DISCAL*DIRT*® deaerator-dirt separator

546 series

ISO 9001 FM 21654
ISO 9001 No. 0003
01123/14 GB
replaces dp 01123/10 GB

Function

Deaerators-dirt separators are used to continuously eliminate the air and dirt contained in the hydraulic circuits of heating and cooling systems. The air discharge capacity of these devices is very high. 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.

The circulation of fully deaerated water enables the equipment to operate under optimum conditions, free from any noise, corrosion, localised overheating or mechanical damage.
Flanged and weld-end deaerators-dirt separators are supplied complete with hot pre-formed shell insulation to ensure perfect thermal insulation when used in both hot and chilled water systems.
Patented.

Reference documentation:
- Tech. broch. 01060 DISCAL® deaerator 551 series
- Tech. broch. 01137 DIRTCAL® dirt separator 5462 series

Gamma prodotti

546 series	DISCALDIRT® deaerator-dirt separator with olive connections	size DN 20 (Ø 22)
546 series	DISCALDIRT® deaerator-dirt separator	size DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4")
5461 series	DISCALDIRTMAG® deaerator-dirt separator with magnet	size DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4")
546 series	DISCALDIRT® deaerator-dirt separator with flanged connections and pre-formed insulation	size DN 50–DN 150
546 series	DISCALDIRT® deaerator-dirt separator with weld ends and pre-formed insulation	size DN 50–DN 150
546 series	DISCALDIRT® deaerator-dirt separator with flanged connections and floor supports	size DN 200–DN 300

Technical specifications

series	546 threaded	546 flanged and weld ends
Materials		
Body:	brass EN 12165 CW617N	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 EN 10270-3 (AISI 302)	stainless steel EN 10270-3 (AISI 302)
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:	up to 5 µm	up 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" F (ISO 228-1)	DN 50–DN 150, PN 16 DN 200–DN 300, PN 10 to be coupled with EN 1092-1 counterflanges 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

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/m³
	- outer part:	80 kg/m³
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

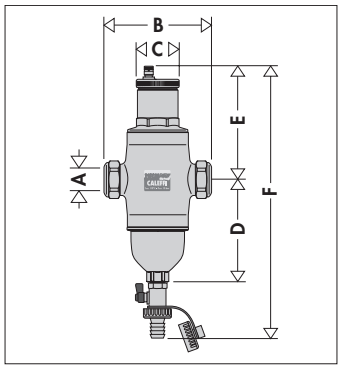
External cover

Material:	embossed unfinished aluminium
Thickness:	0,7 mm
Reaction to fire (DIN 4102):	class 1

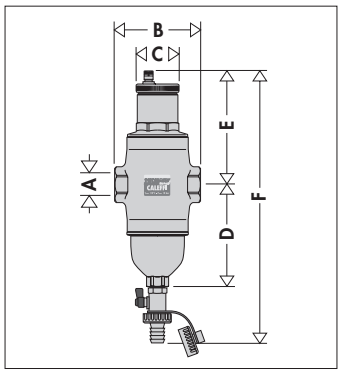
Technical specification of insulation for threaded model (code 546005, 546006 and 546007)

Material:		closed cell expanded PE-X
Thickness:		10 mm
Density:		inner part: 30 kg/m³; outer part: 80 kg/m³
Thermal conductivity (ISO 2581):	- a 0°C:	0,038 W/(m·K)
	- a 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

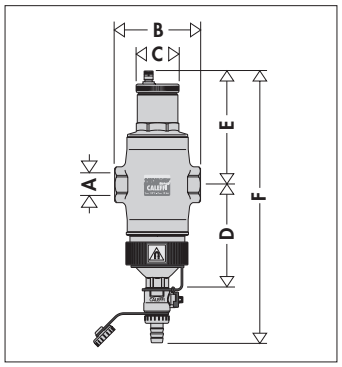
Dimensions



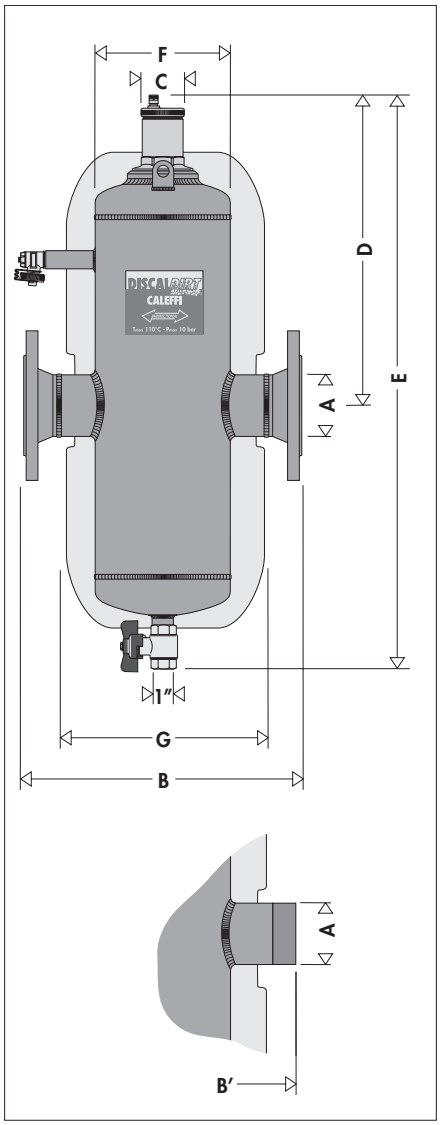
Code	Size	A	B	C	D	E	F	Mass (kg)
546002	DN 20	Ø 22	127	55	128	141	325	3,0



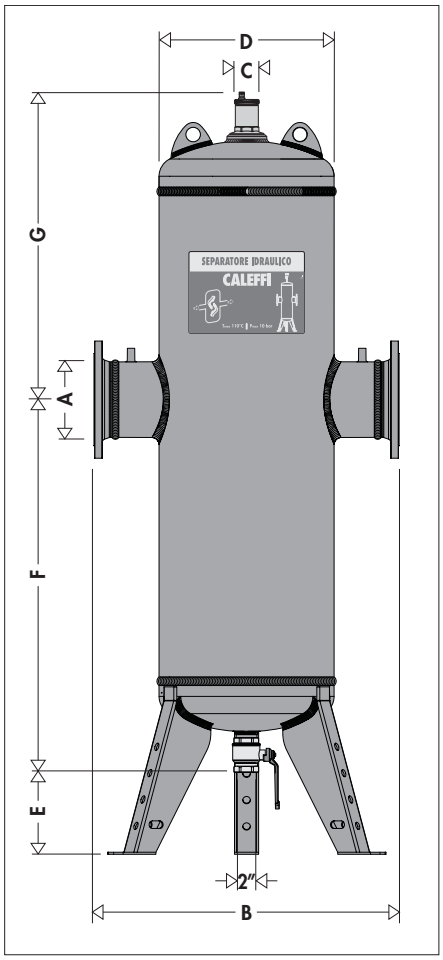
Code	Size	A	B	C	D	E	F	Mass (kg)
546005	DN 20	3/4"	105	55	128	141	325	2,9
546006	DN 25	1"	105	55	128	141	325	2,9
546007	DN 32	1 1/4"	105	55	128	141	325	2,9



Code	Size	A	B	C	D	E	F	Mass (kg)
546105	DN 20	3/4"	105	55	128	141	336	2,9
546106	DN 25	1"	105	55	128	141	336	2,9
546107	DN 32	1 1/4"	105	55	128	141	336	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

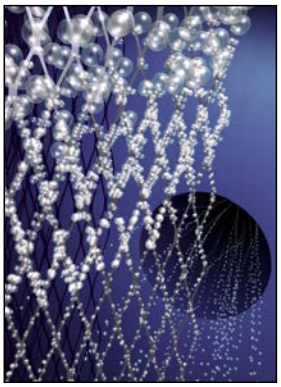


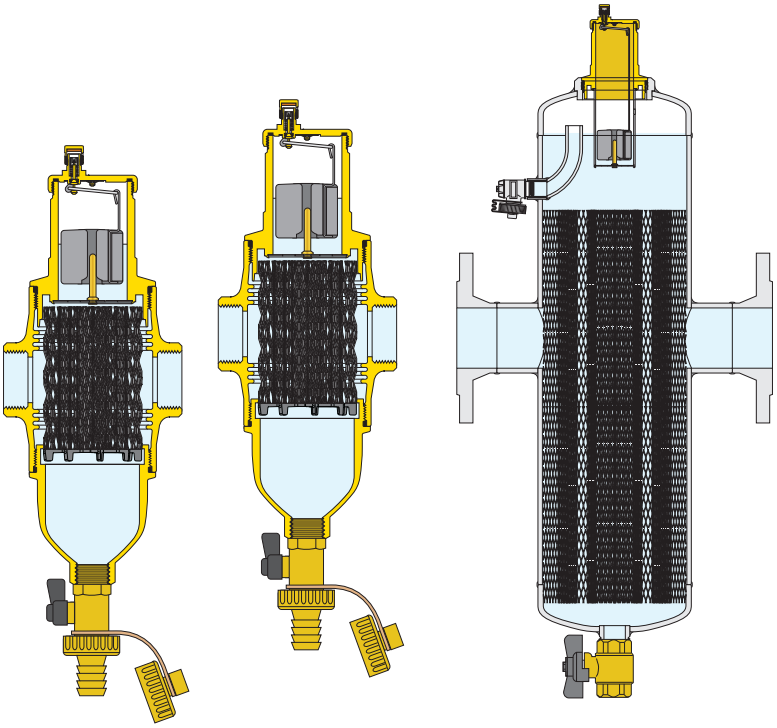
Code	A	B	C	D	E	F	G	Mass (kg)
546200	DN 200	900	55	508	215	1100	815	200
546250	DN 250	1060	55	660	215	1225	900	400
546300	DN 300	1180	55	762	215	1335	980	550

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

Operating principle

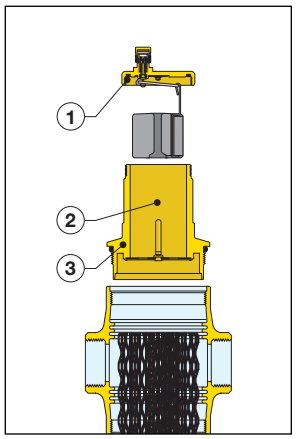
The deaerator-dirt separator uses the combined action of several physical principles. The active part consists of an assembly of concentric metal mesh surfaces. These elements create the whirling movement required to facilitate the release of micro-bubbles and their adhesion to these surfaces.
The bubbles, fusing with each other, increase in volume until the hydrostatic thrust is such as to overcome the adhesion force to the structure. They rise towards the top of the unit from which they are released through a float-operated automatic air release valve.
The impurities in the water, colliding with the metal surfaces of the internal element, are separated out and fall to the bottom of the valve body.

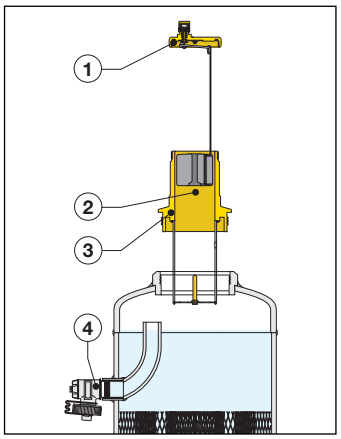




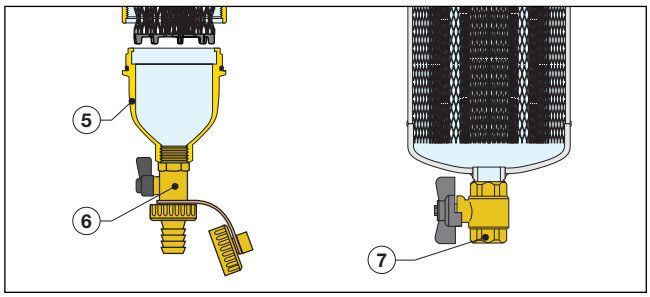
Construction details

The particular construction of the DISCALDIRT® allows it to be maintained and cleaned without removing the device from the system. Note the following:
The moving parts that control the air venting are accessed simply by removing the upper cover (1).
The deaerator-dirt separator automatic air vent, 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 separetors are equipped with a cock (4) that has the dual function of releasing large quantities of air when the system is being filled and of removing the impurities that float on top of the water.



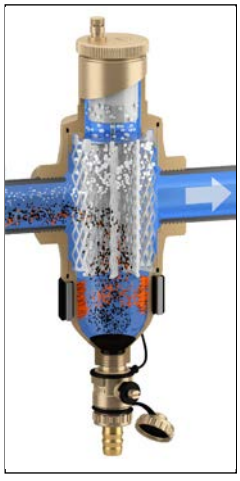


When checking the internal element of threaded deaerators-dirt separators, simply unscrew the large dirt collection chamber (5) to which the internal element is fixed, so that it can be removed for cleaning.
Threaded versions of DISCALDIRT® have a collection chamber equipped with a shut-off cock and 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.



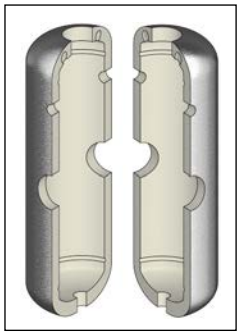
Separation of ferrous impurities

This series of deaerator-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 their decantation and subsequent expulsion 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.

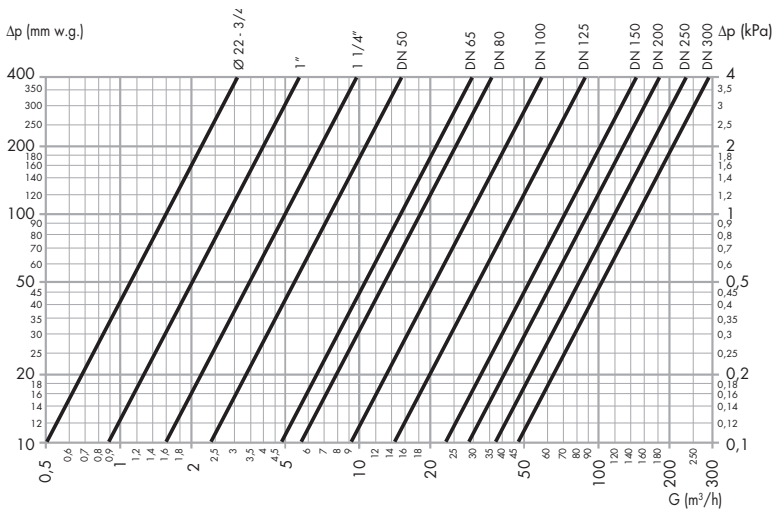


Insulation

Flanged and weld-end DISCALDIRT® devices are supplied complete with hot pre-formed shell insulation.
This system ensures not only perfect thermal insulation, but also the tightness required to prevent atmospheric water vapour from entering the unit. For this reason, this type of insulation may also be used in cooling water circuits as it prevents condensation from forming on the surface of the valve body.



Hydraulic characteristics



The maximum recommended speed of the medium to the device connections is 1,2 m/s. The following table shows the maximum flow rates in order to meet this requirement.

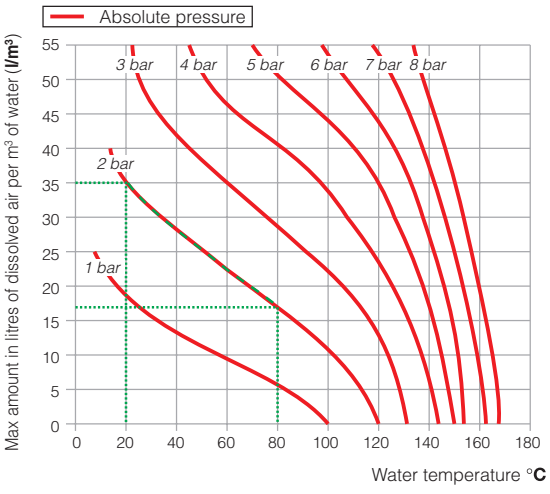
DN	connections	l/min	m³/h
20	Ø 22 - 3/4"	22,7	1,36
25	1"	35,18	2,11
32	1 1/4"	57,85	3,47
50	–	141,2	8,47
65	–	238,6	14,32
80	–	361,5	21,69
100	–	564,8	33,89
125	–	980,0	58,8
150	–	1436,6	86,2
200	–	2433,0	146,0
250	–	3866,0	232,0
300	–	5416,0	325,0

	Threaded version			Flanged version								
DN	**20**	**25**	**32**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300**
Connections	**Ø 22 -3/4"**	**1"**	**1 1/4"**	–	–	–	–	–	–	–	–	–
Kv (m³/h)	16,2	28,1	48,8	75,0	150,0	180,0	280,0	450,0	720,0	900,0	1200,0	1500,0

The process of air formation

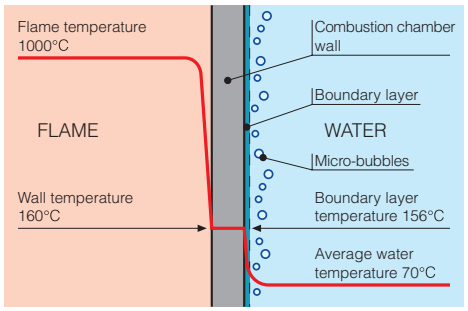
The amount of air which can remain dissolved in a water solution is a function of pressure and temperature. This relationship is governed by Henry's Law and the graph below allows the physical phenomenon of the air content release of the fluid to be quantified.
As an example, at a constant absolute pressure 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 can be seen that the amount of air released increases with temperature rise and pressure reduction. The air comes in the form of micro-bubbles of diameters in the order of tenths of a millimetre.
In heating and cooling systems there are specific points where this process of formation of micro-bubbles takes place continuously: in the boiler and in any device which operates under conditions of cavitation.

Graph: Solubility of air in water



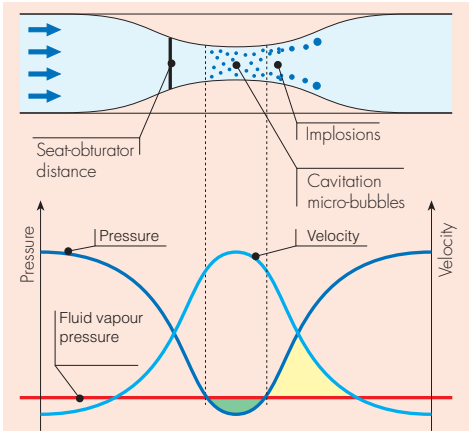
Boiler micro-bubbles

Micro-bubbles are formed continuously on the surface separating the water from the combustion chamber due to the fluid temperature.
This air, carried by the water, collects in the critical points of the circuit from where it must be removed. Some of this air is reabsorbed in the presence of colder surfaces.



Cavitation and micro-bubbles

Micro-bubbles develop where the fluid velocity is very high with the corresponding reduction in pressure.
These points are typically the pump impeller and the regulating valve seating. These air and vapour micro-bubbles, the formation of which is enhanced in the case of non de-aerated water, may subsequently implode due to the cavitation phenomenon.



Separation efficiency

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

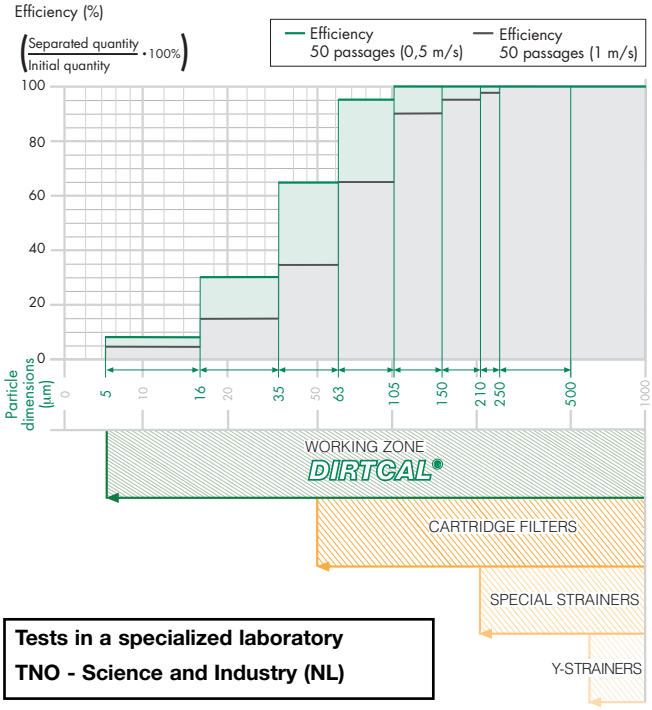
1) It increases as the size and mass of the particle increase. The larger and heavier particles drop before the lighter ones.
2) It increases as the speed decreases. If the speed decreases, there is a calm zone inside the dirt separator and the particles separate more easily.
3) It increases as the number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

The Caleffi DISCALDIRT® deareator-dirt separator, thanks to the special design of its internal element, is able to completely separate the 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 it is able to quickly separate nearly all the impurities. After only 50 recirculations, approximately one day of operation, up to 100% is effectively removed from the circuit for particles of diameter greater than 100 µm and on average up to 80% taking account of the smallest particles. The continual passing of the medium during normal operation of the system gradually leads to complete dirt removal.

Reduced head losses

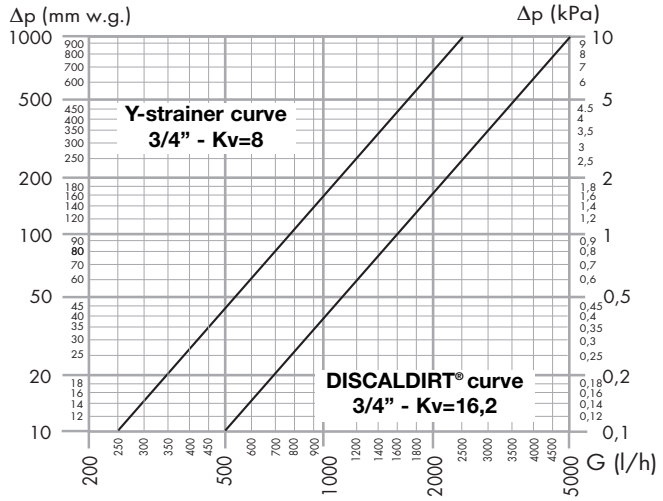
A normal Y strainer performs its function via a metal mesh selected for the size of the largest particle. The medium therefore has a consequent initial loss of head that increases as the degree of clogging increases.
Whereas, the dirt separator carries out its action by the particles striking the internal element and subsequently dropping into the collection chamber. The consequent head losses are greatly reduced and are not affected by the amount of impurities collected.
The graph alongside shows a comparison of the differences in head loss between the two types of device.

Particle separation rating - Deaerator-dirt separator efficiency



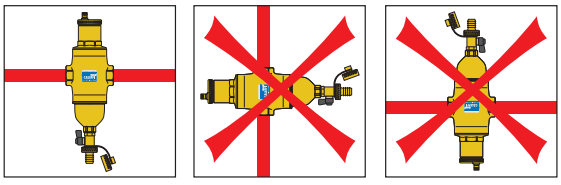
Tests in a specialized laboratory
TNO - Science and Industry (NL)

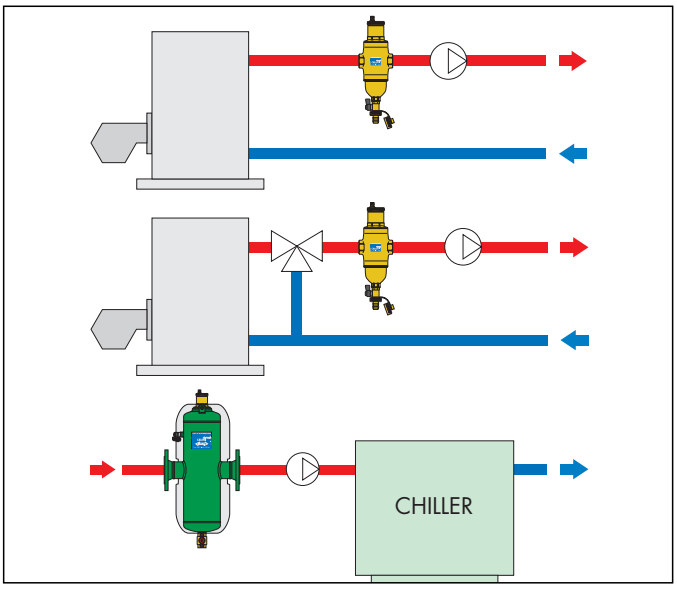
Comparison of head losses: deaerator-dirt separator - Y-STRAINERS



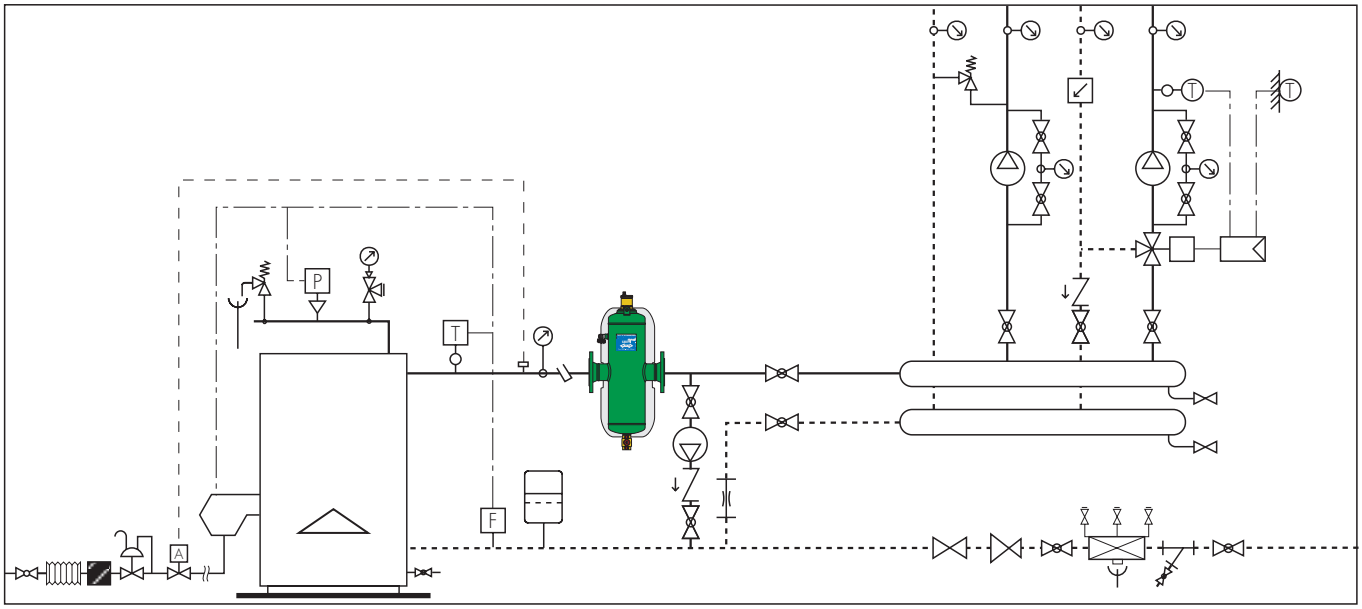
Installation

DISCALDIRT® devices may be used in both heating and cooling circuits, to guarantee progressive elimination of impurities and air which form 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 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
- Ball valve
- BALLSTOP
- Temperature gauge
- Differential by-pass valve
- Flow switch
- Zone valve
- Pump
- AUTOFLOW®
- Flow meter
- Temperature probe
- Safety thermostat
- Regulator
- Expansion vessel
- 3-way valve
- Pressure switch
- Control pocket
- Gas filter
- Gas regulator
- Y-strainer
- Fuel shut-off valve
- Anti-vibration joint
- Sensor pocket
- Safety valve
- Backflow preventer
- Automatic filling unit

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). Brass dirt separation chamber and body. Brass automatic air vent 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 non-dangerous 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. Drain: with hose connection.

DISCALDIRTMAG 5461 series
Deaerator-dirt separator whit magnet. Size DN 20 (from DN 20 to DN 32); connections 3/4" (from 3/4" to 1 1/4") F (ISO 228-1). Brass dirt separation chamber and body. Brass automatic air vent 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, non-hazardous 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. Ring system magnetic induction 2 x 0,3 T. Drain: with hose connection.
PCT - INTERNATIONAL APPLICATION PENDING.

DISCALDIRT® 546 series
Deaerator-dirt separator. Flanged connections DN 50 (from DN 50 to DN 150) PN 16, DN 200 (from DN 200 to DN 300) PN 10, to be coupled with counterflanges EN 1092-1. Weld end connections DN 50 (from DN 50 to DN 150). Drain valve 1" F. Epoxy resin coated steel body. Brass automatic air vent body. Stainless steel internal element. PP float. Brass float guide and stem. Stainless steel float lever and spring. EPDM hydraulic seals. Brass drain valve. Medium: water and non-dangerous 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.

CALEFFI Hydronic Solutions
Caleffi S.p.A.
S.R. 229 n. 25 · 28010 Fontaneto d'Agogna (NO) · Italy
Tel. +39 0322 8491 · Fax +39 0322 863723
info@caleffi.com · www.caleffi.com