

DISCALDIRT® deaerator-dirt separator DISCALDIRTMAG



546 - 5461 series

01123/17 GB

replaces dp 01123/14 GB



PCT
INTERNATIONAL
APPLICATION
PENDING

Function

Deaerators-dirt separators are used to continuously eliminate the air and dirt contained in the hydraulic circuits of heating and cooling systems. They are capable of automatically removing all the air present in the system down to micro-bubble level. At the same time they separate dirt and impurities contained in the water within the circuit and collect them in the lower part of the valve body, from which they may be expelled.

Versions fitted with a magnet are designed for the separation of ferrous impurities.

The circulation of fully deaerated water enables the equipment to operate under optimum conditions, free from any noise, corrosion, localised overheating or mechanical damage.

Threaded, flanged and weld-end deaerators-dirt separators are supplied complete with hot pre-formed shell insulation to ensure perfect heat insulation when used in both hot and chilled water systems.

Reference documentation:

- Brochure 01060 DISCAL® deaerator 551 series
- Brochure 01137 DIRTCAL® dirt separator 5462 series

Product range

546 series	DISCALDIRT® deaerator-dirt separator with compression ends	size DN 20 (Ø 22)
546 series	DISCALDIRT® deaerator-dirt separator	sizes DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4")
5461 series	DISCALDIRT® deaerator-dirt separator with magnet	sizes DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4")
5461 series	DISCALDIRT® deaerator-dirt separator with magnet and insulation	sizes DN 40 (1 1/2"), DN 50 (2")
546 series	DISCALDIRT® deaerator-dirt separator with flanged connections and insulation	sizes DN 50–DN 150
546 series	DISCALDIRT® deaerator-dirt separator with weld-ends and insulation	sizes DN 50–DN 150
546 series	DISCALDIRT® deaerator-dirt separator with flanged connections and floor brackets	sizes DN 200–DN 300

Technical specifications

	series 546 threaded	546 flanged and weld-end
Materials		
Body:	- DN 20–DN 32 brass EN 12165 CW617N - DN 40–DN 50 epoxy resin coated steel	epoxy resin coated steel
Dirt separation chamber:	brass EN 12165 CW617N	-
Automatic air vent body:	brass EN 12165 CW617N	brass EN 12165 CW617N
Internal element:	PA66G30	stainless steel
Float:	PP	PP
Float guide and stem:	brass EN 12164 CW614N	brass EN 12164 CW614N
Float lever and spring:	stainless steel	stainless steel
Hydraulic seals:	EPDM	EPDM
Drain cock:	brass EN 12165 CW617N	-
Drain valve:	-	brass EN 12165 CW617N
Performance		
Medium:	Water, glycol solutions	Water, non-hazardous glycol solutions excluded from the guidelines of directive 67/548/EC
Max. percentage of glycol:	50%	50%
Max. working pressure:	10 bar	10 bar
Working temperature range:	0–110°C	0–110°C
Particle separation rating:	down to 5 µm	down to 5 µm
Ring system magnetic induction:	(5461 series) 2 x 0,3 T	-
Connections		
Main:	with compression ends for Ø 22 mm copper pipe; 3/4", 1", 1 1/4", 1 1/2", 2" F (ISO 228-1)	DN 50–DN 150, PN 16 DN 200–DN 300, PN 10 to be coupled with flat counterflange EN 1092-1 DN 50–DN 150 weld ends
Probe holder:		DN 200–DN 300, inlet/outlet 1/2" F
Drain:	hose connection	DN 50–DN 150, 1" F DN 200–DN 300, 2" F

Technical specifications of insulation for threaded models codes 546005/6/7

Material:	closed cell expanded PE-X
Thickness:	10 mm
Density:	- inner part: 30 kg/m ³ - outer part: 80 kg/m ³
Thermal conductivity (ISO 2581):	- at 0°C: 0,038 W/(m·K) - at 40°C: 0,045 W/(m·K)
Coefficient of resistance to water vapour (DIN 52615):	> 1.300
Working temperature range:	0–110°C
Reaction to fire (DIN 4102):	class B2

Technical specifications of insulation for threaded models codes 546118/9

Material:	closed cell expanded PE-X
Thickness:	20 mm
Density:	- inner part: 30 kg/m ³ - outer part: 80 kg/m ³
Thermal conductivity (ISO 2581):	- at 0°C: 0,038 W/(m·K) - at 40°C: 0,045 W/(m·K)
Coefficient of resistance to water vapour (DIN 52615):	> 1.300
Working temperature range:	0–100°C
Reaction to fire (DIN 4102):	class B2

Technical specifications of insulation for flanged and weld-end models from DN 50 to DN 150

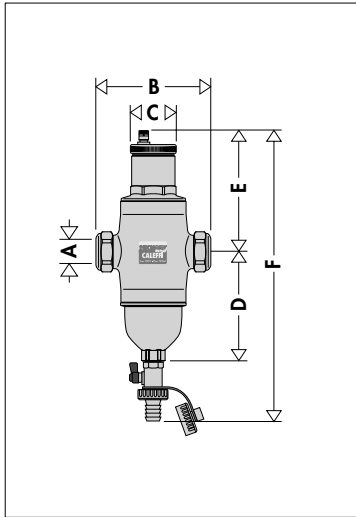
Inner part

Material:	closed cell expanded PE-X
Thickness:	DN 50–DN 100; 60 mm DN 125–DN 150; 50 mm
Density:	- inner part: 30 kg/m ³ - outer part: 80 kg/m ³
Thermal conductivity (ISO 2581):	- at 0°C: 0,038 W/(m·K) - at 40°C: 0,045 W/(m·K)
Coefficient of resistance to water vapour (DIN 52615):	>1300
Working temperature range:	0–100°C
Reaction to fire (DIN 4102):	class B2

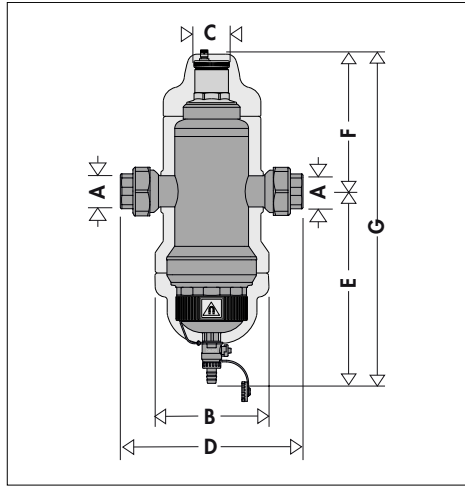
External cover

Material:	embossed unfinished aluminium
Thickness:	0.7 mm
Reaction to fire (DIN 4102):	class 1

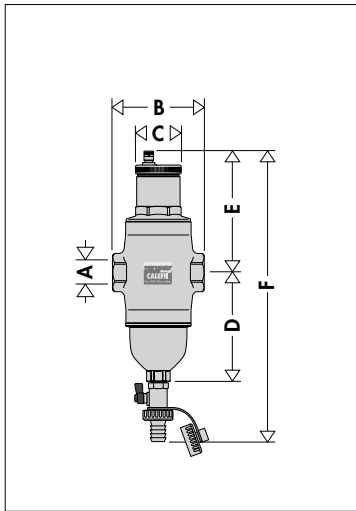
Dimensions



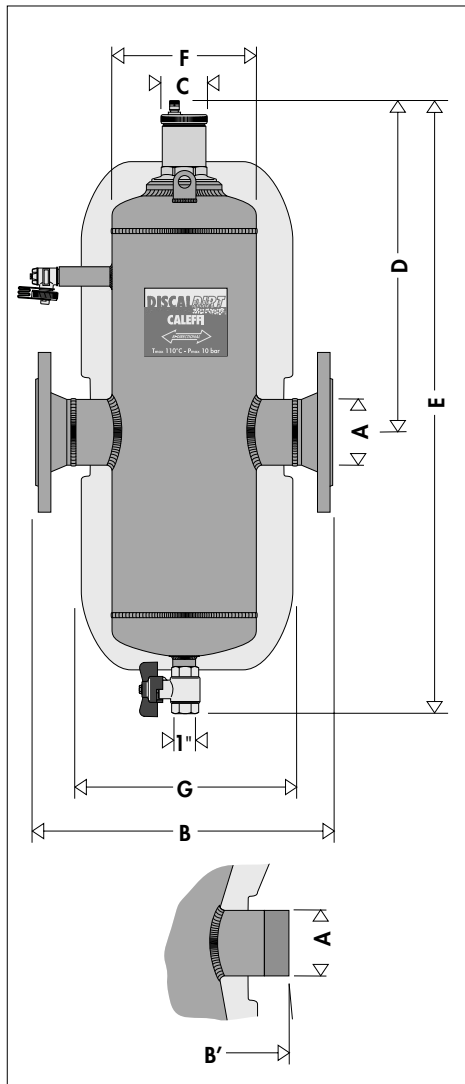
Code	Size	A	B	C	D	E	F	Mass (kg)
546002	DN 20	∅22	127	55	128	141	325	3,0



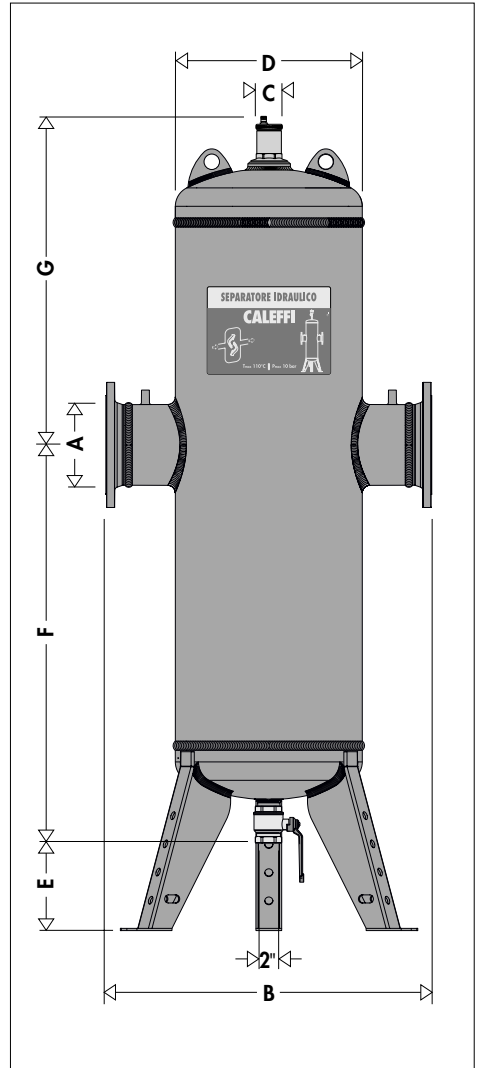
Code	A	B	C	D	E	F	G	Mass (kg)
546118	1 1/2"	180	55	283	297	218,5	515,5	10
546119	2"	180	55	315	311	253,5	564,5	13



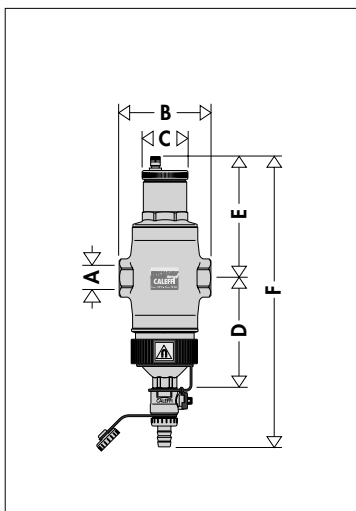
Code	Size	A	B	C	D	E	F	Mass (kg)
546005	DN 20	3/4"	108	55	128	141	325	2,9
546006	DN 25	1"	108	55	128	141	325	2,9
546007	DN 32	1 1/4"	116	55	128	141	325	2,9



Code	A	B	B'	C	D	E	F	G	Mass (kg)
54605.	DN 50	350	260	55	374	775	169	300	18
54606.	DN 65	350	260	55	374	775	169	300	19
54608.	DN 80	466	366	55	436	912	219	370	33
54610.	DN 100	470	366	55	436	912	219	370	35
54612.	DN 125	635	525	55	541	1245	324	480	82
54615.	DN 150	635	525	55	541	1245	324	480	85



Code	A	B	C	D	E	F	G	Mass (kg)
546200	DN 200	900	55	508	215	1100	815	200
546250	DN 250	1060	55	660	215	1225	900	400
546300	DN 300	1180	55	762	215	1335	980	550



Code	Size	A	B	C	D	E	F	Mass (kg)
546105	DN 20	3/4"	108	55	128	141	336	2,9
546106	DN 25	1"	108	55	128	141	336	2,9
546107	DN 32	1 1/4"	116	55	128	141	336	2,9

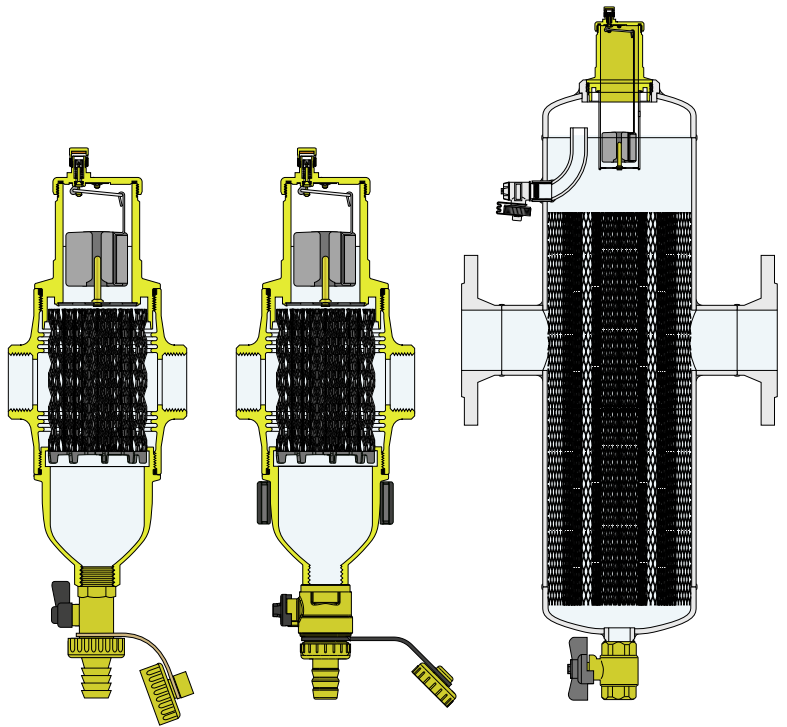
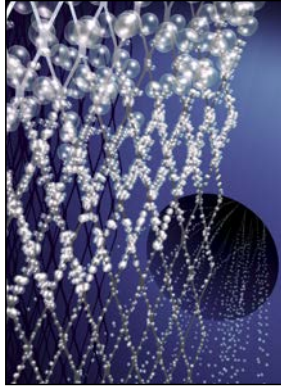
Size	Volume (l)
DN 50	13,6
DN 65	13,8
DN 80	28,6
DN 100	29,6
DN 125	85
DN 150	87
DN 200	371
DN 250	680
DN 300	986

Operating principle

The deaerator-dirt separator utilises the combined action of several physics principles. The active part consists of a set of concentric metal mesh surfaces. These elements create the swirling motion required to facilitate the release of micro-bubbles and their adhesion to the surfaces.

The bubbles, fusing with each other, increase in volume until the hydrostatic thrust is sufficient to overcome the force of adhesion to the structure. They then rise towards the top of the device and are expelled through a float-operated automatic air vent valve.

The impurities in the water, colliding with the metal surfaces of which the internal element is composed, are separated out and fall to the bottom of the valve body.



Construction details

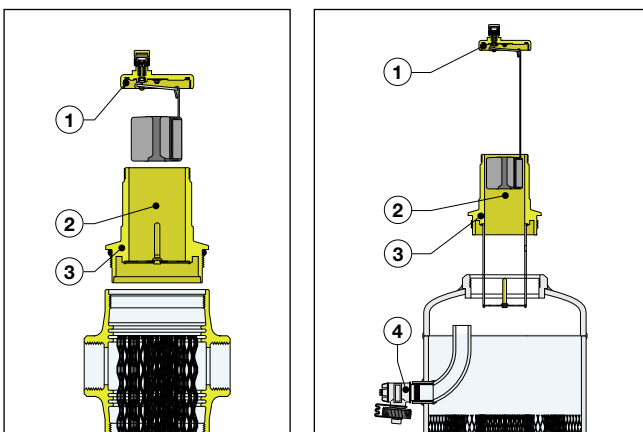
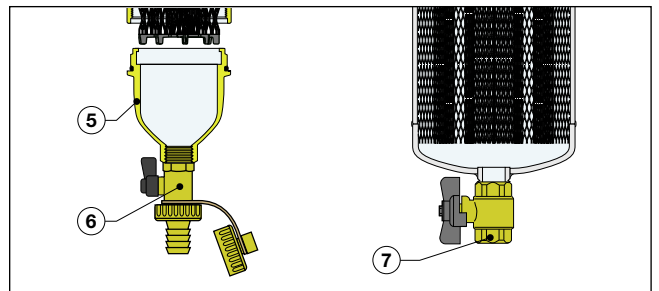
The special construction of DISCALDIRT® allows maintenance and cleaning procedures to be performed without removing the device from the system. Note in particular:

Access to the moving parts controlling the air vent is attained by simply removing the top cover (1).

The deaerator-dirt separator automatic air vent valve, located at the top of the device, is equipped with a long chamber for float movement (2). This feature prevents any impurities in the water from reaching the seal seat.

Simply unscrew the top part of the casing (3) to clean the entire air venting system.

Flanged and weld-end deaerators-dirt separators are also equipped with a cock (4) which performs the dual function of releasing large amounts of air while the system is being filled and eliminating any impurities floating on top of the water.



When checking the internal element of threaded deaerators and dirt separators, simply unscrew the large dirt collection chamber (5) to which the internal element is fixed, so that it can be removed for cleaning.

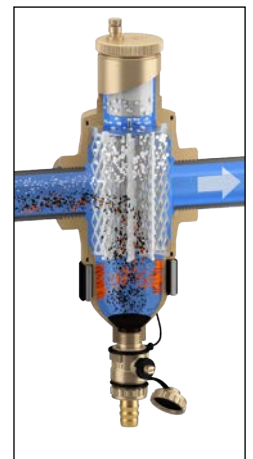
Threaded versions of DISCALDIRT® have a collection chamber equipped with a shut-off cock and hose attachment with plug (6), while flanged and weld-end versions have a ball shut-off valve (7). This means impurities can even be expelled while the system is in operation.

Separation of ferrous impurities

Dirt separators fitted with a magnet offer greater efficiency in the separation and collection of ferrous impurities. The impurities are trapped inside the dirt separator body by the strong magnetic field created by the magnets inserted in the special outer ring.

The outer ring can also be removed from the body to allow the decantation and subsequent expulsion of sludge while the system is still running.

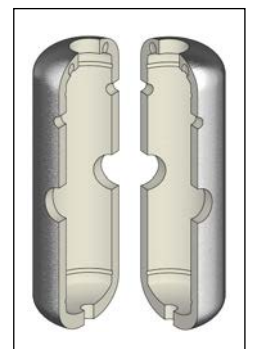
Since the magnetic ring is positioned outside the dirt separator body, the hydraulic characteristics of the device are not altered.



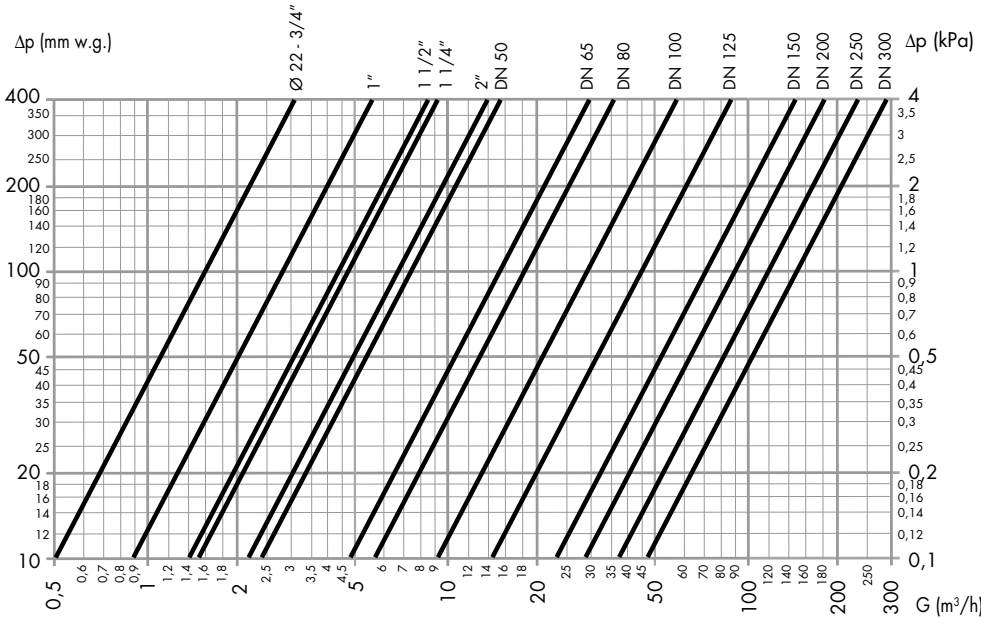
Insulation

The threaded DISCALDIRT® (code 546005/6/7), threaded DISCALDIRTMAG (code 546118/9), flanged and weld-end DISCALDIRT® (DN 50-DN 150) devices are provided with hot pre-formed shell insulation.

This system ensures not only perfect thermal insulation, but also the tightness required to prevent water vapour entering the device from the ambient. For this reason, this type of insulation may also be used in chilled water circuits as it prevents condensation from forming on the surface of the valve body.



Hydraulic characteristics



The maximum recommended flow speed at the device connections is ~ 1,2 m/s.

The following table shows the maximum flow rates in order to meet this requirement.

DN	DN 20	DN 25	DN 32	DN 40	DN 50	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250	DN 300
Connections	$\text{DN } 22-3/4''$	1"	1 1/4"	1 1/2"	2"	-	-	-	-	-	-	-	-	-
Kv (m ³ /h)	16,2	28,1	46,7	43,2	68,3	75	150	180	280	450	720	900	1200	1500
Maximum flow rate														
l/min	22,7	35,18	57,85	56,78	94,63	141,2	238,6	361,5	564,8	980,0	1436,6	2433,0	3866,0	5416,0
m ³ /h	1,36	2,11	3,47	3,41	5,68	8,47	14,32	21,69	33,89	58,8	86,2	146,0	232,0	325,0

The air formation process

The amount of air which can remain dissolved in a water solution depends on the pressure and temperature.

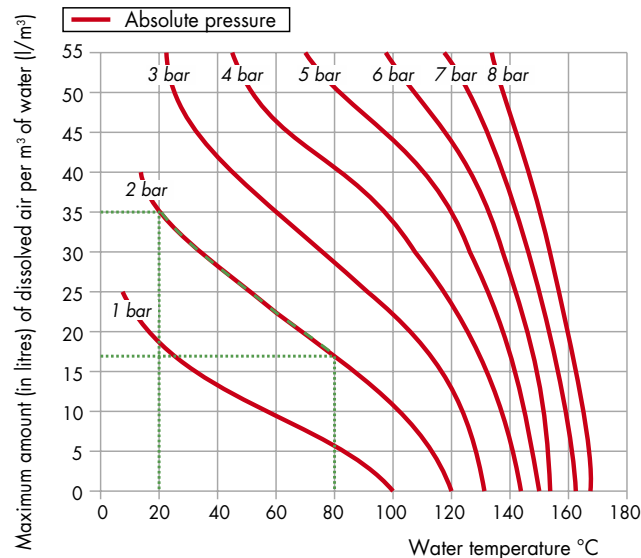
This relationship is known as Henry's law; the graph below allows us to quantify the physical phenomenon of releasing the air contained in the medium.

For example: at a constant absolute pressure of 2 bar, if the water is heated from 20°C to 80°C, the amount of air released by the solution is equal to 18 l per m³ of water.

According to this law, it may be noted how the amount of air released by the solution increases as the temperature rises and the pressure decreases. This air is in the form of micro-bubbles with diameters in the order of tenths of a millimetre.

In circuits of air-conditioning systems there are specific points where this micro-bubble formation process takes place continuously: inside boilers and devices which operate under conditions of cavitation.

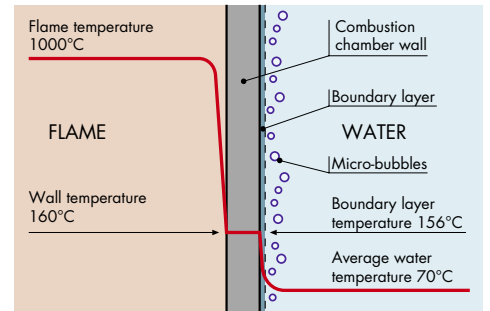
Graph of solubility of air in water



Boiler micro-bubbles

Micro-bubbles form continuously on the surfaces separating the water from the combustion chamber due to the high temperature of the medium.

This air, carried by the water, collects at critical points of the circuit, from which it must be removed. Some of it is reabsorbed where it meets colder surfaces.

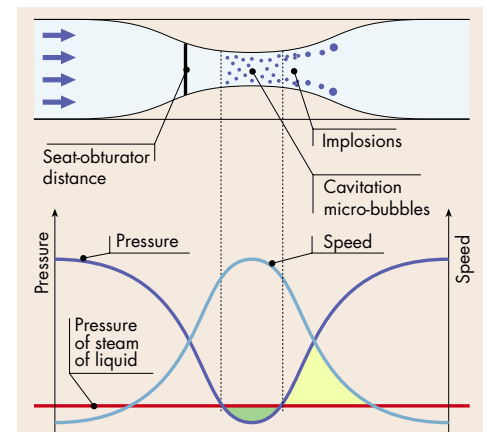


Cavitation micro-bubbles

Micro-bubbles develop where the speed of the medium is particularly high, with a corresponding reduction in pressure.

These points are usually the pump impellers and the water orifices of the regulating valves.

These micro-bubbles of air and steam, the formation of which is accentuated in non-deaerated water, may subsequently implode as a result of the cavitation effect.



Separation efficiency

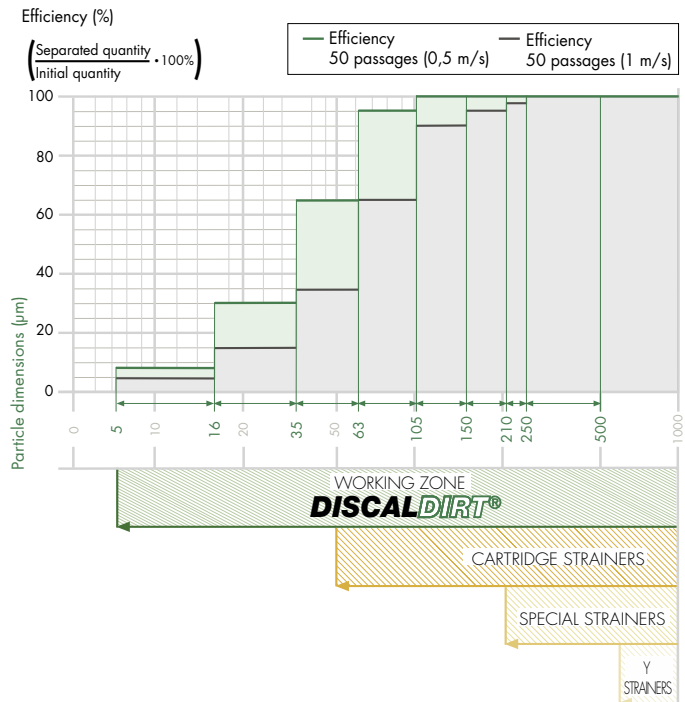
The capacity for separating the impurities in the medium circulating in the closed circuits of the systems basically depends on three parameters:

- 1) it increases as particle size and mass increases. The larger and heavier particles drop before the lighter ones.
- 2) It increases as the speed decreases. If the speed decreases, there is a calm zone inside the dirt separator and the particles separate more easily.
- 3) It increases as the number of recirculations increases. The medium in the circuit, which flows through the dirt separator a number of times during operation, is subjected to a progressive separation action until all impurities have been completely eliminated.

The Caleffi DISCALDIRT® deaerator-dirt separator, thanks to the special design of its internal element, is able to completely separate impurities in the circuit, down to a minimum particle size of 5 µm.

The graph alongside, summarising the tests carried out in a specialised laboratory (TNO - Science and Industry), illustrates how the DISCALDIRT®/DISCALDIRTMAG dirt separators (546 and 5461 series) are able to quickly separate nearly all the impurities. After only 50 recirculations, approximately one day of operation, up to 100% of particles with a diameter greater than 100 µm are effectively removed from the circuit; this figure is up to 80% (on average) for the smaller particles. The continual passing of the medium during normal operation of the system gradually leads to complete dirt removal.

Particle separation capacity Deaerator-dirt separator efficiency



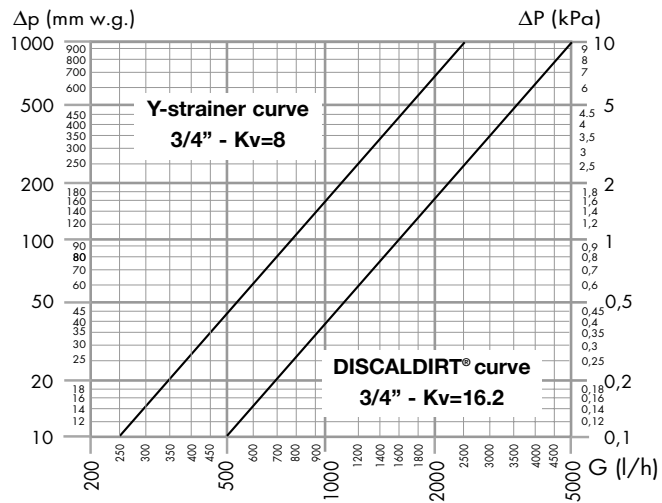
Reduced head losses

A normal Y strainer performs its function via a metal mesh selected for the size of the largest particle. The medium therefore has a consequent initial head loss that increases as the degree of clogging increases.

Whereas, the dirt separator carries out its action by the particles striking the internal element and subsequently dropping into the collection chamber as a result of gravity. The consequent head losses are greatly reduced and are not affected by the amount of impurities collected.

The adjacent graph shows a comparison of the differences in head loss between the two types of device.

Comparison of head losses: deaerator-dirt separator - Y-STRAINERS

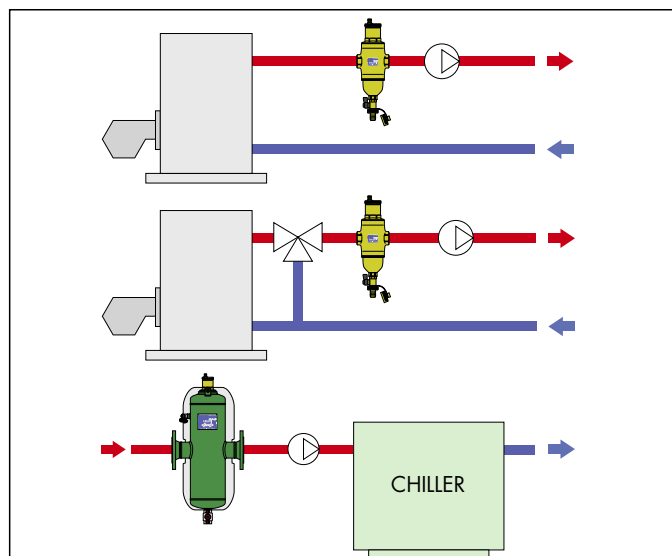
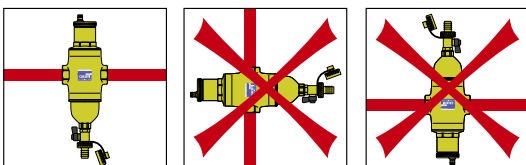


Installation

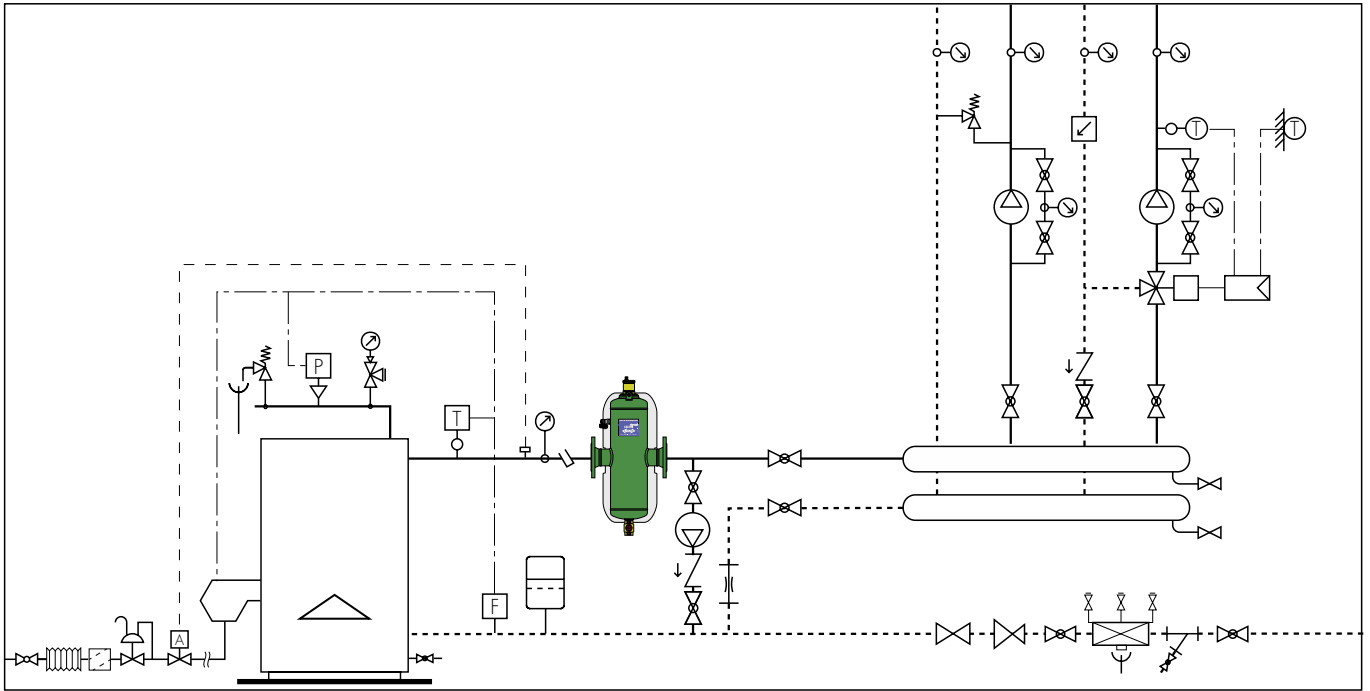
DISCALDIRT® devices may be used in both heating and cooling circuits, to guarantee progressive elimination of impurities and the air which forms continuously. They should preferably be installed after the boiler, on the pump suction side, as this is where most of the micro-bubbles form.

DISCALDIRT® deaerators-dirt separators must be installed in a vertical position.

It is recommended that the air vent valve cap is replaced with a Caleffi 5620 series hygroscopic safety cap if the device is installed in a location that cannot be inspected.



Application diagram



	Shut-off valve		Pump		3-way cock		Anti-vibration joint
	Ball valve		AUTOFLOW®		Test pocket		Pocket
	BALLSTOP		Flow rate metering device		Pressure switch		Safety relief valve
	Temperature gauge		Temperature probe		Gas filter		Backflow preventer
	Differential by-pass valve		Safety thermostat		Gas regulator		Automatic filling unit
	Flow switch		Regulator		Y-strainer		
	Zone valve		Expansion vessel		Fuel shut-off valve		

SPECIFICATION SUMMARY

DISCALDIRT® 546 series

Deaerator-dirt separator. Size DN 20 (from DN 20 to DN 32); connections 3/4" (from 3/4" to 1 1/4") F (ISO 228-1). Size DN 20; Ø 22 mm connections with compression ends for copper pipe. Brass dirt separation chamber and body. Brass automatic air vent valve body. PA66G30 internal element. PP float. Brass float guide and stem. Stainless steel float lever and spring. EPDM hydraulic seals. Brass drain cock. Medium: water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 10 bar. Working temperature range 0–110°C. Particle separation rating down to 5 µm. Drain: with hose connection.

DISCALDIRTMAG 5461 series

Deaerator-dirt separator with magnet. Size DN 20 (from DN 20 to DN 50); connections 3/4" (from 3/4" to 2") F (ISO 228-1). Body made of brass (from DN 20 to DN 32) and epoxy resin coated steel (DN 40 and DN 50). Brass dirt separation chamber. Brass automatic air vent valve body. PA66G30 internal element. PP float. Brass float guide and stem. Stainless steel float lever and spring. EPDM hydraulic seals. Brass drain cock. Medium: water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 10 bar. Working temperature range 0–110°C. Particle separation rating down to 5 µm. Drain: with hose connection. Closed cell expanded PE-X shell insulation; working temperature range 0–100°C (1 1/2" and 2"). PCT - INTERNATIONAL APPLICATION PENDING.

DISCALDIRT® 546 series

Deaerator-dirt separator. Flanged connections DN 50 (from DN 50 to DN 150, PN 16, flanged DN 200 (from DN 200 to DN 300) PN 10, coupling with counterflange EN 1092-1. Weld-end connections DN 50 (from DN 50 to DN 150). Brass drain valve 1" F (from DN 50 to DN 150), 2" F (from DN 200 to DN 300). Epoxy resin coated steel body. Brass automatic air vent valve body. Stainless steel internal element. PP float. Brass float guide and stem. Stainless steel float lever and spring. EPDM hydraulic seals. Medium water and non-hazardous glycol solutions excluded from the guidelines of EC directive 67/548; maximum percentage of glycol 50%. Maximum working pressure 10 bar. Working temperature range 0–110°C. Particle separation rating down to 5 µm. Closed cell expanded PE-X shell insulation and embossed unfinished aluminium external cover. for flanged and weld-end models DN 50 (from DN 50 to DN 150). Working temperature range 0–100°C. Floor brackets for sizes DN 200 (from DN 200 to DN 300).

We reserve the right to make changes and improvements to the products and related data in this publication, at any time and without prior notice.