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Logstor

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Logstor has manufactured pre-insulated pipe systems since 1992. They all adjust the demands on the industrial market. Our primary markets for the pipe systems are provision industry, chemical industry, wood industry, cold stores and marine.

With a wide product range and flexibility the pre-insulated pipe systems are adaptable to even very specific demands.

The pre-insulated pipe systems are characterized as follows:

- Pre-insulated systems with PUR- insulation have a very high insulation capacity.
- Pipe supports are to be fitted outside jacket to avoid thermal bridges
- Insulation and the jacket material have a high mechanical strength, which make the pre-insulated pipe systems resistant to physical effects, for instance when they are used as footbridge.
- The jacket joints are 100 % sealed, so that the pipes are cleanable, and result in low maintenance costs.

The pipes are all dimensionally stable, sturdy and high-insulated. The installation is simple and quick. This means, lower total costs, higher security and longer validity.

For the marine market Logstor has developed an insulation system, which is called LT pipe system, for the low temperature area, which has the above-mentioned advantages contrast with the traditional insulated pipe systems. The properties of the insulation system are higher, the installation is quick and simple, and the system is maintenance-free after installation. If you wish to save time and costs, the pre-insulated pipes are available on the spot, for instance at a shipyard.

Logstor and its customers

Over 40 years experience with the development and sale of complete pre-insulated pipe systems, known with a worldwide reputation. A well developed network of distributors and subsidiaries has resulted in thousands of kilometres of the characteristic Logstor pipes being laid all over the world. Our distributors and subsidiaries represent us in over 30 countries around the world.

We regularly attend international exhibitions manned by personnel from Logstor and local distributors.

Extensive service

Logstor's engineers and technicians provide an extensive service for any given project – right from initial planning to commission, engineering and follow-up servicing and training of fitters.

Years of experience of the installation of joints and devising customized solutions have given us the expertise to carry out installation work and supervision within our market areas.

Production locations

Logstor was founded in the early 60s, in Løgstør, Northern Jutland, in Denmark, which is still the site of most of our production today. Over the years, the factory has expanded to cover 50,000 m2 on a site of 420,000 m2. To cope with rising demand in Eastern Europe, a new factory was opened in Zabrze, Poland. This new facility combines the latest technology and well-proven Logstor traditions.

Large orders for remote areas are generally produced using our mobile production units, in particular offshore pipe systems – one of Logstor's specialities.

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Logstor

Generel introduction 1.1.2 - 2/2

Quality assurance

Logstor has been DS/ISO 9001 certified by Lloyd's since 1992 for product development and manufacturing, plus project management, which has entailed introduction of the strictest requirements for quality assurance in the whole company. Quality control is also the customer's guarantee that all Logstor products and services fulfil our industry's strictest standards.

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

LOGSTOR
Logstor Rør A/S
Logstør
Denmark

has been approved by Lloyd's Register Quality Assurance to the following Quality Management System Standards:

ISO 9001:2000

The Quality Management System is applicable to:

Development and manufacture of isothermal transport systems for liquids and gas, including production on location and installation of joints on site.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

Approval Certificate No: 930476

Original Approval: 2nd July 1992
Current Certificate: 18th December 2003
Certificate Expiry: 30th June 2006

Magnus Fiberg
on behalf of LRQA Denmark

This document is subject to the provision on the reverse.

LLOYD'S REGISTER QUALITY ASSURANCE

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Catalogue layout

Generel introduction 1.1.3 - 1/1

This product catalogue describes Logstor's industrial standard products. It describes how these products can be combined to form systems, and how they should be handled and installed.

This chapter gives an overview of the standard systems of the industrial program. Furthermore, general information is provided on material specifications and handling of the products.

The subsequent chapters – from 2 to 5 – describe the individual pipe systems. The chapters dealing with the individual systems, all have the same basic layout and contain chapters concerning technique, components and joints.

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Product programme

Generel introduction 1.1.4 - 1/3

Logstor industrial systems are designed as complete systems for specific applications and as such, can only be used within those areas.

LT - Low temperature
Operating temperature –200- +120°C

Bondedsystem

Freelysuspendedsystemsonly

See system description page 2.1.1

NT - Normal temperature
Operatingtemperature–60–10°Cfreely suspended system

Operating temperature -10° - +120° C freely suspended and directly buried system

Bonded system only

See system description page 3.1.1

HT3 - High temperature
Operating temperature +120° C - +250° C

Sliding system

Directly buried systems only

See system description page 5.1.1

System types

Bonded system

In a bonded system, the carrier pipe insulation and jacket are bonded together by adhesion, which allows them to expand and move as a single entity.

The outer surface of the carrier pipe and the inner surface of the jacket pipe are pretreated, so that the foam adheres to the pipes, and that stresses can be transmitted through the insulation.

Thepipesmoveasasingleentity.Movements canberestrictedbypipesupportsorother frictionagainstthejacketpipes.Freely suspendedpipesystemsmustbeableto movefreely.

Changeoftemperatureindirectlyburied systemscanbeabsorbedasstressesinthe system.

Asandwichconstructionconsistingofmineral wool and PUR foam is applied in the temperature range from +120° C to + 250° C. Used as a directly buried system (HT3), the pre-insulated high temperature system operates as a sliding system (see sliding system).

Flexible system

Logstor offers flexible pipe systems for temperatures ranging from -200° C up to +120° C.

A characteristic feature of the flexible systems is the carrier pipe, which is manufactured in a flexible material. In general, expansion can be left out of consideration, when it comes to flexible systems.

In the flexible systems, the stresses are absorbed from temperature effects in the carrier pipe.

Minor pipe dimensions are delivered in coils. The pipes can be bent on site for the desired layout of the pipeline.

Sliding system

In a sliding system, the carrier pipe moves inside the insulation, which adheres to the jacket pipe. Therefore, the jacket pipe must be retained from the outside, e.g. by the soil friction in the case of directly buried pipe systems.

The expansion is absorbed in special components within the jacket of the system. Consequently, the carrier pipe must be fixed with anchors (compensators and expansion bends).

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Productprogramme

Generel introduction 1.1.4 - 2/3

Carrier pipes

Logstor's industrial products are manufactured and supplied in different pipe systems including carrier pipes of different types.

The choice of the carrier pipe depends on the transported medium. The carrier pipe is available in steel, stainless steel, copper or in plastic. The pipe can be supplied with tracer pipes.

Insulation

The type of insulation depends on the medium temperature.

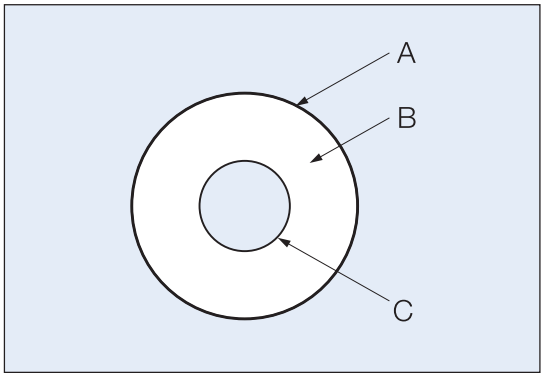
Logstor cooling pipes are insulated with a special HCFC/CFC free PUR- foam, which is applicable in the temperature area -200° C - +120° C.

Furthermore, flexible foam pipe systems are available within temperature variations from -200° C - +120° C.

During temperatures between 120° C and 250° C, the insulation is composed of mineral wool and PUR foam according to the present temperature.

Jacket pipes

The industrial pipes are available with black or white HPDE jackets (polyethylene), as standard. The jacket is UV resistant.



A: Jacket pipe

B: Insulation

C: Carrier pipe

Warning wires

The steel- and copper programme is available with integrated warning wires for registration of moisture in the insulation, which is caused by damages on the jacket or carrier pipe. In this way, moisture damages can be discovered in time and be repaired, before corrosive damages on the carrier pipe arise. See the Logstor district heating catalogue.

Certificates

Logstor offers you complete traceability if we are informed by placing of the order.

Joints

The Logstor industrial programme is primarily based on straight pipes and joints. We offer you a range of joints, which fit applications for pipes and components.

Logstor supplies two different joint solutions:

- Joints for foaming on site.
- Joints consisting of pre-manufactured PUR half shells.

All joints are produced of shrinkable PE plastic materials.

Straight pipes and sleeves up to and including ø315 are used for freely suspended pipe systems. The product programme includes bend joints, straight joints, T- joints, reduction and repair joints plus end caps.

Logstor district heating joints are used for directly buried pipe systems.

Fittings

Logstor offers you a complete fitting programme of joint solutions in St.35.8,St. 37.0 BW, AISI 304 L and AISI 316 L, which complements our joint solutions. The programme includes:

- Elbows
- T-joints
- Reductions
- Anchors

Thus, the customer has all the requisite components at disposal.

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Product programme

Generel introduction 1.1.4 - 3/3

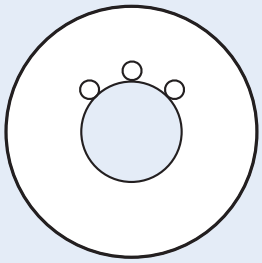
Centring

The insulation centring of carrier pipes is performed using centring spacers. The spacers are made of heat resistant materials with low thermal conductivity.

Tracer pipes

All pipe types can be supplied with an empty pipe laid directly into the insulation, within which self-regulating heat cables can be laid, or a fluid heat medium can be passed through.

Example



Thermal life

A correct installation of the complete pipe system secures a thermal life of more than 10 years, depending on operational conditions.

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Carrier pipes

Steel pipe systems

Material specifications 1.2.1 - 1/5

St. 37.0 BW

High- frequency welded St. 37.0 BW to P235 GH according to EN 10217-2 or EN10217-5 equivalent to St. 37.0 BW according to the previous DIN 1626.

Technical conditions of supply to DIN 1626 (October 1984).

Measurements and weights to DIN 2458.

Wall thicknesses from 21.3 up to 33.7 mm are applicable to DIN 2440, thus, thread tapping is possible .

Bevelled ends to DIN 1626/4.10.5.

Testing pressure min. 50 bar or eddy-current tested.

Welding zone 100% NDT- tested to SEP 1917.

Mill certificate to EN 10204/3.1 B.

Supplied in lengths of 6, 12 and 16 m.

Application

Heat and steam (T≤ 210°C)

Mechanical properties of St. 37.0 BW:		
Density	7850	kg/m^3
Tensile strength	> 360	N/mm^2
Yield stress	> 235	N/mm^2
Young's modulus	$2.1 \cdot 10^5$	N/mm^2
Thermal properties:		
Coefficient of expansion	$1.2 \cdot 10^{-5}$	$°C^{-1}$
Specific heat	0.48	kJ/kg°C
Thermal conductivity	76	W/m°C

St. 35.8 I

Seamless steel pipes St. 35.8 I to P235 GH TC1 according to EN 10216 equivalent to St. 35.8 I according to the previous DIN 17175 (05.79). Measures and weight according to DIN 2448.

Mill certificate to EN 10204/3.1 B.

Ends, in dimensions from 3.2 mm wall thickness, are bevelled according to DIN 2559/2.2 or 2.1. Ends < 3.2 mm wall thickness are bevelled according to DIN 2559/1.

Supplied in lengths of 6 and 12 m.

Application

Heat, steam and condensate.

Mechanical properties of St. 35.8 I:		
Density	7850	kg/m^3
Tensile strength	> 360	N/mm^2
Yield stress	> 235	N/mm^2
Young's modulus	$2,1 \cdot 10^5$	N/mm^2
Thermal properties:		
Coefficient of expansion	$1.2 \cdot 10^{-5}$	$°C^{-1}$
Specific heat	0.43	kJ/kg°C
Thermal conductivity	76	W/m°C

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Carrier pipes

Stainless steel pipe systems

Material specifications 1.2.1 - 2/5

Logstor Industry offers to purchase stainless steel pipes for projects and supply them according to the customer's specifications and Logstor Industry's minimum demands on pre-insulation. This also applies to pipes supplied by the customer.

AISI304L (wst1.4307)

Welded pipes AISI 304L according to EN 10217-7 equivalent to the previous DIN 17457.

Welding factor 1.0.

Tolerances according to DIN 2463.

Mill certificate according to EN 10204/3.1.B.

Supplied in lengths of 6 m.

Application

Chemistry, food, and condensate.

Mechanical properties of AISI 304 L:

Density		7950	kg/m^3
Tensile strength	(20°C)	> 470	N/mm^2
Yield stress	(20°C)	> 180	N/mm^2
Young's modulus	(20°C)	$1.95 \cdot 10^{-5}$	N/mm^2
Thermal properties:			
Coefficient of expansion	(20°C)	$1.7 \cdot 10^{-5}$	$°C^{-1}$
Specific heat		0.50	kJ/kg°C
Thermal conductivity		15	W/m°C

AISI316L (wst1.4432)

Welded pipes AISI 316L according to EN 10217-7 equivalent to the previous DIN 17457.

Welding factor 1.0.

Tolerances according to DIN 2463.

Mill of certificate according to EN 10204/3.1.B.

Supplied in lengths of 6 m.

Application

Chemistry, food and condensate.

Mechanical properties of AISI 316 L:

Density		7950	kg/m^3
Tensile strength	(20°C)	> 490	N/mm^2
Yield stress	(20°C)	> 190	N/mm^2
Young's modulus	(20°C)	$1.95 \cdot 10^{-5}$	N/mm^2
Thermal properties:			
Coefficient of expansion	(20°C)	$1.7 \cdot 10^{-5}$	$°C^{-1}$
Specific heat		0.50	kJ/kg°C
Thermal conductivity		15	W/m°C

Dairy pipes (wst1.4432)

Stainless steel pipes are also supplied as abrasive welded dairy pipes in the quality AISI 316 L, and the inside is yielded and calibrated.

Application

Milk and dairy products

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Carrier pipes

Stainless steel pipe systems

Material specifications 1.2.1 - 3/5

AISI316TI (wst1.4571)

Welded pipes AISI 316 TI according to EN 10217-7 equivalent to the previous DIN 17457.

Welding factor 1.0.

Tolerances according to DIN 2463.

Mill certificate according to EN 10204/3.1.B.

Supplied in lengths of 6 m.

Application

Chemistry, food, and condensate.

Mechanical properties of AISI 316 TI:

Density		7950	kg/m^3
Tensile strength	(20°C)	> 500	N/mm^2
Yield stress	(20°C)	> 210	N/mm^2
Young's modulus	(20°C)	$1.95 \cdot 10^{-5}$	N/mm^2

Thermal properties:

Coefficient of expansion	(20°C)	$1.7 \cdot 10^{-5}$	$°C^{-1}$
Specific heat		0.50	kJ/kg°C
Thermal conductivity		15	W/m°C

Mapress

High-alloyed, austenitic CrNiMo- steel (w. 1.4401) according to EN 1008.

Suitable for all types of potable water. Suitable for all types of treated water from softened to desalinated. Corrosion resistant. No corrosion caused by foreign substances.

The supply is based on the blucher pipes or similar quality.

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Carrier pipes

Copper pipe systems

Material specifications 1.2.1 - 4/5

Hard copper

Hard copper pipes F37 according to DIN 1787/ 17671 corresponding to SIS 5015-04.

Tolerances according to EN 1057.

Application

Heat, oxygenous water and coolants.

Mechanical properties of hard copper:		
Density	8940	kg/m^3
Tensile strength	> 280	N/mm^2
Elongation at break	min. 5	%
Thermal properties:		
Coefficient of expansion	$1.68 \cdot 10^{-5}$	$°C^{-1}$
Specific heat	385	kJ/ kg°C
Thermal conductivity	365	W/ m°C

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Carrier pipes

Plastic pipe systems

Material specifications 1.2.1 - 5/5

PEX

Cross-linked polyethylene (PEX) to DIN 16892/ 16893

Oxygen retainer (EVAL)

Maximum temperature 95° C.

Dimension 22 and 28 mm max. 10 bar at 95° C. Other dimensions max. 6 bar at 95° C and max. 10 bar at 70° C.

Supplied in coils of up to 200 m, depending on the dimension in question.

Application

Heat corrosive dissolution, diesel and petrol.

Mechanical properties of PEX:

Density		938	kg/m^3
Tensile strength	(20°C)	20-26	N/mm^2
	(100°C)	9-13	N/mm^2
Young's modulus			
	(20°C)	600-900	N/mm^2
	(80°C)	300-400	N/mm^2
Elongation at break			
	(20°C)	300-450	%
	(100°C)	500-700	%
Thermal properties:			
Coeffifcient of expansion	(20°C)	$1.4 \cdot 10^{-4}$	$°C^{-1}$
	(100°C)	$2.05 \cdot 10^{-4}$	$°C^{-1}$
Specific heat		0.55	kJ/kg°C
Thermal conductivity		0.38	W/m°C

PE80/PE100 pressure pipes

High-density polyethylene according to DIN 8074 (the industrial pipe standards).

Produced according to DS2119/SBC 218.

Pipe certificate type 2.2.

Application

Provisions.

Mechanical properties of PE80:

Density	> 958	kg/m^3
Yield stress	> 19	N/mm^2
Thermal properties:		
Coefficient of expansion	$1.7 \cdot 10^{-4}$	$°C^{-1}$
Thermal conductivity	0.4	W/m°C
Melt flow rate	0.85	g/10 min.

Mechanical properties of PE100:

Density	> 945	kg/m^3
Yield stress	> 23	N/mm^2
Thermal properties:		
Coefficient of expansion	$1.7 \cdot 10^{-4}$	$°C^{-1}$
Thermal conductivity	0.4	W/m°C
Melt flow rate	0.22	g/10 min.

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Insulation

Material specifications 1.2.2 - 1/1

The pre-insulated straight pipes and components for bonded systems are supplied with a hard polyurethane foam insulation. Pre- insulated pipes in coils are supplied with semi-flexible foam.

PUR insulation

Hard polyurethane foam (PUR) which fulfils the functional requirements of EN 253:

Material: Polyurethane foam made from polyol and isocyanate. The foam is homogeneous with an average cell size of max. 0.5 mm.

Density	≥	60 kg/m^3
Closed cells	>	88%
Water absorption if boiled	≤	10% (Vol)
Compressive strength 10% deformation	≥	0.3 N/mm^2
Axial shear strength	≥	0.12N/mm^2
Tangential shear strength	≥	0.20N/mm^2
Thermal conductivity at 50° C	<	0.03 W/m° C
Max. operating temperature		120° C

The technical requirements are tested according to the EN 253 standard, which is valid for district heating pipes.

The material parameters are subject to revision due to technical developments.

NT and LT insulation

Logstor pipe systems are insulated with PUR foam, which ensures high insulation properties.

The PUR foam must not be subject to temperatures exceeding 120° C, by continuous operation.

HT3 insulation

Two-part insulation is used in directly buried systems where temperatures exceed 120° C. The pipe is designed as a two-part insulation, of which the inner part consists of a half shell of mineral wool and the outer part of a PUR foam layer.

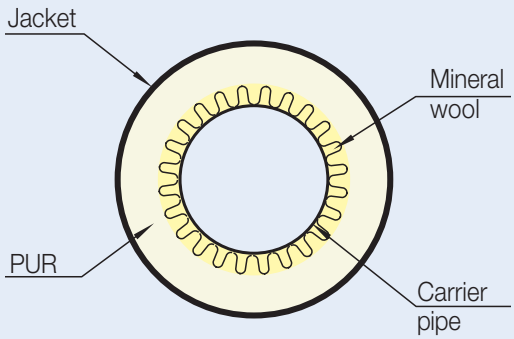
HT3 operates as a sliding system and is applied at max. temperatures of 210° C or 250° C.

Mineral wool

Hard mineral wool.

Density:	Ø < 323 mm	75 kg/m^3
	Ø < 323 mm	40 kg/m^3
Water absorption		< 1% (vol)
Tensile strength		0.01 N/mm^2
Thermal conductivity at 50° C		0.04 W/m° C
Max. operating temperature		250° C

Insulation PUR- mineral wool (HT3)



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Jacketpipes

Materialspecifications 1.2.3 - 1/1

Logstor products with steel carrier pipes complying with EN 253 are supplied with PEH jackets, or with extruded jackets, which fulfill the technical requirements, stated in EN 253.

HDPEjackets

High-density polyethylene.

Mechanical properties of HDPE:		
Density	> 940	kg/m^3
Yield stress	> 19	N/mm^2
Max. load		
(during transport)	3	N/mm
(continually)	0.5	N/mm^2
Thermal properties:		
Coefficient of expansion	$2 \cdot 10^{-4}$	$°C^{-1}$
Thermal conductivity	0.43	W/m° C

Melt flow rate 0.3-0.8 g/10 min.

Material parameters are subject to revision due to technical developments.

Pre-insulated straight pipes are supplied with black as well as white HDPE jackets. Pipes in coils are supplied with black LDPE jackets (low-density polyethylene).

Black HDPE jacket pipes are UV- resistant as a result of addition of UV- impeded additives. Black jacket pipes are therefore suitable outdoor as well as indoor.

White jacket pipes are moderate UV- resistant and are only suitable for indoor insulation.

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Joints

Material specifications 1.2.4 - 1/1

Properties

Shrink sleeves are made of elastic, shrinkable modified PE plastic material.

Black shrink sleeves are UV- stabilized.

White shrink sleeves are not UV-stabilized and is only for indoor installation.

Packing

Black sleeves: White bag, white tape

White sleeves: White bag, yellow tape with black writing.

Do not remove packing before installation. It is recommended to leave the protective bag on the pipe until the installation has been completed.

Cleaning

High pressure cleaning:
Max. pressure 160 bar
Max. water temperature 60° C

Cleaning distance between nozzle and product surface: Min. 30 cm.

Cleaning materials: Topax 18 (with chlorine) or Topax 66(without chlorine) or similar.
Cellosolve (for removal of grease)

Chemicals

The product is resistant to the following chemicals: Lye, petrol, turpentine, petroleum products, salt, sodium sulphate, chlorine etc.

The product has a short-term resistance to the following chemicals: Acetone, cellulose, hydrochloric acid (0.1 M), acetic acid (0.1 M), sulphuric acid (0.1 M).

Test

The values of the joints observe the following:

ASTM E96 permeability test < 0.8 g per joint per day at 38° C and 90% relative air humidity.

ISO 3127 drop test (- 20° C, 0 faults in 100 drops)

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Fittings

Material specifications 1.2.5 - 1/1

The specification for carrier pipes, insulation and jackets apply to all pre-insulated components. The Logstor components comply with the technical requirements of EN 448.

Components with steel carrier pipes are supplied with bevelled ends according to DIN 1626/4.10.5.

Elbows

The angle of deflection is defined as the deviation from a straight pipe.

The bending radius, R, depends on the pipe dimension, as follows:

St. 37.0 BW

d ≤ 508.0 mm bended R = 2.5

St. 35.8 I

d ≤ 323 weld elbow: DIN 2605 Bauart 3

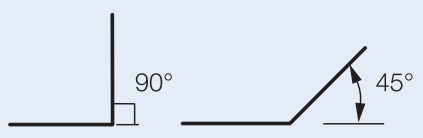
Stainless ISO dimension

Weld elbows R-1651/ABE-211

Stainless metric dimension

Weld elbows R-1651/ABE-111

Standard elbows



Other angels are delivered on order.

T-fittings

The main pipe is supplied with a branch connection stub which is flared into the main pipe, so that the wall thickness of the branch connection is not reduced. Branch pipes are welded with a regular circumferential seam, which ensures ideal stress distribution.

Movable T-fittings only permit expansion in direction of the main pipe. The branch pipe has to be ensured with an anchoring pipe or an expansion element.

Anchoring pipes

The anchor plate consists of a circular flange fully welded to the carrier pipe.

The circular flange has been proportioned to transmit the stresses that arise in connection with axial tension in the carrier pipe of 150 N/mm^2.

Other components

Compensators, valves and other components integrated in the Logstor standard systems are provided by recognised suppliers. The pipe ends on the pre-insulated components have the same dimension as the pipes with which they are to be joined.

The assembly length depends on the component.

Compensators are supplied fully expanded and ready for use. If the compensator is to be integrated in an operational hot system, it is possible to change the presetting.

Compensators and valves have been designed to resist the tensile and compressive stresses that may appear in the pipe system.

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Tracer pipes

Material specifications 1.2.6 - 1/1

Tracer pipes can be supplied as copper or PE.

PE tracer pipe material

Mechanical properties of PE:			
Density	>	940	kg/m^3
Yield stress	>	19	N/mm^2
Thermal properties:			
Coefficient of expansion		$2 \cdot 10^{-4}$	$^\circ C^{-1}$
Thermal conductivity		0.43	W/m$^\circ$ C
Melt flow rate		0.3-0.8	g/10 min.

Cu tracer pipe material

Hard copper F37 according to DIN 1784/17671 corresponding to SIS 5015-04. Tolerances according to EN 1057

Mechanical properties of hard copper:			
Density		8940	kg/m^3
Tensile strength	>	280	N/mm^2
Elongation at rupture	>	min. 5	%
Thermal properties:			
Coefficient of expansion		$1.68 \cdot 10^{-5}$	$^\circ C^{-1}$
Specific heat		385	kJ/kg$^\circ$ C
Thermal conductivity		365	W/m$^\circ$ C
Electrical conductivity		57	Sm/mm^2

Foamed tracer pipes, for heat cables or liquids heat media, can partly frost-proof a pipe system and partly maintain the required temperature. A conductive material is installed between the tracer pipe and the carrier pipe in order to ensure a sufficient conductivity of the heat transmission.

A defective cable can be replaced by moulding a tracer pipe, and an assembly of the cable every 6-12 m will not be necessary.

For further information on tracer pipes, see chapter 2-5 for each individual system.

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Calculation of heat loss

Dimensioning 1.3.1 - 1/2

Underground systems

Heat loss ϕ [W/m] for a pair of underground pipes is calculated:

$$\phi = U\,(T_F + T_R - 2 \cdot T_E)$$

Where: U [W/mK] : Heat transmission coefficient in a pipe
T_F [°C] : Supply temperature
T_R [°C] : Return temperature
T_E [°C] : Soil temperature

Heat transmission coefficient U [Wm · K] defined as:

$$U = 1 / (R_{PUR} + R_R + R_M + R_J + R_H)$$

Where: R_{PUR} [m · K/W] Thermal resistance, PUR
R_R [m · K/W] Thermal resistance, pipe
R_M [m · K/W] Thermal resistance, jacket
R_J [m · K/W] Thermal resistance, soil
R_H [m · K/W] Thermal resistance, media

Thermal resistance values calculated by:

$$R_{PUR} = \ln[Di / d] / [2\pi\lambda_{PUR}]$$

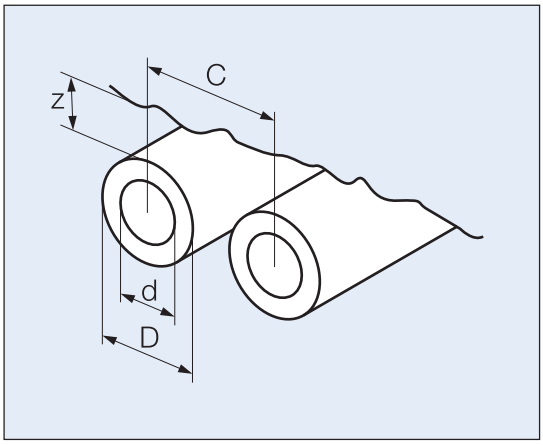
$$R_R = \ln[d / d_i] / [2\pi\lambda_R]$$

$$R_M = \ln[D / D_i] / [2\pi\lambda_{PE}]$$

$$R_J = \ln[4(z + 0{,}0685\,\lambda_E) / D] / [2\pi\lambda_E]$$

$$R_H = \ln[1 + (2(z + 0{,}0685\,\lambda_E))^2 / C^2] / [2\pi\lambda_{PUR}]$$

Where: D_i [m] : Int. dia. Jacket
D [m] : Ext. dia. Jacket
d_i [m] : Int. dia. carrier pipe
d [m] : Ext. dia. carrier pipe
λ_{PUR} [W/m · K]: Thermal conductivity, PUR
λ_R [W/m · K]: Thermal conductivity, carrier pipe
λ_{PE} [W/m · K]: Thermal conductivity, jacket
λ_J [W/m · K]: Thermal conductivity, soil
z [m] : Laying depth
C [m] : Distance between axes



Freely suspended pipes

Heat loss for an above-ground pipe is different compared to that of an underground pipe. This can be calculated as follows:

$$\phi = U\,(t_M - t_L)$$

Where: U [W/mK] : Heat transmission coefficient in a pipe
t_M [°C] : Media temperature
t_L [°C] : Air temperature

The heat transmission coefficient can be defined as:

$$U = 1 / (R_{PUR} + R_R + R_M + R_A)$$

Where: R_A [m · K/W]: Transmission resistance, air

Transmission resistance R_A [mK/W] can be calculated by:

$$R_A = 1 / \pi h D$$

Where: h [W/m² · K] : Thermal conductivity, air

The thermal conductivity of air has two components, convection and radiation:

$$h = h_c + h_R$$

Where: h_c [W/m²K] : Convection coeff.
h_R [W/m²K : Radiation coeff.

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Calculation of heat loss

Convection component:

$$h_c = 0{,}023\ [\ V^{0,8} \cdot k^{0,6} \cdot (\rho \cdot c_p)^{0,4}] / [D^{0,2} \cdot n^{0,4}]$$

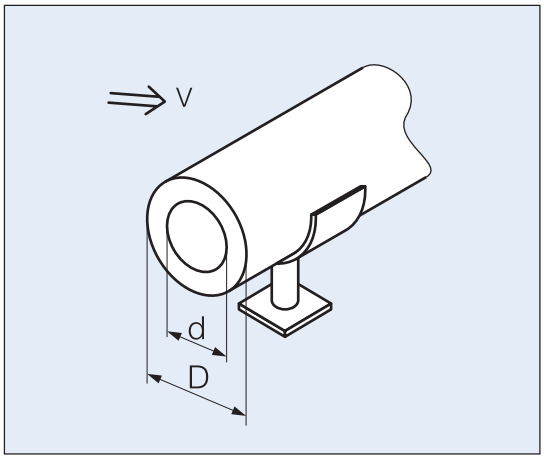
Where:
- v [m/s] : Air velocity
- k [W/mK] : Thermal conductivity, air
- ρ [kg/m³] : Density, air
- c_p [J/kgK] : Heat content, air
- D [m] : Diameter jacket
- n [m²/s] : Kinematic visc. Air

The calculations above can also be used to calculate other media than air if the values exist.

Radiation transmission coefficient h_R [W/m²·K] :

$$h_R = 4 \cdot \varepsilon \cdot \sigma \cdot T^3$$

Where:
- ε [-] : Emmissivity
- σ [W/m²K⁴] : Stefan-Bolzmann constant
- T [°K] : Air temperature, Kelvin



Calculation program

These and many other calculations can easily be performed using the calculation program **StaTech**. The programme is available at Logstor.

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Pipe dimensioning

Dimensioning 1.3.2 - 1/1

This chapter describes the method used to calculate pressure loss.

You can choose either to optimise the pipe, or calculate the capacity of a given pipe.

Optimisation calculation

Pipe dimensioning is calculated using the medium volume and a criterion, either the pressure gradient or the flow.

The total volume to be conveyed in a pipe is:

$$\mathbf{Q = \rho \cdot V}$$

Where: Q [kg/s] : Water flow
ρ [kg/m³] : Density
V [m³/s] : Volume flow

Speed is:

$$\mathbf{v = 4 \cdot Q / \rho \cdot \pi \cdot d_i^2}$$

Where: v [m/sec.] : Velocity
d_i [m] : Int. dia. carrier pipe

Giving:

$$\mathbf{d_{i\,MIN} = (4 \cdot Q / \rho \cdot \pi \cdot v)^{0,5}}$$

Pressure loss Δp (Pa) is calculated as follows:

$$\mathbf{\Delta p = 0,5 \cdot \rho \cdot v^2 \cdot f \cdot L / d_i}$$

Where: Δp [Pa] : Pressure loss
f [-] : Friction factor
L [m] : Pipe length

To calculate friction factor using Colebrook & White, interpolation has to be applied.

This is done using a start value to gradually reach a convergence level.

$$\mathbf{1 / f^{0,5} = 1,14 - 2 \cdot \log[k / d_i + 9,35/Re \cdot f^{0,5}]}$$

Where: k [mm] : Roughness factor
Re [-] : Reynold's formula (vR/n)
n [m²/s] : Kinematic viscosity

A direct calculation can also be made using the following formula:

$$\mathbf{f = 0,25 / [\log[K / 3,7 \cdot d_i + 5,74 / Re^{0,9}]]^2}$$

$$5000 \leq Re \leq 10^8$$

$$10^{-6} \leq k/d_i \leq 10^{-2}$$

Capacity calculation

The calculation above can also be used to calculate pressure loss and capacity of a given pipe.

Calculation program

These and many other calculations can easily be performed using the calculation programme **StaTech**. The programme is available at Logstor.

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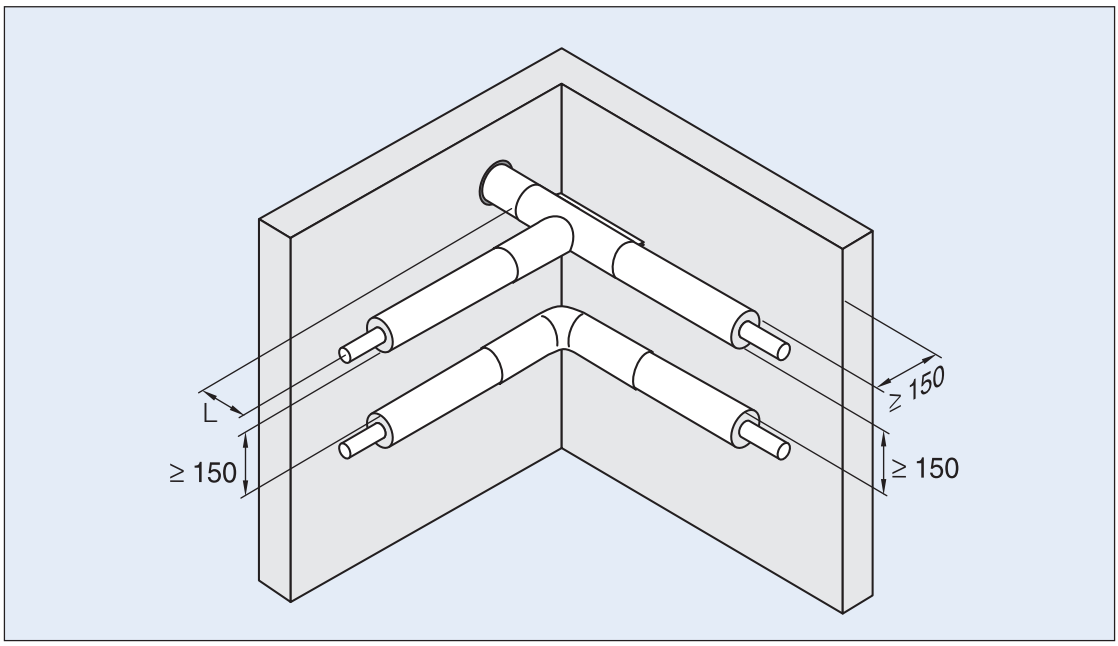
Design rules

Freely suspended system

Dimensioning **1.3.3 - 1/2**

The following drawing indicates the mutual placing of pipes and distances to wall.



Minimal mounting distance between jacket/ jacket and jacket/wall:

L ≥ 320 at installation of the T-joint.

L ≥ 150 after installation of the pipe lengths.

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Design rules

Directly buried system

Dimensioning 1.3.3 - 2/2

Trenches for laying of Logstor pipes should be excavated in accordance with the instructions below.

The trench cross-section must be sufficiently large for a correct pipe and joint installation. The backfilling is to be compacted. Consider any cables and pipes and the need for trench drainage.

In areas with poor soil quality, it may be necessary to replace some of the soil to a substantial depth to avoid settlement.

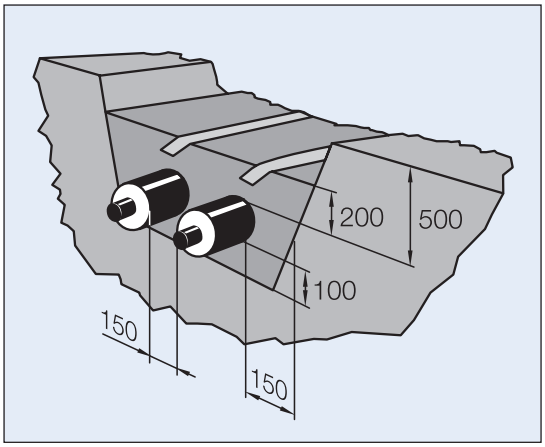
Back filling material

The following specification for the back filling material should be observed:

Maximum grain size	≤	32	mm
Maximum 10% weight	≤	0.075	mm
or 3% weight	≤	0.020	mm
Non- uniformity figure $\frac{d_{60}}{d_{10}}$	>	1.8	

The material is not to contain damaging organic material. Sharp-edged grains, which may damage pipe and joints, should be avoided.

Pipe trenches



Backfilling should be carried out with a shovel, and the material around the pipes should be compacted by hand.

As the backfilling progresses any supports under the pipes should be removed.

Warning tape is placed at least 200 mm above both pipes, and the trench is refilled, rather during recycling of the excavated material.

Compaction of the backfilling from 200-500 mm above the pipes can be carried out using a vibratory plate with a maximum surface pressure of 100 k Pa.

In areas with substantial traffic load, or where a soil cover of min. 500 mm cannot be observed, the pipes must be protected, e.g. by means of a steel plate.

Fitting

To avoid leaks and corrosion, all joints should be free of sand and impurities.

During the process the pipes are placed above or directly next to the deepening, to obtain an optimum joint and tightening test.

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Project preparation

Dimensioning 1.3.4 - 1/1

Any preparatory component count by Logstor shall not be binding and can only be used for advance planning on the customer's behalf for the ordering of materials. The customer shall generally provide a written order indicating the number of components and amounts. A corresponding order confirmation will subsequently be provided.

Pipe routing must be inspected prior to placing the order at which point the customer shall be responsible for defining the precise path of the pipe route and the space available. In the case of large multi-branched networks, Logstor personnel should be involved so that any static or system requirements can be taken into account from the beginning.

If Logstor is to calculate quantities and the basic layout from drawings and plans, the customer shall provide written confirmation of their accuracy and scope to Logstor. Installations in shafts and channels in particular will require an inspection of existing documentation on-site.

Written agreement must be reached as early as possible in the project of the extent to which Logstor is to provide consultation and calculations for the pipe system.

Pre-insulated industrial pipes from Logstor are always project-specific special products, and cannot be returned.

Pipe routing

The LT, NT and HT industrial pipe systems can be subject to significant expansion due to their operating temperatures. Expansion is absorbed using expansion components L-, Z-, or U bends or compensators precisely calculated in accordance with the pipe routing.

Installation may therefore **only** be carried out in accordance with the pipe route agreed with Logstor.

Any amendments must be agreed and approved by Logstor before installation, for the purpose of ensuring pipe stability.

Upon project completion, the "as-build" documentation shall be reviewed on-site and forwarded to Logstor.

If no agreement on pipe routing and installation facilities exists, or if installation has been performed in contradiction of the agreement, no claims for deficiencies will be entertained.

Please note that freely suspended and directly buried systems may only be used for the purpose for which they are designed, as per chapter 1.1.4.

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Transport and storage

Product handling 1.4.1 - 1/2

The present instructions are designed to describe vital aspects to take into account when handling and using Logstor products. In order to ensure that the product does not get damaged in transit and handling.

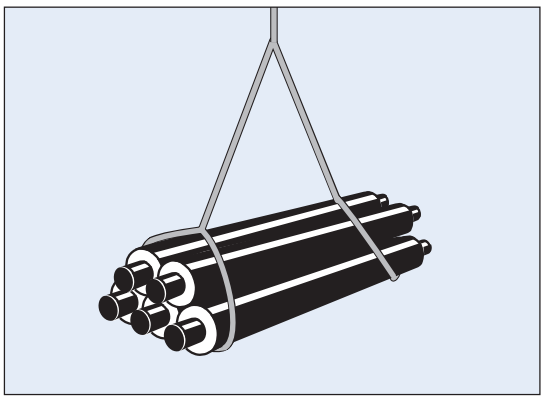
Logstor recommends these instructions are followed. Please note that the instructions are an integrated part of the supplementary technical terms for installation services.

Delivery

Delivery can only be made on firm road surfaces that can bear a truck with an on-board crane. Time of delivery in accordance with the order confirmation is when the goods leave the factory. Delivery on-site will be effected within three days of this time and will be advised. At the time of delivery, there must be sufficient personnel and gear available for unloading. The consignment must be checked for completeness and damage. Receipt of the goods must be signed for on the delivery note.

Logstor industrial pipes can be unloaded manually. If lifted mechanically, at least two woven straps must be used – or preferably a vacuum suction hoist. Distance between the two straps must be approx. ½ the pipe length. When unloading, pipes or fittings must not be tipped or dropped.

The pipes must be unloaded onto a level surface, so that the pipe has a substantial surface of support. To avoid damages of the jacket, the surface must not contain stones.



Transport

During transport of pipes and fittings, care must be taken that they do not come into contact with sharp edges or objects. Pipes must not overhang the end of a trailer or truck bed by more than 2 m. They must be placed flat or upon minimum 100 mm-wide wooden slats with no more than 2 m between them. For the HT3 pipe system, the maximum distance must be 1 m.

Pipes and fittings must be transported in such a way that the ends of the jacket and carrier pipes do not suffer damage.

At very low temperatures below -10° C, jacket pipes contract which creates strong tension. At such temperatures, special care must be taken when transporting jacket pipes. Avoid sharp blows to the pipes.

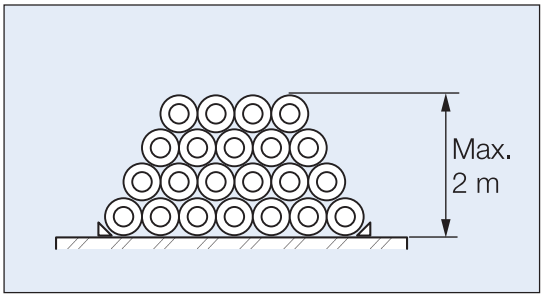
Storage

Pipes and fittings must not be stored in disorderly piles, as this may cause unintended punctual loads.

For temporary storage, pipes must be stacked on a flat surface or wooden slats either in the shape of a pyramid or straight-sided with slats between each layer. When using the pyramidal shape LT and NT pipe systems can be stacked at a maximum height of 2 m. HT3 can only be stacked at a height of 1 m.

All systems may be stacked on slats up to a height of 1 m with a distance of 2 m between the slats.

For the HT3 system, the maximum distance between the slats must be 1 m. The slats must be at least 100 mm wide.



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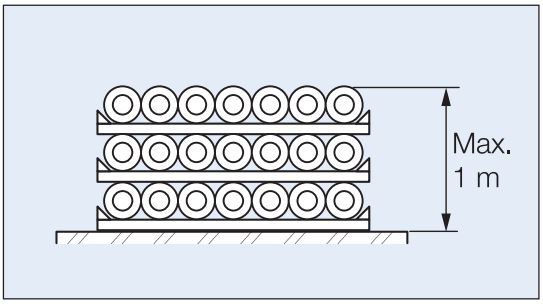
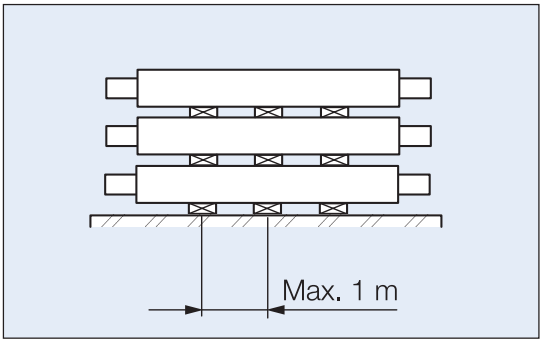
Transport and storage

Product handling 1.4.1 - 2/2





Fittings must also be placed on a level surface. It is important to ensure that the free pipe ends point downwards to avoid rainwater collecting on them.

White pipes are to be stored on slats – preferably indoor.

Shrink sleeves, shrink materials and foam components must be stored dry and cool at temperatures of less than 50° C, to avoid a premature shrinking of the material. If components for polyurethane foam become frozen, they must be slowly thawed at a temperature of 35° C.

Rigid joints are to be stacked upright to avoid them becoming oval.

Coated pipes

Coated pipes must be treated with special care. The pipes must be placed on sand beds and be transported on a soft bedding layer.

Pipes with white HDPE - jackets

The white jacket pipes are supplied covered with a white or transparent polyethylene bag to protect the pipes against impurities, weather, scratches and discolorations.

Handling and storage of the white jacket must take place most carefully, as it is very sensitive to impurities.

If a dirty surface cannot be cleaned with water, use solvents for plastic.

It is recommended to leave the protective bag on the pipe until the installation has been completed. The protective bag is removed by cutting it open with a scissor along the pipe.

The polyethylene bag is to deposit with ordinary garbage, as burned polyethylene is recycled in nature.

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Installation

Product handling 1.4.2 - 1/7

It is crucial for the service life of the components that the joints between the two jacket pipes are – and remain watertight.

If installed correctly, the joint will be just as tight as the jacket pipes and have the same strength.

The pre-treatment of the plastic material is crucial to the effectiveness of the joint. It is of importance, that the materials used in the joint are completely clean and dry.

Any labels on the jacket pipe within the installation area must be removed.

Scratches must be scraped off. Large scratches must be filled with mastic.

When components designed to absorb expansion are installed, it has to be ensured that the necessary expansion is possible.

During joint installation the working premises must be protected against wind and weather.

The joint installation must not be carried out under circumstances, where the activation of the plastic surfaces cannot be maintained throughout the installation process or other circumstances, which might reduce the quality of the joint.

Leak and pressure test

The leak and pressure test must be carried out in accordance with accepted standards, and in all respects as described by the client.

There are five “golden rules” of how to install a Logstor HDPE- jacket pipe joint:

Preparation

All materials must be at hand when the installation work starts.

Cleaning

All surfaces must be cleaned.

Activation

All plastic surfaces must be activated by means of a gas flame to ensure that the plastic oxides are reduced. At the same time, the components are preheated.

Installation

All components of the joint must be installed in a single work routine without interruptions.

Inspection

Finally, the fitter ensures that the joint has been made correctly, and that the surface is even and smooth. Follow the fitting instruction of the joints thoroughly.

Course K3001

The purpose of the course is to communicate the required knowledge of the materials and their application to the assembly fitters, in order to enable them to carry out insulation of the carrier pipe joints in the Logstor pipe systems, and to store and support them. Furthermore, they get acquainted with the most important components of the product catalogue. Many customers require a valid certificate before start-up of the installation.

Qualifications of the participants

None, but it is advantageous to have a professional background from the plastic industry.

After completion

The participant will be qualified for:

- Installations of closed joints
- Installations of open T-joints
- Installations of joints for foaming

This part includes real practical installations which are time-consuming, but give the participant a fundamental experience of joint installations.

At the same time, the participants have become acquainted with components, which will enable them to choose the right spare parts at any given time.

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Installation

Product handling 1.4.2 - 2/7

Furthermore, the participant will have a knowledge of the following:

- Repair materials and auxiliaries
- Transport and handling
- Components of the pipe systems
- Installation of pipe supports
- Estimation of thermal expansion

The present instructions are meant as a help to the fitter, as they will enable him to estimate the circumstances of the installation BEFORE the beginning of the process, and to avoid delay caused by commonplace design errors.

Certificate

A written examination and an evaluation of a chosen assignment are to be carried out. Both are to be passed before a certificate can be issued.

Carrier pipe joints

The Logstor standard carrier pipe programme includes steel, stainless steel, cobber and plastic.

There are different methods to assemble these types of carrier pipes. The table below indicates typical assembling methods for the specific types of carrier pipes.

The diagram is intended as a guide. It is recommended, that the customer contacts Logstor for further information, in connection with special media and e.g. pressure and temperature conditions.

Pipe types	Assembling methods		
	Welding Soldering	Press coupling	Mechanical coupling
Steel pipes			
St. 37.0 BW	√		
St. 35.8 I	√		
Stainless steel pipes			
AISI 316 L	√		
Copper pipes			
Hard	√		
Soft	√	(√)	
Plastic pipes			
PEX		√	√

√ = Typical method.

(√) = Applicable.

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Installation

Jacket pipe joints

Terminology

Shrink sleeve:

Drifted polyolefin pipes shrink when heated.

Shrink wrap:

Open material shaped in the form of a pipe when installed. Mastic on the inside. Sealed with closure patch. Shrinks when heated.

Closure patch:

A patch with melting glue for fixation of longitudinal joints of wrap and cut shrink sleeve. To be heat-treated. Does not shrink.

End cap:

Drifted mastic polyolefin. Used as end cap. Shrinks when heated.

Shrink film:

Thin-walled wrap without closure patch. Cut in lengths suitable for the joint in question. Shrinks when heated.

Shrink collar:

Soft, short sleeve. Mastic on the inside. Shrinks when heated.

Hotmelt/combi-strips:

Glue activated when heated. Adheres to clean and dry surfaces. Mastic on the outside.

Mastic:

Sealing mastic: Activated when heated. Adheres to clean and dry surfaces.

Mastic tape/single strip:

Used for sealing in certain joints.

Adhesive tape:

Film with an adhesive agent. Adheres to clean, degreased surfaces.

Insulation shells:

Half shells used for traditional insulation of pipe joints.

Foaming:

Injection of a suitable volume of mixed polyol and isocyanate. These agents react and develop PUR –foam.

Activation (plastic):

A propane gas flame is used to pre-heat the surface. By this process, the pure basic material stands out and the surface gets dry and temperate. The plastic surfaces of the joint always have to be activated.

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Installation

Jacket pipe joints

Activation

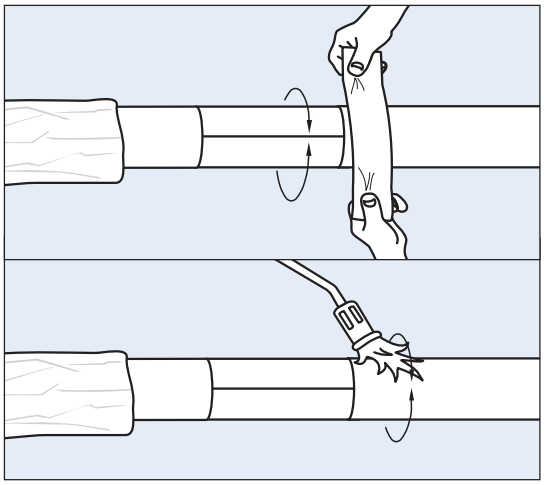
Activation of the surface is intended to remove the plastic oxides (soapy surface coat – “plastic rust”) which cover any plastic surface. Activation ensures that the sealing and adhesion materials adhere directly to the clean plastic surface.

Activation can be made mechanically (grinding), electrically (spark-treatment) or thermally (flame).

Activation of Logstor joints is normally carried out mechanically and thermally.

Thermal activation also ensures that all moisture is removed and that no dew is formed during shrinking.

Activation is carried out by grinding the surface with emery paper, and afterwards slowly heating the surfaces using a soft gas flame (with yellow ends). The flame must “lick” the plastic surfaces.



After a thoroughly activation of the plastic, the surface temperature must be at least 60° C.

Once the right temperature has been reached, i.e. when the plastic oxides have been reduced, the surface of the plastic becomes silk-matt. The plastic material must not look shiny or burned.

The joint must be installed immediately after activation, since plastic oxides reform quickly.

The heat used when activating the surface is also used in the following installation, thereby ensuring a close connection between the surfaces and correct adhesion.

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Installation

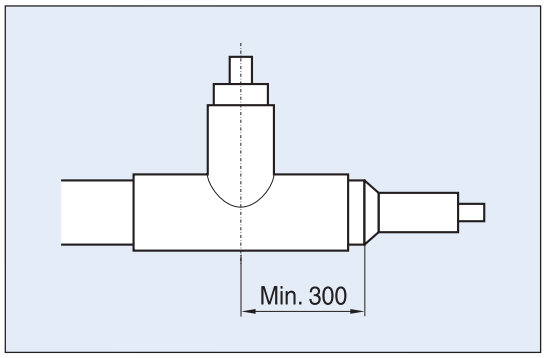
Branch pipe

Reduction

Reductions are not to be placed on the main pipe of the T-joint. Reductions near the T-joint must be completed before the installation of the T-joint.

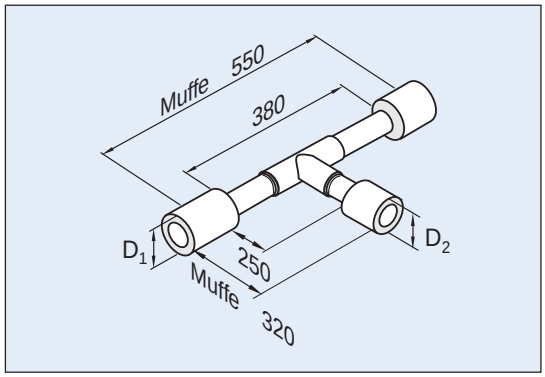
Reductions on branch pipes must be carried through a tee-fitting reduction, not welded directly onto the tee-fitting.

All free pipe ends = 150 mm.



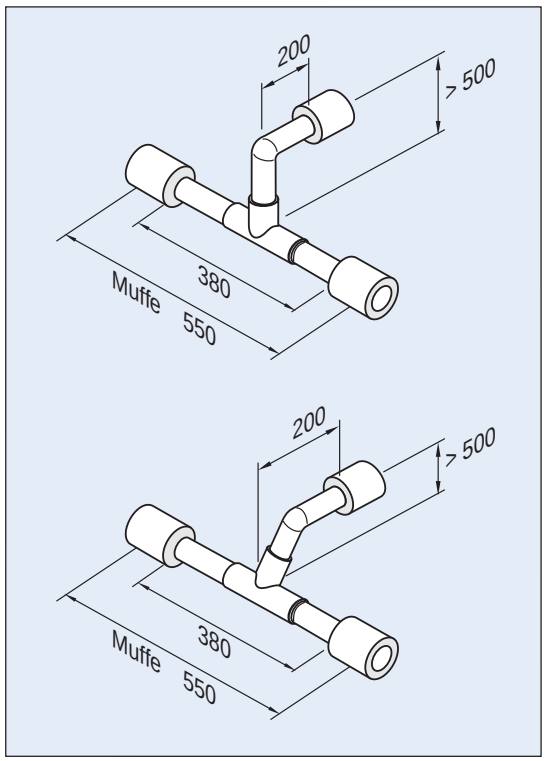
TMC

During branch pipe installation the maximum measures must be observed to use TMC.



TMC and BM

In case of branch pipe with offset, TMC and BM are used together. The maximum measures are stated below.



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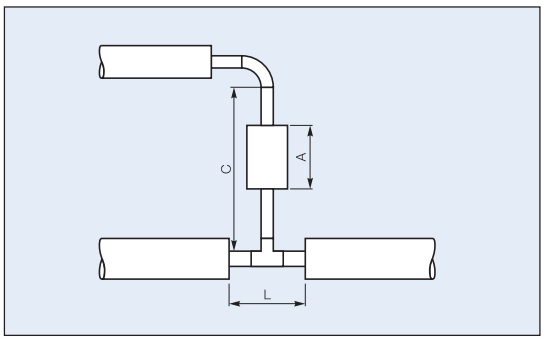
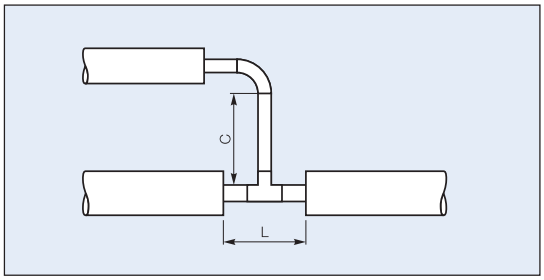
Installation

Branch pipe

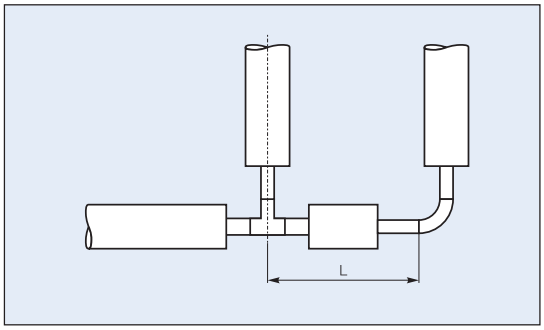
The examples below demonstrate how to shorten free ends or welded T-fittings, so that the stated measures are observed.



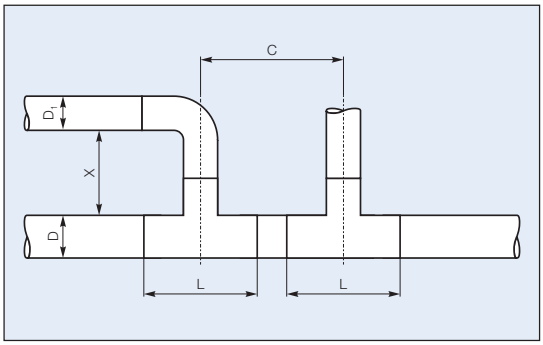
A = C-400, min. 100 mm.
L = Max. 380 mm.



C = Max. 400 mm without use of pre-insulated pipe section.
L = Max. 380



L = Min. 450 mm, at free end of 150 mm.



D = Jacket diameter
X = Min. D
C = Minimum 650 mm
L = 530 mm
$D_1 \leq D$

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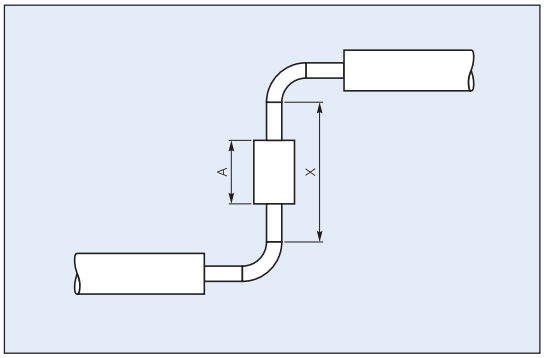
Installation

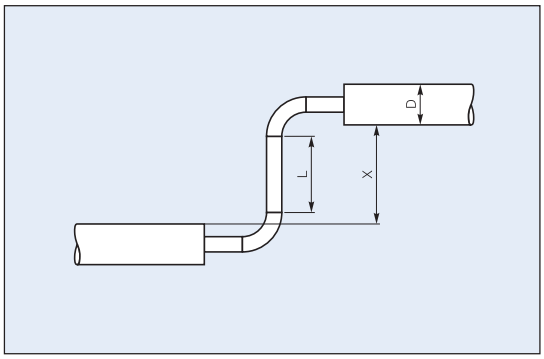
Z-offset and EC/DHEC

Z-offset

The examples below demonstrate how to install two BM units. These measures are valid at free ends of 150 mm and at a weld elbow radius of 1.5xd.



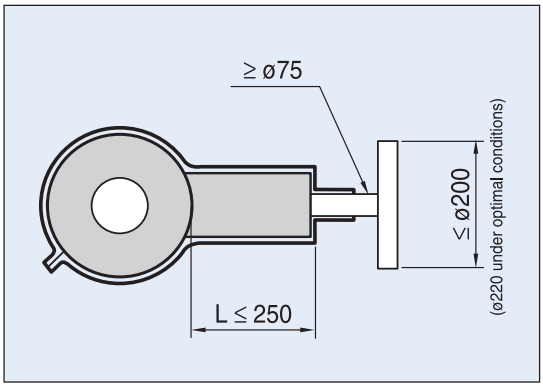
A = X – 400, min. 100 mm.

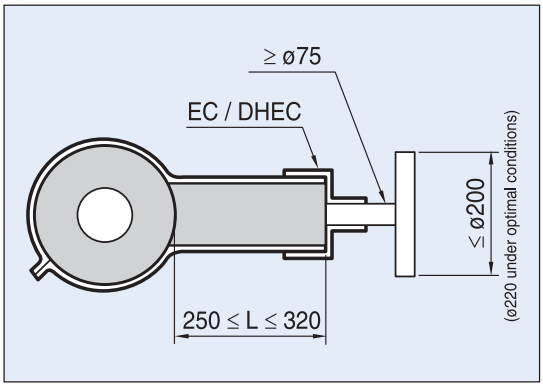


X = Min. D, but may also be carried out in cases, where welding fittings are welded directly together.

L = Pipe section. Max. 400 mm pipe section without using pre-insulated pipe sections.

EC/DHEC





Note: EC/DHEC must be installed before welding of flanges.

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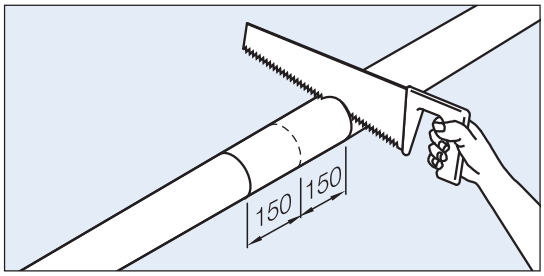
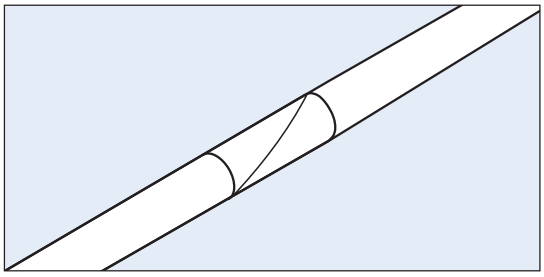
Shortening of pipes

Product handling 1.4.3 - 1/1

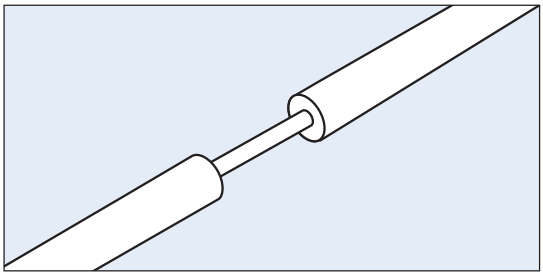
The following procedure is used when shortening pipes:



1. Place two cuts all the way round the jacket and insulation at a distance of 150 mm from either side of the cutting point. It is easiest to use a coarsely toothed hacksaw, handsaw or eclipse saw.



2. Place a diagonal cut through the jacket between the two circumferential cuts. Be careful not to damage the remaining jacket.



3. Remove the jacket and insulation material. Use a knife, a chisel or similar to remove the insulation material. Be careful not to damage any sensor wires installed.

4. Scrape off any remaining insulation residue and treat the carrier pipe until the exposed surface is completely clean. Use a steel brush, abrasive cloth, rotating brushes or similar. Cleaning the pipe prevents polyurethane from degassing/burning off during heat-treatment.

Before flame treatment, the insulation material must be protected against heat and against catching fire.

5. Cut the carrier pipe

When adapting a straight pipe to other components, the straight pipe is the one to be shortened.

Where a pipe is to be shortened, special zebra pipes can be used. This makes it easier to remove the insulation, and the risk of polyurethane degassing/burning off during heat-treatment is avoided.

Version/07.2005.DK

Pipe supports

Produkthandling 1.4.4 - 1/3

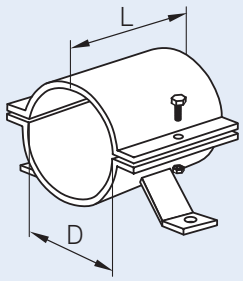
Logstor pre-insulated pipes have such an enormous pressure strength that the pipe supports are to be installed on the outside of the jacket.

This suspension system has the great advantage over traditionally pre-insulated systems, that it prevents problems deriving from heat and thermal bridges and penetration of water and moisture at the pipe supports from arising, thus avoiding corrosion of the steel pipe, which leads to unnecessary energy losses and heavy maintenance costs.

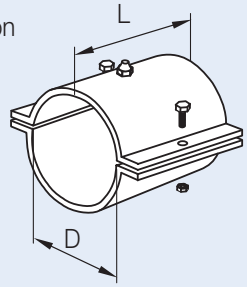
Logstor supplies pipe supports specially produced for pre-insulated pipe systems. These pipe supports can be directly installed on the walls and ceiling or in common racks.

Logstor keeps pipe supports as standard stock goods.They are available in a galvanized and a stainless version. Other qualities are available on order.

Model A is used for bolting



Model B is used for pendular suspension



Calculation of support width

The pipe supports,on the pre-insulated pipes, can be placed with the optimal support width. However, the maximum permissible surface pressure of the insulation material must be observed. The length of the support should be calculated as follows:

$$A = \frac{(G \cdot L_b + \Sigma Fv) \cdot g}{D \cdot \sin\beta/2 \cdot \sigma till.}$$

D = Jacket pipe diameter [mm]

G = Net weight of the pipe, incl. medium [kg/m]

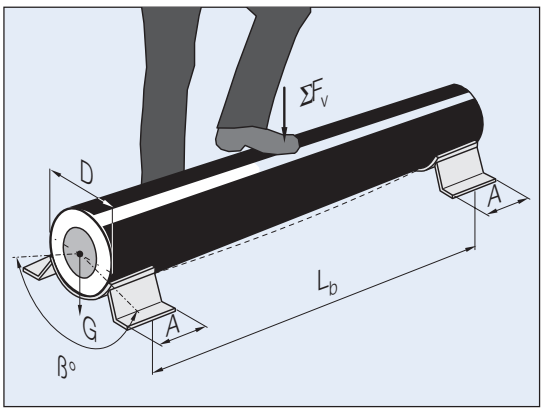
g = Gravity [9.82]

L_b = Distance between supports, or the pipe length to be supported [m]

β = Support angle [45° - 180°]
Logstor uses 180° as standard

ΣF_v = The sum of any vertical, external loads [kg] (snow, walk bridge or support to other pipes)

σ_{til} = Permissible surface pressure on the insulation material is 0.1 N/mm$_2$



Version/07.2005.DK

Pipe supports

Produkthandling 1.4.4 - 2/3

Installation of pipe supports

It is important that the pipe either lies loosely in the support to allow unhindered movement, or that guides are used.

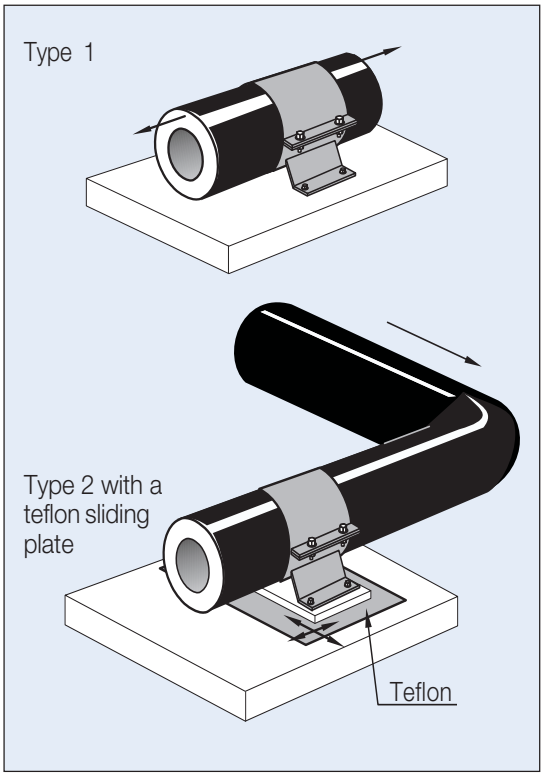
It is also possible to place a teflon sliding plate under the support.

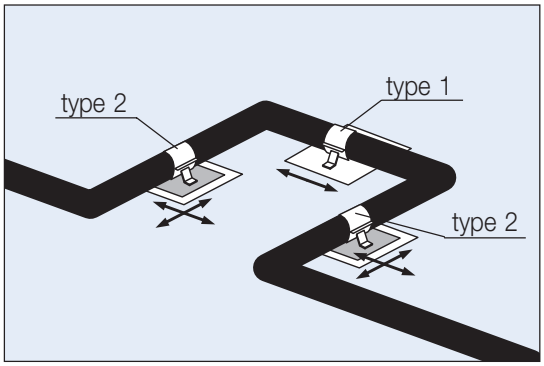
When the pipe is laid in such a way that it moves in the support, it is important not to place the supports on or near the joints, as these would otherwise be damaged by the movement of the pipe.

When expansion is absorbed in the joints, it is important that the support does not block the movement. The supports at the elbows must therefore be able to move in two directions. This can be done by letting the support slide on the plate.

Pendular suspensions are not permitted when using axial compensators.

Avoid placing the supports directly on or near the joint. If this is impossible use a support type 2.





Version/07.2005.DK

Pipe supports

Supporting distance

Logstor recommends that the supporting distance of a pre-insulated pipe, is the same as the one applied on a pipe that has not been insulated.

Steel and threaded pipes

DN	Dimension	Max.distance,metre (max. temperature +210° C)			
		184°C		210°C	
		Water	Steam	Water	Steam
15	21.3 x 2.0 21.3 x 2.6	2.0 2.0	2.0 2.0	1.8 1.8	1.8 1.8
20	26.9 x 2.0 26.9 x 2.3 26.9 x 2.6	1.8 2.0 2.0	2.3 2.5 2.5	1.6 1.8 1.8	1.8 2.0 2.0
25	33.7 x 2.0 33.7 x 2.6 33.7 x 3.2	2.0 2.5 2.5	2.2 2.5 2.7	1.8 2.0 2.0	1.8 2.0 2.0
32	42.4 x 2.0 42.4 x 2.6 42.4 x 3.2	2.5 2.5 2.8	2.8 3.0 3.2	2.0 2.0 2.5	2.5 2.5 2.8
40	48.3 x 2.6 48.3 x 3.2	3.0 3.0	3.5 3.5	2.8 2.8	2.8 2.8
50	60.3 x 2.9 60.3 x 3.6	3.5 3.5	4.0 4.0	2.8 2.8	3.0 3.0
70	76.1 x 2.9	4.0	4.0	3.0	3.5
80	88.9 x 3.2 88.9 x 4.0	4.5 4.5	5.0 5.0	3.5 3.5	4.0 4.0
100	114.3 x 3.6	5.0	6.5	4.0	4.0
130	139.7 x 4.0	5.0	6.5	4.5	5.0
150	168.3 x 4.0	7.5	8.5	5.0	6.5
200	219.1 x 4.5 219.1 x 6.3	9.0 9.0	10.0 10.0	5.0 5.0	6.5 6.5
250	273 x 5	10.0	11.0	7.5	8.5
300	323.9 x 5.6	11.0	11.0	9.0	10.0

Copper pipes

Dimension (Carrier pipe)	Distance,metre
10 x 1 mm	1.0
12 x 1 mm	1.1
15 x 1 mm	1.2
18 x 1 mm	1.3
22 x 1 mm	1.4
28 x 1.2 mm	1.7
35 x 1.5 mm	1.8
42 x 1.5 mm	1.9
54 x 1.5 mm	2.2
70 x 2 mm	2.5
88.9 x 2.5 mm	2.6

Version/07.2005.DK

System description

LT – Low temperature

LT technique **2.1.1 - 1/1**

Operating temperatures from -200° C to +120°C

Bonded system

Only freely suspended systems

LT is applied as a freely suspended system and is **not** for under ground use.

The system is applicable for media such as liquid e.g. nitrogen, natural gas, ethylene and petroleum. The system consists of a special polyurethane foam and has unique insulation properties, which ensure low operating costs.

30% moisture in the foam and the joint, results in a doubling of the heat loss and a reduction of the mechanical properties of the PUR-foam.* Therefore, it is very important to install the joints correctly, and to cover all insulation ends with high temperature end caps in order to ensure low operating costs and a long thermal life. The HEC or HDHEC systems are applied at operating temperatures below -20° C (black) or -36° C (white) and at temperatures above 110° C.

The LT system is available in black or white. White is only for indoor use.

* (Source: Bayer"Das Eigenschaftsbild von Hartschaumstoffen auf Basis von Polyisocyanat"", PU 51052, D 10-7117/67794,1. Ausgabe 1977).

Version/07.2018.UK

Pipe

AISI 304 L (EN 1.4307) / AISI 316 L (EN 1.4404)

LT components **2.2.1 - 1/1**

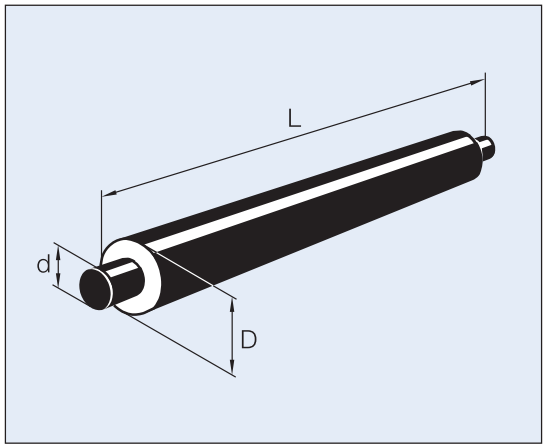
Supplied in lengths of 6 m.

The pipes are available with less PUR insulation on inquiry.

Up to jacket dimension ø315, only straight pipes and joints are supplied. Straight pipes, fittings and straight joints are supplied in dimensions exceeding ø315. This applies to all series of freely suspended and directly buried systems.

Stainless steel pipes are supplied according to EN 10217-7.

Supplied as goods made to order.



Component no. 20000L

Series 5

Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3
Steel pipe wall thickn., mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Jacket pipe diameter D, mm	160	160	160	180	180	200	225	250	315
Weight, kg/m	3.1	3.4	3.7	4.6	4.9	6.0	7.3	8.8	12.6
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6

Version12.2017.DK

System description

NT – Normal temperature

NT technique **3.1.1 - 1/1**

Operating temperature from -60° C to +120°C

The steel systems can be used as freely suspended and directly buried systems. We refer to Logstor's district heating catalogue for choice of components and joints, if the steel pipe systems are to be directly buried. The laying of directly buried stainless pipes requires special attention.

Annealed copper pipes are applicable in directly buried pipe systems. Hard copper is only applicable in freely suspended pipe systems.

Flexible plastic pipe systems (PEX in coils) are only used in directly buried systems. PE80/PE100 are used in directly buried and freely suspended systems.

The NT system is applicable for media such as condensate, ammonia, diesel oil and dairy products. The system consists of pure polyurethane and has unique insulating properties ensuring low operating costs.

30% moisture in the foam and the joint, results in more than a doubling of the heat loss and a reduction of the mechanical properties of the PUR-foam. Therefore, it is very important to install the joints correctly, and to cover the foamed ends with end caps. This ensures low operating costs and long thermal life.

The HEC and HDHEC systems are applied at operating temperatures below -20° C (black) or -36° C (white) and at temperatures higher than 110° C.

The NT system is available in black or white. White is only for indoor use.

Version/07.2018.UK

Carrier pipe matrix

NT technique 3.1.2 - 1/2

The customer's specific wishes and requirements are decisive for the choice of carrier pipes. Logstor insulates carrier pipes designed to user specifications based on demands on insulation thickness. The customer is responsible for the choice of carrier pipe material, in which the medium is transported.

The standard types of industrial carrier pipes in this matrix are listed according to their typical application scopes. The carrier pipe matrix, which is intended as a guide, is based on Logstor's experience in this field.

The matrix indicates the following scopes of application:

Heating

Pipes used for room and process heating up to +140° C.

Product

Pipes applied for transport of liquid products such as dairy products.

Cooling

Pipes applied to cooling classified in the most applied refrigerants.

Water for domestic use

Pipes applied to water for domestic use. Approved for this specific use according to Danish regulations.

		Scope of application					
	Chapter	Heating (temp.)			Cooling (medium)		
LR Industrial pipe systems		<95°C	<120°C	<140°C	Ammonia	Brine	Water
Steel pipe system							
St. 37.0 BW	3.2.1	√	√	√	÷	(√)	√
St. 35.8 I	3.2.2	(√)	(√)	(√)	√	√	(√)
Stainless steel pipe system							
AISI 316 L	3.2.4	(√)	(√)	(√)	(√)	(√)	(√)
Dairy pipes	3.2.5	(√)	(√)	(√)	÷	(√)	(√)
Copper pipe system							
Hard	3.3.2	√	√	÷	÷	√	√
Soft	3.3.1	√	√	÷	÷	(√)	(√)
Plastic pipe system							
PEX	3.4.1	√	÷	÷	÷	(√)	(√)
HDPE	3.4.2	÷	÷	÷	÷	(√)	√

√ = Typical application.
Indicates the primary application of the pipe system.

(√) = Applicable.
Indicates that the pipe system may be applied for this purpose, but that the composition of the medium might require a closer examination of the solution.

\- = Irrelevant.
Indicates that it is more advantageous to use other pipe types, which typically are applied to this specific purpose.

÷ = Not applicable.
Indicates that the pipe type in question, must not be used due to temperature conditions and/or medium compositions.

Version/07.2005.DK

Carrier pipe matrix

NT technique 3.1.2 - 2/2

		Scope of application					
	Chapter	Product (temp.)			Cooling (medium)		Water, domestic use
LR Industrial pipe systems		<95°C	<120°C	<140°C	Co_2	N_2	
Steel pipe system							
St. 37.0 BW	3.2.1	√	√	√	÷	÷	-
St. 35.8 I	3.2.2	(√)	(√)	√	(√)	÷	-
Stainless steel pipe system							
AISI 316 L	3.2.4	√	√	√	(√)	√	(√)
Dairy pipes	3.2.5	√	√	√	(√)	(√)	√
Copper pipe system							
Hard	3.3.2	√	÷	÷	√	÷	-
Soft	3.3.1	√	√	÷	√	√	(√)
Plastic pipe system							
PEX	3.4.1	√	÷	÷	÷	÷	√
HDPE	3.4.2	÷	÷	÷	÷	÷	√

√ = Typical application.
Indicates the primary application of the pipe system.

(√) = Applicable.
Indicates that the pipe system may be applied for this purpose, but that the composition of the medium might require a closer examination of the solution.

- = Irrelevant.
Indicates that it is more advantageous to use other pipe types, which typically are applied to this specific purpose.

÷ = Not applicable.
Indicates that the pipe type in question, must not be used due to temperature conditions and/or medium compositions.

Version/07.2005.DK

Pipes with tracers

When the pipes are provided with the following types of carrier pipes, it is possible to supply them with tracers:

St. 37.0 BW

St. 35,8 I

AISI 304

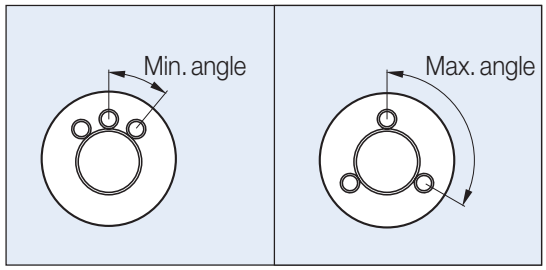
AISI 316L

AISI 316 TI.

Tracer pipe material:

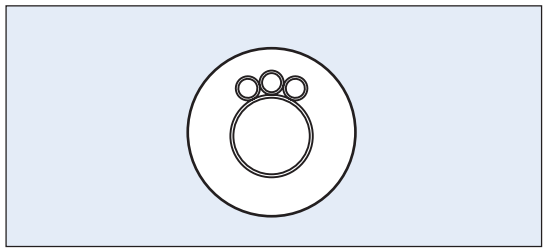
Cu ø18/inside ø16
HDPE ø20/inside ø16

2-4 tracers



Position tolerance: ±15°

Installed tracers



	1 tracer	2 tracers		3 tracers		4 tracers		Installed tracers numbers
Ød [mm]		min [°]	max [°]	min [°]	max [°]	min [°]	max [°]	Antal
21.3	x	-	-	-	-	-	-	-
26.9	x	-	-	-	-	-	-	-
33.7	x	-	-	-	-	-	-	-
42.4	x	120	180	-	-	-	-	2
48.3	x	90	180	90	120	-	-	2-3
60.3	x	90	180	90	120	90	90	2-4
76.1	x	90	180	90	120	90	90	2-4
88.9	x	90	180	90	120	90	90	2-4
114.3	x	60	180	60	120	60	90	2-4
139.7	x	60	180	60	120	60	90	2-4
168.3	x	30	180	30	120	30	90	2-4
219.1	x	30	180	30	120	30	90	2-4
273	x	30	180	30	120	30	90	2-4
323.9	x	30	180	30	120	30	90	2-4
355.6	x	30	180	30	120	30	90	2-4
406.4	x	30	180	30	120	30	90	2-4
457	x	30	180	30	120	30	90	2-4
508	x	30	180	30	120	30	90	2-4

Version/07.2005.DK

Pipe

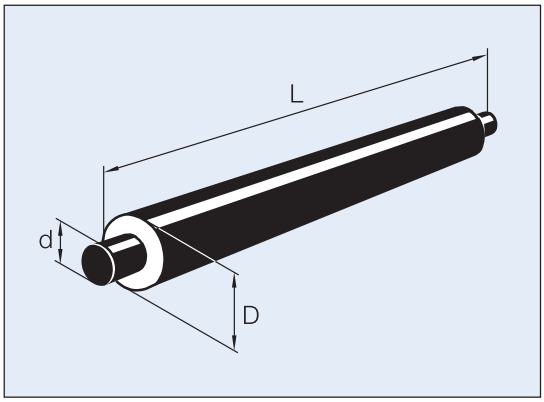
St. 37.0 BW

Supplied in lengths of 6, 12 and 16 m, depending on dimension.

Up to jacket dimension ø315, St. 37.0 BW is supplied as straight pipes and joints. Straight pipes, fittings and straight joints are supplied in dimensions exceeding ø315.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Available with tracer pipes, see page 3.1.3.



Series 1

Component no. 20000L

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3
Steel pipe wall thickn., mm	2.6	2.6	3.2	2.6	2.6	2.9	2.9	3.2	3.6	3.6	4.0
Jacket pipe diameter D, mm	90	90	90	110	110	125	140	160	200	225	250
Weight, kg/m	2.2	2.5	3.4	3.9	4.3	5.7	7.2	9.1	13.2	16.1	20.9
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.4	9.0	13.8	20.2

Steel pipe diameter d, inch	8"	10"	12"	14"	16"	20"
Steel pipe diameter d, mm	219.1	273.0	323.9	355.6	406.4	508.0
Steel pipe wall thickn., mm	4.5	5.0	5.6	5.6	6.3	6.3
Jacket pipe diameter D, mm	315	400	450	500	560	710
Weight, kg/m	31.1	45.0	58.3	66.3	84.4	114.0
Water content, l/m	34.7	54.3	76.8	93.2	121.8	192.8

Series 2

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3
Steel pipe wall thickn., mm	2.6	2.6	3.2	2.6	2.6	2.9	2.9	3.2	3.6	3.6	4.0
Jacket pipe diameter D, mm	110	110	110	125	125	140	160	180	225	250	280
Weight, kg/m	2.9	3.2	4.0	4.5	4.3	6.5	8.1	10.1	14.9	18.1	23.6
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.4	9.0	13.8	20.2

Steel pipe diameter d, inch	8"	10"	12"	14"	16"	20"
Steel pipe diameter d, mm	219.1	273.0	323.9	355.6	406.4	508.0
Steel pipe wall thickn., mm	4.5	5.0	5.6	5.6	6.3	6.3
Jacket pipe diameter D, mm	355	450	500	560	630	800
Weight, kg/m	35.5	51.9	66.4	72.8	92.7	127.8
Water content, l/m	34.7	54.3	76.8	93.2	121.8	192.8

Version/07.2005.DK

Pipe

St. 37.0 BW

Series 3

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3
Steel pipe wall thickn., mm	2.6	2.6	3.2	2.6	2.6	2.9	2.9	3.2	3.6	3.6	4.0
Jacket pipe diameter D, mm	125	125	125	140	140	160	180	200	250	280	315
Weight, kg/m	3.2	3.6	4.4	5.0	5.4	7.1	8.7	10.9	16.3	20.0	26.0
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.4	9.0	13.8	20.2

Steel pipe diameter d, inch	8"	10"	12"	14"	16"	20"
Steel pipe diameter d, mm	219.1	273.0	323.9	355.6	406.4	508.0
Steel pipe wall thickn., mm	4.5	5.0	5.6	5.6	6.3	6.3
Jacket pipe diameter D, mm	400	500	560	630	710	900
Weight, kg/m	39.4	57.4	73.8	81.2	103.7	142.3
Water content, l/m	34.7	54.3	76.8	93.2	121.8	192.8

Version/07.2005.DK

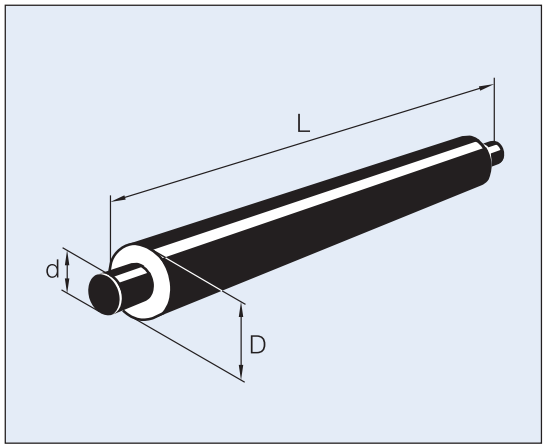
Pipe

St. 35.8 I

Up to jacket dimension ø315, St. 35.8 I is supplied as straight pipes and joints. Straight pipes, fittings and straight joints are supplied in dimensions exceeding ø315.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Available with tracer pipes, see page 3.1.3.



Series 1

Component no. 20000L

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.3	2.6	2.6	2.6	2.9	2.9	3.2	3.6	4.0	4.5	6.3	6.3	7.1
Jacket pipe diameter D, mm	90	90	90	110	110	125	140	160	200	225	250	315	400	450
Weight, kg/m	1.9	2.3	2.9	3.8	4.2	5.6	7.1	9.0	13.0	17.1	22.6	39.8	53.3	69.8
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.3	9.0	13.6	19.9	33.5	53.3	75.3
Length L, m	6	6	6	6	6	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12

Series 2

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.3	2.6	2.6	2.6	2.9	2.9	3.2	3.6	4.0	4.5	6.3	6.3	7.1
Jacket pipe diameter D, mm	110	110	110	125	125	140	160	180	225	250	280	355	450	500
Weight, kg/m	2.3	2.7	3.3	4.1	4.5	6.1	7.6	9.5	13.9	18.3	24.1	43.1	57.6	74.7
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.3	9.0	13.6	19.9	33.5	53.3	75.3
Length L, m	6	6	6	6	6	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12

Series 3

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.3	2.6	2.6	2.6	2.9	2.9	3.2	3.6	4.0	4.5	6.3	6.3	7.1
Jacket pipe diameter D, mm	125	125	125	140	140	160	180	200	250	280	315	400	500	560
Weight, kg/m	2.6	3.0	3.6	4.6	5.0	6.6	8.1	10.2	15.1	19.9	26.1	46.6	62.5	81.2
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.3	9.0	13.6	19.9	33.5	53.3	75.3
Length L, m	6	6	6	6	6	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12

Version/07.2005.DK

Pipe

St. 35.8 I

Series 5

Steel pipe diameter d, inch	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3
Steel pipe wall thickn., mm	2.0	2.3	2.6	2.6	2.6	2.9	2.9	3.2	3.6
Jacket pipe diameter D, mm	160	160	160	180	180	200	225	250	315
Weight, kg/m	3.6	4.0	4.6	5.7	6.0	7.8	9.8	12.3	18.7
Water content, l/m	0.2	0.4	0.6	1.1	1.5	2.3	3.9	5.3	9.0
Length L, m	6	6	6	6	6	6/12	6/12	6/12	6/12

Version/07.2005.DK

Pipe

AISI 304 L wst. 1.4301 / AISI 316 L wst. 1.4432

NT components - Steel pipe system **3.2.3 - 1/2**

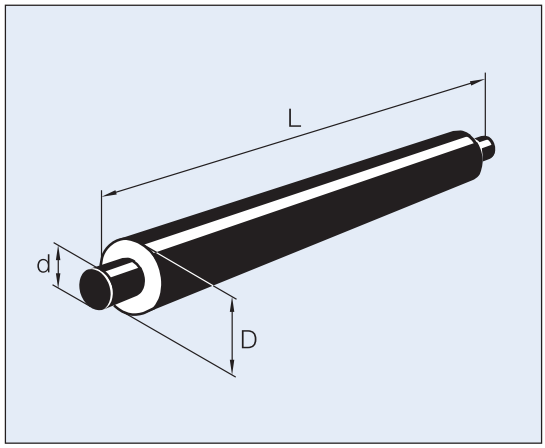
Supplied in lengths of 6 m.

Up to jacket dimension ø315, only straight pipes and joints are supplied. Straight pipes, fittings and straight joints are supplied in dimensions exceeding ø315. This applies to all series of freely suspended and directly buried systems.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Supplied as goods made to order.

Available with tracer pipes, see page 3.1.3.



Series 1 - ISO dimension

Component no. 20000L

Steel pipe diameter, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	90	90	90	110	110	125	140	160	200	225	250	315	400	450
Weight, kg/m	1.9	2.2	2.5	3.3	3.6	4.4	5.6	6.6	8.8	10.9	13.0	18.1	29.6	35.3
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Series 1 - metrisk dimension

Steel pipe diameter, mm	104	129	154	204	254	305
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.5
Jacket pipe diameter D, mm	180	200	225	280	355	400
Weight, kg/m	7.8	9.4	12.4	17.5	24.7	34.8
Water content, l/m	7.9	12.3	17.7	31.4	49.1	70.7

Series 2 - ISO dimension

Steel pipe diameter, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	110	110	110	125	125	140	160	180	225	250	280	355	450	500
Weight, kg/m	2.3	2.6	2.9	3.6	3.9	4.9	6.1	7.2	9.8	12.1	14.7	20.9	33.8	40.2
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Series 2 - metrisk dimension

Steel pipe diameter, mm	104	129	154	204	254	305
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.5
Jacket pipe diameter D, mm	200	225	250	315	400	450
Weight, kg/m	8,5	10,4	14,0	20,1	28,7	39,7
Water content, l/m	7.9	12.3	17.7	31.4	49.1	70.7

Version/07.2005.DK

Pipe

AISI 304 L wst. 1.4301 / AISI 316 L wst. 1.4432

Series 3 - ISO dimension

Steel pipe diameter, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	125	125	125	140	140	160	180	200	250	280	315	400	500	560
Weight, kg/m	2.6	2.9	3.2	4.1	4.4	5.4	6.6	7.9	11.0	13.8	16.8	24.4	38.7	46.8
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Series 3 - metrisk dimension

Steel pipe diameter, mm	104	129	154	204	254	305
Steel pipe wall thickness, mm	2.0	2.0	2.0	2.0	2.0	2.5
Jacket pipe diameter D, mm	225	250	280	355	450	500
Weight, kg/m	9.4	11.5	15.9	23.4	33.4	46.3
Water content, l/m	7.9	12.3	17.7	31.4	49.1	70.7

Version/07.2005.DK

Pipe

AISI 316 Ti wst. 1.4571

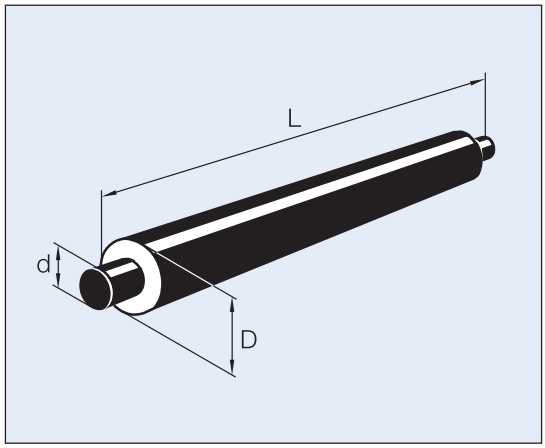
Supplied in lengths of 6 m.

Up to jacket dimension ø315, only straight pipes and joints are supplied. Straight pipes, fittings and straight joints are supplied in dimensions exceeding ø315. This applies to all series of freely suspended and directly buried systems.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Supplied as goods made to order.

Available with tracer pipes, see page 3.1.3.



Serie 1 - available according to ISO 1127/DIN 2463

Component no. 20000L

Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	90	90	90	110	110	125	140	160	200	225	250	315	400	450
Weight, kg/m	1.9	2.2	2.5	3.3	3.6	4.4	5.6	6.6	8.8	10.9	13.0	18.1	29.6	35.3
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Serie 2 - available according to ISO 1127/DIN 2463

Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	110	110	110	125	125	140	160	180	225	250	280	355	450	500
Weight, kg/m	2.3	2.6	2.9	3.6	3.9	4.9	6.1	7.2	9.8	12.1	14.7	20.9	33.8	40.2
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Serie 3 - available according to ISO 1127/DIN 2463

Steel pipe diameter d, mm	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Steel pipe wall thickn., mm	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.6	2.6
Jacket pipe diameter D, mm	125	125	125	140	140	160	180	200	250	280	315	400	500	560
Weight, kg/m	2.6	2.9	3.2	4.1	4.4	5.4	6.6	7.9	11.0	13.8	16.8	24.4	38.7	46.8
Water content, l/m	0.2	0.4	0.7	1.2	1.5	2.5	4.1	5.7	9.6	14.5	21.2	36.3	56.3	79.8

Version/07.2005.DK

Pipe

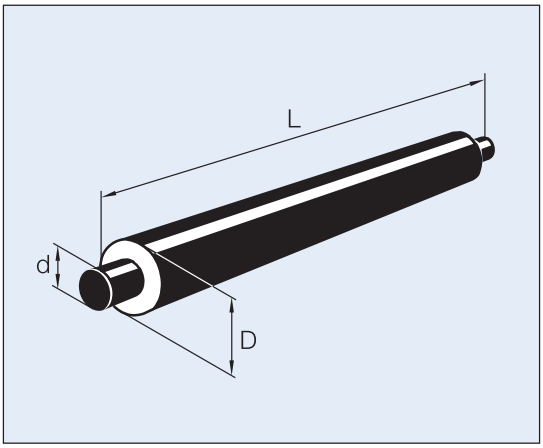
AISI 316 L (Dairy pipes) wst. 1.4432

NT components - Steel pipe system **3.2.5 - 1/1**

Supplied in lengths of 6 m.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Supplied as goods made to order.



Series 1

Component no. 20000L

Steel pipe diameter d, mm	25	32	38	51	63.5	76	101.6
Steel pipe wall thickn., mm	1.2	1.2	1.2	1.2	1.6	2.0	2.0
Jacket pipe diameter D, mm	90	90	110	110	125	140	180
Weight, kg/m	1.7	1.8	2.4	2.8	3.8	5.6	7.7
Water content, l/m	0.4	0.7	1.0	1.9	2.9	4.1	7.5

Series 2

Steel pipe diameter d, mm	25	32	38	51	63.5	76	101.6
Steel pipe wall thickn., mm	1.2	1.2	1.2	1.2	1.6	2.0	2.0
Jacket pipe diameter D, mm	110	110	125	125	140	160	200
Weight, kg/m	2.1	2.3	2.7	3.1	4.3	6.1	8.4
Water content, l/m	0.4	0.7	1.0	1.9	2.9	4.1	7.5

Series 3

Steel pipe diameter d, mm	25	32	38	51	63.5	76	101.6
Steel pipe wall thickn., mm	1.2	1.2	1.2	1.2	1.6	2.0	2.0
Jacket pipe diameter D, mm	125	125	140	140	160	180	225
Weight, kg/m	2.4	2.6	3.2	3.6	4.8	6.6	9.3
Water content, l/m	0.4	0.7	1.0	1.9	2.9	4.1	7.5

Version/07.2005.DK

Pipe

Mapress wst. 1.4404

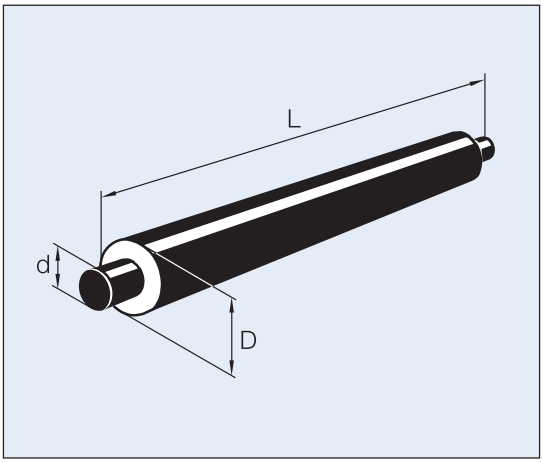
NT components - Steel pipe system **3.2.6 - 1/1**

Supplied in lengths of 6 m.

The pipe is supplied with minor insulation (PUR) on inquiry.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Supplied as goods made to order.



Series 1

Component no. 20000L

Steel pipe diameter d, mm	15	18	22	28	35	42	54	76.1	88.9	108
Steel pipe wall thickn., mm	1.0	1.0	1.2	1.2	1.5	1.5	1.5	2.0	2.0	2.0
Jacket pipe diameter D, mm	90	90	90	90	110	110	125	140	160	180
Weight, kg/m	1.4	1.4	1.6	1.8	2.2	2.9	3.6	5.7	6.7	8.0
Water content, l/m	0.13	0.2	0.3	0.5	0.8	1.2	2.0	4.1	5.7	8.5

Series 2

Steel pipe diameter d, mm	15	18	22	28	35	42	54	76.1	88.9	108
Steel pipe wall thickn., mm	1.0	1.0	1.2	1.2	1.5	1.5	1.5	2.0	2.0	2.0
Jacket pipe diameter D, mm	110	110	110	110	125	125	140	160	180	200
Weight, kg/m	1.8	1.9	2.1	2.2	2.7	3.2	4.1	6.2	7.3	8.8
Water content, l/m	0.13	0.2	0.3	0.5	0.8	1.2	2.0	4.1	5.7	8.5

Series 3

Steel pipe diameter d, mm	15	18	22	28	35	42	54	76.1	88.9	108
Steel pipe wall thickn., mm	1.0	1.0	1.2	1.2	1.5	1.5	1.5	2.0	2.0	2.0
Jacket pipe diameter D, mm	125	125	125	125	140	140	160	180	200	225
Weight, kg/m	2.1	2.2	2.4	2.5	3.0	3.7	4.6	6.8	8.0	9.8
Water content, l/m	0.13	0.2	0.3	0.5	0.8	1.2	2.0	4.1	5.7	8.5

Version/07.2005.DK

Fix pipe

Fix pipes are produced to the same specifications as these of straight pipes. See page:

3.2.1 St. 37.0 BW
3.2.2 St. 35.8 I
3.2.3 AISI 314L/AISI 316L
3.2.4 AISI 316TI
3.2.5 AISI 316L - Dairy pipes

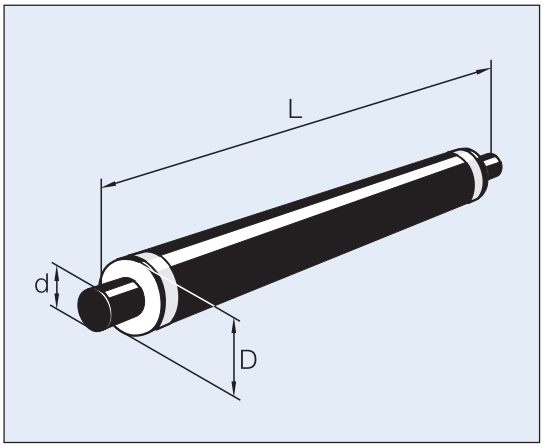
Fix pipes are used as adaptors. A pipe length must not consist of more than one fix pipe.

The insulation of a fix pipe does not adhere to the carrier pipe. It is easy to shorten and strip a fix pipe.

Pipes with jacket dimension ø90 are supplied with 100 mm exposed pipe ends.

Available in series 1, 2 and 3

Supplied as goods made to order.



Component no. 20001L

Version/07.2005.DK

Reduction fitting

St. 37.0 BW, St. 35.8 I

Logstor recommends that jacket reductions are established with reduction sleeves according to EN 489.

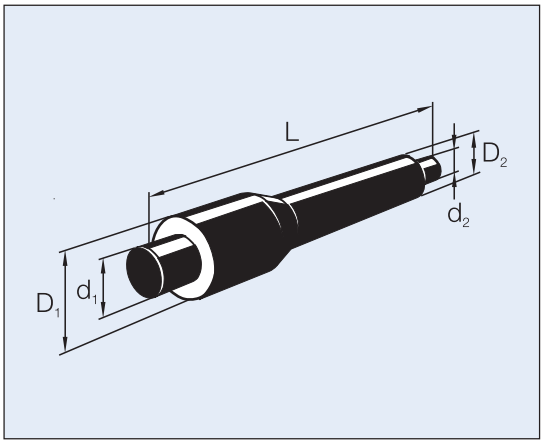
Pre-insulated reduction fittings contain a weld reduction according to DIN 2616-2.

Reduction fittings must not be shortened.

Reduction fittings are concentric.

Available in series 1,2 and 3.

The reduction fittings are to be placed stress-free.



Component no. 49000L

St. 37.0 BW

	d_1	273.0	323.9	355.6	406.4	508.0
	D_1	400	450	500	560	710
	L_1	1500	1500	1500	1500	1500
d_2	D_2					
114.3	200	x				
139.7	225	X	X			
168.3	250	X	X	X		
219.1	315	X	X	X	X	
273.0	400		X	X	X	
323.9	450			X	X	X
355.6	500				X	X
406.4	560					X

St. 35.8 I

	d_1	273.0	323.9
	D_1	400	450
	L_1	1500	1500
d_2	D_2		
168.3	250	X	
219.1	315	X	X
273.0	400		X

Version/07.2005.DK

Elbow 90°

St. 37.0 BW, St. 35.8 l

Pre-insulated elbows are produced according to EN 448.

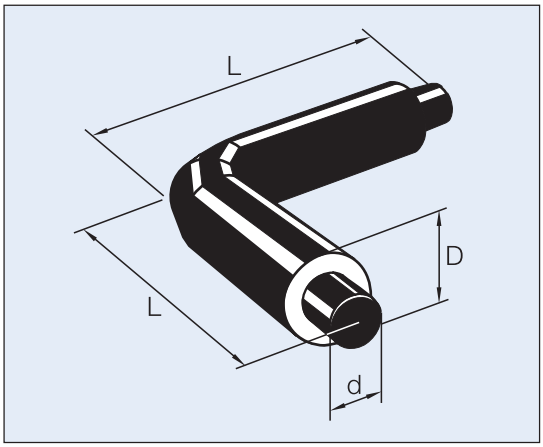
Steel elbows for St. 37.0 BW are bended as follows: R= 2.5 x d

Steel elbows for St. 35.8 l are weld elbows according to DIN 2605 Bauart 3.

Jacket pipe elbows are produced by means of butt welding or extruder welding of jacket segments.

Pre-insulated elbows are not to be shortened.

Elbows with other angles can be supplied on order.



Component no. 25000L

St. 37.0 BW

Series 1

Steel pipe diameter d, mm	273	323.9	355.6	406.4	508
Jacket pipe dia. D, mm	400	450	500	560	710
Length L, mm	1300	1500	1600	1600	1600

Series 2

d, mm	219.1	273	323.9	355.6	406.4	508
D, mm	355	450	500	560	630	800
Length L, mm	1000	1300	1500	1600	1600	1600

Series 3

d, mm	219.1	273	323.9	355.6	406.4	508
D, mm	400	500	560	630	710	900
Length L, mm	1000	1300	1500	1600	1600	1600

St. 35.8 l

Series 1

Steel pipe diameter d, mm	273	323.9
Jacket pipe dia. D, mm	400	450
Length L, mm	1300	1500

Series 2

Steel pipe diameter d, mm	219.1	273	323.9
Jacket pipe dia. D, mm	355	450	500
Length L, mm	1000	1300	1500

Series 3

Steel pipe diameter d, mm	219.1	273	323.9
Jacket pipe dia. D, mm	400	500	560
Length L, mm	1000	1300	1500

Version/07.2005.DK

Elbow 90°

AISI 316 L wst.1.4432

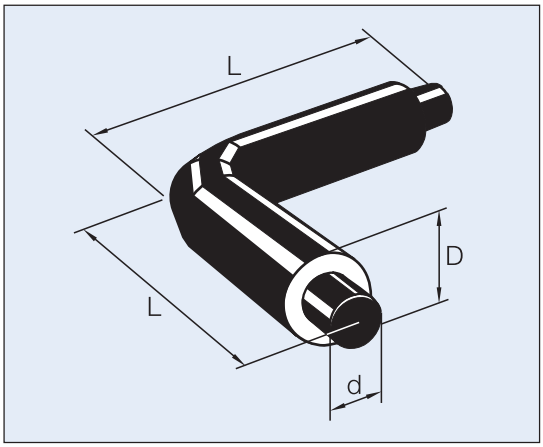
NT componenter - Steel pipe system **3.2.10 - 1/1**

Pre-insulated elbows are produced according to EN 448.

Jacket pipe elbows are produced by means of butt welding or extruder welding of jacket segments.

Pre-insulated elbows are not to be shortened.

Elbows with other angles can be supplied on order.



Component no. 25000L

Series 1 - ISO dimension

Steel pipe diameter d, mm	273	323.9
Jacket pipe dia. D, mm	400	450
Length L, mm	1300	1500

Series 1 - metrisk dimension

Steel pipe diameter d, mm	254	305
Jacket pipe dia. D, mm	355	400
Length L, mm	1300	1500

Series 2 - ISO dimension

Steel pipe diameter d, mm	219.1	273	323.9
Jacket pipe dia. D, mm	355	450	500
Length L, mm	1000	1300	1500

Series 2 - metrisk dimension

Steel pipe diameter d, mm	204	254	305
Jacket pipe dia. D, mm	315	400	450
Length L, mm	1000	1300	1500

Series 3 - ISO dimension

Steel pipe diameter d, mm	219.1	273	323.9
Jacket pipe dia. D, mm	400	500	560
Length L, mm	1000	1300	1500

Series 3 - metrisk dimension

Steel pipe diameter d, mm	204	254	305
Jacket pipe dia. D, mm	355	450	500
Length L, mm	1000	1300	1500

Version/07.2005.DK

T-fitting straight

St. 37.0 BW and St. 35.8 l

NT components - Steel pipe system **3.2.11 - 1/1**

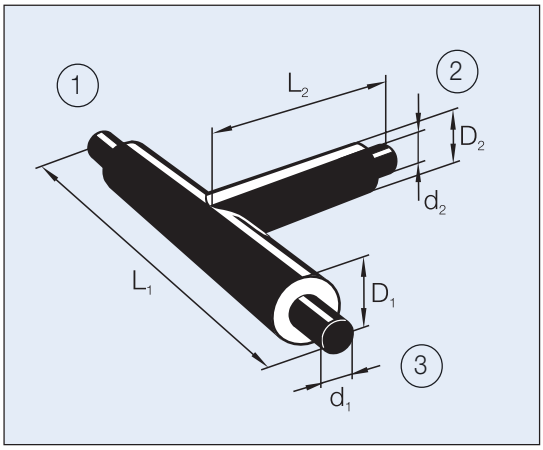
Pre-insulated T-fittings are produced according to EN 448.

Steel branch pipes are produced by drawing a collar of the main pipe or by welding the branch pipe directly onto the main pipe.

According to DIN 2615, a weld T-fitting is applied when the branch and the main pipe are of the same dimensions.

Other dimensions are supplied on inquiry as goods made to order.

St. 35.8 l is supplied in d ≤ ø323.9.



Series 1

Component no. 34000L

	d_1	114.3	139.7	168.3	219.1	273.0	323.9	355.6	406.4	508.0
	D_1	200	225	250	315	400	450	500	560	710
	L_1	1200	1200	1400	1400	1600	1600	1800	2000	2400
d_2	D_2	L_2								
26.9	90		600	600						
33.7	90		600	600	600					
42.4	110		600	600	600	600				
48.3	110		600	600	600	600	600			
60.3	125		600	600	600	600	600	700	700	700
76.1	140		600	600	600	600	600	700	700	700
88.9	160		600	600	600	600	600	700	700	700
114.3	200	600	600	600	600	600	600	700	700	700
139.7	225		600	600	600	600	600	700	700	700
168.3	250			600	600	600	600	700	700	700
219.1	315				600	600	600	700	700	700
273.0	400					600	600	700	700	700
323.9	450						600	700	700	700
355.6	500							700	700	700
406.4	560								700	700
508.0	710									700

Nominal pressure 16 bar.

Version/07.2005.DK

T-fitting straight

AISI 316 L wst.1.4432

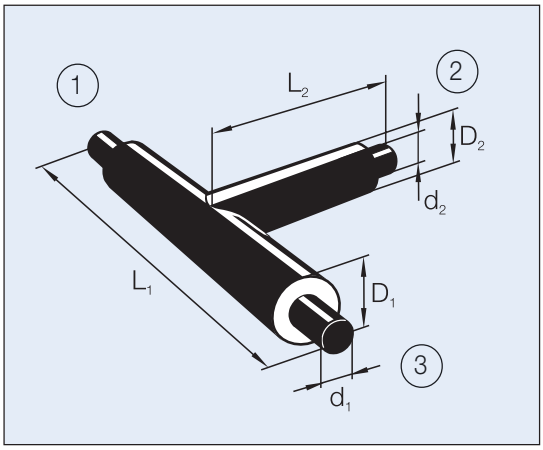
NT components - Steel pipe system **3.2.12 - 1/1**

Pre-insulated T-fittings are produced according to EN 448.

Steel branch pipes are produced by drawing a collar of the main pipe or by welding the branch pipe directly onto the main pipe.

According to DIN 2615, a weld T-fitting is applied when the branch and the main pipe are of the same dimensions.

Other dimensions are supplied on inquiry as goods made to order.



Component no. 34000L

Series 1 - ISO dimension

	d_1	139.7	168.3	219.1	273.0	323.9
	D_1	225	250	315	400	450
	L_1	1200	1400	1400	1600	1600
d_2	D_2	L_2				
88.9	160	600				
114.3	200	600	600			
139.7	225	600	600	600		
168.3	250		600	600	600	
219.1	315			600	600	600
273.0	400				600	600
323.9	450					600

Series 1 - Metrisk dimension

	d_1	104	129	154	204	254	305
	D_1	180	200	225	280	355	400
	L_1	1200	1400	1400	1600	1600	1800
d_2	D_2	L_2					
104	180	600	600	600			
129	200		600	600	600		
154	225			600	600	600	
204	280				600	600	600
254	355					600	600
305	400						600

Nominal pressure 16 bar.

Version/07.2005.DK

T-fitting

St. 37.0 BW and St. 35.8 I

NT components - Steel pipe system **3.2.13 - 1/1**

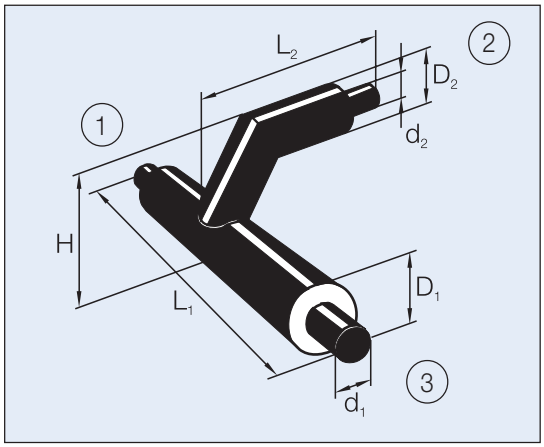
Pre-insulated T-fittings are produced according to EN 448.

Steel branch pipes are produced by drawing a collar of the main pipe or by welding the branch pipe directly onto the main pipe.

According to DIN 2615, a weld T-fitting is applied when the branch and the main pipe are of the same dimensions.

T-fittings are supplied in series 1, 2 and 3.

St. 35.8 I is supplied in d ≤ ø323.9.



Series 1

Component no. 30000L

	d_1	114.3	139.7	168.3	219.1	273.0	323.9	355.6	406.4	508.0
	D_1	200	225	250	315	400	450	500	560	710
	L_1	1200	1200	1400	1400	1600	1600	1800	2000	2400
d_2	D_2	L_2								
26.9	90		1000	1000						
33.7	90		1000	1000	1000					
42.4	110		1000	1000	1000	1000				
48.3	110		1000	1000	1000	1000	1000			
60.3	125		1000	1000	1000	1000	1000	1000	1000	1000
76.1	140		1000	1000	1000	1000	1000	1000	1000	1000
88.9	160		1000	1000	1000	1000	1000	1000	1000	1000
114.3	200	1000	1000	1000	1000	1000	1000	1000	1000	1200
139.7	225		1000	1000	1000	1000	1000	1000	1000	1200
168.3	250			1000	1000	1000	1000	1000	1200	1200
219.1	315				1200	1200	1200	1200	1200	1200
273.0	400					1500	1500	1500	1500	1500
323.9	450						1500	1500	1500	1500
355.6	500							1500	1500	1500
406.4	560								1600	1600
508.0	710									1800

Total height to jacket 450 mm inclusive, $H = D_1 + D_2 + 75$ mm.

Total height from jacket 500 mm, $H = D_1 + D_2 + 100$ mm.

Nominal pressure 16 bar.

Version/07.2005.DK

Anchor

St. 37.0 BW, St. 35.8 I

NT components - Steel pipe system **3.2.14 - 1/1**

Logstor's anchors are produced according to EN 448.

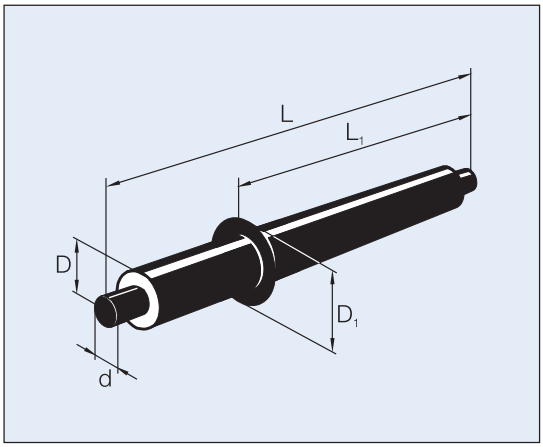
Anchors contain a steel anchor patch.

To avoid an excessive heat transfer from the steel patch to the PEH jacket, a stainless alu-wrap is welded onto the patch.

The component must not be shortened.

Available in series 1, 2 and 3.

Any detection wires are to be transferred through electrical insulation in the steel patch.



St. 37.0 BW, series 1

Component no. 40000L

Steel pipe diameter d, mm	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9	355.6	406.4	508
Jacket pipe dia. D, mm	110	110	125	140	160	200	225	250	315	400	450	500	560	710
Anchor flange dia. D_1, mm	215	215	215	240	260	300	300	350	415	500	550	600	660	810
Anchor flange area, cm^2	268	268	240	298	330	392	309	471	573	707	785	864	958	1068
Max. load, kN	49	56	78	100	129	188	231	310	455	631	840	924	1190	1490
Length L_1, mm	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1400	1400	1400
Total length L, mm	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2500	2500	2500

St. 35.8 I, series 1

Steel pipe diameter d, mm	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9
Jacket pipe dia. D, mm	110	110	125	140	160	200	225	250	315	400	450
Anchor flange dia. D_1, mm	215	215	215	240	260	300	300	350	415	500	550
Anchor flange area, cm^2	268	268	240	298	330	392	309	471	573	707	785
Max. load, kN	49	56	78	100	129	188	231	310	455	631	840
Length L_1, mm	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
Total length L, mm	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

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Pipe

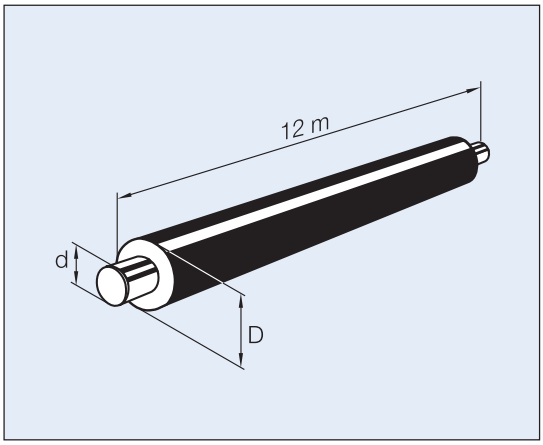
Copper

NT components - Cobber pipe system 3.3.1 - 1/1

According to DIN 1787/17671, the Cu quality of the carrier pipe is a hard copper pipe.

Straight pipes are supplied with 150 mm exposed pipe ends.

Pipes in jacket dimension ø90 are supplied with 100 mm exposed pipe ends.



Series 1

Component no. 20000L

Cu pipe diameter d, mm	35	42	54	70	88.9	
Cu pipe wall thickness, mm	1.5	1.5	1.5	2.0	2.5	
Jacket pipe diam. D, mm	90	110	125	140	160	
Weight, kg/m	2.3	3.0	3.7	5.7	8.3	
Water content, l/m	0.8	1.2	2.0	3.4	5.5	

Series 2

Cu pipe diameter d, mm	35	42	54	70	88.9	
Cu pipe wall thickness, mm	1.5	1.5	1.5	2.0	2.5	
Jacket pipe diam. D, mm	110	125	140	160	180	
Weight, kg/m	2.7	3.2	4.1	6.0	8.7	
Water content, l/m	0.8	1.2	2.0	3.4	5.5	

Series 3

Cu pipe diameter d, mm	35	42	54	70	88.9	
Cu pipe wall thickness, mm	1.5	1.5	1.5	2.0	2.5	
Jacket pipe diam. D, mm	125	140	160	180	200	
Weight, kg/m	2.9	3.7	4.6	6.6	9.3	
Water content, l/m	0.8	1.2	2.0	3.4	5.5	

Version/07.2005.DK

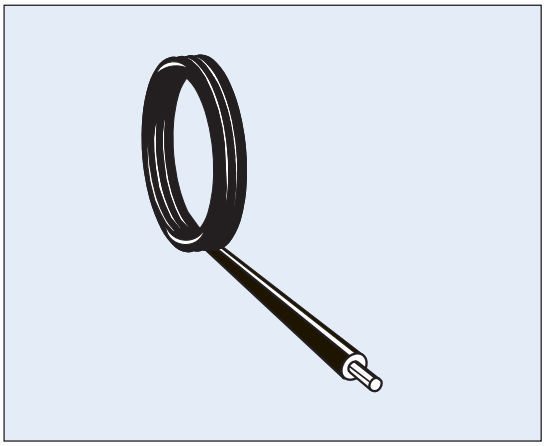
Pipe

Cu-Flex

NT components - Cobber pipe system **3.3.2 - 1/1**

The Cu quality of the carrier pipe is made of annealed copper according to EN 12449.

Pipes in coils are supplied without stripped ends.



Component no. 21000L

Series 1			
Cu pipe diameter d, mm	28	35	
Cu pipe wall thickness, mm	1.2	1.5	
Jacket pipe dia. D, mm	77	90	
Weight, kg/m	1.6	2.3	
Water content, l/m	0.5	0.8	
50 m coil	X	X	
100 m coil	X	X	
Fix length	X	X	

Fix lengths are ordered in exact lengths, minimum 10 m and maximum 99 m.

Series 2					
Cu pipe diameter d, mm	15	18	22	28	35
Cu pipe wall thickness, mm	1.0	1.0	1.0	1.2	1.5
Jacket pipe dia. D, mm	77	77	77	90	110
Weight, kg/m	1.1	1.2	1.3	1.8	2.7
Water content, l/m	0.1	0.2	0.3	0.5	0.8
50 m coil	X	X	X	X	X
100 m coil	X	X	X	X	X
Fix length			X	X	

Fix lengths are ordered in exact lengths, minimum 10 m and maximum 99 m.

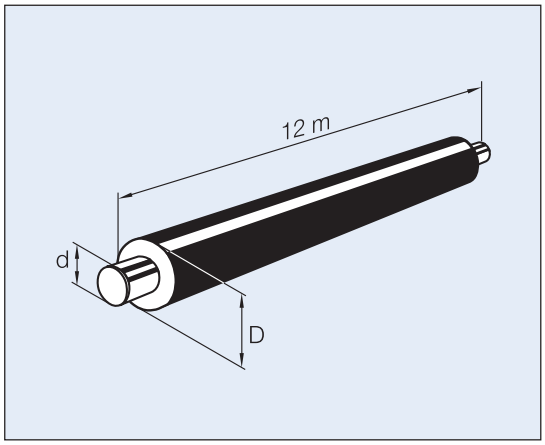
Series 3					
Cu pipe diameter d, mm	15	18	22	28	35
Cu pipe wall thickness, mm	1.0	1.0	1.0	1.2	1.5
Jacket pipe diameter D, mm	90	90	90	110	125
Weight, kg/m	1.3	1.4	1.5	2.2	2.9
Water content, l/m	0.1	0.2	0.3	0.5	0.8
50 m coil	X	X	X	X	X
100 m coil	X	X	X	X	X

Version/07.2005.DK

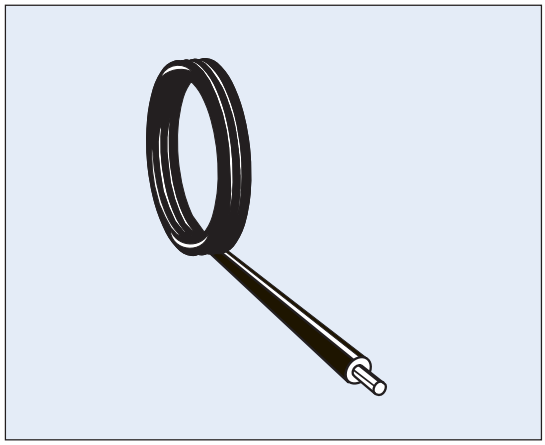
Pipe

PEX

NT components - Plastic pipe system **3.4.1 - 1/1**



Straight pipe component no. 20000L



Pipe in coil component no. 21000L

Series 1	PN6								PN10
Carrier pipe diameter d, mm	25	32	40	50	63	75	90	110	28
Carrier pipe wall thickness, mm	2.5	2.9	3.7	4.6	5.8	6.9	8.2	10.0	4.0
Jacket pipe diameter D, mm	77	77	90	110	125	140	160	180	77
Weight, kg/m	1.0	1.0	1.3	1.9	2.4	3.3	4.2	5.5	1.0
Water content, l/m	0.3	0.5	0.8	1.3	2.1	2.9	4.3	6.4	0.3
50 m coil	X	X	X	X	X	X	X		X
100 m coil	X	X	X	X	X	X	X		X
12 m straiht pipe								X	
Fix length	X	X	X	X	X	X	X		X

Straight pipes and pipes in coils are supplied without stripped ends.

PEX dimension ø110 with jacket dimension ø160 (series 0) are available in coils in lengths of 90/60.

Fix lengths are ordered in min. 10 m. and max. 99 m. The PEX dimensions ø110 (series 0), ø75 and ø90 fix length, are supplied in coils of max. 49 m.

The dimensions ø20 PEX PN6 and ø22 PEX PN10 are supplied in series 2.

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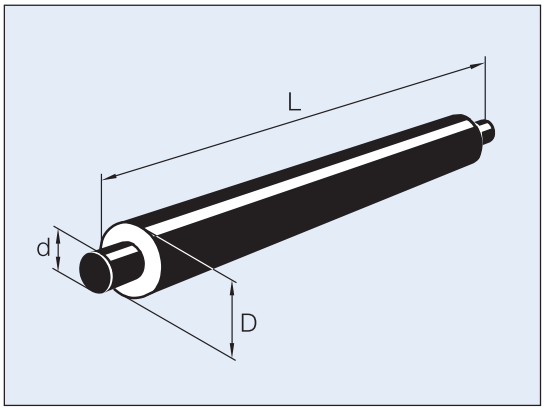
Pipe

HDPE (10 bar) PE80/PE100

NT components - Plastic pipe system **3.4.2 - 1/2**

Supplied in lengths of 6 m. Other lengths are supplied on inquiry.

Up to jacket dimension ø315 only straight pipes and joints are supplied in all series. This applies to both freely suspended and directly buried systems.



Component no. 20000L

HDPE (10 bar) Series 1

Carrier pipe diameter d, mm	25	32	40	50	63	75	90	110	125	140	160
Carrier pipe wall thickness, mm	2.3	2.9	3.7	4.6	3.6	4.3	5.4	6.6	7.4	8.3	9.5
Jacket pipe diameter D, mm	77	77	90	110	125	140	160	200	200	225	250
Weight, kg/m	1.0	1.0	1.3	1.9	2.5	3.3	4.3	6.4	6.9	8.8	10.9
Water content, l/m	0.3	0.5	0.8	1.3	2.1	3.0	4.3	6.4	8.2	10.3	13.4
Lengths L, m	6	6	6	6	6/12	6/12	6/12	6/12	12	12	6/12

Carrier pipe diameter d, mm	180	200	225	250	280	315	355	400
Carrier pipe wall thickness, mm	10.7	11.9	13.4	14.8	16.6	18.7	21.1	23.7
Jacket pipe diameter D, mm	280	280	315	400	400	450	500	560
Weight, kg/m	13.8	15.2	19.2	27.9	30.8	38.8	48.7	61.5
Water content, l/m	17.0	21.0	26.6	33.9	41.3	52.2	66.2	84.1
Lengths L, m	12	12	12	12	12	12	12	12

Series 2

Carrier pipe diameter d, mm	20	25	32	40	50	63	75	90	110	125	140
Carrier pipe wall thickness, mm	2.0	2.3	2.9	3.7	4.6	3.6	4.3	5.4	6.6	7.4	8.3
Jacket pipe diameter D, mm	77	90	90	110	125	140	160	180	225	225	250
Weight, kg/m	0.9	1.2	1.2	1.6	2.1	3.0	3.9	4.8	7.4	7.9	10.0
Water content, l/m	0.2	0.3	0.5	0.8	1.3	2.1	3.0	4.3	6.4	8.2	10.3
Lengths L, m	6	6	6	6	6	6/12	6/12	6/12	6/12	12	12

Carrier pipe diameter d, mm	160	180	200	225	250	280	315	355	400
Carrier pipe wall thickness, mm	9.5	10.7	11.9	13.4	14.8	16.6	18.7	21.1	23.7
Jacket pipe diameter D, mm	280	315	315	355	450	450	500	560	630
Weight, kg/m	12.5	15.8	17.2	22.2	32.1	35.1	43.7	55.3	69.9
Water content, l/m	13.4	17.0	21.0	26.6	32.9	41.3	52.2	66.2	84.1
Lengths L, m	6/12	12	12	12	12	12	12	12	12

Version/07.2005.DK

Pipe

HDPE (10 bar) PE80/PE100

Series 3

Carrier pipe diameter d, mm	20	25	32	40	50	63	75	90	110	125	140
Carrier pipe wall thickness, mm	2.0	2.3	2.9	3.7	4.6	3.6	4.3	5.4	6.6	7.4	8.3
Jacket pipe diameter D, mm	90	110	110	125	140	160	180	200	250	250	280
Weight, kg/m	1.1	1.3	1.5	1.9	2.6	3.6	4.4	5.5	8.6	9.3	11.6
Water content, l/m	0.2	0.3	0.5	0.8	1.3	2.1	3.0	4.3	6.4	8.2	70.3
Lengths L, m	6	6	6	6	6	6/12	6/12	6/12	6/12	12	12

Carrier pipe diameter d, mm	160	180	200	225	250	280	315	355	400
Carrier pipe wall thickness, mm	9.5	10.7	11.9	13.4	14.8	16.6	18.7	21.1	23.7
Jacket pipe diameter D, mm	315	355	355	400	500	500	560	630	710
Weight, kg/m	14.5	18.9	20.3	25.7	37.0	39.9	50.3	63.6	80.9
Water content, l/m	13.4	17.0	21.0	26.6	32.9	41.3	52.2	66.2	84.1
Lengths L, m	6/12	12	12	12	12	12	12	12	12

Version/07.2005.DK

Elbow 90°

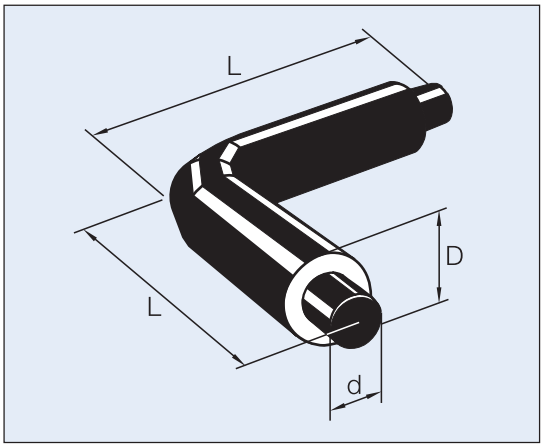
HDPE (10 bar)

NT components - Plastic pipe system **3.4.3 - 1/1**

Jacket pipe elbows are produced by means of butt welding or extruder welding of jacket segments.

Pre-insulated elbows are not to be shortened.

Elbows with other angles are supplied on order.



Component no. 25000L

Series 1

Carrier pipe diameter d, mm	250	280	315	355	400
Jacket pipe diameter D, mm	400	400	450	500	560
Length L, mm	1300	1500	1600	1600	1600

Series 2

Carrier pipe diameter d, mm	225	250	280	315	355	400
Jacket pipe diameter D, mm	355	450	450	500	560	630
Length L, mm	1000	1300	1500	1600	1600	1600

Series 3

Carrier pipe diameter d, mm	200	225	250	280	315	355	400
Jacket pipe diameter D, mm	355	400	500	500	560	630	710
Length L, mm	1000	1000	1300	1500	1600	1600	1600

Version/07.2005.DK

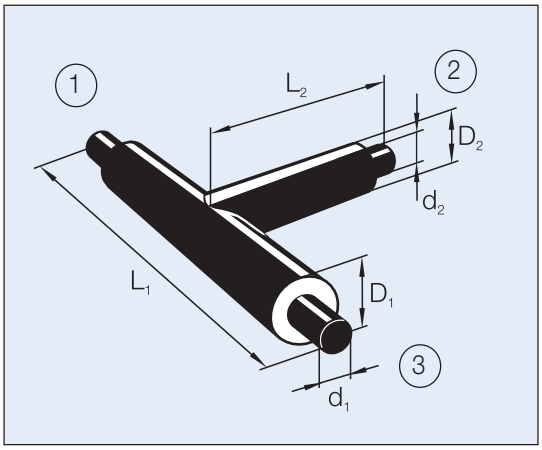
T-fitting straight

HDPE (10 bar)

NT components - Plastic pipe system **3.4.4 - 1/1**

Other dimensions are supplied on inquiry as goods made to order.

Available in series 1,2 and 3.



Series 1

Component no. 34000L

	d_1	110	125	140	160	180	200	225	250	280	315	355	400
	D_1	200	200	225	250	280	280	315	400	400	450	500	560
	L_1	1200	1200	1200	1400	1400	1400	1400	1600	1600	1600	1800	2000
d_2	D_2	L_2											
90	160			600									
110	200	600	600	600	600								
125	200		600	600	600	600							
140	225			600	600	600	600						
160	250				600	600	600	600					
180	280					600	600	600	600				
200	280						600	600	600	600			
225	315							600	600	600	600		
250	400								600	600	600	700	
280	400									600	600	700	700
315	450										600	700	700
355	500											700	700
400	560												700

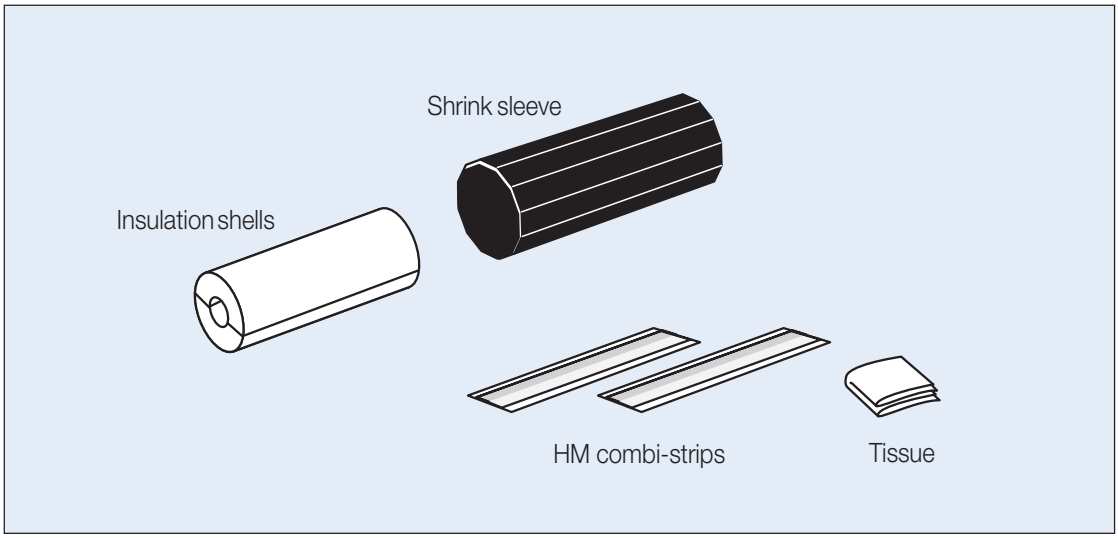
Nominal pressure 16 bar.

Version/07.2005.DK

FXI

Joint with insulation shells, black

NT components - Joints **3.5.1 - 1/1**



Joint FXI

Component no. 5057C

Carrier pipe diameter D, mm	77	90	110	125	140	160	180	200	225	250	315
Shrink sleeve size	77-110	77-110	77-110	125-160	125-160	125-160	180-225	180-225	180-225	250-315	250-315
Shrink sleeve length, mm	500	500	500	500	500	500	500	500	500	500	500

The FX shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by the means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The FXI joint can be used for angles up to max. 5°.

The FXI joint is used for freely suspended systems.

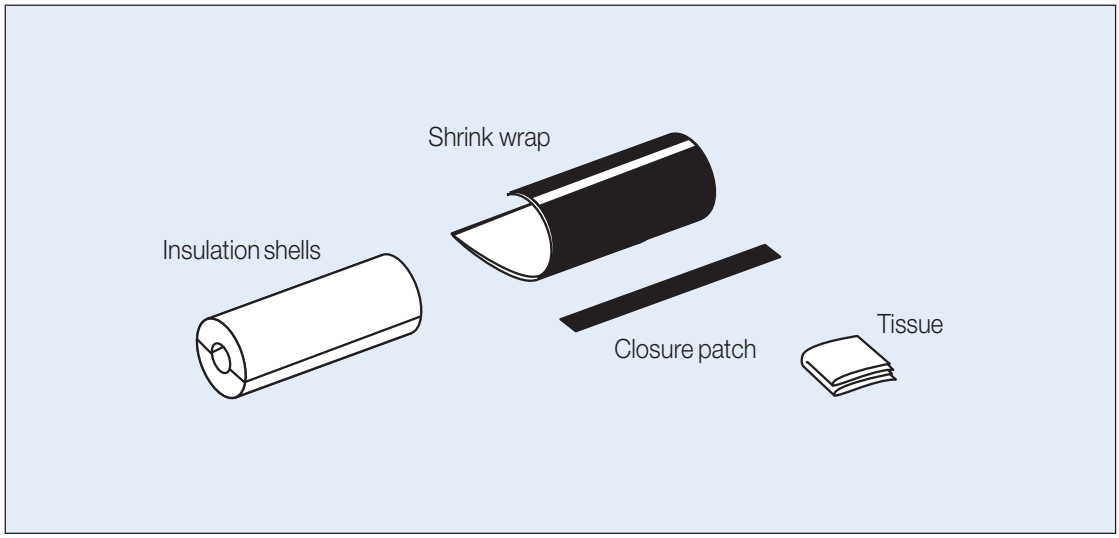
FX joint for flexible systems is ordered as FX district heating.

Version/07.2005.DK

FXC

Repair joint with insulation shells, black

NT components - Joints **3.5.2 - 1/1**



Joint FXC

Component no. 5058

Jacket pipe diameter D, mm	77	90	110	125	140	160	180	200	225	250	315
Shrink wrap length, mm	500	500	500	500	500	500	500	500	500	500	500

The shink wrap is made from elastic shrinkable modified UV-stabilized PE (PEX) material.The joint cannot be pressure tested.

The shrink wrap and closure patch are wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of shrink wrap.

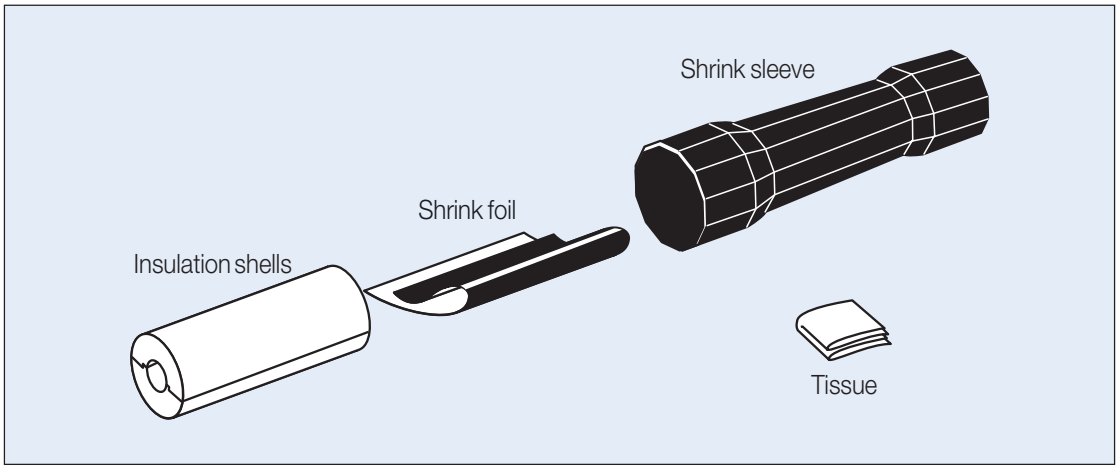
Max. temperature of 70°C during transport and storage.

Version/07.2005.DK

BX

Double sealed joint, black

NT components - Joints **3.5.3 - 1/1**



Joint BX

Component no. 50300L

Steel pipe diameter d, mm	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273.0	323.9	355.6
Jacket pipe diameter D, mm	90	90	110	110	125	140	160	200	225	250	315	400	450	500
Shrink sleeve length, mm	580	580	580	580	580	580	580	580	580	580	580	580	780	780

Steel pipe diameter d, mm	406.4	457
Jacket pipe diameter D, mm	560	630
Shrink sleeve length, mm	780	780

Joint BX is also available in series 2 and 3.

The BX shrink sleeve is made of cross-linked PE (PEX).

The shrink sleeve is wrapped up in a solid white PE foil at delivery. The sleeve is resistant to soil shearing.

Max. temperature of 70°C during transport and storage.

The shrink sleeves must be stored upright.

BX joint is designed for above ground as well as under ground installation.

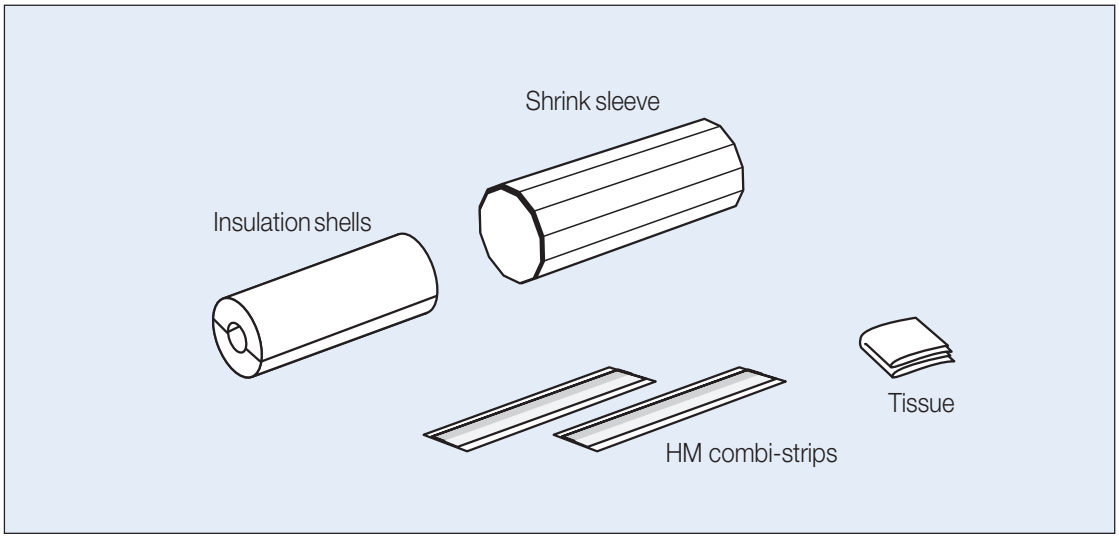
The BX joint has been tested according to EN 489 to confirm that it is able to withstand forces due to the friction of soil and the pressure of ground water.

Version/07.2005.DK

LM

Joint with insulation shells, white

NT components - Joints **3.5.4 - 1/1**



Joint LM

Component no. 53501C

Jacket pipe diameter D, mm	90	110	125	140	160	180	200	225	250	315	
Shrink sleeve length, mm	500	500	500	500	500	500	500	500	500	500	

The LM shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The shrink sleeve is not UV-stabilized and is only for indoor installation.

The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The LM joint can be used for angles up to max. 15°.

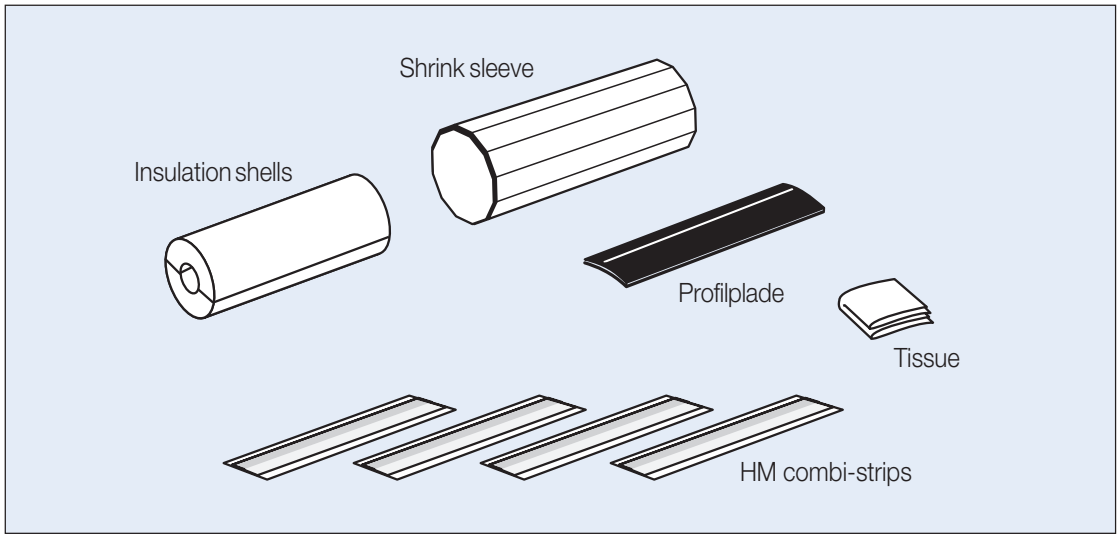
The LM joint is used for freely suspended systems.

Version/07.2005.DK

LMC

Repair joint with insulation shells, white

NT components - Joints **3.5.5 - 1/1**



Joints LMC

Component no. 53700C

Jacket pipe diameter D, mm	90	110	125	140	160	180	200	225	250	315
Shrink sleeve length, mm	500	500	500	500	500	500	500	500	500	500

The shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The shrink sleeve is not UV-stabilized and is only for indoor installation.

Retaining tools are necessary to carry out the installation. The tool is to be ordered separately.

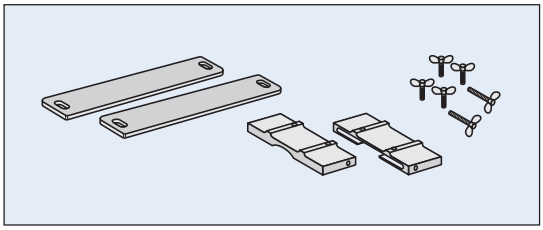
The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The joint is used for freely suspended systems.

Retaining tools for installation

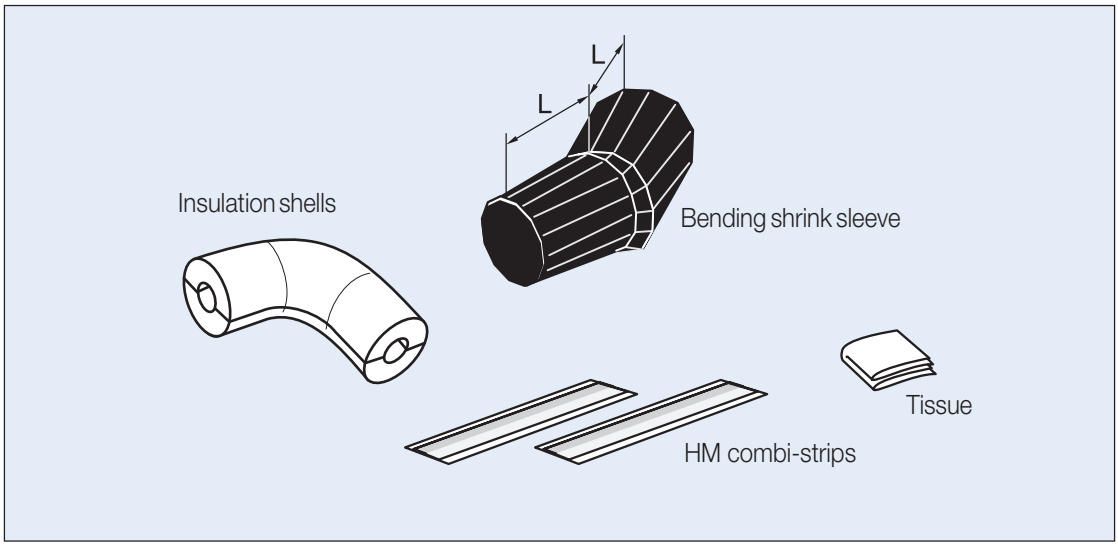
Product code 9000 0000 027 003



Version/07.2005.DK

BM

Elbow joint with insulation shells, black and white



Joint BM

Component no. 54000C

Jacket pipe diameter D, mm	40/50	66/77	90	110	125	140	160	180	200	225	250	280	315
Length L, mm	240	260	260	430	430	495	495	495	655	655	695	695	695

The BM bending shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

White shrink sleeves are not UV-stabilized and is only for indoor installation.

The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The BM joint is used for freely suspended systems.

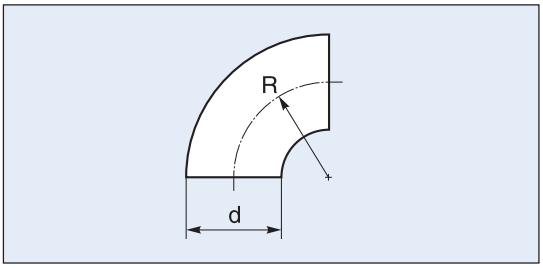
Insulation shells are stocked according to the weld elbows on the following pages.

Version/07.2005.DK

BM

Weld elbow 90° for BM

Logstor does not stock weld elbows. They are to be ordered from an external supplier according to the specifications of the tables.



St. 37.0 BW

d	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9
s	2.6	2.6	3.2	2.6	2.6	2.9	2.9	3.2
R	27.5	28.5	38	47.5	57	76	95	114

d	114.3	139.7	168.3	219.1
s	3.6	3.6	4.0	4.5
R	152	190	229	305

St. 35.8 I

d	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9
s	2.0	2.3	2.6	2.6	2.6	2.9	2.9	3.2
R	27.5	28.5	38	47.5	57	76	95	114

d	114.3	139.7	168.3	219.1
s	3.6	4.0	4.5	6.3
R	152	190	229	305

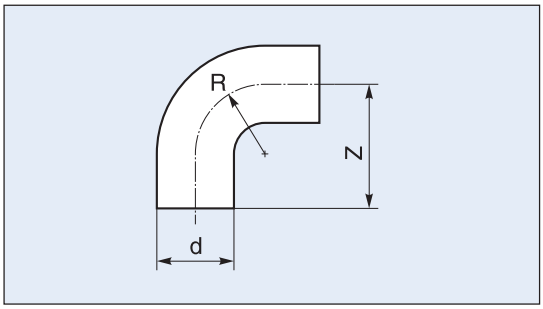
AISI 316 L - ISO dimension acc. to R-1651/ABE-211

d	21.3	26.9	33.7	42.4	48.3	60.3	76.1	88.9
s	2	2	2	2	2	2	2	2
R	27.5	28.5	38	47.5	57	76	95	114

d	114.3	139.7	168.3	219.1
s	2	2	2	2
R	152	190	229	305

AISI 316 L - metric dimension according to R-1651/ABE-111

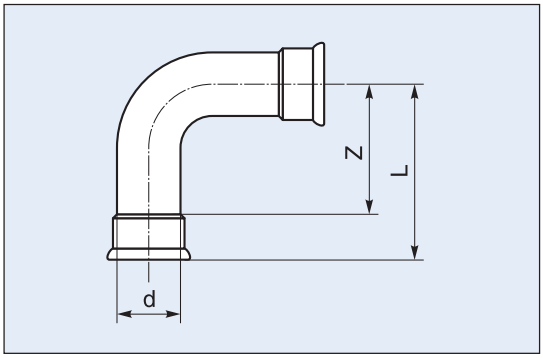
d	104	129	154	204
s	2.0	2.0	2.0	2.0
R	150	188	225	300



AISI 316L (Dairy pipes)

d	25	38	51	63.5	76	101.6
s	1.2	1.2	1.2	1.5	2.0	2.0
R	25	36	46	56	76	150
Z	55	70	82	105	110	150

Mapress



d	15	18	22	28	35	42	54	76.1
s	1.0	1.0	1.2	1.2	1.5	1.5	1.5	2.0
Z	29	33	40	49	96	136	165	182
L	49	53	61	72	122	166	200	235

d	88.9	108
s	2.0	2.0
Z	217	266
L	277	341

d = Weld elbow diameter,mm

s = Wall thickness, mm

R = Radius,mm

Z = Z- measures, mm

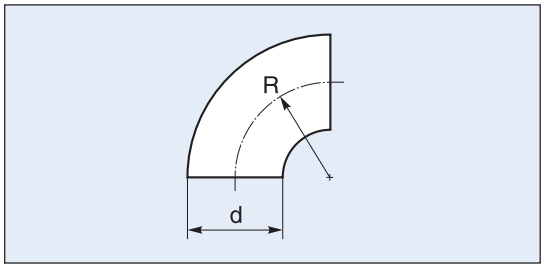
Version/07.2005.DK

BM

Weld elbow 90° for BM

Logstor does not stock weld elbows. They are to be ordered from an external supplier according to the specifications of the tables.

PE pressure pipe elbow

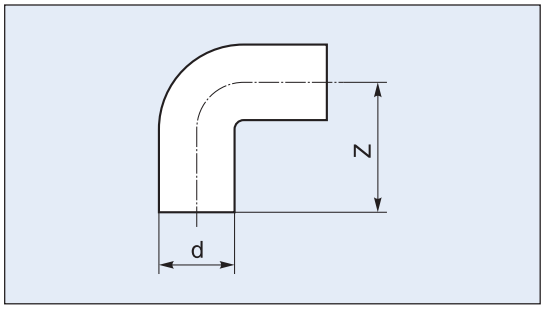


d	63	75	90	110	125	140	160	180

d	200	225

Radius R = d

PE pressure pipe angle



d	25	32	40	50
Z	65	65	74	86

d = Weld elbow diameter,mm

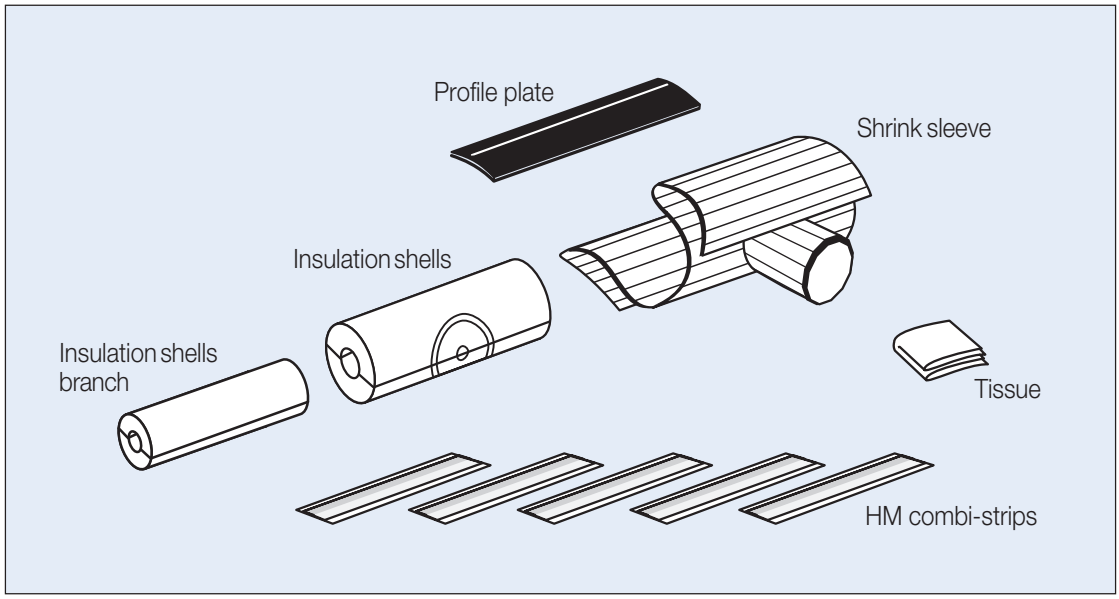
Z = Z- measures, mm

Version/07.2005.DK

TMC

T-joint with insulation shells, white

NT components - Joints **3.5.7 - 1/1**



Joint TMC

Component no. 52500C

	Jacket diameter main pipe, mm						
	90	110	125	140	160	180	200
Branch							
90	X	X	X	X	X	X	X
110	X	X	X	X	X	X	X
125		X	X	X	X	X	X
140			X	X	X	X	X
160				X	X	X	X
180					X	X	X

The shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

White shrink sleeves are not UV-stabilized and is only for indoor installation.

Retaining tools are necessary to carry out the installation. The tool is to be ordered separately.

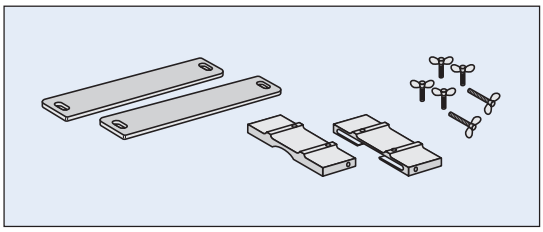
The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The TMC joint is used for freely suspended systems.

Retaining tools for installation

Product code 9000 0000 027 003

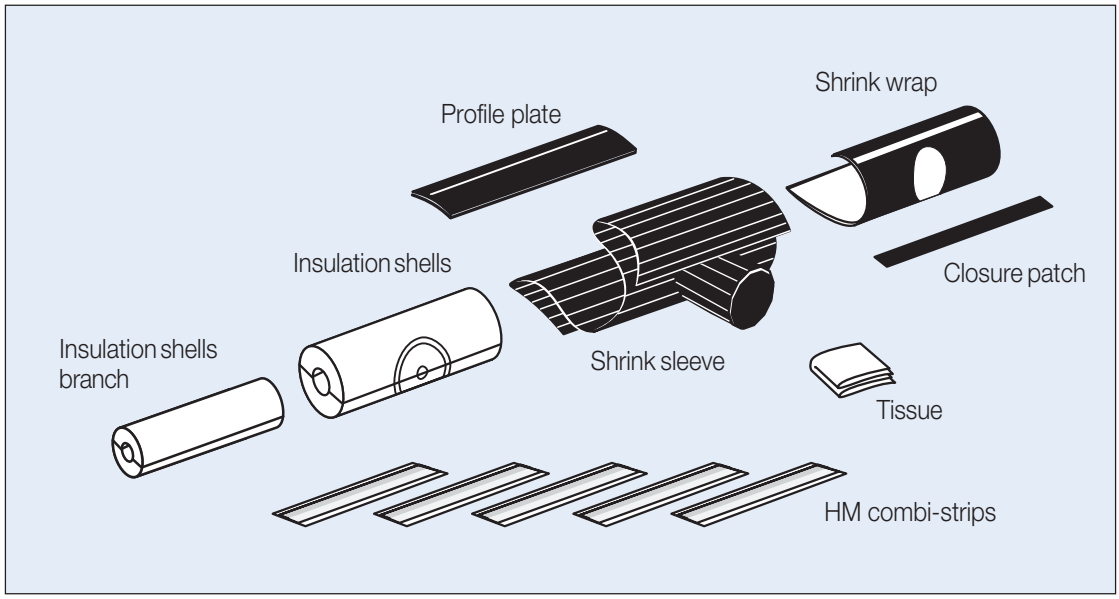


Version/07.2005.DK

TMC-C

T-joint with insulation shells, black

NT components - Joints **3.5.8 - 1/1**



Joint TMC-C

Component no. 52600C

	Jacket diameter main pipe, mm						
	90	110	125	140	160	180	200
Branch							
90	X	X	X	X	X	X	X
110	X	X	X	X	X	X	X
125		X	X	X	X	X	X
140			X	X	X	X	X
160				X	X	X	X
180					X	X	X

The shrink sleeve is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

Retaining tools are necessary to carry out the installation. The tool is to be ordered separately.

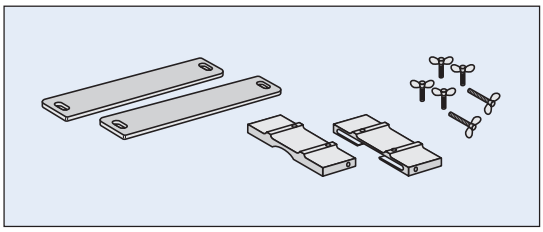
The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape. The joint is sealed by means of HM combi-strips.

Max. temperature of 70°C during transport and storage.

The TMC-C joint is used for freely suspended systems.

Retaining tools for installation

Product code 9000 0000 027 003

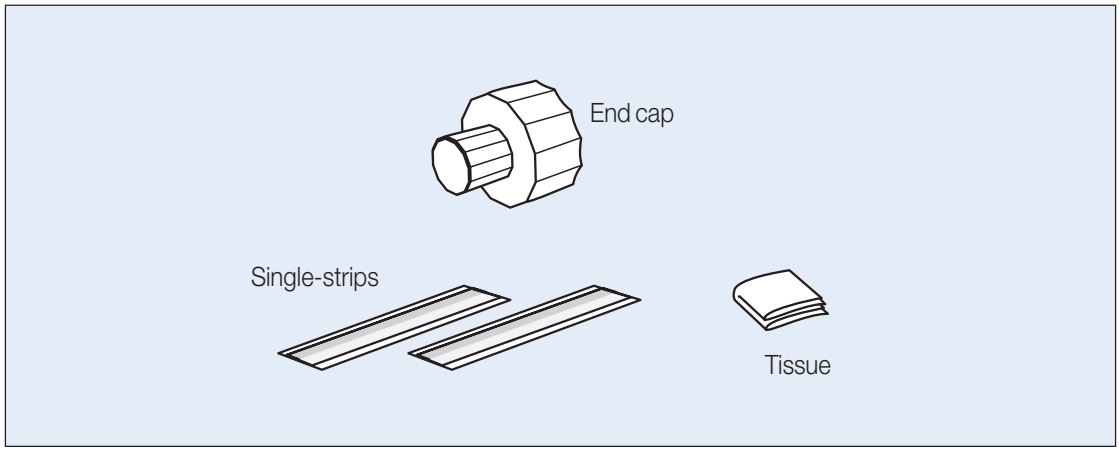


Version/07.2005.DK

EC

End cap, white

NT components - Joints **3.5.9 - 1/1**



End cap EC

Component no. 55000L

Jacket	Carrier pipe diameter d, mm															
diameter	21.3	25.0	26.9	33.7	38.0	42.4	48.3	51.0	54.0	60.3	63.5	70.0	76.1	84.0	88.9	101.6
90	40A	40A	40A	40A	40A	40A										
110	40A	40A	40A	40A	40A	40A	170A	170A	170A	170A	170A					
125						170A	170A	170A	170A	170A	170A	170B	170B			
140						170B	170B	170B	170B	170B	170B	170B	170B	170B	170B	
160						170B	170B	170B	170B	170B	170B	170B	170B	170B	170B	230A
180													230A	230A	230A	230A
200													230A	230A	230A	230A
225													230C	230C	230C	230C

Jacket	Carrier pipe diameter d, mm									
diameter	104.0	114.3	129.0	133.0	139.7	154.0	168.3	193.7	204.0	219.0
180	230A	230B								
200	230A	230B	230B							
225	230C	230C	230C	230C	230C					
250	350A	350A	350A	350A	350A	350A	350A	350C		
280	350C	350C	350B	350B	350B	350B	350B	350C	350C	350C
315	350C	350C	350C	350C	350C	350C	350C	350C	350C	350C

The EC end cap is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The shrink sleeve is not UV-stabilized and is only for indoor installation.

The EC end cap is applicable in temperature ranging from -30° to +70° C.

The end cap is sealed by means of single-strips.

Max. temperature of 70°C during transport and storage.

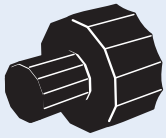
The EC end cap is used for freely suspended systems.

Version/07.2005.DK

DHEC

End cap, black

NT components - Joints **3.5.10 - 1/1**



End cap

End cap DHEC

Component no. 56000L

Carrier pipe diameter d, mm	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	193.7	219.1	273.0	323.9	355.6
Jacket pipe diameter D, mm	90	90	110	110	125	140	160	200	225	250	280	315	400	450	500
DHEC no.	2100	2100	2200	2300	2400	2400	2500	2600	2700	2700	2800	2800	2900	3000	3000

The DHEC end cap is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The end cap is applied for protection of the foamed ends against moisture penetration. Applicable for a max. carrier pipe temperature of 100°C.

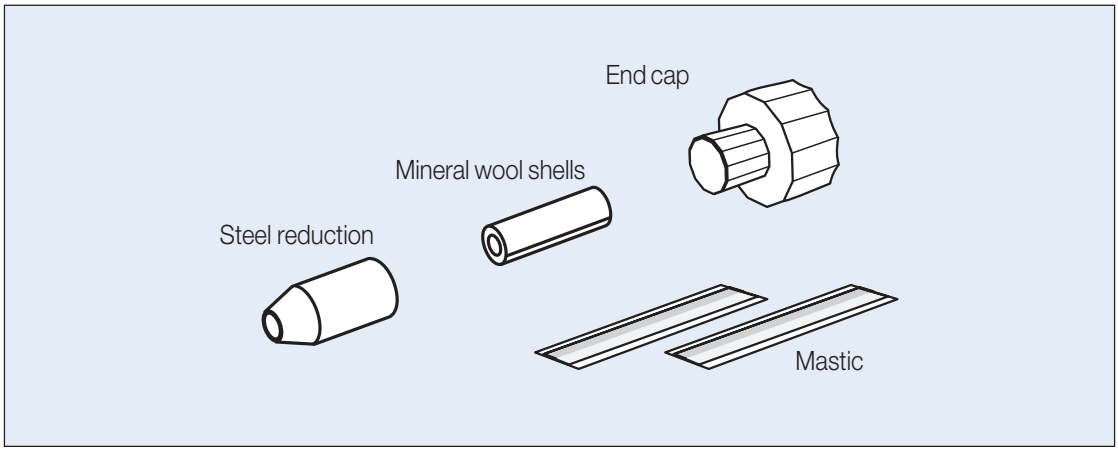
Max. temperature of 70°C during transport and storage.

Version/07.2005.DK

HEC

End cap, white

NT components - Joints **3.5.11 - 1/1**



End cap HEC

Component no. 55001L

The HEC end cap is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The shrink sleeve is not UV-stabilized and is only for indoor installation.

The HEC end cap is applicable in temperature ranging from -200° to +140° C. HEC must be applied in temperature ranging below -30° C and above +120° C.

The end cap is sealed by the means of mastic.

Max. temperature of 70°C during transport and storage.

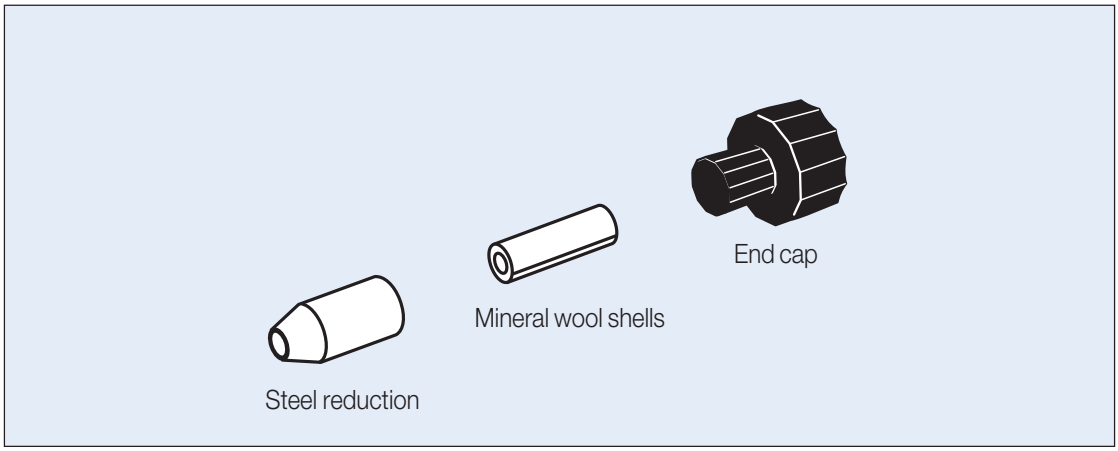
The HEC end cap is used for freely suspended systems.

Version/07.2018.UK

HDHEC

End cap, black

NT components - Joints **3.5.12 - 1/1**



End cap HDHEC

Component no. 55101L

The HDHEC end cap is made of cross-linked PE (PEX) material. The joint cannot be pressure tested.

The HDHEC end cap is applicable in temperature ranging from -200° to +250°C Thw HDHEC must be applied in temperature ranging below -30° C and above +120° C.

HDHEC is applicable for freely suspended and directly buried systems.

The end cap is applied for protection of the foamed ends against moisture penetration. Is applicable for a max. carrier pipe temperature of 140°C.

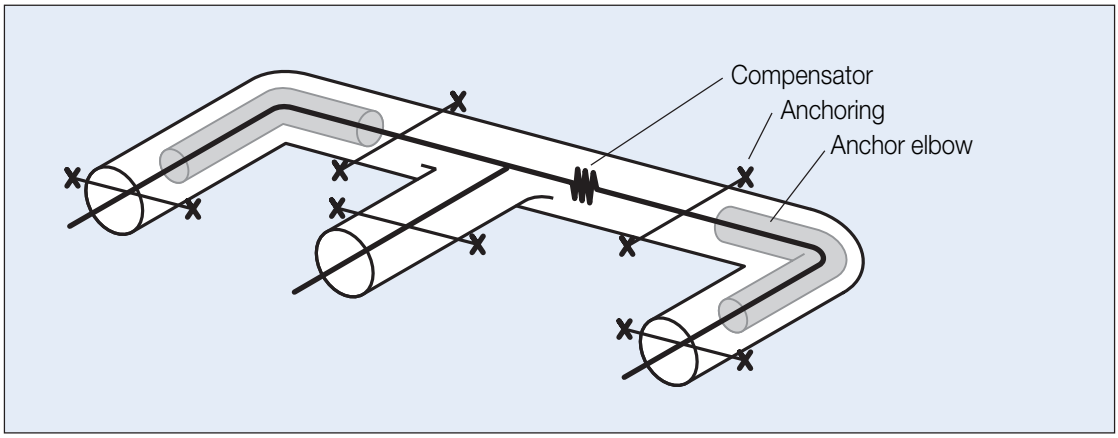
Max. temperature of 70°C during transport and storage.

Version/07.20018.UK

System description

HT3 High temperature

HT3 technique **5.1.1 - 1/1**



Operating temperature from +120°C to +250°C

Directly buried HT3 high temperature systems are laid as compensating sliding systems. In the HT3 system, movements caused by temperature changes are absorbed within the system.

The jacket pipe is held in place by soil friction and thus does not move.

The carrier pipe moves within the insulation, with the movements absorbed by corresponding expansionabsorbing elements such as L, Z or U bends or axial compensators.

When laying, the system is broken down into expansion sections that can be calculated.

Each section is divided from the next at each end using anchors.

The expansionabsorbing elements are placed inside each section, and should ideally be loaded equally from both sides.

Insulation

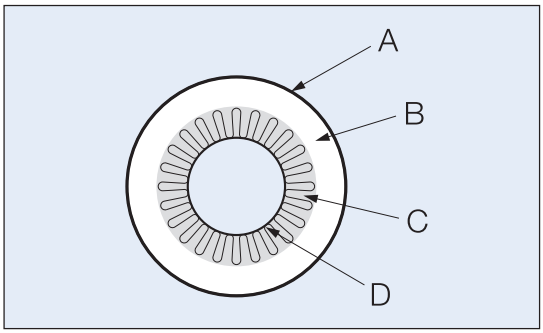
The insulation in the HT 3 system consists of a combination of PUR foam and mineral wool, helping to ensure that neither the PUR foam nor the HDPE jacket temperature capability are exceeded.

A: HDPE jacket

B: PUR foam

C: Mineral wool

D: Carrier pipe

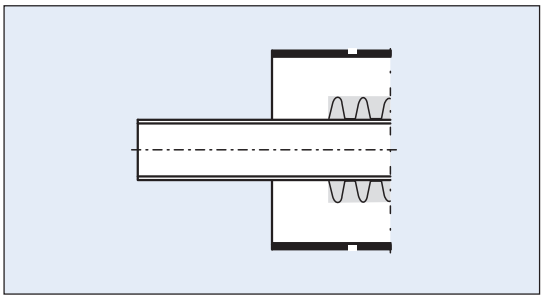


Theinsulationsystemissuppliedintwostandard versions,formediumtemperaturesof210°Cand 250°C.

Pipe ends

Each pipe and all insulated components are filled with foam in the ends.

This protects the mineral wool ends from moisture seeping during storage and handling.



The pipe ends may only be cut and removed after the carrier pipe have been welded and just before installing of the joint.

A notch is milled into the HDPE jacket to mark the place where the ends should be cut.

Version/07.2018.UK

Operating temperature and heat loss

HT3 technique 5.1.2 - 1/2

All pipes and components in the HT 3 system are available as standard for two different levels of maximum operating temperature: 210°C or 250°C.

The wall thickness of the mineral wool and PUR insulation is designed to keep the temperature of the PUR foam below the allowable limits

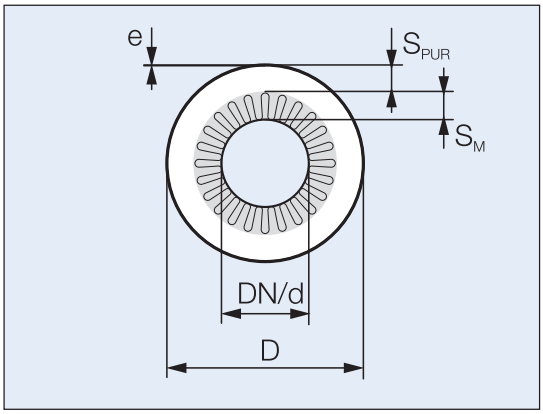
Actual heat loss ϕ is calculated using the following formula:

$$\phi = (t_M - t_E) \times U$$

Where: t_M = Media temperature

t_E = Soil temperature

The U values are calculated on the basis of a soil covering of 600 mm.



DN = Nominel diameter

D = Ext. diameter jacket pipe, mm

e = Wall thickness jacket pipe, mm

d = Ext. diameter carrier pipe, mm

S_M = Mineral wool thickness, mm

S_{PUR} = Insulation thickness PUR, mm

U = Heat trans. coef. total, W/mK

Max. 210°C series

DN	d, mm	D, mm	e, mm	$S_{M,}$ mm	$S_{PUR,}$ mm	U (210°C)
20	26.9	140	3.0	20	34	0.155
25	33.7	140	3.0	20	31	0.180
32	42.4	160	3.0	20	36	0.189
40	48.3	160	3.0	20	33	0.210
50	60.3	200	3.2	30	37	0.219
65	76.1	225	3.4	30	42	0.236
80	88.9	225	3.4	30	35	0.278
100	114.3	250	3.6	30	35	0.327
125	139.7	315	4.1	40	44	0.321
150	168.3	355	4.5	50	39	0.367
200	219.1	400	4.8	50	36	0.455
250	273.0	450	5.2	50	34	0.549
300	323.9	500	5.6	50	33	0.631
350	355.6	560	6.0	50	47	0.576
400	406.4	630	6.6	60	46	0.620

Version/07.2018.UK

Operating Temperature and Heat Loss

HT3 technique 5.1.2 - 2/2

Max. 250°C series

DN	d, mm	D, mm	e, mm	S_M ,mm	S_{PUR} ,mm	U (250°C)
20	26.9	180	3.0	40	34	0.153
25	33.7	180	3.0	40	31	0.174
32	42.4	200	3.2	40	36	0.189
40	48.3	225	3.4	50	35	0.191
50	60.3	225	3.4	50	29	0.224
65	76.1	250	3.6	50	34	0.241
80	88.9	280	3.9	60	32	0.258
100	114.3	315	4.1	60	37	0.285
125	139.7	400	4.8	80	46	0.319
150	168.3	400	4.8	80	32	0.336
200	219.1	450	5.2	80	31	0.417
250	273.0	500	5.6	80	28	0.497
300	323.9	560	6.0	80	33	0.536
350	355.6	630	6.6	100	31	0.534
400	406.4	710	7.2	100	45	0.525

Version/01.2017.UK

Thermal expansion

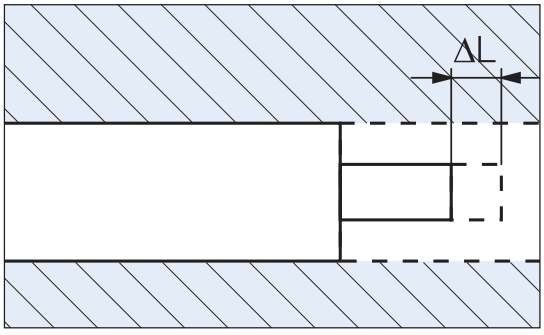
Thermal expansion in straight pipes

The linear thermal expansion in metallic pipes can be calculated using materials depending on expansion coefficients.

$$\Delta L = L \times \alpha \times \Delta T$$

- ΔL Thermal expansion, mm
- L Pipe section length, m
- α Expansion coefficient, mm/mK
- ΔT Operating-installation temp. K
- α St 37 / St 35.8 at 200°C = 0.0121

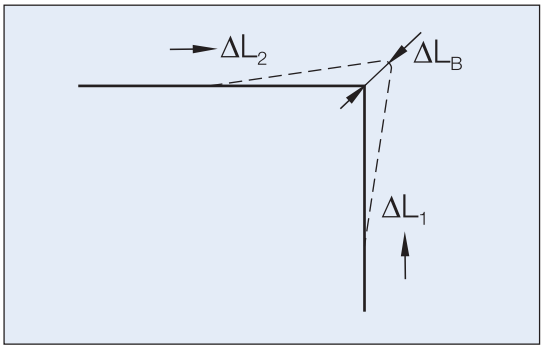
Pure thermal expansion in the HT 3 system is counteracted by friction resistance between the mineral wool and the carrier pipe, soil friction and energy from loading, the pipe bends and compensator.



Thermal expansion in bends

Axial expansion from both directions can occur in bends.

The following figure shows the resultant lateral displacement:



Lateral displacement can be calculated using the following formula:

$$\Delta L_B = \sqrt{\Delta L_1^2 + \Delta L_2^2} \leq \Delta L_{MAX}$$

NB: ΔL_{MAX} for expansion bends must not be exceeded.

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Expansion absorption

HT3 technique 5.1.4 - 1/2

Expansion length

The HT 3 system is designed to allow the insulation to absorb expansion of the carrier pipe within the extemal jacket.

Maximum expansion absorption ΔL_{MAX}. for each expansion absorption element can be found in the following catalogue chapters:

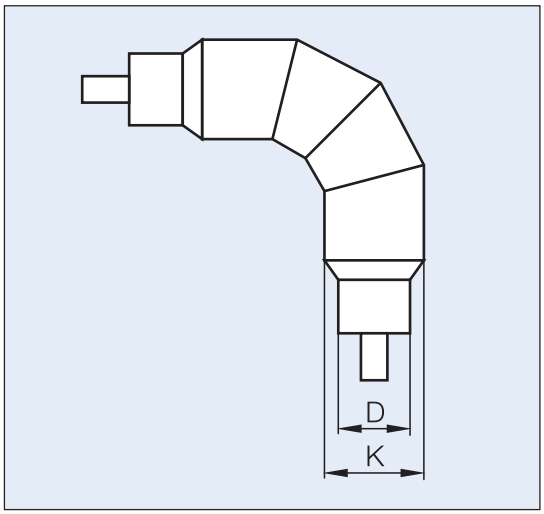
Elbows	5.2.3 and 5.2.4
Axial compensators	5.2.9

The maximum distance L_{MAX} from the anchor to the expansion element is:

$$L_{MAX} = \Delta L_{MAX} / \alpha \times \Delta T$$

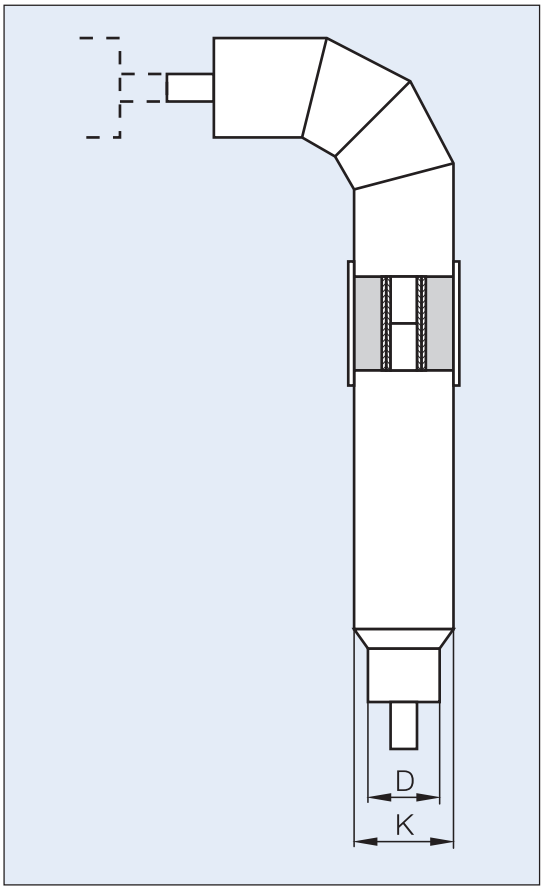
Expansion absorption in 90° bends

Logstor supplies 90° expansion bends for expansion absorption of 20 mm and 40 mm, respectively (see 5.2.3 and 5.2.4)



The bends must be assembled as L, Z or U bends on-site and must not under any circumstances be cut.

When bends are supplied in larger dimensions, the shank length will be too long for transport on a truck and they are therefore divided into three pieces: a short bend and two expansion pipes for assembly on-site.



As a guideline value, the following maximum expansion lengths L_{MAX} can be used from the anchor to the pipe bend.

These distances presume full utilisation of the expansion length and temperatures of 210°C and 250°C respectively.

Max. expansion length L_{MAX} for St 37 / St 35.8

Operating temperature	Expansion length 0 mm	20 mm	40 mm
210°C	3.0 m	8 m	18 m
250°C	2.0 m	7 m	14 m

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Expansion absorption

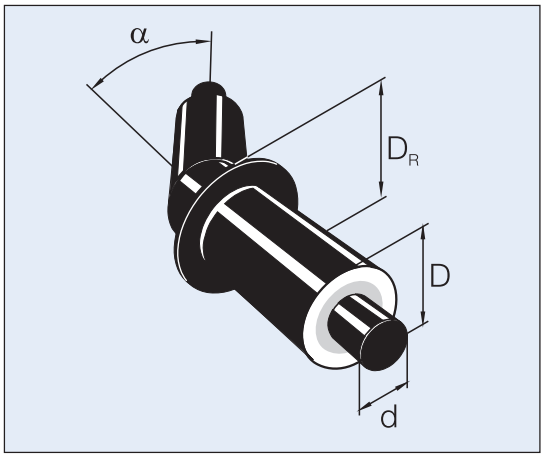
Expansion absorption in 45° - 90° elbows

Elbows of 90° can be used for expansion absorption.

The resulting lateral expansion is calculated as shown in 5.1.3 and must not exceed 20 or 40 mm respectively.

Expansion absorption in 0° - 45° elbows

Pipe elbows with an angle of less than 45° are not suitable for expansion absorption and must usually be built with an anchor elbow.



Expansion absorption in compensators

The expansion absorption capacity of standard compensators ΔL_{MAX} is stated in chapter 5.2.9.

If the customer requires other compensators, all relevant data regarding expansion absorption must be obtained from the manufacturer and submitted to Logstor before they can be approved for insulation.

Only one compensator can be mounted between two anchors, a U-bend or Z-bend for absorption of expansion.

The maximum distance between two anchors ΔL_{MAX} on straight pipe lengths is:

$$L_{MAX} = \Delta L_{MAX} / \alpha \times \Delta T$$

ΔL_{MAX} is the compensator or expansion element's maximum expansion length.

Expansion in T-branches

There are no expansion elements in T-fittings which must always be directly installed together with an anchor in the main pipe.

The maximum distance of a T-fitting to an expansion element in a branch pipe for black steel is:

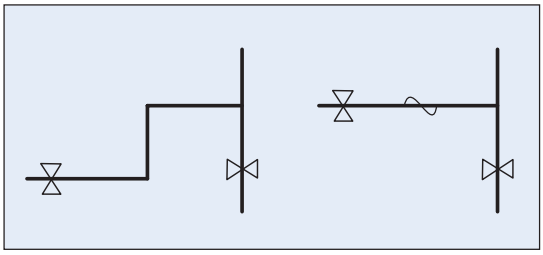
- 6 m for the 210°C series
- 4 m for the 250°C series

Expansion in HT end caps

The maximum distance from a HT end cap to an anchor for black steel is:

- 5 m for the 210°C series
- 3 m for the 250°C series

Installation examples



Absorption of expansion in reductions

Expansions cannot absorb larger expansions, and therefore they are to be installed directly together with a T-fitting or an anchor.

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Anchors

HT3technique 5.1.5 - 1/2

Anchor forces

Anchor forces exerted by thermal expansion and internal compressive force have to be absorbed by the concrete blocks in the excavation trench. Absorption of the axial forces exerted is sufficient for the calculation.

Consequently, anchor force $F_{P,}$ which is to be absorbed can be calculated as follows:

$$F_P = |S \times F_1 - F_2|$$

Where S is a supplementary safety value and $F_1 > F_2$.

The forces exerted on both sides of the anchor consist of different individual elements, depending on the geometric conditions.

They can include:

- Friction.
- The compensator's spring resistance.
- The compensator's internal resistance.
- Resistance from L, Z and U bends.
- Internal compressive force in bends.
- The compensator's start force.

The compensator's spring resistance and resistance in the bends can be ignored as they are built in to the safety factor.

Friction

The reactive forces resulting from friction between the carrier pipe and the mineral wool can be calculated by:

$$F_R = \pi \times d \times L \times \mu$$

Where: d = The carrier pipe's dimensioning [m].

L = The pipe length under friction [m].

μ = The friction factor (7 kN/m^2)

The compensator's internal compressive force

The internal diameter of the compensator's corrugation is greater than that of the carrier pipe, resulting in the corrugation creating hydraulic axial force F_{KP}

$$F_{KP} = p \times A_B$$

A_B = The effective corrugated area [cm^2]

P = Max. operating pressure [N/mm^2]

A_B is stated in chapter 5.2.9.

Compensator start force

The compensator is factory-set for maximum fluctuation and separation bolts are used to retain this setting. The bolts will part once the compensator becomes active, and the required force P kN, is stated in chapter 5.2.9. P should be calculated as a unilateral force.

Anchor force

Thus, the resultant anchor force is:

$$F_{PR} = |S \times \Sigma F_1 - \Sigma F_2|$$

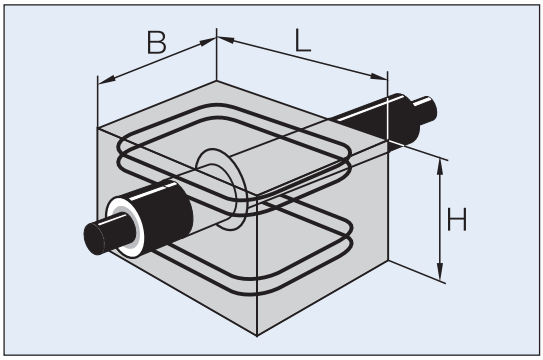
or:

$$F_{PR} = S \times (F_{R1} + F_{KP1}) + P - (F_{R2} + F_{KP2})$$

The supplementary safety factors are given in the local instructions but in most instances S=1.2 will be sufficient.

Anchor construction

Anchors are set in concrete directly onto unprepared ground.



The concrete block must be dimensioned to be able to absorb reaction force F_{PR}

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Anchors

HT3technique 5.1.5 - 2/2

The ground will have a slight elasticity making it impossible to define an anchor precisely, i.e. $\Delta L = 0$. Permitted anchor displacement ΔL_F will require case-by-case evaluation.

Permitted surface pressure σ against the ground, dependent on the ΔL_F that can be tolerated, can then be calculated using the following formula:

$$\sigma = 15 \times \Delta L_F$$

The soil pressure in the vertical direction A_W can be calculated by reaction force F_{PR} and permitted surface pressure σ:

$$A_W = F_{PR} / \sigma$$

The concrete block must be cast to achieve a compressive force of more than 25 MN/m², and must have sufficient height, length and reinforcement to absorb the transmission forces.

Recommended dimensions for the concrete block are calculated on the basis of the following:

Soil pressure	:	150 kN/m² against the entire block
Reinforcement	:	Ks 410 steel bar, $f_{yk} > 410$ N/mm²
Concrete	:	20 N/mm² concrete, $f_{ck} > 20$ N/mm²

Calculating the size of the concrete block is the responsibility of the project engineer.

Steel pipe diameter d, mm	Permitted axial force kN	Concrete block			Reinforcement	
		L, m	H, m	W, m	No. of brackets	Dim, mm
26.9-48.3	30-80	1.0	0.5	1.0	4	8
60.3-76.1	100-130	1.2	0.5	1.0	4	8
88.9-114.3	130-200	1.8	0.7	1.0	4	10
139.7	250	2.3	0.8	1.0	4	12
168.3	350	2.3	0.9	1.0	4	12
219.1	625	2.8	1.2	1.0	6	12
273.0	800	3.0	1.5	1.0	6	16
323.9	1050	3.8	1.5	1.0	6	20
355.6	1300	4.6	1.6	1.2	6	20
406	1600	4.8	1.8	1.4	6	20

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Trenches and soil covering

HT3 technique 5.1.6 - 1/2

Laying depth

Soil friction must be greater than pipe friction for the sliding pipe system to function. In order to ensure this and avoid overloading of the sleeves, a certain amount of soil cover is required. How much depends on the pipe dimensions and the nature of backfill.

The table below shows the minimum soil covering required for the HT 3 system, depending on the nature of backfill and the type of sleeves selected.

Compliance with these recommendations will ensure the pipes that are protected against traffic loads.

Dimensioning the trench

210°C series

Minimum soil covering H				
DN/D	Groundwater under the pipe		Groundwater above the pipe	
	HBXS	HEW	HBXS	HEW
20/140	0.60	-	0.80	-
25/140	0.60	-	0.80	-
32/160	0.60	-	0.90	-
40/160	0.60	-	0.95	-
50/200	0.60	-	1.00	-
65/225	0.75	0.60	1.10	1.00
80/225	0.75	0.60	1.20	1.05
100/250	0.85	0.70	1.40	1.20
125/315	0.90	0.80	1.50	1.25
150/355	-	0.85	-	1.30
200/400	-	0.85	-	1.35
250/450	-	0.90	-	1.50
300/500	-	0.95	-	1.50
350/560	-	1.00	-	1.55
400/630	-	1.00	-	1.60

250°C series

Minimum soil covering H				
DN/D	Groundwater under the pipe		Groundwater above the pipe	
	HBXS	HEW	HBXS	HEW
20/180	0.60	-	0.60	-
25/180	0.60	-	0.60	-
32/200	0.60	-	0.60	-
40/225	0.60	-	0.60	-
50/225	0.60	0.60	0.80	0.80
65/250	0.60	0.60	0.80	0.80
80/280	0.70	0.60	0.80	0.80
100/315	0.80	0.60	0.90	0.90
125/400	-	0.60	-	0.90
150/400	-	0.60	-	1.10
200/450	-	0.70	-	1.30
250/500	-	0.70	-	1.40
300/560	-	0.80	-	1.50
350/630	-	0.90	-	1.60
400/710	-	1.00	-	1.60

Dimensioning of the trench depends on the pipe dimensions. When establishing a trench, local safety regulations must be observed including regulations for shores or other stabilizing soil equipment.

A trench to a minimum depth of 1.7 m with shores or sufficient measures to prevent slippage is recommended in all instances.

The minimum trench width for pipes up to DN 400 are the jacket pipe diameter plus 450 mm. The pipes must rest on minimum 100 mm compressed friction material and the distance between the jacket pipe and trench wall must be no less than 150 mm. A greater distance will be advantageous for welding work and sleeve installation in the trench. Alternatively, proper access around the weld area must be ensured.

Pipes should be supported by supports of polystyrene foam or sandbags. If wooden wedges are used, they must be removed before backfilling.

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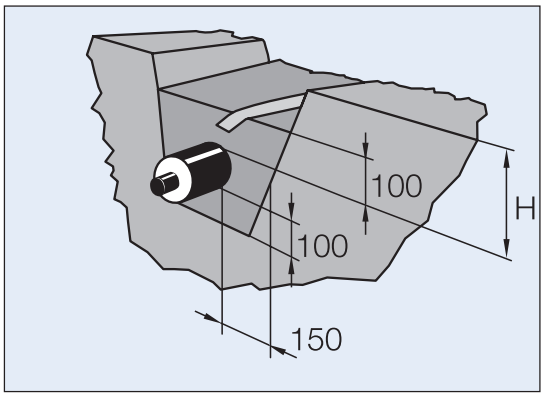
Trenches and soil covering

HT3 technique 5.1.6 - 2/2

The following figure illustrates a support profile:



A minimum 100 mm of friction material must be filled over and around the pipe. Types of friction material are specified below.

Backfill over the jacket pipe must be in accordance with the specifications for the laying depth – and the same applies to any branch pipes.

Once the trench has been dug, check that the soil base is capable of bearing the weight to avoid the risk of settling. If it is not, make the trench deeper and replace the excavated soil with friction material for backfilling.

Compress the material under, around and over the pipes to a standard proctor value of no less than 95. It is vital that the material is also compressed under the pipes to avoid cavities. Compress the material around the sides and between the pipes by hand and finish off with a plate vibrator with a maximum dynamic pressure of 100 Pa.

Friction material

The friction material used must fulfil the following specifications:

Maximum grain size	≤	32	mm
Maximum 9% weight	≤	0.075	mm
or 3% weight	≤	0.020	mm
Non-uniformity figure	>	1.8	

Drainage

Until the sleeve joints are finished and the trench completely backfilled, water must be excluded from the trench as much as possible. Surface water must be diverted away from the trench and if necessary establish a sump using submersible pumps. Beware of the risk of undermining.

When installing the HT 3 system, the trench must not under any circumstances be under water until the sleeve joints are fully installed.

Distance to other directly buried conduits

The immediate surroundings of directly buried heat-conveying pipes are at a higher temperature than normal. This can affect the transmission capacity of underground electrical cables. The maintaining of a minimum distance to other conduits is also necessary with regard to maintenance work.

Refer to the owners of any other directly buried conduits for minimum recommended distance.

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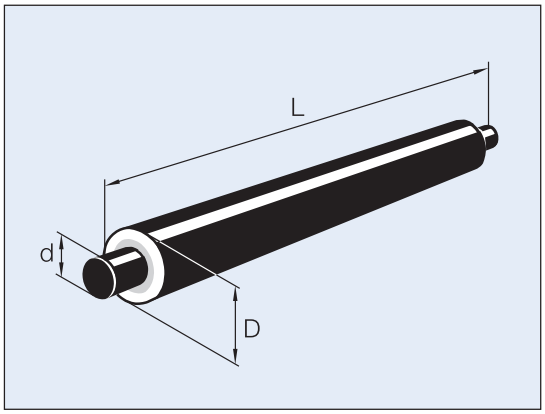
Pipe

HT3 components - Steel pipe system 5.2.1 - 1/1



Component no. 20001L

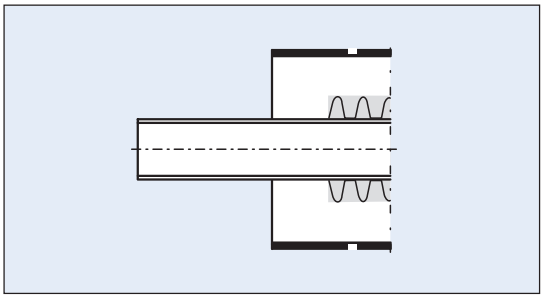
As described in the following table, pipes are supplied in lengths of 6 and 12 m.

As standard all our other pre-insulated components are supplied in two series, the 210°C series and the 250°C series.

All pipes and pre-insulated components are complete foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

For further details, see chapter 5.1.1, System description.

For specifications for carrier pipes, insulations and jackets, see section 1.2 Material specifications, chapter 5.1.2 operating temperature and heat loss.



DN	d	210°C series		250°C series		L 6m	L 12m
		D	Jacket thickness, e	D	Jacket thickness, e		
20	26.9	140	3.0	180	3.0	X	
25	33.7	140	3.0	180	3.0	X	
32	42.4	160	3.0	200	3.2	X	
40	48.3	160	3.0	225	3.5	X	
50	60.3	200	3.2	225	3.5	X	
65	76.1	225	3.5	250	3.9	X	
80	88.9	225	3.5	280	4.4	X	X
100	114.3	250	3.9	315	4.9	X	X
125	139.7	315	4.9	400	6.3	X	X
150	168.3	355	5.6	400	6.3	X	X
200	219.1	400	6.3	450	7.0	X	X
250	273.0	450	7.0	500	7.8	X	X
300	323.9	500	7.8	560	8.8	X	X
350	355.6	560	8.8	630	9.8	X	X
400	406.4	630	9.8	710	11.1	X	X

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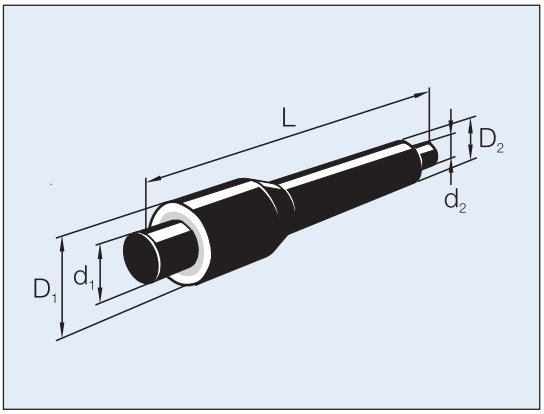
Reductions

HT3 components - Steel pipe system 5.2.2 - 1/1



All pipes and pre-insulated components are complete foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

For further details, see chapter 5.1.1, system description.

For specifications of carrier pipes, insulation and jackets, see section 1.2, Material specifications and chapter 5.1.2, operating temperature and heat loss.

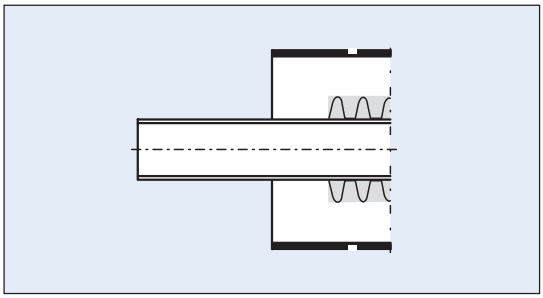
Component no. 49001L

Reductions are supplied complete in lengths as specified in the table below.

Reductions in the carrier pipe are eccentric.

Please observe that the white line must be at the top at installation.

As standard, all reductions and pre-insulated components are manufactured in two series: the 210°C series and the 250°C series.



DN_1	d_1, mm	DN_2	d_2, mm	L, mm	210°C series		250°C series	
					D_1, mm	D_2,mm	D_1, mm	D_2,mm
25	33.7	20	26.9	1200	140	140	180	180
32	42.4	25	33.7	1200	160	140	200	180
40	48.3	32	42.4	1200	160	160	225	200
50	60.3	40	48.3	1200	200	160	225	225
65	76.1	50	60.3	1200	225	200	250	225
80	88.9	65	76.1	1200	225	225	280	250
100	114.3	80	88.9	1200	250	225	315	280
125	139.7	100	114.3	1200	315	250	400	315
150	168.3	125	139.7	1200	355	315	400	400
200	219.1	150	168.3	1200	400	355	450	400
250	273.0	200	219.1	1200	450	400	500	450
300	323.9	250	273.0	1200	500	450	560	500
350	355.6	300	323.9	1200	560	500	630	630
400	406.4	350	355.6	1200	630	560	710	630

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Elbow

As standard, elbows and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

Elbows are manufactured in three versions, without expansion and with 20 mm or 40 mm absorption insulation. These expansions must not be exceeded, see chapter 5.1.3. Elbows can be supplied with 45°, 60°, 75° and 90° angles as standard. Other angles can be supplied with a tolerance of ± 2.5° on special order.

For elbows of less than 45° anchor elbows must be used, see chapter 5.2.8.

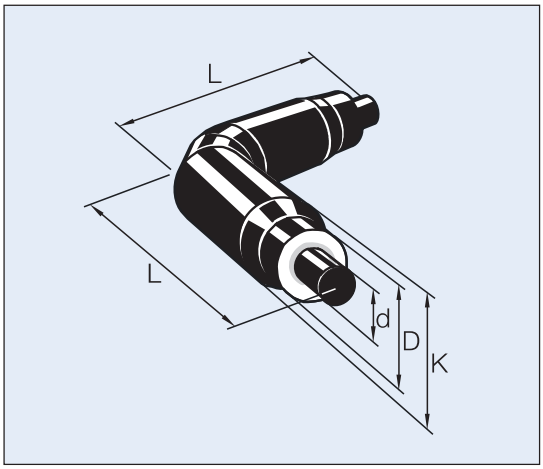
For transporting, large dimensions are manufactured in several components: a short elbow with one or two leg extensions, see chapter 5.2.4, expansion pipes.

All pipes and pre-insulated components are fully foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

For further details, see chapter 5.1.1, system description.

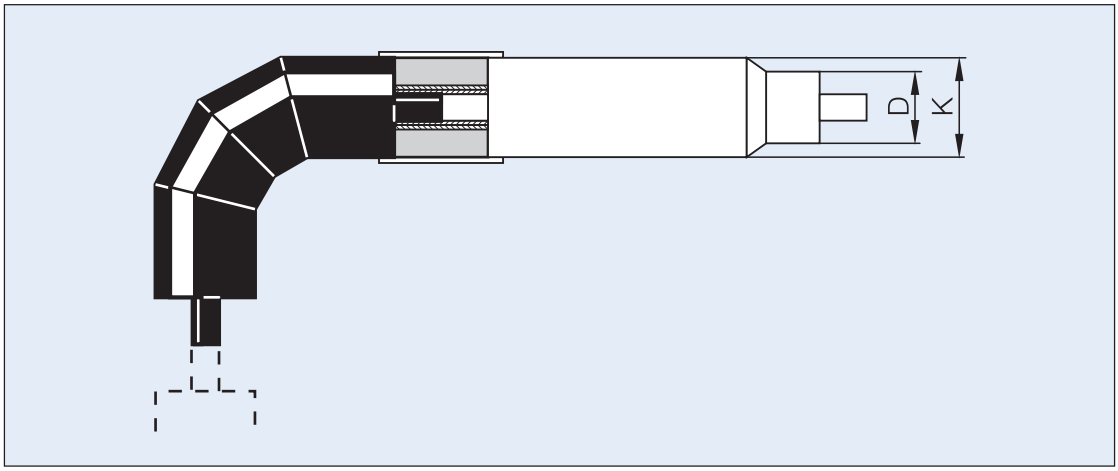
For specifications of carrier pipes, insulations and jackets, see section 1.2 material specifications.

Type 1



Component no. 25001L

Type 2



Component no. 25001L

Version/03.2006.DK

Elbow

210°C series

DN	d, mm	D, mm	Without expansion		20 mm expansion			40 mm expansion		
			L, mm	Type	K, mm	L, mm	Type	K, mm	L, mm	Type
20	26.9	140	1000	1	-	-	-	225	1600	1
25	33.7	140	1000	1	-	-	-	225	1800	1
32	42.4	160	1000	1	-	-	-	250	2000	1
40	48.3	160	1000	1	-	-	-	250	2200	1
50	60.3	200	1000	1	-	-	-	280	2500	1
65	76.1	225	1000	1	280	2000	1	315	2600	1
80	88.9	225	1000	1	280	2200	1	315	1200	2
100	114.3	250	1000	1	315	2400	1	355	1200	2
125	139.7	315	1000	1	355	2600	1	400	1200	2
150	168.3	355	1000	1	400	1500	2	450	1200	2
200	219.1	400	1000	1	450	1500	2	500	1500	2
250	273.0	450	1300	1	500	1500	2	560	1500	2
300	323.9	500	1500	1	560	1500	2	630	1500	2
350	355.6	560	1600	1	630	1500	-	-	-	-
400	406.4	630	1600	1	710	1500	-	-	-	-

250°C series

DN	d, mm	D, mm	Without expansion		20 mm expansion			40 mm expansion		
			L, mm	Type	K, mm	L, mm	Type	K, mm	L, mm	Type
20	26.9	180	1000	1	-	-	-	315	1600	1
25	33.7	180	1000	1	-	-	-	315	1800	1
32	42.4	200	1000	1	-	-	-	315	2000	1
40	48.3	225	1000	1	-	-	-	355	2200	1
50	60.3	225	1000	1	-	-	-	355	2500	1
65	76.1	250	1000	1	355	2000	1	400	2600	1
80	88.9	280	1000	1	355	2200	1	400	1200	2
100	114.3	315	1000	1	400	2400	1	450	1200	2
125	139.7	400	1000	1	450	2600	1	560	1200	2
150	168.3	400	1000	1	450	1500	2	560	1200	2
200	219.1	450	1000	1	500	1500	2	630	1500	2
250	273.0	500	1300	1	560	1500	2	710	1500	2
300	323.9	560	1500	1	630	1500	2	800	1500	2
350	355.6	630	1600	1	710	1500	-	-	-	-
400	406.4	710	1600	1	800	1500	-	-	-	-

Version/03.2006.DK

Expansion pipe

HT3 components - Steel pipe system 5.2.4 - 1/2

As standard, expansion pipes and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

Expansion elbows are produced as three components: a short elbow with two expansion pipes as extensions. Expansion pipes are manufactured in two versions, with 20 mm or 40 mm expansion absorption. These expansion absorptions must not be exceeded and expansion pipes must not be cut.

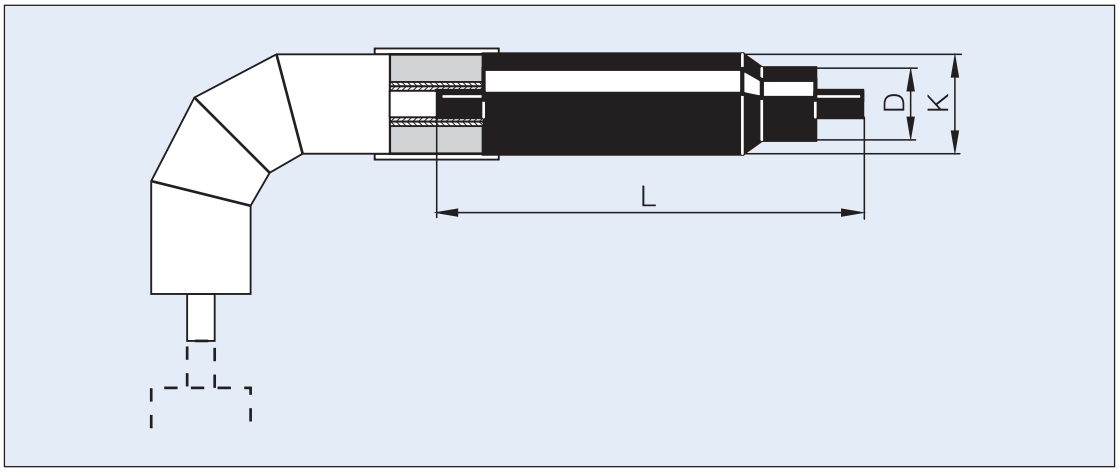
All pipes and pre-insulated components are fully foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

Please note that the text on expansion pipes must be at the top during installation, as expansion is only permitted in a lateral direction to the text.

For further information, see chapter 5.1.1 system description.

For carrier pipe specifications, insulations and jackets, please see section 1.2, material specifications.

Type 2



Component no. 25001L – expansion pipes

DN	d, mm	210°C series						315°C series					
		20 mm expansion			40 mm expansion			20 mm expansion			40 mm expansion		
		L	D	K	L	D	K	L	D	K	L	D	K
80	88.9	-	-	-	2000	225	315	-	-	-	2000	280	400
100	114.3	-	-	-	2200	250	355	-	-	-	2200	315	450
125	139.7	-	-	-	2500	315	400	-	-	-	2500	400	500
150	168.3	1700	355	400	3000	355	450	1700	400	450	3000	400	500
200	219.1	2000	400	450	3500	400	500	2000	450	500	3500	450	560
250	273.0	2300	450	500	4000	450	560	2300	500	560	4000	500	630
300	323.9	2700	500	560	4500	500	630	2700	560	630	4500	560	710
350	355.6	2900	560	630	-	-	-	2900	630	710	-	-	-
400	406.4	3100	630	710	-	-	-	3100	710	800	-	-	-

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Expansion pipe

HT3 components - Steel pipe system 5.2.4 - 2/2

Joint for connection of expansion elbow, type 2, and expansion pipes should not be ordered separately. The joint is automatically supplied with the expansion elbow as a HEW joint with extra mineral wool for expansion absorption. On ordering, DN 65 and DN 80 with 40 mm expansion in series 210° are available with HBXS instead. In this case, the HBXS is provided with extra mineral wool.

Joint for expansion elbow, type 2

20 mm expansion

DN	d, mm	Serie 210°C					Serie 250°C				
		L, mm	D, mm	S_M, mm	PUR, liter	Foam pack size	L, mm	D, mm	S_M, mm	PUR, liter	Foam pack size
150	168,3	700	400	80	12.3	7	700	450	100	15.8	8
200	219,1	700	450	70	17.3	9	700	500	100	17.5	9
250	273,0	700	500	80	14.7	8	700	560	100	21.2	10
300	323,9	700	560	80	18.7	9	750	630	100	28.8	11
350	355,6	750	630	70	35.6	2x9	750	710	120	35.2	2x9
400	406,4	750	710	80	43.2	12	750	800	120	52.3	10+11

40 mm expansion

DN	d, mm	Serie 210°C					Serie 250°C				
		L, mm	D, mm	S_M, mm	PUR, liter	Foam pack size	L, mm	D, mm	S_M, mm	PUR, liter	Foam pack size
80	88,9	700	315	80	8.8	6	700	400	100	18	9
100	114,3	700	355	80	12	7	700	450	100	24.4	10
125	139,7	700	400	80	16.5	9	700	500	120	24.9	10
150	168,3	700	450	100	15.8	8	700	500	120	19.6	10
200	219,1	700	500	100	17.5	9	700	560	120	24.2	10
250	273,0	700	560	100	21.2	10	750	630	120	31.5	11
300	323,9	750	630	100	28.8	11	750	710	120	43.9	12

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Straight T-fitting

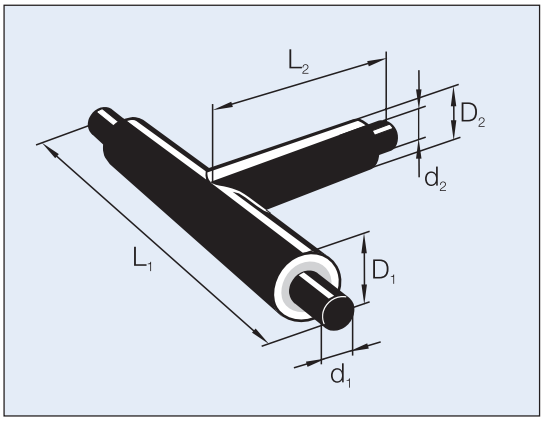
As standard, T-fittings and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively. Carrier pipes are made exclusively to the customer's specification and the branch pipe is welded on at an angle of 90°.

T-fittings cannot be used as expansion-absorbing components and must therefore always be directly placed together with an anchor in the main pipe.

All pipes and pre-insulated components are completely foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the joints.

See also pipe-laying instructions in chapter 5.1.4.

For further information see chapter 5.1.1 system description and for specifications for carrier pipes, insulations and jackets, see section 1.2 material specifications.



Component no. 34001L

T-fittings are supplied in the diameter combinations indicated in the table below. Other combinations are supplied on special order. If the branch pipe of the T-fitting is to be further reduced, use reduction pipes – see chapter 5.2.2. Logstor offers T-fittings with terminations as special products.

210°C series

		DN	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
		d_1	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273.0	323.9	355.6	406.4
		D_1	140	140	160	160	200	225	225	250	315	355	400	450	500	560	630
d_2	D_2	L_1	1000	1000	1000	1000	1200	1200	1200	1200	1200	1400	1400	1600	1600	1800	2000
26.9	140		500	500	500	500	500										
33.7	140			500	500	500	500	500									
42.4	160				500	500	500	500	500								
48.3	160					500	500	500	500	600							
60.3	200						500	500	500	600	600						
76.1	225							500	500	600	600	600					
88.9	225								500	600	600	600	600				
114.3	250									600	600	600	600	700			
139.7	315										600	600	600	700	700		
168.3	355											600	600	700	700	700	
219.1	400												600	700	700	700	800
273.0	450													700	700	700	800
323.9	500														700	700	800
355.6	560															700	800
406.4	630																800

L_2 is shown in the table.

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Straight T-fitting

250°C series

		DN	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
		d_1	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273.0	323.9	355.6	406.4
		D_1	200	200	225	250	315	315	315	355	450	450	500	560	630	630	710
d_2	D_2	L_1	1000	1000	1000	1000	1200	1200	1200	1200	1200	1400	1400	1600	1600	1800	2000
26.9	180		500	500	500	500	500										
33.7	180			500	500	500	500	500									
42.4	200				500	500	500	500	500								
48.3	225					500	500	500	500	600							
60.3	225						500	500	500	600	600						
76.1	250							500	500	600	600	600					
88.9	280								500	600	600	600	600				
114.3	315									600	600	600	600	700			
139.7	400										600	600	600	700	700		
168.3	400											600	600	700	700	700	
219.1	450												600	700	700	700	800
273.0	500													700	700	700	800
323.9	560														700	700	800
355.6	630															700	800
406.4	710																800

L_2 is shown in the table.

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T-fitting

HT3 components - Steel pipe system 5.2.6 - 1/2

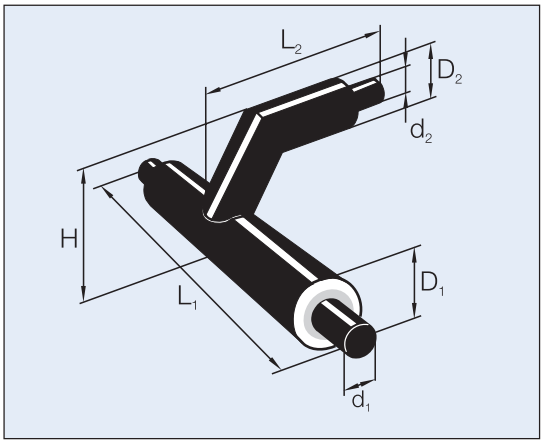
As standard, T-fittings and other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

Carrier pipes are made exclusively to the customer's specifications and the branch pipe is cranked at an angle of 45°.

T-fittings cannot be used as expansion-absorbing components and must therefore always be directly placed together with an anchor.

All pipes and pre-insulated components are completely foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

For further information see chapter 5.1.1 system description and for specifications of carrier pipes, insulation and jackets, see section 1.2 material specifications.



Component no. 30001L

T-fittings are supplied in diameters indicated in the table below. Other combinations can be supplied on order. If the branch pipe of the T-fitting is to be further reduced, use reductions – see chapter 5.2.2.

210°C series

			DN	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
			d_1	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273.0	323.9	355.6	406.4
			D_1	140	140	160	160	200	225	225	250	315	355	400	450	500	560	630
d_2	D_2	L_2	L_1	1000	1000	1000	1000	1200	1200	1200	1200	1400	1400	1600	1600	2000	2000	2000
26.9	140	1000		215	215	225	225	245										
33.7	140	1000			215	225	225	245	258									
42.4	160	1000				235	235	255	268	268								
48.3	160	1000					235	255	268	268	280							
60.3	200	1000						275	288	288	300	333						
76.1	225	1000							300	300	313	345	365					
88.9	225	1000								300	313	345	365	388				
114.3	250	1000									325	358	378	400	425			
139.7	315	1000										390	410	433	458	508		
168.3	355	1000											430	453	478	528	558	
219.1	400	1000												475	500	550	580	615
273.0	450	1000													525	575	605	640
323.9	500	1200														600	630	665
355.6	560	1200															660	695
406.4	630	1200																730

The height of the offset H is indicated in the table.

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T-fitting

HT3 components - Steel pipe system 5.2.6 - 2/2

250°C series

			D2	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
			d1	26.9	33.7	42.4	48.3	60.3	76.1	88.9	114.3	139.7	168.3	219.1	273	323.9	355.6	406.4
			D1	180	180	200	225	225	250	280	315	400	400	450	500	560	630	710
d2	D2	L2	L1	1000	1000	1000	1000	1200	1200	1200	1400	1400	1600	1600	1800	2000	2000	2000
26.9	180	1000		255	255	265	277	277										
33.7	180	1000			255	265	277	277	290									
42.4	200	1000				275	287	287	300	315								
48.3	225	1000					300	300	312	327	345							
60.3	225	1000						300	312	327	345	387						
76.1	250	1000							325	340	357	400	400					
88.9	280	1000								355	372	415	415	440				
114.3	315	1000									390	433	433	458	508			
139.7	400	1000										475	475	500	550	580		
168.3	400	1000											475	500	550	580	615	
219.1	450	1200												525	575	605	640	680
273	500	1200													600	630	665	705
323.9	560	1600														660	695	735
355.6	630	1600															730	770
406.4	710	1600																810

The height of the offset H is indicated in the table.

Total height from the bottom to the top of the jacket < ø450, H = D1 +D2 + 75 mm.

Total height from the bottom to the top of the jacket > ø500, H = D1 +D2 + 100 mm.

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Anchoring

HT3 components - Steel pipe system 5.2.7 - 1/1

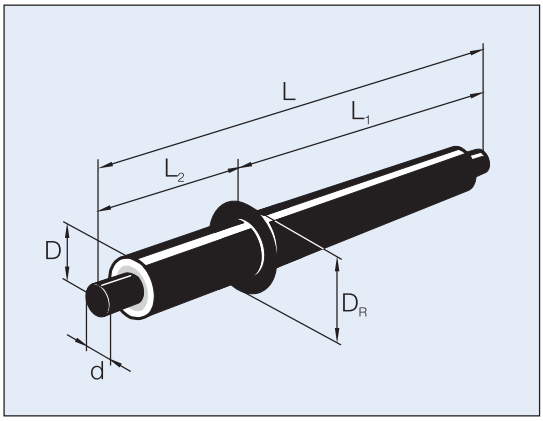
As standard, anchors and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

The anchor plate is sufficiently thermally insulated to ensure that the jacket pipe and shrink seals are not overheated. Its thickness and diameter are designed to ensure that any applied forces are transferred to the concrete block, see chapter 5.1.6.

All pipes and pre-insulated components are fully foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

For further details see chapter 5.1.1, system description.

For specifications of carrier pipes, insulations and jackets, see section 1.2, material specifications.



Component no. 40011L

DN	d	L	L_1	210°C series D	210°C series D_R	315°C series D	315°C series D_R
20	26.9	2000	1000	140	240	180	280
25	33.7	2000	1000	140	240	180	280
32	42.4	2000	1000	160	260	200	300
40	48.3	2000	1000	160	260	225	325
50	60.3	2000	1000	200	300	225	325
65	76.1	2000	1000	225	325	250	350
80	88.9	2000	1000	225	325	280	380
100	114.3	2000	1000	250	350	315	415
125	139.7	2000	1000	315	415	400	500
150	168.3	2000	1000	355	455	400	500
200	219.1	2000	1000	400	500	450	550
250	273.0	2000	1000	450	550	500	600
300	323.9	2000	1000	500	600	560	660
350	355.6	2000	1000	560	660	630	730
400	406.4	2000	1000	630	730	710	810

Anchors can be supplied with HT end cap in L_1 or L_2 ends. See also chapter 5.3.3.

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Anchor elbow

HT3 components - Steel pipe system 5.2.8 - 1/1

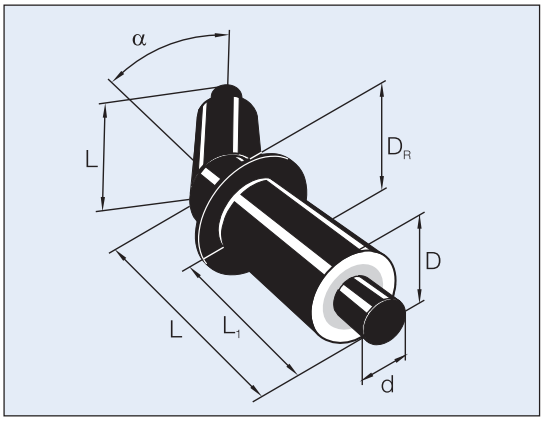
As standard, anchor elbows and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

The anchor plate is sufficiently technically isolated to ensure that the jacket pipe and shrink seals are not overloaded. Its thickness and diameter are designed to ensure that any applied forces are transferred to the concrete block, see chapter 5.1.5.

All pipes and pre-insulated components are fully foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

Further details are given in chapter 5.1.1, system description.

For specifications of carrier pipes, insulation and jackets, see section 1.2, Material specifications.



Component no. 40012L

DN	d	L	L_1	210°C series D	210°C series D_R	250°C series D	250°C series D_R
20	26.9	1700	1015	140	240	180	280
25	33.7	1700	1015	140	240	180	280
32	42.4	1700	1015	160	260	200	300
40	48.3	1700	1015	160	260	225	325
50	60.3	1700	1015	200	300	225	325
65	76.4	1700	1015	225	300	250	350
80	88.9	1700	1015	225	300	280	380
100	114.3	1700	1015	250	350	315	415
125	139.7	1700	1015	315	415	400	500
150	168.3	1700	1015	355	455	400	500
200	219.1	1700	1015	400	500	450	550
250	273.0	1700	1015	450	550	500	600
300	323.9	1700	1015	500	600	560	660
350	355.6	1700	1015	560	660	630	730
400	406.4	1700	1015	630	760	710	810

Anchors can be supplied with HT end caps in L_1 or L_2 ends. See also chapter 5.3.3.

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Compensator

HT3 components - Steel pipe system 5.2.9 - 1/1

As standard, compensators and all other pre-insulated components are supplied in two series, of 210°C and 250°C, respectively.

Compensators are available in standard format of PN 16 or PN 25.

Compensators for higher pressures are made to customer's specifications.

Nominal pressure applies at 120°C.

At 200°C, a pressure reduction factor of 0.91 and at 300°C a factor of 0.82 is required.

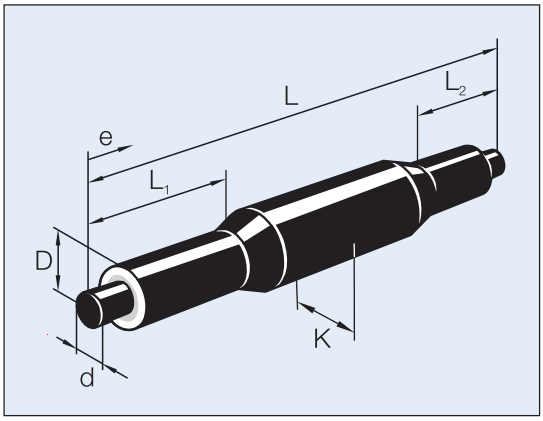
All pipes and pre-insulated components are fully foamed at the ends, protecting the mineral wool end sections against damp during storage and handling. The pipe ends may only be cut and removed after the carrier pipes have been welded and just before shrinkage of the sleeves.

The compensator is factory-set for maximum expansion absorption and retaining bolts are used to retain this setting. The bolts will burst once the compensator becomes active, and the required burst force P, is stated below.

The expansion-absorbing element is a corrugated section consisting of several layers of stainless steel welded to both ends of the pipe. This section is approved to max. 1000 full load cycles.

A housing of either steel or stainless steel protects this construction and the compensator exerts spring force at a constant C_A.

The effective corrugated surface A_B mm^2 is stated below.



Component no. 41001L

Further details are given in chapter 5.1.1, system description.

For specifications of carrier pipes, insulation and jackets, see section 1.2, material specifications.

d, mm	L, mm	210°C / PN 16						250°C / PN 25					
		D, mm	K, mm	ΔLe, mm	P, kN	C_A, N/mm	A_B, mm^2	D, mm	K, mm	ΔLe, mm	P, kN	C_A, N/mm	A_B, mm^2
48.3	2500	160	200	100	18	15	4100	-	-	-	-	-	-
60.3	2500	200	250	100	18	43	5500	-	-	-	-	-	-
76.1	2500	225	280	100	18	51	7600	-	-	-	-	-	-
88.9	2500	225	280	100	18	45	10800	280	400	90	18	37	10900
114.3	2500	250	315	125	18	27	17300	315	400	90	18	31	16700
139.7	2500	315	400	125	23	58	23700	400	500	90	23	58	24800
168.3	2500	355	400	125	23	63	33200	400	500	90	23	45	35100
219.1	3000	400	450	125	23	53	56000	450	560	90	23	66	57600
273.0	3000	450	500	125	41	81	81000	500	630	90	41	106	85700
323.9	3000	500	560	125	41	91	110700	560	710	90	41	153	121600
355.6	3000	560	630	125	64	101	130500	630	710	90	64	105	136500
406.4	3000	630	710	125	64	108	173800	710	800	90	64	119	179300

The compensators can be supplied with double expansion on request.

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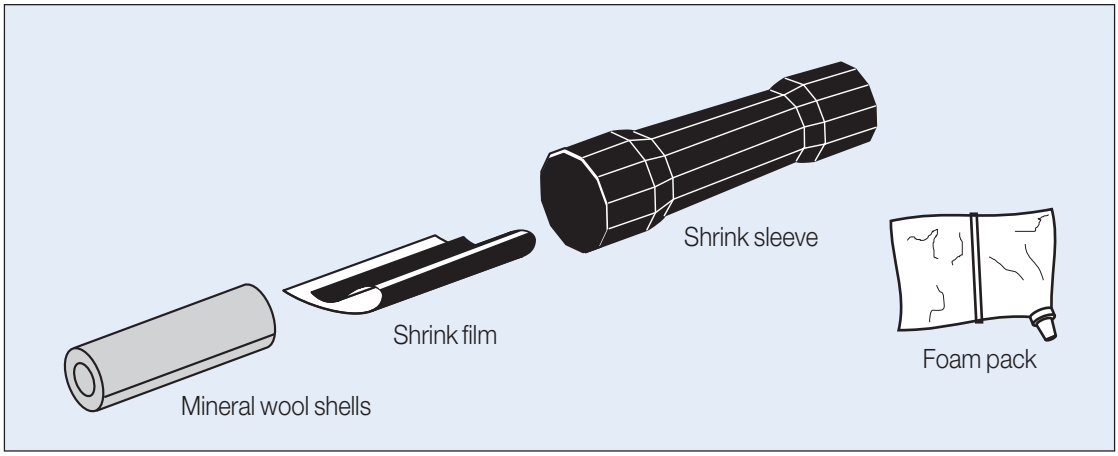
HBXS

High temperature joint for foaming

The HBXS joint consists of a half sleeve of mineral wool covered by foamed PUR insulation in an aluminium sleeve.

The joint is double sealed. Once the sleeves are fitted, a shrink film is applied as the initial seal. For further sealing of the joint and as a mechanically fixed jacket pipe joint, a thick walled PEX shrink sleeve is fitted using a hotmelt adhesive on both ends.

The HBXS joint can be used anywhere it has been established that soil friction can firmly hold the jacket pipe in place. See chapter 5.1.6.



Component no. 50111LC

DN	d, mm	L, mm	210°C series					250°C series				
			D, mm	S_M,mm	S_{PUR}, mm	PUR litre	Foam pack size	D, mm	S_M,mm	S_{PUR}, mm	PUR litre	Foam pack size
20	26.9	780	140	20	34	3.6	1	180	40	33	4.9	3
25	33.7	780	140	20	30	3.3	1	180	40	30	4.6	2
32	42.4	780	160	20	36	4.4	2	200	40	35	5.9	4
40	48.3	780	160	20	33	4.2	2	225	50	35	6.7	4
50	60.3	780	200	30	37	6	4	225	50	29	5.9	4
65	76.1	780	225	30	41	7.6	5	250	50	33	7.4	5
80	88.9	780	225	30	35	6.7	4	280	60	31	8.2	5
100	114.3	780	250	30	34	7.6	5	315	60	36	10.4	6
125	139.7	780	315	40	43	12	7	400	80	44	16.5	9

S_M : Mineral wool thickness in the insulation sleeve

S_{PUR}: PUR insulation thickness

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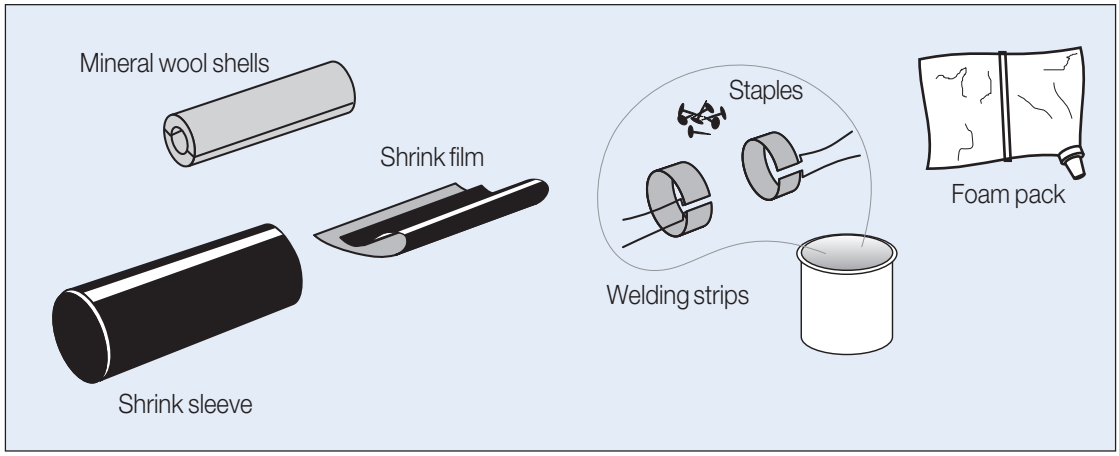
HEW

High temperature joint for foaming

HT3 components - Joints **5.3.2 - 1/1**

The HEW joint consists of mineral wool insulation covered by foamed PUR insulation in an aluminium sleeve. A shrink film is applied as the initial seal. A thick walled HDPE shrink sleeve is fitted to the joint for additional sealing in order to obtain a mechanically solid jacket pipe joint. The sleeve is welded at both ends using electrically-heated welding strips, making the joint tensile resistant and load carrying from one end to another.

The HEW sleeve should be used in instances where it cannot be ascertained that soil friction alone can hold the jacket pipe in place. See chapter 5.1.6.



Component no. 50111LC

HEW joint, standard

DN	d, mm	210°C series					250°C series				
		L, mm	D, mm	S_M, mm	PUR, litre	Foam pack size	L, mm	D, mm	S_M, mm	PUR, litre	Foam pack size
50	60.3	-	-	-	-	-	700	225	50	5.9	4
65	76.1	700	225	30	7.6	5	700	250	50	7.4	5
80	88.9	700	225	30	6,.	4	700	280	60	8.2	5
100	114.3	700	250	30	7.6	5	700	315	60	10.4	6
125	139.7	700	315	40	12	7	700	400	80	16.5	9
150	168.3	700	355	50	12.7	7	700	400	80	12.3	7
200	219.1	700	400	50	13.7	8	700	450	80	13.9	8
250	273	700	450	50	14.9	8	700	500	80	14.7	8
300	323.9	700	500	50	16.6	9	700	560	80	18.7	9
350	355.6	700	560	50	25	10	750	630	100	20.8	10
400	406.4	750	630	60	28.3	11	750	710	100	32.1	11

S_M : Mineral wool thickness in insulation sleeve

S_{PUR}: PUR insulation thickness

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HDHEC

High temperature end cap

The HDHEC end cap is designed to protect all pipe ends in the system against moisture and air seepage. All open pipe ends MUST be fitted with HT caps, as mistakes will reduce the thermal life of the system and no claims for deficiencies will be entertained.

HDHEC consists of:

- A cone of stainless steel that slots into the carrier pipe at one end and into the insulation between the mineral wool and the PUR at the other. The cone is welded to the carrier pipe.
- To insulate the cone from the carrier pipe, a half shell of mineral wool is positioned into the cone.
- The foam is protected by a cross-linked shrinkable termination which shrunks around the jacket and the cone.

HDHEC must never be insulated externally as this will cause an unacceptable temperature increase in the shrink-materials.

HDHEC can only tolerate a certain amount of expansion so the maximum distance from an HDHEC end cap to an anchor cannot exceed:

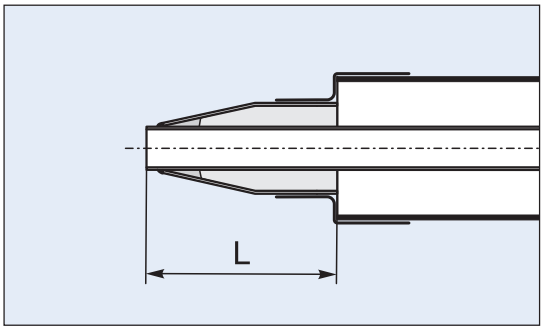
For black steel.

- 5 m in the 210°C series
- 3 m in the 250°C series

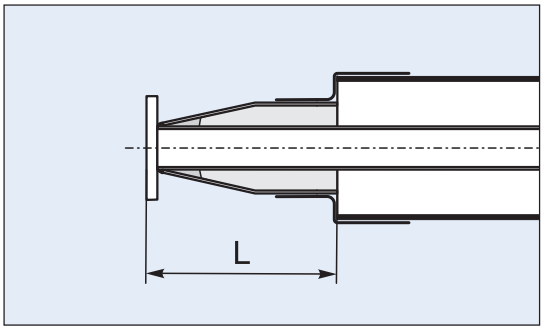
For stainless steel.

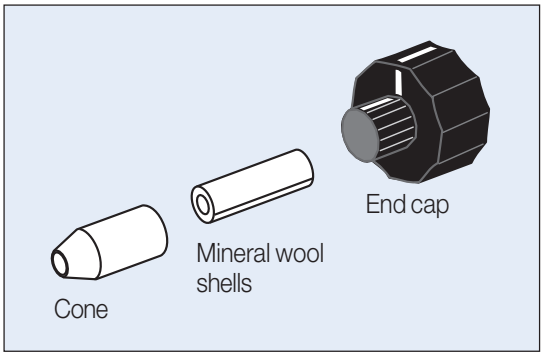
- 3 m in the 210°C series
- 2 m in the 250°C series

Example 1



Example 2





Component no. 55101L

Version/03.2006.DK

HDHEC

High temperature end cap

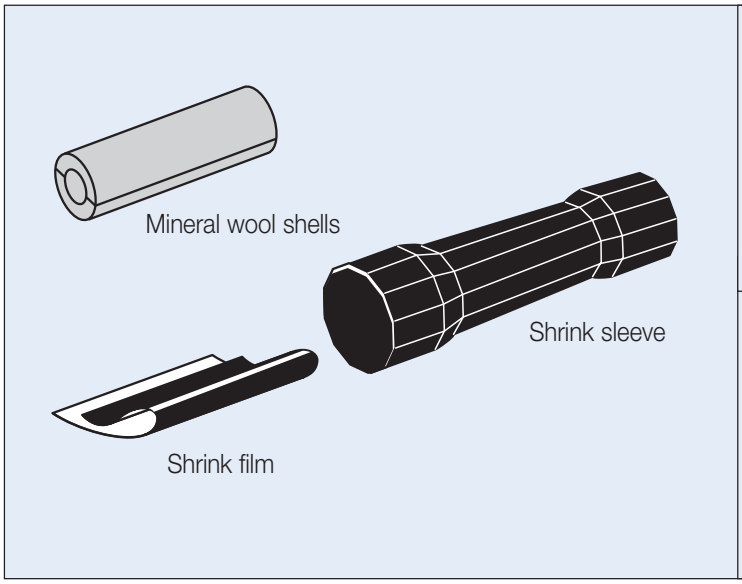
DN	d	Serie 210°C		Serie 250°C	
		D	L	D	L
20	26,9	140	175	180	175
25	33,7	140	195	180	195
32	42,4	160	205	200	205
40	48,3	160	215	225	215
50	60,3	200	215	225	215
65	76,1	225	235	250	235
80	88,9	225	235	280	235
100	114,3	250	235	315	235
125	139,7	315	255	400	255
150	168,3	355	255	400	255
200	219,1	400	275	450	275
250	273,0	450	425	500	425
300	323,9	500	455	560	455
350	355,6	560	485	630	485
400	406,4	630	515	710	515

Version/03.2006.DK

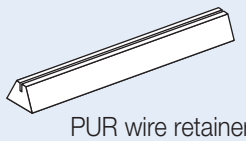
HBXS

High temperature joint for foaming

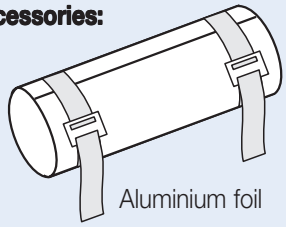
HT3 installation 5.4.1 - 1/3

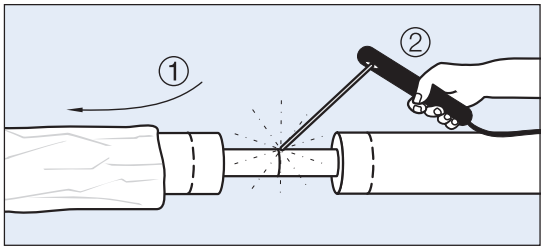


If sensor wires:

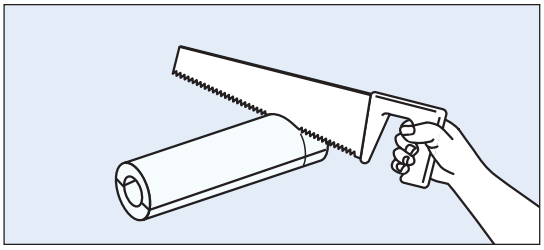


Accessories:

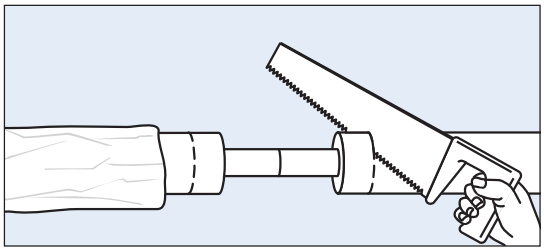




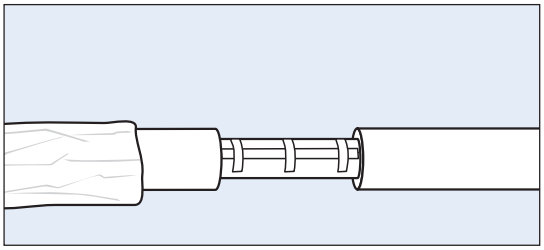
1. Place the shrink sleeve with packing on one of the pipes, before the carrier pipes are joined.



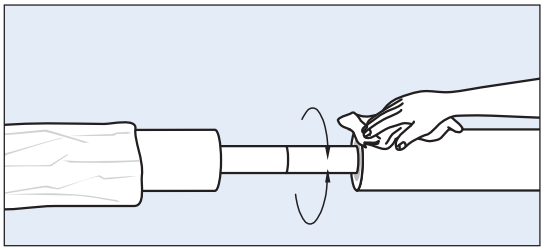
4. Shorten the mineral wool shells to make them fit tightly between the jacket pipes.



2. Cut the jacket pipes at the markings.



5. Fit the mineral wool shells tightly on the carrier pipe using adhesive tape to seal gaps.



3. Clean all surfaces in the mounting area.

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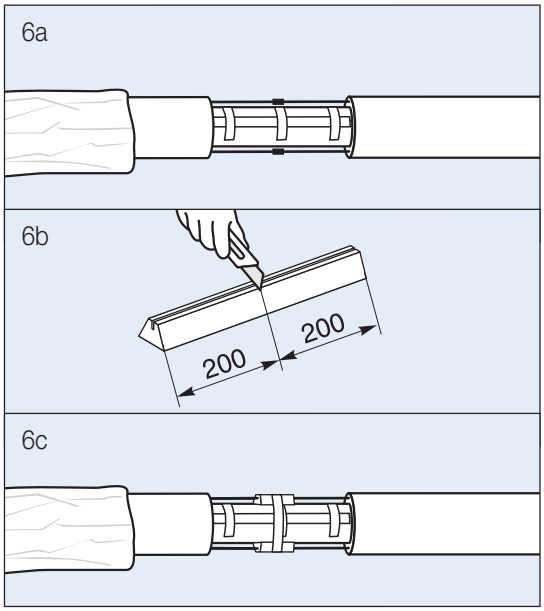
HBXS

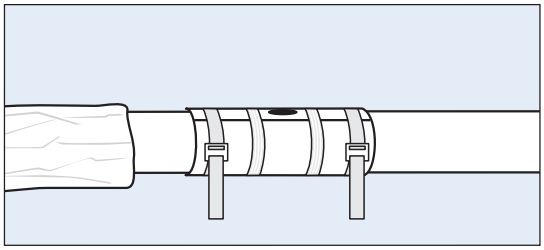
High temperature joint for foaming

HT3 installation 5.4.1 - 2/3

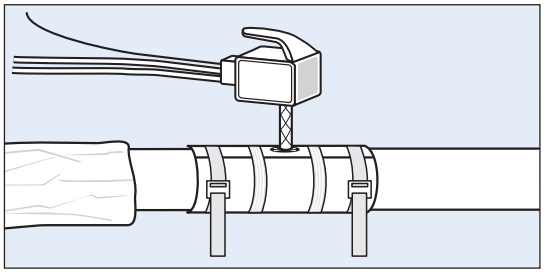


6. The following only applies for sensor wires:

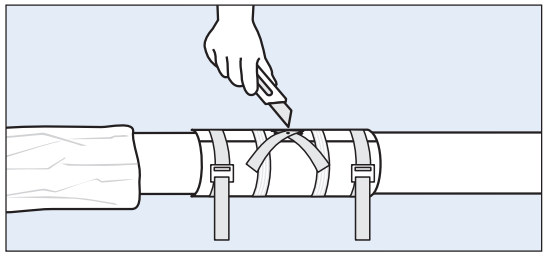
Connect the sensor wires according to the supplier's instructions. Divide the PUR wire retainer in 2 sections. Centre the wire retainers under the sensor wires and fasten them with canvas tape.



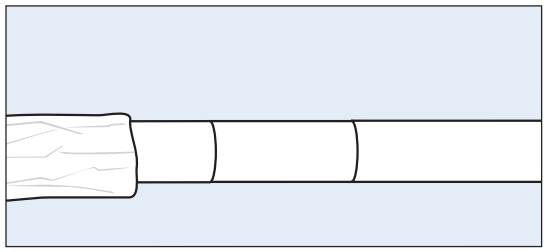
7. Centre the aluminium foil over the joint. Tighten the straps. Wind filament tape round the foil on both sides of the hole.



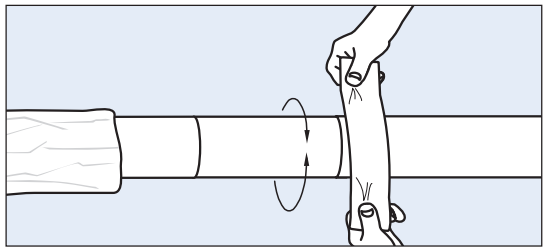
8. Foam the aluminium foil.



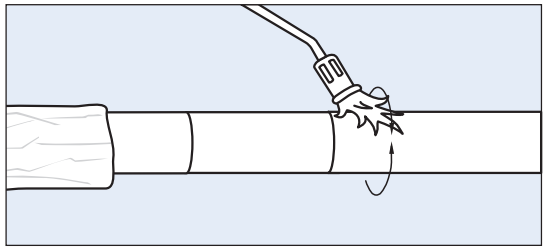
9. Close the opening with canvas tape. Prick a ventilation hole.



10. Wait minimum 30 minutes for degassing. Remove the aluminium foil.



11. Activate the jacket pipes with abrasive cloth grain size 80 at least 150 mm from both jacket ends.



12. Activate the jacket pipes with a gas burner at least 150 mm from both jacket ends, until the surface has a matt, silky look.

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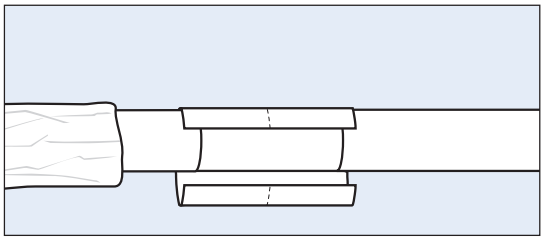
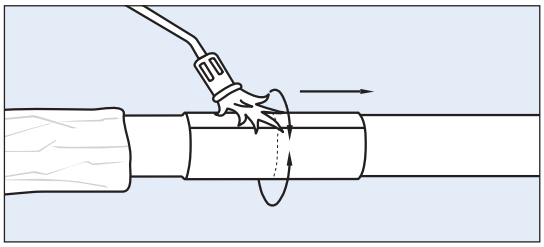
HBXS

High temperature joint for foaming

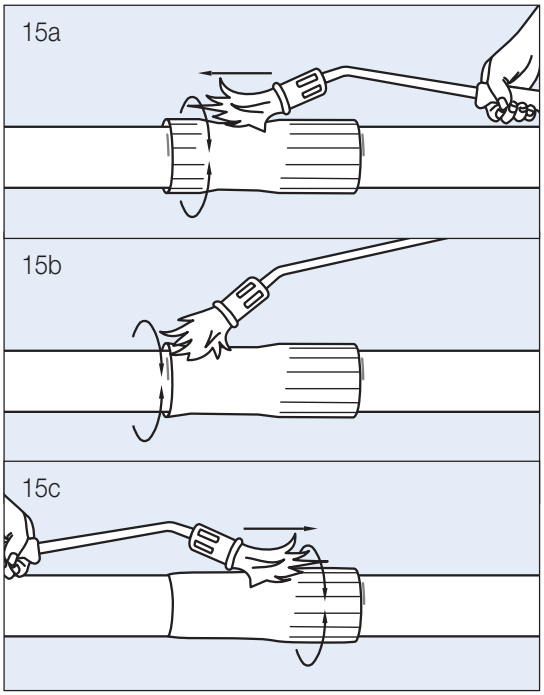
HT3 installation 5.4.1 - 3/3



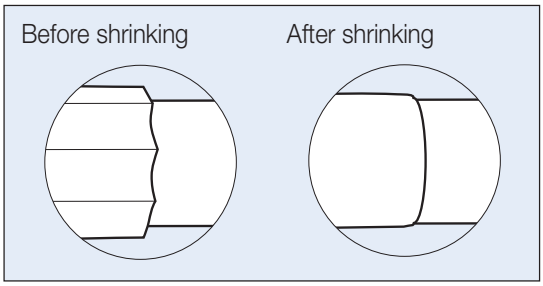
13. Place the shrink film so that the marking line encircles the pipe. Attach one edge of the shrink film at „10 o'clock" position. Pull the film around the pipe by removing the adhesive paper so that the film adheres to the surface beneath.



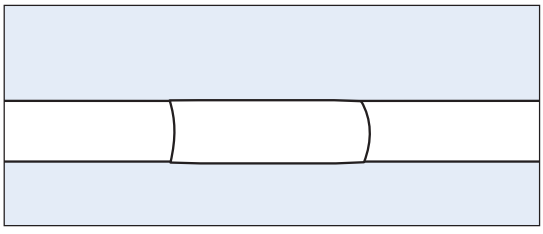
14. Heat the whole film from the centre outwards, ensuring that the mastic becomes visible at all edges and that the shrink film is tightly fitted.



15. Remove the packing from the shrink sleeve. Check that the sleeve is CLEAN and DRY, inside and out. Centre the shrink sleeve on the joint and mark it. First, shrink from the middle towards one end, then from the middle towards the other end. Avoid heating directly on the jacket.



16. Shrink until all expansion marks have vanished and the ends of the sleeve form a smooth encircling edge.



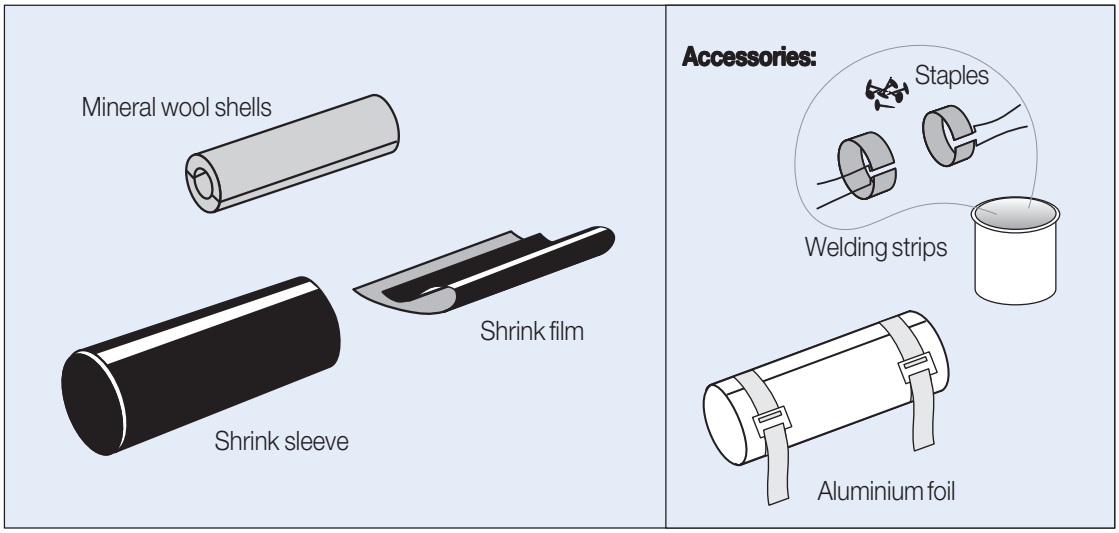
17. The joint is complete.

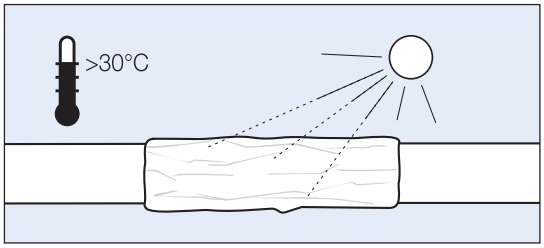
Version/03.2018UK

HEW

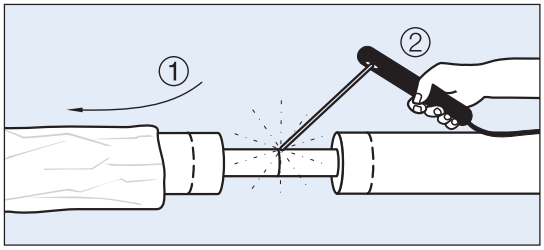
High temperature joint for foaming

HT3 installation 5.4.2 - 1/4

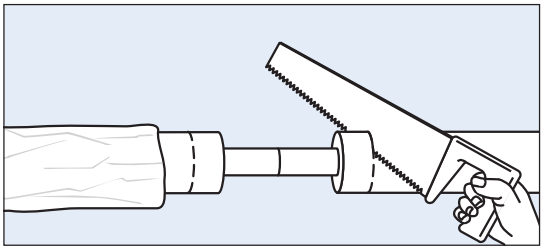




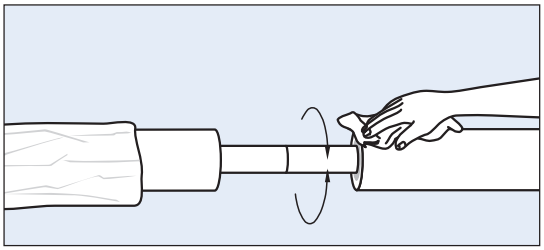
If the surrounding temperature is >30° or the shrinking sleeve is exposed to sunlight, the wrapping foil must remain on the pipeline until the shrinking sleeve has been shrunk. The shrink sleeve must be covered up with wrapping foil when it is not being processed.



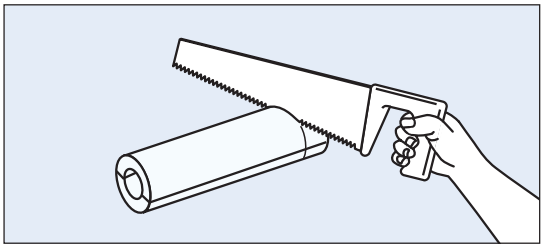
1. Place the shrink sleeve with packing on one of the pipes, before the carrier pipes are joined.



2. Cut the jacket pipes at the markings.



3. Clean all surfaces in the mounting area.



4. Shorten the mineral wool shells to make them fit tightly between the jacket pipes.

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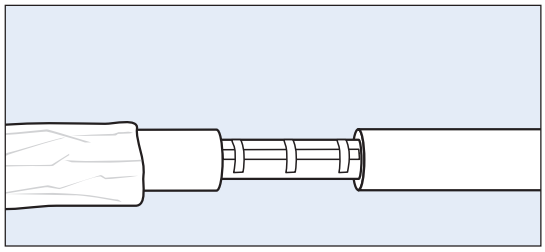
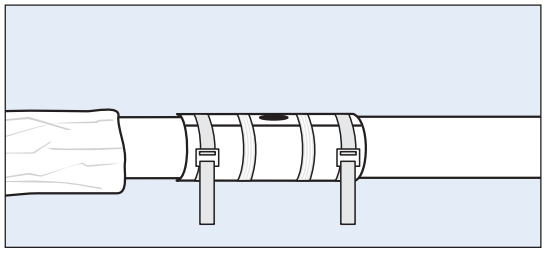
HEW

High temperature joint for foaming

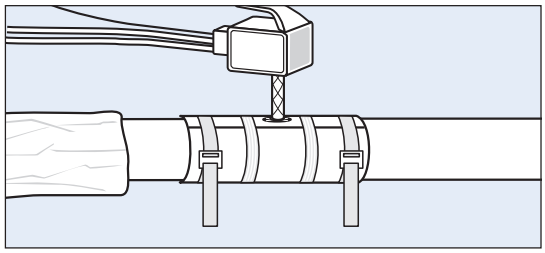
HT3 installation 5.4.2 - 2/4



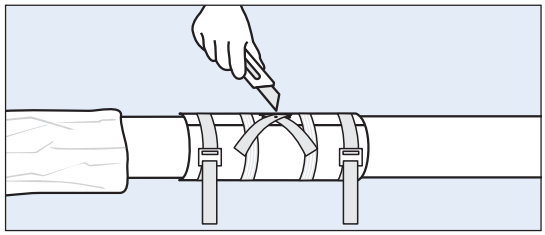
5. Fit the mineral wool shells tightly between the jacket pipes, using canvas tape if required.



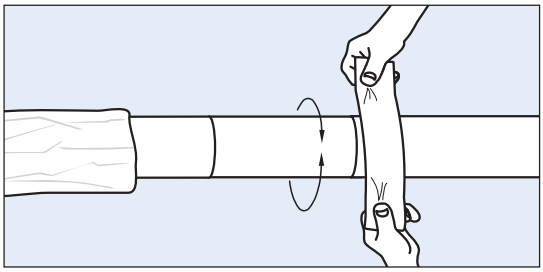
6. Centre the aluminium foil over the joint. Tighten the straps. Wind filament tape round the foil on both sides of the hole.



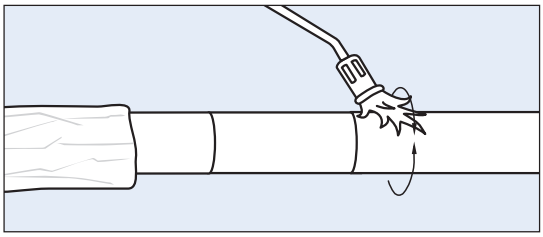
7. Foam the aluminium foil.



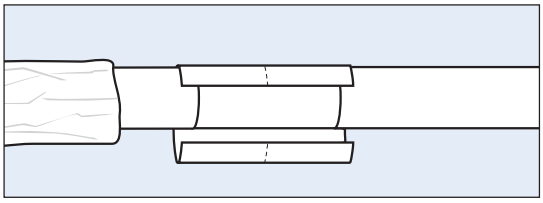
8. Close the opening with canvas tape. Prick a ventilation hole.



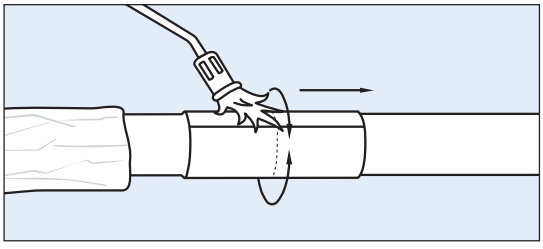
9. Wait minimum 30 minutes for degassing. Remove the aluminium foil. Activate the jacket pipes with abrasive cloth grain size 80 at least 150 mm from both jacket ends.



10. Activate the jacket pipes with gas burner at least 150 mm from both jacket ends, until the surface has a matt, silky look.



11. Place the shrink film so that the marking line encircles the pipe. Attach one edge of the shrink film at „10 o'clock" position. Pull the film around the pipe by removing the adhesive paper so that the film adheres to the surface beneath.



12. Heat the whole film from the centre outwards, ensuring that the mastic becomes visible at all edges and that the shrink film is tightly fitted.

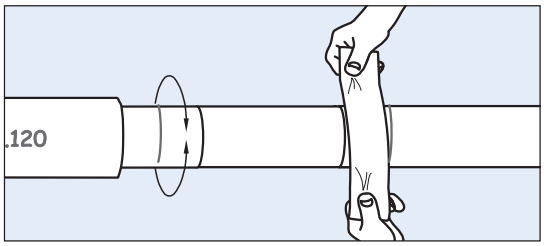
Version/07.2005.DK

HEW

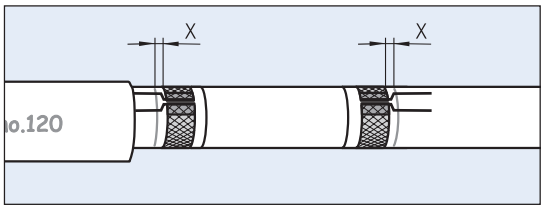
High temperature joint for foaming

HT3 installation 5.4.2 - 3/4

13. Remove the packing from the shrink sleeve. Do not use cutting tools. Leave the packing on the pipeline. Check that the sleeve is CLEAN and DRY, inside and out. Centre the sleeve over the jointing area. Mark the placing of the sleeve on the jacket pipes. Write the sleeve number on the sleeve. Fill in the documentation form.



14. Pull the sleeve away on the cleaned pipe end. Thoroughly activate the jacket pipes with abrasive cloth, grain size 36-40, exactly touching the marking.

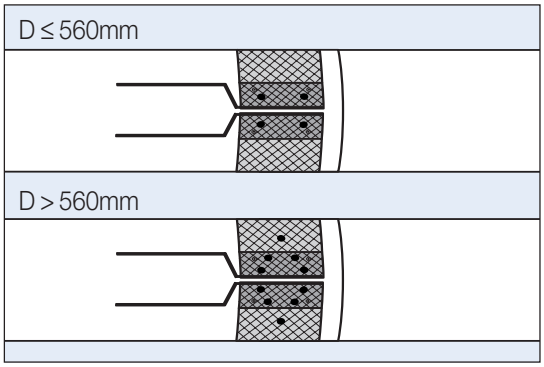


15. Mount the welding elements with the distance X to the marks.

D ≤ 560 mm ⇒ X = 20 mm.

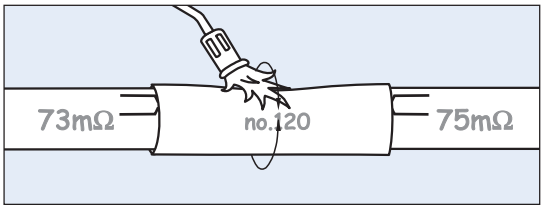
D > 560 mm ⇒ X = 30 mm.

Stretch the elements uniformly so that the element ends exactly do NOT touch.

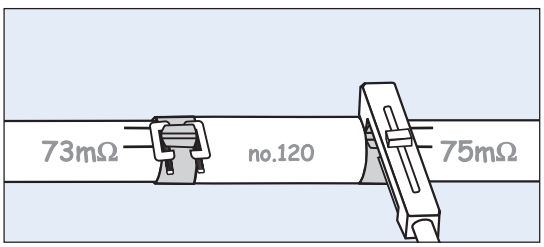


16. Mount the welding elements with nails as shown above and with a nail each 250 mm around the jacket pipes.

17. Place the sleeve between the marks. Write the joint number and resistance values for the welding element on the sleve/jacket pipes and in the documentation form.



18. Shrink the sleeve from the middle towards the ends. Shrink the sleeve until it is in full contact with welding elements, insulation and jacket pipe.

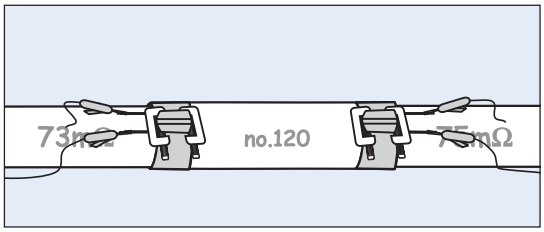


19. Mount clamps 5-10 mm over the sleeve ends. Press the clamps until the jacket pipe starts to deform (max. 0.1 mm). Keep the clamps tightly positioned by using a clamping tool.

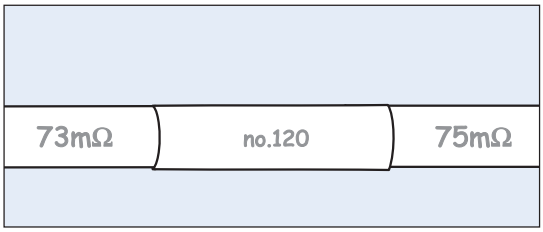
Version/07.2005.DK

HEW

High temperature joint for foaming



20. Adjust the cutoff voltage on the welding machine for each welding element according to the actual welding parameters. Mount the welding clips at the tip of the terminal wires. Start welding. After completed welding wait until the sleeve is hand-warm, at least 30 minutes. Wait until the clamps are handwarm underneath, before they are removed.



21. Check the joint.

Criteria for approval of EW joint:

- No visible welding elements
- No severe local melt out
- No deformation

After approval of the joint, cut off the terminal wires at the joint edge.

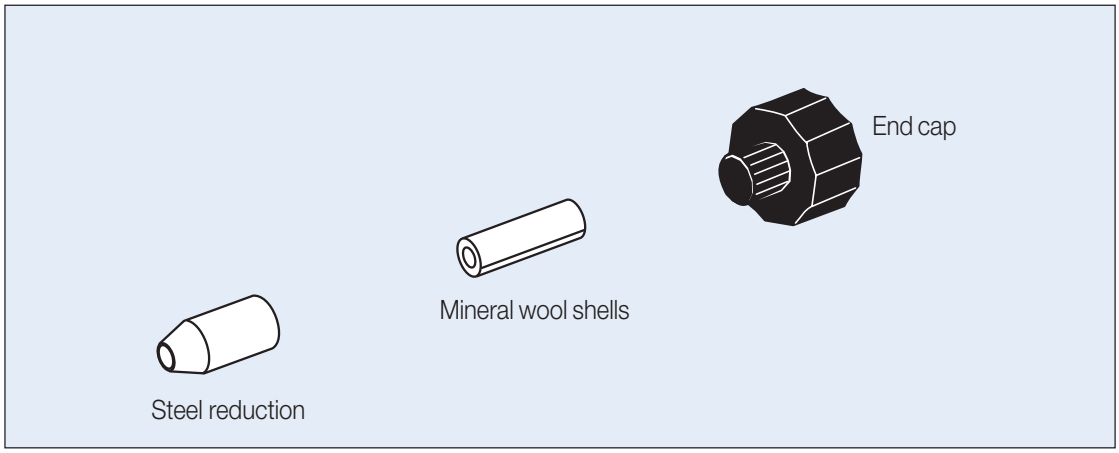
The joint is complete.

Version/07.2005.DK

HDHEC

High temperature end cap

HT3 installation **5.4.3 - 1/3**



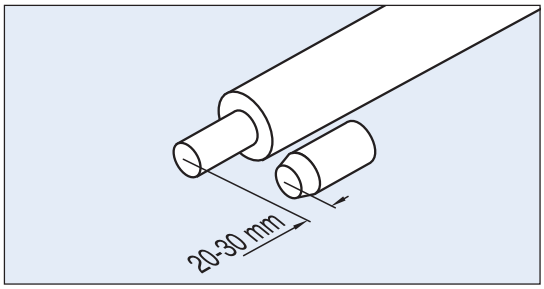
Important:

Never apply heat to creases, if any, since the material will be discoloured and the surface will crack.

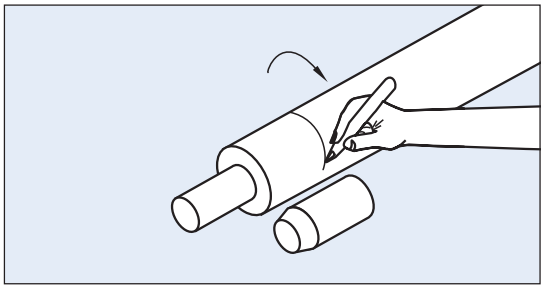
Never apply heat underneath the end cap, as this may damage the end cap permanently.

Pockets of air under the end cap can be removed by bending a piece of welding wire into U-shape and pushing it underneath the end cap while it is still warm.

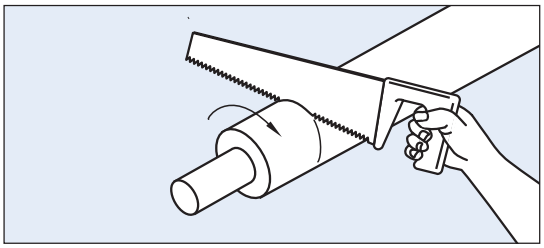
Use burner head dia. 51 mm for all dimensions.



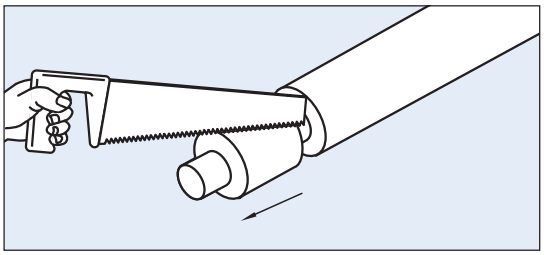
1. Place the steel reduction 20-30 mm from the steel pipe end.



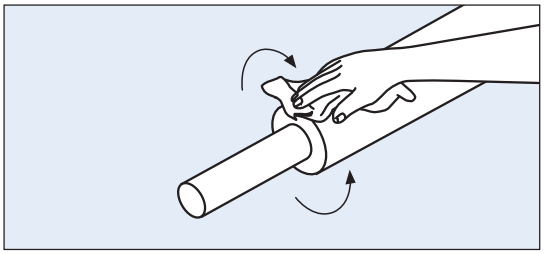
2. Mark the length of the steel reduction on the jacket.



3. Cut the jacket and insulation using the marks as a guide.



4. Cut lengthwise through the jacket and remove jacket and insulation material.



5. Clean all surfaces in the mounting area.

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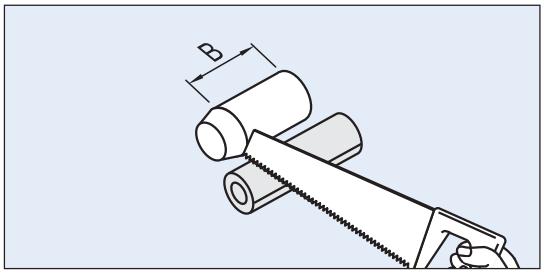
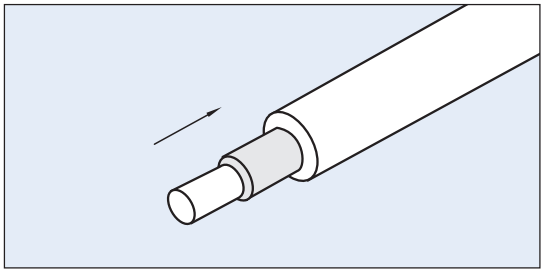
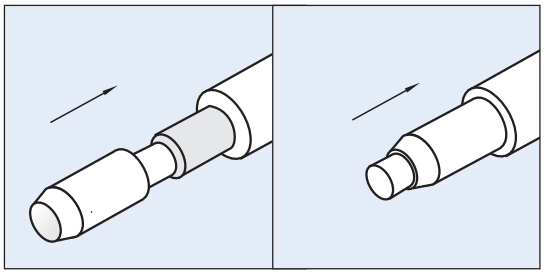


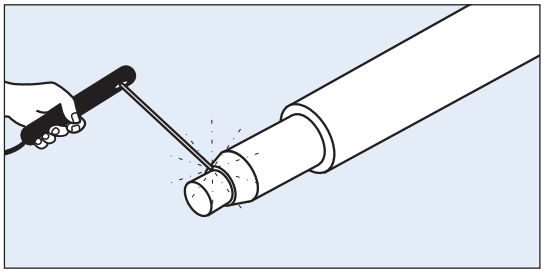
6. Adjust the mineral wool shells to the length (B) of the steel reduction.



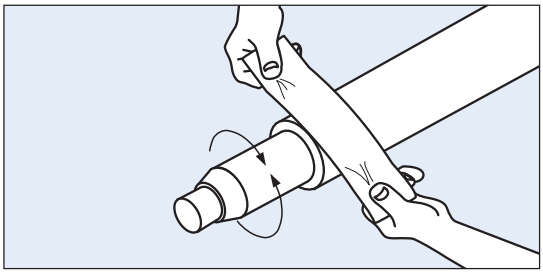
7. Place the mineral wool shells on the carrier pipe as close to the PUR insulation as possible.



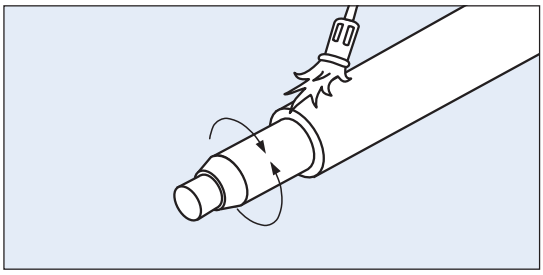
8. Pull the steel reduction onto the carrier pipe and the mineral wool shells. The steel reduction is placed correctly when it is in contact with the PUR insulation.



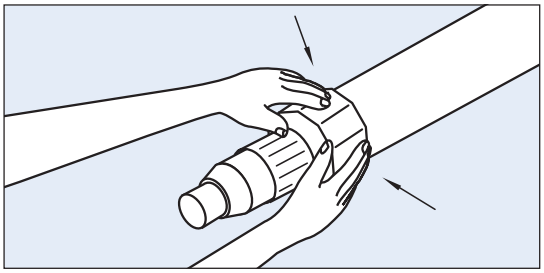
9. Weld the steel reduction to the carrier pipe. The welding has to be tightly.



10. Activate the steel reduction and the jacket pipe with abrasive cloth grain size 80 at least 60 mm from the end of the jacket pipe.



11. Activate the steel reduction and the jacket with gas burner at least 60 mm from the end of the jacket pipe until the jacket surface has a matt, silky look.



12. Remove the foil inside the end cap. Check that it is CLEAN and DRY, inside and out. Pull the end cap onto the steel reduction and jacket.

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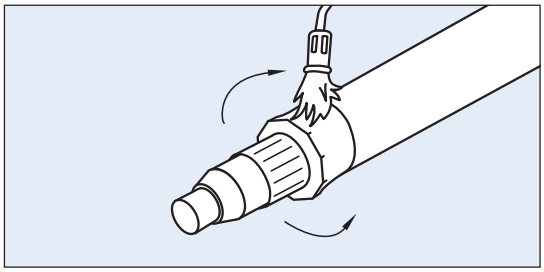
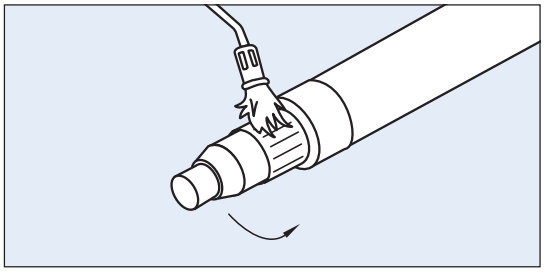
High temperature end cap

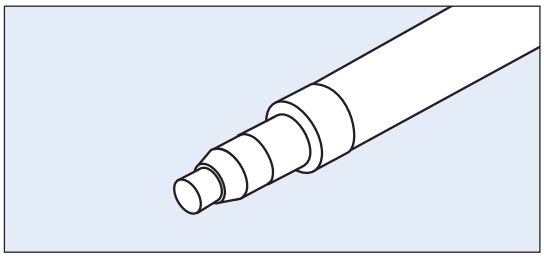
HT3 installation 5.4.3 - 3/3



13. Start shrinking the end cap onto the jacket pipe only. DO NOT YET shrink the edge of the end cap nor the end surface onto the jacket pipe. The flame must be held at a right angle to the pipe surface.



14. After a pause of approx. 3 min. shrink the end cap onto the steel reduction and at the same time the edge of the end cap and the end surface onto the jacket pipe. The flame must be held at a right angle to the pipe surface.



15. The end cap is complete when the sealing becomes visible on the steel reduction and the end cap is smooth.

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