DISCAL*DIRT*® air and dirt separator

series 546 and NA546

BSI EN ISO 9001:2000 Cert. n° FM 21654
UNI EN ISO 9001:2000 Cert. n° 0003
01123/11.1 NA
Replaces 01123/11 NA

Function

Air and dirt separators are used to continuously remove the air and debris contained in the hydronic circuits of heating and cooling systems. The air discharge of these devices is very high. They are capable of automatically removing all of the air present in the system down to the micro-bubble level. The DISCALDIRT® air and dirt separator also separates any solid impurities in the system. The impurities collect at the bottom of the device and can be removed through the drain pipe for the steel versions, to which a separately sourced drain valve can be mounted, or drain shut-off cock for the brass version. The circulation of fully de-aerated and cleaned water enables the equipment to operate under optimum conditions, free from noise, corrosion, localized or mechanical damage.

Product range

Series 546	DISCALDIRT air and dirt separator in brass	Sizes 3/4" and 1" sweat union
Series 546	DISCALDIRT air and dirt separator in brass	Size 1-1/4" integral sweat
Series 546	DISCALDIRT air and dirt separator in brass	Size 1" NPT male union
Series 546	DISCALDIRT air and dirt separator in steel with flanged connections	Sizes 2"–6" ANSI
Series NA546	DISCALDIRT air and dirt separator in steel with flanged connections designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code and tagged and registered with the National Board of Boiler and Pressure Vessel Inspector; CRN registered	Sizes 2"–12" ANSI
Series NA546	DISCALDIRT air and dirt separator in steel with threaded connections designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code and tagged and registered with the National Board of Boiler and Pressure Vessel Inspector; CRN registered	Sizes 2"–4"

Technical specification

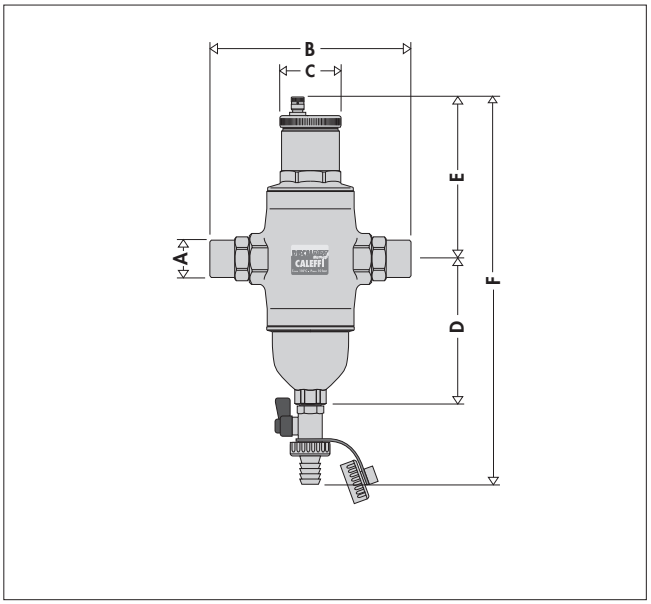
Brass DiscalDirt

Materials:	- Body:	brass
	- Dirt separation chamber:	brass
	- Automatic air vent body:	brass
	- Internal element:	Glass reinforced nylon, PA66GF30
	- Float:	PP
	- Float guide:	brass
	- Stem:	brass
	- Float lever:	stainless steel
	- Spring:	stainless steel
	- Seals:	EPDM
	- Drain shut-off valve:	brass
Suitable fluids:		water, glycol solution
Max percentage of glycol:		50%
Max working pressure:		150 psi (10 bar)
Temperature range:		32–230°F (0–110°C)
Particle separation capacity:		to 5 µm (0.2 mil)
Connections:	- Main:3/4" and 1" sweat union; 1" NPT male union; 1-1/4" integral sweat	
	- Drain shut-off valve:	hose connection

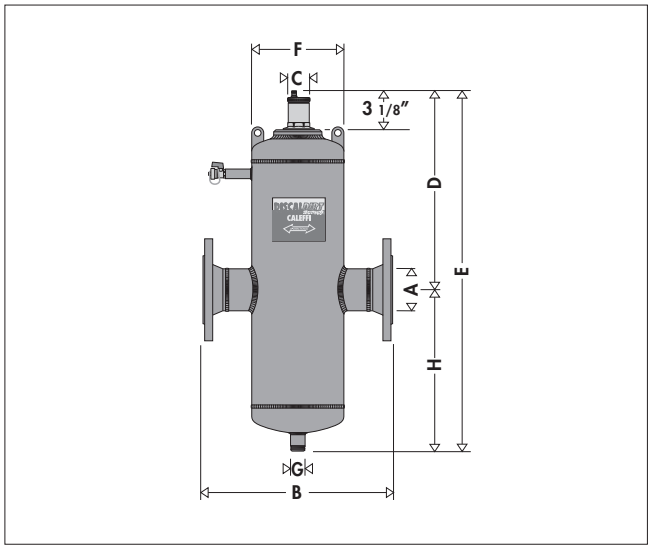
Steel DiscalDirt

Materials:	- Body:	epoxy resin painted steel
	- Automatic air vent body:	brass
	- Internal element:	stainless steel
	- Float:	PP
	- Float guide:	brass
	- Stem:	brass
	- Float lever:	stainless steel
	- Spring:	stainless steel
	- Seals:	EPDM
	- Side drain shufoff valve:	brass
Suitable fluids:		water, glycol solution
Max percentage of glycol:		50%
Max working pressure:		150 psi (10 bar)
Temperature range:		32–250°F (0–120°C)
Particle separation capacity:		to 5 µm (0.2 mil)
Connections:	- Flanged (ASME & CRN Registered):	2"–12" ANSI B16.5 150 CLASS RF
	- Flanged:	2"–6" ANSI B16.5 150 CLASS RF
	- Threaded:	(ASME and CRN Registered) 2"–4"
	- Drain pipe:	2"–6" : 1" NPT male
		8"–12" : 2" NPT male

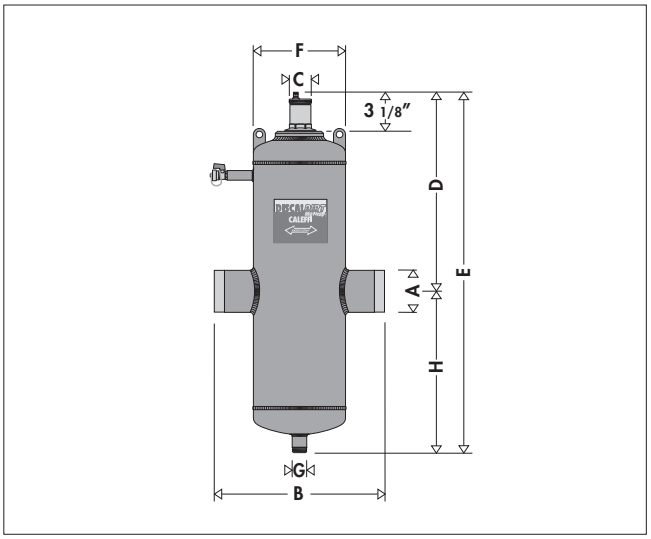
Dimensions



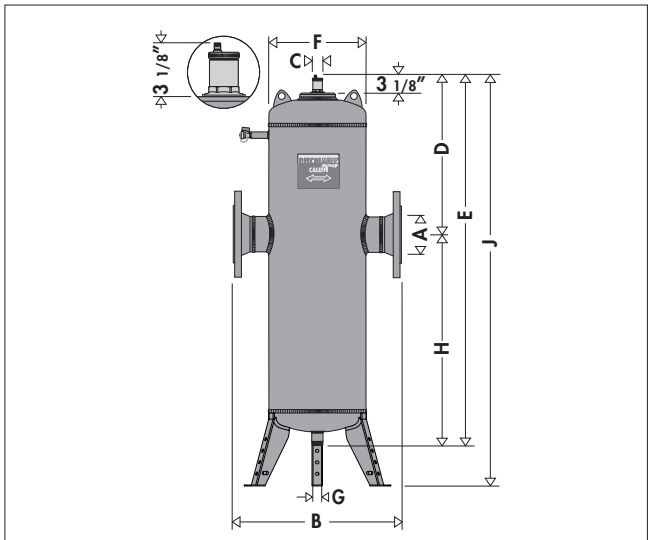
Code	Connections	A	B	C	D	E	F	Weight (lb)	Weight (kg)
546095A	Sweat union	3/4"	7 3/8"	2 1/8"	5"	5 1/2"	12 3/4"	8.3	3.8
546096A	Sweat union	1"	7 3/8"	2 1/8"	5"	5 1/2"	12 3/4"	8.3	3.8
546016A	NPT union	1"	7 3/8"	2 1/8"	5"	5 1/2"	12 3/4"	8.3	3.8
546097A	Integral sweat	1 1/4"	6 3/16"	2 1/8"	5"	5 1/2"	12 3/4"	8.3	3.8



Code	A	B	C	D	E	F	G	H	Cap. (gal)	Weight (lb)	Weight (kg)
***546**050A	2"	13 3/4"	2 3/16"	14 3/4"	28 1/4"	6 5/8"	1"	12 1/2"	3.6	39.7	18.0
***546**060A	2 1/2"	13 3/4"	2 3/16"	14 3/4"	28 1/4"	6 5/8"	1"	12 1/2"	3.6	41.9	19.0
***546**080A	3"	18 3/8"	2 3/16"	17 1/8"	34 1/2"	8 5/8"	1"	16 5/16"	7.6	72.7	33.1
***546**100A	4"	18 1/2"	2 3/16"	17 1/8"	34 1/2"	8 5/8"	1"	16 5/16"	7.8	77.1	35.0
***546**120A	5"	25"	2 3/16"	21 5/16"	46 11/16"	12 3/4"	1"	24 5/8"	22.4	180.7	82.0
***546**150A	6"	25"	2 3/16"	21 5/16"	46 11/16"	12 3/4"	1"	24 7/16"	23	187.3	85.0



Code	A	B	C	D	E	F	G	H	Cap. (gal)	Weight (lb)	Weight (kg)
NA546050T	2"	13 3/4"	2 3/16"	14 3/4"	28 1/4"	6 5/8"	1"	12 1/2"	3.6	28.7	13.0
NA546060T	2 1/2"	13 3/4"	2 3/16"	14 3/4"	28 1/4"	6 5/8"	1"	12 1/2"	3.6	28.7	13.0
NA546080T	3"	18 3/8"	2 3/16"	17 1/8"	34 1/2"	8 5/8"	1"	16 5/16"	7.6	55.1	25.0
NA546100T	4"	18 1/2"	2 3/16"	17 1/8"	31 1/2"	8 5/8"	1"	16 5/16"	7.8	55.1	25.0



Code	A	B	C	D	E	F	G	H	J	Cap. (gal)	Weight (lb)	Weight (kg)
NA546200A	8"	35 7/16"	2 3/16"	35 3/16"	75 3/8"	20"	2"	43 5/16"	92 3/4"	95	355	240
NA546250A	10"	41 3/4"	2 3/16"	38 9/16"	83 11/16"	26"	2"	48 1/4"	101 1/16"	175	555	329
NA546300A	12"	46 7/16"	2 3/16"	41 1/8"	90 9/16"	30"	2"	52 9/16"	107 5/16"	255	825	499

NOTE: *Drawings may not reflect the actual size of the separators.*

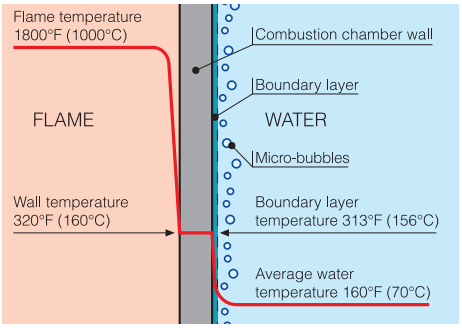
**Add prefix NA to flanged code number when ordering ASME tagged and registered with the National Board of Boiler and Pressure Vessel Inspector and CRN Registered.*

The process of air formation

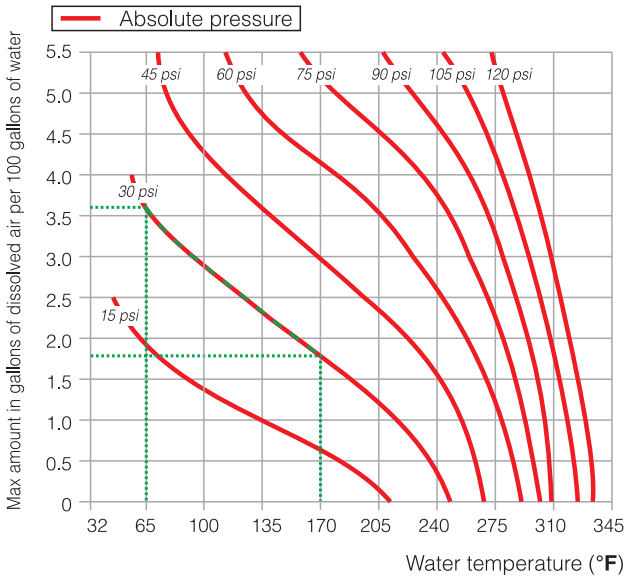
The amount of air which can remain dissolved in a water solution is a function of pressure and temperature. This relationship is governed by Henry's law and the graph demonsrates the physical phenomenon of the air release from water. As an example, at a constant absolute pressure of 30 psi (2 bar), if the water is heated from 65ºF (18ºC) to 170ºF (75ºC), the amount of air released by the solution is equal to 1.8 gallons of air per 100 gallons 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 millmeter.
In heating and cooling systems there are specifi c 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.

Boiler micro-bubbles

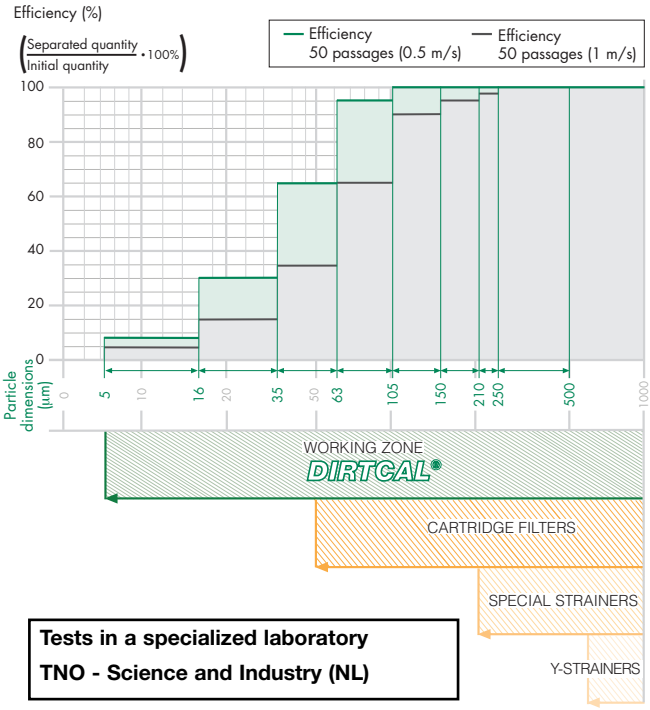
Micro-bubbles are formed continuously on the surface separating the water from the combustion chamber due to the fl uid temperature. This air, carried by the water, collects in the critical points of the circuit from where it must be removed.
Some of this air is reabsorbed in the presence of colder surfaces.



Solubility of air in water



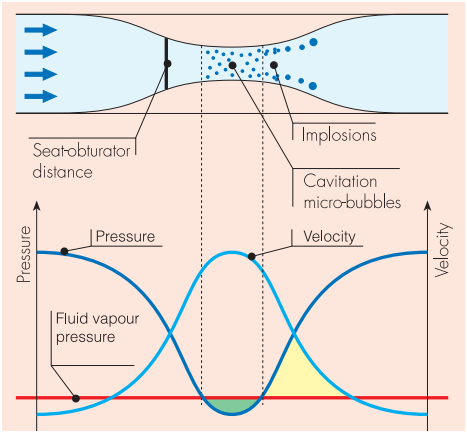
Particle separation rating - Dirt separator efficiency



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

Cavitation and micro-bubbles

Micro-bubbles develop where the fl uid velocity is very high with the corresponding reduction in pressure. These points are typically the pump impeller and the valve port.
These air and vapor micro-bubbles, the formation of which is enchanced in the case of non deaerated water, may subsequently implde 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, fl owing through the dirt separator a number of times during operation, is subjected to a progressive action of separation, until the impurities are completely removed.

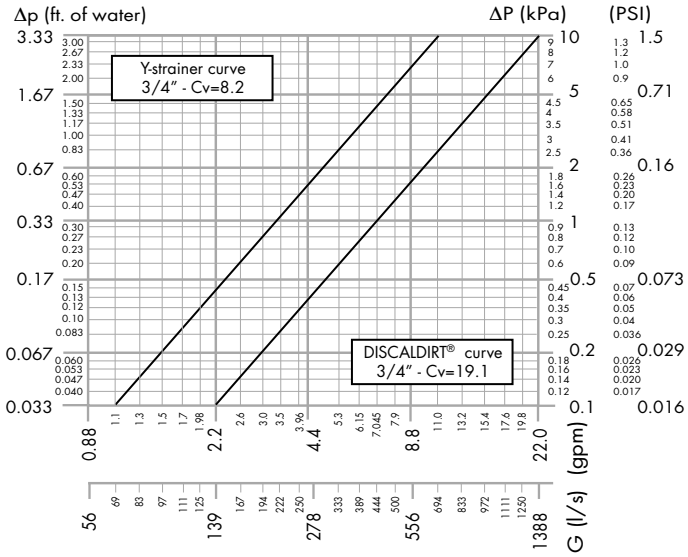
The special design of the internal element in the Caleffi DISCALDIRT air and dirt separator, is able to completely separate the impurities in the circuit down to a minimum particle size of 5 µm (0.2 mil).

The particle separation - dirt separator efficiency graph on the previous page illustrates how DISCALDIRT quickly separates nearly all the impurities. After only 50 circulations, approximately one day of operation, up to 100% is effectively removed from the circuit for particles of diameter greater than 100 µm (3.9 mil) 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.

Comparison of head losses: air and dirt separator to Y-strainers

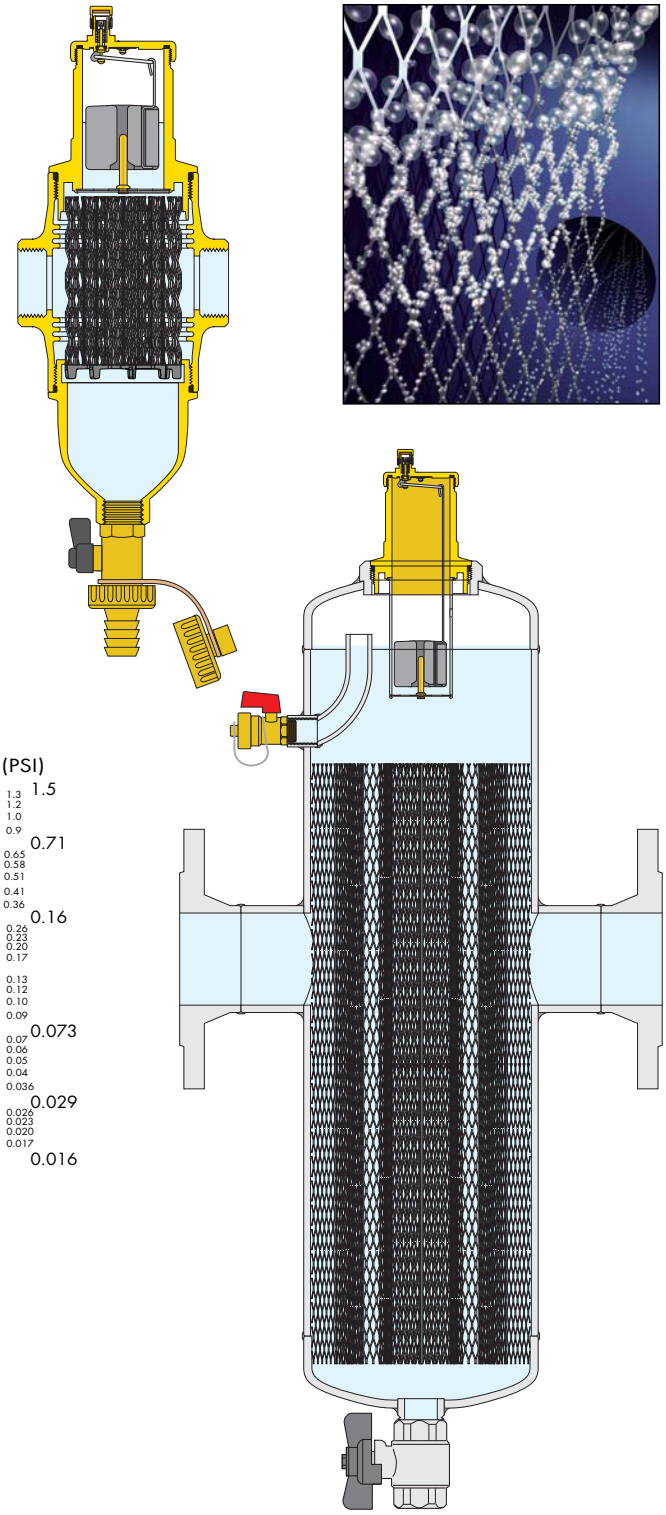
Y-strainers entrap dirt within a basket made of stainless steel or brass mesh, selected for the size of the largest particle. Particles smaller than the mesh size may pass through. On most Y-strainers, the basket must be removed periodically to clear the trapped debris. As the debris collects in the basket, fl ow is impeded resulting in increasing pressure drop and therefore higher head loss. The dirt separation function in the DISCALDIRT performs exactly as it does in the DIRTCAL®, utilizing the low-velocity-zone principle. The flow velocity of fluid flowing into the dirt separation chamber is greatly reduced causing the entrained dirt particles to drop due to their density.
The internal element provides surfaces that assist in separating dirt
particles and guide them downward to ultimately settle to the bottom of the separator. The dirt separator only creates about 25% of the pressure drop of a comparable size basket stainer.

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



Operating principle

The air and 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 vent valve. When the impurities present in the water collide with the metal surfaces of the internal element they become separated and precipitate to the bottom of the separator body.

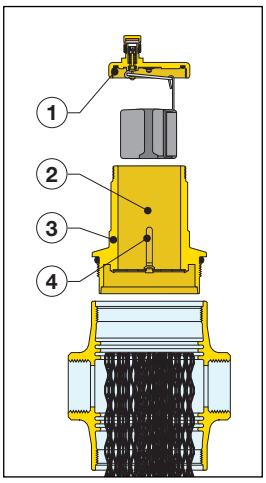


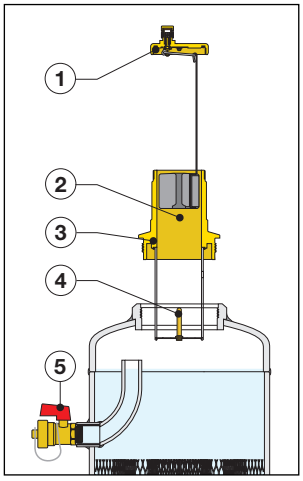
Construction details

The DISCALDIRT air and dirt separator is designed to be maintained and cleaned without removing it from system piping.
The automatic air vent, located at the top of the device, has a long chamber for float movement (2). This prevents any impurities in the water from reaching the seal seat. The non-corroding stainless steel pinned linkage and PP float can be accessed by removing the upper cover (1). The float guide pin (4) prevents the float from jamming against the inside housing in non-vertical installations or from boiler residue buildup.

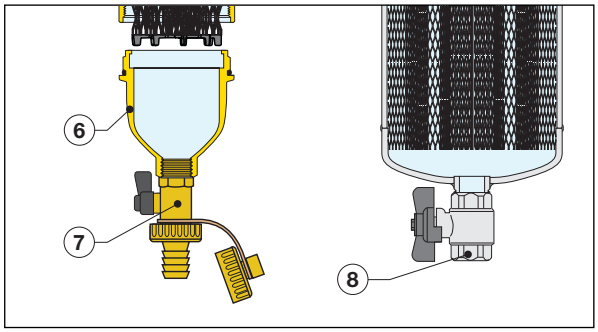
Unscrew the top part of the casing (3) to clean the entire air venting system.
The air venting system in both brass and steel DISCALDIRT air and dirt separators features a pinned float.
Steel DISCALDIRT air and dirt separators with flanged and threaded connections have an integral side drain port with shutoff valve, code 538402 FD (5), which has two functions:

1. Air removed while filling the system during system commissioning
2. Remove debris that float within the air separator.





A separately-sourced drain valve installed to the drain pipe at the base of the steel DISCALDIRT air and dirt separator (8) can be used to remove any debris that has settled at the bottom of the separator, even with the system is in operation. To inspect the internal element of brass DISCALDIRT air and dirt separators, unscrew the large dirt separation chamber (6) with a 26 mm hexagon wrench. The internal element can be removed for cleaning. Additionally, the brass air and dirt separator has a lever operated shut-off drain valve code 538402 FD, and hose attachment with plug (7), to drain accumulated debris as needed.

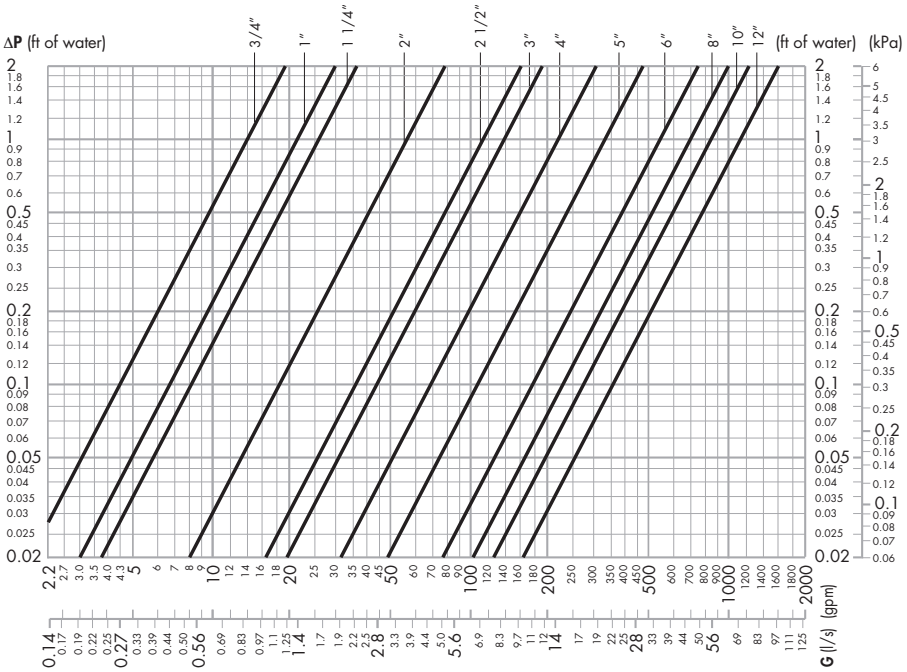


Flow Capacity

The fluid velocity at connections for DISCALDIRT 546 and NA546 series air and dirt separators is recommended to not exceed 10.0 f/s. Above this speed, heavy internal turbulance and noise can occur and air and dirt elimination efficiency begins to fall measurably. Optimal air and dirt separation performance occurs at fl uid velocities of 4.0 f/s or less. See the flow capacity chart.

		FLOW CAPACITY											
		BRASS			STEEL								
	Size	3/4"	1"	1 1/4"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
Optimal (≤4.0 f/s)	GPM	8.0	9.3	10.0	37.3	63.0	95	149	259	380	625	980	1,410
	l/s	0.5	0.6	0.63	2.4	4.0	6.0	9.4	16.3	24.0	40.0	62.0	89.0
Max. (10.0 f/s)	GPM	19.0	22.1	25.0	88.8	150.1	227.4	355.3	616.4	903.6	1,570	2,450	3,530
	l/s	1.2	1.4	1.6	5.6	9.5	14.3	22.4	38.9	57.0	100.0	155.0	222.0
	Cv	19.1	32.5	40.0	87	174	208	324	520	832	1,109	1,387	1,664

Hydraulic characteristics



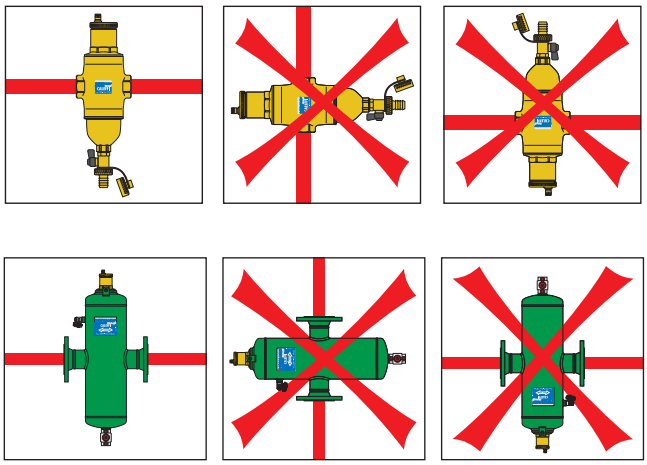
Replacement parts

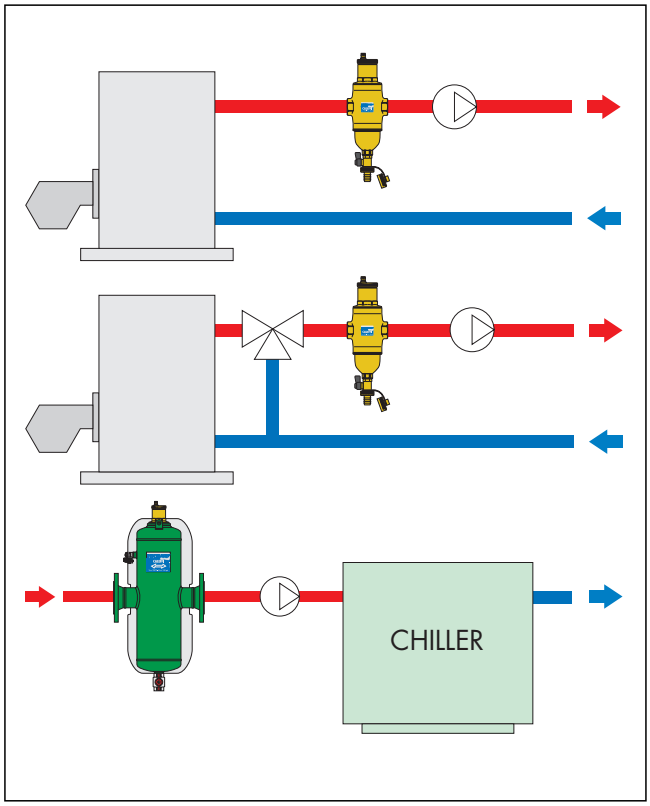
Drain valves, items 5 & 7, code 538402 FD

Air vent assemblies:
- for Brass separators, code 59829
- for Steel separators, code 59756

Installation

DISCALDIRT units may be used in both heating and cooling systems, to ensure continuous air and dirt elimination. The units should be installed after the boiler and on the pump suction side, as these are the points where the formation of micro-bubbles is greatest.
DISCALDIRT air and dirt separators must be installed vertically.
In installation conditions where inspection is not possible, it is recommended that the venting valve cap is replaced by a Caleffi part number R59681 hygroscopic safety vent. The standard replacement cap code number is 59199.





SPECIFICATION SUMMARIES

DISCAL*DIRT* Series NA546 - Flanged Steel
Air and dirt separator with brass side drain valve and automatic air vent with pinned float. Flanged ANSI B16.5 CLASS 150 RF connections from 2" to 12". Epoxy resin painted steel body. EPDM seal. Stainless steel internal mesh element. PP float. Brass float guide and stem. Stainless steel float lever and spring. Maximum working pressure, 150 psi (10 bar). Temperature range 32 to 250°F (0 to 120°C). Glycol maximum 50%. Designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, CRN Registered.

DISCAL*DIRT* Series 546 - Flanged Steel
Air and dirt separator with brass side drain valve and automatic air vent with pinned float. Flanged ANSI B16.5 CLASS 150 RF connections from 2" to 6". Epoxy resin painted steel body. EPDM seal. Stainless steel internal mesh element. PP float. Brass float guide and stem. Stainless steel float lever and spring. Maximum working pressure, 150 psi (10 bar). Temperature range 32 to 250°F (0 to 120°C). Glycol maximum 50%.

DISCAL*DIRT* Series 546 - Brass with Sweat and NPT Union fittings
Air and dirt separator complete with brass automatic air vent containing pinned float. Sweat union connections for 3/4" and 1" sizes, NPT male union connection for 1", and integral sweat connection for 1-1/4". Brass body and dirt separation chamber. EPDM seals. Glass reinforced nylon PA66G30 internal mesh element. PP float. Brass float guide and stem. Stainless steel float lever and spring. Brass drain shut-off valve. Maximum working pressure, 150 psi (10 bar). Temperature range 32 to 230°F (0 to 110°C). Glycol maximum 50%. Particle separation rating down to 5 µm. Drain with hose connection.

DISCAL*DIRT* Series NA546 - Threaded Steel
Air and dirt separator with brass side drain valve and automatic air vent with pinned float. Threaded connections from 2" to 4". Epoxy resin painted steel body. EPDM seal. Stainless steel internal mesh element. PP float. Brass float guide and stem. Stainless steel float lever and spring. Maximum working pressure, 150 psi (10 bar). Temperature range 32 to 250°F (0 to 121°C). Glycol maximum 50%. Designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, CRN Registered.

CALEFFI

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