YALÇINBORU

"Energy, Economy, Ecology"

Engineering - Consultancy - Project - Manufacturing - Training

PREINSULATED PIPING SYSTEMS

PIPES and FITTINGS

www.yalcinboru.com.tr

About Us

YALÇIN BORU JEOTERMAL, subordinate to Doğan Jeotermal Group of Companies that carries on activities in the energy, construction and tourism industry as a leading corporation, was founded in 1997 on a field of 23000 m2 in Polatlı Organised Industry Region, in order to meet the needs of the industry at the top level. YALÇIN BORU carries out the manufacturing of preinsulated (geothermal) pipes and fittings, steam pipes and fittings, polyethylene pipes and fittings.

YALÇIN BORU JEOTERMAL, which has become the industry leader in a short time, has enhanced its standards using the technology that is the requirement of the era, and achieved the standards TS EN 253, TS EN 12201-2, TS EN 448 with its staff specialised in their fields.

In addition, rendering service in accordance with the standard TS EN ISO 9001, YALÇIN BORU JEOTERMAL has adopted the concept of high quality production and service, and accordingly has avoided making compromises from customer satisfaction.

As YALÇIN BORU JEOTERMAL, our objective is to increase our production capacity and product range, and provide benefits to our country and our national economy.

Our Vision

Vision of Yalçın Boru is to provide the energy and the raw material to be used more efficiently for protecting the ecological balance in our globalising world, and continuously improving the production technologies, processes and quality management systems and developing new product designs and finding new fields of studies for itself, to be one of the leading companies of the world in the geothermal industry.

Our Mission

Yalçın Boru, which carries out the activities on preinsulated pipes and fittings and polyethylene pipes in accordance with the relevant standards, has adopted as its mission to contribute to the national economy and to render high quality services on many fields such as localised heating systems, cogeneration plants, boiling oil and steam transmitting plants, industrial and chemical plants, greenhouse heating systems, cold water networks, underground heating and ventilating, geothermal plants by fulfilling the Legislation on OHS and Environment and all of its liabilities.

Our Quality Policy

In line with its principles on being trustable and preferable in the geothermal industry, Yalçın Boru keeps its understanding of high quality service on the foreground and renders services with modern and technological equipment, in accordance with internationally recognised standards (TS EN 253, TS EN 12201-2, TS EN 448), under terms that are mutually agreed with the customers, with accurate and precise results.

As Yalçın Boru, customer satisfaction is our principle of incorporation. With the responsibility of performing production that can meet the customer needs, quality is assured at Yalçın Boru at all stages of production starting from the inputs, and continues as after-sales service as well.

Core value at Yalçın Boru is the human. In order to render this value more effective and efficient, trainings that are required at all levels are planned.

The quality policy of Yalçın Boru is to provide the continuity of our management systems (ISO 9001- ISO 14001 - OHSAS 18001) by improving them, and to become an exemplary organisation at a level that can meet the requirements of this industry by providing the sources needed by the country in the geothermal industry.

Customer Satisfaction

As Yalçın Boru, our purpose is to meet the needs and expectations of our customers in a timely manner and as desired and to provide and increase our customers' satisfaction with our technical support and after-sales services. We make no compromises on the standards of TS EN 253, TS EN 12201-2, TS EN 448 and ISO 9001 in our customer satisfaction policy.

Regarding the products and services rendered by our company in Yalçın Boru, all kinds of recommendations, complaints and requests are reviewed within the shortest time and feedbacks are provided to our customers along with the recommendations of solutions.

Your recommendations, complaints and requests are assessed as opportunities of improvement and development continuously in all of our work processes.

Check-In Quality Control

All kinds of raw materials and supplementary materials received from our suppliers are applied check-in quality control tests according to the standards determined by Yalçın Boru.

Process Quality Control

The raw materials and supplementary materials which are approved as suitable for manufacturing and the samples taken from the manufacturing processes and the process at the manufacturing are subjected to quality control tests and are periodically taken under record.

The process quality control tests applied at Yalçın Boru are:

Physical Compliance

and Chemical Compliance tests.

Final Quality Control

Following the packing of our products that are quality approved;

Labelling control and

Packing bond control

Conformity to transport controls is made and transport is allowed after then.

Quality Management

Yalçın Boru has assured ISO 9001:2008 Total Quality Management System, OHSAS 18001 Occupational Health and Safety Management System and ISO 14001 Environment Management System, and manufacturing processes and all processes that are related to these processes.

Yalçın Boru has adopted a safe manufacturing with ISO 9001 Total Quality Management System and OHSAS 18001 Occupational Health and Safety Management System, and an environment friendly manufacturing with ISO 14001 Environment Management System.

At Yalçın Boru, which aims to continuously improve the process quality, within the frame of continuous improvement principle;

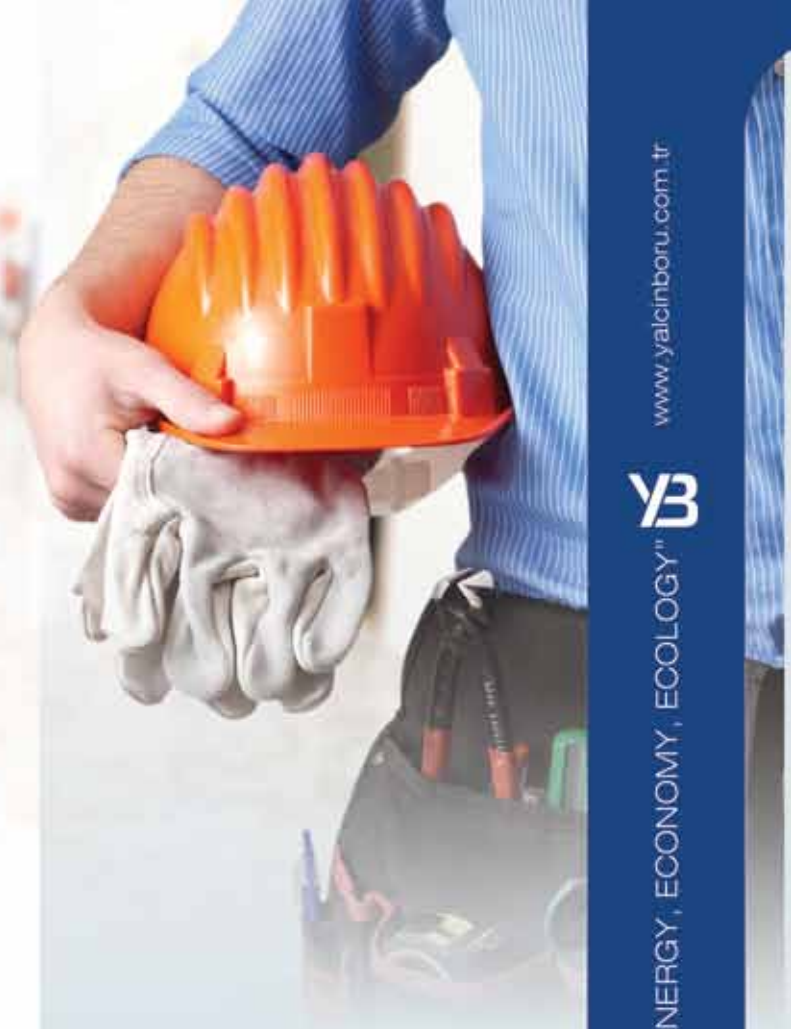
Materials that are qualified and suitable for recycle are used at each step of manufacturing,

All national and international standards and legal liabilities are pursued,

Environment and OHS risks in the working environment are continuously assessed and minimised,

Trainings on all necessary subjects are provided to our personnel,

Production flow is assessed and enhanced at all stages.



Environment and OHS Policy

Carrying out production within the scope of "Environment and OHS Management System" since its foundation, Yalçın Boru provides the safety of soul, goods and environment at the level of international standards of Environment and OHS Management System (ISO 14001, OHSAS 18001) and produces and implements rapid and trustable solutions for the potential problems, and have had approved the Environment and OHS awareness with the documents it has achieved.

Yalçın Boru endeavours to take the required measures before encountering with problems with the purpose of identifying all operations carried out and the exposed OHS risks within the process from order requests from customers to the completion of their transfers, and preventing their scopes and the risks to emerge and reducing them at an acceptable level.

Continuously improving the Environment and OHS Management Programs and making the remedial activities the natural behaviours of all personnel constitute the fundamental of the Environment and OHS Policy of Yalçın Boru.

MANUFACTURING PLANT

POLYETHYLENE PIPE
MANUFACTURING LINE

ONLINE CORONA UNIT

PIPE SANDING UNIT

YALÇINBORU

OUR REFERENCES

°C HEATING & COOLING > Heating and Cooling Systems

İGA & MNG TESİSAT – ISTANBUL 3RD AIRPORT	İSTANBUL
MAPET İNŞAAT - BAKU AIRPORT	AZERBAIJAN
TANAP CAMPING SITES	ESKİŞEHİR, ERZURUM, ERZİNCAN
CİNER GRUP PARK HOLDING	ANKARA
RÖNESANS HOLDING - PRESIDENTIAL PALACE	ANKARA
DOĞUŞ HOLDING - 23RD WORLD UNIVERSITY OLYMPIC GAMES OLYMPIC VILLAGE	İZMİR
SANKO HOLDİNG	GAZİANTEP
ENKA HOLDİNG - SAKHALIN ISLAND	RUSSIA
GAMA HOLDİNG	ANKARA
KOLİN İNŞAAT	ANKARA
YILDIZLAR HOLDİNG	ANKARA
OYAK - RENAULT FACTORY	BURSA
TOFAŞ FACTORY	BURSA
OTOKAR A.Ş. FACTORY	SAKARYA
VESTEL A.Ş. FACTORY	MANİSA
INDESIT A.Ş.	MANİSA
VALF SANAYİ A.Ş. FACTORY	MANİSA
ŞİŞECAM FACTORY	ANKARA
HİTİT SERAMİK FACTORY	UŞAK
PİDOSAN A.Ş.	ANKARA
ESKİŞEHİR ŞEKER FACTORY	ESKİŞEHİR
ETİ GÜMÜŞ A.Ş. FACILITIES	KÜTAHYA
ANADOLU TARIM İŞLETMELERİ FACILITIES	ESKİŞEHİR
NEAR EAST UNIVERSITY	K.K.T.C.
OSMANGAZİ UNIVERSITY	ESKİŞEHİR
ERCİYES UNIVERSITY	KAYSERİ
ATATÜRK UNIVERSITY	ERZURUM
KOCATEPE UNIVERSITY	AFYON
DUMLUPINAR UNIVERSITY	KÜTAHYA
GENDARMERIE GÜVERCİNLİK FACILITIES	ANKARA
GENDARMERIE BEYTEPE LODGEMENTS	ANKARA
MALATYA MILITARY AIRPORT	MALATYA
BURSA PROVINCIAL GENDARMERIE	BURSA
SİLİVRİ PENAL INSTITUTION	İSTANBUL
MENEMEN PENAL INSTITUTION	İZMİR
VAN PENAL INSTITUTION	VAN
OSMANİYE PENAL INSTITUTION	OSMANİYE
KIRKLARELİ PENAL INSTITUTION	KIRKLARELİ
POLATLI PUBLIC HOSPITAL	ANKARA
SALİHLİ PUBLIC HOSPITAL	MANİSA
HOUSING DEVELOPMENT ADMINISTRATION OF TURKEY	ANKARA, ADAPAZARI, YOZGAT, ESKİŞEHİR, BURSA, DENİZLİ

°C | HEATING & COOLING > Power Plant Resourced District Heating Systems

TROMSO DISTRICT HEATING SYSTEM	NORWAY
SOMA HEATING SYSTEM	MANİSA

°C HEATING & COOLING > Geothermal Resourced District Heating Systems

İZMİR JEOTERMAL A.Ş.	İZMİR
AFYON JEOTERMAL A.Ş.	AFYON
SANDIKLI JEOTERMAL A.Ş.	AFYON
DİYADİN JEOTERMAL A.Ş.	AĞRI
DİKİLİ JEOTERMAL A.Ş.	İZMİR
KOZTURTAŞ JEOTERMAL A.Ş.	NEVŞEHİR
EDREMİT JEOTERMAL A.Ş.	BALIKESİR
KIZILCAHAMAM JEOTERMAL A.Ş.	ANKARA
BİGADİÇ MUNICIPALITY	BALIKESİR
SORGUN MUNICIPALITY	YOZGAT
GÜRE MUNICIPALITY	BALIKESİR
BERGAMA MUNICIPALITY	İZMİR
DİKİLİ MUNICIPALITY	İZMİR
SİMAV MUNICIPALITY	KÜTAHYA
NAŞA MUNICIPALITY	KÜTAHYA
GEDİZ MUNICIPALITY	KÜTAHYA
SALİHLİ MUNICIPALITY	MANİSA
KOZAKLI MUNICIPALITY	NEVŞEHİR

°C HEATING & COOLING > Thermal Water Transmission Systems

AFYON JEOTERMAL A.Ş.	AFYON
BURSA JEOTERMAL A.Ş.	BURSA
BOLU MUNICIPALITY	BOLU
HAYMANA MUNICIPALITY	ANKARA
TERMAL MUNICIPALITY	YALOVA
YALOVA MUNICIPALITY	YALOVA
ARMUTLU MUNICIPALITY	YALOVA

THERMAL TOURISM

NARVEN THERMAL TOWN	BOLU
GRANNOS THERMAL	HAYMANA / ANKARA
ARGOS INN CAPPADOCIA	NEVŞEHİR
HELİNAMİN THERMAL	ÇERMİK, DİYARBAKIR
HİTİT AYAŞ THERMAL HOLIDAY RESORT	ANKARA
HATTUŞA ASTYRA THERMAL RESORT & SPA	EDREMİT, BALIKESİR
ERZİN İSOS THERMAL	ERZİN, HATAY
SAROT THERMAL	BOLU
ALYA GORDION	ANKARA
AĞRI DİYADİN THERMAL	AĞRI

ENERGY & COGENERATION

KARADENİZ HOLDİNG – Karadeniz Enerji A.Ş.	AYDIN
SARAY HOLDİNG & ACARSAN HOLDİNG – Greeneco Enerji A.Ş.	DENİZLİ
MTN ENERJİ ELEKTRİK ÜRETİM A.Ş.	ÇANAKKALE
ÇELİKLER HOLDİNG – Çelikler Jeotermal A.Ş.	PAMUKÖREN, AYDIN
TÜRKERLER HOLDİNG – Türkerler Jeotermal A.Ş.	ALAŞEHİR, MANİSA
KİPAŞ HOLDİNG – Maren Enerji A.Ş.	GERMENCİK, AYDIN
KİPAŞ HOLDİNG – Ken Kipaş Enerji A.Ş.	GERMENCİK, AYDIN
AKÇA HOLDİNG – Akça Enerji A.Ş.	SARAYKÖY, DENİZLİ
MB HOLDİNG – Menderes Jeotermal A.Ş.	SULTANHİSAR, AYDIN
BEREKET ENERJİ – Kızıldere Geothermal Energy Power Plant	DENİZLİ
BEREKET ENERJİ – Yatağan Thermal Power Plant	MUĞLA
ZORLU ENERJİ	LÜLEBURGAZ
AK ENERJİ	ÇERKEZKÖY
MOSB ENERJİ	MANİSA
TÜPRAŞ	İZMİR
ÇERKEZKÖY ENERJİ	ÇERKEZKÖY
MODERN ENERJİ	TEKİRDAĞ
İSTİKBAL ENERJİ GRUP	KAYSERİ
KARPEK ENERJİ	MANİSA
GLOBAL ENERJİ	İSTANBUL
CAN TEKSTİL	TEKİRDAĞ
SOLFİN ENERJİ	İSTANBUL
BM HOLDİNG	AYDIN

GREENHOUSING

EMİNEL TARIM	AFYON
KONYA ŞEKER A.Ş.	ÇUMRA, KONYA
BAŞYAZICIOĞLU TARIM	BOĞAZLIYAN, YOZGAT
AGROBAY GREENHOUSING	DİKİLİ, İZMİR
SMYRNA GREENHOUSING	SARAYKÖY, DENİZLİ
BM HOLDİNG - BM Agro Seracılık A.Ş.	SÖKE, AYDIN
ALMER TEKSTİL	KOZAKLI, NEVŞEHİR
LARA TARIM	GAZİANTEP
BOSTAN TARIM	MANİSA
KONYALILAR GREENHOUSING	İSTANBUL

MARITIME

MADENCİ SHIPYARD	KARADENİZ EREĞLİ, ZONGULDAK
ÇELİK TEKNE SHIPYARD	TUZLA, İSTANBUL
RMK MARINE	TUZLA, İSTANBUL
ADRAZHAN SHIPYARD	TUZLA, İSTANBUL
MED MARINE	TUZLA, İSTANBUL
DORA DENİZCİLİK	TUZLA, İSTANBUL
KGS DENİZCİLİK	İSTANBUL
FORCE SHIPPING	İSTANBUL

GENERAL PROPERTIES OF PREINSULATED PIPES

It is a waterproof system by means of insulation and the extruded HDPE casing pipe that protects the steel pipe from corrosive media, humidity, chemicals and UV rays.

Standard typre insulated pipes have an operating life of 30 years at 120 ^{0}C continuous service temperature, and 50 years and more at temperatures up to 115 ^{0}C.

The covalent bonds that form due to the Corona process applied, increase the inner surface tension of the HDPE casing pipe (polyethylene), and provide better cohesive properties of polyurethane to the HDPE casing pipe (polyethylene pipe).

The polyurethane applied is procured from certificate owning companies conforming to TS EN 253 norm that carry out special manufacture for such type of pipes.

The standard type of preinsulated pipes are resistant up to 120 ^{0}C (140 ^{0}C as the peak value), and rock wool reinforced special manufacture preinsulated pipes up to 450 ^{0}C.

Steel, stainless steel, copper, FR PPR, PPR-C, PE-X and HDPE can be used as inner pipe (carrier pipe).

The rigid polyurethane foam that is used as the insulation material has the properties that can conduct the friction forces between the ground and outer pipe in order to meet the steel thermal expansion tensions.

It can be used in prestressed systems; hence the need for a compensator is minimised.

All fittings parts are manufactured as preinsulated.

The steel pipes are exposed to surface treatment (sanding) in SA 2 1/2 standards before insulation. For this reason, there are no elements such as stain and oil on the pipes and the pipes are protected against corrosion.

Since L, Z, U bends are not used in prestressed systems; there is no need for channel expansion in installation of these parts.

The ability to monitor the steel pipes and the insulation all year long by means of the preplaced monitoring (observing) wires inside the insulation material and the connected devices enables the detection of leakage at any point.

A manufacturing in accordance with the quality system certificate ISO 9001 that covers design and production is carried out.

It owns international certificates. (TS EN 253, TS EN 12201- 2 and TS EN 448.)

	CLASSICAL SYSTEM	PREINSULATED PIPE
In concrete flumes and galleries	In this system, pipes are installed in flumes and galleries under the ground.	Pipes are buried into the opened ditches. None of the cost increasing processes such as concrete flume, gallery, and support are needed.
Solution for thermal expansion	In order to compensate the thermal expansion of pipes in galleries, compensators are needed to be used at certain distances. The selection of correct compensator that is the most critical material is essential for service life in installations. As the other application, the omega system that is made with four elbows cause expansion of the channel.	By means of the prestressed installation technique, earth friction forces absorb the expansion of steel pipes. The need for compensator is minimised for solution.
In heat loss	The thermal conductivity coefficient of glasswool/ rockwool that is used in the classical system is 0.040 W/mk.	The thermal conductivity coefficient of polyurethane that is used as insulation material is 0.028 W/mk. This value means less heat loss compared to the classical system.
Length of service life	The insulation material loses its property and heat loss increases in time due to water filling inside the channel.	Since casing pipe is drawn from the extruding machine as seamless, water entry inside the polyurethane material is impossible. The service life of the insulation material is minimum 30 years.
Corrosion	In classical system, corrosion forms on the carrier pipe in time.	Corrosion due to external effects does not form on the carrier pipe.
Insulation life	Very short (decay starts due to expanding humidity on the insulation material)	30 years (at 120 ^{0}C continuous service temperature)
Workmanship on site	Insulation work is completely made on site.	Only the joint insulations are made on site.
Installation duration	Manufacturing duration is long since insulation covering is made besides joint works on site.	Installation duration is as half as the classical system.
Insulation type	The common application is using glasswool / rockwool.	Special polyurethane that is the best insulation material is used.
Insulation casing	Galvanised sheet corrodes in time due to contact with air and water. Moreover, sealing cannot be entirely provided.	Since the casing pipe is polyethylene, leaking is not possible. Polyethylene does not corrode; it is a material that is resistant to impacts.
Leakage monitoring systems	Since humidity and water entry cannot be entirely prevented into the insulation, establishment of a monitoring system is not possible.	When required, the leaking points even inside networks of 10 km can be detected with an accuracy of +- 1-2 m by means of the monitoring wires installed inside the pipes.
Homogeneous heat distribution	Since the insulation is carried out on site, it is environmentally difficult to obtain homogeneity at the insulation thickness.	Homogeneity at the insulation thickness can be provided.
Fittings diversity	The fittings insulation has to be made on site.	The fittings are transported to the site as built-in insulated.
Manufacturing standard	Since it is not a fabricated manufacture, but made on site, a standard manufacturing is not possible. A recognised standard norm does not exist.	Manufacturing is carried out in accordance with EN253 which is established with the 30 years of experience of the European manufacturers.

STANDARD TYPE PREINSULATED PIPE

Standard type preinsulated pipes comprise three basic materials. Carrier pipes are established as steel, copper or plastic based according to the properties of the carried fluids. Casing pipes are manufactured from high density polyethylene (HDPE) raw material, with UV resistance, 100% waterproof and with online corona. There is the insulation material that is manufactured from polyurethane raw material between the carrier and casing pipes, and it prevents heat loss.

CARRIER PIPES

STEEL

Material	P 235 TR1 – TR2, P235 GH, ST 37, ST 35,8, API 5L (Grade A-B), SCH 20-80
Standard	EN 10217-1, EN 10217-2, EN 10216, EN 10255, EN 10220, API 5L
Certificate	EN 10204 – 3.1

STAINLESS STEEL

AISI 304 L, AISI 316 L

PLASTIC

HDPE, PPR-C, FR PPR, EPOKSİ, PEX, PVC

POLYURETHANE

Average Cell Size
< 0,5mm
Core Density
≥ 60 kg/m³
Total Density
≥ 80 kg/m³
Closed Cell
> %88
Compressive Strength
≥ 0,3 N/mm²
Axial Cutting Strength
≥ 0,12 N/mm²
Peripheral Cutting Strength
N/mm² (≥ 0,20)
Thermal Conductivity Coefficient
(at 50 °C) (< 0,026 W/Mk)

HDPE PIPE (CASING PIPE)

Material
High Density Polyethylene

Standard
TS EN 253:2009 + A1 (TS EN 12201 -2)

Density > 944 kg/m³

Thermal Conductivity Coefficient
W/Mk 0,43

Expansion Coefficient 2.10 1/K

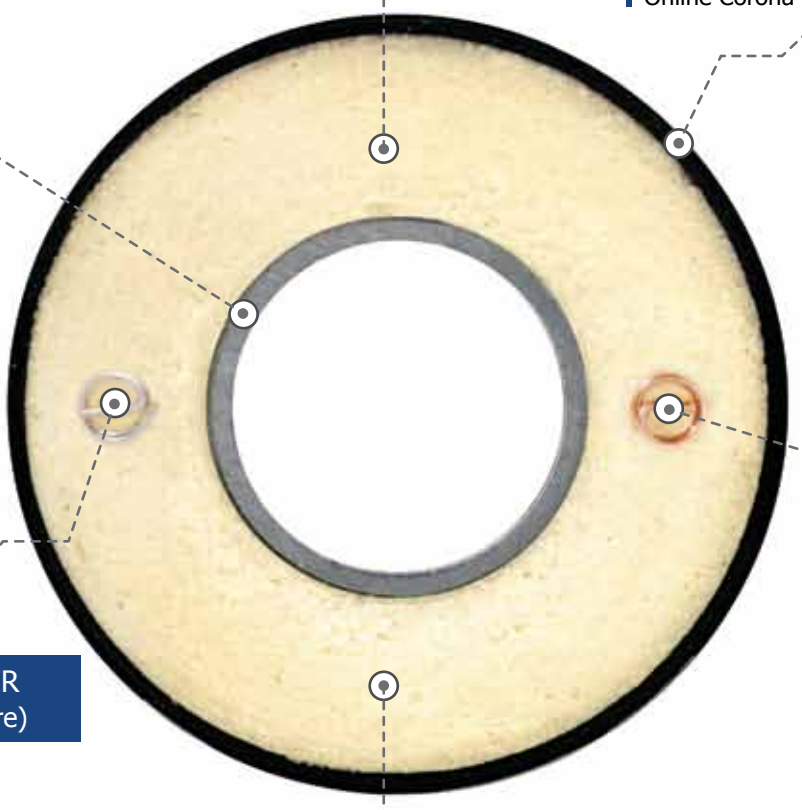
Yield Strength > 19 N/mm²

Melting Flow Rate (MFI) < 0,5 gr /10 min

Thermal Stability (at 210 °C) > 20 min

UV Resistant

Online Corona



TIN COATED COPPER WIRE (Monitoring Wire)

COPPER WIRE (Signal Wire)

INSULATION TYPES

Low Temperature	- 200 °C	- 60 °C
Normal Temperature	- 60 °C	+140 °C
High Temperature	+ 140 °C	+ 250 °C

INDUSTRIAL TYPE ROCKWOOL REINFRCED PREINSULATED PIPE (Ø 15 – Ø 800)

Double insulated pipes are specially manufactured for underground and above ground applications for the temperatures between 150 ^{0}C and 650 ^{0}C.

Along with the high thermal insulation provided by double insulation, they have the properties of standard type preinsulated pipes.

CARRIER PIPES

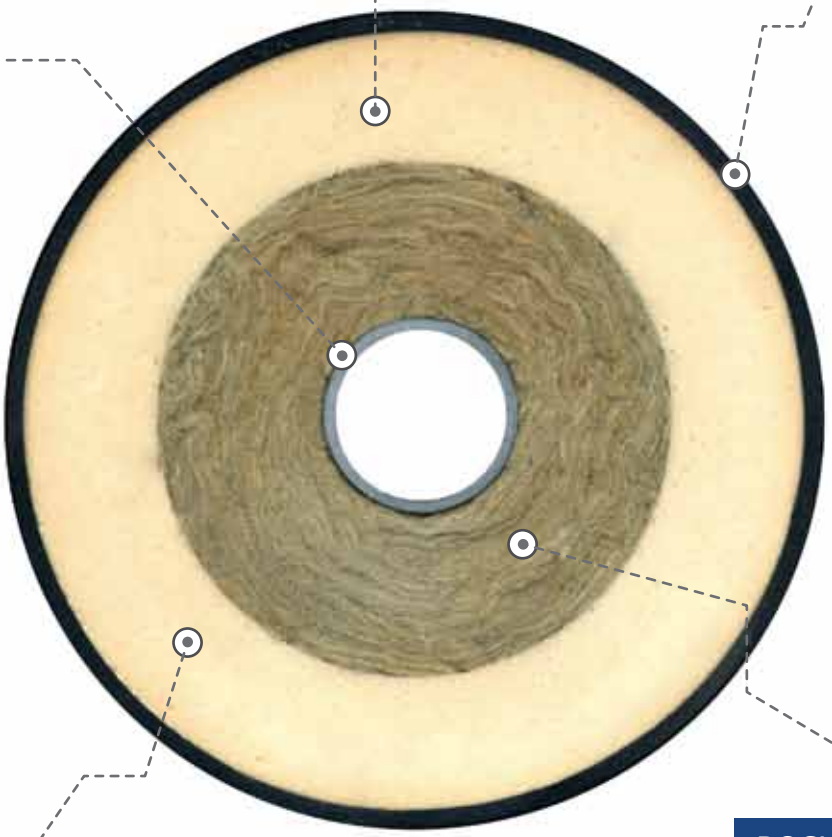
TS EN 10216 -2	P 235 GH
API 5 L	X52 PSL2, Grade B,X42, X46, X52, X56, X60, X65, X70
ASTM A-53/ A106	GRADE A, GRADE B, GRADE C

POLYURETHANE

Total Density > 80kg/m^3
Core Density > 60kg/m^3

CASING PIPES

POLYETHYLENE
HDPE black >944 kg/m^3
UV Resistant
With Online Corona



INSULATION TYPES

High Temperature
Between 140 ^{0}C / 650 ^{0}C

ROCKWOOL

Density
110 -140 kg/m^3

Standard Type Preinsulated Steel Pipe(Ø 15 - Ø 1200)

All steel pipes used in the manufacturing of preinsulated pipes must comply with the norms that are required by TS EN 253 standards.

In standard manufacturing, steel pipes manufactured according to the below norms and standards are used;

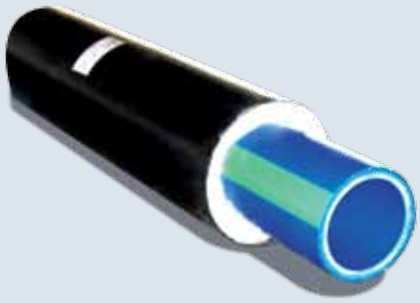
ERW Pipe Manufacturing Standards	Material Quality
TS EN 10217 1-2	P235 TR1 – TR2
TS EN 10255	P 195 T
ASTM A-53	GRADE A, GRADE B
DIN 17100/DIN 1626	St33, St37, St37.4, St35.8, St45.8, St52

SAW Pipe Manufacturing Standards	Material Quality
API 5L PSL1/ PSL2	X52 PSL2, Grade B,X42, X46, X52, X56, X60, X65, X70
TS EN 0217-5	P 195, P 235, P265 TR1/TR2
TS EN ISO 3183	X60 PSL2
ASTM A-53	GRADE A, GRADE B

Preinsulated PPR-C Pipe (Ø 15 – Ø 200)

PPR-C pipes manufactured in TS EN 15874 standards and PN 10 – PN 20 pressure ranges are preinsulated pipe types.

Fiberglass Reinforced PPR-C Pipe (Φ 20 - Φ 630)



Fiberglass reinforced PPR pipes manufactured in ASTM F 2389 standards or equivalent recognised international standards (DIN 8077, DIN 16962 SKZ, etc.) are one of preinsulated pipe types.

HDPE pipes manufactured in TS EN 12201 – 2 and TS EN 253 standards and between PN 2.5 – PN 25 pressure ranges are one of preinsulated pipe types.

Preinsulated HDPE Pipe (Ø 50 – Ø 1000)

Stainless Steel Pipes manufactured in AISI 304/ 304 L and AISI 316 / 316 L standards are one of preinsulated pipe types.

Preinsulated Stainless Steel Pipe (Ø 15 – Ø -200)

Copper pipes manufacturer in TS EN 12449, TS EN 12735, ASTMB68-B88 are on of preinsulated pipe types.

Preinsulated Copper Pipe (Ø 15 – Ø 200)

Other Types of Pipes

The variety of preinsulated pipe types expands on a wide range.
Galvanised steel pipes EN 10240 TS 11348, DIN 244, ASTM A 90,
ASTM A 53, SI 103, SI918, BS 729,
PEX [DIN 16892] pipes, CTP [AWA C950] etc.

POLYURETHANE INSULATION MATERIAL (PUR)

PUR is an insulation material with quite low thermal conductivity coefficient and formed with mixing polyurethane insulation material polyol and isocyanate at particular ratios.

PUR that is injected between the carrier pipe and casing pipe (HDPE) provides heat insulation besides enabling two pipes operating as one pipe by bonding them together. In the manufacturing of preinsulated pipes, PUR in TS EN 253 standards and having a uniform cell structure has to be used and the minimum conditions below have to be provided:

Material	Hard polyurethane foam composed of the mixing of polyol and isocyanate, having a homogeneous cell structure.
Average Cell Size	<0.5 mm.
Core Density	>= 60kg./m^3
Total Density	>=80 kg./m^3
Closed Cell	<%88
Water Absorption at High Temperature	< %10, It must not exceed the 10% of the original volume when tested according to TS EN 253 5.3.5.
Compressive Strength (at %10 relative deformation)	>=0.3 N/mm^2
Axial Cutting Strength	>=0.12N/mm^2
Peripheral Cutting Strength	>=0.20N/mm^2
Thermal Conductivity Coefficient (at ^{0}C)	<0.28 W/mk
Service Life of Insulation according to Continuous Service Temperatures	3 years at 140 ^{0}C |30 years at 120 ^{0}C 50 years at 115 ^{0}C

POLYETHYLENE CASING PIPE (HDPE)

The anti-oxidants inside the casing pipes, protecting the insulation material from external effects and chemicals have UV stabilisers and carbon black and have a density above 944 kg/ m^3, and are exposed to online corona treatment.

The values required to be provided in the manufacturing of polyethylene pipes according to TS EN 253 standard have to be as below:

Material	Polyethylene (High Density)
Density	>944 kg/m^3
Colour	Black (carbon black) > %2.5 by mass
Flow Strength	>19 N/mm^2
Drawing Under Constant Load (CLT)	>2000 hours
Melting Flow rate	<0.5 gr/10 min.
Thermal Stability (at 210 C)	>20 min.
Expansion Coefficient	2.10^{-4} K^{-1}
Thermal Conductivity Coefficient	0.43 W/mK
Min. Wall Thickness	TS EN 253
Corona	Online must be applied.

USE OF PREINSULATED PIPES IN VESSEL BUILDING INDUSTRY

There are many advantages for choosing Yalçın Boru preinsulated pipes for vessels transporting chemical substances, dry cargo, bitumen, LNG, LPG NH3 and crude oil. As Yalçın Boru, we recommend preinsulated pipes for any applications of such as hot water, steam/condensate, boiling oil, bitumen, fire extinguishing equipment, salty water, LN, LPG, HFO, glycol and nitrogen on open decks and cargo areas. Our products are 100% waterproof, UV resistant, maintenance free and usable during the entire service lives of the vessels.

Yalçın Boru has developed an approach for the design and installation of preinsulated pipe systems in ship building applications. This approach is applicable on both the new vessels to be built, and in the restoration of the present lines in the vessels. The advantages of the preinsulated pipes are more apparent on the piping systems on decks. In order to avoid the conditions due to the effects of the salty water from waves, strong winds, rain, hot temperature and human traffic, preinsulated piping is an ideal solution.

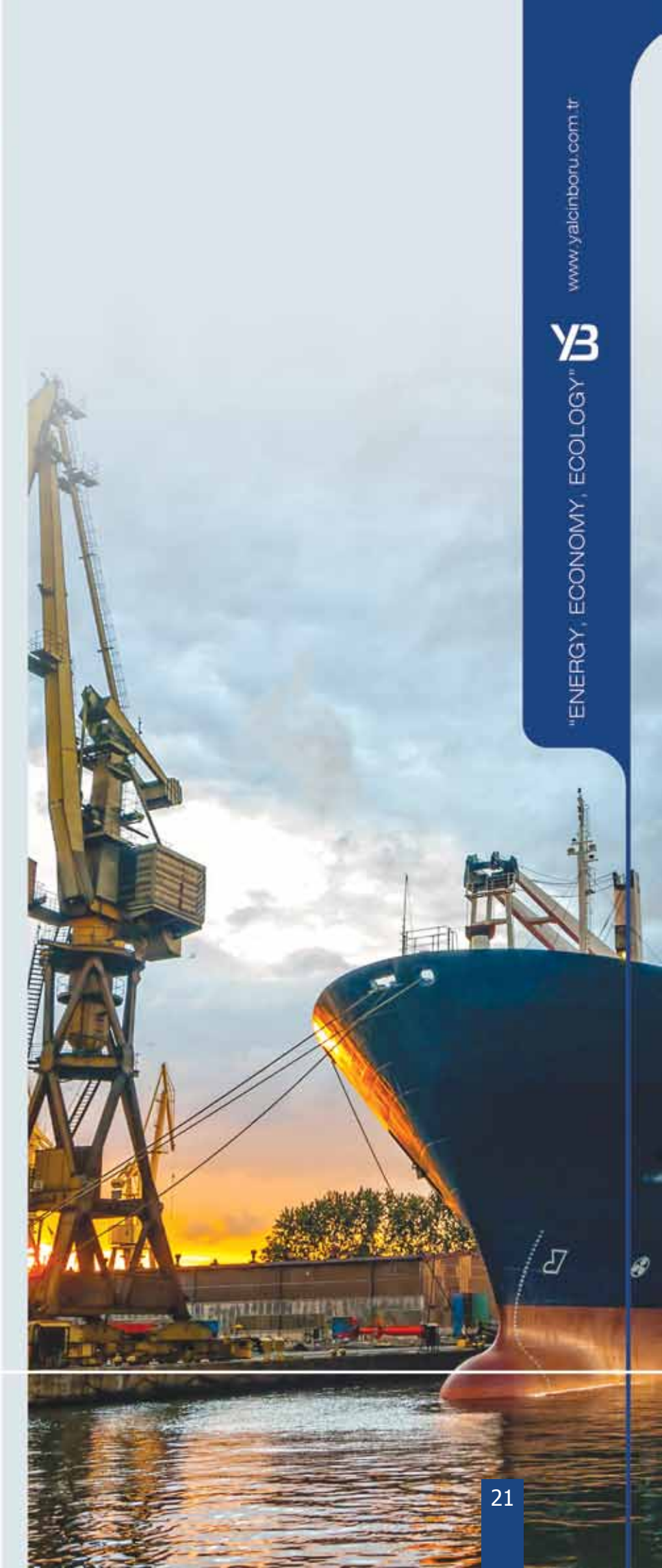
Application / System	Asphalt, Sulfur Transportation	Containens Fishing Ships	VLCC, Connyer Tankers, FPSD	LPG, LEG&LNG Transportation	Dry Cargo Chemical Tanks
Low Temperature -200 ^{0}C - 60 ^{0}C				Liquid lines	
Standard Temperature -50 ^{0}C - 140 ^{0}C	Hot water condense	Cooling	Fuel oil, condense	Glycol	Fire equipment, Fuel oil, condense, Hot water
High Temperature 140 ^{0}C - 175 ^{0}C	Steam, Boiling Oil		Steam	Steam boiling oil	Steam
High Temperature II 140 ^{0}C - 650 ^{0}C	Boiling Oil		Boiling Oil	Steam boiling oil	Steam, Boiling Oil

By means of the piping system we design for vessel building industry, manufacturing and delivery is provided fast and problem-free within precise tolerances generally in flanged connections. The system designed by the service of Yalçın Boru technical sales representatives will be completed on time and affordably. Due to the benefits stated below, this product is an ideal solution for choosing the preinsulated piping systems in maritime industry:

- 100% waterproof
- Low energy loss
- Casing pipe (HDPE) resistant against salt, chemicals and UV rays
- Rough-hard manufacture, high mechanical strength
- Protection of service/carrier pipe against corrosion
- Temperature range from -200 to +315 0C
- Support parts applicable on casing pipe surface

These technical properties are applicable for insulated piping systems manufactured by Yalçın Boru, and the system provides these benefits to vessel owners:

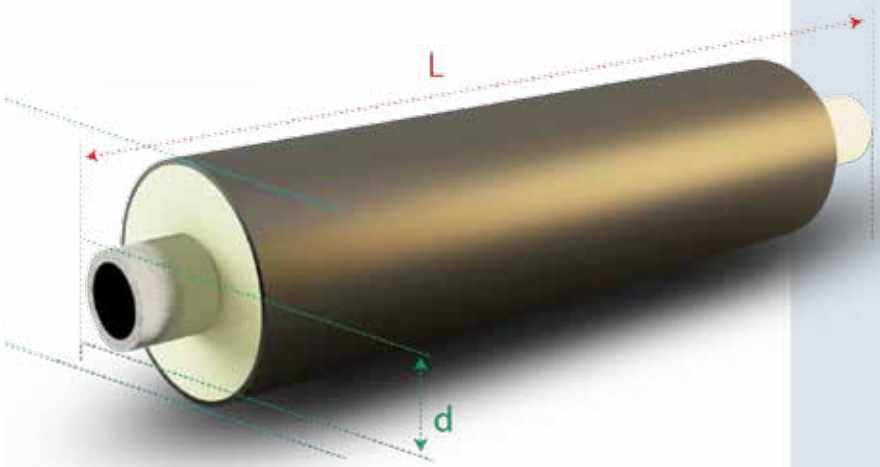
- Easy and fast building
- Optimum operating economy
- Low repair cost
- High environmental safety
- Minimum failure duration
- Long service life



YALÇINBORU

SIZES OF PREINSULATED PIPE AND FITTINGS

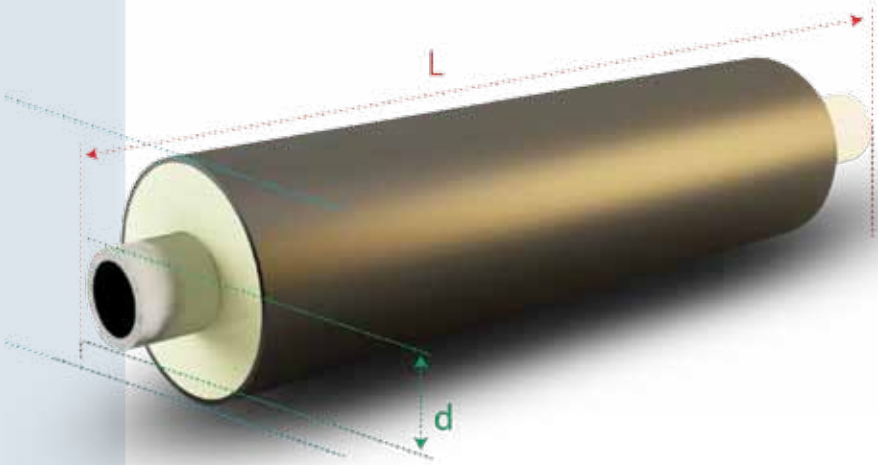
PREINSULATED PIPE SERIES-1 IN ACCORDANCE WITH TS EN 253 STANDARDS



STEEL SERVICE PIPE					HDPE 100 CASING PIPE			INSULATION (PUR)	PACKAGE PIPE WEIGHT	STEEL PIPE UNIT WATER VOLUME	PIPE LENGTH (L)
Steel Pipe Nominal Diameter		Outer Diameter (d)	Inner Diameter	Wall Thickness	Outer Diameter (d)	Inner Diameter	Wall Thickness	Thickness			
DN	inch	mm	mm	mm	mm	mm	mm	mm	kg / m	lt / m	m
15	1/2"	21,30	17,30	2,0	75	69,00	3,0	23,85	1,94	0,27	6
20	3/4"	26,90	21,70	2,6	90	84,00	3,0	28,55	2,74	0,37	6
25	1"	33,70	28,50	2,6	90	84,00	3,0	25,15	3,15	0,67	6
32	1 1/4"	42,40	37,20	2,6	110	104,00	3,0	30,80	4,08	1,09	6
40	1 1/2"	48,30	43,10	2,6	110	104,00	3,0	27,85	4,43	1,46	6
50	2"	60,30	54,50	2,9	125	119,00	3,0	29,35	5,87	2,33	6
65	2 1/2"	76,10	70,30	2,9	140	134,00	3,00	28,95	7,23	3,88	6 - 8
80	3"	88,90	82,50	3,2	160	154,00	3,00	32,55	9,17	5,35	6 - 8
100	4"	114,30	107,10	3,6	200	193,60	3,20	39,65	13,25	9,01	6 - 8 - 12
125	5"	139,70	132,50	3,6	225	218,20	3,40	39,25	16,11	13,79	6 - 8 - 12
150	6"	168,30	160,30	4,0	250	242,80	3,60	37,25	20,80	20,18	6 - 8 - 12
200	8"	219,10	210,10	4,5	315	306,80	4,10	43,85	30,54	34,67	6 - 8 - 12
250	10"	273,00	263,00	5,0	400	390,40	4,80	58,70	43,64	54,33	6 - 8 - 12
300	12"	323,00	311,80	5,6	450	439,60	5,20	58,30	56,45	76,80	6 - 8 - 12
350	14"	355,60	344,40	5,6	500	488,80	5,60	66,60	63,72	93,16	6 - 8 - 12
400	16"	406,40	393,80	6,3	560	548,00	6,00	70,80	80,63	121,80	6 - 8 - 12
450	18"	457,20	444,60	6,3	630	616,80	6,60	79,80	93,16	155,25	6 - 8 - 12
500	20"	508,00	495,40	6,3	710	695,60	7,20	93,80	107,33	192,75	6 - 8 - 12
550	22"	559,00	546,40	6,3	710	695,60	7,20	68,30	127,46	234,56	6 - 8 - 12
600	24"	610,00	595,80	7,1	800	784,20	7,90	87,10	139,61	278,80	6 - 8 - 12
700	28"	711,00	696,80	7,1	900	882,60	8,70	85,80	192,4	379,37	6 - 8 - 12
800	32"	813,00	795,40	8,8	1000	981,20	9,40	84,10	222,42	496,98	6 - 8 - 12
900	36"	914,00	894,00	10,0	1200	1178,00	11,00	132,00	307,8	627,72	6 - 8 - 12
1000	40"	1.106,00	1084,00	11	1200	1175,00	12,5	34,50	350,2	776,02	6 - 8 - 12
1200	48"	1.219,00	1194,00	12,5	1400	1372,00	14,0	76,50	463,9	923,44	6 - 8 - 12

*The data indicated in the table are for informative purposes. Yalçın Boru reserves its rights to modify these data.

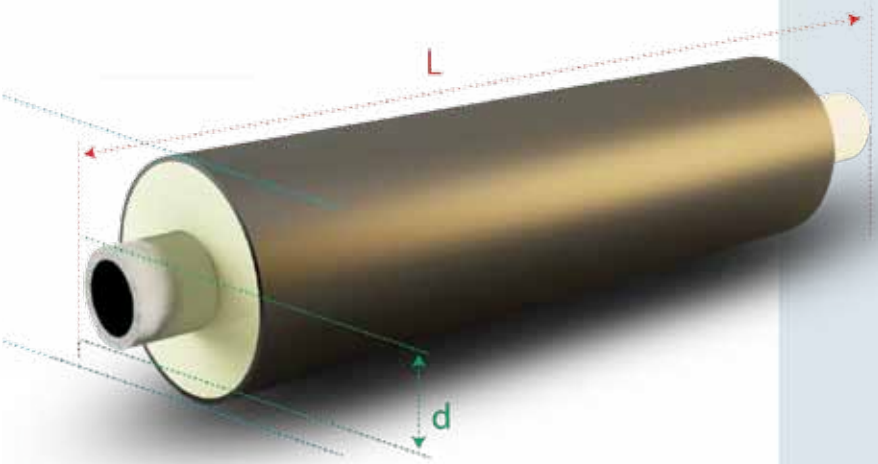
PREINSULATED PIPE SERIES-2 IN ACCORDANCE WITH TS EN 253 STANDARDS



STEEL SERVICE PIPE					HDPE 100 CASING PIPE			INSULATION (PUR)	PACKAGE PIPE WEIGHT	STEEL PIPE UNIT WATER VOLUME	PIPE LENGTH (L)
Steel Pipe Nominal Diameter		Outer Diameter (d)	Inner Diameter	Wall Thickness	Outer Diameter (d)	Inner Diameter	Wall Thickness	Thickness			
DN	inch	mm	mm	mm	mm	mm	mm	mm	kg / m	lt / m	m
15	1/2"	21,30	17,30	2,0	90	84,00	3,0	31,35	2,23	0,27	6
20	3/4"	26,90	21,70	2,6	110	104,00	3,0	38,55	3,16	0,37	6
25	1"	33,70	28,50	2,6	110	104,00	3,0	35,15	3,57	0,67	6
32	1 1/4"	42,40	37,20	2,6	125	119,00	3,0	38,30	4,43	1,09	6
40	1 1/2"	48,30	43,10	2,6	125	119,00	3,0	35,35	4,77	1,46	6
50	2"	60,30	54,50	2,9	140	134,00	3,0	36,85	6,24	2,33	6
65	2 1/2"	76,10	70,30	2,9	160	154,00	3,00	38,95	7,78	3,88	6 - 8
80	3"	88,90	82,50	3,2	180	174,00	3,00	42,55	9,76	5,35	6 - 8
100	4"	114,30	107,10	3,6	225	218,20	3,40	51,95	14,14	9,01	6 - 8 - 12
125	5"	139,70	132,50	3,6	250	242,80	3,60	51,55	17,09	13,79	6 - 8 - 12
150	6"	168,30	160,30	4,0	280	272,20	3,90	51,95	22,09	20,18	6 - 8 - 12
200	8"	219,10	210,10	4,5	355	346,00	4,50	63,45	32,68	34,67	6 - 8 - 12
250	10"	273,00	263,00	5,0	450	439,60	5,20	83,30	46,97	54,33	6 - 8 - 12
300	12"	323,00	311,80	5,6	500	488,80	5,60	82,90	60,15	76,80	6 - 8 - 12
350	14"	355,60	344,40	5,6	560	548,00	6,00	96,20	68,64	93,16	6 - 8 - 12
400	16"	406,40	393,80	6,3	630	616,80	6,60	105,20	87,02	121,80	6 - 8 - 12
450	18"	457,20	444,60	6,3	710	695,60	7,20	119,20	101,35	155,25	6 - 8 - 12
500	20"	508,00	495,40	6,3	800	784,20	7,90	138,10	117,65	192,75	6 - 8 - 12
550	22"	559,00	546,40	6,3	800	784,20	7,90	112,60	137,66	234,56	6 - 8 - 12
600	24"	610,00	595,80	7,1	900	882,60	8,70	136,30	152,47	278,80	6 - 8 - 12

*The data indicated in the table are for informative purposes. Yalçın Boru reserves its rights to modify these data.

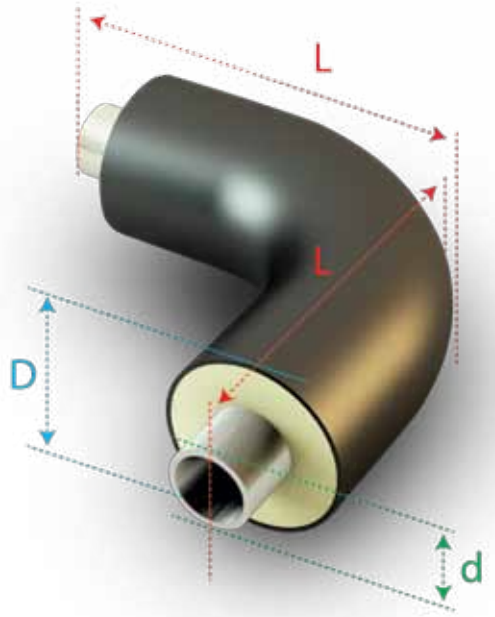
PREINSULATED PIPE SERIES-3 IN ACCORDANCE WITH TS EN 253 STANDARDS



STEEL SERVICE PIPE					HDPE 100 CASING PIPE			INSULATION (PUR)	PACKAGE PIPE WEIGHT	STEEL PIPE UNIT WATER VOLUME	PIPE LENGTH (L)
Steel Pipe Nominal Diameter		Outer Diameter (d)	Inner Diameter	Wall Thickness	Outer Diameter (d)	Inner Diameter	Wall Thickness	Thickness			
DN	inch	mm	mm	mm	mm	mm	mm	mm	kg / m	lt / m	m
15	1/2"	21,30	17,30	2,0	110	104,00	3,0	41,35	2,66	0,27	6
20	3/4"	26,90	21,70	2,6	125	119,00	3,0	46,05	3,51	0,37	6
25	1"	33,70	28,50	2,6	125	119,00	3,0	42,65	3,91	0,67	6
32	1 1/4"	42,40	37,20	2,6	140	134,00	3,0	45,80	4,82	1,09	6
40	1 1/2"	48,30	43,10	2,6	140	134,00	3,0	42,85	5,16	1,46	6
50	2"	60,30	54,50	2,9	160	154,00	3,0	46,85	6,78	2,33	6
65	2 1/2"	76,10	70,30	2,9	180	174,00	3,00	48,95	8,37	3,88	6 - 8
80	3"	88,90	82,50	3,2	200	193,60	3,20	52,35	10,41	5,35	6 - 8
100	4"	114,30	107,10	3,6	250	242,80	3,60	64,25	15,11	9,01	6 - 8 - 12
125	5"	139,70	132,50	3,6	280	272,20	3,90	66,25	18,37	13,79	6 - 8 - 12
150	6"	168,30	160,30	4,0	315	306,80	4,10	69,25	23,75	20,18	6 - 8 - 12
200	8"	219,10	210,10	4,5	400	390,40	4,80	85,65	35,32	34,67	6 - 8 - 12
250	10"	273,00	263,00	5,0	500	488,80	5,60	107,90	50,61	54,33	6 - 8 - 12
300	12"	323,00	311,80	5,6	560	548,00	6,00	112,50	65,02	76,80	6 - 8 - 12
350	14"	355,60	344,40	5,6	630	616,80	6,60	130,60	74,95	93,16	6 - 8 - 12
400	16"	406,40	393,80	6,3	710	695,60	7,20	144,60	95,02	121,80	6 - 8 - 12
450	18"	457,20	444,60	6,3	800	784,20	7,90	163,50	111,52	155,25	6 - 8 - 12
500	20"	508,00	495,40	6,3	900	882,60	8,70	187,30	130,31	192,75	6 - 8 - 12
550	22"	559,00	546,40	6,3	900	882,60	8,70	161,80	149,87	234,56	6 - 8 - 12
600	24"	610,00	595,80	7,1	1000	981,20	9,40	185,60	166,58	278,80	6 - 8 - 12

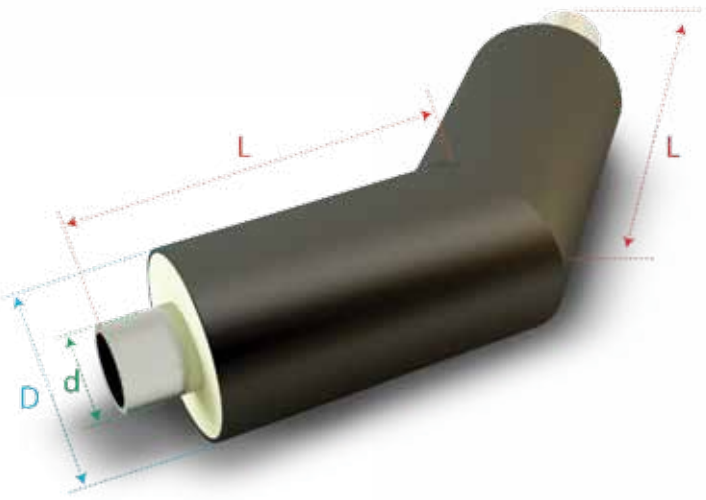
*The data indicated in the table are for informative purposes. Yalçın Boru reserves its rights to modify these data.

PREINSULATED 90⁰ ELBOW IN ACCORDANCE WITH TS EN 448 STANDARDS



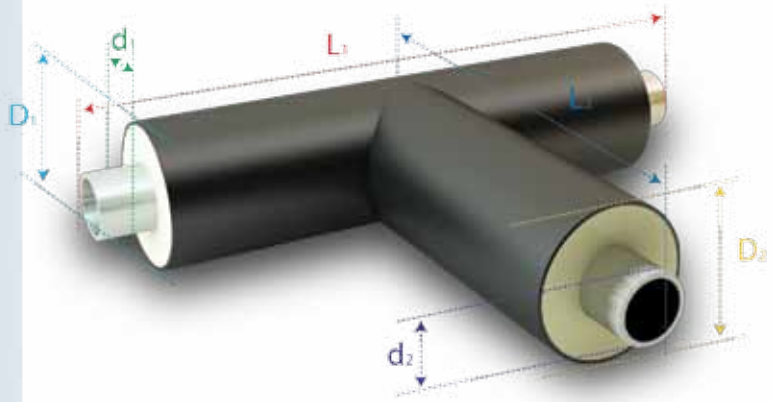
INNER PIPE	NOMINAL DIAMETER	DN	Ø25	Ø32	Ø40	Ø50	Ø65	Ø80	Ø100	Ø125	Ø150	Ø200	Ø250	Ø300	Ø350	Ø400	Ø450	Ø500	Ø600	Ø700	Ø800	Ø900	Ø1000	Ø1100	Ø1200
		inch	1″	1 ¼″	1 ½″	2″	2 ½″	3″	4″	5″	6″	8″	10″	12″	14″	16″	18″	20″	24″	28″	32″	36″	40″	44″	48″
	OUTER DIAMETER (d)	mm	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	572,2	508,0	610,0	711,1	813,0	914,0	1.016,0	1.118,0	1.219,0
CASING PIPE	OUTER DIAMETER(D)	mm	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L LENGTH			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1200	1500	1500	1500	1800	1800	1800	1800	2000	2000	2000

PREINSULATED 45⁰ ELBOW IN ACCORDANCE WITH TS EN 448 STANDARDS



INNER PIPE	NOMINAL DIAMETER	DN	Ø25	Ø32	Ø40	Ø50	Ø65	Ø80	Ø100	Ø125	Ø150	Ø200	Ø250	Ø300	Ø350	Ø400	Ø450	Ø500	Ø600	Ø700	Ø800	Ø900	Ø1000	Ø1100	Ø1200
		inch	1″	1 ¼″	1 ½″	2″	2 ½″	3″	4″	5″	6″	8″	10″	12″	14″	16″	18″	20″	24″	28″	32″	36″	40″	44″	48″
	OUTER DIAMETER (d)	mm	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	572,2	508,0	610,0	711,1	813,0	914,0	1.016,0	1.118,0	1.219,0
CASING PIPE	OUTER DIAMETER(D)	mm	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L LENGTH			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1200	1500	1500	1500	1800	1800	1800	1800	2000	2000	2000

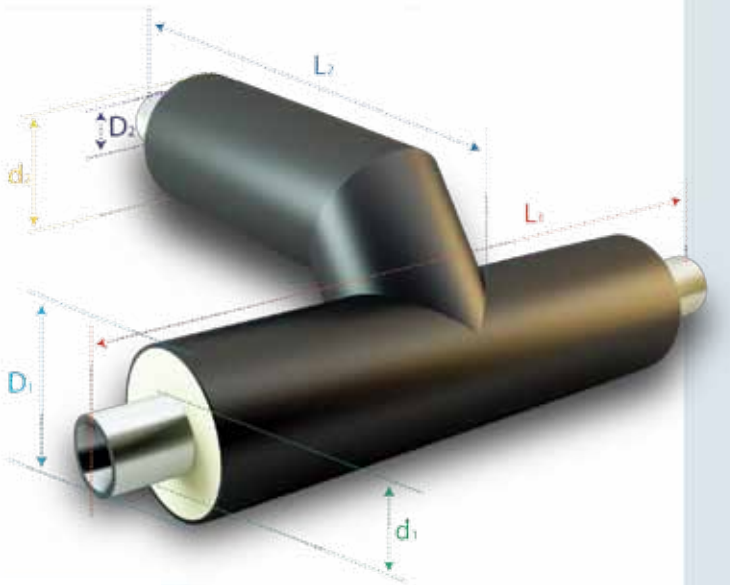
PREINSULATED STRAIGHTTEE IN ACCORDANCE WITH TS EN 448 STANDARDS



INNER PIPE	NOMINAL DIAMETER	DN	ø20	ø 25	ø 32	ø 40	ø 50	ø 65	ø 80	ø 100	ø 125	ø 150	ø 200	ø 250	ø 300	ø 350	ø 400	ø 450	ø 500	ø 600	ø 700	ø 800	ø 900	ø 1000	ø 1100	ø 1200
		Inch	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"	36"	40"	44"	48"
	OUTER DIAMETERI (d_1)	mm	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0	711,1	813,0	914,0	1016,0	1118,0	1219,0
CASING PIPE	OUTER DIAMETER (D_1)	mm	90	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L_1 LENGTH [mm]			1000	1000	1000	1000	1000	1000	1000	1000	1000	1200	1200	1200	1400	1800	2000	2000	2000	2000	2000	2500	2500	2500	2500	2500

INNER PIPE			CASING PIPE	L_2 LENGTH [mm]																								
NOMINAL DIAMETER		OUTER DIAMETER(d_2)	OUTER DIAMETER (D_2)																									
DN	Inch	mm	mm																									
ø 20	¾"	26,9	90	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000															
ø 25	1"	33	90		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000														
ø 32	1¼"	42,4	110			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000													
ø 40	1½"	48,3	110				1000	1000	1000	1000	1000	1000	1000	1000	1000	1000												
ø 50	2"	60,3	125					1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000								
ø 65	2½"	76,1	140						1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000							
ø 80	3"	88,9	160							1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000						
ø100	4"	114,3	200								1000	1000	1000	1000	1000	1000	1000	1000	1200	1200	1200	1200	1000					
ø125	5"	139,7	225									1000	1000	1000	1000	1000	1000	1200	1200	1200	1200	1200	1200	1200				
ø150	6"	168,3	250										1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200			
ø200	8"	219,1	315											1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		
ø250	10"	273	400												1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
ø300	12"	323,9	450													1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
ø350	14"	355,6	500														1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
ø400	16"	406,4	560															1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
ø450	18"	457,2	630																1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
ø500	20"	508	710																	1600	1600	1600	1600	1600	1600	1600	1600	1600
ø600	24"	610	800																		1600	1600	1600	1600	1600	1600	1600	1600
ø700	28"	711	900																			1800	1800	1800	1800	1800	1800	1800
ø800	32"	813	1000																				1800	1800	1800	1800	1800	1800
ø900	36"	914	1200																					2000	2000	2000	2000	2000
ø1000	40"	1016	1200																						2000	2000	2000	2000
ø1100	44"	1118	1400																							2000	2000	2000
ø1200	48"	1219	1400																									2000

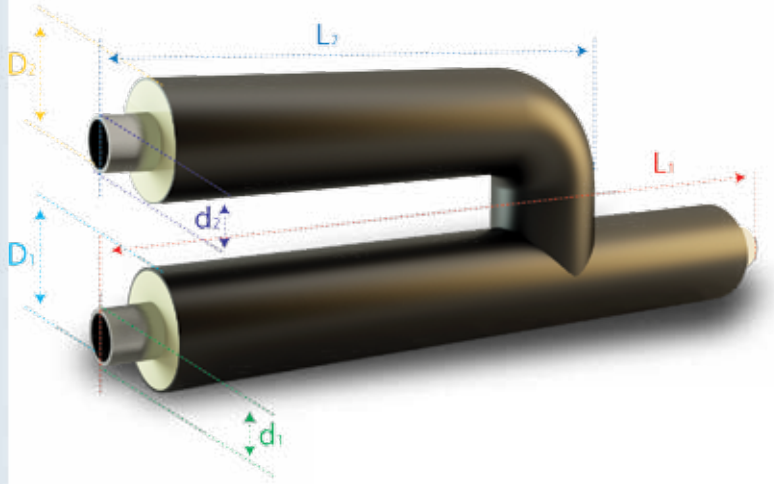
PREINSULATED ELEVATED TEE IN ACCORDANCE WITH TS EN 448 STANDARDS



INNER PIPE	NOMINAL DIAMETER	DN	ø20	ø 25	ø 32	ø 40	ø 50	ø 65	ø 80	ø 100	ø 125	ø 150	ø 200	ø 250	ø 300	ø 350	ø 400	ø 450	ø 500	ø 600	ø 700	ø 800	ø 900	ø 1000	ø 1100	ø 1200
		Inch	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"	36"	40"	44"	48"
	OUTER DIAMETERI (d_1)	mm	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0	711,1	813,0	914,0	1016,0	1118,0	1219,0
CASING PIPE	OUTER DIAMETER (D_1)	mm	90	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L_1 LENGTH [mm]			1000	1000	1000	1000	1000	1000	1000	1000	1000	1200	1200	1200	1400	1800	2000	2000	2000	2000	2000	2500	2500	2500	2500	2500

INNER PIPE			CASING PIPE	L_2 LENGTH [mm]																								
NOMINAL DIAMETER		OUTER DIAMETER(d_1)	OUTER DIAMETER (D_2)																									
DN	Inch	mm	mm																									
ø 20	¾"	26,9	90	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000															
ø 25	1"	33,7	90		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000														
ø 32	1¼"	42,4	110			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000													
ø 40	1½"	48,3	110				1000	1000	1000	1000	1000	1000	1000	1000	1000	1000												
ø 50	2"	60,3	125					1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000									
ø 65	2½"	76,1	140						1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000								
ø 80	3"	88,9	160							1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000							
ø100	4"	114,3	200								1000	1000	1000	1000	1000	1000	1000	1200	1200	1200	1200	1000						
ø125	5"	139,7	225									1000	1000	1000	1000	1000	1200	1200	1200	1200	1200	1200	1200					
ø150	6"	168,3	250										1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200				
ø200	8"	219,1	315											1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500			
ø250	10"	273,0	400											1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		
ø300	12"	323,9	450												1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		
ø350	14"	355,6	500													1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		
ø400	16"	406,4	560														1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		
ø450	18"	457,2	630															1600	1600	1600	1600	1600	1600	1600	1600	1600		
ø500	20"	508,0	710																1600	1600	1600	1600	1600	1600	1600	1600		
ø600	24"	610,0	800																	1600	1600	1600	1600	1600	1600	1600		
ø700	28"	711,0	900																		1800	1800	1800	1800	1800	1800		
ø800	32"	813,0	1000																			1800	1800	1800	1800	1800		
ø900	36"	914,0	1200																				2000	2000	2000	2000		
ø1000	40"	1,016,0	1200																					2000	2000	2000		
ø1100	44"	1,118,0	1400																						2000	2000		
ø1200	48"	1,219,0	1400																							2000		

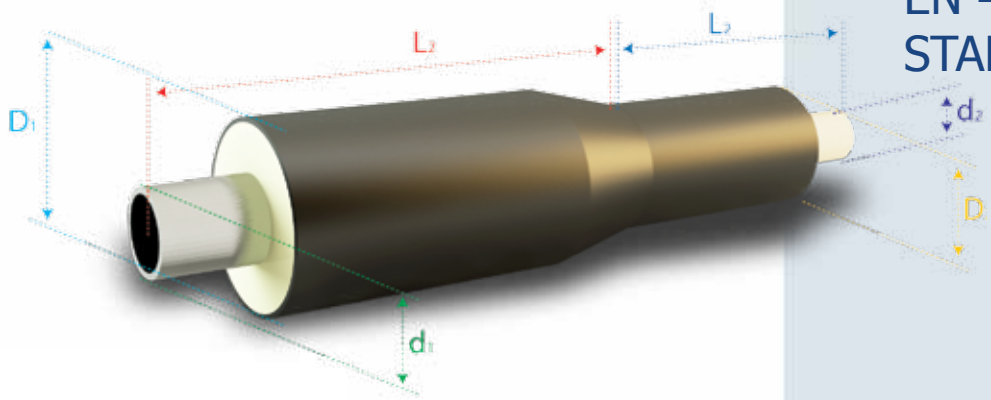
PREINSULATED PARALLEL TEE IN ACCORDANCE WITH TS EN 448 STANDARDS



INNER PIPE	NOMINAL DIAMETER	DN	ø20	ø 25	ø 32	ø 40	ø 50	ø 65	ø 80	ø 100	ø 125	ø 150	ø 200	ø 250	ø 300	ø 350	ø 400	ø 450	ø 500	ø 600	ø 700	ø 800	ø 900	ø 1000	ø 1100	ø 1200
		Inch	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"	36"	40"	44"	48"
	OUTER DIAMETERI (d_1)	mm	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0	711,1	813,0	914,0	1016,0	1118,0	1219,0
CASING PIPE	OUTER DIAMETER (D_1)	mm	90	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L_1 LENGTH [mm]			1000	1000	1000	1000	1000	1000	1000	1000	1000	1200	1200	1200	1400	1800	2000	2000	2000	2000	2000	2500	2500	2500	2500	2500

INNER PIPE			CASING PIPE	L_2 UZUNLUK [mm]																								
NOMINAL DIAMETER		OUTER DIAMETER(d_1)	OUTER DIAMETER (D_1)																									
DN	Inch	mm	mm																									
ø 20	¾"	26,9	90	500	500	500	500	500	500	500	500	500	500															
ø 25	1"	33,7	90		500	500	500	500	500	500	500	500	500	500														
ø 32	1¼"	42,4	110			500	500	500	500	500	500	500	500	500	500													
ø 40	1½"	48,3	110				500	500	500	500	500	500	500	500	500	500												
ø 50	2"	60,3	125					600	600	600	600	600	600	600	600	600	600	600	600	600								
ø 65	2½"	76,1	140						600	600	600	600	600	600	600	600	600	600	600	600	700							
ø 80	3"	88,9	160							600	600	600	600	600	600	600	600	600	600	600	700	700						
ø100	4"	114,3	200								600	600	600	600	600	600	600	600	600	600	750	750	750					
ø125	5"	139,7	225									600	600	600	600	600	600	600	600	600	750	750	750	750				
ø150	6"	168,3	250										700	700	700	700	700	700	700	700	750	800	800	800	800			
ø200	8"	219,1	315											700	700	700	700	700	700	700	800	800	800	800	800	800		
ø250	10"	273,0	400												800	800	800	800	800	800	800	900	900	900	900	900	900	
ø300	12"	323,9	450													800	800	800	800	800	900	900	900	900	900	900	900	
ø350	14"	355,6	500														900	900	900	900	900	1100	1100	1100	1100	1100	1100	
ø400	16"	406,4	560															1000	1000	1000	1100	1100	1100	1100	1100	1100	1100	
ø450	18"	457,2	630																1000	1000	1100	1100	1100	1100	1100	1200	1100	
ø500	20"	508,0	710																	1000	1200	1200	1200	1200	1200	1200	1200	
ø600	24"	610,0	800																		1200	1200	1200	1200	1200	1500	1200	
ø700	28"	711,0	900																			1500	1500	1500	1500	1500	1500	
ø800	32"	813,0	1000																				1500	1500	1500	1750	1500	
ø900	36"	914,0	1200																					1750	1750	1750	1750	
ø1000	40"	1016,0	1200																						1750	1750	1750	
ø1100	44"	1118,0	1400																							2000	2000	
ø1200	48"	1219,0	1400																								2000	

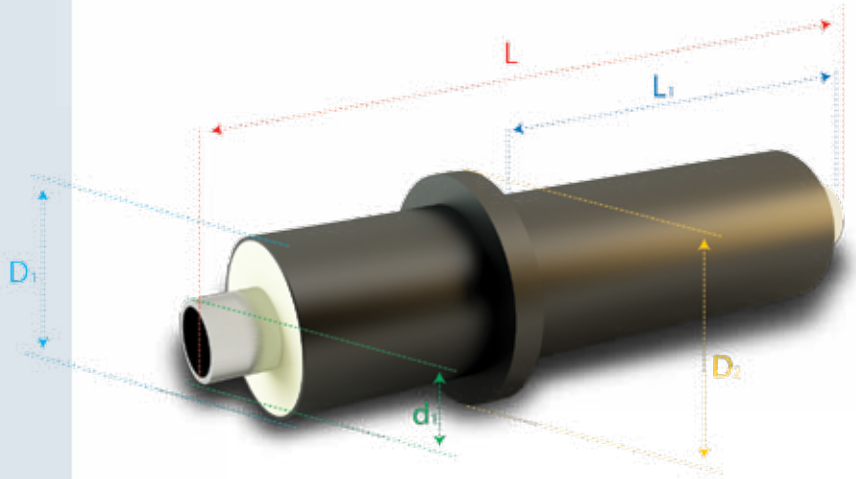
PREINSULATED REDUCING PIPE IN ACCORDANCE WITH TS EN 448 STANDARDS



INNER PIPE	NOMINAL DIAMETER	DN	ø 25	ø 32	ø 40	ø 50	ø 65	ø 80	ø 100	ø 125	ø 150	ø 200	ø 250	ø 300	ø 350	ø 400	ø 450	ø 500	ø 600	ø 700	ø 800	ø 900	ø 1000	ø 1100	ø 1200
		Inch	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"	36"	40"	44"	48"
	OUTER DIAMETERI (d_1)	mm	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3	219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0	711,1	813,0	914,0	1016,0	1118,0	1219,0
CASING PIPE	OUTER DIAMETER (D_1)	mm	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
L_1 LENGTH [mm]			1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500

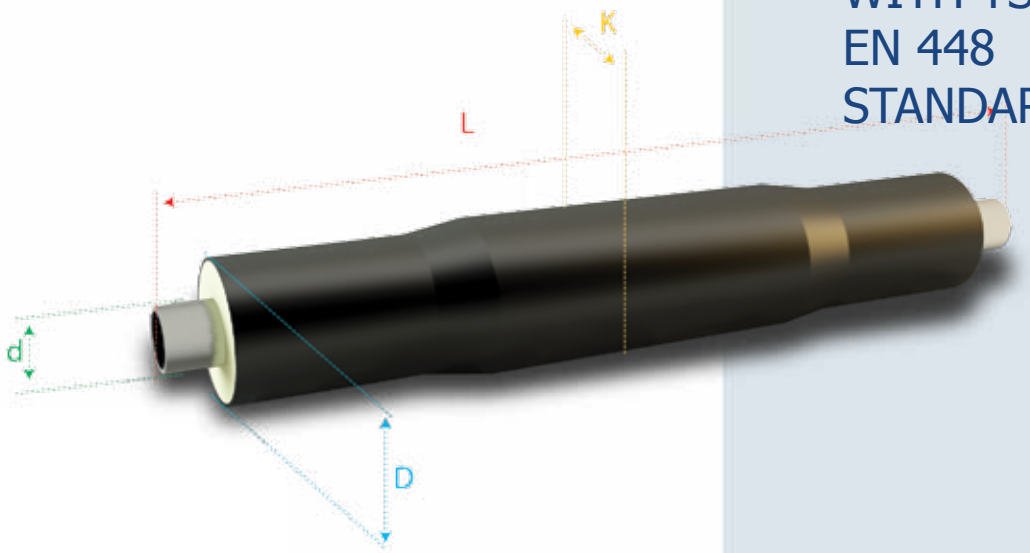
INNER PIPE			CASING PIPE	L_2 UZUNLUK [mm]																							
NOMINAL DIAMETER		OUTER DIAMETER(d_2)	OUTER DIAMETER (D_2)																								
DN	Inch	mm	mm																								
20	¾"	26,9	90	x	x	x	x	x	x	x	x																
25	1"	33,7	90		x	x	x	x	x	x	x	x															
32	1¼"	42,4	110			x	x	x	x	X	x	x	x														
40	1½"	48,3	110				x	x	x	x	x	x	x	x													
50	2"	60,3	125					x	x	x	x	x	x	x	x												
65	2½"	76,1	140						x	x	x	x	x	x	x	x											
80	3"	88,9	160							x	x	x	x	x	x	x	x										
100	4"	114,3	200								x	x	x	x	X	x	x	x									
125	5"	139,7	225									x	x	x	x	x	x	x	x								
150	6"	168,3	250										x	x	x	x	x	x	x	x							
200	8"	219,1	315											x	x	x	x	x	x	x	x						
250	10"	273,0	400												x	x	x	x	x	x	x	x					
300	12"	323,9	450													x	x	x	x	x	x	x	x				
350	14"	355,6	500														x	x	x	x	x	x	x	x			
400	16"	406,4	560															x	x	x	x	x	x	x	x		
450	18"	457,2	630																x	x	x	x	x	x	x	x	x
500	20"	508,0	710																	x	x	x	x	x	x	x	x
600	24"	610,0	800																		x	x	x	x	x	x	x
700	28"	711,0	900																			x	x	x	x	x	x
800	32"	813,0	1000																				x	x	x	x	
900	36"	914,0	1200																					x	x	x	
1000	40"	1,016,0	1200																						x	x	
1100	44"	1,118,0	1400																							x	

PREINSULATED FIXED POINT IN ACCORDANCE WITH TS EN 448 STANDARDS



İÇ BORU	ANMA ÇAPI	DN	Ø20	Ø 25	Ø 32	Ø 40	Ø 50	Ø 65	Ø 80	Ø100	Ø125	Ø150	Ø200	Ø250	Ø300	Ø350	Ø400	Ø450	Ø500	Ø600	Ø700	Ø800	Ø900	Ø 1000	Ø 1100	Ø 1200
		inch	3/4"	1"	1¼"	1½"	2"	2 ½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"	36"	40"	44"	48"
	DIŞ ÇAPI (d_1)	mm	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114	140	168	219	273	324	356	406	457	508	610	711	813	914	1,016,00	1,118,00	1,219,00
KILIF BORU	DIŞ ÇAPI (D_1)	mm	90	90	110	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000	1200	1200	1400	1400
DİSK ÇAPI (D_2) mm			215	215	215	215	215	240	260	300	300	350	415	500	550	600	660	730	810	900	1000	1100	1300	1300	1500	1500
BOY(L_1) mm			1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
TOPLAM BOY(L_2) mm			2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500

PREINSULATED COMPENSATOR IN ACCORDANCE WITH TS EN 448 STANDARDS



İÇ BORU	ANMA ÇAPI	DN	Ø40	Ø50	Ø65	Ø80	Ø100	Ø125	Ø150	Ø200	Ø250	Ø300	Ø350	Ø400	Ø450	Ø500	Ø600	Ø700	Ø800
		inch	1½"	2"	2 ½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	32"
	DIŞ ÇAPI (d_1)	mm	48,3	60,3	76,1	88,9	114	140	168	219	273	324	356	406	457	508	610	711	813
KILIF BORU	DIŞ ÇAPI (D)	mm	110	125	140	160	200	225	250	315	400	450	500	560	630	710	800	900	1000
	DIŞ ÇAPI (K)	mm	140	160	180	200	250	280	315	400	450	500	560	630	710	800	900	1000	1100
TOPLAM BOY (L) mm			1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

All compensators are manufactured as externally pressured and with welding neck, from undulation material AISI 316 L stainless steel customised pressure category according to the customer's choice, and 30-60-90-120mm and 180mm (double) according to the expansion volume.

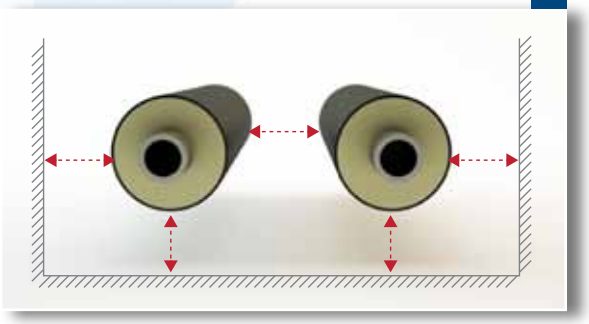
FIELD INSULATION APPLICATION WITH JOINT SET

After the welding of the pipes and fittings, a joint set will be needed for insulating the non-insulated part on the site.

The joint set comprises the parts below:

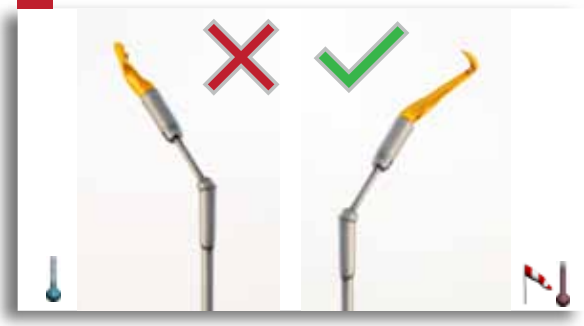
1. HDPE cover
2. Heat-shrink tape
3. Polyol and Isocyanate
4. Plug

1



The distances between the two preinsulated pipes are prepared according to the standard.

!

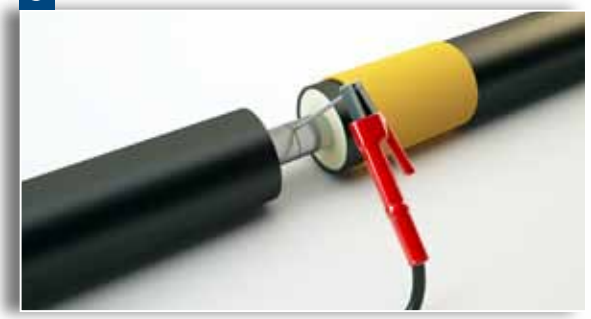


Torch must not be used in windy and cold weather. Please use it only in warm and still weather.

2

Before the assembly and welding of the pipes, the cover must be on the pipe.

3

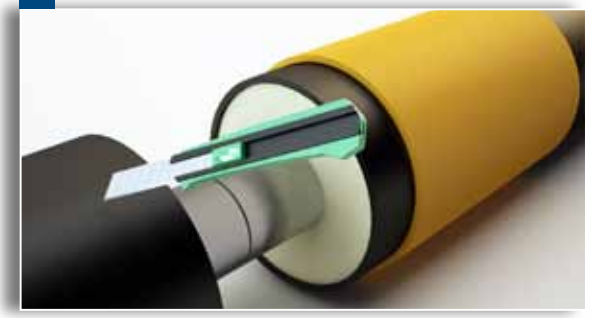


Pipes are welded before insulation.

4

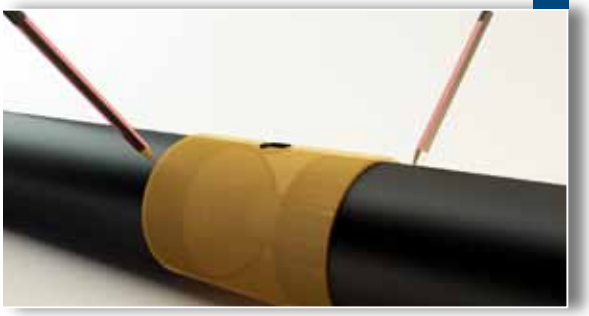
After welding, the outer surface of the casing is cleaned and heated with the torch.

5



The surface is cleaned off from the dirt and trimming that occur after heating.

6



Marking is made as both two casings will match, and the cover is placed according to these markings.

7

While the cover is placed, it has to be placed over the hole into which the insulating material will be spilled.

8

The heat-shrink tapes that will be used for the points to be bonded are prepared.

9

The heat-shrink tapes are covered around the insulation point as half will be applied on the cover and other half on the casing.

10

The heat-shrink tape is heated with the torch and the cover and HDPE 100 pipe are bonded.

11

The heating process is continued until the heat-shrink tapes get uniform.

12

After the welding process, it is waited for the heat-shrink tapes to cool down (at least for 5 minutes) and the joints are checked.

13

After completing all processes, the raw material given at the weight according to cover sizes are put in a bowl and mixed.

The mixed POL and ISO is spilled into the hole on the sleeve and is waited until the air goes out.

14

After the air of the mixture goes out, the plug is nailed and the process is completed.

15

-After the polyol and isocyanate are mixed together, the mixture must be shaken and be applied by being spilled into the hole on the cover.

- The process of mixing, shaking and spilling the raw materials must continue for maximum 15 seconds. If this duration is exceeded, the raw material would foam up.

- The hole on the cover must be closed with the plug as the raw material starts foaming up.

!

As the polyol and isocyanate can be delivered in batch in the volumes that are required for you to mix, is requested, it can separately be prepared on site for each bonding application.

!

SYSTEM COMPONENTS

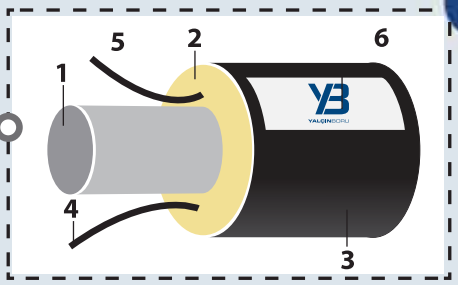
1. Preinsulated pipe with a couple of copper conductive embedded into polyurethane layer (wires must be at 9-3, 10-14 or 11-13 positions and their distance from the steel pipe must be min. 15 mm. max. 20mm.).
2. If detector and failure sensor electronic devices (leakage monitoring system are used, the point of failure can be identified with a particular tolerance; however, if only a detector is preferred, only the information whether there is a failure or not is obtained.)
3. Power supplies

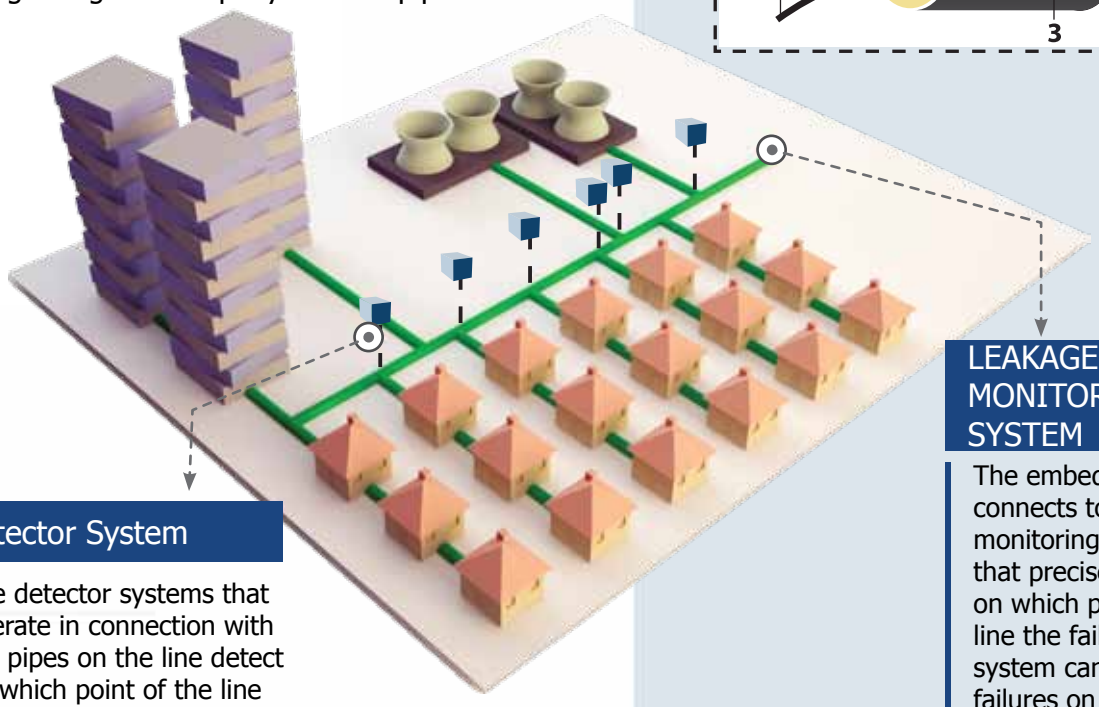
SYSTEM COMPONENTS

1. Steel Pipe
2. Polyurethane layer
3. HDPE outer casing
4. 1.5 mm2 non-insulated copper conductive (tin coated) (the distance between the steel pipe and wire must be 15 to 20 mm.)
5. 1.5 mm2 non-insulated copper conductive (the distance between the steel pipe and wire must be 15 to 20 mm.)
6. 6. The label indicating the information regarding the company and the pipe.

LEAKAGE DETECTION SYSTEM

Purpose: It is a system in line with eliminating the heat loss, corrosion and the possibility of the system to get disengaged in networks on which preinsulated pipe is used, that may be caused due to leaking water into the system either because of external factors or the failures in pipe joint weldings. The failure on a monitoring system depends on the lengths of the wires regardless of which system is used on identifying the failure.





Detector System

The detector systems that operate in connection with the pipes on the line detect on which point of the line the failure is. (4x1000m. or 8x7000m. preinsulated pipe is controlled through a single detector.)

LEAKAGE MONITORING SYSTEM

The embedded wires connects to a leakage monitoring system that precisely indicates on which point of the line the failure is. The system can detect the failures on the line with an accuracy of +-1,5 -2 metres.

CALCULATIONS

Determining Pipe Diameter

The pipe diameter calculation plays a major role on both the problem-free operation of the system and economically with respect to operating costs. The losses occurring in the pipes with internal friction and fluid rate have to be kept at an optimum value. It is possible to ensure these with the calculations indicated below.

As the point of origin of these calculations, generally two factors are worked through regarding heating. Firstly, it can be stated as the water to be transmitted having a particular flow rate and a calculation being made accordingly. However, it has to be taken into consideration that in the calculation of the diameter of the pipe, selecting a diameter at the point of origin and making the control according to that assumption is the most reliable method.

$$V = \frac{4 * Q}{\pi * D_{in}^{2} * 3600}$$

The formula above gives us the fluid rate, and its symbols and units are stated below:

V (m/sn) : Fluid rate

Q (m3/h) : Flow rate

Diç (m) : Carrier pipe inner diameter

After obtaining the fluid rate, we calculate the Reynolds Number that will give us an idea regarding the flow characteristics.

$$Re = \frac{p * V * D_{iç}}{\mu}$$

The descriptions and units of the symbols in this formula are as follows:

Re : Reynolds number

ρ (kg/m^3) : Fluid density

μ (cP) : Fluid dynamic viscosity

After the Reynolds number, we need to find the "relative roughness" which is the final data that we need for calculating the friction loss to be caused by the present assumptions.

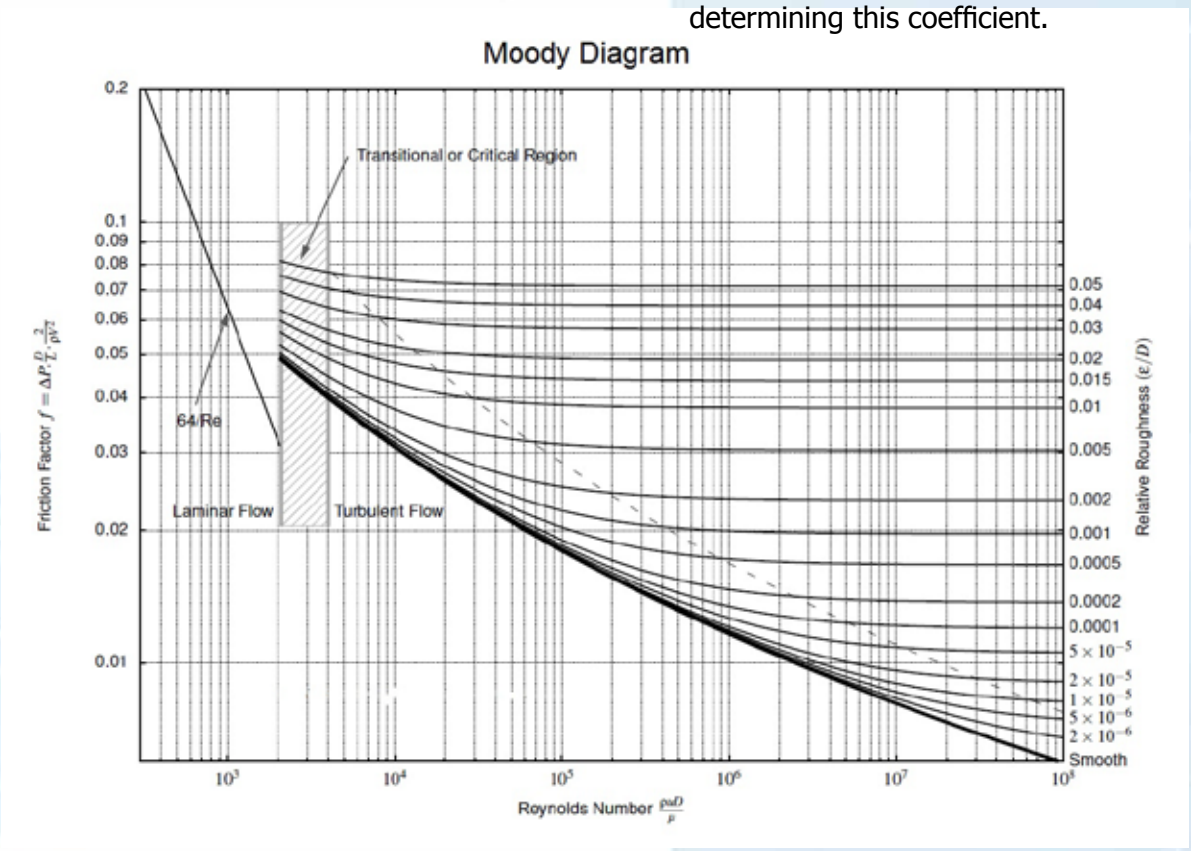
$$\varepsilon_b = \frac{\varepsilon}{D_{in}}$$

The units and the symbols in this formula:

εb : Relative roughness

ε (m) : Carrier pipe roughness coefficient

The results reached inner are adequate for finding the friction coefficient on the present flow. "Moody Diagram" is used for determining this coefficient.



The formula below is the formulised version of the friction coefficient (f) that will be obtained out of this diagram.

$$f = \left[\frac{1}{-1.8 * \log\left(\frac{6.9}{Re} + \left(\frac{\varepsilon_b}{3.7} \right)^{1.11} \right)} \right]^2$$

Finally, the formula below is used for calculating the pressure loss of the line.

ΔP (N/m²) : Pressure decrease

L (m) : Length of the line

ρ (kg/m³) : Fluid Density

$$\Delta P = \frac{f * L * V^2 * \rho}{D_{in} * 2}$$

After determining the pressure loss, it is checked whether the line has reached the range required for operating economically and problem-free. The suitable pipe diameter is determined this way.

Calculation of Termal Expansion

One of the most significant issues regarding the systems in which hot fluids are used is the expansion occurring on the pipes.

Thermal expansion occurs on the service pipe due to the effect of the fluid passing through the service pipe. This issue must definitely be taken into consideration in the application of heating lines. With the calculations indicated below, the expansion status of the line must be determined, and the expansions and the failures that may emerge due to these must be prevented using preinsulated compensators. The calculations are made with the assumption of the existence of steel service pipe, and it is grouped into two according to the principle whether the application is under or above the ground.

The calculation of expansion for the preinsulated pipes, the installations of which are to be done above the ground, is as follows:

$$\Delta L = \alpha * \Delta T * L$$

The symbols and units in this formula is as follows:

ΔL (m)	: Expansion volume of the pipe
α (1/°C)	: Expansion Coefficient (1,2*10-5 is taken for steel)
ΔT (°C)	: The difference of temperature between the fluid and the temperature at the moment of line assembly (Tfluid – Toutside)
L (m)	: Length of line that is exposed to expansion In assemblies made under the ground, it is necessary to take into consideration the friction force between the earth and the pipe.

$$\Delta L = (\alpha * \Delta T * L) - \left(\frac{F * L^2}{2 * E * A} \right)$$

$$F = \mu * D * \pi * z * p * g$$

The units and descriptions of the symbols in these formula are as follows:

F (N/m)	: The friction force applied by the natural ground on the pipe
μ	: Friction coefficient (It is taken 0,4 for earth)
D (m)	: Casing pipe outer diameter
z (m)	: The distance from the axis of the pipe to the ground surface
ρ (kg/m^3)	: Ground density (For soil 1800 can be taken)
g (m/sn^2)	: Gravitational acceleration (It is taken 9,82)
E (N/mm^2)	: Elasticity module (It is taken 2,1*10^5 for steel)

A (mm^2) : Carrier pipe cross sectional area

The expansion force on the pipes (Newton) can as well be calculated by the formula below:

$$P = \Delta T * \alpha * E * A$$

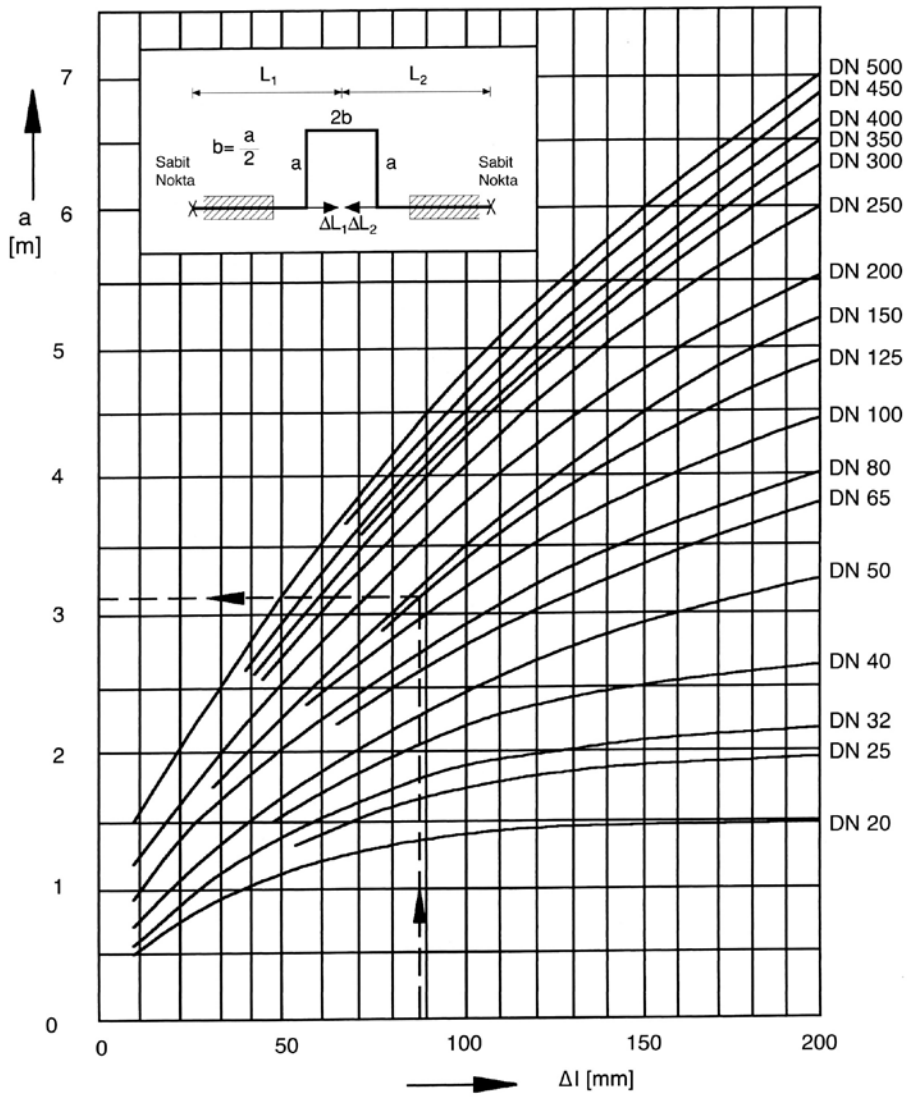
The point to take into consideration here is that the permitted tensile stress for steel in St 37 quality must not exceed 150 N/mm2. (183 N/mm2 for St 37-2, 277 N/mm2 for St 52)

With the purpose of reducing the use of compensator in embedded systems, the pipe length where the extension will be zero can be determined and the line can be fixed with preinsulated fixed support pipe at this point, hence the expansion can be absorbed without using a compensator. The value to be calculated through the formula below can be used for determining the length where fixing is to be done.

$$L_{max} = \frac{2*P}{F}$$

During this calculation, it is a significant factor to take into consideration that the line is not too long and it has to be a straight line.

Except of the use of compensator, in places that are suitable as the area as well, the expansion on the pipes can be absorbed by making the assembly in Z or U forms in the light of the measurements given below:



Example:

Ø125 For

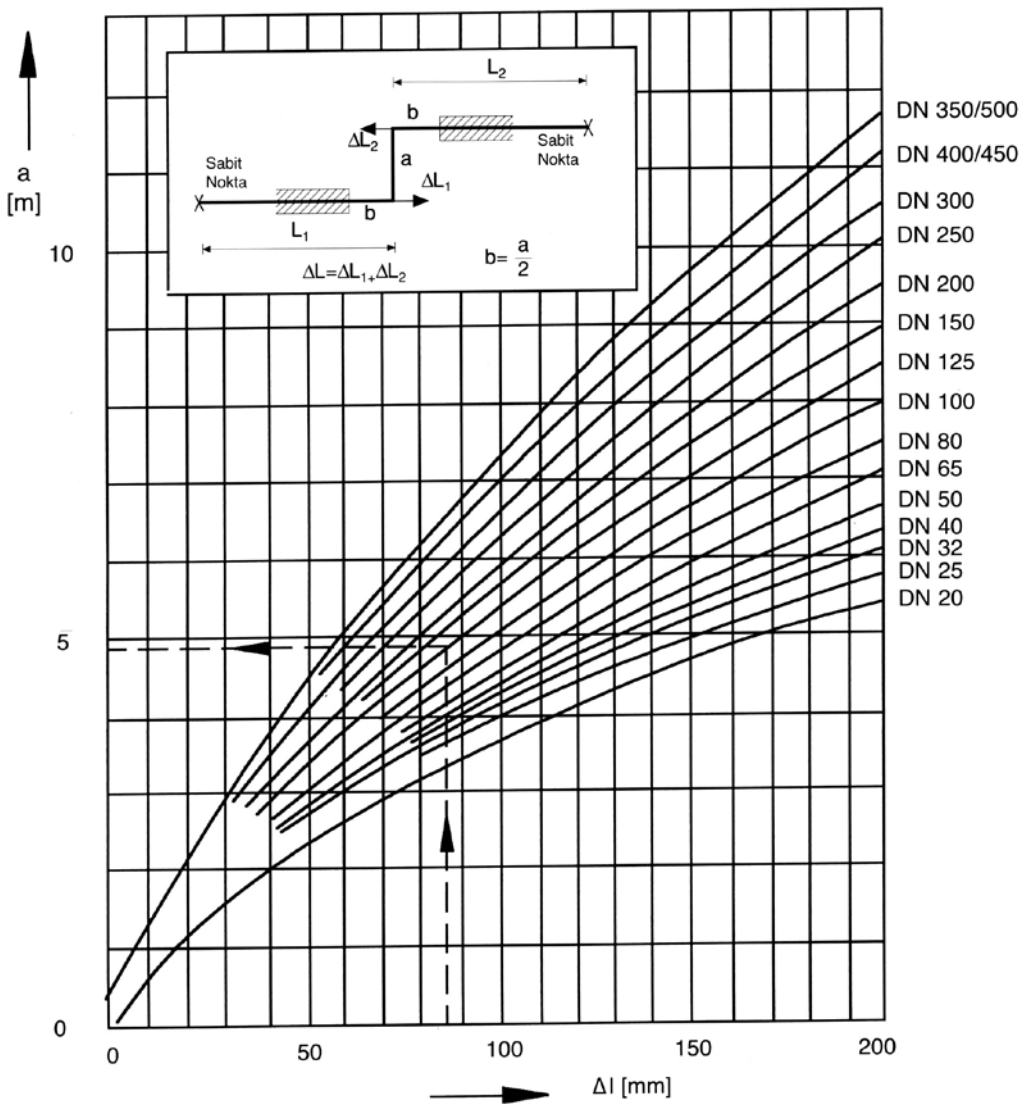
ΔL_1= 24 mm

ΔL_2 = 62 mm

ΔL= 86 mm

a= 3,3 m

b= 1,65 m



Example:

Ø125 for

ΔL_1= 24 mm

ΔL_2 = 62 mm

ΔL= 86 mm

a= 4,8 m

b= 2,4 m

Calculation of Heat Loss

There are many factors that determine the heat loss in preinsulated pipes. We can list these factors as below.

- Type and thickness of the carrier pipe.
- Thickness of the casing pipe.
- Thickness of the polyurethane insulation.
- Thickness of the rockwool insulation (in rockwool reinforced package pipes).
- The place of assembly (under or above the ground).

The calculation of heat loss can be made following the method below.

Firstly, the resistance is calculated for each layer. The heat loss of the insulated package pipe is calculated.

- Carrier pipe inner transmission resistance;

$$R_{tdinner} = \frac{1}{h_{liquid} * \pi * D_{inner}}$$

Rt_{inner} (m.°C / W) : Carrier pipe inner transmission resistance

D_{inner} (m) : Carrier pipe inner diameter

h_{liquid} (W / m2.°C) : Liquid transmission coefficient

- Carrier pipe thermal conductivity resistance;

$$R_{tbi} = \frac{ln\left(\frac{D_{outer}}{D_{inner}}\right)}{2 * \pi * \lambda_{tb}}$$

R_{tbi} (m.°C / W) : Carrier pipe thermal conductivity resistance

D_{outer} (m) : Carrier pipe outer diameter

λ_{tb} (W / m.°C) : Carrier pipe thermal conductivity coefficient

Polyurethane insulation material thermal conductivity resistance

$$R_{pur} = \frac{ln\left(\frac{d_{outer}}{D_{inner}}\right)}{2 * \pi * \lambda_{pur}}$$

R_{pur} (m.°C / W) : PUR insulation thermal conductivity resistance

D_{inner} (m) : Casing pipe inner diameter

λ_{pur} (W / m.°C) : PUR insulation thermal conductivity coefficient

- Casing pipe thermal conductivity resistance

$$R_{kb} = \frac{ln\left(\frac{d_{outer}}{d_{inner}}\right)}{2 * \pi * \lambda_{kb}}$$

R_{kb} (m.°C / W) : Casing pipe thermal conductivity resistance

D_{outer} (m) : Casing pipe outer diameter

λ_{kb} (W / m.°C) : Casing pipe thermal conductivity coefficient

- Thermal conductivity resistance of the earth (with the assumption of underground assembly)

$$R_t = \frac{ln\left(\frac{4z}{D_{outer}}\right)}{2 * \pi * \lambda_t}$$

R_t (m.°C / W) : Ground thermal conductivity resistance

Z (m) : Ground filling height

λ_t (W / m.°C) : Ground pipe thermal conductivity coefficient

TS EN 253

TS EN 448

TS EN 12201-2

ISO 14001

ISO 18001

ISO 9000