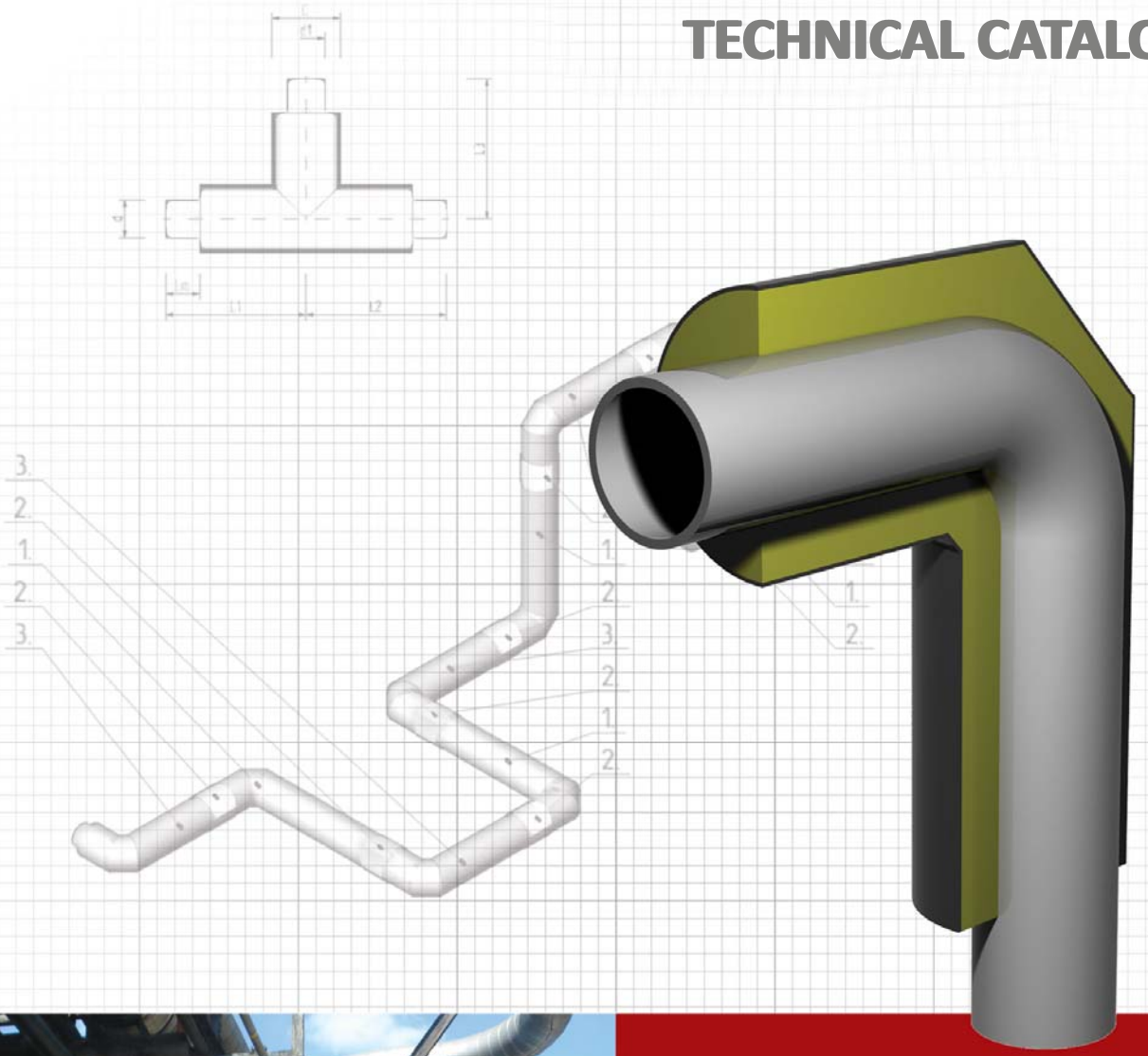
TERMOTECH®
TERMOPLASTY

TECHNICAL CATALOGUE



COMPOSITE PIPELINE SYSTEM

Grupa Konsultingowo-Inżynieryjna

kompleks®

Complete **composite** pipeline system

TERMOTECH® TERMOPLASTY

1. APPLICATION

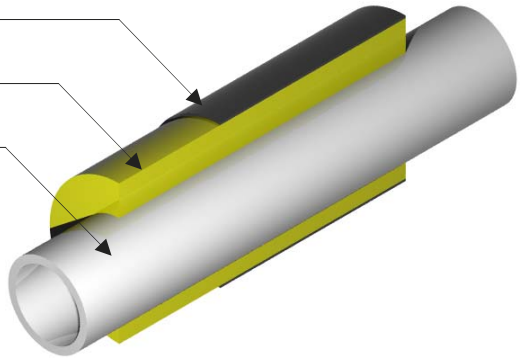
- chemical systems (for acids, bases, various chemical mixtures)
- process water systems
- cooling agent systems
- pipelines requiring the pumped agent to retain constant temperature
- outdoor potable water pipelines (e.g. pipeline river crossings)

2. SYSTEM COMPONENTS

- composite pipes
- composite fittings
- connector unit
- fasteners
- additionally pipes, fittings and valves without preinsulation

3. STRUCTURE

- Sleeve pipe
- Polyurethane foam
- Conduit pipe



Additional elements of the TERMOTECH® TERMOPLASTY sytem

- **Electric heating cable**
- **Tightness monitoring**

3.1. Conduit pipe

Conduit pipe can be made of following materials:

- **PE-HD 100** - rated operating temperature **-50°C ÷ +60°C**
- **PVC-U** - rated operating temperature **0°C ÷ +60°C**
- **PP-H** - rated operating temperature **0°C ÷ +80°C**
- **PB** - rated operating temperature **0°C ÷ +95°C**
- **ABS** - rated operating temperature **-40°C ÷ +60°C**
- **PVC-C** - rated operating temperature **0°C ÷ +90°C**
- **PVDF** - rated operating temperature **-40°C ÷ +140°C**

Rated operating pressure of **6bar, 10bar or 16bar,** depending on material. Detailed description and characteristics of materials can be found in the futher part of this catalogue.

3.2. Thermal insulation

Insulation in the form of PUR polyurethane foam is characterized by very good thermal insulation properties which also greatly increases composite material stiffness.

Basic parameters:

- thermal conductivity ratio **λ<0.027W/mK** at 50°C
- foam core density **ρ>45kg/m^3**

3.3. Sleeve pipe

Depending on the type of system and user preference, 3 types of sleeve pipes are possible:

- hard polyethylene (PE-HD) pipe of density of ρ>944kg/m^3 and corona-treated internal surface meeting the requirements of ***PN-EN 253*** standard.
- SPIRO spiral wound pipes of galvanized sheets as per ***PN-81/H-92125***
- SPIRO spiral wound pipes of aluminum sheets as per ***PN-87/H-92833***

4. DESIGN GUIDELINES

When designing pipelines, two issues shall be taken into consideration. Firstly, adequate distances between pipeline supports should be planned and ensured. Secondly, a system with natural compensation characteristics should be designed or application of expansion joints stipulated.

4.1. Linear thermal expansion

Preface.

Thermal expansion is an important operating parameter of pipeline systems. It is caused by excitation of movements of atoms constituting a given substance as a result of thermal energy supply. This results in linear expansion of the material. Incorrectly adopted compensation of this parameters in the operated system may lead, among others, to excessive stress in the pipe, cracks, misalignment and even leaks leading to pipeline damages. To prevent this phenomenon, following steps may be undertaken:

- build a pipeline with low thermal expansion rate
- apply a system for compensation of linear thermal expansion

Considering the production process of TERMOTECH TERMOPLASTY system, it should be noted that the conduit pipe, sleeve pipe and the foam filling the space between these pipes form a uniform piping system for which the thermal expansion for design calculation purposes is as follows:

- **α = 0.04 mm/mK -** for **PVC-U, PVC-C and ABS** conduit pipe
- **α = 0.08 mm/mK -** for **PE-HD, PP-H and PVDF** conduit pipe

Calculation methods.

Prior to commencement of pipeline thermal expansion calculations, a very important question should be asked: "What is the temperature at which the pipeline will be erected?" This temperature is the basic temperature in reference to which the ΔT for two variants shall be calculated.

Variant I
The pipeline is not in operation but is subject to action of external factors (extreme possible high and low temperatures should be considered).
Variant II
The pipeline is in normal operation; the temperature of the medium to be flowing in this pipeline should be considered together with the influence of external factors on the entire "system".

"System" thermal expansion.

$$\Delta L = L \cdot \Delta T \cdot \alpha$$

ΔL - length change for the entire system, mm
L - basic system length, m
α - unit expansion rate of the system, mm/mK
ΔT - temperature difference, K

4.1. Linear thermal expansion

Calculation example .

We shall examine the linear expansion rate for a 1000 meter pipeline made of various materials for temperature increase of $\Delta T = 30^0C$.

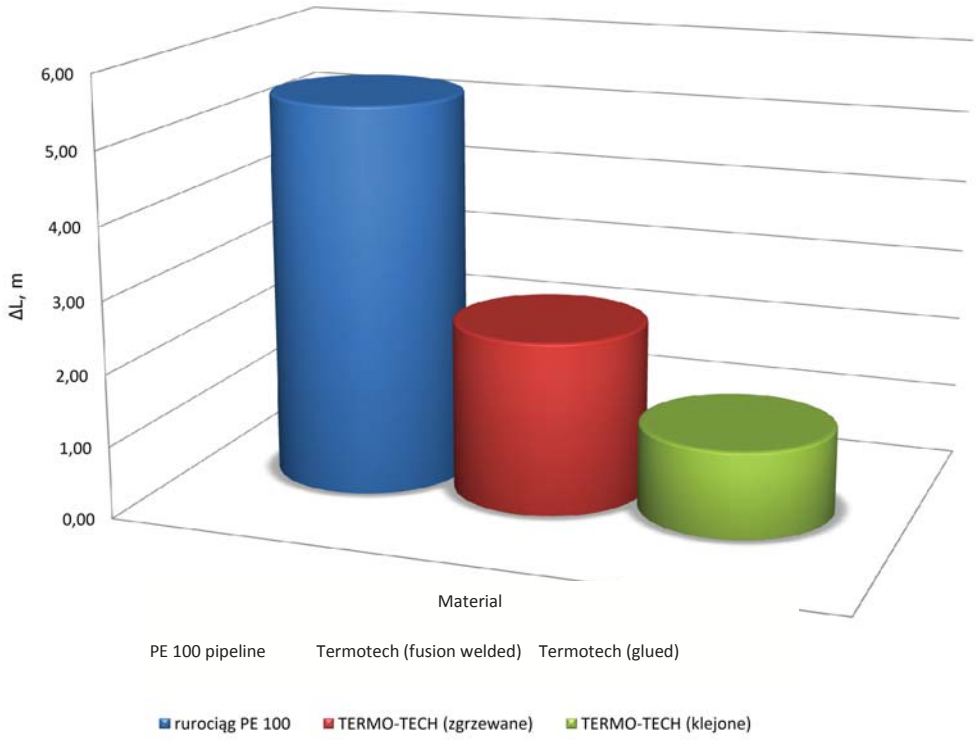
Materials to be tested ar as follows:

- PE 100 pipeline - α = 0.18 mm/mK
- Pipeline system TERMOTECH (**PE-HD, PP-H i PVDF**) - α = 0.08 mm/mK
- Pipeline system TERMOTECH (**PVC-U, PVC-C i ABS**) - α = 0.04 mm/mK

Results:

- PE 100 pipeline - ΔL = 5.40 m
- Pipeline system TERMOTECH (**PE-HD, PP-H i PVDF**) - ΔL = 2.40 m
- Pipeline system TERMOTECH (**PVC-U, PVC-C i ABS**) - ΔL = 1.20 m

Linear expansion L=1000m, dT=30K



Due to the thermal expansion of the TERMOTECH pipeline systems, they are a much better solution that the systems erected in a traditional manner. This brings following benefits in particular:

- reduction of the required number and size of expansion joints
- reduction of the required number of supports
- considerable reduction of the pipeline erection time

The above factors drive the project cost reduction versus pipelines insulated in a traditional manner.

4.2. Support points

The above-ground TERMOTECH TERMOPLASTY pipeline must be installed on supports. To reduce the stress in the pipeline, the supports should be installed at adequate distances. The hanging supports should be installed on rigid structures to prevent additional stress in the pipeline. Following three basic support points can be differentiated:

- **permanent support** – permanently attached to the ground and pipeline. It cannot move in any axis.
- **directional support** – this is a pipeline fastening method to enable pipeline movement along pipeline axis. It moves on a roller or sliding base.
- **moving support** – this is a pipeline fastener which can move both along and perpendicular to the pipeline axis (obviously in a limited range). It is based on a sliding plate in a special casing .

The selection of pipeline routing type (natural or artificial expansion joints) is an individual matter requiring a case -by-case analysis. One should always consider which of the methods is better justified for a given application. The decisive criteria can be as follows:

- number of supports - to be considered for cases of new applications and upgrades of steel pipelines
- conditions at the installation location - possibility or lack of possibility for installation of a given number and type of supports

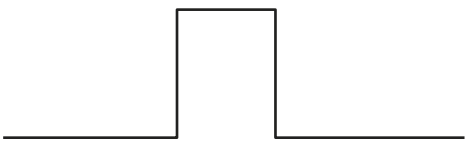
4.2.1. Linear expansion compensation

When designing linear expansion compensation for TERMOTECH TERMOPLASTY pipeline systems in a traditional manner, following two basic issues should be considered:

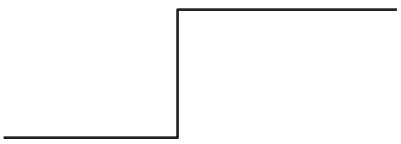
- correct calculation of **ΔL** expansion
- proper planning of fixed point arrangement - **P.S.**
- proper designing of **Lp** spacing between moving supports - **P.R.**
- ensuring minimum compensation arms **H**

The traditional linear expansion compensation methods include:

a. "U-shape" expansion joint



b. "Z-shape" expansion joint



Calculation example is in the further part of this study.

4.2. Support points

4.2.1. Linear expansion compensation

TAB. 1. Spacing of **Lp** moving supports for traditional compensation, m

PIPE DIAMETERS			PE-HD SLEEVE PIPE				SPIRO SLEEVE PIPE			
Conduit	Sleeve		MEDIUM DENSITY				MEDIUM DENSITY			
d	**Dz (PE-HD)**	**Dz (SPIRO)**	**0,0**	**1,0**	**1,5**	**1,8**	**0,0**	**1,0**	**1,5**	**1,8**
25	90	100	2,1	**2,0**	1,6	1,2	2,2	**2,1**	1,7	1,3
32	90	100	2,1	**2,0**	1,6	1,2	2,3	**2,2**	1,8	1,3
40	110	100	2,2	**2,1**	1,7	1,3	2,4	**2,3**	1,8	1,4
50	110	125	2,3	**2,2**	1,7	1,3	2,4	**2,3**	1,8	1,4
63	125	125	2,3	**2,2**	1,8	1,3	2,5	**2,4**	1,9	1,4
75	140	140	2,5	**2,4**	1,9	1,4	2,7	**2,6**	2,1	1,5
90	160	160	2,6	**2,5**	2,0	1,5	2,8	**2,7**	2,2	1,6
110	200	200	2,9	**2,8**	2,2	1,7	3,1	**3,0**	2,4	1,8
125	200	200	3,2	**3,0**	2,4	1,8	3,4	**3,3**	2,6	2,0
140	225	224	3,4	**3,2**	2,6	1,9	3,6	**3,4**	2,7	2,1
160	250	250	3,6	**3,4**	2,7	2,0	3,8	**3,7**	2,9	2,2
180	250	250	3,8	**3,6**	2,9	2,2	4,1	**3,9**	3,1	2,3
200	315	315	4,0	**3,8**	3,1	2,3	4,3	**4,1**	3,3	2,5
225	315	315	4,4	**4,2**	3,3	2,5	4,7	**4,5**	3,6	2,7
250	400	400	4,7	**4,5**	3,6	2,7	5,0	**4,8**	3,8	2,9
280	400	400	5,0	**4,8**	3,8	2,9	5,4	**5,1**	4,1	3,1
315	450	450	5,3	**5,0**	4,0	3,0	5,6	**5,4**	4,3	3,2

TAB. 2. Length of compensation arm **H** depending on expansion, m

d	Pipeline expansion **ΔL**, mm								
	10	**20**	**30**	**40**	**50**	**100**	**150**	**200**	**300**
25	0,8	1,1	1,4	1,6	1,8	2,5	3,0	3,5	4,3
32	0,8	1,1	1,4	1,6	1,7	2,5	3,0	3,5	4,3
40	0,9	1,2	1,5	1,7	1,9	2,7	3,4	3,9	4,7
50	0,9	1,2	1,5	1,7	1,9	2,7	3,4	3,9	4,7
63	0,9	1,3	1,6	1,8	2,1	2,9	3,6	4,1	5,0
75	1,0	1,4	1,7	2,0	2,2	3,1	3,8	4,4	5,3
90	1,0	1,5	1,8	2,1	2,3	3,3	4,0	4,7	5,7
110	1,1	1,6	1,9	2,2	2,5	3,5	4,3	5,0	6,1
125	1,2	1,7	2,0	2,3	2,6	3,7	4,5	5,2	6,4
140	1,2	1,8	2,1	2,5	2,8	3,9	4,8	5,5	6,8
160	1,3	1,9	2,3	2,6	2,9	4,1	5,1	5,9	7,2
180	1,4	2,0	2,4	2,8	3,1	4,4	5,4	6,2	7,6
200	1,5	2,1	2,5	2,9	3,3	4,6	5,6	6,5	8,0
225	1,6	2,2	2,7	3,1	3,5	4,9	6,0	6,9	8,5
250	1,6	2,3	2,8	3,3	3,6	5,2	6,3	7,3	8,9
280	1,7	2,4	3,0	3,4	3,8	5,4	6,6	7,6	9,4
315	1,8	2,5	3,1	3,6	4,0	5,7	6,9	8,0	9,8

4.2. Support points

4.2.1. Linear expansion compensation

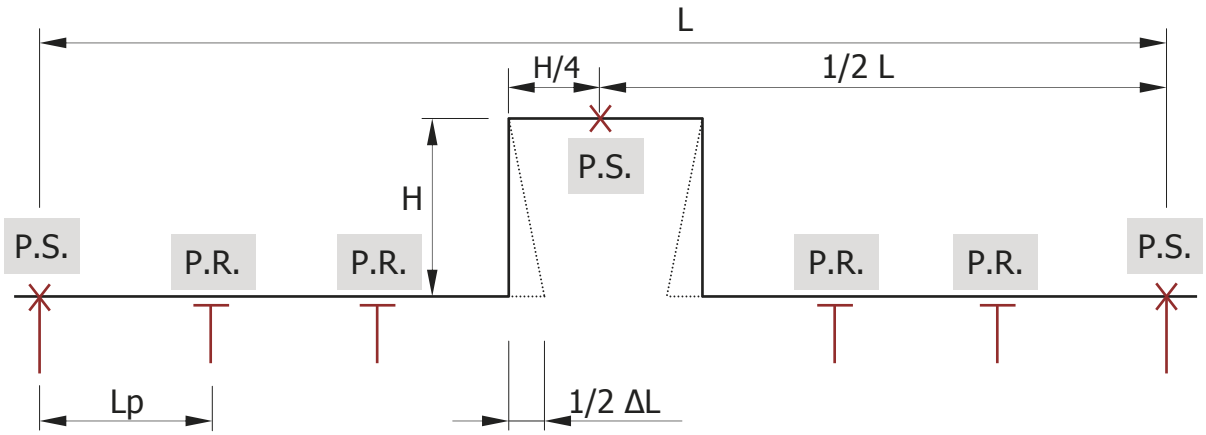
Calculation example:

Assumption data:

- pipeline type - TERMOTECH TERMOPLASTY **d110/200 PE-100/SPIRO**
- lenght of pipeline section - **L=100 m / L_1=40m i L_2=60m**
- trasnsported medium denisity - **1.0**
- expansion rate - **$\alpha = 15 \times 10^{-6} K^{-1}$**
- temperature difference - **ΔT= 30 K**

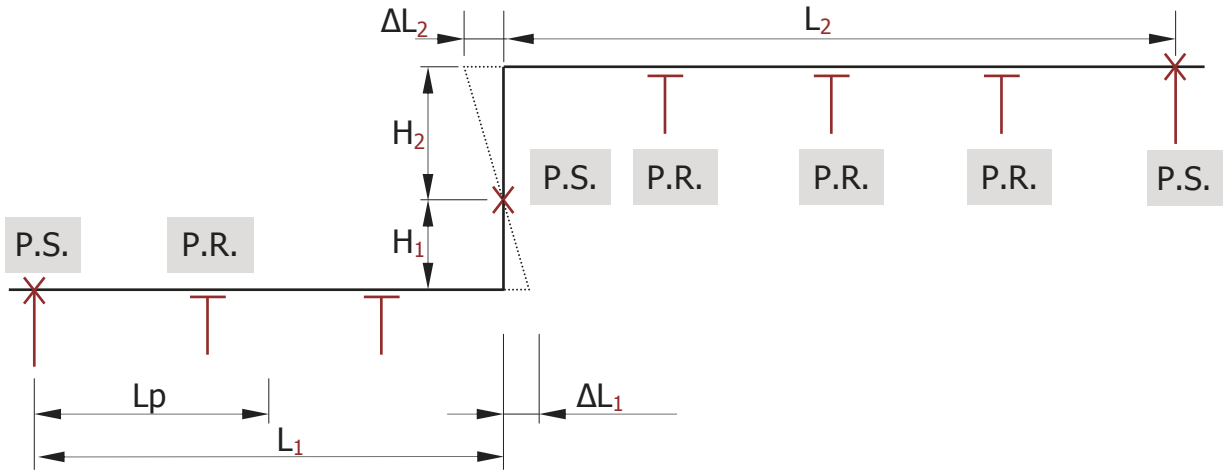
Example 1. *"***U***-shape" expansion joint*

- **ΔL** = 0.08 x 30 x **100** = **240.0mm**
- from **TAB. 1.** for assumption data - **Lp** = **3.0m**
- from **TAB. 2.** **d** and **1/2ΔL** - **H** = **3.9m**



Example 2. *"***Z***-shape" expansion joint*

- **ΔL_1** = 0.08 x 30 x **40** = **96.0mm** / **ΔL_2** = 0.08 x 30 x **60** = **144.0mm**
- from **TAB. 1.** for assumption data - **Lp** = **3.0m**
- from **TAB. 2.** **d** and **ΔL_1/ΔL_2** - **H_1** = **3.5m** / **H_2** = **4.3m**



5. ELECTRIC HEATING CABLE

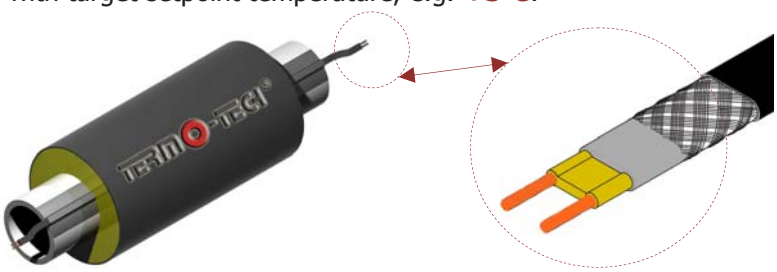
Self-regulating electric heating cable comprises two wires embedded in a semiconductor self-regulating matrix. It means that the cable automatically reacts to external conditions. When the temperature rises, the synthetic materials expands at the molecular level. The bonds between carbon atoms weaken and reduce electric resistance, whereas when the temperature decrease, molecular bonds become strengthened, thus leading to resistance increase. Thus, the heating power changes proportionally to the cable surface temperature. The self-regulating heating cable does not overheat or burn even in places in which two cable sections contact each other.

The self-regulating heating cable is used in the TERMOTECH system in the following cases:

- anti-freezing function - the thermostatic devices has set constant temperature, e.g. +5.0°C
- constant temperature maintenance function for the pumped agent

The cables in a certified version are also available **Ex** - explosion-safe design.

To obtain elements with a heating cable, upon placing an order, please enter **KG** in the **OPTION** field in the order form together with target setpoint temperature, e.g. **+5°C**.



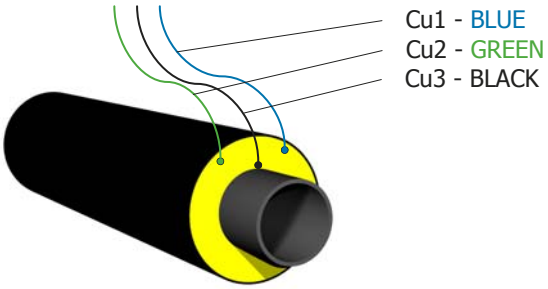
6. TIGHTNESS MONITORING - IMPULSE SYSTEM

The TERMOTECH system can also be equipped with a leak alarm system. It is intended to signal the occurrence of moisture in the PUR foam and allows for checking the moisture level inside the pipes and connections. Currently, two systems are applied:

- **IMPULSE** - with 2x1.5mm^2 copper wires plus an additional wire due to the fact that the pipe is made of plastic - **standard** solution
- **BRANDES resistance** - based - with a NiCr sensor cable in a perforated Teflon insulation and copper wire in Teflon insulation plus an additional wire due to the fact that the pipe is made of plastic - **optional solution**

In both systems, the supervision of the alarm system can be effected using hand held mobile testing devices or stationary failure / leak detection and localization devices

To receive elements with heating cable, place order according to instructions (under catalogue positions and on next page) and enter **M** in the **OPTION** field.



7. SELECTION AND INSTALLATION

Detailed selection of respective TERMO TECH system elements shall be carried out after following details have been taken into account:

- type of pumped agent
- concentration of pumped agent
- temperature of pumped agent
- system type (above ground, underground)
- if constant temperature of pumped medium is required, also the required temperature range
- designed length of preinsulated TERMO TECH pipeline system

The conduit pipe joining method is related to the material they are made of:

- glue joining method (glue type depends on the type of pumped agent)
- fusion welding joining method (butt-weld fusion welding, polyfusion welding)
- electrofusion welding joining method

The sleeve pipe joining method is described in the futher part of this catalogue.

8. MARKING - HOW TO ORDER

CONDUIT PIPE DIAMETER
e.g. 032, 090, 110...

Fields described for respective elements in production scope part.

OPTIONS
KG - HEATING CABLE
M - TIGHTNESS MONITORING

TR . [ ] . [ ] . [ ] . [ ] . [ ]

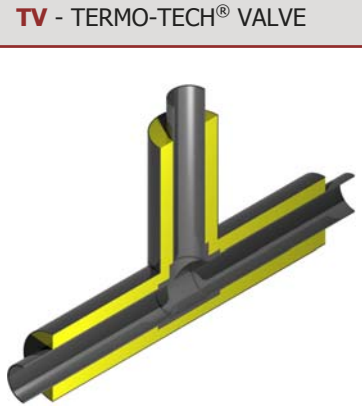
TYPE
1. **TR** - TERMO-TECH® PIPE
2. **TK** - TERMO-TECH® ELBOW
3. **TL** - TERMO-TECH® BEND
4. **TT** - TERMO-TECH® TEE
5. **TZ** - TERMO-TECH® REDUCER
6. **TV** - TERMO-TECH® VALVE

CONDUIT PIPE MATERIAL
1. **PE-HD**
2. **PVC-U**
3. **PP-H**

Other materials on request.

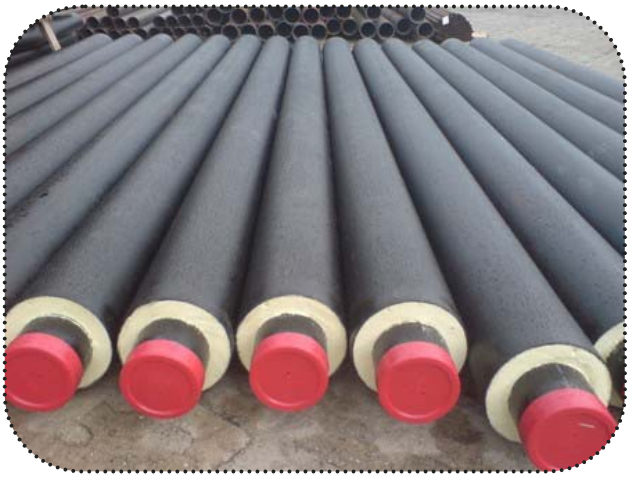
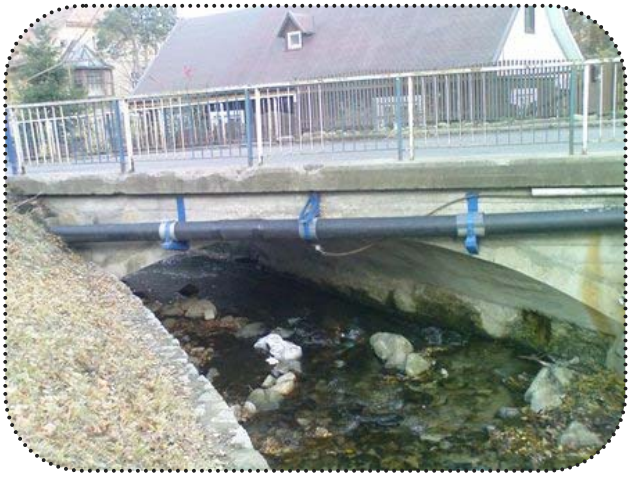
SLEEVE PIPE MATERIAL
1. **PE-HD**
2. GALVANIZED STEEL
3. ALUMINIUM

Materials 2 and 3 - on request.



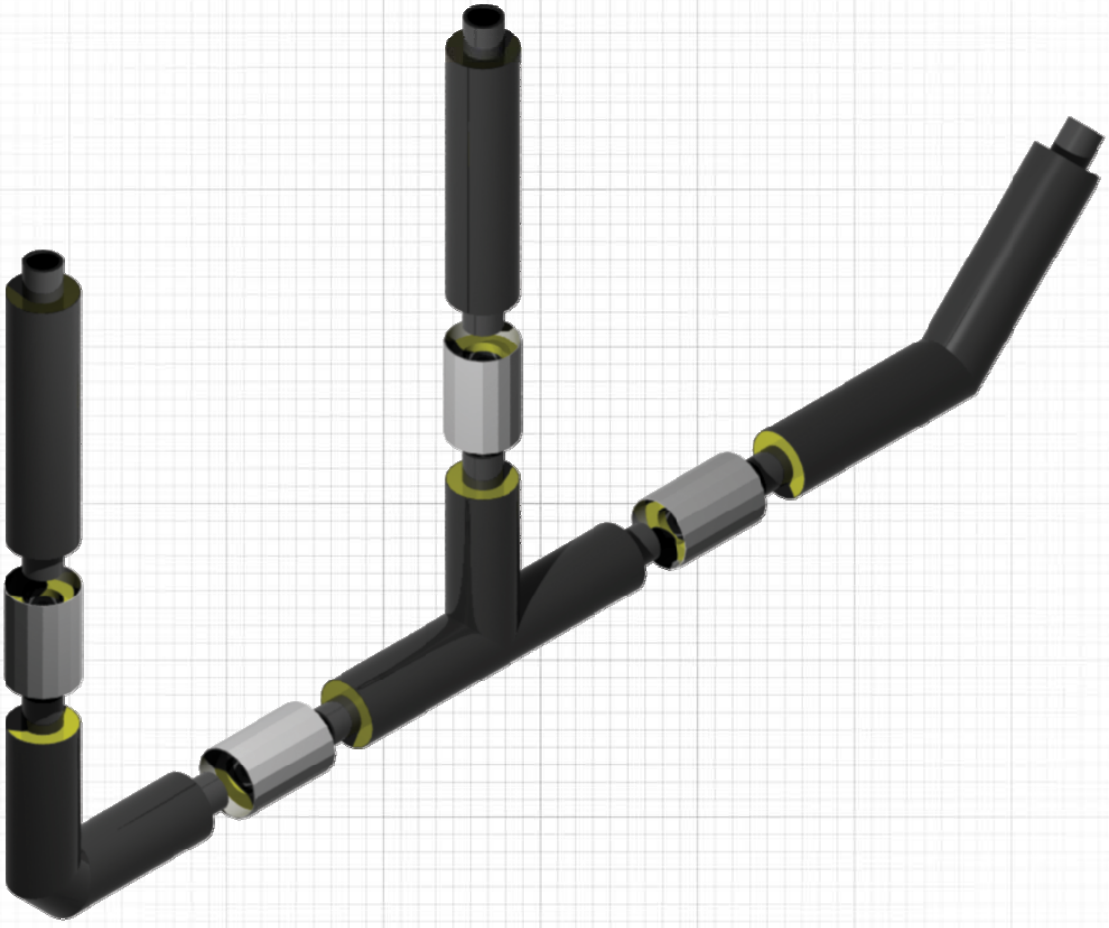

9. EXAMPLE EXECUTIONS



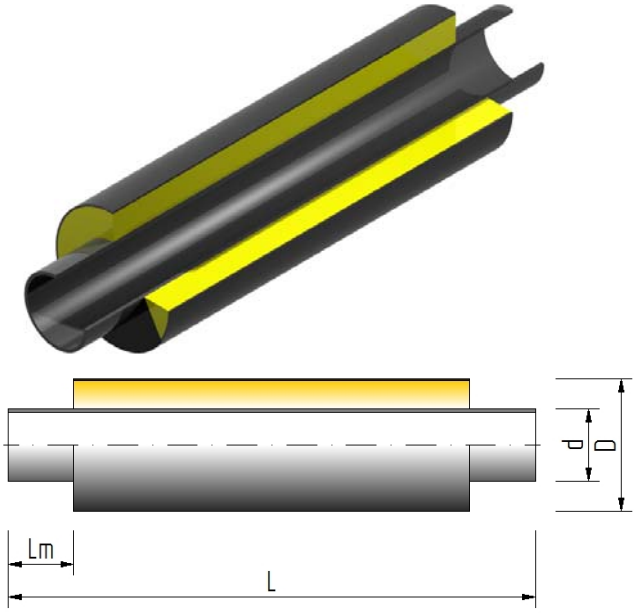





TERMOTECH®
TERMOPLASTY

PE CONDUIT PIPE



COMPOSITE PIPE - **TR**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TR.025.1.1.	20	16	100	0,78
32	90/100*	TR.032.1.	25	16	100	0,79
40	110/100*	TR.040.1.	32	16	100	1,12
50	110/125*	TR.050.1.	40	16	100	1,32
63	125	TR.063.1.	50	16	100	2,04
75	140	TR.075.1.	65	16	100	2,58
90	160	TR.090.1.	80	10	100	2,97
110	200	TR.110.1.	100	10	100	4,25
140	225	TR.140.1.	125	10	100	5,74
160	250	TR.160.1.	150	10	100	7,23
225	315	TR.225.1.	200	10	150	12,26
250	400	TR.250.1.	225	10	150	16,21
280	400	TR.280.1.	250	10	150	18,43
315	450	TR.315.1.	300	10	150	22,91

Note

Standard pipe length - 6m

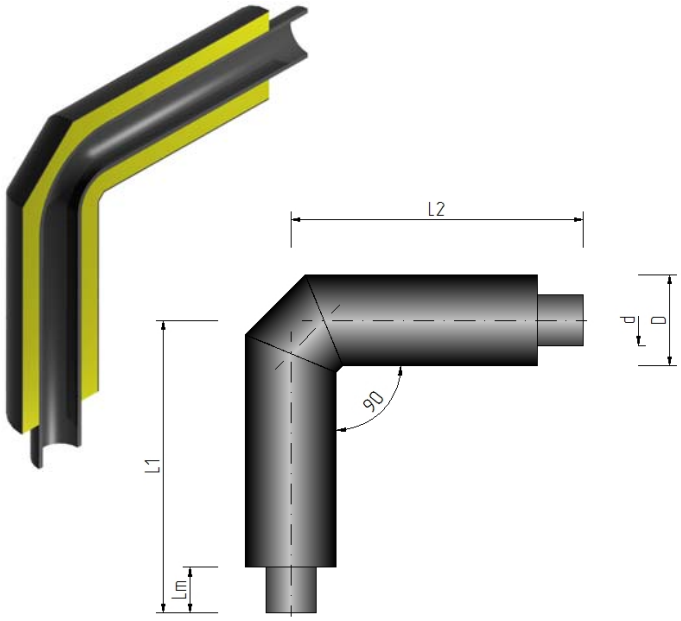
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TR . [ ] . 1 . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE ELBOW - **TK**



d	D	CAT. NO.	DN	PN	Lm	kg
25	90/100*	TK.025.1.	20	16	100	0,77
32	90/100*	TK.032.1.	25	16	100	0,85
40	110/100*	TK.040.1.	32	16	100	1,18
50	110/125*	TK.050.1.	40	16	100	1,37
63	125	TK.063.1.	50	16	100	2,11
75	140	TK.075.1.	65	16	100	2,65
90	160	TK.090.1.	80	10	100	2,85
110	200	TK.110.1.	100	10	100	4,04
140	225	TK.140.1.	125	10	100	5,42
160	250	TK.160.1.	150	10	100	6,74
225	315	TK.225.1.	200	10	150	11,17
250	400	TK.250.1.	225	10	150	22,03
280	400	TK.280.1.	250	10	150	24,69
315	450	TK.315.1.	300	10	150	30,34

Note

Standard lengths:

- d≤160 - L1,L2=500mm

- d>160 - L1,L2=700mm

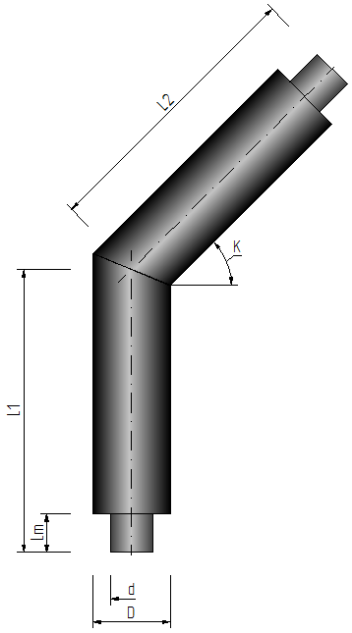
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TK . [ ] . 1 . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE BEND - **TL**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TL.025.1.	20	16	100	0,67
32	90/100*	TL.032.1.	25	16	100	0,87
40	110/100*	TL.040.1.	32	16	100	1,22
50	110/125*	TL.050.1.	40	16	100	1,41
63	125	TL.063.1.	50	16	100	2,18
75	140	TL.075.1.	65	16	100	2,75
90	160	TL.090.1.	80	10	100	2,98
110	200	TL.110.1.	100	10	100	4,24
140	225	TL.140.1.	125	10	100	5,72
160	250	TL.160.1.	150	10	100	7,19
225	315	TL.225.1.	200	10	150	12,16
250	400	TL.250.1.	225	10	150	23,46
280	400	TL.280.1.	250	10	150	26,44
315	450	TL.315.1.	300	10	150	32,78

Note

Standard lengths:

- d ≤ 160 - L1,L2=500mm

- d > 160 - L1,L2=700mm

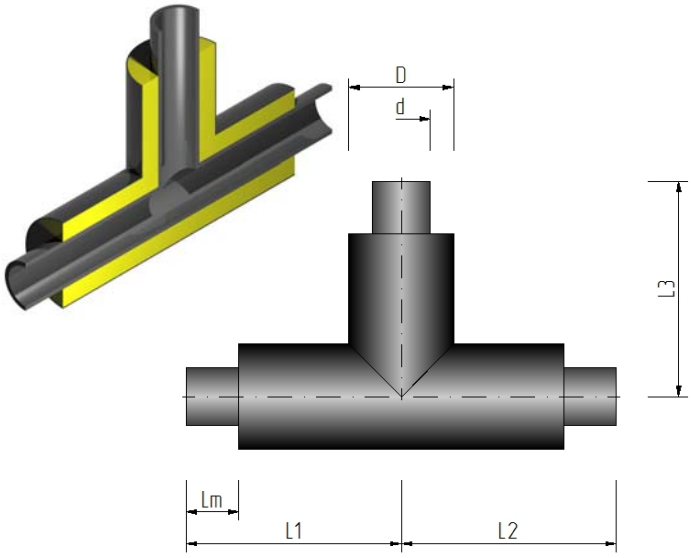
** - **SPIRO** pipe diameter*

- d>315 - on request

TL . [ ] . 1 . [ ] . [ ] . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
ANGLE **11, 22, 30, 45,60**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE TEE - **TT**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TT.025.1.	20	16	100	1,14
32	90/100*	TT.032.1.	25	16	100	1,26
40	110/100*	TT.040.1.	32	16	100	1,76
50	110/125*	TT.050.1.	40	16	100	2,04
63	125	TT.063.1.	50	16	100	3,13
75	140	TT.075.1.	65	16	100	3,93
90	160	TT.090.1.	80	10	100	4,21
110	200	TT.110.1.	100	10	100	5,92
140	225	TT.140.1.	125	10	100	7,93
160	250	TT.160.1.	150	10	100	9,81
225	315	TT.225.1.	200	10	150	16,22
250	400	TL.250.1.	225	10	150	32,03
280	400	TT.280.1.	250	10	150	36,06
315	450	TT.315.1.	300	10	150	44,19

NOTE

Standard lengths:

- d≤160 - L1,L2,L3=500mm

- d>160 - L1,L2,L3=700mm

** - **SPIRO** pipe diameter*

- d>315- on request

TT . [ ] . 1 . [ ] . [ ] . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g.025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
LENGTH **L3** mm
OPTION – **KG** - heating cable or **M** - monitoring

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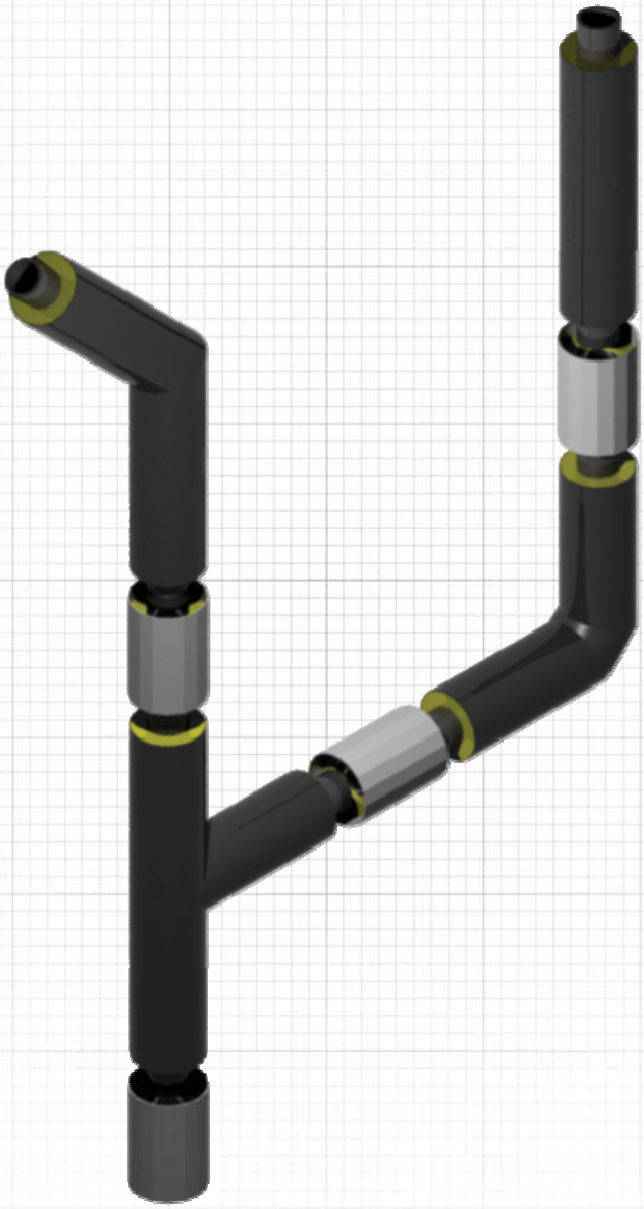
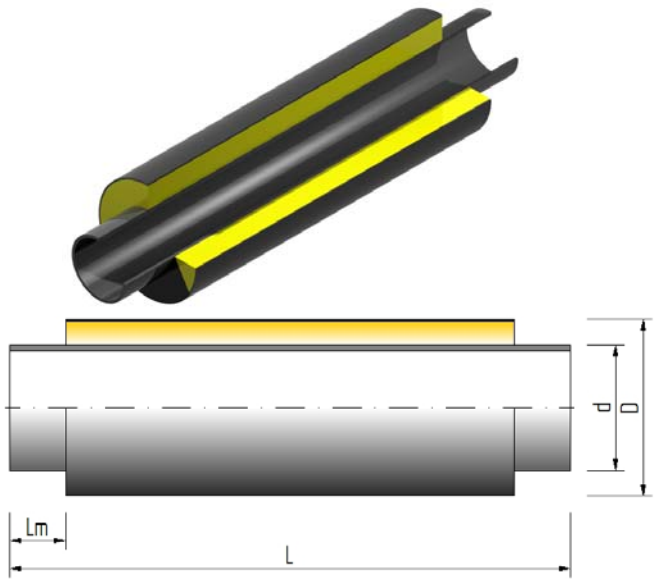
PVC-U CONDUIT PIPE



COMPOSITE PIPE - **TR**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TR.025.2.	20	10	100	0,79
32	90/100*	TR.032.2.	25	10	100	0,86
40	110/100*	TR.040.2.	32	10	100	1,13
50	110/125*	TR.050.2.	40	10	100	1,29
63	125	TR.063.2.	50	10	100	1,97
75	140	TR.075.2.	65	10	100	2,48
90	160	TR.090.2.	80	10	100	3,21
110	200	TR.110.2.	100	10	100	4,62
140	225	TR.140.2.	125	10	100	6,35
160	250	TR.160.2.	150	10	100	8,04
225	315	TR.225.2.	200	10	150	13,83
250	400	TR.250.2.	225	10	150	18,09
280	400	TR.280.2.	250	10	150	20,87
315	450	TR.315.2.	300	6	150	18,57

Note

Standard pipe length- 6m

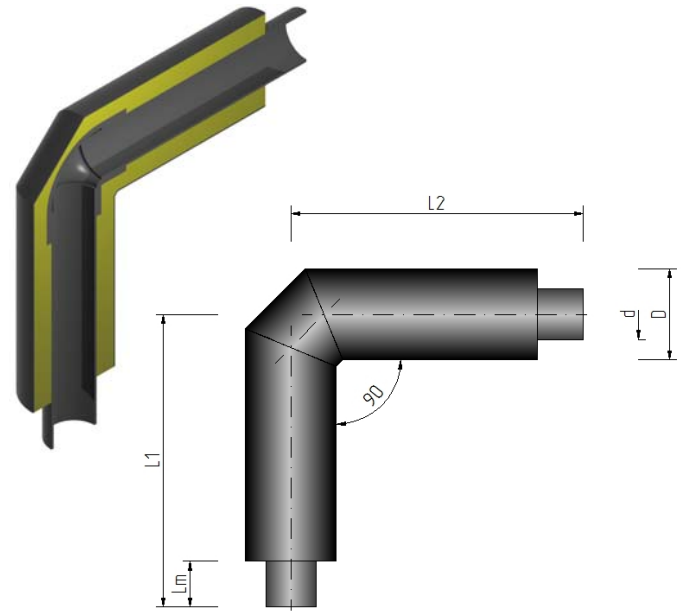
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TR . [ ] . 2 . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L** w mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE ELBOW - **TK**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TK.025.2.	20	10	100	0,79
32	90/100*	TK.032.2.	25	10	100	0,88
40	110/100*	TK.040.2.	32	10	100	1,18
50	110/125*	TK.050.2.	40	10	100	1,37
63	125	TK.063.2.	50	10	100	2,13
75	140	TK.075.2.	65	10	100	2,74
90	160	TK.090.2.	80	10	100	3,67
110	200	TK.110.2.	100	10	100	5,38
140	225	TK.140.2.	125	10	100	7,72
160	250	TK.160.2.	150	10	100	9,15
225	315	TK.225.2.	200	10	150	16,84
250	400	TK.250.2.	225	10	150	31,41
280	400	TK.280.2.	250	10	150	38,22
315	450	TK.315.2.	300	6	150	37,61

Note

Standard lengths:

- d≤160 - L1,L2=500mm

- d>160 - L1,L2=700mm

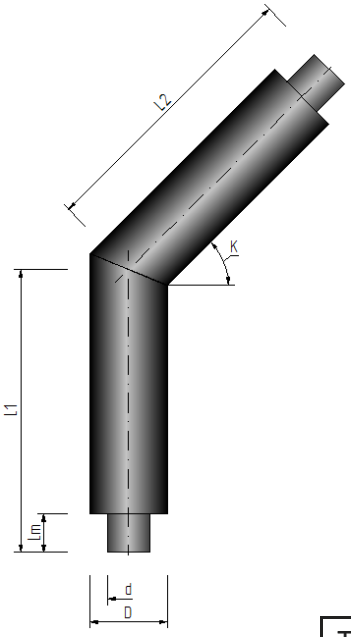
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TK . [ ] . 2 . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE BEND - **TL**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TL.025.2.	20	10	100	0,79
32	90/100*	TL.032.2.	25	10	100	0,88
40	110/100*	TL.040.2.	32	10	100	1,17
50	110/125*	TL.050.2.	40	10	100	1,35
63	125	TL.063.2.	50	10	100	2,09
75	140	TL.075.2.	65	10	100	2,69
90	160	TL.090.2.	80	10	100	3,57
110	200	TL.110.2.	100	10	100	5,21
140	225	TL.140.2.	125	10	100	7,41
160	250	TL.160.2.	150	10	100	8,89
225	315	TL.225.2.	200	10	150	16,18
250	400	TL.250.2.	225	10	150	22,05
280	400	TL.280.2.	250	10	150	27,13
315	450	TL.315.2.	300	6	150	26,67

Note

Standard lengths:

- d ≤ 160 - L1,L2=500mm

- d > 160 - L1,L2=700mm

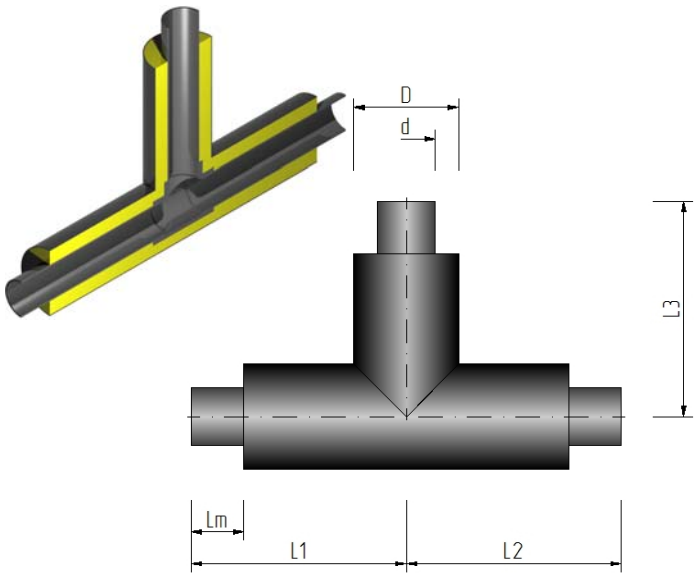
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TL . [ ] . 2 . [ ] . 45 . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
ANGLE **45°**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE TEE - **TT**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TT.025.2.1.	20	10	100	1,15
32	90/100*	TT.032.2.1.	25	10	100	1,27
40	110/100*	TT.040.2.1.	32	10	100	1,70
50	110/125*	TT.050.2.1.	40	10	100	1,95
63	125	TT.063.2.1.	50	10	100	3,01
75	140	TT.075.2.1.	65	10	100	3,86
90	160	TT.090.2.1.	80	10	100	5,11
110	200	TT.110.2.1.	100	10	100	7,35
140	225	TT.140.2.1.	125	10	100	11,43
160	250	TT.160.2.1.	150	10	100	14,81
225	315	TT.225.2.1.	200	10	150	24,75
250	400	TL.250.2.1.	225	10	150	43,76
280	400	TT.280.2.1.	250	10	150	53,03
315	450	TT.315.2.1.	300	6	150	54,53

TT . [ ] . 2 . [ ] . [ ] . [ ] . [ ] . [ ] . [ ]

NOTE

Standard lengths:

- d≤160 - L1,L2,L3=500mm

- d>160 - L1,L2,L3=700mm

** - **SPIRO** sleeve pipe diameter*

- d>315- on request

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
LENGTH **L3** mm
OPTION – **KG** - heating cable or **M** - monitoring

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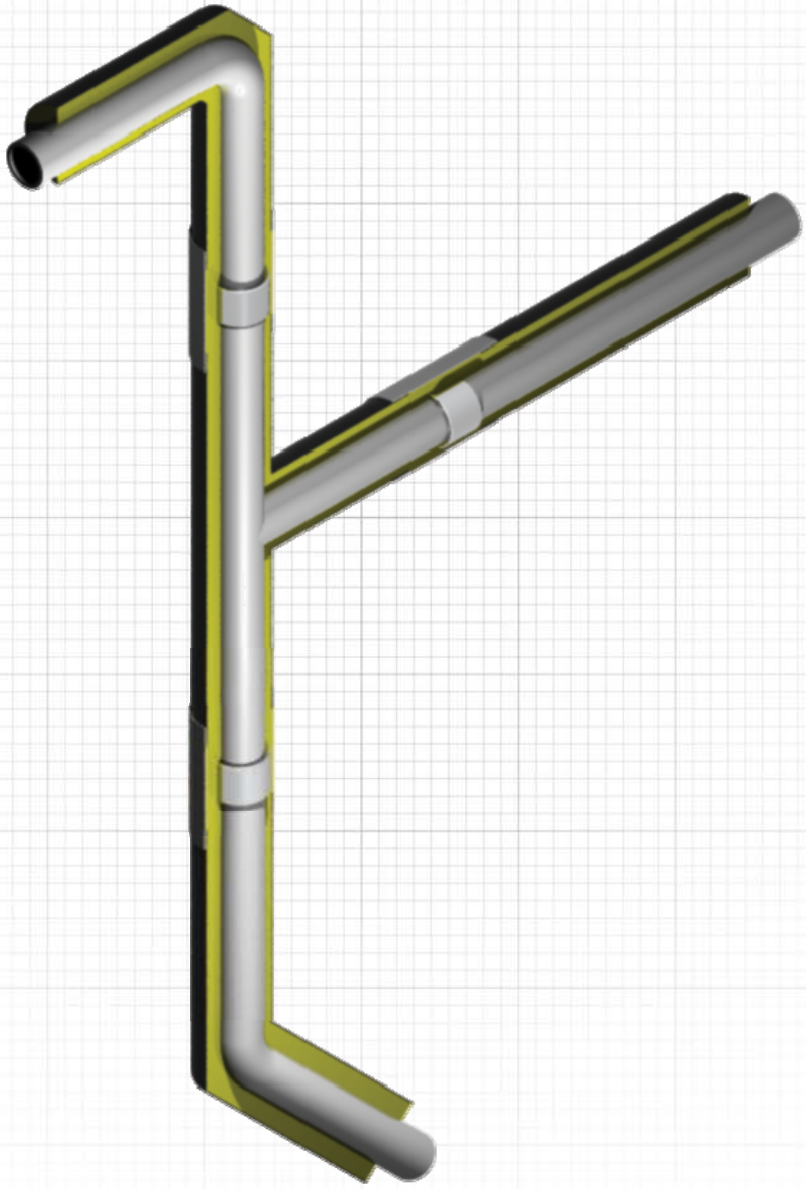
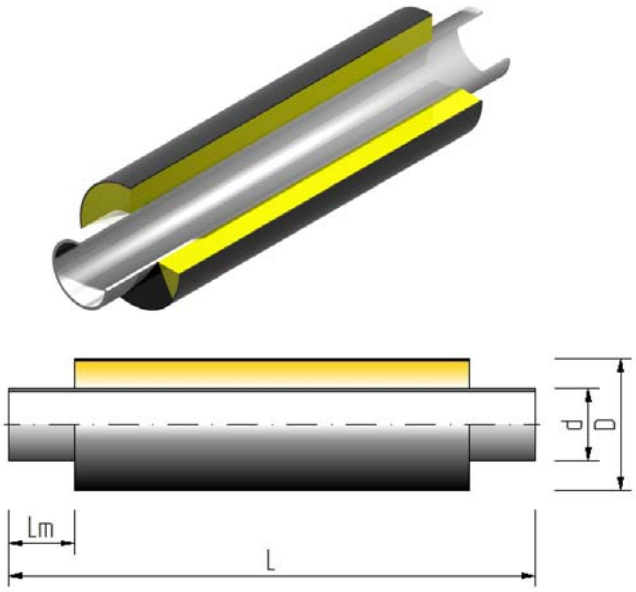
PP-H CONDUIT PIPE



COMPOSITE PIPE - **TR**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TR.025.3.	20	16	100	0,78
32	90/100*	TR.032.3.	25	10	100	0,86
40	110/100*	TR.040.3.	32	10	100	1,19
50	110/125*	TR.050.3.	40	10	100	1,38
63	125	TR.063.3.	50	10	100	2,13
75	140	TR.075.3.	65	10	100	2,68
90	160	TR.090.3.	80	10	100	2,91
110	200	TR.110.3.	100	10	100	4,14
140	225	TR.140.3.	125	10	100	5,57
160	250	TR.160.3.	150	10	100	7,01
225	315	TR.225.3.	200	10	150	11,82
250	400	TR.250.3.	225	10	150	15,67
280	400	TR.280.3.	250	10	150	17,74
315	450	TR.315.3.	300	10	150	22,04

Note

Standard pipe length- 6m

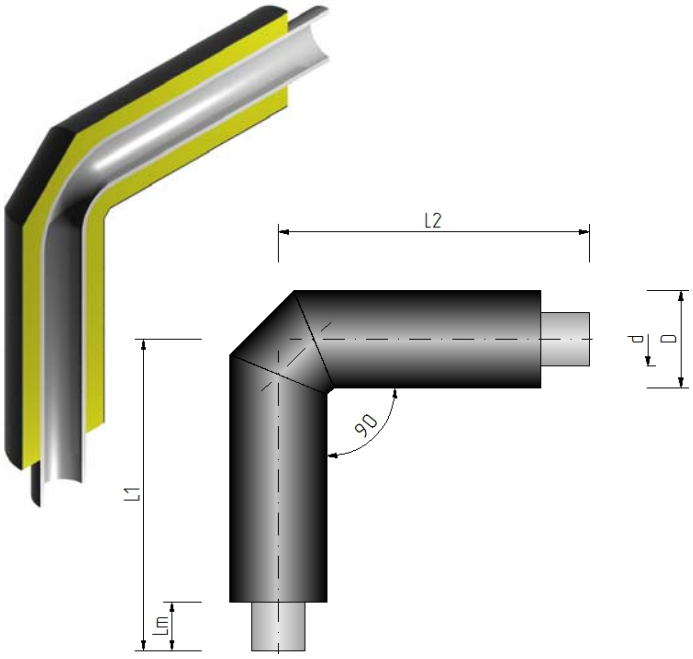
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TR . [ ] . 3 . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L** w mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE ELBOW - **TK**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TK.025.3.	20	16	100	0,75
32	90/100*	TK.032.3.	25	10	100	0,84
40	110/100*	TK.040.3.	32	10	100	1,16
50	110/125*	TK.050.3.	40	10	100	1,34
63	125	TK.063.3.	50	10	100	2,06
75	140	TK.075.3.	65	10	100	2,58
90	160	TK.090.3.	80	10	100	2,79
110	200	TK.110.3.	100	10	100	3,94
140	225	TK.140.3.	125	10	100	5,26
160	250	TK.160.3.	150	10	100	6,53
225	315	TK.225.3.	200	10	150	10,77
250	400	TK.250.3.	225	10	150	21,29
280	400	TK.280.3.	250	10	150	23,82
315	450	TK.315.3.	300	10	150	29,24

Note

Standard lengths:

- d≤160 - L1,L2=500mm

- d>160 - L1,L2=700mm

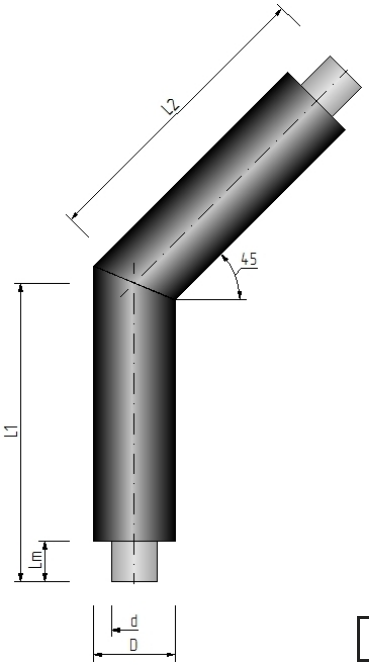
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TK . [ ] . 3 . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

COMPOSITE BEND - **TL**



d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TL.025.3.	20	10	100	0,79
32	90/100*	TL.032.3.	25	10	100	0,86
40	110/100*	TL.040.3.	32	10	100	1,19
50	110/125*	TL.050.3.	40	10	100	1,38
63	125	TL.063.3.	50	10	100	2,13
75	140	TL.075.3.	65	10	100	2,68
90	160	TL.090.3.	80	10	100	2,91
110	200	TL.110.3.	100	10	100	4,13
140	225	TL.140.3.	125	10	100	5,55
160	250	TL.160.3.	150	10	100	6,97
225	315	TL.225.3.	200	10	150	11,73
250	400	TL.250.3.	225	10	150	22,79
280	400	TL.280.3.	250	10	150	25,59
315	450	TL.315.3.	300	10	150	31,71

TL . [ ] . 3 . [ ] . 45 . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
ANGLE **45°**
LENGTH **L1** mm
LENGTH **L2** mm
OPTION – **KG** - heating cable or **M** - monitoring

Note

Standard lengths:

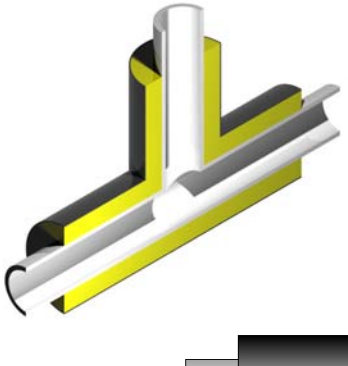
- d ≤ 160 - L1,L2=500mm

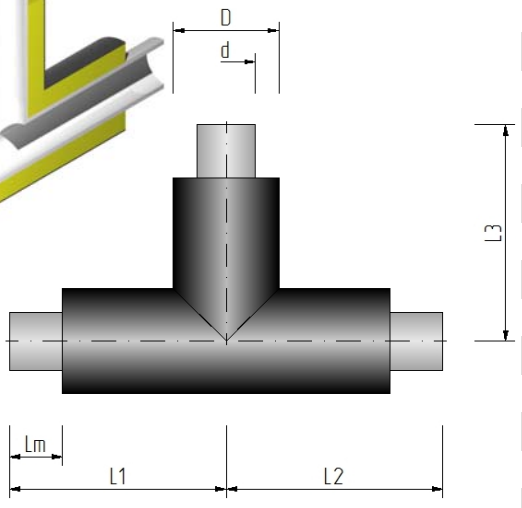
- d > 160 - L1,L2=700mm

** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

COMPOSITE TEE - **TT**





d	D	CAT. NO.	dn	PN	Lm	kg
25	90/100*	TT.025.3.	20	10	100	1,12
32	90/100*	TT.032.3.	25	10	100	1,24
40	110/100*	TT.040.3.	32	10	100	1,73
50	110/125*	TT.050.3.	40	10	100	1,99
63	125	TT.063.3.	50	10	100	3,06
75	140	TT.075.3.	65	10	100	3,82
90	160	TT.090.3.	80	10	100	4,11
110	200	TT.110.3.	100	10	100	5,77
140	225	TT.140.3.	125	10	100	7,69
160	250	TT.160.3.	150	10	100	9,49
225	315	TT.225.3.	200	10	150	15,61
250	400	TL.250.3.	225	10	150	30,97
280	400	TT.280.3.	250	10	150	34,73
315	450	TT.315.3.	300	10	150	42,53

TT . [ ] . 3 . [ ] . [ ] . [ ] . [ ] . [ ] . [ ]

DIAMETER **d**, e.g. 025
SLEEVE PIPE MATERIAL - **1, 2 or 3**
LENGTH **L1** mm
LENGTH **L2** mm
LENGTH **L3** mm
OPTION – **KG** - heating cable or **M** - monitoring

NOTE

Standard lengths:

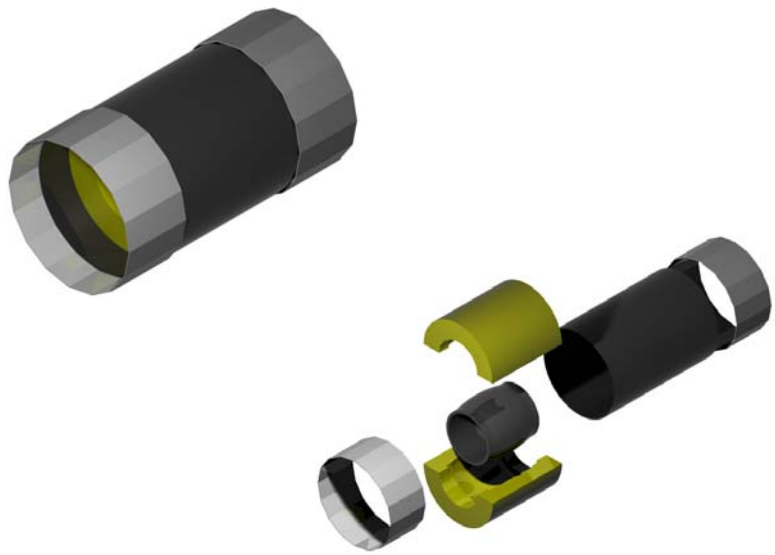
- d≤160 - L1,L2,L3=500mm

- d>160 - L1,L2,L3=700mm

** - **SPIRO** sleeve pipe diameter*

- DN>300 - on request

"DRY" CONNECTOR - **TS**



d	D	CAT. NO.	dn	Lm
25	90/100*	TS.025.	20	200
32	90/100*	TS.032.	25	200
40	110/100*	TS.040.	32	200
50	110/125*	TS.050.	40	200
63	125	TS.063.	50	200
75	140	TS.075.	65	200
90	160	TS.090.	80	200
110	200	TS.110.	100	200
140	225	TS.140.	125	200
160	250	TS.160.	150	300
225	315	TS.225.	200	300
250	400	TS.250.	225	300
280	400	TS.280.	250	300
315	450	TS.315.	300	300

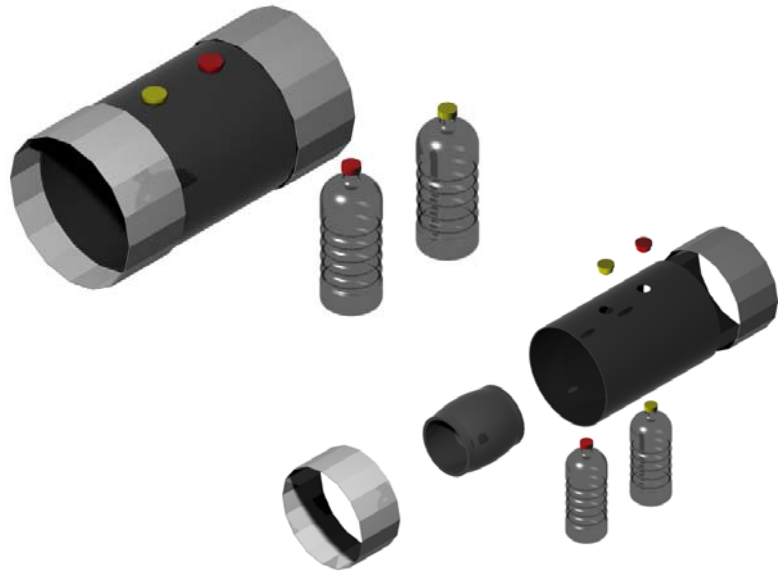
** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

TS . [ ] . [ ] . [ ] . [ ]

DIAMETER **d** mm
CONDUIT PIPE MATERIAL
SLEEVE PIPE MATERIAL - **1, 2 or 3**
OPTION – **KG** - heating cable or **M** - monitoring

"WET" CONNECTOR - **TM**



d	D	CAT. NO.	dn	Lm
25	90/100*	TM.025	20	200
32	90/100*	TM.032	25	200
40	110/100*	TM.040	32	200
50	110/125*	TM.050	40	200
63	125	TM.063	50	200
75	140	TM.075	65	200
90	160	TM.090	80	200
110	200	TM.110	100	200
140	225	TM.140	125	200
160	250	TM.160	150	300
225	315	TM.225	200	300
250	400	TM.250	225	300
280	400	TM.280	250	300
315	450	TM.315	300	300

** - **SPIRO** sleeve pipe diameter*

- d>315 - on request

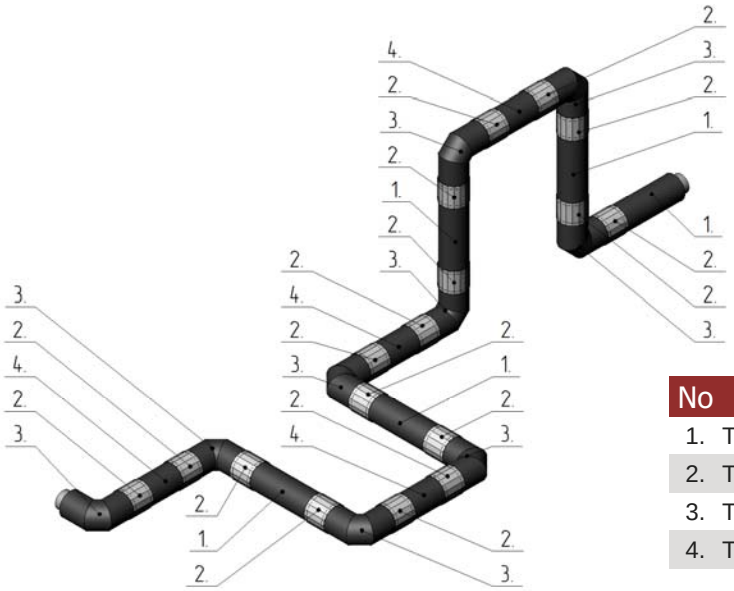
TM . [ ] . [ ] . [ ] . [ ]

DIAMETER **d** mm
CONDUIT PIPE MATERIAL
SLEEVE PIPE MATERIAL - **1, 2 or 3**
OPTION – **KG** - heating cable or **M** - monitoring

10. COMPARISON

PRICE COMPARISION BETWEEN INSTALATION MADE OF STANDARD ELEMENTS AND CUSTOM-MADE ELEMENTS.

Instalation made of standard elements - standard variant

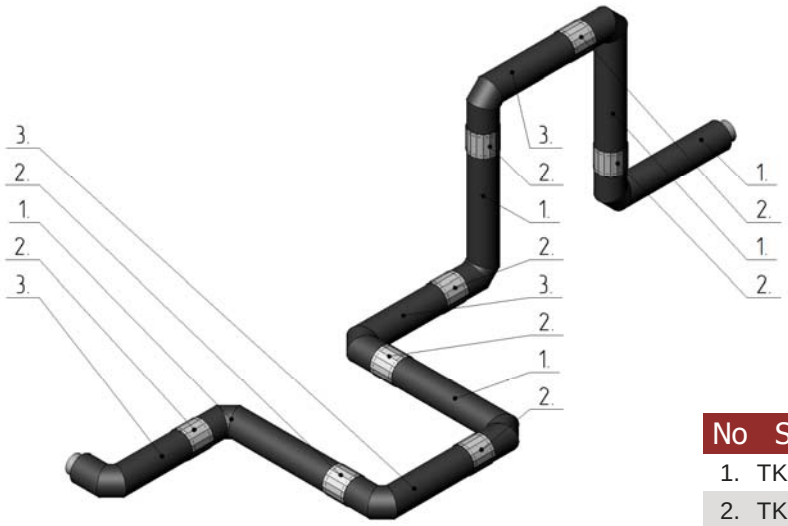


No	Symbol	Qty.
1.	TK.315.1.1.	9
2.	TR.315.1.1.1500.	5
3.	TR.315.1.1.1000.	4
4.	TS.315.1.1.	17

Standard variant cost:

- Labour cost - 100%
- Material cost - 100%

Instalation made of custom-made elements - custom variant



No	Symbol	Qty.
1.	TK.315.1.1.1700.700.	4
2.	TK.315.1.1.2200.700.	5
3.	TS.315.1.1	8

Cost compared to standard variant:

- Labour cost - 78%
- Material cost - 73%

Estimated savings ~29%

NOTES: