CALEFFI
Hydronic Solutions



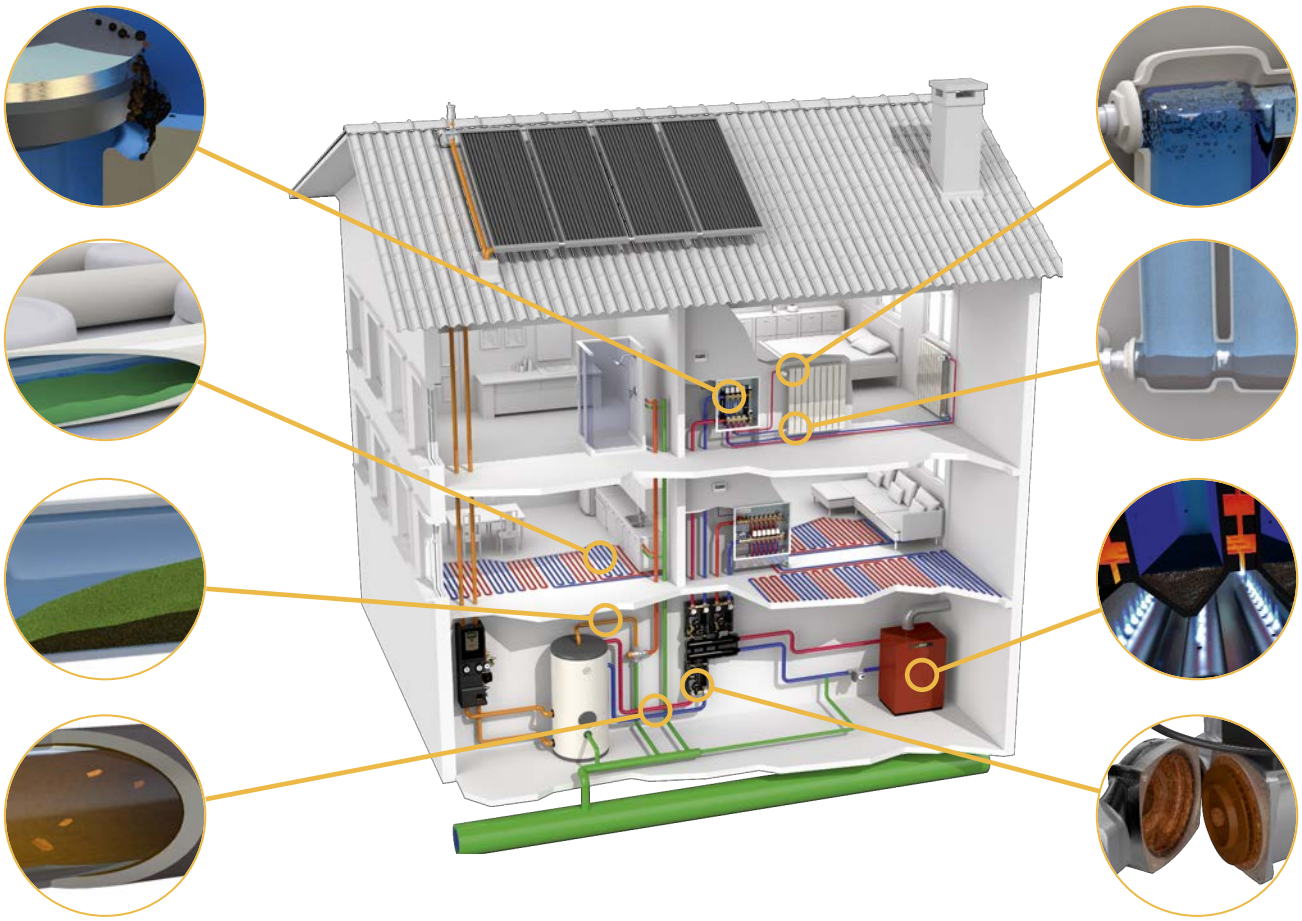


WATER TREATMENT IN HVAC SYSTEMS

2016

AIR AND DIRT IN AIR-CONDITIONING SYSTEMS

Heating systems are often subject to problems such as deposits and encrustations, loss of efficiency in heat exchange, high noise, breakage of appliances, blocking of lines. These problems are mostly caused by the quality of the water, by the presence of air and impurities that provoke the formation of encrustations and facilitate the phenomenon of corrosion.



Problems linked to the presence of air

The problems due to the air contained in hydronic systems can be serious and unpleasant both for the users and for the professionals who service the system. If these problems are not analysed thoroughly, they can often lead to solutions that are not decisive in the long term.
Initially it is very important to identify the phenomena that the air in the system can provoke.

Noise in the pipes and in the terminals
The air in the system causes noise in the pipes and in the regulating devices due to the presence of air bubbles, which are more evident in the phase of switching on the system, therefore at the time when the flow is beginning to move in the pipes.

Insufficient flow rates or total circulation blocks.
Circulation can be partially or totally blocked by air bubbles present in some points in the system. This phenomenon is particularly serious in systems with radiant panels.

Insufficient heat exchange between the emission terminals and the environment
The quantity of the heat that is transferred to the environment decreases considerably where there is air in the radiators or in the exchange batteries. A lower efficiency of the heating bodies can cause serious thermal imbalances and therefore insufficient comfort levels, as well as greater running costs.

Corrosion of the system
This is provoked by the oxygen present in the air and can lead to the weakening but also the breakage of components such as pipes, radiators and boiler heat exchangers.

Problems linked to the presence of dirt

The impurities suspended in the water of the hydronic circuits can cause a series of problems that should not be underestimated.

Corrosion due to differential ventilation
This is due to the fact that, in the presence of water, a layer of dirt on a metal surface leads to the formation of two zones (water/dirt and dirt/metal) with a different oxygen content; for this reason, localised batteries are activated with current flows that lead to corrosion of the metal surfaces.

Irregular operation of the valves
This is due to dirt which can adhere stubbornly to the valve seats and cause deformities in regulation and leaks.

Blocking and seizing the pumps
These are caused by dirt that circulates through the pumps and can build up in them, due both to the particular geometry of the pumps and to the effect of the magnetic fields generated by the pumps themselves.

Lower efficiency of the heat exchangers
Dirt deposits can appreciably reduce both the flow rates of the fluids and the heat exchanging surfaces.

Devices for eliminating air

Automatic air vents

- ROBOCAL — 5024 - 5025 - 5026 - 5027 series
- MINICAL — 5020 - 5021 series
- VALCAL — 5022 series
- MAXCAL — 501 serie
- DISCALAIR® — 551 series



Air vents for radiators

- automatic — 504 - 507 series
- valves for radiators — 505 - 5055 - 5054 - 5080 series


Deaerators

- for horizontal pipes — 551 series
- for vertical pipes — 551 series



Devices for eliminating impurities

Dirt separators

- standard — 5462 series, 5469 series, 5465 series
- with magnet — 5463 series, 5468 series, 5466 series
- in polymer with magnet — 5453 series
- in polymer under-boiler — 5451-5452 series








Dirt separator strainer

- multifunction device — 5453 series

Strainers

- oblique in bronze — 577 series
- oblique in cast iron — 579 series


Devices for eliminating air and impurities

Deaerator-dirt separators

- standard — 546 series
- with magnet — 5461 series



Devices for softening and demineralisation

- filling and demineralisation unit — 5741 series
- filling and softening unit — 5741 series



THE PRESENCE OF AIR

The presence of air in air-conditioning systems is due to several causes:

- to the air not ejected during filling, that is the air that remains in non-vented niches, or in the highest part of the radiators, or even in pipes installed with a counter-slope.
- to the air sucked in from zones working with negative pressure. This air enters the system, instead of leaving it, through the normal venting systems.
- to the air dissolved in the water which the system is filled with: air dissolved in the water at the level of ions and molecules.

Air not ejected during filling: formation of bubbles

Before being started up, every hydronic system is obviously full of air. An inaccurate design/installation of the system that "foresees" particular routes for the lines can favour the entrapment of air during filling.
In particular, the air tends to gather:

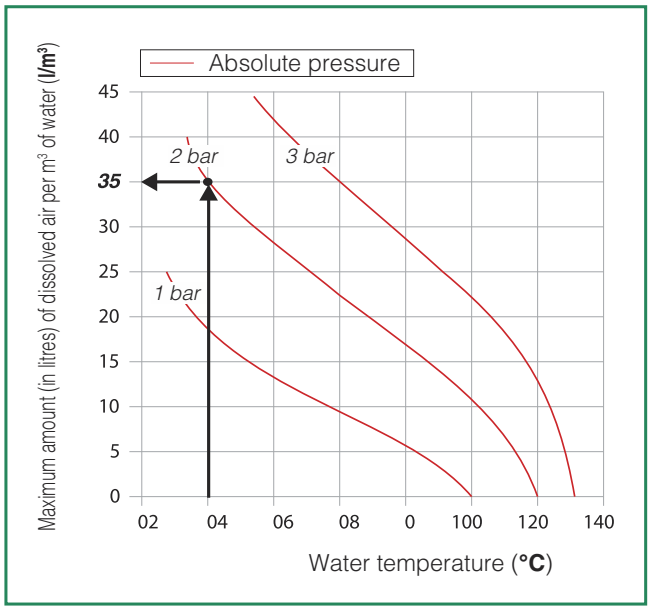
- in the upper part of the heating bodies;
- in pipe sectors that have to go round an obstacle;
- in long stretches of horizontal pipes that then turn downwards;
- in the upper part of the risers.

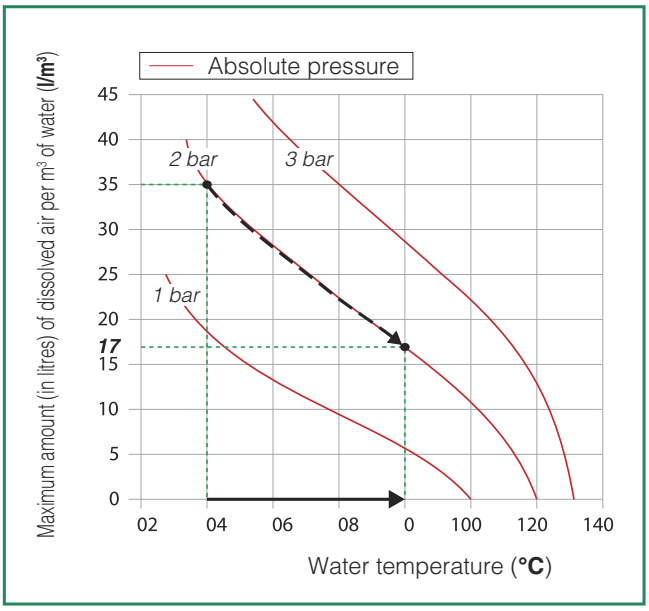
The air that enters during system operation

The air that enters during system operation is the air that can get in through the free surface of an open vessel (systems now little used), or that can filter through the venting systems, the gaskets and fittings if the system is working with negative pressure.
The latter case occurs when the sum of the static pressure of the system and the dynamic negative pressure induced by the pump is negative; this is possible especially in the higher parts of the system, that is where the static pressure is lower.
Generally, to understand whether a system is working with a negative pressure it is sufficient to open, for example, the valve on the highest radiator and to see whether water comes out or air goes in.

Air dissolved in a water solution: formation of micro-bubbles

The amount of air that can remain dissolved in a water solution depends on the pressure and temperature. This relationship is shown by Henry's law (the graph of which is provided), which links the water temperature to the number of litres of air dissolved in one m^3 of water.
The air dissolved in the cold water used for filling or topping up is released principally when the water in the system is heated, for example in a 1000 l system (more or less a 100000 kcal/h system), when the filling water is heated from 20 to 80°C, at a constant pressure of 2 bar, from 17 to 18 litres of air are released.
This air appears in the system in the form of micro-bubbles.
In circuits of air-conditioning systems there are also specific points where this micro-bubble formation process takes place continuously: inside boilers and devices which operate under conditions of cavitation.



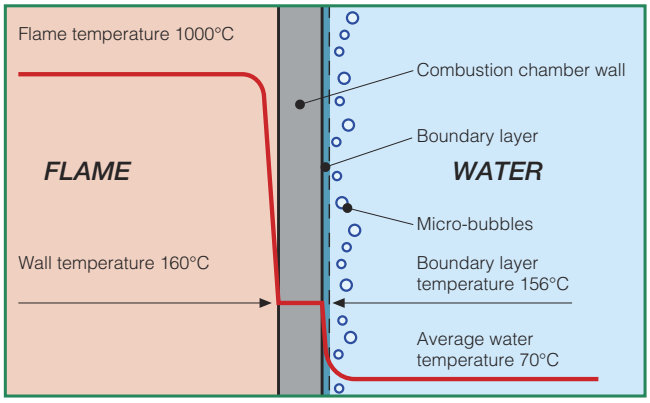


Micro-bubbles

These are very small air bubbles with diameters between 0,02 and 0,10 mm, in heating systems **they are formed on the internal surfaces of the boilers**; the heating fluid then drags these micro-bubbles into the system, where they are absorbed by the medium itself or they gather, forming air bubbles, in the most critical points of the system, for example in the highest zones of the radiators.

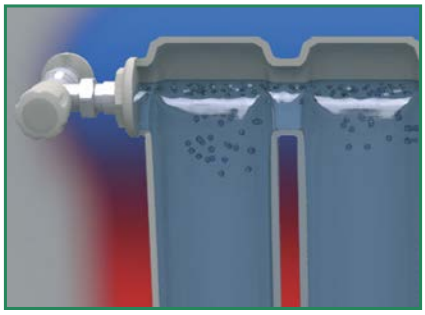
Boiler micro-bubbles

Micro-bubbles form continuously on the surfaces separating the water from the combustion chamber due to the high temperature of the medium. The phenomenon is similar to the one we can observe on the walls of a pan when we are heating water.
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.

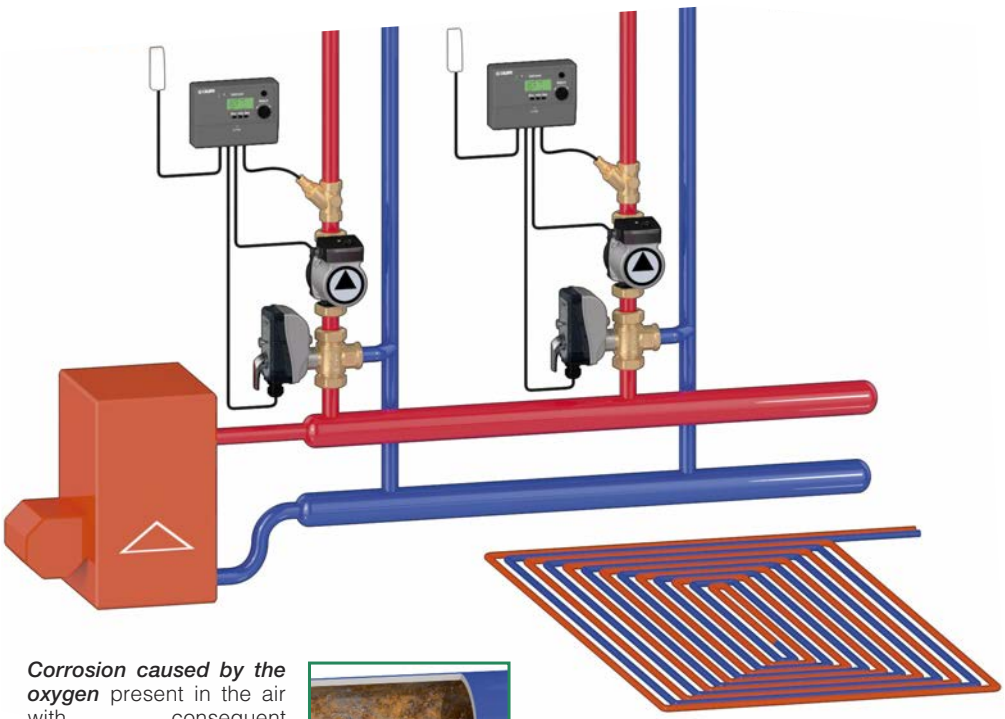


Problems linked to the presence of air in the systems

Insufficient heat exchange between the emission terminals
The thermal conductivity of air is notably lower than that of water. When the air collects in the highest points of the radiators or of the heat exchange batteries, the amount of heat that is transferred to the room decreases considerably. A lower efficiency of the heating bodies can cause serious thermal imbalances and therefore insufficient comfort levels, as well as greater running costs.

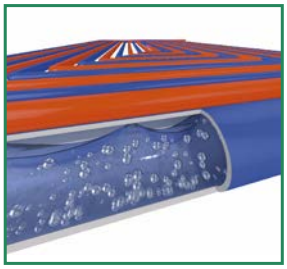


Noise in the heating bodies due to the passing of bubbles and micro-bubbles through the radiator valves and due to the formation of resonance chambers.



Cavitation phenomena that can compromise the duration and operation, especially of the pumps and regulating valves.

Total or partial blocks of circulation due to the formation of air bubbles in the pipes and in the panels, on both the floor and the wall.



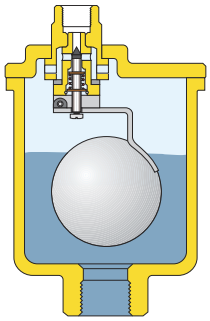
Corrosion caused by the oxygen present in the air with consequent weakening, and sometimes even breaking, of boilers, pipes and radiators.

Devices for eliminating air bubbles

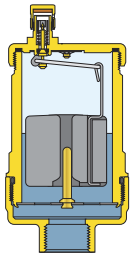
Automatic air vents

The accumulation of air bubbles in the valve body causes the float to drop so that the obturator opens automatically.
They are installed in the central heating system, on risers or in areas where bubbles collect.
There are various types which differ in the maximum working pressure and the air discharge pressure, as well as in the quantity of air that can be discharged with relation to the pressure existing in the system and the unit of time.
Correct valve operation is ensured as long as the water pressure remains under the maximum discharge pressure.

high discharge capacity



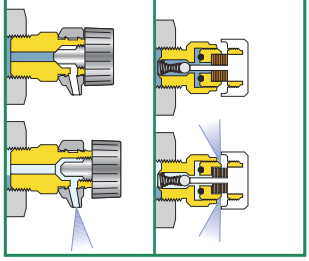
high discharge pressure



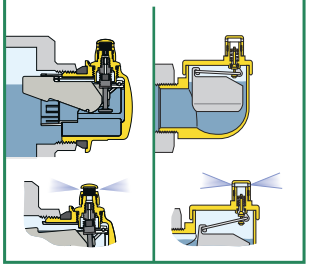
Standard and small air vents for radiators

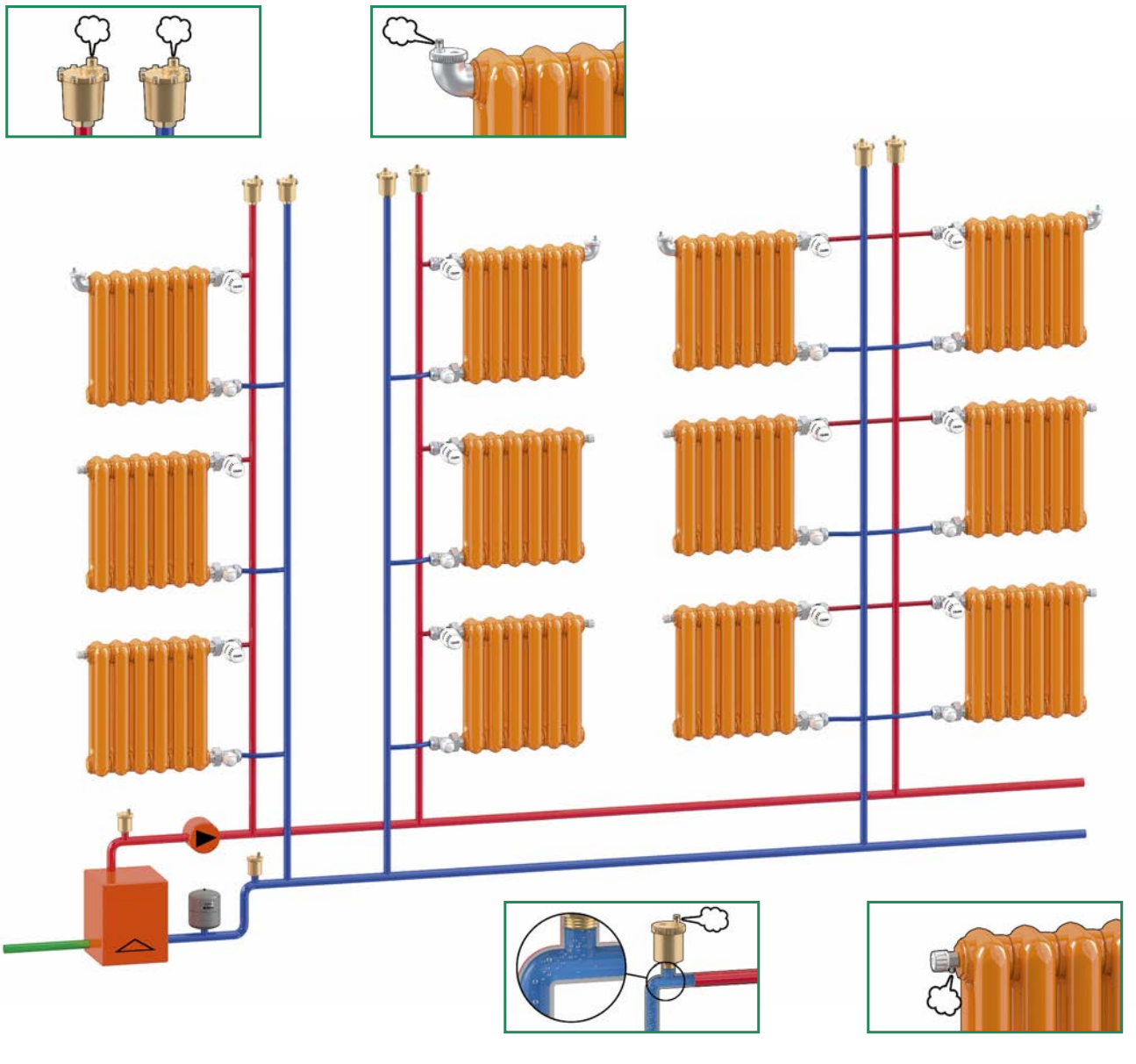
These may be manually or automatically controlled. The automatic controls may have a float or hygroscopic disks.
In ***manually operated valves*** the handwheel is unscrewed until the air present in the heating body is completely ejected with the consequent beginning of the water escape.
Instead, the ***valves with hydroscopic disks*** have special disks that expand in contact with water, keeping the valve closed, while in contact with air they contract, thus ejecting the air.
The operation of ***float valves*** is substantially similar to that of automatic air vents: the accumulation of air bubbles in the cup causes the float to come down, thus opening the obturator.

manual *hygroscopic*



float operation



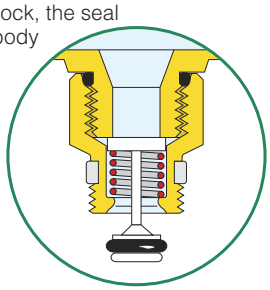


	Air vents with medium-high discharge pressure			Automatic air vents of traditional type					
Series	501	551	5022	5020	5020	5020	5020	5021	5021
	MAXCAL	DISCALAIR®	VALCAL	MINICAL					
									
Material	brass		chrome plated brass	brass	chrome plated brass	brass	chrome plated brass	brass	chrome plated brass
Maximum working pressure	16 bar	10 bar		10 bar					
Maximum discharge pressure	6 bar	10 bar	4 bar	2.5 bar					
Maximum working temperature	-20–120°C	0–110°C	120°C	120°C				110°C	
Automatic shutoff	-	-	optional	optional		-		✔	
Hygroscopic cap	-	optional		optional		✔		optional	
Connections	3/4"	1/2"	1/4" - 3/8" - 1/2"	3/8" - 1/2"	3/8" - 1/2"	3/4" - 1"	3/4" - 1"	3/8" - 1/2"	3/8" - 1/2"

	Automatic air vents with float anti-vibration system			
Series	5024	5025	5026	5027
	ROBOCAL			
				
Material	brass			
Maximum working pressure	10 bar			
Maximum discharge pressure	4 bar		6 bar	
Maximum working temperature	115°C	110°C	115°C	110°C
Automatic shut-off	optional	✔	115°C	✔
Hygroscopic cap	-	-	-	-
Connections	1/4" - 3/8"	3/8"	3/8" - 1/2"	3/8"

Automatic shut-off cock

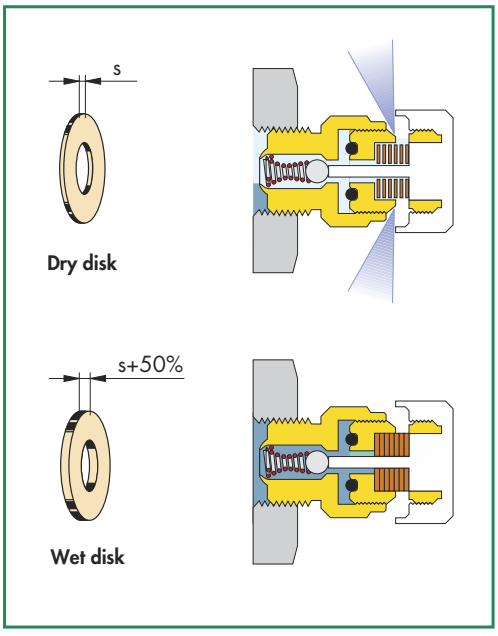
The automatic shut-off cock, the seal of which with the valve body is ensured by an EPDM O-ring, facilitates servicing operations, blocking the flow of water when the valve is deactivated, and the control of the functionality of the venting device.



Hygroscopic cap

The operating principle is based on the properties of the cellulose fibre disks forming the retaining cartridge These discs increase in volume by 50% when they come into contact with water, thus closing the valve. In this way, when the system is working in normal conditions, the disks are wet and, thanks to their increase in volume, they close the valve. Instead, when air is present, the disks dry and allow it to escape. This avoids any damage in the event of water leakage

	Air vents for radiators		Air vents for radiators			
Series	504	507	505	5055	5054	5080
	AERCAL					HYGRO
						
Material	chrome plated brass		chrome plated brass / technopolymer			
Maximum working pressure	10 bar		10 bar			
Maximum discharge pressure	2.5 bar	6 bar	-			
Maximum working temperature	100°C		90°C			100°C
Hygroscopic function	✔	✔	-			✔
Operating mode	Automatic		Manual			automatic hygroscopic
Drain positioning	Fixed		Fixed		adjustable	Fixed
Connections	1/2" - 3/4" - 1"	1" - 1 1/4"	1/8" - 1/4" - 3/8"	1/8" - 1/4" - 3/8" - 1/2"		



AUTOMATIC AIR VENTS

501 MAXCAL

tech. broch. 01031

Automatic air vent for heating, air conditioning and refrigeration.
High discharge capacity.
Brass body and cover, stainless steel internal components.
Max. working pressure: 16 bar.
Max. discharge pressure: 6 bar.
Temperature range: -20–120°C.

Code	
501500	3/4" F x 3/8" F

551 DISCALAIR®

tech. broch. 01124

High performance automatic air vent.
Brass body.
Female connection.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.

Code	
551004	1/2"

5022 VALCAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
Chrome plated.
Max. working pressure: 10 bar.
Max. discharge pressure: 4 bar.
Max. working temperature: 120°C.

Code	
502221	1/4" M
502231	3/8" M
502241	1/2" M

5020 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
Chrome plated.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 120°C.

Code	
502031	3/8" M
502041	1/2" M

5020 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
Chrome plated.
With hygroscopic safety cap.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 120°C.

Code	
502051	3/4" M
502061	1" M

5020 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 120°C.

Code	
502030	3/8" M
502040	1/2" M

5020 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
With hygroscopic safety cap.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 120°C.

Code	
502050	3/4" M
502060	1" M

AUTOMATIC AIR VENTS

5021 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
With automatic shut-off cock.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 110°C.

Code	
502130	3/8" M
502140	1/2" M

5021 MINICAL

tech. broch. 01054

Automatic air vent.
In hot-stamped brass.
Chrome plated.
With automatic shut-off cock.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 110°C.

Code	
502131	3/8" M
502141	1/2" M

561

tech. broch. 01054

Automatic shut-off cock.
For automatic air vents 5020 series.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 110°C.

Code		
561300	3/8" M	
561400	1/2" M	without PTFE seal

561

tech. broch. 01054

Automatic shut-off cock.
For automatic air vents 5020 and 5022 series.
Chrome plated.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 110°C.

Code		
561301	3/8" M	
561401	1/2" M	without PTFE seal

5024 ROBOCAL

tech. broch. 01033

Automatic air vent.
In hot-stamped brass.
Max. working pressure: 10 bar.
Max. discharge pressure: 4 bar.
Max. working temperature: 115°C.

Code	
502420	1/4" M
502430	3/8" M

5025 ROBOCAL

tech. broch. 01033

Automatic air vent.
In hot-stamped brass.
With automatic shut-off cock.
Max. working pressure: 10 bar.
Max. discharge pressure: 4 bar.
Max. working temperature: 110°C.

Code	
502530	3/8" M

5026 ROBOCAL

tech. broch. 01033

Automatic air vent.
In hot-stamped brass.
Max. working pressure: 10 bar.
Max. discharge pressure: 6 bar.
Max. working temperature: 115°C.

Code	
502630	3/8" M
502640	1/2" M

5027 ROBOCAL

tech. broch. 01033

Automatic air vent.
In hot-stamped brass.
With automatic shut-off cock.
Max. working pressure: 10 bar.
Max. discharge pressure: 6 bar.
Max. working temperature: 110°C.

Code	
502730	3/8" M

END PLUG FOR RADIATORS WITH AUTOMATIC AIR VENT

507 AERCAL®

tech. broch. 01032

End plug for radiators
with automatic air vent.
In hot-stamped brass.
Chrome plated.
With hygroscopic safety cap.
With rubber seal.
Max. working pressure: 10 bar.
Max. discharge pressure: 6 bar.
Max. working temperature: 100°C.

Code	
507611	1" M right
507621	1" M left
507711	1 1/4" M right
507721	1 1/4" M left

504 AERCAL®

tech. broch. 01055

Automatic air vent for radiators.
In hot-stamped brass.
Chrome plated.
With hygroscopic safety cap.
Max. working pressure: 10 bar.
Max. discharge pressure: 2,5 bar.
Max. working temperature: 100°C.

Code	
504401	1/2" M
504501	3/4" M
504611	1" M right
504621	1" M left

ACCESSORIES FOR AUTOMATIC VALVES

R59720 AQUASTOP®

tech. broch. 01032

Hygroscopic safety cap.
For end plugs 507 series.
Chrome plated.

Code
R59720

R59681 AQUASTOP®

tech. broch. 01054

Hygroscopic safety cap.
For automatic air vents 5020 and 5021 series.

Code
R59681

5620 AQUASTOP®

tech. broch. 01054

Hygroscopic safety cap.
For automatic air vents
5020, 5021, 5022 and 504 series.
Chrome plated.

Code
562000

5621 AQUASTOP®

tech. broch. 01054

Anti-vacuum cap.
For automatic air vents
5020, 5021 and 5022 series.

Code
562100

5622

tech. broch. 01033

Anti-vacuum cap.
For automatic air vents
5024, 5025, 5026 and 5027 series.

Code
562200

AIR VENTS AND DRAIN COCKS

505

tech. broch. 01056

Manual air vent for radiators.
Chrome plated.
White POM (acetal resin) knob.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 90°C.

Code	
505111	1/8" M
505121	1/4" M
505131	3/8" M

5055

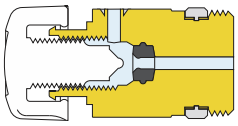
tech. broch. 01056

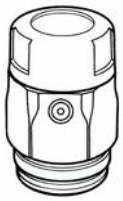
Manual air vent for radiators.
Rubber seal.
Chrome plated.
White POM (acetal resin) knob.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 90°C.

Code	
505511	1/8" M
505521	1/4" M
505531	3/8" M
505541	1/2" M

Manual air vent for radiators 5055 series

The identifying detail of this valve is an internal seal in a special elastic material which provides a tight seal in relation to limited tightening of the knob and possible temperature changes.





The knob of the valve is shaped so as to be similar in appearance to Caleffi thermostatic valve heads, which enhances the uniformity of the radiator component range.

For all the radiator air vents, the knob should be tightened with the system still cold.

5054

tech. broch. 01056

Manual air vent for radiators.
Chrome plated.
White POM (acetal resin) knob.
Adjustable outlet.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 90°C.

Code	
505411	1/8" M
505421	1/4" M
505431	3/8" M
505441	1/2" M

5080

tech. broch. 01056

Automatic hygroscopic air vent for radiators. Chrome plated.
White POM (acetal resin) knob.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 100°C.

Code	
508011	1/8" M
508021	1/4" M
508031	3/8" M
508041	1/2" M

5081

tech. broch. 01056

Spare hygroscopic cartridge for 5080 series.

Code	
508100	12 p.1,5

337

Drain cock.
Adjustable outlet.
PTFE seal on thread.
Max. working pressure: 6 bar.
Max. working temperature: 85°C.

WRAS APPROVED PRODUCT CERTIFICATION MARK

Code	
337121	1/4"
337131	3/8"

337

Drain cock with metal seal.
Adjustable outlet.
PTFE seal on thread.
Max. working pressure: 10 bar.
Max. working temperature: 100°C.

WRAS APPROVED PRODUCT CERTIFICATION MARK

Code	
337221	1/4"
337231	3/8"

560

tech. broch. 01056

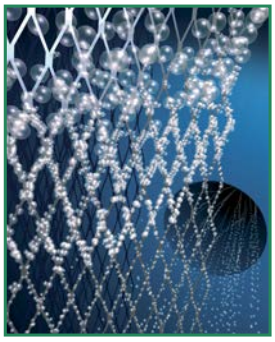
Drain cock for radiators and wall-mounted boilers.
Chrome plated.
Max. working pressure: 10 bar.
Max. working temperature: 100°C.

Code	
560421 ◆	1/2"
560000	extractor drain hose

◆ *One extractor drain hose code 560000 is included in each 10-item package*

Devices for eliminating micro-bubbles: deaerators

To avoid or minimise the phenomena considered, it is advisable to equip the systems with deaerators: suitable means for eliminating air micro-bubbles and composed essentially of an appropriate net and an air vent.
The net, arranged in radial pattern, creates swirling movements that facilitate the release of micro-bubbles and combine them into bubbles that can be eliminated by the air vent. The deaerators make the systems work with water with a low air content that is thus able to absorb, and then eliminate, the air bubbles lurking in critical zones in the systems.

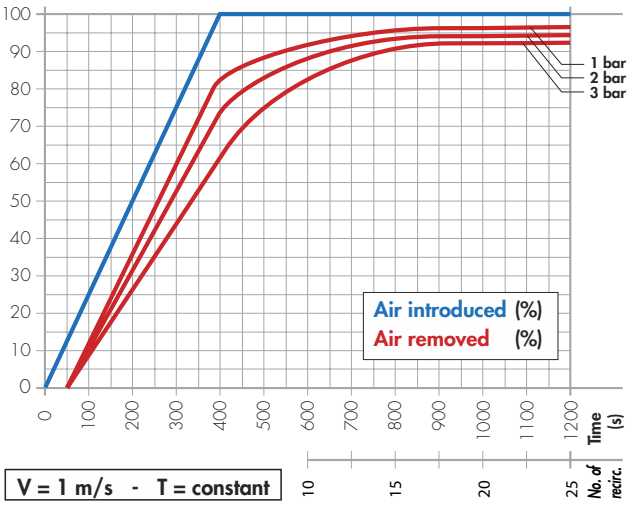


Operating principle

The deaerator utilises the combined action of several physics principles. The active part consists of a set of concentric mesh surfaces. These elements create the swirling movements 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.
It is designed in such a way that the direction in which the medium is flowing inside it makes no difference.

Air separation efficiency

The amount of air that can be removed from a circuit depends on different parameters: it increases as the circulation speed and the pressure decrease. After just 25 recirculations at the maximum recommended speed, almost all the air introduced into the circuit is eliminated by the DISCAL® deaerator, with variable percentages according to the pressure within the circuit.
The small amount which remains is then gradually eliminated during normal system operation. In conditions where the speed is slower or the temperature of the medium is higher, the amount of air separated is even greater.



Systems with glycol solutions

It is also useful to use deaerators in systems with antifreeze mixtures of water and glycol.
Water-glycol mixtures are highly viscous and therefore have a strong tendency to trap both air bubbles and micro-bubbles, preventing their elimination.

Recommended speeds for good separation efficiency

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	Connections	l/min	m³/h
20	3/4"	22.7	1.36
25	1"	35.18	2.11
32	1 1/4"	57.85	3.47
40	1 1/2"	90.33	5.42
50	2"	136.6	8.20

DN	l/min	m³/h
50	141.20	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	5461.0	325.0

DEAERATORS

551 DISCALAIR®

tech. broch. 01124

High performance automatic air vent.
Brass body.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.

Code	
551004	1/2" F

551 DISCAL®

tech. broch. 01060

Deaerator.
Brass body.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.

Code	
551002	Ø 22 mm
551003	3/4" F

551 DISCAL®

tech. broch. 01060

Deaerator for vertical pipes.
Brass body.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.

Code	
551902	Ø 22 mm
551905	3/4" F
551906	1" F

551 DISCAL®

tech. broch. 01060

Deaerator.
Brass body.
With drain.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.

Code	
551005	3/4"
551006	1"
551007	1 1/4"
551008	1 1/2"
551009	2"

Insulation
for deaerators 551 series.

Code	Use
CBN551005	551005-551006
CBN551007	551007-551008
CBN551009	551009

551 DISCAL®

tech. broch. 01060

Deaerator.
Epoxy resin coated steel body.
Flanged connections PN 16.
To be coupled with flat counterflanges EN 1092-1.
With insulation.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range:
0–105°C (DN 50–DN 100),
0–100°C (DN 125-DN 150).

Code	
551052	DN 50
551062	DN 65
551082	DN 80
551102	DN 100
551122	DN 125
551152	DN 150

551 DISCAL®

tech. broch. 01060

Deaerator.
Epoxy resin coated steel body.
Weld ends.
With insulation.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range:
0–105°C (DN 50–DN 100),
0–100°C (DN 125-DN 150).

Code	
551053	DN 50
551063	DN 65
551083	DN 80
551103	DN 100
551123	DN 125
551153	DN 150

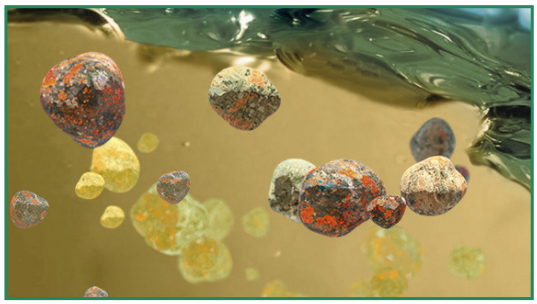
551 DISCAL®

tech. broch. 01060

Deaerator.
Epoxy resin coated steel body.
Flanged connections PN 10.
To be coupled with flat counterflanges EN 1092-1.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.
Temperature probe connection: 1/2" F.

Code	
551200	DN 200
551250	DN 250
551300	DN 300

THE PRESENCE OF IMPURITIES



The presence of impurities is due to:

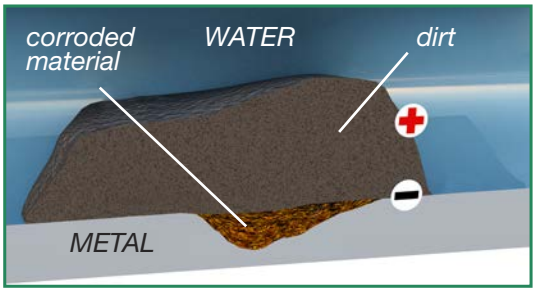
- particles arriving from the water supply mains,
- dirt resulting from processing and from the system components,
- corrosion due to differential ventilation,
- the oxidation of the metal surfaces caused by the oxygen present in the dissolved air.

Particles arriving from the mains, from processing and from the system components

These consist of sealing residue (hemp, PTFE tape), lubricants (oil and grease), impurities left by materials (metal burrs, casting sand, clots and flakes of paint).

Corrosion due to differential ventilation

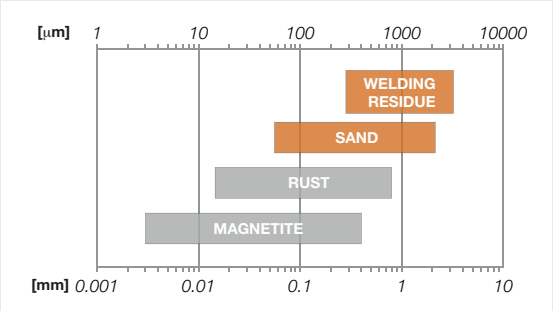
Corrosion due to differential ventilation is caused by the fact that, in the presence of water, a layer of dirt on a metal surface leads to the formation of two zones (water/dirt and dirt/metal) with a different oxygen content.
The water/dirt zone is appreciably richer in oxygen than the dirt/metal zone. For this reason, localised batteries are activated (the cathodes are the zones rich in oxygen, the anodes are the poor zones), with current flows that lead to corrosion of the metal surfaces.
Like corrosion due to oxidation, this can lead to the weakening, but also the breaking, of components such as boilers and radiators.



Corrosion due to oxidation of the metal surfaces

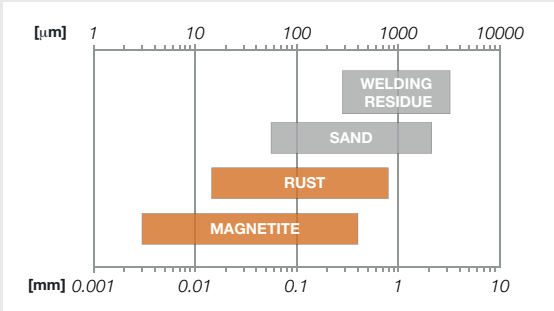
This is caused by the presence of air, and therefore of oxygen, in the water.
A thin film of oxide which, within limits, protects the metal form corrosion, forms on the metal surface. This patina usually has a different colour from the original metal, and with time it tends to change further, generally becoming lighter or darker. In this case we speak of an oxidised (or coated) surface, a surface which, from the point of view of colour, is transforming continuously. If the protective patina deteriorates for any reason, the corrosion continues until it makes a hole in the metal.

Particles of dirt



These are suspended particles (sand, iron chips, foreign bodies) originating from the water mains (aqueduct) or as residue from processing and system maintenance (welding residue, hemp, lubricants). These particles are deposited and form encrustations that cause clogging of the pipes, the heat exchangers and the components with small passages, with consequent blocks of circulation.

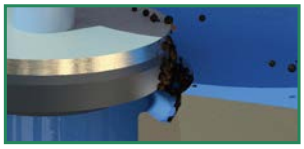
Micro-particles of dirt



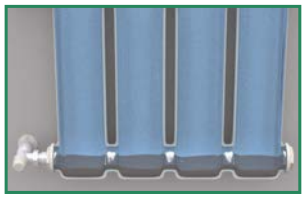
For systems, not only visible dirt can be a hazard, but also non-visible dirt, consisting of micro-particles with dimensions of up to 5-10 µm (0,005-0,010 mm), such as magnetite and rust.
Corrosion produces and releases in the water both non-magnetic iron dust (rust) and magnetic dust (magnetite, which forms in tiny flakes and possesses very high magnetic properties).

Problems linked to the presence of impurities in the systems

Irregular operation of the valves due to dirt which can adhere stubbornly to the valve seats and cause both problems in regulation and leaks.

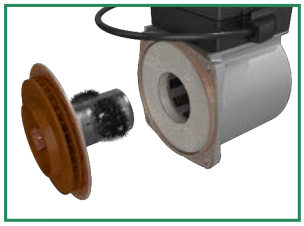


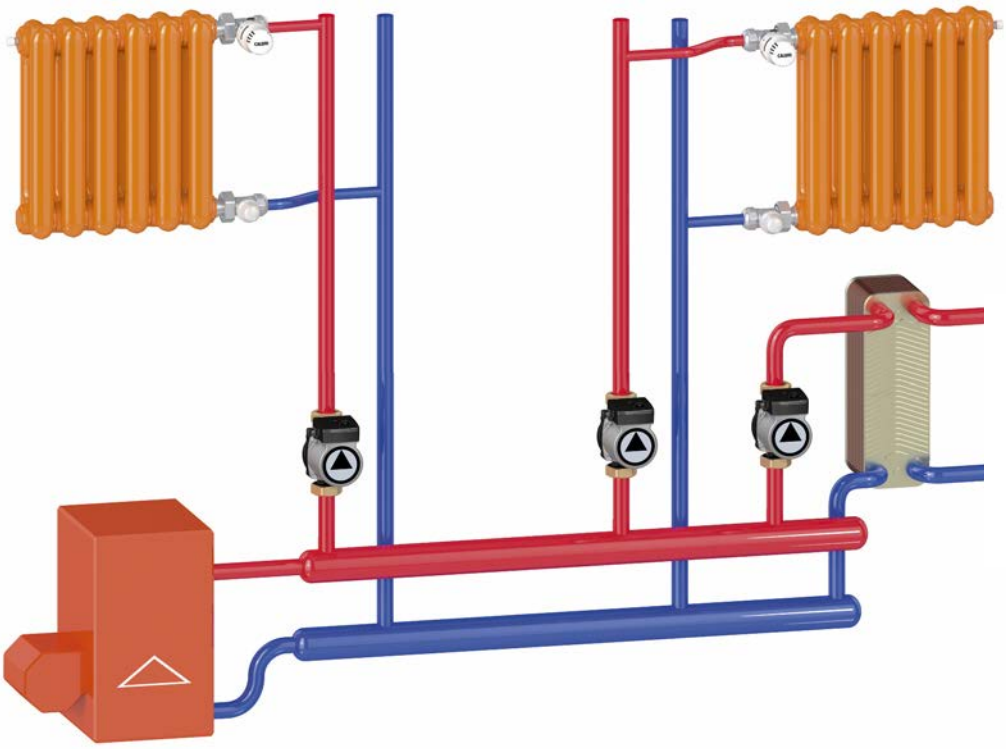
Insufficient heat exchange due to the presence of dirt in the lower part of the radiator.



Lower efficiency of the heat exchangers due to the reduction of flow rates and of the heat exchanging surfaces.

Blocking and seizing of the pumps caused by dirt that can build up in them, due both to the particular geometry of the pumps and to the effect of the magnetic fields generated by the pumps themselves.

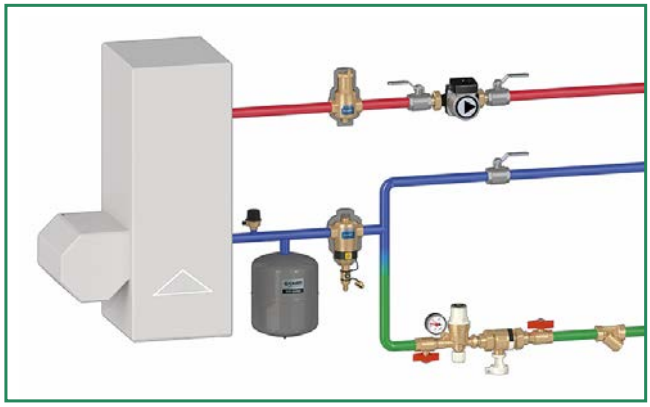




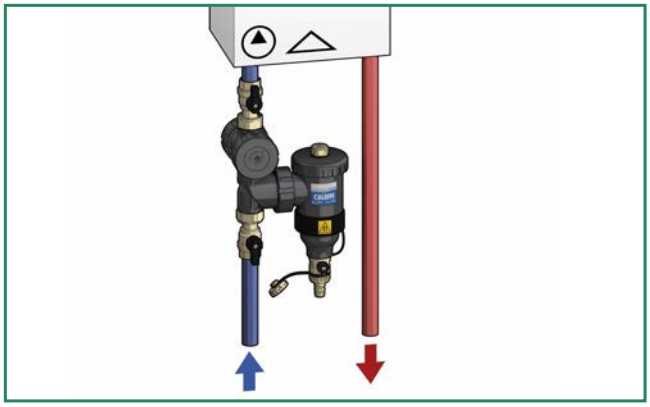
Corrosion caused by oxidation and differential ventilation with consequent weakening, and sometimes even breaking, of boilers, pipes and radiators.

Encrustations and deposits in the pipes can appreciably reduce the section of the passage and therefore the flows of medium.

The separation of the impurities in the water of the closed circuit presents difficulties especially as regards the elimination of the smallest particles, consisting essentially of sand, rust (non-magnetic iron oxides) and magnetite.
The following are generally used to eliminate these particles: ***Y-strainers, simple dirt separators (horizontal and vertical) and dirt separators with a magnet***. Since the main objective is to preserve the heat exchangers of heat generators against blocking and clogging, it is advisable to install strainers and dirt separators on the return line before the generator.



Medium/large systems: *installation of a strainer on the filling line and of a dirt separator or dirt separator strainer on the system.*



Small systems*: installation of a multi-function device (dirt separator strainer) or of a compact under-boiler dirt separator.*

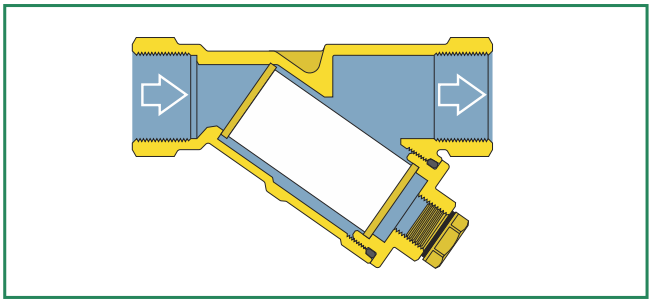
The operating principle of strainers and dirt separators is completely different; for this reason, refer to the sections below for further information.

Strainers

Filtration is a physical-mechanical process in which a moving medium separates from the solid particles dispersed in it thanks to their being captured by a porous filtering strainer through which the medium is passed.

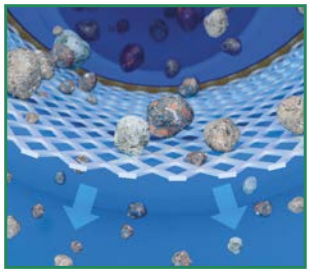
Operating principle

They are composed essentially of a metal mesh basket that acts as a filtering element and a dirt collector.
The metal mesh is characterised by various parameters, one of the most important of which is the mesh size (or filtering capacity): it indicates the minimum dimensions of the particles that the strainer is able to intercept.
For example, a strainer with mesh size 0,4 mm (400 µm) is able to capture dirt particles from that value upward.
The strainer therefore holds back at the first passage all the particles larger than the diameter of the strainer mesh.



Head losses

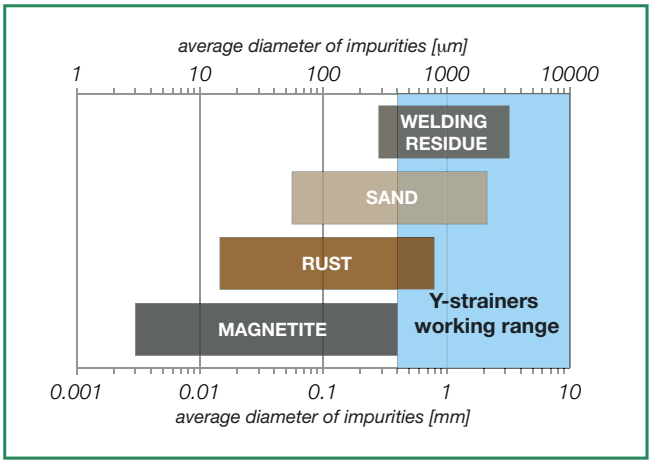
Due to the passage through the strainer mesh, a head loss is produced in the medium which increases as the degree of clogging increases.
A strainer (size 1") with mesh size 400 µm has a head loss (with clean strainer) of about 180 mm w.g. in a system with a flow rate of 1500 l/h.
Its head loss with 70% clogging increases by more than 4 times, amounting to about 810 mm w.g..
It is extremely important to carry out periodic maintenance of the strainer.



Dirt separation efficiency

The strainers block at the first passage all the particles with dimensions larger than the mesh size.
The limit of these devices lies in the fact that they are not able to intercept, and thus remove from circulation, particles of dirt smaller than that value (generally, for air-conditioning systems, 0,4-0,5 mm, that is 400-500 µm).
As a result they are not sufficiently able to combat particles of fine sand, rust and magnetite.

It should also be considered that the intercepted particles adhere to the basket, often stubbornly, considerably increasing the head losses of the strainer: this situation requires frequent interventions to clean or replace the basket.



577

Y-strainer.
Bronze body,
1/2"–2": PN 16,
2 1/2" - 3": PN 10.
Female connections.
Temperature range: -20–110°C.
Max. percentage of glycol: 30%.
Strainer in stainless steel stretched plate.

Code		Mesh size Ø (mm)
577004	1/2"	0,40
577005	3/4"	0,40
577006	1"	0,40
577007	1 1/4"	0,47
577008	1 1/2"	0,47
577009	2"	0,53
577020	2 1/2"	0,53
577030	3"	0,53

579

Y strainer for heating systems.
Grey cast iron body.
Max. working pressure: 16 bar.
Temperature range: -10–100°C.
Max. percentage of glycol: 50%.
Flanged connections PN 16.
To be coupled with flat counterflanges EN 1092-2.
Filtering mesh in stainless steel AISI 304.

Code		Mesh size Ø (mm)
579051	DN 50	0,87
579061	DN 65	0,87
579081	DN 80	1,55
579101	DN 100	1,55
579121	DN 125	1,55
579151	DN 150	1,55*
579201	DN 200	1,55*
579251	DN 250	1,55*

** Rhomboidal reinforcing mesh*

Dirt separators

Dirt separation is a physical treatment similar to filtration but more effective from the point of view of particle dimensions. Exploiting the principle of precipitation by gravity, it is able to separate and deposit even particles with dimensions down to 0,005 mm (5 µm).

Operating principle

The action of separating impurities carried out by the dirt separator is based on the combined action of several phenomena: the reduction of the speed of the medium favours the precipitation by gravity of the dirt particles into the collection chamber.
The internal element with reticular surfaces instead of the ordinary strainer, due to its constitution, opposes a low resistance to the passage of the medium, while still guaranteeing separation.
This occurs due to the particles colliding with the reticular surfaces and then settling, and not by filtration.
In subsequent passages, the dirt separator completely eliminates the impurities present in the water down to a rated dimension of 5 µm.

Standard version

Dirt collection chamber

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 impurities are not affected by the swirling of the flow through the mesh;
- it is large enough to increase the dirt accumulating capacity, which means emptying/discharging procedures are required less often (in contrast to strainers, which need to be frequently cleaned);
- it has a drain cock for discharging the impurities collected in the lower part even while the system is operating.

Flanged version with magnet

Head losses

Unlike strainers, the head losses of dirt separators are greatly reduced and are not affected by the amount of impurities collected.

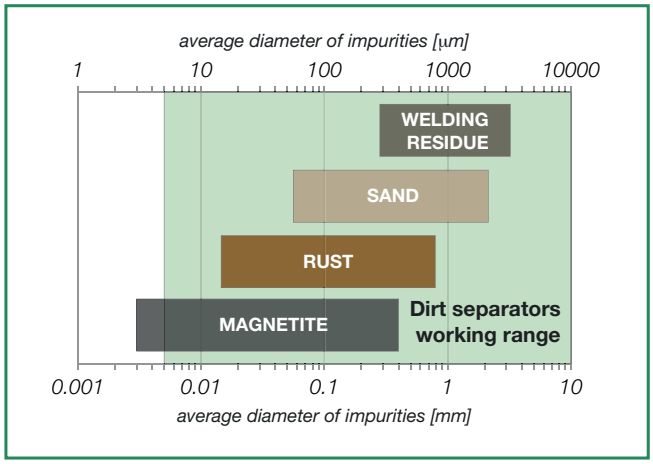
VERSION WITH MAGNET

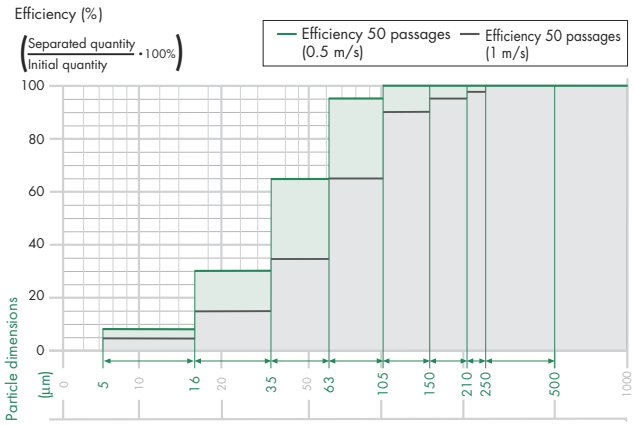
As well as the traditional functional characteristic of dirt separation, the magnetic dirt separator is equipped with a special system for collecting the ferromagnetic impurities contained in the circuit water. A special ring, with two housings for holding the magnets, is located on the outside of the device body, in the impurity collecting area.
Ferromagnetic particles are thus retained in the collection chamber and prevented from returning to circulation.
In the flanged version, the magnetic element consists of an articulated cylinder inserted in the device by means of a pocket.

Version with magnet

Particle separation capacity

The Caleffi 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.
Tests performed in a specialist lab (TNO - Science and Industry - NL) established that the Caleffi dirt separator can quickly remove almost all impurities after just 50 recirculations, i.e. about one day of operation. Up to 100% impurities with a particle diameter greater than 100 µm are removed from the circuit and on average up to 80% considering the smallest particles.
The continual passing of the medium during normal operation of the system gradually leads to complete dirt removal.





Tests in the specialised laboratory TNO - Science and Industry (NL)

DIRT SEPARATORS

5462 tech. broch. 01137
DIRTCAL®

Dirt separator.
Brass body.
Drain cock with hose connection.
Top connection with plug.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.
Particle separation rating down to 5 µm.

Code	
546205	3/4" F
546206	1" F
546207	1 1/4" F
546208	1 1/2" F
546209	2" F

Pre-formed insulation
for dirt separators 5462 series.

Code	Use
CBN546205	546205-546206
CBN546207	546207-546208
CBN546209	546209

5469 tech. broch. 01137
DIRTCAL®

Dirt separator for vertical pipes.
Brass body.
Drain cock with hose connection.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.

Code	
546902	Ø 22 mm
546905	3/4" F
546906	1" F

5465 tech. broch. 01137
DIRTCAL®

Dirt separator.
Epoxy resin coated steel body.
Flanged connections PN 16.
To be coupled with flat counterflanges EN 1092-1.
With pre-formed insulation.
Max. working pressure: 10 bar.
Temperature range:
0–105°C (DN 50–DN 100),
0–100°C (DN 125-DN 150).
Particle separation rating down to 5 µm.

Code	
546550	DN 50
546560	DN 65
546580	DN 80
546510	DN 100
546512	DN 125
546515	DN 150

5465 tech. broch. 01137
DIRTCAL®

Dirt separator.
Epoxy resin coated steel body.
Flanged connections PN 10.
To be coupled with flat counterflanges EN 1092-1.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.
Temperature probe connection: 1/2" F.
Particle separation rating down to 5 µm.

Code	
546520	DN 200
546525	DN 250
546530	DN 300

Discharge and maintenance

The collected impurities are discharged, even with the system running, by opening the drain cock located in the lower part of the collection chamber.

In threaded versions, the collection chamber is easy to inspect by unscrewing it from the valve body for any servicing of the internal element required in the event of obstruction by fibres or large dirt particles.

DIRT SEPARATORS WITH MAGNET

5463 tech. broch. 01137

DIRTMAG®

Dirt separator **with magnet**.
Brass body.
Drain cock with hose connection.
Top connection with plug.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.
Particle separation rating down to 5 µm.

Code	
546305	3/4" F
546306	1" F
546307	1 1/4" F
546308	1 1/2" F
546309	2" F

5463 tech. broch. 01137

DIRTMAG®

Dirt separator **with magnet**.
Brass body.
Drain cock with hose connection.
Top connection with plug.
With pre-formed insulation.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.
Particle separation rating down to 5 µm.

Code	
546315	3/4" F
546316	1" F
546317	1 1/4"
546318	1 1/2"
546319	2"

5468 tech. broch. 01137

DIRTMAG®

Dirt separator **with magnet** for vertical pipes. Brass body.
Drain cock with hose connection.
Max. working pressure: 10 bar.
Temperature range: 0–110°C.

Code	
546802	Ø 22 mm
546803	Ø 28 mm
546805	3/4" F
546806	1" F

5466 tech. broch. 01137

DIRTMAG®

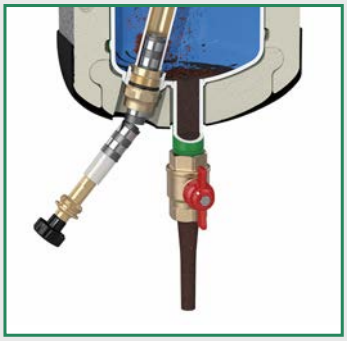
Dirt separator **with magnet**.
Epoxy resin coated steel body.
Flanged connections PN 16.
To be coupled with flat counterflanges EN 1092-1.
With pre-formed insulation.
Max. working pressure: 10 bar.
Temperature range: 0–100°C.

Code	
546650	DN 50
546660	DN 65
546680	DN 80
546610	DN 100
546612	DN 125
546615	DN 150

Discharge and maintenance

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

In the flanged version, the magnet is inserted in a special pocket and is articulated so that it can be extracted easily. This characteristic facilitates removal and reduces the space required for maintenance.



DIRT SEPARATORS IN COMPOSITE WITH MAGNET

5453

tech. broch. 01240

DIRTMAG®

Dirt separator **with magnet**.
Composite body.
Adjustable for horizontal and vertical pipes.
Drain cock with hose connection.
Max. working pressure: 3 bar.
Temperature range: 0–90°C.

PCT INTERNATIONAL APPLICATION PENDING

Code	
545302	Ø 22 mm
545303	Ø 28 mm
545305	3/4" F
545306	1" F

Operating principle

As well as the traditional functional characteristic of dirt separation, the magnetic dirt separator in polymer is equipped with a special patented system for collecting the ferromagnetic impurities contained in the circuit water.
The impurities in the water, on striking the internal reticular surfaces, get separated, dropping into the bottom of the body where they are collected.
Ferrous impurities are also trapped inside the dirt separator body, thanks to the action of the two magnets inserted in a special removable outer ring.
The large internal volume of the DIRTMAG® slows down the flow speed of the medium thus helping, by gravity, to separate the contained particles.

Vertical installation

Horizontal installation

5451

tech. broch. 01327

DIRTMAGSLIM®

PCT INTERNATIONAL APPLICATION PENDING

Dirt separator **with magnet** for under-boiler installation.
Technopolymer body.
Drain cock.
Fitting for wall connection: 3/4" M.
Fitting for Ø 18 mm copper pipe.
Maximum working pressure: 3 bar.
Temperature range: 0–90°C

Code	
545101	3/4"

5452

tech. broch. 01327

DIRTMAGSLIM®

PCT INTERNATIONAL APPLICATION PENDING

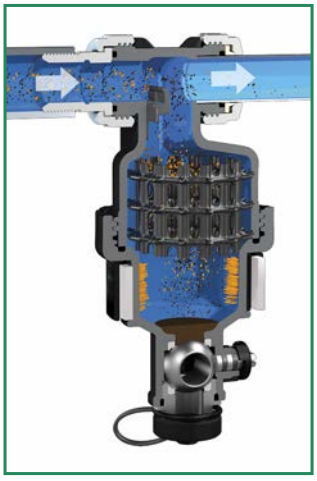
Dirt separator **with magnet** for under-boiler installation.
Suitable for non-linear installations, with crossed pipes.
Technopolymer body.
Drain cock.
Fitting for wall connection: 3/4" M.
Fitting for connection with flexible pipe: 3/4"F.
Max. working pressure: 3 bar.
Temperature range: 0–90°C

Code	
545205	3/4"

Code	
F0000117	Off-centre connection kit for 5451 series
F0000118	Fitting for pipe Ø 22 mm for 5451 - 5452 series

Operating principle

The DIRTMAGSLIM® magnetic dirt separator removes and collects impurities present in the circuit thanks to an internal deflector located in the medium flow. This device creates turbulence in the medium that helps to transfer impurities to the decanting chamber where, thanks to the low medium velocity, the particles are captured and unable to return to the circuit. This operating principle makes it possible to keep the head loss inside the device to the minimum.
Separation efficacy is enhanced by the presence of an external magnetic collar.



Under-boiler installation 5451 series

Under-boiler installation 5452 series

DIRT SEPARATORS IN COMPOSITE WITH MAGNET AND STRAINER

5453 tech. broch. 01258

DIRTMAGPLUS®

Multifunction device
with dirt separator and strainer.
Specific for the complete cleaning of the hydraulic circuit, to protect continuously generator and components.
Composite body.
Dirt separator with technopolymer internal element, **with magnet**.
Two inspectable strainers with stainless steel mesh:
1 for first passage (blue) already installed,
1 for maintenance (grey) in package.
Shut-off valve with nut, brass body.
Adjustable for horizontal, vertical or 45° pipes.
Drain cock with hose connection.

PCT INTERNATIONAL APPLICATION PENDING

Max. working pressure: 3 bar.
Temperature range: 0–90°C.

Code	
545372	Ø 22 mm
545373	Ø 28 mm
545375	3/4" F
545376	1" F"

Strainer accessories.

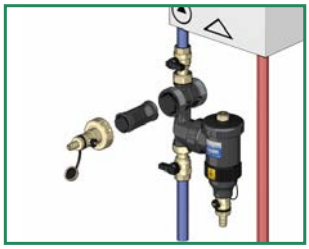
Code	
F49474/BL	first passage strainer (blue) *
F49474/GR	maintenance strainer (grey) **

* First passage strainer (blue): mesh size Ø = 0,30 mm
** Maintenance strainer (grey): mesh size Ø = 0,80 mm

Accessory kit for circuit filling and flushing for device 5453 series.

Code
F49476

Accessory kit for circuit filling and flushing
A specific accessory kit, composed of a plug with a drain cock and an internal element for flow separation (black), allows the connection to an external machine for system flushing.



Operating principle

The multifunction device is obtained by coupling a dirt separator and a cartridge strainer arranged in series.
The water circulating in the system flows, in sequence, first through the dirt separator and then through the cartridge strainer.
The dirt separator separates the impurities contained in the water by means of the action of the internal element.
Ferrous impurities are also trapped inside the body of the device thanks to the action of the two magnets inserted in a special removable outer ring.
The first passage through the dirt separator makes it possible to separate a high percentage of the impurities in the circulating water, down to minimal particle sizes.
The cartridge strainer separates impurities by means of mechanical selection of the particles in accordance with their size, by means of a special metal mesh.
All the particles with diameter bigger than the mesh size are automatically stopped and separated, **with maximum separation efficiency at the first passage**.

Circuit cleaning and maintenance

The strainer (blue) downstream of the dirt separator and fitted with a specific strainer mesh is able to intercept all particles remaining in circulation, thereby ensuring optimal initial cleaning of the pipe, to protect generator and system components. The strainer is available also with a second cartridge (grey) fitted with a filtering mesh of bigger passage cross-section, which can be used **during maintenance phase after the first cleaning**.

Installation

Thanks to the special coupling between the locking nut and the tee fitting, it is adjustable so that it can be fitted on vertical pipes, horizontal pipes, or 45° angled pipes, without affecting its functional characteristics.

Additives dosing

The multifunction device can also be used as an access point to inject into the circuit chemical additives designed to protect the system.

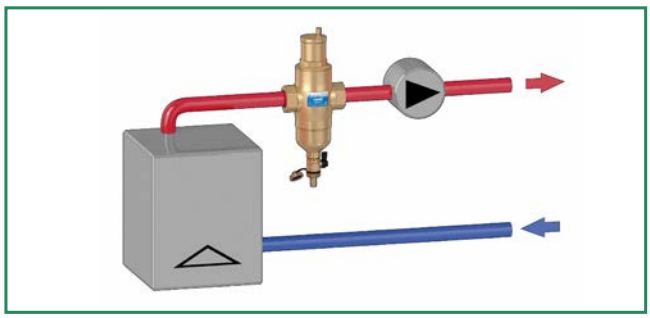
ELIMINATION OF AIR AND IMPURITIES

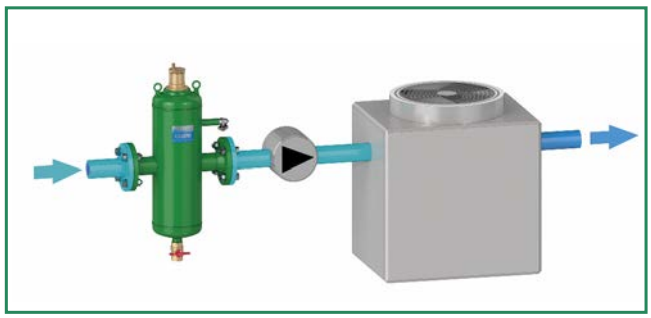
This is achieved by assembling, in a single product, a deaerator and a dirt separator (of a simple or magnetic type). A single product can therefore be used both to eliminate air and to eliminate the impurities present in the system water.

Operating principle

The device makes use of the combined action of the deaerator and of the dirt separator.
The internal element creates swirling movements that facilitate the release of micro-bubbles and the subsequent creation of bubbles that then rise to the top of the device, from which they are evacuated by means of an automatic air vent with float.
Moreover, the impurities in the water, striking against the surfaces of the internal element, are separated and fall to the bottom of the valve body.

With respect to the solutions that call for the installation of separate deaerators and dirt separators, the deaerator-dirt separators present the following advantages: they take up less space and require a smaller number of connections, and are therefore ideal for systems where it is not possible to install the two separate components.





DEAERATORS-DIRT SEPARATORS

546 DISCALDIRT®

tech. broch. 01123

Deaerator-dirt separator.
Brass body.
Drain cock with hose connection.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.
Particle separation rating down to 5 µm.

Code

546002	Ø 22 mm
546005	3/4" F
546006	1" F
546007	1 1/4" F

5461 DISCALDIRTMAG

tech. broch. 01123

Deaerator-dirt separator **with magnet**.
Brass body.
Drain cock with hose connection.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.
Particle separation rating down to 5 µm.

PCT INTERNATIONAL APPLICATION PENDING

Code

546105	3/4" F
546106	1" F
546107	1 1/4" F

Insulation for deaerators-dirt separators 546 series.

Code	Use
CBN546002	546005-546006
CBN546007	546007

DEAERATORS-DIRT SEPARATORS

546 DISCALDIRT®

tech. broch. 01123

Deaerator-dirt separator.
Epoxy resin coated steel body.
Flanged connections PN 16.
To be coupled with flat counterflanges EN 1092-1.
With insulation.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range:
0–105°C (DN 50–DN 100),
0–100°C (DN 125-DN 150),
Particle separation rating down to 5 µm.

Code	
546052	DN 50
546062	DN 65
546082	DN 80
546102	DN 100
546122	DN 125
546152	DN 150

546 DISCALDIRT®

tech. broch. 01123

Deaerator-dirt separator.
Epoxy resin coated steel body.
Weld ends.
With insulation.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range:
0–105°C (DN 50–DN 100),
0–100°C (DN 125-DN 150),
Particle separation rating down to 5 µm.

Code	
546053	DN 50
546063	DN 65
546083	DN 80
546103	DN 100
546123	DN 125
546153	DN 150

546 DISCALDIRT®

tech. broch. 01123

Deaerator-dirt separator.
Epoxy resin coated steel body.
Flanged connections PN 10.
To be coupled with flat counterflanges EN 1092-1.
Max. working pressure: 10 bar.
Max. discharge pressure: 10 bar.
Temperature range: 0–110°C.
Temperature probe connection: 1/2" F.
Particle separation rating down to 5 µm.

Code	
546200	DN 200
546250	DN 250
546300	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.

0319416GB

CALEFFI
Hydronic Solutions

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