/7	25,3	27,1	29,9	27,5	29,5	32,9
5520/D	5590/9	30,3	32,6	35,9	33,0	35,4	39,5
	5590/11	35,4	38,0	41,9	38,5	41,3	46,1
5520/E	5590/13	40,4	43,4	47,9	4,0	47,2	52,7
	5590/M42						

(1): Refrigerant flow capacity with overheating values of vapour sucked by compressor of 10 °C. No liquid subcooling.

Maximum pressure drop of 0,15 bar



www.castel.it



ed. 001-C0-ENG

Castel Srl
Via Provinciale 2-4 - 20060 Pessano con Bornago - MI