

## 优质碳素结构钢化学成分和力学性能

Chemical composition and mechanical properties of high-quality carbon structural steel

根据 GB699-1999, 按统一数字代号和牌号规定的化学成分和物理性能见以下各表:

According to GB699-1999, the chemical composition and physical properties specified by the unified digital code and grade are shown in the following tables:

表 1: 化学成分 Sheet 1 Chemical Components

序号 NO.	统一数字 代号 Unified Numerical Code	牌号 Grade	化学成分 Chemical Components (%)					
			碳 C Range	硅 Si Range	锰 Mn Range	铬 Cr Max	镍 Ni Max	铜 Cu Max
1	U20080	08F	0.05~0.11	≤0.03	0.25~0.50	0.10	0.30	0.25
2	U20100	10F	0.07~0.13	≤0.07	0.25~0.50	0.15	0.30	0.25
3	U20150	15F	0.12~0.18	≤0.07	0.25~0.50	0.25	0.30	0.25
4	U20082	08	0.05~0.11	0.17~0.37	0.35~0.65	0.10	0.30	0.25
5	U20102	10	0.07~0.13	0.17~0.37	0.35~0.65	0.15	0.30	0.25
6	U20152	15	0.12~0.18	0.17~0.37	0.35~0.65	0.25	0.30	0.25
7	U20202	20	0.17~0.23	0.17~0.37	0.35~0.65	0.25	0.30	0.25
8	U20252	25	0.22~0.29	0.17~0.37	0.50~0.80	0.25	0.30	0.25
9	U20302	30	0.27~0.34	0.17~0.37	0.50~0.80	0.25	0.30	0.25
10	U20352	35	0.32~0.39	0.17~0.37	0.50~0.80	0.25	0.30	0.25
11	U20402	40	0.37~0.44	0.17~0.37	0.50~0.80	0.25	0.30	0.25
12	U20452	45	0.42~0.50	0.17~0.37	0.50~0.80	0.25	0.30	0.25
13	U20502	50	0.47~0.55	0.17~0.37	0.50~0.80	0.25	0.30	0.25
14	U20552	55	0.52~0.60	0.17~0.37	0.50~0.80	0.25	0.30	0.25
15	U20602	60	0.57~0.65	0.17~0.37	0.50~0.80	0.25	0.30	0.25

16	U20652	65	0.62~0.70	0.17~0.37	0.50~0.80	0.25	0.30	0.25
17	U20702	70	0.67~0.75	0.17~0.37	0.50~0.80	0.25	0.30	0.25
18	U20752	75	0.72~0.80	0.17~0.37	0.50~0.80	0.25	0.30	0.25
19	U20802	80	0.77~0.85	0.17~0.37	0.50~0.80	0.25	0.30	0.25
20	U20852	85	0.82~0.90	0.17~0.37	0.50~0.80	0.25	0.30	0.25
21	U21152	15Mn	0.12~0.18	0.17~0.37	0.70~1.00	0.25	0.30	0.25
22	U21202	20Mn	0.17~0.23	0.17~0.37	0.70~1.00	0.25	0.30	0.25
23	U21252	25Mn	0.22~0.29	0.17~0.37	0.70~1.00	0.25	0.30	0.25
24	U21302	30Mn	0.27~0.34	0.17~0.37	0.70~1.00	0.25	0.30	0.25
25	U21352	35Mn	0.32~0.39	0.17~0.37	0.70~1.00	0.25	0.30	0.25
26	U21402	40Mn	0.37~0.44	0.17~0.37	0.70~1.00	0.25	0.30	0.25
27	U21452	45Mn	0.42~0.50	0.17~0.37	0.70~1.00	0.25	0.30	0.25
28	U21502	50Mn	0.48~0.56	0.17~0.37	0.70~1.00	0.25	0.30	0.25
29	U21602	60Mn	0.57~0.65	0.17~0.37	0.70~1.00	0.25	0.30	0.25
30	U21652	65Mn	0.62~0.70	0.17~0.37	0.90~1.20	0.25	0.30	0.25
31	U21702	70Mn	0.67~0.75	0.17~0.37	0.90~1.20	0.25	0.30	0.25

注：表 1 所列牌号为优质钢。如果是高级优质钢，在牌号后面加“A”(统一数字代号最后一位数字改为“3”)；如果是特级优质钢，在牌号后面加。E”(统一数字代号最后一位数字改为“6”)；对于沸腾钢，牌号后面为“F”。

Note: The grades listed in Table 1 are high-quality steel. If it is high-quality steel, add "A" after the grade (the last digit of the unified number code is changed to "3"); if it is super high-quality steel, add it after the grade. E" (the last digit of the unified number code is changed to "6"); for boiling steel, the grade is followed by "F".

(统一数字代号最后一位数字为“0”)；对于半镇静钢，牌号后面为“b”(统一数字代号最后一位数字为“1”) (The last digit of the unified digital code is "0"); for semi-killed steel, the designation is followed by "b" (the last digit of the unified digital code is "1")

冷冲压用沸腾钢含硅量不大于 0.03%。氧气转炉冶炼的钢其含氮量应不大于 0.008%。供方能保证合格时，可不作分析。经供需双方协议，08~25 钢可供应硅含量不大于 0.17% 的半镇静钢，其牌号为 08b 25b。

The silicon content of boiling steel for cold stamping is not more than 0.03%. The nitrogen content of steel smelted by oxygen converter should not exceed 0.008%. When the supplier can guarantee the qualification, no analysis is required. According to the agreement between the supplier and the buyer, 08-25 steel can supply semi-killed steel with silicon content not more than 0.17%, and its grade is 08b 25b.

钢材(或坯)的化学成分允许偏差应符合 GB / T 222--1984 标准中表 2 的规定。

The allowable deviation of the chemical composition of the steel (or billet) shall comply with the provisions in Table 2 of the GB/T 222--1984 standard.

表 2 Sheet 2

组 别 Group	P	S
	不大于≤, %	
优质钢 high quality steel	0.035	0.035
高级优质钢 senior high quality steel	0.030	0.030
特级优质钢 special grade high quality steel	0.025	0.020

切削加工用钢材或冷拔坯料用钢材交货状态硬度应符合表 3 规定。不退火钢的硬度，供方若能保证合格时，可不作检验。高温回火或正火后的硬度指标，由供需双方协商确定。

The hardness of the steel for machining or cold-drawn billet as delivered shall meet the requirements in Table 3. The hardness of non-annealed steel may not be inspected if the supplier can ensure that it is qualified. The hardness index after high temperature tempering or normalizing shall be determined by negotiation between the supplier and the buyer.

表 3 Sheet 3

序号 NOO	牌号 Grade	试样 毛坯 尺寸 mm	推荐热处理 Heat treatment			力学性能 Mechanical properties					钢材交货状态硬度 HBS10 / 3000 不大于≤	
			正火 normalizing	淬火 quenching	回火 tempering	$\sigma_b$	$\sigma_s$	$\delta_5$	$\psi$	$A_{ku2}$	未热处理钢 Not heat treatment	退火钢 annealing
						MPa	MPa	%	%	J		
1	08F	25	930			295	175	35	60		131	
2	10F	25	930			315	185	33	00		137	
3	15F	25	920			355	205	29	55		143	
4	08	25	930			325	195	33	60		131	
5	10	25	930			335	205	31	00		137	
6	15	25	920			375	225	27	55		143	
7	20	25	910			410	245	25	55		1 S6	
8	25	25	900	870	600	450	275	23	50	71	170	
9	30	25	880	860	600	490	295	21	50	63	179	
10	35	25	870	850	600	530	315	20	45	55	197	
11	40	25	860	840	600	570	335	19	45	47	217	187
12	45	25	850	840	600	600	355	16	40	39	229	197
13	50	25	830	830	600	630	375	14	40	31	241	207
14	55	25	820	820	600	645	380	13	35		255	217
15	60	25	810			675	400	12	35		255	229
16	65	25	810			695	410	10	30		255	229
17	70	25	790			715	420	9	30		269	229
18	75			820	480	1080	880	7	30		285	241

19	80			820	480	1080	93()	6	30		285	241
20	85			820	480	1130	980	6	30		302	255
21	15Mn	25	920			410	245	26	55		163	
22	20Mn	25	910			450	275	24	50		197	
23	25M13	25	900	870	600	490	295	22	50	71	207	
24	30Mn	25	880	860	600	540	315	20	45	63	217	187
25	35Mrl	25	870	850	600	560	335	18	45	55	229	197
26	40Mn	25	860	840	600	590	355	17	45	47	229	207
27	45Mrl	25	850	840	600	620	375	15	40	39	241	217
28	50M13	25	830	830	600	64S	390	13	40	31	255	217
29	60M13	25	810			695	410	11	35		269	229
30	65Mn	25	830			735	430	9	30		285	229
31	70M1	25	790			785	450	8	30		285	229

注 Note

1 对于直径或厚度小于 25 mm 的钢材，热处理是在与成品截面尺寸相同的试样毛坯上进行。

1 For steel with a diameter or thickness of less than 25 mm, the heat treatment is carried out on a sample blank of the same size as the finished section.

2 表中所列正火推荐保温时间不少于 30 min.空冷；淬火推荐保温时间不少于 30 min, 75、80 和 85 钢油冷.其余钢水冷；回火推荐保温时间不少于 1 h

1 For steel with a diameter or thickness of less than 25 mm, the heat treatment is carried out on a sample blank of the same size as the finished section.

2 The recommended holding time for normalizing listed in the table is not less than 30 min. Air cooling; the recommended holding time for quenching is not less than 30 min, 75, 80 and 85 steel is oil-cooled. The rest of the steel is water-cooled; h

低倍组织 Low magnification tissue

镇静钢钢材的横截面酸浸低倍组织试片上不得有目视可见的缩孔、气泡、裂纹、夹杂、翻皮和白供切削加工用的钢材允许有不超表面缺陷允许深度的皮下夹杂等缺陷。

The cross-sectional acid leaching low-magnification microstructure test piece of killed steel shall not have visible shrinkage cavities, bubbles, cracks, inclusions, skins and whites. The steels used for cutting are allowed to have subcutaneous inclusions that do not exceed the allowable depth of surface defects, etc. defect.

2 酸浸低倍组织应符合表 4 的规定。

Acid leaching low magnification tissue should meet the requirements of Table 4.

表 4

质量等级 Grade	一般疏松	中心疏松	锭型偏析
	generally loose	loose center	Ingot segregation
	级别 Grade 不大于 ≤		
优质钢 High quality steel	3.0	3.0	3.0
高级优质钢 Senior quality steel	2.5	2.5	2.5
特级优质钢 Special grade high quality steel	2.0	2.0	2.0

6.6.3 如供方能保证低倍检验合格，允许采用 GB / T 7736 标准规定的超声波探伤法或其他无损探伤.法代替低倍检验。

If the supplier can ensure that the low magnification inspection is qualified, it is allowed to use the ultrasonic flaw detection method specified in the GB/T 7736 standard or other non-destructive flaw detection methods to replace the low magnification inspection.