

Pre-insulated pipes for industrial applications



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The most ambitious solutions for the industrial sectors

It has been over 50 years since LOGSTOR, part of Kingspan Group 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, industry, and oil and gas.

LOGSTOR is headquartered in Løgstør, Denmark, and employs app. 1400 skilled people distributed in 13 countries worldwide. Production is carried out at 7 plants, situated in Denmark, Sweden, Finland and Poland.

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

Pipes from Kingspan 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 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. Heat tracers can be integrated to maintain the temperature and minimise problems with coagulation. Efficient insulation in pipes carrying steam means that the number of steam traps can be reduced.

Advantages of using pre-insulation instead of conventional insulation:

- 100% watertight
- 100% corrosion protected
- Energy saving
- No maintenance costs
- UV resistant
- increased surface strength



LOGSTOR pre-insulated pipes

A pre-insulated pipe consists of three parts

The carrier pipe, made of made steel, stainless steel, plastic or copper. The insulation, made of polyurethane 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 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 designed for a specific project together with the customer.

Carrier pipes

The pipes are normally supplied with carrier pipes of steel; however, LOGSTOR also pre-insulates other types of carrier pipe like PE pressure pipes, GRE/GRP pipes, coated pipes etc. The pipe can be fitted with one or more heat tracer pipes. We also offer insulation of customer supplied carrier pipes.

Carrier Pipes

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

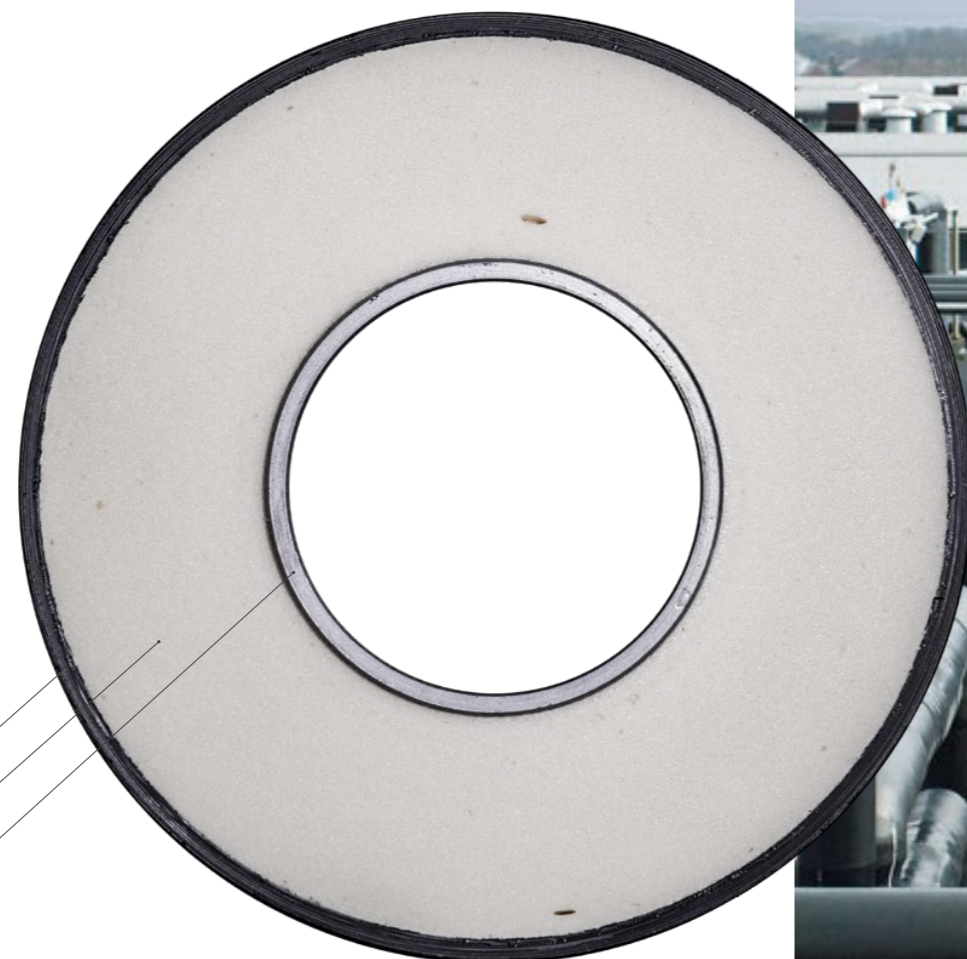
We insulate all types of carrier pipe supplied by the customer.

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

Casing Pipes

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



Casing Pipes
Insulation
Carrier Pipes

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.

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



Pre-insulated pipe systems have several advantages over conventionally insulated pipes

1. Pre-insulated pipes with polyurethane foam (PUR foam) or polyisocyanurate foam (PIR foam) 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 conventional insulation (mineral wool and metal casing).

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.

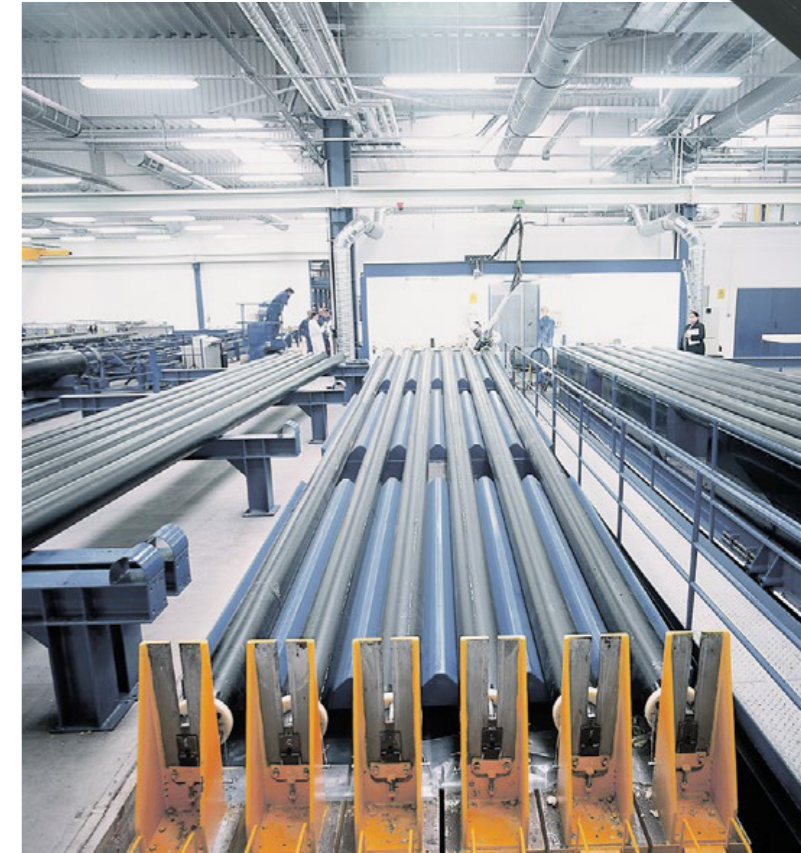
6. A report on the cleanability of the surfaces of LOGSTOR pipe and joints made by an external accredited test institute shows that the smooth surfaces are very easy to clean and comparable with the surfaces of stainless steel.

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

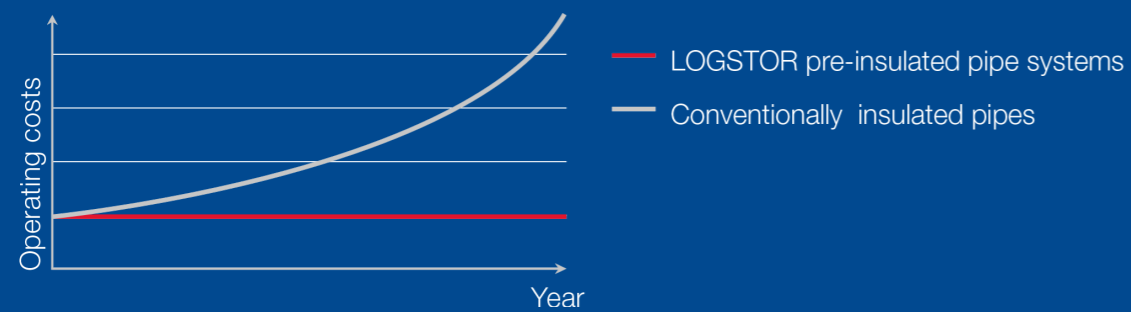
8. Quick, problem-free installation in one process, without long periods of disruption of operations.

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

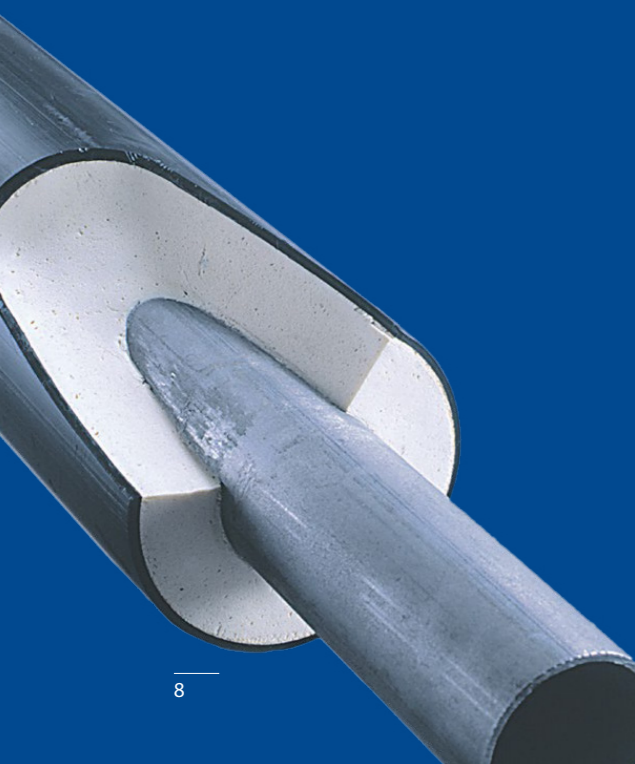
Pre-insulated pipe systems are used by the food and beverage, chemical, pharmaceutical and other process industries for the transport of:

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

At operating temperatures below room temperature, condensation will be formed in conventional 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 insulated with polyurethane foam (PUR foam) 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 construction. PUR retains its mechanical properties for more than 30 years.

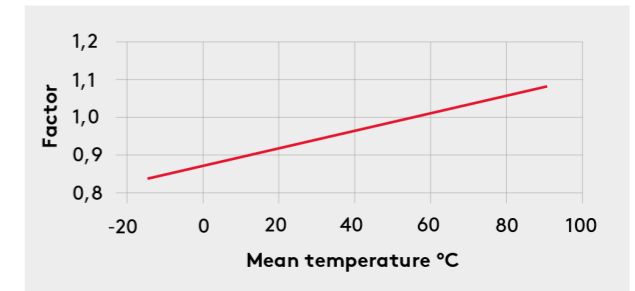


PUR Insulation	
Material	Polyurethane foam is made of polyol and isocyanate. The foam is homogeneous, the medium size of the cells is max. 0.5 mm
Density	55 kg/m ³
Water absorption if boiled	10% (Vol)
Compressive strength 10% deformation	0,3 N/mm ²
Axial shear strength	0,12 N/mm ²
Tangential shear strength	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 pipeline, series 2:

- Operating temperature (tf) = 100°C
- Surrounding temperature (t0) = 20°C
- U according to the table 0,332 W/m°C

The heat loss for a single pipe will be as follows:

$$\Phi = U \cdot (t_f - t_0) = 0,332 \text{ W/m°C} \cdot (100^\circ\text{C} - 20^\circ\text{C}) = 26,56 \text{ W/m}$$

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.

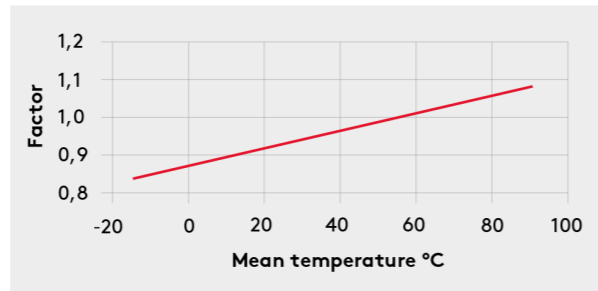


PUR Insulation	
Material	Polyisocyanurate foam is made of polyol and isocyanate. The foam is homogeneous, the average size of the cells is max. 0.5 mm
Density	55 kg/m ³
Water absorption if boiled	10% (Vol)
Compressive strength 10% deformation	0,3 N/mm ²
Axial shear strength	0,12 N/mm ²
Tangential shear strength	0,20 N/mm ²
Thermal conductivity at 50°C	0,028 W/m°C
Max. operating temperature	170°C (peak = 180°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	0,119	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:

- operating temperature (tf) = 100°C
- surrounding temperature (t0) = 20°C.
- U according to the table 0,250 W/m°C.

The heat loss for a single pipe will be as follows:

$$f = U \cdot (t_f - t_0) = 0.250 \text{ W/m}^\circ\text{C} \cdot (100^\circ\text{C} - 20^\circ\text{C}) = 20.00 \text{ W/m}$$

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 also 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 assembly tool

Joint assembly

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

Example:



Double-sealed BX joint set



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, dairy products etc

The pipe system is particularly suited for the food industry where there are high demands on hygiene. There are no problems with growth of bacteria in the insulation or condensed water on the floor due to surface condensation. 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 LOGSTOR 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.



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 joints 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.

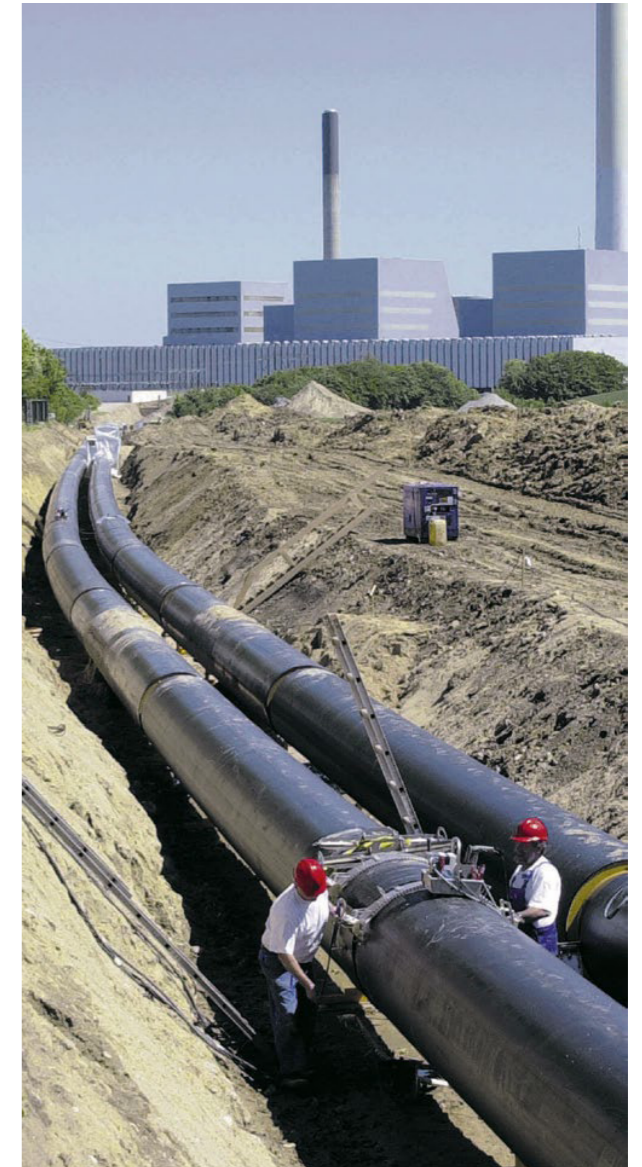


Our insulation systems are delivered in two standards at 210°C and 250°C respectively. All systems are complete – ie. in addition to pre-insulated pipes, they consist of fittings, joints, anchors and compensators.

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.



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.

The insulation is sufficiently strong to allow the necessary forces to be transferred. It is recommended that anchors are installed on straight pipe sections, either by fixation of the casing pipe or the use of pre-insulated anchors.

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 and corrosion.

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

WARNING SYSTEM

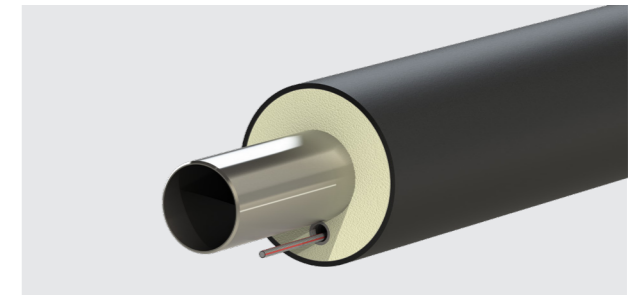
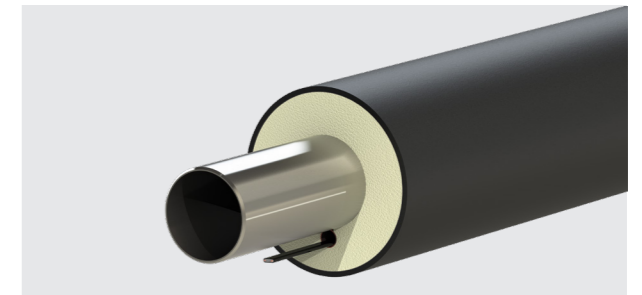
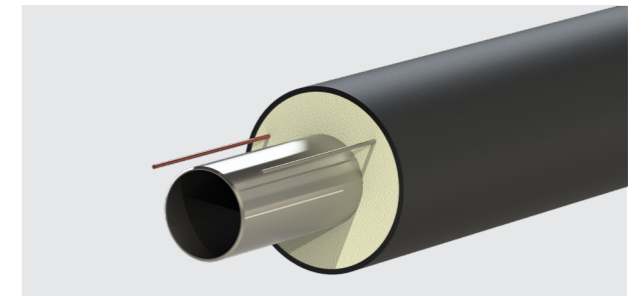
A monitoring system for conductive liquids directly integrated in the foam able to detect leaks from the service pipe and moisture ingress from the outside in case of damages or ruptures to a joint or the outer casing. The system makes it possible to pinpoint and deal with the damage without delay.

TRACER

Pre-insulated pipe with built-in heat tracer pipe(s) for e.g. self-regulating heating cables to maintain a flow temperature / viscosity of the liquid being transported. The pipes are supplied with heat tracer pipes from $\varnothing 18$ to $\varnothing 28$ with one or more tracer in each pipe.

SAFEPIPE™

Built-in perforated tracer pipe in combination with a leak detection cable for oils and chemicals. This solution guarantees fast detection of possible leaks of oil, chemicals, solvents, and prevents environmentally harmful emissions. For more detailed information, see the SafePipe brochure on www.logstor.com.



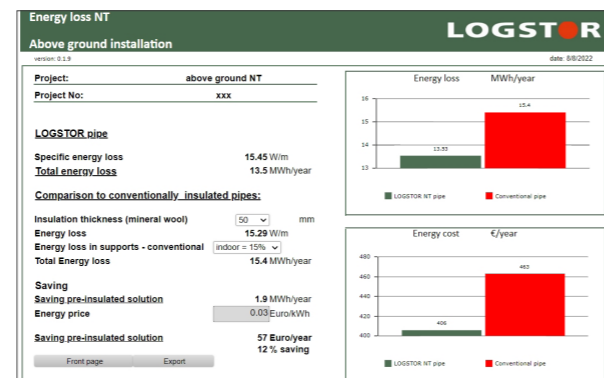
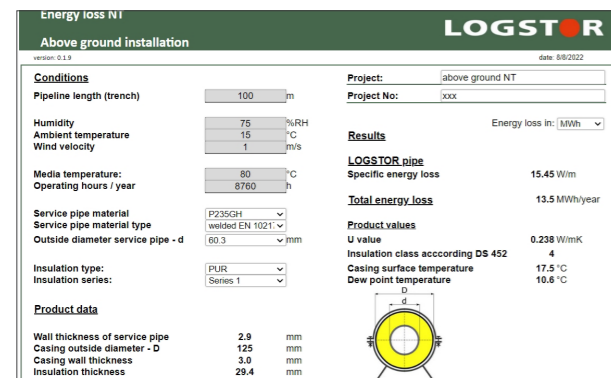
Support

LOGSTOR Industry Calculator

LOGSTOR Industry 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.

LOGSTOR Industry 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 the 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, temperature etc.), calculations and comparison bases are found that make it easy to choose the right pipe system.

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



Kingspan Academy

- the best solution deserves the best installation

Kingspan 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 shows that pipe systems installed by installers professionally trained by Kingspan Academy have the longest durability and maximum reliability. The training takes place in our modern training centers with theoretical and practical exercises.

Standard steel pipes and casing pipes

Quality and efficiency

The quality assurance is defined and planned before each production commences, hence we are able to meet the strictest demands of our customers. LOGSTOR are ISO 9001, 14001, 45001 and 50001 certified.

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)
1/2"	15	21.3 x 2.6	21.3 x 2.0	21.3 x 2.0	25.0 x 1.2	90	110	125	140	160
3/4"	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
1 1/4"	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
1 1/2"	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
2 1/2"	65	76.1 x 2.9	76.1 x 2.9	76.1 x 2.0	76.1 x 2.0	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	540
8"	200	219.1 x 4.5	219.1 x 6.3	219.1 x 2.0		315	355	400	450	500
10"	250	273.0 x 5.0	273.0 x 6.3	273.0 x 2.6		400	450	500	560	630
12"	300	323.9 x 5.6	323.9 x 7.1	323.9 x 2.6		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 8.0				900	1000	1100		
30"	750	762.0 x 8.8				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 11.0					1400			
48"	1200	1220.0 x 12.5								

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