

## PRODUCT CATALOGUE 2023:2

POWERPIPE

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## POWERPIPE

Order form
at the end of the catalogue

## Introduction

This catalogue provides a description of Powerpipe and the standard products offered by the company. The aim is to provide interested parties with important information about the company and its products, how the products are composed and how they should be managed and installed.
The standards, norms and regulations mentioned in the catalogue have been taken into account in their current version at the time of printing.

## Please note

Specifications stated in the catalogue can change without advance notice. Always check the catalogue data available on Powerpipe's website: www.powerpipe.se

## Company description

The company has around 70 employees and a turnover of approx. MSEK 300. Every year, we sell around 27,000 pipes, 15,000 pipe fittings and 50,000 sleeves.
A significant share (approx. 30\%) of our production is exported, primarily to countries in the Nordic region, France and the UK.

## Technical support

With many years in the market, Powerpipe has developed extensive knowledge of pipe products, their production and use. As our customer, should you require it, you have full access to our technical resources, together with our environmental and quality departments. Otherwise, your first technical support contact will normally be our technically experienced sales people and our back office personnel.

## Advantages of Powerpipe

Our factory is located in Hisings Kärra, near Gothenburg. Salespeople, technical staff and production planners can also be found here. We are a small company in a big group - an ideal combination that means we're flexible and can offer rapid service and support, but that we're also strong enough to handle major projects. Powerpipe's number 1 goal is always to "Deliver what we Promise".
We offer customised solutions to fulfil our customers' needs for their specific application.
We also strive to operate combined transports and provide notifications by telephone.
We want to be the friendly company where our priorities are extremely high delivery reliability and short delivery times.
Above all for our standard range.

## Technology, quality, environment and energy 2:101

## Products in district heating systems

Our products are designed as a sandwich construction with service pipes in steel and polyurethane foam and casing in polyethylene which together create a fixed unit without any relative movement between the service and casings. Pipes and pipe fittings are delivered as standard with two copper alarm wires for connection to an electronic moisture surveillance system. (We offer the electronic surveillance system as supplementary product.) Powerpipe's pipe fittings have been developed to cover a wide range of applications for the customer in terms of deflection, valves, branching, draining, venting etc. All components fulfil the technical functional requirements in the standards below, and we have more than 30 years' experience of manufacturing robust constructions.

Powerpipe's technical philosophy is also to invest in:

- effective insulation
- flexible and reinforced double pipe systems

For example, we can offer extra thick insulation for single pipes as standard in all dimensions (Series 4). You can extend our double pipe systems in stages, ending with a choice of pipe fitting, as these systems are designed from the outset to deal with expansion forces. Nor do straight branches for any double pipes ever need expansion bends, as the T-pieces are designed with built-in reinforcement.
Powerpipe can also offer super insulated pipes. These are available as single pipes but are also particularly appropriate as double pipes. In this case, the supply pipe is equipped with a high insulated vacuum panel. This reduces heat losses from the supply pipe by 40-50\% while losses from the entire construction are reduced by $30 \%$ despite the external diameter of the pipe package being maintained. See also chapters 9 and 10.

## Norms and standards

Powerpipe's business is based on the European standards for prefabricated pipes and pipe fittings regarding:
District heating pipe systems - Factory made buried pipes consisting of a service pipe in steel, PUR foam thermal insulation and an outer casing of polyethylene, with a solid bond between the thermal insulation, the service pipe and the casing respectively for direct distribution of hot water.

EN 253:2019 Single pipe systems
EN 448:2019 Single pipe systems

EN 488:2019 Valve assembly

EN 489-1:2019 Joint casing assemblies
EN 13941-1:2019 Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks. Part 1: Design
EN 13941-2:2019 Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks. Part 1: Installation
EN 14419:2019 Surveillance system

EN 15698-1:2019

EN 15698-2:2019
Twin pipe systems, Part 1: Factory made fittings
Twin pipe systems, Part 2: Factory made fittings and valve assembly

In addition, there are national standards and norms that set requirements for our activities and our products.

# Technology, quality, environment and energy 2:102 

## Specifications

## Steel service pipes

Unless otherwise stated in the order, inquiry or tender, the following steel pipe qualities are delivered as standard. As standard, the products are designed for 16 bar, but many are approved for use up to 25 bar. The pressure class not taking into account corrosion is stated at the top left of each product page.

## Straight pipes Longitudinally or spirally welded pipe

| Material: | P235GH according to EN10217-2 or EN10217-5 |
| :--- | :--- |
| Certification: | According to EN 10204/3 3.1. |
|  | Can be attached to each delivery provided the customer requests this in advance. |
| Joint preparation: | EN ISO 9692-1 |
| Standard: | EN 253 |

## Seamless steel pipes (can be delivered by specific request)

```
Material: Normally P235GH according to EN 10216-2.
Certification: According to EN 10204/3.1.
    Can be attached to each delivery provided the customer requests this in advance.
Standard: EN 253
```


## Insulation (PUR)

Powerpipe's insulation consists of hard polyurethane foam insulation with excellent thermal insulating ability, good mechanical properties and good resistance to ageing.

| Material: | Polyurethane made from polyol and isocyanate. C-pentane is used as propellant. <br> Production is a modern high pressure process. |
| :--- | :--- |
| Standard: | EN 253 |


|  | Approximate type values | Requirements according to EN 253 |
| :---: | :---: | :---: |
| Cell size, mm | 0.24 | $<0.5$ |
| Closed cell content, \% | 90.6 | $\geq 88$ |
| Core density, kg/m3 | 61 | $\geq 55$ |
| Compression strength, MPa | 0.36 | $\geq 0.30$ |
| Water absorption, \% | 3.50 | $\leq 10$ |
| Axial shear strength, MPa |  |  |
| $+23^{\circ} \mathrm{C}$, new | 0.35 | $\geq 0.12$ |
| $+23^{\circ} \mathrm{C}$, aged | 0.14 | $\geq 0.12$ |
| $+140^{\circ} \mathrm{C}$, new | 0.20 | $\geq 0.08$ |
| $+140^{\circ} \mathrm{C}$, aged | 0.14 | $\geq 0.08$ |
| Thermal conductivity, W/mK | 0.026 | $\leq 0.029$ |
| Thermal conductivity after ageing | 0.028 |  |
| Maximum continuous working temperature ${ }^{\circ} \mathrm{C}$ | *) | 120 |
| Free steel ends | $210 \pm 30$ | min. 150, max. 250, tolerance $\pm 10$ |

${ }^{*}$ ) According to older definition in EN253, CCOT 161 is for 30 years

## Technology, quality, environment and energy 2:103

## Specifications

## Casing

Products are delivered with polyethylene casings (bimodal PE80 or PE100) and comply with all requirements set in EN 253.
Manufacturing takes place according to Standard 5100 issued by the Swedish Plastic Pipe Manufacturer's Association. All casings are corona treated during the extrusion process.

The material fulfils the technical functional requirements set in EN 253 and is stabilised for thermal, chemical, oxidative and other degradation, has a high impact strength and abrasion resistance even at low temperatures, and has excellent welding characteristics and high resistance to stress corrosion.
Pipes with a casing diameter of $\geq 560 \mathrm{~mm}$ should be handled with particular care at temperatures between 0 and $-20^{\circ} \mathrm{C}$. Below $-20^{\circ} \mathrm{C}$, pipes should not be handled without consulting Powerpipe for advice.

| Material: | high density polyethylene (PEH) |
| :--- | :--- |
| Density: | $\geq 944 \mathrm{~kg} / \mathrm{m}^{3}$ |
| Standard: | EN 253 |

Pipe wall thickness according to EN 253

## Sleeves

Powerpipe provides joints of different types to suit all installation conditions and customer requirements. The joints fulfil the technical functional requirements set in EN 489.

- Welding sleeve
- Double expanded shrinkable sleeve PEH
- Shrinkable sleeve PEX
- Double sealing shrinkable sleeve (PEH) with tightening tube

The sleeves are manufactured in high density polyethylene ( PEH ). The tightening tube is made of cross-linked material. The majority of joint types are installed using a gas torch, while the weld joints are installed with electrical welding equipment.

## Pipe fittings

All pipe fittings fulfil the technical functional requirements set in EN 448 and are designed to cope with the loads that normally occur in a district heating system. Depending on the design of the system, a number of different loads will affect the pipe fittings during operation, which in turn governs their dimensions and design. Some components therefore have reinforced service pipes to increase flexibility during system design.

Steel bends are delivered cold or hot formed according to EN 448.
As standard, Powerpipe's T-pieces are designed to fulfil nominal requirements in EN 13941 with an internal overpressure of 16 or 25 bar respectively and in accordance with the instructions in Värmeforskrapporter nos. 170 and 258. The corrosion allowance is set to 0 mm as no corrosion is expected from outside or inside.

Valves in Powerpipe's product programme are normally supplied as yield stress valves. This means that they should tolerate a normal force in connecting service pipes corresponding to an axial stress of 300 MPa without jeopardising valve function.

In summary, Powerpipe's products fulfil appropriate sections of all relevant standards, and in addition to this the company has more than 30 years' practical experience of robust constructions.

If PN25 is required, it must be stated here: single T-pieces, valve products and reductions

## Technology, quality, environment and energy 2:104

## Powerpipe's double pipe systems are designed to be flexible and strong.

This means that:

- All twin pipes have built-in fixing plates to withstand the full shear force between the supply and return line, which means that pipelines can permanently or temporarily end in any twin pipe section without extra reinforcement.
- The straight twin-T is designed so that the branch need not have any bend after a certain length, as a result of forces on the main pipe. This means you can build a practical solution without extra expansion bends.


## Pipe fittings overview



## Technology, quality, environment and energy 2:105

## Quality - Certified according to ISO 9001:2015

Powerpipe has been certified according to ISO 9001 since 1997. The quality system helps us ensure that customer requirements, standards and regulatory requirements are fulfilled. The quality management system governs how we work with external requirements, organisational structure, division of responsibility, work processes, procedures and resources everything to ensure that products we supply of the right quality, in accordance with our quality policy and the customer's wishes.

## Quality policy

Powerpipe Systems AB develops, produces and delivers environmentally friendly products for district heating, district cooling and industrial applications. By providing society with premium insulated products that provide good energy management, we contribute to long-term sustainable development. We are convinced that an active and thoughtful quality process creates long-term competitiveness and reinforces our image, both internally, for our customers and in our operating context as a whole.

We work as follows:

- We will manufacture products that comply with the customer's wishes and requirements, and with current EN standards
- We will deliver the right products and services, at the right time and to the right place, with the expected quality
- We will comply with legislation and other regulations
- We will continuously strive to improve our processes, with a view to improving the quality of both the products and our work


## Testing

Testing of products and equipment takes place continuously to fulfil customer and regulatory requirements etc. As part of our quality process, we carry out continuous visual inspection and testing of alarms on $100 \%$ of products. We also carry out ongoing testing of foam density on straight pipes and pipe fittings. All tests are documented and followed up. All manufactured products are labelled according to current standards.

RISE (formerly SP) tests our products once per year on the basis of the functional requirements in EN 253 and the Euroheat \& Power certification guidelines. The tests are carried out in the following areas:

## - Adhesion

- Tensile test
- Compressive strength
- Voids and bubbles
- Thermal conductivity
- Resistance to stress cracking
- Thermal stability
- Axial shear strength at $23^{\circ} \mathrm{C}$ and $140^{\circ} \mathrm{C}$
- Density
- Centreline deviation

The results are documented in official reports.
Welded joints in steel pipe fittings are X-ray inspected according to the requirements in EN 448 or according to customer requirements in addition to the standard.

## Technology, quality, environment and energy 2:106

## Environment - Certified according to ISO 14001:2015.

Powerpipe's organisation has always been characterised by an environmental focus. We have been certified since the outset in 2005. This ensures that we continuously work on improvements to reduce the environmental impact of our activities and products.
The system includes an inspection programme for the external environment. It describes the organisation, emissions and authorisations for emissions, inspections, waste management including recycling, and reporting both internally and to regulatory authorities. Once a year the Environment Department carries out an inspection of the organisation. Every three years a third party inspection is carried out by an independent consultancy agency.

## Environmental policy

Powerpipe Systems AB develops, produces and sells low environmental impact products for district heating, district cooling and industrial applications. By providing society with premium insulated products that provide good energy management, we contribute to long-term sustainable development. We are convinced that an active and thoughtful environmental process creates long-term competitiveness and reinforces our image for customers and in our operating context.
We will make continuous improvements in our environmental performance.
We do this by:

- Preventing pollution of the air, soil and water
- Striving to achieve a reduced environmental impact during transport both internally and externally
- Implementing continuous improvements in our production facilities that lead to efficiency gains in the form of reduced consumption of energy and materials
- Complying with legislation and other requirements


## Recycling

Some waste is generated during the production of district heating pipes, for example during the start and end phases of processes. We have therefore established procedures for how to manage this waste.

- PEH material is ground down and reused.
- Steel pipes are reused for new straight pipes/pipe fittings as far as possible.
- Excess PUR foam is sent for incineration, generating district heating.
- Waste from alarm wires is resold.

We collect hazardous waste, such as incandescent light bulbs, lubricants and chemical residues in our environmental station for separate collection where necessary.
We offer collection of customer waste, for example from residues of surplus material, for a fee.

# Technology, quality, environment and energy 2:107 

## Energy - Certified according to ISO 50001:2018

Our products enable good energy management and in use contribute to long-term sustainable development, but the energy used by our activities and production also affects the world around us. Energy consumption affects both the environment and competitiveness.

Powerpipe has embarked upon a systematic energy saving process. As part of this process, we have carried out an energy inventory of our entire organisation to review the most important systems that consume the most energy. We have drawn up action plans in the form of operating procedures and inventory and review of our machinery.

Powerpipe is certified according to environmental management standard ISO 50001:2018.

## Energy policy

Powerpipe Systems $A B$ develops, produces and sells products for district heating, district cooling and industrial applications. By providing society with premium insulated products that provide good energy management, we contribute to long-term sustainable development. We are convinced that an active and thoughtful energy saving process creates long-term competitiveness and reinforces our image for customers and in our operating context.

We will make continuous improvements in our energy performance.
We do this by:

- Planning our activities including purchasing for the greatest possible energy efficiency.
- Coordinating maintenance measures with measures to achieve energy efficiency.
- Maintaining a good dialogue with our property owners.
- Striving to achieve reduced energy use during transport both internally and externally.
- Implementing continuous improvements in our production facilities that lead to more efficient use of energy and materials.
- Complying with legislation and other requirements.


## Technology, quality, environment and energy 2:108

## Work environment - Certified according to ISO 45001:2018

Powerpipe's operations include handling of large and heavy products and a safe working environment is thus a natural and necessary part of the business. The management system places demands on continuous improvements. We have been certified according to ISO 45001: 2018 since 2021.

## Work environment policy

A good, safe working environment is an important strategic issue for Powerpipe. The aim of our work environment management is to create a developing workplace where a physical, psychological, socially sound environment is ensured for all employees and where risks of work-related injuries and work-related ill health are prevented.

We also work to achieve a long-term efficient operation that at the same time provides conditions for good physical and mental health, well-being and job satisfaction for all employees and that prevents accidents from occurring.

## We achieve this as follows:

- In collaboration with the employees, continuously evaluate the company's efforts within the work environment area in order to be able to make continuous improvements in the daily work regarding the work environment.
- As far as possible, adapt the demands of the work to human conditions in physical, mental and social terms.
- Ensure that measures to improve the work environment also have positive effects both for the company and for the individual.
- Ensure that efficiencies and changes in operations never involve ignoring the work environment.


## Technology, quality, environment and energy 2:109

## Certification

| EUROHEAT \& POWER CERTIFICATE NUMBER 01/12 | c |
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## Technology, quality, environment and energy 2:110




Straight pipes


Vent/drain


Preinsulated valves
with 2 vent/drain units
(variants A and B )


Anchor units


Curved pipes


Preinsulated valves


Single-use compensator

Bends


Preinsulated valves
with 1 vent/drain unit



T-pieces


Preinsulated valves
with 2 vent/drain units (standard)

Valve assembly, compact


Combination valves with gear


Reduction pipes

## Straight pipe Series 1

PN25


PART NO. 1102, 1103, 1104, 1105
KMAT 2000PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight <br> [kg/m] | Water content [ $1 / \mathrm{m}$ ] | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $90 \times 3.0$ | 2.4 | 0.4 |  |
| 25 | $33.7 \times 2.6$ | $90 \times 3.0$ | 3.1 | 0.6 |  |
| 32 | $42.4 \times 2.6$ | $110 \times 3.0$ | 4.3 | 1.1 |  |
| 40 | $48.3 \times 2.6$ | $110 \times 3.0$ | 4.6 | 1.5 |  |
| 50 | $60.3 \times 2.9$ | $125 \times 3.0$ | 6.1 | 2.3 |  |
| 65 | $76.1 \times 2.9$ | $140 \times 3.0$ | 7.4 | 3.5 |  |
| 80 | $88.9 \times 3.2$ | $160 \times 3.0$ | 9.4 | 5.3 |  |
| 100 | $114.3 \times 3.6$ | $200 \times 3.2$ | 13.6 | 9.0 |  |
| 125 | $139.7 \times 3.6$ | $225 \times 3.4$ | 16.6 | 13.8 |  |
| 150 | $168.3 \times 4.0$ | $250 \times 3.6$ | 21.5 | 20.2 |  |
| 200 | $219.1 \times 4.5$ | $315 \times 4.1$ | 31.9 | 34.7 |  |
| 250 | $273.0 \times 5.0$ | $400 \times 4.8$ | 43.9 | 54.3 |  |
| 300 | $323.9 \times 5.6$ | $450 \times 5.2$ | 60.0 | 76.8 |  |
| 350 | $355.6 \times 5.6$ | $500 \times 5.6$ | 68.3 | 93.1 |  |
| 400 | $406.4 \times 6.3$ | $560 \times 6.0$ | 86.9 | 121.7 |  |
| 450 | $457.0 \times 6.3$ | $630 \times 6.6$ | 101.0 | 155.0 |  |
| 500 | $508.0 \times 6.3$ | $710 \times 7.2$ | 118.0 | 193.0 |  |
| 600 | $610.0 \times 7.1$ | $800 \times 7.9$ | 153.6 | 277.0 |  |
| 700 | $711.0 \times 8.0$ | $900 \times 8.4$ | 210.0 | 378.0 |  |
| 800 | $813.0 \times 8.8$ | $1000 \times 9.4$ | 246.0 | 497.0 |  |

12 m Series 1, 1103 - DN - 000-000 can be ordered from dim DN 20 - DN800
16 m Series 1, 1104 - DN - 000-000 can be ordered from dim DN100-DN800
18 m Series 1, 1105 - DN - 000-000 can be ordered from dim DN150 - DN800
Can also be ordered in 6 m lengths: 1102-DN-000-000.

## Order example

Straight pipe series 1, L1 = 12 m with dim DN200, part number 1103-200-000-000.

## Straight pipe Series 2

PN25


PART NO. 1202, 1203, 1204, 1205
KMAT 2000PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight <br> [kg/m] | Water content [l/m] | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $110 \times 3.0$ | 3.3 | 0.4 |  |
| 25 | $33.7 \times 2.6$ | $110 \times 3.0$ | 3.5 | 0.6 |  |
| 32 | $42.4 \times 2.6$ | $125 \times 3.0$ | 4.6 | 1.1 |  |
| 40 | $48.3 \times 2.6$ | $125 \times 3.0$ | 5.0 | 1.5 |  |
| 50 | $60.3 \times 2.9$ | $140 \times 3.0$ | 6.5 | 2.3 |  |
| 65 | $76.1 \times 2.9$ | $160 \times 3.0$ | 8.0 | 3.5 |  |
| 80 | $88.9 \times 3.2$ | $180 \times 3.0$ | 10.1 | 5.3 |  |
| 100 | $114.3 \times 3.6$ | $225 \times 3.4$ | 14.8 | 9.0 |  |
| 125 | $139.7 \times 3.6$ | $250 \times 3.6$ | 17.7 | 13.8 |  |
| 150 | $168.3 \times 4.0$ | $280 \times 3.9$ | 23.6 | 20.2 |  |
| 200 | $219.1 \times 4.5$ | $355 \times 4.5$ | 35.1 | 34.7 |  |
| 250 | $273.0 \times 5.0$ | $450 \times 5.2$ | 47.0 | 54.3 |  |
| 300 | $323.9 \times 5.6$ | $500 \times 5.6$ | 65.5 | 76.8 |  |
| 350 | $355.6 \times 5.6$ | $560 \times 6.0$ | 75.7 | 93.1 |  |
| 400 | $406.4 \times 6.3$ | $630 \times 6.6$ | 96.3 | 121.7 |  |
| 450 | $457.0 \times 6.3$ | $710 \times 7.2$ | 113.5 | 155.0 |  |
| 500 | $508.0 \times 6.3$ | $800 \times 7.9$ | 133.6 | 193.0 |  |
| 600 | $610.0 \times 7.1$ | $900 \times 8.7$ | 173.0 | 277.0 |  |
| 700 | $711.0 \times 8.0$ | $1000 \times 9.4$ | 231.8 | 378.0 |  |

12 m Series 21203 - DN - 000-000 can be ordered from dim DN 20 - DN700 16 m Series 21204 - DN - 000-000 can be ordered from dim DN100-DN700 18 m Series 21205 - DN - 000-000 can be ordered from dim DN150 - DN700 Can also be ordered in 6 m lengths: 1202-DN-000-000.

## Order example

Straight pipe series 2, L1 = 16 m with dim DN200, part number 1204-200-000-000.

## Straight pipe Series 3 <br> PN25



PART NO. 1302, 1303, 1304, 1305
KMAT 2000PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight [kg/m] | Water content [1/m] | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $125 \times 3.0$ | 3.7 | 0.4 |  |
| 25 | $33.7 \times 2.6$ | $125 \times 3.0$ | 3.9 | 0.6 |  |
| 32 | $42.4 \times 2.6$ | $140 \times 3.0$ | 5.0 | 1.1 |  |
| 40 | $48.3 \times 2.6$ | $140 \times 3.0$ | 5.4 | 1.5 |  |
| 50 | $60.3 \times 2.9$ | $160 \times 3.0$ | 7.1 | 2.3 |  |
| 65 | $76.1 \times 2.9$ | $180 \times 3.0$ | 8.7 | 3.5 |  |
| 80 | $88.9 \times 3.2$ | $200 \times 3.2$ | 10.9 | 5.3 |  |
| 100 | $114.3 \times 3.6$ | $250 \times 3.6$ | 16.2 | 9.0 |  |
| 125 | $139.7 \times 3.6$ | $280 \times 3.9$ | 19.9 | 13.8 |  |
| 150 | $168.3 \times 4.0$ | $315 \times 4.1$ | 25.7 | 20.2 |  |
| 200 | $219.1 \times 4.5$ | $400 \times 4.8$ | 39.0 | 34.7 |  |
| 250 | $273.0 \times 5.0$ | $500 \times 5.6$ | 51.4 | 54.3 |  |
| 300 | $323.9 \times 5.6$ | $560 \times 6.0$ | 76.9 | 76.8 |  |
| 350 | $355.6 \times 5.6$ | $630 \times 6.6$ | 85.1 | 93.1 |  |
| 400 | $406.4 \times 6.3$ | $710 \times 7.2$ | 108.8 | 121.7 |  |
| 450 | $457.0 \times 6.3$ | $800 \times 7.9$ | 124.0 | 155.0 |  |
| 500 | $508.0 \times 6.3$ | $900 \times 8.7$ | 147.0 | 193.0 |  |
| 600 | $610.0 \times 7.1$ | $1000 \times 9.4$ | 189.0 | 277.0 |  |

12 m Series 31303 - DN - 000-000 can be ordered from dim DN 20 - DN600 16 m Series 31304 - DN - 000-000 can be ordered from dim DN100-DN600 18 m Series 31305 - DN - 000-000 can be ordered from dim DN150 - DN600 Can also be ordered in 6 m lengths: 1302-DN-000-000

## Order example

Straight pipe series 3, L1 = 18 m with dim DN200, part number 1305-200-000-000.

## Straight pipe Series 4

PN25


PART NO. 1402, 1403, 1404, 1405
KMAT 2000PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight <br> [kg/m] | Water content [l/m] | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $140 \times 3.0$ | 4.1 | 0.4 |  |
| 25 | $33.7 \times 2.6$ | $140 \times 3.0$ | 4.4 | 0.6 |  |
| 32 | $42.4 \times 2.6$ | $160 \times 3.0$ | 5.5 | 1.1 |  |
| 40 | $48.3 \times 2.6$ | $160 \times 3.0$ | 6.0 | 1.5 |  |
| 50 | $60.3 \times 2.9$ | $180 \times 3.0$ | 7.8 | 2.3 |  |
| 65 | $76.1 \times 2.9$ | $200 \times 3.2$ | 9.6 | 3.5 |  |
| 80 | $88.9 \times 3.2$ | $225 \times 3.4$ | 11.9 | 5.3 |  |
| 100 | $114.3 \times 3.6$ | $280 \times 3.9$ | 17.4 | 9.0 |  |
| 125 | $139.7 \times 3.6$ | $315 \times 4.1$ | 22.5 | 13.8 |  |
| 150 | $168.3 \times 4.0$ | $355 \times 4.5$ | 28.0 | 20.2 |  |
| 200 | $219.1 \times 4.5$ | $450 \times 5.2$ | 42.0 | 34.7 |  |
| 250 | $273.0 \times 5.0$ | $560 \times 6.0$ | 56.6 | 54.3 |  |
| 300 | $323.9 \times 5.6$ | $630 \times 6.6$ | 82.5 | 76.8 |  |
| 350 | $355.6 \times 5.6$ | $710 \times 7.2$ | 93.5 | 93.1 |  |
| 400 | $406.4 \times 6.3$ | $800 \times 7.9$ | 119.0 | 121.7 |  |
| 450 | $457.0 \times 6.3$ | $900 \times 8.7$ | 140.0 | 155.0 |  |
| 500 | $508.0 \times 6.3$ | $1000 \times 9.4$ | 167.0 | 193.0 |  |

12 m Series 41403 - DN - 000-000 can be ordered from dim DN 20 - DN500 16 m Series 41404 - DN - 000-000 can be ordered from dim DN100 - DN500 18 m Series 41405 - DN - 000-000 can be ordered from dim DN150 - DN500 Can also be ordered in 6 m lengths: 1402-DN-000-000

## Order example

Straight pipe series 4, L1 = 12 m with dim DN200, part number 1403-200-000-000.

## Cut-to-length pipes Series 1, 2, 3 and 4

PN25



Cut-to-length pipes 1113, 1213, 1313, 1413 and 1114, 1214, 1314, 1414
KMAT 2490PP

## General

Cut-to-length pipes are manufactured for all dimensions. In these pipes, the steel pipe is clad with foil every other metre, allowing the insulation material to be removed easily.
The parts covered with foil are clearly marked on the outside of the casing.
The entire cut-to-length pipe or parts of it can be installed at any point in the system

| CUT-TO- <br> LENGTH | Series 1 | Series 2 | Series 3 | Series 4 |
| :--- | :--- | :--- | :--- | :--- |
| PIPES |  |  |  |  |
| $L=12 m$ | $1113-D N$ | $1213-D N$ | $1313-D N$ | $1413-D N$ |
| $L=16 m$ | $1114-D N$ | $1214-D N$ | $1314-D N$ | $1414-D N$ |

For dimension information, see details for the relevant straight pipe and series.

## Order example, cut-to-length pipes

DN 200 in Series 2 and 12 m, part number 1213-200-000-000
DN 250 in Series 3 and 16 m, part number 1314-250-000-000

## Curved pipes Series 1, 2, 3 and 4

PN25


CURVED PIPES 1123, 1124, 1223, 1224, 1323, 1324, 1423, 1424
KMAT 2005PP

| Single pipes | Maximum deflection |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| DN | $\mathrm{L} 1=12 \mathrm{~m}$ | L 1 = 16 m | Note |  |
| 25-65 | $35^{\circ}$ |  | Bent on site |  |
| 80 | $30^{\circ}$ | $22^{\circ}$ | Bent in the factory |  |
| 100 | $30^{\circ}$ | $18^{\circ}$ | Bent in the factory |  |
| 125 | $32^{\circ}$ | $21^{\circ}$ | Bent in the factory |  |
| 150 | $32^{\circ}$ | $24^{\circ}$ | Bent in the factory |  |
| 200-250 | $27^{\circ}$ | $30^{\circ}$ | Bent in the factory |  |
| 300 | $22^{\circ}$ | $25^{\circ}$ | Bent in the factory | *) Values stated in brackets refer to pipe wall thickness greater than standard |
| 350 | $14^{\circ}$ | $23^{\circ}$ | Bent in the factory |  |
| 400 | 11-(18) ${ }^{\circ}$ | 16-(23) ${ }^{\circ}$ | Bent in the factory *) |  |
| 450 | $7-(11)^{\circ}$ | 11-(18) ${ }^{\circ}$ | Bent in the factory *) |  |
| 500 | $6-(9)^{\circ}$ | $9-(12)^{\circ}$ | Bent in the factory *) |  |
| 600 | - | 5- (9 ${ }^{\circ}$ | Bent in the factory *) |  |
| 700 | - | 2-(4) | Bent in the factory *) |  |


| Manufacturing tolerance | DN 100-200 | $+/-2^{\circ}$ |
| :--- | :--- | :--- |
| DN 250-600 |  |  |
| $+/-1^{\circ}$ |  |  |

The above named maximum deflection can often be increased by increasing the wall thickness of the steel pipe.
However, this means a higher price and longer delivery time.
For larger dimensions (DN800-900), segment-welded curved pipes are available.
For technical reasons, the alarm wires are evenly distributed on the inside of the bend.

## Part no. series 1

1123-DN-xxx-000 for 12 m pipe length 1124-DN-xxx-000 for 16 m pipe length

## Part no. series 2

1223-DN-xxx-000 for 12 m pipe length 1224-DN-xxx-000 for 16 m pipe length
$x x x=$ Degrees

## Part no. series 3

1323-DN-xxx-000 for 12 m pipe length 1324-DN-xxx-000 for 16 m pipe length

## Part no. series 4

1423-DN-xxx-000 for 12 m pipe length
1424-DN-xxx-000 for 16 m pipe length

## Order example

Curved pipe series $1, L 1=12 \mathrm{~m}$ with $\operatorname{dim} \mathrm{DN} 200,15^{\circ}$ bend, part number 1123-200-015-000.

## Curved pipe Deflection, design radius

 Series 1, 2, 3 and 4PN25



RELATIONSHIP BETWEEN DEFLECTION AND DESIGN RADIUS

| Deflection | Design rad $\mathrm{L} 1=12 \mathrm{~m}$ | $\mathrm{L} 1=16 \mathrm{~m}$ | Deflection | Design radius $\mathrm{L} 1=12 \mathrm{~m}$ | L 1 = 16 m |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $1^{\circ}$ | 690 | 910 | $21^{\circ}$ | 33.0 | 44.0 |
| $2^{\circ}$ | 345 | 460 | $22^{\circ}$ | 31.0 | 42.0 |
| $3^{\circ}$ | 230 | 305 | $23^{\circ}$ | 30.0 | 40.0 |
| $4^{\circ}$ | 170 | 230 | $24^{\circ}$ | 29.0 | 38.0 |
| $5^{\circ}$ | 140 | 185 | $25^{\circ}$ | 28.0 | 37.0 |
| $6^{\circ}$ | 115 | 155 | $26^{\circ}$ | 27.0 | 36.0 |
| $7{ }^{\circ}$ | 98 | 130 | $27^{\circ}$ | 26.0 | 34.0 |
| $8^{\circ}$ | 86 | 115 | $28^{\circ}$ | 25.0 | 33.0 |
| $9^{\circ}$ | 76 | 100 | $29^{\circ}$ | 24.0 | 32.0 |
| $10^{\circ}$ | 69 | 92 | $30^{\circ}$ | 23.2 | 30.9 |
| $11^{\circ}$ | 62 | 83 | $31^{\circ}$ | 22.5 | 30.0 |
| $12^{\circ}$ | 57 | 76 | $32^{\circ}$ | 21.8 | 29.1 |
| $13^{\circ}$ | 53 | 71 | $33^{\circ}$ | 21.1 | 28.1 |
| $14^{\circ}$ | 49 | 65 | $34^{\circ}$ | 20.5 | 27.3 |
| $15^{\circ}$ | 46 | 61 | $35^{\circ}$ | 20.0 | 26.7 |
| $16^{\circ}$ | 43 | 57 | $36^{\circ}$ | 19.4 | 25.8 |
| $17^{\circ}$ | 40 | 54 | $37^{\circ}$ | 18.9 | 25.2 |
| $18^{\circ}$ | 38 | 51 | $38^{\circ}$ | 18.4 | 24.6 |
| $19^{\circ}$ | 36 | 48 | $39^{\circ}$ | 18.0 | 23.9 |
| $20^{\circ}$ | 34 | 46 | $40^{\circ}$ | 17.5 | 23.4 |

Pipe trench: For technical reasons, pipes cannot be bent along their entire length. Some straight pipe at each end must be accepted.*
This deviation from the ideal radius can be compensated for by making
the pipe trench wider at the centre of the pipe.
The extra width should be $\approx 200 \mathrm{~mm}$ for a deflection of $<10^{\circ}$
The extra width should be $\approx 500 \mathrm{~mm}$ for a deflection of $>10^{\circ}$

* For $\mathrm{DN}<250$ 1-1.5 m and $\mathrm{DN} \geq 2502 \mathrm{~m}$ or slightly more in each pipe end.


## SINGLE PIPES

# Curved pipes Elastic radius Series 1, 2, 3 and 4 

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PN25
```



## ELASTIC RADIUS

| Dim <br> DN | Elastic radius <br> $\mathbf{[ m} \mathbf{]}$ | Deflection/ <br> $\mathbf{1 2} \mathbf{~ m}$ |
| :--- | :--- | :--- |
|  |  |  |
| 25 | 15 | $45.0^{\circ}$ |
| 32 | 19 | $35.0^{\circ}$ |
| 40 | 22 | $31.0^{\circ}$ |
| 50 | 27 | $25.0^{\circ}$ |
| 65 | 34 | $20.0^{\circ}$ |
| 8 | 40 | $17.0^{\circ}$ |
| 100 | 52 | $13.0^{\circ}$ |
| 125 | 63 | $11.0^{\circ}$ |
| 150 | 76 | $9.0^{\circ}$ |
| 200 | 99 | $7.0^{\circ}$ |
| 250 | 124 | $5.6^{\circ}$ |
| 300 | 147 | $4.7^{\circ}$ |
| 350 | 161 | $4.3^{\circ}$ |
| 400 | 184 | $3.7^{\circ}$ |
| 450 | 207 | $3.3^{\circ}$ |
| 500 | 230 | $3.0^{\circ}$ |
| 60 | 276 | $2.5^{\circ}$ |
| 700 | 322 | $2.2^{\circ}$ |
| 800 | 368 | $1.9^{\circ}$ |
| 900 | 414 | $1.7^{\circ}$ |

The table above shows the elastic radius, i.e. when the steel pipe is plasticised. In other words, this is the least deflection that can be manufactured while retaining the form.

## Bend - Horizontal Series 1, 2, 3 and 4



PART NO. 2100, 2200, 2300, 2400


KMAT 2500PP

| DN | Service pipe <br> Dy x s [mm] | Series 1 <br> DY [mm] | Series 2 <br> DY [mm] | Casing <br> Series 3 <br> DY [mm] | Series 4 <br> DY [mm] | $\begin{aligned} & \mathrm{L} 1 \\ & {[\mathrm{~mm}]} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.3$ | - | 110 | 125 | 140 | 1000 |
| 25 | $33.7 \times 2.6$ | 90 | 110 | 125 | 140 | 1000 |
| 32 | $42.4 \times 2.6$ | 110 | 125 | 140 | 160 | 1000 |
| 40 | $48.3 \times 2.6$ | 110 | 125 | 140 | 160 | 1000 |
| 50 | $60.3 \times 2.9$ | 125 | 140 | 160 | 180 | 1000 |
| 65 | $76.1 \times 2.9$ | 140 | 160 | 180 | 200 | 1000 |
| 80 | $88.9 \times 3.2$ | 160 | 180 | 200 | 225 | 1000 |
| 100 | $114.3 \times 3.6$ | 200 | 225 | 250 | 280 | 1000 |
| 125 | $139.7 \times 3.6$ | 225 | 250 | 280 | 315 | 1000 |
| 150 | $168.3 \times 4.0$ | 250 | 280 | 315 | 355 | 1000 |
| 200 | $219.1 \times 4.5$ | 315 | 355 | 400 | 450 | 1000 |
| 250 | $273.0 \times 5.0$ | 400 | 450 | 500 | 560 | 1300 |
| 300 | $323.9 \times 5.6$ | 450 | 500 | 560 | 630 | 1500 |
| 350 | $355.6 \times 5.6$ | 500 | 560 | 630 | 710 | 1600 |
| 400 | $406.4 \times 6.3$ | 560 | 630 | 710 | 800 | 1600 |
| 450 | $457.0 \times 6.3$ | 630 | 710 | 800 | 900 | 1200 |
| 500 | $508.0 \times 6.3$ | 710 | 800 | 900 | 1000 | 1600 |
| 600 | $610.0 \times 7.1$ | 800 | 900 | 1000 |  | 1300 |
| 700 | $711.0 \times 8.0$ | 900 | 1000 |  |  | 1500 |
| 800 | $813.0 \times 8.8$ | 1000 |  |  |  | 1700 |

## The standard angle is $90^{\circ}$

Other bends, such as $75^{\circ}, 60^{\circ}, 45^{\circ}, 30^{\circ}$ and $15^{\circ}$ and/or other leg lengths can be supplied on request.

## Part no. Series 1

2100-DN-degrees-000

Part no. Series 2
2200-DN-degrees-000

## Part no. Series 3

2300-DN-degrees-000

## Part no. Series 4

2400-DN-degrees-000

## Space for sleeve

To have space for the sleeve when installing $\mathrm{DN} \leq 200$, an extended leg $1500 \times 1500 \mathrm{~mm}$ is available.
State suffix -302.
Order example
Bend, series 3, dim DN100, $90^{\circ}$, part number 2300-100-900-000.

## Termination bend - Vertical <br> Series 1, 2, 3 and 4

## PN25



PART NO. 2110, 2210, 2310, 2410

|  | Service pipe | Sy x s [mm] | Series 1 <br> DY [mm] | Series 2 <br> DY [mm] | Casing <br> Series 3 <br> DY [mm] |
| ---: | :---: | :--- | :--- | :--- | :--- |

## The standard angle is $90^{\circ}$

Other angles and/or leg lengths can be supplied on request.
Can be ordered with end cap. (suffix -811) with accessible alarm wires, see Chapter 8.

## Part no. series 1

2110-DN-000-000

## Part no. series 2

2210-DN-000-000

## Part no. series 3

2310-DN-000-000

## Part no. series 4

2410-DN-000-000

## Order example

Backfilling may not reach the alarm wire.
Plastic protection should be retained until installation takes place.

Termination bend Series 1 dim DN 50, part number 2110-050-000-000.

## SINGLE PIPES

T-piece
Series 1, 2, 3 and 4

PN16 - standard
PN25-option

## KMAT 3500PP

Measurement in mm

| PART NO. 3100, 3200 |  |  |  | PART NO. 3300, 3400 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Main pipe | Branch | L1 | L2 | Main pipe | Branch | L1 | L2 |
| DN 600-900 | DN 25-80 | 1200 | 1200 | DN 600-700 | DN 25-80 | 1200 | 1200 |
| DN 600-900 | DN 100-200 | 1500 | 1200 | DN 600-700 | DN 100-200 | 1500 | 1200 |
| DN 600-900 | DN 250-450 | 1800 | 1500 | DN 600-700 | DN 250-500 | 1800 | 1500 |
| DN 600-900 | DN 500 | 1800 | 1700 | DN 600-700 | DN 500 | 1800 | 1700 |
| DN 600-900 | DN 600-900 | 2100 | 2100 | DN 600 | DN 600 | 1900 | 1500 |
|  |  |  |  | DN 700 | DN 600-700 | 2100 | 2100 |


|  |  | PART NO. 3100, 3200 |  | 3300 |  | 3400 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Main pipe | Main pipe $x$ branch | L1 | L2 | L1 | L2 | L1 | L2 |
| DN20 | $26.9 \times 26.9$ | 1000 | 670 | 1000 | 690 | 1200 | 1000 |
| DN25 | $33.7 \times 26.9$ | 1000 | 670 | 1000 | 690 | 1200 | 1000 |
| DN25 | $33.7 \times 33.7$ | 1000 | 670 | 1000 | 690 | 1200 | 1000 |
| DN32 | $42.4 \times 26.9$ | 1000 | 677 | 1000 | 697 | 1200 | 1000 |
| DN32 | $42.4 \times 33.7$ | 1000 | 677 | 1000 | 697 | 1200 | 1000 |
| DN32 | $42.4 \times 42.4$ | 1000 | 685 | 1000 | 705 | 1200 | 1000 |
| DN40 | $48.3 \times 26.9$ | 1000 | 677 | 1000 | 697 | 1200 | 1000 |
| DN40 | $48.3 \times 33.7$ | 1000 | 677 | 1000 | 697 | 1200 | 1000 |
| DN40 | $48.3 \times 42.4$ | 1000 | 685 | 1000 | 705 | 1200 | 1000 |
| DN40 | $48.3 \times 48.3$ | 1000 | 685 | 1000 | 705 | 1200 | 1000 |
| DN50 | $60.3 \times 26.9$ | 1200 | 685 | 1200 | 707 | 1200 | 1000 |
| DN50 | $60.3 \times 33.7$ | 1200 | 685 | 1200 | 707 | 1200 | 1000 |
| DN50 | $60.3 \times 42.4$ | 1200 | 692 | 1200 | 715 | 1200 | 1000 |
| DN50 | $60.3 \times 48.3$ | 1200 | 692 | 1200 | 715 | 1200 | 1000 |
| DN50 | $60.3 \times 60.3$ | 1200 | 700 | 1200 | 725 | 1200 | 1000 |
| DN65 | $76.1 \times 26.9$ | 1200 | 695 | 1200 | 717 | 1200 | 1000 |
| DN65 | $76.1 \times 33.7$ | 1200 | 695 | 1200 | 717 | 1200 | 1000 |
| DN65 | $76.1 \times 42.4$ | 1200 | 702 | 1200 | 725 | 1200 | 1000 |
| DN65 | $76.1 \times 48.3$ | 1200 | 702 | 1200 | 725 | 1200 | 1000 |
| DN65 | $76.1 \times 60.3$ | 1200 | 710 | 1200 | 735 | 1200 | 1000 |
| DN65 | $76.1 \times 76.1$ | 1200 | 720 | 1200 | 745 | 1200 | 1000 |
| DN80 | $88.9 \times 26.9$ | 1200 | 705 | 1200 | 727 | 1200 | 1000 |
| DN80 | $88.9 \times 33.7$ | 1200 | 705 | 1200 | 727 | 1200 | 1000 |
| DN80 | $88.9 \times 42.4$ | 1200 | 712 | 1200 | 735 | 1200 | 1000 |
| DN80 | $88.9 \times 48.3$ | 1200 | 712 | 1200 | 735 | 1200 | 1000 |
| DN80 | $88.9 \times 60.3$ | 1200 | 720 | 1200 | 745 | 1200 | 1000 |
| DN80 | $88.9 \times 76.1$ | 1200 | 730 | 1200 | 755 | 1200 | 1000 |


|  |  | PART NO. 3100, 3200 |  | 3300 |  | 3400 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Main pipe | Main pipe $x$ branch | L1 | L2 | L1 | L2 | L1 | L2 |
| DN80 | 88.9x88.9 | 1200 | 740 | 1200 | 765 | 1200 | 1000 |
| DN100 | $114.3 \times 26.9$ | 1200 | 727 | 1200 | 752 | 1200 | 1000 |
| DN100 | $114.3 \times 33.7$ | 1200 | 727 | 1200 | 752 | 1200 | 1000 |
| DN100 | $114.3 \times 42.4$ | 1200 | 735 | 1200 | 760 | 1200 | 1000 |
| DN100 | $114.3 \times 48.3$ | 1200 | 735 | 1200 | 760 | 1200 | 1000 |
| DN100 | $114.3 \times 60.3$ | 1200 | 742 | 1200 | 770 | 1200 | 1000 |
| DN100 | $114.3 \times 76.1$ | 1200 | 752 | 1200 | 780 | 1200 | 1000 |
| DN100 | $114.3 \times 88.9$ | 1200 | 762 | 1200 | 790 | 1200 | 1000 |
| DN100 | $114.3 \times 114.3$ | 1200 | 835 | 1200 | 865 | 1500 | 1000 |
| DN125 | $139.7 \times 26.9$ | 1200 | 740 | 1200 | 767 | 1200 | 1000 |
| DN125 | $139.7 \times 33.7$ | 1200 | 740 | 1200 | 767 | 1200 | 1000 |
| DN125 | $139.7 \times 42.4$ | 1200 | 747 | 1200 | 775 | 1200 | 1000 |
| DN125 | $139.7 \times 48.3$ | 1200 | 747 | 1200 | 775 | 1200 | 1000 |
| DN125 | $139.7 \times 60.3$ | 1200 | 755 | 1200 | 785 | 1200 | 1000 |
| DN125 | $139.7 \times 76.1$ | 1200 | 765 | 1200 | 795 | 1200 | 1000 |
| DN125 | $139.7 \times 88.9$ | 1200 | 775 | 1200 | 805 | 1200 | 1000 |
| DN125 | $139.7 \times 114.3$ | 1200 | 847 | 1200 | 880 | 1500 | 1000 |
| DN125 | $139.7 \times 139.7$ | 1200 | 860 | 1200 | 895 | 1500 | 1000 |
| DN150 | $168.3 \times 26.9$ | 1200 | 755 | 1200 | 785 | 1200 | 1000 |
| DN150 | $168.3 \times 33.7$ | 1200 | 755 | 1200 | 785 | 1200 | 1000 |
| DN150 | $168.3 \times 42.4$ | 1200 | 762 | 1200 | 792 | 1200 | 1000 |
| DN150 | $168.3 \times 48.3$ | 1200 | 762 | 1200 | 792 | 1200 | 1000 |
| DN150 | $168.3 \times 60.3$ | 1200 | 770 | 1200 | 802 | 1200 | 1000 |
| DN150 | $168.3 \times 76.1$ | 1200 | 780 | 1200 | 812 | 1200 | 1000 |
| DN150 | $168.3 \times 88.9$ | 1200 | 790 | 1200 | 822 | 1200 | 1000 |
| DN150 | $168.3 \times 114.3$ | 1200 | 862 | 1200 | 897 | 1500 | 1000 |
| DN150 | $168.3 \times 139.7$ | 1200 | 875 | 1200 | 912 | 1500 | 1000 |
| DN150 | $168.3 \times 168.3$ | 1200 | 890 | 1200 | 930 | 1500 | 1000 |
| DN200 | $219.1 \times 26.9$ | 1500 | 792 | 1500 | 827 | 1200 | 1000 |
| DN200 | $219.1 \times 33.7$ | 1500 | 792 | 1500 | 827 | 1200 | 1000 |
| DN200 | $219.1 \times 42.4$ | 1500 | 800 | 1500 | 835 | 1200 | 1000 |
| DN200 | $219.1 \times 48.3$ | 1500 | 800 | 1500 | 835 | 1200 | 1000 |
| DN200 | $219.1 \times 60.3$ | 1500 | 807 | 1500 | 845 | 1200 | 1000 |
| DN200 | $219.1 \times 76.1$ | 1500 | 817 | 1500 | 855 | 1200 | 1000 |
| DN200 | $219.1 \times 88.9$ | 1500 | 827 | 1500 | 865 | 1200 | 1000 |
| DN200 | $219.1 \times 114.3$ | 1500 | 900 | 1500 | 940 | 1500 | 1000 |
| DN200 | $219.1 \times 139.7$ | 1500 | 912 | 1500 | 955 | 1500 | 1000 |
| DN200 | $219.1 \times 168.3$ | 1500 | 927 | 1500 | 972 | 1500 | 1000 |
| DN200 | $219.1 \times 219.1$ | 1500 | 1015 | 1500 | 1065 | 1500 | 1000 |
| DN250 | $273 \times 26.9$ | 1500 | 840 | 1500 | 877 | 1200 | 1200 |
| DN250 | $273 \times 33.7$ | 1500 | 840 | 1500 | 877 | 1200 | 1200 |
| DN250 | $273 \times 42.4$ | 1500 | 847 | 1500 | 885 | 1200 | 1200 |
| DN250 | $273 \times 48.3$ | 1500 | 847 | 1500 | 885 | 1200 | 1200 |
| DN250 | $273 \times 60.3$ | 1500 | 855 | 1500 | 895 | 1200 | 1200 |
| DN250 | $273 \times 76.1$ | 1500 | 865 | 1500 | 905 | 1200 | 1200 |
| DN250 | $273 \times 88.9$ | 1500 | 875 | 1500 | 915 | 1200 | 1200 |
| DN250 | $273 \times 114.3$ | 1500 | 947 | 1500 | 990 | 1500 | 1200 |
| DN250 | $273 \times 139.7$ | 1500 | 960 | 1500 | 1005 | 1500 | 1200 |
| DN250 | $273 \times 168.3$ | 1500 | 975 | 1500 | 1023 | 1500 | 1200 |


| Main pipe | Main pipe $x$ branch | L1 | L2 | L1 | L2 | L1 | L2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN250 | $273 \times 219.1$ | 1500 | 1063 | 1500 | 1115 | 1500 | 1200 |
| DN250 | $273 \times 273$ | 1500 | 1218 | 1500 | 1273 | 1800 | 1500 |
| DN300 | $323.9 \times 26.9$ | 1500 | 865 | 1500 | 908 | 1200 | 1200 |
| DN300 | $323.9 \times 33.7$ | 1500 | 865 | 1500 | 908 | 1200 | 1200 |
| DN300 | $323.9 \times 42.4$ | 1500 | 872 | 1500 | 915 | 1200 | 1200 |
| DN300 | $323.9 \times 48.3$ | 1500 | 872 | 1500 | 915 | 1200 | 1200 |
| DN300 | $323.9 \times 60.3$ | 1500 | 880 | 1500 | 925 | 1200 | 1200 |
| DN300 | $323.9 \times 76.1$ | 1500 | 890 | 1500 | 935 | 1200 | 1200 |
| DN300 | $323.9 \times 88.9$ | 1500 | 900 | 1500 | 945 | 1200 | 1200 |
| DN300 | $323.9 \times 114.3$ | 1500 | 972 | 1500 | 1020 | 1500 | 1200 |
| DN300 | $323.9 \times 139.7$ | 1500 | 985 | 1500 | 1035 | 1500 | 1200 |
| DN300 | $323.9 \times 168.3$ | 1500 | 1000 | 1500 | 1053 | 1500 | 1200 |
| DN300 | $323.9 \times 219.1$ | 1500 | 1088 | 1500 | 1145 | 1500 | 1200 |
| DN300 | $323.9 \times 273$ | 1500 | 1243 | 1500 | 1303 | 1800 | 1500 |
| DN300 | $323.9 \times 323.9$ | 1500 | 1229 | 1500 | 1294 | 1800 | 1500 |
| DN350 | $355.6 \times 26.9$ | 1500 | 895 | 1500 | 943 | 1200 | 1200 |
| DN350 | $355.6 \times 33.7$ | 1500 | 895 | 1500 | 943 | 1200 | 1200 |
| DN350 | $355.6 \times 42.4$ | 1500 | 903 | 1500 | 950 | 1200 | 1200 |
| DN350 | $355.6 \times 48.3$ | 1500 | 903 | 1500 | 950 | 1200 | 1200 |
| DN350 | $355.6 \times 60.3$ | 1500 | 910 | 1500 | 960 | 1200 | 1200 |
| DN350 | $355.6 \times 76.1$ | 1500 | 920 | 1500 | 970 | 1200 | 1200 |
| DN350 | $355.6 \times 88.9$ | 1500 | 930 | 1500 | 980 | 1200 | 1200 |
| DN350 | $355.6 \times 114.3$ | 1500 | 1003 | 1500 | 1055 | 1500 | 1200 |
| DN350 | $355.6 \times 139.7$ | 1500 | 1015 | 1500 | 1070 | 1500 | 1200 |
| DN350 | $355.6 \times 168.3$ | 1500 | 1030 | 1500 | 1088 | 1500 | 1200 |
| DN350 | $355.6 \times 219.1$ | 1500 | 1118 | 1500 | 1170 | 1500 | 1200 |
| DN350 | $355.6 \times 273$ | 1500 | 1243 | 1500 | 1308 | 1800 | 1500 |
| DN350 | $355.6 \times 323.9$ | 1500 | 1239 | 1500 | 1309 | 1800 | 1500 |
| DN350 | $355.6 \times 355.6$ | 1500 | 1301 | 1500 | 1376 | 1800 | 1500 |
| DN400 | $406.4 \times 26.9$ | 1600 | 930 | 1600 | 983 | 1200 | 1200 |
| DN400 | $406.4 \times 33.7$ | 1600 | 930 | 1600 | 983 | 1200 | 1200 |
| DN400 | $406.4 \times 42.4$ | 1600 | 938 | 1600 | 990 | 1200 | 1200 |
| DN400 | $406.4 \times 48.3$ | 1600 | 938 | 1600 | 990 | 1200 | 1200 |
| DN400 | $406.4 \times 60.3$ | 1600 | 945 | 1600 | 1000 | 1200 | 1200 |
| DN400 | $406.4 \times 76.1$ | 1600 | 955 | 1600 | 1010 | 1200 | 1200 |
| DN400 | $406.4 \times 88.9$ | 1600 | 965 | 1600 | 1020 | 1200 | 1200 |
| DN400 | $406.4 \times 114.3$ | 1600 | 1038 | 1600 | 1095 | 1500 | 1200 |
| DN400 | $406.4 \times 139.7$ | 1600 | 1050 | 1600 | 1110 | 1500 | 1200 |
| DN400 | $406.4 \times 168.3$ | 1600 | 1065 | 1600 | 1128 | 1500 | 1200 |
| DN400 | $406.4 \times 219.1$ | 1600 | 1153 | 1600 | 1220 | 1500 | 1200 |
| DN400 | $406.4 \times 273$ | 1600 | 1268 | 1600 | 1338 | 1800 | 1500 |
| DN400 | $406.4 \times 323.9$ | 1600 | 1264 | 1600 | 1339 | 1800 | 1500 |
| DN400 | $406.4 \times 355.6$ | 1600 | 1326 | 1600 | 1406 | 1800 | 1500 |
| DN400 | $406.4 \times 406.4$ | 1600 | 1353 | 1600 | 1438 | 1800 | 1500 |
| DN450 | $457 \times 26.9$ | 2000 | 970 | 2000 | 1028 | 1200 | 1200 |
| DN450 | $457 \times 33.7$ | 2000 | 970 | 2000 | 1028 | 1200 | 1200 |
| DN450 | $457 \times 42.4$ | 2000 | 978 | 2000 | 1035 | 1200 | 1200 |
| DN450 | $457 \times 48.3$ | 2000 | 978 | 2000 | 1035 | 1200 | 1200 |
| DN450 | $457 \times 60.3$ | 2000 | 985 | 2000 | 1045 | 1200 | 1200 |

## SINGLE PIPES

|  |  | PART NO. 3100, 3200 |  | 3300 |  | 3400 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Main pipe | Main pipe $x$ branch | L1 | L2 | L1 | L2 | L1 | L2 |
| DN450 | 457x76.1 | 2000 | 995 | 2000 | 1055 | 1200 | 1200 |
| DN450 | $457 \times 88.9$ | 2000 | 1005 | 2000 | 1065 | 1200 | 1200 |
| DN450 | $457 \times 114.3$ | 2000 | 1078 | 2000 | 1140 | 1500 | 1200 |
| DN450 | $457 \times 139.7$ | 2000 | 1090 | 2000 | 1155 | 1500 | 1200 |
| DN450 | $457 \times 168.3$ | 2000 | 1105 | 2000 | 1173 | 1500 | 1200 |
| DN450 | $457 \times 219.1$ | 2000 | 1193 | 2000 | 1265 | 1500 | 1200 |
| DN450 | $457 \times 273$ | 2000 | 1288 | 2000 | 1363 | 1800 | 1500 |
| DN450 | $457 \times 323.9$ | 2000 | 1294 | 2000 | 1374 | 1800 | 1500 |
| DN450 | $457 \times 355.6$ | 2000 | 1346 | 2000 | 1431 | 1800 | 1500 |
| DN450 | $457 \times 406.4$ | 2000 | 1373 | 2000 | 1463 | 1800 | 1500 |
| DN450 | $457 \times 457$ | 2000 | 1454 | 2000 | 1549 | 1800 | 1500 |
| DN500 | $508 \times 26.9$ | 2000 | 1015 | 2000 | 1078 | 1200 | 1200 |
| DN500 | $508 \times 33.7$ | 2000 | 1015 | 2000 | 1078 | 1200 | 1200 |
| DN500 | $508 \times 42.4$ | 2000 | 1023 | 2000 | 1085 | 1200 | 1200 |
| DN500 | $508 \times 48.3$ | 2000 | 1023 | 2000 | 1085 | 1200 | 1200 |
| DN500 | $508 \times 60.3$ | 2000 | 1030 | 2000 | 1095 | 1200 | 1200 |
| DN500 | $508 \times 76.1$ | 2000 | 1040 | 2000 | 1105 | 1200 | 1200 |
| DN500 | $508 \times 88.9$ | 2000 | 1050 | 2000 | 1115 | 1200 | 1200 |
| DN500 | $508 \times 114.3$ | 2000 | 1123 | 2000 | 1190 | 1500 | 1200 |
| DN500 | $508 \times 139.7$ | 2000 | 1135 | 2000 | 1205 | 1500 | 1200 |
| DN500 | $508 \times 168.3$ | 2000 | 1150 | 2000 | 1223 | 1500 | 1200 |
| DN500 | $508 \times 219.1$ | 2000 | 1238 | 2000 | 1315 | 1500 | 1200 |
| DN500 | $508 \times 273$ | 2000 | 1303 | 2000 | 1383 | 1800 | 1500 |
| DN500 | $508 \times 323.9$ | 2000 | 1299 | 2000 | 1384 | 1800 | 1500 |
| DN500 | $508 \times 355.6$ | 2000 | 1379 | 2000 | 1469 | 1800 | 1500 |
| DN500 | $508 \times 406.4$ | 2000 | 1414 | 2000 | 1509 | 1800 | 1500 |
| DN500 | $508 \times 457$ | 2000 | 1504 | 2000 | 1604 | 1800 | 1500 |
| DN500 | $508 \times 508$ | 2000 | 1549 | 2000 | 1654 | 1800 | 1500 |

Part no. series 1 3100-DN main pipe-DN branch-000

Part no. series 2 3200-DN main pipe-DN branch-000

Part no. series 3 3300-DN main pipe-DN branch-000

Part no. series 4 3400-DN main pipe-DN branch-000

## Order example

T-piece series 1 with main pipe DN 200 and branch DN 50, part number 3100-200-050-000.
If PN25, this must be stated when ordering.

## Extended T-piece Series 1, 2, 3 and 4

PN16 - standard PN25 - option

PART NO. 3120, 3220, 3320, 3420


| Main pipe DN | Branch DN | $\begin{aligned} & \text { L2 + L3 [mm] } \\ & \text { Series } 1 \text { and } 2 \end{aligned}$ | $\begin{aligned} & \mathrm{L} 2+\mathrm{L} 3[\mathrm{~mm}] \\ & \text { Series } 3 \text { and } 4 \end{aligned}$ | Main pipe DN | Branch DN | $\begin{aligned} & \text { L2 + L3 [mm] } \\ & \text { Series } 1 \text { and } 2 \end{aligned}$ | L2 + L3 [mm] <br> Series 3 and 4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 25-50 | 25-50 | 1330 | 1530 | 500 | 25-200 | 2200 | 2300 |
| 65-80 | 25-80 | 1370 | 1570 | 500 | 250 | 2500 | 2600 |
| 100-125 | 25-125 | 1500 | 1600 | 500 | 300 | 2500 | 2600 |
| 150 | 25-150 | 1530 | 1630 | 500 | 350 | 2500 | 2600 |
| 200 | 25-200 | 1600 | 1700 | 500 | 400 | 2500 | 2600 |
| 250 | 25-200 | 1900 | 2000 | 500 | 450 | 2500 | 2600 |
| 250 | 250 | 2200 | 2300 | 500 | 500 | 2700 | 2800 |
| 300 | 25-200 | 1950 | 2060 | 600 | 25-80 | 2300 | 2400 *) |
| 300 | 250 | 2250 | 2360 | 600 | 100-200 | 2300 | 2400 *) |
| 300 | 300 | 2250 | 2360 | 600 | 250-450 | 2600 | 2700 *) |
| 350 | 25-200 | 2050 | 2130 | 600 | 500 | 2800 | 2900 *) |
| 350 | 250 | 2350 | 2430 | 600 | 600 | 3200 | 3300 *) |
| 350 | 300 | 2350 | 2430 | 700 | 25-80 | 2400 |  |
| 350 | 350 | 2350 | 2430 | 700 | 100-200 | 2400 |  |
| 400 | 25-200 | 2130 | 2200 | 700 | 250-450 | 2700 |  |
| 400 | 250 | 2430 | 2500 | 700 | 500 | 2900 |  |
| 400 | 300 | 2430 | 2500 | 700 | 600-700 | 3300 |  |
| 400 | 350 | 2430 | 2500 | 800 | 25-80 | 2500 |  |
| 400 | 400 | 2430 | 2500 | 800 | 100-200 | 2500 |  |
|  |  |  |  | 800 | 250-450 | 2800 |  |
|  |  |  |  | 800 | 500 | 3000 |  |
|  |  |  |  | 800 | 600-800 | 3400 |  |

For L1 and L2 see p. 3:301
${ }^{*}$ ) applies to Series 3
A branch cannot be designed with dimensions larger than the main pipe.
An extended T-piece enables easy connection of a valve unit, transition unit etc. after a branch.
An extended T-piece helps ensure safer welding work.

## Part no. series 1

3120-DN main pipe-DN branch-000

## Part no. series 2

3220-DN main pipe-DN branch-000
Part no. series 3
3320-DN main pipe-DN branch-000

## Part no. series 4

3420-DN main pipe-DN branch-000

## Order example

T-piece series 1 with main pipe DN 200 and branch DN 50, part number 3120-200-050-000.
If PN25, this must be stated when ordering.

## T-piece, straight Series 1, 2, 3 and 4



PART NO. 3130, 3230, 3330 (DN20-DN500)

| Main pipe | L1 | L2 | Main pipe | Branch | L1 | L2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN20 | 1000 | 500 | DN600-900 | DN25-100 | 1200 | 1100 |
| DN25 | 1000 | 500 | DN600-900 | DN125-200 | 1500 | 1100 |
| DN32 | 1000 | 500 | DN600-900 | DN250-500 | 1800 | 1100 |
| DN40 | 1000 | 500 | DN600-900 | DN600-800 | 2100 | 1100 |
| DN50 | 1200 | 600 |  |  |  |  |
| DN65 | 1200 | 600 | PART NO. 3330 (DN600-DN900) |  |  |  |
| DN80 | 1200 | 600 | Main pipe | Branch | L1 | L2 |
| DN100 | 1200 | 600 | DN600-900 | DN25-100 | 1200 | 1100 |
| DN125 | 1200 | 600 | DN600-900 | DN125-200 | 1500 | 1100 |
| DN150 | 1200 | 600 | DN600-900 | DN250-500 | 1800 | 1100 |
| DN200 | 1500 | 700 | DN600 | DN600 | 1900 | 1100 |
| DN250 | 1500 | 700 | DN700 | DN600-700 | 2100 | 1100 |
| DN300 | 1500 | 800 |  |  |  |  |
| DN350 | 1500 | 800 | PART NO. 3430 (DN20-DN900) |  |  |  |
| DN400 | 1600 | 800 | Main pipe | Branch | L1 | L2 |
| DN450 | 2000 | 900 | DN20-200 | DN20-100 | 1200 | 700 |
| DN500 | 2000 | 900 | DN125-200 | DN125-200 | 1500 | 700 |
|  |  |  | DN250-500 | DN25-100 | 1200 | 900 |
|  |  |  | DN250-500 | DN125-200 | 1500 | 900 |
|  |  |  | DN250-500 | DN250-500 | 1800 | 900 |
|  |  |  | DN600-900 | DN25-100 | 1200 | 1100 |
|  |  |  | DN600-900 | DN125-200 | 1500 | 1100 |
|  |  |  | DN600-900 | DN250-500 | 1800 | 1100 |
|  |  |  | DN600 | DN600 | 1900 | 1100 |
|  |  |  | DN700 | DN600-700 | 2100 | 1100 |

The T-piece, straight is delivered in equal strength version as standard, and the branch can be designed at the same level as the main pipe. A branch cannot be designed with dimensions larger than the main pipe.

## Part no. series 1

3130-DN main pipe-DN branch-000

## Part no. series 2

3230-DN main pipe-DN branch-0000

## Part no. series 3

3330-DN main pipe-DN branch-000

## Part no. series 4

3430-DN main pipe-DN branch-000

## Order example

T-piece series 1 with main pipe DN 200 and branch DN 50, part number 3130-200-050-000.
If PN25, this must be stated when ordering.

## SINGLE PIPES

## T-piece, parallel Series 1, 2, 3 and 4

```
PN16 - standard
    PN25 - option
```


## KMAT 3600PP

Measurement in mm


PART NO. 3110, 3210

| Main pipe | Main pipe x branch | L1 | L2 | H | L1 | L2 | H | L1 | L2 | H |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN20 | $26.9 \times 26.9$ | 1000 | 550 | 270 | 1000 | 550 | 285 | 1200 | 600 | 290 |
| DN25 | $33.7 \times 26.9$ | 1000 | 550 | 270 | 1000 | 550 | 285 | 1200 | 600 | 290 |
| DN25 | $33.7 \times 33.7$ | 1000 | 550 | 270 | 1000 | 550 | 285 | 1200 | 600 | 290 |
| DN32 | $42.4 \times 26.9$ | 1000 | 550 | 278 | 1000 | 550 | 293 | 1200 | 600 | 300 |
| DN32 | $42.4 \times 33.7$ | 1000 | 550 | 278 | 1000 | 550 | 293 | 1200 | 600 | 300 |
| DN32 | $42.4 \times 42.4$ | 1000 | 550 | 285 | 1000 | 550 | 300 | 1200 | 600 | 310 |
| DN40 | $48.3 \times 26.9$ | 1000 | 550 | 278 | 1000 | 550 | 293 | 1200 | 600 | 300 |
| DN40 | $48.3 \times 33.7$ | 1000 | 550 | 278 | 1000 | 550 | 293 | 1200 | 600 | 300 |
| DN40 | $48.3 \times 42.4$ | 1000 | 550 | 285 | 1000 | 550 | 300 | 1200 | 600 | 310 |
| DN40 | $48.3 \times 48.3$ | 1000 | 550 | 285 | 1000 | 550 | 300 | 1200 | 600 | 310 |
| DN50 | $60.3 \times 26.9$ | 1200 | 550 | 285 | 1200 | 550 | 303 | 1200 | 600 | 310 |
| DN50 | $60.3 \times 33.7$ | 1200 | 550 | 285 | 1200 | 550 | 303 | 1200 | 600 | 310 |
| DN50 | $60.3 \times 42.4$ | 1200 | 550 | 293 | 1200 | 550 | 311 | 1200 | 600 | 320 |
| DN50 | $60.3 \times 48.3$ | 1200 | 550 | 293 | 1200 | 550 | 311 | 1200 | 600 | 320 |
| DN50 | $60.3 \times 60.3$ | 1200 | 600 | 300 | 1200 | 600 | 320 | 1200 | 600 | 330 |
| DN65 | $76.1 \times 26.9$ | 1200 | 550 | 295 | 1200 | 550 | 312 | 1200 | 600 | 320 |
| DN65 | $76.1 \times 33.7$ | 1200 | 550 | 295 | 1200 | 550 | 312 | 1200 | 600 | 320 |
| DN65 | $76.1 \times 42.4$ | 1200 | 550 | 303 | 1200 | 550 | 320 | 1200 | 600 | 330 |
| DN65 | $76.1 \times 48.3$ | 1200 | 550 | 303 | 1200 | 550 | 321 | 1200 | 600 | 330 |
| DN65 | $76.1 \times 60.3$ | 1200 | 600 | 310 | 1200 | 600 | 330 | 1200 | 600 | 340 |
| DN65 | $76.1 \times 76.1$ | 1200 | 600 | 320 | 1200 | 600 | 340 | 1200 | 600 | 350 |
| DN80 | $88.9 \times 26.9$ | 1200 | 550 | 305 | 1200 | 550 | 322 | 1200 | 600 | 333 |
| DN80 | $88.9 \times 33.7$ | 1200 | 550 | 305 | 1200 | 550 | 322 | 1200 | 600 | 333 |
| DN80 | $88.9 \times 42.4$ | 1200 | 550 | 313 | 1200 | 550 | 331 | 1200 | 600 | 343 |
| DN80 | $88.9 \times 48.3$ | 1200 | 550 | 313 | 1200 | 550 | 330 | 1200 | 600 | 343 |
| DN80 | $88.9 \times 60.3$ | 1200 | 600 | 320 | 1200 | 600 | 340 | 1200 | 600 | 353 |
| DN80 | $88.9 \times 76.1$ | 1200 | 600 | 330 | 1200 | 600 | 350 | 1200 | 600 | 363 |
| DN80 | $88.9 \times 88.9$ | 1200 | 650 | 340 | 1200 | 650 | 360 | 1200 | 600 | 375 |
| DN100 | $114.3 \times 26.9$ | 1200 | 550 | 328 | 1200 | 550 | 348 | 1200 | 600 | 360 |
| DN100 | $114.3 \times 33.7$ | 1200 | 550 | 328 | 1200 | 550 | 348 | 1200 | 600 | 360 |
| DN100 | $114.3 \times 42.4$ | 1200 | 550 | 335 | 1200 | 550 | 355 | 1200 | 600 | 370 |
| DN100 | $114.3 \times 48.3$ | 1200 | 550 | 335 | 1200 | 550 | 355 | 1200 | 600 | 370 |
| DN100 | $114.3 \times 60.3$ | 1200 | 600 | 343 | 1200 | 600 | 366 | 1200 | 600 | 380 |
| DN100 | $114.3 \times 76.1$ | 1200 | 600 | 353 | 1200 | 600 | 376 | 1200 | 600 | 390 |
| DN100 | $114.3 \times 88.9$ | 1200 | 650 | 363 | 1200 | 650 | 386 | 1200 | 600 | 403 |
| DN100 | $114.3 \times 114.3$ | 1200 | 700 | 406 | 1200 | 700 | 415 | 1200 | 600 | 430 |
| DN125 | $139.7 \times 26.9$ | 1200 | 550 | 340 | 1200 | 550 | 363 | 1200 | 600 | 378 |
| DN125 | $139.7 \times 33.7$ | 1200 | 550 | 340 | 1200 | 550 | 363 | 1200 | 600 | 378 |

PART NO. 3110, 3210
Main pipe
Main pipe Main pipe DN125 139.7×42.4
DN125 139.7×48.3
DN125 139.7×60.3
DN125 139.7×76.1
DN125 139.7×88.9
DN125 139.7×114.3
DN125
DN150 $168.3 \times 26.9$
DN150 168.3×33.7
DN150 $168.3 \times 42.4$
DN150 $168.3 \times 48.3$
DN150 168.3×60.3
DN150 168.3×76.1
DN150 168.3×88.9
DN150 $168.3 \times 114.3$
DN150 $168.3 \times 139.7$
DN150 $168.3 \times 168.3$
DN200 $219.1 \times 26.9$
DN200 219.1×33.7
DN200 $219.1 \times 42.4$
DN200 219.1×48.3
DN200 $219.1 \times 60.3$
DN200 219.1×76.
DN
DN200 219.1×114.3
DN200 219.1×139.7
DN200 $219.1 \times 168.3$
DN200 219.1×219.1
DN250 273×26.9
DN250 273x33.7
DN250 273x42.4
DN250 273×48.3
DN250 273x60.3
DN250 273x76.1
DN250 273×88.9
DN250 $273 \times 114.3$
DN250 $273 \times 139.7$
DN250 $273 \times 168.3$
DN250 273×219.1
DN250 273×273
DN300 323.9×26.9
DN300 323.9x33.7
DN300 323.9x42.4
DN300 323.9x48.3
DN300 323.9x60.3
DN300 323.9x76.1
DN300 323.9×88.9
DN300 323.9x114.3
DN300 $323.9 \times 139.7$
DN300 $323.9 \times 168.3$
DN300 $323.9 \times 219.1$

| L1 | L2 | H | L1 | L2 | H | L1 | L2 | H |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1200 | 550 | 348 | 1200 | 550 | 371 | 1200 | 600 | 388 |
| 1200 | 550 | 347 | 1200 | 550 | 370 | 1200 | 600 | 388 |
| 1200 | 600 | 355 | 1200 | 600 | 380 | 1200 | 600 | 398 |
| 1200 | 600 | 365 | 1200 | 600 | 390 | 1200 | 600 | 408 |
| 1200 | 650 | 375 | 1200 | 650 | 400 | 1200 | 600 | 420 |
| 1200 | 700 | 403 | 1200 | 700 | 430 | 1200 | 600 | 448 |
| 1200 | 700 | 413 | 1200 | 700 | 440 | 1500 | 750 | 465 |
| 1200 | 550 | 355 | 1200 | 550 | 380 | 1200 | 600 | 398 |
| 1200 | 550 | 355 | 1200 | 550 | 380 | 1200 | 600 | 398 |
| 1200 | 550 | 363 | 1200 | 550 | 388 | 1200 | 600 | 408 |
| 1200 | 550 | 363 | 1200 | 550 | 388 | 1200 | 600 | 408 |
| 1200 | 600 | 370 | 1200 | 600 | 398 | 1200 | 600 | 418 |
| 1200 | 600 | 380 | 1200 | 600 | 408 | 1200 | 600 | 428 |
| 1200 | 650 | 390 | 1200 | 650 | 418 | 1200 | 600 | 440 |
| 1200 | 700 | 415 | 1200 | 700 | 447 | 1500 | 750 | 468 |
| 1200 | 700 | 426 | 1200 | 700 | 458 | 1500 | 750 | 485 |
| 1200 | 700 | 489 | 1200 | 700 | 489 | 1500 | 750 | 505 |
| 1500 | 550 | 393 | 1500 | 550 | 423 | 1200 | 600 | 445 |
| 1500 | 550 | 393 | 1500 | 550 | 423 | 1200 | 600 | 445 |
| 1500 | 550 | 400 | 1500 | 550 | 430 | 1200 | 600 | 455 |
| 1500 | 550 | 400 | 1500 | 550 | 430 | 1200 | 600 | 455 |
| 1500 | 600 | 408 | 1500 | 600 | 441 | 1200 | 600 | 465 |
| 1500 | 600 | 418 | 1500 | 600 | 451 | 1200 | 600 | 475 |
| 1500 | 650 | 428 | 1500 | 650 | 461 | 1200 | 600 | 488 |
| 1500 | 700 | 450 | 1500 | 700 | 490 | 1200 | 600 | 515 |
| 1500 | 700 | 463 | 1500 | 700 | 501 | 1500 | 750 | 533 |
| 1500 | 700 | 499 | 1500 | 700 | 529 | 1500 | 750 | 553 |
| 1500 | 800 | 626 | 1500 | 800 | 627 | 1500 | 750 | 600 |
| 1500 | 550 | 440 | 1500 | 550 | 473 | 1200 | 600 | 500 |
| 1500 | 550 | 440 | 1500 | 550 | 473 | 1200 | 600 | 500 |
| 1500 | 550 | 448 | 1500 | 550 | 480 | 1200 | 600 | 510 |
| 1500 | 550 | 447 | 1500 | 550 | 480 | 1200 | 600 | 510 |
| 1500 | 600 | 455 | 1500 | 600 | 490 | 1200 | 600 | 520 |
| 1500 | 600 | 465 | 1500 | 600 | 500 | 1200 | 600 | 530 |
| 1500 | 650 | 475 | 1500 | 650 | 510 | 1200 | 600 | 543 |
| 1500 | 700 | 498 | 1500 | 700 | 540 | 1200 | 600 | 570 |
| 1500 | 700 | 510 | 1500 | 700 | 550 | 1500 | 750 | 588 |
| 1500 | 700 | 545 | 1500 | 700 | 579 | 1500 | 750 | 608 |
| 1500 | 800 | 627 | 1500 | 800 | 677 | 1500 | 750 | 655 |
| 1500 | 800 | 647 | 1500 | 800 | 660 | 1800 | 900 | 710 |
| 1500 | 550 | 465 | 1500 | 550 | 503 | 1200 | 600 | 535 |
| 1500 | 550 | 465 | 1500 | 550 | 503 | 1200 | 600 | 535 |
| 1500 | 550 | 473 | 1500 | 550 | 511 | 1200 | 600 | 545 |
| 1500 | 550 | 473 | 1500 | 550 | 510 | 1200 | 600 | 545 |
| 1500 | 600 | 480 | 1500 | 600 | 520 | 1200 | 600 | 555 |
| 1500 | 600 | 490 | 1500 | 600 | 530 | 1200 | 600 | 565 |
| 1500 | 650 | 500 | 1500 | 650 | 540 | 1200 | 600 | 578 |
| 1500 | 700 | 523 | 1500 | 700 | 570 | 1200 | 600 | 605 |
| 1500 | 700 | 535 | 1500 | 700 | 580 | 1500 | 750 | 623 |
| 1500 | 700 | 570 | 1500 | 700 | 609 | 1500 | 750 | 643 |
| 1500 | 800 | 653 | 1500 | 800 | 707 | 1500 | 750 | 690 |

## SINGLE PIPES

PART NO. 3110, 3210
3310
3410

| Main pipe | Main pipe x branch | L1 | L2 | H | L1 | L2 | H | L1 | L2 | H |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN300 | $323.9 \times 273$ | 1500 | 800 | 635 | 1500 | 800 | 690 | 1800 | 900 | 745 |
| DN300 | $323.9 \times 323.9$ | 1500 | 850 | 711 | 1500 | 850 | 751 | 1800 | 900 | 780 |
| DN350 | $355.6 \times 26.9$ | 1500 | 550 | 495 | 1500 | 550 | 538 | 1200 | 600 | 575 |
| DN350 | $355.6 \times 33.7$ | 1500 | 550 | 495 | 1500 | 550 | 538 | 1200 | 600 | 575 |
| DN350 | 355.6x42.4 | 1500 | 550 | 503 | 1500 | 550 | 546 | 1200 | 600 | 585 |
| DN350 | $355.6 \times 48.3$ | 1500 | 550 | 503 | 1500 | 550 | 546 | 1200 | 600 | 585 |
| DN350 | $355.6 \times 60.3$ | 1500 | 600 | 510 | 1500 | 600 | 555 | 1200 | 600 | 595 |
| DN350 | $355.6 \times 76.1$ | 1500 | 600 | 520 | 1500 | 600 | 565 | 1200 | 600 | 605 |
| DN350 | $355.6 \times 88.9$ | 1500 | 650 | 530 | 1500 | 650 | 575 | 1200 | 600 | 618 |
| DN350 | $355.6 \times 114.3$ | 1500 | 700 | 560 | 1500 | 700 | 605 | 1200 | 600 | 645 |
| DN350 | $355.6 \times 139.7$ | 1500 | 700 | 565 | 1500 | 700 | 615 | 1500 | 750 | 663 |
| DN350 | 355.6x168.3 | 1500 | 700 | 601 | 1500 | 700 | 644 | 1500 | 750 | 683 |
| DN350 | $355.6 \times 219.1$ | 1500 | 800 | 697 | 1500 | 800 | 742 | 1500 | 750 | 730 |
| DN350 | $355.6 \times 273$ | 1500 | 800 | 665 | 1500 | 800 | 725 | 1800 | 900 | 785 |
| DN350 | 355.6x323.9 | 1500 | 850 | 728 | 1500 | 850 | 792 | 1800 | 900 | 820 |
| DN350 | $355.6 \times 355.6$ | 1500 | 900 | 852 | 1500 | 900 | 882 | 1800 | 900 | 900 |
| DN400 | $406.4 \times 26.9$ | 1600 | 550 | 530 | 1600 | 550 | 578 | 1200 | 600 | 620 |
| DN400 | $406.4 \times 33.7$ | 1600 | 550 | 530 | 1600 | 550 | 578 | 1200 | 600 | 620 |
| DN400 | 406.4x42.4 | 1600 | 550 | 538 | 1600 | 550 | 586 | 1200 | 600 | 630 |
| DN400 | $406.4 \times 48.3$ | 1600 | 550 | 538 | 1600 | 550 | 586 | 1200 | 600 | 630 |
| DN400 | $406.4 \times 60.3$ | 1600 | 600 | 545 | 1600 | 600 | 595 | 1200 | 600 | 640 |
| DN400 | $406.4 \times 76.1$ | 1600 | 600 | 555 | 1600 | 600 | 605 | 1200 | 600 | 650 |
| DN400 | $406.4 \times 88.9$ | 1600 | 650 | 565 | 1600 | 650 | 615 | 1200 | 600 | 663 |
| DN400 | $406.4 \times 114.3$ | 1600 | 700 | 588 | 1600 | 700 | 645 | 1200 | 600 | 690 |
| DN400 | $406.4 \times 139.7$ | 1600 | 700 | 600 | 1600 | 700 | 655 | 1500 | 750 | 708 |
| DN400 | $406.4 \times 168.3$ | 1600 | 700 | 636 | 1600 | 700 | 686 | 1500 | 750 | 728 |
| DN400 | $406.4 \times 219.1$ | 1600 | 800 | 722 | 1600 | 800 | 782 | 1500 | 750 | 775 |
| DN400 | $406.4 \times 273$ | 1600 | 800 | 700 | 1600 | 800 | 765 | 1800 | 900 | 830 |
| DN400 | 406.4×323.9 | 1600 | 850 | 753 | 1600 | 850 | 832 | 1800 | 900 | 865 |
| DN400 | $406.4 \times 355.6$ | 1600 | 900 | 842 | 1600 | 900 | 910 | 1800 | 900 | 918 |
| DN400 | 406.4×406.4 | 1600 | 1000 | 985 | 1600 | 1000 | 995 | 1800 | 900 | 990 |
| DN450 | 457x26.9 | 2000 | 550 | 570 | 2000 | 550 | 623 | 1200 | 600 | 620 |
| DN450 | 457x33.7 | 2000 | 550 | 570 | 2000 | 550 | 623 | 1200 | 600 | 620 |
| DN450 | $457 \times 42.4$ | 2000 | 550 | 578 | 2000 | 550 | 630 | 1200 | 600 | 630 |
| DN450 | 457x48.3 | 2000 | 550 | 578 | 2000 | 550 | 630 | 1200 | 600 | 630 |
| DN450 | $457 \times 60.3$ | 2000 | 600 | 585 | 2000 | 600 | 640 | 1200 | 600 | 640 |
| DN450 | $457 \times 76.1$ | 2000 | 600 | 595 | 2000 | 600 | 650 | 1200 | 600 | 650 |
| DN450 | 457x88.9 | 2000 | 650 | 605 | 2000 | 650 | 660 | 1200 | 600 | 663 |
| DN450 | $457 \times 114.3$ | 2000 | 700 | 628 | 2000 | 700 | 690 | 1200 | 600 | 690 |
| DN450 | $457 \times 139.7$ | 2000 | 700 | 640 | 2000 | 700 | 700 | 1500 | 750 | 708 |
| DN450 | $457 \times 168.3$ | 2000 | 700 | 676 | 2000 | 700 | 729 | 1500 | 750 | 728 |
| DN450 | $457 \times 219.1$ | 2000 | 800 | 757 | 2000 | 800 | 827 | 1500 | 750 | 775 |
| DN450 | $457 \times 273$ | 2000 | 800 | 740 | 2000 | 800 | 810 | 1800 | 900 | 830 |
| DN450 | $457 \times 323.9$ | 2000 | 850 | 793 | 2000 | 850 | 877 | 1800 | 900 | 886 |
| DN450 | $457 \times 355.6$ | 2000 | 900 | 872 | 2000 | 900 | 955 | 1800 | 900 | 1005 |
| DN450 | $457 \times 406.4$ | 2000 | 1000 | 977 | 2000 | 1000 | 1027 | 1800 | 900 | 1050 |
| DN450 | $457 \times 457$ | 2000 | 1050 | 1109 | 2000 | 1050 | 1119 | 1800 | 900 | 1079 |
| DN500 | $508 \times 26.9$ | 2000 | 550 | 605 | 2000 | 550 | 673 | 1200 | 600 | 670 |
| DN500 | $508 \times 33.7$ | 2000 | 550 | 605 | 2000 | 550 | 673 | 1200 | 600 | 670 |
| DN500 | $508 \times 42.4$ | 2000 | 550 | 613 | 2000 | 550 | 680 | 1200 | 600 | 680 |
| DN500 | $508 \times 48.3$ | 2000 | 550 | 613 | 2000 | 550 | 680 | 1200 | 600 | 680 |



## L1 and L2, Series 1-4

Main pipe Branch L1 L2

| DN600-900 | DN25-80 | 1200 | 600 |
| :---: | :---: | :---: | :---: |
| DN600-900 | DN100-200 | 1500 | 750 |
| DN600-900 | DN250-400 | 1800 | 900 |
| DN600-900 | DN450-500 | 2400 | 1200 |
| DN600-900 | DN600 | 2400 | 1200 |
| DN700 | DN600 | 2800 | 1400 |
| DN800-900 | DN700 | 3000 | 1500 |

## H-DIMENSIONS

| Main pipe Series | Branch <br> DN20 | DN25 | DN32 | DN40 | DN50 | DN65 | DN80 | DN100 | DN125 | DN150 | DN200 |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DN600 | $1 \& 2$ | 605 | 605 | 613 | 613 | 620 | 630 | 640 | 663 | 675 | 690 | 728 |  |
| DN600 | $3 \& 4$ | 720 | 720 | 730 | 730 | 740 | 750 | 763 | 790 | 808 | 828 | 875 |  |
| DN700 | $1 \& 2$ | 655 | 655 | 663 | 663 | 670 | 680 | 690 | 713 | 725 | 740 | 778 |  |
| DN700 | $3 \& 4$ | 770 | 770 | 780 | 780 | 790 | 800 | 813 | 840 | 858 | 878 | 925 |  |
| DN800 | $1 \& 2$ | 705 | 705 | 713 | 713 | 720 | 730 | 740 | 763 | 775 | 790 | 828 |  |
| DN800 | 3 | 770 | 770 | 780 | 780 | 790 | 800 | 813 | 840 | 858 | 878 | 925 |  |
| DN900 | $1 \& 2$ | 755 | 755 | 763 | 763 | 770 | 780 | 790 | 813 | 825 | 840 | 878 |  |

## SINGLE PIPES

## H-DIMENSIONS

| Main pipe | Series | Branch DN250 | DN300 | DN350 | DN400 | DN450 | DN500 | DN600 | DN700 | DN800 | DN900 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN600 | 1\&2 | 815 | 854 | 928 | 1016 | 1091 | 1194 | 1346 |  |  |  |
| DN600 | 3\&4 | 930 | 965 | 1063 | 1150 | 1226 | 1280 | 1426 |  |  |  |
| DN700 | 1\&2 | 825 | 905 | 989 | 1067 | 1142 | 1245 | 1422 | 1588 |  |  |
| DN700 | 3\&4 | 980 | 1015 | 1105 | 1201 | 1277 | 1325 | 1482 | 1588 |  |  |
| DN800 | 1\&2 | 875 | 964 | 1040 | 1118 | 1203 | 1295 | 1473 | 1639 | 1816 |  |
| DN800 | 3 | 980 | 1015 | 1105 | 1168 | 1278 | 1295 | 1473 | 1639 | 1816 |  |
| DN900 | 1\&2 | 925 | 1014 | 1090 | 1169 | 1251 | 1346 | 1524 | 1689 | 1867 | 2045 |

A branch cannot be designed with dimensions larger than the main pipe. See Chapter 7 for type drawing of alarm system.

Part no. series 1 3110-DN main pipe-DN branch-000
Part no. series 2 3210-DN main pipe-DN branch-000
Part no. series 3 3310-DN main pipe-DN branch-000
Part no. series 4 3410-DN main pipe-DN branch-000

## Order example

T-piece series 1 with main pipe DN 200 and branch DN 50, part number 3110-200-050-000.
If PN25, this must be stated when ordering.

## Vent/drain <br> Series 1, 2, 3 and 4

PN 16/PN25

PART NO. 3140, 3240, 3340, 3440
KMAT 3410PP


| Main pipe DN | H [mm] | Vent/drain DN | B <br> [mm] |
| :---: | :---: | :---: | :---: |
| 25 | 409 | 25 | 114 |
| 32 | 414 | 40 | 114 |
| 40 | 417 | 50 | 140 |
| 50 | 423 | 65 | 170 |
| 65 | 431 |  |  |
| 80 | 438 |  |  |
| 100 | 450 |  | NB The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10 |
| 125 | 463 |  |  |
| 150 | 477 |  |  |
| 200 | 502 |  |  |
| 250 | 530 |  |  |
| 300 | 554 |  | The sealing shall not lie continuously under water. |
| 350 | 570 |  |  |
| 400 | 596 |  |  |
| 500 | 650 |  | Backfilling may not reach the sealing, alarm wire or marking tape. |
| 600 | 700 |  |  |
| 700 | 758 |  |  |
| 800 | 800 |  |  |
| 900 | 850 |  |  |

The end cap and valve body are in stainless material.
Vent/drain valves are available in dimensions DN 25, DN 40, DN 50 and DN 65. Available in a choice of dimensions, but standard dimensions are DN25 for DN25-DN200 main pipes, DN40 for DN250-DN300 main pipes, DN50 for DN350-600 main pipes and DN65 for DN700-DN900 main pipes.
Alarm wires not accessible.
The valve is delivered with an end cap for the spindle as standard.

## Part no. series 1

3140-DN main pipe-DN vent/drain-000

## Part no. series 2

3240-DN main pipe-DN vent/drain-000

## Part no. series 3

3340-DN main pipe-DN vent/drain-000

## Part no. series 4

3440-DN main pipe-DN vent/drain-000

## Order example

Venting for main pipe in Series 1 dimension DN 200 and venting DN 25, part number 3140-200-025-000.

## Preinsulated valves Series 1, 2, 3 and 4

PN 16/PN25

## PART NO. 4100, 4200, 4300, 4400

| Main pipe DN | Service pipe Dyx smm | $\begin{aligned} & \text { L1 } \\ & {[\mathrm{mm}]} \end{aligned}$ | H <br> [mm] | $\begin{aligned} & \text { B } \\ & {[\mathrm{mm}]} \end{aligned}$ | Wrench size [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 25 | $33.7 \times 2.3$ | 1500 | 382 | 110 | 19 |
| 32 | $42.4 \times 2.6$ | 1500 | 388 | 110 | 19 |
| 40 | $48.3 \times 2.6$ | 1500 | 401 | 110 | 19 |
| 50 | $60.3 \times 2.9$ | 1500 | 406 | 110 | 19 |
| 65 | $76.1 \times 2.9$ | 1500 | 415 | 110 | 19 < 1) |
| 80 | $88.9 \times 3.2$ | 1500 | 426 | 110 | 19 |
| 100 | $114.3 \times 3.6$ | 1500 | 450 | 125 | 27 |
| 125 | $139.7 \times 3.6$ | 1500 | 455 | 125 | 27 |
| 150 | $168.3 \times 4.0$ | 1500 | 475 | 125 | 27 |
| 200 | $219.1 \times 4.5$ | 1500 | 517 | 160 | 50 |
| 250 | $273.0 \times 5.0$ | 1500 | 560 | 160 | 50 - 2) |
| 300 | $323.9 \times 5.6$ | 1800 | 610 | 160 | 50 |
| 350 | $355.6 \times 5.6$ | 1800 | 830 | 350 |  |
| 400 | $406.4 \times 6.3$ | 2000 | 909 | 350 | (3) |
| 500 | $508.3 \times 6.3$ | custom | 947 | 350 |  |
| 600 | $610.0 \times 7.1$ | custom | 1020 | 350 |  |

H-dimension is up to mount for T-key up to and including DN300, including fixed gear.
The alarm wire is accessible from outside the sealing. For fixed gear, order alarm wire placement separately.
The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. Valves can come with T-key, portable planetary gear, fixed gear, hydraulic or electronic actuator. See Accessories, Chapter 8. Comes with end cap as standard. Is available with separate measurement sleeve by special order. See Chapter 6.
Also available with stem extension $250,500,750,1000,1250$ or 1500 mm for DN25-DN300 as standard.

## As standard, the valve is delivered as follows:

1) DN 25-DN150 with mount for T-key.
2) DN 200-DN 300 with mount for portable gear.
3) DN $350-\mathrm{DN} 900$ with fixed gear and wire placement are ordered separately.

## Part no. series 1

4100-DN-000-000
Part no. series 3
4300-DN-000-000

## Part no. series 2

4200-DN-000-000

Part no. series 4
4400-DN-000-000

NB The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

The end cap shall not lie continuously under water.

Backfilling may not reach the end cap, alarm wire or marking tape.

## Order example

Pre-insulated valve Series 1 with main pipe DN 200, part number 4100-200-000-000.

## Valve with 1 vent/drain unit. Series 1, 2, 3 and 4

PN 16/PN25



PART NO. 4141, 4241, 4341, 4441
KMAT 4220PP

| Main pipe DN | $\begin{aligned} & \text { L1 } \\ & \text { [mm] } \end{aligned}$ | $\begin{aligned} & \mathrm{H} \\ & {[\mathrm{~mm}]} \end{aligned}$ | $\begin{aligned} & \text { B } \\ & {[\mathrm{mm}]} \end{aligned}$ | Wrench size [mm] | Vent/drain |  | Change in B dimension for larger dimension of vent/drain |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | DN <br> [mm] | $\begin{aligned} & \text { D } \\ & {[\mathrm{mm}]} \end{aligned}$ |  |
|  |  |  |  | ) |  |  |  |
| 25 | 1500 | 382 | 370 | 19 | 25 | 110 | +0 |
| 32 | 1500 | 388 | 365 | 19 | 40 | 110 | +0 |
| 40 | 1500 | 401 | 365 | 19 | 50 | 125 | +7.5 |
| 50 | 1500 | 406 | 365 | 19 1) | 65 | 140 | +15.0 |
| 65 | 1500 | 415 | 365 | 19 |  |  |  |
| 80 | 1500 | 426 | 365 | 19 |  | NB The valves must be operated at least twice a year in order to ensure a good function. For care instructions for valves, see Chapter 10. |  |
| 100 | 1500 | 450 | 365 | 27 |  |  |  |  |
| 125 | 1500 | 455 | 365 | 27 |  |  |  |  |
| 150 | 1500 | 475 | 365 | 27 |  |  |  |  |
| 200 | 1500 | 517 | 365 | 50 ¢ 2) |  |  |  |  |
| 250 | 1500 | 560 | 420 | 50 |  | The end cap shall not lie continuously under water. |  |
| 300 | 1800 | 610 | 470 | 50 |  |  |  |  |
| 350 | 1800 | 830 | 535 | (3) |  | Backfilling may not reach the end cap, alarm wire or marking tape. |  |
| 400 | 2000 | 909 | 660 |  |  |  |  |  |
| 500 | 2200 | 947 | 800 | ) |  |  |  |  |
| 600 | 2400 | 1020 | 875 |  |  |  |  |

H-dimension is up to mount for T-key up to and including DN300, including fixed gear. The alarm wire is accessible from outside the sealing. For fixed gear, order alarm wire placement separately. The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. Valves can come with T-key, portable planetary gear, fixed gear, hydraulic or electronic actuator. See Accessories, Chapter 8. Comes with end cap as standard. Is available with separate measurement sleeve by special order. See Chapter 6.
The valve stem for vent/drain unit is oriented towards the stop valve. Vent/drain valves are available in dimensions DN 25, DN 40, DN 50 and DN 65.
Stop valve available with stem extension 250, 500, 750, 1000, 1250 or 1500 mm for DN25-DN300 as standard.

## As standard, the valve is delivered as follows:

1) DN 25-DN150 with mount for T-key.
2) DN 200-DN 300 with mount for portable gear.
3) DN $350-\mathrm{DN} 900$ with fixed gear and wire placement are ordered separately.

## Part no. series 1

4141-DN main pipe-DN venting-000

## Part no. series 2

4241-DN main pipe-DN venting-000

## Part no. series 3

4341-DN main pipe-DN venting-000

## Part no. series 4

4441-DN main pipe-DN venting-000

## Order example

Pre-insulated valve series 2 with main pipe DN 100 and vent DN 25, part number 4241-100-025-000.

# Valve with 2 vent/drain units (standard) <br> Series 1, 2, 3 and 4 

PN 16/PN25
Standard version (see alternative version on next page).

PART NO. 4142, 4242, 4342, 4442

## KMAT 4240PP




H-dimension is up to mount for T-key up to and including DN300, including fixed gear. The alarm wire is accessible from outside the sealing. For fixed gear, order alarm wire placement separately. The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. Valves can come with T-key, portable planetary gear, fixed gear, hydraulic or electronic actuator. See Accessories, Chapter 8. Comes with end cap as standard. The valve stem for vent/drain unit is oriented towards the stop valve. Vent/drain valves are available in dimensions DN 25, DN 40, DN 50 and DN 65.
Stop valve available with stem extension $250,500,750,1000,1250$ or 1500 mm for DN25-DN300 as standard.

## As standard, the valve is delivered as follows:

1) DN 25-DN150 with mount for T-key.
2) $\mathrm{DN} 200-\mathrm{DN} 300$ with mount for portable gear.
3) DN 350-DN 900 with fixed gear and wire placement are ordered separately.

## Order example

## Part no. series 1

4142-DN main pipe-DN venting-000

## Part no. series 2

4242-DN main pipe-DN venting-000

## Part no. series 3

4342-DN main pipe-DN venting-000

## Part no. series 4

4442-DN main pipe-DN venting-000

Pre-insulated valve series 2 with main pipe DN 100 and vent DN 25, part number 4242-100-025-000.

## Valve with 2 vent/ drain units (Variant A and B) Series 1, 2, 3 and 4

PN 16/PN25



PART NO. 4142, 4242, 4342, 4442


H-dimension is up to mount for T-key up to and including DN300, in addition including fixed gear. As standard, the alarm wires are connected through the stainless end cap. For fixed gear, order alarm wire placement separately. The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. Valves can come with T-key, portable planetary gear, fixed gear, hydraulic or electronic actuator. See Accessories, Chapter 8. Comes with end cap as standard. The valve stem for vent/drain unit is oriented towards the stop valve. Vent/drain valves are available in dimensions DN 25, DN 40, DN 50 and DN 65. Stop valve available with stem extension $250,500,750,1000,1250$ or 1500 mm for DN25DN300 as standard.

As standard, the valve is delivered as follows:

1) DN 25-DN150 with mount for T-key.
2) DN 200-DN 300 with mount for portable gear.
3) DN 350-DN 900 with fixed gear and wire placement are ordered separately.

NB The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

The end cap shall not lie continuously under water.

Backfilling may not reach the end cap, alarm wire or marking tape.

Variant A has suffix -622 Variant B has suffix -637

## Order example

Valve series 2 with main pipe DN 300 and vent DN 40 in variant A, part number 4242-300-040-622.
Variant B, part number 4242-300-040-637

## Combination valves Series 1, 2, 3 and 4

PN 16/PN25

PART NO. 4841, 4842, 4843, 4844

| Main pipe | Dy <br> Series 2 <br> [mm] | Bypass <br> valves <br> DN (3 pcs) | L1 | Lmm] | [mm] | Da | B |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | | H |
| :--- |
| [mN] |

Dimensions in the table apply to the venting variant. H-dimension is up to mount for T-key. As standard, the alarm wires are connected through the stainless end cap. The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. T-key and portable planetary gear can be supplied for valves. Comes with end cap as standard. For design with gear, see next page. Can be customised to specific requirements. Stop valve, outlet pipe and sealing are manufactured in stainless material. The valve stem for vent/drain unit is oriented towards the stop valve. Stop valve available with stem extension $250,500,750,1000,1250$ or 1500 mm for DN25-DN300 as standard.

## As standard, the valve is delivered as follows:

1) DN 100-DN 150 with mount for T-key.
2) DN 200-DN 300 with mount for portable gear.

The variant with drain has suffix -040
The variant with venting has suffix -000

## Part no. 1

4841-DN-000-000.
Part no. 2
4842-DN-000-000.

Part no. 3
4843-DN-000-000.
Part no. 4
4844-DN-000-000.

## Order example

Combination valve for DN 200 Series 3, part number 4843-200-000-000.

Draining -040


Venting -000


Connection of valve


## NB

Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

The valve must be operated at least twice a year in order to ensure good function.
For care instructions for valves, see Chapter 10.
The sealing shall not lie continuously under water.
Backfilling may not reach the sealing, alarm wire or marking tape.

## Combination valves with gear <br> Series 1, 2, 3 and 4

PN 16/PN25

KMAT 4250PP

PART NO. 4841, 4842, 4843, 4844 in version 637 and 635


| Main pipe DN | Dy <br> Series 2 <br> [mm] | Bypass valves DN (3 pcs) | L1 [mm] | L2 <br> [mm] | Da <br> [mm] | H [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 350 | 560 | 50 | 3200 | 800 | 140 | 830 |
| 400 | 680 | 50 | 3400 | 800 | 140 | 909 |
| 500 | 800 | 50 | 3600 | 900 | 140 | 947 |

Dimensions in the table apply to the venting
variant.
H-dimension is for fixed gear.
As standard, the alarm wires are connected through the stainless end cap.
The pipe has a ball valve as standard, but is also available with a gate valve or valve with full bore. Comes with fixed gear (standard), hydraulic or electronic actuator. Comes with end cap as standard. Can be customised to specific requirements.

Stop valve, outlet pipe and sealing are manufactured in stainless material.
The variant with drain has suffix -637
The variant with venting has suffix -635


## Part no.

4841-DN-000-XXX
4842-DN-000-XXX
4843-DN-000-XXX
4844-DN-000-XXX

## Order example

Combination valve for DN 400 Series 3 in vent variant, part number 4843-400-000-635.

Drain


Venting


Connection of valve

## NB

Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

The valve must be operated at least twice a year in order to ensure good function.
For care instructions for valves, see Chapter 10.
The sealing shall not lie continuously under water.
Backfilling may not reach the sealing, alarm wire or marking tape.

## Valve assembly, compact Series 1, 2, 3 and 4

PN 16/PN25

## KMAT 4251PP

PART NO. 4170, 4270, 4370, 4470

| DN | $\mathbf{C - C}$ | $\mathbf{H}$ <br> Standard <br> $[\mathbf{m m}]$ | $\mathbf{H}$ <br> $\mathbf{M i n}$ <br> $[\mathbf{m m}]$ | $\mathbf{[ m m}]$ | B | L1 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

The valve assembly is used for draining or venting. It is constructed so it will fit in a standard manhole. Spindle height " H " is available with standard height or min. height according to the table above. The valve assembly can be supplemented with loose stem extensions of $250,500,750,1000,1250$ or 1500 mm . See Accessories, Chapter 8 . The outlet pipe is manufactured in stainless material. The valve is delivered with an end cap for the spindle as standard.

## Alarm wires not accessible as standard, but can be ordered.

As standard, the valve is delivered as follows:

1) DN 25-DN150 with mount for T-key.

## Part no. series 1

4170-DN-000-XXX

## Part no. series 3

4370-DN-000-XXX

## Part no. series 2

4270-DN-000-XXX
Part no. series 4
4470-DN-000-XXX

Outlet $90^{\circ}$ right has suffix -032 (see image)
Outlet $90^{\circ}$ left has suffix -031
For valve assemblies with minimal stem height, -000 - is replaced with Hmin.

## Order example

Valve assembly, compact, left Series 2 dim DN 50, part number 4270-050-000-031.
When ordering minimal spindle height, state as below: Valve assembly, compact, left, Series 2 . DN 50 with minimal spindle height, part number 4270-050-210-031.


## NB

Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

The sealing shall not lie continuously under water.

Backfilling may not reach the end cap, alarm wire or marking tape.

## Anchor unit, Series 1, 2, 3 and 4

PN25

PART NO. 5100, 5200, 5300, 5400

| DN | Max load [kN] $\Delta \mathrm{T}=60^{\circ} \mathrm{C}$ | $\begin{array}{r} \mathbf{A} \\ {[\mathrm{mm}]} \end{array}$ | $\begin{array}{r} \mathbf{h} \\ {[\mathrm{mm}]} \end{array}$ | Pressure area (Series 2) [ $\mathrm{cm}^{2}$ ] |
| :---: | :---: | :---: | :---: | :---: |
| 25 | 38 | 200 | 25 | 191 |
| 32 | 49 | 220 | 25 | 243 |
| 40 | 56 | 220 | 25 | 243 |
| 50 | 78 | 240 | 25 | 289 |
| 65 | 100 | 280 | 25 | 452 |
| 80 | 129 | 300 | 30 | 392 |
| 100 | 187 | 350 | 30 | 565 |
| 125 | 230 | 400 | 30 | 765 |
| 150 | 310 | 450 | 30 | 875 |
| 200 | 455 | 550 | 35 | 1385 |
| 250 | 630 | 650 | 40 | 1730 |
| 300 | 840 | 700 | 40 | 1885 |
| 350 | 920 | 700 | 40 | 1385 |
| 400 | 1200 | 850 | 40 | 2560 |
| 500 | 1500 | 1000 | 65 | 4000 |
| 600 | 2000 | 1200 | 65 | 6200 |

The anchor unit is manufactured for casting in concrete quality K 250 . Design compression strength: Normal value in concrete $5 \mathrm{MN} / \mathrm{m}^{2}\left(50 \mathrm{~kg} / \mathrm{cm}^{2}\right)$ and normal value in soil $0.15 \mathrm{MN} / \mathrm{m}^{2}\left(1.5 \mathrm{~kg} / \mathrm{cm}^{2}\right)$.

A and t dimensions are stated above for Series 2.

## Part no. series 1

5100-DN-000-000
Part no. series 2
5200-DN-000-000
Part no. series 3
5300-DN-000-000
Part no. series 4
5400-DN-000-000

## Order example

Anchor unit Series 1 with dim DN 200, part number 5100-200-000-000

## SINGLE PIPES

## Single-use compensator

PN 16/PN25


PART NO. 7810

| DN | Movement absorption <br> [mm] | Ln | Du |
| ---: | :---: | :---: | :---: |
|  |  |  |  |
| 40 | 50 | 450 | 60 |
| 50 | 50 | 450 | 70 |
| 65 | 70 | 500 | 90 |
| 80 | 70 | 500 | 102 |
| 100 | 80 | 550 | 127 |
| 125 | 80 | 550 | 152 |
| 150 | 100 | 630 | 178 |
| 200 | 120 | 700 | 232 |
| 250 | 120 | 700 | 286 |
| 300 | 140 | 730 | 338 |
| 35 | 140 | 730 | 371 |
| 400 | 140 | 730 | 426 |
| 450 | 150 | 800 | 477 |
| 50 | 150 | 800 | 528 |
| 60 | 150 | 800 | 635 |
| 700 | 150 | 780 | 735 |
| 80 | 150 | 850 | 838 |

Single-use compensator is used where thermal pre-stressing cannot be carried out for practical reasons

## Part no.

7810-DN-000-000

## Order example

Single-use compensator for DN 200, part number 7810-200-000-000,
Associated sleeve is specified in Chapter 6.

## Reduction pipes

```
PN16 - standard
    PN25 - option
```



PART NO. 1571, 1572, 1573, 1574
KMAT 4900PP

| DN1 | L1 <br> [mm] |
| ---: | :--- |
| $25-50$ | 900 |
| $65-150$ | 1000 |
| 200 | 1100 |
| $250-800$ | 1500 |

Transition units are used for dimension transitions. An alternative to a transition unit is a steel cone + PEH reduction.

## Part no. series 1

1571-DN1-DN2-000

## Part no. series 2

1572-DN1-DN2-000

## Part no. series 3

1573-DN1-DN2-000

## Part no. series 4

1574-DN1-DN2-000

## NB

Consult with the designer to determine where the transition unit should be positioned and how large it can be.

## Order example

Reduction pipe Series 1 with dim DN 200 to DN 150, part number 1571-200-150-000. If PN25, this must be stated when ordering.


Straight pipes


Transition unit


Valve assembly, compact


Curved pipes


Transition valve


Bends


Preinsulated valves


T-pieces


Valve assembly, direct
Vent/drain


Straight pipe, super insulated


Anchor units


## Straight pipe, standard (Series 1)

PN25


PART NO. 1503, 1504, 1505
KMAT 2090PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight [kg/m] | Water content [ $1 / \mathrm{m}$ ] | $\begin{aligned} & \mathrm{C} \\ & {[\mathrm{~mm}]} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $125 \times 3.0$ | 6.1 | 0.8 | 19 |
| 25 | $33.7 \times 2.6$ | $140 \times 3.0$ | 7.1 | 1.2 | 19 |
| 32 | $42.4 \times 2.6$ | $160 \times 3.0$ | 9.1 | 2.2 | 19 |
| 40 | $48.3 \times 2.6$ | $160 \times 3.0$ | 9.6 | 3.0 | 19 |
| 50 | $60.3 \times 2.9$ | $200 \times 3.2$ | 13.1 | 4.6 | 20 |
| 65 | $76.1 \times 2.9$ | $225 \times 3.4$ | 16.5 | 7.0 | 20 |
| 80 | $88.9 \times 3.2$ | $250 \times 3.6$ | 20.7 | 10.6 | 25 |
| 100 | $114.3 \times 3.6$ | $315 \times 4.1$ | 30.7 | 18.0 | 25 |
| 125 | $139.7 \times 3.6$ | $400 \times 4.8$ | 41.5 | 27.6 | 30 |
| 150 | $168.3 \times 4.0$ | $450 \times 5.2$ | 51.0 | 40.4 | 40 |
| 200 | $219.1 \times 4.5$ | $560 \times 6.0$ | 76.0 | 69.4 | 45 |

For heat losses and transmission capacity see p. 9:301-

Powerpipe's double pipes are normally laid with the supply pipe at the bottom.

Part no. Standard, 12 m: 1503-DN-000-000 can be ordered from dim DN 20-DN200 Part no. Standard, 16 m : 1504-DN-000-000 can be ordered from dim DN100-DN200 Part no. Standard, 18 m: 1505-DN-000-000 can be ordered from dim DN150-DN200

Can also be ordered in 6 m lengths: 1502-DN-000-000

## Order example

Straight pipe Double Standard, L1 = 12 m with dim DN 200, part number 1503-200-000-000.

## Straight pipe, double+ (Series 2)

PN25



PART NO. 1603, 1604, 1605
KMAT 2090PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight <br> [kg/m] | Water content [l/m] | $\begin{aligned} & \mathrm{C} \\ & {[\mathrm{~mm}]} \end{aligned}$ | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $140 \times 3.0$ | 6.7 | 0.8 | 19 |  |
| 25 | $33.7 \times 2.6$ | $160 \times 3.0$ | 7.8 | 1.2 | 19 |  |
| 32 | $42.4 \times 2.6$ | $180 \times 3.0$ | 9.9 | 2.2 | 19 |  |
| 40 | $48.3 \times 2.6$ | $180 \times 3.0$ | 10.3 | 3.0 | 19 |  |
| 50 | $60.3 \times 2.9$ | $225 \times 3.4$ | 14.0 | 4.6 | 20 |  |
| 65 | $76.1 \times 2.9$ | $250 \times 3.6$ | 17.6 | 7.0 | 20 |  |
| 80 | $88.9 \times 3.2$ | $280 \times 3.9$ | 22.8 | 10.6 | 25 |  |
| 100 | $114.3 \times 3.6$ | $355 \times 4.5$ | 33.9 | 18.0 | 25 |  |
| 125 | $139.7 \times 3.6$ | $450 \times 5.2$ | 46.3 | 27.6 | 30 |  |
| 150 | $168.3 \times 4.0$ | $500 \times 5.6$ | 56.5 | 40.4 | 40 |  |
| 200 | $219.1 \times 4.5$ | $630 \times 6.6$ | 82.9 | 69.4 | 45 |  |

Powerpipe's double pipes are normally laid with the supply pipe at the bottom.

Part no. Double+, 12 m: 1603-DN-000-000 can be ordered from dim DN 20-DN200 Part no. Double+, $16 \mathrm{~m}: 1604-$ DN-000-000 can be ordered from dim DN100-DN200 Part no. Double+, 18 m: 1605-DN-000-000 can be ordered from dim DN150-DN200

Can also be ordered in 6 m lengths: 1602-DN-000-000

## Order example

Straight pipe Double+ Series 2, L1 = 12 m with dim DN 200, part number 1603-200-000-000.

## Straight pipe, double++ (Series 3)

PN25



PART NO. 1703, 1704, 1705
KMAT 2090PP

| DN | Service pipe DYxS [mm] | Casing DYxS [mm] | Weight [kg/m] | Water content [I/m] | C <br> [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | $160 \times 3.0$ | 7.4 | 0.8 | 19 |
| 25 | $33.7 \times 2.6$ | $180 \times 3.0$ | 8.5 | 1.2 | 19 |
| 32 | $42.4 \times 2.6$ | $200 \times 3.2$ | 10.6 | 2.2 | 19 |
| 40 | $48.3 \times 2.6$ | $200 \times 3.2$ | 11.1 | 3.0 | 19 |
| 50 | $60.3 \times 2.9$ | $250 \times 3.6$ | 15.1 | 4.6 | 20 |
| 65 | $76.1 \times 2.9$ | $280 \times 3.9$ | 19.7 | 7.0 | 20 |
| 80 | $88.9 \times 3.2$ | $315 \times 4.1$ | 24.9 | 10.6 | 25 |
| 100 | $114.3 \times 3.6$ | $400 \times 4.8$ | 37.8 | 18.0 | 25 |
| 125 | $139.7 \times 3.6$ | $500 \times 5.6$ | 51.8 | 27.6 | 30 |
| 150 | $168.3 \times 4.0$ | $560 \times 6.0$ | 63.7 | 40.4 | 40 |
| 200 | $219.1 \times 4.5$ | $710 \times 7.2$ | 91.2 | 69.4 | 45 |

For heat losses and transmission capacity see p. 9:301-
*) Is also available with jacket pipe $180 \times 3.0$
Powerpipe's double pipes are normally laid with the supply pipe at the bottom.

Part no. Double++, 12 m: 1703-DN-000-000 can be ordered from dim DN 20-DN200
Part no. Double++, 16 m : 1704-DN-000-000 can be ordered from dim DN100-DN200
Part no. Double++, 18 m: 1705-DN-000-000 can be ordered from dim DN150-DN200
Can also be ordered in 6 m lengths: 1702-DN-000-000

## Order example

Straight pipe Double++, L1 $=12 \mathrm{~m}$ with dim DN $2 \times 200$, part number 1703-200-000-000.

## Cut-to-length pipes Series 1, 2 and 3

PN25

KMAT 2496PP


PART NO. 1513, 1613, 1713 (12m), 1514, 1614, 1714 (16 m)

## $\mathrm{L}=12 \mathrm{~m}$

## Part no.

1513-DN-000-000 (STANDARD)
1613-DN-000-000 (DOUBLE+)
1713-DN-000-000 (DOUBLE++)

## $\mathrm{L}=16 \mathrm{~m}$

## Part no.

1514-DN-000-000 (STANDARD)
1614-DN-000-000 (DOUBLE+)
1714-DN-000-000 (DOUBLE++)

## General

Cut-to-length pipes are manufactured for all dimensions. In these pipes, the steel pipe is clad with foil every other metre, allowing the insulation material to be removed easily. The parts covered with foil are clearly marked on the outside of the casing. The entire cut-to-length pipe or parts of it can be installed at any point in the system.
For other information, see Straight pipes.

## Order example

Cut-to-length pipe, Double pipe, DN $2 \times 100$, STANDARD, part number 1513-100-000-000.

## Curved pipes

Series 1, 2 and 3

PN25


PART NO. 1523, 1623, 1723 (12 m)
PART NO. 1524, 1624, 1724 (16 m)

## KMAT 2095PP

| Double pipes | Maximum deflection |  |  |
| :--- | :--- | :--- | :--- |
| DN | $\mathbf{L 1 = \mathbf { 1 2 ~ m }}$ | $\mathbf{L 1}=\mathbf{1 6} \mathbf{~ m}$ | Note |
|  |  |  |  |
| $25-65$ | $30^{\circ}$ |  | Bent on site |
| 80 | $35^{\circ}$ | Bent in the factory |  |
| 100 | $30^{\circ}$ | $18^{\circ}$ | Bent in the factory |
| 125 | $32^{\circ}$ | $21^{\circ}$ | Bent in the factory |
| 150 | $32^{\circ}$ | $24^{\circ}$ | Bent in the factory |
| 200 | $27^{\circ}$ | $30^{\circ}$ | Bent in the factory |
|  |  |  |  |
| Manufacturing tolerance | DN $2 \times 80-2 \times 200$ | $+/-2^{\circ}$ |  |

Curved pipes are manufactured for horizontal deflection. For vertical deflection, see page "Profile bends".

## Part no. (applies to 12 m)

1523-DN-xxx-000 (STANDARD)
1623-DN-xxx-000 (DOUBLE+)
1723-DN-xxx-000 (DOUBLE++)
xXX = Degrees

## Order example

Curved pipe Double pipe, L1 $=12 \mathrm{~m}$ with $\operatorname{dim}$ DN $2 \times 100$, STANDARD, bend $15^{\circ}$, part number 1523-100-015-000.

## Curved pipes <br> Deflection Design radius

PN25



## RELATIONSHIP BETWEEN DEFLECTION AND DESIGN RADIUS

| Deflection | Design radius $\mathrm{L}=12 \mathrm{~m}$ | Deflection | Design radius $\mathrm{L}=12 \mathrm{~m}$ |
| :---: | :---: | :---: | :---: |
| $1^{\circ}$ | 690 | $21^{\circ}$ | 33.0 |
| $2^{\circ}$ | 345 | $22^{\circ}$ | 31.0 |
| $3^{\circ}$ | 230 | $23^{\circ}$ | 30.0 |
| $4^{\circ}$ | 170 | $24^{\circ}$ | 29.0 |
| $5^{\circ}$ | 140 | $25^{\circ}$ | 28.0 |
| $6^{\circ}$ | 115 | $26^{\circ}$ | 27.0 |
| $7{ }^{\circ}$ | 98 | $27^{\circ}$ | 26.0 |
| $8^{\circ}$ | 86 | $28^{\circ}$ | 25.0 |
| $9^{\circ}$ | 76 | $29^{\circ}$ | 24.0 |
| $10^{\circ}$ | 69 | $30^{\circ}$ | 23.2 |
| $11^{\circ}$ | 62 | $31^{\circ}$ | 22.5 |
| $12^{\circ}$ | 57 | $32^{\circ}$ | 21.8 |
| $13^{\circ}$ | 53 | $33^{\circ}$ | 21.1 |
| $14^{\circ}$ | 49 | $34^{\circ}$ | 20.5 |
| $15^{\circ}$ | 46 | $35^{\circ}$ | 20.0 |
| $16^{\circ}$ | 43 | $36^{\circ}$ | 19.4 |
| $17^{\circ}$ | 40 | $37^{\circ}$ | 18.9 |
| $18^{\circ}$ | 38 | $38^{\circ}$ | 18.4 |
| $19^{\circ}$ | 36 | $39^{\circ}$ | 18.0 |
| $20^{\circ}$ | 34 | $40^{\circ}$ | 17.5 |

For technical reasons, pipes cannot be bent along their entire length. Some straight pipe occurs at each pipe end. For $\mathrm{DN}<100,1-1.5 \mathrm{~m}$ and for $\mathrm{DN} \geq 100$ approx. 2 m .

This deviation from the ideal radius can be compensated for by making the pipe trench wider at the centre of the pipe.

The extra width should $\mathrm{be} \approx 200 \mathrm{~mm}$ for a deflection of $<10^{\circ}$
The extra width should be $\approx 500 \mathrm{~mm}$ for a deflection of $>10^{\circ}$

## Curved pipes

 Elastic radiusPN25


## ELASTIC RADIUS

| DN | Elastic radius <br> $\mathbf{m}$ | Deflection/ <br> $\mathbf{1 2 ~} \mathbf{~}$ |
| :--- | :--- | :--- |
| 25 | 15 | $45^{\circ}$ |
| 32 | 19 | $35^{\circ}$ |
| 40 | 21 | $31^{\circ}$ |
| 50 | 27 | $25^{\circ}$ |
| 65 | 34 | $20^{\circ}$ |
| 80 | 40 | $17^{\circ}$ |
| 100 | 52 | $13^{\circ}$ |
| 125 | 63 | $11^{\circ}$ |
| 150 | 76 | $9^{\circ}$ |
| 200 | 98 | $7^{\circ}$ |

The table above shows the elastic radius, i.e. when the steel pipe is plasticised. In other words, this is the least deflection that can be manufactured while retaining the form.

## DOUBLE PIPES

## Straight pipe, super insulated hybrid pipe with vacuum panel <br> Series 1, 2 and 3

PN25

PART NO. 1503, 1603, 1703


| DN | Service pipe <br> DYxS [mm] | Casing <br> S1/S2/S3 <br> DYxS [mm] | $\begin{aligned} & \mathrm{C} \\ & {[\mathrm{~mm}]} \end{aligned}$ | For heat losses and transmission capacity see p. 9:301- |
| :---: | :---: | :---: | :---: | :---: |
| 20 | $26.9 \times 2.6$ | 125 / 140 / 160 *) | 19 |  |
| 25 | $33.7 \times 2.6$ | 140/160/180 | 19 |  |
| 32 | $42.4 \times 2.6$ | 160/180/200 | 19 |  |
| 40 | $48.3 \times 2.6$ | 160/180/200 | 19 |  |
| 50 | $60.3 \times 2.9$ | 200/225/250 | 20 |  |
| 65 | $76.1 \times 2.9$ | 225/250/250 | 20 |  |
| 80 | $88.9 \times 3.2$ | 250/280/315 | 25 |  |
| 100 | $114.3 \times 3.6$ | 315/355/400 | 25 |  |
| 125 | $139.7 \times 3.6$ | 400/450/500 | 30 |  |
| 150 | $168.3 \times 4.0$ | 450/500/500 | 40 |  |

*) Is also available with casing 180
In the super insulated and patented pipe, the supply pipe is equipped with a high insulated vacuum panel. This reduces thermal losses from the supply pipe by $50 \%$, while losses from the entire construction are reduced by $30 \%$ given temperatures in the supply and return pipes and ground as stated in Chapter 9.
The product fulfils the requirements in EN 15698-1 and EN 253.
The pipe type is relatively compact but still highly efficient and effectively reduces the installation's life cycle cost.

## Order example

Super insulated pipe Double++ Dn2x100, part no. 1703-100-000-857

## DOUBLE PIPES

## Bend - Horizontal

## PN25



PART NO. 2500, 2600, 2700
KMAT 2590PP

|  |  | STANDARD $2500$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 2600 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 2700 \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DN | Service pipe Dyxs [mm] | Casing DY [mm] | Casing DY [mm] | Casing DY [mm] | $\begin{aligned} & \text { L1 } \\ & {[\mathrm{mm}]} \end{aligned}$ |
| 20 | $26.9 \times 2.0$ | 125 | 140 | 160* | 1000 |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 | 1000 |
| 32 | $42.4 \times 2.6$ | 160 | 180 | 200 | 1000 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 1000 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 1000 |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 1000 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 1000 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 1000 |
| 125 | $139.7 \times 3.6$ | 400 | 450 | 500 | 1000 |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 1500 |
| 200 | $219.1 \times 4.5$ | 560 | 630 | 710 | 1500 |

*) Is also available with casing 180 (KMAT 2800PP)

## The standard bend is $9 \mathbf{0}^{\circ}$

Other bends, such as $75^{\circ}, 60^{\circ}, 45^{\circ}, 30^{\circ}$ and $15^{\circ}$ and/or other leg lengths can be supplied on request

## Part no.

2500-DN-degrees-000 (STANDARD)
2600-DN-degrees-000 (DOUBLE+)
2700-DN-degrees-000 (DOUBLE++)

## Space for sleeve

To have space for the sleeve when installing $D N \leq 2 \times 125$, an extended leg $1500 \times 1500 \mathrm{~mm}$ is available. State suffix -302

## Order example

Curved double pipe with dim DN $2 \times 80,90^{\circ}$, standard version, part number 2500-080-900-000.

## Termination bend - Vertical

```
PN25
```



TERMINATION BEND 2510, 2610, 2710

|  |  | STANDARD $2510$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 2610 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 2710 \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN | Service pipe <br> Dyx s [mm] | Casing DY [mm] | Casing DY [mm] | Casing DY [mm] | $\begin{aligned} & \mathrm{L} 1 \\ & {[\mathrm{~mm}]} \end{aligned}$ | $\begin{aligned} & \mathrm{L} 2 \\ & {[\mathrm{~mm}]} \end{aligned}$ |
| 20 | $26.9 \times 2.0$ | 125 | 140 | 160* | 1500 | 1500 |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 | 1500 | 1500 |
| 32 | $42.4 \times 2.6$ | 160 | 180 | 200 | 1500 | 1500 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 1500 | 1500 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 1500 | 1500 |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 1500 | 1500 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 1500 | 1500 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 1500 | 1500 |
| 125 | $139.7 \times 3.6$ | 400 | 450 | 500 | 1500 | 1500 |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 1500 | 1500 |

Termination bends are delivered as standard with $a=90^{\circ}$ deflection. Other leg lengths and other deflections can be supplied upon request.
The termination bend is also available in a version with riser rotation $90^{\circ}$. See figure below.

## Part no.

2510-DN-000-000 (STANDARD)
2610-DN-000-000 (DOUBLE+)
2710-DN-000-000 (DOUBLE++)
Can be ordered with end cap (suffix -811) with accessible alarm wires, see Chapter 8.

Pipe under - right, suffix -032
Pipe under - left, suffix -031

## Order example

Termination bend double pipe with dim DN $2 \times 50$, standard version under - riser right, part number 2510-050-000-032.

NB Plastic protection should be retained until installation takes place.


## Connection bend for façade installation, DN 20-25

PN 16/PN25

PART NO. 2540, 2640, 2740
KMAT 2593PP


|  | Service pipe <br> Dy $\boldsymbol{x}$ [mm] | Double++ <br> $\mathbf{2 7 4 0}$ <br> Casing Dy $[\mathbf{m m}]$ |
| :--- | :--- | :--- |
|  |  |  |
| 20 | $26.9 \times 2.0$ | 160 |
| 25 | $33.7 \times 2.3$ | 180 |

L1, L2 and H are stated separately in the order.
Connector bend for façade installation is supplied with valve with extended neck. Red control is installed on the supply pipe, blue on the return pipe. As standard with shut off valve ending in copper pipe. The connection bend can be supplied with increased leg length - max. 6 m . Can be supplied in $30^{\circ}$ angled version and in dimensions larger than DN 25.

## Part no.

2740-DN-xxx-xxx (DOUBLE++)

NB Plastic protection should be retained until installation takes place.

## Order example

Connection valve for façade installation, DN $2 \times 25$ with handle right, part no. 2740-025-xxx-032

## Profile bends

PROFILE BENDS 2520, 2620, 2720

| DN | Service pipe Dyxs [mm] | STANDARD <br> 2520 <br> Casing <br> DY [mm] | $\begin{aligned} & \text { DOUBLE+ } \\ & 2620 \\ & \text { Casing } \\ & \text { DY [mm] } \end{aligned}$ | ```DOUBLE++ 2720 Casing DY [mm]``` |
| :---: | :---: | :---: | :---: | :---: |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 |
| 32 | $42.4 \times 2.6$ | 160 | 180 | 200 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 |
| 125 | $139.7 \times 3.6$ | 400 | 450 | 500 |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 |
| 200 | $219.1 \times 4.5$ | 560 | 630 | 710 |

The bend is available with a choice of angle.


KMAT 2594PP

180
200
200
250
280
400
500

710

NB Plastic protection should be retained until installation takes place.

## Part no.

2520-DN-xxx-000 (STANDARD)
2620-DN-xxx-000 (DOUBLE+)
2720-DN-xxx-000 (DOUBLE++)
$x x x=$ Degrees.

## Order example

Profile bend double pipe with dim DN $2 \times 80$. version with $8^{\circ}$ deflection. part number 2520-080-008-000.

## Bend out of plane

## PN25

PART NO. 2530, 2630, 2730

|  |  | STANDARD $2530$ | $\begin{aligned} & \text { DOI } \\ & 263 \end{aligned}$ | $\begin{aligned} & \text { JBLE } \\ & 0 \end{aligned}$ |  |  | LE++ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN | Service pipe Dy x s [mm] | Casing DY [mm] |  | ng mm] |  |  |  |  | $\begin{aligned} & \mathrm{L} 1 \times \mathrm{L} \\ & \text { [mm] } \end{aligned}$ |  |  |
| 25 | $33.7 \times 2.3$ | 140 | 160 |  |  | 180 |  |  | $1000 \times$ | 000 |  |
| 32 | $42.4 \times 2.6$ | 160 | 180 |  |  | 200 |  |  | $1000 \times$ | 000 |  |
| 40 | $48.3 \times 2.6$ | 160 | 180 |  |  | 200 |  |  | $1000 \times$ | 000 |  |
| 50 | $60.3 \times 2.9$ | 200 | 225 |  |  | 250 |  |  | $1000 \times$ | 000 |  |
| 65 | $76.1 \times 2.9$ | 225 | 250 |  |  | 280 |  |  | $1000 \times$ | 000 |  |
| 80 | $88.9 \times 3.2$ | 250 | 280 |  |  | 315 |  |  | $1000 \times$ | 000 |  |
| 100 | $114.3 \times 3.6$ | 315 | 355 |  |  | 400 |  |  | $1000 \times$ | 000 |  |
| 125 | $139.7 \times 3.6$ | 400 | 450 |  |  | 500 |  |  | $1000 \times$ | 000 |  |
| 150 | $168.3 \times 4.0$ | 450 | 500 |  |  | 560 |  |  | $1500 \times$ | 500 |  |
| 200 | $219.1 \times 4.5$ | 560 | 630 |  |  | 710 |  |  | $1500 \times$ | 500 |  |
| $90^{\circ}$ bend out of plane to absorb changes in profile direction. Standard angle in plane is $90^{\circ}$. Choice of profile deflection. |  | $\mathrm{a}^{\circ}$ |  | 3 | 5 | 7.5 | 10 | 12.5 | 15 | 20 | 25 |
|  |  | h, vertical [mm] where $L=1000 \mathrm{~mm}$ |  | 50 | 90 | 130 | 170 | 215 | 260 | 340 | 420 |
|  |  | x) h, vertical [mm] where $L=1500 \mathrm{~mm}$ |  | 80 | 130 | 195 | 260 | 325 | 390 | 515 | 635 |

## Part no.

2530-DN-000-032
2530-DN-000-031

2630-DN-000-032
2630-DN-000-031

2730-DN-000-032
2730-DN-000-031

STANDARD, right-hand version
STANDARD, left-hand version
DOUBLE+, right-hand version DOUBLE+, left-hand version

DOUBLE ++ , right-hand version
DOUBLE++, left-hand version

NB Plastic protection should be retained until installation takes place.

## Order example

Bend double pipe with dim DN $2 \times 80,90^{\circ}$, right-hand version, part number 2530-080-000-032. Angle for deviation in profile is stated in separate row. Angle a in the figure is calculated as positive, i.e. upwards in the above image. Negative angle for downwards.

## T-piece

PN25

PART NO. 3510, 3610, 3710
KMAT 3490PP


|  |  |  | STANDARD <br> $\mathbf{3 5 1 0}$ | DOUBLE+ <br> $\mathbf{3 6 1 0}$ | DOUBLE++ <br> $\mathbf{3 7 1 0}$ |  |
| :--- | :--- | :--- | ---: | :--- | :--- | :--- |
| Main pipe | L1 | L2 |  | Casing <br> Dy <br> DN | [mm] | Casing <br> Dy [mm] |
|  |  |  |  | Casing <br> Dy [mm] |  |  |
| DN25-40 | 1100 | 700 | 25 | 140 | 160 |  |
| DN50-65 | 1200 | 700 | 32 | 160 | 180 | 200 |
| DN80-100 | 1300 | 700 | 40 | 160 | 180 | 200 |
| DN125 | 1500 | 750 | 50 | 200 | 225 | 250 |
| DN150 | 1600 | 800 | 65 | 225 | 250 | 280 |
| DN200 | 1700 | 1000 | 80 | 250 | 280 | 315 |
|  |  |  | 100 | 315 | 355 | 400 |
|  |  |  | 125 | 400 | 450 | 500 |
|  |  | 150 | 450 | 500 | 560 |  |
|  |  | 200 | 560 | 630 | 710 |  |

T-pieces are delivered in reinforced version and with increased wall thickness.
Branches can be designed without expansion bends. A branch cannot be designed with dimensions larger than the main pipe.

## Space for sleeve

To safely have space for the sleeve during installation of the T-piece, the product is available in extended version.
State L1 and L2 when ordering.

## Part no.

3510-DN main pipe-DN branch-000 (STANDARD)
3610-DN main pipe-DN branch-000 (DOUBLE+)
3710-DN main pipe-DN branch-000 (DOUBLE++)

## Order example

T-piece double pipe with main pipe DN $2 \times 100$ and branch DN 2x50, standard version, part number 3510-100-050-000.
Or (extended T-piece), part number 3510-100-050-XXX with associated L1 and L2.

## Cross-piece

```
PN25
```



PART NO. 3570, 3670, 3770

|  |  |  | STANDARD $3570$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 3670 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 3770 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Main pipe DN | Branch DN | DN | Casing Dy [mm] | Casing Dy [mm] | Casing Dy [mm] |
| 25-200 | 25-65 | 25 | 140 | 160 | 180 |
|  |  | 32 | 160 | 180 | 200 |
|  |  | 40 | 160 | 180 | 200 |
|  |  | 50 | 200 | 225 | 250 |
|  |  | 65 | 225 | 250 | 280 |
|  |  | 80 | 250 | 280 | 315 |
|  |  | 100 | 315 | 355 | 400 |
|  |  | 125 | 400 | 450 | 500 |
|  |  | 150 | 450 | 500 | 560 |
|  |  | 200 | 560 | 630 | 710 |

T-pieces are delivered in reinforced version and with increased wall thickness.
Branches can be designed without expansion bends. A branch cannot be designed with dimensions larger than the main pipe.
Can also be supplied with branches in different dimensions, upon request

## Part no.

3570-DN main pipe-DN branch-000 (STANDARD) 3670-DN main pipe-DN branch-000 (DOUBLE + )
3770-DN main pipe-DN branch-000 (DOUBLE++)

## Order example

Cross-piece double pipe in standard version with main pipe DN $2 \times 65$ and branch DN $2 \times 32$, part number 3570-065-032-000.


## T-piece with vertical deflection

| PN25 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| PART NO. 3510, 3610, 3710 |  |  |  | L2 from the centre of the main pipe <br> KMAT 3491PP |  |  |  |
|  |  |  |  |  | STANDARD $3510$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 3610 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 3710 \end{aligned}$ |
| Main pipe DN | Branch DN | $\begin{aligned} & \text { L1 } \\ & {[\mathrm{mm}]} \end{aligned}$ | $\begin{aligned} & \mathrm{L} 2 \\ & {[\mathrm{~mm}]} \end{aligned}$ | DN | Casing Dy [mm] | Casing Dy [mm] | Casing Dy [mm] |
| 25-100 | 25-100 | 1200 | 1000 | 25 | 140 | 160 | 180 |
| 125-200 | 25-100 | 1200 | 1200 | 32 | 160 | 180 | 200 |
| 125-200 | 125-200 | 1500 | 1500 | 40 | 160 | 180 | 200 |
|  |  |  |  | 50 | 200 | 225 | 250 |
|  |  |  |  | 65 | 225 | 250 | 280 |
|  |  |  |  | 80 | 250 | 280 | 315 |
|  |  |  |  | 100 | 315 | 355 | 400 |
|  |  |  |  | 125 | 400 | 450 | 500 |
|  |  |  |  | 150 | 450 | 500 | 560 |
|  |  |  |  | 200 | 560 | 630 | 710 |

H= Dy main pipe +50 mm (assuming that the parallel pipe has the same dim).
T-pieces are delivered in reinforced version.
A branch cannot be designed with dimensions larger than the main pipe.
NB The branch pipe on the T-piece with bend out of plane may need an expansion bend.

## Part no.

3510-DN main pipe-DN branch-238 (STANDARD)
3610-DN main pipe-DN branch-238 (DOUBLE+)
3710-DN main pipe-DN branch-238 (DOUBLE++)

## Order example

T-piece double pipe in standard version
with main pipe DN $2 \times 100$ and branch DN $2 \times 50$, part number 3510-100-050-238.

## Transition T-piece Double/single

PN25



PART NO. 3520, 3620, 3720
KMAT 3492PP

| Main pipe <br> DN | Branch <br> [mm] | L1 <br> $\mathbf{[ m m}]$ | L2 <br> [mm] | Branch | c/c |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |
| DN $2 \times 25-200$ | DN20-80 | 1500 | 700 | 20 | 310 |
|  |  |  | 25 | 310 |  |
|  |  | 32 | 325 |  |  |
|  |  |  | 40 | 325 |  |
|  |  |  | 50 | 340 |  |
|  |  | 65 | 360 |  |  |
|  |  |  | 80 | 380 |  |

For combinations where the branch is relatively large compared to the main pipe and a cast T-piece is used, the length can be longer.

The T-piece is delivered in reinforced version. The branch can be designed without expansion bends, in the case of thermal pre-stressing.

Standard version has branch 3520 in Series 2. 3620=S3, $3720=$ S4.

## Part no.

3520-DN main pipe-DN branch-000 (STANDARD)
3620-DN main pipe-DN branch-000 (DOUBLE+)
3720-DN main pipe-DN branch-000 (DOUBLE++)


## Order example

T-piece Double/single in standard version with main pipe DN $2 \times 65$ and branch DN 25 (Series 2), part number 3520-065-025-000.


## Reduction unit, angle Single pipe-Double pipe

PN25

PART NO. 1580, 1680, 1780
KMAT 3072PP


| Dim <br> DN | C-C <br> [mm] | L1 <br> [mm] | L2 <br> [mm] |
| :--- | :--- | :--- | :--- |
|  |  |  |  |
| 20 | 265 | 1586 | 1000 |
| 25 | 265 | 1586 | 1000 |
| 32 | 280 | 1593 | 1000 |
| 40 | 280 | 1610 | 1000 |
| 50 | 305 | 1630 | 1000 |
| 6 | 330 | 1603 | 700 |
| 8 | 360 | 1620 | 700 |
| 100 | 435 | 1740 | 700 |
| 125 | 530 | 1780 | 700 |
| 150 | 580 | 1835 | 700 |
| 200 | 710 | 2015 | 900 |

Used as a transition between double and single pipes
NB This solution cannot absorb axial forces or expansion movements from the single pipe.
Standard version has branch 1580 in Series 2. 1680=S3, 1780=S4.
Marked steel goes together.
For design engineering, see Chapter 9:402

## Part no.

1580-DN-000-031 (STANDARD)
1580-DN-000-032 (STANDARD)
1680-DN-000-031 (DOUBLE+)
1680-DN-000-032 (DOUBLE+)
1780-DN-000-031 (DOUBLE++)
1780-DN-000-032 (DOUBLE++)

## Order example

Transition unit, angle, DN $2 \times 50$, righthand flow, STANDARD, part number 1580-050-000-032.

*) Figure references $A, B, C$ and $D$ apply to part no. 4580, 4680, 4780

## Reduction unit, straight Single pipe-Double pipe

## PN25

| DN | C-C <br> $[\mathbf{m m}]$ | $\mathbf{L}$ <br> $[\mathbf{m m}]$ |
| ---: | :--- | :--- |
|  |  |  |
| 20 | 265 | 1973 |
| 25 | 265 | 1973 |
| 32 | 280 | 1971 |
| 40 | 280 | 1971 |
| 50 | 305 | 1969 |
| 65 | 330 | 1966 |
| 80 | 360 | 1962 |
| 100 | 435 | 1955 |
| 125 | 530 | 2500 |
| 150 | 580 | 2500 |
| 200 | 710 | 2500 |

Used as a transition between double and single pipes in the case of large expansion forces.
Standard version has branch 1590 in Series $2.1690=$ S3, 1790=S4. Marked steel goes together.
The transition pipe should be laid within the friction length corresponding to a pre-heated system, i.e. where max. axial stress is 160 mPa . See example in Chapter 9

## Part no.

1590 DN main pipe-000-032 right-hand flow STANDARD 1590 DN main pipe-000-031 left-hand flow STANDARD

1690 DN main pipe-000-032 right-hand flow DOUBLE+ 1690 DN main pipe-000-031 left-hand flow DOUBLE+

1790 DN main pipe-000-032 right-hand flow DOUBLE++ 1790 DN main pipe-000-031 left-hand flow DOUBLE++

## Order example

Transition unit, straight, DN 50, left-hand flow, standard version, part number 1590-050-000-031.


## DOUBLE PIPES

## Transition valve angle Single pipe-Double pipe

PN 16/PN25


PART NO. 4580, 4680, 4780
PART NO.4580,4680,4780

| DN | $\begin{aligned} & \mathrm{C}-\mathrm{C} \\ & {[\mathrm{~mm}]} \end{aligned}$ | $\begin{aligned} & \mathrm{L} 1 \text { * } \\ & {[\mathrm{mm}]} \end{aligned}$ | L2 [mm] | B <br> [mm] | H [mm] | Wrench size |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | 265 | 1600 | 1000 |  |  | 19 |
| 25 | 265 | 1600 | 1000 |  |  | 19 |
| 32 | 280 | 1600 | 1000 | 295 | 420 | 19 |
| 40 | 280 | 1700 | 1000 | 295 | 435 | 19 |
| 50 | 305 | 1700 | 1000 | 295 | 451 | 19 |
| 65 | 330 | 1800 | 700 | 295 | 463 | 19 ( 1) |
| 80 | 360 | 1900 | 700 | 295 | 484 | 19 |
| 100 | 435 | 1900 | 700 | 415 | 520 | 27 |
| 125 | 530 | 2500 | 700 | 415 | 540 | 27 |
| 150 | 580 | 3000 | 700 | 415 | 580 | 27 |
| 200 | 710 | 3200 | 900 |  |  | 50 2) |

H refers up to the shut-off device/main valve

* Approximate lengths

The alarm wire is accessible through the stainless end cap. Vent is done in DN 25. NOTE This solution cannot absorb axial forces or expansion movements from the single pipe. Standard version has branch 4580 in Series 2. $4680=S 3,4780=S 4$.

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

The valve is delivered with an end cap for the spindle as standard.
For installation, see 9:402
For positioning of transition valve angle, when ordering refer to one of images $A, B, C$ or $D$ in the description of part no. 1580, 1680, 1780.

## Part no.

4580-DN-000-031 (STANDARD) left-hand flow 4580-DN-000-032 (STANDARD) right-hand flow 4680-DN-000-031 (DOUBLE+) left-hand flow 4680-DN-000-032 (DOUBLE+) right-hand flow 4780-DN-000-031 (DOUBLE++) left-hand flow 4780-DN-000-032 (DOUBLE++) right-hand flow

## Ordering example

Transition valve, angle for DN2×50, left-hand flow, STANDARD, part number 4580-050-000-031


Outline diagram

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.

## Transition valve, straight Single pipe-Double pipe

PN 16/PN25

PART NO. 4590, 4690, 4790
KMAT 4298PP


|  | C-C | L1 | B | H (between centre of single pipe and upper edge of main valve) |
| :--- | :--- | :--- | :--- | :--- |
| DN | $[\mathrm{mm}]$ | $[\mathrm{mm}]$ | $[\mathrm{mm}]$ | $[\mathrm{mm}]$ |

$\left.\begin{array}{rllll}20 & & & \\ 25 & 270 & 2000 & 315 & 409 \\ 32 & 280 & 2300 & 315 & 419 \\ 40 & 280 & 2300 & 315 & 435 \\ 50 & 380 & 2400 & 315 & 451 \\ 65 & 420 & 2400 & 315 & 463 \\ 80 & 450 & 2400 & 315 & 483 \\ 100 & 540 & 2400 & 340 & 520 \\ 125 & 540 & 3150 & 355 & 540 \\ 150 & 750 & 3600 & 450 & 579 \\ 200 & 750 & 3600 & 500 & 650 \\ \hline\end{array}\right\}$

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

The alarm wire is accessible through the stainless end cap. Vent is done in DN 25.
The valve is delivered with an end cap for the spindle as standard.
The transition valve must be placed within 12-15 m from an expansion bend.

See other information under transition unit straight,
Part no. 1590, 1690, 1790.
In the images -031 and -032 on p. 4:306, the centre pot is placed on the upper side.

## Part no.

4590-DN-000-031 (STANDARD) left-hand flow 4590-DN-000-032 (STANDARD) right-hand flow 4690-DN-000-031 (DOUBLE+) left-hand flow 4690-DN-000-032 (DOUBLE+) right-hand flow 4790-DN-000-031 (DOUBLE++) left-hand flow 4790-DN-000-032 (DOUBLE++) right-hand flow

## Ordering example

Transition valve, straight for DN $2 \times 65$ left-hand flow (DOUBLE+) part number 4690-050-000-031.


Outline diagram

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.

## Preinsulated valves

PN 16/PN25

PART NO. 4500, 4600, 4700
KMAT 4290PP


|  |  | STANDARD 4500 | $\begin{aligned} & \text { DOUBLE+ } \\ & 4600 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 4700 \end{aligned}$ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Service pipe, 2 pcs | Casing | Casing | Casing | L | H | B | Wrench size |
| DN | Dyx s [mm] | DY [mm] | DY [mm] | DY [mm] | [mm] | [mm] | [mm] | [mm] |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 | 1800 | 409 | 150 | 19 |
| 32 | $42.4 \times 2.6$ | 160 | 180 | 200 | 1800 | 422 | 170 | 19 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 1800 | 435 | 170 | 19 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 1800 | 451 | 190 | 19 1) |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 1800 | 463 | 190 | 19 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 2600 | 483 | 190 | 19 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 2800 | 519 | 235 | 27 |
| 125 | $139.7 \times 3.6$ | 400 | 450 | 500 | 3200 | 540 | 295 | 27 ) |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 3400 | 578 | 295 | 27 2) |
| 200 | $219.1 \times 4.5$ | 560 | 630 | 710 | 3600 | 652 | 295 | 50 |

The alarm wires are accessible through the stainless steel end cap.
The valve is delivered with an end cap for the spindle as standard.

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

## Part no.

4500-DN-000-000 (STANDARD)
4600-DN-000-000 (DOUBLE+)
4700-DN-000-000 (DOUBLE++)

## Order example

Pre-insulated valve double pipe in standard version with dim DN $2 \times 100$, part number 4500-100-000-000.

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.

## Valve with single/ double vent

PN 16/PN25

KMAT 4291PP (enkel), KMAT 4292PP (dubbel)

PRE-INSULATED VALVE WITH SINGLE/DOUBLE VENT, 4541, 4542, 4641, 4642, 4741, 4742
$\left.\begin{array}{r|lll|llll}\hline & \begin{array}{l}\text { STANDARD } \\ \text { 4541, 4542 }\end{array} & \begin{array}{l}\text { DOUBLE+ } \\ \text { 4641, 4642 }\end{array} & \begin{array}{l}\text { DOUBLE++ } \\ \mathbf{4 7 4 1 , 4 7 4 2}\end{array} & & & & \\ \hline & \begin{array}{lllllll}\text { Casing } \\ \text { DY [mm] }\end{array} & \begin{array}{l}\text { Casing } \\ \text { DY [mm] }\end{array} & \begin{array}{l}\text { Casing } \\ \text { DY [mm] }\end{array} & \begin{array}{l}\text { L1 } \\ \text { [mm] }\end{array} & \begin{array}{l}\text { H } \\ \text { [mm] }\end{array} & \begin{array}{l}\text { B (double) } \\ \text { [mm] }\end{array} & \begin{array}{l}\text { Wrench size } \\ \text { [mm] }\end{array} \\ \hline \text { DN } & & & & & & & \\ \hline 25 & 140 & 160 & 180 & 2300 & 409 & 315 & 19 \\ \hline 32 & 160 & 180 & 200 & 2300 & 422 & 315 & 19 \\ 40 & 160 & 180 & 200 & 2300 & 440 & 315 & 19 \\ 50 & 200 & 225 & 250 & 2400 & 451 & 315 & 19 \\ 65 & 225 & 250 & 280 & 2400 & 463 & 315 & 19 \\ \hline 80 & 250 & 280 & 315 & 2600 & 483 & 315 & 19 \\ 100 & 315 & 355 & 400 & 2800 & 519 & 415 & 27 \\ \hline 125 & 400 & 450 & 500 & 3200 & 540 & 415 & 27 \\ \hline 150 & 450 & 500 & 560 & 3400 & 578 & 450 & 27\end{array}\right\}$

H refers up to the shut-off device/main valve
The alarm wires are accessible through the stainless steel end cap. Vent is carried out in DN25.
Vent on one side, part number 4541.
Vent on both sides, part number 4542.

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

The valve is delivered with an end cap for the spindle as standard.

## Part no.

4541-DN-000-000 (STANDARD) Single vent 4542-DN-000-000 (STANDARD) Double vent

4641-DN-000-000 (DOUBLE+) Single vent
4642-DN-000-000 (DOUBLE+) Double vent
4741-DN-000-000 (DOUBLE++) Single vent
4742-DN-000-000 (DOUBLE++) Double vent

## Order example

Pre-insulated valve with double vent in standard version DN 2x80, part number 4542-080-000-000.


Outline diagram

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.

## DOUBLE PIPES

## Combination valve, double-sided

PN 16/PN25



PART NO. 4845, 4846, 4847
KMAT 4294PP

$H$ refers up to the shut-off device/main valve
The alarm wires are accessible through the stainless end cap*. Delivered with venting in DN25 together with end cap for the spindle as standard.

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

* The outlet valve and outlet pipe are in stainless material.


## Part no.

4845-DN-000-000 (STANDARD)
4846-DN-000-000 (DOUBLE+)
4847-DN-000-000 (DOUBLE++)

## Order example

Pre-insulated valve double pipe in standard version with dim DN $2 \times 100$ and vent DN25, part number 4845-100-025-000.


## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.

Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

## DOUBLE PIPES

## Combination valve, single-sided

PN 16/PN25

PART NO. 4745, 4746, 4747
KMAT 4293PP


|  |  | STANDARD $4745$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 4746 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 4747 \end{aligned}$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN | Service pipe, 2 pcs <br> Dyx s [mm] | Casing DY [mm] | Casing DY [mm] | Casing DY [mm] | L1 [mm] | H [mm] | L2 [mm] | B [mm] | Wrench <br> size <br> [mm] |
|  |  |  |  |  |  |  |  |  |  |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 | 2300 | 409 | 700 | 415 | 19 |
| 32 | $42.4 \times 2.3$ | 160 | 180 | 200 | 2300 | 422 | 700 | 415 | 19 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 2400 | 435 | 700 | 415 | 19 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 2400 | 451 | 700 | 415 | 19 19 1) |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 2400 | 463 | 700 | 415 |  |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 2600 | 483 | 700 | 415 | 19 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 2800 | 519 | 700 | 415 | 27 |
| 125 | $139.7 \times 3.6$ | 400 | 455 | 500 | 3200 | 540 | 700 | 415 | 27 ) |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 3400 | 578 | 700 | 415 | 2750 |
| 200 | $219.1 \times 4.5$ | 560 | 630 | 710 | 3600 | 652 | 900 | 415 |  |

$H$ refers up to the shut-off device/main valve
The alarm wires are accessible through the stainless end cap*.

1) Supplied with mount for T-key
2) Supplied with mount for portable gear

Delivered with venting in DN25 together with end cap for the spindle as standard.

* The outlet valve and outlet pipe are in stainless material.


## Part no.

4745-DN-000-000 (STANDARD)
4746-DN-000-000 (DOUBLE+)
4747-DN-000-000 (DOUBLE++)
Right-hand version has suffix -032
Left-hand version has suffix -031.

## Order example

Pre-insulated valve double pipe in right-hand version with $\operatorname{dim}$ DN $2 \times 100$, part number 4745-100-000-032.


## NB

The valve must be operated at least twice a year in order to ensure good function.
For care instructions for valves, see Chapter 10.
Do not backfill above the sealing.
The sealing shall not lie continuously under water.
Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

## DOUBLE PIPES

## Valve assembly, compact

```
PN 16/PN25
```



PART NO. 4570, 4670, 4770

| DN | Standard <br> 4570 <br> Casing <br> Dy [mm] | Double+ 4670 <br> Dy [mm] | $\begin{aligned} & \text { Double++ } \\ & 4770 \\ & \text { Dy }[\mathrm{mm}] \end{aligned}$ | H* <br> Standard [mm] | H* <br> Min <br> [mm] | B <br> [mm] | L1 <br> [mm] | L2 <br> [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 25 | 140 | 160 | 180 | 382 | 190 | 488 | 850 | 520 |
| 32 | 160 | 180 | 200 | 388 | 200 | 521 | 965 | 560 |
| 40 | 160 | 180 | 200 | 401 | 200 | 533 | 885 | 570 |
| 50 | 200 | 225 | 250 | 411 | 210 | 569 | 1055 | 610 |

* H is measured from the centre of the single pipe.

The outlet pipe is manufactured in stainless material.
Alarm wires not accessible as standard, but can be ordered.


Outline diagram

## Part no.

4570-DN-000-000 (STANDARD)
Outlet right has suffix -032.
Outlet left has suffix -031

Valve assembly with minimal spindle height is stated separately. Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

## Order example

Valve assembly, compact, right standard version dim
DN 50, part number 4570-050-000-032.

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not refill above the end cap.
The end cap shall not lie continuously under water.

Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

## Valve assembly, direct

PN 16/PN25

PART NO. 4575, 4675, 4775
KMAT 4297PP


|  |  | STANDARD $4575$ | $\begin{aligned} & \text { DOUBLE+ } \\ & 4675 \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 4775 \end{aligned}$ |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN | Dyx s [mm] | Casing <br> DY [mm] | Casing <br> DY [mm] | Casing <br> DY [mm] | L1 <br> [mm] | L2 <br> [mm] | Outlet DN <br> [mm] | Wrench size vent | B <br> [mm] | H <br> [mm] |
| 25 | $33.7 \times 2.3$ | 140 | 160 | 180 | 1500 | 585 | 25 | 19 | 340 | 480 |
| 32 | $42.4 \times 2.6$ | 160 | 180 | 200 | 1500 | 645 | 25 | 19 | 340 | 480 |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 1500 | 645 | 25 | 19 | 340 | 480 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 1500 | 555 | 25 | 19 | 340 | 480 |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 1500 | 565 | 25 | 19 | 340 | 480 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 1800 | 700 | 32 | 19 | 415 | 485 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 1800 | 960 | 40 | 27 | 415 | 485 |
| 125 | $139.9 \times 3.6$ | 400 | 450 | 500 | 1800 | 960 | 40 | 27 | 415 | 485 |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 1800 | 960 | 40 | 27 | 415 | 485 |

The unit can be used as both drain and vent.
The alarm wires are connected through the stainless end cap.
Outlet valve and outlet pipe in stainless material. The valve is delivered with an end cap for the spindle as standard.

## Part no.

4575-DN main pipe-000-000 (STANDARD)
4675-DN main pipe-000-000 (DOUBLE+)
4775-DN main pipe-000-000 (DOUBLE++)


Outline diagram

## Order example

Valve assembly left, double pipe in standard version with dim DN $2 \times 50$ (with vent/drain DN 25), part number 4575-050-000-000.

## NB

The valve must be operated at least twice a year in order to ensure good function. For care instructions for valves, see Chapter 10.

Do not backfill above the sealing.
The sealing shall not lie continuously under water.
Allow a valve on the bypass line to be open to permit expansion during heating or freezing.

## Vent/drain

PN 16/PN25



PART NO. 3540, 3640, 3740
KMAT 3790PP

| Main- <br> Service pipe DN [mm] | $\begin{aligned} & 2 \times \text { Dyxs } \\ & \text { [mm] } \end{aligned}$ | STANDARD 3540 <br> Casing <br> DY [mm] | $\begin{aligned} & \text { DOUBLE+ } \\ & 3640 \\ & \text { Casing } \\ & \text { DY [mm] } \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & 3740 \\ & \text { Casing } \\ & \text { DY }[\mathrm{mm}] \\ & \hline \end{aligned}$ | $[\mathrm{mm}]$ | Vent/ drain DN [mm] | $\begin{aligned} & \mathrm{D} \\ & {[\mathrm{~mm}]} \end{aligned}$ | B <br> [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 40 | $48.3 \times 2.6$ | 160 | 180 | 200 | 467 | 25 | 110 | 325 |
| 50 | $60.3 \times 2.9$ | 200 | 225 | 250 | 479 | 40 | 110 | 325 |
| 65 | $76.1 \times 2.9$ | 225 | 250 | 280 | 495 | 50 | 125 | 325 |
| 80 | $88.9 \times 3.2$ | 250 | 280 | 315 | 510 | 65 | 140 | 340 |
| 100 | $114.3 \times 3.6$ | 315 | 355 | 400 | 535 |  |  |  |
| 125 | $139.7 \times 3.6$ | 400 | 450 | 500 | 563 |  |  |  |
| 150 | $168.3 \times 4.0$ | 450 | 500 | 560 | 596 |  |  |  |
| 200 | $219.1 \times 4.5$ | 560 | 630 | 710 | 649 |  |  |  |

Alarm wires not accessible. The sealing is manufactured in stainless material.
Vent/drains are available in dim. DN 25, DN 40, DN 50, DN 65 and are equipped with threaded plugs.
The valve is delivered with an end cap for the spindle as standard.

## Part no.

3540-DN main pipe-DN vent-000 (STANDARD)
3640-DN main pipe-DN vent-000 (DOUBLE+)
3740-DN main pipe-DN vent-000 (DOUBLE++)

## Order example

Vent double pipes with main pipe DN $2 \times 100$ in standard version and vent DN 25,
part number 3540-100-025-000.

## Anchor units

PN25



FIXED PIPE SECTION 1520, 1620, 1720
KMAT 4091PP

|  | STANDARD | DOUBLE+ | DOUBLE++ |
| ---: | :--- | :--- | :--- |
|  | $\mathbf{1 5 2 0}$ | $\mathbf{1 6 2 0}$ | $\mathbf{1 7 2 0}$ |
|  | Casing | Casing | Casing |
| DN | DY [mm] | DY [mm] | DY [mm] |
|  |  |  |  |
| 25 | 140 | 160 | 180 |
| 32 | 160 | 180 | 200 |
| 40 | 160 | 180 | 200 |
| 5 | 200 | 225 | 250 |
| 65 | 225 | 250 | 280 |
| 8 | 250 | 280 | 315 |
| 100 | 315 | 355 | 400 |
| 125 | 400 | 450 | 500 |
| 150 | 450 | 500 | 560 |
| 200 | 560 | 630 | 710 |

Pipe sections with double pipes and which do not end in bends, transition units, valves or T-pieces must be equipped with anchor points before heating/commissioning.
Alternatively, the steel pipe can be attached with fixation plates according to the manufacturer's instructions.

## Part no.

1520-DN-000-000 (STANDARD)
1620-DN-000-000 (DOUBLE+)
1720-DN-000-000 (DOUBLE++)

## Order example

Anchor point for DN $2 \times 50$ in standard version, ordering number 1520-050-000-000.

## Anchor units

PN25



## FIXED PIPE SECTION 5500, 5600, 5700

KMAT 4090PP

| DN | $\begin{aligned} & \text { Max load [kN] } \\ & \Delta T=60^{\circ} \mathrm{C} \end{aligned}$ | A [mm] | $\begin{aligned} & \mathbf{h} \\ & {[\mathrm{mm}]} \end{aligned}$ | Pressure area [ $\mathrm{cm}^{2}$ ] |
| :---: | :---: | :---: | :---: | :---: |
| 25 | 63 | 250 | 20 | 337 |
| 32 | 82 | 300 | 20 | 505 |
| 40 | 93 | 300 | 20 | 505 |
| 50 | 130 | 300 | 20 | 390 |
| 65 | 167 | 350 | 30 | 565 |
| 80 | 215 | 400 | 30 | 765 |
| 100 | 315 | 450 | 30 | 810 |
| 125 | 385 | 550 | 35 | 1120 |
| 150 | 515 | 650 | 40 | 1720 |
| 200 | 750 | 800 | 40 | 1950 |

The anchor unit is manufactured for casting in concrete. Quality K 250.
Design compression strength:
In concrete $5 \mathrm{MN} / \mathrm{m}^{2}$ ( $50 \mathrm{~kg} / \mathrm{cm}^{2}$ ), normal value.
In soil $0.15 \mathrm{MN} / \mathrm{m}^{2}\left(1.5 \mathrm{~kg} / \mathrm{cm}^{2}\right)$, normal value.
$\Delta T$ here refers the deviation in the pipes' current average temperature
$\qquad$ Tf $\times$ Tr)
2

Tp=supply pipe temperature
$\mathrm{Tr}=$ return pipe temperature

## Part no.

5500-DN-000-000 (STANDARD)
5600-DN-000-000 (DOUBLE+)
5700-DN-000-000 (DOUBLE++)

## Order example

Anchor unit for 2xDN 50 in standard version, part number 5500-050-000-000.

## Reduction pipes

```
PN16 - standard
PN25 - option
```



## KMAT 4990PP

| DN1 | L1 <br> [mm] |
| ---: | :--- |
| $25-40$ | 1100 |
| $50-100$ | 1200 |
| $125-200$ | 1500 |

The part is used for dimension transitions.
Alternatively the reduction can be carried out in the field with eccentric steel cones and reduction sleeves.

## Part no.

1575-DN1-DN2-000 (STANDARD)
1675-DN1-DN2-000 (DOUBLE+)
1775-DN1-DN2-000 (DOUBLE++)

## NB

Consult with the designer to determine where the transition unit should be positioned and how large it can be

## Order example

Transition unit for pipe DN $2 \times 50$ to DN $2 \times 40$ in standard version, part number 1575-050-040-000.
If PN25, this must be stated when ordering.


Straight pipe - district cooling


Trench and backfilling



Special pipes


Flexible pipe, steel


PEX, Alupex


District heating for individual homes


Flexible pipes


Installation of flexible pipes

## SPECIAL PIPES

## Pipe for District cooling, Series 0

PN25



PART NO. 1003, 1004

| DN | Service pipe Dy x s <br> [mm] | Casing DY [mm] | Weight [kg/m] | Water content [I/m] |
| :--- | :--- | :---: | :---: | :---: |
|  |  |  |  |  |
| 100 | $114.3 \times 3.6$ | 180 | 12.5 | 9.0 |
| 125 | $139.7 \times 3.6$ | 200 | 15.3 | 13.8 |
| 150 | $168.8 \times 4.0$ | 225 | 20.0 | 20.2 |
| 200 | $219.1 \times 4.5$ | 280 | 30.0 | 34.7 |
| 250 | $273.0 \times 5.0$ | 355 | 42.0 | 54.3 |
| 300 | $323.9 \times 5.6$ | 400 | 58.0 | 76.8 |
| 350 | $355.6 \times 5.6$ | 450 | 65.0 | 93.1 |
| 400 | $406.4 \times 6.3$ | 500 | 83.0 | 122.0 |
| 450 | $457.0 \times 6.3$ | 560 | 87.0 | 155.0 |
| 500 | $508.0 \times 6.3$ | 630 | 101.0 | 193.0 |
| 60 | $610.0 \times 7.1$ | 710 | 138.0 | 277.0 |
| 700 | $711.0 \times 7.1$ | 800 | 190.0 | 378.0 |
| 800 | $813.0 \times 8.8$ | 900 | 222.0 | 497.0 |
| 900 | $914.0 \times 10.0$ | 1000 | 261.0 | 627.0 |

## PART NO. 2100, 3100, 4100, 5100 etc.

Bends, T-pieces, Anchor points, Curved pipes and Valves manufactured with casing diameters as shown in the above table, with the exception of DN100 which is manufactured according to series 1 (see Chap. 3).

Part no. 12 m district cooling: $1003-\mathrm{DN}-000-000$
16 m district cooling: $1004-\mathrm{DN}-000-000$

## Part no.

2100-DN-degrees-000 (Bends)
3100-DN main pipe-DN branch-000 (T-piece)
4100-DN-000-000 (Valves) 5100-DN-000-000 (Anchor points)

## Order example

Straight pipe, district cooling, dim DN 500 in 16 m, part no. 1004-500-000-000

## SPECIAL PIPES

## Pipes for District cooling, Insulated pressure pipes PE, Series 1



PART NO. 1903, 1904

|  | SDR 17/PN10 | SDR11/PN16 |  |
| :--- | :--- | :--- | :--- |
| Service pipe | Service pipe | Casing |  |
| Dy pressure pipe | Wall thickness [mm] | Wall thickness $[\mathrm{mm}]$ | DY [mm] |


| 32 | 2.0 | 2.9 | 90 |
| ---: | ---: | ---: | ---: |
| 40 | 2.4 | 3.7 | 110 |
| 75 | 4.5 | 6.8 | 140 |
| 90 | 5.4 | 8.2 | 160 |
| 110 | 6.6 | 10.0 | 200 |
| 140 | 8.3 | 12.7 | 250 |
| 160 | 9.5 | 14.6 | 315 |
| 200 | 11.9 | 18.2 | 315 |
| 225 | 13.4 | 20.5 | 400 |
| 250 | 14.8 | 22.7 | 400 |
| 280 | 16.6 | 25.4 | 450 |
| 315 | 18.7 | 28.6 | 450 |
| 355 | 21.1 | 32.3 | 560 |
| 400 | 23.7 | 36.4 | 560 |
| 450 | 26.7 | 40.9 | 630 |
| 500 | 29.7 | 45.4 | 710 |
| 560 | 33.2 | 50.8 | 800 |
| 630 | 37.1 | 57.3 | 800 |
| 710 | 42.1 | 64.5 | 900 |
| 800 | 47.4 | 72.6 | 1000 |

12 m district cooling: 1903-DN-000-000
16 m district cooling: 1904-DN-000-000
According to EN 12001/EN 13244. The free end is stated when ordering, depending on the welding method on the service pipe.
Details such as bends,T-pieces, valves, etc. Part no. 2900, 3900, 4900 etc. Standard version without alarm wire, can be ordered with alarm wire of type 3DC.

When ordering, state the pressure class.

## Order example

Straight pipes, insulated pressure pipes, dim DN 560 in 16 m, part no. 1904-560-000-000

## SPECIAL PIPES

## Other types of special pipe system.

Powerpipe can produce many different types of pipe, not only for district heating or cooling.
The service pipe can be made of material such as stainless, PEH or other material, and the casing can be in PEH, galvanised spiral pipe, glass fibre reinforced, stainless etc. We also provide stainless steel insulated flexible pipes and connections of Casaflex type, single and double.

The insulation need not be in PUR, but can be made of mineral wool, for example.
Pipes can be produced with one or more conduits in the insulation, making it possible to lay, for example, an electric cable (heating cable), fibre etc.

Pipes can be produced to tolerate different temperatures and media in the service pipe, both to deal with higher or lower temperatures (standard $120^{\circ} \mathrm{C}$ ).

And of course this also applies to our pipe fittings and the rest of our range.

We can produce a number of different variants which we call special pipes.

Please contact our sales team or technical advisers if you have any questions.

## PEX and ALUPEX, insulated flexible pipes



## PEX - FLEX single and double pipes for heating

Powerpipe also has a range of insulated, flexible PEX and ALUPEX pipes with associated components. PEX-Flex is a pipe system for transporting liquid media such as district heating or coolant.

The pipe is supplied with two different service pipes: PEX-A and Alu-PEX. The pipes have the very best properties on the market when it comes to insulation and flexibility. Our manufacturing methods allow us to very easily customise different types of double pipes to optimise operation for our customers.

Our product range includes a complete system of couplings for service pipes, together with sleeves for joining the outer casing.
This range has obtained excellent values in tests of average heat losses, flexibility and long-term impact carried out by Dansk Teknisk Institut on behalf of Dansk Fjärrvärmeförening, the Danish District Heating Association.

The pipes are available in single, twin and double versions.
For more information, contact our sales team.


## SPECIAL PIPES

## 1. System description

Flexpipe is a flexible pre-insulated pipe system for temperatures up to $120^{\circ} \mathrm{C}$. The pipe is typically used for connecting individual homes to a larger pre-insulated pipe network which is normally made of steel.
The media pipe is made of copper and is very simple to use. The thermal insulation consists of flexible polyurethane insulation with excellent insulation properties.
The flexibility of Flexpipe means it can adapt to virtually any conditions in piping systems without problems. The tubes can pass intersecting pipelines either above or below. Other barriers can easily be passed during installation.
Flexpipe makes it possible to choose the shortest route without having to allow for conventional considerations. Flexpipe is delivered to the construction site in 100 metre coils. The pipes can usually be laid without branching in the pipe trench, which therefore can be minimum width. This provides significant cost reductions. Another advantage is that construction time is reduced.
The above advantages mean that Flexpipe isn't merely an excellent technical solution but also provides both time and cost savings.

## 2. Applications

Copper pipes: $\quad \max 120^{\circ} \mathrm{C} / \max 16 \mathrm{bar}$
Steel pipe: $\quad \max 120^{\circ} \mathrm{C} / \max 16$ bar

## 3. Specifications

3.1 Service pipes
3.2 Insulation
3.3 Casings

Casing is made of low density polyethylene (PEL)
Properties
Density $\quad 928-938 \mathrm{~kg} / \mathrm{m}^{3}$
Crystalline melt $\quad 105^{\circ} \mathrm{C}$
temperature

Yield strength $\quad 225 \mathrm{~N} / \mathrm{mm}^{2}$
Tensile strength $\quad 360 \mathrm{~N} / \mathrm{mm}^{2}$
Elastic modulus $\quad 205,000 \mathrm{~N} / \mathrm{mm}^{2}$
Coefficient of linear $\quad 12,3 \times 10^{-4} 1 /{ }^{\circ} \mathrm{C}$
expansion
$<140 \mathrm{~N} / \mathrm{mm}^{2}$
$220 \mathrm{~N} / \mathrm{mm}^{2}$
$125,000 \mathrm{~N} / \mathrm{mm}^{2}$
$16,6 \times 10^{-4} 1 /{ }^{\circ} \mathrm{C}$

Polyurethane foam made from polyol and isocyanate.
Propellant: Cyclopentane
Properties
Density $\quad>60 \mathrm{~kg} / \mathrm{m} 3$
Thermal conductivity $\quad 0.024 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$ (Copper, steel flex)
$0.025 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$ (Casaflex)
Number of closed cells >90\%
Water absorption <10\%

## Flexpipe 3E, copper



## SINGLE FLEX COPPER 3E

| Part no . | Service pipe <br> Dy x s <br> [mm] | Casing <br> Dy [mm] | Weight <br> [kg/m] | Water content [ $1 / \mathrm{m}$ ] | Transmission capacity [kW] $\Delta \mathrm{T}=50^{\circ} \mathrm{C}$, $\Delta p=1 \mathrm{mbar} / \mathrm{m}$ | Bend radius $\min m^{* *}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1366-018-000-820 | $18 \times 1.0$ | $90 \times 1.0$ | 1.2 | 0.201 | 13 | 0.9 |
| 1266-022-000-820 | 22x1,0 | $90 \times 1.0$ | 1.3 | 0.314 | 23 | 0.9 |
| 1366-022-000-820 | 22x1,0 | $110 \times 1.1$ | 1.3 | 0.314 | 23 | 1.1 |
| 1366-028-000-820 | 28x1,2 | $110 \times 1.1$ | 2.1 | 0.515 | 44 | 1.1 |
| 1466-028-000-820 | 28x1,2 | $125 \times 1.2$ | 2.6 | 0.515 | 44 | 1.2 |

## DOUBLE FLEX COPPER 3E

| Part no . | Service pipe <br> Dy x <br> [mm] | Casing <br> Dy [mm] | Weight <br> [kg/m] | Water content [ $1 / \mathrm{m}$ ] | Transmission capacity [kW] $\begin{aligned} & \Delta \mathrm{T}=50^{\circ} \mathrm{C} \\ & \Delta \mathrm{p}=1 \mathrm{mbar} / \mathrm{m} \end{aligned}$ | Bend radius $\min m^{* *}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1566-018-018-820 | $2 \times 18 \times 1.0$ | $90 \times 1.0$ | 1.7 | 0.402 | 13 | 0.9 |
| 1567-018-018-820 | $2 \times 18 \times 1.0$ | $110 \times 1.1$ | 1.7 | 0.402 | 13 | 1.1 |
| 1568-018-018-820 | $2 \times 18 \times 1.0$ | $125 \times 1.2$ | 2.2 | 0.402 | 13 | 1.2 |
| 1569-018-018-820 | $2 \times 18 \times 1.0$ | $160 \times 1.4$ | 2.6 | 0.402 | 13 | 1.5 |
| 1567-022-022-820 | $2 \times 22 \times 1.0$ | $110 \times 1.1$ | 2.4 | 0.628 | 23 | 1.1 |
| 1568-022-022-820 | $2 \times 22 \times 1.0$ | $125 \times 1.2$ | 2.8 | 0.628 | 23 | 1.2 |
| 1569-022-022-820 | $2 \times 22 \times 1.0$ | $160 \times 1.4$ | 3.2 | 0.628 | 23 | 1.5 |
| 1568-028-028-820 | $2 \times 28 \times 1.2$ | $125 \times 1.2$ | 3.1 | 1.03 | 44 | 1.2 |
| 1569-028-028-820 | $2 \times 28 \times 1.2$ | $160 \times 1.4$ | 3.9 | 1.03 | 44 | 1.5 |

$3 E$ Cu-Flex is a pipe system for transporting liquid media such as district heating or coolant. Max. $+120^{\circ} \mathrm{C}$ and 16 bar. The service pipe fulfils the requirements in DIN 17671 and EN 1057.
The flexpipe can be bent $10 \times$ casing diameter. The bend radius can be less than when using bending springs.

[^0]
## Order example

Double flex copper 3E 2x22 in 160 mantel. Part no. 1569-022-022-820

## Flexible pipe, copper



## SINGLEFLEX, COPPER 1366, 1266

| Part no . | Service pipe <br> Dyxs(mm) | Casing <br> DY (mm) | Weight $(\mathrm{kg} / \mathrm{m})$ | Water content $(1 / \mathrm{m})$ | Transmission capacity [kW] $\begin{aligned} & \Delta \mathrm{T}=50^{\circ} \mathrm{C} \\ & \Delta \mathrm{p}=1 \mathrm{mbar} / \mathrm{m} \end{aligned}$ | Bend radius <br> $\min m$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1366-022 | $22 \times 1.0$ | $91 \times 2.2$ | 1.61 | 0.31 | 27 | 0.8 |
| 1266-028 | 28x1.2 | $91 \times 2.2$ | 1.90 | 0.51 | 50 | 0.8 |
| 1266-035*) | $35 \times 1.5$ | $91 \times 2.2$ | 2.27 | 0.83 | 85 | 0.8 |

DOUBLE FLEX, COPPER 1566, 1567

| Part no . | Service pipe <br> Dy x s (mm) | Casing <br> DY (mm) | Weight <br> (kg/m) | Water content (I/m) | Transmission capacity [kW] $\begin{aligned} & \Delta \mathrm{T}=50^{\circ} \mathrm{C} \\ & \Delta \mathrm{p}=1 \mathrm{mbar} / \mathrm{m} \end{aligned}$ | Bend radius <br> $\min \mathbf{m}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1566-015*) | $2 \times 15 \times 1.0$ | $91 \times 2.2$ | 1.35 | 2x0.31 | 9 | 0.8 |
| 1566-018*) | $2 \times 18 \times 1.0$ | $91 \times 2.2$ | 1.50 | $2 \times 0.20$ | 15 | 0.8 |
| 1566-022 | $2 \times 22 \times 1.0$ | $91 \times 2.2$ | 1.72 | $2 \times 0.31$ | 27 | 0.8 |
| 1566-028 | $2 \times 28 \times 1.2$ | $91 \times 2.2$ | 2.30 | 2x0.51 | 50 | 0.8 |
| 1567-018*) | $2 \times 18 \times 1.0$ | $113 \times 2.4$ | 1.95 | $2 \times 0.20$ | 15 | 1.0 |
| 1567-022*) | $2 \times 22 \times 1.0$ | $113 \times 2.4$ | 2.17 | 2x0.31 | 27 | 1.0 |
| 1567-028*) | $2 \times 28 \times 1.2$ | $113 \times 2.4$ | 2.75 | $2 \times 0.51$ | 50 | 1.0 |

Flexible pipe primarily for connection of individual homes is supplied as a reel. (approx. 100 m ). The reel diameter is approx. 2.4 m.
Delivered length may differ slightly from the ordered length. With regard to heat losses, see Chapter 9 and for Installation of T-piece, see Chapter 6.
Flexible pipe, copper, supplied with alarm with minimum order quantity 500 m .
The alarm wire is multi-strand and therefore flexible. The alarm function cannot be guaranteed after bending.
For more information regarding alarms etc., please consult Powerpipe.
*) NOTE! These single and double flexible pipes are available by special order. Not kept in stock

## Order example

Double flex copper $2 \times 22 / 91 \mathrm{~mm}$ has part number 1566-022-022-000 without alarm wire and 1566-022-022-230 with alarm wire.

## Flexible pipe, steel



SINGLE FLEX STEEL 1206, 1306, 1406, 1506

| Part no . | Service pipe <br> Dy x s (mm) | Casing <br> DY (mm) | Weight <br> (kg/m) | Water content (I/m) | $\begin{aligned} & \text { Transmission } \\ & \text { capacity }[\mathrm{kW}] \\ & \Delta T=50^{\circ} \mathrm{C} \\ & \Delta p=1 \mathrm{mbar} / \mathrm{m} \end{aligned}$ | Bend radius $\min \mathbf{m}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1306-020-000-000 | $20 \times 2.0$ | $91 \times 2.2$ | 1.52 | 0.2 | 14 | 0.8 |
| 1206-028-000-000 | $28 \times 2.0$ | $91 \times 22$ | 223 | 0.45 | 40 | 1.0 |
| 1406-020-000-820 | 20x2.0 | $110 \times 1.1$ | 2.0 | 0.2 | 13 | 1.1 |

minimum quantity 500 m
Flexible pipe for connection of individual homes is supplied as a reel (approx. 100 m ). The reel diameter is approx. 2.4 m . Delivered length may differ slightly from the ordered length. With regard to heat losses, see Chapter 9 and for Installation of T-piece, see Chapter 6 and Chapter 10.
Flexible pipe, steel, delivered without alarm.
Alarm is available by special order. The alarm wire is multi-strand and therefore flexible.
The alarm function cannot be guaranteed after bending.
For more information regarding alarms etc., please consult Powerpipe.
NB! These single flex pipes are available by special order. Not kept in stock

## Order example

Single flex steel 28/90 mm has part number 1206-028-000-000 without alarm wire and 1206-028-000-230 with alarm wire.

## SPECIAL PIPES

## General information

Powerpipe has a broad product line for connection of individual homes, providing greater opportunities to select unique solutions for each property or project.
The prerequisite for profitability in these areas is that investment costs and heat losses are kept low.
Of course this must not be at the expense of quality or reliability. When installing to individual homes, flexible pipe is advantageous due to the total investment costs.

## The right quality

To obtain investment costs and heat losses that are as low as possible, double pipes are recommended.
Because the number of joints is reduced in a double pipe system, the risk of future leaks in the system is also reduced.
Dimensioning pipes and district heating control centres is also extremely important in reducing costs.
Over-dimensioning costs money both in terms of investment and operating costs.

## The right dimensioning

We offer several different options for expanding district heating systems in areas of individual homes.
All types contain Double pipes (supply and return in the same casing), as the main pipeline.
This ensures lower costs for ground works and lower heat losses.
To reduce both thermal and temperature losses, extra insulated double pipes
(DOUBLE+ or DOUBLE++) are often preferable. See Chapter 9.

## Options

We offer several different options to connect an individual home from a main pipeline (usually double pipes) in the street. The choice of the type is governed by

- Dimension
- Ease of laying
- Size of heat losses
- Cost

We offer

- Flexpipe, copper single pipes Chapter 5
- Flexpipe, copper double pipes Chapter 5
- Flexible pipe, steel single pipes Chapter 5
- Standard double pipes Chapter 4
- Extra-insulated double pipes Chapter 4


## Instructions

See also the District Heating Association's laying instructions for district heating pipes FVF D:211

## System assumptions

Temperature: Max. $120^{\circ} \mathrm{C}$
Printing: Max. 16 bar

## Dimensioning

See diagram for pressure drop calculation, Chapter 9

## Flexible pipes, single and double, copper

## Assembly and jointing of service pipes



For $L \geq 3 m$, see type drawing in Chapter 5

- The system is laid as a fixed system that exploits the annealed copper's flow properties. Preheating of the pipe before foaming/backfilling is recommended.
- The pipes are joined with capillary pipe fittings (SS-EN 1254-1) by hard soldering. Capillary fittings with grooves may not be used.
- Capillary fittings must be of reinforced type.
- Silver/phosphorus/copper brazing rods according to SS-EN 1044 should be used for brazing.
- Brazing expertise is required.
- For brazing technique, see SMS 3209.
- In general, see the District Heating Association's technical provisions for copper pipelines in district heating systems, FVF D213.


## The main pipe-main pipe connection is assumed to be of double pipe type.

- The transition from steel pipe to copper pipe should be done with a transition piece. See p. 8:303
- To protect the connection point against harmful loads, expansion is made possible according to the figure on $p$. 5:503 where $L \geq 3 \mathrm{~m}$.
- Reduction of the media pipe should be supported within 6 m of the reduction cone.
- Connection to main pipe including foaming takes place according to Installation, Chapter 10 and with parts, for example, as in Chapter 6.
- Special expansion absorbing parts are not normally required.
- If expansion in the main pipe is expected to be longer than 10 mm , the flexible pipe connection should be protected with expansion absorbing material. See p. 9:401.


## Flexpipe, single, steel

## Assembly and jointing of service pipes

- The system is laid as a fixed system and may be laid cold without special expansion absorbing devices. Preheating of the pipe before foaming/backfilling is recommended.
- The branch service pipe is welded to the main pipe. Branch pipes are installed between the flexible and main pipe, see p. 8:303, or alternatively standard steel pipe.
- Welding expertise is required.


## Connection main pipe

- Connection to main pipe including foaming takes place according to Installation, Chapter 10, and for example, with parts according to Sleeves, Chapter 6
- Special expansion absorbing parts are required



Copper flex
connection





## SPECIAL PIPES

## Trench and backfilling

Powerpipe's flexible pipes have high strength and tolerate high loads in terms of pressure, impact and abrasion.

## Pipes in the street

Trench depth for the pipes in the street can be minimised and only the street owners' requirements need be taken into account. Minimum coverage of 400 mm .

Excavated soil can be reused and backfilled around the pipes. However, the largest particle size is limited to 16 mm at the joint sites and 32 mm around the pipes.

Trench width can be minimised to about 20 cm wider than the pipe DY. At each joint site, the trench must be made wider to accommodate installation work. The pipes can even be assembled above ground, to be laid in the trench later.

## Mains supply pipes

Trench depth is minimised, 400 mm coverage is sufficient in non-traffic loaded surfaces. Warning mesh should be placed 100-200 mm above the pipes to prevent future damage.

Excavated soil can be reused and backfilled around the pipes. Limitations, see above.
Trench width is minimised, approx. 150-200 mm.
The pipes can easily be bent on site using suitable bending tools. Bushes, stones etc. can be passed without problems.
For property connections, the pipe is bent up out of the ground with the bending tool.
Connections to main pipeline are performed with Powerpipe T-sleeve. See Chapter 6, Sleeves.

For type sections flexible pipes, see Chapter 5
For type sections, fixed single and double pipes, see Chapter 10

TYPE SECTION FLEXIBLE SINGLE PIPES


Alternatively, pipes can be laid without sand directly on the trench bottom and filled around with existing stonefree soil.
$T=\min 600$ in street surface min 400 in non-drivable surface

| Dy (mm) | $\mathbf{B}(\mathbf{m m})$ |
| ---: | :--- |
| $<100$ | 350 |
| $100-150$ | 500 |
| $150-200$ | 600 |

TYPE SECTION FLEXIBLE DOUBLE PIPES


Alternatively, pipes can be laid without sand directly on the trench bottom and filled around with existing stonefree soil.
$T=\min 600$ in street surface min 400 in non-drivable surface

Dy (mm) $\quad B(\mathrm{~mm})$
$\leq 150 \quad 300$
$>150400$
Depending on the trench method and materials, the lower requirement $\mathrm{B}>$ Dy can apply.


Sleeves overview


Balloon sleeves


Tightening band, tubing


Welding sleeves


Reduction sleeve


Tapping/connection


Shrinkable sleeves


End sleeve


T-sleeves


Repair kit


Flexible sleeve


Measurement sleeve

## Overview

## General information

When choosing sleeve from our product portfolio, the welding sleeve is easiest to install and most cost-effective from sleeve diameter of approx. 400 mm and upwards.

Double expanded sleeve: thicker than double sealing up to and including diameter approx. 315 mm , i.e. works better if you slice it and need a longitudinal weld. Also works better in expansion zones due to a lack of tightening tube, which might otherwise be damaged.

In sections with axial movement: special double sealing shrinkable sleeve with tightening tube must be surrounded with sand. For other refilling material, double expanded sleeve or welding sleeve is recommended.

For all dimension transitions, reduction sleeves are recommended. Only in an emergency can double expanded sleeve be used for a dimension transition to the nearest size. In this case, extra mastic is required

The most common types are straight sleeves as stated below:

## Material

## requirements

Sleeve
Welding band
Welding plugs

Shrinkable sleeve
Welding band
Welding plugs

Shrinkable sleeve DX
Mastic strip
Welding plugs
FOPS


## Double sealing sleeve, PEH

The shrinkable sleeve is manufactured in PEH and is always equipped with tightening tube for additional sealing, in which case it is called "double sealing".

## Material

## requirements

Shrinkable sleeve DTK
Mastic strip Tightening tube/ tightening band Welding plugs FOPS

Shrinkable sleeve PEX
Mastic strip
Welding plugs FOPS


Other than the above, balloon, end, flex, reduction and T-sleeves are also available. See the following pages.

## Welding sleeve, Mittel



## PART NO. 6110

Powerpipe offer a joint made by Mittel $A B$. The method involves welding the sleeve to the casing with a metal mesh which is made electrically conducting by the welding machine, and which melts the PEH material together. This takes place under pressure and controlled temperature conditions. Larger sleeve dimensions are slitted. They are longitudinally extrusion welded together with specially designed extrusion welding equipment. The joint is pressure tested before foaming.

Can be delivered in different lengths (standard $L=700 \mathrm{~mm}$ ), for example for repairs.
See exhaustive instructions under Chapter 10, Installation.

## Welding sleeve, Mittel

## Part no. Casing Dy [mm]

6110-Dy
90-1000

For sleeve dimensions, $D y=450$, the sleeves are supplied slitted in a pack of 6 .
For larger dimensions ( $D y \geq 500 \mathrm{~mm}$ ) and volumes, delivery can be made in racks, slitted and packed as 12 per rack

## Order example

Welding sleeve, Mittel for DN 500/710 (Series 2), part number 6110-710-000-000.

## Welding sleeve, Shrink



## PART NO. 6111, 6112

Powerpipe offers a welding sleeve with shrink in two versions. The choice depends on the welding machine used. The method involves a welded joint of the shrinkable sleeve and the casing. The weld consists of a metal mesh that is made electrically conducting by the welding machine and which melts the PEH material together. This takes place under pressure and controlled temperature conditions. The joint is pressure tested before foaming.

See exhaustive instructions under Chapter 10, Installation.

## Welding sleeve, shrink

| Part no. | Dy casing $[\mathbf{m m}]$ | For welding machine |
| :--- | :--- | :--- |
| 6111-Dy | $200-1000$ | (Belmaflex welding method) |
| 6112-Dy | $225-1000$ | (Salling welding method) |

## Order example

The welding sleeve shrinkage is determined according to the welding method;
Belmaflex: DN500/710 (series 2), part number 6111-710-000-000
Salling: DN500/800 (series 3), part number 6112-800-000-000

## Double expanded shrinkable sleeve PEH



## PART NO. 6361

Double expanded shrinkable sleeve, DEX, is a heat shrinkable sleeve manufactured from PEH. Manufactured with a greater wall thickness for extrusion welding. The sleeve shrinks when heated by a gas torch.

A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch.
See exhaustive instructions under Chapter 10, Installation.

## Double expanded shrinkable sleeve

## Casing Dy [mm]

90-900

## Part no.

6361-Dy-000-000
Woven mastic band is recommended and ordered separately. See p. 8:301.

## Order example

Shrinkable sleeve, double expanded for DN 80/180, part number 6361-180-000-000

## Double sealing shrinkable sleeve, PEH



## PART NO. 6364

Double sealing shrinkable sleeve, DTK, is a heat shrinkable sleeve manufactured from PEH material. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.

See exhaustive instructions under Chapter 10, Installation.
\(\left.\begin{array}{lcc}\hline Part no. \& Casing Dy [mm] \& Tubing/wrap Width [mm] <br>
\hline 6364-090 \& 90 \& 150 <br>
6364-110 \& 110 \& 150 <br>
6364-125 \& 125 \& 150 <br>
6364-140 \& 140 \& 150 <br>
6364-160 \& 160 \& 150 <br>
6364-180 \& 180 \& 150 <br>
6364-200 \& 200 \& 150 <br>
6364-225 \& 225 \& 150 <br>
6364-250 \& 250 \& 150 <br>
6364-280 \& 280 \& 150 <br>
6364-315 \& 315 \& 225 <br>
6364-355 \& 355 \& 225 <br>
6364-400 \& 400 \& 225 <br>
6364-450 \& 450 \& 225 <br>
6364-500 \& 500 \& 225 <br>
6364-560 \& 560 \& 225 <br>
6364-630 \& 630 \& 300 <br>
6364-710 \& 710 \& 300 <br>
6364-800 \& 800 \& 300 <br>

6364-900 \& 900 \& 300\end{array}\right\}\) Tightening tube |  |
| :--- |

Woven mastic band is recommended and ordered separately. See p. 8:301.

## Part no.

6364-Dy -000-000 includes two pcs of shrinkable tightening tube/band.
If extra tightening tube/tightening band is required, see part no. 6241-p. 6:301

## Order example

Shrinkable sleeve, double sealing for DN 80/180, part number 6364-180-000-000.

## Shrinkable sleeve PEX



PART NO. 6362

Shrinkable sleeve, PEX, is a heat shrinkable sleeve manufactured from cross-linked multi-layer PEX material. Installation is carried out using a gas torch, and due to the cross-linked material, the shrinkage is both predictable and easily controlled. The shrinkable sleevecan be equipped with tightening tubes/bands as extra sealing. Not weldable.

See exhaustive instructions under Chapter 10, Installation.

## Shrinkable sleeve PEX

## Casing Dy [mm]

90-900 L1 [mm]

The product is delivered in a kit with loose mastic.

## Not kept in stock.

## Part no.

6362-Dy-000-000

## Order example

Shrinkable sleeve, PEX for DN 80/180, part number 6362-180-000-000.

# Shrinkable sleeve <br> Repair kit PEH 



PART NO. 6364

Double sealing shrinkable sleeve, DTK, is a heat shrinkable sleeve manufactured from PEH material. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch.
See exhaustive instructions under Chapter 10, Installation.

## Repair kit

Casing Dy [mm]
90-710

The minimum wall thickness in the shrinkable sleeveis 4.5 mm .

## Part no.

6364-Dy-140-000
Woven mastic band is recommended and ordered separately. See p. 8:301.

## Order example

Shrinkable sleeve, double sealing repair kit for DN 80/180, part number 6364-180-140-000

## Double sealing balloon sleeve

PART NO. 6113, 6115


The balloon sleeve is used for single-use compensators, single-use valves or for other purposes.
This is a heat shrinkable casing manufactured from PEH material. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.

| Casing diam. <br> connecting pipe <br> Dy $[\mathbf{m m}]$ | Dy2 | Dy1 | L1 for 6113- | Tubing/wrap |
| :--- | :--- | :--- | :--- | :--- |
|  | $[\mathbf{m m}]$ | [mm] | [mm] | [mm] |
| 90 | 110 | 125 | 900 | 150 |
| 110 | 125 | 140 | 900 | 150 |
| 125 | 140 | 160 | 900 | 150 |
| 140 | 156 | 180 | 1200 | 150 |
| 160 | 177 | 200 | 1200 | 150 |
| 80 | 197 | 225 | 1200 | 150 |
| 200 | 218 | 250 | 1200 | 150 |
| 225 | 244 | 315 | 1500 | 150 |
| 250 | 269 | 355 | 1500 | 150 |
| 280 | 300 | 400 | 1500 | 150 |
| 315 | 336 | 450 | 1500 | 225 |
| 355 | 377 | 500 | 1500 | 225 |
| 400 | 425 | 560 | 1500 | 225 |
| 50 | 474 | 637 | 1500 | 225 |
| 500 | 530 | 710 | 1500 | 225 |

Length L1 for 6115 - is $\mathbf{1 1 0 0} \mathbf{~ m m}$ for all Dy

Woven mastic band is recommended and ordered separately. See p. 8:301.

## Balloon sleeve, Part no.

6113-Dy-000-000 includes two pcs of shrinkable tightening tube/band.

## Balloon end sleeve, Part no.

6115-Dy-000-000 for single-use valve, length 1100 mm

## Order example

Balloon sleeve for a single-use valve in dim. DN200/355 (Series 2), part number 6113-355-000-000

## Double sealing reduction sleeve

## PART NO. 6124



The reduction sleeve is used for jointing two different dimensions of outer casing.
This is a heat shrinkable casing manufactured from PEH material. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.

| Dimension connecting pipe [mm] |  |
| :---: | :---: |
| Dy1 Dy2 | L1 |
| 110 | 900 |
| 125 | 900 |
| 140 | 900 |
| 160 | 900 |
| 160 | 900 |
| 180 | 900 |
| 200 | 900 |
| 225 | 900 |
| 250 | 900 |
| 280 | 900 |
| 315 | 900 |
| 355 | 900 |
| 400 | 900 |
| 450 | 900 |
| 500 | 1200 |
| 560 | 1200 |
| 630 | 1200 |
| 710 | 1200 |
| 800 | 1200 |

Transition units in several steps and other lengths can be manufactured to special order.
Woven mastic band is recommended and ordered separately. See p. 8:301.

## Part no.

6124-Dy1-Dy2-000 includes two pcs of shrinkable tightening tube/band.

## Order example

Reduction sleeve for DN 80/180-65/160, part number 6124-180-160-000.

## Double sealing end sleeve



## PART NO. 6134

The end sleeve is used at the end of a district heating pipe. This is a heat shrinkable casing manufactured from PEH material. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint. See exhaustive instructions under Chapter 10, Installation.

## Casing Dy [mm]

## 90-900

The end sleeve can be delivered with length $=1000,1100$ and 1200 mm . Part no. for 1100 mm 6134-Dy-110-000.
Woven mastic band is recommended and ordered separately. See p. 8:301.

## Part no.

6134-Dy-000-000 includes two pcs of shrinkable tightening tube/band.

## Order example

End sleeve for DN 80/180, part number 6134-180-000-000

## Double sealing flexible sleeve (kit) PEX



## PART NO. 6200

The flexible sleeve is a bendable, heat shrinkable casing manufactured from PEX. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. The flex casing can be equipped with tightening tubes/bands as extra sealing.
After the joint has cooled, seal testing, foaming and sealing of the foam hole are carried out. See exhaustive instructions under Chapter 10, Installation.

## Double sealing flexible sleeve

| Casing <br> Dy $[\mathbf{m m}]$ | Radius steel pipe bend <br> [mm] | L1 <br> [mm] |
| :--- | :--- | :--- |
|  |  |  |
| 90 | 200 | 815 |
| 110 | 200 | 865 |
| 125 | 200 | 865 |
| 140 | 240 | 865 |
| 160 | 240 | 865 |
| 180 | 240 | 975 |
| 200 | 240 | 975 |
| 225 | 300 | 980 |
| 250 | 380 | 980 |
| 280 | 420 | 1225 |
| 315 | 550 | 1225 |

Flexible sleeve with kit is available for Series 2 and double pipes.
Woven mastic band is recommended and ordered separately. See p. 8:301.

## Part no.

6200-Dy-000-000 inc. steel pipe bend and tightening tube.

NB! For double pipe bends, fixation plates are required between the steel pipes. These are ordered separately. See Chapter 8.

Not recommended for bends greater than $60^{\circ}$.

## Order example

Flexible sleeve for double pipe DN 40/160 including parts above, order number 6200-140-160-000.

## Tightening band, tightening tube



Tightening tube

## PART TIGHTENING TUBE NO. 6241, TIGHTENING BAND 6240

The tightening tube is thick walled, internally covered with mastic and has a high tensile strength.
Delivered individual packaged in protective plastic, which protects from dirt before assembly.
During assembly, the tightening band is attached using a closure strip. The wrap is delivered packed in pre-cut lengths.

| Dy <br> casing <br> [mm] | Dy <br> sleeve <br> [mm] | Width [mm] Double sealing <br> Hose <br> Part no. 6241 | Wrap <br> Part no. 6240 | Miscellaneous <br> Tubing/wrap | Tubing* |
| :--- | :--- | :--- | :--- | :--- | :--- |

* Original/shrunk D [mm] / D [mm]

Tightening tube part no.
6241 - Tightening tube-000-000

## Order example

1 pcs tightening tube for DN 80/180,
part number 6241-180-000-000.

Tightening band part no.
6240 - Tightening tube-000-000

## Order example

1 pcs tightening band for DN 200/400,
part number 6240-400-000-000.

## Tapping/connection



OrdinaryT-piece

Powerpipe has a complete system for tapping/connection of branches.
Tapping must take place according to Swedenergy's Technical Provisions on tapping, D: 217 (2021)
Requisite parts and instructions are available for
$45^{\circ}$ branch single pipe DN $20-$ DN 150
Branch double pipe DN 20 - DN 100

All parts for tapping/connection are made for double sealing function.
The main sleeve is split before being slid onto the main pipe, after which it is longitudinally extrusion welded.
After shrinking the sleeve, tightening bands are applied to the sleeve, creating a double sealing joint See exhaustive instructions under Chapter 10, Installation.

Woven mastic band is recommended and ordered separately. See p. 8:301.
A complete tapping/connection requires:

- $\quad$ Steel parts (p. 8:201, 8:303, 10:304)
- $\quad$ Sleeve parts (p. 6:404-407)
- $\quad$ Foam liquids (p. 10:323-325)

When tapping double pipes, the spindles should be rotated in position so there is room for the sleeve.

## Double sealing T-sleeve for connecting double pipe to double pipe, straight

PART NO. 6530

Double sealing T-sleeve is a heat shrinkable casing manufactured from PEH material. Installation is done by extrusion welding the split sleeve. Woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.

## D2 is inserted into D1, then D1 is shrunk.

Woven mastic band is recommended and ordered separately. See p. 8:301.
See branch pipe 8205-, Chapter 8

Dy $y_{1}=$ External diameter casing main pipe in mm
$D y_{2}=$ External diameter casing branch in $\mathbf{m m}$

## Part no.

6530-Dy $y_{1}$-Dy $y_{2}-000$ includes shrinkable casing, two pcs tightening tubes and two pcs tightening bands. For dimension table, see next page.

| D1 inv. $\varnothing$ [mm] | D2 |
| :---: | :--- |
|  |  |
| 125 | 110 |
| 140 | 125 |
| 156 | 140 |
| 177 | 160 |
| 197 | 180 |
| 218 | 200 |
| 244 | 225 |
| 269 | 250 |
| 300 | 280 |
| 336 | 315 |
| 377 | 355 |
| 425 | 400 |

For part no. and dimensions, see next page.

## Order example

T-sleeve Double-Double for main pipe, two pcs tightening tube and two pcs tightening band DN $2 \times 100$, part no. 6530-315-200-000.

## Double sealing T-sleeve for connecting double pipe to double pipe (cont.)



|  | Part no . |  |  | D1 |  | L1 <br> [mm] |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Dim [mm] |  |  | Ext. <br> $\varnothing$ <br> [mm] |  |  |
|  | Dy1 | Dy2 |  |  |  |  |
| 6530 | 280 | 090 | 000 | 227 | 218 | 700 |
| 6530 | 280 | 110 | 000 | 227 | 218 | 700 |
| 6530 | 280 | 125 | 000 | 227 | 218 | 700 |
| 6530 | 280 | 140 | 000 | 254 | 244 | 700 |
| 6530 | 280 | 160 | 000 | 279 | 269 | 700 |
| 6530 | 280 | 180 | 000 | 279 | 269 | 700 |
| 6530 | 280 | 200 | 000 | 279 | 269 | 700 |
| 6530 | 280 | 225 | 000 | 308 | 300 | 700 |
| 6530 | 280 | 250 | 000 | 348 | 336 | 700 |
| 6530 | 315 | 090 | 000 | 254 | 244 | 700 |
| 6530 | 315 | 110 | 000 | 254 | 244 | 700 |
| 6530 | 315 | 125 | 000 | 254 | 244 | 700 |
| 6530 | 315 | 140 | 000 | 279 | 269 | 700 |
| 6530 | 315 | 160 | 000 | 308 | 300 | 700 |
| 6530 | 315 | 180 | 000 | 308 | 300 | 700 |
| 6530 | 315 | 200 | 000 | 308 | 300 | 700 |
| 6530 | 315 | 225 | 000 | 348 | 336 | 700 |
| 6530 | 315 | 250 | 000 | 348 | 336 | 700 |
| 6530 | 400 | 090 | 000 | 279 | 269 | 700 |
| 6530 | 400 | 110 | 000 | 279 | 269 | 700 |
| 6530 | 400 | 125 | 000 | 279 | 269 | 700 |
| 6530 | 400 | 140 | 000 | 308 | 300 | 700 |
| 6530 | 400 | 160 | 000 | 348 | 336 | 700 |
| 6530 | 400 | 180 | 000 | 348 | 336 | 700 |
| 6530 | 400 | 200 | 000 | 348 | 336 | 700 |
| 6530 | 400 | 225 | 000 | 390 | 377 | 1200 |
| 6530 | 400 | 250 | 000 | 390 | 377 | 1200 |
| 6530 | 450 | 090 | 000 | 348 | 336 | 700 |
| 6530 | 450 | 110 | 000 | 348 | 336 | 700 |
| 6530 | 450 | 125 | 000 | 348 | 336 | 700 |
| 6530 | 450 | 140 | 000 | 348 | 336 | 700 |
| 6530 | 450 | 160 | 000 | 390 | 377 | 900 |
| 6530 | 450 | 180 | 000 | 390 | 377 | 900 |
| 6530 | 450 | 200 | 000 | 390 | 377 | 900 |
| 6530 | 450 | 225 | 000 | 390 | 377 | 900 |
| 6530 | 450 | 250 | 000 | 440 | 425 | 1200 |
| 6530 | 500 | 250 | 000 |  |  | 1260 |

## Double sealing T-sleeve, $45^{\circ}$ flexible, branch $\leq$ Dy 25



## PART NO. 6540

T-sleeve $45^{\circ}$ flexible, is a shrinkable casing manufactured from PEH material. Installation is done by extrusion welding the split sleeve. Place a woven mastic band between the casing and sleeve, which are heated with a gas torch.
After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.
Woven mastic band is recommended and ordered separately. See p. 8:301.

| Main pipe L1=1000 | Branch casing [mm] |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 75 |  | 90 |  | 110 |  | 125 |  | 140 |  | 160 |  | 180 |  |
| [mm] | D3 | L2 | D3 | L2 | D3 | L2 | D3 | L2 | D3 | L2 | D3 | L2 | D3 | L2 |
| 90 | 103 | 690 | 125 | 690 |  |  |  |  |  |  |  |  |  |  |
| 110 |  |  | 125 | 690 | 140 | 690 |  |  |  |  |  |  |  |  |
| 125 |  |  | 125 | 690 | 156 | 820 | 156 | 820 |  |  |  |  |  |  |
| 140 |  |  | 125 | 690 | 156 | 820 | 177 | 820 | 197 | 820 |  |  |  |  |
| 160 |  |  | 125 | 690 | 156 | 820 | 177 | 820 | 218 | 820 | 218 | 820 |  |  |
| 180 |  |  | 125 | 690 | 156 | 820 | 177 | 820 | 218 | 820 | 244 | 820 | 218 | 820 |
| 200-250 |  |  | 125 | 690 | 156 | 820 | 177 | 820 | 218 | 820 | 244 | 820 | 269 | 820 |
| 280-710 |  |  | 125 | 690 | 156 | 820 | 177 | 820 | 218 | 820 | 244 | 820 | 269 | 820 |


| Main <br> pipe | Branch casing [mm] |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathbf{2 0 0}$ |  | $\mathbf{2 2 5}$ |  | $\mathbf{2 5 0}$ |  |
| [mm] | L1 | D3 | $\mathbf{L 2}$ | D3 | $\mathbf{L 2}$ | D3 | L2 |
|  |  |  |  |  |  |  |  |
| $100-250$ | 1000 | 279 | 860 | 308 | 950 | 348 | 1100 |
| $280-710$ | 1200 | 279 | 860 | 308 | 950 | 348 | 1100 |

NB! The corrugated pipe requires careful heating to become flexible. There is space to install Vexve's tapping valve for Series 2 and Series 3. The installed steel bend (branch pipe p. 8:303) must have a radius of 5D or greater. C-C dimension for tapping must be min. 650 mm .

## Part no.

6540-Dy main pipe-Dy branch-000 includes shrinkable casing, two pcs tightening tube and two pcs tightening band

## Order example

T-sleeve $45^{\circ}$ flexible including two pcs tightening tube and two pcs tightening band for main pipe DN 400/630 and branch DN 80/180, part no. 6540-630-180-000.
The branch must be at least one DN smaller than the main pipe.

## T-sleeve, $45^{\circ}$ <br> Branch $\geq$ Dy 280



## PART NO. 6540

T-sleeve $45^{\circ}$, is a heat shrinkable casing manufactured from PEH material. Installation is done by extrusion welding the split sleeve. Place a woven mastic band between the casing and sleeve, which are heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.

See exhaustive instructions under Chapter 10, Installation.

Outer casing main pipe: 355-900 mm, Dy = 355 mm .

There is space to install Vexve's tapping valve for Series 2 and Series 3.

## Part no.

6540-Dy main pipe-Dy branch-000 includes shrinkable bottom sleeve, $45^{\circ}$ knee (or flex up to and including branch $315 \mathrm{~mm})$, reduction, three tightening tubes and two heat shrink wraps.

Woven mastic band is recommended and ordered separately. See p. 8:301.
For foam liquid requirements, see Chapter 8

## Order example

T-sleeve for main pipe DN 400/630 and branch DN 200/355, part no. 6540-630-355-000.
The branch must be at least one DN size smaller than the main pipe.

## Double sealing <br> T-sleeve for flexible pipe

PART NO. 6540

Double sealing T-sleeve for flexible pipes, is a heat shrinkable casing manufactured from PEH material. Installation is done by extrusion welding the split sleeve. Place a woven mastic band between the casing and sleeve, which are heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.
Woven mastic band is recommended and ordered separately. See p. 8:301.

| Part no. | Outer casing branch/main <br> pipe $[\mathbf{m m}]$ | Dy $[\mathbf{m m}]$ <br> shrinkable |
| :--- | :--- | :--- |
| $6540-090$ | 90 | 105 |
| $6540-110$ | 110 | 125 |

T-sleeve for flexible pipes is adapted for simple assembly of flexible pipe to flexible pipe.
NB! The corrugated PEH pipe requires careful heating to become flexible.

## Part no.

6540-Dy main pipe-Dy branch-395 includes T sleeve, one pcs tightening tube and two pcs tightening band

## Order example

T-sleeve with main pipe Dy 110 for branch Dy 110 mm, part no. 6540-110-110-395

## Double sealing T-sleeve for connection/tapping of single pipe to double pipe

PART NO. 6535


T-sleeve for double/single pipes, is a heat shrinkable casing manufactured from PEH material. Installation is done by extrusion welding the split sleeve. Place a woven mastic band between the casing and sleeve, which are heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.
See exhaustive instructions under Chapter 10, Installation.
When using this sleeve, the tapping valve and steel pipe must be angled in towards the centre line of the double pipe, and the C-C distance must agree.

The sleeve is vertically symmetrical, i.e. according to the image.


Woven mastic band is recommended and ordered separately. See p. 8:301.

| DN / DY <br> main pipe | Dy1 <br> [mm] | Dy 2 branch <br> [mm] | Dy 3 (tapping) <br> [mm] | c/c <br> [mm] |
| :--- | :--- | :--- | :--- | :--- |
|  | 174 | 90 |  |  |
| $2 \times 25 / 140$ | 193 | 110 | 125 | 310 |
| $2 \times 32 / 160$ | 193 | 125 | 140 | 325 |
| $2 \times 40 / 160$ | 242 | 140 | 160 | 340 |
| $2 \times 50 / 200$ | 255 | 160 | 360 |  |
| $2 \times 65 / 225$ | 281 |  | 380 |  |
| $2 \times 80 / 250$ | 348 |  |  |  |
| $2 \times 100 / 315$ | 435 |  |  |  |
| $2 \times 125 / 400$ | 533 |  |  |  |
| $2 \times 150 / 450$ | 660 |  |  |  |
| $2 \times 200 / 560$ |  |  |  |  |

## Double-sealing PEH sleeve double/single part no.

6535-Dy1-Dy2-000 includes shrinkable sleeve, two pcs tightening tubes and two pcs tightening band.
The branch must be at least one DN smaller than the main pipe, and the opening must not exceed 600 mm .

## Order example

T-sleeve double/single including two pcs tightening tube and two pcs tightening band for main pipe DN 2x80/250 and branch DN 25/90, part no. 6535-250-090-000.

## Measurement sleeve

PART NO. 6270


Measurement sleeves are used where you require access to alarm wires for simple measurement of any faults. Delivered with lid and branch pipe. Can be customised in terms of height (400-900 mm).

The measurement sleeve is a heat shrinkable casing manufactured in PEH. A woven mastic band is placed between the casing and sleeve, which is heated with a gas torch. After this, tightening tubes are applied to the sleeve joint, creating a double sealing joint.

See exhaustive instructions under Chapter 10, Installation.
Woven mastic band is recommended and ordered separately. See p. 8:301.


Example application

## Part no.

6270-Dy casing-000-000

## Order example

Measurement sleeve for DN 300/500, part number 6270-500-000-000

## 7. Moisture surveillance system

The purpose of a moisture surveillance system is to detect and locate moisture in the pipe insulation. This provides a cost-effective and easy-to-use tool to monitor and troubleshoot the pipes during their entire lifetime. A permanently installed surveillance system is used for continuous monitoring of the pipes. When the system detects moisture in the pipes, or faults in the alarm wires, it automatically sends a message to the maintenance staff. This means that you discover any damage and can take action at an early stage, avoiding operational disruptions and expensive
 leakage.

## ALARM WIRES

## Steel service pipes

Two alarm wires (diameter 1.38 mm , cross-section area 1.5 mm 2 , soft copper wire) are inlaid in all insulated pipes and pipe fittings.
The position of the alarm wires is at 10 and 2 o'clock as standard. TDR speed PVF (Propagation Velocity Factor) is normally $273 \mathrm{~m} / \mu \mathrm{s}(0.91)$. The resistance in the copper wire is 1.2-1.3 ohms $/ 100 \mathrm{~m}$ of alarm wire.

## Plastic service pipes

Another solution is required here because the service pipe is not electrically conductive. Instead, the electrical properties are measured between the conductors. This solution can work in different ways. See more in this chapter.

## Moisture surveillance system

### 7.1 System Wideco

## 3dc

The WiDetect Cooling 3dc sensor cable patented by Wideco is intended for use in remote cooling systems with steel or plastic service pipes. The cable's unique construction allows for the avoidance of problems with condensation moisture between wire/wire and service pipe along the pipes, but above all on the ends of the pipes and pipe fittings and in other parts of the sleeve.

When manufacturing district cooling pipes and pipe fittings, the WiDetect Cooling 3dc is installed directly against the service pipe with double sided tape in between - a fast and easy process. In joints and branches in the field, the cable is also laid directly against the service pipe. The special construction of the cable makes it possible for impedance changes of certain sizes from wet insulation to be detected even if the cable is insulated along the entire pipe length.

The alarm cable should be positioned at 5 o'clock. TDR speed PVF (Propagation Velocity Factor) is normally $238 \mathrm{~m} / \mu \mathrm{s}$.
The resistance in the copper wire is 2.54 ohms $/ 100 \mathrm{~m}$ of alarm wire. The 3 dc is monitored via the WiDetect X 6 alarm unit which continuously sends information from the alarm wire/pipe insulation to the XTool PC) and WISION (web) system software.

Please note that the sensor cable must be handled with great care to prevent damage occurring during transport, production etc. Wideco's installation instructions must be followed.


## WiDetect ${ }^{\text {TM }}$ system

Even smaller leaks can cause significant damage. This can result in heat losses, corrosion on the pipes or operational disruptions. The WiDetect ${ }^{\text {TM }}$ system has been developed to guarantee continuous monitoring of the entire pipe and to report any faults at an early stage.

WiDetect ${ }^{\text {TM }}$ is used to automatically monitor insulated pipes for district heating, district cooling and non-conductive media such as oil (point monitoring with sensors).

The system consists of both alarm units for easy monitoring without software and more advanced units for central monitoring and analysis together with a range of associated services. The web software WISION offers a complete system for all platforms, giving you as a customer total control over all of your units. WISION consists of several different widgets that can be adapted to your needs. Read more about WISION at www.wideco.se

WiDetect's primary strengths are:
Wide range of proven measurement units.
High reliability.
Easy to add more units when your network grows.
Easy to maintain because the units can be updated wirelessly.
WiDetect Online, a service for more convenient management of measurement data.
Flexible communication via network or wirelessly.
Can be integrated with SCADA systems.

## Moisture surveillance system

## WiDetect ${ }^{\text {™ }}$ monitoring units

## Level 1 units - fault detection only

## WiDetect X1e

WiDetect ${ }^{T M} \times 1$ e has been developed to monitor and detect faults in insulated pipes. WiDetect ${ }^{T M} \times 1$ e is the easiest way to monitor each section. Connect the alarm wires to WiDetect ${ }^{\text {TM }} \mathrm{X} 1 \mathrm{e}$ in an alarm loop of up to $2 \times 2500 \mathrm{~m}$ pipe. WiDetect ${ }^{T M}$ X1e can be connected to both the supply and return pipe. The alarm control centre reports changes in insulation resistance, breaks in alarm wires or short circuits between alarm wires and service pipes.
Reporting can be optical (red lamp on alarm control centre). Buzzer and alarm can be forwarded through the relay output. After an alarm the fault must be located using a traditional wireless pulse echometer (TDR) or the WiDetect ${ }^{\text {TM }}$ XPM portable measurement system. An integrated 2G/3G modem is available as an option for wireless communication to the parent software, together with an integrated battery pack with a lifetime of up to 7 years.

## WiDetect X1L

WiDetect X1L has been developed to monitor and detect faults in insulated pipes. Connect the alarm wires to WiDetect X1L in an alarm loop of up to $4 \times 3500 \mathrm{~m}$ pipe. WiDetect X 1 L can be connected to both the supply and return pipe.

## WiDetect A1e

WiDetect A1e is an advanced monitoring unit for registering moisture, temperature, water levels etc. in manholes, water/sewage manholes, data centre flooring or other low points and for detection of moisture in insulated pipes.
WiDetect A1e has four PT 1000 inputs and four analogue or digital inputs (4-20mA, $0-10 \mathrm{~V}$ ) to measure values such as room temperature and air humidity, supply and return temperatures on service pipes and water levels, in several steps, in manholes and other wet spaces. The unit can also register insulated pipe loop and insulation
 resistance. WiDetect A1e is available in several different models with battery operation or mains operation and modems for different means of communication.

## Level 2 units - fault detection and location

## WiDetect X6

The X6 has been developed to monitor and detect faults in insulated pipes and can monitor lengths up to $8 \times 9000$ $m$ (depending on the sensor cable type), immediately detecting and locating where a leak has occurred. The X6 also continuously checks that the sensor wires are functional and undamaged. The X6 detectors can connect to up to 8 sensor wires, and it is therefore possible to monitor four separate pipes. For optimal use, the WiDetect X6 is connected via wireless connection (2G/3G) to the hosting service WiDetect Online - WDO, where you can easily handle and analyse your entire system.
The WiDetect $\times 6$ consists of a base unit and various connection boxes. You choose the connection box depending on what type of alarm wire you want to monitor.

CB Heating - connection box using copper alarm wires (Nordic system)
CB Cooling - connection box for 3dc sensor cable
CB Water - connection box for W3 sensor cable

## Moisture surveillance system

## PORTABLE MEASUREMENT SYSTEM

## WiDetect XPM

The XPM system is used for maintenance and troubleshooting on your pipes or moisture band.
WiDetect XPM ${ }^{\top M}$ is a portable, modern and convenient measurement system that makes it easy for you as an operator to measure different types of alarm wire systems with high accuracy while working in the field, to follow up warranties and to protect facilities from operational disruptions. The system gives you full control of measurements, analyses in the field, and in addition a safer working environment.

XPM $^{\text {™ }}$ can be used in all types of environments and on almost all types of measurement wires, for example the Nordic system, 3dc sensor cable, W3 sensor cable, MultiZone sensor cable, moisture band etc. The system consists of a measurement unit to which the alarm wire can easily be connected. The XTool XPM software has been specially developed for touchscreens and is run on a rain, dust and impact resistant, powerful touchscreen computer.

As standard, $\mathrm{XPM}^{\text {TM }}$ is equipped with a 3G module to facilitate synchronisation, but also field measurements via our central WiDetect Online hosting service. The system also has GPS for effective site identification, together with Wi-Fi for quick and wireless connection between the touchscreen and measurement unit. A simple, convenient way to measure, analyse and consider in your vehicle instead of on site where the measurement unit is connected.

A free user account for the WiDetect Online hosting service is included when you buy WiDetect XPM ${ }^{\text {™ }}$. The major advantage with WiDetect XPM $^{\text {™ }}$ is that all measurements and reports are integrated into XTool 5 , where your other stationary alarm units can be found, rather than separate systems.

## Moisture surveillance system

## SOFTWARE

## WiDetect XTool

XTool is the WiDetect system's software for managing data, units, reports and users etc. XTool gives you full control of alarm units, channels, markers etc. The system is very easy to install and use. XTool includes measurement database, language database, OPC server (option), documentation database, comparison function, group divisions, dynamic report management, GPS positioning, automatic measurement reports, manual measurements and lots more. XTool automatically detects the alarm units you connect and adapt the system accordingly. XTool is available in Arabic, Chinese, Danish, English, Finnish, French, German and Swedish.

## WISION

WISION is a software platform that simplifies monitoring, analysis and statistics for your units. WISION allows you to measure and monitor almost anything - water levels, temperature, gas, flow etc. - in a user-friendly way. WISION is cloud-based and comes with a widget design for full access, anywhere. You simply carry our smart unit with you to get total control. Read more about WISION at www.wideco.se

## WiDetect Online (Hosting)

WiDetect Online - monitors your insulated pipes, any time, anywhere. WiDetect Online contains everything you need:
Wireless communication via 2G/3G/4G or LoRaWan, XTool software on our server for analysis and presentation of measurement data, together with continuous operation, maintenance and support.

## Advantages

Your own XTool account on Wideco's server for analysis, documentation and presentation of data. Plug \& Play monitoring units.
Wireless communication.
More effective maintenance and support.


## Moisture surveillance system

## A flexible system

The image shows examples of different communication solutions.

## Software

XTool is developed to cope with several different users and alarm units simultaneously and functions in a client/server environment. It is also possible to use remote access, for example via Citrix solutions to control the software.

The XTool software also includes an integrated OPC server that makes it possible to forward different parameters to the parent SCADA system.


There are many accessories for the WiDetect ${ }^{\text {TM }}$ system. For more information, please visit www.wideco.se.

## Connection boxes

Connection boxes (MultiBox) are available in different versions and are used when you want to connect the alarm wires to other cables.

## Control cabinets

IP67 control cabinet for secure mounting of alarm equipment.

## Communication modem

Where the existing network cannot be used, we recommend 2G/3G
 communication via the internet. We can help you with subscriptions and modems.

## Antennas

We have several different types of antennas which are suitable for and tested with WiDetect ${ }^{\text {TM }}$.

## Cabling

93 ohm RG62 coaxial cable for connection of WiDetect ${ }^{\text {™ }}$ X6 alarm units to district heating or district cooling pipes. Available in lengths of 2.5 and 5 m including BNC contacts. Delivered with red and blue bend protection. Can be extended.

## Network cables

Available in different lengths for connection of WiDetect ${ }^{\text {TM }}$ alarm units to network equipment or external modems.

## Take Off



WiDetect Sensor Take Off cable is used when alarm wires are to be removed from the pipe. Available in 10 metre lengths. Other lengths available to order. Tool for simple installation is sold separately.

## Overview of alarm components

## Part no.

WiDetect X1e
WiDetect X1L
WiDetect A1e
WiDetect X6
WiDetect XTool
WiDetect XPM
Multibox C2
Multibox S2
Multibox CS
Multibox M1

6810-901-000-000
6810-901-001-000
6810-906-000-000
6810-907-000-000
6810-908-000-000

6810-900-000-000
6810-910-000-000
6810-915-000-000
6810-920-000-000

State the required length for connection cable in a separate row.


Use a connection box (Multibox C2) for easy connection.

## Moisture surveillance system

### 7.2 System Pipeguard



Pipeguard provides maintenance staff with a current image of the condition of the pipe network. The system is suitable for facilities where data from many different sensors needs to be stored and presented in a clear manner.
Pipeguard develops and supplies monitoring modules and surveillance systems, provides support, and always keeps facility operation and function in focus.
Pipeguard's primary advantages:

- A proven system with reliable technology that copes with the stressful challenges faced by alarm modules installed in the field.
- Management of alarms, history and settings from a number of sensors in a single system.
- Accessibility from computers, tablets or smartphones.
- Easy customisation of the system to your own needs through the flexible range of modules for collection of several different types of measurement values. In addition to moisture surveillance, it also offers manhole surveillance, pressure and temperature measurement, boiler surveillance, pump surveillance etc.
- Easy administration of the system as the modules are updated and configured remotely.
- An open system with the possibility of linking to a central GIS/NIS system.


## Moisture surveillance system

## PGweb monitoring system

The Pipeguard system is a web-based monitoring system that collects measurement values from alarm units and other sensors, and presents them in a way that gives the user an overview so they can quickly make the right decision. The programme has a clear and well-designed interface, making alarms, log values and settings easy to find and work with. Alarms can be set to automatically be sent via mail or SMS to a range of recipients.

The built in map view shows all modules with status indication. It is also possible to export your own map information to PGweb, such as pipe systems, manholes,
 alarm wires etc.
The system is easily accessible and connection takes place to a website from computers, tablets and smartphones. If necessary you can even integrate information from the Pipeguard system into your own GIS/NIS system to make the information more accessible to your own organisation.

## Moisture surveillance with status assessment microPG/miniPG

The Pipeguard modules are compact alarm units with built-in GPRS modems.
A special measurement method means that the length of the alarm loop does not affect the measurement values. This means that it is easier to interpret alarms and trend curves because same moisture quantity always gives the same result, regardless of how far from the module the leakage occurs. The modules send alarms via SMS or provide data to Pipeguard via GPRS. You can also review your log data in an easy-to-use website. The modules are intended to be configured and updated remotely. The Pipeguard modules are available in two versions. microPG has connections to two pipes (four wires) and miniPG has connections for four pipes (eight wires).

Insulation resistance
Loop resistance
Terminal voltage
Communication
Power supply
Voltage
Current 15 mA (Max 500 mA )
Degree of protection

0-10 000 Kohm
0-100 ohm
0-1 $000 \mathrm{mV} @ 1$ Mohm GSM, GPRS and SMS
Mains, battery
10-30 Volt (14.4 Volt)
Alarm output $48 \mathrm{~V} / 200 \mathrm{~mA}$
IP 67

## Section length

module type (Pipe/Alarm wire loop) microPG ( $2 \times 4000 \mathrm{~m} / 2 \times 8000 \mathrm{~m}$ ) miniPG ( $4 \times 4000 \mathrm{~m} / 4 \times 8000 \mathrm{~m}$ )

I/O
Alarm input Disconnection/ connection

LED indication Yes


## Moisture surveillance system

## Moisture surveillance, status and location with TDR pulsPG

pulsPG is a localised alarm control centre that uses TDR (time-domain reflectometry) technology, which is also known as pulse echometry. The unit is used to monitor district heating, district cooling and pipes containing, for example, oil. The unit consists of a module system with a main unit together with 1-8 external measurement modules. Unique advantages of pulsPG:

The measurement modules are directly connected to the pipe without signal cables.
Modular construction, can be adapted to 1-8 measurement loops per pipe.
External measurement cards, can collect measurement data from measurement points, for example, in separate buildings. Pay only for the equipment you really need.
Easily adapt the system when the pipe network changes.
Accessible monitoring via the PGweb Surveillance system.
Proven TDR technology based on measurement cards from Stateview.
The measurement modules consist of pulse echometers for two wires (loop). pulsPG collect and sends the measurement values to the Pipeguard system via GPRS or Ethernet. The system is fully compatible with Stateview System II.

## Pulse echometer/TDR

Range (PVF 0.90) 8000 m

## Measurement card

Insulation resistance 0-10 000 Kohm Loop resistance 0-100 ohm
Terminal voltage 0-1 000 mV @1Mohm

Power supply Mains/Battery
Voltage 110-230VAC / 15-30VDC
Power 30w
Protection level IP 65
Communication GPRS, Ethernet

## Measurement values:

In addition to resistance and galvanic voltage, pulsPG also measures a pipe status, the TDR curve deviation from reference, and in the case of damage the distance to the fault. In the case of faults, a TDR curve is also saved for analysis of the damage.


## Moisture surveillance system

## Alarm and Measurement value collection

Using the alarm modules, you can for example collect values from sensors for moisture, pressure, flow, air and pipe temperature, hatch alarms, sabotage alarms. The modules have a long lifetime even in tough environments. They have protection level IP 67/68, and as extra protection the circuit boards are equipped with moisture and temperature alarms that report directly in Pipeguard if the unit is in danger. The modules are available in different types customised for different situations.
The Pipeguard system contains several different types of modules for different types of conditions.For more information, contact your salesperson at Powerpipe, or visit www.pipeguard.se.

## MT713

MT713 is a compact alarm/measurement value collection module with a built-in battery and GPRS modem.
MT713 is used for monitoring manholes and detecting water level, temperature and moisture. You can easily set alarm levels in PGweb, where trends over time are displayed. MT713 is also suitable for collection of media temperatures (return temperatures) and pressures from sites where external power supply is missing.


Power supply Internal battery (up to 5 years) IP class IP68
Inputs:
Alarm input DI
5 pcs NO contact Measurement

3st input AI

## Miscellaneous:

Built-in hatch alarm, condensation protection, moisture membrane, indication on front.

## Accessories:

Level sensors with brackets, Combined temp/moisture sensor, contact temperature sensor, pressure sensor, spare battery, various versions of antennas, antenna cable.

## Moisture surveillance system

## Accessories

There is a wide range of accessories. Contact Pipeguard for more information.

## Fixbox ${ }^{\circledR}$,

Fixed measurement point with perfect earth.
When measuring pipes, it's important to have a good connection
 to wires and pipes earth. Fixbox is used as a fixed measurement point and is installed directly on the pipe or as a coupling between the coaxial cabling and alarm module. Fixbox also has a FixID which is used
by pulsPG or the Stateview System II measurement system.

## Installation kit for Fixbox,

for installation direct on pipe without welding equipment
As an alternative to a welded bolt, a Fixbox can be installed on a pipe with an installation kit containing a wrap and a clamping bolt.

## Connection cables,

Prepared delivery for fast installation.
On delivery, we can supply alarm modules with connected cables so installation in the field is quick and convenient.

## Installation plates,

microPG, miniPG, MT713
For simpler insulation on uneven surfaces, for example in manholes.

## Street cabinet

for alarm output.
Cabinet with space for alarm output, Fixboxes and alarm modules. Can be supplied assembled and ready to use. Grey or painted green.

## Battery packs,

for microPG, miniPG
Up to 5 years' operation

## Antennas,

for different needs
Good antennas are important. We have a selection of antenna types to suit different installation methods.


## Moisture surveillance system

## cTube ${ }^{T m}$ alarm output

cTube ${ }^{\text {TM }}$ provides secure and flexible access to the district heating pipe alarm wires. This means time savings, a better working environment and a simpler, more economical surveillance system.

## Advantages:

- Easily accessible measurement points.
- Better working environment.
- Less disruption for the end customer.
- Rationalise inspections and service by connecting several sections to a central point.
- The cables are protected by impact resistant PEM conduit.
- Cast weld part - fully watertight.
- Low profile - remains clear of ground movements.
- Flexible cable length.
- Minimal damping of echometer pulse.
- Facilitate monitoring where no manhole or building is present.
- Alarm and communication equipment is placed above ground level - no risk of flooding, better transmission from wireless
 units.
- Delivered with FixBox ${ }^{\circledR}$ for simple and secure connection of measurement equipment.
- Can be pressure tested.


## Specifications

| Standard lengths | $8 \mathrm{~m}, 12 \mathrm{~m}$ |
| :--- | :--- |
| Other lengths | According to order |
| Number of cables | 2 or 4 |
| Contacts | BNC + FixBox ${ }^{\oplus}$ |
| Impedance | $180 \Omega$ |
| Installation | Extruder weld, shrink mat |

## Ordering

Alarm output, 2 wire, part number 6890-020-000-000
Alarm output, 4 wire, part number 6890-025-000-000
State desired cable length on separate row. cTube, coaxial cable 2-wire/m 6890-020-001-000
cTube, coaxial cable 4-wire/m 6890-025-001-000

### 7.3 Type drawings, Alarm



Valve
Venting
Draining


For alarm wire lengths, see the last page in Chapter 7.


## Type drawings, Alarm




Measurement device with earth connection

T-piece, parallel


Wires 1 and 3 are blank. The wires not connected to the branch are accessible (wires 1 and 3 or 2 and 4).


For alarm wire lengths, see the last page in
Chapter 7.

## Moisture surveillance system

## Alarm wire loop for certain components

The information below on the length of alarm wire in affected components facilitates accurate measurement of any future damage. The length has been calculated from the steel pipe edge.

## Part number suffix for our standard alarm wires:

-239 means 4 wires at the top (10, 11, 1 and 2 o'clock) for straight pipes from DN350. Other 4 -wires have positioning (4, 8, 10 and 2 o'clock).
-566 for "Alarm wires not accessible" (applies to valves)

## Preinsulated valves

|  | DN 25-125 | DN 150-250 | DN 300 |
| :--- | :--- | :--- | :--- |
| Accessible | 2.3 m | 2.5 m | 3.0 m |
| alarm wires |  |  |  |
| Standard | 1.5 m | 1.5 m | 1.5 m |

## Reduction unit, straight

| DN 25-50 | DN 65-150 |
| :--- | :--- |
| $L=1400$ | $L=2250 \mathrm{~mm}$ |
| 1.4 m | 2.3 m |
| 0.8 m | 0.9 m |

Wire $20.8 \mathrm{~m} \quad 0.9 \mathrm{~m}$

Reduction unit, angle

|  | DN 25-40 | DN 50-100 | DN 125-150 |
| :--- | :--- | :--- | :--- |
| Wire 1 | 2.0 m | 2.3 m | 2.5 m |
| Wire 2 | 1.5 m | 1.7 m | 1.8 m |
| Wire 3 | 1.7 m | 1.7 m | 1.8 m |

Valve assembly, angle, single pipe Valve assembly, straight, single pipe

DN 25-80
Wire $1 \quad 1.3 \mathrm{~m}$
Wire $2 \quad 3.7 \mathrm{~m}$

Valve assembly, straight, single pipe
DN 25-80
Wire 1
Wire 2
1.9 m
1.4 m

## Parallel T-piece

DN 20-400 / DN 20-100
$\mathrm{L}=1200 \mathrm{~m}$
Wire 1, 2, 3, $4 \quad 1.4$ m

DN 125-400/DN 125-300
$\mathrm{L}=1500 \mathrm{~m}$
1.7 m

Valve assembly, straight, double pipe Valve assembly, angle, double pipe
DN 25-80 DN 25-80
Wire length $3.3 \mathrm{~m} \quad$ Wire length 2.3 m

## Measurement device

Addition for normal laying depth for choice of measurement device

| DN 25-125 | DN $150-250$ | DN 300 |
| :--- | :--- | :--- |
| 0.8 m | 1.0 m | 1.5 m |

## ACCESSORIES

## Wall penetration 6510

Our original W801 seal is intended as a water and radon barrier during casting of pipes in concrete walls and floors. It is designed to function without fault with both low and high water pressure and for all types of pipe material. W801 also permits axial movements in the embedded pipe. The seal is adjustable after casting.

| Dimension | A | B | C |
| :--- | :--- | :--- | :--- |
|  |  |  |  |
| DY 110-180 | 25 | 40 | 22 |
| DY 200-1000 | 31 | 50 | 27 |

## Part no.

6510-DY PEH pipe-000-000

## Order example

Wall penetration for dim DN 200/355, Part number 6510-355-000-000.

## Embedding ring 6520



Wall penetration W801 is used as a seal between pipe and concrete wall where the axial movement is large and there is a high risk of groundwater pressure.

The W802 embedding ring is the market's most effective seal for water and/or radon sealing during casting of round pipes in concrete walls and floors. It suits all types of pipe material, such as plastic, steel, cast iron, concrete etc., and should be installed directly on the casing pipe to be cast together with it. In some cases, where necessary the ring can also be used on corrugated plastic pipes. The unique profile design of the ring, together with the associated hose clamp, provides effective sealing between the pipe and the concrete. The excellent sealing properties result from the hose clamp's ability to hold the rubber ring firmly against the pipe during the casting process. The "ears" of the ring also become efficiently embedded in the concrete when it shrinks during the curing process. The W802 ring is ideal for use where the pipe will not be exposed to major axial movement.

| Dimension | B | C |
| :--- | :--- | :--- |
|  |  |  |
| DY 90-180 | 40 | 22 |
| DY 200-1000 | 50 | 27 |

The embedding ring is used as a seal between district heating pipe and concrete wall where the axial movement is small.

## Part no.

6520-DY PEH pipe-000-000

## Order example

Embedding ring for dim DN 200/355,
Part number 6520-355-000-000.


## Positioning the W802 in concrete

If holes are to be drilled in the concrete wall for later casting of pipes/rubber rings, we recommend the following minimum drill holes:

## PEH dim

B


90-180 PEH Casing dim. +100 mm .
$\geq 200 \quad$ PEH Casing dim. +120 mm .
For installation in other types of holes (e.g. rectangular), there should be free space above the rubber ring of 20 mm

## ACGESSORIES

## End caps



## PART NO. 6291, 6292

Heat shrinkable end caps for installation over the free pipe end to prevent water penetrating into the insulation foam. It is internally covered with seal mastic that tolerates the same temperatures as the insulation foam. The end caps are available for dimensions $\varnothing 90-\varnothing 500$ (on the casing pipe).

## Table showing end cap sizes

| Single pipes (CSS) | Double pipes (CSS2) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Part no. to be delivered | Interval DI | Interval DY | Part no. to be delivered | Interval DI | Interval DY |
| 6291-030 | 24-40 | 75-105 | 6292-010 | 10-28 | 85-135 |
| 6291-040 | 24-55 | 75-135 | 6292-030 | 60-24 50-20 | 105-160 |
| 6291-050 | 24-60 | 75-148 | 6292-040 | 48-24 28-14 | 135-185 |
| 6291-060 | 30-60 | 135-175 | 6292-060 | 48-24 | 140-200 |
| 6291-070 | 40-90 | 90-150 | 6292-070 | 60-24 | 140-235 |
| 6291-080 | 50-95 | 130-195 | 6292-090 | 85-55 | 175-250 |
| 6291-090 | 68-145 | 145-240 | 6292-100 | 105-55 | 175-260 |
| 6291-100 | 68-150 | 145-270 |  |  |  |
| 6291-110 | 120-180 | 220-295 |  |  |  |
| 6291-120 | 120-255 | 220-360 | Flexpipe Single (rubber, not heat shrinkable)) |  |  |
| 6291-130 | 200-280 | 340-420 | 6297-001 | 14-32 | 90 |
| 6291-140 | 200-415 | 340-540 | 6297-005 | 15-35 | 110 |
| 6291-150 | 360-570 | 480-680 |  |  |  |
|  |  |  | Flexpipe Double (rubber, not heat shrinkable)) |  |  |
|  |  |  | 6297-002 | 15-25 | 90 |
|  |  |  | 6297-006 | 14-35 | 110 |
|  |  |  | 6297-007 | 14-45 | 125-130 |
|  |  |  | 6297-008 | 14-45 | 160 |

See exhaustive instructions under Chapter 10, Installation.

## Part no.

6291-XXX (according to table above for suitable DI and DY) followed by -000-000.
6292-XXX (according to table above for suitable DI and DY) followed by -000-000.
6297-XXX (according to table above for suitable DI and DY) followed by -000-000.

## Order example

End cap for single pipe DN 100/250, Part number 6291-100-000-000.

## T-KEY FOR VALVE AND VENTING

Part no. 4130-019-027-000 - Key widths 19 and 27 mm .
Part no. 4130-019-000-000 - T-key 6K-19 DN25-80
Part no. 4130-027-000-000 - T-key 6K-27 DN100-150
Part no. 4130-050-000-000 - T-key 6K-50 PN200-250

$$
\begin{aligned}
& H=1200 \\
& H=800 \\
& H=1200
\end{aligned}
$$



## END CAP FOR VALVE AND VENTING

Part no. 6136-Dim valve-000-000.
Standard length 250 mm


| PORTABLE GEAR |  |
| :--- | :--- |
| Valve | Part no. |
| DN 100-150 | $7801-027-090-000$ |
| DN 200-400 | $7801-050-090-000$ |


|  |  | Length [mm] | Construction measurement spindle [mm] | $\sqrt{n}$ | ${ }^{4}$ Construction |
| :---: | :---: | :---: | :---: | :---: | :---: |
| TAPPING VALVE | DN 25 | 209 | 46 | - | $\downarrow$ measurement |
| DN25-150 | DN 32 | 209 | 55 | - | spindle |
| Part no. 9260-DN-000-000 | DN 40 | 228 | 63 |  |  |
|  | DN 50 | 260 | 74 | $\longleftarrow$ Length |  |
| Consult Powerpipe if reinforcement | DN 65 | 280 | 88 |  |  |
| plate is required | DN 80 | 312 | 102 |  |  |
|  | DN 100 | 349 | 123 |  |  |
|  | DN 125 | 363 | 143 |  |  |
|  | DN 150 | 350/365 | 143 |  |  |

DN25-DN125 are full flow valves, DN150 is a reducing valve.

## TAPPING TOOL

| Valve | Part no. |
| :--- | :--- |
| DN 20 | $7871-002-000-000$ |
| DN 25-100 | $7871-001-000-000$ |

## ADAPTER FOR TAPPING TOOL

Dim: DN 125-150 - Part no. 7871-003-000-000

## CENTRAL DRILL

Part no. 7871-004-000-000

|  | Length [mm] |  |
| :--- | :--- | :--- |
| SINGLE-USE VALVE REDUCED | DN 20-25 | 230 |
| DN 20 - DN 200 | DN 32-40 | 260 |
| Part no. 9247-DN-000-333 | DN 50-80 | 300 |
| Part no. 9247-DN-000-000 (with handle) | DN 100-125 | 325 |
|  | DN 150 | 350 |
|  | DN 200 | 390 |

Balloon sleeves are required for single-use valves. See p. 6:205.
FULL-FLOW VALVE
Part no. 9247-DN-000-907

## SERVICE VALVE FOR CONNECTING INDIVIDUAL HOME

Copper/int. thread Copper/copper Weld/copper Weld/weld with handle Weld/weld with knob
$\varnothing 15-88$, DN 10-25
Ø 15-54
DN 15-50, Ø 15-54

9247-DN-000-456
9247-DN-000-675
9247-DN-000-332
9247-DN-000-000
9247-DN-000-334


## TWIN VALVE FOR CONNECTING INDIVIDUAL HOME, incl. brackets

```
Copper/copper
\varnothing 18-28
Copper/int. thread
Weld/copper
Weld/weld
Weld/int. thread
Int. thread/int. thread
Ø 22/3/4"-Ø 28/1"
DN 20 / Ø
DN 20,25
DN 20 /3/4"
3/4"
```

Part no. 7750-DN-000-000.


Only knob Ø22: part no. 7751-022-000-00X ( $X$ is for blue knob=B, red knob=R)
Only knob Ø28: part no. 7751-028-000-00X ( $X$ is for blue knob=B, red knob=R)

## VENTING VALVE STEEL

DN 25-50 inc. plug
Part no. 9300-DN-000-000

## STEEL CONE

Concentric version for single pipe DN 25-500, Part no. 9190-DN - DN $_{2}-000$
Eccentric version for double pipe DN 25-500, Part no. 9190-DN $-\mathrm{DN}_{2}-325$


## FIXING PLATE FOR DOUBLE PIPE

See Chapter 10. Alternative to anchor point
Part no. 8500-DN-000-000


## REINFORCEMENT PLATES

Used to reinforce a branch from the service pipe where the construction requires. Manufactured to order.
Reinforcement plate, Part no. 9191-DN (main pipe) -DN (branch) -000


## END CAP STEEL

DN25-500
Part no. 9192-DN-000-000


## WARNING MESH

Width 500 mm, length 100 m , purple, approx. 20 pcs per pallet.
Part no. 6990-000-000-000.

## WARNING STRIP

Width 150 mm , length 250 m , purple, 4 pcs per carton.
Part no. 6990-001-000-000


Part no. 6990-002-000-000 (Marked district cooling).

## VENTING PLUG

21 mm, pre-drilled with 20 mm drill, approx. 2000 pcs per bag.
Part no. 6550-035-000-000.

## CONICAL DRILL



Part no. 6890-100-201-000.

## WELDING PLUG

Width 22 mm . Used for sealing foam holes. Requires special tool.
See instruction Chapter 10. Pack size: 2000 pcs.
Part no. 6550-050-000-000.


## FOPS (COVER PATCH)

Diameter 90 mm . Used above the weld plug to provide extra security.
Pack size: 100 pcs.
Part no. 6550-040-000-000


## PLASTIC COATED MASTIC

Width: $70 \mathrm{~mm}, 30 \mathrm{~m} /$ reel. 2 pcs per carton.
Part no. 6550-004-000-000.

## WOVEN MASTIC

Width approx. $50 \mathrm{~mm}, 25 \mathrm{~m} /$ reel. 8 pcs per carton.
Part no. 6550-012-000-000


Width approx. $100 \mathrm{~mm}, 25 \mathrm{~m} /$ reel. 4 pcs per carton.
Part no. 6550-011-000-000

## SHRINK MAT

15 metres/roll
Part. no. 6226-250-000-000
30 metres/roll
Part. no. 6226-150-000-000

## CLOSURE STRIP

15 metres/roll
Part. no. 6232-100- (CLR)
Part. no. 6232-000- (CLW)

## THERMAL PROTECTION MEMBRANE

30 m reel: Part no. 6890-001-000-000

## WELD WIRE PEH

Black. Diameter 4 mm. approx. $2.3 \mathrm{~kg} /$ reel
Part no. 9551-001-000-000.

## ALARM GUIDE

Length 400 mm Pack size 100 pcs
Part no. 6890-010-000-000.


## TAPE

Part no. 9901-022-000-000,
red, $66 \mathrm{~m} \times 15 \mathrm{~mm}, 120$ pcs per carton.

## HYGROSCOPIC FELT

$400 \times 100 \mathrm{~mm}$. Pack size: 100 pcs.
Part no. 6890-011-000-000

## SPLICING JOINT FOR ALARM WIRE

Pack size: 1000 pcs.
Part no. 6890-100-000-000.


INSULATED ALARM WIRE
(for special applications, such as bridging in buildings, manholes).
Part no. 9720-020-000-000

## STANDARD ALARM WIRE

Diameter 1.38 mm . Cross-section area $1.5 \mathrm{~mm}^{2} .1 \mathrm{~kg}=75.2 \mathrm{~m}$.
Roll of approx. 10 kg : part. no. 9720-010-000-000
Roll of approx. 1 kg: part. no. 9720-001-000-000

## ALARM GUIDE FOR ALARM WIRE, WIDETECT

Part no. 6890-013-000-000 (for district cooling and steam).

SPLICING JOINT, WIDETECT
Part no. 6890-100-050-000
T-CONNECTION, WIDETECT

## ALARM WIRE, WIDETECT

Part no. 9720-100-050-000-00

## SPLICING PLIER

Used to insert the alarm wire into the splicing joint


Part no. 6890-100-100-000.

## POLYOL (delivered in drums)

One drum contains approx. 200 kg . For smaller deliveries, please contact Powerpipe.
Study the instructions in Chapter 10 before use.
Part no. 6707-000-000-000.


ISOCYANATE (delivered in drums)
One drum contains approx. 250 kg . For smaller deliveries, please contact Powerpipe.
Study the instructions in Chapter 10 before use.
Part no. 6721-000-000-000


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## MEGGER INSULATION TESTER 1000V

Part no. 6870-000-000-000.


## PULSE ECHOMETER

Part no. 6871-000-000-000.


## EXPANSION CUSHIONS

Flat: Length 1200 mm, height 2000 mm, thickness 40 mm: Part no. 9607-005-000-000 Slitted: Length 1000 mm, height 2000 mm, thickness 40 mm : Part no. 9607-003-000-000.
The slit length is 1000 mm .
50 pcs per pallet.
For Installation, see p. 9:401

## TRANSITION COPPER-STEEL

Straight Ø 22 - DN 20 (26.9)
Ø 28 - DN 25 (33.7)
Ø 35 - DN 32 (42.4)
Part no. 6800-ØCu-DN-000.

## EQUIPMENT BOX FOR SLEEVE WORK

```
- megger
- plug welding equipment
- plug
- splicing joints
    - splicing plier
    - FOPS press
    - conical drill
    - pressure testing equipment
```


-

| - megger | - plug welding equipment |
| :--- | :--- |
| - plug | - splicing joints |
| - splicing plier | - FOPS press |
| - conical drill | - pressure testing equipment |
| - mm. (according to equipment list) |  |



Part no. 9908-000-000-000.

## PLUG WELDING EQUIPMENT

Plug welder, electronic MSG 41E inc. requisite equipment Part no. 6890-100-200-000.

## CONICAL DRILL

Part no. 6890-100-201-000

## BRANCH PIPES

Used when connecting double pipe to double pipe.
Available for DN 25, 32, 40 and 50.
Part no. 8205-DN2-000-000
Connection for single pipe - Part no. 8202-DN2-000-000
DN1 is stated separately when ordering


## STEEL BEND 5D

Part no. 8201-DN-900-000

## Haelok press fittings

## HAELOK <br> SWISS PRECISION



Haelok brand tools and press fittings for district heating. Facilitates and accelerates connections above ground, primarily indoors. The advantage is that no "hot works" are required. Can be installed without the pipe having to be "dried out" (which is required for welding). Extremely short installation time. More dimensions can be added later. The range below is only part of the total range. For more information on the product, range or technology, contact our sales team or technical advisers

|  | Powerpipe Part no. | Haelok Part no. | Name |
| :---: | :---: | :---: | :---: |
| Tool (Box) |  |  |  |
| DN12-DN20 | 7870-012-020-000 | HLK-60PT-PN28 | Tool box 12-28 mm |
| DN25-DN50 | 7870-025-050-000 | HLK-60PT-PN60 | Tool box 30-60 mm |
| Insert for Tool (must be ordered separate from box) |  |  |  |
| DN20 | 7870-020-000-000 | HLK-60PT-IN-28 | Insert (4 pcs) DN20 |
| DN25 | 7870-025-000-000 | HLK-60PT-IN-33 | Insert (4 pcs) DN25 |
| DN32 | 7870-032-000-000 | HLK-60PT-IN-34 | Insert (4 pcs) DN32 |
| DN40 | 7870-040-000-000 | HLK-60PT-IN-35 | Insert (4 pcs) DN40 |
| DN50 | 7870-050-000-000 | HLK-60PT-IN-36 | Insert (4 pcs) DN50 |
| Straight couplings |  |  |  |
| DN20 | 6806-020-000-000 | HLK-10SF-26-CC | Straight coupling DN20 |
| DN25 | 6806-025-000-000 | HLK-10SF-33-CC | Straight coupling DN25 |
| DN32 | 6806-032-000-000 | HLK-10SF-42-CC | Straight coupling DN32 |
| DN40 | 6806-040-000-000 | HLK-10SF-48-CC | Straight coupling DN40 |
| DN50 | 6806-050-000-000 | HLK-10SF-60-CC | Straight coupling DN50 |
| Repair couplings |  |  |  |
| DN20 | 6806-020-000-200 | HLK-10SR-26-CC | Rep coupling DN20 |
| DN25 | 6806-025-000-200 | HLK-10SR-33-CC | Rep coupling DN25 |
| DN32 | 6806-032-000-200 | HLK-10SR-42-CC | Rep coupling DN32 |
| DN40 | 6806-040-000-200 | HLK-10SR-48-CC | Rep coupling DN40 |
| DN50 | 6806-050-000-200 | HLK-10SR-60-CC | Rep coupling DN50 |
| Reduction couplings |  |  |  |
| DN25-DN20 | 6806-025-020-000 | HLK-10RE-33-26-CC | Red coupling DN25-DN20 |
| DN32-DN25 | 6806-032-025-000 | HLK-10RE-42-33-CC | Red coupling DN32-DN25 |
| DN40-DN32 | 6806-040-032-000 | HLK-10RE-48-42-CC | Red coupling DN40-DN32 |
| DN50-DN40 | 6806-050-040-000 | HLK-10RE-60-48-CC | Red coupling DN50-DN40 |

For warranty conditions, refer to Haelok: https://www.haelok.com/wp-content/uploads/2019/07/2019_General-Terms-and-conditions-of-Sale-and-Supply-HAELOK-AG.pdf

## Foam packs, Joints, single pipe

## FOAM PACKS, 6480 Dimensioning table, single pipe



| Dim. <br> DN <br> [mm] | Serie <br> PEH <br> Dy | Bottle no. <br> Stand. | Flex | Seri <br> PEH <br> Dy | Bottle no. <br> Stand. | Flex | Serie <br> PEH <br> Dy | Bottle no. <br> Stand. | Flex | Seri <br> PEH <br> Dy | Bottle no. <br> Stand. | Flex |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 |  |  |  | 110 | 3 | 4 | 125 | 4 | 5 | 140 | 6 | 7 |
| 25 | 90 | 2 | 3 | 110 | 3 | 4 | 125 | 4 | 5 | 140 | 6 | 7 |
| 32 | 110 | 3 | 4 | 125 | 4 | 5.1 | 140 | 5 | 6.1 | 160 | 6.1 | 8.1 |
| 40 | 110 | 3 | 4 | 125 | 4 | 5.1 | 140 | 5 | 6.1 | 160 | 6.1 | 8.1 |
| 50 | 125 | 4 | 5.1 | 140 | 5.1 | 6.1 | 160 | 6.1 | 8 | 180 | 7 | 9 |
| 65 | 140 | 5 | 6.1 | 160 | 6.1 | 8 | 180 | 7 | 8.1 | 200 | 8 | 10.1 |
| 80 | 160 | 6 | 7 | 180 | 7 | 8.1 | 200 | 8 | 10.1 | 225 | 9 | 11.1 |
| 100 | 200 | 7 | 8 | 225 | 8.1 | 10 | 250 | 9.1 | 12 | 280 | 11 | 13 |
| 125 | 225 | 8 | 9.1 | 250 | 9 | 11.1 | 280 | 10.1 | 12 | 315 | 11.1 | 13 |
| 150 | 250 | 8.1 | 11 | 280 | 10 | 12 | 315 | 11 | 13 | 355 | 12 |  |
| 200 | 315 | 10 | 12 | 355 | 11.1 |  | 400 | 12 |  | 450 | 13 |  |
| 250 | 400 | 11.1 |  | 450 | 12 |  | 500 | 13.1 |  | 560 | $12+12$ |  |
| 300 | 450 | 12 |  | 500 | 13 |  | 560 | 13.1+6.1 |  | 630 | $12+13$ |  |
| 350 | 500 | 13 |  | 560 | 13.1 |  | 630 | $13.1+11$ |  | 710 | $13.1+1$ |  |
| 400 | 560 | 13 |  | 630 | 13.1+9 |  | 710 | $13.1+13$ |  |  |  |  |
| 450 | 630 | 13.1+5 |  | 710 | 12+13 |  | 800 | 13.1+13.1 |  |  |  |  |
| 500 | 710 | 13.1+11.1 |  | 800 | $13.1+1$ |  |  |  |  |  |  |  |
| 600 | 800 | $13.1+12$ |  | 900 | $13.1+1$ |  |  |  |  |  |  |  |

Ready to use packs for each sleeve joint are supplied in bottles. "Flex" above refers to installation of T-piece with bend and flexible sleeve for flexible pipe.

The quantities are based on:

- Free sleeve length $2 \times 225=450 \mathrm{~mm}$.
- Dimensions for shrinkable casing
- Temperature $+15^{\circ} \mathrm{C}-+40^{\circ} \mathrm{C}$ in sleeve and steel pipe.

Foam liquids should have a temperature of approx. $20^{\circ} \mathrm{C}$. If a welding sleeve is used, the quantity should be reduced by approx. 20\% due to the smaller sleeve diameter.

## Part no.

6480-bottle no.-000-000.

## Order example

Bottle set no. 5.1, part no. 6480-051-000-000.

## Foam packs, Joints, double pipes/ Twin pipes



## FOAM PACKS, 6480 Dimensioning table, double pipe

| Dimension DN | STANDARD PEH Dy [mm] | Bottle no. | DOUBLE+ PEH Dy [mm] | Bottle no. | DOUBLE++ PEH <br> Dy [mm] | Bottle no. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $2 \times 20$ | 125 | 3 | 140 | 5 | 160 | 6.1 |
| $2 \times 25$ | 140 | 5 | 160 | 6.1 | 180 | 8 |
| $2 \times 32$ | 160 | 6.1 | 180 | 7 | 200 | 8.1 |
| $2 \times 40$ | 160 | 6.1 | 180 | 7 | 200 | 8.1 |
| $2 \times 50$ | 200 | 8 | 225 | 9 | 250 | 10.1 |
| $2 \times 65$ | 225 | 8.1 | 250 | 10 | 280 | 11 |
| $2 \times 80$ | 250 | 9.1 | 280 | 10.1 | 315 | 11.1 |
| $2 \times 100$ | 315 | 11 | 355 | 12 | 400 | 13 |
| $2 \times 125$ | 400 | 12 | 450 | 13 | 500 | $11.1+12$ |
| $2 \times 150$ | 450 | 13 | 500 | 13.1 | 560 | $12+12$ |
| $2 \times 200$ | 560 | 12+12 | 630 | $13+12$ | 710 | $13.1+13.1$ |

Ready to use packs for each sleeve joint are supplied in bottles."
The quantities are based on:

- Free sleeve length $2 \times 225=450 \mathrm{~mm}$.
- Dimensions for shrinkable casing
- Temperature $+15^{\circ} \mathrm{C}-+40^{\circ} \mathrm{C}$ in sleeveand steel pipe.

Foam liquids should have a temperature of approx. $20^{\circ} \mathrm{C}$. If a welding sleeve is used, the quantity should be reduced by approx. $15 \%$ due to the smaller sleeve diameter.

## Part no.

6480-bottle no.-000-000.

## Order example

Bottle set 8.1, part no. 6480-081-000-000.

## EN 13941

In Sweden, as in the rest of Europe, standard EN 13941, which is divided into two parts, applies to calculation of district heating pipes. The standard is not harmonised with the Pressure Equipment Directive (PED) and may only be applied for pipes in the ground. In Sweden, AFS 2017:3 applies overall. The standard provides regulations regarding calculation, design and installation of pre-insulated pipes laid in the ground.

## A calculation program for static calculations can be requisitioned from Powerpipe

The standard sets requirements for three aspects of pipe calculation:

1. Stresses due to internal overpressure (force controlled load) Limitations are stated within "Limit state A" and are essentially the same as in RN 78.
2. Loads that result from repeated loads;"Fatigue".

The limitations are stated in "Limit state B".
The following applies:
Transmission pipes should withstand 100 cycles.
Distribution pipes should withstand 250 cycles.
House connections should withstand 1000 cycles.
Each cycle should be based on a temperature change of $110^{\circ} \mathrm{C}$.
3. Loads which can lead to instability or buckling.
(Movement controlled load). The limitations are stated in "Limit state C".
The pipes are divided into three project classes:
Project class A (secondary facilities)
Project class B (primary facilities with DN $\leq 300$ )
Project class C (primary facilities with DN $>300$ )

| Project class | Weld inspection <br> during <br> installation | Safety factor <br> fatigue | Documentation |
| :---: | :---: | :---: | :---: |
| A | $>5 \%$ | 5 | Generalised |
| B | $>10 \%$ | 6.67 | Generalised |
| C | $>20 \%$ | 10 | Specific |

The generalised documentation can be company standard or manufacturer
 manuals. The specific documentation should contain:

Design pressure and temperature, together with the number of expected cycles including calculations according to "Limit state A-C".

Pipe information such as drawings, dimensions, material data, installation assumptions, as-built drawings.

Quality assurance


Project classes

## Forces, movements and expansion bends

## Expansion

When a buried district heating pipe is exposed to a temperature increase, this means that the pipe tries to expand.

The expansion is prevented by friction that occurs between the moving pipe and the surrounding sand (the soil).

This friction creates an axial tension in the pipe and counteracts free expansion.

## The district heating pipe has two different zones:

1. The part which is fixed (may be in the middle of a straight section) (Zone 1).
2. The part which moves (located at both ends of a straight section) (Zone 2).

The stress in the fixed part is only due to the temperature change from the temperature which applied when the pipe trench was filled. The force in the pipe is the stress multiplied by the steel pipe's cross-section area.

The part of the pipe which moves is designated the "Friction length". This acts as an attachment for the fixed part.

## Pre-stressing

For purposes including limiting stresses and movements, it is common to thermally pre-stress the pipe.
This means that you get pressure stresses in the pipe at high temperatures and tensile stresses at low temperatures.

## Cold laying

Narrow and medium dimensions can be cold laid. This means that you get very high (but acceptable in terms of the standard) axial stresses. For example, the movements in a bend can be up to four times as large as where pre-stressing is used.

## Table of friction lengths and movements

The table of friction lengths and movements is on the next page.
The values shown are based on a number of conditions, which are stated. In the case of changes in the conditions, the data stated naturally also changes.


$$
\sigma=E \cdot a \cdot \Delta T
$$

$\sigma=$ Stress
E = Elastic modulus
a = Coefficient of linear expansion
$\Delta T=$ Temperature change


Stress in a cold laid pipe

## Example calculations, pre-heated system

Max. axial stress 150 MPa for single pipe (corresponds to $\Delta \mathrm{T}=60^{\circ} \mathrm{C}$ ). Max. axial stress $150+50 \mathrm{MPa}$ for double pipes (temperature difference between supply and return pipe is $40^{\circ} \mathrm{C}$ ), coverage 0.6 m , friction coefficient $\mu=0.4$.
Bend radius: Powerpipe standard, number of full cycles: 1000 for DN 25-65; 250 cycles for DN80-300; 100 cycles for DN 350-900.

| Series 1 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |  |
| 25 | 912 | 43 | 16 | 0.6 |  |
| 32 | 1122 | 44 | 16 | 0.7 |  |
| 40 | 1125 | 51 | 19 | 0.8 |  |
| 50 | 1289 | 62 | 23 | 1.1 |  |
| 65 | 1457 | 70 | 26 | 1.2 |  |
| 80 | 1680 | 79 | 29 | 1.4 |  |
| 100 | 2137 | 90 | 33 | 1.7 |  |
| 125 | 2438 | 97 | 36 | 2.1 |  |
| 150 | 2755 | 115 | 42 | 2.6 |  |
| 200 | 3577 | 130 | 48 | 3.3 |  |
| 250 | 4690 | 138 | 51 | 3.9 |  |
| 300 | 5424 | 158 | 59 | 4.7 |  |
| 350 | 6126 | 154 | 57 | 4.7 |  |
| 400 | 7052 | 172 | 64 | 5.3 |  |
| 450 | 7202 | 190 | 70 | 7.3 |  |
| 500 | 8293 | 184 | 68 | 6.6 |  |
| 600 | 9801 | 210 | 78 | 9.4 |  |
| 700 | 11563 | 234 | 87 | 10.8 |  |
| 800 | 13594 | 251 | 93 | 12.1 |  |
| 900 | 15781 | 276 | 102 | 13.4 |  |


| Series 2 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |  |
| 25 | 1118 | 35 | 13 | 0.5 |  |
| 32 | 1279 | 39 | 14 | 0.7 |  |
| 40 | 1281 | 45 | 17 | 0.8 |  |
| 50 | 1447 | 55 | 20 | 1.0 |  |
| 65 | 1669 | 61 | 23 | 1.1 |  |
| 80 | 1895 | 70 | 26 | 1.3 |  |
| 100 | 2412 | 80 | 29 | 1.6 |  |
| 125 | 2716 | 87 | 32 | 2.0 |  |
| 150 | 3094 | 102 | 38 | 2.4 |  |
| 200 | 4046 | 115 | 43 | 3.1 |  |
| 250 | 5301 | 122 | 45 | 3.7 |  |
| 300 | 6050 | 142 | 52 | 4.4 |  |
| 350 | 6896 | 137 | 51 | 4.4 |  |
| 400 | 7978 | 152 | 56 | 5.0 |  |
| 450 | 8128 | 168 | 62 | 6.8 |  |
| 500 | 9386 | 162 | 60 | 6.2 |  |
| 600 | 11075 | 186 | 69 | 8.8 |  |
| 700 | 13035 | 208 | 77 | 10.1 |  |
| 800 | 15123 | 225 | 83 | 11.4 |  |
| 900 | 17369 | 251 | 93 | 12.8 |  |


| Series 3 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |  |
| 25 | 1275 | 31 | 11 | 0.5 |  |
| 32 | 1436 | 35 | 13 | 0.6 |  |
| 40 | 1439 | 40 | 15 | 0.8 |  |
| 50 | 1659 | 48 | 18 | 1.0 |  |
| 65 | 1884 | 54 | 20 | 1.0 |  |
| 80 | 2112 | 63 | 23 | 1.2 |  |
| 100 | 2690 | 71 | 26 | 1.5 |  |
| 125 | 3055 | 77 | 29 | 1.9 |  |
| 150 | 3496 | 91 | 33 | 2.3 |  |
| 200 | 4584 | 101 | 38 | 2.9 |  |
| 250 | 5928 | 109 | 40 | 3.5 |  |
| 300 | 6821 | 126 | 47 | 4.2 |  |
| 350 | 7823 | 121 | 45 | 4.1 |  |
| 400 | 9072 | 134 | 49 | 4.7 |  |
| 450 | 9221 | 148 | 55 | 6.4 |  |
| 500 | 10661 | 143 | 53 | 5.8 |  |
| 600 | 12547 | 164 | 61 | 8.3 |  |
| 700 | 14564 | 186 | 69 | 9.6 |  |
| 800 | 16712 | 204 | 75 | 10.9 |  |


| Series 4 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |  |
| 25 | 1433 | 27 | 10 | 0.5 |  |
| 32 | 1649 | 30 | 11 | 0.6 |  |
| 40 | 1651 | 35 | 13 | 0.7 |  |
| 50 | 1874 | 43 | 16 | 0.9 |  |
| 65 | 2101 | 49 | 18 | 1.0 |  |
| 80 | 2387 | 55 | 20 | 1.2 |  |
| 100 | 3029 | 63 | 23 | 1.5 |  |
| 125 | 3457 | 68 | 25 | 1.8 |  |
| 150 | 3965 | 80 | 30 | 2.2 |  |
| 200 | 5195 | 89 | 33 | 2.7 |  |
| 250 | 6698 | 96 | 36 | 3.3 |  |
| 300 | 7747 | 111 | 41 | 3.9 |  |
| 350 | 8916 | 106 | 39 | 3.9 |  |
| 400 | 10346 | 117 | 43 | 4.4 |  |
| 450 | 10496 | 130 | 48 | 6.0 |  |
| 500 | 12133 | 125 | 46 | 5.5 |  |
| 600 | 14077 | 146 | 54 | 7.8 |  |
| 700 | 16153 | 168 | 62 | 9.1 |  |
|  |  |  |  |  |  |

Other input data gives other results. It is easiest to use Powerpipe's calculation program for the relevant case.

## Example calculations, pre-heated system

Max. axial stress 150 MPa for single pipe (corresponds to $\Delta T=60^{\circ} \mathrm{C}$ ). Max. axial stress $150+50 \mathrm{MPa}$ for double pipes (temperature difference between supply and return pipe is $40^{\circ} \mathrm{C}$ ), coverage 0.6 m , friction coefficient $\mu=0.4$.
Bend radius: Powerpipe standard, number of full cycles: 1000 for DN 25-65; 250 cycles for DN80-300; 100 cycles for DN 350-900.

| Double, standard |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |
| $2 \times 20$ | 1437 | 42 | 14 | 0.5 |
| $2 \times 25$ | 1443 | 54 | 18 | 0.6 |
| $2 \times 32$ | 1660 | 60 | 20 | 0.8 |
| $2 \times 40$ | 1669 | 68 | 23 | 0.9 |
| $2 \times 50$ | 2116 | 75 | 26 | 1.1 |
| $2 \times 65$ | 2411 | 84 | 29 | 1.2 |
| $2 \times 80$ | 2713 | 97 | 33 | 1.5 |
| $2 \times 100$ | 3505 | 109 | 37 | 1.8 |
| $2 \times 125$ | 4565 | 103 | 35 | 2.1 |
| $2 \times 150$ | 5257 | 120 | 41 | 2.5 |
| $2 \times 200$ | 6822 | 136 | 46 | 3.2 |


| Double+ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |
| $2 \times 20$ | 1650 | 37 | 13 | 0.4 |
| $2 \times 25$ | 1655 | 47 | 16 | 0.6 |
| $2 \times 32$ | 1878 | 53 | 18 | 0.7 |
| $2 \times 40$ | 1883 | 60 | 21 | 0.9 |
| $2 \times 50$ | 2391 | 67 | 23 | 1.1 |
| $2 \times 65$ | 2690 | 76 | 26 | 1.2 |
| $2 \times 80$ | 3052 | 86 | 29 | 1.4 |
| $2 \times 100$ | 3974 | 96 | 33 | 1.7 |
| $2 \times 125$ | 5177 | 91 | 31 | 2.0 |
| $2 \times 150$ | 5883 | 107 | 37 | 2.4 |
| $2 \times 200$ | 7748 | 119 | 41 | 3.0 |


| Double++ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Dimension | Friction force <br> $\mathrm{N} / \mathrm{m}$ | Friction length <br> m | Movement <br> mm | Length L bend <br> m |
| $2 \times 20$ | 1864 | 32 | 11 | 0.4 |
| $2 \times 25$ | 1870 | 41 | 14 | 0.6 |
| $2 \times 32$ | 2095 | 47 | 16 | 0.7 |
| $2 \times 40$ | 2101 | 54 | 19 | 0.8 |
| $2 \times 50$ | 2670 | 60 | 20 | 1.0 |
| $2 \times 65$ | 3029 | 67 | 23 | 1.1 |
| $2 \times 80$ | 3454 | 76 | 26 | 1.3 |
| $2 \times 100$ | 4512 | 85 | 29 | 1.6 |
| $2 \times 125$ | 5803 | 81 | 28 | 1.9 |
| $2 \times 150$ | 6654 | 95 | 32 | 2.3 |
| $2 \times 200$ | 8841 | 105 | 36 | 2.8 |

Other input data gives other results. It is easiest to use Powerpipe's calculation program for the relevant case.

## Calculating pressure drop for flexible pipes

## Requisite flow

Each connected building has a specific power demand at design temperature.
This power demand together with available temperature drop determines the required flow.

| For example | Power demand | Q | 12 kW. |  |
| :--- | :--- | :--- | :--- | :--- |
|  | Temperature drop | $\Delta \mathrm{T}$ | $40^{\circ} \mathrm{C}$ |  |
|  | Requisite flow | m | $258 \mathrm{~kg} / \mathrm{h}$ | $\mathrm{m}=\mathrm{Qx860} / \Delta \mathrm{T}$ |

## Required dimension

For copper pipes, see calculation diagram 9:203
With a pressure drop of $1 \mathrm{mbar} / \mathrm{m}(10 \mathrm{~mm} v p / \mathrm{m})$ the dimension required for the example stated above is $18 \times 1 \mathrm{~mm}$.

## Total pressure drop

The available pressure drop is divided up over the longest pipe section from the connection point to the furthest district heating control centre.
E.g.: The average pressure drop can generally be estimated as $1 \mathrm{mbar} / \mathrm{m}$.

The pressure drop for the connection pipe (copper flex 18x1) if it is 14 m long is $2 \times 14 \times 1=28 \mathrm{mbar}$
Higher pressure drops can be taken on connection pipes located closer to the connection point.
However, the water speed should not exceed $2 \mathrm{~m} / \mathrm{s}$ in a copper pipe.

## Flexible steel pipes

Average temperature, water $80^{\circ} \mathrm{C}$ - Roughness $\varepsilon=0.0016 \mathrm{~mm}$ steel flex ( $1 \mathrm{~mm} v p=9.81 \mathrm{~Pa}$ )

$$
\dot{\mathrm{m}} \approx \frac{\mathrm{Q} \cdot 860}{\Delta \mathrm{~T}} \quad \begin{aligned}
& \dot{\mathrm{m}}=\text { flow in } \mathrm{kg} / \mathrm{h} \\
& \mathrm{Q}=\text { power } \mathrm{kW} \\
& \Delta \mathrm{~T}=\text { temperature difference }{ }^{\circ} \mathrm{C}
\end{aligned}
$$

$$
\begin{aligned}
\text { Example: } & \text { Power demand } 30 \mathrm{~kW} \\
& \Delta \mathrm{~T}=40^{\circ} \mathrm{C} \\
& \text { Requisite flow }=\frac{30 \times 860}{40}=645 \mathrm{~kg} / \mathrm{h}
\end{aligned}
$$



## Flexible copper pipes

Average temperature, water $80^{\circ} \mathrm{C}-$ Roughness $\varepsilon=0.0015 \mathrm{~mm}$ steel flex ( $1 \mathrm{~mm} \mathrm{vp}=9.81 \mathrm{~Pa}$ )

$$
\dot{\mathrm{m}} \approx \frac{\mathrm{Q} \cdot 860}{\Delta \mathrm{~T}} \quad \begin{aligned}
& \dot{\mathrm{m}}=\text { flow in } \mathrm{kg} / \mathrm{h} \\
& \mathrm{Q}=\text { power } \mathrm{kW} \\
& \Delta \mathrm{~T}=\text { temperature difference }{ }^{\circ} \mathrm{C}
\end{aligned}
$$

Example: Power demand 30kW

$$
\Delta \mathrm{T}=40^{\circ} \mathrm{C}
$$

$$
\text { Requisite flow }=\frac{30 \times 860}{40}=645 \mathrm{~kg} / \mathrm{h}
$$



## Casaflex

Average temperature, water $80^{\circ} \mathrm{C}$
Roughness $\varepsilon=0.0016 \mathrm{~mm}$ steel pipe
$(1 \mathrm{~mm} \mathrm{vp}=9.81 \mathrm{~Pa}$ )
$\dot{\mathrm{m}} \approx \frac{\mathrm{Q} \cdot 860}{\Delta \mathrm{~T}}$
$\dot{\mathrm{m}}=$ flow in $\mathrm{kg} / \mathrm{h}$
$\mathrm{Q}=$ power kW
$\Delta T=$ temperature difference ${ }^{\circ} \mathrm{C}$

$$
\begin{aligned}
\text { Example: } & \text { Power demand } 30 \mathrm{~kW} \\
& \Delta \mathrm{~T}=40^{\circ} \mathrm{C} \\
& \text { Requisite flow }=\frac{30 \times 860}{40}=645 \mathrm{~kg} / \mathrm{h}
\end{aligned}
$$

## Q [kw]



## Steel pipes

| DN | External diam. [mm] | Thickness [mm] | Average <br> speed <br> [m/s] | Flow <br> [liter/s] | Pressure drop [Pa/m] | Transmission cap. at $\Delta \mathrm{T}=50^{\circ} \mathrm{C}[\mathrm{kW}]$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | 26.9 | 2.6 | 0.8 | 0.3 | 300 | 60 |
| 25 | 33.7 | 2.6 | 0.8 | 0.5 | 200 | 100 |
| 32 | 42.4 | 2.6 | 0.8 | 0.9 | 200 | 180 |
| 40 | 48.3 | 2.6 | 0.9 | 1.3 | 200 | 270 |
| 50 | 60.3 | 2.9 | 0.9 | 2.1 | 200 | 430 |
| 65 | 76.1 | 2.9 | 1.0 | 3.9 | 150 | 790 |
| 80 | 88.9 | 3.2 | 1.0 | 5.3 | 150 | 1100 |
| 100 | 114.3 | 3.6 | 1.1 | 9.9 | 150 | 2000 |
| 125 | 139.7 | 3.6 | 1.3 | 18.0 | 150 | 3700 |
| 150 | 168.3 | 4 | 1.4 | 28.0 | 150 | 5800 |
| 200 | 219.1 | 4.5 | 1.6 | 55.0 | 150 | 11000 |
| 250 | 273 | 5 | 1.8 | 98.0 | 150 | 20000 |
| 300 | 323.9 | 5.6 | 2.0 | 154.0 | 150 | 31000 |
| 350 | 355.6 | 5.6 | 2.0 | 186.0 | 100 | 38000 |
| 400 | 406.4 | 6.3 | 2.0 | 244.0 | 100 | 50000 |
| 450 | 457 | 6.3 | 2.0 | 310.0 | 100 | 63000 |
| 500 | 508 | 6.3 | 2.0 | 385.0 | 100 | 79000 |
| 600 | 610 | 7.1 | 2.0 | 557.0 | 100 | 110000 |
| 700 | 711 | 8 | 2.0 | 785.0 | 50 | 160000 |
| 800 | 813 | 8.8 | 2.0 | 993.0 | 50 | 200000 |

## Transmission capacity

## Different $\boldsymbol{\Delta T}$, other than $50^{\circ} \mathrm{C}$

The transmission capacity in the table above applies for $\Delta T=50^{\circ} \mathrm{C}$. This is linearly dependent on $\Delta T$ as follows:

| $\Delta T$ | Transmission capacity in \% of $\Delta T=50^{\circ}$ |
| :--- | :--- |
| 20 | 40 |
| 25 | 50 |
| 30 | 60 |
| 35 | 70 |
| 40 | 80 |
| 45 | 90 |
| 50 | 100 |
| 55 | 110 |
| 60 | 120 |

## Example

For the calculation of $\Delta T=40^{\circ}$ DN200, single pipe, the transmission capacity is: $11.000 \times 0.8=8.800 \mathrm{~kW}$

## Design guidelines

## Different flow

Transmission capacity is linearly dependent on flow, as shown below (below for DN200):

| Flow <br> $[$ litre/s] | Transmission capacity in \% |
| :--- | :--- |
| 44 | 80 |
| 55 | 100 |
| 66 | 120 |

## Example:

For calculation of transmission capacity where the flow deviates from the table, and is 44 litre/s for DN200, the transmission capacity becomes: $44 / 55 * 11,000=8,800 \mathrm{~kW}$

## Pressure drop

Caused by the friction factor, which in turn is a function of surface roughness. Can vary with the age of the pipe. In normal cases, the pressure drop is lower for larger pipe dimensions.

The pressure drop is proportional to the speed squared.

The pressure drop is presented in the table for Steel Pipes above, assumed friction factor $=0.022$ and tabled flows. Note that the friction factor and thus the pressure drop can vary significantly.

## Heat losses

## Calculation assumptions for single and double pipes

## Laying conditions

| Fill height <br> Free distance <br> between pipes | 0.80 m |  |
| :--- | :--- | :--- |
|  | 0.20 m | $\varnothing 110 \leq \mathrm{Dy} \leq \varnothing 180$ |
|  | 0.25 m | $\varnothing 200 \leq \mathrm{Dy} \leq \varnothing 500$ |
|  | 0.30 m | $\varnothing 630 \leq \mathrm{Dy} \leq \varnothing 900$ |

## Ground

Thermal conductivity: $\quad \lambda m=1.5 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$

## PUR foam insulation

Thermal conductivity:

$$
\lambda \mathrm{i}=0.026 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}
$$

Temperature, annual average value (primary system)

Supply line temperature:
$\mathrm{Tf}=85^{\circ} \mathrm{C}$
Return pipe temperature:
$\operatorname{Tr}=55^{\circ} \mathrm{C}$
Ambient temperature:
$\mathrm{To}=5^{\circ} \mathrm{C}$
$\Delta T=65^{\circ} \mathrm{C}$

## Heat loss Q

$T_{0}$


$\lambda=$ insulation's thermal conductivity
$\Delta T=\frac{\mathrm{Tf}+\mathrm{Tr}}{2}-\mathrm{To}_{0}$
if $\Delta T$ changes by $10^{\circ}$, the loss is affected by

$$
\frac{10}{65}=15 \%
$$

Heat losses for district heating pipes in ground depend on:

1-Thermal resistance of the soil:

2-Thermal resistance of the pipe insulation

3- Interaction between supply and return pipe

$$
\begin{aligned}
& \operatorname{Rm}=\frac{1}{2 \pi \lambda_{m}} \ln \left(\frac{4 Z_{c}}{D_{c}}\right) \\
& \operatorname{Rr}=\frac{1}{2 \pi \lambda_{i}} \ln \left(\frac{D \text { pur }}{d_{o}}\right) \\
& R_{2}=\frac{1}{4 \pi \lambda_{s}} \ln \left(1+\left(\frac{2 Z_{c}}{C}\right)^{2}\right)
\end{aligned}
$$

For calculation see EN 13941

## Different series, different heat losses

The table below summarises the differences, in this case DN 80. Data from p. 9:305 and 9:308

| DN 80/160 | Series 1 | $33 \mathrm{~W} / \mathrm{m}$ | + $18 \%$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DN 80/180 | Series 2 | $28 \mathrm{~W} / \mathrm{m}$ | 0 \% | comparison starting point |  |
| DN 80/200 | Series 3 | $24 \mathrm{~W} / \mathrm{m}$ | - 14 \% |  | (All calculated losses |
| DN 80/225 | Series 4 | $22 \mathrm{~W} / \mathrm{m}$ | - 22 \% |  | supply + return) |
| DN2*80/250 | Double Std | $23 \mathrm{~W} / \mathrm{m}$ | - $18 \%$ |  |  |
| DN2*80/280 | Double+ | $18 \mathrm{~W} / \mathrm{m}$ | - $36 \%$ |  |  |
| DN2*80/315 | Double++ | $15 \mathrm{~W} / \mathrm{m}$ | - $46 \%$ |  |  |
| DN2*80/315 | Panel pipe | $11 \mathrm{~W} / \mathrm{m}$ | - $60 \%$ | (only supply pipe, in additio | wer losses, -71\%) |

## Assumed: Supply $85^{\circ} \mathrm{C}$, return $55^{\circ} \mathrm{C}$, surrounding $5^{\circ} \mathrm{C}, \mathbf{0 . 8} \mathrm{m}$.

## Life cycle cost

To achieve optimal overall economy, a life cycle cost analysis should be carried out. A number of parameters are relevant. Consult with Powerpipe. The result of the analysis can be presented graphically, for example:


## Heat losses

## Single pipe - Heat losses at $\Delta \mathrm{T}=65^{\circ} \mathrm{C}$ (refers to supply + return pipe together)



## Double pipe - Heat losses at $\Delta T=65^{\circ} \mathrm{C}$

| DN | STANDARD W/m | kWh/m.year | DOUBLE+ W/m | kWh/m.year | DOUBLE++ W/m | kWh/m.year |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $2 \times 20$ | 12.1 | 106 | 10.1 | 88 | 8.9 | 78 |
| $2 \times 25$ | 13.2 | 116 | 11.2 | 97 | 9.9 | 87 |
| $2 \times 32$ | 14.6 | 128 | 12.2 | 107 | 10.8 | 95 |
| $2 \times 40$ | 16.6 | 145 | 14.3 | 125 | 12.4 | 109 |
| $2 \times 50$ | 16.4 | 144 | 13.8 | 121 | 12.2 | 107 |
| $2 \times 65$ | 20.2 | 177 | 16.3 | 143 | 13.7 | 120 |
| $2 \times 80$ | 22.8 | 200 | 17.8 | 156 | 14.6 | 128 |
| $2 \times 100$ | 22.9 | 201 | 17.4 | 152 | 14.4 | 126 |
| $2 \times 125$ | 20.8 | 182 | 16.7 | 146 | 13.6 | 119 |
| $2 \times 150$ | 25.6 | 224 | 19.7 | 173 | 16.1 | 141 |
| $2 \times 200$ | 30.5 | 267 | 20.8 | 182 | 16.4 | 144 |

The "Ekodim" computer program, EN 13941 and the insulation value $\lambda=0.026 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{C}$ have been used during calculation of heat consumption, together with the fact that the casing pipe expanded $1 \%$. For calculations of future heat losses, see the "Ekodim" program.

## Heat losses, flexible pipe

## Laying conditions

Fill height $\quad 0.6 \mathrm{~m}$
Free distance between pipes $\quad 0.1 \mathrm{~m}$

## Ground

Thermal conductivity: $\quad \lambda_{\mathrm{m}}=1.5 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$
Insulation PUR foam
Thermal conductivity: $\quad \lambda_{i}=0.024 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$

Temperatures, annual average values
\(\left.$$
\begin{array}{lll} & \begin{array}{l}\text { Primary } \\
\text { system }\end{array}
$$ \& Secondary <br>

system\end{array}\right\}\)| Supply line temperature | $85^{\circ} \mathrm{C}$ |
| :--- | :--- |

$\lambda_{\mathrm{i}}=0.025 \mathrm{~W} / \mathrm{m}^{\circ} \mathrm{K}$ (applies to Casaflex).

## Heat losses, copper flex, single

| Dimension | Primary system $W / \mathrm{m}$ | $\mathrm{kWh} / \mathrm{m}$, year | Secondary system | $\mathrm{kWh} / \mathrm{m}$, year |
| :---: | :---: | :---: | :---: | :---: |
| $22 / 91$ | 13.7 | 120 | 10.5 | 92 |
| $28 / 91$ | 16.5 | 145 | 12.7 | 111 |
| 35191 | 20.4 | 179 | 15.7 | 137 |

Heat losses, 3E-copper flex, single

| $18 / 90$ | 11.5 | 101 | 8.8 | 77 |
| :---: | ---: | ---: | ---: | ---: |
| $22 / 90$ | 13.2 | 116 | 10.1 | 89 |
| $22 / 110$ | 11.7 | 103 | 9.0 | 79 |
| $28 / 110$ | 13.9 | 122 | 10.7 | 94 |
| $28 / 125$ | 10.8 | 111 | 9.8 | 86 |

Heat losses, copper flex, double

| $2 \times 15 / 91$ | 8.7 | 76 | 6.7 | 59 |
| ---: | ---: | ---: | ---: | ---: |
| $2 \times 18 / 91$ | 10.2 | 89 | 7.8 | 68 |
| $2 \times 22 / 91$ | 12.5 | 110 | 9.7 | 84 |
| $28 / 91$ | 18.2 | 159 | 14.0 | 63 |
| $2 \times 18 / 113$ | 7.9 | 69 | 7.1 | 53 |
| $222 / 113$ | 9.2 | 80 | 8.1 | 78 |
| $2 \times 28 / 113$ | 11.6 | 102 | 8.9 | 78 |

## Heat losses, 3E-copper flex, double

| $2 \times 18 / 90$ | 9.5 | 83 | 7.3 | 64 |
| :---: | ---: | ---: | ---: | :--- |
| $2 \times 18 / 110$ | 8.3 | 72 | 6.4 | 56 |
| $2 \times 22 / 110$ | 9.9 | 87 | 7.6 | 67 |
| $2 \times 18 / 125$ | 7.6 | 66 | 5.8 | 61 |
| $2 \times 22 / 125$ | 8.3 | 78 | 60 |  |
| $2 \times 28 / 125$ | 11.3 | 99 | 6.7 | 58 |
| $2 \times 18 / 160$ | 6.1 | 54 | 4.7 | 41 |
| $2 \times 22 / 160$ | 7.2 | 63 | 5.6 | 49 |
| $2 \times 28 / 160$ | 8.7 | 76 | 6.7 | 58 |

Heat losses, steel flex, single

| $20 / 91$ | 12.90 | 113.0 | 9.9 | 87.0 |
| :---: | ---: | ---: | ---: | ---: |
| $28 / 91$ | 16.50 | 145.0 | 12.7 | 111.0 |

## Design guidelines

## Heat losses, 3E steel flex, single

$\left.\begin{array}{ccccc}\text { Dimension } & \text { Primary system W/m } & \mathrm{kWh} / \mathrm{m} \text {, year } & \text { Secondary system } & \mathrm{kWh} / \mathrm{m} \text {, year } \\ \hline & 11.1 & 97 & \mathrm{~W} / \mathrm{m}\end{array}\right]$

The heat losses above refer to both supply and return pipe. If $\Delta T$ changes, the heat losses are affected linearly.
NB! The heat losses increase with time for all district heating pipes. Consult Powerpipe regarding optimisation.

## Heat losses and savings when using super insulated pipes

## Super insulated Double Standard

| Dimension | Losses |  | Saving |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | W/m | kWh/m, year | Total \% | Supply pipe \% |  |
| DN2x 20/125 |  |  |  |  |  |
| DN $2 \times 25 / 140$ | 9.8 | 86 | 26 | 48 |  |
| DN $2 \times 32 / 160$ | 10.7 | 93 | 27 | 49 |  |
| DN2× 40/160 | 12.1 | 106 | 27 | 49 |  |
| DN2x 50/200 | 11.9 | 104 | 27 | 49 |  |
| DN $2 \times 65 / 225$ | 14.6 | 128 | 27 | 49 |  |
| DN2x 80/250 | 16.2 | 142 | 29 | 49 |  |
| DN $2 \times 100 / 315$ | 16.7 | 146 | 27 | 46 |  |
| DN $2 \times 125 / 400$ | 15.6 | 137 | 25 | 43 |  |
| DN2×150/450 | 19.5 | 170 | 24 | 40 |  |

## Super insulated Double+

| Dimension | Losses |  | Saving |  |
| :---: | :---: | :---: | :---: | :---: |
|  | W/m | kWh/m, year | Total \% | Supply pipe \% |
| DN2x 20/140 | 7.9 | 69 | 22 | 46 |
| DN2x 25/160 | 8.5 | 75 | 24 | 45 |
| DN2x 32/180 | 9.2 | 80 | 25 | 46 |
| DN2x 40/180 | 10.7 | 93 | 25 | 46 |
| DN2x 50/225 | 10.4 | 91 | 24 | 45 |
| DN2x 65/250 | 12.3 | 108 | 24 | 45 |
| DN2x 80/280 | 13.4 | 117 | 25 | 45 |
| DN2×100/355 | 13.2 | 116 | 24 | 43 |
| DN2×125/450 | 13.0 | 114 | 22 | 39 |
| DN2×150/500 | 15.6 | 136 | 21 | 36 |

Super insulated Double++

| Dimension | Losses |  | Saving |  |
| :---: | :---: | :---: | :---: | :---: |
|  | W/m | kWh/m, year | Total \% | Supply pipe \% |
| DN2x 20/160 | 7.1 | 62 | 20 | 44 |
| DN2x 25/180 | 7.7 | 68 | 22 | 44 |
| DN2 $32 / 200$ | 8.4 | 73 | 23 | 45 |
| DN2x 40/200 | 9.5 | 83 | 23 | 45 |
| DN2x 50/250 | 9.5 | 83 | 22 | 44 |
| DN2x 65/280 | 10.8 | 94 | 21 | 43 |
| DN2x 80/315 | 11.4 | 100 | 22 | 46 |
| DN $2 \times 100 / 400$ | 11.4 | 100 | 21 | 44 |
| DN $2 \times 125 / 500$ | 11.0 | 97 | 19 | 40 |
| DN2×150/560 | 13.2 | 116 | 18 | 37 |

Savings are based on the same pipe but without vacuum panels
Calculation assumptions, see p. 9:301

## Design guidelines

## Foam pillows

## Function:

Foam pillows should be used to protect bends, T-pieces etc. during large axial movements and when backfill material other than natural sand is used. Foam pillows often need to be used during cold laying.
The material can withstand $70 \%$ compression.
See part no. and dimensions p. 8:303.

## Positioning

Cutting with
Height = casing pipe diameter.
Width and length calculation/description.

## Installation

The foam pillows are placed on both sides of the pipe. It is recommended that the expansion cushions and pipes are covered with geotextile to prevent material falling in from above.

In the case of cold laying with large initial movements, the thickness of the pillows in the elbow of the bend can be reduced by $50 \%$.

The pillows can be installed vertically (version A) or around the pipe (version B) as the figure shows.

Version B should be avoided around double sealing shrinkable sleeves.


## Installation of transition unit in angle, Part no. 1580, 1680 and 1780

## Background

Transition unit in angle, Part no. 1580, 1680 and 1780 has a limited ability to absorb forces and expansion movements from the single pipe.

| Max. temperature | $120^{\circ} \mathrm{C}$ |
| :--- | ---: |
| Min. laying temperature | $0^{\circ} \mathrm{C}$ |

## Max. length

The maximum lengths for single pipe from the transition unit bend to the next $90^{\circ}$ bend for thermally pre-stressed and cold-laid systems are:

| DN 25-80 | 14 m. |
| :--- | ---: |
| DN 100 | 12 m. |
| DN 125 | 8 m. |
| DN 150 | 4 m. |
| DN 200 | 2 m. |



[^1]These regulations should be seen as a complement to the instructions issued by the Swedish District Heating Association

## Transportation and storage

Pipes and pipe fittings are usually delivered to the construction site by truck, with the recipient being responsible for unloading.

Broad straps must be used during unloading and further transport. Chains or round lifting equipment such as wires may not be used.
Flat forks must be used during unloading and lifting. Pipes and pipe fittings may never be tipped or thrown off as the casing and insulation can be damaged.

NB! T-pieces may not be lifted by the branch pipe! Great care should be taken to ensure that the casing pipe or protruding parts are not scratched or damaged by being subject to loads.

Pipes and pipe fittings should be stored on a flat and dry surface.
Pipes and pipe fittings should be stored so that the insulation cannot come into contact with water. The storage site should be organised so that steel pipes do not corrode.

Pipes of larger dimensions ( $\geq$ DN 125) should be stored with spacers. Stack height may not exceed 2 m . The width and distance between spacers should be dimensioned so that the maximum pressure on the outer casing does not exceed 200 kPa .

It is recommended that the spacers supplied with the delivery are used.
These make stacking safer and prevent accidents due to collapse.
Upon receipt of the delivery, the products should be inspected for visible damage and obvious faults (can be carried out with alarm wire measurement).

Pipe fittings should be stored so that steel pipe ends face downwards.
Pipes with casing diameters of $\geq 560 \mathrm{~mm}$ should be handled with particular care at temperatures of between 0 and $-20^{\circ} \mathrm{C}$. Below $-20^{\circ} \mathrm{C}$, Powerpipe should be consulted before handling.


Broad straps must be used during unloading and further transport. Chains or round lifting equipment such as wires may not be used.


NB! T-pieces may not be lifted by the branch pipe!


It is recommended that the spacers supplied with the delivery are used. These make stacking safer and prevent accidents due to collapse.


Pipe fittings should be stored so that steel pipe ends face downwards or are protected in some other way.

## Loading, unloading

Flexible pipes are delivered on large reels.
The pipes must not be lifted with narrow straps or unprotected forks.
The minimum strap width should be 50 mm .
Fork protection can consist of steel pipe or pressurised water pipe.


## Storage, unrolling

- The reels should be stored horizontally on spacers to avoid ground-borne moisture/ sharp edged objects.
- The reels may be stored upright on completely smooth surfaces. The storage area must be completely free of foreign/sharp-edged material.



## Unrolling can be done from:

1. Vertical reels which are unrolled.

Check that the reel is not unrolling over sharp-edged material.
2. Horizontal rotating reels, for example on a spool holder.
3. When unrolling the pipe, it may not be compressed by drive rollers.
4. Horizontal fixed reel. In this situation, the pipe may be unwound from the reel.


## Laying

- Pipe should not be laid at temperatures below $0^{\circ} \mathrm{C}$ without consulting Powerpipe.



## Dimensions

Powerpipe's district heating pipes are laid directly on the prepared pipe bed (2). The recommended trench type section is shown in the figure on the right. Alternatively, the pipes can be laid on pallets during the installation phase. A drainage layer and drainage pipe (1) facilitate the installation work and reduce heat losses because dry soil insulates better than wet soil.

The coverage over the crown of the pipe should be at least:

- 500 mm for heavily trafficked areas. - 300 mm for park land.


## Pipe trenches

The bed is executed with a thickness of 150 mm . The pipe bed should be designed with stone-free material with a largest grain size of 20 mm according to Construction AMA 2013 CEC. 2131. If sharp-edged material with a grain size above 8 mm is used, the pipe bed should be equipped with a 50 mm thick levelling layer of stone-free material.

| Dimensions according to drawing |  | Svensk Fjärrvärme D:211 | Standard <br> EN13941 |
| :---: | :---: | :---: | :---: |
| A | Dy<=180 | Min 350 | Min 150 |
|  | $200<=$ Dy<=500 | Min 350 | Min 250 |
|  | Dy>=560 | Min 350 | Min 300 |
| C | Dy<=180 | Min 350 | Min 150 |
|  | $200<=D y<=500$ | Min 350 | Min 250 |
|  | Dy>=560 | Min 400 | Min 300 |

Excavation at sleeves, or laying of pipes on pallets, shall be carried out so that there is a free installation space around the joint site over a length of 2 m - see figure.
The space should be min. 200 mm for dim $\leq 500$ and 300 mm for $\operatorname{dim} \geq 560 \mathrm{~mm}$.
At joints where the pipes cannot be rolled, the free installation space should be increased to 400 mm over a width of $2 \times 600 \mathrm{~mm}$ (counted from the welding point) so that welding work can be carried out.

## Drainage

Trenches for district heating pipes should be drained. Dry trenches during the construction period reduce the risk of construction moisture in the insulation. Dry trenches during the operating period lead to reduced heat losses and a reduced risk of moisture entering the insulation from outside. Stiff drainage pipes of approved type, such as DV, should be used. The drainage pipes may not be connected to crossing drain water pipes but should instead connect at a low point to an existing pipe. Filling around drainage pipes is carried out according to Construction AMA 2013 CEC. 3112.

## Installation conditions

It must be possible for the installation to be carried out according to the supplier's document instructions if the warranty is to be valid. To execute an approved joint, the following general installation conditions must be fulfilled:

The pipe trenches must have functioning drainage so that the joint site is dry. It must also be free of snow and ice.
Before jointing and insulation takes place, the remainder of the facility must be installed and have undergone final testing.
Alarm and signal wires should be connected according to the established alarm diagram.
At joint sites, splicing joint, casing pipe ends, free steel pipe ends and free foam surfaces should be dry and clean.
Surfaces against which PUR foam will be cast should normally have a temperature of 15$40^{\circ} \mathrm{C}$. In cold weather, this can be achieved by circulating hot water through the pipe.


1: Drainage pipe
2: Pipe trenches


Space for installation


Trenches for district heating pipes should always be drained

Joint sites should be protected against precipitation between work stages and during foaming and jointing.

## Laying

Before laying begins, check that the pipe bed is carried out according to the instructions on the previous page, is free of foreign objects and is so even that the pipe is level along its entire length. District heating pipes should be laid on special pallets or rollers. Pallets or rollers should be positioned before the pipe is laid.

Check that the alarm wires in each pipe and fitting are turned upwards. However, for technical reasons the alarm wires in curved pipes and profile bends are positioned differently.

Ensure during the entire installation period that water does not collect in the bottom of the pipe trench at any time. Insulation must be kept dry. Wet insulation at pipe ends causes problems during joint insulation and leads to alarm errors.

## Welding, testing and inspection of welds

Where stipulated, welding of steel pipes should be carried out by a company with a welding licence. Welders should have certification. Each weld should be marked so the welder can be identified. When welding straight sections, the pipes should be rotated by hand on rollers/ supports. This minimises problematic welding. Window welds should be avoided.
Testing is carried out according to EN 13941 (or AFS 2005:3). Seal testing is carried out with cold water and 1.43 times the highest permitted operating pressure. The pressure must be maintained for one hour before inspection. All joints should be visible. NB! Test pressurisation against close valves may only take place with $1.1 \times$ PN (valve pressure class).

Seal testing may also be carried out with air, in which case leak indication is carried out by brushing on soapy water or similar. Maximum pressure $3 \mathrm{kPa}(0.03 \mathrm{kp} / \mathrm{cm} 2)$. See AFS 2006:8, the Swedish Work Environment Authority's regulations for testing with over or underpressure.

Radiography is carried out to the extent stipulated by the programme documents. Before commissioning, the pipe is cleaned with a pig or pressure cleaning tool.

## Cut-to-length pipes, cutting

Where fitting pieces are required, cut-to-length pipes should be used. The construction of the cut-to-length pipes means that it is easy to remove the insulation from the service pipe and provide an absolutely clean surface in the steel pipe. This simplifies the installation work and prevents the risk of gases hazardous to health developing during welding or brazing.

The part of the pipe which is a cut-to-length pipe is marked "kaprör".
The cut-to-length pieces should be placed where friction movement is as small as possible, i.e. as far as possible from a deflection.

Cut-to-length pieces may not be cast into walls etc. on straight sections.
When cutting the casing pipe, it is important not to create an axial direction which can cause the pipe to split. This is particularly important in cold conditions. The pipe should first be cut tangentially.


District heating pipes should be laid on special pallets or rollers. Pallets or rollers should be positioned before the pipe is laid. Check that the alarm wires in each pipe and fitting are turned upwards.


The part of the pipe which is a cut-to-length pipe is marked "kaprör"


The cut-to-length pieces should be placed where friction movement is as small as possible, i.e. as far as possible from a deflection.

## Deflections (for thermally pre-stressed systems)

Where deflection is required, standard bends should be used as far as possible. For narrower dimensions, alternatives with bend sleeves should be used. To guarantee pipe strength, bends with angles between $25^{\circ}$ and $60^{\circ}$ may only be used if at least one leg is short.

To guarantee pipe strength, it is important that small deflections greater than $10^{\circ}-25^{\circ}$ are not permitted to move laterally if deflections have straight sections on either side. For this reason particularly careful packing is required around these deflections.

Deflections smaller than $3^{\circ}$ can be executed by mitring the steel pipe. Several mitres following each other can be accepted. Mitring can be replaced by the complete joined culvert pipe being held in a broad curve.

The deflection can also be created using special curved pipes. These are manufactured in 12 or 16 m lengths in the form of a curve with a deflection of a maximum of $35^{\circ}$. See also Chapters 3 and 4, Curved pipes.

## Branches

## Single pipes

Powerpipe's T-pieces are normally dimensioned to be equally strong as the pipe. Despite the fact that the $T$-piece is reinforced, it will not withstand excessive forces from the branched pipe. If the branch is longer than $12-15 \mathrm{~m}$, it must be supported with a bend or fixation. When designing bends and distance between the main pipe and the fixation, any axial movement in the main pipe must be taken into account.

For parallel T-pieces, the length of the branch parallel with the main pipe should be at least the leg length for the branch. The maximum length of same is very long if the main pipe has minimal movement, or otherwise approx. 5 m . Naturally, expansion-absorbing material should be used if required.

## Double pipes

T-pieces for double culvert pipes dimensioned to withstand full force from branched pipe. No expansion bends or fixings are required for straight T-pieces.

## Flexible pipes

For instructions for flexible pipes, see Chapter 5.

## Tapping

Tapping is permitted on non pressurised pipes without specific authorization. In a pressurised system, however, the description in Swedenergy D:217 (2021), Tapping, should be followed.

## Wall penetrations

Wall penetrations must be carried out carefully to prevent locking of district heating pipes or ingress of groundwater.

Where the pipe does not move axially and where the groundwater pressure is normally low, embedding ring 6520 is used - see Chapter 8. The embedding ring is positioned in the centre of the wall and the hose clamp is tightened before concrete casting.

Where movement can be expected and where the probability of groundwater pressure is high, wall penetration 6510 is used - see Chapter 8.


To guarantee pipe strength, it is important that deflections greater than $25^{\circ}$ are not permitted to move laterally if the bend has straight sections on either side.


To guarantee pipe strength, bends with angles between $30^{\circ}$ and $60^{\circ}$ may only be used if at least one leg is short.


If the branch is longer than 12-15 $m$, it must be supported with a bend or fixation.


## Valves, drain and vent devices

Valves
Valves should be positioned so they are not exposed to bending torque or lateral movements.
Axial movements should be as small as possible. During installation, valves should always be in fully open position.

The stem should be protected, for example by concrete pipe $\varnothing 600 \mathrm{~mm}$, resting on a concrete slab or equivalent. These should be placed so that the concrete pipe does not damage the district heating pipe.
The concrete pipe ends at ground level with a district heating cover.
In streets or in ground with traffic loads, a telescopic cover should be used so that the traffic loads are not transferred to the concrete pipe.

The concrete pipe should be positioned so that the valve can move longitudinally without the stem extension being subject to load.

## Drain and vent devices

Low and high point with relevant drain/vent devices are best positioned where the main pipe does not move, i.e. at least a friction length from a $90^{\circ}$ bend.

Vent can be carried out to advantage at a branch.

## Prefabricated parts

T-piece is connected to valve assembly or Vent/Drain. See Chapter 3 (single pipes) or Chapter 4 (double pipes).

For single pipes, a joint can be avoided if an Extended T-piece, see Chapter 3, is used. By using a Combination valve, see Chapter 3, Stop and Vent/Drain are coordinated.

## Site-built devices

Site-built vent/drain devices are used in concrete access manholes and in buildings.
After welding, ironwork, valves and pipes should be rustproofed. Valves should be covered with insulation up to the connecting district heating pipe.
To prevent a risk of freezing, a bypass device with a choke valve should be installed. The valve is adjusted to ensure a low flow rate. If possible, the valve should be equipped with a thermostat.

## Anchor points

The thermal forces occurring in the service pipe are normally transferred to the soil via friction during movement in the district heating pipes. In the majority of cases these movements can be absorbed in naturally occurring deflections. In some cases however, the district heating pipe needs to be attached to prevent, limit or direct the expansion movement.


The stem should be protected by a concrete pipe resting on a concrete slab or equivalent. In streets or in ground with traffic loads, a telescopic cover should be used so that the traffic loads are not transferred to the concrete pipe.


Pre-fabricated drain and vent units


In the majority of cases movements from thermal forces can be absorbed in naturally occurring deflections.

## Ground anchoring

During pre-heating can be desirable to guide the expansion movement into a particular direction. This can be achieved by backfilling one or two pipe lengths (ground anchoring).

## Anchor units

Anchor units are used when you wish to limit the pipe section's axial movements, to ensure that a section does not slide from one expansion point to another, for example where there is a steep gradient, or where compensators are used.

The anchor unit is installed so that the offset between each anchor flange is $100-200 \mathrm{~mm}$. The flange package is cast into a reinforced concrete block. This should be dimensioned to take into account the anchor force and the design compression strength of the soil.

## Anchor units

The steel pipes in double pipes are attached to each other in bends, anchor points, T-pieces, valves and reduction units.

Where a straight section does not end with one of these parts, e.g. after passing a foundation wall or on a straight section, anchor points must be used. This is to prevent the insulation from being torn off the steel pipe where there are different temperatures in the supply and return pipes.

When commissioning double pipes, it is important not to immediately increase to high temperature in the supply pipe if the return pipe is cold, but instead to do this gradually, as initial stresses caused by the temperature difference occur in the fixation plates.

## Alternative to anchor points

Steel plates with the dimensions below and installed according to the figure can replace anchor points or interconnected branches from double pipes.



The anchor unit is installed so that the offset between each anchor flange is $100-200 \mathrm{~mm}$. The flange package is cast into a reinforced concrete block.


The steel pipes in double pipes are attached to each other in bends, anchor points, T-pieces, valves and reduction units.


## Pre-heating and expansion absorption

Thermal forces occur in the steel pipe during temperature changes in operation. At natural deflections and expansion devices, these forces are transformed into movement either wholly or partially. The size of the movement primarily depends on the pipe dimension, temperature differential and laying depth.

## Pre-heating

To minimise movement, the pipe can be thermally pre-stressed to a temperature between the lowest surrounding and highest operating temperatures. The pre-heating temperature is stated in the design documents. Pre-heating should be carried out with a slow increase of temperature. Pre-heating is normally carried out with water and often with the water used for pressure testing. The water is either heated with an electric boiler or is taken from the existing district heating network. When the district heating network is used as the heat source, the water should be shunted in to avoid rapid temperature changes.

Large dimensions and long sections can be pre-heated with electricity - consult with Powerpipe.

Before pre-heating, the expansion movement must be calculated and inspection points drawn up so that the calculated expansion movement can be inspected in practice. During pre-heating, the pipes must be free to move.

When the fixing temperature is achieved, the expansion movement should agree with the calculated figure. If this has not been reached, the pre-heating temperature can be increased a few degrees so that the right expansion is obtained.
The pipes can also be helped to achieve the right expansion mechanically, through lifting and stretching at certain points. The pre-heating temperature should be kept constant during packing and backfilling work.


To minimise movement, the pipe can be thermally pre-stressed to a temperature between the lowest surrounding and highest operating temperatures. The preheating temperature is stated in the design documents.


Before pre-heating, the expansion movement must be calculated and inspection points drawn up so that the calculated expansion movement can be inspected in practice.

## Expansion absorption

As the temperature changes during operation, movements occur in expansion devices, bends etc. These movements can often be absorbed by the surrounding sand. If the temperature difference between laying temperature (pre-heating temperature) and maximum/minimum occurring temperature is greater than approx. $50^{\circ} \mathrm{C}$ and/or the surrounding soil is very firm, bends etc. must be protected against ground pressure.

The movement is facilitated if the pipe in the expansion zone is surrounded by foam pillows/ ground slabs, for example of foam pillows - see Figure 2, right, and Chapter 8 and 9.

In the case of very large movements, the protection can consist of concrete ducting or special steel elements. These should be ventilated to avoid excessive temperatures. For concrete ducting and steel elements, special installation instructions should be followed.

In the case of large movements (cold laying), expansion devices ( $90^{\circ}$ bends) can be protected by backfilling these parts first after commissioning.

## Surveillance system

Powerpipe's pipes and pipe fittings are supplied with two separate embedded alarm wires. At joint sites these should be connected to a monitoring system.
The alarm wires consist of soft annealed naked copper wires, $\varnothing 1.5 \mathrm{~mm}^{2}$.
The pipe network is divided into sections of up to 5000 m of pipe each ( 1000 m supply and 1000 m return pipe). For further information, see the text in Chapter 7. Each section creates an alarm circuit and is connected to the alarm control centre designated by Powerpipe. The alarm control centre can either be used as an individual alarm unit or as part of a larger monitoring system.


To guarantee alarm function - i.e. that it functions and does not give incorrect alarm indications, ensure that water has not penetrated the pipe insulation during transport and assembly.

## Alarm diagrams and installation instructions

Alarm connection should be carried out according to the alarm diagram. This shows the alarm route, how the alarm wires are connected and the section divisions to be made. It also shows the alarm path and which pipe sections are connected to the different alarm units. The position of alarm wires in Powerpipe's pipe fittings is described in Chapter 7.

To guarantee alarm function - i.e. that it functions and does not give incorrect alarm indications, ensure that:

- The service pipe, steel pipe is welded/brazed in such a way that the alarm wires are oriented at 10 and 2 o'clock.
- Water has not penetrated the district heating pipe insulation during transport and assembly.
- The alarm wires are laid straight from pipe end to pipe end and do not cross each other.
- The alarm wires are laid parallel to the steel pipe.


As the temperature changes during operation, movements occur in expansion devices, bends etc. These movements can be absorbed by the surrounding sand.


Pipes in the expansion zone can be surrounded with ground slabs, for example made from mineral wool.


Powerpipe's pipes and pipe fittings are supplied with two separate embedded alarm wires.


The position of alarm wires in Powerpipe's pipe fittings is described in Chapter 7.

## Connection of alarm wires

## Alarm spacers

1. Carefully straighten out the alarm wires. Gently pull on the wires and check that they are undamaged and whole.
2. Clean the alarm wires with emery cloth.
3. Cut off the excess length from the stretched alarm wires.
4. Compress the wires in stretched condition in an approved splicing joint
(Part no. 6890-100-000-000) using an approved special tool (Part no. 6890-100-100-000).
5. Slide the alarm spacers beneath the stretched wires and press the wires into the alarm spacers.
6. Tape the alarm spacers into place.
7. Insulation should be carried out immediately after alarm wire installation.

## Hygroscopic felt

As an alternative to alarm spacers, hygroscopic felt can be used with single pipes but are recommended for use with double pipes.

## Looping of alarm wire

Unless otherwise stated on the alarm diagram, the wire must always be connected in a loop at the terminations of a pipe section. For looping, the alarm wire is spliced and laid according to the figure. The uninsulated wire should be insulated with an insulating joint or alarm spacer. The alarm spacer is cut and laid in segments around the steel pipe. The distance between alarm wire and pipe may not be less than 15 mm . Unless otherwise stated on the alarm diagram, for penetrations into manholes or similar, insulated wire EK 1.5 mm 2 should be used.


At the endpoints to be connected to
Powerpipe's section unit, a mounting eye should be permanently welded to the steel pipe for earth connection - see Figure 2, right.

The uninsulated wire should be insulated with an insulating sleeve or alarm spacer. The alarm spacer is cut and laid in segments around the steel pipe.

The distance between alarm wire and pipe may not be less than 15 mm .

## Signal wire

Powerpipe's district heating pipe can be supplied with an insulated signal wire cast into the insulation, by special order. This is spliced according to what is stated above. However, the stripped part of the wire and the splicing joint should be insulated with a shrinkable insulating sleeve. Where the pipe ends without being connected further, the wire end should be insulated with a shrinkable insulating sleeve.

## Inspection of alarm connection

Control measurement of loop and insulation resistances should be carried out after each connection of wires and after foaming work and before backfilling begins.


Slide the alarm spacers beneath the stretched wires and press the wires into the alarm spacers. Tape the alarm spacers into place.


A mounting eye should be permanently welded to the steel pipe for earth connection at the endpoints.


The stripped part of the wire and the splicing joint should be insulated with a shrinkable insulating sleeve.


Megger control appliance for alarm wires. See Chapter 8.

Loop resistances is measured with an ohmmeter. As a target value, the resistance should be 1.2-1.3 ohms per 100 m connected alarm wire. Other values will not be approved. Low values indicate short circuits and high values poor contacts in splices.

After the completion of work, insulation resistances should be a minimum of 10 $\mathrm{M} \Omega / 1000 \mathrm{~m}$ alarm wire ( 500 m pipe). Lower values can occur temporarily, particularly during foaming of cold pipes. However, approved values should be reached no later than four weeks after start of operations. Note that moisture ingress is indicated by the insulation resistance reducing in one location.

Insulation resistance verification may take place no earlier than one hour after the completion of foaming.
These values should be documented in consultation with the inspector.
NB! Check the instrument and batteries before each control measurement.

## Installation of alarm and information units

The linked alarm wires should be connected to Powerpipe's alarm control centres or cable radar. These should be installed in an appropriate place along the route of the section. The alarm control centre is supplied with 220 V power or via a signal wire. The alarm wires and earth are connected to the section unit using $3 \times 1.5 \mathrm{~mm}^{2}$ cable. The signal wire is connected either through an external signal cable or a signal wire laid in the district heating pipe to the selected alarm control centre.

The different control centres' characteristics and functions are described in Chapter 7.
The pulse echometer speed PVF (propagation velocity factor) is 0.91 .


The linked alarm wires should be connected to Powerpipe's alarm control centres or cable radar.


The alarm control centre can also cope with inputs from switches, detector units etc.

## Functional test

When the alarm and information units have been connected, functional tests should be carried out as follows:

## 1. Test of alarm limit

To test the alarm limit, a resistor is connected which has approximately $10 \%$ lower resistance than the alarm unit's set value.

## 2. Test of wire break

A wire break is simulated as far from the alarm unit as is practically possible.

## 3. Test of all alarms and alarm functions

All functional tests carried out should be documented in consultation with the inspector. Loop resistance and insulation resistance should be measured separately for each loop and documented in consultation with the inspector. Reports should be drawn up.


## Assembly, welding assembly

## Assembly instructions - joint insulation

## General information

Insulation in a pipe system may not have any weak points. Each joint must therefore be carefully insulated in the field. The insulation material should consist of Powerpipe's installation foam. Joint installation shall be carried out by specialist, licensed companies, using trained personnel (for Powerpipe's guarantee to apply). They are equipped with mobile foaming machines that have automatic pressure, volume and temperature control. In certain cases manual foaming can be carried out with foam packs. The current regulation AFS 2014:32"Hard plastics" must be followed during all foaming work.

As seal testing of joints is stipulated, joint insulation must be carried out after seal testing. Casing pipes should be cut so that axial fractures do not occur. The sleeve/casing pipe overlap should be approx. 100 mm .

## Assembly instruction for weld assembly, T-pieces

2 Excavation
3 Cleaning
$4 \quad$ Peeling

5 Sliding on the casing pipe

6A

## Welding of flexible T-piece

- T-sleeve double/double Part no. 6530
- T-sleeve flexible Part no. 6540
- Bend with long radius 5D bend or greater for branch
- Check that the sleeve and accessories are undamaged and of the right dimension

The trench dimensions need to be expanded. See figure (1)
Clean the outer casing on the branch and main pipe that will be in contact with the sleeve.

Peel off the requisite amount of outer casing and insulation for branch installation. NB Avoid axial damage or cuts to the casing during peeling. Slice the bottom sleeve with a straight cut in the top side of the sleeve $\left(90^{\circ}\right.$ from the branch) See figure (3) and (4)

Slide the flex sleeve or reduction sleeve with tightening tubes onto the branch pipe. See figure (2) NB The shrinkable end should be positioned furthest from the main pipe. Push the bottom sleeve onto the branch.

Weld in the branch with bend. See figure (3) NB the bend should be 5D or greater. Weld the branch to the weldedon socket. Fitting pieces and flat reinforcement may be required. "L"fitting pieces should be:
DN L[mm]

32-80 200
100-150 250
200-500 300
c/c measured between branches should be $\approx 500 \mathrm{~mm}$.

7 Installation of bottom pipe

The bottom sleeve should be pushed back over the main pipe. NB The longitudinal joint should be at the top.

6A Welding of straight T-piece

Spread the free steel ends of the branch so they can be welded to the main pipe. Weld the branch pipes (Part no. 8205. See Chapter 8) to the main pipe. Any reinforcements according to the designer's instructions.


Dimensions, excavation and welding.


Slide the sleeve and tubing onto the branch.


Installation of flexible T-piece.


Installation of straight T-piece.

## Welding sleeve, Mittel

General information
Mittel welding sleeves should be executed by authorised companies and by personnel with specific training. The overall procedure is described below.

## Material

The requisite material, Part no. 6110 Chapter 6 is delivered in batches for each dimension of outer casing. Alarm spacers, mastic, plugs and FOPS are supplied by the sleeving contractor.

Special electrical equipment is used to weld the Mittel joint.

## Execution

- Clean dirt, grease, moisture etc. from sleeve and casing.
- Connect the alarm wires (see Chapter 10, connection alarm wires)
- Sand the areas of the pipe and sleeve that will be covered by the Mittel joint and the inside of the Mittel joint.
Wash with ethanol.
- Apply guide and welding net. (1)
- Cut and fit the sleeve on the pipe. (2)
- Assemble and connect the welding equipment to the electrodes. (3)
- Weld the radial weld. (3)
- Cut and weld the axial weld. (4)
- Drill holes for pressure testing/foaming/venting. The holes should be positioned at the edge of the casing pipe.
- Pressure test. (5)
- Foam the sleeve. (6)
- Foam and air holes should be welded closed.


Install welding net around the casing pipe.


The computer-controlled welding procedure takes 3-4 minutes.


Pressure testing.


The sleeve is cut and installed on the casing pipe.

The longitudinal joint is carried out using an extrusion welder.

Foam the sleeve.




## Installation

## Shrink welding sleeve

## General information

Shrink welding sleeves should be executed by authorised companies and by personnel with specific training. The overall procedure is described below

## Material

The requisite material, Part no. 6112 or 6111 (Chapter 6) delivered in batches for each dimension of outer casing. The sleeve should be installed on the district heating pipe before welding steel pipes. Alarm spacers, plugs and FOPS are supplied by the sleeving contractor.

Special electrical equipment is used to weld the shrink welding sleeve.

## Execution

- Clean dirt, grease, moisture etc. from sleeve and casing.
- Connect the alarm wires (See Chapter 10, "Connect the alarm wires")
- Sand the areas of the pipe and sleeve that will be covered by the shrink welding sleeve and the inside of the sleeve. Wash with ethanol.
- Measure out and mark where welding net and sleeve should be applied. (1)
- Apply welding net. (2)
- Shrink the sleeve with a gas torch.
- Install the clamping tools. (3)
- Assemble and connect the welding equipment to the electrodes.
- Weld the radial weld. (4)
- Drill holes for pressure testing/foaming/venting. The holes should be positioned at the edge of the casing pipe.
- Pressure test. (5)
- Foam the sleeve. (6)
- Weld the foam and vent holes closed. See image 10 on the next page.



Install welding net around the casing pipe.


Install the clamping tools.


The computer control welding procedure begins.


Pressure testing.


## Double expanded sleeve

## General information

Double expanded sleeve (PEH) should be executed by authorised companies and by personnel with specific training. The overall procedure is described below.

## Material

The requisite material, Part no. 6361 (Chapter 6) delivered in batches for each dimension of outer casing. The sleeve should be installed on the district heating pipe before welding steel pipes. Alarm spacers, mastic, plugs and FOPS are supplied by the sleeving contractor.

## Execution

- Clean dirt, grease, moisture etc. from sleeves and casing pipes with ethanol. (1)
- Connect the alarm wires (see Chapter 10, "Connecting alarm wires")
- Sand the areas of the pipe that will be covered by the PEH sleeve and the inside of the sleeve. (1)
- Mark out the position for sleeve and mastic. (2) Positioning of mastic must be approx. 1 cm inside the sleeve edge.
- Pre-heat the sanded areas. (3)
- Remove the plastic protection around the sleeve and tightening band. (4)
- Wrap broad (approx. 50-100 mm) woven mastic around the casing pipe. (5)
- Centre the sleeve and remove the outer protection from the mastic strip. (5)
- Use a soft gas flame and start to shrink one end of the sleeve. Move the flame carefully around the sleeve. Ensure that the underside of the sleeve receives sufficient heat. Use silicone cloth to protect the casing pipe from overheating. (6)
- Check the shrinkage all around the pipe. The mastic should be visible at the edge of the sleeve. (7)
- Pressure test. Allow the sleeve to cool to a max. of $40^{\circ} \mathrm{C}$ before pressure testing and foaming.
- Drill 20 mm holes for foaming and venting. 8
- Foam the sleeve. (9)
- Foam and air holes should be welded closed. Sand the weld plug and surface; pre-heat the surface to $40^{\circ} \mathrm{C}$. Pre-heat the FOPS and press it over the weld plug with your hand or a roller. (10)

See plug instruction Chapter 10,"Plug instructions".


Clean and sand the casing and the inside of the sleeve.


Pre-heat to $40-50^{\circ} \mathrm{C}$


Remove the protective paper from the mastic and wrap it around the casing pipe.


After shrinking, the mastic is visible at the end of the sleeve.


Foam the sleeve.


Mark out the position for sleeve and mastic.


Remove the plastic protection from the sleeve


Shrink the sleeve with a soft gas flame with even movements.


Pressure testing. The temperature of the sleeve may be a maximum of $40^{\circ} \mathrm{C}$ during pressure testing. Drill holes for foaming.


Weld the vent and top-up holes with weld plugs.

NB! Ensure that water (snow and rain) cannot enter the sleeve during the installation process.

## Double sealing sleeve (PEH)

## General information

Double sealing sleeve (PEH) should be executed by authorised companies and by personnel with specific training. The overall procedure is described below.

## Material

The requisite material, Part no. 6364 (Chapter 6) delivered in batches for each dimension of outer casing. The sleeve should be installed on the district heating pipe before welding steel pipes. Alarm spacers, mastic, plugs and FOPS are supplied by the sleeving contractor.

## Execution

- Clean dirt, grease, moisture etc. from sleeves and casing pipes with ethanol. (1)
- Connect the alarm wires (see Chapter 10, "Connecting alarm wires")
- Sand the areas of the pipe that will be covered by the PEH sleeve and the inside of the sleeve. (1)
- Mark out the position for sleeve and mastic. (2) Positioning of mastic must be approx. 1 cm inside the sleeve edge.
- Pre-heat the sanded areas. (3)
- Remove the plastic protection around the sleeve and tightening band. (4)
- Wrap mastic around the casing pipe.
- Centre the sleeve and remove the outer protection from the mastic strip. (5)
- Use a soft gas flame and start to shrink one end of the sleeve. Move the flame carefully around the sleeve. Ensure that the underside of the sleeve receives sufficient heat. Use silicone cloth to protect the casing pipe from overheating. (6)
See Accessories.


## See next page.



Clean and sand the casing and the inside of the sleeve.


Pre-heat to $40-50^{\circ} \mathrm{C}$


Remove the protective paper from the mastic and wrap it around the casing pipe.


After shrinking, the mastic is
visible at the end of the sleeve.


Mark out the position for sleeve and mastic.


Remove the plastic protection from the sleeve.


Shrink the sleeve with a soft gas flame with even movements.

- Check the shrinkage all around the pipe. The mastic should be visible at the edge of the sleeve. (7) (8)
- Remove the plastic protection from around the tightening tube/tightening band. (9)
- Shrink the tightening tube/tightening band with a soft gas flame using even movements from the middle outwards. (10)
- Check the result.(1)
- Drill 20 mm holes for pressure testing/foaming/ venting.
The holes should be positioned at the edge of the casing pipe. (12)
- Pressure test. Allow the sleeve to cool to a max. of $40^{\circ} \mathrm{C}$ before pressure testing and foaming.
- Foam the sleeve.(13)
- Foam and vent holes are closed. Sand the weld plug and surface; pre-heat the surface to $40^{\circ} \mathrm{C}$. Pre-heat the FOPS and press it over the weld plug with your hand or a roller.(14)
See plug instruction Chapter 10,"Powerpipe Plug instructions".

NB! Ensure that water (snow and rain) cannot enter the sleeve during the installation process.


After shrinking, the mastic is visible at the end of the sleeve.


Shrink from the middle outwards.


Pressure testing. The temperature of the sleeve may be a maximum of $40^{\circ} \mathrm{C}$ during pressure testing. Drill holes for foaming.


Weld the vent and top-up holes with weld plugs.


8 Remove the plastic protection from the tightening tube/
tightening band.


Check the result.


Foam the sleeve.

## Shrinkable sleeves (PEX)

## General information

Shrinkable sleeves (PEX) should be executed by authorised companies and by personnel with specific training. The overall procedure is described below.

## Material

The requisite material, part no. 6362 including mastic (Chapter 6) delivered in batches for each dimension of outer casing. The sleeve should be installed on the district heating pipe before welding steel pipes. Alarm spacers, plugs and FOPS are supplied by the sleeving contractor.

## Execution

- Clean dirt, grease, moisture etc. from sleeve and casing.
- Connect the alarm wires (see Chapter 10, "Connecting alarm wires")
- Mark out the position for sleeve and mastic. (1) Positioning of mastic must be approx. 1 cm inside the sleeve edge.
- Sand the areas of the pipe that will be covered by the PEX sleeve and the inside of the sleeve. Wash with ethanol (methylated spirits). (1)
- Pre-heat the sanded areas to $40-50^{\circ} \mathrm{C}$. Place spacers (for dimensions larger than 200 mm ) at 10 and 2 o'clock. (2)
- Remove the protective paper from the mastic and wrap the mastic around the casing pipe. (2)
- Centre the sleeve and remove the outer protection from the mastic strip. (3)
- Drill 1 hole, diameter 20 mm , for pressure testing/ foaming/venting. The holes should be positioned at the edge of the casing pipe. (3)
- Use a soft gas flame and start to shrink one end of the sleeve. Move the flame carefully around the sleeve. Ensure that the underside of the sleeve receives sufficient heat. (4)


Clean, mark out and sand.


Centre the sleeve. Drill holes for pressure testing/foaming/ venting.


Pressure testing.
Foam the joinjt


Close the foaming and vent holes.

- Check the shrinkage all around the pipe.
- Pressure test. Allow the sleeve to cool to a max. of $40^{\circ} \mathrm{C}$ before pressure testing and foaming. (5)
- Drill an additional hole for venting.
- Foam the sleeve. (5)
- Drill a conical hole and weld the vent and top-up holes with weld plugs. The sleeve has areas inlaid with PEH, and it is here the holes should be drilled for easy plugging. See plug instruction Chapter 10,"Powerpipe Plug instructions".
- Sand the weld plug and surface; pre-heat the surface to $40^{\circ} \mathrm{C}$. Pre-heat the FOPS and press it over the weld plug with your hand or a roller. (6) (7)


## Flexible sleeve/Bend sleeve

## General information

Flexible sleeves are used instead of prefabricated bends, but primarily for odd degree angles (not recommended for larger than $60^{\circ}$ ). Compared with prefabricated bends, it is important to carefully dry off the sleeve/bend before sleeving begins. The area must be $100 \%$ dry to prevent moisture from being enclosed in the bend.

## Material

The requisite material, part number 6200 (See Chapter 6), together with a short 5D bend (by welder) is used during assembly and other ordinary sleeving components inc. a "spacer" (by the sleeve fitter).

## Execution

- Cut the 5D steel bend to the required angle and weld in place. Insert a spacer if required. (1)
- Clean dirt, grease, moisture etc. from sleeve and casing with ethanol or similar. (2)
- Measure $L$ on the flexible sleeve and mark out where the sleeve should end on the casing pipe. $L$ should correspond to half the sleeve length from the middle of the steel bend. Peel so that the foaming hole is inside the edge of the casing pipe. (3)
- Drill 1 hole, diameter 20 mm , for pressure testing/ foaming/venting. The holes should be positioned at the edge of the casing pipe. (4)
- Connect the alarm wires with alarm guides and spacers. (5)
- Sand the casing pipe where it will be covered by the sleeve. (6)
- Pre-heat the sanded areas to $40-50^{\circ} \mathrm{C}$. (7)
- Heat the "grooved" part of the sleeve (not the smooth part). Continue until the bellows feels flexible enough to bend. NOTE! Do not overheat, as the sleeve can split if not handled carefully. (1)
- Pull the sleeve over the steel bend and place it so that it overlaps the edge of the casing pipe equally at both ends. Slide wedges into both ends so the sleeve is centred.
Allow to cool until it is stiff again. Remove the wedges and use a soft gas flame as if for a normal sleeve until the sleeve has completely shrunk down. After this, shrink the included tightening band. (8) (9)
- After this, pressure testing, foaming and plugging should be carried out in the same way as for other sleeves according to previous pages. (10)
- For foaming and plugging, see the following pages.


Cut and weld in 5D steel pipe


Measure the length of the flexible sleeve and mark out where the sleeve should end on the casing pipe.


Sand the areas that will be covered by the sleeve.


Heat the "grooved" part of the sleeve.


Shrink the accompanying tightening band.


Clean surfaces where the sleeve is to be shrunk.


Connect the alarm wires with alarm guides and spacers.


Pre-heat the sanded areas to $40-50^{\circ} \mathrm{C}$


Slide wedges into both ends so the sleeve is centred.


Pressure testing before foaming and plugging.

## End caps

## General information

The end cap, mounted on the pipe fitting, is intended to be used inside foundation walls, in manholes and should not lie continuously under the water.

## Material

End caps, see Chapter 8

## Execution

- The outer casing, foam and steel pipe should be cleaned of dirt, grease, moisture etc. at least 150 mm from the pipe ends.
- Sand the pipe surface to be covered by the end cap.
- Carry out alarm installation according to specific instructions.
- Sliding on the right dimension of end cap.
- Heat and shrink the part of the protection that lies over the outer casing until mastic escapes.
- Heat and shrink the remainder of the protection until mastic escapes and forms a tight seal.


## End sleeve

## General information

The end sleeve is intended as mechanical protection and insulation for a pipe end in a manhold, inside foundation walls or buried in the ground.

## Material

End sleeve, see Chapter 6

## Execution

- The outer casing, foam and steel pipe should be cleaned of dirt, grease, moisture etc. at least 150 mm from the pipe ends.
- Sand the part of the sleeve and pipe surface that will be covered by the tightening tube.
- Install the alarm. To create a loop, the alarm wires should be accessible.
- Install the insulation on the pipe:
a) Pipe insulation with a length of 300 mm and insulating plugs at the end of the pipe insulation or
b) Pre-fabricated insulating joints.
- Install the end sleeve.
- Seal with tightening tube using a suitable method.


## Insulation of joints

## Mechanical foaming

- Check that the affected surfaces are dry and clean.
- To achieve the best results, the temperature of the surfaces onto which the insulation will be cast should be between $+15^{\circ} \mathrm{C}$ and $+40^{\circ} \mathrm{C}$. The ideal temperature is $22^{\circ} \mathrm{C}$. To achieve the right temperature, the steel pipe can be heated with circulating hot water, or from outside with air or a gas torch. The sleeve can be heated carefully with a soft gas torch.
- The sleeve should be centred over the joint.
- If necessary, centre the sleeve with wedge strip.
- Drill top up hole and vent hole if insulation is to be carried out after installation of the joint material.
- Fill with the requisite quantity of foam. Knock in sealing plugs.
- Allow the sleeve to cool for at least 1 hour before completing sleeve installation.

If the temperature is lower than $+15^{\circ} \mathrm{C}$ or higher than $+40^{\circ} \mathrm{C}$ in the sleeve/steel pipe, foaming can still take place under certain circumstances. Consult with Powerpipe.

## Hand foaming

This can be done in two ways. By using foam packs, see Chapter 8, or with manual mixing in a container. Foam packs are recommended from a safety viewpoint.

Both methods are difficult to execute when insulating larger dimensions.
Mechanical foaming is recommended.

- The same preparations as for mechanical foaming.
- Ensure that the temperature in the foam liquids is at least $20^{\circ} \mathrm{C}$.
- Measure out the quantity of polyol and isocyanate in separate containers according to the table below, or choose the right dimension of foam pack.
- Mix and stir vigorously until the mixture has a uniform colour (approx. 15-20 sec).
- Pour the mixture into the filling hole.
- After this, the procedure is the same as for mechanical foaming.


## Sealing of top up and vent holes

A non-welded plug should be sealed an extra time using a special cover patch (FOPS) with a seal surface of hot melt adhesive. For sleeves with tightening band, the top up/vent holes are placed at the edge of the sleeve so they are covered by the shrink material.

- Sand.
- Use a soft gas flame.
- Pre-heat the surface around the plug to approx. $60^{\circ} \mathrm{C}$.
- Check the temperature with a temperature indicator.
- Pre-heat the hot melt adhesive surface on the cover patch for 2-3 sec. so it has a shiny, semi-liquid character.
- Press the cover patch firmly over the plug, ensuring it is centred.
- Heat the upper side until the structure of the upper side disappears and the hot melt adhesive flows out around the edges.
- Press the cover patch in place from the centre and outwards.
- Check that the cover patch is in complete contact with the surface without air bubbles.


The ideal temperature is $22^{\circ} \mathrm{C}$. Drill top up hole and vent hole if insulation is to be carried out after installation. Fill with the requisite quantity of foam. Knock in sealing plugs.


Hand foaming


The plugs should be sealed and extra time using a special cover patch with a seal surface of hot melt adhesive.

## Plug instruction Powerpipe

1 Connect the plug welder to a 230 volt supply.
2 Check that the tool is clean and that the heating element has heated up. This is indicated by a steady LED light. The thermostat should be set at $260^{\circ} \mathrm{C} .+/-10^{\circ} \mathrm{C}$.

3 Check the temperature with a temperature sensor. If required, the temperature should be adjusted to the right conditions.

4 Drill out the foaming hole with a 20 mm drill. Foam the sleeve, knock in vent plug. Harden for at least 20 min . See image 1.

5 The vent plug is dismantled and the hole is drilled out with a conical drill. Clean the hole and surrounding casing pipe of any foam residues. See images 2 and 3.

## See next page.



6 Place the plug welder in the hole and the weld plug into the holder to pre-heat until a weld bead of approx. 1-2 mm has formed. Remove the tool and press the melted plug into the hole under pressure for approx. 1 min until the plastic has cooled. See images 4 and 5 .

7 If a FOPS (cover patch) is to be installed, the weld plug must be ground down to an even surface. See Image 6.

8 Pre-heat the FOPS and the surface around the plug. Place the FOPS over the plug, heat with a gas torch and press with a FOPS press.
See images 7 and 8.


## Table of foam liquids for foaming

Double pipes

| DN | DOUBLE STANDARD |  |  | DOUBLE+ |  |  | DOUBLE++ |  |  |
| :--- | :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: |
|  | PEH <br> DY | Polyurethane <br> kg/sleeve | Foam <br> bottles | PEH <br> DY | Polyurethane <br> kg/sleeve | Foam <br> bottles | PEH <br> DY | Polyurethane <br> kg/sleeve | Foam <br> bottles |
|  | 125 | 0.50 | 3 | 140 | 0.72 | 5 | 160 | 0.94 | 6.1 |
| $2 \times 25$ | 140 | 0.70 | 5 | 160 | 0.92 | 6.1 | 180 | 1.12 | 8 |
| $2 \times 32$ | 160 | 0.89 | 6.1 | 180 | 1.14 | 7 | 200 | 1.36 | 8.1 |
| $2 \times 40$ | 160 | 0.84 | 6.1 | 180 | 1.09 | 7 | 200 | 1.32 | 8.1 |
| $2 \times 50$ | 200 | 1.27 | 8 | 225 | 1.68 | 9 | 250 | 1.90 | 10.1 |
| $2 \times 65$ | 225 | 1.52 | 8.1 | 250 | 1.94 | 10 | 280 | 2.40 | 11 |
| $2 \times 80$ | 250 | 1.80 | 9.1 | 280 | 2.37 | 10.1 | 315 | 2.90 | 11.1 |
| $2 \times 100$ | 315 | 2.75 | 11 | 355 | 3.45 | 12 | 400 | 4.60 | 13 |
| $2 \times 125$ | 400 | 4.47 | 12 | 450 | 5.20 | 13 | 500 | 7.10 | $11.1+12$ |
| $2 \times 150$ | 450 | 5.34 | 13 | 500 | 6.55 | 13.1 | 560 | 8.60 | $12+12$ |
| $2 \times 200$ | 560 | 8.03 | $12+12$ | 630 | 10.2 | $13+12$ |  |  |  |

Single pipes

| DN | SERIE 1 |  |  | SERIE 2 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | PEH <br> DY mm | Polyurethane kg/sleeve | Foam bottles | PEH <br> DY mm | Polyurethane kg/sleeve | Foam bottles |
| 20 |  |  |  | 110 | 0.50 | 3 |
| 25 | 90 | 0.32 | 2 | 110 | 0.46 | 3 |
| 32 | 110 | 0.45 | 3 | 125 | 0.58 | 4 |
| 40 | 110 | 0.43 | 3 | 125 | 0.55 | 4 |
| 50 | 125 | 0.51 | 4 | 140 | 0.65 | 5.1 |
| 65 | 140 | 0.60 | 5 | 160 | 0.81 | 6.1 |
| 80 | 160 | 0.75 | 6 | 180 | 0.98 | 7 |
| 100 | 200 | 1.04 | 7 | 225 | 1.47 | 8.1 |
| 125 | 225 | 1.21 | 8 | 250 | 1.68 | 9 |
| 150 | 250 | 1.34 | 8.1 | 280 | 1.97 | 10 |
| 200 | 315 | 1.98 | 10 | 355 | 2.99 | 11.1 |
| 250 | 400 | 3.21 | 11.1 | 450 | 4.84 | 12 |
| 300 | 450 | 3.09 | 12 | 500 | 5.52 | 13 |
| 350 | 500 | 4.63 | 13 | 560 | 7.08 | 13.1 |
| 400 | 560 | 5.60 | 13 | 630 | 8.77 | 13.1+9 |
| 450 | 630 | 7.42 | $13.1+5$ | 710 | 9.7 | $12+13$ |
| 500 | 710 | 9.56 | 13.1+11.1 | 800 | 12.44 | 13.1+13.1 |

The quantities are based on:

- Free sleevelength $2 \times 225=450 \mathrm{~mm}$.
- Dimensions for shrinkable sleeves
- Temperature $+15^{\circ} \mathrm{C}-+40^{\circ} \mathrm{C}$ in sleeve and steel pipe.
- In the table above, a supplement $(\approx 10 \%)$ is included for liquids that remain in the mixing vessel

Foam liquids should have a temperature of approx. $20^{\circ} \mathrm{C}$. If a welding sleeve is used, the quantity should be reduced by approx. $15 \%$ for twin pipes and approx. $20 \%$ for single pipes due to the smaller sleeve diameter.

## Table of foam liquids for foaming

Single pipes Part 2

| DN | SERIE 3 |  | SERIE 4 |  |  |  |
| :--- | :--- | :--- | :---: | :--- | :--- | :---: |
|  | PEH <br> DY $\mathbf{~ m m ~}$ | Polyurethane <br> kg/sleeve | Foam bottles | PEH <br> DY $\mathbf{~ m m}$ | Polyurethane <br> kg/sleeve | Foam bottles |
|  | 125 | 0.57 | 4 | 140 | 0.71 | 6 |
| 25 | 125 | 0.56 | 4 | 140 | 0.70 | 6 |
| 32 | 140 | 0.73 | 5 | 160 | 0.89 | 6.1 |
| 40 | 140 | 0.70 | 5 | 160 | 0.92 | 6.1 |
| 50 | 160 | 0.88 | 6.1 | 180 | 1.12 | 7 |
| 65 | 180 | 1.04 | 7 | 200 | 1.35 | 8 |
| 80 | 200 | 1.25 | 8 | 225 | 1.65 | 9 |
| 100 | 250 | 1.88 | 9.1 | 280 | 2.50 | 11 |
| 125 | 280 | 2.24 | 10.1 | 315 | 3.0 | 11.1 |
| 150 | 315 | 2.69 | 11 | 355 | 3.65 | 12 |
| 200 | 400 | 3.93 | 13.1 | 560 | 5.70 | 13 |
| 250 | 500 | 6.05 | $13.1+6.1$ | 630 | 8.10 | 10.0 |
| 300 | 560 | 7.26 | $13.1+11$ | 710 | 12.2 | $12+12$ |
| 350 | 630 | 9.34 | $13.1+13$ |  |  | $13.1+13.1$ |
| 400 | 710 | 11.65 | $13.1+13.1$ |  |  |  |
| 450 | 800 | 14 |  |  |  |  |

## The quantities are based on:

- Free sleevelength $2 \times 225=450 \mathrm{~mm}$.
- Dimensions for shrinkable casing
- Temperature $+15^{\circ} \mathrm{C}-+40^{\circ} \mathrm{C}$ in sleeve and steel pipe.
- In the table above, a supplement $(\approx 10 \%)$ is included for liquids that remain in the mixing vessel.

Foam liquids should have a temperature of approx. $20^{\circ} \mathrm{C}$. If a welding sleeve is used, the quantity should be reduced by approx. $15 \%$ for twin pipes and approx. $20 \%$ for single pipes due to the smaller sleeve diameter.

Foam pack, bottle, see Chapter 8.

## Foam liquids for tapping/connection, single pipe

The quantity of foam liquids required can be calculated using the tables below for guidance

## Bottle set for foaming 6480



## Requirements for branch:

| Dimension | $\begin{aligned} & \text { Series } 1 \\ & \text { kg } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { Series } 2 \\ & \text { kg } \end{aligned}$ | $\text { Series } 3$ $\mathbf{k g}$ | $\begin{aligned} & \text { Series } 4 \\ & \text { kg } \end{aligned}$ | $\begin{aligned} & \text { Quantity } \\ & \text { kg } \end{aligned}$ | Bottle no. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DN 25 | 0.40 | 0.55 | 0.70 | 0.80 | 0.2-0.25 | 1 |
| DN 32 | 0.56 | 0.65 | 0.85 | 1.0 | 0.25-0.35 | 1 |
| DN 40 | 0.52 | 0.62 | 0.80 | 1.0 | 0.35-0.45 | 2 |
| DN 50 | 0.60 | 0.80 | 1.0 | 1.2 | 0.45-0.55 | 3 |
| DN 65 | 0.71 | 1.0 | 1.1 | 1.4 | 0.55-0.70 | 4 |
| DN 80 | 1.09 | 1.2 | 1.4 | 1.7 | 0.70-0.75 | 5 |
|  |  |  |  |  | 0.75-0.85 | 5.1 |
|  |  |  |  |  | 0.85-1.00 | 6 |
| Requirements for main pipe: |  |  |  |  | 1.00-1.15 | 6.1 |
| Dimension | Series 1 kg | Series 2 kg | Series 3 kg | Series 4 kg | 1.15-1.30 | 7 |
|  |  |  |  |  | 1.30-1.60 | 8 |
|  |  |  |  |  | 1.601 .75 | 8.1 |
| DN 40 | 0.43 | 0.55 | 0.70 | 0.92 | 1.75-1.90 | 9 |
| DN 50 | 0.51 | 0.65 | 0.88 | 1.12 | 1.90-2.30 | 10 |
| DN 65 | 0.60 | 0.81 | 1.04 | 1.35 | 2.30-2.60 | 10.1 |
|  |  |  |  |  | 2.60-3.0 | 11 |
| DN 80 | 0.75 | 0.98 | 1.25 | 1.65 | 3.0-3.5 | 11.1 |
| DN 100 | 1.04 | 1.47 | 1.88 | 2.50 | 3.5-4.8 | 12 |
| DN 125 | 1.21 | 1.68 | 2.24 | 3.00 | 4.8-6.0 | 13 |
|  |  |  |  |  | 6.0-7.0 | 13.1 |
| DN 150 | 1.34 | 2.97 | 2.69 | 3.65 |  |  |
| DN 200 | 1.98 | 2.99 | 3.93 | 5.70 |  |  |
| DN 250 | 3.21 | 4.84 | 6.05 | 8.10 |  |  |
| DN 300 | 3.09 | 5.52 | 7.26 | 10.0 |  |  |
| DN 350 | 4.63 | 7.08 | 9.34 | 12.2 |  |  |
| DN 400 | 5.60 | 8.77 | 11.65 | 15.6 |  |  |
| DN 450 | 7.42 | 9.7 | 14.4 | 18.2 |  |  |
| DN 500 | 9.56 | 12.44 | 18.3 | 22.6 |  |  |

NB! The table values are calculated for:

- An opening of 450 mm on the main pipe. In the case of a smaller opening, the quantity should be reduced.
- Shrinkable sleeve dimensions.

Calculate and add the requirements for main pipe and branches. In the table above, a supplement ( $\approx 10 \%$ ) is included for liquids that remain in the mixing vessel.

Part no. 6480-bottle no.-000-000.

## Foam liquids for tapping/connection, double pipe

The quantity of foam liquids required can be calculated using the tables below for guidance

## Bottle set for foaming 6480



Requirements for branch (double pipe)

| Dimension | STANDARD $\mathbf{K g}$ | $\begin{aligned} & \text { DOUBLE+ } \\ & \text { Kg } \end{aligned}$ | $\begin{aligned} & \text { DOUBLE++ } \\ & \mathbf{K g} \end{aligned}$ | Quantity kg | Bottle no. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DN 25 | 0.44 | 0.55 | 0.7 | 0.2-0.25 | 1 |
| DN 32 | 0.70 | 0.90 | 1.10 | 0.25-0.35 | 1 |
| DN 40 | 0.67 | 0.87 | 1.10 | 0.35-0.45 | 2 |
| DN 50 | 1.11 | 1.45 | 1.60 | 0.45-0.55 | 3 |
| DN 65 | 1.60 | 2.05 | 2.50 | 0.55-0.70 | 4 |
|  |  |  |  | 0.70-0.75 | 5 |
|  |  |  |  | 0.75-0.85 | 5.1 |
|  |  |  |  | 0.85-1.00 | 6 |
| Requirements for main pipe (double pipe) |  |  |  | 1.00-1.15 | 6.1 |
| Dimension | STANDARD | DOUBLE+ | DOUBLE++ | 1.15-1.30 | 7 |
|  | $\mathbf{K g}$ | $\mathbf{K g}$ | $\mathbf{K g}$ | 1.30-1.60 | 8 |
|  |  |  |  | 1.60-1.75 | 8.1 |
| DN 32 | 0.89 | 1.14 | 1.36 | 1.75-1.90 | 9 |
| DN 40 | 0.84 | 1.09 | 1.32 | 1.90-2.30 | 10 |
| DN 50 | 1.27 | 1.68 | 1.90 | 2.30-2.60 | 10.1 |
| DN 65 | 1.52 | 1.94 | 2.40 | 2.60-3.0 | 11 |
|  |  |  |  | 3.0-3.5 | 11.1 |
| DN 80 | 1.80 | 2.37 | 2.90 | 3.5-4.8 | 12 |
| DN 100 | 2.75 | 3.45 | 4.60 | 4.8-6.0 | 13 |
| DN 125 | 4.47 | 5.20 | 7.10 | 6.0-7.0 | 13.1 |
| DN 150 | 5.34 | 6.55 | 8.60 |  |  |
| DN 200 | 8.03 | 10.2 |  |  |  |

NB! The table values are calculated for:

- An opening of 450 mm on the main pipe. In the case of a smaller opening, the quantity should be reduced.
- Shrinkable sleeve dimensions.

Calculate and add the requirements for main pipe and branches. In the table above, a supplement ( $\approx 10 \%$ ) is included for liquids that remain in the mixing vessel.

## Part no.

6480-bottle no.-000-000.

## Installation

## Foam liquids for tapping/connection

If the right bottle size is not available, the table below may be useful.

| Bottle | Can be replaced with bottle |  |  |
| :--- | :--- | :--- | :--- |
| 4 | $1+1$ |  |  |
| 5 | $1+2$ | $2+2$ |  |
| 5.1 | $2+2$ | $3+1$ | $1+4$ |
| 6 | $2+3$ | $3+3$ | $5.1+1$ |
| 6.1 | $3+4$ | $5+2$ | $6+1$ |
| 7 | $4+4$ | $3+4$ | $6.1+2$ |
| 8 | $5+5.1$ | $6+4$ | $6.1+3$ |
| 8.1 | $5.1+5.1$ | $6+5$ | $7+5$ |
| 9 | $6+6$ | $6.1+5.1$ | $7+6$ |
| 9.1 | $6+6.1$ | $7+5.1$ | $8+5.1$ |
| 10 | $6.1+6.1$ | $7+6$ | $8.1+5.1$ |
| 10.1 | $7+7$ | $8+6$ | $9.1+5.1$ |
| 11 | $8.1+7$ | $9+6.1$ | $9.1+7$ |
| 11.1 | $8.1+8.1$ | $9+8$ | $11+8.1$ |
| 12 | $10+10$ | $10.1+9.1$ | $12+8.1$ |
| 13 | $11+11$ | $11.1+8$ | $13+6$ |

## Backfilling

Backilling should be carried out with 0-16 mm stone-free gravel material according to Construction AMA 2013 CEC. 3131. Backilling should be packed according to Class 2, Table CE/4. See below.
Individual particles with a largest grain size of 50 mm may occur, but not adjacent to casing pipe joints without approval from Powerpipe.

Support filling should be carried out with the same material as for pipe trenches and packed evenly. Particular care should be taken when filling and packing beneath the pipes. At branches, backfilling must be done with care. Care should be taken when filling and packing material at deflection between $10^{\circ}-30^{\circ}$.
If support pallets have been used, this must be removed before backfilling. Marking strip or net should be laid over the filling material.


1. Drainage pipe
2. Pipe trenches
3. Backfilling
4. Backfill soils

Excavation material
5. Marking strip/mesh

## Backfilling with alternative material

See exhaustive information in Chapter 9.

## Marking strip

The use of marking strip to facilitate location of pipes is recommended. Execution in accordance with Construction AMA 02013. Marking strip and mesh should be violet in colour. See Chapter 8.

## Residual filling

Execution in accordance with Construction AMA 2013 CEC. 4131. Maximum stone size 100 mm may occur evenly distributed in the filling.

## Terracing, pile-driving, ground reinforcement, soil layers etc.

Table CE/4. Filling and packing around pipes. Largest layer thickness in metres after packing and minimum number of passes per layer during packing.

Backfill material should have a bearing capacity fulfilling the mechanical and hydraulic characteristics required for the construction.

The material shall have such properties that it can be compressed with a reasonable effort from the packing equipment.

Backfill material should lie within the limits shown in Figure 15.

| Packing tool | Material type <br> $\mathbf{2}$ | Min. number of passes |
| :--- | :---: | :---: |
| Hand tamper, min. 15 kg. | 0.15 |  |
| Vibrator, min. 70 kg. | 4 |  |
| Vibrator plate | 0.30 | 4 |
| $\min 50 \mathrm{~kg}$. | 0.10 | 6 |
| $\min 100 \mathrm{~kg}$. | 0.15 | 6 |
| $\min 200 \mathrm{~kg}$. | 0.20 | 6 |

Fig. 15


## Backfilling with alternative material

Limitations and guidelines for use of alternative backfill material are provided below.
If coarse material is to be used as material to fill around insulated district heating pipes, thorough inspection of the execution is required, together with great care when handling soils to avoid damaging pipes and joints.
$\left.\begin{array}{|l|l|l|l|}\hline \text { Conditions } & \text { Non-trafficked surface } & \text { Trafficked paved surface } & \text { Trafficked unpaved surface } \\ \hline & \text { No external load on pipe } & \begin{array}{l}\text { The pipe is assumed to lie } \\ \text { beneath the superstructure } \\ \text { of the paved surface - i.e. in } \\ \text { previously hard packed soil. The } \\ \text { fill material distributes the traffic } \\ \text { loads so that point loads do not } \\ \text { occur on the pipe. } \\ \text { It must be possible to pack fill } \\ \text { material. }\end{array} & \begin{array}{l}\text { There is a risk of point loads } \\ \text { on the pipe where there is } \\ \text { insufficient fill material. }\end{array} \\ \hline \text { Friction attached section } & \begin{array}{l}\text { Existing natural and/or crushed } \\ \text { aggregate with a largest grain } \\ \text { size of 50 mm }\end{array} & \begin{array}{l}\text { Existing natural and/or crushed } \\ \text { aggregate with a largest grain } \\ \text { size of 50 mm }\end{array} & \begin{array}{l}\text { It me possible to pack fill } \\ \text { material }\end{array} \\ \hline \text { natural mat-sial with a largest } \\ \text { grain size of 50 mm or crushed } \\ \text { aggregate 4-32 mm }\end{array}\right]$

Regarding backfilling material and packing, see Chapter 10.

## Safety regulations/instructions

## Safety regulations and protective devices

Powerpipe pipes are insulated with a high quality rigid polyurethane cellular plastic. This is produced through a reaction and fermentation process following the combination of polyol and isocyanate.

## Work environment risks

Three procedures can involve special risks during work with insulated district heating pipes if safety measures are not taken.

## For:

- Welding/brazing of service pipes producing a high temperature (in excess of $150^{\circ} \mathrm{C}$ ) in any part of the insulation, whereupon harmful gases may be produced.
- Mixing of the polyol and isocyanate components for supplementary insulation at joints.
- Carrying out jointing of the outer casing which produces a high temperature (in excess of $150^{\circ} \mathrm{C}$ ) in any part of the insulation, whereupon harmful gases may be produced.


## Instructions and protection

Working with polyurethane cellular plastic insulation entails risks for the affected personnel. These risks can be eliminated if the right methods and protective equipment are used.

In general, smoking is prohibited during work with polyurethane. Personnel working with polyurethane products must have specific training in aspects such as work protection, legislation and materials handling. The personnel should also have undergone a medical examination.

Work environment matters are regulated by the Swedish National Board of Occupational Safety and Health's statute AFS 2005:18,"Hard plastics".

## Welding

## Welding/brazing of factory-manufactured pipes and pipe fittings

1. Check that the uninsulated service pipe ( min .150 mm ) is entirely free of polyurethane residues.
2. When welding/brazing: do not aim the gas torch at the insulation. Do not heat the pipe more than necessary to achieve a good joint.

## Welding/brazing of pipes and pipe fittings cut on the construction site

1. Cut and remove the outer casing and insulation so that the uninsulated pipe end is min. 150 mm . Breathing protection should be worn when using cutting wheels to remove insulation.
2. Service pipe (min. 150 mm ) should be scraped/sanded with emery to remove all residues of insulation.
3. If smaller insulation residues remain, breathing protection of carbon filter type should be used when welding/brazing. In restricted spaces, a fresh air breathing mask is recommended. Alternatively, minor foam residues can be burned away provided breathing protection/fresh air breathing mask is worn - before welding/ brazing work.
4. When welding/brazing: do not aim the gas torch at the insulation. Do not heat the pipe more than necessary to achieve a good joint.


Use protective equipment: When welding/brazing service pipes, a high temperature (in excess of $150^{\circ} \mathrm{C}$ ) is produced in part of the insulation, whereupon harmful gases may be produced.


Follow instructions in the Swedish National Board of Occupational Safety and Health's statute AFS 2005:18


Do not aim the gas torch at the insulation. Service pipe (min. 150 mm ) should be sanded with emery to remove all residues of insulation.

## Safety regulations/instructions

## Joint insulation

Close handling of foaming liquids minimises the risk of leakage of harmful gases. However, a certain quantity leaks out from the sleeve during the foam fermentation process. Good ventilation is required. In narrow and poorly ventilated spaces, breathing protection with gas and dust filter Class II should be used against organic vapours.

Containers which have contained isocyanate must not be filled with water and later closed. Significant production of carbon dioxide can result.

## Joining of outer casing

The outside and edges of PEH pipes should be cleaned thoroughly so that any residues of insulation material are completely removed before joining the outer casing. The gas flame must not be aimed at free polyurethane cellular plastic.

## In case of accident

Isocyanate on the skin must be rinsed off immediately with clean water. Isocyanate in the eyes must be rinsed off immediately with plenty of clean water. Rinse the eyes until a doctor arrives.

If isocyanate has been swallowed, large quantities of lukewarm, clean water or milk should be drunk immediately. A doctor should then be consulted.

Polyurethane cellular plastic on bare skin can be scraped off and the area washed with soap and water.

## Decontamination solution for isocyanate:

5\% ammonia
50\% methylated spirit
45\% water

## Decontamination powder for absorbing isocyanate:

25\% sawdust
37\% kieselgur
20\% methylated spirit

4\% triethanolamine
4\% ammonia
$10 \%$ water


A certain quantity of isocyanate vapour leaks out from the sleeve during the foam fermentation process. Good ventilation is required.


Isocyanate on the skin must be rinsed off immediately with clean water.


Use protective equipment: When welding/brazing the service pipe, a high temperature is produced

## Instructions for installation, operation and maintenance of ball valves

## Installation

Check that the product with ball valve(s) is of the right dimensions and that there is no dirt or foreign particles in the valve/pipe. The valve is installed in a position that means it is not exposed to uncontrolled thermal forces or high bending stresses.
The file should be open when welded in place and may not be operated before the pipe fitting has cooled. Ensure that the network pressure/temperature does not exceed the valve performance.

## NB

On valves with bypass pipes, one valve must always be open to permit expansion during heating or freezing.

## Pressure testing.

When the valve is installed in the network, you can pressure test it with $1.1 \times \mathrm{PN}$ against the closed valve and $1.5 \times \mathrm{PN}$ against the open valve.
After pressure testing, the valve can be seal tested.

## Use

To avoid pressure shocks, close the valve slowly. For dimensions $\geq$ DN 200 a gear is recommended.
If the valve is the final flow limiter in a pipeline, the pipe must end with a sealing flange or plug.
When such a flange or plug is installed, the valve should be left in the open position.

## Maintenance

Valves should be exercised at least twice a year. At this time, check that the top of the stem is not soaked or contaminated with dirt.

## Stem leakage

If necessary, the O-ring of the stem can be replaced according to specific instructions. During such an O-ring replacement, the valve must be de-pressurised and the enclosed position.


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| Marking |  | Desired delivery date |  |  |  |
| Your order no. |  | Last delivery date |  |  |  |
| PART NO. | NAME | DN | LÄNGD | ANTAL | PRIS |
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| Miscellaneous |  |  |  |  |  |

## ORDER FORMS UNIQUE PRODUCTS

## Check list

1. Enter dimensions already known and specific requirements in the box below, such as any specific requirements for alarm wire position.

- Lengths/dimensions
- Stem heights
- Dimensions
- Alarm wire position
- Position in section
- Which type of valve. Full flow or choke
- Gear/actuator. Fixed, portable or model requirement


## Sketches


[^0]:    Important! Please note that it is not appropriate to bend/straighten Cu-Flex more than once.
    The flexpipe is delivered in full reels (approx. 100 m ). The reel diameter is approx. 2.4 m . Not kept in stock Can be ordered with alarm wire, suffix -935

[^1]:    NOTE: Calculate the supply pipe!

