



PPSL DISTRICT ENERGY

The Coach House, Boxwell Road, Berkhamsted, Herts, HP4 3ET

Tel: 01442 874808

Fax: 01442 876293

info@ppsl-districtenergy.co.uk

www.ppsl-districtenergy.co.uk

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TO:		FAX:	
FROM:	Estimating Department	DATE:	
RE:	Copper Pipes	PAGES:	13
<input type="checkbox"/> URGENT	<input type="checkbox"/> FOR REVIEW	<input type="checkbox"/> PLEASE COMMENT	<input type="checkbox"/> PLEASE REPLY

Further to your enquiry, please find attached data sheets and Guide Specification for Logstor Ror Copper pipes.

Data sheets attached:

Page 7.1.1: Cu-Flex Design - General Description

Page 7.1.2: Cu-Flex Design - General Description

Page 7.1.5: Cu-Flex Design - Pipe Laying

Page 7.2.1: Cu-Flex Components - Pipe

Page 7.2.2: Cu-Flex Components - Pipe

Page 7.2.6: Cu-Flex Components - FX

Page 7.2.10: Cu-Flex Components - SXB

Page 7.2.19: Cu-Flex Components - End Cap

Page 7.2.22: Cu-Flex Components - Seal Ring

Logstor Ror Copper Guide Specification

Regards

Estimating Department

System description

Cu-Flex - Design

7.1.1

Application

The Logstor Cu-Flex system is used for separate secondary networks or for house connections in the district heating system.

Cu-Flex is also applicable for distribution of hot or cold domestic water. As the pipes have not been rinsed for impurities before delivery, the water may have a disagreeable taste at the start-up of the system.

The continuous operating temperatures up to 120°C, max. temperature is 130°C. The max. working pressure is 16 bar.

There is no risk of corrosion involved in using Cu-Flex together with steel in district heating systems, provided that normally treated district heating water is used.

Pipes

Pipe dimensions 15 to 35 mm are supplied in coils of 50 or 100 m, pipe dimensions 35 to 88 mm are supplied in straight lengths of 12 m. All dimensions are supplied as single or double pipes.

Hot domestic water can be distributed by two pipes of unequal dimension in the same casing.

For the purpose of the patent rights of other companies, the straight lengths are slightly double curved.

Cu-Flex system

Bury the pipes without expansion absorbing elements. The plastic properties of the soft copper pipes are exploited for expansion absorption.

Assemble the pipes with Cu-joints, Cu-fittings or straight pressing joints by means of hard-soldering.

Establish change of direction by means of bent pipes or Cu-bends and SXB joints.

Establish branches with Cu-Tees and SXT joints.

Use prefabricated TIG welded connections as transition pipes from steel to copper.

Carrier pipes

Carrier pipes are made of soft annealed copper Cu-DHP - H040 according to EN 12449 and with tolerances according to EN 1057. The tolerances of the pipes have been tightened up in order to enable assembly with capillary soldering.

Casings

Casings are made of polyethylene (PE). An aluminium diffusion barrier is embedded between the insulation and the casing to prevent deterioration of the insulation over time.

Insulation

The space between the carrier pipe and the casing pipe is filled with polyurethane foam (PUR) with high insulation properties.

The thermal conductivity is 0.023 W/mK.

The flexibility of the insulation ensures that the foam does not crack when the pipes are bent. On the other hand it is sufficiently rigid to tolerate stress during operation.

Material properties of soft copper:

Mechanical properties:

Density	8940	kg/m ³
Tensile strength	210	N/mm ²
Yield stress	approx. 80	N/mm ²
Elongation at rupture	30	%

Thermal properties:

Coefficient of expansion	$1.68 \cdot 10^{-5}$	°C ⁻¹
Specific heat	385	KJ/kg°C
Thermal conductivity	365	W/m°C
Electric conductivity:	57	Sm/mm ²

Pipe laying rules

Cu-Flex - Design

7.1.2

Velocity of water

In order to avoid erosion corrosion, the constant velocity of water in copper pipes must not exceed 2 m/s for deoxidized district heating water and 1.5 m/s for hot, neutral domestic water containing oxygen.

Pressure and temperature

Cu-Flex is applicable for pressure of 16 bars.
Tensile test with cold water (20°C) up to 21 bar.
The polyurethane foam limits the continuous operating temperatures to 120°C and the short-termmax. temperature to 130°C.

Heat loss and pipe dimensioning

The principles for the heat loss calculations are described in chapter 3 page 3.4.1
The principles for the pipe dimensioning are described in chapter 3 page 3.4.2.

StaTech

Logstor has developed the programme StaTech for calculation of heat loss and pipe dimensioning. The programme calculates the heat loss of both new and old pipes with or without diffusion barrier. In addition to this, the programme calculates the economical consequences of heat loss and the increasing heat loss caused by ageing pipes without diffusion barrier.

Expansion

Bury the Cu-Flex system as a bonded system. The system is fixed by the friction of the surrounding earth and the reaction in the changes of direction.

The powers in the system are low due to the small cross section of the material and the low yield stress of soft copper.

The movements deriving from here are so insignificant that built-in of special expansion absorbing elements for compensation of the movements is not required.

Residual expansion may occur at exposed ends of straight pipe lengths. That is not acceptable at, e.g., basement entrances. In such cases, an anchor can be mounted approx. 1 m outside the foundations.

Assembly of carrier pipes

Only press fittings of dimension 15-42 mm or soldering fittings of dimension 15-88 mm supplied by Logstor must be applied in order to ensure that stress generated by the expansion of the material can be absorbed in the entire system.

Curvatures

Wherever changes of direction require it, Cu-Flex in coils can be bent on site to a min. radius of curvature according to the dimension of the casing.

Casing diameter, mm	Radius of curvature, m
77	0,8
90	0,9
110	1,1
125	1,2

At temperatures below 5°C, the casing must be heated with a gas burner to „hand-warm“, before the pipe is unrolled or bent.

Straight pipe lengths of bigger dimensions can be bent to a radius of approx. 100 x the Cu-pipe diameter. Bending springs are not required, as the Logstor Cu-Flex is enclosed in fixed PUR foam.

Pipe laying rules

Cu-Flex - Design

7.1.5

Transition from steel system

Transition from a steel to copper is to be established with a prefabricated transition pipe or a Cu-steel press couplings.

At transition from steel to copper on a straight pipe length it is important to ensure that no longitudinal movements are conveyed from the steel system to the copper system. In that case the transition from steel to copper must be established after a 90° bend.

Press couplings

When press couplings are used for branch pipes from concrete trenches they must not be embedded in concrete, as the alkaline concrete may have a detrimental effect on the brass in the coupling. The press coupling must be protected by an anti-corrosion tape before concreting.

Hard-soldering

Carry through the soldering with solder containing min. 5% Ag.

Casing joints

FX joints with half shells or SX for foaming are used for straight casing joints.

SXB joints are used for insulation of bends.

SXT joints are used for insulation of branches.

Pressing and drilling

The smooth casing and the excellent adherence between the casing, the insulation and the pipe make the Logstor Cu-Flex suitable for horizontal directional drilling, as it tolerates being pulled through a drilled hole without being damaged.

The drilling hole must be sufficiently large for the pipe to be pulled freely through it.

Pipe trench

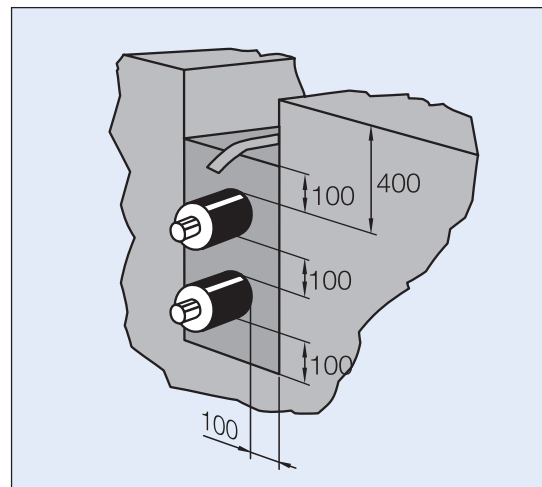
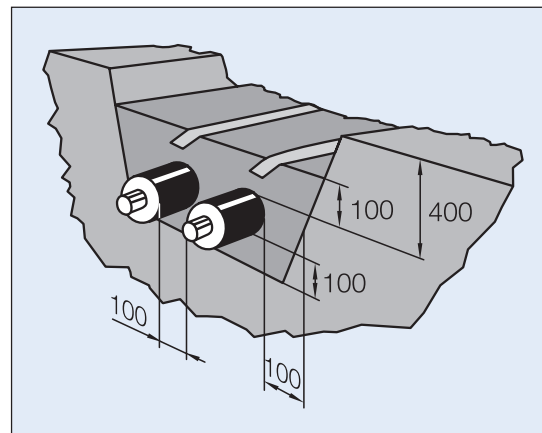
Prepare the pipe trench according to the drawings, make sure that the pipes are covered by at least 400 mm of soil. Place the pipes on a layer free from stones and sharp-edged objects.

In order to avoid cavities between the pipes it is important to ensure that the distance between them is sufficiently large.

Fill the trench until the last 4 m from a pipe end with the dug-up material, provided that it has been cleared of stones and sharp-edged objects. A specific backfilling material must be used for the last 4 m in order to limit expansion.

If the pipes are buried under a trafficked passage it is recommended to backfill the trench at the entire length of the pipe with specified material to avoid the risk of settling. Place warning tapes over the pipes.

Ensure that the cross section of the trench is sufficiently large for a proper pipe and joint installation and for an adequate compression of the bedding layer and the backfilling.



Pipe

Cu-Flex - Components 7.2.1

The Cu quality of the carrier pipe is made of annealed copper, quality Cu-DHP - H040 according to EN 12449, with tolerance according to EN 1057.

The pipes are provided with an aluminium diffusion barrier between the insulation and the casing.

Two copper threads are embedded into the insulation of the detection system.

Pipe in coils are supplied without stripped ends.



Component no. 2100

Series 1		
Cu-pipe diameter d, mm	28	35
Cu-pipe wall thickness, mm	1.2	1.5
Casing 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

Delivery time at fixed length is stated on enquiry.

Fix lengths are ordered in exact lengths, min. 10 m and max. 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
Casing 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	X	X	X

Delivery time at fixed length is stated on enquiry.

Fix lengths are ordered in exact lengths, min. 10 m and max. 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
Casing pipe dia. 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
Fix length	X	X	X	X	X

Delivery time at fixed length is stated on enquiry.

Fix lengths are ordered in exact lengths, min. 10 m and max. 99 m.

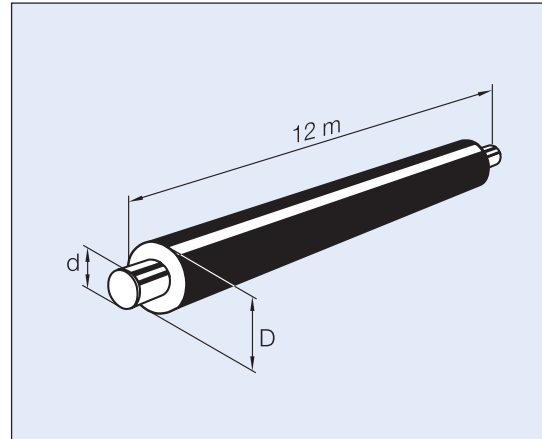
Cu-Flex - Components **7.2.2**

The Cu quality of the carrier pipe is made of annealed copper, quality Cu-DHP - H040 according to EN 12449, with tolerance according to EN 1057.

All straight pipes are bent at two different places. The arrow height of the two curves is approx. 10 cm.

Two copper threads are embedded into the insulation of the detection system.

Straight pipes are supplied with 150 mm free pipe ends.



Component no. 2000

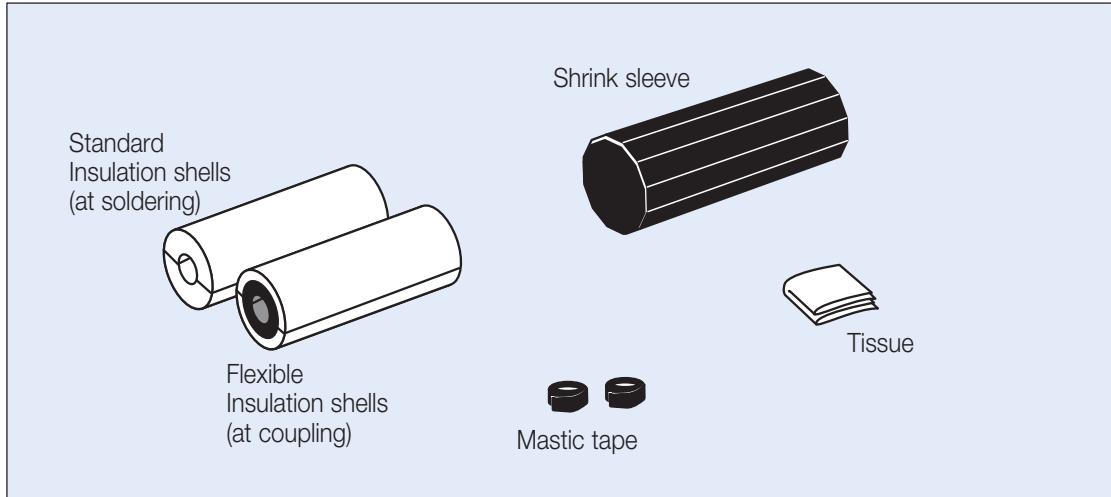
Series 1					
Cu-pipe diameter d, mm	35	42	54	70	88.9
Cu-pipe wall thickn. mm	1.5	1.5	1.5	2.0	2.5
Casing pipe diam. D, mm	90	110	125	140	160
Weight, kg/m	2.3	3.0	3.7	5.7	8.3
Water content, l/m	0.8	1.2	2.0	3.4	5.5

Series 2					
Cu-pipe diameter d, mm	35	42	54	70	88.9
Cu-pipe wall thickn. mm	1.5	1.5	1.5	2.0	2.5
Casing 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 thickn. mm	1.5	1.5	1.5	2.0	2.5
Casing 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

Joint with insulation shells

Cu-Flex - Components 7.2.6



Joint FX

Component no. 5057C

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

Supplied without couplings.

The FX joint shall be installed on underground buried flexible pipes. The FX joint is resistant to all normally occurring forces in the ground.

The FX joint has been tested to fulfil all strength and tightness requirements of EN 489. The joint cannot be pressure tested.

The FX joint is sealed with polyisobutylene strips delivered separately with it. The FX joint is insulated with Insulations shells made of polyurethane at soldering. And Insulations shells made of polyurethane foam with a soft intermediate layer of Insul-tube for couplings.

The shrink sleeve is produced by expanding a crosslinked PE (PEX) pipe.

The shrink sleeve is wrapped up in a solid white PE foil at delivery. The foil is closed with white tape.

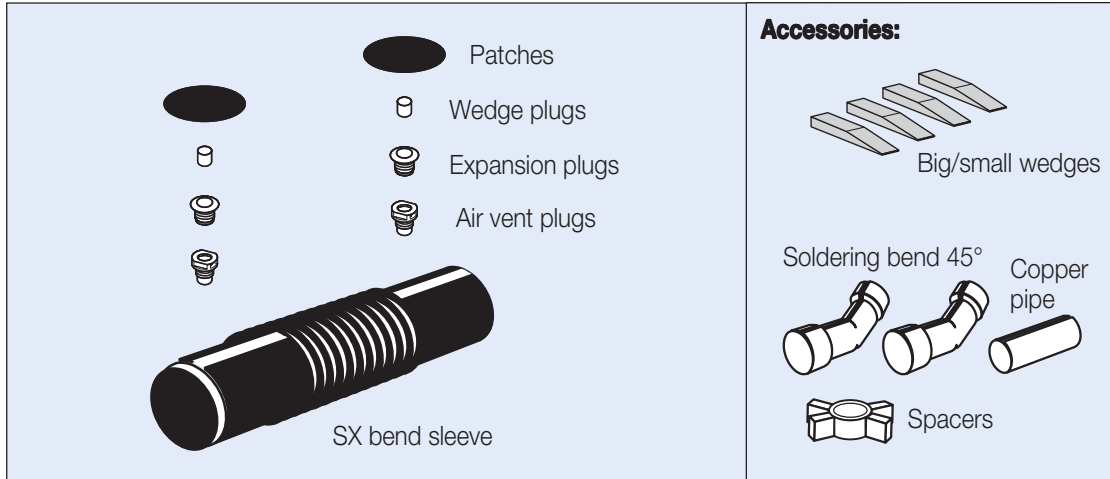
The FX joint shall be protected from temperatures over 70°C during transport and storage.

The FX joint may be installed at deflection up to 5 deg.

FX joints for freely suspended systems shall be ordered as FXI Industry.

Bend joint for foaming

Cu-Flex - Components 7.2.10



Joint SXB, covering length in accordance with installation instructions

Component no. 5208

Casing pipe diameter D, mm	90	110	125	140	160	180	200
Shrinkable until diameter, mm	66	90	110	125	140	180	200
Shrink sleeve length L, mm	865	895	895	895	895	900	965
Foam volume for series 1, l	5.8	7.6	9.2	11	13.4	-	-
Foam pack size series 1	3	5	6	6	7	-	-
Foam volume for series 2, l	-	8.2	9.7	12	15	29.8	-
Foam pack size series 2	-	5	6	7	8	11	-
Foam volume for series 3, l	-	-	10.6	12.6	16	31.6	29.8
Foam pack size series 3	-	-	6	7	8	11	11

Joint SXB is used when changing directions in any angle from 0°-90° in stead of pre-insulated elbows.

The SX bend sleeve is made of cross-linked PE (PEX) and wrapped up in a solid white PE foil at delivery. The joint ends are contain mastic.

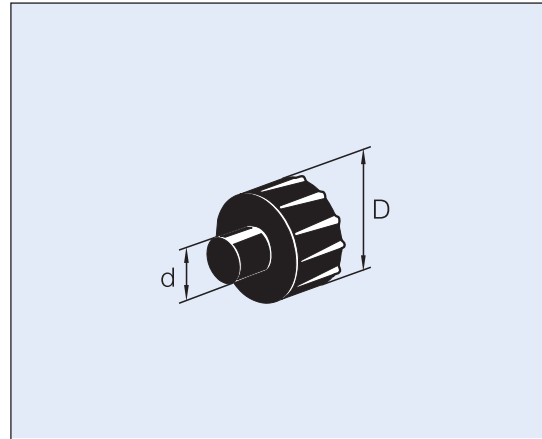
The wavy central part of the bend joint becomes soft and flexible when heated with a gas flame.

After bending and cooling the form becomes stable again. The SXB replaces a pre-insulated bend and two straight joints.

On ordering SXB for Cu-bend, two 45° bends, a Cu intermediary piece and a spacer are supplied along with it.

Cu-Flex - Components **7.2.19**

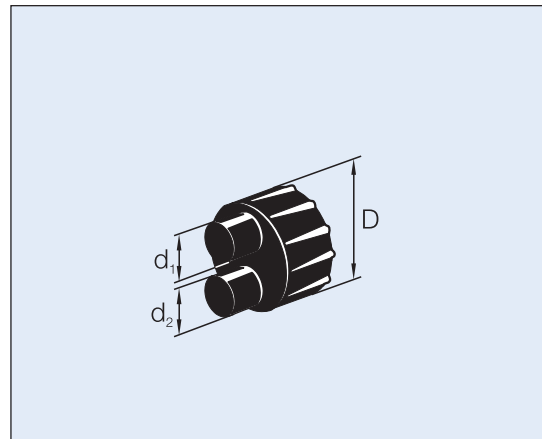
The end cap is applied for protection of the foamed ends against moisture penetration. The end cap has shrinking properties.



Component no. 5600

Cu-pipe diameter d, mm	18	22	28	35	42	54	70	88.9	
Casing pipe diameter D,mm	66	66	77	90	110	125	140	160	
DHEC no.	2000	2000	2000	2100	2200	2300	2400	2500	

End cap double



Component no. 5610

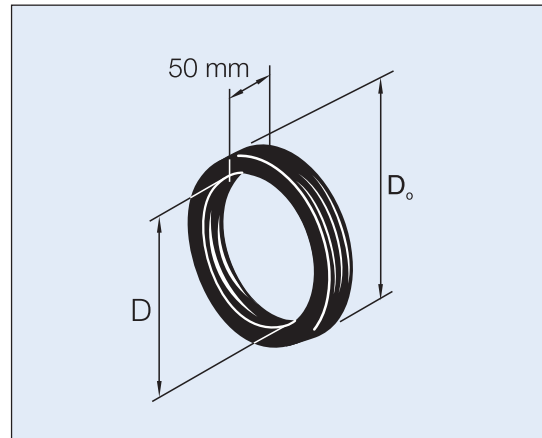
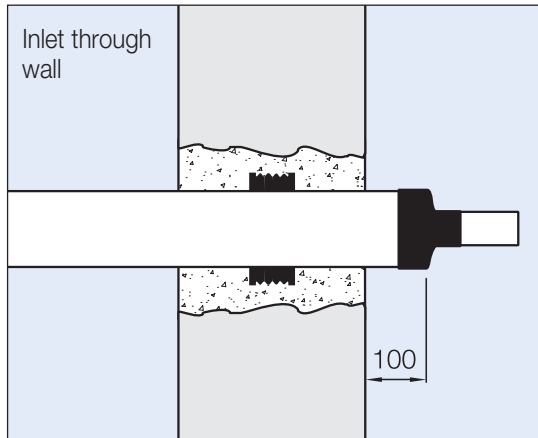
Cu-pipe diameter d ₁ /d ₂ , mm	18/18	22/22	28/28	35/35	42/42
Casing pipe diameter D, mm	90	110	125	140	160
DHEC no.	3200	3200	3200	3280	3350-2

Cu-pipe diameter d ₁ /d ₂ , mm	22/15	28/18	35/22	42/28	54/35
Casing pipe diameter D, mm	90	110	125	140	160
DHEC no.	3200	3200	3200	3280	3350

Seal ring



Cu-Flex - Components **7.2.22**



Component no. 5800

Casing pipe diameter D, mm	77	90	110	125	140	160	180	200	
Outside diameter D _o , mm	110	124	145	159	175	194	214	233	

A seal ring is applied for sealing of the pipe lead-through in foundations.

A seal ring cannot seal against subsoil water.
Contact Logstor in case the occasion arises.



• PPSL District Energy

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Tel: +44 (0) 1442 874808 Fax: + 44 (0) 1442 876293

Email: info@ppsl-districtenergy.co.uk Web: www.ppsl-districtenergy.co.uk

GUIDE SPECIFICATION FOR LØGSTØR RØR POLYETHYLENE CASED PRE-INSULATED COPPER PIPEWORK

For the distribution of:

- **Low/Medium Temperature Hot Water**
- **Heating**

The **Løgstør Rør** pre-insulated distribution system shall consist of a composite bonded, insulated, jacketed pipework system, composed of copper service pipe, polyurethane rigid foam thermal insulation, encased in a high density polyethylene jacket.

As supplied by:

PPSL District Energy

The Coach House
Boxwell Road
Berkhamsted
Hertfordshire
HP4 3ET

Tel: 01442 874808

Fax: 01442 876293

Email: info@ppsl-districtenergy.co.uk

Web Site: www.ppsl-districtenergy.co.uk

General

All **Løgstør Rør** products and corresponding materials are to meet with the requirements, where relevant, as stated in the EN 253 and associated standards, published by the CEN (European Committee for Standardisation). The features are to include the following:



Copper Pipes

DN 15 - DN 88 Copper Pipes are manufactured in accordance with DIN 1787/17671, corresponding to SIS 5015-02.

Pre-Insulated pipes and pipe fittings are to be identification marked when delivered. Copies of quality control certificates and test certificates are to be made available to order.

CFC-Free Polyurethane Insulation

CFC-free polyurethane insulation is to be used in all tubes and fittings. The insulation shall have good thermal insulating qualities, excellent mechanical properties and excellent ageing resistance, including the following features:

Number of closed cells:	Minimum:	88%
Water absorption when boiled:	Maximum:	10%
Compression strength:	Minimum:	300 kPa
Thermal conductivity @ 50°C:		0.030 W/mK
Maximum continuous operating temperature:	140°C	

Jacket Pipe

The jacket pipe is to be made of high-density polyethylene (HDPE) and is to be manufactured to DIN 8075 or be directly extruded.

The material has to be stabilised against thermal, chemical, oxidising and other kinds of decomposition, ie. must fulfil the technical/functional requirements stated in EN 253.

The impact and wear strengths are to be very high, even at low temperatures.

The material is to be suitable for welding and is very resistant to stress corrosion cracking. The thickness of material is to be in accordance with international standards.

Alarm System

All **Logstør Rør** straight lengths and fittings are to be delivered with an alarm system with two alarm wires. The monitoring equipment is to use the well tried and tested water conductivity method to sense the presence of water within the foam filled annular space around the steel pipe using two bare wires for sensing and locating. The system is to use a low frequency, very low power, AC signal to sense both loop continuity and conductivity,

When an Alarm or Fault condition has been detected the relevant LED is to be illuminated - in addition an output relay is to be provided that can either de-activate or activate associated equipment. (**Note:** the relay shall have voltage free contacts rated at 1A at 30 volts DC or 0.3A at 150 volts AC - the relay is supplied so that the alarm may be connected into a Building Management System or any other associated plant).