NONAIR®
Micro bubbles Separator
Int.Patents

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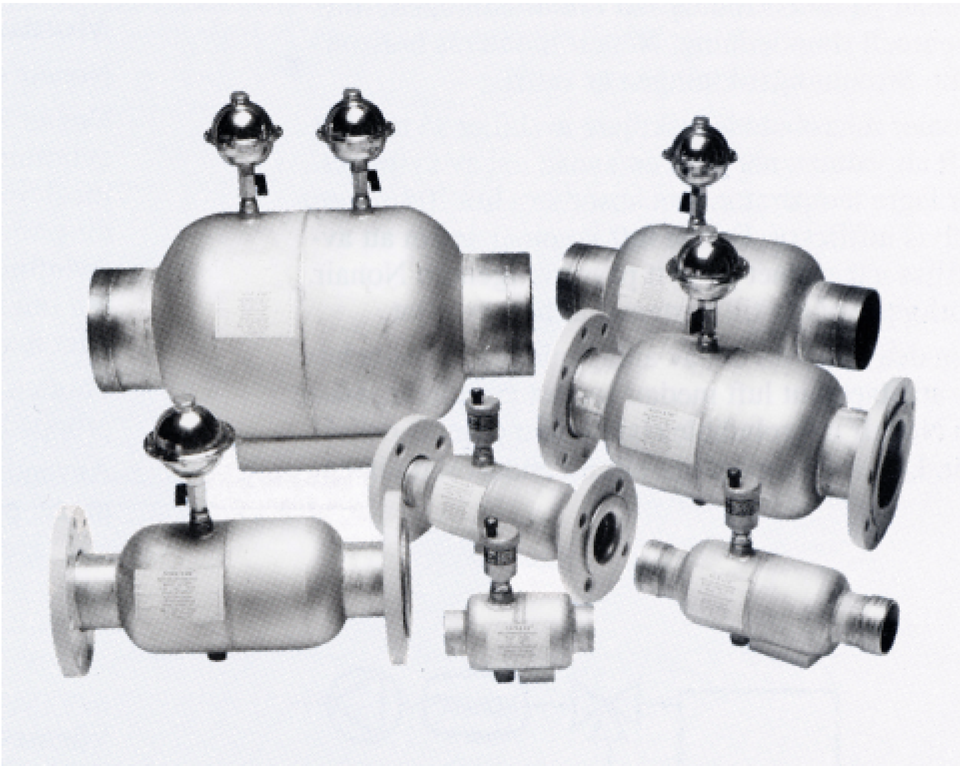

the Ultimate

Micro bubbles Separator

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ENCLOSED DOCUMENTS:

- Summary — why a micro bubbles separator in general, why **Nonair**® particularly
- Air in water — explains the problem and how it can be solved with **Nonair**®
- Function — the function of **Nonair**® and the things taking place inside
- Function, sketches
- Diagram of efficiency — From the test made by SP in Sweden, according to “Nordtest method NT VVS 090”
- Installation — how and where to install the **Nonair**® in a circulating system
- Mounting samples
- Table of measure and weight
- Diagram of pressure drop
- Examples of Nonair® — A collection of figures of **Nonair**® in various dimensions and connections.

SUMMARY:

Air in water causes a lot of problem in circulating cooling and heating systems. Until some years ago, this problem considered to be impossible to solve. But a gentleman from Holland pointed out a method.

As far as we know, there are still only three well working micro bubbles separators on the market. Two brands produced in Holland and **Nonair®** made in Sweden.

Why a micro bubbles separator

- Air in water, both as normal bubbles and as micro bubbles, is the condition for a corrosion process to take place. The air consists of about 20% oxygen and it is the oxygen together with water that feeds the corrosion process. If the air is removed no corrosion will occur.

- Micro bubbles will contribute towards cavitation erosion in pumps that will lead to wear out pump wheels and create noise in the pumps. The efficiency of the pumps will also be reduced. Removing of the micro bubbles will solve the problem.

- Micro bubbles in a circulating system will create disturbing noise. Removing of the micro bubbles will solve the problem.

- Micro bubbles will result in a reduction of heat transmission in boilers, heat- and cooling batteries and heat exchangers, as the micro bubbles will work as insulation on the heat-transferring surface. Removing of the micro bubbles will solve the problem.

- Micro bubbles will lead to poor circulation with increased problem with the regulating of the system. Removing of the micro bubbles will solve the problem.

But remember it is only a reel micro bubbles separator that separates micro bubbles. The ones that on the whole just are enlarged pipes are no micro bubbles separators.

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Why Nonair®

Nonair® separates air and other gases from circulating water in heating and cooling system.

Nonair® is developed from a new patented principle and the advantages we use to call attention to are listed below:

- An efficient micro bubbles separator will solve the entire problem described above. **Nonair®** has a documented high efficiency of micro bubbles separation.
- **Nonair®** is made of stainless steel, which prevent it from all inside and outside corrosion. Inside corrosion is a case for separators of carbon steel as air is collected in top of the separator and air is the condition for corrosion.
- As the **Nonair®** is made of stainless steel it have been possible to reduce the thickness of material. The weight of the Nonair® is much less than all other types and this makes the transport and mounting work easier.
- **Nonair®** has full through flow and it could not get clogged up, even after long time.
- **Nonair®** has low pressure drop, even after long time, which will reduce need of pump capacity and cost for pump energy.
- **Nonair®** has no general limitation for the flow rate.
- **Nonair®** is designed to be supplied with a detachable automatic de-aerator. With built-in ones it is necessary to empty a great deal of the system if maintenance is needed with the automatic de-aerator. With the **Nonair®** this work is easily done.

Compare **Nonair®** with other brands for the parameters above and the advantages with **Nonair®** will be clear. If you value these advantages the choice is easy.

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AIR IN WATER:

Air (e.g. different gases as oxygen, nitrogen, ...) is a normal component dissolved in fresh water. According to the law of physics, water with lower temperature can dissolve more air than water with higher temperature. When water is boiling you can se the air bubbles leaving the water. Water with higher pressure can dissolve more air than water with lover pressure.

Air in water has been a problem since water has been circulated in Heating and Cooling systems. In these systems undissolved air also causes problems. When the system is filled up with water, there will be some free air left. This air will travel around with the water because of the high velocity on the water in modern installations, and large air bubbles will be transformed to micro bubbles, which can't be removed without special equipment, e.g. **Nonair**®

Some of the problems related to air in water are
- Cavitation and noise in pumps and valves.
- Lower degree of efficiency in pumps, heat exchangers and boilers.
- Corrosion.

It has been accepted to have this problem because there haven't been any reel solution to the problem before short. The **Nonair**® Micro bubbles Separator is the solution.

The **Nonair**® Micro bubbles Separator should normally be installed where the water is at the highest temperature and the lowest available pressure. But, make notice to that 1 metre difference in pressure have the same effect as 4ºC difference in temperature. Also, 1 metre less pressure is similar to 4ºC higher temperature. Especial in Cooling system, it will normally be more efficient to take account to the pressure.

- **Nonair**® is simply installed. Just put the **Nonair**® in the pipe, similar to a valve.
- **Nonair**® has a straight free flowing path, no risk of clogging.
- **Nonair**® has minimal pressure drop (e.g. ~50 Pa at 1 m/s), and this minimal pressure drop will not change because there is no build up of particulate matter.
- **Nonair**® will work properly also with a high flow rate. Choose the same dimension for **Nonair**® as the pipe it is connected with.
- **Nonair**® has a separate air-vent. It is possible to service to the air-vent without losing any water, if an intermediate valve is installed.
- **Nonair**® cannot cause any negative influence to the system.

FUNCTION:

The kinetic energy in the water will like the water to pass through the **Nonair®** slide on the bottom of the through pipe (1). But, because there is a loss of guidance in the upper part of these pipe an appropriate amount of water leave this main stream and flow into the annular space (2), where the flow rate is lowered. The water gives the opportunity to get rid of the air contents. Water with big bubbles will go direct to the upper space (3). Water with small bubbles will pass through the gaps (4), down into the space (5). The water flowing into the space (5) is replaced, relative slowly, with fresh water containing air bubbles, and can be considered to be totally free of turbulence. The minute bubbles of air in the water present in the space (5) will rapidly fuse together to form separate, highly buoyant larger air bubbles, which float up through the gaps (6) and rises upwards externally of the water flow passing directly through the **Nonair®**, and thus passes undisturbed upwards to the upper space (3) and the air outlet (7).

In order for the extremely small air bubbles present in the water, or in any other liquid used, to fuse together to form large air bubbles having sufficient buoyancy to rise up to the upper space (3) and the air outlet (7), it is necessary to drastically decrease the speed of the water and for turbulence to cease, or at least substantially cease. This being achieved by means of the flow retarding spaces (2) and (5).

The reason why the **Nonair®** is symmetrical is because the **Nonair®** shall also be capable to function if mounted in the opposite flow direction.

Numbers (1) – (7) according to sketches on next side.

FUNCTION, SKETCHES:

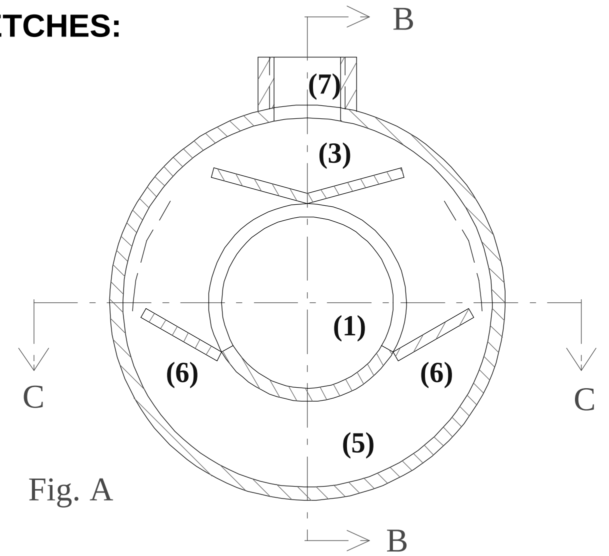


Fig. A

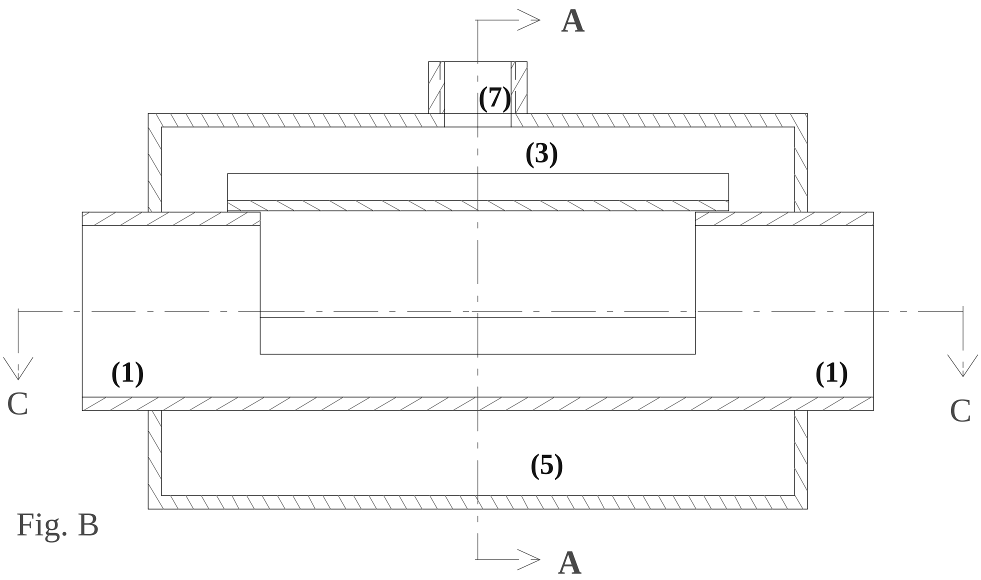


Fig. B

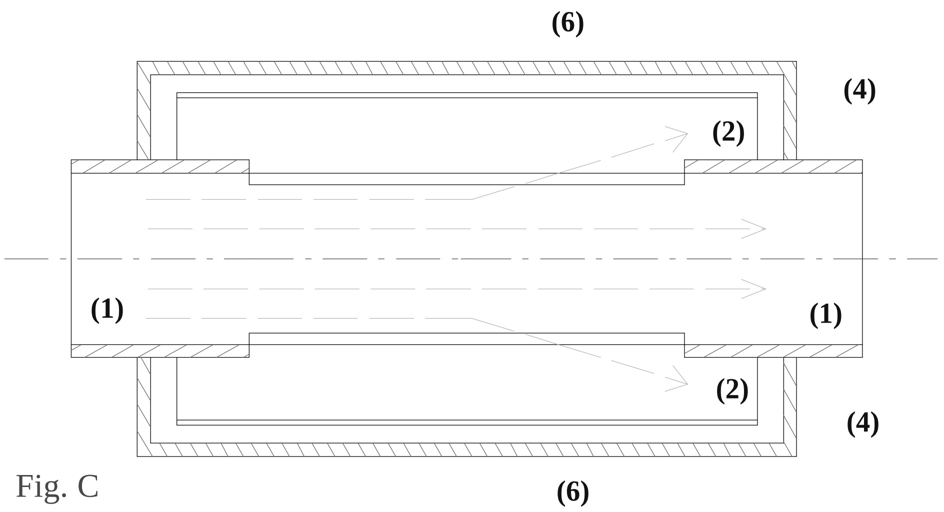
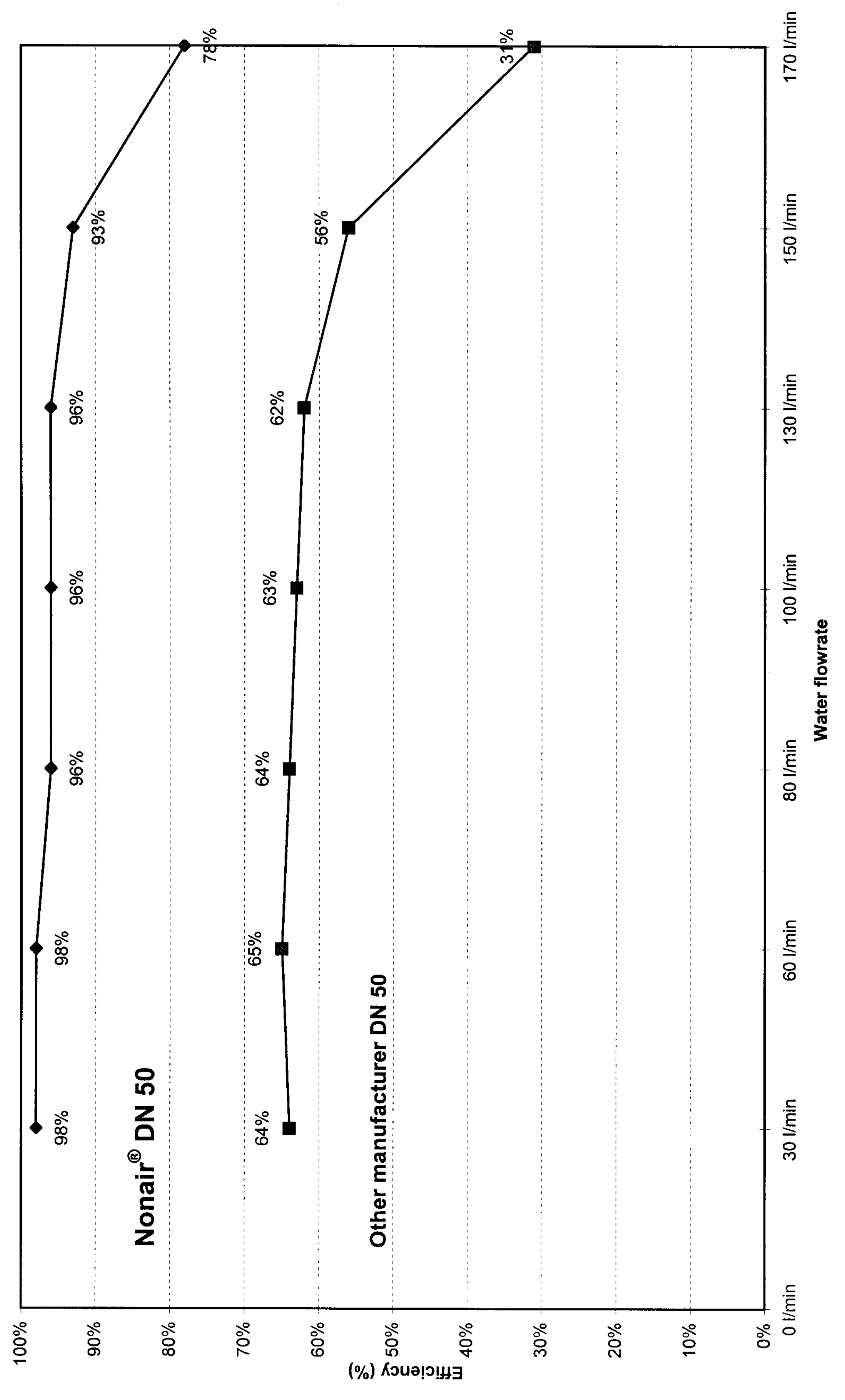


Fig. C

Test made by SP, Swedish National Testing and Research Institute



Efficiency: Capacity to remove air according to "Nordtest method NT VVS 090"

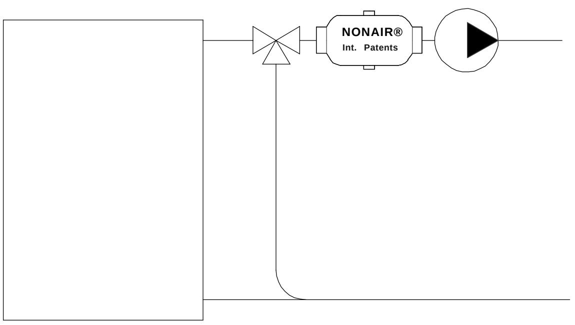
INSTALLATION:

The **Nonair**® Micro bubbles Separator should normally be installed where the water is at the highest temperature and the lowest *available* pressure. Hot water will according to the law of physics, absorb less air than colder water. In a heating system 'A' for that reason it is common to place the **Nonair**® Micro bubble Separator before the pump in the outlet pipe from the boiler or heat exchanger. In a cooling system 'B' the **Nonair**® Micro bubbles Separator should be placed in the return pipe. The **Nonair**® Micro bubbles Separator should be horizontally mounted. The direction of flow is optional.

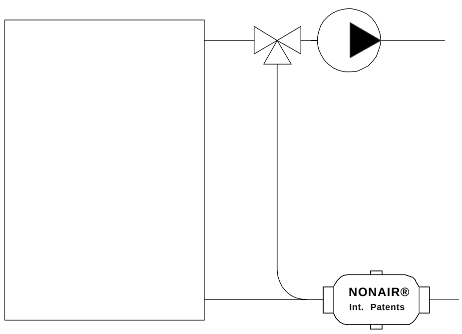
Nonair® Micro bubbles Separator will remove a certain amount of air from the system per circuit, therefore should air be absorbed into the water at any other part of the system which may be at a lower temperature. This air will then be removed when it passes again through the **Nonair**® Micro bubbles Separator. This process will continue until the system is completely air free.

If in some other part of the system, there is a need to release air while the water is circulating, it is pointless installing an air container, air release valve or similar. The velocity of the water in a modern installations is too high. Large air bubbles will be transformed to micro bubbles, which will travel round with the water and not be removed. The only method of separating micro bubbles is to install a **Nonair**® Micro bubbles Separator at that point.

A **Nonair**® Micro bubbles Separator is supplied with either 1, 2 or 3 - ½" threaded connections at the top depending on the size of the **Nonair**® Micro bubbles Separator. These are for standard air vent valves, servicing of which will be simplified by insertion of a adequate servicing valve between the **Nonair**® Micro bubbles Separator and the air vent valve. The ½" (1" for DN 200 and bigger) threaded connection at the bottom of **Nonair**® Micro bubbles Separator is for discharge *to drain*.



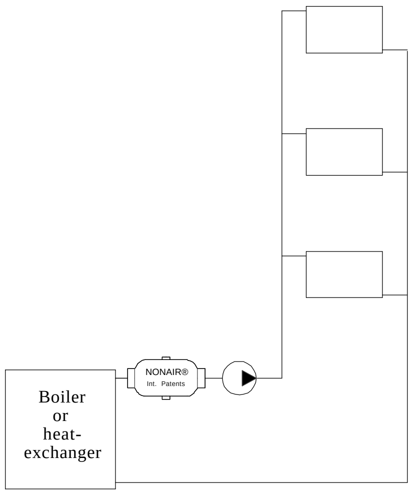
Heating system
Diagram 'A'

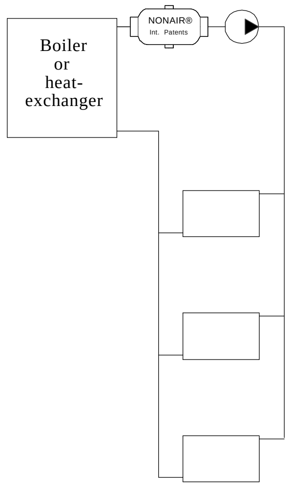


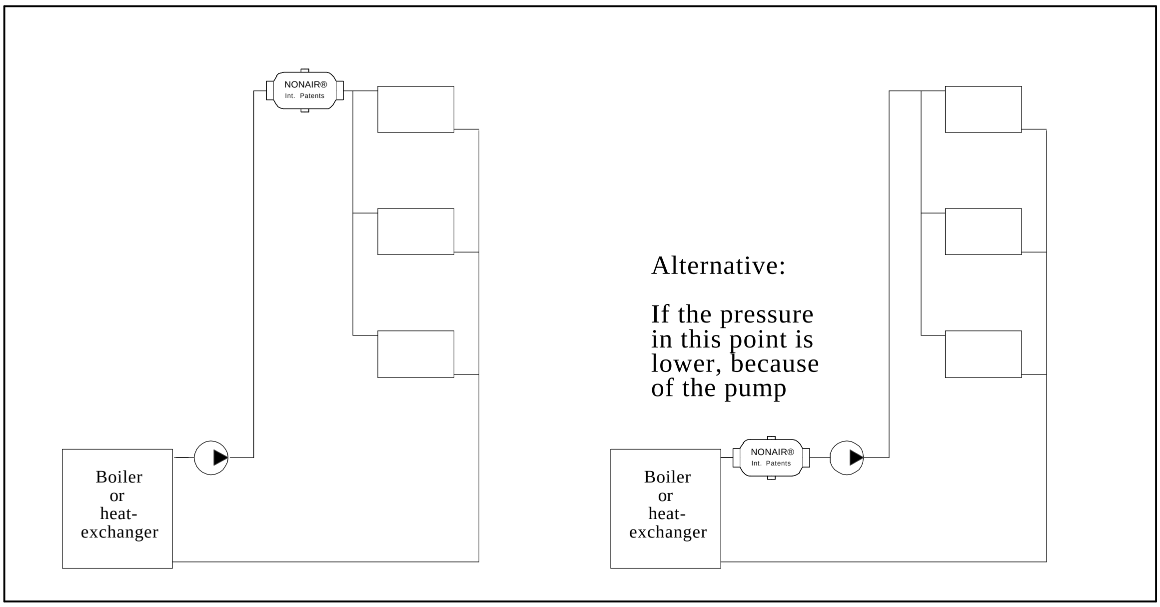
Cooling system
Diagram 'B'

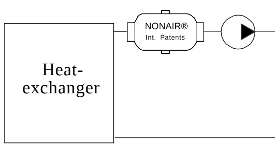
Further mounting samples on next side:

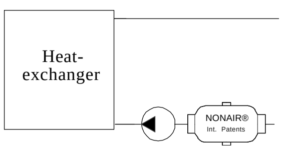
MOUNTING SAMPLES:

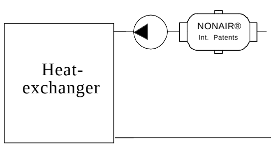








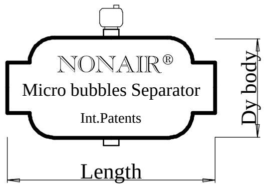




NONAIR® Micro bubbles Separator

TABLE OF MEASURE AND WEIGHT:

DIM	Dy	length, mm				weight, kg				volume
	body	socket	basic	welding ends	flanges	socket	basic	welding ends	flanges	litre
R 20 (¾")	70	140				0,6				0,5
R 25 (1")	70	145				0,6				0,5
R 32 (1¼")	90	180				1				0,8
R 40 (1½")	90	180				1				0,8
R 50 (2")	129	330				1,9				3
DN 50 (60,3)	129		280	340	310		1,5	1,7	3,3	3
DN 65 (76,1)	154		340	400	370		1,8	2,1	4,2	5
DN 80 (88,9)	168		380	440	410		3,5	3,8	6,5	6
DN 100 (114,3)	204		420	480	460		5,1	5,6	8,7	8
DN 125 (139,7)	256		470	530	510		8,1	8,8	13	16
DN 150 (168,3)	306		520	580	565		10	11	16	25
DN 200 (219,1)	406		620	680	665		26	28	35	56
DN 250 (273,0)	458		880	940			44	50	60	103
DN 300 (323,9)	550		950	1010			68	77	112	165
DN 350 (355,6)	610		1050	1110			86	97	147	225
DN 400 (406,4)	700		1140	1200			122	135	195	329



The socket, at the top of the body, for **air outlet** is ½" threaded.
A reduction plug ½" x 3/8" in brass material will be enclosed.
DN 125 - DN 250 have two ½" sockets for air outlet.
DN 300 - DN 400 have three ½" sockets for air outlet.

The ½" treaded socket, at the bottom of the body, is for **discharge** to drain.
It will be pluged with a brass plug at the factory. The white sealing is of silicone material.
DN 200 and bigger have 1" treaded socket. It will be pluged with a stainless steel plug.

Standard design pressure PN10, 10 bar, for all sizes. PN16, 16 bar can be delivered.

The Socket Model is made total in Stainless Steel material 316L.
Is used at threaded pipe joint with stainless or carbon steel pipes.

The Basic Model is made total in Stainless Steel material 316L. Welding ends of Stainless steel.
Is used at welded pipe joint with stainless steel pipes

The Welding Model is the Basic Model + welding ends in steel material, DIN 171 75.
Is used at welded pipe joint with carbon steel pipes

The Flange Model is the Basic Model + collars in Stainless Steel material 316L and
Is used at flanged pipe joint with stainless or carbon steel pipes.
DN 50 - DN 250 have flanges PN10, DIN 2642, in Silumin material.
DN 300 - DN 400 have flanges PN16, DIN 2642, in galvanized steel material.
Flanges PN 16, DIN 2633, in various material, can be delivered.

Dimensioning: Choose the same dimension as the pipe it is connected with.

Presssure drop: Minimal (~5 mm water column at 1 m/s), (~50 Pa at 1 m/s).

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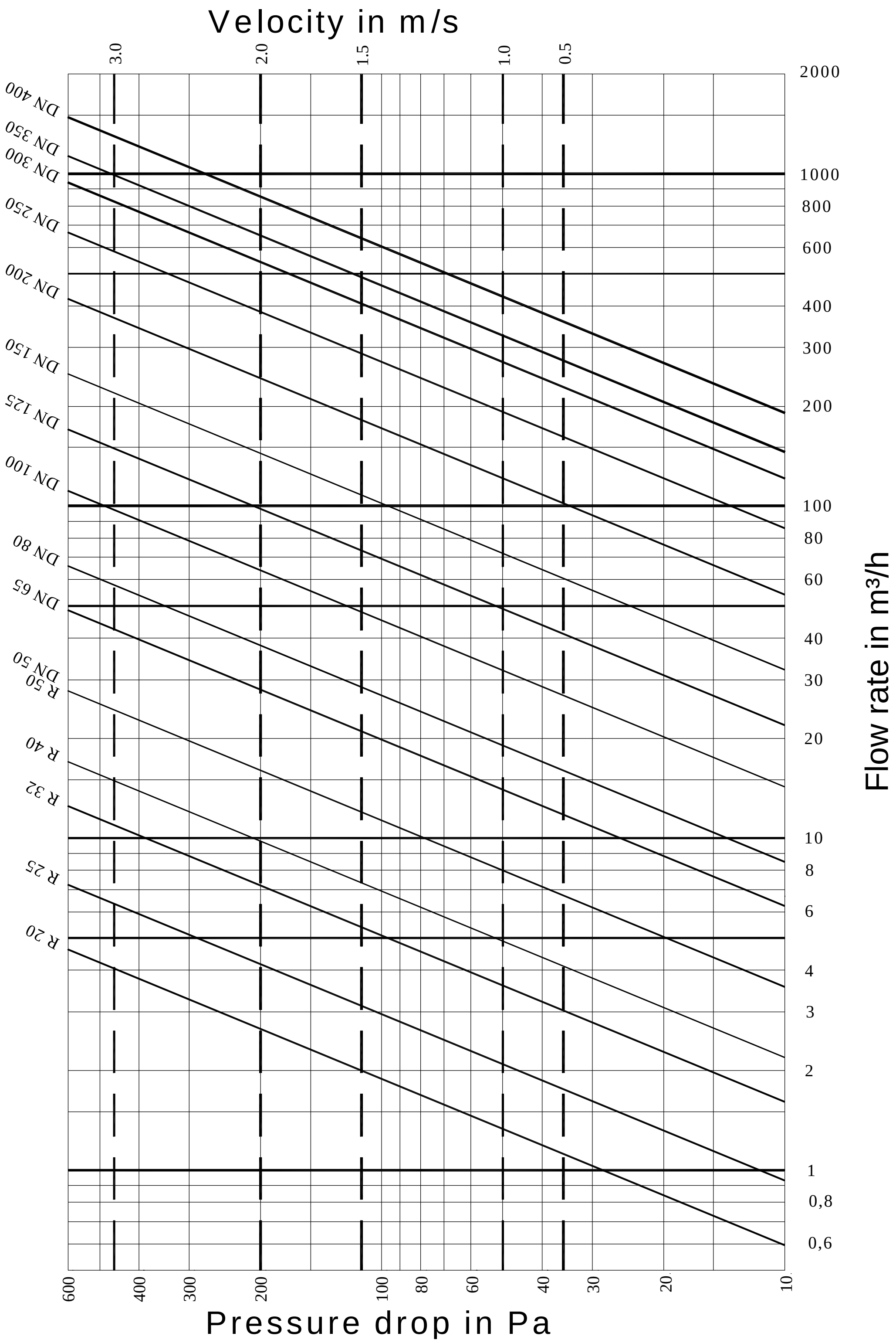
Diagram of the pressure drop through Nonair® as a function of the flow rate



EXAMPLES OF NONAIR®:

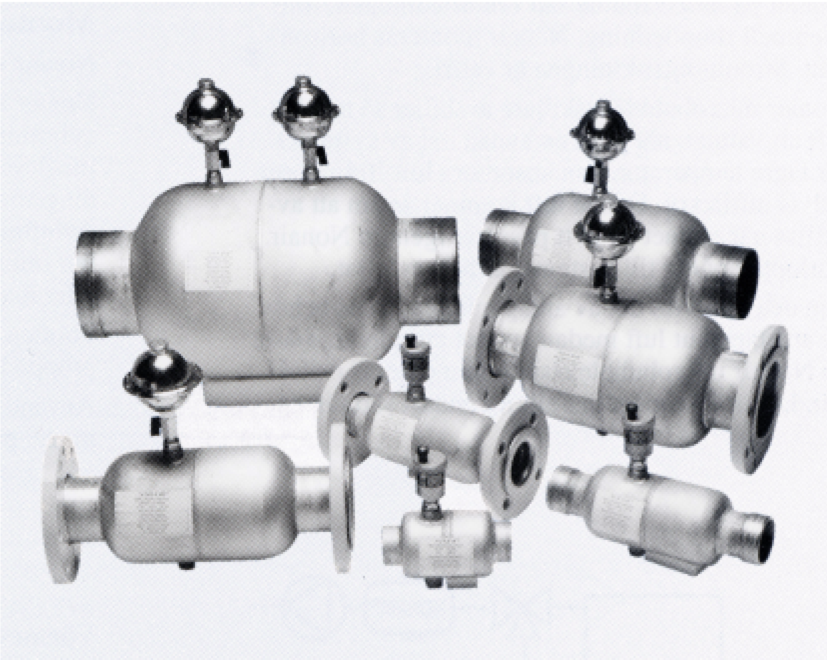


Fig 1: Nonair® with various dimensions and connections.

Fig 2: Nonair® with flange connections

Fig 3: Nonair® with welding ends

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