Composition and mechanical properties of commonly used carbon steel and alloy steel

steel	standard		C	Si	Mn	P	S	Cr	Ni	Mo	Al	Cu	Ti	V	Nb	tensile strength (Mpa)	Yield Strength (Mpa)	Elongation %	Shrinkage %	Test temp.	Shock J	Hardness HB
A105	ASTM A105-2011	MIN		0.10	0.60											485	250	22	30			
		MAX	0.35	0.35	1.05	0.035	0.040	0.30	0.40	0.12		0.40		0.08								187
20#	俄标	MIN	0.17	0.17	0.35											390	195	26	55			111
		MAX	0.24	0.37	0.65	0.035	0.040	0.25	0.30			0.30										156
20#	JB/T4726-2000	MIN	0.17	0.2	0.60											390	215	24		20℃	34	106
		MAX	0.23	0.37	1.00	0.03	0.020	0.25	0.25			0.25				540						159
20#	NB/T47008-2010	MIN	0.17	0.2	0.60											410～560	235	24		0℃	31	110～160
																400～550	225	24				
		MAX	0.23	0.40	1.00	0.030	0.020	0.25	0.25			0.25				380～530	205	24				
C21	VdTUV399/3:2007	MIN	0.18	0.2	0.80											485	250	20	45	20℃	31	143
		MAX	0.23	0.35	1.35	0.035	0.030	0.30	0.40	0.12		0.40		0.030	0.020	630						185
C22.8	VdTUV350/3:2009	MIN	0.18		0.40						0.015					410	250	20		20℃	31	125
1.0460		MAX	0.23	0.40	0.90	0.025	0.015	0.30	0.30	0.08	0.050	0.30		0.020	0.010	540						160
20Mn	GB/T699-1999	MIN	0.17	0.17	0.70											450	275	24	50			
		MAX	0.23	0.37	1.00	0.035	0.035	0.25	0.30			0.25										
P245GH	EN10222-2:2000	MIN	0.08		0.50											410	245	23		20℃	27	125
1.0352		MAX	0.20	0.40	1.30	0.025	0.015		0.30	0.08		0.30		0.020	0.010	530						160
P280GH	EN10222-2:2000	MIN	0.08		0.90											460	280	23				
1.0426		MAX	0.20	0.40	1.50	0.025	0.015		0.30	0.08		0.30		0.020	0.01	580						
A350LF2	ASTM A350:2010	MIN		0.2	0.60											485	250	22	30	–46℃	27	
		MAX	0.30	0.30	1.35	0.035	0.040	0.30	0.40	0.12		0.40		0.030		655						197
A350LF6	ASTM A350:2010	MIN	0.22	0.2	1.15									0.04	N 0.01	515	415	20	40			
		MAX		0.30	1.50	0.025	0.025	0.30	0.40	0.12		0.40		0.11	N 0.03	690						197
Q235A	GB/T700-2006	MIN														375	235	26				
		MIX	0.22	0.35	1.40	0.045	0.050									500						
Q235B	GB/T700-2006	MIN														375	235	26		20℃	27	
		MIX	0.20	0.35	1.40	0.045	0.045									500						
P265GH	DIN10222-2	MIN	0.10	0.20	0.50						0.020					410	265	23			31	138
		MAX	0.20	0.40	1.40	0.025	0.020	0.30	0.30	0.08		0.30	0.030	0.020		530						170
P250GH	DIN10222-2	MIN	0.18		0.40						0.015					410	250	20			31	125
1.0460		MAX	0.23	0.40	0.90	0.025	0.015	0.30	0.30	0.08	0.050	0.30		0.020	0.010	540						160
16Mn	NB/T47008-2010	MIN	0.13	0.20	1.20											480～630	305	20			34	128～180
																470～620	295	20		0℃		
		MAX	0.20	0.60	1.60	0.030	0.020	0.30	0.30			0.25				450～600	275	20				
Steel	standard		C	Si	Mn	P	S	Cr	Ni	Mo	Al	Cu	Ti	V	Nb	tensile strength (Mpa)	Yield Strength (Mpa)	Elongation %	Shrinkage %	Test temp.	Shock J	Hardness HB
16MnD	NB/T47009-2010	MIN	0.13	0.20	1.20											480～630	305	20		–45℃	47	
																470～620	295	20		–40℃		
		MAX	0.20	0.60	1.60	0.025	0.012	0.30	0.40			0.25			0.030	450～600	275	20				
16Mn(HIC)		MIN		0.20	1.15						O	Cep				450	275	20			34	
		MAX	0.20	0.40	1.30	0.008	0.002		0.20		0.004	0.43				600				–30℃		

Q345A/B	GB1591-2008	MAX	1.20	1.40	2.30	1.008	1.002		1.20		<0.005	1.43				601						
		MAX	0.20	0.50	1.70	0.035	0.035	0.30	0.50	0.10		0.30	0.20	0.15	0.07	630						
Q345C	GB1591-2008	MIN									0.015					470	345	20				
		MAX	0.20	0.50	1.70	0.030	0.030	0.30	0.50	0.10		0.30	0.20	0.15	0.07	630						
Q345D	GB1591-2008	MIN									0.015					470	345	21				
		MAX	0.18	0.50	1.70	0.030	0.025	0.30	0.50	0.10		0.30	0.20	0.15	0.07	630						
Q345E	GB1591-2008	MIN									0.015					470	345	21				
		MAX	0.18	0.50	1.70	0.025	0.020	0.30	0.50	0.10		0.30	0.20	0.15	0.07	630						
Q460C	GB1591-2008	MIN									0.015					550～720	≥400	≥16		0℃	34	
		MAX	0.20	0.60	1.80	0.030	0.030	0.30	0.80	0.20		0.55	0.20	0.20	0.11	530～700	≥380	≥16				
Q500D	GB1591-2008	MIN									0.015					590～750	≥450	≥17		−20℃	47	
		MAX	0.18	0.60	1.80	0.030	0.025	0.60	0.80	0.20		0.20	0.20	0.12	0.11	540～730	≥440	≥17				
Q550D	GB1591-2008	MIN									0.015					600～790	≥500	≥16		−20℃	47	
		MAX	0.18	0.60	2.00	0.030	0.025	1.00	0.80	0.30		0.80	0.20	0.12	0.11	590～780	≥490	≥16				
09Г$_2$С	Russian standard	MIN	0.07	0.50	1.30											470	245	22	48	-60℃	30	143
		MAX	0.12	0.80	1.70	0.040	0.040	0.30	0.30			0.30										179
ST37.2		MIN	0.10	0.2	0.50											340	235	24		20℃	27	100
		MIX	0.17	0.3	1.40	0.045	0.045					0.30				470						140
S235JRG2	EN10250-2	MIN														340	235	24		20℃	27	100
		MIX	0.20	0.6	1.40	0.045	0.045									470						140
A516 F60	ASTM A516-2010	MIN		0.15	0.60											415	220	25				
		MAX	0.21	0.40	0.90	0.035	0.035									550						
A516 F65	ASTM A516-2010	MIN		0.15	0.85											450	240	23				
		MAX	0.24	0.40	1.20	0.035	0.035									585						
A516 F70	ASTM A516-2010	MIN		0.15	0.85											485	260	21				
		MAX	0.27	0.40	1.20	0.035	0.035									620						
A694 F52	ASTM A694:2008	MIN		0.15												455	360	20				
		MAX	0.26	0.35	1.60	0.025	0.025															
A694 F60	ASTM A694:2008	MIN		0.15												515	415	20				
		MAX	0.26	0.35	1.60	0.025	0.025															
A694 F65	ASTM A694:2008	MIN		0.15												530	450	20				
		MAX	0.26	0.35	1.60	0.025	0.025															
A694 F70	ASTM A694:2008	MIN		0.15												565	485	18				
		MAX	0.26	0.35	1.60	0.025	0.025															
Steel	standard		C	Si	Mn	P	S	Cr	Ni	Mo	Al	Cu	Ti	V	Nb	tensile strength (Mpa)	Yield Strength (Mpa)	Elongation %	Shrinkage %	Test temp.	Shock J	Hardness HB
F11 Class2	ASTM A182-2013	MIN	0.10	0.50	0.30			1.00		0.44						485	275	20	30			156
		MAX	0.20	1.00	0.80	0.040	0.040	1.50		0.65												207
F5	ASTM A182-2013	MIN			0.30			4.00		0.44						485	275	20	35			143
		MAX	0.15	0.50	0.60	0.030	0.030	6.00	0.50	0.65												217
F5A	ASTM A182-2013	MIN						4.00		0.44						620	450	22	50			187
		MAX	0.25	0.50	0.60	0.040	0.030	6.00	0.50	0.65												248
F9	ASTM A182-2013	MIN		0.50	0.30			8.00		0.90						585	380	20	40			179
		MAX	0.15	1.00	0.60	0.030	0.030	10.00		1.10												217
F22 Class3	ASTM A182-2013	MIN	0.05		0.30			2.00		0.87						515	310	20	30			156
		MAX	0.15	0.50	0.60	0.04	0.040	2.50		1.13												207
1Cr5Mo	NB/T47008-2010	MIN						4.00		0.45						590	390	18		20℃	47	
		MAX	0.15	0.50	0.60	0.025	0.015	6.00	0.50	0.65		0.25				760						
15CrMo	NB/T47008-2010	MIN	0.12	0.10	0.30			0.80		0.45						480～640	280	20		20℃	47	
		MAX	0.18	0.60	0.80	0.025	0.015	1.25	0.30	0.65		0.25				470～630	270	20				
12Cr1MoV	NB/T47008-2010	MIN	0.09	0.15	0.40			0.90		0.25				0.15		470～630	280	20		20℃	47	
		MAX	0.15	0.40	0.70	0.025	0.015	1.20	0.30	0.35		0.25		0.30		460～620	270	20				
09MnNiD	NB/T47009-2010	MIN	0.06	0.15	1.20				0.45							440～590	280	23		-70℃	60	
		MAX	0.12	0.35	1.60	0.020	0.010	0.30	0.85		0.05	0.25				430～580	270	23				
16Mo3	EN10222-2:2000	MIN	0.12		0.40					0.25						440	295	23				
1.5415		MAX	0.20	0.35	0.90	0.025	0.015			0.35						570						

13CrMo4-5	EN10222-2:2000	MIN	0.08		0.40			0.70		0.40						440	295	20		20℃	31	156
1.7335		MAX	0.18	0.35	1.00	0.025	0.015	1.15		0.60						590						
42CrMo	GB3077-88	MIN	0.38		0.60			0.90		0.15						800	640	13	50			
		MAX	0.45	0.40	0.90	0.035	0.035	1.20		0.30						1100						240
20MnMo	GB3077-88	MIN	0.16	0.2	0.90					0.20						530	370	18		0℃	41	
		MAX	0.22	0.4	1.20	0.030	0.035			0.30						700						

1、Seamless steel pipe, welded steel pipe (straight seam pipe and spiral steel pipe), stainless steel pipe, etc.

2、A series is international universal series (imperial tube), B series is domestic series (metric tube)

Nominal diameter DN	Imperial	Outer		thickness of pipe wall（mm) and theoretical weight（m/kg）											
		A	B	2.5	3	3.5	4	4.5	5	6	7	8	9	10	12
15	1/2"	21.3	18	1	1.11	1.25	1.38	1.5	1.6						
20	3/4"	26.9	25	1.4	1.63	1.86	2.07	2.28	2.47	2.81	3.11				
25	1"	33.7	32	1.8	2.15	2.46	2.76	3.05	3.33	3.85	4.32	4.47			
32	1 1/4"	42.4	38	2.2	2.59	2.98	3.35	3.72	4.07	4.74	5.35	5.95			
40	1 1/2"	48.3	45	2.6	3.11	3.58	4.04	4.49	4.93	5.77	6.56	7.3	7.99		
50	2"	60.3	57	3.4	4	4.62	5.23	5.83	6.41	7.55	8.63	9.67	10.7		
65	2 1/2"	76.1	76	4.5	5.4	6.26	7.1	7.93	8.75	10.36	11.9	13.1	14.4		
80	3"	88.9	89	5.3	6.36	7.38	8.38	9.38	10.36	12.28	14.2	16	17.8		
100	4"	114	108	6.5	7.77	9.02	10.26	11.49	12.7	15.09	17.4	19.7	22		
125	5"	140	133				12.73	14.26	15.78	18.79	21.8	24.7	27.5	30.33	35.81
150	6"	168	159					17.15	18.99	22.64	26.2	29.8	33.3	36.75	43.5
200	8"	219	219							31.52	36.6	41.6	46.6	51.54	61.26
250	10"	273	273							39.51	45.9	52.3	58.6	64.86	77.24
300	12"	324	325							47.2	54.9	62.5	70.1	77.68	92.63
350	14"	355	377							54.89	63.9	72.8	81.7	90.51	108
400	16"	406	426							62.14	72.3	82.5	92.6	102.6	122.5
450	18"	457	480									93.1	105	115.9	139.5
500	20"	508	530									103	116	128.2	154.3
600	24"	610	630									123	138	152.9	182.9

Steel grade	Material	C	Si	Mn	P	S	Cr	Steel grade	Material	Ni	Mo	Cu	V	Al	Mark
J55	——				≤ 0.030	≤ 0.030		J55	——						
	37Mn5	0.34-0.39	0.20-0.35	1.25-1.50	≤ 0.025	≤ 0.015	≤0.15		37Mn5	≤0.20		≤0.20		0.01-0.04	
	34Mn6	0.35	0.26	1.38	0.018	0.005	0.09		34Mn6	0.04	0.011	0.07		0.022	
	30Mn2Cr	0.27-0.34	0.17-0.35	1.40-1.80	≤ 0.025	≤0.02	0.2-0.4		30Mn2Cr	≤0.25		≤0.20			
	30Mn2	0.27-0.34	0.17-0.37	1.40-1.80	Allowable residual content≦0.35	Allowable residual content≦0.35	Allowable residual content≦0.30		30Mn2	Allowable residual content≦0.30		Allowable residual content≦0.30			
	30CrMo	0.26-0.34	0.17-0.37	0.40-0.70			0.80-1.10		30CrMo		0.15-0.25				
	25Mn2V	0.24-0.28	0.17-0.37	1.40-1.70	≤0.02	≤ 0.015	≤0.15		25Mn2V	≤0.20		≤0.20	0.08-0.12		
	34Mn5	0.32-0.38	0.15-0.35	1.10-1.30	≤ 0.025	≤ 0.025			34Mn5					0.01-0.04	

K55	——				≤ 0.030	≤ 0.030		K55	——						
	37Mn5	0.34-0.39	0.20-0.35	1.25-1.50	≤ 0.025	≤ 0.015	≤0.15		37Mn5	≤0.20		≤0.20		0.01-0.04	
	34Mn6	0.35	0.26	1.38	0.018	0.005	0.09		34Mn6	0.04	0.011	0.07		0.022	
	30Mn2Cr	0.27-0.34	0.17-0.35	1.40-1.80	≤ 0.025	≤0.02	0.2-0.4		30Mn2Cr	≤0.25		≤0.20			
L80-1	——	≤ 0.50	≤0.45	≤ 1.90	≤ 0.030	≤ 0.030		L80-1	——	≤0.25		≤0.35			
	30Mn2	0.27-0.34	0.17-0.37	1.40-1.80	Allowable residual content≦0.35	Allowable residual content≦0.35	Allowable residual content≦0.30		30Mn2	Allowable residual content≦0.30		Allowable residual content≦0.30			
	37Mn5	0.34-0.39	0.20-0.35	1.25-1.50	≤ 0.025	≤ 0.015	≤0.15		37Mn5	≤0.20		≤0.20		0.01-0.04	
	34Mn6	0.35	0.26	1.38	0.018	0.005	0.09		34Mn6	0.04	0.011	0.07		0.022	
	30Mn2Cr	0.27-0.34	0.17-0.35	1.40-1.80	≤ 0.025	≤0.02	0.2-0.4		30Mn2Cr	≤0.25		≤0.20			
	25Mn2V	0.24-0.28	0.17-0.37	1.40-1.70	≤0.02	≤ 0.015	≤0.15		25Mn2V	≤0.20		≤0.20	0.08-0.12		
	25Mn2	0.32-0.39	0.17-0.37	1.40-1.80	≤ 0.025	≤ 0.025	≤0.30		25Mn2	≤0.30		≤0.25			
	36Mn2V	0.34-0.39	0.25-0.40	1.45-1.70	≤ 0.025	≤ 0.015	≤0.15		36Mn2V	≤0.20		≤0.20	0.11-0.16		

L80-1	37Mn2V								37Mn2V						
N80Q	——				≤ 0.030	≤ 0.030		**N80Q**	——						
	37Mn5	0.34-0.39	0.20-0.35	1.25-1.50	≤ 0.025	≤ 0.015	≤0.15		37Mn5	≤0.20		≤0.20		0.01-0.04	
	34Mn6	0.35	0.26	1.38	0.018	0.005	0.09		34Mn6	0.04	0.011	0.07		0.022	
Steel grade	**Material**	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Steel grade**	**Material**	**Ni**	**Mo**	**Cu**	**V**	**Al**	**Mark**
N80Q	30Mn2	0.27-0.34	0.17-0.37	1.40-1.80	Allowable residual content≦0.35	Allowable residual content≦0.35	Allowable residual content≦0.30	**N80Q**	30Mn2	Allowable residual content≦0.30		Allowable residual content≦0.30			
	25Mn2	0.32-0.39	0.17-0.37	1.40-1.80	≤ 0.025	≤ 0.025	≤0.30		25Mn2	≤0.30		≤0.25			
	37Mn2V								37Mn2V						
	30Mn2Cr	0.27-0.34	0.17-0.35	1.40-1.80	≤ 0.025	≤0.02	0.2-0.4		30Mn2Cr	≤0.25		≤0.20			
N80Q	20Mn2	0.17-0.24	0.17-0.37	1.40-1.80	≤ 0.025	≤ 0.025	≤0.30		20Mn2	≤0.30		≤0.25			
	SAE1527	0.22-0.29		1.20-1.50	≤ 0.040	≤ 0.050			SAE1527						

P110	——							P110	——						
	25Mn2V	0.24-0.28	0.17-0.37	1.40-1.70	≤0.02	≤0.015	≤0.15		25Mn2V	≤0.20		≤0.20	0.08-0.12		
	36Mn2V	0.34-0.39	0.25-0.40	1.45-1.70	≤0.025	≤0.015	≤0.15		36Mn2V	≤0.20		≤0.20	0.11-0.16		
	37Mn2V								37Mn2V						
	30Mn2	0.27-0.34	0.17-0.37	1.40-1.80	Allowable residual content≦0.35	Allowable residual content≦0.35	Allowable residual content≦0.30		30Mn2	Allowable residual content≦0.30		Allowable residual content≦0.30			
	30Mn2Cr	0.27-0.34	0.17-0.35	1.40-1.80	≤0.025	≤0.02	0.2-0.4		30Mn2Cr	≤0.25		≤0.20			
	37Mn5	0.34-0.39	0.20-0.35	1.25-1.50	≤0.025	≤0.015	≤0.15		37Mn5	≤0.20		≤0.20		0.01-0.04	
	35CrMo	0.32-0.40	0.17-0.37	0.40-0.70	Allowable residual content≦0.035	Allowable residual content≦0.035	0.80-1.10		35CrMo	Allowable residual content≦0.030	0.15-0.25	Allowable residual content≦0.030			
	30CrMo	0.26-0.34	0.17-0.37	0.40-0.70			0.80-1.10		30CrMo		0.15-0.25				

Q125	——	≤ 0.35		≤ 1.35	≤ 0.020	≤ 0.010	≤1.50	Q125	——	≤0.99	≤0.85				
	30CrMo	0.26-0.34	0.17-0.37	0.40-0.70			0.80-1.10		30CrMo		0.15-0.25				
	25CrMoMo								25CrMoMo						
	HCP110								HCP110						
——	32Mn6	0.320	0.23	1.26	0.015	0.015	0.062	——	32Mn6	0.065	0.020	0.15		0.012	
——	10# steel	0.1	0.188	0.4	0.016	0.01									
——	20#steel	0.23	0.231	0.4	0.031	0.03	0.022	——	20# steel	0.018		0.04			
——	35#steel	0.38	0.237	0.7	0.021	0.02	0.041	——	35# steel	0.028		0.05		0.051（Als）	
——	H08steel	0.07	0.022	0.5	0.016	0.020	0.017	——	H08 steel	0.013		0.05			

Items	Steel grade	Types of steel	chemical composition, %										
			C	Si	Mn	Cr	Ni	Cu	Ti	Mo	V	P	S
1	H40、J55	A658 Ⅱ	0.27-0.35	0.17-0.37	1.25-1.50	≤0.25	≤0.25	≤0.20		—	0.10-0.14	≤0.028	≤0.028
	K55	33MnV	0.31-0.35	0.17-0.37	1.35-1.50	≤0.25	≤0.25	≤0.20	—	—	0.10-0.14	≤0.028	≤0.028

1	N80Q	D＜244.48	30Mn	0.28-0.32	0.17-0.37	1.30-1.45	≤0.25	≤0.25	≤0.20	—	—	—	≤0.028	≤0.028
		D≥244.48	25MnV	0.22-0.29	0.17-0.37	1.30-1.60	≤0.25	≤0.25	≤0.20	—	—	0.07-0.12	≤0.025	≤0.025
2	L80 1 series	D＜244.48	30Mn(L)	0.28-0.32	0.17-0.37	1.30-1.45	≤0.25	≤0.25	≤0.20	—	—	—	≤0.020	≤0.020
		D≥244.48	25MnV(L)	0.22-0.29	0.17-0.37	1.30-1.60	≤0.25	≤0.20	≤0.20	—	—	0.07-0.12	≤0.020	≤0.020
	C90 1 series C90 2 series		27CrMoTi	0.26-0.3	0.17-0.37	0.35-0.60	0.80-1.10	≤0.20	≤0.20	0.05-0.15	0.25-0.35	—	≤0.018	≤0.008
	T95 1 series T95 2 series		27CrMoTi	0.26-0.3	0.17-0.37	0.35-0.60	0.80-1.10	≤0.20	≤0.20	0.05-0.15	0.25-0.35	—	≤0.018	≤0.008
	C95		25MnV	0.22-0.29	0.17-0.37	1.30-1.60	≤0.25	≤0.20	≤0.20	—	—	0.07-0.12	≤0.025	≤0.025
3	P110	D＜244.48	25MnV	0.22-0.29	0.17-0.37	1.30-1.60	≤0.25	≤0.20	≤0.20	—	—	0.07-0.12	≤0.025	≤0.025
		D≥244.48	25MnMoV	0.22-0.29	0.17-0.37	1.30-1.60	≤0.25	≤0.20	≤0.20	—	0.20-0.30	0.07-0.12	≤0.025	≤0.025

1. As (arsenic) and Sn(tin) of petroleum pipe couplings shall meet: As≤0.03％， Sn≤0.01％， 0.4As+6Sn≤0.072％

2. When coupling material and finished coupling are delivered from the factory, Cr、Ni、Mo of Ni、Cu and C90、T95 listed

3. D in the table is the outer diameter of the steel pipe.