

# DISCAL DIRT® air and dirt separator



01123/23 NA

Replaces 01123/22 NA

## 546 series



### 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 microbubble level. The DISCALDIRT® air and dirt separator also removes any solid impurities in the system. The impurities collect at the bottom of the device and can be flushed through the integral drain shut-off valve. The circulation of fully de-aerated and cleaned water enables the equipment to operate under optimum conditions, free from noise, corrosion, or mechanical damage.

Insulation shells are available separately for field installation on the brass DISCALDIRT.

### Product range

54609 series	DISCALDIRT air and dirt separator in brass.....connections 1", 1¼" sweat
546016A	DISCALDIRT air and dirt separator in brass.....connection 1" NPT male
546 series	DISCALDIRT air and dirt separator in steel.....connections 2"-5" ANSI flanged
NA546 series	DISCALDIRT air and dirt separator in steel, ASME & CRN.....connections 2½" to 14" ANSI flanged
NA546050T	DISCALDIRT air and dirt separator in steel, ASME & CRN.....connections 2" NPT threaded

### Technical specifications

#### Brass body air and dirt separators

<b>Materials</b> - body:	brass
- dirt separation chamber:	brass
- air vent body:	brass
- internal element:	glass reinforced nylon, PA66GF30
- air vent float:	PP
- air vent float guide pin:	stainless steel
- air vent float linkages:	stainless steel
- spring:	stainless steel
- seals:	peroxide-cured EPDM
- bottom drain shut-off valve:	brass

#### Performance

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)
Air separation efficiency:	100% removal to microbubble level
Particle separation capacity:	to 5 µm (0.2 mil)

<b>Connections</b> - main:	1", 1¼" sweat; 1" NPT male
- drain shut-off valve:	¾" garden hose (GHT)

#### Steel body air and dirt separators

<b>Materials</b> - body:	epoxy resin painted steel
- air vent body:	brass
- mesh internal element:	stainless steel
- air vent float:	PP
- air vent float guide pin:	stainless steel
- air vent float linkages:	stainless steel
- spring:	stainless steel
- seals:	peroxide-cured EPDM
- bottom drain shut-off valve:	brass
- side drain shut-off valve:	brass

#### Performance

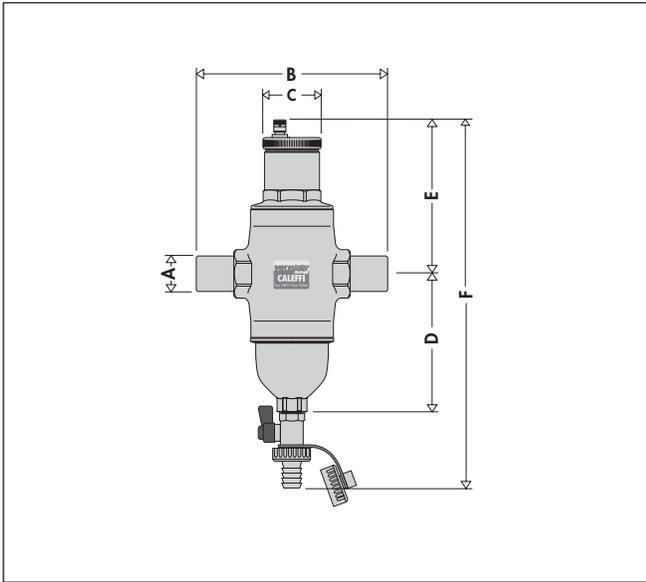
Suitable fluids:	water, glycol solution
Max. percentage of glycol:	50%
Max. working pressure:	150 psi (10 bar)
Temperature range (vessel):	32–270°F (0–132°C)
Air separation efficiency:	100% removal to microbubble level
Particle separation capacity:	to 5 µm (0.2 mil)

<b>Connections</b> - flanged:	2½"-14" ANSI B16.5 150 CLASS RF
- threaded:	2" NPT male
- bottom drain valve:	sizes 2 – 6 inch: 1" NPT female sizes 8 - 14 inch: 2" NPT female
- side drain shut-off valve:	¾" GHT

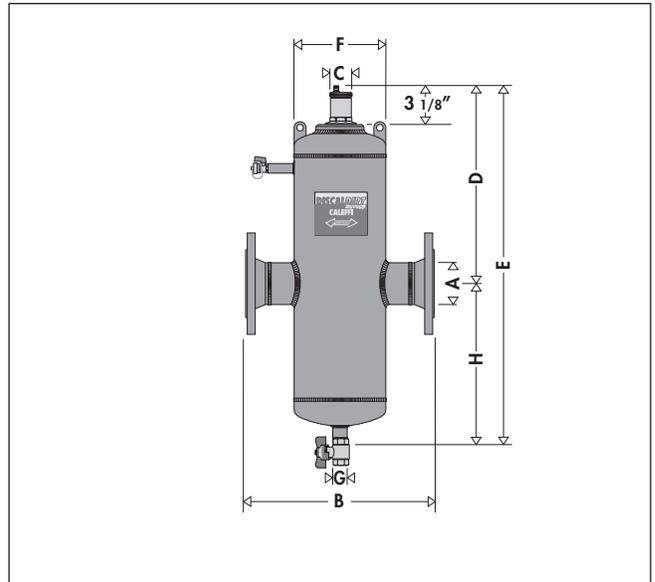
#### Agency approval

NA546 series designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code and tagged, registered with the National Board of Boiler and Pressure Vessel Inspectors, stamped for 150 psi (10 bar) working pressure, with ASME U stamp, CRN registered. 14" is CRN pending, consult Caleffi.

**Dimensions**

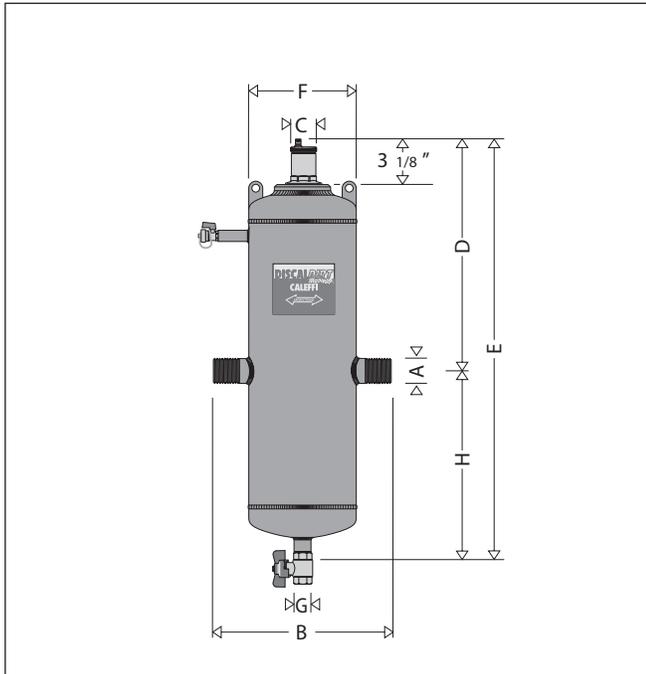


Code	Connections	A	B	C	D	E	F	Wt. (lb)	Wt. (kg)
546096A	Sweat	1"	7 <sup>3</sup> / <sub>8</sub> "	2 <sup>1</sup> / <sub>8</sub> "	5"	5 <sup>1</sup> / <sub>2</sub> "	12 <sup>3</sup> / <sub>4</sub> "	8.3	3.8
546016A	NPT male	1"	7 <sup>3</sup> / <sub>8</sub> "	2 <sup>1</sup> / <sub>8</sub> "	5"	5 <sup>1</sup> / <sub>2</sub> "	12 <sup>3</sup> / <sub>4</sub> "	8.3	3.8
546097A	Sweat	1 <sup>1</sup> / <sub>4</sub> "	6 <sup>3</sup> / <sub>16</sub> "	2 <sup>1</sup> / <sub>8</sub> "	5"	5 <sup>1</sup> / <sub>2</sub> "	12 <sup>3</sup> / <sub>4</sub> "	8.3	3.8



Code	A	B	C	D	E	F	G	H	Cap. (gal)	Wt. (lb)	Wt. (kg)
546050A	2"	13 <sup>3</sup> / <sub>4</sub> "	2 <sup>3</sup> / <sub>16</sub> "	14 <sup>3</sup> / <sub>16</sub> "	28 <sup>3</sup> / <sub>4</sub> "	6 <sup>5</sup> / <sub>16</sub> "	1"	13 <sup>1</sup> / <sub>16</sub> "	3.6	40	18.1
*546060A	2 <sup>1</sup> / <sub>2</sub> "	13 <sup>3</sup> / <sub>4</sub> "	2 <sup>3</sup> / <sub>16</sub> "	14 <sup>3</sup> / <sub>16</sub> "	28 <sup>3</sup> / <sub>4</sub> "	6 <sup>5</sup> / <sub>16</sub> "	1"	13 <sup>1</sup> / <sub>16</sub> "	3.6	42	18.6
*546080A	3"	18 <sup>5</sup> / <sub>8</sub> "	2 <sup>3</sup> / <sub>16</sub> "	17"	34 <sup>1</sup> / <sub>2</sub> "	8 <sup>5</sup> / <sub>16</sub> "	1"	17 <sup>1</sup> / <sub>2</sub> "	7.6	73	33.1
*546100A	4"	18 <sup>1</sup> / <sub>2</sub> "	2 <sup>3</sup> / <sub>16</sub> "	17"	34 <sup>1</sup> / <sub>2</sub> "	8 <sup>5</sup> / <sub>16</sub> "	1"	17 <sup>1</sup> / <sub>2</sub> "	7.8	78	35.4
*546120A	5"	25"	2 <sup>3</sup> / <sub>16</sub> "	21 <sup>1</sup> / <sub>16</sub> "	46 <sup>1</sup> / <sub>16</sub> "	12 <sup>3</sup> / <sub>4</sub> "	1"	25 <sup>5</sup> / <sub>8</sub> "	22.4	181	82.1
*546150A	6"	25"	2 <sup>3</sup> / <sub>16</sub> "	21 <sup>1</sup> / <sub>16</sub> "	46 <sup>1</sup> / <sub>16</sub> "	12 <sup>3</sup> / <sub>4</sub> "	1"	25 <sup>5</sup> / <sub>8</sub> "	23.0	188	85.3

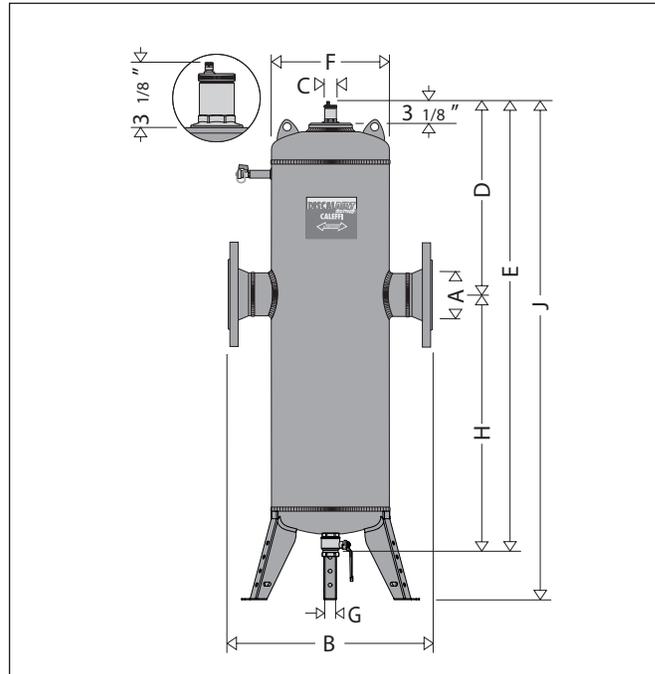
\*Add prefix NA to flanged code number when ordering ASME tagged and registered with the National Board of Boiler and Pressure Vessel Inspector and CRN registered.



Code	A	B	C	D	E	F	G	H	Cap. (gal)	Wt. (lb)	Wt. (kg)
NA546050T	2"	13"	2 <sup>3</sup> / <sub>16</sub> "	14 <sup>3</sup> / <sub>16</sub> "	28 <sup>3</sup> / <sub>4</sub> "	6 <sup>5</sup> / <sub>16</sub> "	1"	13 <sup>1</sup> / <sub>16</sub> "	3.6	28	12.7

This model is ASME tagged and registered with the National Board of Boiler and Pressure Vessel Inspector and CRN registered.

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



Code	A	B	C	D	E	F	G	H	J	Cap. (gal)	Wt. (lb)	Wt. (kg)
NA546200A	8"	35 <sup>7</sup> / <sub>16</sub> "	2 <sup>3</sup> / <sub>16</sub> "	35 <sup>3</sup> / <sub>16</sub> "	75 <sup>3</sup> / <sub>16</sub> "	20"	2"	43 <sup>3</sup> / <sub>16</sub> "	92 <sup>3</sup> / <sub>4</sub> "	95	355	161
NA546250A	10"	41 <sup>1</sup> / <sub>4</sub> "	2 <sup>3</sup> / <sub>16</sub> "	38 <sup>5</sup> / <sub>16</sub> "	86 <sup>9</sup> / <sub>16</sub> "	26"	2"	48 <sup>1</sup> / <sub>4</sub> "	101 <sup>1</sup> / <sub>16</sub> "	175	555	252
NA546300A	12"	46 <sup>7</sup> / <sub>16</sub> "	2 <sup>3</sup> / <sub>16</sub> "	41 <sup>1</sup> / <sub>8</sub> "	93 <sup>1</sup> / <sub>16</sub> "	30"	2"	52 <sup>3</sup> / <sub>16</sub> "	107 <sup>3</sup> / <sub>16</sub> "	255	825	375
NA546350A	14"	48"	2 <sup>3</sup> / <sub>16</sub> "	46 <sup>5</sup> / <sub>16</sub> "	112 <sup>3</sup> / <sub>16</sub> "	36"	2"	66 <sup>5</sup> / <sub>16</sub> "	127 <sup>3</sup> / <sub>4</sub> "	420	1270	576

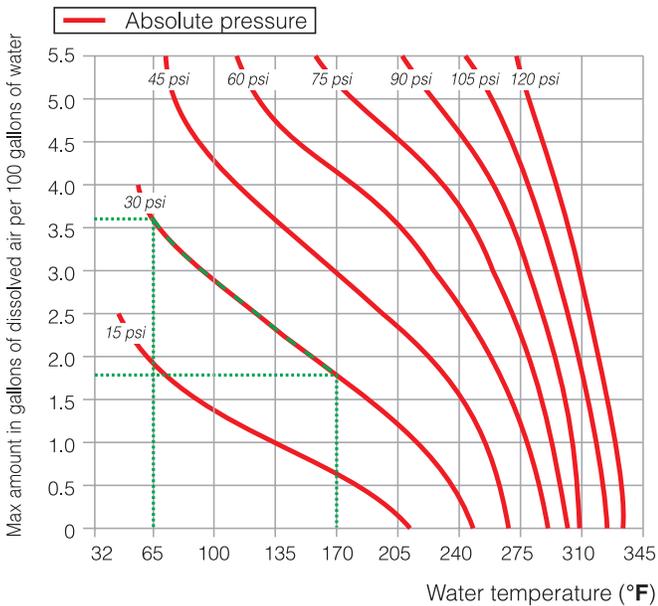
These models are ASME tagged and registered with the National Board of Boiler and Pressure Vessel Inspector and CRN registered, except 14" is CRN pending. Consult Caleffi.

## 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 demonstrates 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 65°F (18°C) to 170°F (75°C), 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 millimeter.

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.

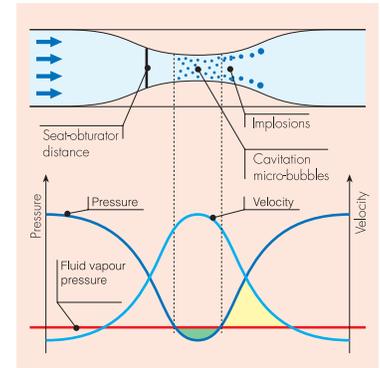
## Solubility of air in water



## Cavitation and micro-bubbles

Micro-bubbles develop where the fluid velocity is very high with the corresponding reduction in pressure. These points are typically pump impellers and valve ports.

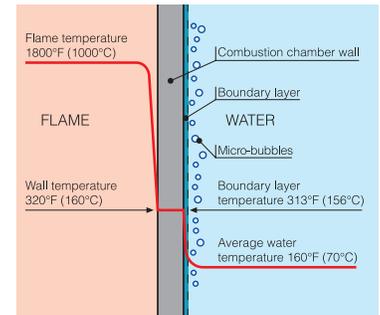
These air and vapor micro-bubbles, the formation of which is enhanced in the case of non-deaerated water, may subsequently implode due to the cavitation phenomenon.



## 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.

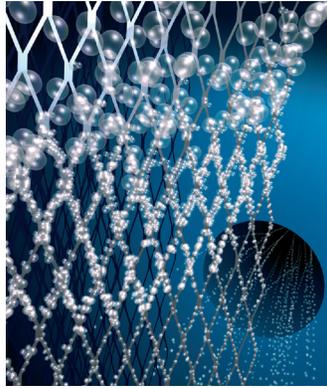
Some of this air is reabsorbed in the presence of colder surfaces.



## Operating principle

### Microbubble air separation

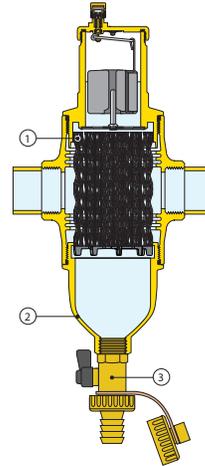
The air and dirt separator uses the combined action of several physical principles. The active part is the internal element (1) and consists of a glass-reinforced nylon mesh for the brass DISCALDIRT or for the steel DISCALDIRT an assembly of concentric metal mesh (stainless steel) surfaces. These elements create the whirling movement required to facilitate the release of micro-bubbles and their adhesion to these surfaces.



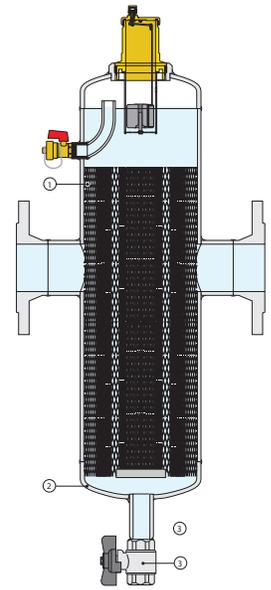
The bubbles, fusing with each other, increase in volume until the hydrostatic thrust is such as to overcome the adhesion force to the structure. They rise towards the top of the unit from which they are released through a float-operated automatic air vent valve.

### Microparticle dirt separation

The dirt separating action performed by the same internal element (1) offers little resistance to the flowing medium while ensuring dirt separation. The particles collide with the concentric diamond pattern mesh surfaces and then settle to the bottom in the dirt collection chamber (2), and not by filtration unlike mesh strainers; which, over time, get progressively clogged. By contrast, the DISCALDIRT's low-velocity zone dirt separator function efficiently removes the particles to as small as  $5\mu\text{m}$  (0.2 mil) with very low head loss. The dirt can then be removed through the bottom drain port (3).



Brass DISCALDIRT

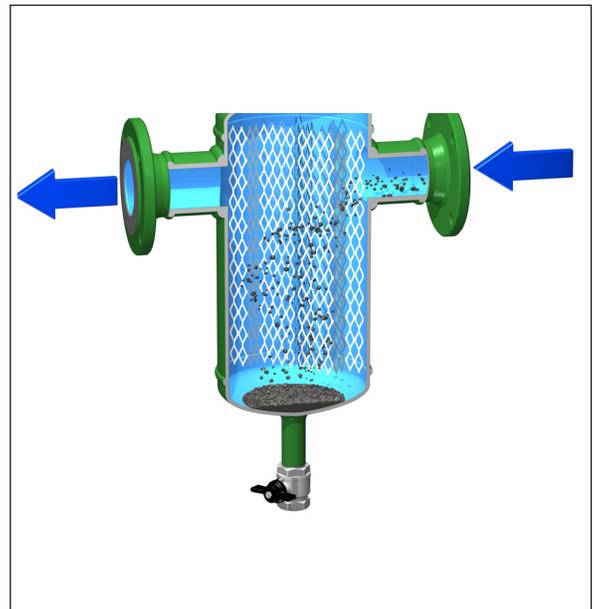


Steel DISCALDIRT

## Geometric structure and large dirt collection chamber

The geometrical structure of DISCALDIRT reduces the flow media velocity to help separate dirt particles. The dirt collection chamber has the following features:

- It is located at the bottom of the device at such a distance from the connections that the collected dirt is not affected by the swirl of the flow through the mesh element.
- It has enough capacity to increase the amount of dirt stored and therefore decreases the frequency of emptying it compared to filters that need to be cleaned frequently.



## 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 corrosion resistant stainless steel pinned linkage and PP float can be accessed by removing the upper cover (1). The stainless steel float guide pin (4) prevents the float from jamming against the inside housing, sticking due to accumulating residue in the flowing fluids, in non-vertical installations or from boiler or chiller residue buildup.

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

The air venting system in the brass DISCALDIRT and steel DISCALDIRT air and dirt separators features a pinned float.

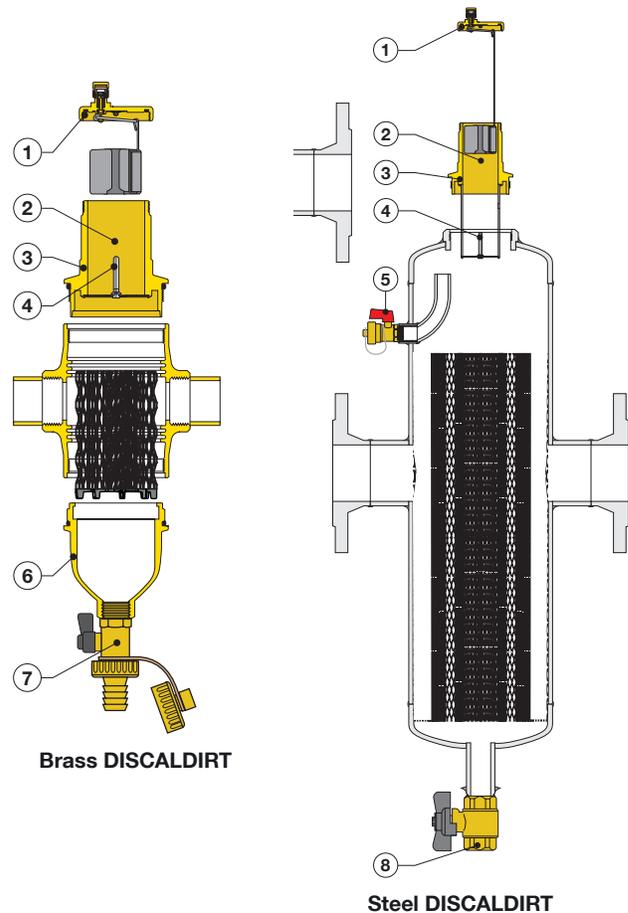
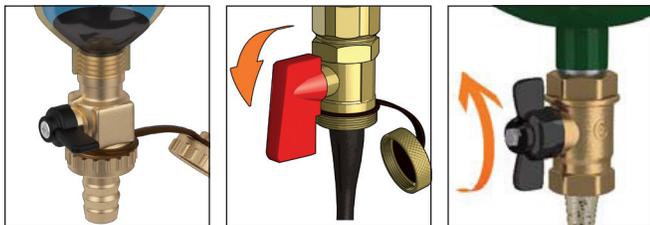
Steel DISCALDIRT air and dirt separators with flanged and threaded connections have an integral side drain port with shutoff valve, code 538402 FD (5), which has two functions:

1. Air removal while filling the system during system commissioning.
2. Debris removal that float within the air separator.

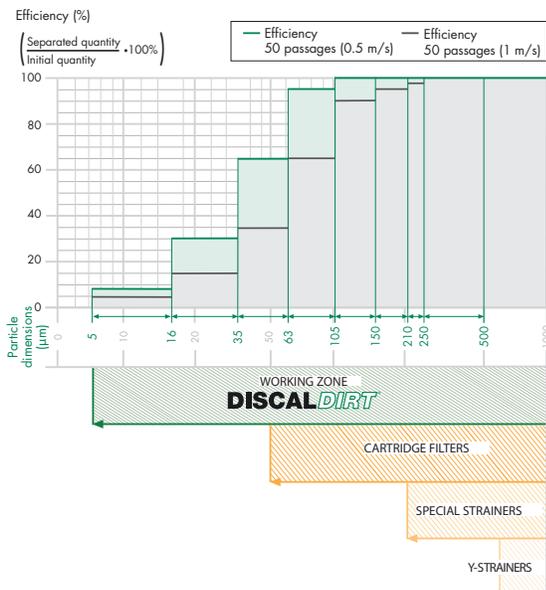
The drain valve (code NA39753 - 1 inch or code NA59600 - 2 inch) installed on the drain pipe at the base of the steel DISCALDIRT air and dirt separator (8) can be used to remove any debris that has settled at the bottom of the separator, even while the system is in operation. To inspect the internal 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 separators have a lever operated shut-off drain valve code 538402 FD, and 3/4" garden hose attachment with plug (7), to drain accumulated debris as needed.

## Draining off dirt and ferrous impurities

The dirt separator collection chamber has a drain valve. Using the handle provided it is possible to drain off the accumulated dirt particles even with the system in operation.



## Particle separation rating – dirt separator efficiency



## Separation efficiency

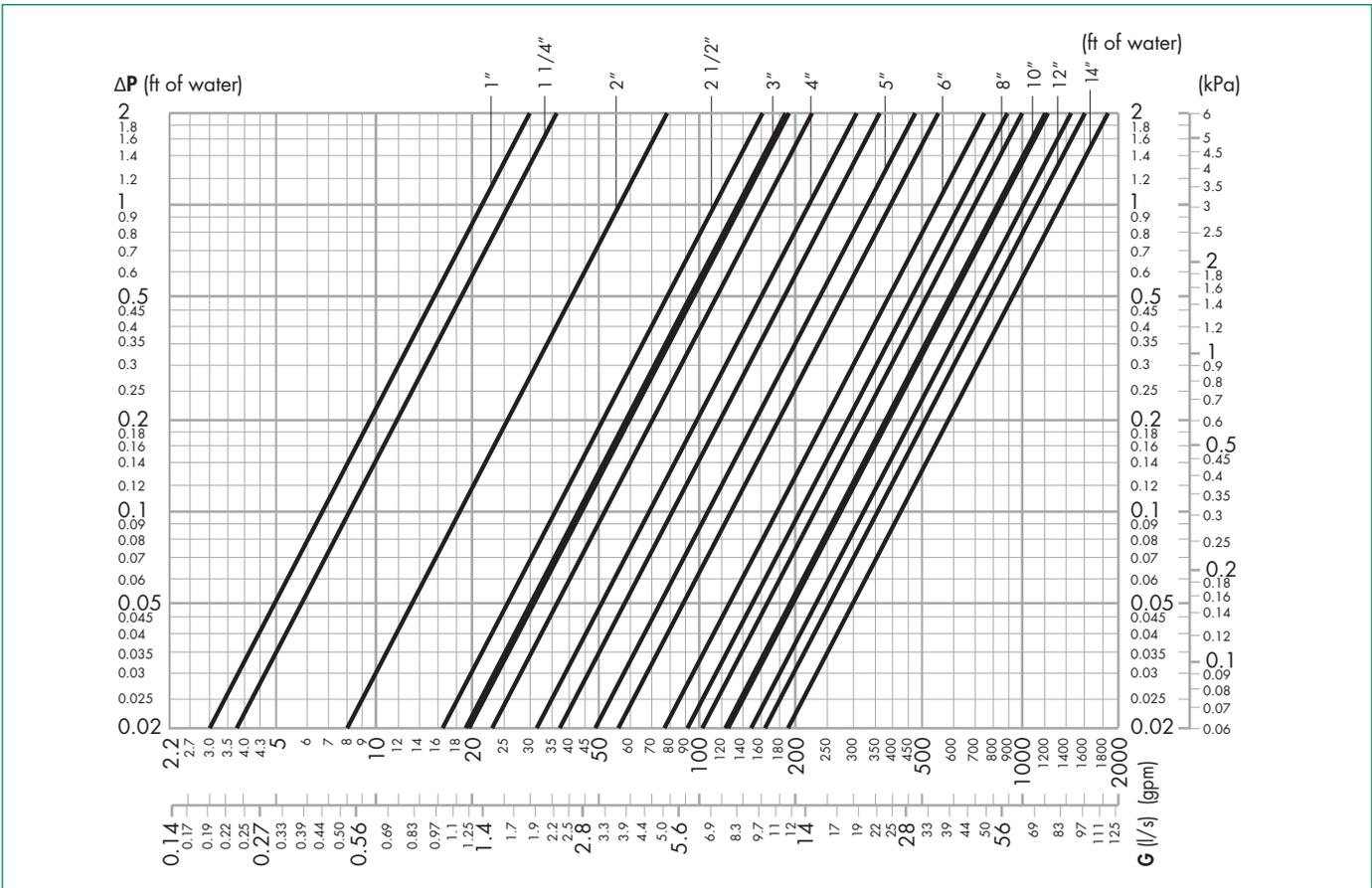
The capacity for separating the impurities in the medium circulating in the closed circuits of the systems basically depends on three parameters:

- 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 special design of the internal element in the Caleffi DISCALDIRT® air and dirt separators, are 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 (left) 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.

# Hydraulic characteristics



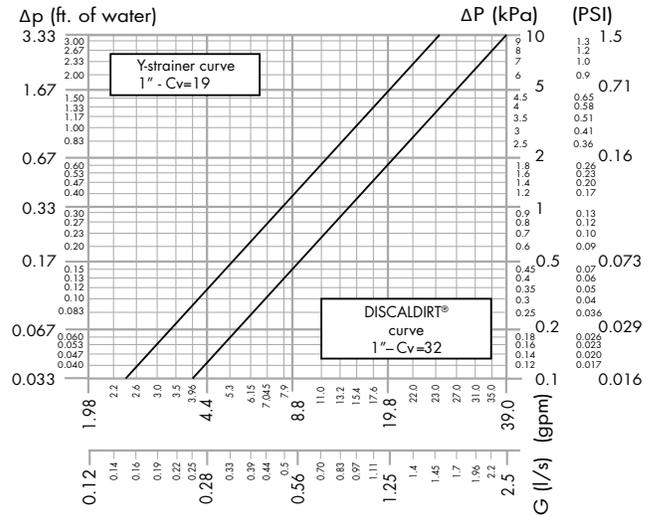
ft of water x .433 = psi

		Brass		Steel union		Steel flanged body									
Size		1"	1 1/4"	1 1/2"	2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	14"
4.0 f/s	GPM	10	15	22	39	39	60	90	160	245	355	625	980	1,410	1,920
	l/s	0.63	0.95	1.04	2.5	2.5	4.0	6.0	10	15	22	40	62	89	121
10.0 f/s	GPM			55	98	100	155	220	400	615	880	1,570	2,450	3,525	4,800
	l/s			3.5	6.2	6.3	9.8	14	25	39	55	99	155	222	303
	Cv	32	40	50	79	87	174	208	324	520	832	1,109	1,387	1,664	1,967

## 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, flow 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 DIRTAL<sup>®</sup>, 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 sized, clean basket strainer, depending on mesh size and amount of filtered debris. These head losses are not affected by the amount of dirt collected.



## Insulation shells

The brass DISCALDIRT 5460 series can be supplied with the optional insulated cover, code CBN546002 series (purchased separately), to minimize heat loss.

### Technical specifications

Material: closed cell expanded PE-X  
 Thickness: 25/64" (10 mm)  
 Density: - inner part: 1.9 lb/ft<sup>3</sup> (30 kg/m<sup>3</sup>)  
 - outer part: 5.0 lb/ft<sup>3</sup> (80 kg/m<sup>3</sup>)  
 Thermal conductivity (DIN 52612):  
 - at 32°F (0°C): 0.263 BTU·in/hr·ft<sup>2</sup>·°F (0.038 W/(m·K))  
 - at 104°F (40°C): 0.312 BTU·in/hr·ft<sup>2</sup>·°F (0.045 W/(m·K))  
 Coefficient of resistance to water vapor (DIN 52615): >1,300  
 Working temperature range: 32–230°F (0–110°C)  
 Reaction to fire (DIN 4102): CLASS B2



Code	Size
CBN546002	1", 1¼" DISCALDIRT

### Removing insulation and draining impurities

1. Remove the insulation by taking off the bottom casing of the collection chamber first, and if necessary, the top insulation casing later.
3. Flush out the debris by turning the handle to open the drain valve.
4. When finished, replace the insulation shells.

## Replacement parts

Drain valves (5) & (7), code 538402 FD. Drain valves (8), separator sizes 2" - 6", code NA39753; separator sizes 8" - 14", code NA59600. Refer to construction figures on page 5.



(5), (7)



(8)

A replacement air vent assembly for the brass DISCALDIRT 5460 series is code 59829; for the steel DISCALDIRT 546, NA546 series is code 59756.

The moving parts that control air venting are accessed simply by removing the upper cover. Replacement cap and float assembly for all versions of the brass DISCALDIRT 546 series is code F39807, for all versions of the steel DISCALDIRT 546 and NA546 series is code F0001470.

When cleaning, simply unscrew the portion of the body containing the automatic air vent.

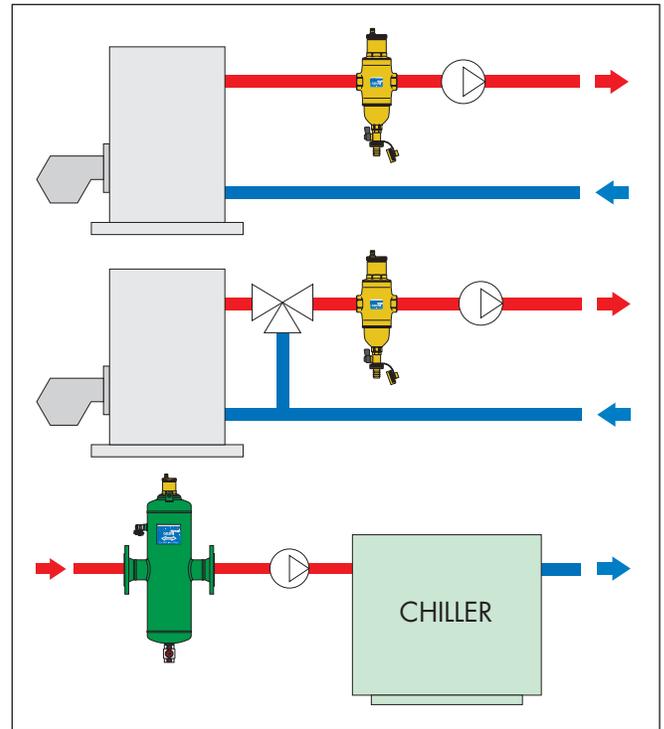
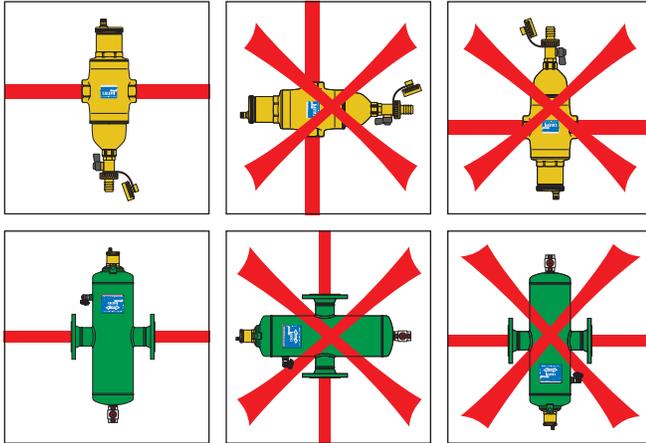


F39807

## 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

### 5460 series DISCALDIRT – brass with sweat and NPT connections

Air and dirt separator complete with brass automatic air vent containing pinned float. Connections for horizontal pipes, sweat connections for 1" and 1-1/4" sizes, NPT male connection for 1". Brass body and dirt separation chamber. Peroxide-cured EPDM seals. Glass reinforced nylon PA66G30 internal mesh element, removable for cleaning. PP float. Stainless steel float linkages. Stainless steel float guide pin. Brass drain shut-off valve. Maximum working pressure, 150 psi (10 bar). Temperature range 32 to 250°F (0 to 120°C). Glycol maximum 50%. Air separation efficiency: 100% removal to micro-bubble level. Particle separation capacity: to 5 µm (0.2 mil). Drain shut-off valve with 3/4" garden hose connection. Pre-formed insulation shells available for field installation.

### 546 series DISCALDIRT – flanged steel

Air and dirt separator in steel with brass side drain valve and automatic air vent with pinned float. Flanged ANSI B16.5 CLASS 150 RF connections from 2" to 6" for horizontal pipes. Epoxy resin painted steel body. Peroxide-cured EPDM seal. Stainless steel internal mesh element. PP float. Stainless steel float linkages. Stainless steel float guide pin. Supplied with drain ball valve with T handle, brass body and 1" NPT female connection, code NA39753, and side drain port supplied with integral brass shutoff valve, code 538402 FD, and 3/4" garden hose connection. Maximum working pressure, 150 psi (10 bar). Vessel working temperature range 32 to 270°F (0 to 132°C). Glycol maximum 50%. Air separation efficiency: 100% removal to micro-bubble level. Particle separation capacity: to 5 µm (0.2 mil).

### NA546 series DISCALDIRT – flanged steel, ASME & CRN

Air and dirt separator in steel with brass side drain valve and automatic air vent with pinned float. Flanged ANSI B16.5 CLASS 150 RF connections from 2" to 14", and 2" NPT threaded connections, for horizontal pipes. Epoxy resin painted steel body. Peroxide-cured EPDM seal. Stainless steel internal mesh element. PP float. Stainless steel float linkages. Stainless steel float guide pin. Supplied with brass drain ball valve, for 2" to 6" size separators 1" NPT female with T handle, code NA39753, for 8" to 14" size separators 2" NPT female with lever handle, code NA59600. Side drain port supplied with integral brass shutoff valve, code 538402 FD, and 3/4" garden hose connection. Maximum working pressure, 150 psi (10 bar). Vessel working temperature range 32 to 270°F (0 to 132°C). Glycol maximum 50%. Air separation efficiency: 100% removal to micro-bubble level. Particle separation capacity: to 5 µm (0.2 mil). Designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code and tagged and registered with National Board of Boiler and Pressure Vessel Inspector, CRN registered (size 14" pending, contact Caleffi), and stamped for 150 psi (10 bar) working pressure, with ASME U stamp.

We reserve the right to change our products and their relevant technical data, contained in this publication, at any time and without prior notice.



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