

EŞANJÖR BORULARI

*HEAT EXCHANGE
PIPES*



ORTA KARBONLU KAZAN VE EŞANJÖR BORULARI

MEDIUM CARBON STEEL TUBES FOR HEATEXCHANGER AND BOILER

Kimyasal Kompozisyon / Chemical Composition

Standart Standard	Kalite Grade	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	V	Al	N	Nb,Ti, B,As,W
ASTM A210	A1	≤ 0.27	≤ 0.93	≥ 0.10	≤ 0.035	≤ 0.035								
ASME A210	C	≤ 0.35	0.29 - 1.06	≥ 0.10	≤ 0.035	≤ 0.035								
ASTM A556	A2	≤ 0.18	0.27 - 0.63		≤ 0.035	≤ 0.035								
ASTM A556	B2	≤ 0.27	0.29 - 0.93	≥ 0.10	≤ 0.035	≤ 0.035								
ASTM A556	C2	≤ 0.30	0.29 - 1.06	≥ 0.10	≤ 0.035	≤ 0.035								

Mekanik Özellikler / Mechanical Properties

Standart Standard	Kalite Grade	Isıl İşlem Heat Treatment	Akma Noktası Re Min. (MPa) Yield Strength (MPa)			Kopma Dayanımı Rm (Mpa) Tensile Strength (Mpa)	Uzama A5 Min (%) Elongation A5 Min (%)	Darbe Enerjisi (J) Impact Energy (J)	Uygulama Sıcaklığı (°C) Temperature of Application (°C)
			t 0 - 16 mm	t 16 - 40 mm	t 40 - 65 mm				
ASTM A210	A1			≥ 255		≥ 415	30		
ASME A210	C			≥ 275		≥ 485	30		
ASTM A556	A2			≥ 180		≥ 320	35		
ASTM A556	B2			≥ 260		≥ 410	30		
ASTM A556	C2			≥ 280		≥ 480	30		

Uluslararası Standart Karşılaştırma Tablosu / International Comparison Table

ASTM	BS	DIN	NFA	JIS
A210 A1	3602 Pt1	17175	A 49215/9	G 3461
A556 B2	ST 430 Cat2	St 45.8/1	T 442 b/F	ST B 410
210 Gr. C	3606	17175	-	-
A 556 Gr. C2	St 440 Cat2	17 Mn 4	-	-

DÜŞÜK KARBONLU KAZAN VE EŞANJÖR BORULARI

LOW CARBON STEEL TUBES FOR HEATEXCHANGER AND BOILER

Kimyasal Kompozisyon / Chemical Composition

Standart Standard	Kalite Grade	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	V	Al	N	Nb,Ti, B,As,W
ASTM A179	Dikişsiz / Seamless	0.06 - 0.18	0.27 - 0.63		≤ 0.035	≤ 0.035								
ASTM A214	ERW	≤ 0.18	0.27 - 0.63		≤ 0.035	≤ 0.035								
ASTM A192	Dikişsiz / Seamless	0.06 - 0.18	0.27 - 0.63	≤ 0.25	≤ 0.035	≤ 0.035								
ASTM A226	ERW	0.06 - 0.18	0.27 - 0.63	≤ 0.25	≤ 0.035	≤ 0.035								

Mekanik Özellikler / Mechanical Properties

Standart Standard	Kalite Grade	Isıl İşlem Heat Treatment	Akma Noktası Re Min. (MPa) Yield Strength (MPa)			Kopma Dayanımı Rm (Mpa) Tensile Strength (Mpa)	Uzama A5 Min (%) Elongation A5 Min (%)	Darbe Enerjisi (J) Impact Energy (J)	Uygulama Sıcaklığı (°C) Temperature of Application (°C)
			t 0 - 16 mm	t 16 - 40 mm	t 40 - 65 mm				
ASTM A179	Dikişsiz / Seamless			≥ 180		≥ 325	≥ 35		
ASTM A214	ERW			≥ 180		≥ 325	≥ 35		
ASTM A192	Dikişsiz / Seamless			≥ 180		≥ 325	≥ 35		
ASTM A226	ERW			≥ 180		≥ 325	≥ 35		

Uluslararası Standart Karşılaştırma Tablosu / International Comparison Table

ASTM	DIN	BS	NFA	JIS
A 179	3602 Pt1 3059 Pt2 St 360	17175 ST 35.8/1	A 49215 TU 37C	G 3461 STB 340
A 192	CAT2 3602 Pt1 3059 Pt2 ST 360 CAT2	17175 ST 35.8/1	A 49215 TU 37C	JIS G 3461 STB 340
A 214	BS 3059 Pt2 3602 Pt1 ERW 360 CAT2	17177 ST 37.8/1	A 49242 A 49245 TS 37C	G 3461 STB 340
A 226	BS 3059 Pt2 BS 3602 Pt1 ERW 360 CAT2	17177 ST 37.8/1	A 49242 A 49245 TS 37C	G 3461 STB 340

	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	BWG	BWG	ISWG	ISWG	ISWG	ISWG	ISWG	ISWG	ISWG	ISWG	ISWG	AD				
	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	M/W	OD			
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	ED				
	15	14	14	14	14	13	13	13	13	12	12	12	12	11	11	11	11	10	10	10	10	9	9	9	9	8	8	8	8	7	7	7	7						
	1828	2,032	2,032	2,108	2,108	2,337	2,337	2,413	2,413	2,642	2,642	2,768	2,768	2,947	2,947	3,048	3,048	3,251	3,251	3,403	3,403	3,658	3,658	3,658	3,760	4,064	4,064	4,191	4,191	4,471	4,471	4,572	4,572						
																																				3/16"			
																																				4,76 mm			
04	0,204																																			1/4"			
																																					6,35 mm		
47	0,347																																				3/8"		
																																					9,53 mm		
90	0,490	0,581	0,536	0,599	0,551	0,647	0,597	0,662	0,612	0,706	0,655	0,729	0,678																								1/2"		
																																						12,35 mm	
34	0,633	0,758	0,694	0,781	0,716	0,850	0,78	0,872	0,801	0,936	0,862	0,895	0,895																								5/8"		
																																						15,88 mm	
77	0,777	0,936	0,853	0,964	0,881	1,053	0,962	1,082	0,990	1,165	1,069	1,210	1,111																								3/4"		
																																						19,05 mm	
19	0,918	1,112	1,012	1,147	1,045	1,255	1,146	1,290	1,179	1,394	1,276	1,450	1,328	1,523	1,401	1,523	1,441	1,657	1,521		1,5579																7/8"		
																																						22,2 mm	
63	1,063	1,29	1,171	1,331	1,211	1,459	1,329	1,502	1,368	1,624	1,483	1,691	1,545	1,780	1,635	1,835	1,680	1,940	1,776	2,014	1,846	2,137	1,961		2,007		2,137		2,192							1"			
																																						25,4 mm	
35	1,134	1,377	1,251	1,424	1,294	1,561	1,421	1,607	1,463	1,742	1,586	1,814	1,654	1,895	1,747	1,972	1,800	2,083	1,903	2,165	1,980	2,298	2,105														11/16"		
																																						26,99 mm	
07	1,206	1,466	1,330	1,514	1,376	1,521	1,170	1,557	1,854	1,690	1,933	1,763	2,041	1,862	2,101	1,919	2,223	2,310	2,112	2,455	2,248																11/8"		
																																						28,58 mm	
49	1,349	1,644	1,489	1,697	1,541	1,865	1,695	1,921	1,764	2,082	1,897	2,171	1,979	2,290	2,093	2,356	2,157	2,505	2,285	2,607	2,379	2,772	3,107	2,836	2,596	3,030	2,775	3,108	2,848							11/4"			
																																							31,75 mm
35	1,636	1,998	1,807	2,064	1,871	2,268	2,061	2,341	2,124	2,541	2,310	2,656	2,412	2,801	2,555	2,894	2,635	3,071	2,794	3,199	2,912	3,408	3,680	3,489	3,134	3,736	3,411	3,836	3,505	4,055	3,708	4,133	3,780			11/2"			
																																							38,1 mm
			2,351	2,126	2,430	2,201	2,676	2,427	2,759	2,502	3,003	2,724	3,137	2,845	3,311	3,015	3,423	3,112	3,636	3,303	3,791	3,445	4,044	4,253	4,142	3,772	4,443	4,047	4,564	4,161	4,833	4,408	4,928	4,496			13/4"		
																																							44,45 mm
																																							2"
			2,704	2,444	2,796	2,531	3,084	2,793	3,180	2,879	3,461	3,138	3,619	3,279	3,822	3,478	3,953	3,589	4,201	3,812	4,38	3,978	4,680	3,939	4,795	4,361	5,149	4,684	5,292	4,817	5,610	5,108	5,717	5,212			50,8 mm		
																																							21/4"
			3,054	2,762	3,163	2,861	3,490	3,159	3,596	3,256	3,920	3,551	4,098	3,712	4,332	3,939	4,482	4,066	4,765	4,321	4,975	4,510	4,332	3,398	5,450	4,949	5,856	5,320	6,022	5,473	6,387	5,808	6,517	5,928			57,15 mm		
																																							21/2"
			3,407	3,080	3,529	3,192	3,896	3,525	4,020	3,635	4,379	3,965	4,582	4,146	4,843	4,401	5,011	4,544	5,332	4,830	5,567	5,044	5,951	5,398	6,101	5,538	6,562	5,957	6,751	6,130	7,164	6,508	7,312	6,644			63,5 mm		
																																							23/4"
			3,761	3,399	3,896	3,552	4,302	3,891	4,436	4,013	4,838	4,379	5,060	4,580	5,353	4,862	5,541	5,021	5,897	5,339	6,159	5,576	4,687	5,971	6,757	6,126	7,268	6,593	7,479	6,786	7,941	7,208	8,106	7,36			69,85 mm		
																																							3"
			4,121	3,716	4,262	3,852	4,708	4,257	4,859	4,391	5,298	4,792	5,545	5,013	5,864	5,323	6,07	5,499	6,462	5,848	6,751	6,109	7,223	6,644	7,411	6,715	7,975	7,229	8,208	7,442	8,718	7,908	8,901	8,076			76,2 mm		
																																							31/4"
																																							82,55 mm
																																							31/2"
																																							88,9 mm
																																							33/4"
																																							95,25 mm
																																							33/4"
																																							95,25 mm

ALAŞIMLI ÇELİKLERİN MEKANİK ÖZELLİKLERİ

MECHANICAL PROPERTIES OF ALLOY STEEL

İşlem Sıcaklığı Service Temperature	EN 10216-2+A2 2007	ASTM A213-08	ASTM A335-06	ASTM'ye Göre Isıl İşlem Heat Treatment ACC to ASTM	ASTM A213'e Göre According to ASTM A213
350°C (662°F)	16M03 YS 280/TS 450-600 N 890°C-950°C	-	P1 YS 205/TS 380	T > 650°C veya T: 650°C-705°C	-
570°C (1058°F)	-	T2 YS 205/TS 415 163 HB (85HRB)	P2 YS 205/TS 380	T > 650°C-730°C(A213) T: 650°C-705°C(A335) veya > 675°C (A335)	C 0.10 0.20 Cr 0.50-0.81 Mo 0.44 -0.65
570°C (1058°F)	10CrMo5-5 YS 275/TS 410-560 N 900-960 °C T 650-750 °C	T11 YS 205/TS 415 163 HB (85HRB)	P11 YS 205/TS 415	T > 650°C	C 0.10 0.20 Cr 0.50-0.81 Mo 0.44 -0.65
570°C (1058°F)	13CrMo4-5 YS 290/TS 440-560N 900-960 °C T 660-730 °C	T12 YS 220/TS 415 163 HB (85HRB)	P12 YS 220/TS 415	T > 650°C - 730°C(A213) T: 650°C-705°C (A335) veya >650°C (A335)	C 0.05-0.15 Cr 0.80 -1.25 Mo 0.44 -0.65
570°C (1058°F)	10CrMo9-10 YS 280/TS 480-630 N 900-960 °C T 680-750 °C	T22 YS 205/TS 415 163 HB (85HRB)	P22 YS 205/TS 415	T > 675°C	C 0.05-0.15 Cr 0.90 -2.60 Mo 0.87-1.13
570°C (1058°F)	-	T5 YS 205/TS 415 163 HB (85HRB)	P5 YS 205/TS 415	T > 675°C	C 0.15 Cr 4.0-6.0 Mo 0.45-0.65
570°C (1058°F)	7CrWVMoNb9-6 YS 400/TS 510-740 N 1040-1080°C T 7300-780 °C	T23 YS 400/TS 510 220 HB (97HRB)	P23 YS 400/TS 510	N: 1040°C-1080°C T:730°C -800°C	C 0.04 -0.10 Cr 1.90-2.60 Mo 0.05-0.30 V 0.20 0.30 W 1.45-1.75
570°C (1058°F)	7CrWVMoNb10-10 YS 450/TS 565-840 N 980-1020 °C T 730-770 °C	T24 YS 415/TS 585 250 HB (25HRB)	-	N: 980°C -1080°C T:730°C-800°C	C 0.05-0.10 Cr 2.20-2.60 Mo 0.90-1.10 V 0.20 0.30 Ti 0.60 -0.10
570°C (1058°F)	X11CrMo9-1+1 YS 210/TS 460-640 I 1950-980 °C	T9 YS 205/TS 415 179 HB (89HRB)	P9 YS 205/TS 415	T > 675°C	C 0.15 Cr 8.0-10.0 Mo 0.90-1.10
610°C (1130°F)	X10CrMoVNb9-1 YS 450/TS 630-830 N 1040-1090 °C T 730-780 °C	T91 YS 415/TS 585 250 HB (25HRB)	P91 YS 415/TS 585 250HB (25HRC)	N: 1040°C 1080°C T:730°C-800°C	C 0.07 -0.14 Cr 8.0-9.5 Mo 0.85-1.05 V 0.18-0.25 Nb 0.06 0.10
610°C (1130°F)	X10CrWMOVNb9-2 YS 440/TS 620-850 N 1040 1090 °C T 730-780 °C	T92 YS 440/TS 620 250 HB (25HRC)	P92 YS 440/TS 620 250HB (25HRC)	N: 1040°C-1080°C T:730°C-800°C	C 0.07 -0.13 Cr 8.5-9.5 Mo 0.30-0.60 V 0.15 0.25 W 1.5-2.00

YS: Akma Dayanımı / Yield Strength

TS: Kopma Dayanımı / Tensile Strength

R: Haddelenmiş / Rolled

N: Normalize Edilmiş / Normalized

QT: Sertleştirilmiş ve Tempelenmiş / Quenched and Tempered

ALAŞIMLI KAZAN VE EŞANJÖR BORULARI

ALLOY STEEL TUBES FOR HEATEXCHANGER AND BOILERS

Kimyasal Kompozisyon / Chemical Composition

Standart Standard	Kalite Grade	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	V	Al	N	Nb,Ti, B,As,W
ASTM A209	T1	0.10 - 0.20	0.30 - 0.80	0.10 - 0.50	0.025					0.44 - 0.65				
ASTM A209	T1a	0.15 - 0.25	0.30 - 0.80	0.10 - 0.50	0.025					0.44 - 0.65				
ASTM A209	T1b	≤ 0.14	0.30 - 0.80	0.10 - 0.50	0.025					0.44 - 0.65				

Mekanik Özellikler / Mechanical Properties

Standart Standard	Kalite Grade	Isıl İşlem Heat Treatment	Akma Noktası Re Min.(MPa) Yield Strength (MPa)			Kopma Dayanımı Rm (Mpa) Tensile Strength (Mpa)	Uzama A5 Min (%) Elongation A5 Min (%)	Darbe Enerjisi (J) Impact Energy (J)	Uygulama Sıcaklığı (°C) Temperature of Application (°C)
			t 0 - 16 mm	t 16 - 40 mm	t 40 - 65 mm				
ASTM A209	T1			≥ 205		≥ 380	30		
ASTM A209	T1a			≥ 220		≥ 415	30		
ASTM A209	T1b			≥ 195		≥ 365	30		

ASTM A199 (94) ÇELİK ÇEKME BORULAR

ASTM A199 (94) STEEL SEAMLESS PIPES

Kimyasal Kompozisyon / Chemical Composition

Element Kalite Element Grade	C	Mn	Si	P	S	Ni	Cr	Mo	Nb	Al	V	N	Ti	Zr
T4	0.05-0.15	0.30 - 0.60	0.50 - 1.00	≤ 0.025	≤ 0.025		2.15 - 2.85	0.44 - 0.65						
T5	≤ 0.15	0.30 - 0.60	≤ 0.50	≤ 0.025	≤ 0.025		4.00 - 6.00	0.45 - 0.65						
T9	≤ 0.15	0.30 - 0.60	0.25 - 1.00	≤ 0.025	≤ 0.025		8.00 - 10.00	0.90 - 1.10						
T11	0.05-0.15	0.30 - 0.60	0.50 - 1.00	≤ 0.025	≤ 0.025		1.00 - 1.50	0.44 - 0.65						
T21	0.05-0.15	0.30 - 0.60	≤ 0.50	≤ 0.025	≤ 0.025		2.65 - 3.35	0.80 - 1.06						
T22	0.05-0.15	0.30 - 0.60	≤ 0.50	≤ 0.025	≤ 0.025		1.90 - 2.60	0.87 - 1.13						
T91	0.07-0.14	0.30 - 0.60	0.20 - 0.50	≤ 0.020	≤ 0.010	≤ 0.40	8.00 - 9.50	0.85 - 1.05	0.06 - 0.10	≤ 0.02	0.18 - 0.25	0.03 - 0.07	≤ 0.01	≤ 0.01

* Ni 0.40 max.; V 0.18 - 0.25; Cb 0.06 - 0.10; N 0.03 - 0.07; Al 0.04 max.

Mekanik Özellikler / Mechanical Properties

Kalite Grade	Akma Noktası Re Min.(MPa) Yield Strength (Mpa)	Kopma Dayanımı Rm (Mpa) Tensile Strength (Mpa)	Uzama A5 Min (%) Elongation A5 Min. (%)
T91 Dışındaki Tüm Kaliteler Except T91 All Grade	415	170	30
Gr. T91	585	415	20



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