

PETROL, GAZ ve HAT BORULARI

*OIL, GAS AND
LINE PIPES*



Eşdeğer Karbon Carbon Equivalent	Kaynak Yapılabilirlik Weldability
< 35	Mükemmel / Excellent
0,36-0,40	Çok İyi / Very Good
0,41-0,45	İyi / Good
0,46-0,50	Orta / Fair
50 <	Zayıf / Poor

Eşdeğer karbon içeriği (CE) farklı alaşım elementlerinin çeliğin sertliği ve kaynak yapılabilirliğini nasıl etkilediğini anlamak için kullanılır.

Equivalent carbon content (CE) is used to understand how the different alloying elements affect hardness of the steel being welded.

$$CE = \%C + \frac{(\%Mn + \%Si)}{6} + \frac{(\%Cr + \%Mo + \%V)}{5} + \frac{(\%Cu + \%Ni)}{15}$$

Uzunluk Length	
fit (ft)	0,3048 metre (m)
feet (ft)	meter (m)
inch (in)	25,4 milimetre (mm)
inch (in)	milimeter (mm)
yarda (yd)	0,9144 metre (m)
yard (yd)	meter (m)
kara mili (USA)	1.609 metre (m)
mile (USA)	meter (m)
metre (m)	3,28 fit (ft)
meter (m)	feet (ft)
metre (m)	39,37 inch (in)
meter (m)	inch (in)
metre (m)	10,936 yarda (yd)
meter (m)	yard (yd)

Ağırlık Weight	
Pound veya Libre. (lb.)	0,4536 kg
Pound or Libre (lb.)	kg
lb/ft ³	16,02 kg/m ³
lb/in ³	27.680 kg/m ³
kg/m ³	0,0624 lb/ft ³
kg/dm ³	62,4 lb/ft ³
kg/dm ³	0,036 lb/in ³
lb/galon (USA)	119,83 kg/m ³
lb/yarda küp	0,5933 kg/m ³
ton, long (22.401 bs)	1.016 kg
tonne, long (22.401 bs)	kg
ton, short (20.000 lbs)	907,2 kg
tonne, short (20.000 lbs)	kg
ton, metrik	1.000 kg
tonne, metric	kg

Alan Area	
feet kare (ft ²)	0,0929 metre (m ²)
square feet (ft ²)	square meter (m ²)
inch kare (in ²)	0,0006451 metre kare (m ²)
square inch (in ²)	square meter (m ²)
yarda kare (yd ²)	0,8361 metre kare (m ²)
square yard (yd ²)	square meter (m ²)
metre kare (m ²)	10,76 feet kare (ft ²)
square meter (m ²)	square feet (ft ²)
metre kare (m ²)	1550 inch kare (in ²)
square meter (m ²)	square inch (in ²)
metre kare (m ²)	1.196 yarda kare (yd ²)
square meter (m ²)	square yard (yd ²)
Ar	100 metre kare (m ²)
Ar	square meter (m ²)

Sıcaklık Temperature	
9/5 x °C + 32	°F (Fahrenheit)
5/9 x (°F - 32)	°C (Celsius)

Kuvvet Force	
Kilogramfors (kgf)	9,81 Newton (N)
Kilogramforce (kgf)	Newton (N)
Newton (N)	0,102 Kilogramfors (kgf)
Newton (N)	Kilogramforce (kgf)

Basınç Pressure	
Pascal (Pa)	1 (Newton/metre kare (N/m ²))
Pascal (Pa)	(Newton/squaremeter (N/m ²))
Pascal (Pa)	0,001 kiloPascal (kPa)
kg/cm ²	98.066 kPa
kg/cm ²	9,81 Pa
kg/m ²	9,81 Pa
	100 Pa
	0,0102 kg/cm ²

Enerji Energy	
kiloWattsaat (kWs)	3.600 kjoule (kJ)
kilo Watthour (kWh)	kjoule (kJ)
BTU	1.055 Joule (J)
Joule	0,24 kalori (cal)
Joule	calorie (cal)
Wattsaat (kWs)	3.600 Joule
Watthour (Wh)	Joule
Watt.saniye (Ws)	1 Joule
BTU	0,252 kilocalorie (kcal)
kalori (cal)	4,19 Joule
calorie (cal)	Joule
kalori (cal)	0,427 kgm
calorie (cal)	kgm
kilogrammetre (kgm)	9,81 Joule
kilogrammeter (kgm)	Joule
Joule/saniye (J/s)	1 Watt (W)
Joule/second (J/s)	Watt (W)
BTU/saat	0,293 Watt (W)
BTU/h	Watt (W)
cal/saniye	41.868 Watt (W)
cal/second	Watt (W)
kcal	1.163 Watt (W)
kcal	Watt (W)

Debi Flow	
ft/saniye	0,02832 m ³ /saniye
ft/second	m ³ /second
ft/saniye	1700 litre/dakika
ft/second	liter/min
in/dak	2,73x10 m ³ /saniye
in ³ /min	m ³ /second
in/dak	2,73x10 litre/saniye
in ³ /min	liter/second
m ³ /saat	0,588 ft/dak (cfm)
m ³ /h	ft ³ /min (cfm)
m ³ /saat	4.404 galon/dak (gpm), USA
m ³ /h	gallon/min (gpm), USA

Hacim Volume	
feet küp (ft ³)	0,02832 metreküp (m ³)
cubic feet (ft ³)	cubic meter (m ³)
inch küp (in ³)	16.387 santimetre küp (m ³)
cubic inch (in ³)	cubic centimeter (m ³)
galon (İngiliz)	4,546 litre (dm ³)
gallon (GB)	liter (dm ³)
galon (USA)	3.785 litre (dm ³)
gallon (USA)	liter (dm ³)
metreküp (m ³)	35,31 feet küp (ft ³)
cubic meter (m ³)	cubic feet (ft ³)
litre (dm ³)	61.024 inch küp (in ³)
liter (dm ³)	cubic inch (in ³)
litre (dm ³)	0,22 galon (İngiliz)
liter (dm ³)	gallon (GB)
litre (dm ³)	0,2642 galon (USA)
liter (dm ³)	gallon (USA)
Varil Petrol (42 US Galon)	159 litre
Barrel Petrol (42 US Gallon)	liter

ASTM A53 / A106 / A333

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 A53	Gr. A	≤ 0.25	≤ 0.95	-	≤ 0.050	≤ 0.045	≤ 0.40	≤ 0.40	≤ 0.40	≤ 0.15	≤ 0.080			
ASTM A53	Gr. B	≤ 0.30	≤ 1.20	-	≤ 0.050	≤ 0.045	≤ 0.40	≤ 0.40	≤ 0.40	≤ 0.15	≤ 0.080			
ASTM A106	Gr. A	≤ 0.25	0.27 - 0.93	≤ 0.10	≤ 0.035	≤ 0.035	≤ 0.40	≤ 0.40	≤ 0.40	≤ 0.15	≤ 0.080			
ASTM A106	Gr. B	≤ 0.30	0.29 - 1.06	≤ 0.10	≤ 0.035	≤ 0.035	≤ 0.40	≤ 0.40	≤ 0.40	≤ 0.15	≤ 0.080			
ASTM A106	Gr. C	≤ 0.35	0.29 - 1.06	≤ 0.10	≤ 0.035	≤ 0.035	≤ 0.40	≤ 0.40	≤ 0.40	≤ 0.15	≤ 0.080			
ASTM A333	Gr.1	0.30	0.40 - 1.06		0.25	0.025								
ASTM A333	Gr.6	0.30	0.29 - 1.06	0.1	0.25	0.025								

Mekanik Özellikler / Mechanical Properties

Standart Standard	Kalite Grade	Isıl İşlem Heat Treatment	Akma Noktası Re Min. (MPa) Yield Strength (MPa)			Kopma Dayanımı Rm Tensile Strength (Mpa)	Uzama Elongation A5 Min (%)	Darbe Enerjisi Impact Energy (J)	Uygulama Sıcaklığı Temperature of Application
			t 0 - 16 mm	t 16 - 40 mm	t 40 - 65 mm				
ASTM A53	Gr. A	U, N	205	205	205	≥ 330		20	
ASTM A53	Gr. B	U, N	240	240	240	≥ 415		20	
ASTM A106	Gr. A	N	205	205	205	≥ 330	35	475	
ASTM A106	Gr. B	N	240	240	240	≥ 415	30	475	
ASTM A106	Gr. C	N	275	275	275	≥ 485	30	20	
ASTM A333	Gr.1	U, N	205	205	205	Min. 380	35	L= 18 (-45°C)	-50
ASTM A333	Gr.6	U, N	240	240	240	Min. 415	30	L= 18 (-45°C)	-50

T: Et Kalınlığı / Wall Thickness

U: Isıl İşlemsiz / Without Heat Treatment

N: Normalize Edilmiş / Normalizing

Malzemeler aynı zamanda ASME SA standartına uygun olarak tedarik edilebilir.

The materials can also be supplied in accordance with the ASME SA standard.

API 5L / LINE PIPES

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
API Spec. 5L	A (L210) PSL 1	≤ 0.22	≤ 0.90		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				
API Spec. 5L	B (L245) PSL1	≤ 0.28	≤ 1.20		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V ≥ 0.06 Nb+V+Ti ≤ 0.15
API Spec. 5L	BR (L245R) PSL 2	≤ 0.24	≤ 1.20	≤ 0.40	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.30	≤ 0.30	≤ 0.15				Ti ≤ 0.04 Nb+V ≥ 0.06
API Spec. 5L	X42 (L290) PSL 1	≤ 0.28	≤ 1.30		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X42N (L290N) PSL 2	≤ 0.24	≤ 1.20	≤ 0.40	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.30	≤ 0.30	≤ 0.15	≤ 0.060			Nb ≥ 0.05 Ti ≤ 0.04
API Spec. 5L	X46(L320) PSL 1	≤ 0.28	≤ 1.40		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X46N (L320N) PSL 2	≤ 0.24	≤ 1.40	≤ 0.40	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.30	≤ 0.30	≤ 0.15	≤ 0.070			Nb ≤ 0.05 Ti ≤ 0.04 Nb+V+Ti ≤ 0.15
API Spec. 5L	X52 (L360) PSL 1	≤ 0.28	≤ 1.40		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X52N (L360N) PSL 2	≤ 0.24	≤ 1.40	≤ 0.40	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15	≤ 0.010			Nb ≤ 0.05 Ti ≤ 0.04 Nb+V+Ti ≤ 0.15
API Spec. 5L	X56 (L390) PSL 1	≤ 0.28	≤ 1.40		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X56N (L390N) PSL 2	≤ 0.24	≤ 1.40	≤ 0.45	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.30	≤ 0.30	≤ 0.15	≤ 0.010			Nb ≤ 0.05 Ti ≤ 0.04 Nb+V+Ti ≤ 0.15
API Spec. 5L	X60 (L415) PSL 1	≤ 0.28	≤ 1.40		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X60N (L415N) PSL 2	≤ 0.24	≤ 1.40	≤ 0.45	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15	≤ 0.010			Nb ≤ 0.05 Ti ≤ 0.04 Nb+V+Ti ≤ 0.15
API Spec. 5L	X65 (L450) PSL 1	≤ 0.28	≤ 1.40		≤ 0.030	≤ 0.030	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15				Nb+V+Ti ≤ 0.15
API Spec. 5L	X65Q (L450Q) PSL 2	≤ 0.18	≤ 1.70	≤ 0.45	≤ 0.025	≤ 0.015	≤ 0.50	≤ 0.50	≤ 0.50	≤ 0.15	≤ 0.010			Nb ≤ 0.05 Ti ≤ 0.04 Nb+V+Ti ≤ 0.15

Mekanik Özellikler / Mechanical Properties

Standart Standard	Kalite Grade	Isıl İşlem Heat Treatment	Akma Noktası Re Min. Yield Strength (MPa)			Kopma Dayanımı Rm Tensile Strength (Mpa)	Uzama Elongation A5 Min (%)	Darbe Enerjisi Impact Energy (J)	Uygulama Sıcaklığı Temperature of Application
			t up to 16 mm	t 16 - 40 mm	t 40 - 65 mm				
API Spec. 5L	A (L210) PSL 1	U, N	210	210	210	≥ 335			
API Spec. 5L	B (L245) PSL1	U, N	245	245	245	≥ 415			
API Spec. 5L	BR (L245R) PSL 2	U, N	245 - 450	245 - 450		415 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X42 (L290) PSL 1	U, N	290	290	290	≥ 415			
API Spec. 5L	X42N (L290N) PSL 2	U, N	290 - 495	290 - 496		415 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X46(L320) PSL 1	U, N	320	320	320	≥ 435			
API Spec. 5L	X46N (L320N) PSL 2	U, N	320 - 525	320 - 525		435 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X52 (L360) PSL 1	U, N	360	360	360	≥ 460			
API Spec. 5L	X52N (L360N) PSL 2	U, N	360 - 530	360 - 531		460 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X56 (L390) PSL 1	U, N	390	390	390	≥ 490			
API Spec. 5L	X56N (L390N) PSL 2	U, N	390 - 545	390 - 545		490 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X60 (L415) PSL 1	U, N	415	415	415	≥ 520			
API Spec. 5L	X60N (L415N) PSL 2	U, N	415 - 565	415 - 565		520 - 760	T = 27 (0°C); L = 41 (0°C)		
API Spec. 5L	X65 (L450) PSL 1	U, N	450	450	450	≥ 535			
API Spec. 5L	X65Q (L450Q) PSL 2	U, N	450 - 600	450 - 600		535 - 760	T = 27 (0°C); L = 41 (0°C)		

T: Et Kalınlığı / Wall Thickness

U: Isıl İşlemsiz / Without Heat Treatment

N: Normalize Edilmiş / Normalizing

API 5L / ASTM A106 Gr B VEYA A333 Gr 6'YA GÖRE DİKİŞSİZ HAT BORULARI ÖLÇÜLERİ

SIZE RANGE OF SEAMLESS LINE PIPE ACC.
TO API 5L / ASTM A106 GR. B OR A333 GR. 6

Dış Çap Outside Diameter			Mm olarak Et Kalınlığı, kg/m Olarak Ağırlık / Wall Thickness in mm, Weight in kg/m											
			Seri / Schedule									Seri Dışı / Non-schedule		
NPS	DN	MM	20	30	40	60	80	100	120	140	160	STD	XS	XXS
3/8	10	171			2.31 0.84		3.20 1.10					2.31 0.84	3.20 1.10	
1/2	15	21.3			2.77 1.27		3.73 1.62				4.78 1.95	2.77 1.27	3.73 1.62	7.47 2.55
3/4	20	26.7			2.87 1.69		3.91 2.20				5.56 2.90	2.87 1.69	3.91 2.20	7.82 3.64
1	25	33.4			3.38 2.50		4.55 3.24				6.35 4.24	3.38 2.50	4.55 3.24	9.09 5.45
1 1/4	32	42.2			3.56 3.39		4.85 4.47				6.35 5.61	3.56 3.39	4.85 4.47	9.70 7.77
1 1/2	40	48.3			3.68 4.05		5.08 5.41				7.14 7.25	3.68 4.05	5.08 5.41	10.15 9.55
2	50	60.3			3.91 5.44		5.54 7.48				8.74 11.11	3.91 5.44	5.54 7.48	11.07 13.44
2 1/2	65	73			5.16 8.63		7.01 11.41				9.53 14.92	5.16 8.63	7.01 11.41	14.02 20.39
3	80	88.9			5.49 11.29		7.62 15.27				11.13 21.35	5.49 11.29	7.62 15.27	15.24 27.68
3 1/2	90	101.6			5.74 13.57		8.08 18.64					5.74 13.57	8.08 18.64	
4	100	114.3			6.02 16.08		8.56 22.32		11.13 28.32		13.49 33.54	6.02 16.08	8.56 22.32	17.12 41.03
5	125	141.3			6.55 21.77		9.53 30.97		12.70 40.28		15.88 49.12	6.55 21.77	9.53 30.97	19.05 57.43
6	150	168.3			7.11 28.26		10.97 42.56		14.27 54.21		18.26 67.57	7.11 28.26	10.97 42.56	21.95 79.22
8	200	219.1	6.35 33.32	7.04 36.82	8.18 42.55	10.31 53.09	12.70 64.64	15.09 75.92	18.26 90.44	20.62 100.93	23.01 111.27	8.18 42.55	12.70 64.64	22.23 107.93
10	250	273	6.35 41.76	7.80 51.01	9.27 60.29	12.70 81.53	15.09 95.98	18.26 114.71	21.44 133.01	25.40 155.10	28.58 127.27	9.27 60.29	12.70 81.53	25.40 155.10
12	300	323.8	6.35 49.71	8.38 65.19	10.31 79.71	14.27 108.93	17.48 132.05	21.44 159.87	25.40 186.92	28.58 208.08	33.32 238.69	9.53 73.86	12.70 97.44	25.40 186.92
14	350	355.6	7.92 67.91	9.53 81.33	11.13 94.55	15.09 126.72	19.05 158.11	23.83 194.98	27.79 224.66	31.75 253.58	35.71 281.72	9.53 81.33	12.70 107.40	
16	400	406.4	7.92 77.83	9.53 93.27	12.70 123.31	16.66 160.13	21.44 203.54	26.19 245.57	30.96 286.66	36.53 333.21	40.49 365.38	9.53 93.27	12.70 123.31	
18	450	457	7.92 81.71	11.13 122.38	14.27 155.81	19.05 205.75	23.83 254.57	29.36 309.64	34.93 363.58	39.67 408.28	45.24 459.39	9.53 105.17	12.70 139.16	
20	500	508	9.53 117.15	12.70 155.13	15.09 183.43	20.62 247.84	26.19 311.19	32.54 381.55	38.10 441.52	44.45 508.15	50.01 564.85	9.53 117.15	12.70 155.13	
22	550	559	9.53 129.14	12.70 171.10		22.23 294.27	28.58 373.85	34.93 451.45	41.28 527.05	47.63 600.67	53.98 672.30	9.53 129.14	12.70 171.10	
24	600	610	9.53 141.12	14.27 209.65	17.48 255.43	24.61 355.28	30.96 442.11	38.89 547.74	46.02 640.07	52.37 720.19	59.54 808.27	9.53 141.12	12.70 187.07	
26	650	660	12.70 202.74									9.53 152.88	12.70 202.74	
28	700	711	12.70 218.71	15.88 272.23								9.53 164.86	12.70 218.71	



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