

SINTEF Building and Infrastructure confirms that

LK Universal pipe in tube system

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

LK Systems AB
 P.O. Box 9113
 SE-200 39 Malmö

2. Product description

LK Universal is a pipe in a tube system for distribution of cold and hot water inside buildings, see Fig. 1-5. Table 1 shows LK Universal pipe in tube system's main components.

3. Fields of application

The approval concerns cold and hot water distribution inside buildings. The system can also be used as heating or cooling plant, but these plants are not a part of this approval.

4. Properties

PEX-pipes

The use of PEX-pipes has the following limitations:

- Maximum allowed pressure is 1,0 MPa (10 bar)
- Maximum allowed temperature for a short period of time is 95 °C
- Maximum continuous operating temperature is 70 °C

Water tightness

The pipe in tube system has passed type testing of water tightness in accordance with NT VVS 129 *Pipe in tube systems* for PEX-pipes as described in Table 1. PEX-pipes and fittings are certified in accordance with current product standards.

Exchangeability

PEX-pipe dimension 16 x 2.0 mm and 16 x 2.2 mm (both with 25 mm protection tube) is documented to be exchangeable for up to 10 meters length, included three bends plus wall box.

Acoustic characteristics

The pipe in tube systems acoustic characteristics depends on how it is installed, noise levels of taps, water hammer levels etc. The noise levels from technical installations shall be in accordance with limit values given in TEK and NS 8175, Class C.

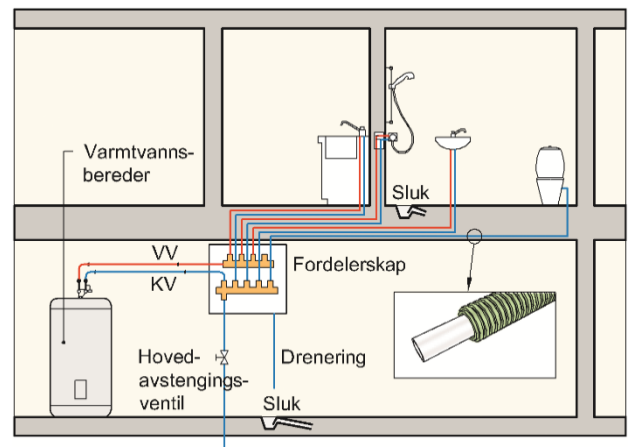


Fig.1
Principle sketch of a pipe in tube system



Fig.2
LK Manifold UNI-Valve



Fig. 3
LK Wall Box UNI



Fig. 4
LK SmartBox



Fig. 5
LK Manifold Cabinet UNI

Table 1
Product specifications for LK Universal pipe in tube system

Component	Description
LK PEX Universal Pipe X PiP	Dimension 16 x 2.0 mm (25 mm), 16 x 2.2 mm (25 mm), 20 x 2.8 mm (34 mm) and 25 x 3.5 mm (34 mm). External diameter of the belonging corrugated PE protection tubes is given in parenthesis. SINTEF Product Certificate no. 0675.
LK PressPEX	Fitting system for LK PEX Universal Pipe X PiP. SINTEF Product Certificate no. 0951.
LK Tube Adaptor	Fitting system for LK PEX Universal Pipe X PiP. SP SITAC Certificate no. SC0058-11.
LK PushFit	Fitting system for LK PEX Universal Pipe X PiP. SINTEF Product Certificate no. 1905.
LK Wall Box UNI	Wall box - 16 mm PEX-pipe and 25 mm protection tube
LK Pipe Membrane 48, Wall Box	Water tightening between LK Wall Box UNI and liquid membrane and watertight boards in wet zones. Outside diameter 120 mm. Hole diameter 48 mm.
LK SmartBox	Wall box with LK PushFit for 16 mm PEX-pipe and 25 mm protection tube
LK Membrane for SmartBox	Water tightening between LK SmartBox and liquid membrane and watertight boards in wet zones. Outside diameter 135 mm. Hole diameter 25 mm.
LK Pipe Membrane 25	Water tightening between 25 mm LK protection tube (draining from manifold cabinet) and liquid membrane and watertight boards in wet zones. Outside diameter 97 mm. Hole diameter 17 mm.
LK Manifold UNI	Nickel-plated manifold - DR brass.
LK Manifold UNI-Valve	Nickel-plated manifold with valve - DR brass.
LK Manifold Cabinet UNI 350, 450, 550 and 700	Enamelled steel cabinet included splash protection and bracket for fastening of manifolds.
LK Frame with lid for UNI INB for cabinet 350, 450, 550 and 700	Enamelled steel frame with lid and key for use together with LK Manifold Cabinet UNI. The frame can also be ordered with draining holes when mounted of cabinets in ceilings.
LK Frame with lid for UNI TAK 350 and 550	Enamelled steel frame with lid with drainage holes for use in ceilings.
LK Pipe Inlet Conduit 25 mm	Bushings to obtain watertight connection between manifold cabinet and protection tubes.
LK Pipe Inlet UNI 12-34 mm	Bushings to obtain watertight connection between manifold cabinet and protection tubes.
LK Fixing Plate	Fixing plate, for 25 mm protection tubes, that must be used inside the cabinet to obtain exchangeability of PEX-pipes.
LK Leaking Indication Plate	Leakage indication plate (chromium plated brass) for use as ending 25 mm draining from manifold cabinet
LK Nail Clip	Clamping of protection tubes (25 and 34 mm).
LK Jointing Sleeve	Jointing of 25 mm LK protection tubes.
LK End Protection	Water tightening between PEX-pipe and protection tubes with dimension 16 x 2.2 mm (25 mm) and 20 x 2.8 mm (34 mm).
LK Clip for Sleeve Pipe	Clamping of protection tubes (25 and 34 mm) in timber work etc.
LK Nail Protection Plate	Used when it is necessary to protect the outer tube (25 mm) in studs from nails etc.
LK Wall Box tool UNI	Used when mounting and demounting of the inside plastic nut in LK Angle Wall Box.
LK Fitting/Pipe Exchanger UNI	Used to pull the inner PEX- pipe trough LK Angle Wall Box UNI when exchanging the pipe.

5. Environmental aspects

Substances hazardous to health and environment

The product contains no hazardous substances with priority in quantities that pose any increased risk for human health and environment. Chemicals with priority include CMR, PBT or vPvB substances.

Effect on indoor environment

The product is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health.

Waste treatment/recycling

The product shall be sorted as metal and residual waste. The product shall be delivered to an authorized waste treatment plant for material and energy recovery.

Environmental declaration

No environmental declaration (EPD) has been worked out for the product.

Effect on drinking water

The system is judged to not release compounds to drinking water in amounts that can cause taste, odour or be dangerous to human health.

6. Special conditions for use and installation

Design considerations

The PEX-pipes shall be easily accessible for replacement after installation. The outer protection tubes shall be installed so that damaged PEX-pipes can be replaced without damaging any building construction. Leakages shall be easily discovered and shall not damage other installations or building parts. The main goal for the outer protection tube is to drain potential leakages to the floor gully in a wet room. Water leakages shall be directed through the manifold cupboard's draining tube to a visible spot, not into the floor gully directly.

Installation

LK Universal pipe in tube system shall be installed as described in Building Research Design Sheet 553.117 *Rør-i-rør-systemer for vannforsyning* and in accordance with the manufacturer's installation instructions. Components, as described in Table 1, shall be used when installing LK Universal pipe in tube system only. The internal control form, accompanying the manifold cabinet, shall be completed before commissioning.

Dimensioning

Chosen pipe dimensions shall give enough water to the sanitary equipment. The PEX-pipes shall be easily accessible for replacement after installation also. The following factors are controlling the exchangeability; pipe dimension, pipe length, fixation and number of bends. The exchangeability of the PEX-pipe must be controlled before finishing the building construction if the pipe lengths are more than 10 meters.

Table 2 shows suggested water flow capacity for different sanitary equipment with recommended pipe dimensions and maximum pipe length with respect to exchangeability. The water pressure must be at least 5 bars in front of the manifold for Table 2 to be valid.

Table 2
PEX-pipe dimensioning

Sanitary equipment	Water flow [l/s]	Recommended external diameter for PEX-pipe ²⁾ [mm]	
		16 x 2.0	16 x 2.2
Water closet	0,10	X	X
Basin mixer	0,20	X	X
Kitchen mixer	0,20	X	X
Shower mixer	0,20	X	X
Washing and dishwashing machines	0,20	X	X
Bath mixers	0,30	X ¹⁾	X ¹⁾

¹⁾ Pipe lengths > 5 meter should be controlled regarding capacity.

²⁾ X is recommended pipe dimension

Manifold Cabinet

When LK Manifold Cabinet UNI 350/450/550/700 is installed in a wet room, then the cabinet must be placed in a dry zone.

Outer protection tubes must be fastened to the cabinet by using LK Pipe Inlet together with LK Fixing Plate. The outer protection tubes must be cut above the sill height in the bottom of the cabinet. The drain tube must be cut as close as possible to the cabinet's bottom as described in Fig. 6.

Manifold Cabinets for wall installation shall be mounted at a height that ensures the outer protection tubes come straight into the cabinet.

Draining of water leakage from the cabinet to the floor gully must be guided through a protection tube with an outside diameter of 25 mm and an LK Leaking Indication Plate. LK Pipe Membrane 25 must be used when the draining penetrates the wall in a wet zone. The drain tube has a capacity ≥ 0.25 l/s. The drain tube can not be more than 1.5 meters.

When LK Manifold Cabinet UNI is installed in the ceiling, then it must be mounted in a wet room with draining ability to a water tight floor with gully. The front door must be installed level with the ceiling and the water splash protector must be removed. Water shut off valves should not be located inside cabinets in ceilings. If the valve has to be located inside, then it must be easily accessible.

LK Pipe Inlet in the cabinet shall be controlled for water tightness before completion of the building construction. The water capacity of the drain tube shall also be controlled before finishing the wall.

The water splash protector shall always be placed inside LK Manifold Cabinet UNI with exception of when the cabinet is mounted in a ceiling.

It is important that the manifolds are clamped inside the cupboard to avoid bothersome noise from water hammers when closing of taps.

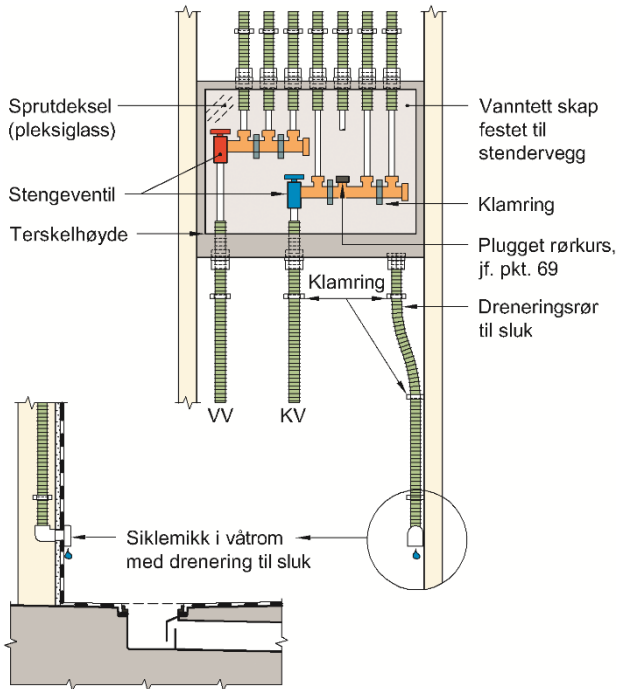


Fig. 6
Correct installation of LK Manifold Cabinet UNI in wet rooms

Manifold Cabinets without any chance of draining water leakages to a floor gully must be installed with a leakage detector as described in Fig. 7. LK VannStopp with SINTEF Technical Approval no. 20598 should be used. This solution can be relevant if the cabinet must be installed in rooms like offices, toilet room or kitchens without floor gullies.

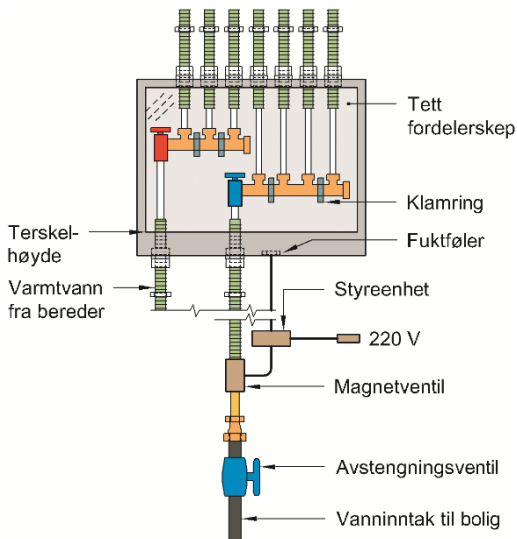


Fig. 7
Manifold cabinet without draining must be installed with a leakage detector which shuts off the water supply immediately if leakages occur

Manifolds

Manifolds should preferably be installed inside a manifold cabinet, but manifolds can be installed visibly in a wet room with a watertight floor membrane and gully. It is important to fix the manifolds well to the building construction.

Clamping of protection tubes

Fixations in accordance with Table 1 that fixes the protection tubes well to the building construction shall be used.

Clamping of protection tubes is especially important before and after a bend, in the middle of a bend, and also where tubes pass through a building part and in conjunction with wall boxes and manifold cabinets.

Protection tubes should be clamped in conjunction with wall boxes and manifold cabinets with a distance of 150-300 mm. The clamp space on straight pipes should not exceed 0.6 m.

LK Pipe Holding Nail should be used for clamping of protection tubes when the building construction is made of concrete.

Installation of wall boxes

LK Wall Box UNI shall be installed as described in installation instruction NO.29.C.14.1410 and LK SmartBox shall be installed as described in installation instruction NO.29.C.30.170109.

Installation of wall boxes in wet zones

Wall boxes and belonging sleeve/collar shall always be used in wet zones made of liquid membrane or watertight boards to ensure a water tight connection to the construction. The sleeve/collar must be installed as described in the installation instruction from LK Systems AB.

The tightening procedure of LK wall boxes in wet zones with bathroom panels shall follow the description as given in the technical approval of the panels.

Water leakages protection in kitchen and toilet room

Kitchen unit and toilet rooms are considered dry zones, i.e. rooms without gully and water tight floor. It is not required to use wall boxes in dry zones, but it is highly recommended. The wall box ensures a watertight connection between box and protection tube, and a good fixation to avoid trouble with expansion forces.

Floors in toilet rooms or the bottom floor inside the kitchen sink unit should have a watertight covering and a leakage detector to avoid damages from potential water leakages, see Fig. 8.

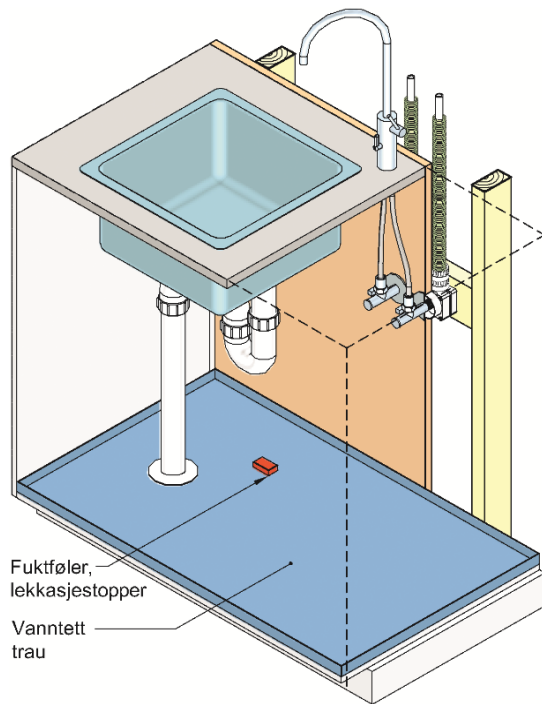


Fig. 8
Main principles for water leakage protection in dry zones

Special tools

Special tools for installation of the system from LK Systems AB shall be used if required.

Expansion forces

Expansion forces shall not cause damage to the pipe in tube system, taps or building constructions it is fastened to. The pipe expansion with regard to temperature must be considered when installing the system. PEX-pipes has 0.18 mm/(m°C) length expansion, i.e. 90 mm per 10 m and 50° C temperature difference. If the pipes are installed with small curves, much of the expansion will be picked up between the space of the PEX- pipe and the protection tube.

Water hammer

Water hammer can cause noise from the pipe in tube system due to movement (strokes) between PEX-pipes and protection tubes. This movement can be avoided if the pipes are installed with small curves with clamp spacing 0.6 meter as described in Building Research Design Sheet 553.117 and 553.185. It is also recommended to use special taps that have a water hammer reducing device closing mechanism installed.

Pipe protection

LK Nail Protection Plate should be installed in stud partitions where there is a risk of penetrating the pipes with nails, etc. Protection tubes can be destroyed by expansion forces and water hammers when they go through steel partitions, but this can be avoided by protecting the tubes.

PEX-pipes must not be exposed to solvents, and tape can not be used on the outside of the pipes. PEX-pipes must not be exposed to sunlight (UV- radiation) for a long period of time.

Cold and hot water insulation

Insulation of pipes must be considered if it is necessary in systems where it is needed for cold and hot water or for instance when the pipes are cast in concrete.

Protection against frost

When pipes are installed in an external wall/floor/roof, then the pipes must be placed on the warmest side of the construction to avoid pipe freezing.

Penetration of fire walls

Penetrating fire classified building walls or floors must not weaken the building construction's fire resistance. If plastic pipes with external diameter less than 32 mm penetrates:

- bricked or casted building constructions with fire resistance up to class EI 90 A"-s,d0, or
- isolated non-loadbearing wall with fire resistance up to class EI 60 A2-s1,d0,

then it must be used a sealant which is classified for the purpose. The sealant must have the same fire resistance as the construction. Penetration of fire walls shall be carried out as described in Building Research Design Sheet 520.342.

Pressure testing of the system

The pipe in tube system shall be pressure tested in accordance with LK installation instruction NO.29.C.14.1410 before handing it over to the owner of the building.

Marking of water circuits

The water circuit should be marked somewhere inside the manifold cabinet with exact length and where it delivers water. A circuit form, accompanying the cabinet, should be used.

Protection against Legionellosis

Cold and hot water pipes should not be in contact with each other to avoid heat transmission when installed. Cold water pipes should not be laid in areas with high temperature, f. ex. in timber work with floor heating.

Unused pipe circuits should be emptied of water and plugged or closed at the manifold.

7. Factory production control

The product is produced by LK Pex AB, Ulricehamn, Sverige.

The holder of the approval is responsible for the factory production control in order to ensure that the product is produced in accordance with the preconditions applying to this approval.

The manufacturing of the product is subject to continuous surveillance of the factory production control in accordance with the contract regarding SINTEF Technical Approval.

8. Basis for the approval

The approval is based on a system assessment, documentation of the properties of the subcomponents, and type testing of a complete system as documented in the following reports:

- SINTEF Building and Infrastructure. Test report 3B040932 dated 5.6.2012.
- SINTEF Building and Infrastructure. Test report 3B040933 dated 6.8.2012.
- SINTEF Building and Infrastructure. Test report 3B040935 dated 14.5.2012.
- SINTEF Building and Infrastructure. Test report 3B040943 dated 28.9.2012.
- SINTEF Building and Infrastructure. Test report 102004276-3 dated 14.08.2013.
- SINTEF Building and Infrastructure. Test report 102004276-54 dated 29.4.2016.
- SINTEF Product Certificate no. 0675
- SINTEF Product Certificate no. 0951
- SINTEF Product Certificate no. 1905

9. Marking

All packaging should be marked with the manufacturer's name, product name and production date. The approval mark for SINTEF Technical Approval No. 20312 may also be used.



Approval mark

10. Liability

The holder/manufacturer has sole product responsibility according to existing law. Claims resulting from the use of the product cannot be brought against SINTEF beyond the provisions of Norwegian Standard NS 8402

for SINTEF Byggforsk

A handwritten signature in blue ink that reads 'Hans Boye Skogstad'.

Hans Boye Skogstad
Approval Manager