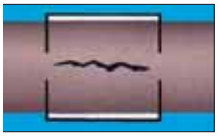
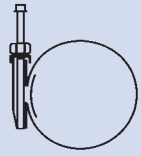
Stainless Steel repair and tapping products

will seal



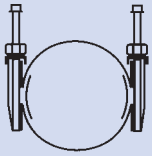
Longitudinal cracks

Types of HandiClamp and HandiTap available



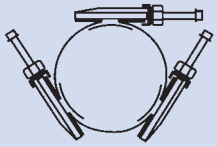
SINGLE BAND

OD Tolerance Range = 10mm/0.375"
Min OD size = 48mm/2"
Max OD size = 350mm/14"
Max Clamp Length = 300mm/12"



DOUBLE BAND

OD Tolerance Range = 20mm/0.75"
Min OD size = 88mm/3 1/2"
Max OD size = 450mm/18"
Max Clamp Length = 600mm/24"



TRIPLE BAND

OD Tolerance Range = 30mm/1.25"
Min OD size = 270mm/10 1/2"
Max OD size = 600mm/24"
Max Clamp Length = 600mm/24"

HandiTap
HandiTap provides a quick, cost effective method of installing or replacing service pipe connections whilst under operating pressure. Connections can be made without any interruption to the water supply. It has the same design features as HandiClamp and incorporates either a 1" or 2" female threaded outlet. The product can be used with standard under-pressure drilling equipment.

HandiClamp
HandiClamp is a repair clamp constructed 100 % from stainless steel and is designed to effect a first time, permanent repair on any type of pipe damage. It is suitable for use on cast iron, ductile iron, steel, PVCu, polyethylene (PE), asbestos cement (AC) and copper pipes.

Double band HandiClamp

Single band HandiClamp

HandiBand
HandiBand is a cost effective, high quality repair clamp designed to effect permanent repairs to small bore pipes. HandiBand forms a leaktight seal on localized pipe damage.

VN - Pumpen

Pressure tank according to DIN 4810

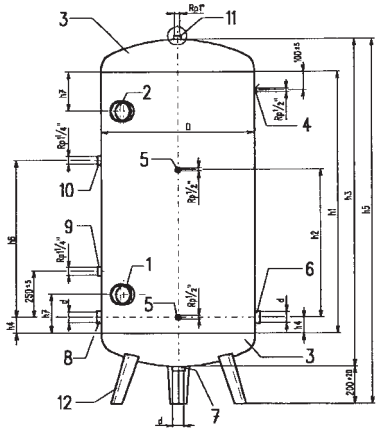
The pressure tank is manufactured as welded construction from material St 37.2 acc. DIN 17100 with material test certificate and welded acc. to DIN 50049. Vertical pressure tank for water systems can be delivered up to 3000 liter acc. to DIN 4810. Pressure tanks with a content of 4000 liter or bigger are manufactured acc. to manufacturer standard. The sizes from 150 liter up to 1000 liter are provided with a hand-hole 100 x 150 mm (1000 liter tank with two hand-holes), tanks of 1500 liter and bigger are provided witha man-hole 320 x 420 mm. Design temperature 50° C. Testing obligation and pressure testing with water: A prototype testing acc. to UVV (accident prevention rules) is allowed for pressure tank of water system acc. DIN 4810 and covering following sizes

up to 1500 liter content and 4 bar operating pressure
up to 1000 liter content and 6 bar operating pressure
up to 500 liter content and 10 bar operating pressure

All other tanks and tanks with non-standard dimensions and non standard connections are to be tested by TÜV (Technischer Überwachungsverein).

Surface protection: a) inner surfaces not treated, outer surfaces primed
b) inner and outer surfaces primed and painted
c) inner and outer surfaces are galvanized.

Tank with plastic coating can only be delivered acc. to manufacturer's standards, i.e. all screwed connections with external thread, and up to 500 liter content with screwed-on top cover.



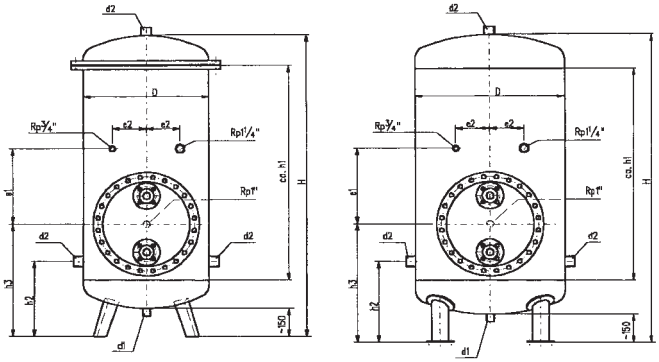
1.) hand-hole or manhole
2.) 2nd hand-hole only for tanks with nom. content of 1000 liter
3.) cover acc. to DIN 28011
4.) connections for pressure switch
5.) connections for water level gauge
6.) connection for pump discharge line
7.) connection for drain or supply line
8.) connection for house pipe line or for supply line
9.) venting connection
10.) aeration connection
11.) connection for spare
12.) 3 feet

content liter	D mm	d mm	h1 mm	h2 mm	h3 mm	h4 mm	h5 mm	h6 mm	h7 mm	hand-hole or manhole Qty	Size mm	weight kg 4 bar	6 bar	10 bar
150	450	Rp 2"	790	500	1010	85	1230	500	210	1	100x150	40	42	50
300	550	Rp 2"	1100	700	1360	85	1570	675	210	1	100x150	62	64	85
500	650	Rp 2"	1310	700	1610	85	1810	800	210	1	100x150	85	100	130
750	800	Rp 2"	1250	700	1610	85	1810	800	210	1	100x150	110	143	185
1000	800	Rp 2"	1750	1000	2110	85	2310	1050	210	2	100x150	135	178	230
1500	1000	Rp 3"	1560	1000	1992	120	2185	1000	300	1	320x420	233	289	383
2000	1100	Rp 3"	1770	1000	2242	120	2452	1125	300	1	320x420	304	353	470
3000	1150	Rp 3"	2500	1000	2992	120	3175	1500	300	1	320x420	395	457	649
4000	1400	Rp 3"	2160	1000	2780	120	2980	1390	300	1	320x420	550	664	939
5000	1500	Rp 3"	2440	1000	3100	120	3300	1550	300	1	320x420	652	834	1162
6000	1500	Rp 3"	2990	1000	3650	120	3850	1825	300	1	320x420	728	938	1313
7000	1600	Rp 3"	3050	1000	3750	120	3950	1875	300	1	320x420	765	1089	1516
8000	1600	Rp 3"	3550	1000	4250	120	4450	2125	300	1	320x420	955	1199	1731
10000	1600	Rp 3"	4550	1000	5250	120	5450	2625	300	1	320x420	1117	1474	2015

Water heater (calorifer)

Single wall, vertical design according to manufacturer standards,
with front flange and covers, calorifer made of steel, operating pressure 6 or 10 bar.

Manufacturer standards valid for following operating conditions:
domestic water boiler: operating pressure 6 bar and or 10 bar – operating temperature: max. 95° C. Heating coil: max. heating medium temperature 200° C and max. heating medium pressure up to 10 bar. Regarding accessories and acceptance test on the installation place the “AD-leaflet No. A 3” has to be provided.



Material:
For shell, covers and front flange of St 37.2 acc. DIN 17100 with material certificate acc. DIN 50049, section 3B – and section 2 for flanges.

Surface Protection:
inner/outer surfaces are completely hot galvanized or inner/outer surfaces are painted. It is to be checked if the galvanizing or painting can be used as a corrosion protection and at an operating temperature over 60° C. We strongly recommend that an inner plastic coating should be used in such cases.

Testing obligation and pressure testing with water:
Water heater according to the manufacturing standards is to be tested and certified for heating medium temperatures over 110° C. It is an obligation of the national control society that the water heater be tested and controlled acc. to “AD”-leaflets. The testing in the manufacturer´s workshop is carried out by “Technischen Überwachungsverein e.V.”. In addition to the testing and acceptance stamp of “TÜV” a marking of manufacturer (name, fabrication number and production year) is stamped on the water heater. With this mark it is ensured that the water heater is manufactured according to standards. Water heater with 6 and 10 bar operating pressure is tested with 8 and 13 bars. The same water heater is delivered to the non-tested water boiler plants.

content	D	H	h1	h2	h3	e1	e2	d1	d2	max. heating coil surface	weight kg	
liter	mm	mm	mm	mm	mm	mm	mm			m²	6 bar	10bar
150	450	1100	790	300	450	350	125	Rp 1”	Rp 1½”	1,7	107	107
300	550	1450	1100	320	470	350	150	Rp 1”	Rp 1 ½”	2,3	153	153
500	650	1700	1310	340	540	400	175	Rp 1”	Rp 1 ½”	5,0	210	231
800	800	1800	1320	350	590	400	200	Rp 1”	Rp 1 ½”	7,0	227	243
1000	800	2200	1720	350	590	400	200	Rp 1 ¼”	Rp 2”	7,0	259	278
1500	1000	2100	1540	410	630	400	250	Rp 1 ¼”	Rp 2”	8,5	324	386
2000	1100	2350	1750	430	660	400	275	Rp 1 ¼”	Rp 2”	9,0	438	510
3000	1300	2500	1825	480	700	400	325	Rp 1 ½”	Rp 2 ½”	10,0	585	749
4000	1300	3300	2625	480	700	400	325	Rp 2”	Rp 3”	10,0	726	926
5000	1500	3250	2485	530	740	400	375	Rp 2”	Rp 3”	12,0	888	1157
6000	1500	3750	3000	530	740	400	375	Rp 2”	Rp 3”	12,0	1043	1359
7000	1600	3850	3100	560	770	400	400	Rp 2”	Rp 3”	14,0	1271	1679
8000	1600	4350	3600	560	770	400	400	Rp 2”	Rp 3”	14,0	1401	2022
10000	1600	5350	4500	560	770	400	400	Rp 2”	Rp 3”	14,0	1636	2185

Shell-and pipe type heat exchanger

Application: The heat exchanger is used as a cooler or heater on board sea-going ships and also for land installations such as general engineering, petro-chemical industry and power plants.

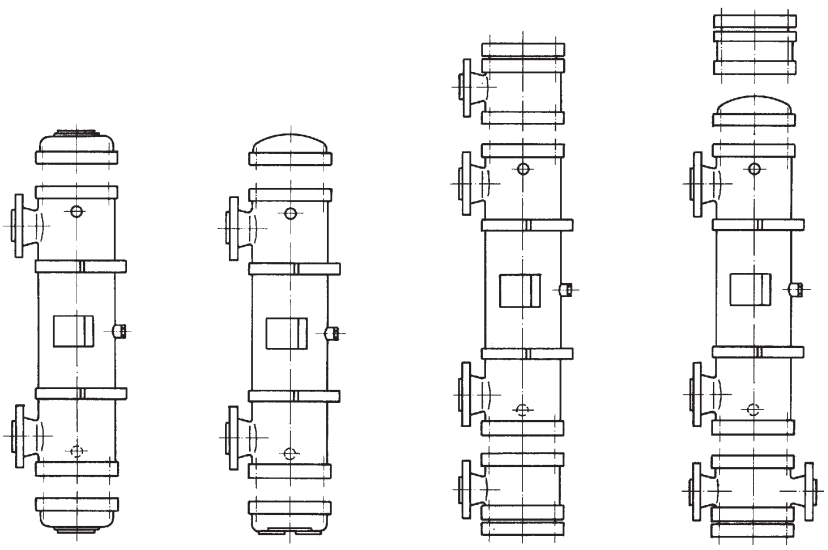
Media to be cooled: fresh water, lubrication oil, condensate, steam, hydraulic oil, air, gases, chemicals.

Cooling media: seawater, fresh water, raw water

Media to be heated: fuel oil, lubrication oil, fresh water, hydraulic oil, air, gases and chemicals, feed water.

Heating media: steam, fresh water, electric power, thermal oil, condensate, flue gas.

Design: The heat exchanger is designed for horizontal or vertical installation. It can be arranged as single-pass or multi-pass heat exchanger with drawable or non-drawable tube bundles, with seamless drawn plain steel tubes, single or double sealings, welded or seamless drawn shells with or without expansion bellows, welded or cast head covers or return covers and with machined pipe sheets. Based on these design alternatives and by using different kinds of material combinations it is possible to comply with the requirements of every operating condition.



Description of components and materials:
Shells: are made either with rolled and welded plates or by seamless drawn precision pipes. By the selection of a standard precision pipe size as shell for wide range of heat exchanging, it is ensured that the tube bundles are interchangeable for the same type. All necessary connections are standardized and provided on shell and covers. Flanges are acc. to DIN, other standards are available optionally.

Materials: carbon steel, stainless steel, copper nickel alloys. The shells made of carbon steel can be coated or galvanized internally if required.

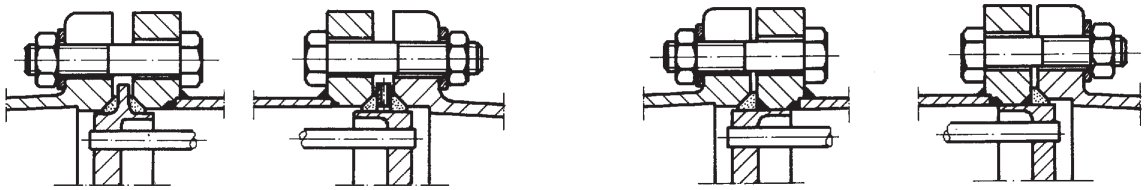
Inlet / outlet boxes for cooling mediums / covers and reserving heads:
Inlet / outlet boxes for cooling medium are of ample size to avoid turbulence on tube sheets. Water boxes for seawater application are delivered either as unprotected boxes with protective anodes or coated with a corrosion resistant coating. (such as: belzona, rilsan or hard rubber lining). The boxes are manufactured as welded construction or are cast.

Shell- and pipe type heat exchanger

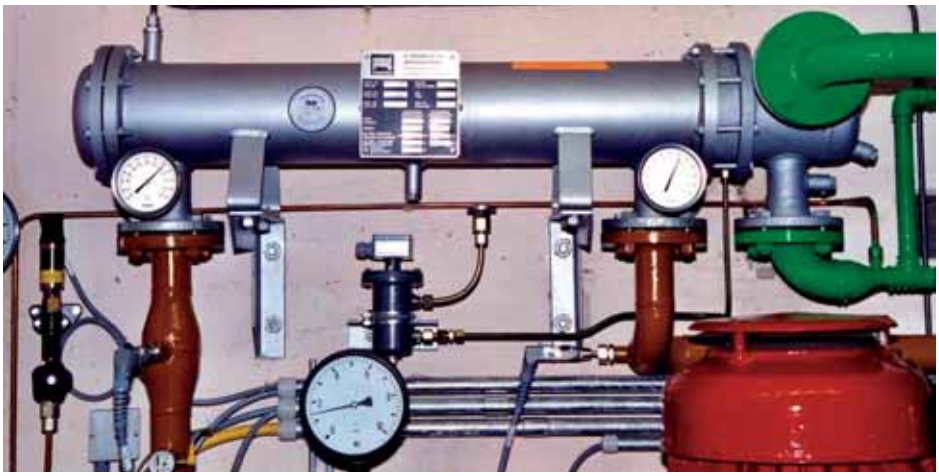
Materials for boxes and covers:
cast iron, carbon steel, stainless steel, copper nickel alloys, gunmetal.

Tube bundles / tube plates:
The heat exchanger is provided with fixed or with drawable tube bundles. The tubes are normally fixed with tube sheet by roller expanding. In special cases they can be welded if required. The optimum flow velocity across the tubes is determined by the number of baffles. The velocity through the pipes is influenced by the size and amount of pipes. In both cases it is recommended not to exceed a reasonable flow velocity and pressure drop to avoid erosion on the medium touched surfaces.

Materials:	**Tubes:**	aluminium brass, copper nickel 90/10, copper nickel 70/30, carbon steel, stainless steel and titanium.
	Tube plates:	naval brass, nickel-aluminium bronze, bronze, carbon steel, stainless steel.
	Tube baffles:	brass, carbon steel, stainless steel
	Sealing rings and arrangements:	oil-, fuel- and seawater resistant rings in suitable form are provided as single sealing or double sealing. In most cases the sealing arrangement is provided with leakage detecting holes to make sure that no leakage exists (see sketches).

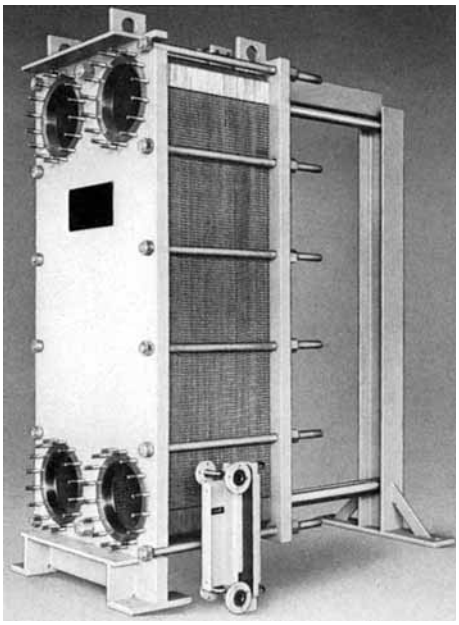


We are able to select and offer you any kind of cooler or heater exactly acc. to your demand within above-stated application fields.



VN - Pumpen

Plate-type heat exchanger for ship building industry



The heat exchanging problems in several marine applications are still solved by the pipe- and shell-type heat exchanger. This kind of heat exchanger is voluminous and heavy. It needs frequent checking and cleaning. Furthermore, for dismounting pipe bundles, additional space and lifting gear arrangements are needed.
With a modern design plate-type heat exchanger, the above mentioned disadvantages of conventional heat exchanger can be disregarded. The plate-type heat exchanger is designed for high heat transfer coefficients. Their application on board ship are realized to the full satisfaction of the yards and owners.

The design of the plate-type heat exchanger allows the installation of large heat exchanging surface in relatively small spaces. Compared with a conventional heat exchanger, the plate-type heat exchanger is light, needs no additional space for dismounting of plates and, based on high heat transfer coefficients, the necessary surface will be approx. 1/3 of the pipe and shell-type heat exchanger.

Further advantages of the plate-type heat exchanger:

- an important advantage of the plate heat exchanger is its flexibility. If, after installation, the design data have to be revised, for example:
  increasing the flow or pressure and decreasing of the pressure drops and/or the changing of the temperature levels; all these are no problem for the plate-type heat exchanger.

- By adding or removing the required amount of heat exchange plates, the necessary modification can be realized in a relatively short time without any alteration on the existing system. Such modifications cannot be carried out on a conventional heat exchanger. In most cases a new heat exchanger must be installed.

- The heat losses of the plate-type heat exchanger are low, since the edges of the plates are exposed to air only.

- Low weight of the plate-type heat exchanger allows easy transport and installation and needs small foundations.

- Based on high heat transfer coefficient and small heat transfer surfaces, a considerable amount of cost saving on equipment can be achieved especially if special materials are used.

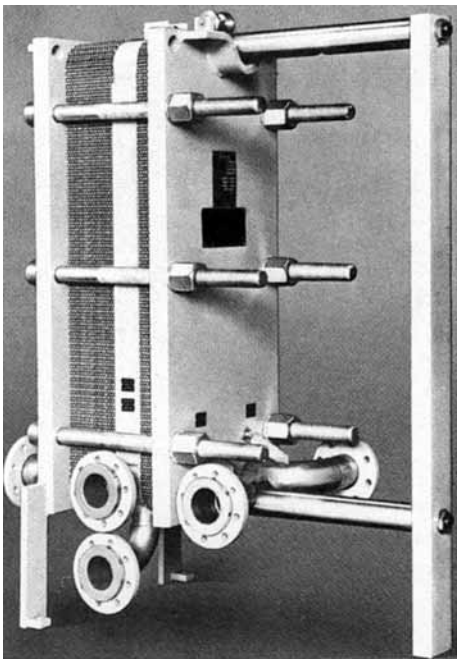


Plate-type heat exchanger for ship building industry

Advantages:

– Inspection, cleaning and maintenance of the plate-type heat exchanger is much easier (low repair costs).

– The flow direction can be changed acc. to space requirements on board.

– The water content of a plate-type heat exchanger is much lower than a conventional heat exchanger.

Design:

The construction of a plate-type heat exchanger is simple. A number of specially formed plates are supported on four frame pipes and are joined to each other face to face. The special form of the plates on both sides of each plate provides the channels for the medium to be cooled or heated and for the heating or cooling medium.

The application field of the plate-type heat exchanger in shipbuilding industry can be shown as follows:

- main and auxiliary cooling,
- piston cooling,
- lubrication oil cooling,
- nozzle cooling,
- cylinder cooling water heating.
- As purifier L.O. heater or F.O. heater,
- main engine H.F.O. heater,
- heater in heat recovery systems.

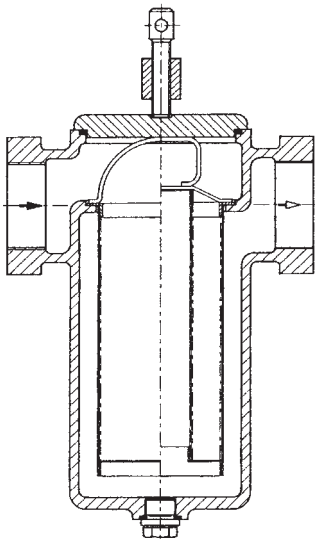
Materials for plate-type heat exchanger:

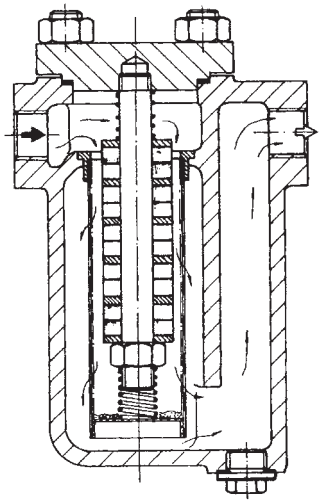
- chrome nickel steel (1.4301 – AISI: A-304)
- chrome nickel molybdenum steel (1.4401 – AISI 316)
- titanium
- monel
- inconel
- hastelloy B and C
- tantal

Gaskets:	nitril-rubber, hypalon, silicon, viton, perbunan
Capacities:	up to 1500 m³/h
Pressure range:	up to 16 bar
Operating temperatures:	250 °C

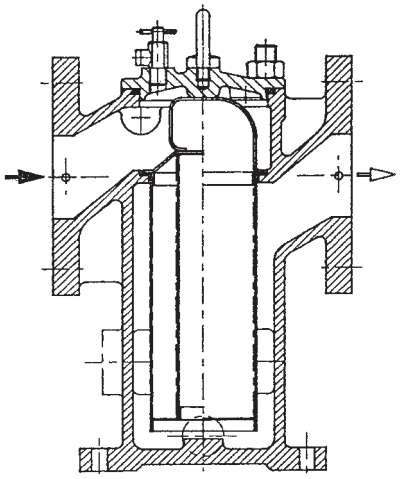
We are able to prepare a proper layout of the cooling system on your ships with plate-type heat exchangers tailored exactly acc. to your needs. The conventional pipe-and shell-type heat exchanger can also be delivered if required.

VN - Pumpen





with magnet cartridge



Filter application in ship machinery plants and factories

Application:
The developments made by the well-known filter manufacturers during the last 30 years have enabled them to present a new filter program on the market, of great reliability and versatile application.
The selection of the filters for a certain application is carried out according to the amount of flow, the kind of viscosity of the medium, the mesh size of the filter cloth, the place of installation and system pressure.

We can deliver: Filtering plants for the filtering of lubrication oils, fuel oils, seawater, freshwater, condensate, feed water, bunker fuels, thermal oils, hydraulic oils and cargo oils for the installation on board ship and in other industrial plants.

Design and forms:
Three main groups can be mentioned:

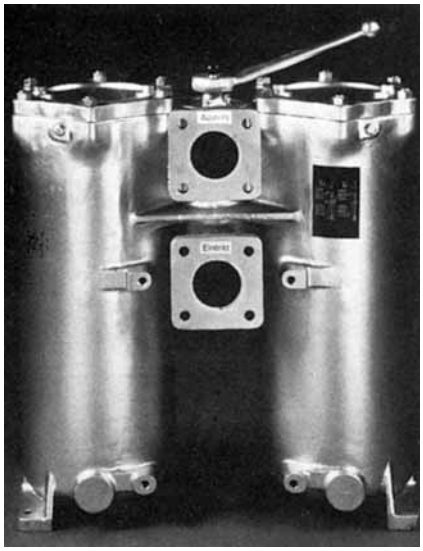
- single chamber filter
- double or multi-chamber filter
- automatic operating self-cleaning filter

Single chamber filter

If the flow may be interrupted for the cleaning of the filter, then a single chamber filter may be selected. This will be installed as suction- or discharge filter and can be delivered with steam or electric heating.

Nominal sizes:	DN 15 – 800
Nominal pressure:	PN 10 – PN 64
Connections:	up to R 2" with female thread. All sizes with flanges acc. to DIN. Other flange standards (i.e. ANSI or BS) can be delivered on request.
Filter mesh sizes:	as coarse filter 3 – 10 mm as suction filter 150 – 450 micron as discharge filter 10 – 150 micron The determining of the mesh sizes is done according to the requirements of engine- or pump manufacturers.

Filter application in ship machinery plants and factories

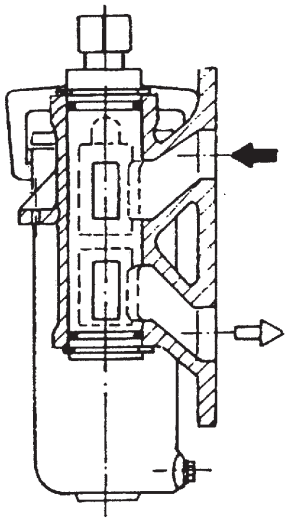


Change-over-type double filter

If the flow may not be interrupted for the cleaning of the filter then a change-over-type double or more multi-chamber filter must be selected. Mainly double filters with change-over cocks or valves are installed. Version with electrical or steam heating is available. Multi-chamber filter (up to 4 chambers) can be delivered. Magnet cartridges or discs are provided to increase the filtering efficiency (especially for filtering of metallic parts).

Sizes: DN 20 – DN 500
Nominal pressures: PN 10 – PN 64

Connections: up to R 1" with female thread. All other sizes with flanges acc. to DIN. Other flange standards (i.e. ANSI or BS) can be delivered on request.

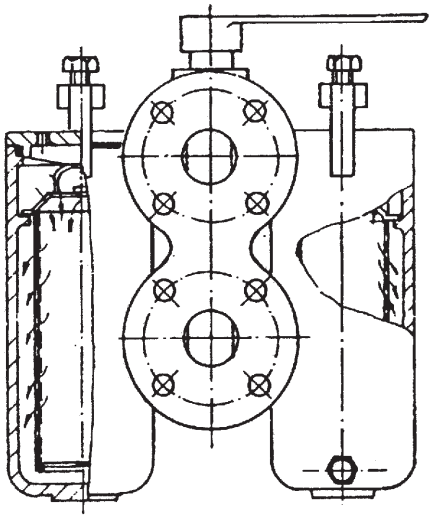


The double filters can be provided with quick opening devices and flushing arrangements for the cleaning of the filter in closed conditions. The flushing arrangements are recommended especially for the bigger filter sizes.

A differential pressure indicator gives an alarm in case one of the filter chambers is dirty. The cleaning is done manually by means of compressed air pistols or by an external flushing medium, if a flushing device for the cleaning in closed condition is provided.

Materials:

Casing: cast iron, spheroidal cast iron, cast steel, stainless steel cast, steel welded, aluminium cast
Filter cloths: stainless steel, monel, bronze
Filter inserts:
– basket filter elements
– ring filter elements
– multimantle filter elements
– multimantle filter elements with magnet discs
– cartridge filter elements for extremely contaminated liquids for 5 – 20 micron



VN - Pumpen

Compressors for use on board of ships and for industrial application

Application:
The compressor can be delivered either as reciprocating (piston type) or screw type. The reciprocating-type compressor is still the most commonly used, but screw compressor for the refrigeration of cargo and/or for producing high quality air for large capacity, ship service- and control airsystems are becoming increasingly popular.

Reciprocating piston-type compressor:
The cylinders of the reciprocating piston-type compressor are arranged in V, W or inline form.
The number of cylinders can be 2, 3 or more. The piston type reciprocating compressor is available in 1, 2, 3 and 4 stages depending on the selected pressure ranges. Generally, three discharge pressure ranges can be named:

- low pressure compressor: applicable up to 10 or 15 bar operating pressure.
- medium pressure compressor: selected for the pressures up to 35 bar
- high pressure compressor: selected from 35 bar up to 450 bar

Piston type reciprocating- and/or screw type compressor for ship service or control air system

a) **Piston type reciprocating compressor**
can be delivered in lubricated or oil-free design. The cooling is done by air or water. Oil-free compressors are installed on board ship for control air systems, where well treated air with extremely low oil content is required.
Oil-free compressors are also used for the chemical industy, food industry, process engineering, pharmaceutical industry, laboratories and several offshore systems.
The pressure range of the oil-free piston compressor for use on board of ships is up to 10 bar with an F.A.D. volume of 9.4 - 150 m^3/h.
The lubricated piston type compressor is used as low pressure version or design, on ship-, dock- and off-shore service air systems, where a certain amount of oil in the air is required for the operating tools.

b) **Screw-type compressor**
A screw-type compressor with a properly selected air treatment system is recommended for ship installations as an alternative to the piston-type oil-free compressor, especially if bigger F.A.D. volumes are required.

Compressors for use on board of ships and for industrial application

The air on the compressor outlet is de-oiled as option (by a centrifugal separator and micro-fine filter) and dried by a refrigeration-type or adsorption-type air dryer.
In a separate section, the air is treated in accordance with the use and application of the air treatment system. The screw-type compressors are delivered as air-cooled or water-cooled compact units.
By using the latest technical know-how and intensive contacts between manufacturer and consumer, a completely new and modern design concept of screw-type compressor has been developed with the following advantages:

- maximum efficency
- absolute operating safety
- long life
- high ecological value

Screw-type compressor units consist of the following main components:

- screw compressor block with air suction filter and main full load/idle-controller
- electric motor V-belt driven
- oil separation system with fine separation cartridge
- oil cooler
- compressor air after cooler
- min. pressure control and non-return valve
- oil/air receiver
- cooling fan
- electric switchboard

Compressor capacities: up to 1700m³/h or more
Pressure ranges: 8-13 bar
Certificate of any classification can be delivered.

Design:
Two screws (male and female) are mounted into an air-end housing inlet and outlet ports. The housing and screws are designed with minimum tolerances to each other. For the cooling and lubrication of the male and female screws, the oil is injected into the rotor housing. The circulated oil also provides the lubrication of the bearings. Radial and axial forces are absorbed by roller and ball bearings. Axial thrust is equalized.
The screw compressor operates nearly vibration-free and at low noise levels. By using several standardized screws and other compressor elements together with different electric motor sizes, a wide range of capacities and pressures is achieved according to customers' demands. The air cooling is generally selected if a sufficient amount of fresh air to and from the compressor by a suitable ducting system is ensured. The arrangement of the air-cooling system is simple.
Water cooling is used if seawater (special heat exchanger) or a sufficient amount of fresh water and/or recycled water is available. The compressed air temperature is approx. 6 - 10 °C above the inlet temperature of the cooling water.

VN - Pumpen

Compressors for use on board of ships and for industrial application

Starting air compressor for main engine or aux. engine starting
The starting air compressor is designed for a discharge pressure of up to 35 bar. Cylinder arrangements are on line or "V", "W" form. 2 or 3 stage compressor with air- or water cooling.

Some advantages of three-stage compressor:

- three stage compressor gives low compressions and temperatures
- no coking oil on valves and piston ring which ensures long valve service life
- low piston speed resulting in low wearing
- robust design for heavy duty operation
- separate external cooler, easy to mount and repair

Main components of the reciprocating piston type starting compressors are:

- Compressor block with fly wheel,
- Silence insulated suction air filter,
- Safety valve for each stage,
- Manometer for each stage,
- Oil cooler
- Inter cooler
- After cooler
- Closed circuit F.W. cooling system if heat exchanger cooling is provided,
- Flow control
- Unloaded start-stop system
- Centrifugal oil separator,
- Control box

Marine oilfree compressor with cooler, dryer and air-tank

The starting air compressor is delivered with all above mentioned equipment, mounted to a compact unit ready for installation. The yard needs to install electric control box, to connect cooling liquid inlet outlet and compressed air outlet to air receiver.

Kind of drive:	electric motor or diesel engine
Capacities:	10 - 750 m^3/h
Speeds:	800 - 1800 rpm
Power supply:	3 x 400 V, 50 Hz or 3 x 440 V, 60 Hz

The compressors are delivered with certificate of a classification society.

Emergency starting compressor

Compressors for use on board of ships and for industrial application

Breathing air compressor for diving equipment
Breathing air compressor is delivered for a max. pressure of 350 bar. It is designed as 3 or 4 stages compressor and delivered as fully mounted compact unit for stationary installations or transportable/moveable diesel-driven compressor unit.
The compressor is mounted on a common base plate or frame and connected to the electric motor directly or to the diesel engine via "V"-belt drive. The units are provided with non-return valves, oil- and moisture separator after second stage, filter-box and active coal filter, safety valves, automatic onloader, automatic cooler- and separator drains. A charging panel (can be mounted separately) including HP switch, pressure maitaining valve, air charging pressure gauge, charging hoses with international connections are delivered. A multistage absorption filter provided with CO_2 converter, saturation indicator and manual blow-down valve belongs to the extent of delivery. Maximum capacities of breathing air compressors are up to 360 m^3/h at 230 bar. Air treatment is done acc. to international standards. Stationary units with compact sound insulation boxes including all charging equipments and gauges can be delivered.

Following features are to be considered on selection of a breathing air compressor:
- driving engine (benzine or diesel) should be silent and ecologically beneficial
- easy installation, also in sand if necessary
- connection and disconnection of filling cock with venting must be possible without danger
- flexible hose connections
- compressor must be able to work under tropical and arctic conditions
- must be designed for heavy duty operation
- low compression end temperature (approx. 10 °C more than ambient)
- all rotating parts must be especially cooler and filter with fittings must be made of corrosion-resistant material.

The quality of the breathing air corresponds to DIN 3188.

Remaining water content at 330 bar	35 mg/m^3
Remaining water content at 225	50 mg/m^3
Remaining oil	0,3 mg/m^3

Free of odor, neutral
Compressors in our delivery program can fulfil all the above stated requirements.

Double working air screw compressor unit

Air dryers on compressed air systems of the ship machinery and dock service air supply plants:

The atmospheric air contains moisture in the form of water vapor (depending on ambient conditions). The volume of the compressed air is decreased on the compressor outlet but the content of moisture is still the same. In addition to this, all other contaminations such as oil drops, particles from the wearing of the mechanical parts, dust etc. are collected in the air and these must be separated by a suitable method to avoid a damaging of system components. The separation of the moisture and all the contaminations from the compressed air can be done by 3 different methods:

1) air treatment by the mechanical filters, separators
2) air treatment by the thermodynamical process (cooling)
3) air treatment by the adsorption process

Method 1)

The mechanical air treatment is carried out by means of the centrifugal-type cyclone separator, which is able to move oil and water drops from 50 microns upwards. The content of moisture with drops smaller than 50 micron is much bigger (in percentage). It is clear that the result of the mechanical treatment is not sufficient. The air on the way from compressor to air receiver and from receiver to system is cooled down to the ambient condition, and some of the moisture is moved from the air and the distribution system. The air still contains a large amount of moisture (near saturation). This moisture must be separated together with other contaminations from the compressed air to overcome the danger of damage and loss of system efficiency. That means, another possibility to remove the moisture from the compressed air must be found, since the conventional arrangements such as filter, separators and condensate traps cannot fulfil these requirements.

Method 2)

The air treatment by thermodynamical process occurs with refrigerated air dryers. There are a lot of manufacturers on the market who offer this kind of dryers for ship installations, dock service systems, off-shore applications where necessary.

The working principle of this dryer is to lower the dew point of the air by cooling and to remove the moisture from the air. The units operate in two steps (cooling and drying).

The moisture-saturated air enters the first stage of the dryer and is precooled there by the refrigeration unit, consisting of compressor, condenser, receiver, expansion valve, pressure switch.

The compressed air is cooled in the refrigerant-to-air heat exchanger theoretically down to a pressure dew point of 1,7 °C which corresponds to an atmospheric dew point of - 23 °C. But in practice, a dew point of 3 °C at pressure is reached. The moisture on the compressed air is separated by this cooling. The separated moisture is drained via a condensate drain trap. By means of a control system, it is ensured that the dryer can operate sufficiently on load variations between 0 - 100 %. The cooled and dehumidified air enters the second stage of the dryer and is heated here by the incoming, untreated air. This air-to-air heat exchanger enables the heating of the treated air up to 8 °C below the temperature of the untreated air.

This results in a further reduction of the relative humidity of the treated air. The danger of the sweating on the piping system is no longer given. It is usual practice that, on the outlet of the dryer, a microfine-filter is installed, to remove the remaining contaminations (dust, oil, wearing particles). There are a lot of manufacturers on the market who offer their fine filter with a removal rate of 99,9 % of the contaminations over the 5 microns.

Capacity range of the refrigerated dryers: up to 5000 m^3/h, pressure dew point 2 ÷ 3 °C

Air dryers on compressed air systems of the ship machinery and dock service air supply plants:

Method 3) - Adsorption method

The most efficient drying effect is achieved by the adsorption method. It is possible to extract the water vapor from the compressed air up to a content of 0,0033 gram per m^3. The word "adsorption" means: the accumulation of a medium (adsorbed substance) on the surface of a solid material (adsorbent). Adsorbents are solid materials with fine multipores on their surfaces which give very big contact area.
The adsorption dryer unit in its simple form consists of two (2) cylindrical receivers which are connected to each other by piping via automatic operating three-way valves. Both cylinders are filled with a suitable adsorbent, for example silicia gel, aluminium oxyde powder or molecular sieve. The untreated wet air enters the adsorbent-bed from the bottom of the receiver. Passing this bed upwards, the moisture is adsorbed by the adsorbent. The capacity of each adsorbent is limited. After a certain operation time, the adsorbent becomes saturated. It is necessary therefore to change the saturated receiver to the next receiver which is waiting on stand-by. The regeneration is achieved by a partial flow (approx. 15% of main-flow after drying on the top of the receiver. This small flow enters the regeneration chamber from the top and flows in counter direction (i.e. downwards). The moisture from the surface of the adsorbent is taken by the partial air flow and expanded on the bottom of the receiver to the atmospheric pressure. This process is called "Air drying by heat less regeneration and adsorption". The dryer works fully automatically in the pressure exchange mode. The dryer is used for the operation pressures from 5 bar upwards. The standard pressure dew point is - 40 °C. Pressure dew point - 70 °C for special application is available. The air inlet temperature should be no more than 60 °C. The drying agents (adsorbents) have a service life of 3 - 5 years.
That means the adsorption system works very economically.

Since it does not contain big moving parts, it is easy to maintain and repair. For larger flows, it is necessary to use hot air regenerated adsorption units. The heating can be done by an internal heating coil in receiver. The heating medium is circulated through this coil, or by the external heating.

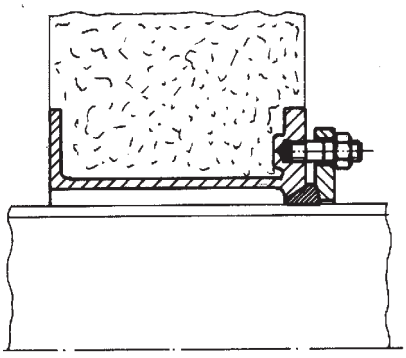
This kind of adsorption plants is used by process engineering and other industrial applications. For the ships and dock service air systems, a heatless dryer is sufficient.

Capacity range: up to 5000 m^3/h
Dew point: - 40 °C

We would like to point out that the demand of ship machinery plants, docks and off-shore systems can be completely covered by the methods as explained under 1) - 3).
If you can give us your specific demand, we will prepare a correct air treatment system compatible with your compressors.
Compact packages, beginning with compressor and ending with fine-filter, can be delivered with testing and acceptance certificates of all wellknown classification societies (incl. USSR).

VN - Pumpen

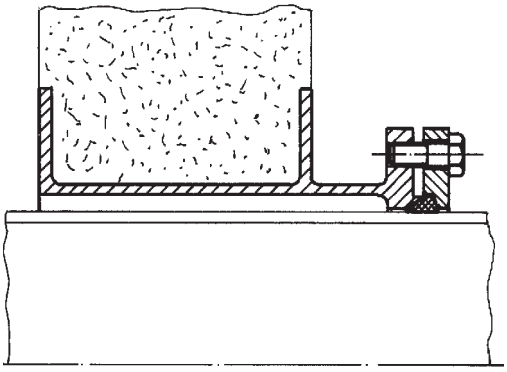
Pipe wall duct



Application:

Elastic pipe ducts on elevated and low-level tanks, water towers, pumping stations, sump structures, swimming- and filtration-pools, digestion tanks and industrial structures, in particular for the chemical and mineral oil industries.

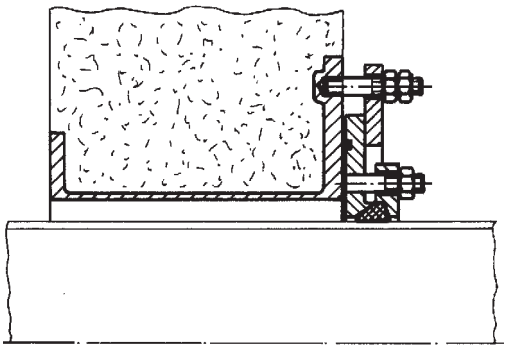
Sealing of pipe ducts on underground structures and tanks against ground and surface water as well as on structures of all types against entry or exit of the various liquids.



Suitable for use as ducts for steel pipes, cast-iron pipes, concrete pipes and stone ware pipes as well as plastic pipes.

Design:

Wall ducts consist of the wall-casing pipe with welded-on wall flanges (if required with a flange ring drawn in front of the masonry).



Wall flange takes the form of a sealing compartment. Sealing is effected by means of special gasket, which is forced into the sealing compartment with a thrust ring. Maximum possible movement in axial direction and angular direction of the pipe up to 4° .

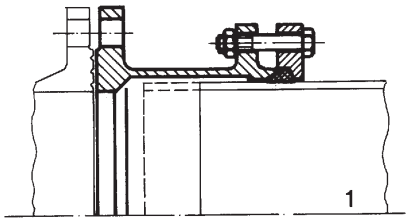
Maximum possible allround movement of the barrel in axial and radial direction; angular deflection of the barrel in central position up to 4° is possible with version having an additional O-ring-seal pressed with the clamping ring into the wall flange, which forms a sliding surface on one side.

Max. differential pressure: 60 m W.C.

Max. temperature: 100 °C

Size: DN 40 – DN 1600

Socket-spigot joint



Application and design:

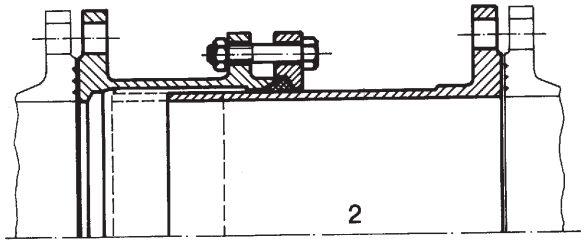
For use as valve removal section in installation conditions. Adapter for compensation of length differences.

Flexible:

Expansion joint to accommodate axial movement and angular movement of pipeline, for operation pressure PN 10, PN 16 and PN 25

(1) adapter from flange connection to plain pipe end

(2) adapter for different flange measurements.

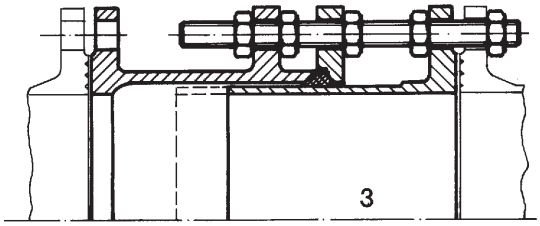


Rigid:

Adapter for compensation of length differences, for operation pressure PN 10, PN 16, PN 25 and PN 40

(3) adapter for different flange sizes, also available as reducing section.

(4) almost all installation conditions, even without fixed points on the pipeline.

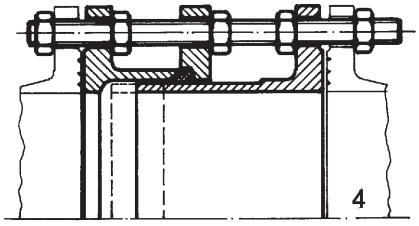


Liquid:

Suitable for practically all conventional flow liquids, including mineral oil, petrol, kerosene (JP 4), propane, butane, town gas, natural gas etc.

Size:

DN 40 - DN 1600

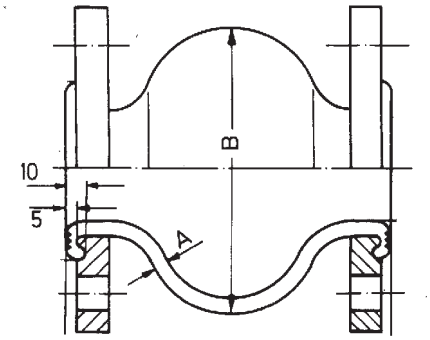


Temperature:

For water up to 100 °C continuous temperature

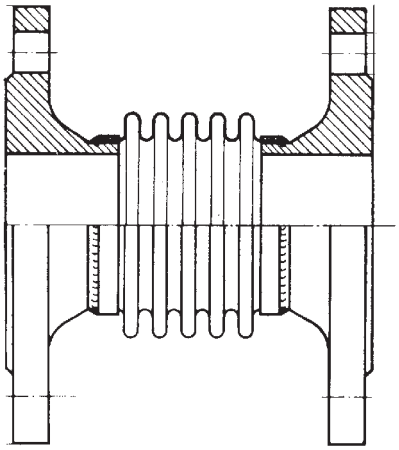
VN - Pumpen

Compensator



As flexible connection in pipeline-, ship-, tank, truck- and aggregate-building. Pipelines subject to temperature changes will expand and contract. However, even pipes conveying cold water, oil or compressed air can expand and contract appreciably due to the effect of the sun, daily and seasonal temperature changes. Mechanical vibrations of compressors, pumps, turbines, motors, diesel engines can break connected pipe work if care is not taken.

Design:



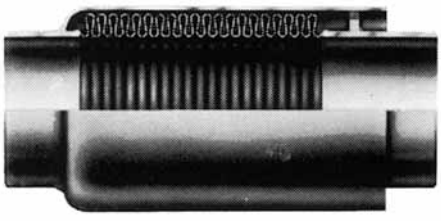
A) Rubber compensators
inside rubber made of EPDM, perbunan, butyl, hypalon etc.
operation pressure 16 bar for size DN 25 – DN 150 operation pressure 10 bar for size DN 175 – DN 1000 higher operation pressure possible, test pressure +50 %
temperature up to 90° C
loose steel backing flanges.
Unit can be delivered with tie rods for lateral movements.

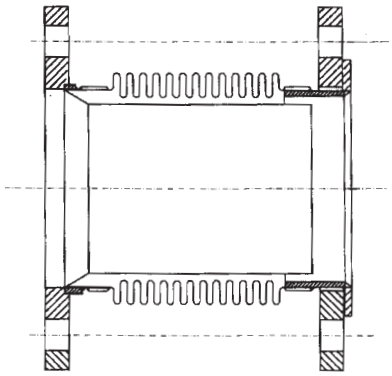
B) Steel axial compensator
with bellows made of stainless steel material 1.4571
operation pressure PN 10, PN 16 and PN 25
temperature up to 250° C

Size:

with flanges	DN 15 – DN 2000
with welding sockets	DN 15 – DN 600
with thread unions	¼" up to 2"

In our range of delivery: pre-stressed version and with protection jacket.
Special design as articulated compensators and angular compensators.





Axial expansion joint for exhaust gas

Flexible Metal Hose

with various end connections

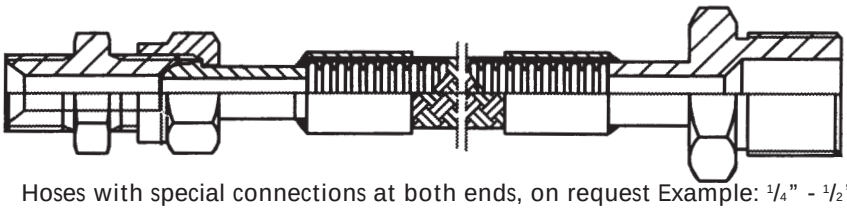
1. Hoses with joints at both ends, metric threaded M14 - M64

Application: Bio gas units, exhaust gases

Materials:
Metal Hose: Stainless Steel
Braid: Stainless Steel
Joint screws: CS galvanised

Size DN	Pressure PN bar	Temperature liquids, gases
6 - 350 lg	230 max	10 - 550 ºC
50 - 550 lg	50 bar	10 - 550 ºC

Length on request up to 40 m



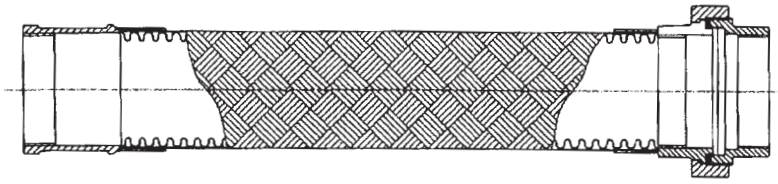
2. Hoses with special connections at both ends, on request Example: ¼" - ½" Union

Application: Bio gas units, exhaust gases

Materials:
Metal Hose: Stainless Steel
Braid: Stainless Steel 1.4301
Joint screws CS galvanised

Size DN	Pressure PN bar	Temperature liquids, gases
6 - 80 lg	230 max	10 - 550 ºC

Length on request up to 40 m



3. Hoses with special connections at both ends, on request Example: 2" - 2 ½" Union

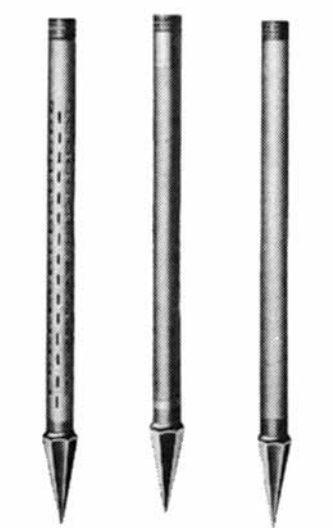
Application: Bio gas units, exhaust gases

Materials:
Metal Hose: Stainless Steel
Braid: Stainless Steel 1.4301
Joint screws CS galvanised

Size DN	Pressure PN bar	Temperature liquids, gases
50 - 500 lg	230 max	10 - 550 ºC
65 - 500 lg	230 max	10 - 550 ºC

Length on request up to 40 m

VN - Pumpen

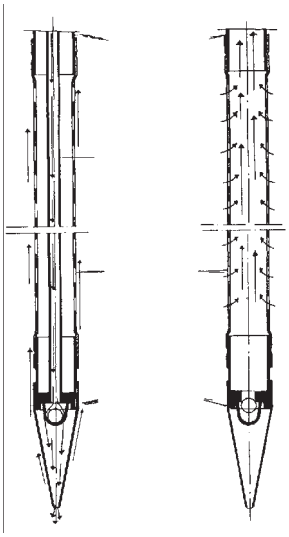


Galvanized steel screen for rammed wells

Design: steel galvanized deep well point with simple round holes with meshes and protected brass coat; with male pipe thread at upper end ram tip at lower end.

Length: 1,15 m

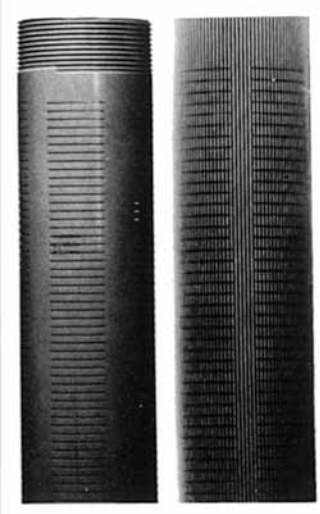
Nom. diameter: 1 ¼", 1 ½", 2"



Combined jetting/drive well point

consisting of outer PVC-screen jacket and inner galvanized steel tube for different penetration methods. No covering with wire necessary. Complete assembly including jetting nozzle.

Diameter: 1 ½"

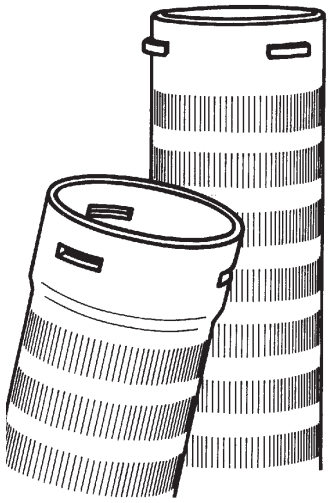


Plastic-well-screen (PVC) and PVC riser pipe

with ribbed and plain surface acc. to DIN 4925

Material:	PVC acc. to DIN 4925
Thread style:	male/female (socketed) or threaded flush joints for greater wall thickness
Nom. diameter:	35 – 400 mm
Slot sizes:	0,2 – 0,3 – 0,5 – 0,75 – 1,00 – 1,50 – 2,00 – 3,00 mm
Lengths:	1- 2 – 3 and 4 m
Accessories:	PVC bottom cap – wooden plug – sealing ring

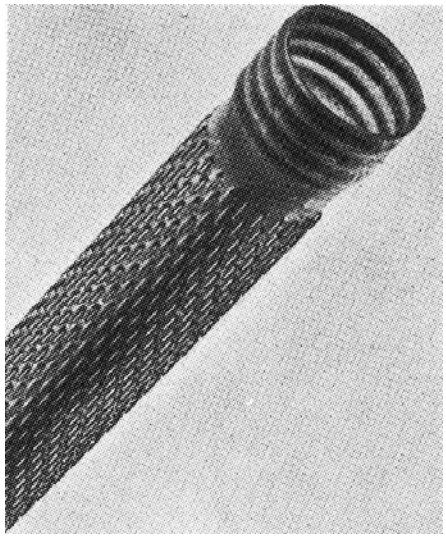
PVC well-screen and casing for draining



Material:	PVC acc. to DIN 8061
Connection:	press button rapid connection, 120° staggered
Nom. diameter:	150 – 400 mm / 6” – 16”
Lengths:	1 + 2 m
Wall thickness:	4 – 6,5 mm
Slot width:	vertical slotting 1 mm
free opening area:	8 %

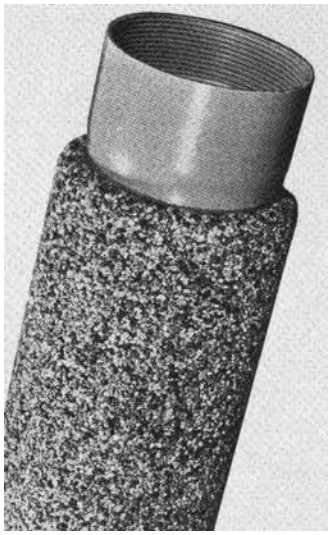
Bridge slotted steel well screen and casing

with threaded connections



Material:	St. 37.2, rough black and galvanized	
Nom. diameter:	150 – 400 mm	
Wall thickness:	3 mm, dia 350/400 mm = 4 mm	
Slot bridge opening:	1,7 mm ± 0,2 mm	
Lengths:	filter	2 + 4 m
	casing	1,5 – 3,0 and 4,5 m
Applications:	dewatering and water wells	

PVC-well-screen with bonded-on gravel pack



Pre-packed with outside porous mantle of carefully graded quartz gravel of high purity. Preferable installation in small bore holes and for re-lining operation in corroded or damaged wells

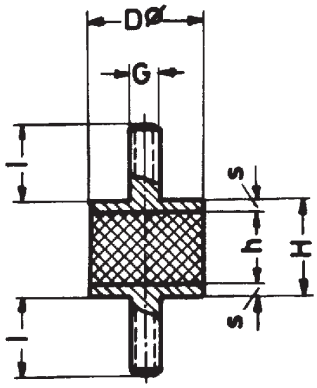
Nom. diameter: 35 – 400 mm

Gravel-granulation	slot-size
0,7 – 1,2 mm	0,75 mm
1,0 – 2,0 mm	1,0 mm
2,0 – 3,0 mm	1,5 mm
3,0 – 6,0 mm	2,0 mm

Rubber buffer

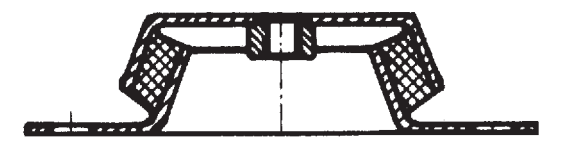
Application field:
as vibration absorber for flexible installation of the pumping sets, any kind of motors, diesel engine aggregates, ventilation systems and many other applications.

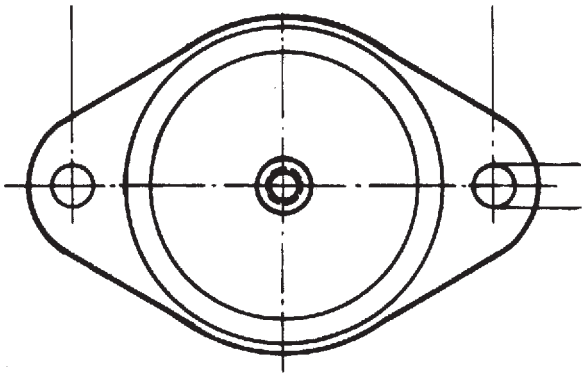
Design:
metal-rubber-elements with one or two threaded stay-bolts or inner threads for fixing on the foundation plates, top plates or other suitable fixing areas.



Dimensions:

D	H	h	s	G	l	surface cm²
25	20	14	3	M 6	16	4,91
25	20	14	3	M 6	10	4,91
25	10	6	2	M 6	16	4,91
30	15	10	2,5	M 8	21	7,07
30	20	14	3	M 8	21	7,07
30	20	14	3	M 8	16	7,07
30	30	24	3	M 8	20	7,07
40	30	24	3	M 8	21	12,57
40	40	34	3	M 8	21	12,57
50	24	18	3	M 10	26,5	19,64
50	20	14	3	M 10	18,5	19,64
50	30	24	3	M 10	26,5	19,64
50	40	34	3	M 10	26,5	19,64





Anti-vibration mounting (engine foot)

Application field:
as vibration absorber and for the flexible installation of the pump units and pumping plants, any kind of motors (electric, pneumatic, hydraulic), diesel engine-aggregates and ventilation systems.

Design:
Anti-vibration mounting is designed for high load capacity with relatively large static deflections in an axial direction. The high load for a given size is obtained by utilizing the rubber to the best advantage in both compression and shear. The combination of the metal and rubber with low mounting height and long time durability. This horizontal stiffness on all directions is bigger than vertical stiffness. This article is suitable for an excellent damping of vibrations and noises if properly selected. The anti-vibration mounting can also be delivered with a vertical adjusting possibility for a correct setting of the aggregates.