Introduction

System **KAN-therm** PP is a complete installation system consisting of pipes and fittings made of polypropylene PP-R (type3).
The system is widely used in construction, particularly in water supply systems.
The elements of the system are connected by socket welding (thermal polyfusion) with the use of electric welders. Welding technique through a homogeneous combination provides outstanding tightness and mechanical strength of the installation.

The material

The plastic used in the production of pipes and fittings of the System **KAN-therm** PP is the high quality random polypropylene copolymer (PP-R) which used to be marked as Type 3.

System **KAN-therm** PP is characterised by a number of advantages:

- high microbiological and physiological inertness of products
- high chemical resistance,
- resistance to material corrosion,
- low thermal conductivity,
- low specific mass,
- resistance to scale accumulation,
- dampening of flow vibrations and noises,
- mechanical strength,
- homogeneity of connections,
- high operation durability.

The scope of uses

The installation System **KAN-therm** PP, due to its material properties, has a wide range of use:

- cold (20°C/1.0 MPa) and hot (60°C/1.0 MPa) water in residential buildings in hospitals, hotels, office buildings, schools,
- central heating systems (temp. up to 90°C, working pressure up to 0.6 MPa),
- compressed air systems,
- balneological installations,
- installations in agriculture and gardening,
- industrial pipelines, e.g. for transporting of aggressive media and food substances,
- naval installations.

The scope of applications includes new installations, as well as repairs, modernisations and replacements.

Sanitary systems installation

System **KAN-therm** PP installations, thanks to the special properties of PP-R polypropylene (physiological and microbiological inertness, resistance to corrosion, to scale accumulation, vibration resistance, high thermal insulation of pipes), they are widely used especially in water supply systems, in particular in the installation of risers and horizontal pipes.

This refers to both cold and hot water installations - in residential buildings, hospitals, hotels, office buildings, schools, on ships, etc.

System **KAN-therm** PP installations are indispensable in the replacement of old, corroded water supply installations. Due to the specific technique of connection, thermal polyfusion, i.e. welding, tightness and durability of the installation is guaranteed.

Elements of the system

System **KAN-therm** PP includes the following elements:

- PP-R pipes in the form of straight sections, uniform and compound,
- uniform PP-R fittings,
- „adaptor" couplings with metal threads,
- sleeves for flange connections, pipe joint connections,
- expansion bends, wallplates, ball valves,
- fixing elements,
- tools for cutting, machining and welding.

Pipes

Pipe types

KAN-therm PP System features four pipe types which differ in wall thickness and structure (compound pipes):

- uniform pipes PN 10 (20 -110 mm),
- uniform pipes PN 16 (20 -110 mm),
- uniform pipes PN 20 (16 -110 mm),
- compound pipes PN 16 Stabi Al (20 - 75 mm),
- compound pipes PN 20 Stabi Al (16 -110 mm).
- compound pipes PN16 Glass (20 - 110mm)

Dimension (range) and pressure classification of PP-R pipes

S - pipe dimension series in accordance with ISO 4065
S = (D-s)/2s
SDR - standard dimension ratio
SDR = 2×S+1 = D/s
D - nominal external tube diameter
s - nominal tube wall thickness
PN - pipe pressure range

S	SDR	PN
5	11	10
3,2	7,4	16
2,5	6	20

PN10 pipes (S5/SDR11)						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
20 × 1,9	20	1,9	16,2	0,206	0,107	Uniform, thin-walled pipes, for cold water.
25 × 2,3	25	2,3	20,4	0,327	0,164	Diameter range from 20×1,9 to 110×10,0 mm.
32 × 2,9	32	2,9	26,2	0,531	0,267	**Used in installations:** cold utility water, with the operating pressure of 10 bar and calculation temperature of 20°C.
40 × 3,7	40	3,7	32,6	0,834	0,412	
50 × 4,6	50	4,6	40,8	1,307	0,638	
63 × 5,8	63	5,8	51,4	2,075	1,010	
75 × 6,8	75	6,8	61,4	2,941	1,420	4 m sections.
90 × 8,2	90	8,2	73,6	4,254	2,030	
110 × 10,0	110	10,0	90,0	6,362	3,010	

PN16 pipes (S3,2/SDR7,4)						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
20 × 2,8	20	2,8	14,4	0,163	0,148	Uniform pipes.
25 × 3,5	25	3,5	18,0	0,254	0,230	Diameter range from 20×2,8 mm to 110×15,1 mm.
32 × 4,4	32	4,4	23,2	0,415	0,370	**Used in installations:** cold and hot utility water, with the operating pressure of 8 bar and calculation temperature of up to 60°C.
40 × 5,5	40	5,5	29,0	0,615	0,575	
50 × 6,9	50	6,9	36,2	1,029	0,896	
63 × 8,6	63	8,6	45,8	1,633	1,410	
75 × 10,3	75	10,3	54,4	2,307	2,010	4 m sections.
90 × 12,3	90	12,3	65,4	3,358	2,870	
110 × 15,1	110	15,1	79,8	4,999	4,300	

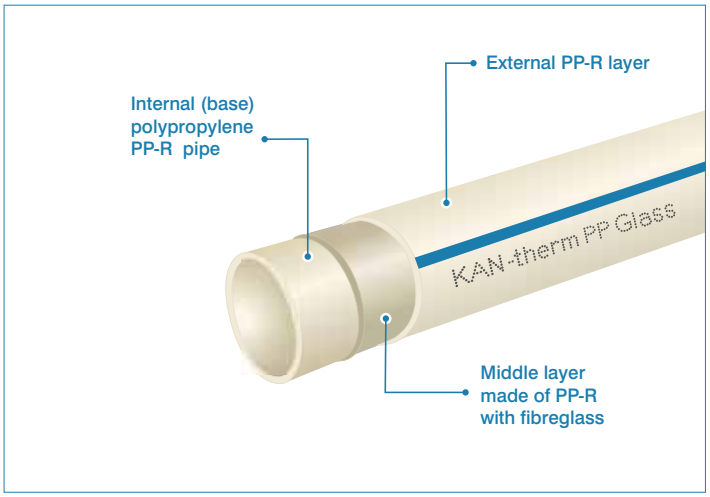
PN20 pipes(S2,5/SDR6)						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
16 × 2,7	16	2,7	10,6	0,088	0,110	Uniform, thick-walled, universal pipes.
20 × 3,4	20	3,4	13,2	0,137	0,172	Diameter range from 16×2,7 to 110×18,4 mm.
25 × 4,2	25	4,2	16,6	0,216	0,266	**Used in installations:** cold and hot utility water, with the operating pressure of 10 bar and calculation temperature of up to 60°C, and in heating systems (6 bar/80°C, tmax=90°C).
32 × 5,4	32	5,4	21,2	0,353	0,434	
40 × 6,7	40	6,7	26,6	0,556	0,671	
50 × 8,3	50	8,3	33,4	0,866	1,050	
63 × 10,5	63	10,5	42,0	1,385	1,650	
75 × 12,5	75	12,5	50,0	1,963	2,340	4 m sections.
90 × 15,0	90	15,0	60,0	2,827	3,360	
110 × 18,3	110	18,3	73,4	4,208	5,040	

PN 16 pipes Stabi Al						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
20×2,8	20 (21,7)	2,8	14,4	0,163	0,194	Compound pipes, stabilize, protected by Al foil. Diameter range from 20×2,8 to 75×10,3 mm.
25×3,5	25 (26,7)	3,5	18	0,254	0,292	**Used in installations:** cold and hot utility water, with the operating pressure of 10 bar and calculation temperature of up to 60°C, and in heating systems (6 bar/80°C, tmax=90°C).
32×4,4	32 (33,7)	4,4	23,2	0,415	0,462	
40×5,5	40 (41,6)	5,5	29	0,615	0,682	
50×6,9	50 (51,6)	6,9	36,2	1,029	1,003	4 m sections.
63×8,6	63 (64,5)	8,6	45,8	1,633	1,540	* external outer diameter of the tube with Al foil and protection layer
75×10,3	75 (76,5)	10,3	54,4	2,307	2,590	

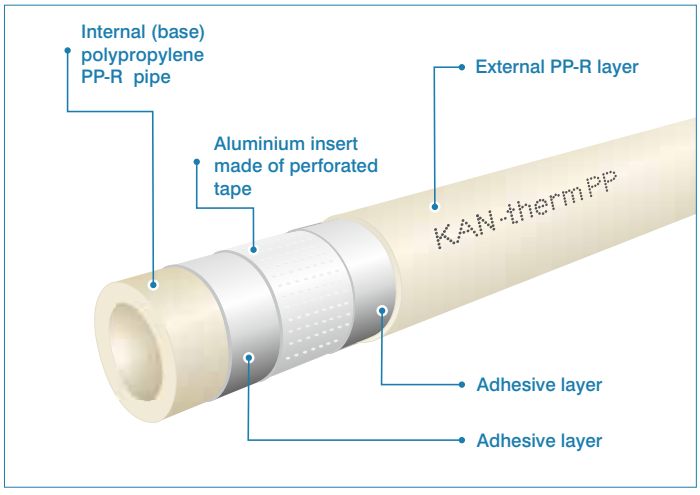
PN 20 pipes Stabi Al						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
16 × 2,7	16 (17,8)*	2,7	10,6	0,088	0,160	Compound, stabilized pipes, reinforced with aluminium film. Diameter range from 16×2,7 to 110×15,1 mm. **Used in installations:** hot utility water, with the operating pressure of 10 bar and calculation temperature of up to 60°C, and in heating systems (6 bar/80°C, tmax=90°C). 4 m sections. * in brackets: internal diameter of the pipe with Al film and protective layer
20 × 3,4	20 (21,8)*	3,4	13,2	0,137	0,218	
25 × 4,2	25 (26,9)*	4,2	16,6	0,216	0,328	
32 × 5,4	32 (33,9)*	5,4	21,2	0,353	0,520	
40 × 6,7	40 (41,9)*	6,7	26,6	0,556	0,770	
50 × 8,3	50 (51,9)*	8,3	33,4	0,866	1,159	
63 × 10,5	63 (64,9)*	10,5	42,0	1,385	1,770	
75 × 12,5	75 (76,9)*	12,5	50,0	1,963	2,780	
90 × 15,0	90 (92)*	15,0	60,0	2,830	3,590	
110 × 18,3	110 (112)*	18,3	73,4	4,210	5,340	

PN 16 pipes Glass						
Dimensions	Ext. diameter D	Wall thick. s	Int. diameter d	Unit volume	Unit mass	
[mm]	[mm]	[mm]	[mm]	[l/m]	[kg/m]	
20 × 2,8	20	2,8	14,4	0,163	0,160	Compound, fibreglass reinforced pipes. Diameter range from 20×2,8 to 110×15,1 mm. **Used in installations:** hot utility water, with the operating pressure of 10 bar and operating temperature of up to 60°C, and in heating systems (6 bar/80°C, tmax=90°C). 4 m sections.
25 × 3,5	25	3,5	18,0	0,254	0,250	
32 × 4,4	32	4,4	23,2	0,415	0,430	
40 × 5,5	40	5,5	29,0	0,615	0,650	
50 × 6,9	50	6,9	36,2	1,029	1,000	
63 × 8,6	63	8,6	45,8	1,633	1,520	
75 × 10,3	75	10,3	54,4	2,307	2,200	
90 × 12,3	90	12,3	65,4	3,358	3,110	
110 × 15,1	110	15,1	79,8	4,999	4,610	

Compound pipes Glass



Compound pipes Stabi

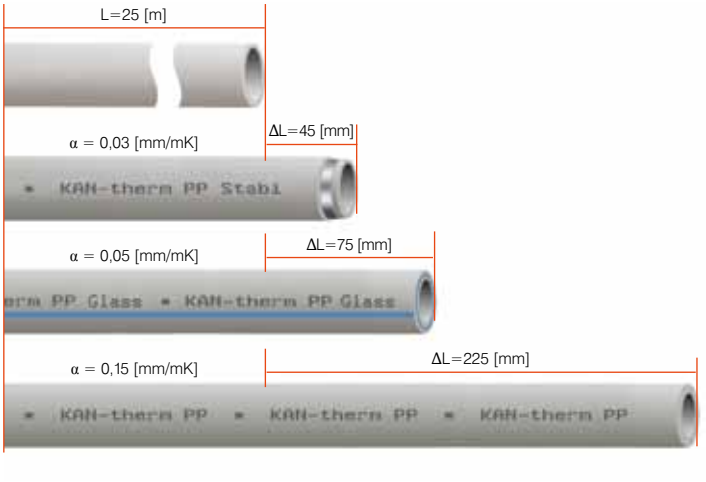


Thermal elongation

Every pipeline, when exposed to temperature difference ΔT, undergoes elongation (or shortening) by the ΔL value. This amount is calculated with the below formula:

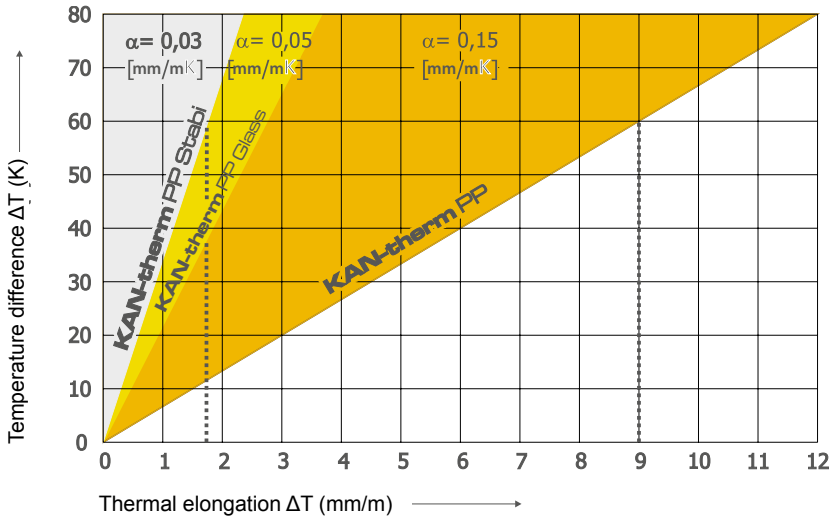
$$\Delta L = \alpha \times L \times \Delta T$$

α - thermal linear elongation coefficient [mm/mK]
0,15 [mm/mK] - homogenous PP pipes
0,05 [mm/mK] - PP Glass pipes
0,03 [mm/mK] - PP Stabi pipes
L - pipeline section length [m]
ΔT - temperature difference during installation and use [K]



Example:
Elongation of 25 m pipe
KAN-therm PP Stabi,
KAN-therm PP Glass,
KAN-therm PP homogenous
at temperature difference 60°C.

- **KAN-therm** PP Stabi
  ΔL = 0,03×25×60 = 45 [mm]
- **KAN-therm** PP Glass
  ΔL = 0,05×25×60 = 75 [mm]
- **KAN-therm** PP
  ΔL = 0,15×25×60 = 225 [mm]



Compensators

In order to eliminate linear elongation effects (uncontrolled movements of pipelines and their deformation), compensation solutions with different structures are sued (flexible arm, U- and Z-shape compensators).

$$L_s = K \times \sqrt{Dz \times \Delta L}$$

Ls - flexible arm's length [mm]

K - material coefficient = 20

Dz - external diameter of the pipe [mm]

ΔL - elongation of the pipe-line length [mm]

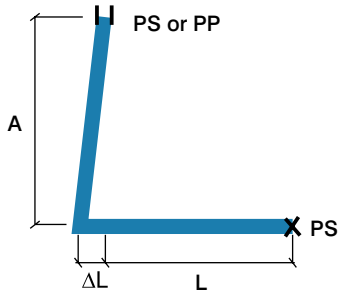
System KAN-therm PP - „L", „Z", and „U" compensator selection

Table 1 Required expansion compensation length A [mm] for System KAN-therm PP

Elongation values ΔL [mm]	Pipe external diameters d_z [mm]									
	16	20	25	32	40	50	63	75	90	110
	Required expansion compensation length A [mm]									
2	113	126	141	160	179	200	225	245	268	297
4	160	179	200	226	253	283	318	346	380	420
6	196	219	145	277	310	346	389	424	465	514
8	226	253	283	320	358	400	449	490	537	593
10	253	283	316	358	400	447	502	548	600	663
12	277	310	346	392	438	490	550	600	657	727
14	299	335	374	423	473	529	594	648	710	785
16	320	358	400	453	506	566	635	693	759	839
18	339	379	424	480	537	600	674	735	805	890
20	358	400	447	506	566	632	710	775	849	938
22	375	420	469	531	593	663	745	812	890	984
24	392	438	490	554	620	693	778	849	927	1028
26	408	456	510	577	645	721	809	883	968	1070
28	423	473	529	599	669	748	840	917	1004	1110
30	438	490	548	620	693	775	869	949	1039	1149
32	453	506	566	640	716	800	898	980	1073	1187
34	466	522	583	660	738	825	926	1010	1106	1223

Table 1 presents required expansion compensation length A for different thermal elongation values ΔL and pipe external diameters (d_z).
Rules for selection of different types of compensators are given below:

„L" type compensator



A - flexible arm length

PP - sliding support (allows only axial movement of a pipeline)

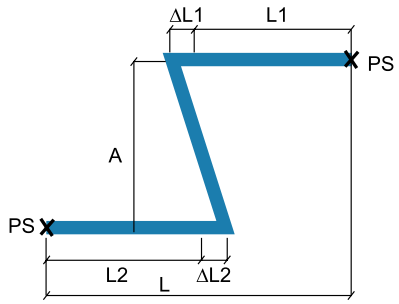
PS - fixed point (prevents any movement of a pipeline)

L - the initial length of a pipeline

ΔL - pipeline thermal elongation

For compensation arm A dimensioning, a substitute length Lz = L is taken, and for Lz length the thermal elongation value ΔL is determined from formula. Next, the expansion compensation length A is determined on the basis of Tab. 1.

„Z" type compensator



A - expansion compensation length;

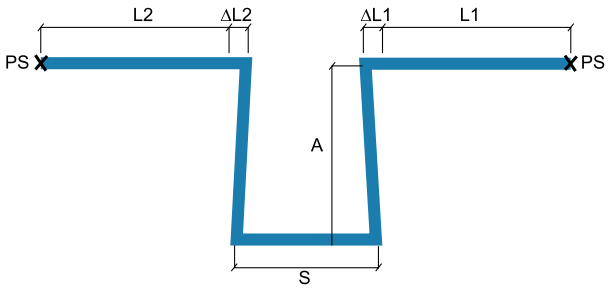
PS - fixed point (prevents the pipeline from moving);

L - pipeline initial length;

ΔL - pipeline thermal elongation.

For compensation arm A dimensioning, L1 and L2 sum is taken as a substitute length Lz = L1+L2, and for Lz length a substitute ΔL is determined from formula. Next, the expansion compensation length A is determined on the basis of Tab. 1.

„U" type compensator



A - expansion compensation length;

PS - fixed point (prevents the pipeline from moving);

L - pipeline initial length;

ΔL - pipeline thermal elongation.

S - U type compensator width

If a fixed point is placed within compensator width W, then for compensation arm A dimensioning, L1 and L2 bigger value is taken as a substitute length Lz = max (L1, L2), and for Lz length a substitute ΔL is determined from formula. Next, the expansion compensation length A is determined on the basis of Tab. 1.
Compensator width W = A/2.


1


2


3


4


5


6

Connection technique

Mechanical preparation

1. Cutting the pipes with scizors.
2. Removing of the aluminium foil with a coarse file (only for compound Stabi pipes).
3. Marking of the welding depth.

Welding

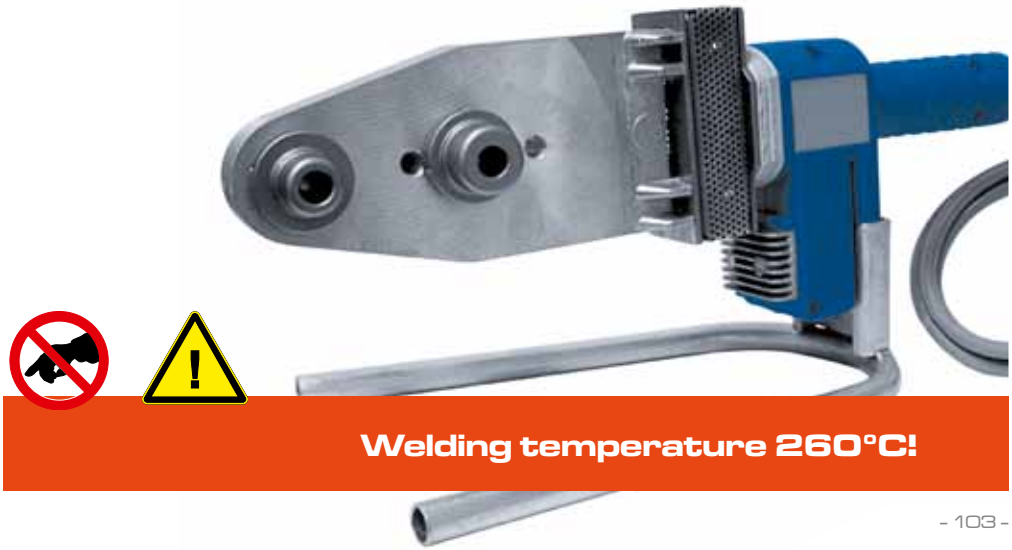
4. Heating of the pipe and the connector. Parameters:
   - welding depth,
   - welding time.

5. Connecting of the elements. Parameters:
   - joining time.

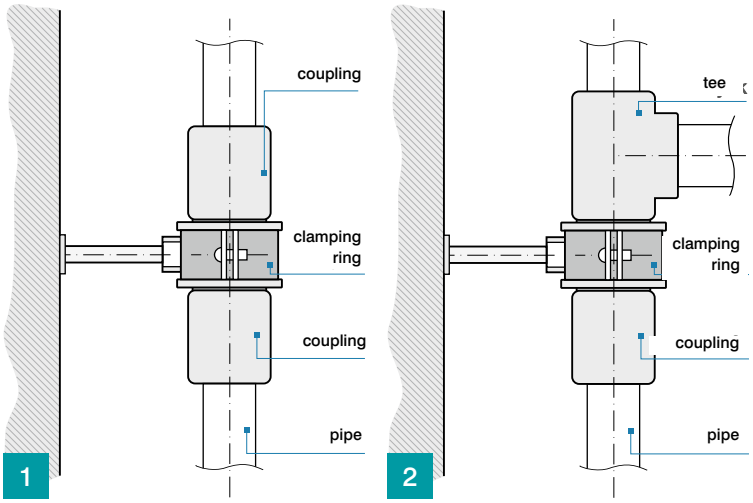
6. Holding and cooling of the joint. Parameters:
   - cooling time.

Welding parameters				
Ext. pipe diameter.	Welding depth	Heating time	Joining time	Cooling time
[mm]	[mm]	[sek.]	[sek.]	[min.]
16	13,0	5	4	2
20	14,0	5	4	2
25	15,0	7	4	2
32	16,0	8	6	4
40	18,0	12	6	4
50	20,0	18	6	4
63	24,0	24	8	6
75	26,0	30	10	8
90	29,0	40	10	8
110	32,5	50	10	8

The heating time of thin-walled pipes (PN 10) **is reduced by half** (the heating time for fittings remains unchanged). The heating time at external temperatures below +5°C should be increased by 50%.

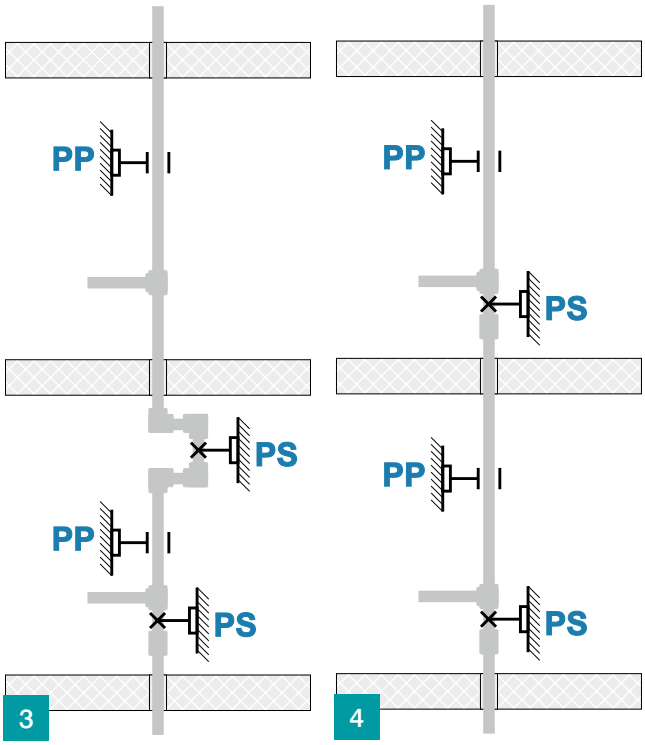


Installation procedures



Fixed installation points - installation examples (Fig. 1 and 2)

Installation made of pipes:
KAN-therm PP System PN16, PN20



Examples of installation of hot water risers depending on pipe types (Fig. 3 and 4)

Installation made of pipes:
KAN-therm PP Stabi System
PP - slidable point
PS - fixed point

T [°C]	External pipe diameter D [mm]									
	16	20	25	32	40	50	63	75	90	110
Distance between fixing points [cm]										
20	50	60	70	90	100	120	140	150	160	180
30	50	60	70	90	100	120	140	150	160	180
40	50	60	65	80	90	110	130	140	150	170
50	50	60	65	80	90	110	130	140	150	170
60	50	55	60	75	85	100	115	125	140	160
70	50	50	60	70	80	95	105	115	125	140

Maximum distances between supports for **KAN-therm** PP System uniform pipes

depending on the diameter and medium temperature.

For vertical pipeline sections, the distance between the supports can be increased byabout 30%.

T [°C]	External pipe diameter D [mm]									
	16	20	25	32	40	50	63	75	90	110
Distance between fixing points [cm]										
20	100	120	130	150	170	190	210	220	230	250
30	100	120	130	150	170	190	210	220	230	240
40	100	110	120	140	160	180	200	210	220	230
50	100	110	120	140	160	180	200	210	220	210
60	80	100	110	130	150	170	190	200	210	200
70	70	90	100	120	140	160	180	190	200	200

Maximum distances between supports for **KAN-therm** Stabi Al System pipes

depending on the diameter and medium temperature.

For vertical pipeline sections, the distance between the supports can be increased by about 30%.

Temperature difference	External pipe diameter D [mm]								
	20	25	32	40	50	63	75	90	110
Distance between fixing points [cm]									
0	120	140	160	180	205	230	245	260	290
20	90	105	120	135	155	175	185	195	215
30	90	105	120	135	155	175	185	195	210
40	85	95	110	125	145	165	175	185	200
50	85	95	110	125	145	165	175	185	190
60	80	90	105	120	135	155	165	175	180
70	70	80	95	110	130	145	155	165	170

Maximum distances between supports for **KAN-therm** System PP Glass pipes depending on the diameter and medium temperature.

For vertical pipeline sections, the distance between the supports can be increased by about 30%.

Tools - safety

All tools must be applied and used in accordance with their purpose and the manufacturer's instructions.
Use for other purposes or in other areas are considered to be inconsistent with the intended use.
Intended use also requires compliance with the instructions, conditions of inspection and maintenance and relevant safety regulations in their current version.
All works done with tools, which do not meet the application compatible with the intended purpose may result in damage to tools, accessories and pipes.
The consequence may be the leak and / or damage.