



TBS797

TECHNICAL BULLETIN

AISI S7 Air Hardening Shock Steel Annealed

Typical Analysis:	Carbon	Chromium	Moly.	Mang.	Silicon
	0.50	3.25	1.40	0.70	0.25

Color Code: Yellow with Blue Stripe

HEAT TREATMENT

- FORGING** Preheat 1200 to 1300°F, forge at 2000 to 2050°F, stop at 1700°F and cool slowly
- NORMALIZING** Do not normalize
- ANNEALING** 1500 to 1550°F, cool slowly to 1000°F, air cool, max Brinell 197
- PREHEATING** 1200 to 1300°F, prior to hardening
- HARDENING** 1725°F. Quench in air if cross section is 2 1/2-in. or smaller; sections 2 1/2-in. to 6 in. should be oil quenched to black (1000°F) followed by air-cooling to 150°F
- TEMPERING** 400°F minimum. Double temper oil quenched masses

CHARACTERISTICS

MACHINABILITY — When annealed to Brinell 197 max, S7 is rated at 95, as compared to a rating of 100 for a 1.00% carbon tool steel.

DIMENSIONAL STABILITY — When quenched in air from the proper hardening temperature, S-7 can be expected to expand 0.001 in./in. of cross section.

IMPACT PROPERTIES — To determine the impact properties of S7, unnotched Charpy impact specimens were selected. They were machined oversize, heat treated and finish ground to 0.250 in. x 0.375 in. x 2.165 in. The heat-treatment consisted of preheating at 1300°F, quenching in still air from 1725°F and tempering at increasing temperatures. For the average impact values obtained values obtained at room temperature, see Figure 1.

Tempering Temperature -°F	Rockwell C	Unnotched Charpy Specimens (ft-lb)
400	58	180
500	56	227
600	55	228
700	54	199
800	53	179
900	52	190
1000	51	239
1100	46	*264 (no break)
1200	39	*264 (no break)
1300	33	*264 (no break)

Figure 1

* Maximum impact value obtainable on impact testing machine.

TENSILE PROPERTIES — Figure 2 shows the results of tests made on 0.505 in. diameter x 2 in. gage-length tensile specimens which were first rough-machined oversize, hardened in still air from 1725°F and tempered at various temperatures. Following the heat treatment, the specimens were finish-ground to size and tested. S7 has an ideal combination of properties for many applications. Tempered at 400°F (RC 58), it develops a tensile strength greater than 300,000 psi. And, as indicated in Figure 2, there is a 20% reduction of area for the size tested.

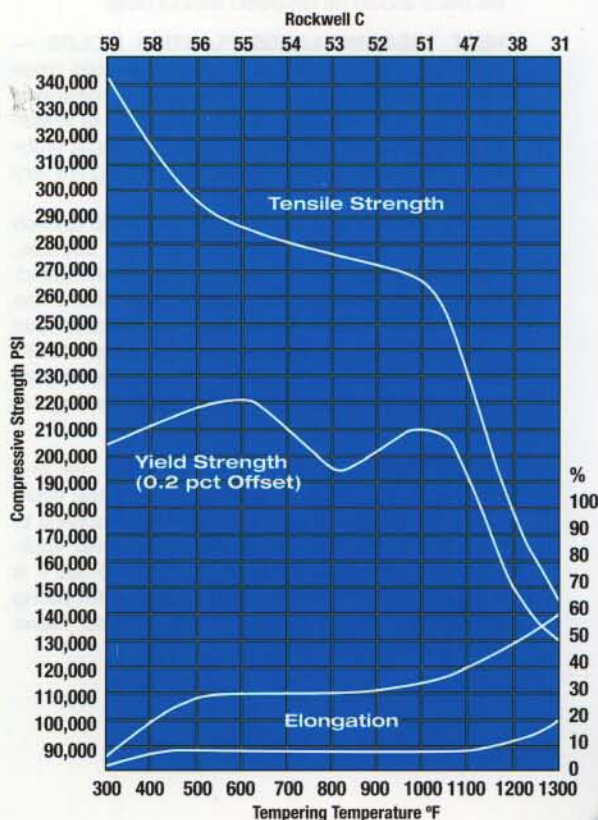


Figure 2

(cont'd on back)



TECHNICAL BULLETIN (cont'd)

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Typical Analysis:	Carbon 0.50	Chromium 3.25	Moly. 1.40	Mang. 0.70	Silicon 0.25
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GENERAL INSTRUCTIONS

HARDENING — S7 should be preheated at 1200 to 1300°F and raised to the hardening temperature of 1725°F, holding at temperature for a minimum of one hour for up to 1 in. thickness and one hour for each additional inch of thickness. Sections 2 1/2 in. or less should be quenched in still air. Upon reaching 150°F, the piece should be tempered without delay.

HEAT TREATING LARGE PLASTICS MOLDS —

When large plastics molds (over 6 in. in solid cross section) must be heat treated, it may not be possible to full oil quench. The potentially rapid buildup of stresses associated with liquid quenching may cause problems due to distortion or even initiate cracking in a very intricate design.

For these large mold sections, use an air quench and a 400°F temper. The high quenching stresses, resulting from the liquid quenching, will be eliminated. This procedure will usually produce a hardness in the range of HRC 50/54. Experience has indicated that when large molds are treated to a hardness of HRC 50/54, there is little or no difference in service life from that of molds treated to the higher hardness range of 56/58.

TEMPERING — S7 is normally tempered one and one-half to two hours for each inch of greatest thickness. The tempering temperature varies according to the intended use. For cold working and similar applications, a tempering temperature of 400 to 500°F is suggested. For hot-work applications, a tempering temperature of 900 to 1000°F is suggested. Never temper at less than 400°F.

When interrupted oil quench (to 1000°F) has been utilized in hardening, always temper immediately. Then, after cooling all the way down to room temperature, temper again to insure complete transformation.

Specimens 1 in. round by 3 in. long were air-hardened from 1725°F and tempered at various temperatures for two hours. Results are shown in Figure 3.

Tempering Temperature -°F	Rockwell C
As Quenched	60
300	59
400	58
500	56
600	55
700	54
800	53
900	52
1000	51
1100	47
1200	38
1300	31

Figure 3

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