



REFRIGERATING SYSTEMS AND DEHYDRATION OF REFRIGERANTS

Among contaminating agents causing serious damages to refrigerating systems moisture plays a major role. This is due to many factors: inadequate or insufficiently prolonged vacuum before refrigerant charging, oil used for topping up remained exposed to air humidity, refrigerant used for subsequent additions contained in non dried vessels, sealing defects especially in systems not designed for operation at low temperatures, etc.

High temperatures combined with humidity give rise to complex phenomena enhancing acid formation both in lubricating oil and refrigerant.

Oil organic acids react with metal and favour the formation of sludge, which are viscous clots consisting of insoluble metal salts and large molecules of polymerised oil.

Sludge affects the lubrication of the moving elements of the compressor, can clog valves and filters and cause serious damages.

Acids, especially hydrofluoric acid, produced by the

hydrolysis of the fluorinated refrigerant (in compressors iron and aluminium act as catalysts) are particularly corrosive.

Acids etch metal surfaces with the consequent formation of crystal salts which stick to surfaces and affect the total heat exchange coefficient in the condenser and in the evaporator.

In the sealed and semi-sealed groups, these salts damage the windings of electric motors as in these groups cold gas cools windings through direct contact.

On the other hand, water solubility in fluorinated refrigerants (such as DuPont's "Freon") in a liquid phase is quite reduced, especially at low temperatures.

For instance, in the case of R12 it reaches 118 p.p.m. (0.118 g/kg) at + 30 °C, and drops to 7 p.p.m. at -20°C (fig. 1).

As a consequence, when in the system water exceeds the very low limits of solubility admitted at low temperature, excess water turns into ice, and blocks expansion valves and capillaries

either partially or totally.

Consequently, refrigerating plants must be equipped with a filter drier on the liquid line.

As it is extremely difficult to precisely quantify the amount of water in an operating refrigerating system, ARI STANDARDS provide effective help in selecting the adequate filter.

These standards are based on a + 25 °C temperature:

– moisture in the refrigerant entering the filter:

550	p.p.m.	for	R 12
990	p.p.m.	for	R 22
990	p.p.m.	for	R 502

– moisture in the refrigerant flowing out of the filter:

15	p.p.m.	for	R 12
60	p.p.m.	for	R 22
30	p.p.m.	for	R 502

As at low temperature water solubility in R12 is much lower than in R22, refrigerating systems using R12 require greater dehydration than systems using R22.

The above initial moisture values refer to systems which were accurately cleaned and dried during assembly.

Castel supplies two types of dehydrators: molecular sieve and solid core dehydrators.

In filter driers (molecular sieves) with a charge constituted by non agglomerated products, the dehydrating mass is pressed in between two fine steel mesh disks kept in place by a spring.

°C	R12	R22	R502
-40	1,7	120	40
-30	3,5	186	65
-20	7	280	104
-10	14	423	160
0	26	603	239
+10	45	830	339
+20	74	1120	472
+30	118	1480	649
+40	178	1900	860

Fig. 1 - Water solubility in liquid refrigerants in p.p.m. in weight.

In fact, the granules must neither be stirred by the flowing refrigerant nor be submitted to mutual abrasion (fig. 2).

In case of abrasion, a rather fine powder is produced which cannot be blocked by filters. Furthermore, due to its siliceous characteristics, the powder may damage compressor valves, pistons and cylinders.

Filters with this type of charges should never be mounted horizontally as granules tend to accumulate in the lower section, and might leave part of the flow area uncovered with the consequent formation of a sort of refrigerant by-pass.

The refrigerant should flow through the filter drier from top to bottom for two reasons.

The first relates to partially filled filter driers (molecular sieves). These must not become liquid receiver and interfere with the good operation of the system especially in the case of a reduced refrigerant charge and of a large size filter drier.

The second reason is that dehydrating granules tend to jump and stir if the refrigerant flows from bottom to top. Even if the charge is kept pressed by means of a spring, the fluid flow should complete the action of the spring and not be in contrast with it.

In solid core dehydrators, the block is constituted by dehydrating and deacidifying

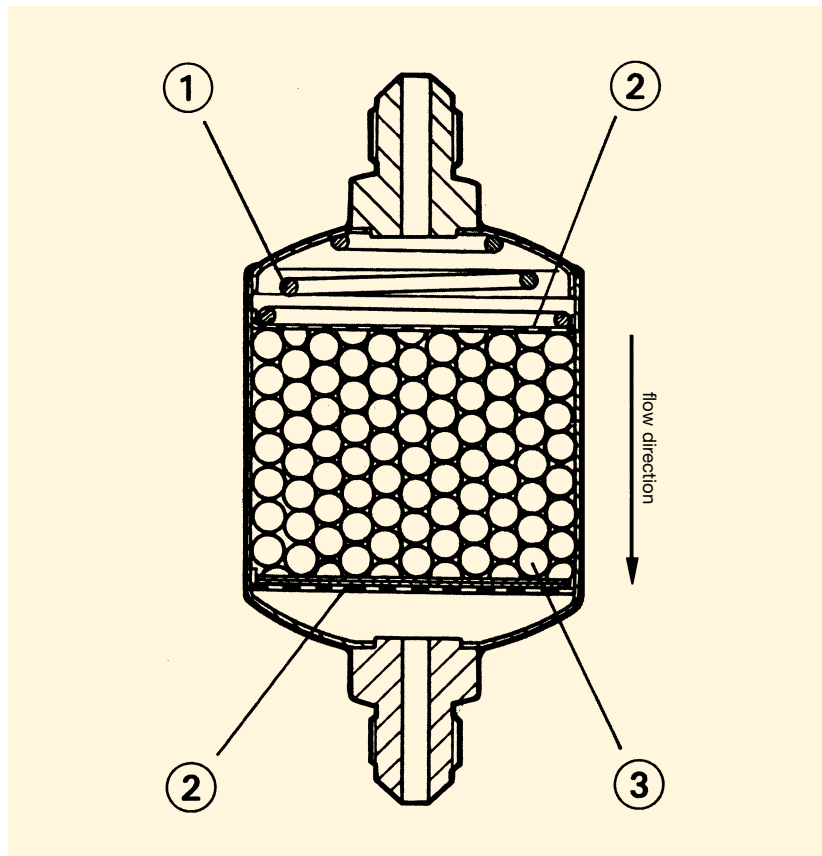


Fig. 2 - Molecular sieve dehydrator
1 - Spring
2 - Stainless steel mesh
3 - Dehydrating charge

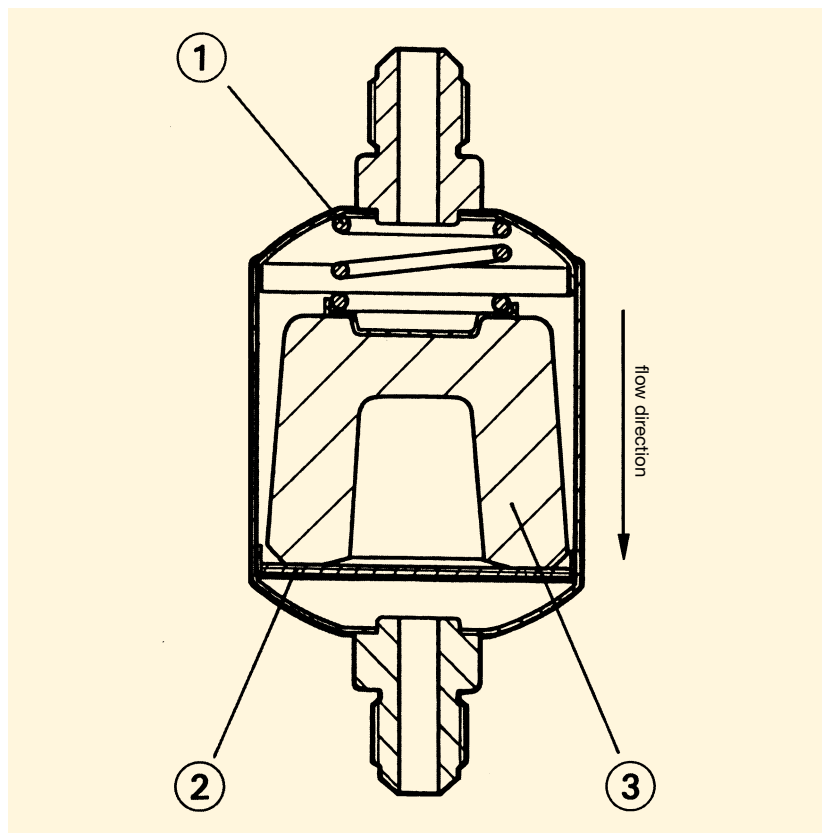


Fig. 3 - Solid core dehydrator
1 - Spring
2 - Stainless steel mesh
3 - Block



products with binders (fig. 3). Water adsorption combines with the neutralisation of acids that may be present in the refrigerant, and with a strong filtering action.

As there is no risk of abrasion, the position of the solid core dehydrator is not a problem.

It is always advisable to install a moisture indicator after the filter, which will show the refrigerant moisture and, consequently, the degree of efficiency of the filter (fig. 4).

The dehydrating capacity of Castel drier is relative to the charge of refrigerant and not to the refrigeration potential of the plant.

As a matter of fact, for the same refrigerant potential and for the same type of refrigerant fluid, there can be different refrigerant charges according to the type, design and working conditions of the plant as well as to the shutter degree.

The data shown in the following tables are deduced from the test results of the present Castel production.

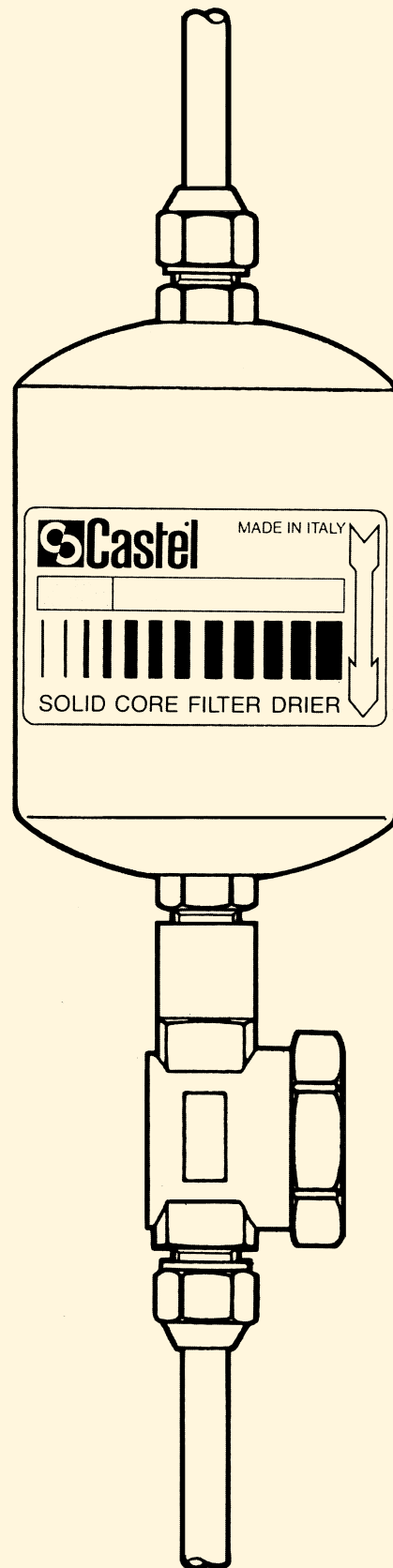
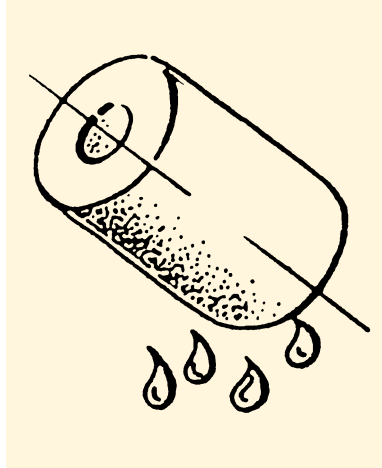


Fig. 4
Direct connection between a filter drier and a moisture-liquid indicator

DEHYDRATION AND OIL QUANTITY

It is important to note in the case of a high oil level in the circuit (> 5%) the data shown in the tables will be reduced considerably.



Important!

If there is no information about residual moisture according to ARI STANDARD, Castel suggests, taking into consideration that water is dissolvable in R134a, according

to official diagrams published by the producers of such fluids (fig. 5), to comply with the values mentioned in the catalogue for R22, and to use the data mentioned in the table relative to R502 also for R404A.

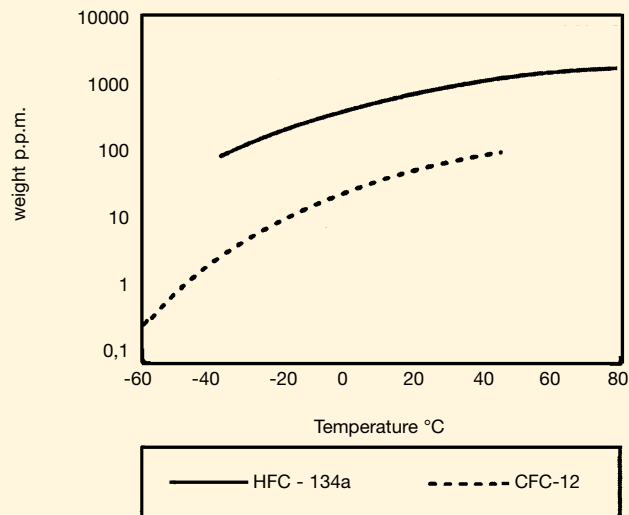


Fig. 5
Solubility of water in the refrigerant (from DuPont's bulletin ER 9).



MOLECULAR SIEVE FILTER DRIERS – MSD

APPLICATIONS

Molecular sieve filter driers – MSD are specially suitable for use with refrigerant fluids CFC, HCFC and HFC.

Maximum working pressure:
28 [bar].

Temperature of the refrigerant:

- min: - 40 °C;
- MAX: + 80 °C.

CONSTRUCTION

The filter is completely manufactured in steel, with nickel plated connections. The filter charge is not replaceable.



EXAMPLE

Choice of a drier

System data:

Refrigerant: R22

Condensing temperature: + 50 [°C]

Weight of refrigerant: 34 [kg]

According to ARI STANDARDS, the adsorption capacity of the drier is given by:

$$(990 - 60) \times 34 / 1,000 = 31.69 \text{ g of H}_2\text{O}$$

being the weight of the refrigerant = 34 kg;
therefore, drier mod. 4032 should be selected
with an adsorption capacity of 47.5 g H₂O at +

50 °C (see Table 1: Adsorption Capacity at + 50 °C).

If the dehydrating capacity of products is expressed in water drops, it must be remembered that:

$$1\text{g H}_2\text{O} = 20 \text{ water drops}$$

In this case and when a molecular sieve drier is selected, the following result is obtained:

$$31,7 \times 20 = 634 \text{ water drops.}$$

If moisture exceeds the values specified in ARI STANDARDS, a drier with a higher adsorption capacity shall be selected.

TABLE 1 - Adsorption Capacity - Weight of Dehydratable Refrigerant																	
Catalogue Number	Nominal Volume	Connections SAE flare	Refrigeration capacity with a pressure drop of 0,14 bar (1) [kW]			Water adsorption capacity at +25°C [g]			Weight of dehydratable refrigerant at +25°C [kg]			Water adsorption capacity at +50°C [g]			Weight of dehydratable refrigerant at +50°C [kg]		
	[cm³]		R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A
4003/2	50	1/4"	5,2	5,7	3,8	4,43	4,43	4,30	4,7	4,7	4,5	4	4	3,9	4,2	4,2	4,1
4003/3		3/8"	19,9	21,7	14,4												
4005/2	80	1/4"	5,4	5,9	3,9	8,5	8,5	8,4	9	9	8,6	7,7	7,7	7,5	8,1	8,1	7,9
4005/3		3/8"	20,3	22,2	14,6												
4008/2	130	1/4"	5,5	6,1	4,0	15,2	15,2	14,6	16,1	16,1	15,4	13,8	13,8	13,3	14,5	14,5	14,1
4008/3		3/8"	20,9	22,7	15,0												
4008/4		1/2"	27,3	29,5	19,6												
4016/2	250	1/4"	5,8	6,2	4,2	28,8	28,8	28	30,8	30,8	29,3	26,3	26,3	25,5	28	28	27,1
4016/3		3/8"	21,5	23,3	15,4												
4016/4		1/2"	32,2	35,0	23,3												
4016/5		5/8"	43,3	47,2	31,3												
4032/4	500	1/2"	34,3	37,3	24,7	52,2	52,2	50,7	55,6	55,6	53	47,5	47,5	46,1	50,1	50,1	48,8
4032/5		5/8"	46,2	46,7	33,3												
4041/4	670	1/2"	34,8	37,9	25,2	80,5	80,5	78,2	85,8	85,8	81,6	73,2	73,2	71,3	77,4	77,4	75,3
4041/5		5/8"	47,4	51,6	34,2												
4041/6		3/4"	67,9	72,9	48,5												

(1) Maximum values of refrigerating capacity at which the drier can be used when fluid dehydration is not a major problem, provided that the original moisture before the installation of the filter is limited. A total 0,14 bar pressure drop (inlet and outlet connections included) corresponds to such maximum capacity (ARI STANDARD 710 - 86, capacity corresponding to a 0,14 bar pressure drop, with condensation at +30°C and evaporation at -15°C).

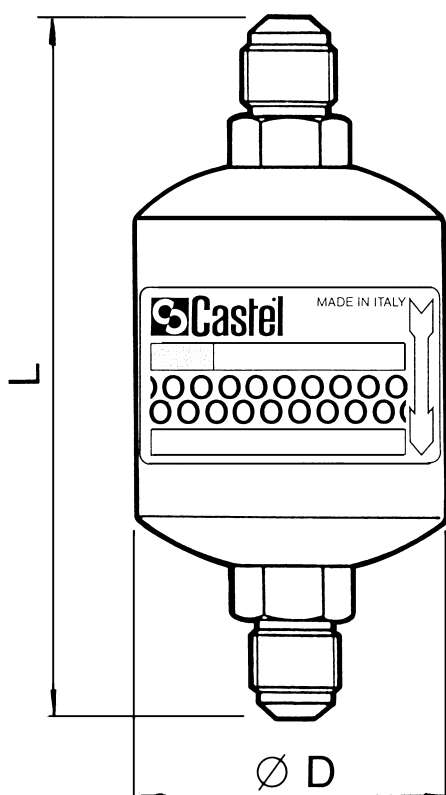


TABLE 2 - Dimensions and Weights				
Catalogue Number	Connections SAE flare	Dimensions [mm]		Weight [g]
		Ø D	L	
4003/2	1/4"	52	99	250
4003/3	3/8"		113	275
4005/2	1/4"	52	115	300
4005/3	3/8"		129	320
4008/2	1/4"	52	142	390
4008/3	3/8"		156	415
4008/4	1/2"		162	450
4016/2	1/4"	73	154	700
4016/3	3/8"		168	720
4016/4	1/2"		174	755
4016/5	5/8"	91	183	865
4032/4	1/2"		185	1415
4032/5	5/8"		195	1460
4041/4	1/2"	91	222	1645
4041/5	5/8"		231	1710
4041/6	3/4"		233	1775



ANTI-ACID SOLID CORE FILTER DRIERS

Approved by Underwriters Laboratories Inc. 

APPLICATIONS

The anti-acid solid core filter driers are designed for use with refrigerant fluids CFC, HCFC and HFC.

Maximum working pressure: 28 [bar].

Temperature of the refrigerant:

- min: - 40 °C;
- MAX: + 80 °C.

CONSTRUCTION

The filter is completely manufactured in steel either with copper plated connections, in the case of solder connection, or nickel plated connections, in the case of threaded connections. The production range includes types with solder connections offering the possibility to solder the copper pipe inside the connection (ODF) or outside the connection, using a copper sleeve (ODM). The solid core of Castel filters, not replaceable, is formed by a block moulded from adequately proportioned granules of dehydrating materials and special binders. As a result, the block is compact and highly resistant to shocks and abrasion.

The shape of the block is designed in order to offer the maximum possible surface area to the incoming fluid. The internal cavity is also positioned in such a way as to have a uniform wall thickness. As a result, the fluid encounters



a constant strength at all points, flows linearly through the block, and ensures efficient dehydration and minimum charge loss.

The block is chemically inert, not deliquescent, does not

react with refrigerating fluids, and is capable of blocking oil by-products dragged into the circuit. Impurities accumulate in the ring between the metal shell and the block, this prevents filter clogging.

TABLE 1 - Adsorption Capacity - Weight of Dehydratable Refrigerant																							
Catalogue. Number		Block filtering surface [cm²]	Nominal volume [cm³]	Connections				Refrigeration capacity with a pressure drop of 0,14 bar (1) [kW]			Water adsorption capacity at + 25° C [g]			Weight of dehydratable refrigerant at +25°C [kg]			Water adsorption capacity at +50°C [g]			Weight of dehydratable refrigerant at +50°C [kg]			
SAE flare	Solder			SAE flare	Solder Ø				R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A
					[mm]	[in.]	ODF	ODM															
4303/2		47	50	1/4"	-	-	-	-				1,7	1,7	1,6	1,82	1,82	1,77	1,38	1,38	1,34	1,52	1,52	1,48
4303/2F(2)				1/4"	-	-	-	-															
	4303/2S			-	-	-	1/4"	3/8"	8,3	13,7	9,6												
4303/3				3/8"	-	-	-	-	12,6	13,7	9,0												
4305/2				1/4"	-	-	-	-	4,8	5,2	3,4												
	4305/2S			-	-	-	1/4"	3/8"	8,8	9,0	6,0												
4305/3		70	80	3/8"	-	-	-	-	12,6	13,7	9,0	2,7	2,7	2,6	2,9	2,9	2,8	2,25	2,25	2,18	2,47	2,47	2,4
	4305/3S			-	-	-	3/8"	1/2"	18,9	20,5	13,5												
	4305/M10S			-	10	12	-	-															
4308/2				1/4"	-	-	-	-	4,8	5,2	3,4												
	4308/2S			-	-	-	1/4"	3/8"	8,3	9,0	6,0												
4308/3				3/8"	-	-	-	-	12,6	13,7	9,6												
4308/3F(2)				3/8"	-	-	-	-															
	4308/3S	103	130	-	-	-	3/8"	1/2"	25,3	27,5	18,0	4,52	4,52	4,38	4,97	4,97	4,8	3,77	3,77	3,65	4,15	4,15	4
	4308/M10S			-	10	12	-	-															
	4308/M12S			-	12	14	-	-															
4308/4				1/2"	-	-	-	-															
	4308/4S			-	-	16	1/2"	5/8"															
4316/2				1/4"	-	-	-	-	4,8	5,2	3,4												
4316/3				3/8"	-	-	-	-	13,4	14,6	9,7												
	4316/3S			-	-	-	3/8"	1/2"	19,8	21,5	14,2												
	4316/M10S			-	10	12	-	-															
	4316/M12S	155	250	-	12	14	-	-				8,11	8,11	7,85	8,92	8,92	8,63	6,76	6,76	6,55	7,43	7,43	7,2
4316/4				1/2"	-	-	-	-	33,2	36,1	23,7												
	4316/4S			-	-	16	1/2"	5/8"															
4316/5				5/8"	-	-	-	-	42,0	45,6	30,1												
	4316/5S			-	16	-	5/8"	3/4"															
4332/4				1/2"	-	-	-	-	33,2	36,1	24,0												
	4332/4S	255	500	-	-	16	1/2"	5/8"	38,0	41,3	27,5	15,7	15,7	15,2	17,2	17,2	16,7	13	13	12,7	14,4	14,4	13,9
4332/5				5/8"	-	-	-	-	45,1	49,0	32,7												
	4332/5S			-	16	-	5/8"	3/4"	48,2	52,4	34,9												
4341/5				5/8"	-	-	-	-	46,8	50,0	33,0												
	4341/5S			-	16	-	5/8"	3/4"	49,0	53,9	36,3												
4341/6		330	670	3/4"	-	-	-	-	57,0	62,0	41,3	21,4	21,4	20,7	23,5	23,5	22,7	17,8	17,8	17,2	19,6	19,6	19
	4341/6S			-	-	-	3/4"	7/8"															
	4341/7S			-	-	-	7/8"	1.1/8"	61,6	67,0	44,4												

(1) Maximum values of refrigerating capacity at which the drier can be used when fluid dehydration is not a major problem, provided that the original moisture before the installation of the filter is limited. A total 0,14 bar pressure drop (inlet and outlet connections included) corresponds to such maximum capacity (ARI STANDARD 710 - 86, capacity corresponding to a 0,14 bar pressure drop, with condensation at + 30 °C and evaporation at -15°C).

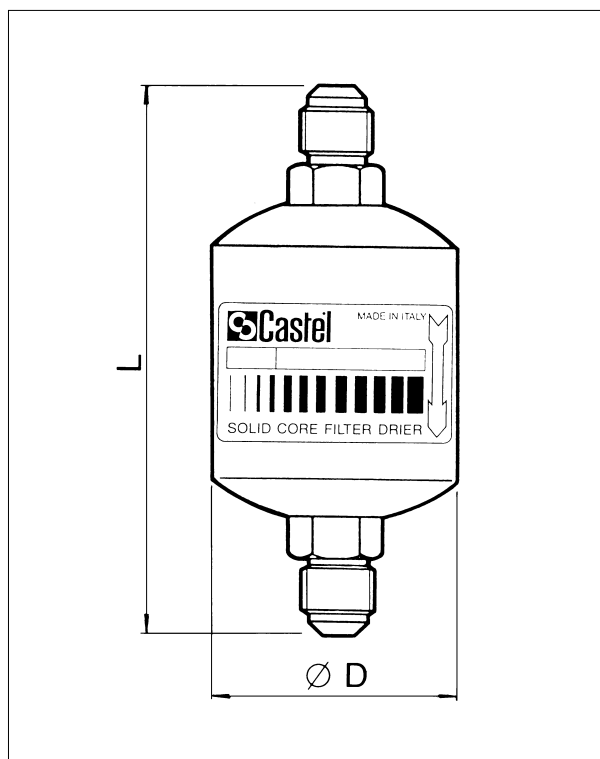
(2) Male - female connections (female - in)



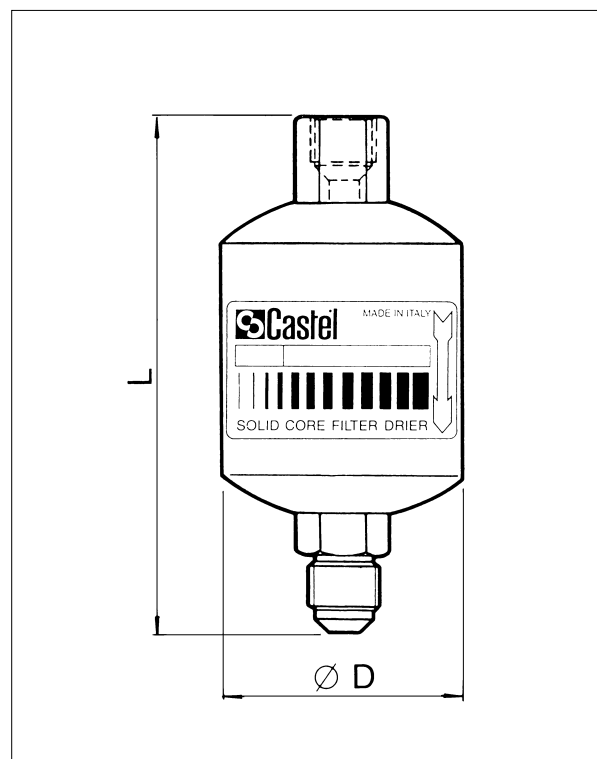
TABLE 2 - Dimensions and Weights

TABLE 2 - Dimensions and Weights											
Catalogue Number		Block filtering surface [cm²]	Nominal volume [cm³]	Connections					Dimensions [mm]		Weight [g]
SAE flare	Solder Ø			SAE flare	Solder Ø				ØD	L	
					[mm]	[in.]					
4303/2		47	50	1/4"	–	–	–	–	52	103	230
4303/2F(1)				1/4"	–	–	–	–		92	230
	4303/2S			–	–	–	1/4"	3/8"		93	215
4303/3				3/8"	–	–	–	–		113	245
4305/2		70	80	1/4"	–	–	–	–	52	119	275
	4305/2S			–	–	–	1/4"	3/8"		109	260
4305/3				3/8"	–	–	–	–		129	260
	4305/3S			–	–	–	3/8"	1/2"		111	215
	4305/M10S			–	10	12	–	–		111	215
4308/2		103	130	1/4"	–	–	–	–	52	146	360
	4308/2S			–	–	–	1/4"	3/8"		136	345
4308/3				3/8"	–	–	–	–		156	380
4308/3F(1)				3/8"	–	–	–	–		143	390
	4308/3S			–	–	–	3/8"	1/2"		138	340
	4308/M10S			–	10	12	–	–		138	330
	4308/M12S			–	12	14	–	–		140	340
4308/4				1/2"	–	–	–	–		162	405
	4308/4S	–	–	16	1/2"	5/8"	149	330			
4316/2		155	250	1/4"	–	–	–	–	73	158	635
4316/3				3/8"	–	–	–	–		168	660
	4316/3S			–	–	–	3/8"	1/2"		150	620
	4316/M10S			–	10	12	–	–		150	630
	4316/M12S			–	12	14	–	–		152	640
4316/4				1/2"	–	–	–	–		174	680
	4316/4S			–	–	16	1/2"	5/8"		160	640
4316/5				5/8"	–	–	–	–		183	760
	4316/5S	–	16	–	5/8"	3/4"	168	660			
4332/4		255	500	1/2"	–	–	–	–	91	185	1265
	4332/4S			–	–	16	1/2"	5/8"		172	1145
4332/5				5/8"	–	–	–	–		195	1335
	4332/5S			–	16	–	5/8"	3/4"		180	1150
4341/5		330	670	5/8"	–	–	–	–	91	231	1620
	4341/5S			–	16	–	5/8"	3/4"		216	1470
4341/6				3/4"	–	–	–	–		233	1680
	4341/6S			–	–	–	3/4"	7/8"		218	1345
	4341/7S			–	–	–	7/8"	1.1/8"		218	1400

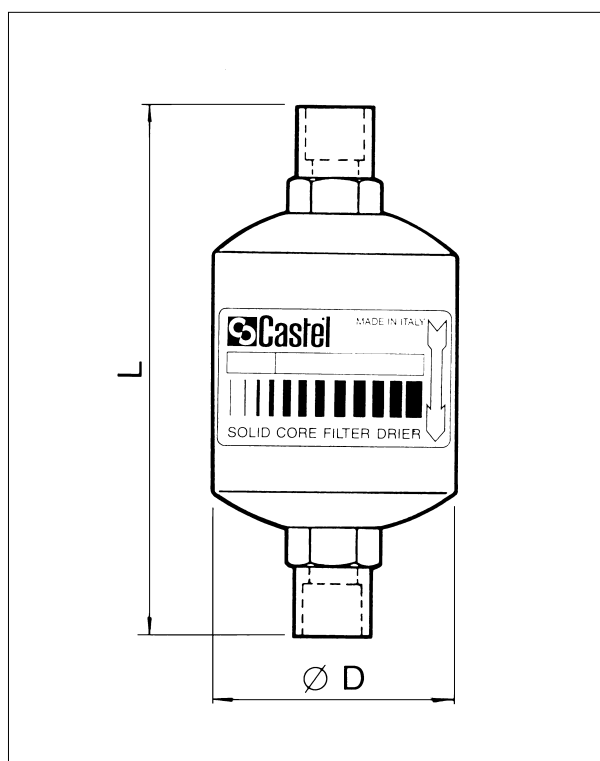
(1) Male - female connections (female - in)



Male connections



Male-Female connections (female-in)



Solder connections



FILTER DRIERS WITH REPLACEABLE ANTI-ACID SOLID CORE

Approved by Underwriters Laboratories Inc.



Except filters 4423/17A - /21A - /25A e 4424/25A - /33A

APPLICATIONS

Filter driers with replaceable anti-acid solid core are designed for use with refrigerant fluids CFC, HCFC and HFC.

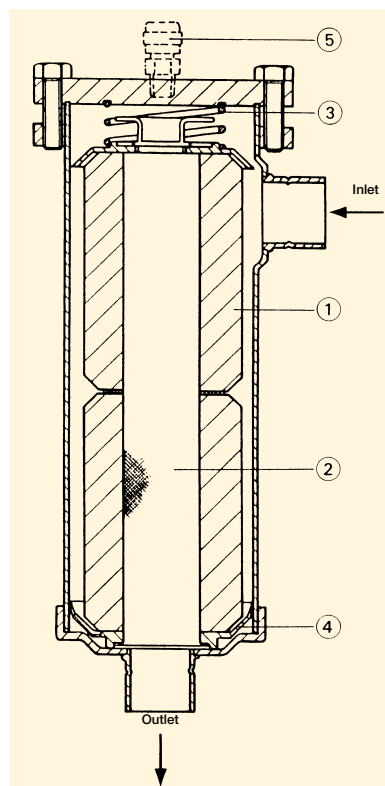
Maximum working pressure: 32 [bar].

Temperature of the refrigerant:

- min: - 40 °C;
- MAX: + 80 °C.

OPERATION

In the case of filters with more than one block, the passage of the fluid takes place in parallel; as a result, the pressure drop does not increase proportionately to the number of blocks. A large ring between the block and the inner surface of the filter permits the



accumulation of solid particles, and prevents clogging. Before leaving the filter, the refrigerant fluid must pass through the mesh sieve on which blocks are mounted. The danger that small particles of dehydrating material being introduced into the system is thus avoided. Furthermore, at filter outlet, a plastic cup, the edge of which

closely adheres to the inner surface of the filter, prevents dirt from reaching the outlet connection during normal operation and block change.

CONSTRUCTION

The filters type 4410 are manufactured in steel, with the exception of the connections

Sketch of filter with 2 blocks

- Fig. 1**
- 1 - Block
 - 2 - Mesh sieve serving as block support
 - 3 - Spring
 - 4 - Retainer cup
 - 5 - Access fitting 1/4" SAE flare (to order separately)

which are made of copper in order to facilitate soldering to pipes. On the contrary, the filters type 4420 are completely manufactured in steel.

The 4490/A – 4490/B – 4491/A block is chemically inert, is not deliquescent and is capable of blocking oil by products dragged into the system.

The block is moulded from a blend of granules of dehydrating materials and a special binding agent in appropriate proportions.

As a result, the block is compact and highly resistant to shocks and abrasion. The block

4490/A – 4490/B has a volume of 48 cu.in. (equivalent to approx. 800 cm³), the block 4491/A has a volume of 96 cu.in. (equivalent to approx. 1600 cm³).

These are shaped as a hollow cylinder and their overall dimensions correspond to those of other international brands.

Consequently they are interchangeable.

The hollow cylinder shape offers a large surface area to the inflowing fluid, which crosses the block radially.

As a result, dehydration is

highly efficient with a minimum loss of charge. Filters may be supplied also with a charge connection kit (G9150/R05) to be ordered separately.

TABLE 1 - Adsorption Capacity - Weight of Dehydratable Refrigerant

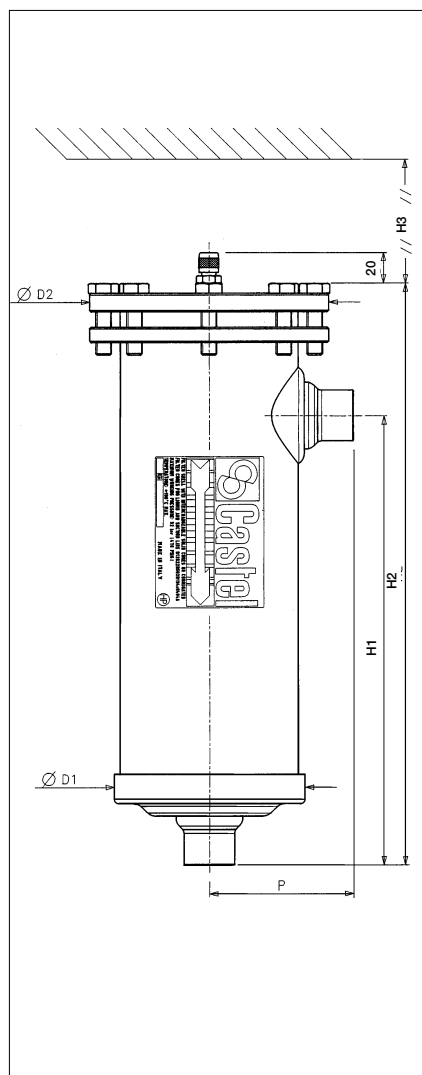
TABLE 1 - Adsorption Capacity - Weight of Dehydratable Refrigerant																						
Catalogue Number	Blocks N.	Nominal capacity		Connections solder			Block filtering surface	Refrigeration capacity with a pressure drop of 0,14 bar (1) [kW]			Water adsorption capacity at + 25° C [g]			Weight of dehydratable refrigerant at +25°C [kg]			Water adsorption capacity at +50°C [g]			Weight of dehydratable refrigerant at +50°C [kg]		
		[cu.in.]	[cm³]	ODS Ø		W Ø		R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A	R134a	R22	R404A
				[in]	[mm]																	
4411/5A				5/8"	16			58	63	41												
4411/7A				7/8"	22			76	83	54												
4411/9A				1.1/8"	-			83	90	60												
4411/11A	1	48	800	1.3/8"	35		420	92	100	66	31,2	31,2	30,2	34,3	34,3	33,2	26	26	25,2	28,6	28,6	27,7
4411/13A				1.5/8"	-																	
4411/M42A				-	42			98	107	71												
4411/17A				2.1/8"	54																	
4412/7A				7/8"	22			121	132	87												
4412/9A	2	96	1600	1.1/8"	-		840	158	172	113	62,4	62,4	60,5	68,6	68,6	66,4	52	52	50,4	57,2	57,2	56
4412/11A				1.3/8"	35			178	194	127												
4413/11A				1.3/8"	35			230	250	165												
4413/13A	3	144	2400	1.5/8"	-		1260	262	285	188	93,6	93,6	90,6	103	103	100	78	78	75,6	86	86	89
4413/M42A				-	42																	
4414/13A				1.5/8"	-																	
4414/M42A	4	192	3200	-	42		1680	322	350	234	125	125	121	137	137	133	104	104	101	114,4	114,4	111
4414/17A				2.1/8"	54																	
4423/17A				2.1/8"	54	60,3		607	661	401												
4423/21A	3	300	4800	2.5/8"	-	76,1	1890	813	885	537	187	187	182	206	206	199	156	156	151	172	172	168
4423/25A				3.1/8"	-	88,9		1159	1262	765												
4424/25A				3.1/8"	-	88,9		1240	1350	818												
4424/33A	4	400	6400	4.1/8"	-	114,3	2520	2039	2221	1347	250	250	242	275	275	266	208	208	202	230	230	224

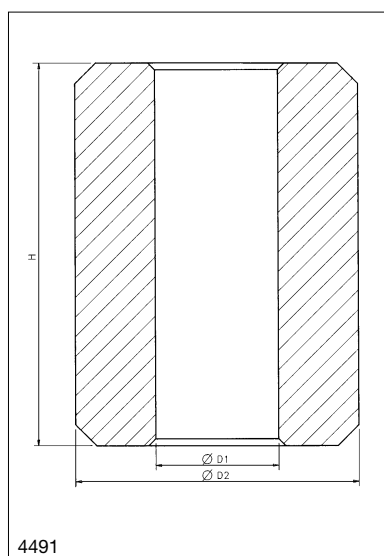
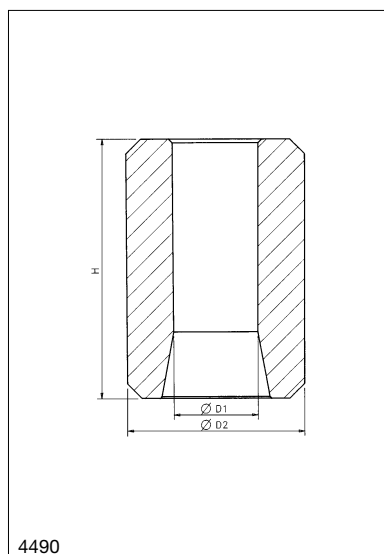
(1) Maximum values of refrigerating capacity at which the drier can be used when fluid dehydration is not a major problem, provided that the original moisture before the installation of the filter is limited. A total 0.14 bar pressure drop (inlet and outlet connections included) corresponds to such maximum capacity (ARI STANDARD 710 – 86, capacity corresponding to a 0.14 bar pressure drop, with condensation at + 30 °C and evaporation at - 15 °C).



TABLE 2 - Dimensions and Weights

Catalogue Number	Dimensions [mm]						Weight [g]
	ØD ₁	ØD ₂	H ₁	H ₂	H ₃	P	
4411/5A			144	231		88	5360
4411/7A			149	236		93	5405
4411/9A			149	236		93	5395
4411/11A			154	241	185	98	5465
4411/13A			159	246		103	5435
4411/M42A			159	246		103	5410
4411/17A			169	256		113	5585
4412/7A	123	154	290	377		93	6880
4412/9A			290	377		93	6880
4412/11A			295	382		98	7015
4413/11A			435	524		98	8510
4413/13A			440	529	324	103	8470
4413/M42A			440	529		103	8445
4414/13A			582	670		103	9940
4414/M42A			582	670		103	10010
4414/17A			592	680		113	10110
4423/17A			520	641		143	18000
4423/21A			520	641	600	143	18200
4423/25A	163	200	525	646		148	18400
4424/25A			693	814	760	148	21600
4424/33A			693	814		148	22000





BLOCKS REPLACEMENT

Blocks must be ordered separately from the filter. They are supplied in individual packages which are hermetically sealed in suitable wrappings (type 4490), and in special bags (type 4491)

TABLE 3 - Block type 4490/A - 4490/B - 4491/A							
Catalogue Number	Nominal volume		Filtering surface [cm ²]	Dimensions [mm]			Weight [g]
	[cu.in.]	[cm ³]		ØD ₁	ØD ₂	H	
4490/A	48	800	420	47	96	140	825
4490/B ⁽¹⁾							
4491/A	96	1600	630	53	122	165	1250

(1) Supplied without the replacement gasket for the cover of the drier.

for safe storage over long periods of time.

If the filter has no by-pass, the operation can be done by:

- 1 closing the departing line of the liquid receiver;
- 2 starting the compressor and its auxiliaries in order to transfer the refrigerant charge into the high pressure section of the plant (liquid receiver);
- 3 stopping the compressor at a suction pressure sufficiently higher than the atmospheric pressure;
- 4 shutting off the service valve at the suction side of the compressor.

NOTE: if during the transfer of the refrigerant at the high pressure section of the plant, the charging pressures reach too high values (the condenser is flooded due to insufficient capacity of the liquid receiver), stop immediately the compressor and shut off the valve on the suction side.

Then:

- 5 Replace quickly the filter

block. During the preparation of the new block, close the filter with a clean cloth.

The slight over-pressure inside the filter and the ability of the technician will prevent air from getting into the plant.

- 6 The internal cleanliness of the body is guaranteed by the cleaning effect of the cup which is characteristic of Castel filters (fig. 1, page 58). However, if air is supposed to have entered the plant during filter block replacement, produce a vacuum in the low pressure section of the plant, and always in the sector of the circuit involved.

Finally:

- 7 Open the valve on the departure line of the liquid.
- 8 Slowly open the suction valve of the compressor and start the compressor and its auxiliaries.
- 9 Top the charge up, if necessary.



MECHANICAL FILTERS WITH REPLACEABLE FILTERING BLOCK (FOR SUCTION LINES)

Approved by Underwriters Laboratories Inc.



Except filters 4421/21C - /25C - /33C

APPLICATIONS

Mechanical filters with replaceable filtering block are designed for applications on suction pipe of refrigerating systems using refrigerant fluids CFC, HCFC and HFC.

Maximum working pressure: 32 [bar].

Temperature of the refrigerant:

- min: - 40 °C;
- MAX: + 80 °C.

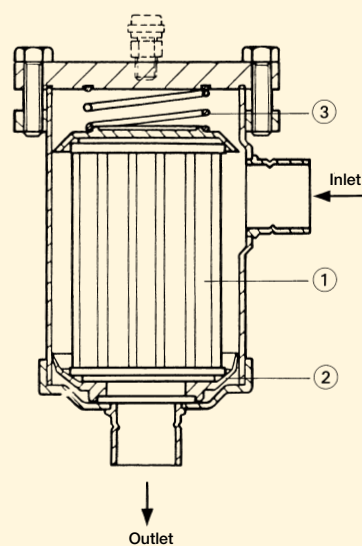
OPERATION

Good filtering of the refrigerant on the low pressure section of the system is a guarantee of protection for the compressor. System cleanliness is ensured by microfiltering cores which filter out impurities derived from manufacture and assembly of the refrigerating system.

TABLE 1 - Dimensions and Weights

Catalogue Number	Dimensions [mm]						Weight [g]
	ØD ₁	ØD ₂	H ₁	H ₂	H ₃	P	
4411/7C			149	236		93	5450
4411/9C			149	236		93	5375
4411/11C			154	241		98	5435
4411/13C	123	154	159	246	185	103	5410
4411/M42C			159	246		103	5410
4411/17C			169	256		113	5585
4411/21C			184	271		128	6030
4421/21C			187	308		143	12000
4421/25C	163	200	192	313	200	148	12200
4421/33C			192	313		148	12500

Sketch of filter with mechanical blocks



- 1 - Block
- 2 - Retainer cup
- 3 - Spring

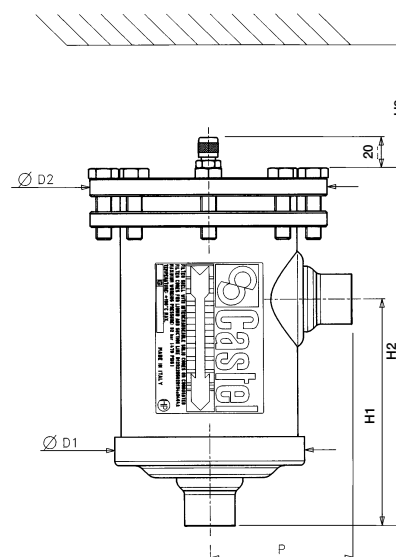


TABLE 2 - Suction line - Refrigerating capacity

Catalogue Number	Surface of block				Connections solder			Evaporation Temperature	Pressure drop	R134a (1) Refrigerating capacity [kW]	R22 (1) Refrigerating capacity [kW]	R404A (1) Refrigerating capacity [kW]
	4495/C		4496/C		ODS Ø		W Ø					
	[sq. in.]	[cm²]	[sq. in.]	[cm²]	[in.]	[mm]						
4411/7C					7/8"	22				16,4	25,46	25,6
4411/9C					1.1/8"	–				28	43,3	43,6
4411/11C					1.3/8"	35				42,6	66,1	66,5
4411/13C	127	820	–	–	1.5/8"	–	–			60	93	93,5
4411/M42C					–	42		+5	0,21	60	93	93,5
4411/17C					2.1/8"	54				105	163,1	164
4411/21C					2.5/8"	–				130	201	203
4421/21C					2.5/8"	–	76,1			162,8	252,8	254,2
4421/25C	–	–	287	1850	3.1/8"	–	88,9			231,1	358,8	360,8
4421/33C					4.1/8"	–	114,3			405,8	630	633,5

(1) Refrigerating capacities and pressure drops refer to the following operating conditions:

– liquid temperature before expansion valve: +35°C

– vapour overheating: 6°C

The pressure drops correspond approximately to a variation of 1°C of the saturation temperature at the suction side.

CONSTRUCTION

The filters type 4411 are manufactured in steel with the exception of the connections which are made of copper in order to facilitate soldering to pipes.

On the contrary, the filters type 4421 are completely manufactured in steel.

The block, which features a

large surface, is formed by zinc plated wire cloths and a filtering baffle with controlled porosity. The block can stop solid particles up to 10 ÷ 12 micrometers.

At the two ends, soft felt gaskets ensure perfect sealing.

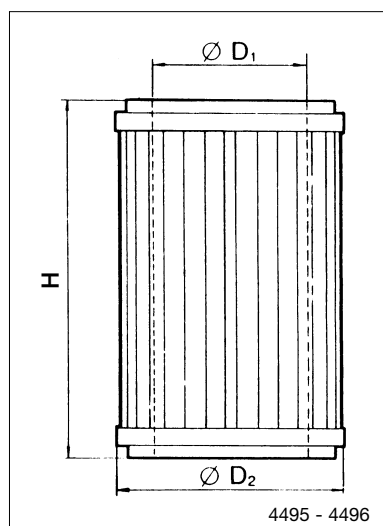
Filters may also be supplied with a charge connection kit (G9150/R05) to be ordered separately.

Important!

It is to be considered for operating conditions different

from those indicated in Table 2 that the refrigerating capacity of a compressor, using the same refrigerant, depends mainly on condensing temperature and evaporating temperature. That is why it is possible to evaluate on average:

- a reduction of the refrigerating capacity of 1 % for every increase of 1 °C of the condensing temperature;
- a reduction of the refrigerating capacity of 3 % for every decrease of 1 °C of the evaporating temperature.


TABLE 3 - Block type 4495/C - 4496/C

Catalogue Number	Filtering surface		Dimensions [mm]			Weight [g]
	[sq. in.]	[cm²]	ØD ₁	ØD ₂	H	
4495/C	127	820	60	87	142	480
4496/C	287	1850	80	113	169	750



STRAINERS

APPLICATIONS

The strainers illustrated herein are designed for use with refrigerant fluids CFC, HCFC and HFC.

Maximum working pressure:
28 [bar].

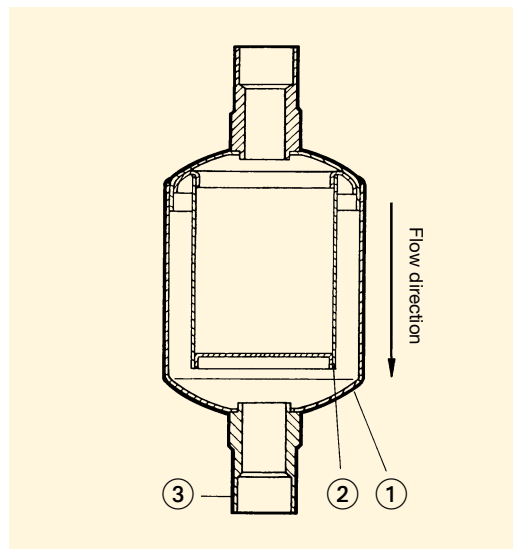
Temperature of the refrigerant:

- min: - 40 °C;
- MAX: + 80 °C.

CONSTRUCTION

4510 and 4520 filters are manufactured in steel either with copper plated connections, in the case of solder connection, or nickel plated connections, in the case of threaded connections. Inside there is a large austenitic stainless steel (type AISI 304) basket. These filters cannot be cleaned.

Sketch of strainers



- 1 - Body
2 - Stainless steel mesh basket
3 - Connection

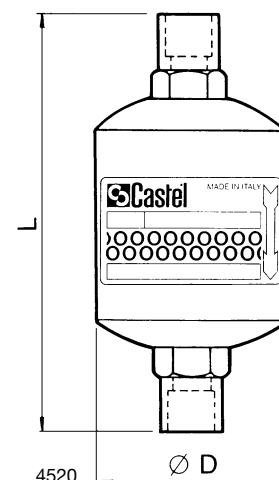
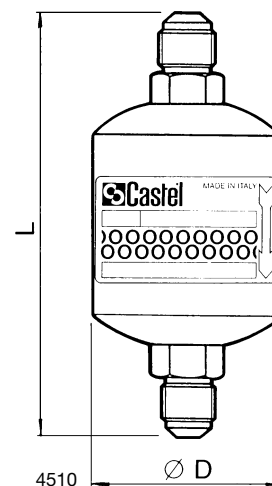


TABLE 1 - General Characteristics

TABLE 1 - General Characteristics											
Catalogue Number	SAE flare	Connections				kv Factor	Surface	Mesh	Dimensions [mm]		Weight [g]
		Solder Ø							ØD	L	
		[in.]	[mm]								
		ODF	ODM	ODF	ODM	[m³/h]	[cm²]				
4510/4	1/2"	–	–	–	–	3,20	142		76	174	515
4520/3	–	3/8"	1/2"	–	–	2,40			52	109	195
4520/M10	–	–	–	10	12	2,40			52	109	195
4520/M12	–	–	–	12	14	3,40	58	90	52	113	205
4520/4	–	1/2"	5/8"	–	16	3,40			52	122	215
4520/5	–	5/8"	3/4"	16	–	3,40			52	126	245
4520/M18	–	–	–	18	22	8,00	142		76	170	495



OIL SEPARATORS





OIL SEPARATORS

APPLICATIONS

The efficiency of the oil separator on the discharge line of a compressor in a refrigeration system is confirmed by many years of experience. The oil separator intercepts the oil mixed with compressed gas, and returns it to the oil sump 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 reduces system noise with an open or semi-hermetic compressor, as it neutralises the noise of valves and pistons. 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 valve noise.

Table 1 shows the technical data relating to the working conditions of oil separators. Oil separator are designed for use with refrigerant fluids CFC, HCFC and HFC.

Maximum working pressure:
32 [bar].

Maximum temperature of the refrigerant: + 130 °C.

CONSTRUCTION

Castel manufactures two types of oil separators, 5520 that can be disassembled and 5540 that cannot be disassembled.

The bodies are manufactured from steel pipe of adequate thickness.

Flanges and connectors are also made of steel. The internal mechanism is simple in order to assure a trouble-free long operation.

The oil separator bottom includes a chamber which

collects all metal impurities through the action of a permanent magnet in order to prevent impurities from stopping or damaging the operation of the plunger moved by the float.

Appropriate steel plates and metal filters rapidly reduce gas speed, and create the conditions required for the separation of the oil from the refrigerant.

The inlet and outlet connections of the 5520 Castel oil separator can be removed

5540/7



for maintenance purposes or in order to disassemble the circuit without cutting the pipings. Connectors 5590 have to be ordered separately.

ASSEMBLY

The oil separator has to be mounted in a strictly vertical position.

TABLE 1 - General Characteristics

Catalogue Number	Connections solder (1)				Inlet and Outlet connectors			Oil return connection SAE flare	Maximum differential pressure [bar]	Oil addition (2) [kg]	Suggested refrigerating capacity (3) [kW]					
	[in.]		[mm]		Catalogue Number	Connections ODS solder(1)					R134a	R22		R404A		
	ODF	ODM	ODF	ODM		[in.]	[mm]				Evaporation Temperature [°C]					
5540/4	1/2"	5/8"	–	16							– 20	+ 5	– 40	+ 5	– 40	+ 5
5540/5	5/8"	3/4"	16	–						0,4	10,6	13,5	13,0	17,3	10,7	15,5
5540/7	7/8"	1.1/8"	–	–				1/4"		÷	14,8	18,8	18,2	24,2	15,0	21,6
5540/9	1.1/8"	1.3/8"	–	35						0,5	21,8	27,8	26,8	35,0	20,4	31,8
5540/11	1.3/8"	1.5/8"	35	–	–	–					26,0	33,0	31,8	42,4	26,1	37,7
5540/13	1.5/8"	–	–	–						0,6	30,3	38,6	37,2	49,7	30,6	44,2
5540/M42	–	–	42	–				3/8"		÷	45,5	58,0	55,8	74,6	46,0	66,3
5540/17	2.1/8"	–	54	–					21	0,7	54,8	70,0	67,3	90,1	55,4	80,0
5520/C					5590/5	5/8"	16				14,8	18,8	18,2	24,2	15,0	21,6
	–				5590/7	7/8"	–				21,8	27,8	26,8	35,0	20,4	31,8
5520/D					5590/9	1.1/8"	–			0,4	26,0	33,0	31,8	42,4	26,1	37,7
	–				5590/11	1.3/8"	35	1/4"		÷	30,3	38,6	37,2	49,7	30,6	44,2
5520/E					5590/13	1.5/8"	–			0,5						
	–				5590/M42	–	42				31,5	40,1	39,0	52,0	32,0	46,0

(1) Connection diameter should never be smaller than the discharge shut-off valve of the compressor.

(2) Oil remaining on the separator bottom is required for trouble-free operation.

(3) Refrigerating capacity with a condensing temperature of +40°C and normal overheating values of the vapour sucked by the compressor.

Maximum pressure drops 0.15 bar.

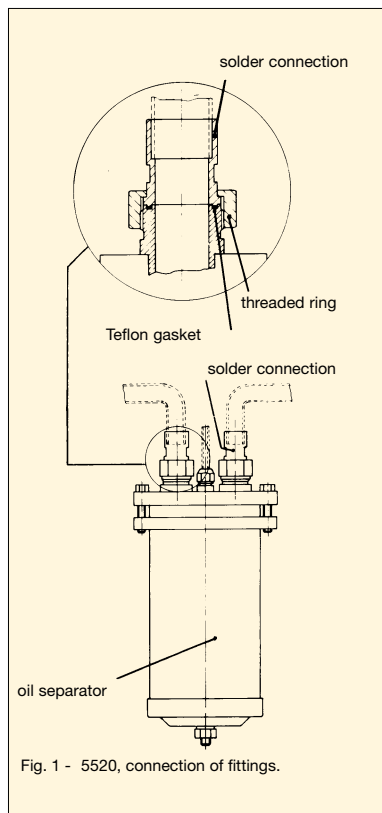


Fig. 1 - 5520, connection of fittings.

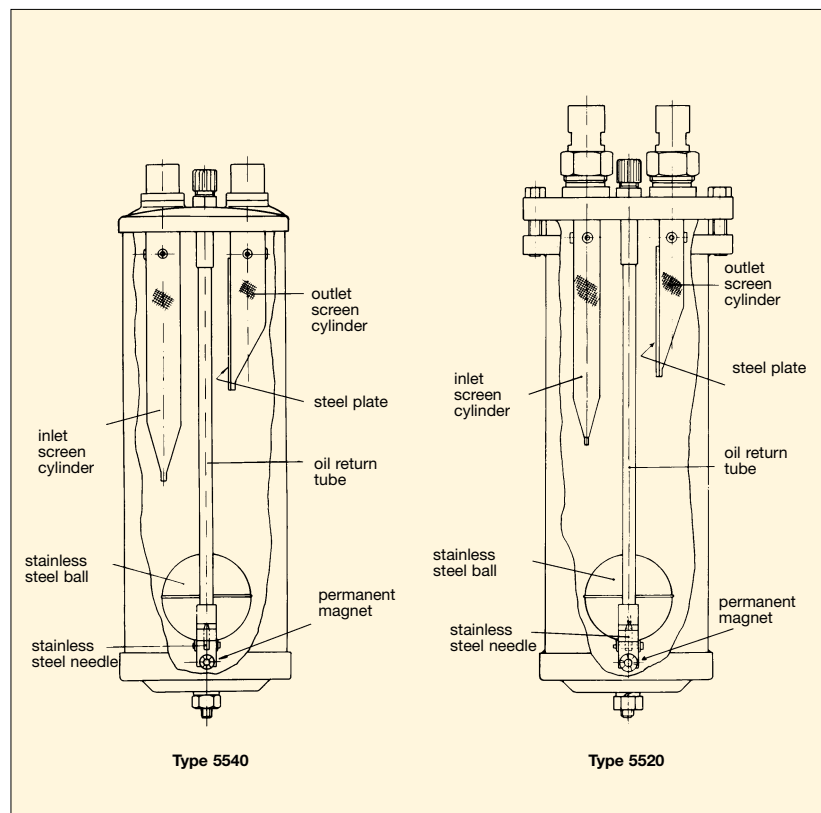




TABLE 2 - Dimensions and Weights

Catalogue Number	Dimensions [mm]						Weight [g]
	D ₁	D ₂	H ₁	H ₂	H ₃	H ₄	
5540/4						280	4175
5540/5							4910
5540/7	123	-	17,5	-	-	367	5030
5540/9							5835
5540/11						428	5845
5540/13							9350
5540/M42	163,5	-	-	-	-	471	
5540/17						481	9550
5520/C				339	61	400	6865
5520/D	123	154	17,5	394	67	461	7935
5520/E					92	486	7675

