

Pre-insulated pipes for industrial applications



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ABOUT LOGSTOR

LOGSTOR is a global supplier of complete pre-insulated pipe systems, focusing on ensuring our customers greater energy efficiency. Our company is based on years of experience and knowledge of insulation as a means of improving energy efficiency.

FACTS ABOUT THE COMPANY

- Head quarters in Denmark
- More than 50 years of experience with proven results
- More than 200,000 km of pre-insulated pipes delivered
- Complete solutions

THE MOST AMBITIOUS SOLUTIONS FOR THE INDUSTRIAL SECTORS

It has been over 50 years since LOGSTOR invented the technology of groundbreaking district heating solutions that revolutionized and still sets new standards for the energy sector. As the world's leading manufacturer of pre-insulated pipe systems, the requirement for LOGSTOR's energy efficient products is high. Production is characterized by extensive experience and constant innovation with the latest technology. This ensures that our customers invest in the future's most energy efficient and sustainable supply of liquids and gases for district heating and cooling, the ship and oil and gas industry.

LOGSTOR is headquartered in Logstør, Denmark, and employs approx. 1200 skilled people distributed in 13 countries worldwide. Production is carried out at 8 plants, situated in Denmark, Sweden, Finland and Poland.

The world's leading producer of pre-insulated pipe systems

When choosing pipes for industrial use, you often face a challenge. For example, do you choose pipes with expensive supplementary insulation, or do you take the new option and choose a modern, ready insulated pipe system that is installed once and for all?

Pipes from LOGSTOR are totally non-corrosive, and are supplied ready insulated (pre-insulated) from the factory. Ready for installing and fitting in a system that rarely requires any further maintenance. Thus, there is no need of supplementary insulation, and at the same time the best insulation in the market is obtained: the lambda value is below $0.027 \text{ W/m}^{\circ}\text{C}$ during the entire service life of the pipe system. The pipes are easy to clean, and tolerate strong detergents and high-pressure cleaning.

The tight insulation guarantees a long service life span. Carrier pipes are kept dry, and therefore do not corrode. The result is fewer repair costs and production stops as a result of external corrosion. The pipes' insulation qualities guarantee an ideal working environment. The integration of tracers to maintain the temperature minimises problems with coagulation and the resulting production stops. Efficient insulation in pipes carrying steam means that the number of steam traps can be reduced.



ADVANTAGES OF USING PRE-INSULATION INSTEAD OF TRADITIONAL INSULATION:

- 100% watertight
 - 100% corrosion protected
 - energy saving
 - no maintenance costs
 - UV resistant
 - increased surface strength
-



Pre-insulated pipes from LOGSTOR

A PRE-INSULATED PIPE NORMALLY CONSISTS OF THREE PARTS

Inside is the carrier pipe, which is typically made of steel, stainless steel, copper or plastic. Then comes an insulating layer of polyurethan foam (PUR foam) or polyisocyanurate foam (PIR foam), which is specially suited due to its high insulation qualities compared to mass and volume. On the outside is a protective casing of plastic or steel.

The choice of carrier pipe, foam type and foam thickness, as well as the material for the casing, is made by the customer, who can also choose to supply carrier pipes for the project.

1 CARRIER PIPES

Steel	Seamless or welded
Stainless steel	Seamless or welded
Plastic	PE, PP etc.
Copper	

We insulate all types of carrier pipe supplied by the customer.

2 INSULATION

Low temperature · LT	-200°C to -60°C
Normal temperature · NT	-60°C to +120°C
High temperature · HT	+120°C to +250°C · PUR/Mineral wool · PIR

3 CASING PIPES

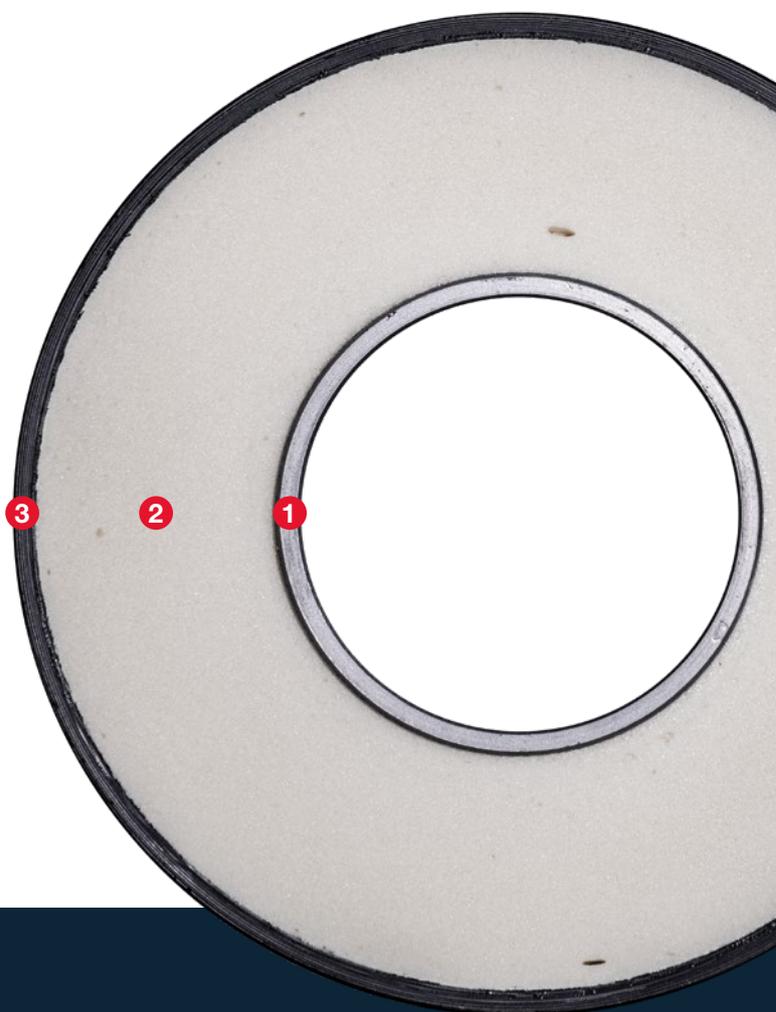
Plastic	PE-HD · Black or white
Steel	Black or stainless
Spiro	Galvanised · Aluminium · Stainless

CASING

As standard, industrial pipes are supplied with a PE-HD (polyethylene) casing, in black or white. These casings have many advantages, as they are impact-proof, watertight, resistant to salt and chemicals, hygienic and non-corrosive. Pipes with black PE-HD casings are UV-resistant, as a result of the addition of UV-retardant additives. Black casing pipes can therefore be used both outdoors and indoors. Pipes with black PE-HD casings are always used for buried pipe systems. White casings can only be used for indoor pipe installations.

CARRIER PIPES

The pipes are normally supplied with carrier pipes of steel; however, LOGSTOR also pre-insulates other types of carrier pipe on request, for instance PE pressure pipes and copper pipes. The pipe can be fitted with one or more tracer pipes.



The various casings are approved in accordance with NT Fire 036. The relevant fire classifications are listed in the figure to the right.

Casing pipes in other qualities and materials can be supplied to order. Some examples include: coated steel pipes, Corten pipes, and special plastic pipes.



Fire classifications · NT Fire 036

Black PE-HD	Class 3
White PE-HD	Class 3
Aluminium spiro	Class 2
Galvanised steel	Class 1
Steel in steel	Class 1

Ten good reasons to choose LOGSTOR

Pre-insulated pipe systems have several advantages over traditionally insulated pipes:

1 Pre-insulated pipes using polyurethan foam (PUR foam) or polyisocyanurate foam (PIR foam) as insulation have high insulation qualities. It is a fact that heat loss in a pre-insulated pipe from LOGSTOR is approx. 40% less than in a corresponding system with traditional insulation (mineral wool and metal casing). This saving is often so significant that any additional costs at the point of delivery are recovered in less than one year.

LOGSTOR's online calculation program calculates the savings based on customer specifications. See page 20 for more information.

2 Pipe supports are fitted outside the casing, thus avoiding cold and heat bridges.

3 The casing is made of black or white polyethylene, produced in accordance with EN 253.

Pipes with black PEH casings are UV-resistant, as UV-retardant additives are added. Black casing pipes can therefore be used both indoors and outdoors without limitations.

PEH casing pipes are also resistant to salt and chemicals.

4 The insulation and casing together have a very high mechanical strength, which makes pre-insulated pipe systems resistant to physical effects, e.g. when they are used as a foot bridge.

5 Pipe and casing units are 100% watertight, so the pipe systems can be rinsed and washed. Clean pipes result in a better working environment, with low maintenance costs.

6 A report on the cleanability of the surfaces of LOGSTOR pipe and joints made by Danish Technological Institute (DTI) shows that the smooth surfaces of casing pipes and joints are just as easy to clean as the surfaces of stainless steel.

7 Low operating costs throughout the service life time of the pipe system:

8 Quick, problem-free installation in one process, without long periods of disruption of operations.

9 Minimal maintenance costs.

10 Effective corrosion resistance.

7 Low operating costs throughout the service life time of the pipe system:





Areas of application for pre-insulated pipe systems

In a large number of projects, major benefits can be achieved by using pre-insulated pipe systems

Pre-insulated pipe systems are used by the chemical, pharmaceutical, petro chemical and food industries for the transport of:

- Waste water
- Cooling water
- Hot water
- Steam
- Hydrocarbon
- Condensate
- Chemicals
- Lye
- Oil

At operating temperatures below room temperature, condensation will be formed in traditional insulation. The required diffusion density can be achieved in the easiest and cheapest way with the LOGSTOR system.



Our engineers and technicians offer a system analysis for each project, in order to determine whether it is advantageous to use pre-insulated pipes.

PUR insulation

LOGSTOR pre-insulated industrial pipes are insulated with polyurethane foam (PUR foam), which has extremely high insulation properties. Polyurethane has a lambda value of 0.022 at -20°C and 0.027 at +50°C.

The polyurethane foam is produced from polyol and isocyanate. The foam is homogenous and complies with the functional requirements of EN 253.

PUR is unsurpassed as insulation material for pipe systems between -200°C and +120°C and in combination with mineral wool up to +250°C. It is pressure-resistant, and in combination with the carrier and casing pipe it creates a solid sandwich design. PUR retains its mechanical properties for more than 30 years.



PUR INSULATION

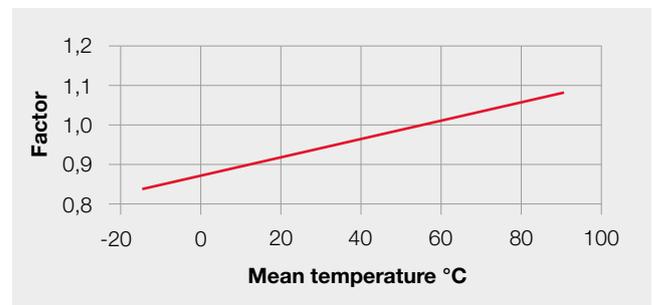
Material	Polyurethane foam is made of polyol and isocyanate. The foam is homogeneous, the medium size of the cells is max. 0.5 mm
Density	55 kg/m ³
Water absorption if boiled	10% (Vol)
Compressive strength 10% deformation	0,3 N/mm ²
Axial shear strength	0,12 N/mm ²
Tangential shear strength	0,20 N/mm ²
Thermal conductivity at 50°C	0,027 W/m°C
Max. operating temperature	120°C (peak = 140°C for maximum 300 hours per year)

U-VALUES

Mean temperature in PUR insulation at 50°C

Carrier pipe DN	Series 1, U W/m°C	Series 2, U W/m°C	Series 3, U W/m°C
15	0,113	0,101	0,094
20	0,136	0,119	0,109
25	0,165	0,140	0,127
32	0,172	0,153	0,141
40	0,197	0,173	0,157
50	0,222	0,197	0,171
65	0,267	0,222	0,194
80	0,278	0,235	0,207
100	0,295	0,248	0,217
125	0,347	0,289	0,245
150	0,420	0,332	0,272
200	0,467	0,356	0,287

U-VALUES CORRECTION FACTOR



EXAMPLE

Heat loss in DN 150 conduit pipeline, series 2: $t_i = 100^\circ\text{C}$; $t_o = 20^\circ\text{C}$. U is in the table at 0.332 W/m°C.

The heat loss for a single pipe is obtained as follows:
 $\Phi = U \cdot (t_i - t_o) = 0,332 \text{ W/m}^\circ\text{C} \cdot (100^\circ\text{C} - 20^\circ\text{C}) = 26,56 \text{ W/m}$

PIR insulation

LOGSTOR pre-insulated industrial pipes insulated with polyisocyanurate foam (PIR foam) have same high insulation properties as PUR foam. Polyisocyanurate has a lambda value of 0.023 at -20°C and 0.028 at + 50°C.

The polyisocyanurate foam is made of polyol and isocyanate. The foam is homogeneous and meets the functional requirements of EN 253.

PIR is a unique insulation material for all piping systems between -60°C and + 170°C. It is pressure-resistant, and forms together with the carrier- and casing pipe, a solid sandwich structure. PIR retains its mechanical properties unchanged for 30 years, and has improved fire properties compared to PUR.



PIR

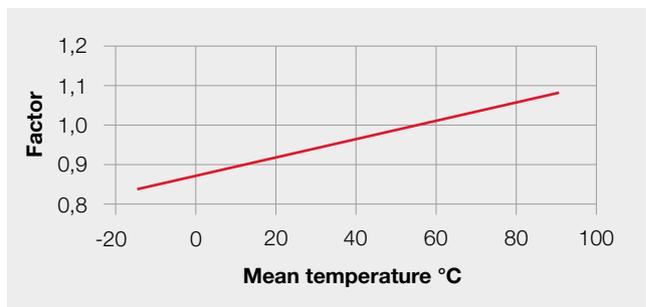
Material	Polyisocyanurate foam is made of polyol and isocyanate. The foam is homogeneous, the average size of the cells is max. 0.5 mm
Density	55 kg/m ³
Water absorption when boiling	10% (Vol)
Pressure strength 10% deformatio	0,3 N/mm ²
Axial shear strength	0,12 N/mm ²
Tangential shear strength	0,20 N/mm ²
Heat conductivity at 50°C	0,028 W/m°C
Maximum continuous operating temperature	170°C (peak = 180°C for maximum 300 hours per year)

U-VALUES

Mean temperature in PIR insulation at 50°C

Carrier pipe DN	Series 1, U W/m°C	Series 2, U W/m°C	Series 3, U W/m°C
15	0,119	0,104	0,096
20	0,142	0,122	0,111
25	0,175	0,145	0,131
32	0,180	0,158	0,143
40	0,208	0,180	0,161
50	0,234	0,202	0,175
65	0,277	0,228	0,198
80	0,287	0,247	0,210
100	0,301	0,250	0,218
125	0,351	0,290	0,245
150	0,420	0,332	0,272
200	0,461	0,352	0,285

U-VALUES CORRECTION FACTOR



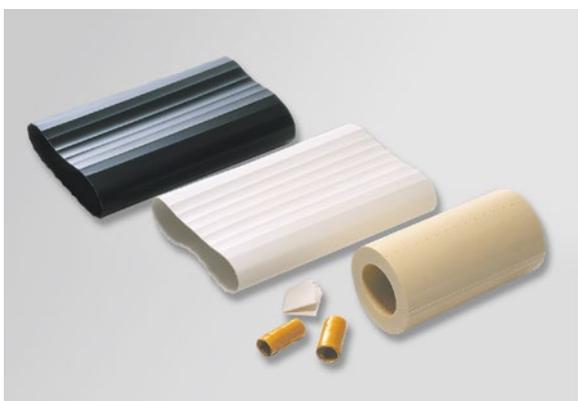
EXAMPLE

Heat loss in DN 100 pipeline, series 2: $t_i = 100^\circ\text{C}$; $t_o = 20^\circ\text{C}$.
U can be found in the table at 0.332 W/m°C.

The heat loss for a single pipe is obtained as follows:
 $f = U \cdot (t_i - t_o) = 0.250 \text{ W/m}^\circ\text{C} \cdot (100^\circ\text{C} - 20^\circ\text{C}) = 20.00 \text{ W/m}$

Watertight joint systems

The pre-insulated pipe systems are assembled and installed quickly and efficiently with the aid of LOGSTOR's comprehensive range of standard joints, which consists of straight joints and bend joints, T-joints, end caps and other accessories. This guarantees an optimal pipe layout for all projects. The joints are just as well insulated and secure as the rest of the system.



STRAIGHT JOINT SET

- With PUR or PIR half shells, shrink sleeves and accessories.
- Black or white.
- Angle 0-5°.



CURVED JOINT SET

- With PUR or PIR half shells, shrink sleeves and accessories.
- Black or white.
- Angle 5-90°.

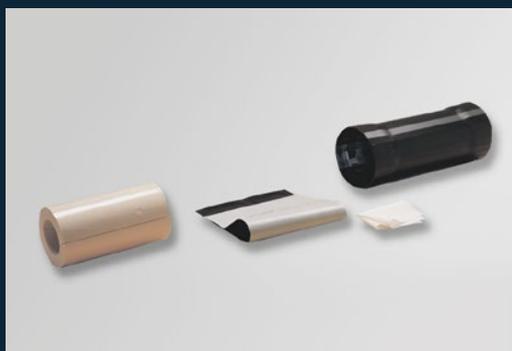


T-JOINT

- With PUR or PIR half shells, shrink sleeves and accessories.
- Black or white.
- Main pipe dimensions 90 to 200 mm.
- Branch pipe dimensions 90 to 180 mm.
- Angled branch pipes are available.
- Require separate connection tool.

Joint assembly

When the pipe system's carrier pipes have been installed and tested for pressure, and any tracer cables have been installed, the pipes are connected using our unique joint systems.



Double-sealed BX joint set for buried systems.



Assembly of insulation half shells.



Shrink film.



Shrinking of the joint.

We can perform joint assembly, or we can train the customer or the customer's fitters or supervisors in fitting the casing connections using LOGSTOR's shrinking products.

Low temperature

THE LOW TEMPERATURE SYSTEM FOR MEDIA TEMPERATURE FROM -200°C TO -60°C

For projects within the temperature range -200°C til -60°C, we offer a specially developed low-temperature system, which guarantees long durability under extreme conditions.

The low-temperature system is used for such purpose as marine, offshore installations, as well as projects involving LPG, LNG, nitrogen and ethylene.

The system consists of straight pipes, bend fittings and joints.



Normal temperature

THE NORMAL TEMPERATURE SYSTEM FOR MEDIA TEMPERATURE FROM -60°C TO +120°C

The system is used for media such as water, condensate, ammonia (NH₃), diesel oil and dairy products.

The pipe system is particularly suited for the food industry where there are high demands on hygiene. Thus, the pipes offer no such problems as growth of bacteria in the insulation or condensed water on the floor due to condensed penetration. The insulation quality is uniform and provides well-documented insulation properties. Handling and installation is fast and simple since most installments are carried out using only straight pipes and our joints system, which comprises straight joints, bend joints and t-joints.

In order to obtain low operating costs and a long service life, it is important that all joints are correctly installed and that all free ends are covered with end caps. The system is supplied with black or white casing pipes. White pipes should only be used indoors.

The pipe supports are positioned directly on the casing surface so that neither water nor moisture can penetrate and damage the insulation or cause corrosion.

The pipe system is supplied with a 100% watertight polyethylene casing, which resists most chemicals. During its entire service life it remains simple to clean – even when using strong detergents as well as high and low pressure cleaning if necessary.



High temperature

ABOVE GROUND SYSTEM FOR MEDIA TEMPERATURE FROM +120°C TO +170°C

The system is insulated with polyisocyanurate (PIR foam), and is typically used for mediums such as steam and hot water. Besides being suited for above ground installations, the system can also be installed as a buried system. The remarkable insulation ensures low operating costs and minimal maintenance. The system can be supplied with black or white casing, however, the white casing for indoor pipe installation only.





Our insulation systems are delivered in two standards at 210°C and 250°C respectively. All systems are complete – ie. in addition to pre-insulated pipes, they consist of fittings, joints, anchors and compensators.

BURIED SYSTEM FOR MEDIA TEMPERATURE FROM +120°C TO +250°C

This is an underground high-temperature system. The insulation, which can be used for media such as steam and hot oil, consists of polyurethane with an inner layer of mineral wool. The mineral wool brings down the temperature to the permissible application temperature for polyurethane foam. The carrier pipe is supported by special spacers made of stainless steel. The system has good insulation qualities, which guarantee low operating costs. The system can be supplied with black casing pipes.

High temperature pipes are available in dimensions up to DN 400.

Expansion compensation

All pipes react on temperature changes: they expand during heat up and contract when cooled. The movements and stresses released in the carrier pipe caused by the change in temperature must be controlled and calculated. The methods in question are different depending on whether the pipes are buried or installed above ground.

BURIED SYSTEMS

Buried systems are either a bonded system with PUR / PIR foam or a HT system with mineral wool and PUR as insulation. These two types must be designed according to different methods.

A bonded system has full adhesion between the individual components of the sandwich structure (PEH casing, PUR / PIR insulation and carrier pipe). Strengths/movements are transferred from the casing pipe to the carrier pipe through the foam and vice versa. The friction against the casing in the ground prevents free expansion of the steel pipe by temperature changes in the medium.

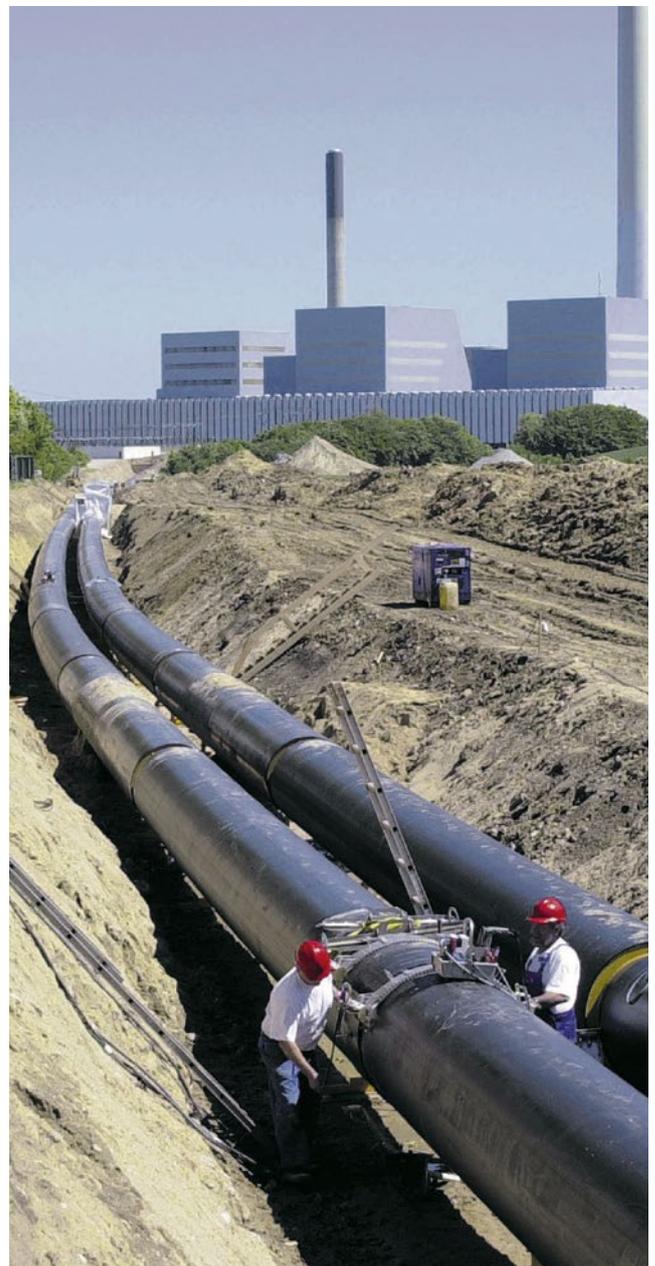
As the pipe cannot expand freely, axial tension will occur in the media pipe, and by directional changes, the entire system will move. In a bonded system, all temperature changes in the medium are absorbed as changes in the axial tension in the carrier pipe, or by movement throughout the sandwich structure (the pre-insulated pipe) at bends.

Here, expansion pads are mounted outside the PEH casing around the bends to accommodate this movement. Only large dimensions or large temperature changes may require compensation for excessive movements/high tensions. In these cases, compensation using loops or by preheating the pipe system is possible.

For that purpose, we use fittings that are tested and approved for buried installation, such as double sealed BX joints with insulation half shells or BXS (double sealed with insulation foamed in alu wrap-round) or SX joints that are foamed on site and sealed with a welding plug.

Buried high temperature systems with mineral wool and PUR foam as insulation act as a sliding system. The casing pipe is maintained by the soil friction, and the expansion of the carrier pipe is absorbed inside the insulation. The system is divided into sections with anchors, which are embedded in concrete. The expansion in each section is absorbed in an axial compensator or by expansion bends with room for the pipe bend to move up to 40 mm in the mineral wool.

HBX shrink joints or electric welded HEW joints insulated with mineral wool and PUR foam are used for high temperature systems.





ABOVE GROUND SYSTEMS

All above ground systems must be bonded PUR or PIR sandwich systems, which expand as one unit. Expansions are absorbed in L, Z or U bends.

It must be ensured that the pipes can move freely by using suitable pipe supports that can slide in the axial direction of the pipe. For all pipe bends, supports that allow both longitudinal and lateral movements must be used. Pipe supports are attached on the outside of the casing pipe. This means that cold bridges are avoided

entirely. The insulation is sufficiently strong to allow the necessary forces to be transferred. It is recommended that an anchor is attached in the middle of all straight pipe sections and tightened on the outside of the casing pipe.

All joints (straight, bend and T-joints) are insulated with PUR or PIR insulation half shells.

Intelligent pipes

LOGSTOR's intelligent pipe series provide extra security regarding the monitoring and prevention of irregularities such as leaks, corrosion etc. The system can also be used to detect other conductive liquids, such as glycol solutions.

The pipes are supplied with one or more of the following three solutions:

WARNING SYSTEM

A monitoring system directly integrated in the foam which detects leaks in water systems. This is a clear advantage when a system must be checked before initialising. At the same time it detects possible flaws within the warranty period. The system gives warnings in the case of possible ruptures, damages from excavation etc.

TRACER

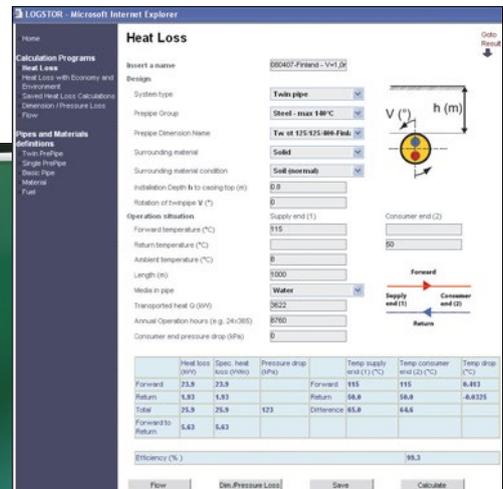
Pre-insulated pipe with a built-in CU tracer. They are used when laying self-regulating heating cables, maintaining flowing temperatures and in ducts with signal cables, e.g. TV. The pipes are supplied with tracer from $\varnothing 18$ to $\varnothing 28$ with several tracers in each pipe.

SAFEPIPE™

Built-in perforated tracer in cables for the detection of leaks in pipes for oil and chemicals. This solution guarantees fast detection of possible leaks of oil, chemicals, solvents etc., and prevents environmentally harmful emissions. For more detailed information, see the SafePipe brochure on www.logstor.com.



Support



LOGSTOR CALCULATOR

LOGSTOR Calculator is an internet based calculation program designed to provide our customers with the best basis of assessment when it comes to establishing the most energy efficient and environmentally friendly pre-insulated pipe system. The program is designed for district heating systems, but can also be used for buried industrial pipes up to 120°C.

LOGSTOR Calculator is the most accurate program for calculating the energy loss in a pre-insulated pipe system. It is based on extensive mathematical-physical models, yet LOGSTOR Calculator is a simple and user-friendly tool focusing on user requirements for quick and effective access to and overview of facts.

Merely by entering parameters for a given project (pipe type, flow and return temperature, energy type and price, lifetime, etc.), calculations and comparison bases are found that make it easy to choose the right pipe system.

For free access to the LOGSTOR Calculator, go to our website www.logstor.com/calculator.



LOGSTOR ACADEMY

- the best solution deserves the best installation

LOGSTOR Academy provides training and certification for those who need to dimension, handle and service our pre-insulated pipe systems.

With training, education and ultimately optimal installation, we ensure that the supply of safety to your customers is also of the best quality. Courses can be arranged locally throughout the world. We offer open as well as customized courses to international clients, supervisors, advisors and contractors.

Danish knowhow – international experience.

Experience suggests that pipe systems installed by joint installers professionally trained by LOGSTOR Academy have the longest durability and maximum reliability. The training takes place in LOGSTOR's modern training center, with theory facilities and a workshop.

Standard steel pipes and casing pipes

Nominal diameter		P235GH EN10217-2 (ST. 37.0)	P235GH EN10216-2 (ST. 35.8 l)	Stainless Isometric dim. AISI 304/316	Dairy pipes AISI 304/316L	Series 1	Series 2	Series 3	Series 4	Series 5
Inches	DN	Welded (mm)	Seamless (mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
½"	15	21.3 X 2.6	21.3 X 2.0	21.3 X 1.6	25.0 X 1.2	90	110	125	140	160
¾"	20	26.9 X 2.6	26.9 X 2.3	26.9 X 2.0		90	110	125	140	160
1"	25	33.7 X 2.6	33.7 X 2.6	33.7 X 2.0		90	110	125	140	160
1¼"	32	42.4 X 2.6	42.4 X 2.6	42.4 X 2.0	38.0 X 1.2	110	125	140	160	180
1½"	40	48.3 X 2.6	48.3 X 2.6	48.3 X 2.0	51.0 X 1.2	110	125	140	160	180
2"	50	60.3 X 2.9	60.3 X 2.9	60.3 X 2.0	63.5 X 1.6	125	140	160	180	200
2½"	65	76.1 X 2.9	76.1 X 2.9	76.1 X 2.0	76.1 X 1.6	140	160	180	200	225
3"	80	88.9 X 3.2	88.9 X 3.2	88.9 X 2.0		160	180	200	225	250
	100	108.0 X 3.6	108.0 X 3.6		101.6 X 2.0	180	200	225	250	280
4"	100	114.3 X 3.6	114.3 X 3.6	114.3 X 2.0		200	225	250	280	315
	125	133.0 X 3.6	133.0 X 4.0			200	225	250	280	315
5"	125	139.7 X 3.6	139.7 X 4.0	139.7 X 2.0		225	250	280	315	355
	150	159.0 X 4.0	159.0 X 4.5			250	280	315	355	400
6"	150	168.3 X 4.0	168.3 X 4.5	168.3 X 2.0		250	280	315	355	400
	175	193.7 X 4.5	193.7 X 5.6			280	315	355	400	450
8"	200	219.1 X 4.5	219.1 X 6.3	219.1 X 2.0		315	355	400	450	500
	200	219.1 X 5.0				315	355	400	450	500
10"	250	273.0 X 5.0	273.0 X 6.3	273.0 X 2.0		400	450	500	560	630
12"	300	323.9 X 5.6	323.9 X 7.1			450	500	560	630	710
14"	350	355.6 X 5.6	355.6 X 8.0			500	560	630		
16"	400	406.4 X 6.3	406.4 X 8.8			560	630	710		
18"	450	457.0 X 6.3	457.0 X 10.0			630	710	800		
20"	500	508.0 X 6.3	508.0 X 11.0			710	800	900		
22"	550	559.0 X 6.3	559.0 X 12.5			710	800	900		
24"	600	610.0 X 7.1	610.0 X 12.5			800	900	1000		
26"	650	660.0 X 7.1	660.0 X 14.5			800	900	1000		
28"	700	711.0 X 7.1				900	1000	1100		
30"	750	762.0 X 8.0				900	1000	1100		
32"	800	813.0 X 8.0				1000	1100	1200		
36"	900	914.0 X 10.0					1200			
40"	1000	1016.0 X 10.0					1400			
48"	1200	1220.0 X 10.0								

ABOUT LOGSTOR

LOGSTOR is a global supplier of complete pre-insulated pipe systems with a focus on providing better energy efficiency to our customers. Our company is based on years and years of experience and know-how related to insulation as a means of improving energy efficiency.

COMPANY FACTS

- Headquarters in Denmark
- More than 50 years of experience with an extensive track record
- Around 200 000 km of delivered insulated pipes
- Complete end-to-end solutions

-
- defining network efficiency

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Responsibility for this lies solely with the buyer. LOGSTOR will provide advice in connection with this, however it is hereby emphasised that it shall always be the responsibility of the buyer to ensure the legality of each specific application.

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