Pre-insulated pipes for industrial applications

[We document the difference]

www.logstor.com

LOGSTOR Industry

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LOGSTOR is the world's leading manufacturer of complete pre-insulated pipe systems for the transportation of gases and liquids to the district heating and cooling, oil and gas, marine and industrial sectors.

LOGSTOR is an international group with subsidiaries in 11 European countries and China, and joint ventures in South Korea and the United Arab Emirates.

LOGSTOR's own sales offices, 30 distributors and agents support the sales activities in Europe, Asia, The Middle East, and North America. LOGSTOR supplies the market in approximately 50 countries and sells pre-insulated pipe systems in countries where rising energy prices call for efficient and energy-saving solutions.

LOGSTOR has comprehensive experience in managing the entire process of planning, design, training, installation, maintenance and all aspects of system integration.

The company is headquartered in Løgstør, Denmark. It has some 1,400 employees..The manufacture of the company's products takes place in its own nine factories in Denmark, Poland, Sweden, Finland, China and in two joint ventures.

For more information, please go to www.logstor.com

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 Industry 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 W/m°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 taps can be reduced.

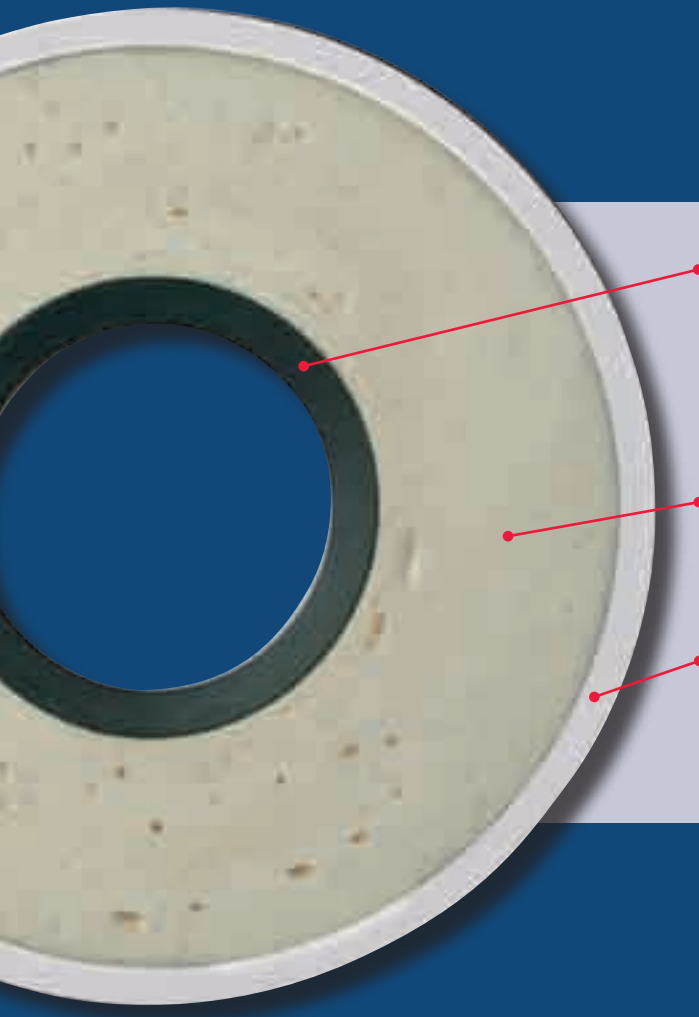
Advantages of using pre-insulation instead of traditional insulation:

- **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 polyurethane foam (PUR foam), which is specially suited due to its high insulation qualities compared to mass and volume.
On the outside is a protective jacket of plastic or steel.
The choice of carrier pipe, foam type and foam thickness, as well as the material for the jacket, is made by the customer, who can also choose to supply carrier pipes for the project.



CARRIER PIPES

Steel	Seamless or welded
Stainless steel	Seamless or welded
Plastic	
Copper	

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

INSULATION

Low temperature · LT	-200˚C to -60˚C
Normal temperature · NT	-60˚C to +140˚C
High temperature · HT	+140˚C to +250˚C · PUR · Mineral wool

JACKET PIPES

Plastic	PEH · Black or white
Steel	Black or stainless
Spiro	Galvanised · Aluminium · Stainless

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.

Jacket

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

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

Jackets 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 PEH	Class 2
White PEH	Class 2
Aluminium spiro	Class 2
Galvanised steel spiro	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 polyurethane foam as insulation have high insulation qualities. It is a fact that heat loss in a pre-insulated pipe from LOGSTOR Industry is approx. 40% less than in a corresponding system with traditional insulation (mineral wool and metal jacket). This saving is often so significant that any additional costs at the point of delivery are recovered in less than one year.

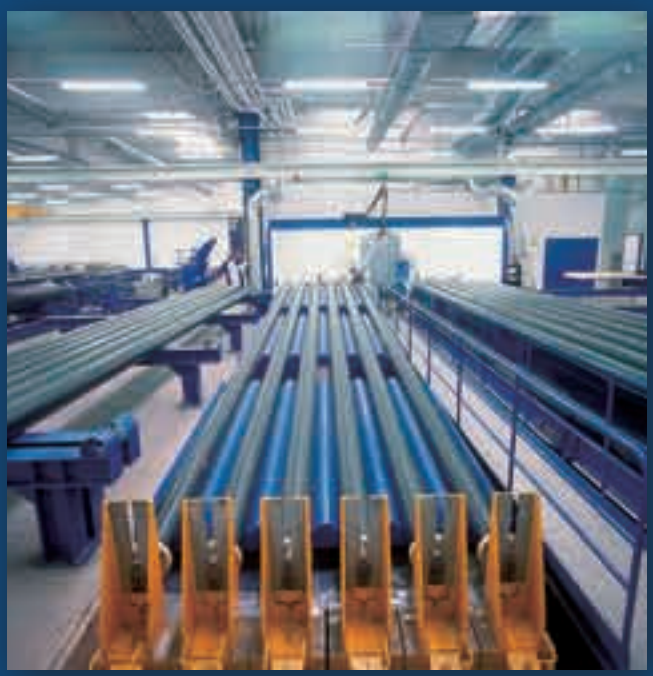
LOGSTOR's online program calculates the exact saving based on the customer's specifications. See also page 20 for further information.

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

3
The jacket is made of black or white polyethylene, produced in accordance with EN 253 and DIN 8075.

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

PEH jacket pipes are also resistant to salt and chemicals.

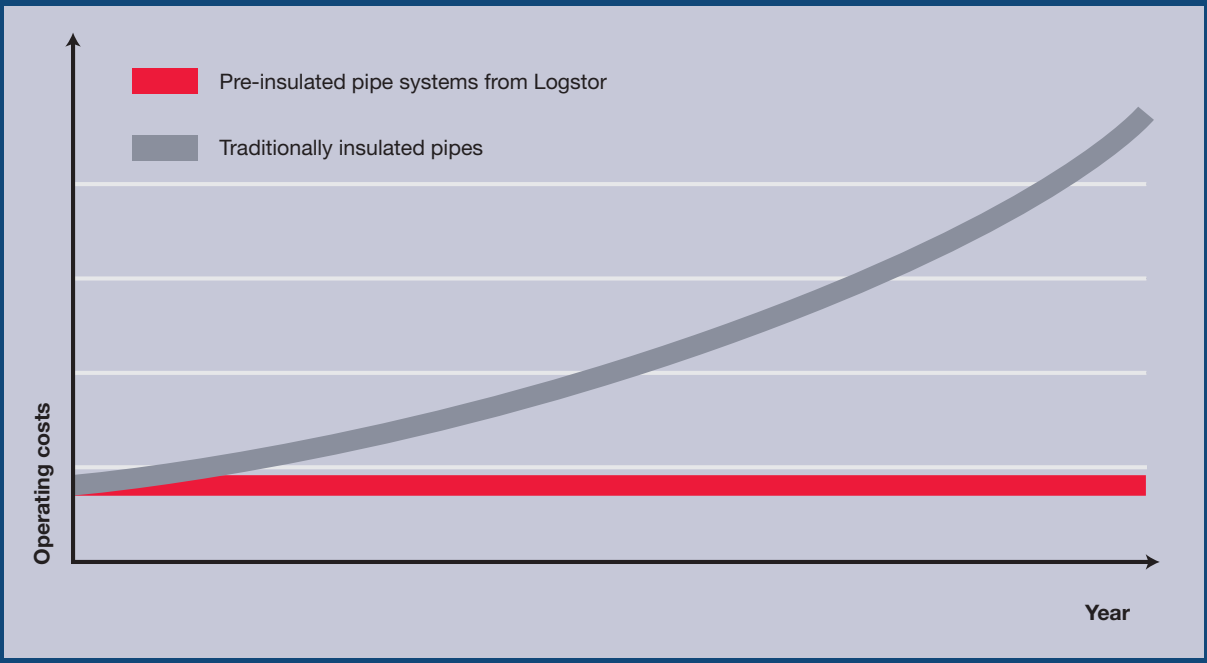


4
The insulation and jacket together have a very high mechanical strength, which makes pre-insulated pipe systems resistant to physical effects, e.g. when they are used as a foot bridge.

5
Pipe and jacket 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 recent report on the cleanability of the surfaces of LOGSTOR pipe and joints made by Danish Technological Institute (DTI) shows that the smooth surfaces of jacket 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.

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

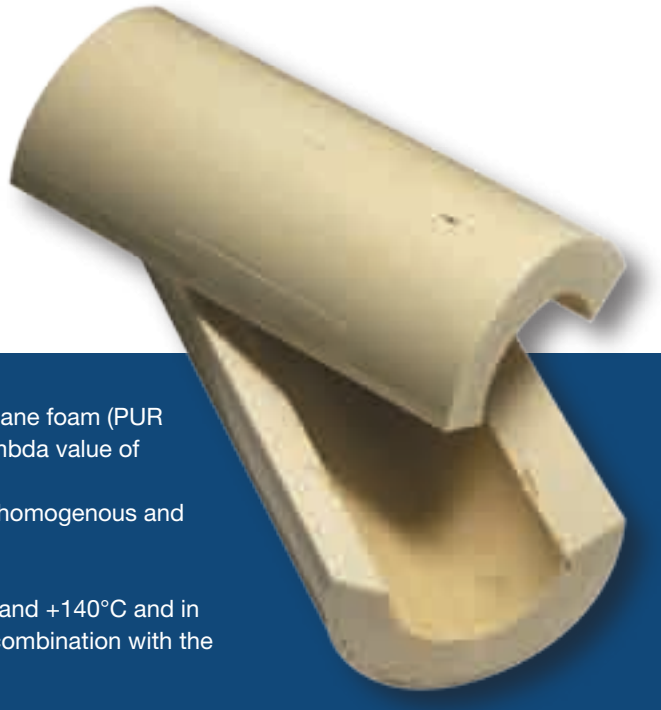
Pre-insulated pipe systems are used by the chemical, pharmaceutical, petro-chemical and food insustries for the transport of:

- Drinking water
- 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.

Insulation



LOGSTOR Industry 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 +140°C and in combination with mineral wool up to +250°C. It is pressure-resistant, and in combination with the carrier and jacket pipe it creates a sandwich design.
PUR retains its mechanical properties for more than 30 years.

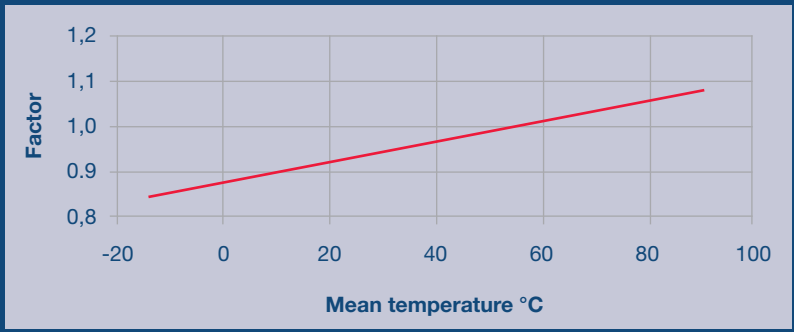
PUR insulation (min. requirement according to EN 253)

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	60 kg/m^2
Water absorption if boiled	10% (Vol)
Compressive strength 10% deformation	0.3 N/mm^2
Axial sheer strength	0.12 N/mm^2
Tangential sheer strength	0.20 N/mm^2
Thermal conductivity at 50˚C	< 0.028 W/m˚C
Max. operating temperature	140˚C

U-values

Mean temperature in PUR insulation 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 of correction factor



Example

Heat loss in DN 150 conduit pipeline, series 2: t_f = 100˚C; t_0 = 20˚C.
U is in the table at 0.332 W/m˚C.

The heat loss for a single pipe is obtained as follows:
$\phi = U \cdot (t_f - t_0) = 0.332$ W/m°C · (100˚C - 20˚C) = 26.56 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 half shells, shrink sleeves and accessories.
Black or white.
Angle 0-15°.

CURVED JOINT SET

With PUR half shells, shrink sleeves and accessories.
Black or white.
Angle 15-90°.

T-JOINT

With PUR half shells, shrink sleeves and accessories.
Black or white.
Main pipe dimensions 90 to 200 mm
Branch pipe dimensions 66 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 jacket connections using LOGSTOR's shrinking products.

Low temperature

The low temperature system with media temperature from -200°C to -60°C

For projects within the temperature range -200°C to +120°C, we offer a specially developed low-temperature system, which guarantees long durability under extreme conditions. The low-temperature system is used for such purposes as marine, onshore and offshore installations, as well as projects involving LPG, LNG, nitrogen and ethylene.

The system consists of straight pipes, bend fittings and joints. The jacket can be supplied in black or white.

The diagrams display the transmission coefficient (U-value) for carrier and jacket pipes in various dimensions.

Mean temperature in insulation 0°C			
Carrier pipe mm	Series 3, U W/m°C	Series 4, U W/m°C	Series 5, U W/m°C
15	0.084	0.076	0.071
18	0.094	0.083	0.078
22	0.107	0.094	0.087
28	0.110	0.101	0.094
35	0.118	0.109	0.100
42	0.126	0.113	0.104
54	0.139	0.126	0.116
70	0.160	0.144	0.130
89	0.188	0.164	0.147

U-values Cu pipes, freely suspended

Carrier pipe	Copper, soft copper SIS 501502 cleaned with protection cap
Temperature	-200°C to -60°C
Medium	Liquid nitrogen, LNG and LEG
Insulation	Straight sections: Polyurethane foam (PUR) Coils: Semi-flexible polyurethane foam (PUR)
Jacket	Straight sections: HDPE, black and white Coils: PEL, black

Mean temperature in insulation 0°C			
Carrier pipe mm	Series 3, U W/m°C	Series 4, U W/m°C	Series 5, U W/m°C
15	0.085	0.080	0.075
20	0.098	0.091	0.084
25	0.115	0.106	0.097
32	0.127	0.114	0.105
40	0.142	0.126	0.115
50	0.155	0.138	0.126
65	0.176	0.157	0.140
80	0.187	0.164	0.147
100	0.195	0.171	0.151
125	0.221	0.189	0.165
150	0.246	0.207	0.178
200	0.259	0.215	0.188

U-values of steel pipes, freely suspended

Medium	Steel 35.8 I
Temperature	-20°C
Insulation	Hard polyurethane foam (PUR)
Jacket	PEH, black and white

Normal temperature

The normal temperature system with media temperature from -60°C to +140°C

The system is used for media such as water, condensate, ammonia (NH_3), 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 jacket pipes. White pipes should only be used indoors.

The pipe supports are positioned directly on the jacket 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 jacket, 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 with media temperature from +140°C to +250°C

This is an above ground high-temperature system that cannot be laid underground. The insulation, which is 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 system has good insulation qualities, which guarantee low operating costs and minimum maintenance.

The system can be supplied with black or white jacket pipes.

Our pre-insulated systems are supplied in two standards for 210°C and 250°C respectively.
All systems are complete – i.e. besides pre-insulated pipes they consist of fittings, joints, anchors and compensators.

Buried system with media temperature from +140°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 jacket pipes.

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

Expansion compensation

A change of temperature causes a reaction in all pipe systems. They expand during heat up and shrink during cooling. The movements and stresses released in the carrier pipe caused by the change of temperature must be controlled and estimated. The methods used depend on whether they are directly buried or above ground pipe systems.

Buried systems

The NT system (Normal Temperature) is a directly buried district heating system with joints that have been developed for that particular purpose. It is a so-called bonded system with a plastic casing. The components in the pipe system transmit the expansion stresses among themselves.
The friction between the casing and the earth prevents the free expansion of the steel pipe during heating up. As the pipe cannot expand freely, the carrier pipe will generate stress reactions.
If the pipe end can move freely the axial stress at a free pipe end will be 0 (zero). During expansion, the force of reaction of the pipe will be proportional to the cross-sectional area of the carrier pipe, the E module and the accumulating heat. The greater the distance is from the free end, the greater the frictional force of the casing and the axial stress will be. These stresses in the carrier pipe must be limited to the allowable value in each individual case. One method to ensure that the stresses are limited to the relevant value could be to limit the operating temperature:
The pipe can be heated to half the working temperature and kept at that temperature during backfilling and compression of the filling material in the trench – also called heat pre-stressing.
Or the pipe routing can be divided into suitably short parts that meet the requirements. This procedure is called cold installation.
All corners must be provided with safety cushions for expansion compensation.

For that purpose we use fittings that are approved for district heating installations such as double-sealed BX joints with insulated 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 double sealed plug system.

Underground high temperature system functions as a sliding system where the jacket pipe is held in place by the earth friction, and the carrier pipe's expansion is absorbed by the insulation. The system is divided into sections by clamps, which are embedded in concrete. The expansion in each section is absorbed by an axial compensator or in the expansion bends, where there is sufficient room for the pipe bend to be able to move up to 40 mm.

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

Above ground systems

The LT (Low Temperature) and NT (Normal Temperature)
systems are foam sandwich systems, which expand as one unit.
Expansion is absorbed by L-bends, Z-bends or U-bends. Make sure that the pipes can move freely by using suitable sliding pipe supports. Supports that permit both longitudinal and lateral movements must be used in all pipe bends. Pipe supports are attached on the outside of the jacket pipe. This means that cold bridges are avoided entirely. The insulation is sufficiently strong to ensure that the necessary forces can 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 jacket pipe. Connection joints, bend joints and T-joints are insulated with PUR insulation half shells and straight FXI joints, BM bend joints and TMC T-joints.

Above ground high temperature systems function as bonded systems that also move as one unit.
Expansion is absorbed by L-bends, Z-bends or U-bends. Make sure that the pipes can move freely by using suitable sliding pipe supports. Supports that permit both longitudinal and lateral movements must be used in all pipe bends. Pipe supports are fitted on the outside of the jacket pipe, thus avoiding cold bridges entirely. The insulation is sufficiently strong to ensure transfer of the necessary forces. Depending on the system, a pre-insulated anchor is attached to the middle of all straight pipe sections.

Shrink joints are used for connections and bends. Straight HBX joints and HBM bend joints are insulated with PUR insulation half shells with mineral wool.

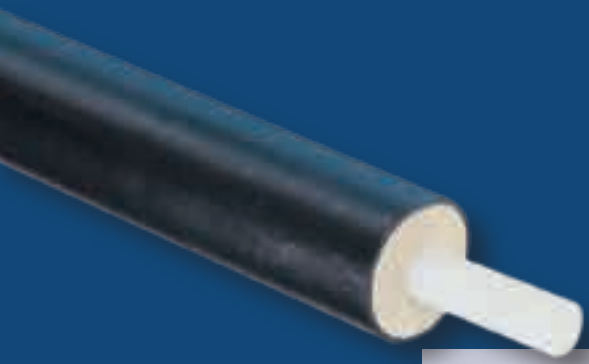
Flexible pipe systems

LOGSTOR is a leader in the field of flexible pipe systems, which are available with carrier pipes in steel, copper or PEX, in both single-pipe and double-pipe systems.

PexFlex

PexFlex has a carrier pipe made of PEX, which is designed for temperatures of max. 95°C, and depending on the dimensions can tolerate a pressure of 6-10 bar. The PEX carrier pipe is also fitted with an oxygen diffusion retainer made of EVOH, so that oxygen cannot diffuse into the water.

PexFlex	Dim.: Carrier pipe/jacket pipe								
Coil length	20/77	25/77	32/77	40/90	50/110	63/125	75/140	90/160	110/160
10-100 m	•	•	•	•	•	•	•	•	•



PexFlex for tap water

PexFlex for tap water has a PEX carrier pipe, without an oxygen diffusion retainer, and it tolerates a max. temperature of 95°C and a max. pressure of 10 bar.

PexFlex for tap water	Dim.: Carrier pipe/jacket pipe					
Coil length	22/77	28/77	32/77	40/90	50/110	63/125
10-100 m	•	•	•	•	•	•

CuFlex

CuFlex has a carrier pipe made of soft copper. The system can be used up to 130°C and tolerates pressure to a max. 16 bar.

CuFlex	Dim.: Carrier pipe/jacket pipe								
Coil length	15/77	18/77	22/77	28/77	35/90	42/110	54/125	70/140	88,9/160
10-100 m	•	•	•	•	•				
12 m længde					•	•	•	•	•

Intelligent pipes

LOGSTOR's intelligent pipe series provides extra security regarding the monitoring and prevention of irregularities such as leaks, corrosion etc.

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 ø18 to ø28 with several tracers in each pipe.

Safe*Pipe*™

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.

Support

LOGSTOR Online calculation

With this electronic calculation program, the user is able to optimise investments and operating costs by calculating important parameters such as pipe dimensioning and heat loss. The program can be accessed at www.logstor.com.

The program can be used for industrial products – particularly above ground systems.
Below is a brief summary of topics covered:

1
Pipe dimensioning
This tool determines which pipe dimension is to be used to achieve a given flow or output. The program optimises the dimension to meet this need, and calculates the resulting loss of pressure.

2
Heat loss
Heat loss is an important factor in the implementation of a new pipe system. In this calculation it is possible to make comparisons with other insulation materials. The result shows the saving achieved and the resulting present value.

3
Temperature drop
Depending on the relevant flow and the medium in the pipe, the temperature will drop between the pipe's inlet and outlet. It is also possible to calculate the cooling time down to a given temperature if the system is closed down.

LOGSTOR service and training

LOGSTOR's engineers and technicians offer full service in all phases of a project from initial planning to commissioning. After sales service, including training of fitters etc., is an integral part of Logstor's services. Years of experience in installing joints and drawing up miscellaneous customized solutions has made us experts in carrying out installations and traning in our markets. Our training courses can be arranged all over the world.
We offer open as well as specially adapted courses for international customers, supervisors, advisors and contractors.

Experience suggests that systems which have been installed by professionally trained joint installers from LOGSTOR have the strongest durability and reliability. The training takes place at LOGSTOR's modern training centre with theory rooms and a workshop.
Besides Denmark, there are training centres in Sweden, Finland and Poland.

Nominal dia.		P235GH EN10217-2 (St. 37.0)	P235GH EN10216-2 (St. 35.8 I)	Stainless Isometric dim. AISI 304/316	Dairy pipes AISI 304/316L	Series 1	Series 2	Series 3
Inches	DN	Welded (mm)	Seamless (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
¾”	20	26.9 x 2.6	26.9 x 2.3	26.9 x 2.0		90	110	125
1”	25	33.7 x 2.6	33.7 x 2.6	33.7 x 2.0		90	110	125
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
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
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
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
3”	80	88.9 x 3.2	88.9 x 3.2	88.9 x 2.0		160	180	200
	100	108.0 x 3.6	108.0 x 3.6		101.6 x 2.0	180	200	225
4”	100	114.3 x 3.6	114.3 x 3.6	114.3 x 2.0		200	225	250
	125	133.0 x 3.6	133.0 x 4.0			200	225	250
5”	125	139.7 x 3.6	139.7 x 4.0	139.7 x 2.0		225	250	280
	150	159.0 x 4.0	159.0 x 4.5			250	280	315
6”	150	168.3 x 4.0	168.3 x 4.5	168.3 x 2.0		250	280	315
	175	193.7 x 4.5	193.7 x 5.6			280	315	355
8”	200	219.1 x 4.5	219.1 x 6.3	219.1 x 2.0		315	355	400
	200	219.1 x 5.0				315	355	400
10”	250	273.0 x 5.0	273.0 x 6.3	273.0 x 2.0		400	450	500
12”	300	323.9 x 5.6	323.9 x 7.1			450	500	560
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						

Series 4	Series 5
(mm)	(mm)
140	160
140	160
140	160
160	180
160	180
180	200
200	225
225	250
250	280
280	315
280	315
315	355
355	400
355	400
400	450
450	500
450	500
560	630
630	710

Quality

LOGSTOR has a comprehensive quality department which complies with the strict demands from our customers, including oil companies, chemical industries and large food industries.

All projects with specific demands made by the customers can be completed in cooperation with external test institutes. All products are manufactured in accordance with the regulations of the international quality and environmental standards ISO 9001 and ISO 14001.

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