

MODUS PEX-A PIPES TECHNICAL SPECIFICATION

1- MODUS HEATING SYSTEMS

PEX-a, the main raw material used in MODUS Heating Systems pipes, is cross-linked high-density polyethylene. While pipes produced from standard high-density polyethylene raw materials cannot withstand high temperatures, pipes produced using PEX-a raw material, obtained by cross-linking the molecules, can be used for long periods at high temperatures. To provide flexibility and long service life to its pipes, MODUS employs cross-linking using peroxide. MODUS PEX-a pipes are manufactured in diameters of 16, 17, 20, 25, and 32 mm according to TS 10762-2 EN ISO 15875-2 standards.

PEX-a is produced in coil form to facilitate assembly and transportation. Coil lengths vary between 25m and 500m depending on the pipe diameters.

PEX-a, preferred in Underfloor Heating Systems and Mobile Radiator Systems, is also used in hot and cold water supply lines. After our quality control team performs all the tests required by the standards, the products are prepared for shipment, having been 100% inspected.

Features of MODUS Heating Systems:

FIRST PE-XA FACTORY OF TURKIYE

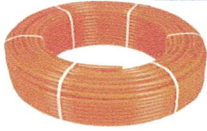
PE-XA AND PE-RT PIPES WITH EVOH

PIPES PEX-A FOR HEATING SYSTEM



PIPE PE-XA
WITH EVOH BARRIER, SDR7,4

PE-XA AND PE-RT FOR UNDERFLOOR HEATING



PIPE PE-XA
WITH EVOH BARRIER, S3,5



PIPE PE-RT
WITH EVOH BARRIER

- Compliance with TS 10762-2 EN ISO 15875-2 standards
- Resistance to high and low temperatures
- High resistance to chemicals
- Quick and waste-free assembly with optimized coil lengths
- Production between 16mm – 32mm

MODUS PLASTİK METAL A.Ş.
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1- GENERAL FEATURES



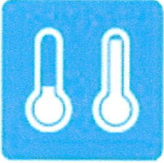
Non-liming, stainless, non-decaying

While corrosion formation due to oxygen permeability is observed in many other pipes used in plumbing systems, corrosion is not an issue in MODUS Indoor Heating Systems pipes. MODUS Indoor Heating Systems pipes are resistant to many chemicals and can even be used for carrying acidic water. Especially in underfloor heating pipes, the low temperature of the circulating water, the low roughness of the inner surface, minimal evaporation within the system, and the lack of chemical reaction with lime prevent the formation of lime inside the pipes..



No Diameter Contraction

MODUS Indoor Heating Systems pipes have a good memory, known as thermal memory. This means that if the pipe is subjected to excessive bending and twisting, the situation can be rectified with a hot air blower. When the material is heated above +100°C and then cooled again, it returns to its original shape without any diameter contraction occurring.



Resistant to High and Low Temperatures

It is resistant to high temperatures (95°C) and low temperatures (-10°C) during use.



Practical to Assemble, Easy to Cut

MODUS Indoor Heating Systems pipes can be easily and effortlessly joined thanks to a wide variety of suitable fittings available for all plumbing systems. Additionally, pipes can be easily cut using hand pipe cutters.



Compliant with Standards

MODUS PEX-a pipes are manufactured in accordance with the cross-linking degree and performance specifications determined by DIN 16892, DIN 16893, and TS 10762-2 EN 15875-2 standards.



Low Friction Coefficient

The friction coefficient of MODUS Indoor Heating Systems pipes is low, offering numerous advantages in water distribution. The smooth surface prevents sediment accumulation, thus preventing blockages and ensuring the interior of the pipe remains clean at all times. Erosion is also minimized.

3- TECHNICAL SPECIFICATIONS

Material: Cross-linked polyethylene (PE) with advanced polymeric structure

Pipe Dimensions: 16mm, 17mm, 20mm, 25mm, 32mm

Density: 0.945 g/cm³ (DIN 53497)

Linear Expansion Coefficient: 1.4x 10⁻⁴ K⁻¹ (DIN 53752)

Thermal Conductivity Coefficient: 0.38 W/mK (DIN 52612-1)

Elastic Modulus: 600 N/mm² (DIN 53457)

Surface Resistance: >10¹² W (DIN 53482)

Elongation at Break: 400% (ASTM D638)

Cross-linking Degree: Min. 75% (DIN 16892)

Applications: Radiator connections, snow melting systems, regional heating and cooling systems, underfloor and wall heating systems, solar heating systems

Service Life: MODUS PEX-a pipes are designed to have an average service life of 50 years or more under normal operating pressure and conditions.

3- MODUS PEX-a SERVICE LIFE TABLE

After determining the desired service life of the pipe and selecting the operating temperature, the allowable pressure value at this temperature is read from the Time-Equivalent Stress graph. (Data obtained from DIN 16893 standard.)

Calculation of Maximum Operating Pressure;

Table 5: Allowable working pressure for pipes conveying water, with SF = 1,5

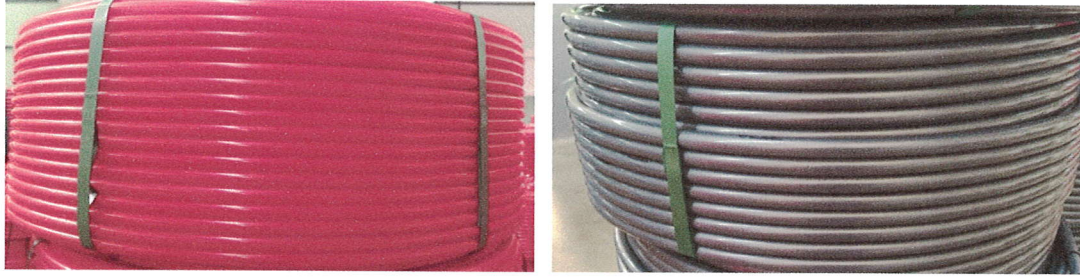
Temperature, in °C	Years of service	Pipe series (S)			
		6.3	5	4	3.2
		Standard dimension ratio (SDR)			
		13,6	11	9	7,4
Allowable working pressure, in bar ²⁾					
10	1	11,8	14,9	18,7	23,6
	5	11,6	14,6	18,4	23,2
	10	11,5	14,5	18,3	23,0
	25	11,4	14,4	18,1	22,8
	50	11,3	14,2	17,9	22,6
20	1	11,2	14,1	17,8	22,4
	5	10,5	13,2	16,6	20,9
	10	10,3	12,9	16,3	20,5
	25	10,2	12,8	16,2	20,4
	50	10,1	12,7	16,0	20,1
30	1	10,0	12,6	15,9	20,0
	5	9,9	12,5	15,7	19,8
	10	9,3	11,7	14,7	18,5
	25	9,1	11,5	14,4	18,2
	50	9,0	11,4	14,3	18,1
40	1	8,9	11,3	14,2	17,9
	5	8,9	11,2	14,1	17,7
	10	8,8	11,1	14,0	17,6
	25	8,2	10,4	13,1	16,5
	50	8,1	10,2	12,8	16,2
50	1	8,0	10,1	12,7	16,1
	5	7,9	10,0	12,6	15,9
	10	7,9	9,9	12,5	15,7
	25	7,8	9,8	12,4	15,6
	50	7,3	9,3	11,7	14,7
60	1	7,2	9,1	11,4	14,4
	5	7,1	9,0	11,3	14,3
	10	7,1	8,9	11,2	14,1
	25	7,0	8,8	11,1	14,0
	50	6,9	8,8	11,0	13,9
70	1	6,6	8,3	10,4	13,1
	5	6,4	8,1	10,2	12,9
	10	6,4	8,0	10,1	12,8
	25	6,3	7,9	10,0	12,6
	50	6,2	7,9	9,9	12,5
80	1	5,9	7,4	9,3	11,8
	5	5,7	7,3	9,1	11,5
	10	5,7	7,2	9,1	11,4
	25	5,6	7,1	9,0	11,3
	50	5,6	7,0	8,9	11,2
90	1	5,3	6,6	8,4	10,5
	5	5,2	6,5	8,2	10,3
	10	5,1	6,4	8,1	10,2
	25	5,0	6,4	8,0	10,1
95	1	4,7	6,0	7,5	9,5
	5	4,6	5,8	7,4	9,3
	10	4,6	5,8	7,3	9,2
	(15) ¹⁾	(4,6) ¹⁾	(5,7) ¹⁾	(7,3) ¹⁾	(9,1) ¹⁾
	1	4,5	5,7	7,1	9,0
100	5	4,4	5,5	7,0	8,8
	10	(4,3) ¹⁾	(5,5) ¹⁾	(6,9) ¹⁾	(8,7) ¹⁾

¹⁾ The bracketed values apply where testing can be shown to have been carried out for longer than one year at 110 °C.

²⁾ Values calculated to two decimal places, deleting the second.

4- MODUS PEX-a

With its three-layered structure, the outer surface of MODUS PEX-a prevents the entry of air from the environment into the pipe, thus preventing corrosion caused by oxygen. The service life of all metal equipment used in installations, such as pumps, valves, and radiators, is shortened due to corrosion. As a result, repair and replacement costs can arise. The only way to stop corrosion is to prevent oxygen from entering the system. MODUS has produced PEX-a pipes to solve this problem.



OD Dış Çap (mm)	S Et Kalınlığı (mm)	Standart Boyut Oranı (SDR)	MODUS PEX-a Uygulama Sınıfları	Uzunluk /Kangal (m)	Oksijen Geçirgenlik (mg.O ₂ /m ² .gün<0,1 µg O ₂ /litre
16	2.0	SDR 8 / S3,5	1,2,4/10 bar Class 5/6 bar	50-100-200-400-500-600	≤0,32
	2.2	SDR 7,4 / S3,2	1,2,4,5/10 bar	25-100-200	
17	2.0	SDR 8.5 / S3,5	1,2,4,5/10 bar	50-100-200-400-500-600	≤0,32
20	2.0	SDR 10 / S4,5	1,2,4/10 bar Class 5/6 bar	50-200-600	≤0,32
	2.8	SDR 7,4 / S3,2	1,2,4,5/10 bar	25-100-200	
25	3.5	SDR 7,4 / S3,2	1,2,4,5/10 bar	25-50	≤0,32
32	4.4	SDR 7,4 / S3,2	1,2,4,5/10 bar	25-50	≤0,32

5- MODUS PEX-a TSE ISO and ACCREDITED LABORATORY TEST REPORTS

TSE DENETİM VE KALİBRASYON MERKEZİ BAŞKANLIĞI KİMYA LABORATUVARI
HEADSHIP OF THE TEST and CALIBRATION CENTER CHEMISTRY LABORATORY

MUAYENE - DENEY SONUÇLARI TEST RESULTS

Laboratuvarımıza gönderilmiş olan PE-Xa Boru numuneleri (BOREALIS Hammaddesi), TS 10762-2 EN ISO 15875-2/ Mart 2006 sayılı "Plastik Boru Sistemleri-Sıcak ve Soğuk Su İçin Çapraz Bağlı Polietilen(PE-X). Bölüm 2: Borular" Türk Standardına göre muayene ve deneylere tabi tutulmuş olup, test sonuçları aşağıda verilmiştir.

PE-Xa Pipe specimens (BOREALIS Raw Material) have been tested according to TS 10762-2 EN ISO 15875-2/ March 2006 numbered "Plastics Piping Systems for Hot and Cold Water Installations - Crosslinked Polyethylene (PE-X) - Part 2: Pipes" Turkish Standard and following results have been obtained.

Ozellikler Features	Standartta İstenilen Değerler Values Demanded by Standard	Bulunan Sonuç ve Değerlendirme Results and Evaluations
1) Çapraz Bağlanma İşlemi (TS EN 579)	1) Peroksit (PE-Xa) için $\geq 70\%$ olmalıdır.	Ortalama: 87% UYGUN
1) Degree of Crosslinking (TS EN 579)	1) It shall be $\geq 70\%$ for peroxide (PE-Xa).	Mean: 87% CONFORMED

TSE DENETİM VE KALİBRASYON MERKEZİ BAŞKANLIĞI KİMYA LABORATUVARI
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Ozellikler Features	Standartta İstenilen Değerler Values Demanded by Standard	Bulunan Sonuç ve Değerlendirme Results and Evaluations
1) Hidrostatik Mukavemet* (95°C, 22saat (13.43 bar) (TS EN ISO 1167-1, TS EN ISO 1167-2, PE-Xa boru, Ø16 mm, e _{max} : 2.0mm, 40cm, su/su, Kapak Tip A, Kondisyonlama 3saat)	1) Deney süresince hiçbir hasar oluşmamalıdır.	Hasar oluşmamıştır. UYGUN
1) Resistance to Internal Pressure* (95°C, 22hours(13.43 bars), (TS EN ISO 1167-1, TS EN ISO 1167-2, PE-Xa pipe: Ø16mm, e _{max} : 2.0mm, water in water, End cap type:A, Conditioning 3 hrs.)	1) No failure during the test period.	No failure observed. CONFORMED



95°C 1000h TEST RAPORU

NUMARASI	Sİ ENİSİ NO	İSTASYON NO	ÜRÜN ADI RENGİ	ÇAP ET KALINLIĞI	SICAKLIK BAŞLANGIÇ (°C / h/s)	TEST BAŞLANGIÇ TARİHİ	TEST BİTİŞ TARİHİ	MASİNE NO
1	***	1. İSTASYON	PE-Xa 16x2.2	16.15 / 2.20	95°C / 13.88	20.12.2023	30.01.2024	M7/1
2	***	2. İSTASYON	PE-Xa 20x2.0	20.20 / 2.00	95°C / 9.67	20.12.2023	30.01.2024	M2/1
3	***	4. İSTASYON	PE-Xa 16x2.0	16.10 / 2.00	95°C / 12.48	21.12.2023	31.01.2024	M8/1
4	***	3. İSTASYON	PE-Xa 16x2.0	16.10 / 2.00	95°C / 12.48	27.12.2023	6.02.2024	M15/1
5	***	6. İSTASYON	PE-Xa 16x2.0	16.15 / 2.00	95°C / 12.44	4.01.2024	14.02.2024	M5/2
6	***	5. İSTASYON	PE-Xa 16x2.0	16.15 / 2.00	95°C / 12.44	5.01.2024	15.02.2024	M8/2
7	***	2. İSTASYON	PE-Xa 20x3.5	20.15 / 3.50	95°C / 14.23	1.02.2024	13.03.2024	M3/1
8	***	7. İSTASYON	PE-Xa 16x2.0	16.15 / 2.00	95°C / 12.44	1.01.2024	13.03.2024	M11/2
9	***	4. İSTASYON	PE-Xa 20x2.8	20.20 / 2.80	95°C / 14.80	8.02.2024	20.03.2024	M5/1
10	***	6. İSTASYON	PE-Xa 16x2.2	16.20 / 2.20	95°C / 13.83	16.02.2024	28.03.2024	M9/1
HAZIRLAYAN: Emre KÖKSAL				ONAY: Hacer VARLI				

Form No: KK-F-037 Rev: 00 Tarih: 12.10.2023



QUALITY CONTROL

PE-Xa PIPES ANALYSIS REPORT

Date: 11.03.2024

ANALYSIS	Test Method	MODUS-8-2	MODUS-15-2						
Work order uncapped	ISO 9001	***	***						
Work order covered	ISO 9002	***	***						
Name of the product	EN ISO 15874-2	Pe-Xa 16x2.0	Pe-Xa 16x2.0						
Colour / Appearance	EN ISO 15874-2	Red	Red						
Diameter / Wall thickness	EN ISO 15874-2	16.30 / 2.00	16.25 / 2.00						
Raw / Masterbatch material (lot no)	EN ISO 15874-2	LG 23601 / KR24-276	LG 23601 / KR24-276						
Dimensional stability 120°C e.s. 8mm (PE-Xa s. 9.3)	EN ISO 2505	%2.0	%2.0						
PE-Xa Degree of Crosslinking (min.: %70)	EN 579	87%	87%						
PE-Xa Internal Pressure 20°C / 1 h / bar	EN ISO 1167-1 EN ISO 1167-2	33.57 33.57	33.68 33.68						
PE-Xa Internal Pressure 95°C / 1 h / bar	EN ISO 1167-1 EN ISO 1167-2	13.43 13.43	13.47 13.47						
PE-Xa Internal Pressure 95°C / 22 h / bar	EN ISO 1167-1 EN ISO 1167-2	13.15 13.15	13.19 13.19						
PE-Xa Internal Pressure 95°C / 165 h / bar	EN ISO 1167-1 EN ISO 1167-2	12.87 12.87	12.91 12.91						
PE-Xa Internal Pressure 95°C / 1000 h / bar	EN ISO 1167-1 EN ISO 1167-2	12.87 12.87	12.91 12.91						
Prepared by: Emre KÖKSAL		Approved by: Hacer VARLI							

Form No: KK-F-90 Rev: No:00 Tarih: 12.10.2023

The values must be intended as an average values of the samples tested on the batch, of which the consignments is a part.

The test results are manufactured according to ISO 15874-2 standard

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