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Hardenability Bands for Carbon and Alloy H Steels—SAE J1268 JUN81

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HARDENABILITY BANDS FOR CARBON AND ALLOY H STEELS—SAE J1268 JUN81

SAE Standard

Report of the Iron and Steel Technical Committee, approved June 1980, editorial change June 1981.

[The SAE Iron and Steel Technical Committee—Division 14 in cooperation with the Technical Committee on Alloy Steel Bars of the American Iron and Steel Institute devised hardenability bands for the constructional alloy steels. The initial SAE Standard for H Steels was published in 1948 and numerous revisions and additions have been issued in the intervening years. The SAE Iron and Steel Technical Committee established Division 8 in 1960 to devise hardenability bands for carbon steels. As a result of their efforts, the SAE Recommended Practice J776 came into being.

Since that time, Division 14 has been dissolved and Division 1 came into being and is responsible for Carbon and Alloy Steel Bars, and Division 8 is now responsible for Hardenability for Carbon and Alloy Steels. This trend has also been followed by the American Iron and Steel Institute which now has a technical committee for bars which covers both carbon and alloy steels.

Thus, with this revision, the SAE Recommended Practice J776 and the SAE Standard J407 will be retired and the carbon and alloy H-Band Steels will be combined in this new standard.]

Grades of Steel—H steels and their corresponding minimum and maximum hardenability limits are shown for all of the carbon and alloy steels for which there are sufficient hardenability data and for which grades the standard end quench test can be used. As information is accumulated on other grades, this standard will be revised to include such grades.

Chemical Composition Limits—To permit steel producers the necessary latitude to meet a common standard of hardenability limits, the chemical composition limits of these steels have been modified somewhat from those limits applicable to the same grades when specified by chemical composition only. These modifications permit adjustments in manufacturing ranges of chemistry to correct for individual plant melting characteristics which might otherwise influence the levels and widths of the bands. The modifications have not been great enough to influence the general characteristics of the original compositions of the series under consideration.

The chemical composition limits for electric furnace, open hearth, and BOF steels are outlined in Tables 1 and 2 and are subject to the permissible variations for product analysis outlined in Tables 1 and 3 of SAE J409.

Identification—As a means of identifying steels specified to hardenability band limits, the suffix letter *H* has been added to the conventional series number. In the Unified Numbering System, the *H* appears as a prefix. It is important that steel consumers use this letter in specification requirements, as there is no other means of determining when hardenability band limits apply. When the letter is used, all conditions pertaining to chemical composition limits, restrictions, testing technique, and so forth, as outlined herein apply.

Grain Size—The limits set forth for bands are intended to apply to steels exhibiting austenitic grain size 5 or finer (see SAE J418). In cases where coarse grain steel is desired, the hardenability limits shall be a matter of agreement between producer and consumer.

Use of Hardenability Limits—Band limits are shown graphically and are so depicted for convenience in estimating the hardness value obtainable at various locations on the end quench test bar and for quick comparisons of the various H grades. The values of *Diameter of Rounds with Same As-Quenched Hardness* shown above each H-band, are approximate and were selected from the ranges appearing in Fig. 7 of SAE J406. It should be noted that starting with this issue of J1268 that Standard H Steels are presented graphically in both U. S. customary units and also in metric (SI) units. The metric hardenability bands were prepared by careful conversion from existing bands in U. S. customary units.

In either case, for specification purposes, the tabulated values of Rockwell hardness (HRC) are used. Values below 20 HRC are not specified because such values are invalid.

Two points from the tabulated values are commonly designated according to one of methods A, B, C, D, or E, which are defined in the following paragraphs. Those various methods are illustrated graphically in Figs. 1 and 2.

A. The minimum and maximum hardness values at any desired distance. This method is illustrated in Figs. 1 and 2 as points A–A.

B. The minimum and maximum distance at which any desired hardness value occurs. This method is illustrated in Figs. 1 and 2 as points B–B. If the desired hardness does not fall on an exact sixteenth (or 1.5 mm) position, the minimum distance selected should be the nearest sixteenth (or 1.5 mm) position toward the quenched end and the maximum should be the nearest sixteenth (or 1.5 mm) position away from the quenched end.

C. Two maximum hardness values at two desired distances, illustrated in Figs. 1 and 2 as points C–C.

D. Two minimum hardness values at two desired distances, illustrated in Figs. 1 and 2 as points D–D.

E. Any minimum hardness plus any maximum hardness, illustrated in Figs. 1 and 2 as points E–E.

When hardenability is specified according to one of the aforementioned methods A to E, the balance of the hardenability band is not applicable.

In cases when it is considered desirable, the maximum and minimum limits at a distance of $\frac{1}{16}$ in (or 1.5 mm) from the quenched end can be specified in addition to the other two points as previously described in paragraphs A to E, inclusive.

When the full H-band is specified the hardenability can be reported by listing hardness values from the quenched end to the test specimen for each $\frac{1}{16}$ – $\frac{1}{4}$ in and $\frac{1}{4}$ in increments from there to $\frac{3}{16}$ in. In the case of the metric end quench test, hardness values would be reported starting at the quenched end, for each 1.5 mm out to 24 mm and in 6 mm increments from there to 51 mm. Except at the $\frac{1}{16}$ in or 1.5 mm position, it is customary to accept a tolerance of two points HRC for a $\frac{3}{16}$ in or 5 mm portion of the curve. This tolerance is necessary because curves of individual heats vary somewhat in shape from the standard band limits and thus deviate slightly at one or more positions in the full length of the curves.

For shallow hardening carbon H steels, distances from the quenched end may be reported by listing hardness values for each $\frac{1}{16}$ in or 1.5 mm or $\frac{1}{32}$ in or 0.75 mm (rather than full sixteenths or 1.5 mm only as with alloy steels).

The technique of testing for acceptance should be in accordance with SAE J406.

General—The hardenability limits set forth have been formulated to conform with steel production practices which represent, at this time, the narrowest limits that can be produced with regular quality steel. Those limits may be used in conjunction with higher quality classifications when desired. In either case, all conditions and quality features outlined in AISI Steel Products Manual Section—Alloy, Carbon and High Strength Low Alloy Steels: Semifinished for Forging, Hot Rolled Bars, Cold Finished Bars 1977 apply except for the conditions concerning chemical compositions, size, and shape of products which are modified herein.

TABLE 1—CARBON AND CARBON BORON H STEELS COMPOSITION

UNS No.	SAE or AISI Steel No.	Chemical Composition, %				
		C	Mn	Si	P, max ^b	S, max ^b
H10380	1038H	0.34/0.43	0.50/1.00	0.15/0.35	0.040	0.050
H10450	1045H	0.42/0.51	0.50/1.00	0.15/0.35	0.040	0.050
H15220	1522H	0.17/0.25	1.00/1.50	0.15/0.35	0.040	0.050
H15240	1524H	0.18/0.26	1.25/1.75	0.15/0.35	0.040	0.050
H15260	1526H	0.21/0.30	1.00/1.50	0.15/0.35	0.040	0.050
H15410	1541H	0.35/0.45	1.25/1.75	0.15/0.35	0.040	0.050
H15211	15B21H ^a	0.17/0.24	0.70/1.20	0.15/0.35	0.040	0.050
H15351	15B35H ^a	0.31/0.39	0.70/1.20	0.15/0.35	0.040	0.050
H15371	15B37H ^a	0.30/0.39	1.00/1.50	0.15/0.35	0.040	0.050
H15411	15B41H ^a	0.35/0.45	1.25/1.75	0.15/0.35	0.040	0.050
H15481	15B48H ^a	0.43/0.53	1.00/1.50	0.15/0.35	0.040	0.050
H15621	15B62H ^a	0.54/0.67	1.00/1.50	0.40/0.60	0.040	0.050

^a These steels contain 0.0005–0.003% boron.

^b If electric furnace practice is specified or required, the limits for phosphorus and sulfur are 0.025%, respectively and the prefix E is added to the SAE or AISI number.

TABLE 2^a—STANDARD ALLOY H STEEL COMPOSITIONS

ed.

UNS No.	SAE or AISI Steel No.	Chemical Composition, % ^{b,c}						
		C	Mn	Si	Ni	Cr	Mo	V
H13300	1330H	0.27/0.33	1.45/2.05	0.15/0.35	—	—	—	—
H13350	1335H	0.32/0.38	1.45/2.05	0.15/0.35	—	—	—	—
H13400	1340H	0.37/0.44	1.45/2.05	0.15/0.35	—	—	—	—
H13450	1345H	0.42/0.49	1.45/2.05	0.15/0.35	—	—	—	—
H40270	4027H	0.24/0.30	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H40280 ^d	4028H ^d	0.24/0.30	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H40320	4032H	0.29/0.35	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H40370	4037H	0.34/0.41	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H40420	4042H	0.39/0.46	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H40470	4047H	0.44/0.51	0.60/1.00	0.15/0.35	—	—	0.20/0.30	—
H41180	4118H	0.17/0.23	0.60/1.00	0.15/0.35	—	0.30/0.70	0.08/0.15	—
H41300	4130H	0.27/0.33	0.30/0.70	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41350	4135H	0.32/0.38	0.60/1.00	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41370	4137H	0.34/0.41	0.60/1.00	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41400	4140H	0.37/0.44	0.65/1.10	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41420	4142H	0.39/0.46	0.65/1.10	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41450	4145H	0.42/0.49	0.65/1.10	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41470	4147H	0.44/0.51	0.65/1.10	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41500	4150H	0.47/0.54	0.65/1.10	0.15/0.35	—	0.75/1.20	0.15/0.25	—
H41610	4161H	0.55/0.65	0.65/1.10	0.15/0.35	—	0.65/0.95	0.25/0.35	—
H43200	4320H	0.17/0.23	0.40/0.70	0.15/0.35	1.55/2.00	0.35/0.65	0.20/0.30	—
H43400	4340H	0.27/0.44	0.55/0.90	0.15/0.35	1.55/2.00	0.65/0.95	0.20/0.30	—
H43406 ^f	E4340H ^f	0.37/0.44	0.60/0.95	0.15/0.35	1.55/2.00	0.65/0.95	0.20/0.30	—
H46200	4620H	0.17/0.23	0.35/0.75	0.15/0.35	1.55/2.00	—	0.20/0.30	—
H47180	4718H	0.15/0.21	0.60/0.95	0.15/0.35	0.85/1.25	0.30/0.60	0.30/0.40	—
H47200	4720H	0.17/0.23	0.45/0.75	0.15/0.35	0.85/1.25	0.30/0.60	0.15/0.25	—
H48150	4815H	0.12/0.18	0.30/0.70	0.15/0.35	3.20/3.80	—	0.20/0.30	—
H48170	4817H	0.14/0.20	0.30/0.70	0.15/0.35	3.20/3.80	—	0.20/0.30	—
H48200	4820H	0.17/0.23	0.40/0.80	0.15/0.35	3.20/3.80	—	0.20/0.30	—
H50401 ^e	50B40H ^e	0.37/0.44	0.65/1.10	0.15/0.35	—	0.30/0.70	—	—
H50441 ^e	50B44H ^e	0.42/0.49	0.65/1.10	0.15/0.35	—	0.30/0.70	—	—
H50460	5046H	0.43/0.50	0.65/1.10	0.15/0.35	—	0.13/0.43	—	—
H50461 ^e	50B46H ^e	0.43/0.50	0.65/1.10	0.15/0.35	—	0.13/0.43	—	—
H50501 ^e	50B50H ^e	0.47/0.54	0.65/1.10	0.15/0.35	—	0.30/0.70	—	—
H50601 ^e	50B60H ^e	0.55/0.65	0.65/1.10	0.15/0.35	—	0.30/0.70	—	—
H51200	5120H	0.17/0.23	0.60/1.00	0.15/0.35	—	0.60/1.00	—	—
H51300	5130H	0.27/0.33	0.60/1.10	0.15/0.35	—	0.75/1.20	—	—
H51320	5132H	0.29/0.35	0.50/0.90	0.15/0.35	—	0.65/1.10	—	—
H51350	5135H	0.32/0.38	0.50/0.90	0.15/0.35	—	0.70/1.15	—	—
H51400	5140H	0.37/0.44	0.60/1.00	0.15/0.35	—	0.60/1.00	—	—
H51470	5147H	0.45/0.52	0.60/1.05	0.15/0.35	—	0.80/1.25	—	—
H51500	5150H	0.47/0.54	0.60/1.00	0.15/0.35	—	0.60/1.00	—	—
H51550	5155H	0.50/0.60	0.60/1.00	0.15/0.35	—	0.60/1.00	—	—
H51600	5160H	0.55/0.65	0.65/1.10	0.15/0.35	—	0.60/1.00	—	—
H51601 ^e	51B60H ^e	0.55/0.65	0.65/1.10	0.15/0.35	—	0.60/1.00	—	—
H61180	6118H	0.15/0.21	0.40/0.80	0.15/0.35	—	0.40/0.80	—	0.10/0.15
H61500	6150H	0.47/0.54	0.60/1.00	0.15/0.35	—	0.75/1.20	—	0.15
H81451 ^e	81B45H ^e	0.42/0.49	0.70/1.05	0.15/0.35	0.15/0.45	0.30/0.60	0.08/0.15	—
H86170	8617H	0.14/0.20	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86200	8620H	0.17/0.23	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86220	8622H	0.19/0.25	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86250	8625H	0.22/0.28	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86270	8627H	0.24/0.30	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86300	8630H	0.27/0.33	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86301 ^e	86B30H ^e	0.27/0.33	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86370	8637H	0.34/0.41	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86400	8640H	0.37/0.44	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86420	8642H	0.39/0.46	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86450	8645H	0.42/0.49	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86451 ^e	86B45H ^e	0.42/0.49	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86500	8650H	0.47/0.54	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86550	8655H	0.50/0.60	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H86600	8660H	0.55/0.65	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.15/0.25	—
H87200	8720H	0.17/0.23	0.60/0.95	0.15/0.35	0.35/0.75	0.35/0.65	0.20/0.30	—
H87400	8740H	0.37/0.44	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.20/0.30	—
H88220	8822H	0.19/0.25	0.70/1.05	0.15/0.35	0.35/0.75	0.35/0.65	0.30/0.40	—
H92600	9260H	0.55/0.65	0.65/1.10	1.70/2.20	—	—	—	—
H93100 ^f	9310H ^f	0.07/0.13	0.40/0.70	0.15/0.35	2.95/3.55	1.00/1.45	0.08/0.15	—
H94151 ^e	94B15H ^e	0.12/0.18	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15	—
H94171 ^e	94B17H ^e	0.14/0.20	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15	—
H94301 ^e	94B30H ^e	0.27/0.33	0.70/1.05	0.15/0.35	0.25/0.65	0.25/0.55	0.08/0.15	—

^a The ranges and limits on this table apply only to material not exceeding 200 in² (0.13 m²) in cross sectional area, 18 in (460 mm) in width, or 10 000 lb (4.5 tonne) per piece in weight. Ranges and limits are subject to the permissible variations for product analysis shown in Table 4 of SAE J409.

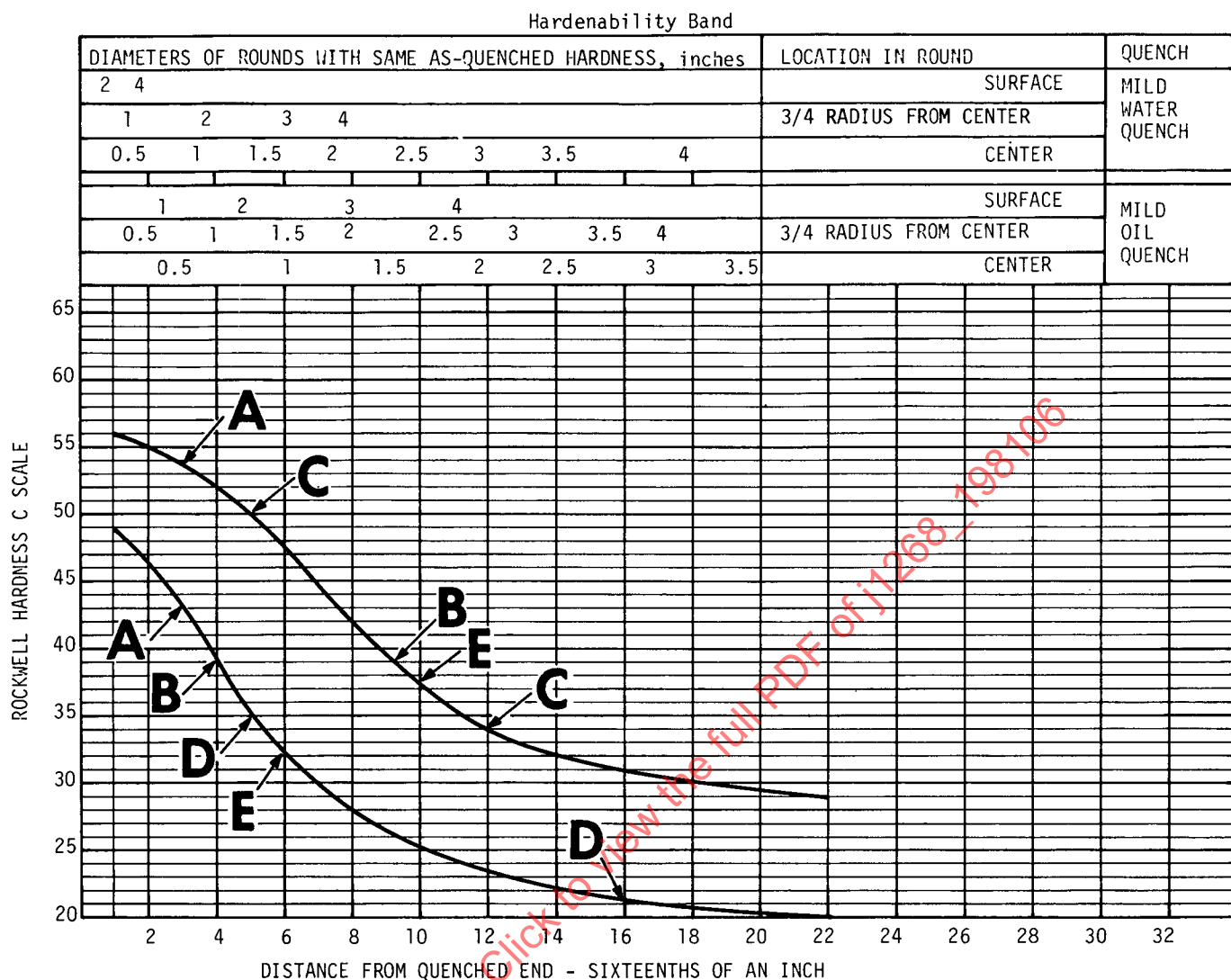
^b Small quantities of certain elements may be found in alloy steel which are not specified or required. These elements are to be considered as incidental and acceptable to the following maximum amounts: copper to 0.35%, nickel to 0.25%, chromium to 0.20%, and molybdenum to 0.06%.

^c For open hearth and basic oxygen steels maximum sulfur content is to be 0.040% and maximum phosphorus content is to be 0.035%. Maximum phosphorus and sulfur in basic electric furnace steels are to be 0.025% each.

^d Sulfur content range is 0.035/0.050%.

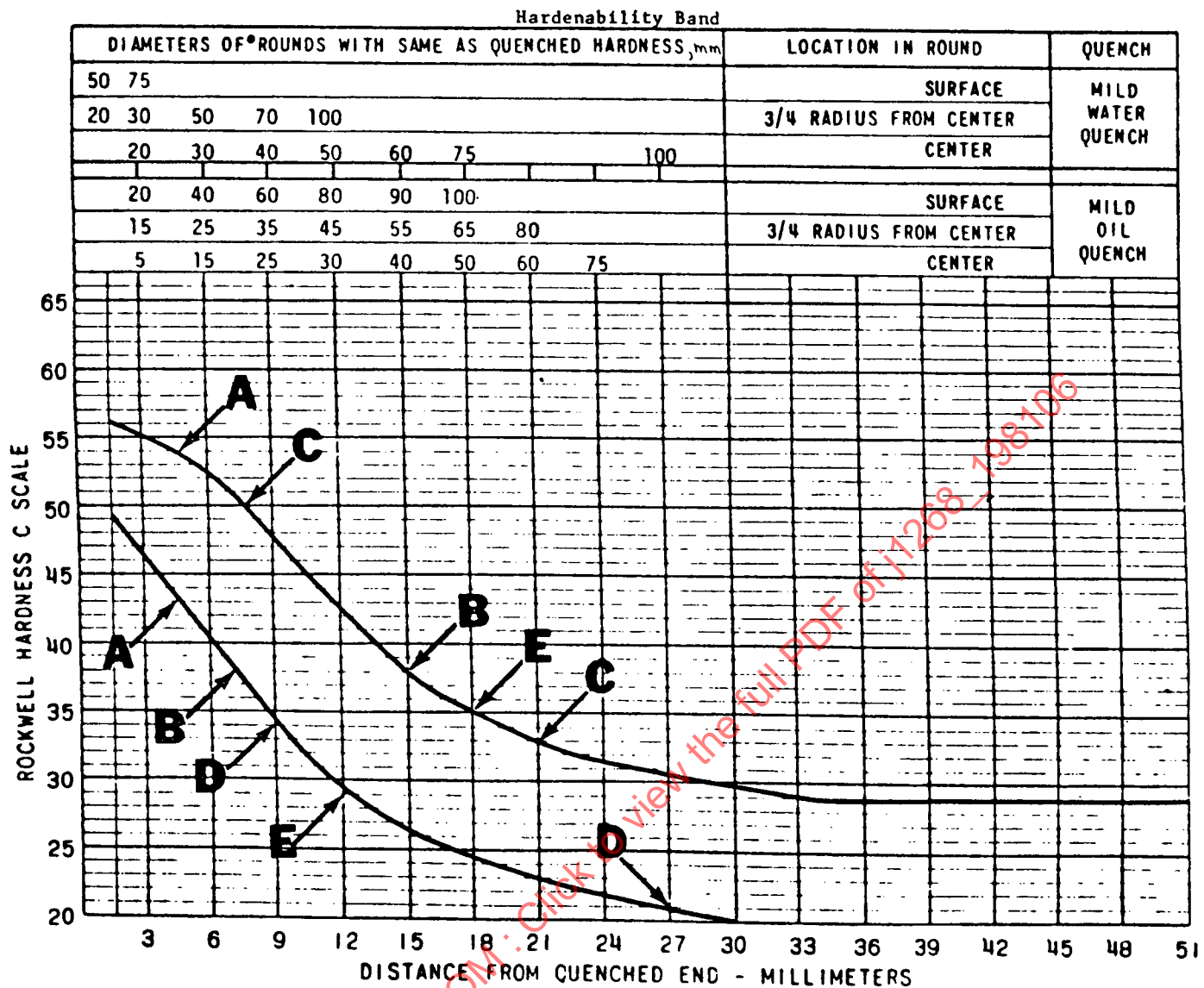
^e These steels contain 0.0005–0.003% boron.

^f Electric furnace steel.



Method	Example
A Minimum and maximum hardness values at a designated distance	A-A 43 to 54 HRC at J 3/16
B A hardness value at minimum and maximum distances	B-B 39 HRC at J 4/16 min 39 HRC at J 9/16 max
C Two maximum hardness values at two designated distances	C-C 50 HRC at J 5/16 max 34 HRC at J 12/16 max
D Two minimum hardness values at two distances	D-D 35 HRC at J 5/16 min 21 HRC at J 16/16 min
E Any minimum hardness plus any maximum hardness	E-E 32 HRC at J 6/16 min 37 HRC at J 10/16 max

FIG. 1—EXAMPLES ILLUSTRATING ALTERNATE METHODS OF SPECIFYING HARDENABILITY REQUIREMENTS IN U. S. CUSTOMARY UNITS

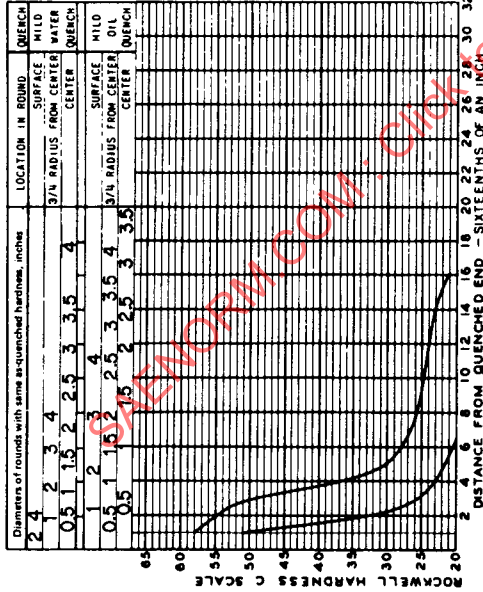


Method	Example
A Minimum and maximum hardness values at a designated distance	A-A 43 to 54 HRC at J 4.5 mm
B A hardness value at minimum and maximum distance	B-B 38 HRC at J 7.5 mm min 38 HRC at J 15 mm max
C Two maximum hardness values at two designated distances	C-C 50 HRC at J 7.5 mm max 33 HRC at J 21 mm max
D Two minimum hardness values at two distances	D-D 34 HRC at J 9 mm min 21 HRC at J 27 mm min
E Any minimum hardness plus any maximum hardness	E-E 29 HRC at J 12 mm min 35 HRC at J 18 mm max

FIG. 2—EXAMPLES ILLUSTRATING ALTERNATE METHODS OF SPECIFYING HARDENABILITY REQUIREMENTS IN METRIC (SI) UNITS

UNS H10380 Hardenability Band SAE/AISI 1038H

C	Min	Si	Ni	Cr	Mo
0.14/0.43	0.50/1.00	0.15/0.35			

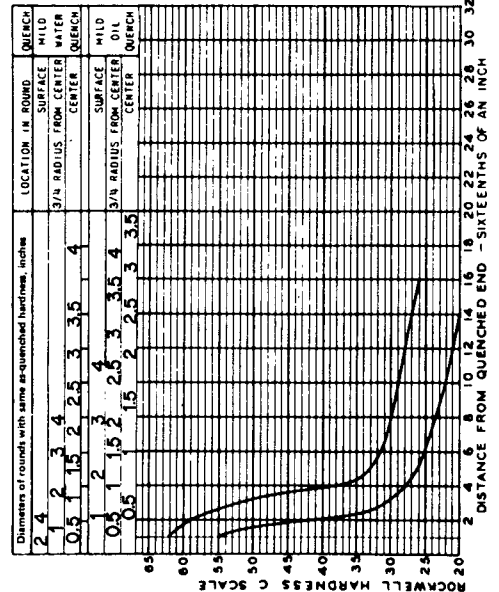


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		H	MIN.
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	1	50
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	2	47
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3	44
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	4	41
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	5	38
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	6	35
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	7	32
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	8	29
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	9	26
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	10	23
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	11	20
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	12	17
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	13	14
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	14	11
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	15	8
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	16	5

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1700 OF
*AUSTERITIZE 1700 OF
*for forged or rolled specimens only.

UNS H10450 Hardenability Band SAE/AISI 1045H

C	Min	Si	Ni	Cr	Mo
0.42/0.51	0.50/1.00	0.15/0.35			

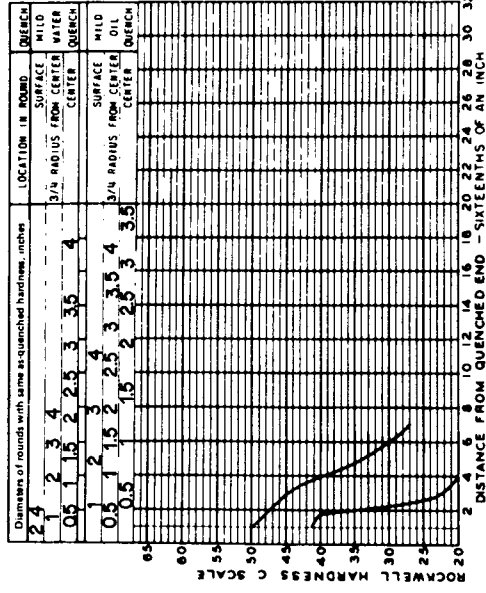


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		H	MIN.
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	1	51
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	2	48
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3	45
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	4	42
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	5	39
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	6	36
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	7	33
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	8	30
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	9	27
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	10	24
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	11	21
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	12	18
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	13	15
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	14	12
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	15	9
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	16	6

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1650 OF
*AUSTERITIZE 1600 OF
*for forged or rolled specimens only.

UNS H15220 Hardenability Band SAE/AISI 1522H

C	Min	Si	Ni	Cr	Mo
0.17/0.25	1.00/1.50	0.15/0.35			

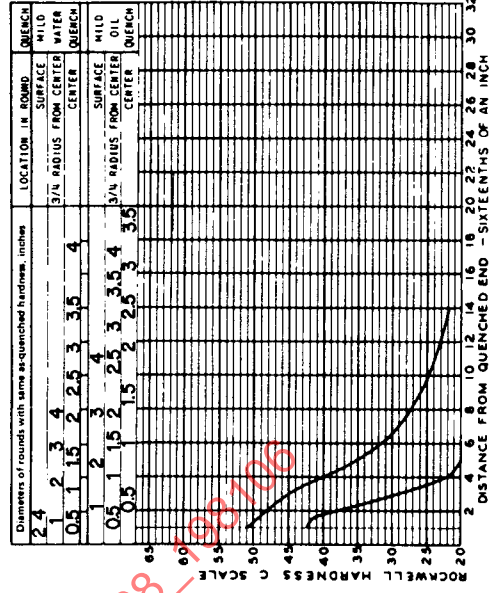


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		H	MIN.
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	1	50
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	2	47
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3	44
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	4	41
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	5	38
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	6	35
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	7	32
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	8	29
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	9	26
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	10	23
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	11	20
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	12	17
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	13	14
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	14	11
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	15	8
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	16	5

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1700 OF
*AUSTERITIZE 1700 OF
*for forged or rolled specimens only.

UNS H15240 Hardenability Band SAE/AISI 1524H

C	Min	Si	Ni	Cr	Mo
0.18/0.26	1.25/1.75	0.15/0.35			

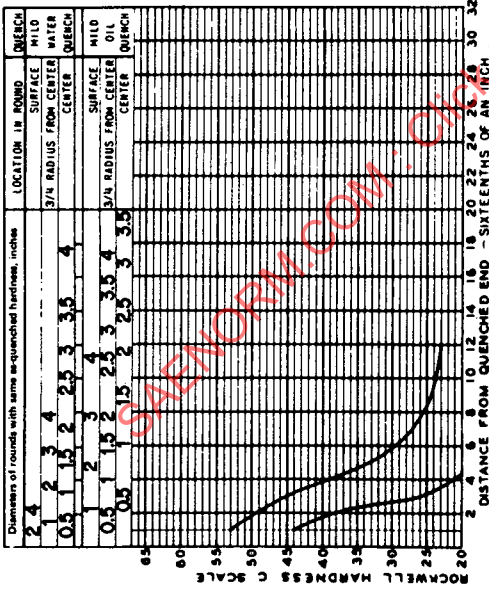


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		H	MIN.
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	1	51
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	2	48
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3	45
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	4	42
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	5	39
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	6	36
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	7	33
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	8	30
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	9	27
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	10	24
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	11	21
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	12	18
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	13	15
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	14	12
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	15	9
1/2" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	16	6

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1650 OF
*AUSTERITIZE 1600 OF
*for forged or rolled specimens only.

UNS H15260 Hardenability Band SAE/AISI 1526H

C	Min	Si	Mn	Cr	Mo
0.31/0.30	1.00/1.50	0.15/0.31			



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCH	MIN.	MAX.	WIR.
1	46	51	51
1.5	46	51	51
2	47	50	50
2.5	47	50	50
3	46	50	50
3.5	45	50	50
4	44	50	50
4.5	42	50	50
5	40	50	50
5.5	38	50	50
6	36	50	50
6.5	32	50	50
7	27	50	50
7.5	22	50	50
8	20	50	50
9	-	50	50
10	-	50	50
12	-	50	50
14	-	50	50
16	-	50	50

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
"NORMALIZE 1700 OF
AUSTENITIZE 1700 OF
For forged or rolled specimens only."

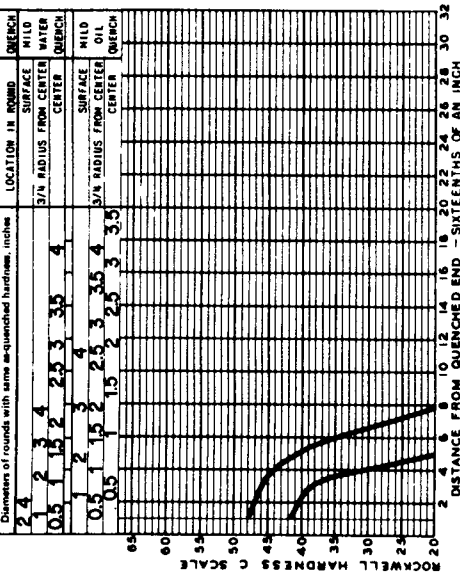
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCH	MIN.	MAX.	WIR.
1	53	58	58
1.5	50	58	58
2	49	58	58
2.5	47	58	58
3	46	58	58
3.5	42	58	58
4	39	58	58
4.5	37	58	58
5	32	58	58
5.5	31	58	58
6	30	58	58
6.5	28	58	58
7	27	58	58
7.5	26	58	58
8	26	58	58
9	24	58	58
10	24	58	58
12	23	58	58
14	-	58	58
16	-	58	58

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
"NORMALIZE 1550 OF
AUSTENITIZE 1600 OF
For forged or rolled specimens only."

UNS H15211 Hardenability Band SAE/AISI 15B21H

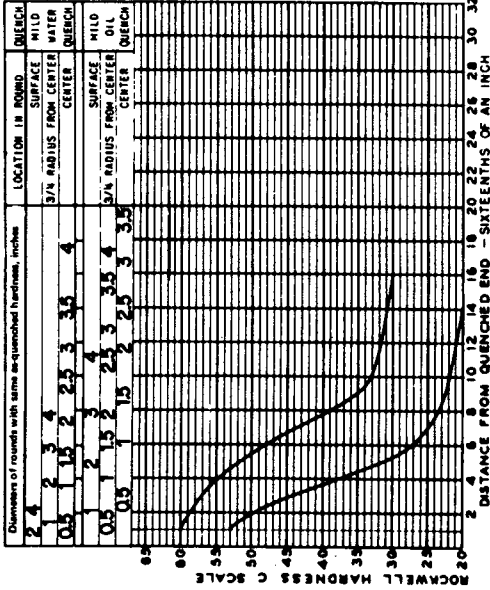
C	Min	Si	Mn	Cr
0.17/0.24	0.70/1.20	0.15/0.35		

*Can be expected to be a minimum of 0.0005.



UNS H15410 Hardenability Band SAE/AISI 1541H

C	Min	Si	Mn	Cr	Mo
0.35/0.45	1.25/1.75	0.15/0.35			



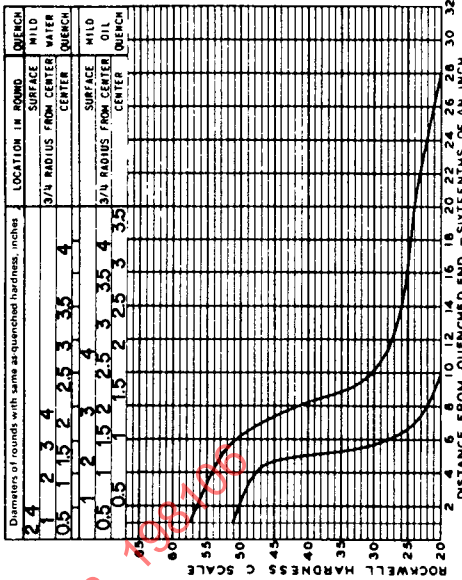
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCH	MIN.	MAX.	WIR.
1	60	63	63
1.5	58	63	63
2	58	63	63
2.5	58	63	63
3	57	63	63
3.5	56	63	63
4	55	63	63
4.5	53	63	63
5	52	63	63
5.5	50	63	63
6	48	63	63
6.5	46	63	63
7	44	63	63
7.5	41	63	63
8	38	63	63
9	35	63	63
10	33	63	63
12	32	63	63
14	31	63	63
16	30	63	63

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
"NORMALIZE 1600 OF
AUSTENITIZE 1550 OF
For forged or rolled specimens only."

UNS H15351 Hardenability Band SAE/AISI 15B35H

C	Min	Si	Mn	Cr	Mo
0.31/0.39	0.70/1.20	0.15/0.35			

*Contains 0.0005-0.003% boron.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCH	MIN.	MAX.	WIR.
1	58	61	61
1.5	56	61	61
2	55	61	61
2.5	54	61	61
3	53	61	61
3.5	51	61	61
4	50	61	61
4.5	48	61	61
5	46	61	61
5.5	44	61	61
6	42	61	61
6.5	40	61	61
7	38	61	61
7.5	36	61	61
8	34	61	61
9	32	61	61
10	30	61	61
12	27	61	61
14	25	61	61
16	23	61	61
18	21	61	61
20	19	61	61
22	17	61	61
24	15	61	61
26	13	61	61
28	11	61	61
30	9	61	61
32	7	61	61

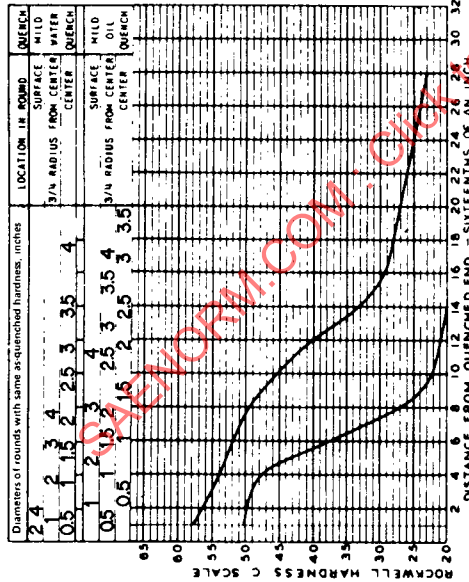
HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
"NORMALIZE 1600 OF
AUSTENITIZE 1550 OF
For forged or rolled specimens only."

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" BALLS DIA. IN INCH	H	MIN.	MAX.
1	14	54	50
2	16	56	52
3	18	58	54
4	20	60	56
5	22	62	58
6	24	64	60
7	26	66	62
8	28	68	64
9	30	70	66
10	32	72	68
11	34	74	70
12	36	76	72
13	38	78	74
14	40	80	76
15	42	82	78
16	44	84	80
18	48	88	84
20	52	92	88
22	56	96	92
24	60	100	96
26	64	104	100
28	68	108	104
30	72	112	108
32	76	116	112

UNS H15371 Hardenability Band SAE/AISI 15B37H

C	Mn	Si	Ni	Cr	Mo
0.30/0.38	1.00/1.50	0.15/0.35			

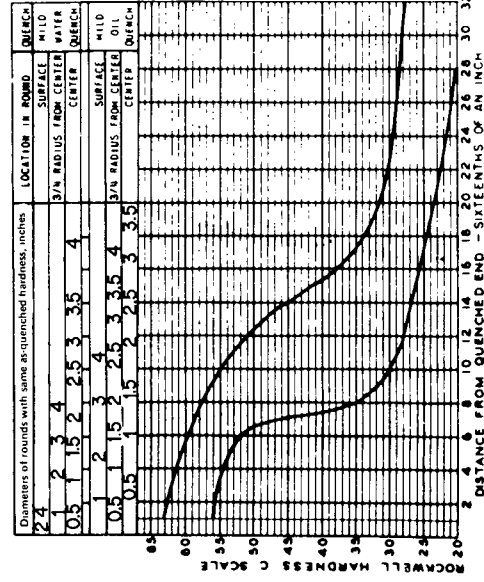
*Contains 0.0005-0.003% boron.



UNS H15481 Hardenability Band SAE/AISI 15B48H

C	Mn	Si	Ni	Cr	Mo
0.43/0.53	1.00/1.50	0.15/0.35			

*Contains 0.0005-0.003% boron.

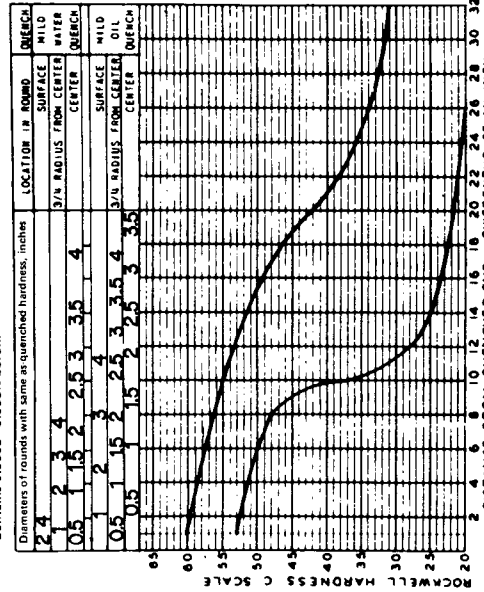


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" BALLS DIA. IN INCH	H	MIN.	MAX.
1	14	54	50
2	16	56	52
3	18	58	54
4	20	60	56
5	22	62	58
6	24	64	60
7	26	66	62
8	28	68	64
9	30	70	66
10	32	72	68
11	34	74	70
12	36	76	72
13	38	78	74
14	40	80	76
15	42	82	78
16	44	84	80
18	48	88	84
20	52	92	88
22	56	96	92
24	60	100	96
26	64	104	100
28	68	108	104
30	72	112	108
32	76	116	112

UNS H15411 Hardenability Band SAE/AISI 15B41H

C	Mn	Si	Ni	Cr	Mo
0.35/0.45	1.25/1.75	0.15/0.35			

*Contains 0.0005-0.003% boron.

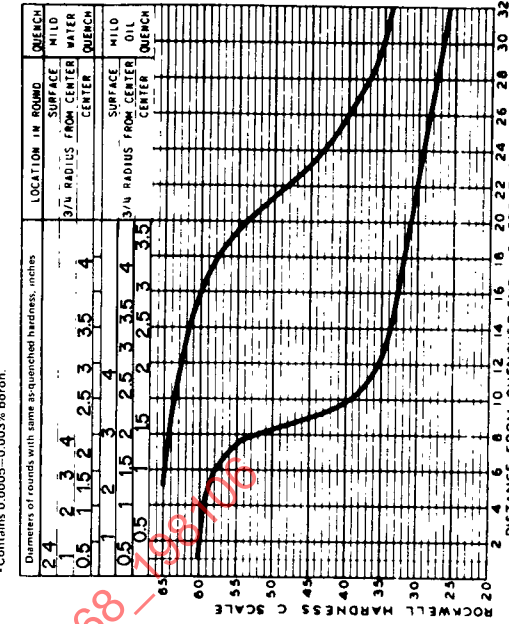


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" BALLS DIA. IN INCH	H	MIN.	MAX.
1	14	54	50
2	16	56	52
3	18	58	54
4	20	60	56
5	22	62	58
6	24	64	60
7	26	66	62
8	28	68	64
9	30	70	66
10	32	72	68
11	34	74	70
12	36	76	72
13	38	78	74
14	40	80	76
15	42	82	78
16	44	84	80
18	48	88	84
20	52	92	88
22	56	96	92
24	60	100	96
26	64	104	100
28	68	108	104
30	72	112	108
32	76	116	112

UNS H15621 Hardenability Band SAE/AISI 15B62H

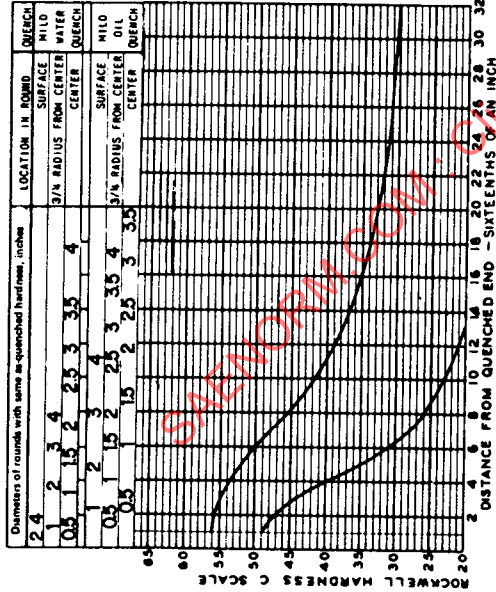
C	Mn	Si	Ni	Cr	Mo
0.54/0.67	1.00/1.50	0.40/0.60			

*Contains 0.0005-0.003% boron.



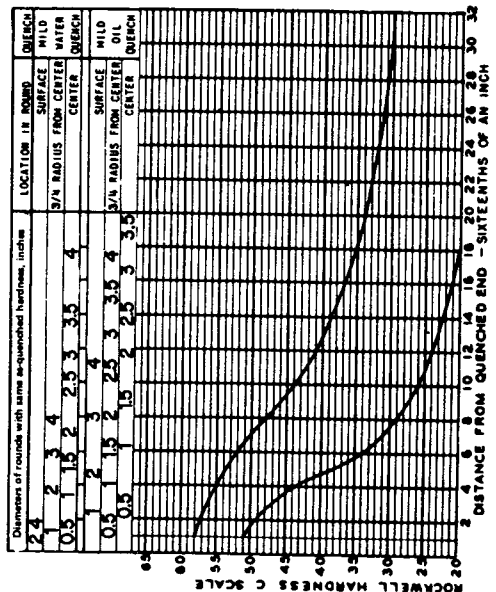
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF 1/2" INCH	1330 H		
	MAX	MIN	HIR
1	56	46	46
2	56	47	47
3	55	48	48
4	53	49	49
5	52	50	50
6	50	51	51
7	48	50	50
8	45	50	50
9	43	49	49
10	42	48	48
11	40	47	47
12	38	46	46
13	36	45	45
14	37	44	44
15	36	43	43
16	35	42	42
17	34	41	41
18	33	40	40
19	32	39	39
20	31	38	38
21	31	37	37
22	30	36	36
23	30	35	35
24	29	34	34
25	28	33	33
26	27	32	32
27	26	31	31
28	25	30	30
29	24	29	29
30	23	28	28
31	22	27	27
32	21	26	26
33	20	25	25
34	19	24	24
35	18	23	23
36	17	22	22
37	16	21	21
38	15	20	20
39	14	19	19
40	13	18	18
41	12	17	17
42	11	16	16
43	10	15	15
44	9	14	14
45	8	13	13
46	7	12	12
47	6	11	11
48	5	10	10
49	4	9	9
50	3	8	8
51	2	7	7
52	1	6	6
53	0	5	5
54	0	4	4
55	0	3	3
56	0	2	2
57	0	1	1
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0
62	0	0	0
63	0	0	0
64	0	0	0
65	0	0	0
66	0	0	0
67	0	0	0
68	0	0	0
69	0	0	0
70	0	0	0
71	0	0	0
72	0	0	0
73	0	0	0
74	0	0	0
75	0	0	0
76	0	0	0
77	0	0	0
78	0	0	0
79	0	0	0
80	0	0	0
81	0	0	0
82	0	0	0
83	0	0	0
84	0	0	0
85	0	0	0
86	0	0	0
87	0	0	0
88	0	0	0
89	0	0	0
90	0	0	0
91	0	0	0
92	0	0	0
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	0	0	0
100	0	0	0

UNS H13300 Hardenability Band SAE/AISI 1330H			
C	Min	Si	
0.37	1.45	0.15/0.35	
0.44	2.05		



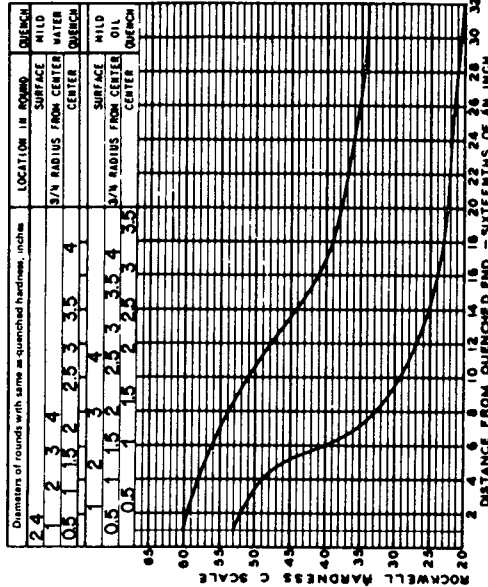
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF 1/2" INCH	1335 H		
	MAX	MIN	HIR
1	58	48	48
2	57	49	49
3	56	50	50
4	55	51	51
5	54	52	52
6	53	53	53
7	52	54	54
8	51	55	55
9	50	56	56
10	49	57	57
11	48	58	58
12	47	59	59
13	46	60	60
14	45	61	61
15	44	62	62
16	43	63	63
17	42	64	64
18	41	65	65
19	40	66	66
20	39	67	67
21	38	68	68
22	37	69	69
23	36	70	70
24	35	71	71
25	34	72	72
26	33	73	73
27	32	74	74
28	31	75	75
29	30	76	76
30	29	77	77
31	28	78	78
32	27	79	79
33	26	80	80
34	25	81	81
35	24	82	82
36	23	83	83
37	22	84	84
38	21	85	85
39	20	86	86
40	19	87	87
41	18	88	88
42	17	89	89
43	16	90	90
44	15	91	91
45	14	92	92
46	13	93	93
47	12	94	94
48	11	95	95
49	10	96	96
50	9	97	97
51	8	98	98
52	7	99	99
53	6	100	100
54	5	101	101
55	4	102	102
56	3	103	103
57	2	104	104
58	1	105	105
59	0	106	106
60	0	107	107
61	0	108	108
62	0	109	109
63	0	110	110
64	0	111	111
65	0	112	112
66	0	113	113
67	0	114	114
68	0	115	115
69	0	116	116
70	0	117	117
71	0	118	118
72	0	119	119
73	0	120	120
74	0	121	121
75	0	122	122
76	0	123	123
77	0	124	124
78	0	125	125
79	0	126	126
80	0	127	127
81	0	128	128
82	0	129	129
83	0	130	130
84	0	131	131
85	0	132	132
86	0	133	133
87	0	134	134
88	0	135	135
89	0	136	136
90	0	137	137
91	0	138	138
92	0	139	139
93	0	140	140
94	0	141	141
95	0	142	142
96	0	143	143
97	0	144	144
98	0	145	145
99	0	146	146
100	0	147	147

UNS H13350 Hardenability Band SAE/AISI 1335H			
C	Min	Si	
0.37	1.45	0.15/0.35	
0.44	2.05		



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF 1/2" INCH	1340 H		
	MAX	MIN	HIR
1	60	50	50
2	60	51	51
3	59	52	52
4	58	53	53
5	57	54	54
6	56	55	55
7	55	56	56
8	54	57	57
9	53	58	58
10	52	59	59
11	51	60	60
12	50	61	61
13	49	62	62
14	48	63	63
15	47	64	64
16	46	65	65
17	45	66	66
18	44	67	67
19	43	68	68
20	42	69	69
21	41	70	70
22	40	71	71
23	39	72	72
24	38	73	73
25	37	74	74
26	36	75	75
27	35	76	76
28	34	77	77
29	33	78	78
30	32	79	79
31	31	80	80
32	30	81	81
33	29	82	82
34	28	83	83
35	27	84	84
36	26	85	85
37	25	86	86
38	24	87	87
39	23	88	88
40	22	89	89
41	21	90	90
42	20	91	91
43	19	92	92
44	18	93	93
45	17	94	94
46	16	95	95
47	15	96	96
48	14	97	97
49	13	98	98
50	12	99	99
51	11	100	100
52	10	101	101
53	9	102	102
54	8	103	103
55	7	104	104
56	6	105	105
57	5	106	106
58	4	107	107
59	3	108	108
60	2	109	109
61	1	110	110
62	0	111	111
63	0	112	112
64	0	113	113
65	0	114	114
66	0	115	115
67	0	116	116
68	0	117	117
69	0	118	118
70	0	119	119
71	0	120	120
72	0	121	121
73	0	122	122
74	0	123	123
75	0	124	124
76	0	125	125
77	0	126	126
78	0	127	127
79	0	128	128
80	0	129	129
81	0	130	130
82	0	131	131
83	0	132	132
84	0	133	133
85	0	134	134
86	0	135	135
87	0	136	136
88	0	137	137
89	0	138	138
90	0	139	139
91	0	140	140
92	0	141	141
93	0	142	142
94	0	143	143
95	0	144	144
96	0	145	145
97	0	146	146
98	0	147	147
99	0	148	148
100	0	149	149

UNS H13400 Hardenability Band SAE/AISI 1340H			
C	Min	Si	
0.37	1.45	0.15/0.35	
0.44	2.05		

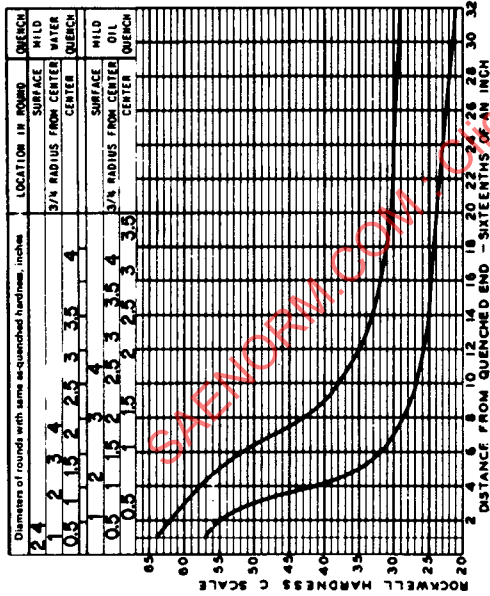


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF 1/2" INCH	1345 H		
	MAX.	MIN.	HIR.
1	63	56	
2	62	56	
3	62	55	
4	61	54	
5	61	53	
6	60	52	
7	60	51	
8	59	50	
9	58	50	
10	57	50	
11	56	50	
12	55	50	
13	54	49	
14	53	49	
15	52	48	
16	51	47	
17	50	46	
18	49	45	
19	48	45	
20	48	45	
21	47	44	
22	47	44	
23	46	43	
24	46	42	
25	45	41	
26	45	40	
27	45	40	
28	45	40	
29	45	40	
30	45	40	
31	45	40	
32	45	40	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE	
*NORMALIZE	of
AUSTENITISE	
For forged or rolled specimens only.	

UNS H40470 Hardenability Band SAE/AISI 4047H

C	Min	Si	Gr	Ms
.44	.40	0.15/0.35	.20	.30



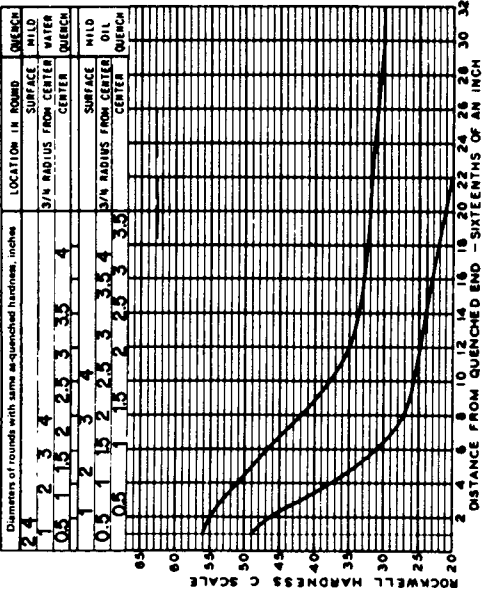
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCHES	MIN	MAX	HIT
1	64	57	
2	62	55	
3	60	50	
4	58	42	
5	55	35	
6	52	32	
7	47	30	
8	43	28	
9	40	26	
10	38	27	
11	37	26	
12	35	25	
13	34	25	
14	33	25	
15	33	25	
16	32	25	
18	31	24	
20	30	24	
22	30	23	
24	30	22	
26	30	22	
28	30	21	
30	30	21	
32	29	21	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 1550 OF
 AUSTENITIZE 1700 OF

*For forged or rolled specimens only.

UNS H41300 Hardenability Band SAE/AISI 4130H

C	Min	Si	Gr	Ms
.37	.30	0.15/0.35	.75	.15



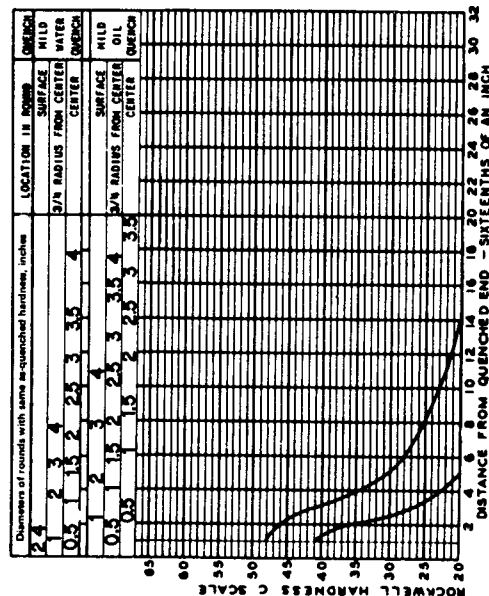
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCHES	MIN	MAX	HIT
1	56	40	
2	55	40	
3	53	42	
4	51	38	
5	48	34	
6	47	31	
7	44	29	
8	42	27	
9	40	26	
10	38	26	
11	36	25	
12	35	25	
13	34	24	
14	34	24	
15	33	23	
16	33	23	
18	32	22	
20	32	21	
22	32	20	
24	31	-	
26	31	-	
28	30	-	
30	30	-	
32	29	-	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 1550 OF
 AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

UNS H41180 Hardenability Band SAE/AISI 4118H

C	Min	Si	Gr	Ms
.17	.40	0.15/0.35	.30	.15



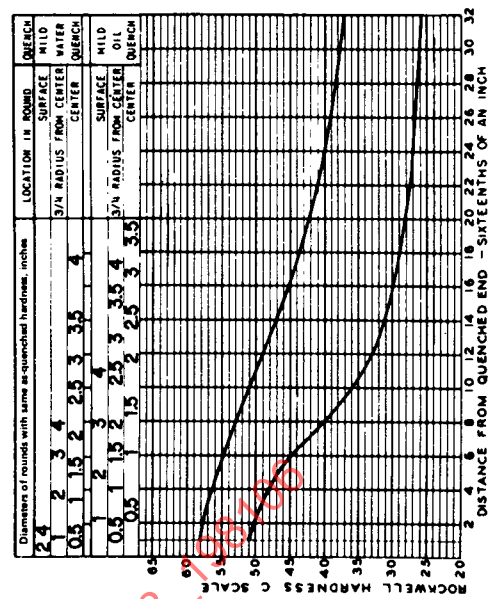
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCHES	MIN	MAX	HIT
1	46	41	
2	46	38	
3	46	37	
4	46	36	
5	41	30	
6	38	27	
7	37	26	
8	36	25	
9	34	24	
10	33	23	
11	32	22	
12	31	21	
14	31	21	
16	30	20	
18	-	-	
20	-	-	
22	-	-	
24	-	-	
26	-	-	
28	-	-	
30	-	-	
32	-	-	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 1700 OF
 AUSTENITIZE 1700 OF

*For forged or rolled specimens only.

UNS H41350 Hardenability Band SAE/AISI 4135H

C	Min	Si	Gr	Ms
.37	.40	0.15/0.35	.75	.15



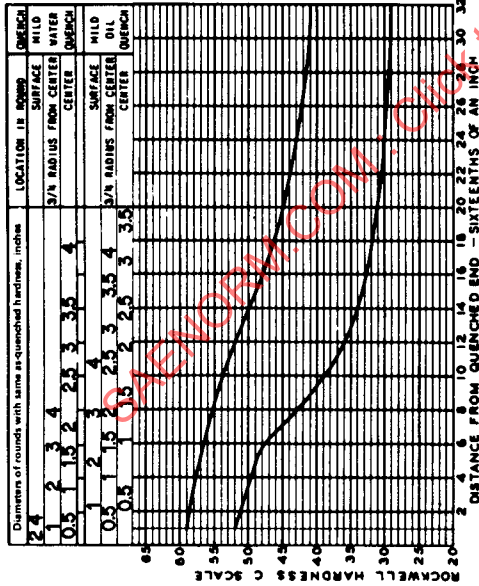
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"A" DISTANCE BETWEEN SPECIMENS OF INCHES	MIN	MAX	HIT
1	54	51	
2	50	50	
3	47	46	
4	46	46	
5	45	47	
6	44	45	
7	42	42	
8	40	40	
9	38	38	
10	37	36	
11	36	34	
12	34	33	
13	32	32	
14	31	31	
15	30	30	
16	30	30	
18	29	29	
20	28	28	
22	27	27	
24	27	27	
26	27	27	
28	26	26	
30	26	26	
32	25	25	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 1600 OF
 AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

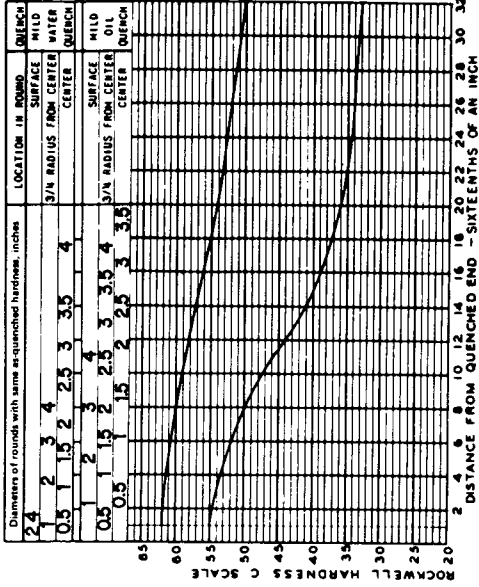
UNS H41370 Hardness Band SAE/AISI 4137H

C	Min	Si	Cr	Mo
.34	.40	0.15/0.35	.75	.15
.41	1.00		1.20	.25



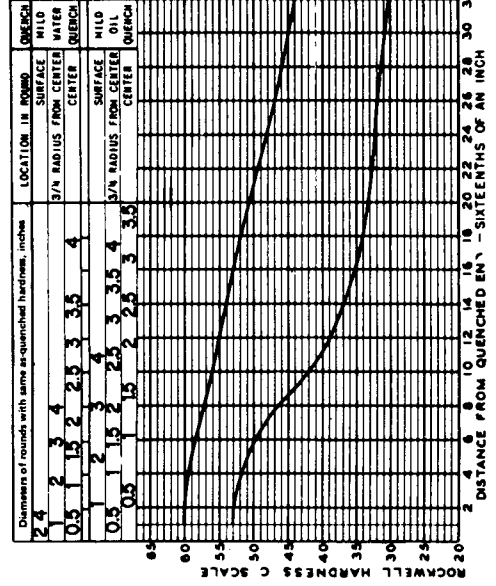
UNS H41420 Hardness Band SAE/AISI 4142H

C	Min	Si	Cr	Mo
.39	.65	0.15/0.35	.75	.15
.46	1.10		1.20	.25



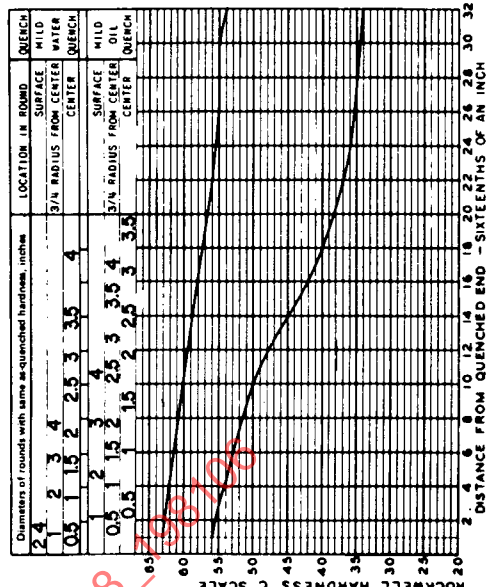
UNS H41400 Hardness Band SAE/AISI 4140H

C	Min	Si	Cr	Mo
.37	.45	0.15/0.35	.75	.15
.44	1.10		1.20	.25



UNS H41450 Hardness Band SAE/AISI 4145H

C	Min	Si	Cr	Mo
.42	.65	0.15/0.35	.75	.15
.49	1.10		1.20	.25

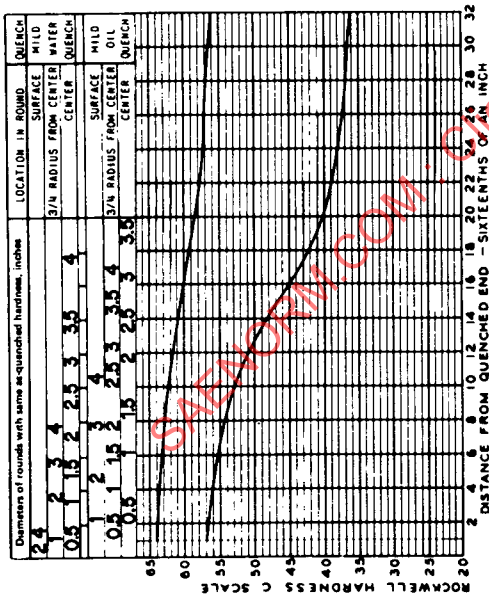


HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/4" DISTANCE FROM QUENCHED END	MIN
1	50
2	51
3	52
4	53
5	54
6	55
7	56
8	57
9	58
10	59
11	60
12	61
13	62
14	63
15	64
16	65
17	66
18	67
19	68
20	69
21	70
22	71
23	72
24	73
25	74
26	75
27	76
28	77
29	78
30	79
31	80
32	81

HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/4" DISTANCE FROM QUENCHED END	MIN
1	50
2	51
3	52
4	53
5	54
6	55
7	56
8	57
9	58
10	59
11	60
12	61
13	62
14	63
15	64
16	65
17	66
18	67
19	68
20	69
21	70
22	71
23	72
24	73
25	74
26	75
27	76
28	77
29	78
30	79
31	80
32	81

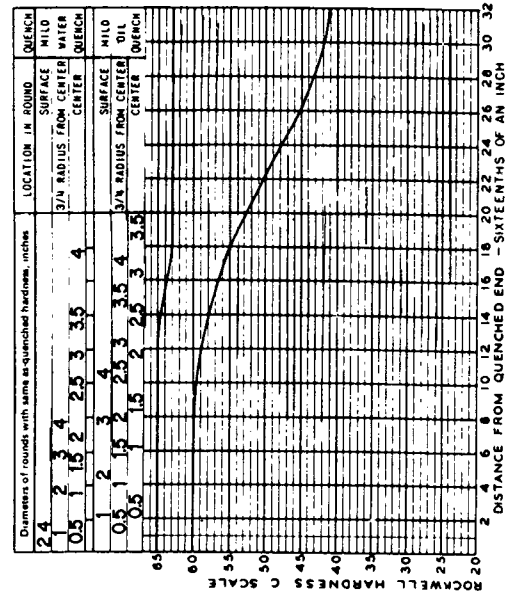
UNS H41470 Hardenability Band SAE/AISI 4147H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		1417 H		1417 H	
"J" DISTANCE BETWEEN SPECIMENS OF IN. INCH	MAX.	MIN.	MAX.	MIN.	MAX.
1	64	57	64	57	57
2	64	56	64	56	56
3	64	56	64	56	56
4	64	56	64	56	56
5	63	55	63	55	55
6	63	55	63	55	55
7	63	55	63	55	55
8	63	54	63	54	54
9	63	54	63	54	54
10	62	53	62	53	53
11	62	52	62	52	52
12	62	51	62	51	51
13	61	49	61	49	49
14	61	48	61	48	48
15	60	46	60	46	46
16	60	45	60	45	45
17	59	42	59	42	42
18	58	40	58	40	40
19	57	37	57	37	37
20	56	36	56	36	36
21	56	36	56	36	36
22	56	36	56	36	36
23	56	36	56	36	36
24	56	36	56	36	36
25	56	36	56	36	36
26	56	36	56	36	36
27	56	36	56	36	36
28	56	36	56	36	36
29	56	36	56	36	36
30	56	36	56	36	36
31	56	36	56	36	36
32	56	36	56	36	36



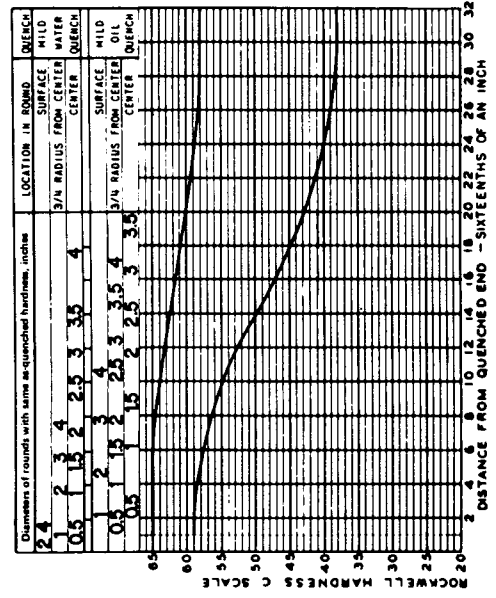
UNS H41610 Hardenability Band SAE/AISI 4161H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		4161 H		4161 H	
"J" DISTANCE BETWEEN SPECIMENS OF IN. INCH	MAX.	MIN.	MAX.	MIN.	MAX.
1	65	60	65	60	60
2	65	60	65	60	60
3	65	60	65	60	60
4	65	60	65	60	60
5	65	60	65	60	60
6	65	60	65	60	60
7	65	60	65	60	60
8	65	60	65	60	60
9	65	59	65	59	59
10	65	59	65	59	59
11	65	59	65	59	59
12	64	59	64	59	59
13	64	58	64	58	58
14	64	57	64	57	57
15	64	56	64	56	56
16	64	56	64	56	56
17	64	55	64	55	55
18	64	55	64	55	55
19	63	53	63	53	53
20	63	50	63	50	50
21	63	48	63	48	48
22	63	48	63	48	48
23	63	48	63	48	48
24	63	48	63	48	48
25	63	45	63	45	45
26	63	45	63	45	45
27	63	45	63	45	45
28	63	45	63	45	45
29	63	45	63	45	45
30	63	45	63	45	45
31	63	45	63	45	45
32	63	45	63	45	45



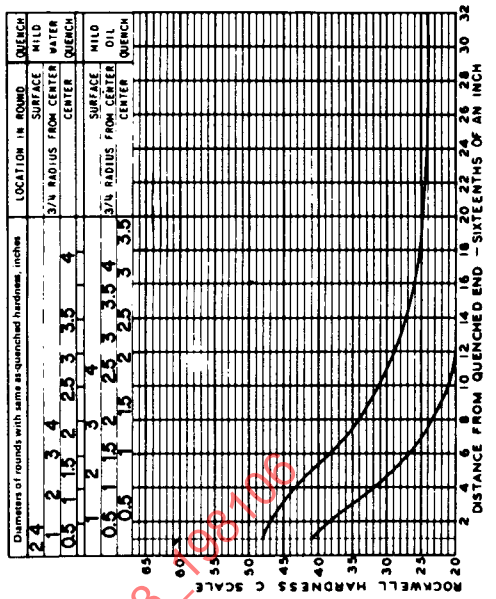
UNS H41500 Hardenability Band SAE/AISI 4150H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		4150 H		4150 H	
"J" DISTANCE BETWEEN SPECIMENS OF IN. INCH	MAX.	MIN.	MAX.	MIN.	MAX.
1	65	59	65	59	59
2	65	58	65	58	58
3	65	58	65	58	58
4	65	58	65	58	58
5	65	57	65	57	57
6	65	57	65	57	57
7	65	57	65	57	57
8	65	56	65	56	56
9	65	56	65	56	56
10	65	55	65	55	55
11	65	54	65	54	54
12	65	53	65	53	53
13	65	51	65	51	51
14	65	50	65	50	50
15	65	48	65	48	48
16	65	47	65	47	47
17	65	47	65	47	47
18	65	47	65	47	47
19	65	47	65	47	47
20	65	47	65	47	47
21	65	47	65	47	47
22	65	47	65	47	47
23	65	47	65	47	47
24	65	47	65	47	47
25	65	47	65	47	47
26	65	47	65	47	47
27	65	47	65	47	47
28	65	47	65	47	47
29	65	47	65	47	47
30	65	47	65	47	47
31	65	47	65	47	47
32	65	47	65	47	47



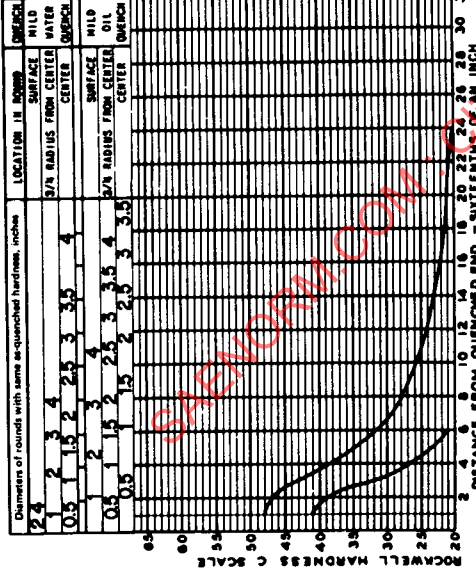
UNS H43200 Hardenability Band SAE/AISI 4320H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		4320 H		4320 H	
"J" DISTANCE BETWEEN SPECIMENS OF IN. INCH	MAX.	MIN.	MAX.	MIN.	MAX.
1	49	41	49	41	41
2	49	40	49	40	40
3	49	40	49	40	40
4	49	40	49	40	40
5	49	40	49	40	40
6	49	40	49	40	40
7	49	40	49	40	40
8	49	40	49	40	40
9	49	40	49	40	40
10	49	40	49	40	40
11	49	40	49	40	40
12	49	40	49	40	40
13	49	40	49	40	40
14	49	40	49	40	40
15	49	40	49	40	40
16	49	40	49	40	40
17	49	40	49	40	40
18	49	40	49	40	40
19	49	40	49	40	40
20	49	40	49	40	40
21	49	40	49	40	40
22	49	40	49	40	40
23	49	40	49	40	40
24	49	40	49	40	40
25	49	40	49	40	40
26	49	40	49	40	40
27	49	40	49	40	40
28	49	40	49	40	40
29	49	40	49	40	40
30	49	40	49	40	40
31	49	40	49	40	40
32	49	40	49	40	40



UNS H47200 Hardenability Band SAE/AISI 4720H

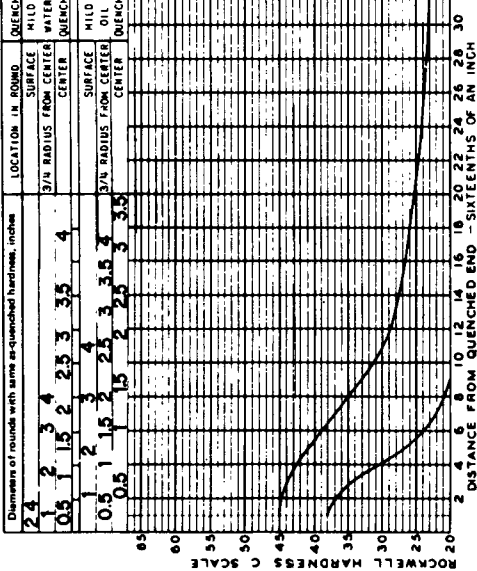
C	Min	Si	Mn	Cr	Ms
.17	.45	0.15/0.35	.85	.30	.15
.33	.75	1.25	.60	.75	



HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3/4" DISTANCE FROM QUENCHED END
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102

UNS H48150 Hardenability Band SAE/AISI 4815H

C	Min	Si	Mn	Cr	Ms
.17	.45	0.15/0.35	.85	.30	.15
.33	.75	1.25	.60	.75	



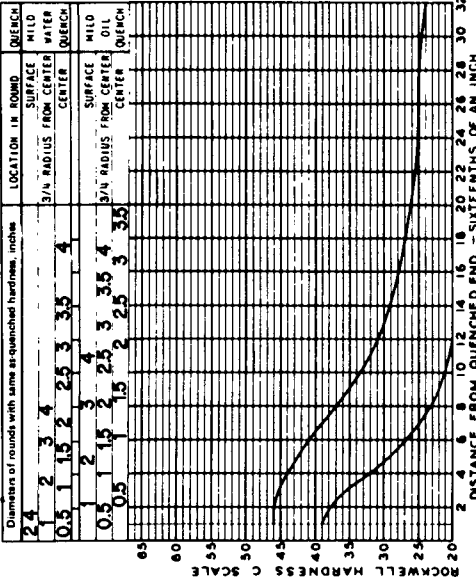
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3/4" DISTANCE FROM QUENCHED END
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3/4" DISTANCE FROM QUENCHED END
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE FROM QUENCHED END	1/2" DISTANCE FROM QUENCHED END	3/4" DISTANCE FROM QUENCHED END
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102

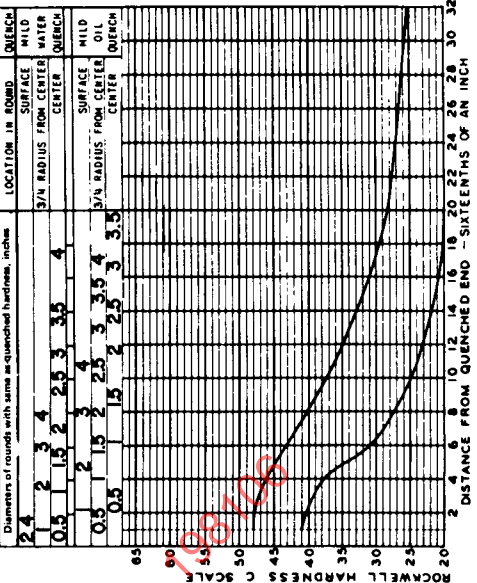
UNS H48170 Hardenability Band SAE/AISI 4817H

C	Min	Si	Mn	Cr	Ms
.14	.30	0.15/0.35	3.20	.20	.30
.20	.70	1.80	1.20	.30	



UNS H48200 Hardenability Band SAE/AISI 4820H

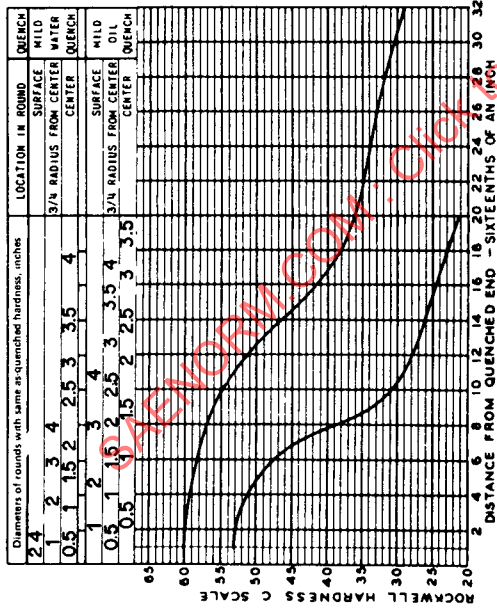
C	Min	Si	Mn	Cr	Ms
.17	.40	0.15/0.35	3.20	.20	.30
.23	.80	1.80	1.20	.30	



UNS H50401 Hardenability Band SAE/AISI 50B40H

C	Mn	Si	Cr	B
.37	.45	0.15/0.25	.30/.70	.

*Contains 0.0005-0.003% boron.



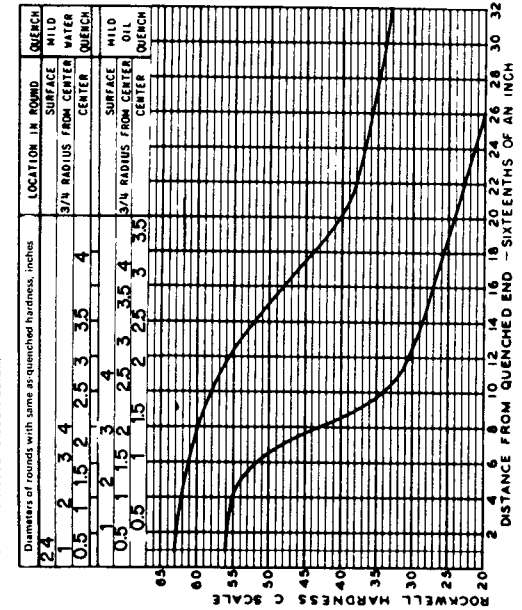
HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
"A" DISTANCE BETWEEN SPECIMENS OF INCH	HRA
1	60
2	60
3	60
4	60
5	60
6	60
7	60
8	60
9	60
10	60
11	60
12	60
13	60
14	60
15	60
16	60
17	60
18	60
19	60
20	60
21	60
22	60
23	60
24	60
25	60
26	60
27	60
28	60
29	60
30	60
31	60
32	60

*For forged or rolled specimens only.

UNS H50441 Hardenability Band SAE/AISI 50B44H

C	Mn	Si	Cr	B
.47	.45	0.15/0.25	.30/.70	.

*Contains 0.0005-0.003% boron.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
"A" DISTANCE BETWEEN SPECIMENS OF INCH	HRA
1	63
2	63
3	63
4	63
5	61
6	61
7	60
8	60
9	59
10	58
11	57
12	56
13	55
14	54
15	53
16	52
17	51
18	50
19	49
20	48
21	47
22	46
23	45
24	44
25	43
26	42
27	41
28	40
29	39
30	38
31	37
32	36

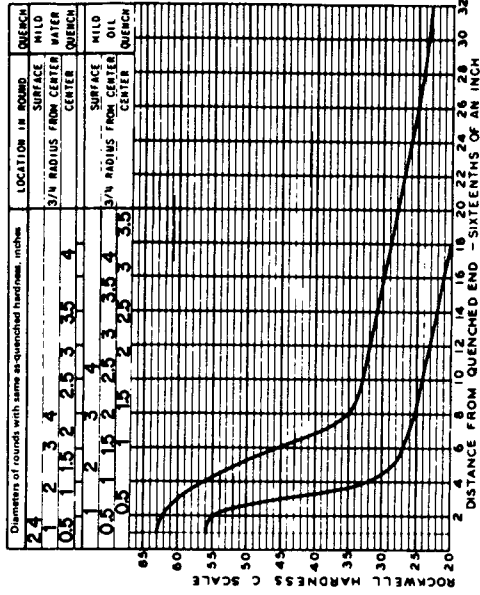
*For forged or rolled specimens only.

HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
"A" DISTANCE BETWEEN SPECIMENS OF INCH	HRA
1	63
2	62
3	60
4	59
5	58
6	57
7	56
8	55
9	54
10	53
11	52
12	51
13	50
14	49
15	48
16	47
17	46
18	45
19	44
20	43
21	42
22	41
23	40
24	39
25	38
26	37
27	36
28	35
29	34
30	33
31	32
32	31

*For forged or rolled specimens only.

UNS H50460 Hardenability Band SAE/AISI 50B46H

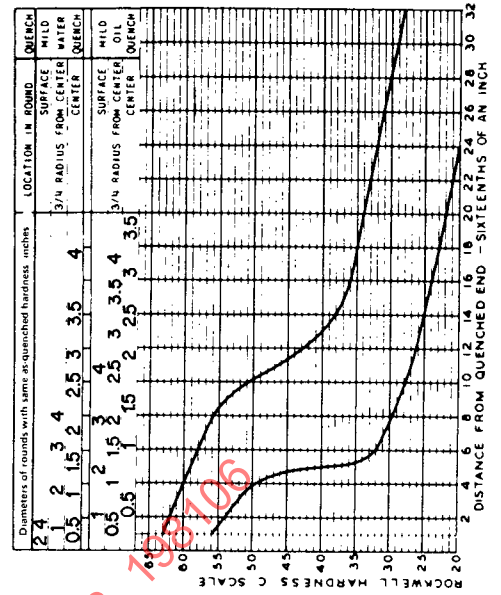
C	Mn	Si	Cr
.43	.45	0.15/0.25	.13/.43



UNS H50461 Hardenability Band SAE/AISI 50B46H

C	Mn	Si	Cr
.43	.45	0.15/0.25	.13/.43

*Contains 0.0005-0.003% boron.



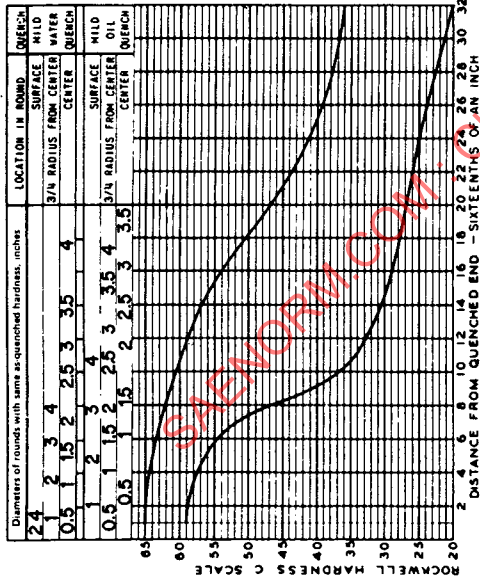
HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
"A" DISTANCE BETWEEN SPECIMENS OF INCH	HRA
1	63
2	62
3	60
4	59
5	58
6	57
7	56
8	55
9	54
10	53
11	52
12	51
13	50
14	49
15	48
16	47
17	46
18	45
19	44
20	43
21	42
22	41
23	40
24	39
25	38
26	37
27	36
28	35
29	34
30	33
31	32
32	31

*For forged or rolled specimens only.

UNS H50501 Hardenability Band SAE/AISI 50B50H

C	Mn	Si	C ₁	B
.47	.65	1.10	30	1.70

*Contains 0.0005-0.003% boron.



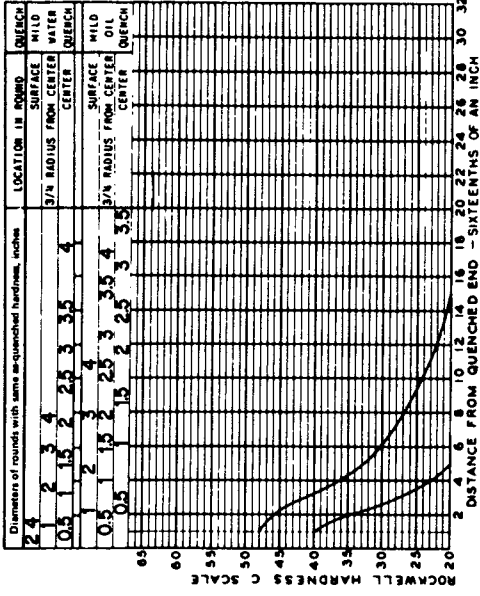
HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/2" DISTANCE FROM QUENCHED END	HARDNESS
1	65
2	65
3	64
4	64
5	63
6	63
7	62
8	62
9	61
10	60
11	60
12	59
13	58
14	57
15	56
16	56
17	55
18	54
19	53
20	52
21	51
22	50
23	49
24	48
25	47
26	46
27	45
28	44
29	43
30	42
31	41
32	40

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1500 OF

*For forged or rolled specimens only.

UNS H51200 Hardenability Band SAE/AISI 5120H

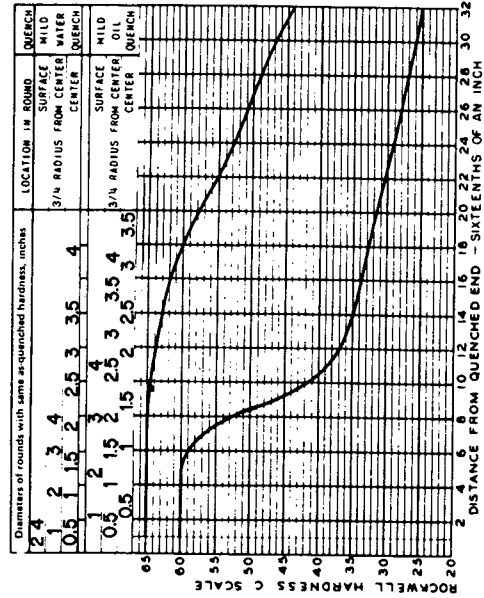
C	Mn	Si	C ₁
.17	.40	0.15/0.35	.60



UNS H50601 Hardenability Band SAE/AISI 50B60H

C	Mn	Si	C ₁	B
.65	.65	1.10	30	1.70

*Contains 0.0005-0.003% boron.



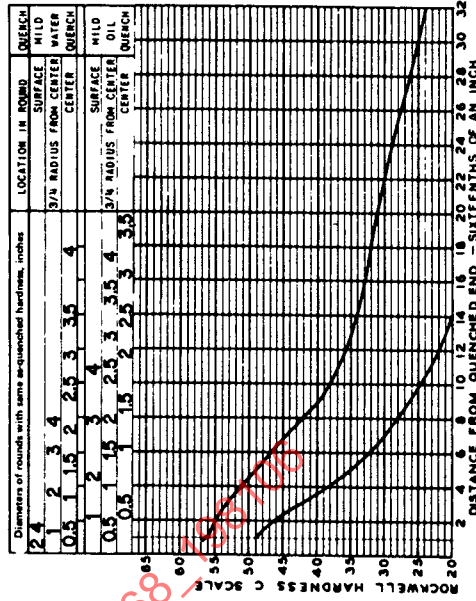
HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/2" DISTANCE FROM QUENCHED END	HARDNESS
1	60
2	60
3	60
4	60
5	60
6	60
7	59
8	59
9	58
10	57
11	56
12	55
13	54
14	53
15	52
16	51
17	50
18	49
19	48
20	47
21	46
22	45
23	44
24	43
25	42
26	41
27	40
28	39
29	38
30	37
31	36
32	35

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1500 OF

*For forged or rolled specimens only.

UNS H51300 Hardenability Band SAE/AISI 5130H

C	Mn	Si	C ₁
.37	.40	0.15/0.35	.75



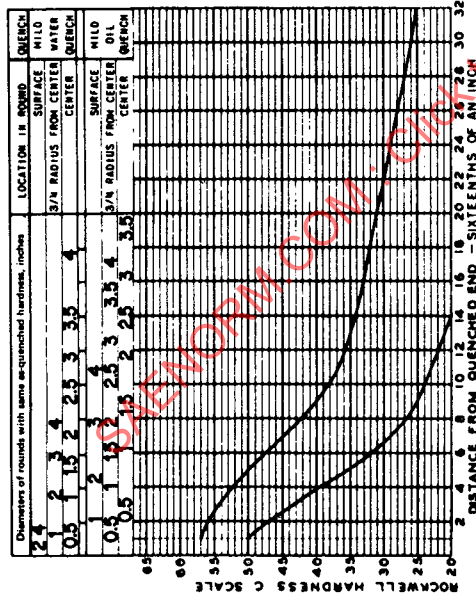
HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/2" DISTANCE FROM QUENCHED END	HARDNESS
1	44
2	45
3	45
4	45
5	44
6	43
7	42
8	41
9	40
10	39
11	38
12	37
13	36
14	35
15	34
16	33
17	32
18	31
19	30
20	29
21	28
22	27
23	26
24	25
25	24
26	23
27	22
28	21
29	20
30	19
31	18
32	17

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1500 OF

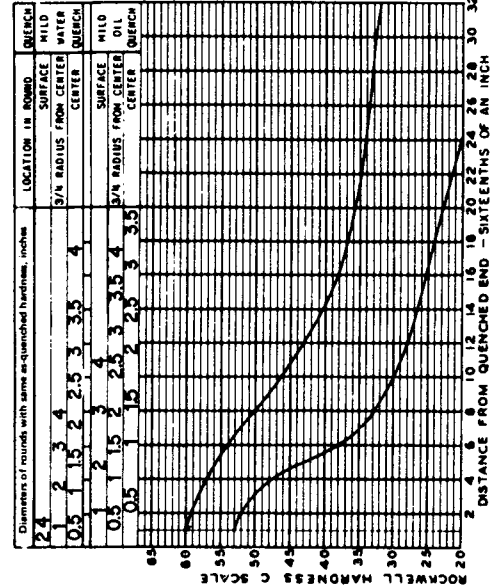
*For forged or rolled specimens only.

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1" DISTANCE FROM SURFACE OF ROLL	MIN	MAX	H12H
1	50	57	50
2	56	63	57
3	54	61	55
4	52	60	54
5	50	58	53
6	48	56	52
7	46	54	51
8	44	52	50
9	42	50	49
10	40	48	48
11	38	46	47
12	36	44	46
13	35	43	45
14	34	42	44
15	33	41	43
16	32	40	42
17	31	39	41
18	30	38	40
19	29	37	39
20	28	36	38
21	27	35	37
22	26	34	36
23	25	33	35
24	24	32	34
25	23	31	33
26	22	30	32
27	21	29	31
28	20	28	30
29	19	27	29
30	18	26	28
31	17	25	27
32	16	24	26

UNS H51320 Hardenability Band SAE/AISI 5132H			
C	Min	Si	Cr
.39 / .35	.50 / .40	.15 / 0.35	.45 / 1.10

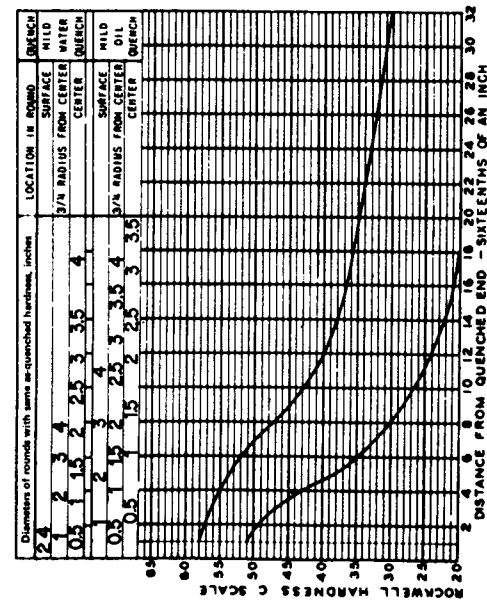


UNS H51400 Hardenability Band SAE/AISI 5140H			
C	Min	Si	Cr
.37 / .44	.40 / 1.00	.15 / 0.35	.40 / 1.00

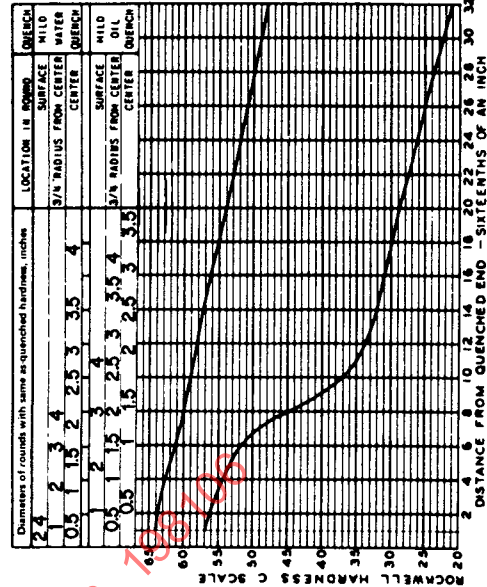


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1" DISTANCE FROM SURFACE OF ROLL	MIN	MAX	H12H
1	50	57	50
2	56	63	57
3	54	61	55
4	52	60	54
5	50	58	53
6	48	56	52
7	46	54	51
8	44	52	50
9	42	50	49
10	40	48	48
11	38	46	47
12	36	44	46
13	35	43	45
14	34	42	44
15	33	41	43
16	32	40	42
17	31	39	41
18	30	38	40
19	29	37	39
20	28	36	38
21	27	35	37
22	26	34	36
23	25	33	35
24	24	32	34
25	23	31	33
26	22	30	32
27	21	29	31
28	20	28	30
29	19	27	29
30	18	26	28
31	17	25	27
32	16	24	26

UNS H51350 Hardenability Band SAE/AISI 5135H			
C	Min	Si	Cr
.32 / .38	.50 / .70	.15 / 0.35	.70 / 1.15

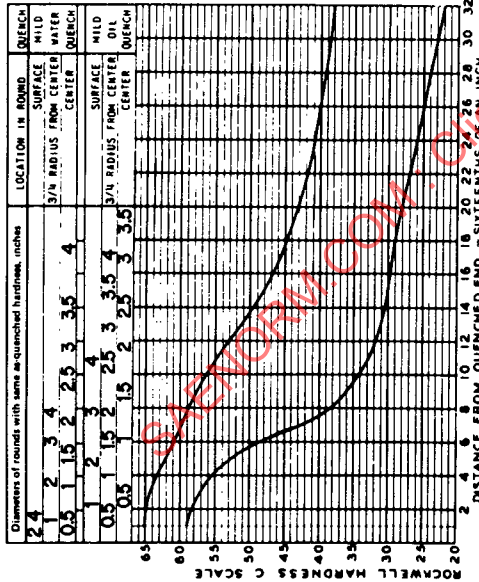


UNS H51470 Hardenability Band SAE/AISI 5147H			
C	Min	Si	Cr
.45 / .52	.40 / 1.05	.15 / 0.35	.80 / 1.25



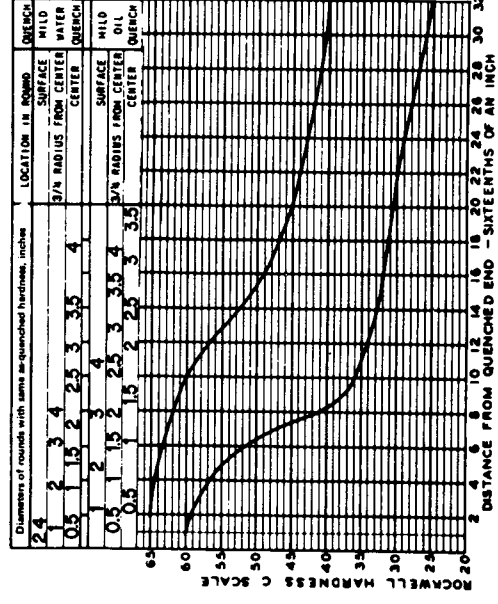
UNS H51500 Hardenability Band SAE/AISI 5150H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
*1" DISTANCE DIA. IN INCH	MIN	SI	MAX
1	.47	.40	60
2	.45	.35	59
3	.43	.30	58
4	.41	.25	57
5	.39	.20	56
6	.37	.15	55
7	.35	.10	54
8	.33	.05	53
9	.31	.00	52
10	.29		51
11	.27		50
12	.25		49
13	.23		48
14	.21		47
15	.19		46
16	.17		45
17	.15		44
18	.13		43
19	.11		42
20	.09		41
21	.07		40
22	.05		39
23	.03		38
24	.01		37
25			36
26			35
27			34
28			33
29			32
30			31
31			30
32			29
33			28
34			27
35			26
36			25
37			24
38			23
39			22
40			21
41			20
42			19
43			18
44			17
45			16
46			15
47			14
48			13
49			12
50			11
51			10
52			9
53			8
54			7
55			6
56			5
57			4
58			3
59			2
60			1

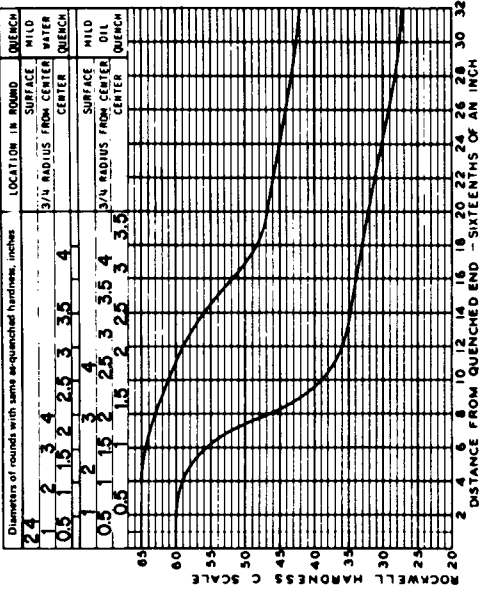


UNS H51550 Hardenability Band SAE/AISI 5155H

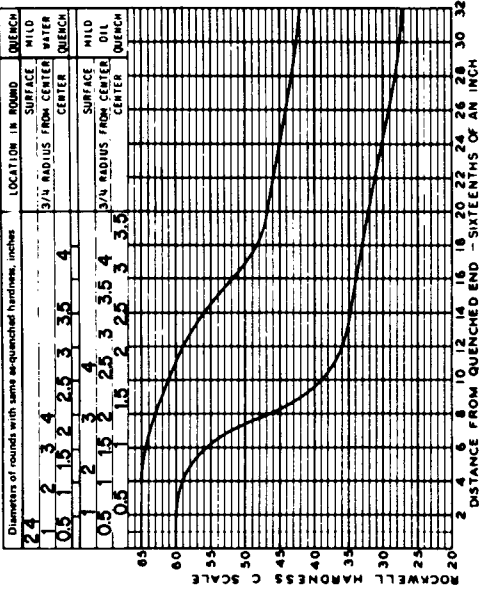
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
*1" DISTANCE DIA. IN INCH	MIN	SI	MAX
1	.47	.40	60
2	.45	.35	59
3	.43	.30	58
4	.41	.25	57
5	.39	.20	56
6	.37	.15	55
7	.35	.10	54
8	.33	.05	53
9	.31	.00	52
10	.29		51
11	.27		50
12	.25		49
13	.23		48
14	.21		47
15	.19		46
16	.17		45
17	.15		44
18	.13		43
19	.11		42
20	.09		41
21	.07		40
22	.05		39
23	.03		38
24	.01		37
25			36
26			35
27			34
28			33
29			32
30			31
31			30
32			29
33			28
34			27
35			26
36			25
37			24
38			23
39			22
40			21
41			20
42			19
43			18
44			17
45			16
46			15
47			14
48			13
49			12
50			11
51			10
52			9
53			8
54			7
55			6
56			5
57			4
58			3
59			2
60			1



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
*1" DISTANCE DIA. IN INCH	MIN	SI	MAX
1	.47	.40	60
2	.45	.35	59
3	.43	.30	58
4	.41	.25	57
5	.39	.20	56
6	.37	.15	55
7	.35	.10	54
8	.33	.05	53
9	.31	.00	52
10	.29		51
11	.27		50
12	.25		49
13	.23		48
14	.21		47
15	.19		46
16	.17		45
17	.15		44
18	.13		43
19	.11		42
20	.09		41
21	.07		40
22	.05		39
23	.03		38
24	.01		37
25			36
26			35
27			34
28			33
29			32
30			31
31			30
32			29
33			28
34			27
35			26
36			25
37			24
38			23
39			22
40			21
41			20
42			19
43			18
44			17
45			16
46			15
47			14
48			13
49			12
50			11
51			10
52			9
53			8
54			7
55			6
56			5
57			4
58			3
59			2
60			1

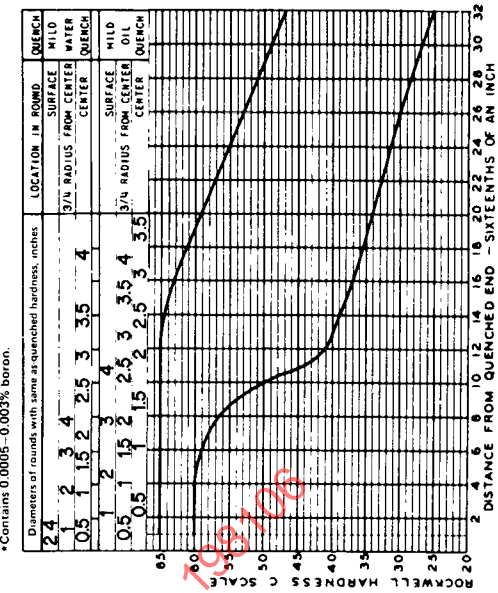


UNS H51600 Hardenability Band SAE/AISI 5160H



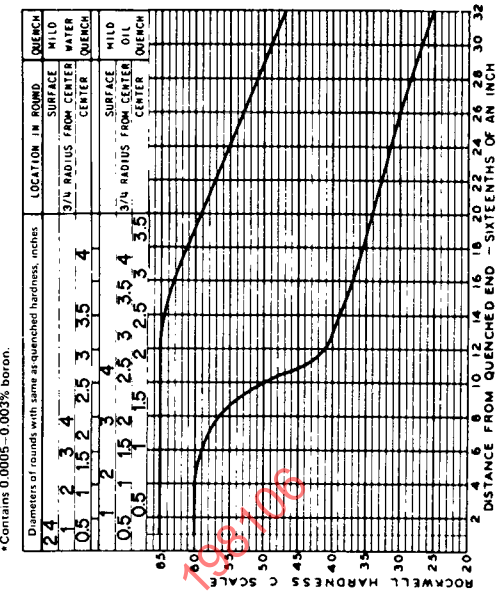
UNS H51601 Hardenability Band SAE/AISI 51601H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
*1" DISTANCE DIA. IN INCH	MIN	SI	MAX
1	.47	.40	60
2	.45	.35	59
3	.43	.30	58
4	.41	.25	57
5	.39	.20	56
6	.37	.15	55
7	.35	.10	54
8	.33	.05	53
9	.31	.00	52
10	.29		51
11	.27		50
12	.25		49
13	.23		48
14	.21		47
15	.19		46
16	.17		45
17	.15		44
18	.13		43
19	.11		42
20	.09		41
21	.07		40
22	.05		39
23	.03		38
24	.01		37
25			36
26			35
27			34
28			33
29			32
30			31
31			30
32			29
33			28
34			27
35			26
36			25
37			24
38			23
39			22
40			21
41			20
42			19
43			18
44			17
45			16
46			15
47			14
48			13
49			12
50			11
51			10
52			9
53			8
54			7
55			6
56			5
57			4
58			3
59			2
60			1



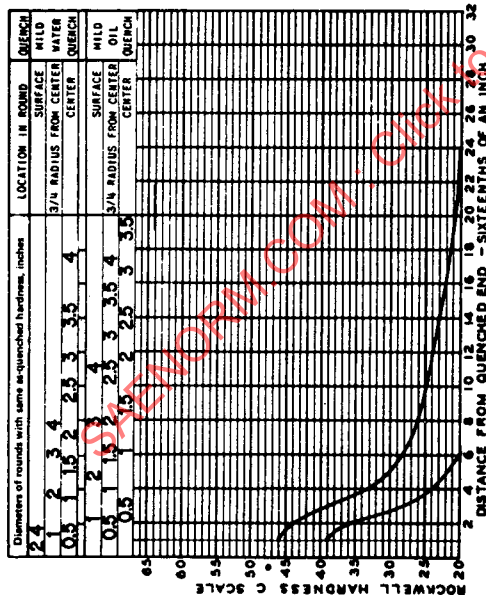
UNS H51601 Hardenability Band SAE/AISI 51601H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
*1" DISTANCE DIA. IN INCH	MIN	SI	MAX
1	.47	.40	60
2	.45	.35	59
3	.43	.30	58
4	.41	.25	57
5	.39	.20	56
6	.37	.15	55
7	.35	.10	54
8	.33	.05	53
9	.31	.00	52
10	.29		51
11	.27		50
12	.25		49
13	.23		48
14	.21		47
15	.19		46
16	.17		45
17	.15		44
18	.13		43
19	.11		42
20	.09		41
21	.07		40
22	.05		39
23	.03		38
24	.01		37
25			36
26			35
27			34
28			33
29			32
30			31
31			30
32			29
33			28
34			27
35			26
36			25
37			24
38			23
39			22
40			21
41			20
42			19
43			18
44			17
45			16
46			15
47			14
48			13
49			12
50			11
51			10
52			9
53			8
54			7
55			6
56			5
57			4
58			3
59			2
60			1



UNS H61180 Hardenability Band SAE/AISI 6118H

C	Min	Si	Cr	Mo
.18	.21	.40	.30	.10
.47	.49	.15	.30	.15

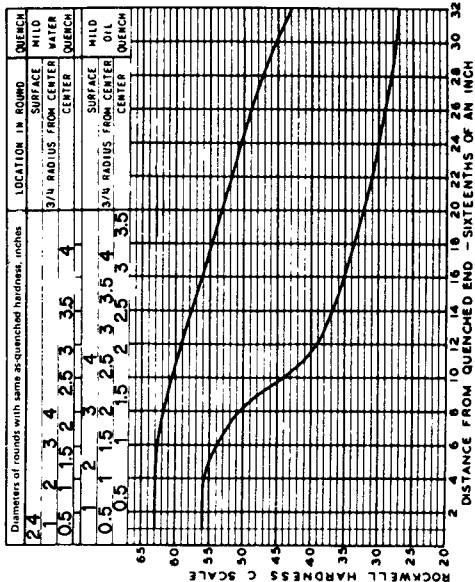


1/2" DISTANCE SIXTEENTHS OF AN INCH	HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
	MIN.	MAX.
1	63	50
2	63	50
3	63	50
4	63	50
5	63	50
6	63	50
7	63	50
8	63	50
9	63	50
10	63	50
11	63	50
12	63	50
13	63	50
14	63	50
15	63	50
16	63	50
17	63	50
18	63	50
19	63	50
20	63	50
21	63	50
22	63	50
23	63	50
24	63	50
25	63	50
26	63	50
27	63	50
28	63	50
29	63	50
30	63	50
31	63	50
32	63	50

UNS H81451 Hardenability Band SAE/AISI 8145H

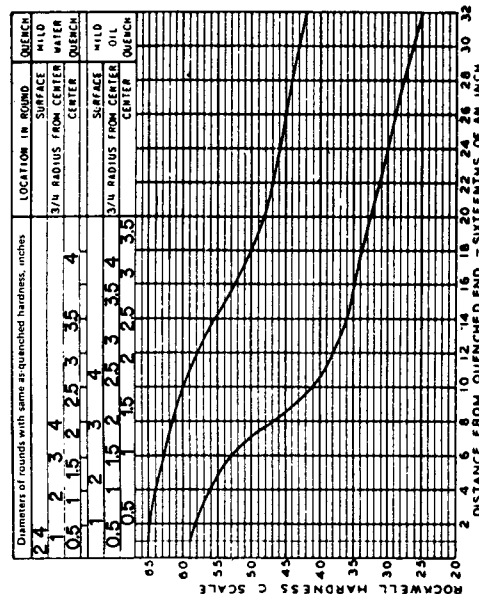
C	Min	Si	Cr	Mo
.47	.49	.15	.30	.15
.47	.49	.15	.30	.15

*Contains 0.0005-0.003% boron.



UNS H61500 Hardenability Band SAE/AISI 6150H

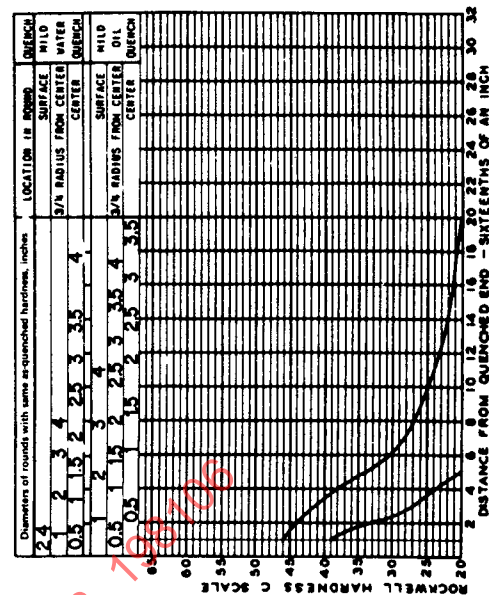
C	Min	Si	Cr	Mo
.47	.49	.15	.30	.15
.47	.49	.15	.30	.15



1/2" DISTANCE SIXTEENTHS OF AN INCH	HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
	MIN.	MAX.
1	63	50
2	63	50
3	63	50
4	63	50
5	63	50
6	63	50
7	63	50
8	63	50
9	63	50
10	63	50
11	63	50
12	63	50
13	63	50
14	63	50
15	63	50
16	63	50
17	63	50
18	63	50
19	63	50
20	63	50
21	63	50
22	63	50
23	63	50
24	63	50
25	63	50
26	63	50
27	63	50
28	63	50
29	63	50
30	63	50
31	63	50
32	63	50

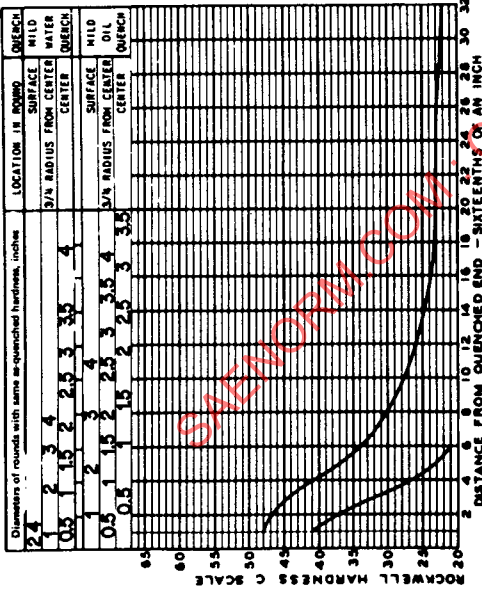
UNS H86170 Hardenability Band SAE/AISI 8617H

C	Min	Si	Cr	Mo
.47	.49	.15	.30	.15
.47	.49	.15	.30	.15



UNS H86200 Hardenability Band SAE/AISI 8620H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF INCHES	H8620H		
	MIN	H8620H	MIN
1	40	41	41
2	47	48	48
3	54	55	55
4	61	62	62
5	68	69	69
6	75	76	76
7	82	83	83
8	89	90	90
9	96	97	97
10	103	104	104
11	110	111	111
12	117	118	118
13	124	125	125
14	131	132	132
15	138	139	139
16	145	146	146
17	152	153	153
18	159	160	160
19	166	167	167
20	173	174	174
21	180	181	181
22	187	188	188
23	194	195	195
24	201	202	202
25	208	209	209
26	215	216	216
27	222	223	223
28	229	230	230
29	236	237	237
30	243	244	244
31	250	251	251
32	257	258	258



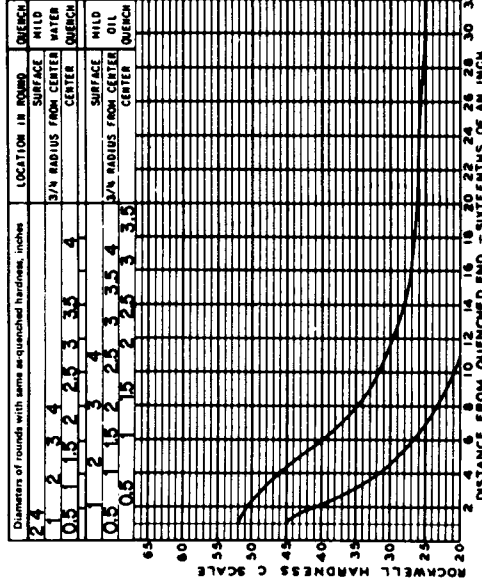
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF INCHES	H8620H		
	MIN	H8620H	MIN
1	52	53	53
2	59	60	60
3	66	67	67
4	73	74	74
5	80	81	81
6	87	88	88
7	94	95	95
8	101	102	102
9	108	109	109
10	115	116	116
11	122	123	123
12	129	130	130
13	136	137	137
14	143	144	144
15	150	151	151
16	157	158	158
17	164	165	165
18	171	172	172
19	178	179	179
20	185	186	186
21	192	193	193
22	199	200	200
23	206	207	207
24	213	214	214
25	220	221	221
26	227	228	228
27	234	235	235
28	241	242	242
29	248	249	249
30	255	256	256
31	262	263	263
32	269	270	270

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

UNS H86250 Hardenability Band SAE/AISI 8625H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF INCHES	H8625H		
	MIN	H8625H	MIN
1	40	41	41
2	47	48	48
3	54	55	55
4	61	62	62
5	68	69	69
6	75	76	76
7	82	83	83
8	89	90	90
9	96	97	97
10	103	104	104
11	110	111	111
12	117	118	118
13	124	125	125
14	131	132	132
15	138	139	139
16	145	146	146
17	152	153	153
18	159	160	160
19	166	167	167
20	173	174	174
21	180	181	181
22	187	188	188
23	194	195	195
24	201	202	202
25	208	209	209
26	215	216	216
27	222	223	223
28	229	230	230
29	236	237	237
30	243	244	244
31	250	251	251
32	257	258	258

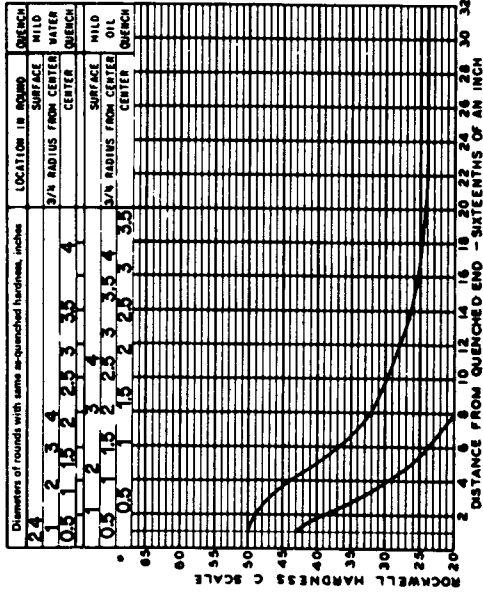


HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

UNS H86220 Hardenability Band SAE/AISI 8622H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF INCHES	H8622H		
	MIN	H8622H	MIN
1	40	41	41
2	47	48	48
3	54	55	55
4	61	62	62
5	68	69	69
6	75	76	76
7	82	83	83
8	89	90	90
9	96	97	97
10	103	104	104
11	110	111	111
12	117	118	118
13	124	125	125
14	131	132	132
15	138	139	139
16	145	146	146
17	152	153	153
18	159	160	160
19	166	167	167
20	173	174	174
21	180	181	181
22	187	188	188
23	194	195	195
24	201	202	202
25	208	209	209
26	215	216	216
27	222	223	223
28	229	230	230
29	236	237	237
30	243	244	244
31	250	251	251
32	257	258	258

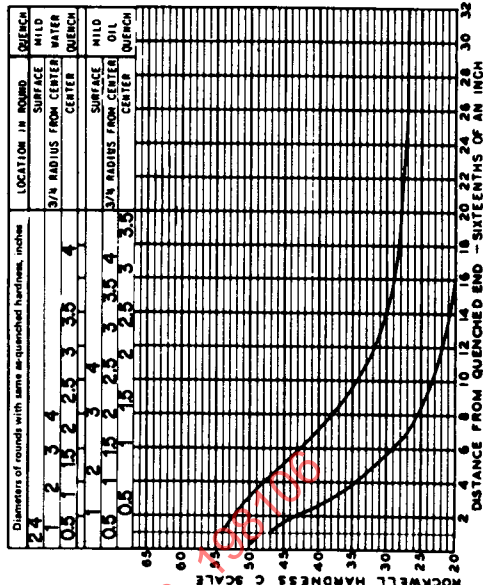


HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

UNS H86270 Hardenability Band SAE/AISI 8627H

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DISTANCE BETWEEN SPECIMENS OF INCHES	H8627H		
	MIN	H8627H	MIN
1	40	41	41
2	47	48	48
3	54	55	55
4	61	62	62
5	68	69	69
6	75	76	76
7	82	83	83
8	89	90	90
9	96	97	97
10	103	104	104
11	110	111	111
12	117	118	118
13	124	125	125
14	131	132	132
15	138	139	139
16	145	146	146
17	152	153	153
18	159	160	160
19	166	167	167
20	173	174	174
21	180	181	181
22	187	188	188
23	194	195	195
24	201	202	202
25	208	209	209
26	215	216	216
27	222	223	223
28	229	230	230
29	236	237	237
30	243	244	244
31	250	251	251
32	257	258	258

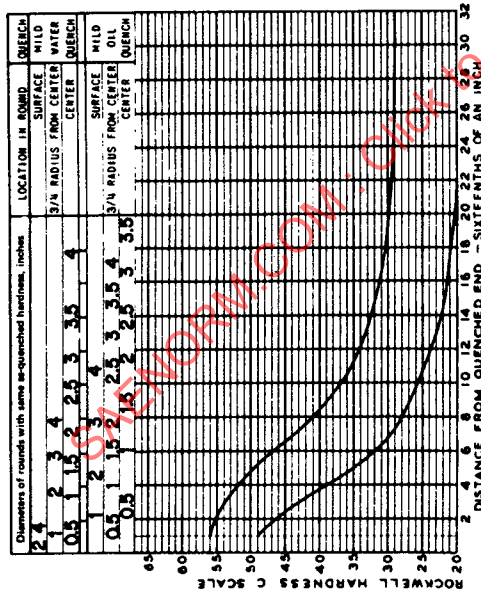


HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1600 OF
AUSTENITIZE 1600 OF

*For forged or rolled specimens only.

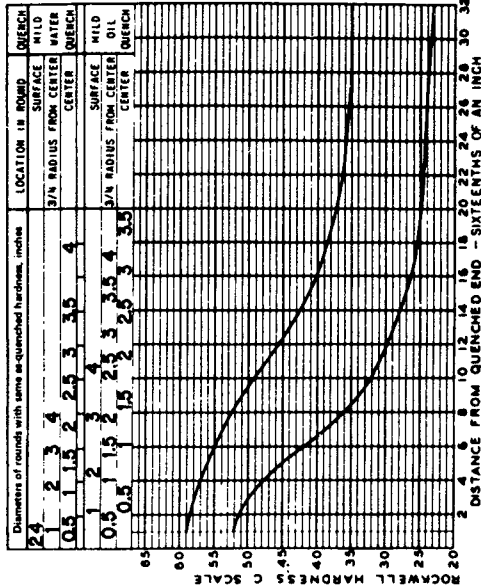
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" DISTANCE BETWEEN SPECIMENS OF IN. THICK	MIN.	MAX.	H.R.
1	96	100	49
2	95	100	48
3	94	100	47
4	92	100	46
5	90	100	45
6	87	100	44
7	84	100	43
8	81	100	42
9	79	100	41
10	77	100	40
11	75	100	39
12	73	100	38
13	71	100	37
14	69	100	36
15	67	100	35
16	65	100	34
17	63	100	33
18	61	100	32
19	59	100	31
20	57	100	30
21	55	100	29
22	53	100	28
23	51	100	27
24	49	100	26
25	47	100	25
26	45	100	24
27	43	100	23
28	41	100	22
29	39	100	21
30	37	100	20
31	35	100	19
32	33	100	18

UNS H86300 Hardenability Band SAE/AISI 8630H			
C	Mn	Si	Mo
.27	.40	.95	.15
.33	.75	.35	.45
.35	.75	.35	.45
.45	.75	.35	.45



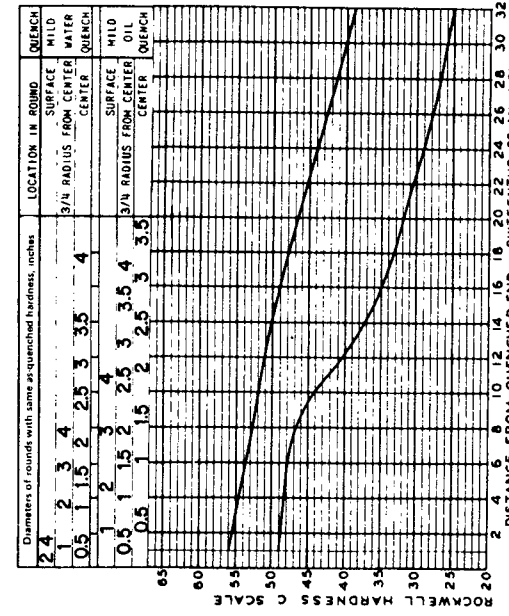
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" DISTANCE BETWEEN SPECIMENS OF IN. THICK	MIN.	MAX.	H.R.
1	96	100	42
2	95	100	41
3	94	100	40
4	92	100	39
5	90	100	38
6	87	100	37
7	84	100	36
8	81	100	35
9	79	100	34
10	77	100	33
11	75	100	32
12	73	100	31
13	71	100	30
14	69	100	29
15	67	100	28
16	65	100	27
17	63	100	26
18	61	100	25
19	59	100	24
20	57	100	23
21	55	100	22
22	53	100	21
23	51	100	20
24	49	100	19
25	47	100	18
26	45	100	17
27	43	100	16
28	41	100	15
29	39	100	14
30	37	100	13
31	35	100	12
32	33	100	11

UNS H86370 Hardenability Band SAE/AISI 8637H			
C	Mn	Si	Mo
.34	.70	1.05	.15
.41	.75	.35	.45
.45	.75	.35	.45
.55	.75	.35	.45



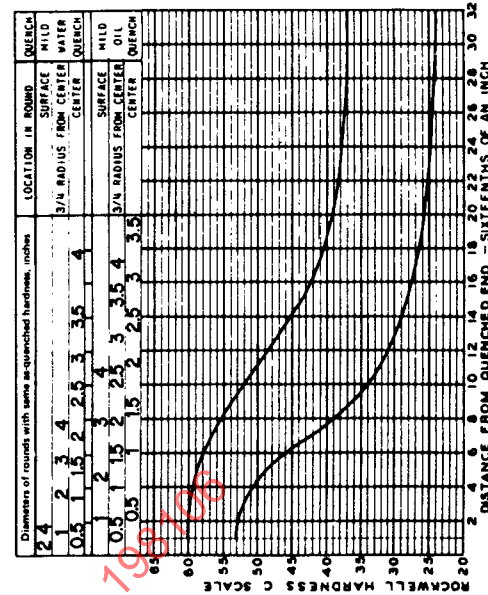
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" DISTANCE BETWEEN SPECIMENS OF IN. THICK	MIN.	MAX.	H.R.
1	94	100	48
2	93	100	47
3	91	100	46
4	89	100	45
5	87	100	44
6	85	100	43
7	83	100	42
8	81	100	41
9	79	100	40
10	77	100	39
11	75	100	38
12	73	100	37
13	71	100	36
14	69	100	35
15	67	100	34
16	65	100	33
17	63	100	32
18	61	100	31
19	59	100	30
20	57	100	29
21	55	100	28
22	53	100	27
23	51	100	26
24	49	100	25
25	47	100	24
26	45	100	23
27	43	100	22
28	41	100	21
29	39	100	20
30	37	100	19
31	35	100	18
32	33	100	17

UNS H86301 Hardenability Band SAE/AISI 86B30H			
C	Mn	Si	Mo
0.27/0.33	0.60/0.95	0.15/0.35	0.35/0.75
0.35/0.65	0.35/0.75	0.35/0.75	0.15/0.25



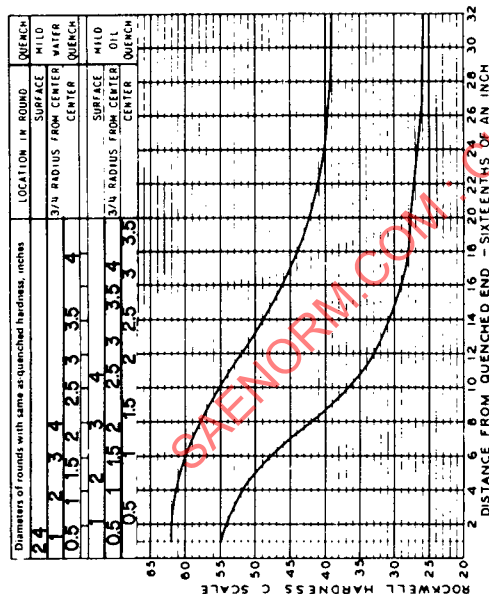
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"J" DISTANCE BETWEEN SPECIMENS OF IN. THICK	MIN.	MAX.	H.R.
1	94	100	43
2	93	100	42
3	91	100	41
4	89	100	40
5	87	100	39
6	85	100	38
7	83	100	37
8	81	100	36
9	79	100	35
10	77	100	34
11	75	100	33
12	73	100	32
13	71	100	31
14	69	100	30
15	67	100	29
16	65	100	28
17	63	100	27
18	61	100	26
19	59	100	25
20	57	100	24
21	55	100	23
22	53	100	22
23	51	100	21
24	49	100	20
25	47	100	19
26	45	100	18
27	43	100	17
28	41	100	16
29	39	100	15
30	37	100	14
31	35	100	13
32	33	100	12

UNS H86400 Hardenability Band SAE/AISI 8640H			
C	Mn	Si	Mo
.37	.70	1.05	.15
.44	.75	.35	.45
.45	.75	.35	.45
.55	.75	.35	.45



UNS H86420 Hardenability Band SAE/AISI 8642H

C	Mn	Si	Ni	Cr	Mo
.39 / .46	.70 / 1.05	with .03%	.35 / .75	.35 / .65	.15 / .25



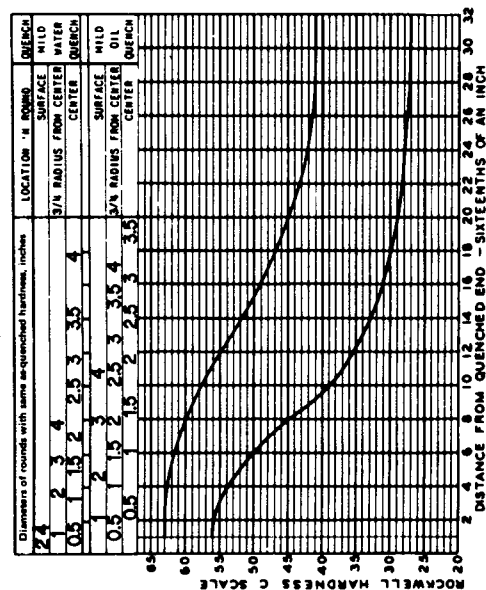
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
DISTANCE FROM SURFACE OF WELD	MAX. MIN.	
	1	MIN
1	62	50
2	63	50
3	62	53
4	61	52
5	61	50
6	60	48
7	58	45
8	56	42
9	57	39
10	55	37
11	54	36
12	52	33
13	50	32
14	49	31
15	46	30
16	45	29
18	44	28
20	42	26
22	41	27
24	40	27
26	40	26
28	39	26
30	39	26
32	39	26

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
"NORMALIZE 1000 OF AUSTENITIZE 1550 OF

*For forged or rolled steels only.

UNS H86450 Hardness Band SAE/AISI 8645H

C	Mn	Si	Ni	Cr	Mo
.42 / .49	.70 / 1.05	0.15 / 0.25	.35 / .75	.35 / .65	.15 / .25

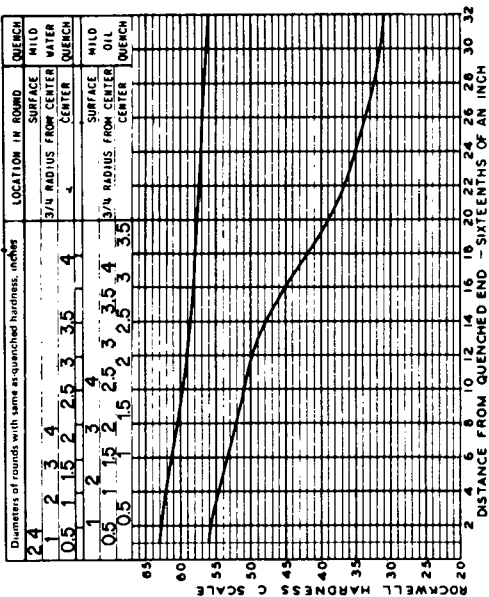


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
J ¹ DISTANCE FROM SURFACE IN INCHES	BRINELL		HIT
	MAX.	MIN.	
1	63	50	
2	63	50	
3	63	50	
4	63	50	
5	63	50	
6	63	50	
7	61	48	
8	60	46	
9	50	41	
10	50	39	
11	50	37	
12	55	35	
13	54	34	
14	52	33	
15	51	32	
16	50	31	
17	47	30	
18	47	30	
19	45	29	
20	43	28	
21	42	28	
22	42	28	
23	42	28	
24	42	28	
25	40	27	
26	40	27	
27	40	27	
28	40	27	
29	40	27	
30	41	27	
31	41	27	
32	41	27	

HEAT TREATING TEMPERATURES
 RECOMMENDED BY SAE
 "NORMALIZE 1600 OF
 AUTEMPERITZ 1500 OF
 "for forged or rolled specimens only.

UNS H86451 Hardenability Band SAE/AISI 86B45H

C	Mn	Si	Ni	Cr	Mo	S
42 / 49	.70 / 1.05	0.15 to .35	35 / 75	.35 / .65	.15 / .25	

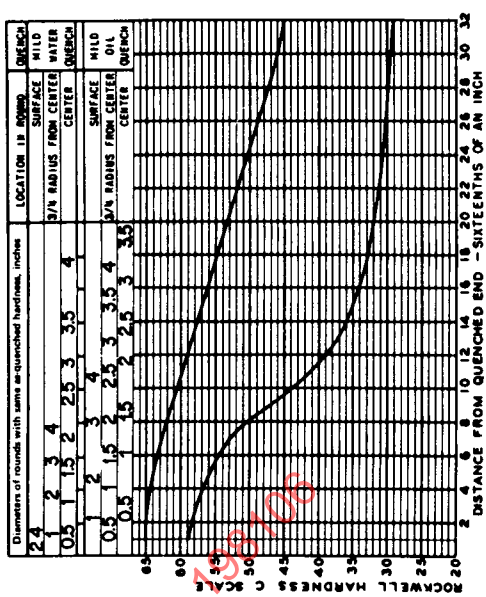


HARDNESS (LIMITS FOR SPECIFICATION PURPOSES)			
1. DISTANCE FROM SURFACE OF PART	2. BRINELL		
	MAX.	MIN.	HAR.
1	63	56	
2	63	56	
3	62	55	
4	62	54	
5	62	54	
6	61	53	
7	61	52	
8	60	52	
9	60	51	
10	59	50	
11	59	50	
12	58	50	
13	58	49	
14	58	48	
15	58	48	
16	58	48	
18	58	42	
20	58	39	
22	57	37	
24	57	35	
26	57	34	
28	57	32	
30	56	32	
32	56	31	

HEAT TREATING TEMPERATURES	
RECOMMENDED BY SAE	
*NORMALIZE 1600 °F	
*AUSTERITIZE 1600 °F	
*or forged or rolled specimens only.	

UNS H86500 Hardenability Band SAE/AISI 8650H

C	Mn	Si	Ni	Cr	Mo
.47 / .54	.70 / 1.05	0.15 / 0.35	.35 / .75	.35 / .65	.15 / .25



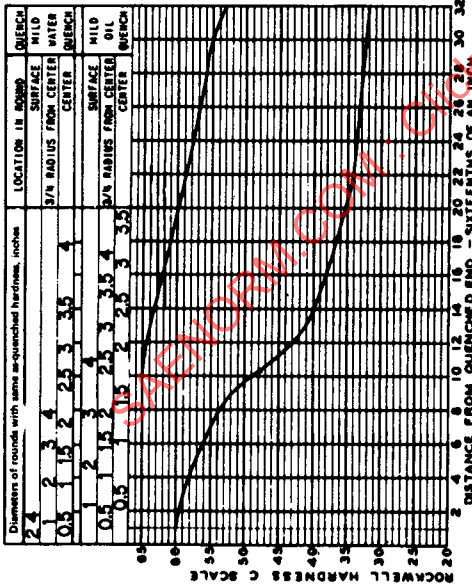
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
TYP. PLATE THICKNESS OF 1/2 INCH	RANGE		
	MIN.	MAX.	HIT
1	65	50	
2	65	50	
3	65	57	
4	65	57	
5	65	50	
6	65	54	
7	65	53	
8	62	50	
9	61	47	
10	60	44	
11	60	41	
12	50	30	
13	50	37	
14	50	30	
15	37	30	
16	30	34	
18	55	33	
20	53	32	
22	52	31	
24	50	31	
26	40	30	
28	47	30	
30	46	29	
32	45	29	

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
NORMALIZE 1000 OF
AUSTENITIZE 1050 OF

*for forged or rolled specimens only.

UNS H86550 Hardenability Band SAE/AISI 8655H

C	Min	Si	Mn	C _r	M _h
.50	.70	0.15/0.35	.35	.35	.15
	.40		.75	.45	.25



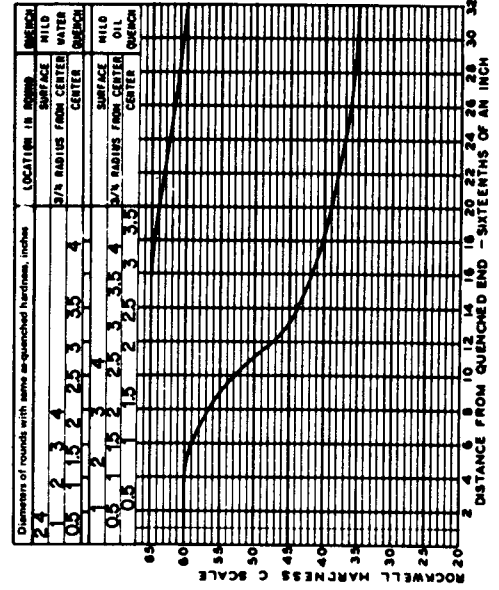
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"1" DISTANCE FROM QUENCHED END	MIN	MAX	HIT
1	40	45	30
2	40	45	30
3	40	45	30
4	40	45	30
5	40	45	30
6	40	45	30
7	40	45	30
8	40	45	30
9	40	45	30
10	40	45	30
11	40	45	30
12	40	45	30
13	40	45	30
14	40	45	30
15	40	45	30
16	40	45	30
17	40	45	30
18	40	45	30
19	40	45	30
20	40	45	30
21	40	45	30
22	40	45	30
23	40	45	30
24	40	45	30
25	40	45	30
26	40	45	30
27	40	45	30
28	40	45	30
29	40	45	30
30	40	45	30
31	40	45	30
32	40	45	30
33	40	45	30
34	40	45	30
35	40	45	30
36	40	45	30
37	40	45	30
38	40	45	30
39	40	45	30
40	40	45	30

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1700 OF AUSTENITIZE 1700 OF

*For forged or rolled specimens only.

UNS H86600 Hardenability Band SAE/AISI 8660H

C	Min	Si	Mn	C _r	M _h
.55	.70	0.15/0.35	.35	.35	.15
	.45		.75	.45	.25



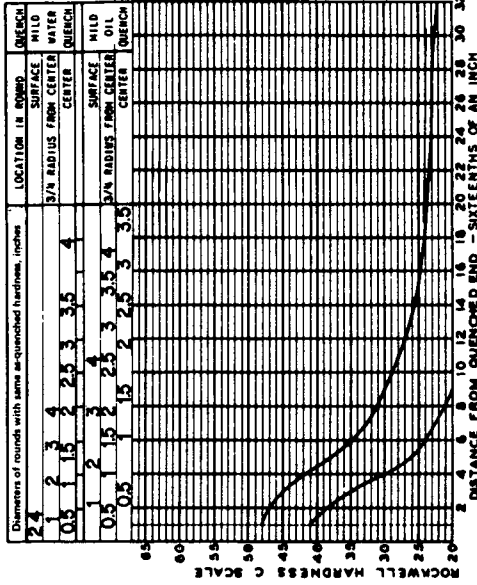
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
"1" DISTANCE FROM QUENCHED END	MIN	MAX	HIT
1	40	45	30
2	40	45	30
3	40	45	30
4	40	45	30
5	40	45	30
6	40	45	30
7	40	45	30
8	40	45	30
9	40	45	30
10	40	45	30
11	40	45	30
12	40	45	30
13	40	45	30
14	40	45	30
15	40	45	30
16	40	45	30
17	40	45	30
18	40	45	30
19	40	45	30
20	40	45	30
21	40	45	30
22	40	45	30
23	40	45	30
24	40	45	30
25	40	45	30
26	40	45	30
27	40	45	30
28	40	45	30
29	40	45	30
30	40	45	30
31	40	45	30
32	40	45	30
33	40	45	30
34	40	45	30
35	40	45	30
36	40	45	30
37	40	45	30
38	40	45	30
39	40	45	30
40	40	45	30

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 1700 OF AUSTENITIZE 1700 OF

*For forged or rolled specimens only.

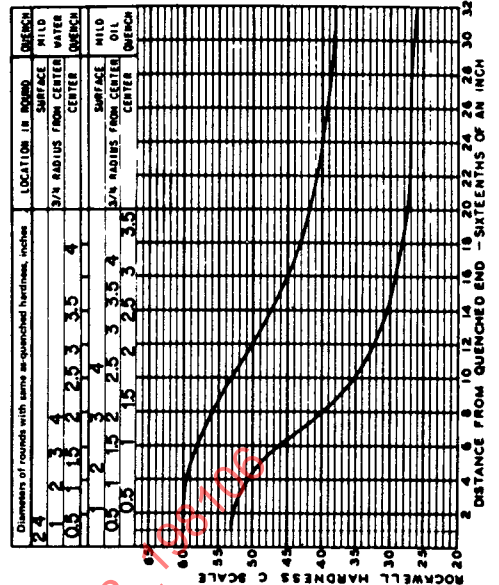
UNS H87200 Hardenability Band SAE/AISI 8720H

C	Min	Si	Mn	C _r	M _h
.17	.35	0.15/0.35	.35	.35	.30
	.30		.75	.45	.30



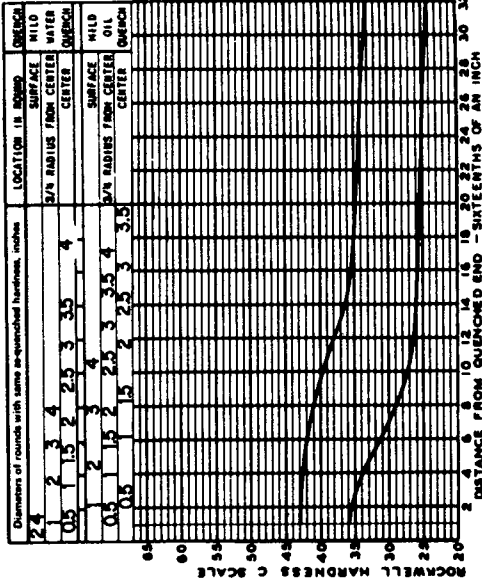
UNS H87400 Hardenability Band SAE/AISI 8740H

C	Min	Si	Mn	C _r	M _h
.37	.70	0.15/0.35	.35	.35	.30
	.44		.75	.45	.30



UNS H93100 Hardenability Band SAE/AISI 9310H

C	Mn	Si	P	S	Cr	Mo
.07	.13	.70	0.15/0.35	2.85	1.00	.08
				2.50	1.05	.15



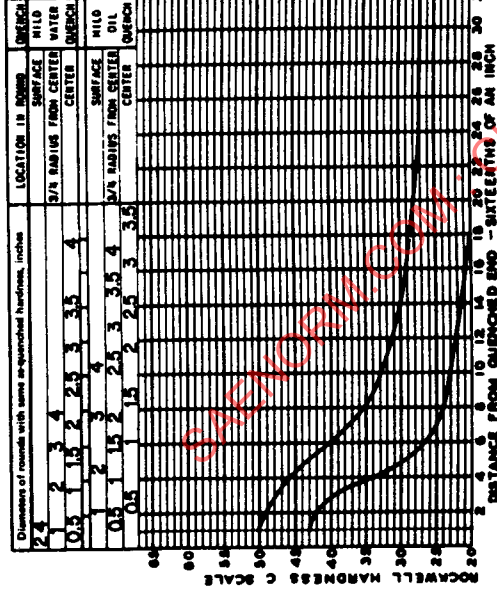
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		MAX	MIN
"A" DISTANCE BETWEEN SPECIMENS BY INCH	"B" DISTANCE BETWEEN SPECIMENS BY INCH		
1	1	50	30
2	2	45	25
3	3	40	20
4	4	35	15
5	5	30	10
6	6	25	5
7	7	20	0
8	8	15	0
9	9	10	0
10	10	5	0
11	11	0	0
12	12	0	0
13	13	0	0
14	14	0	0
15	15	0	0
16	16	0	0
17	17	0	0
18	18	0	0
19	19	0	0
20	20	0	0
21	21	0	0
22	22	0	0
23	23	0	0
24	24	0	0
25	25	0	0
26	26	0	0
27	27	0	0
28	28	0	0
29	29	0	0
30	30	0	0
31	31	0	0
32	32	0	0

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE: "NORMALIZE" 1700 or "AUSTENITIZE" 1600 of

*For forged or rolled specimens only.

UNS H88220 Hardenability Band SAE/AISI 8822H

C	Mn	Si	P	S	Cr	Mo
.10	.20	.70	0.15/0.35	.35	.75	.02
				.30	.70	.00



HARDNESS LIMITS FOR SPECIFICATION PURPOSES		MAX	MIN
"A" DISTANCE BETWEEN SPECIMENS BY INCH	"B" DISTANCE BETWEEN SPECIMENS BY INCH		
1	1	50	30
2	2	45	25
3	3	40	20
4	4	35	15
5	5	30	10
6	6	25	5
7	7	20	0
8	8	15	0
9	9	10	0
10	10	5	0
11	11	0	0
12	12	0	0
13	13	0	0
14	14	0	0
15	15	0	0
16	16	0	0
17	17	0	0
18	18	0	0
19	19	0	0
20	20	0	0
21	21	0	0
22	22	0	0
23	23	0	0
24	24	0	0
25	25	0	0
26	26	0	0
27	27	0	0
28	28	0	0
29	29	0	0
30	30	0	0
31	31	0	0
32	32	0	0

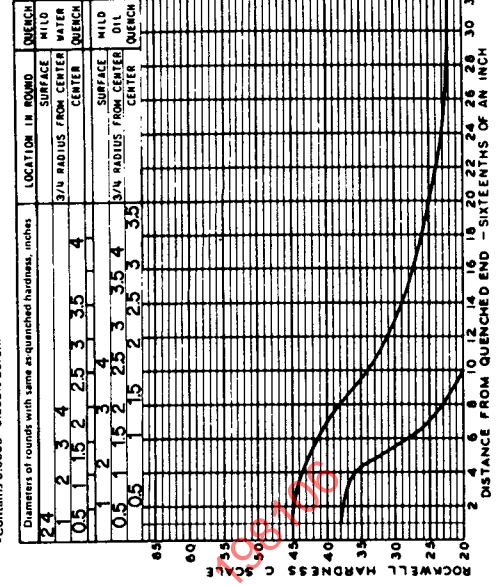
HEAT TREATING TEMPERATURES RECOMMENDED BY SAE: "NORMALIZE" 1700 or "AUSTENITIZE" 1600 of

*For forged or rolled specimens only.

UNS H94151 Hardenability Band SAE/AISI 94B15H

C	Mn	Si	P	S	Cr	Mo
.12	.18	.70	0.15/0.35	.25	.75	.05
				.20	.70	.15

*Contains 0.0005-0.003% boron.



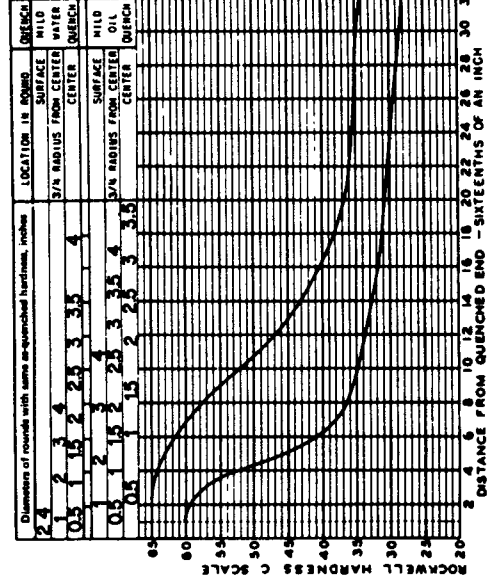
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		MAX	MIN
"A" DISTANCE BETWEEN SPECIMENS BY INCH	"B" DISTANCE BETWEEN SPECIMENS BY INCH		
1	1	50	30
2	2	45	25
3	3	40	20
4	4	35	15
5	5	30	10
6	6	25	5
7	7	20	0
8	8	15	0
9	9	10	0
10	10	5	0
11	11	0	0
12	12	0	0
13	13	0	0
14	14	0	0
15	15	0	0
16	16	0	0
17	17	0	0
18	18	0	0
19	19	0	0
20	20	0	0
21	21	0	0
22	22	0	0
23	23	0	0
24	24	0	0
25	25	0	0
26	26	0	0
27	27	0	0
28	28	0	0
29	29	0	0
30	30	0	0
31	31	0	0
32	32	0	0

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE: "NORMALIZE" 1700 or "AUSTENITIZE" 1600 of

*For forged or rolled specimens only.

UNS H92600 Hardenability Band SAE/AISI 9260H

C	Mn	Si	P	S	Cr	Mo
.05	.05	.70	0.15/0.35	.20	.70	.02
				.15	.65	.00



HARDNESS LIMITS FOR SPECIFICATION PURPOSES		MAX	MIN
"A" DISTANCE BETWEEN SPECIMENS BY INCH	"B" DISTANCE BETWEEN SPECIMENS BY INCH		
1	1	60	40
2	2	55	35
3	3	50	30
4	4	45	25
5	5	40	20
6	6	35	15
7	7	30	10
8	8	25	5
9	9	20	0
10	10	15	0
11	11	10	0
12	12	5	0
13	13	0	0
14	14	0	0
15	15	0	0
16	16	0	0
17	17	0	0
18	18	0	0
19	19	0	0
20	20	0	0
21	21	0	0
22	22	0	0
23	23	0	0
24	24	0	0
25	25	0	0
26	26	0	0
27	27	0	0
28	28	0	0
29	29	0	0
30	30	0	0
31	31	0	0
32	32	0	0

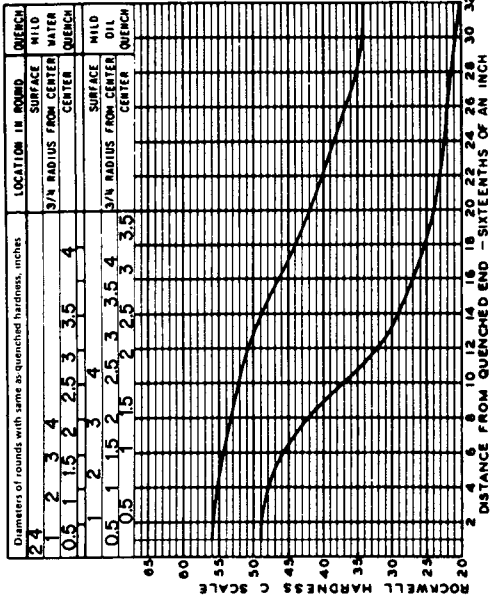
HEAT TREATING TEMPERATURES RECOMMENDED BY SAE: "NORMALIZE" 1600 or "AUSTENITIZE" 1500 of

*For forged or rolled specimens only.

UNS H94301 Hardenability Band SAE/AISI 94B30H

C		Min	Si	Ni	Cr	Mo	B
.27	.33	.70	1.05	.25	.25	.08	.15

*Contains 0.0005-0.003% boron.

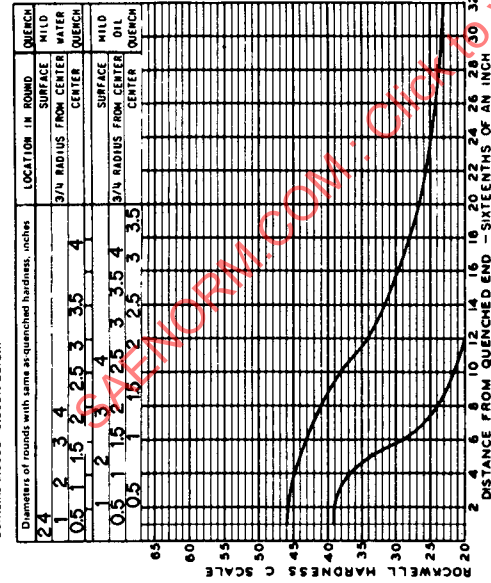


HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/4" DISTANCE FROM END	1/2" DISTANCE FROM END
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
10	11
11	12
12	13
13	14
14	15
15	16
16	17
17	18
18	19
19	20
20	21
21	22
22	23
23	24
24	25
25	26
26	27
27	28
28	29
29	30
30	31
31	32
32	33
33	34
34	35
35	36
36	37
37	38
38	39
39	40
40	41
41	42
42	43
43	44
44	45
45	46
46	47
47	48
48	49
49	50
50	51
51	52
52	53
53	54
54	55
55	56
56	57
57	58
58	59
59	60
60	61
61	62
62	63
63	64
64	65
65	66
66	67
67	68
68	69
69	70
70	71
71	72
72	73
73	74
74	75
75	76
76	77
77	78
78	79
79	80
80	81
81	82
82	83
83	84
84	85
85	86
86	87
87	88
88	89
89	90
90	91
91	92
92	93
93	94
94	95
95	96
96	97
97	98
98	99
99	100

UNS H94171 Hardenability Band SAE/AISI 94B17H

C		Min	Si	Ni	Cr	Mo	B
.18	.20	.70	1.05	.25	.25	.08	.15

*Contains 0.0005-0.003% boron.

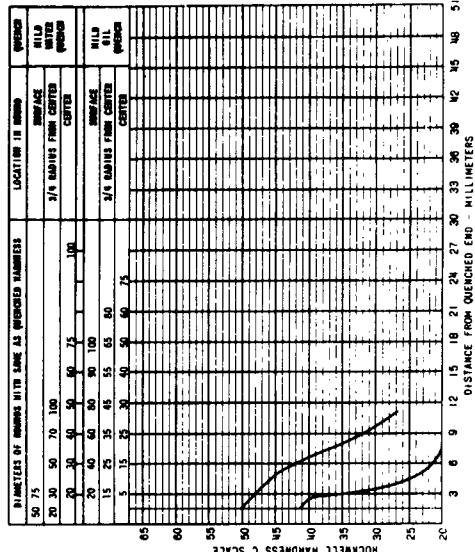


HARDNESS LIMITS FOR SPECIFICATION PURPOSES	
1/4" DISTANCE FROM END	1/2" DISTANCE FROM END
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
10	11
11	12
12	13
13	14
14	15
15	16
16	17
17	18
18	19
19	20
20	21
21	22
22	23
23	24
24	25
25	26
26	27
27	28
28	29
29	30
30	31
31	32
32	33
33	34
34	35
35	36
36	37
37	38
38	39
39	40
40	41
41	42
42	43
43	44
44	45
45	46
46	47
47	48
48	49
49	50
50	51
51	52
52	53
53	54
54	55
55	56
56	57
57	58
58	59
59	60
60	61
61	62
62	63
63	64
64	65
65	66
66	67
67	68
68	69
69	70
70	71
71	72
72	73
73	74
74	75
75	76
76	77
77	78
78	79
79	80
80	81
81	82
82	83
83	84
84	85
85	86
86	87
87	88
88	89
89	90
90	91
91	92
92	93
93	94
94	95
95	96
96	97
97	98
98	99
99	100

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JNS H15220
HARDENABILITY BAND
SAE/AISI 1522H

C	Mn	Si	Mi	Cr	Mo
.11/.25	1.00/1.50	.16/.35			



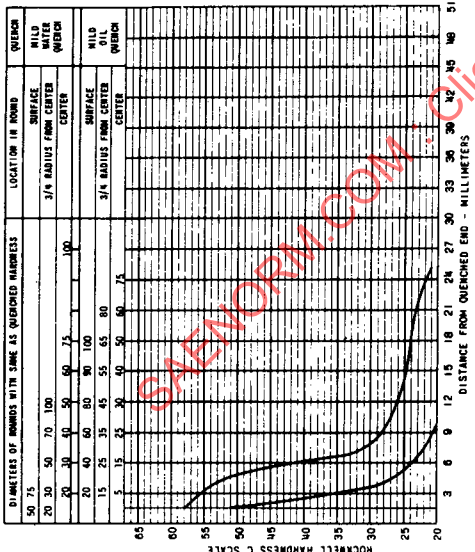
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
J" DISTANCE MILLIMETERS	HRC		
	MAX.	MIN.	HV.
1.5	50	41	
3	48	35	
6.5	46	25	
6	42	21	
9.5	37		
9	32	--	
10.5	28	--	
12	--	--	
15.5	--	--	
18	--	--	
16.5	--	--	
19	--	--	
19.5	--	--	
21	--	--	
22.5	--	--	
24	--	--	
27	--	--	
30	--	--	
33	--	--	
36	--	--	
39	--	--	
42	--	--	
45	--	--	
48	--	--	
51	--	--	

HEAT TREATING TEMPERATURES	
RECOMMENDED BY SAE	
*NORMALIZE	925 °C
AUSTENITIZE	925 °C

For forged or rolled specimens only.

JUNS H10380

C	Mn	Si	Al	Cr	Mo
.34/.43	.50/.00	.15/.38			

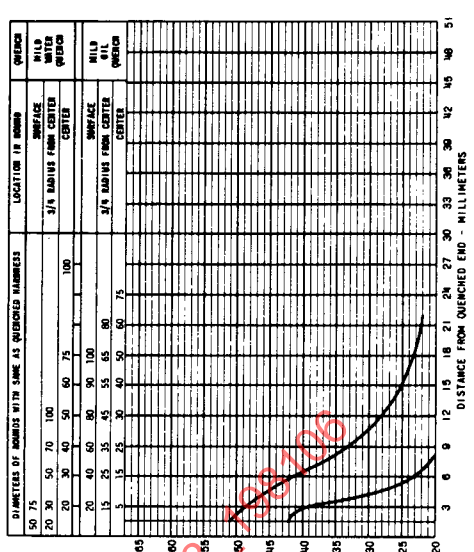


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			HRC	
"J" DISTANCE MILLIMETERS	MAX.	MIR.		
1.5	58	51		
3	56	37		
6.5	52	27		
8	43	24		
7.5	31	22		
9	29	20		
10.5	27	20		
12	26	--		
13.5	26	--		
15	25	--		
16.5	25	--		
18	24	--		
19.5	24	--		
21	24	--		
22.5	23	--		
24	22	--		
27	--	--		
30	--	--		
32	--	--		
36	--	--		
40	--	--		
42	--	--		
46	--	--		
50	--	--		
51	--	--		

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE		
*NORMALIZE	870 °C	
AUSTENITIZE	845 °C	
For forged or rolled specimens only.		

NS H15240

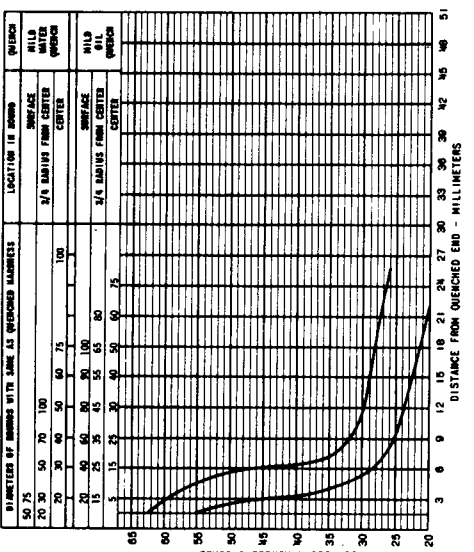
C	Mn	Si	Mi	Cr	Mo
.18/.26	1.25/.75	.15/.35			



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
D	D	D	D
1.5	51	MIN.	
2	49	32	
3	45	32	
4	42	23	
5	37	21	
6	34	21	
7	31	21	
8	28	21	
9	27	21	
10	27	21	
11	27	21	
12	27	21	
13	27	21	
14	27	21	
15	27	21	
16	27	21	
17	27	21	
18	27	21	
19	27	21	
20	27	21	
21	27	21	
22	27	21	
23	27	21	
24	27	21	
25	27	21	
26	27	21	
27	27	21	
28	27	21	
29	27	21	
30	27	21	
31	27	21	
32	27	21	
33	27	21	
34	27	21	
35	27	21	
36	27	21	
37	27	21	
38	27	21	
39	27	21	
40	27	21	
41	27	21	
42	27	21	
43	27	21	
44	27	21	
45	27	21	
46	27	21	
47	27	21	
48	27	21	
49	27	21	
50	27	21	
51	27	21	

NS H10460
HARDENABILITY BAND
SAE/AISI 1045H

C	Mo	Si	Mn	Cr	Mo
.42/.51	.50/.00	.16/.36			



MAXIMUM LIMITS FOR SPECIFICATION PURPOSES			
Q ₁ PLASTICIZER WALLTHICKNESS	HALL	HILL	INC
1.5	62	55	
2	60	45	
4.5	55	33	
8	46	28	
7.5	34	26	
9	32	25	
10.5	31	25	
12	30	24	
13.5	30	23	
15	29	22	
16.5	29	22	
18	29	21	
19.5	28	21	
21	28	20	
22.5	27	--	
26	27	--	
27	--	--	
30	--	--	
33	--	--	
36	--	--	
39	--	--	
42	--	--	
46	--	--	
50	--	--	
51	--	--	

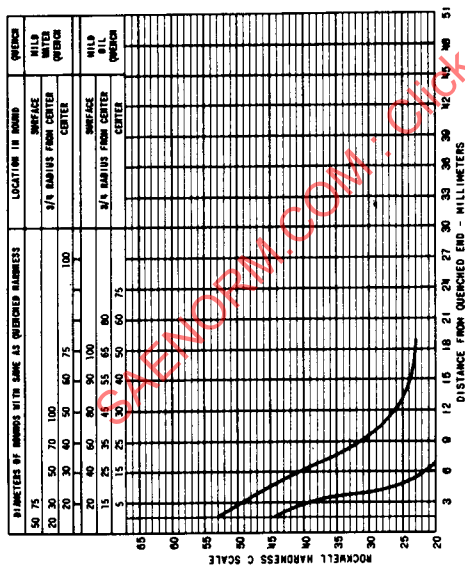
HEAT TREATING TEMPERATURES		
RECOMMENDED BY SAE	INC	Q ₁
AUTOMATIZE	500	50
AUTOMATIZE	685	50
For forced or rolled specimens only.		

UNS H15280 HARDENABILITY BAND SAE/AISI 1528H

C	Mn	Si	Bi	Cr	Mo	B
.27/.30	1.00/1.50	.15/.35				*

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
"J" DISTANCE MILLIMETERS	MAX.	MIN.	
1.5	53	44	
3	50	39	
4.5	46	27	
6	41	21	
7.5	36	--	
9	32	--	
10.5	28	--	
12	25	--	
12.5	25	--	
15	24	--	
16.5	24	--	
18	23	--	
19.5	--	--	
21	--	--	
22.5	--	--	
24	--	--	
27	--	--	
29	--	--	
30	--	--	
32	--	--	
34	--	--	
36	--	--	
38	--	--	
40	--	--	
42	--	--	
44	--	--	
46	--	--	
48	--	--	
50	--	--	
51	--	--	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 870 °C
 *AUSTENITIZE 870 °C
 *For forged or rolled specimens only.

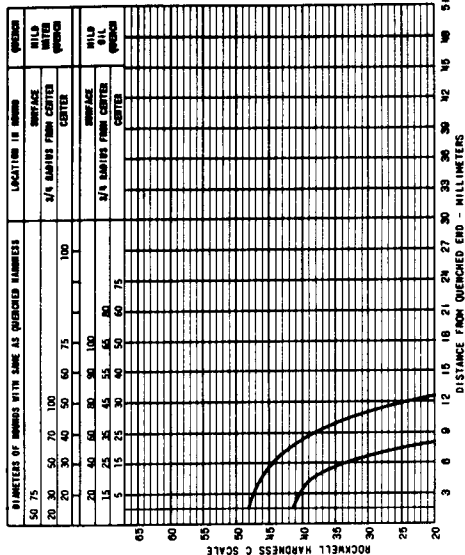


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
"J" DISTANCE MILLIMETERS	MAX.	MIN.	
1.5	48	41	
3	46	40	
4.5	46	38	
6	45	33	
7.5	42	25	
9	38	--	
10.5	33	--	
12	24	--	
12.5	--	--	
15	--	--	
16.5	--	--	
18	--	--	
19.5	--	--	
21	--	--	
22.5	--	--	
24	--	--	
27	--	--	
29	--	--	
30	--	--	
32	--	--	
34	--	--	
36	--	--	
38	--	--	
40	--	--	
42	--	--	
44	--	--	
46	--	--	
48	--	--	
50	--	--	
51	--	--	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 925 °C
 *AUSTENITIZE 925 °C
 *For forged or rolled specimens only.

UNS H15211 HARDENABILITY BAND SAE/AISI 1521H

C	Mn	Si	Bi	Cr	Mo	B
.17/.24	.70/1.20	.15/.35				*

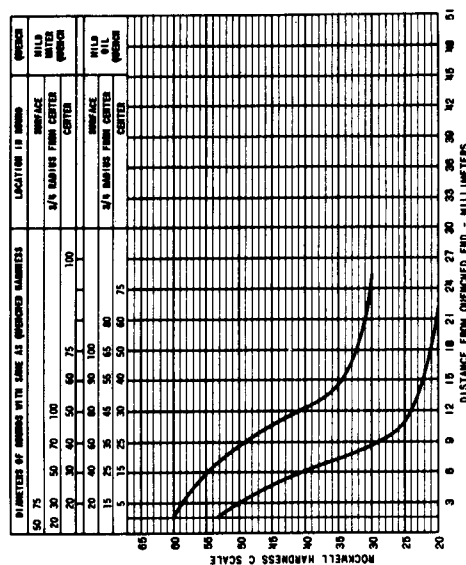


UNS H15410 HARDENABILITY BAND SAE/AISI 1541H

C	Mn	Si	Bi	Cr	Mo	B
.35/.45	1.25/1.75	.15/.35				

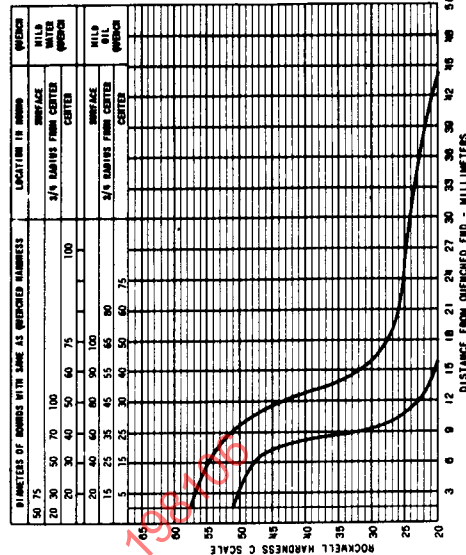
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
"J" DISTANCE MILLIMETERS	MAX.	MIN.	
1.5	60	53	
3	58	50	
4.5	57	45	
6	56	40	
7.5	52	34	
9	49	29	
10.5	45	25	
12	41	24	
12.5	37	23	
15	35	22	
16.5	34	21	
18	33	21	
19.5	32	20	
21	31	20	
22.5	31	--	
24	30	--	
27	--	--	
29	--	--	
30	--	--	
32	--	--	
34	--	--	
36	--	--	
38	--	--	
40	--	--	
42	--	--	
44	--	--	
46	--	--	
48	--	--	
50	--	--	
51	--	--	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 870 °C
 *AUSTENITIZE 845 °C
 *For forged or rolled specimens only.



UNS H15351 HARDENABILITY BAND SAE/AISI 1535H

C	Mn	Si	Bi	Cr	Mo	B
.31/.39	.70/1.20	.15/.35				*



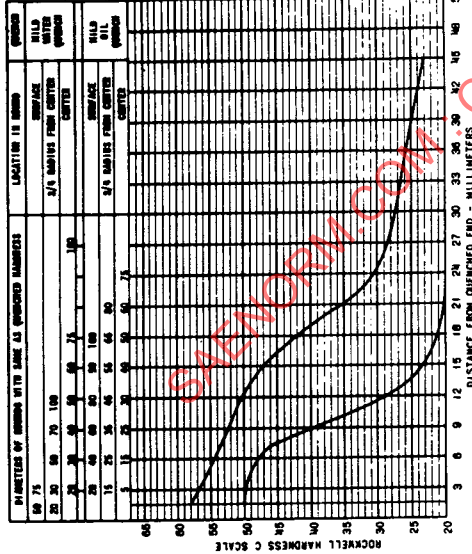
HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
"J" DISTANCE MILLIMETERS	MAX.	MIN.	
1.5	58	51	
3	57	50	
4.5	56	49	
6	55	48	
7.5	53	44	
9	52	42	
10.5	48	35	
12	44	23	
12.5	37	21	
15	--	--	
16.5	29	20	
18	--	--	
19.5	27	--	
21	--	--	
22.5	26	--	
24	--	--	
27	25	--	
29	--	--	
30	--	--	
32	--	--	
34	--	--	
36	--	--	
38	--	--	
40	--	--	
42	--	--	
44	--	--	
46	--	--	
48	--	--	
50	--	--	
51	--	--	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
 *NORMALIZE 870 °C
 *AUSTENITIZE 845 °C
 *For forged or rolled specimens only.

UNS H15371 HARDENABILITY BAND SAE/AISI 15B41H

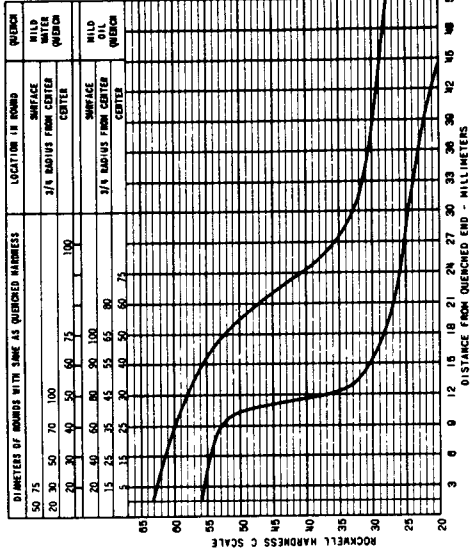
C	Mn	Si	Cr	Mo	B
.30/.29	1.00/1.50	.15/.25			

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE MILLIMETERS	MAX.	MIN.
1.5	56	50
3	57	50
6	56	49
10	55	48
15	54	45
20	53	43
25	52	41
30	50	39
35	49	37
40	48	35
45	46	33
50	44	31
55	42	29
60	40	27
65	38	25
70	36	23
75	34	21
80	32	19
85	30	17
90	28	15
95	26	13
100	24	11
105	22	9
110	20	7
115	18	5
120	16	3
125	14	1
130	12	-
135	10	-
140	8	-
145	6	-
150	4	-
155	2	-
160	0	-
165	-	-
170	-	-
175	-	-
180	-	-
185	-	-
190	-	-
195	-	-
200	-	-
205	-	-
210	-	-
215	-	-
220	-	-
225	-	-
230	-	-
235	-	-
240	-	-
245	-	-
250	-	-
255	-	-
260	-	-
265	-	-
270	-	-
275	-	-
280	-	-
285	-	-
290	-	-
295	-	-
300	-	-
305	-	-
310	-	-
315	-	-
320	-	-
325	-	-
330	-	-
335	-	-
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400	-	-
405	-	-
410	-	-
415	-	-
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440	-	-
445	-	-
450	-	-
455	-	-
460	-	-
465	-	-
470	-	-
475	-	-
480	-	-
485	-	-
490	-	-
495	-	-
500	-	-
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515	-	-
520	-	-
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530	-	-
535	-	-
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565	-	-
570	-	-
575	-	-
580	-	-
585	-	-
590	-	-
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615	-	-
620	-	-
625	-	-
630	-	-
635	-	-
640	-	-
645	-	-
650	-	-
655	-	-
660	-	-
665	-	-
670	-	-
675	-	-
680	-	-
685	-	-
690	-	-
695	-	-
700	-	-
705	-	-
710	-	-
715	-	-
720	-	-
725	-	-
730	-	-
735	-	-
740	-	-
745	-	-
750	-	-
755	-	-
760	-	-
765	-	-
770	-	-
775	-	-
780	-	-
785	-	-
790	-	-
795	-	-
800	-	-
805	-	-
810	-	-
815	-	-
820	-	-
825	-	-
830	-	-
835	-	-
840	-	-
845	-	-
850	-	-
855	-	-
860	-	-
865	-	-
870	-	-
875	-	-
880	-	-
885	-	-
890	-	-
895	-	-
900	-	-
905	-	-
910	-	-
915	-	-
920	-	-
925	-	-
930	-	-
935	-	-
940	-	-
945	-	-
950	-	-
955	-	-
960	-	-
965	-	-
970	-	-
975	-	-
980	-	-
985	-	-
990	-	-
995	-	-
1000	-	-



UNS H15481 HARDENABILITY BAND SAE/AISI 15B48H

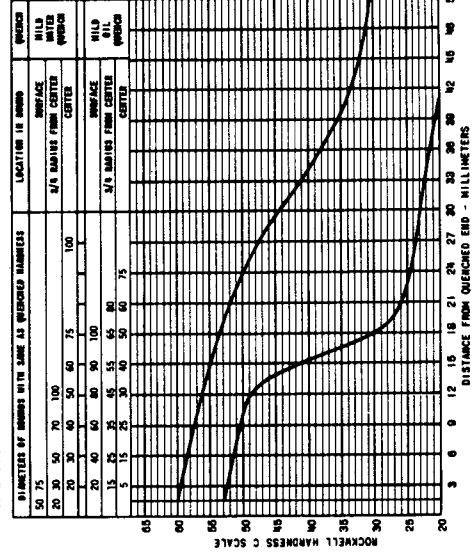
C	Mn	Si	Cr	Mo	B
.43/.53	1.00/1.50	.15/.25			



UNS H15411 HARDENABILITY BAND SAE/AISI 15B41H

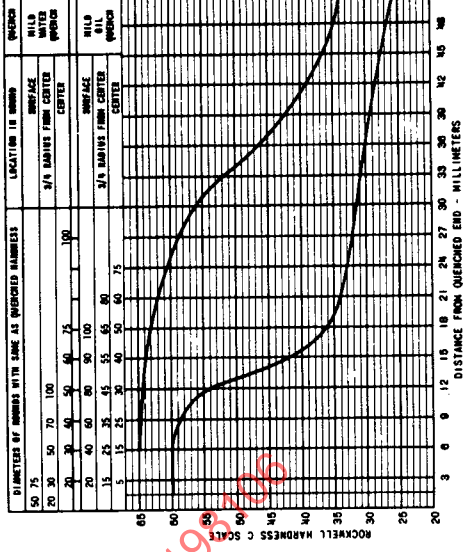
C	Mn	Si	Cr	Mo	B
.35/.45	1.25/1.75	.15/.25			

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
1/4" DISTANCE MILLIMETERS	MAX.	MIN.
1.5	60	53
3	60	52
6	59	52
10	58	51
15	56	51
20	54	50
25	52	49
30	50	48
35	48	46
40	46	44
45	44	42
50	42	40
55	40	38
60	38	36
65	36	34
70	34	32
75	32	30
80	30	28
85	28	26
90	26	24
95	24	22
100	22	20
105	20	18
110	18	16
115	16	14
120	14	12
125	12	10
130	10	8
135	8	6
140	6	4
145	4	2
150	2	0
155	0	-
160	-	-
165	-	-
170	-	-
175	-	-
180	-	-
185	-	-
190	-	-
195	-	-
200	-	-
205	-	-
210	-	-
215	-	-
220	-	-
225	-	-
230	-	-
235	-	-
240	-	-
245	-	-
250	-	-
255	-	-
260	-	-
265	-	-
270	-	-
275	-	-
280	-	-
285	-	-
290	-	-
295	-	-
300	-	-
305	-	-
310	-	-
315	-	-
320	-	-
325	-	-
330	-	-
335	-	-
340	-	-
345	-	-
350	-	-
355	-	-
360	-	-
365	-	-
370	-	-
375	-	-
380	-	-
385	-	-
390	-	-
395	-	-
400	-	-
405	-	-
410	-	-
415	-	-
420	-	-
425	-	-
430	-	-
435	-	-
440	-	-
445	-	-
450	-	-
455	-	-
460	-	-
465	-	-
470	-	-
475	-	-
480	-	-
485	-	-
490	-	-
495	-	-
500	-	-
505	-	-
510	-	-
515	-	-
520	-	-
525	-	-
530	-	-
535	-	-
540	-	-
545	-	-
550	-	-
555	-	-
560	-	-
565	-	-
570	-	-
575	-	-
580	-	-
585	-	-
590	-	-
595	-	-
600	-	-
605	-	-
610	-	-
615	-	-
620	-	-
625	-	-
630	-	-
635	-	-
640	-	-
645	-	-
650	-	-
655	-	-
660	-	-
665	-	-
670	-	-
675	-	-
680	-	-
685	-	-
690	-	-
695	-	-
700	-	-
705	-	-
710	-	-
715	-	-
720	-	-
725	-	-
730	-	-
735	-	-
740	-	-
745	-	-
750	-	-
755	-	-
760	-	-
765	-	-
770	-	-
775	-	-
780	-	-
785	-	-
790	-	-
795	-	-
800	-	-
805	-	-
810	-	-
815	-	-
820	-	-
825	-	-
830	-	-
835	-	-
840	-	-
845	-	-
850	-	-
855	-	-
860	-	-
865	-	-
870	-	-
875	-	-
880	-	-
885	-	-
890	-	-
895	-	-
900	-	-
905	-	-
910	-	-
915	-	-
920	-	-
925	-	-
930	-	-
935	-	-
940	-	-
945	-	-
950	-	-
955	-	-
960	-	-
965	-	-
970	-	-
975	-	-
980	-	-
985	-	-
990	-	-
995	-	-
1000	-	-



UNS H15621 HARDENABILITY BAND SAE/AISI 15B62H

C	Mn	Si	Cr	Mo	B
.54/.67	1.00/1.50	.40/.60			

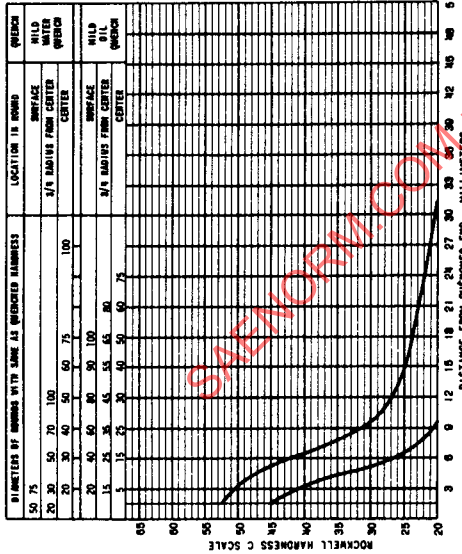


HARDENABILITY BAND

C	Ms	Si	Mn	Cr	No
.24/.30	.60/1.00	.15/.25			.20/.30

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
1/4" DIAMETER BALL	1/2" DIAMETER BALL	1/4" DIAMETER BALL	1/2" DIAMETER BALL
1.5	59	52	52
3	57	50	50
4.5	55	48	48
6	52	46	46
7.5	48	44	44
9	41	41	41
10.5	36	38	38
12	33	35	35
13.5	31	33	33
15	30	31	31
16.5	29	29	29
18	28	28	28
19.5	27	27	27
21	26	26	26
22.5	25	25	25
24	25	25	25
25	25	25	25
27	25	25	25
28	25	25	25
30	25	25	25
32	24	24	24
34	24	24	24
36	23	23	23
38	23	23	23
40	23	23	23
42	23	23	23
44	23	23	23
46	23	23	23
48	23	23	23
50	23	23	23
52	23	23	23
54	23	23	23
56	23	23	23
58	23	23	23
60	23	23	23
62	23	23	23
64	23	23	23
66	23	23	23
68	23	23	23
70	23	23	23
72	23	23	23
74	23	23	23
76	23	23	23
78	23	23	23
80	23	23	23
82	23	23	23
84	23	23	23
86	23	23	23
88	23	23	23
90	23	23	23
92	23	23	23
94	23	23	23
96	23	23	23
98	23	23	23
100	23	23	23

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
NORMALIZE 870 °C
AUSTENITIZE 870 °C
*For forged or rolled specimens only.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
1/4" DIAMETER BALL	1/2" DIAMETER BALL	1/4" DIAMETER BALL	1/2" DIAMETER BALL
1.5	57	50	50
3	55	48	48
4.5	52	46	46
6	48	44	44
7.5	43	40	40
9	38	36	36
10.5	33	31	31
12	30	28	28
13.5	28	26	26
15	27	25	25
16.5	26	24	24
18	25	23	23
19.5	24	22	22
21	23	21	21
22.5	22	20	20
24	22	20	20
25	21	19	19
27	21	18	18
28	21	17	17
30	21	16	16
32	21	15	15
34	21	14	14
36	21	13	13
38	21	12	12
40	21	11	11
42	21	10	10
44	21	9	9
46	21	8	8
48	21	7	7
50	21	6	6
52	21	5	5
54	21	4	4
56	21	3	3
58	21	2	2
60	21	1	1
62	21	0	0
64	21	0	0
66	21	0	0
68	21	0	0
70	21	0	0
72	21	0	0
74	21	0	0
76	21	0	0
78	21	0	0
80	21	0	0
82	21	0	0
84	21	0	0
86	21	0	0
88	21	0	0
90	21	0	0
92	21	0	0
94	21	0	0
96	21	0	0
98	21	0	0
100	21	0	0

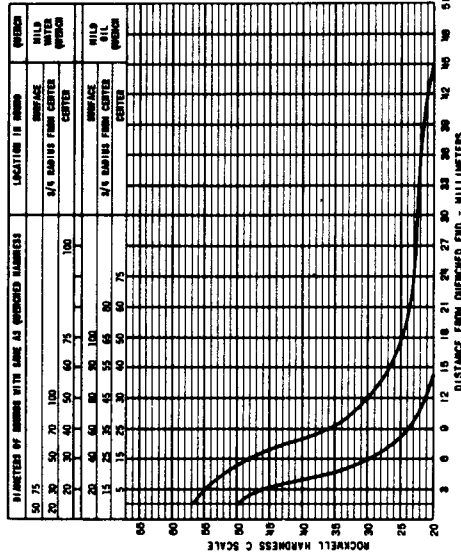
HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
NORMALIZE 870 °C
AUSTENITIZE 870 °C
*For forged or rolled specimens only.

HARDENABILITY BAND

C	Ms	Si	Mn	Cr	No
.27/.35	.60/1.00	.16/.25			.20/.30

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
1/4" DIAMETER BALL	1/2" DIAMETER BALL	1/4" DIAMETER BALL	1/2" DIAMETER BALL
1.5	62	55	55
3	60	53	53
4.5	58	51	51
6	56	49	49
7.5	53	46	46
9	48	43	43
10.5	41	40	40
12	37	37	37
13.5	35	35	35
15	33	33	33
16.5	32	32	32
18	32	32	32
19.5	31	31	31
21	30	30	30
22.5	30	30	30
24	29	29	29
25	29	29	29
27	29	29	29
28	28	28	28
30	28	28	28
32	28	28	28
34	28	28	28
36	27	27	27
38	27	27	27
40	27	27	27
42	27	27	27
44	26	26	26
46	26	26	26
48	26	26	26
50	26	26	26
52	26	26	26
54	26	26	26
56	26	26	26
58	26	26	26
60	26	26	26
62	26	26	26
64	26	26	26
66	26	26	26
68	26	26	26
70	26	26	26
72	26	26	26
74	26	26	26
76	26	26	26
78	26	26	26
80	26	26	26
82	26	26	26
84	26	26	26
86	26	26	26
88	26	26	26
90	26	26	26
92	26	26	26
94	26	26	26
96	26	26	26
98	26	26	26
100	26	26	26

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
NORMALIZE 870 °C
AUSTENITIZE 870 °C
*For forged or rolled specimens only.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
1/4" DIAMETER BALL	1/2" DIAMETER BALL	1/4" DIAMETER BALL	1/2" DIAMETER BALL
1.5	57	50	50
3	55	48	48
4.5	52	46	46
6	48	44	44
7.5	43	40	40
9	38	36	36
10.5	33	31	31
12	30	28	28
13.5	28	26	26
15	27	25	25
16.5	26	24	24
18	25	23	23
19.5	24	22	22
21	24	21	21
22.5	24	20	20
24	23	19	19
25	23	18	18
27	23	17	17
28	22	16	16
30	22	15	15
32	22	14	14
34	22	13	13
36	22	12	12
38	22	11	11
40	22	10	10
42	21	9	9
44	21	8	8
46	21	7	7
48	21	6	6
50	21	5	5
52	21	4	4
54	21	3	3
56	21	2	2
58	21	1	1
60	21	0	0
62	21	0	0
64	21	0	0
66	21	0	0
68	21	0	0
70	21	0	0
72	21	0	0
74	21	0	0
76	21	0	0
78	21	0	0
80	21	0	0
82	21	0	0
84	21	0	0
86	21	0	0
88	21	0	0
90	21	0	0
92	21	0	0
94	21	0	0
96	21	0	0
98	21	0	0
100	21	0	0

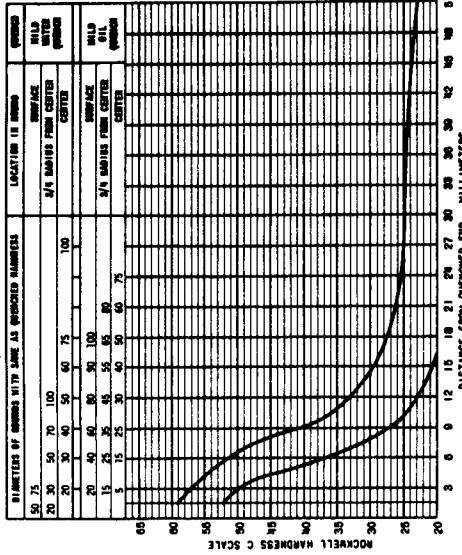
HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
NORMALIZE 870 °C
AUSTENITIZE 870 °C
*For forged or rolled specimens only.

HARDENABILITY BAND

C	Ms	Si	Mn	Cr	No
.24/.30	.60/1.00	.15/.25			.20/.30

HARDNESS LIMITS FOR SPECIFICATION PURPOSES		HRC	
1/4" DIAMETER BALL	1/2" DIAMETER BALL	1/4" DIAMETER BALL	1/2" DIAMETER BALL
1.5	59	52	52
3	57	50	50
4.5	55	48	48
6	52	46	46
7.5	48	44	44
9	41	41	41
10.5	36	38	38
12	33	35	35
13.5	31	33	33
15	30	31	31
16.5	29	29	29
18	28	28	28
19.5	27	27	27
21	26	26	26
22.5	25	25	25
24	25	25	25
25	25	25	25
27	25	25	25
28	25	25	25
30	25	25	25
32	24	24	24
34	24	24	24
36	23	23	23
38	23	23	23
40	23	23	23
42	23	23	23
44	23	23	23
46	23	23	23
48	23	23	23
50	23	23	23
52	23	23	23
54	23	23	23
56	23	23	23
58	23	23	23
60	23	23	23
62	23	23	23
64	23	23	23
66	23	23	23
68	23	23	23
70	23	23	23
72	23	23	23
74	23	23	23
76	23	23	23
78	23	23	23
80	23	23	23
82	23	23	23
84	23	23	23
86	23	23	23
88	23	23	23
90	23	23	23
92	23	23	23
94	23	23	23
96	23	23	23
98	23	23	23
100	23	23	23

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
NORMALIZE 870 °C
AUSTENITIZE 870 °C
*For forged or rolled specimens only.



HARDENABILITY BAND

C	Ms	Si	Mn	Cr	No
.27/.44	.60/1.00	.16/.25			.20/.30

HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/4" DIAMETER BALL	HRC		HRC
	MAX.	MIN.	
1.5	62	55	
3	61	53	
4.5	59	50	
6	56	43	
7.5	53	36	
9	48	30	
10.5	41	28	
12	37	26	
13.5	35	25	
15	33	24	
16.5	32	24	
18	32	23	
19.5	31	23	
21	30	23	
22.5	30	23	
24	29	22	
25	29	22	
27	29	22	
28	28	21	
30	28	21	
32	28	21	
34	28	20	
36	28	20	
38	27	20	
40	27	20	
42	27	20	
44	27	20	
46	27	20	
48	26	20	
50	26	20	
51	26	20	

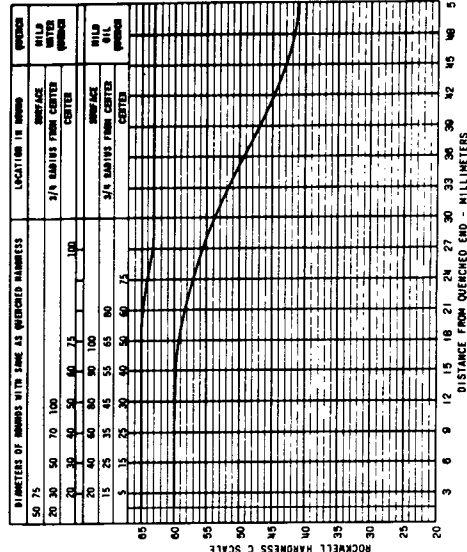
HEAT TREATING TEMPERATURES			
TEMPERATURES REQUIRED BY SAC			
*NORMALIZE	845	OC	
AUSTENITIZE	845	OC	
*for forged or rolled specimens only.			

UNS H41370					HARDENABILITY BAND					SAE/AISI 4137H				
C	Mn	Si	NI	Cr	Mo						SAE	AISI	4137H	
.37/.41	.40/.50	.15/.25	.75/1.20	.15/.25										

HARDNESS LIMITS FOR SPECIFICATION PURPOSES				HEAT TREATING TEMPERATURES			
VICKERS MILLIMETERS		HRC		RECOMMENDED BY "NORMALIZE" AUSTENITIZE			
HRA		HRC		BY DIP °C			
1.5	59	52		37	47	32	
2	59	51		38	46	31	
2.5	58	50		39	45	31	
3	58	50		40	44	30	
3.5	58	50		41	43	30	
4	58	50		42	42	29	
4.5	58	50		43	42	29	
5	58	50		44	41	29	
5.5	58	50		45	41	29	
6	58	50		46	41	29	
6.5	58	50		47	41	29	
7	58	50		48	41	29	
7.5	58	50		49	41	29	
8	58	50		50	41	29	
8.5	58	50		51	41	29	
9	58	50		52	41	29	
9.5	58	50		53	41	29	
10	58	50		54	41	29	
10.5	58	50		55	41	29	
11	58	50		56	41	29	
11.5	58	50		57	41	29	
12	58	50		58	41	29	
12.5	58	50		59	41	29	
13	58	50		60	41	29	
13.5	58	50		61	41	29	
14	58	50		62	41	29	
14.5	58	50		63	41	29	
15	58	50		64	41	29	
15.5	58	50		65	41	29	
16	58	50		66	41	29	
16.5	58	50		67	41	29	
17	58	50		68	41	29	
17.5	58	50		69	41	29	
18	58	50		70	41	29	
18.5	58	50		71	41	29	
19	58	50		72	41	29	
19.5	58	50		73	41	29	
20	58	50		74	41	29	
20.5	58	50		75	41	29	
21	58	50		76	41	29	
21.5	58	50		77	41	29	
22	58	50		78	41	29	
22.5	58	50		79	41	29	
23	58	50		80	41	29	
23.5	58	50		81	41	29	
24	58	50		82	41	29	
24.5	58	50		83	41	29	
25	58	50		84	41	29	
25.5	58	50		85	41	29	
26	58	50		86	41	29	
26.5	58	50		87	41	29	
27	58	50		88	41	29	
27.5	58	50		89	41	29	
28	58	50		90	41	29	
28.5	58	50		91	41	29	
29	58	50		92	41	29	
29.5	58	50		93	41	29	
30	58	50		94	41	29	
30.5	58	50		95	41	29	
31	58	50		96	41	29	
31.5	58	50		97	41	29	
32	58	50		98	41	29	
32.5	58	50		99	41	29	
33	58	50		100	41	29	
33.5	58	50		101	41	29	
34	58	50		102	41	29	
34.5	58	50		103	41	29	
35	58	50		104	41	29	
35.5	58	50		105	41	29	
36	58	50		106	41	29	
36.5	58	50		107	41	29	
37	58	50		108	41	29	
37.5	58	50		109	41	29	
38	58	50		110	41	29	
38.5	58	50		111	41	29	
39	58	50		112	41	29	
39.5	58	50		113	41	29	
40	58	50		114	41	29	
40.5	58	50		115	41	29	
41	58	50		116	41	29	
41.5	58	50		117	41	29	
42	58	50		118	41	29	
42.5	58	50		119	41	29	
43	58	50		120	41	29	
43.5	58	50		121	41	29	
44	58	50		122	41	29	
44.5	58	50		123	41	29	
45	58	50		124	41	29	
45.5	58	50		125	41	29	
46	58	50		126	41	29	
46.5	58	50		127	41	29	
47	58	50		128	41	29	
47.5	58	50		129	41	29	
48	58	50		130	41	29	
48.5	58	50		131	41	29	
49	58	50		132	41	29	
49.5	58	50		133	41	29	
50	58	50		134	41	29	
50.5	58	50		135	41	29	
51	58	50		136	41	29	
51.5	58	50		137	41	29	
52	58	50		138	41	29	
52.5	58	50		139	41	29	
53	58	50		140	41	29	
53.5	58	50		141	41	29	
54	58	50		142	41	29	
54.5	58	50		143	41	29	
55	58	50		144	41	29	
55.5	58	50		145	41	29	
56	58	50		146	41	29	
56.5	58	50		147	41	29	
57	58	50		148	41	29	
57.5	58	50		149	41	29	
58	58	50		150	41	29	
58.5	58	50		151	41	29	
59	58	50		152	41	29	
59.5	58	50		153	41	29	
60	58	50		154	41	29	
60.5	58	50		155	41	29	
61	58	50		156	41	29	
61.5	58	50		157	41	29	
62	58	50		158	41	29	
62.5	58	50		159	41	29	
63	58	50		160	41	29	
63.5	58	50		161	41	29	
64	58	50		162	41	29	
64.5	58	50		163	41	29	
65	58	50		164	41	29	
65.5	58	50		165	41	29	
66	58	50		166	41	29	
66.5	58	50		167	41	29	
67	58	50		168	41	29	
67.5	58	50		169	41	29	
68	58	50		170	41	29	
68.5	58	50		171	41	29	
69	58	50		172	41	29	
69.5	58	50		173	41	29	
70	58	50		174	41	29	
70.5	58	50		175	41	29	
71	58	50		176	41	29	
71.5	58	50		177	41	29	
72	58	50		178	41	29	
72.5	58	50		179	41	29	
73	58	50		180	41	29	
73.5	58	50		181	41	29	
74	58	50		182	41	29	
74.5	58	50		183	41	29	
75	58	50		184	41	29	
75.5	58	50		185	41	29	
76	58	50		186	41	29	
76.5	58	50		187	41	29	
77	58	50		188	41	29	
77.5	58	50		189	41	29	
78	58	50		190	41	29	
78.5	58	50		191	41	29	
79	58	50		192	41	29	
79.5	58	50		193	41	29	
80	58	50		194	41	29	
80.5	58	50		195	41	29	
81	58	50		196	41	29	
81.5	58	50		197	41	29	
82	58	50		198	41	29	
82.5	58	50		199	41	29	
83	58	50		200	41	29	
83.5	58	50		201	41	29	
84	58	50		202	41	29	
84.5	58	50		203	41	29	
85	58	50		204	41	29	
85.5	58	50		205	41	29	
86	58	50		206	41	29	
86.5	58	50		207	41	29	
87	58	50		208	41	29	
87.5	58	50		209	41	29	
88	58	50		210	41	29	
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89	58	50		212	41	29	
89.5	58	50		213	41	29	
90	58	50		214	41	29	
90.5	58	50		215	41	29	
91	58	50		216	41	29	
91.5	58	50		217	41	29	
92	58	50		218	41	29	
92.5	58	50		219	41	29	
93	58	50		220	41	29	
93.5	58	50		221	41	29	
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95	58	50		224	41	29	
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96	58	50		226	41	29	
96.5	58	50		227	41	29	
97	58	50		228	41	29	
97.5	58	50		229	41	29	
98	58	50		230	41	29	
98.5	58	50		231	41	29	
99	58	50		232	41	29	
99.5	58	50		233	41	29	
100	58	50		234	41	29	
100.5	58	50		235	41	29	
101	58	50		236	41	29	
101.5	58	50		237	41	29	
102	58	50		238	41	29	
102.5	58	50		239	41	29	
103	58	50		240	41	29	
103.5	58	50		241	41	29	
104	58	50		242	41	29	
104.5	58	50		243	41	29	
105	58	50		244	41	29	
105.5	58	50		245	41	29	
106	58	50		246	41	29	
106.5	58	50		247	41	29	
107	58	50		248	41	29	
107.5	58	50		249	41	29	
108	58	50		250	41	29	
108.5	58	50		251	41	29	
109	58	50		252	41	29	
109.5	58	50		253	41	29	
110	58	50		254	41	29	
110.5	58	50		255	41	29	
111	58	50		256	41		

JUNS H41610 **HARDENABILITY BAND** SAE/AISI 4161H

C	Mn	Si	Bi	Cr	Mo
.55/.65	.65/.10	.15/.35		.65/.95	.25/.35

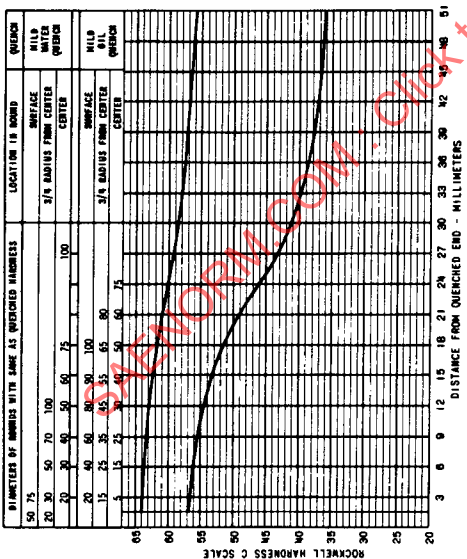


HARDNESS LIMITS FOR SPECIFICATION PURPOSES			HRC
"J" DISTANCE MILLIMETERS	MAX.	MIN.	
1.5	65	60	
3	65	60	
4.5	65	60	
6	65	60	
7.5	65	60	
9	65	60	
10.5	65	60	
12	65	60	
13.5	65	60	
15	65	59	
16.5	65	59	
18	65	59	
19.5	64	58	
21	64	58	
22.5	64	57	
24	64	57	
27	64	55	
30	63	53	
33	63	51	
36	63	49	
39	63	47	
42	63	43	
45	63	43	
48	63	41	
51	63	41	

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE
*NORMALIZE 870 °C
AUSTENITIZE 945 °C
For forged or rolled specimens only.

JNS H41470 **HARDENABILITY BAND** **SAE/AISI 4147H**

C	Mn	Si	NI	Cr	Mo
.44/.51	.65/1.10	.15/.36		.75/1.20	.15/.25



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			HRC	
"J" DISTANCE MILLIMETERS	HAEL.	HR.		
1.5	64	57		
3	64	56		
4.5	64	56		
6	64	56		
7.5	64	56		
9	63	55		
10.5	63	55		
12	63	54		
13.5	63	54		
15	63	53		
16.5	62	52		
18	62	51		
19.5	62	50		
21	61	49		
22.5	61	47		
24	60	46		
27	60	43		
30	59	41		
33	58	39		
36	58	38		
39	57	38		
42	57	37		
45	57	37		
48	56	36		
51	56	36		

HEAT TREATING TEMPERATURES
RECOMMENDED BY SAE

*NORMALIZE 845 °C
AUSTERITIZE 845 °C

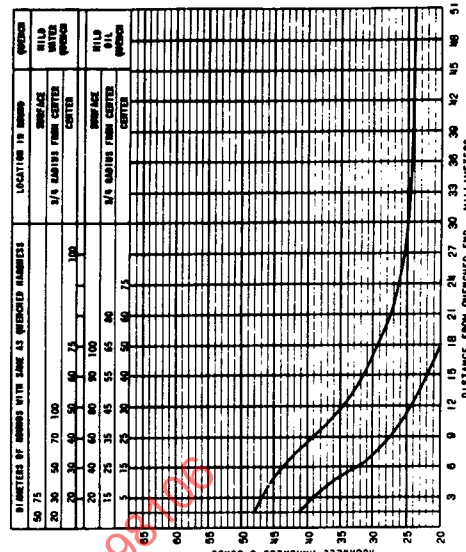
For forged or rolled specimens only.

INS H43200

HARDENABILITY BAND

SAE/AISI 4320H

C	Mn	Si	Ni	Cr	Mo
.17/.23	.40/.70	.15/.35	1.55/2.00	.35/.65	.20/.30



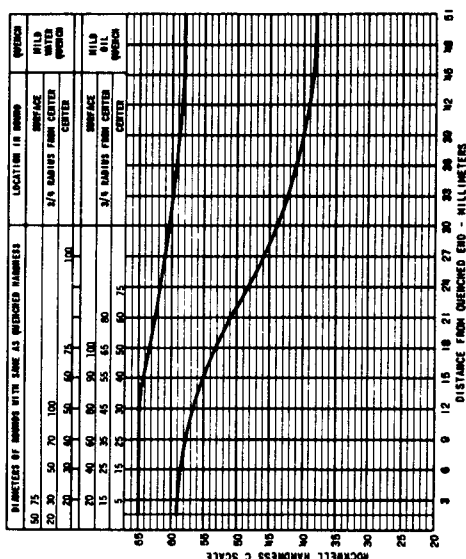
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
DISTANCE MILLIMETERS	INCH		
	1/16	1/8	1/4
1.8	48	41	34
3	5	39	30
5	47	36	28
6	44	32	26
7.5	42	30	25
9	39	27	23
10.5	37	25	21
12	35	24	20
15.9	33	23	
15	32	22	
16.5	30	21	
18	30	20	
18.5	29	--	
21	28	--	
22.5	27	--	
26	27	--	
27	26	--	
28	25	--	
33	25	--	
36	24	--	
39	24	--	
42	24	--	
46	24	--	
48	24	--	
51	24	--	

HEAT TREATING TEMPERATURES		
AS SUPPLIED BY SAC	QC	QC
*NORMALIZED	875	875
AUSTENITIZED	875	875

For forged or rolled specimens only.

INS H41500

C	Mn	Si	Mi	Cr	Mo
.47/.54	.65/.10	.18/.26		.75/.20	.15/.25

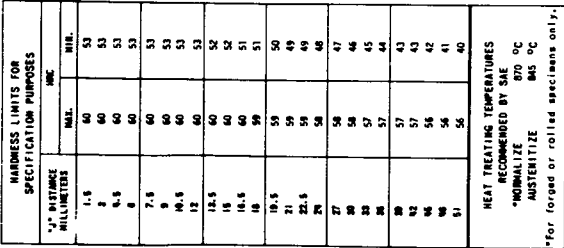
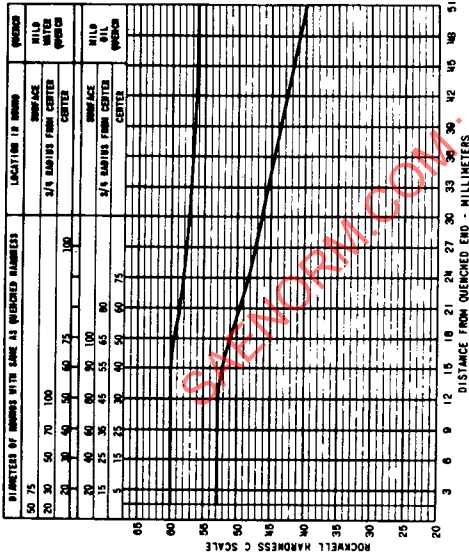
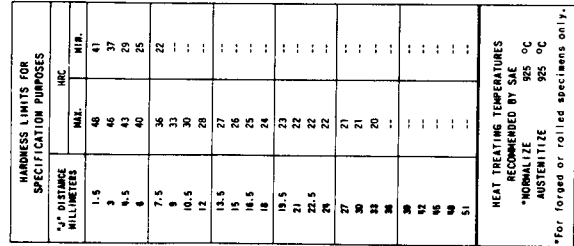


HARDNESS LIMITS FOR SPECIFICATION PURPOSES		
HRC	VICKERS	
	1/16" BALL	1/16" DIA.
1.5	66	59
2	66	59
4.5	65	59
6	65	58
7.5	65	58
9	65	57
10.5	65	57
12	65	56
13.5	64	56
15	64	55
16.5	64	54
18	64	53
19.5	63	52
21	63	51
22.5	62	49
24	62	48
27	61	46
28	61	44
29	60	42
30	59	41
35	59	40
42	58	39
46	58	38
50	58	38
51	58	38

HEAT TREATING TEMPERATURES
 RECOMMENDED BY SAE
 *NORMALIZE 870 °C
 AUSTENITIZE 845 °C
 For forged or rolled specimens only.

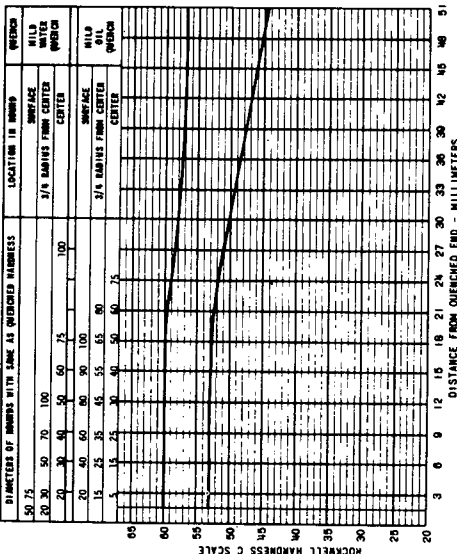
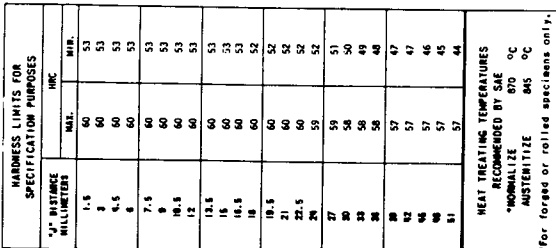
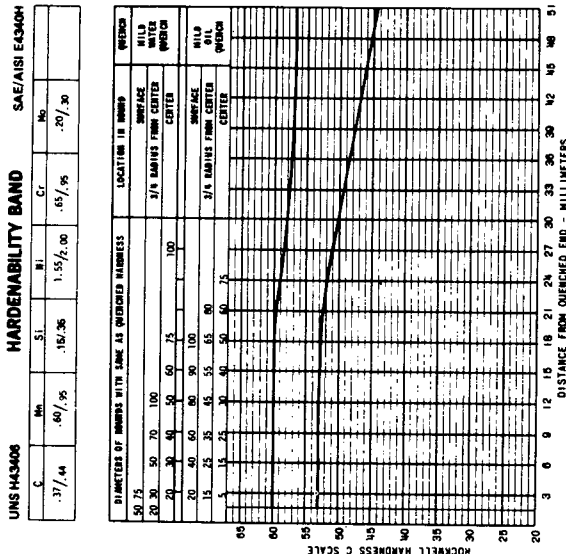
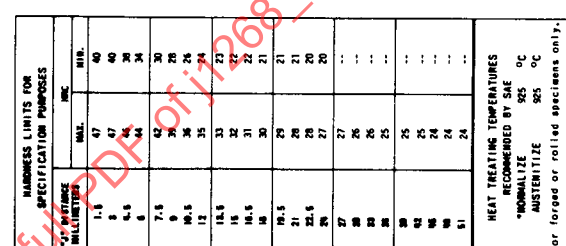
HARDENABILITY BAND									
UNS H43400									
SAE/AISI E4340H									
C	Mn	Si	NI	Cr	Mo				
.37/.44	.55/.90	.15/.35	1.55/2.00	.65/.95	.20/.30				

HARDENABILITY BAND									
UNS H46200									
SAE/AISI 4620H									
C	Mn	Si	NI	Cr	Mo				
.17/.23	.35/.75	.15/.35	1.55/2.00	.70/.90	.20/.30				

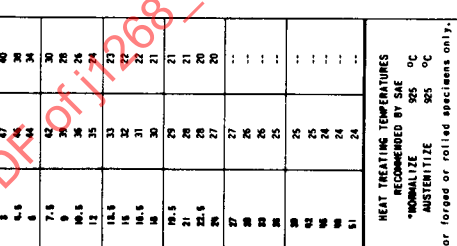


HARDENABILITY BAND									
UNS H43400									
SAE/AISI E4340H									
C	Mn	Si	NI	Cr	Mo				
.37/.44	.55/.90	.15/.35	1.55/2.00	.65/.95	.20/.30				

HARDENABILITY BAND									
UNS H47180									
SAE/AISI 4718H									
C	Mn	Si	NI	Cr	Mo				
.15/.21	.60/.95	.15/.35	.85/1.25	.70/.90	.30/.40				

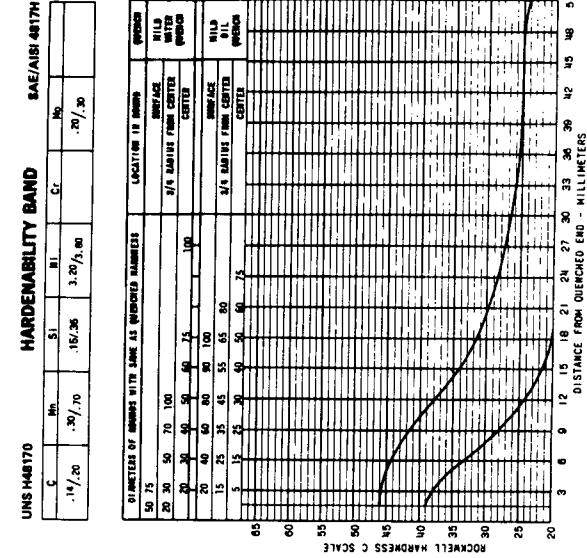
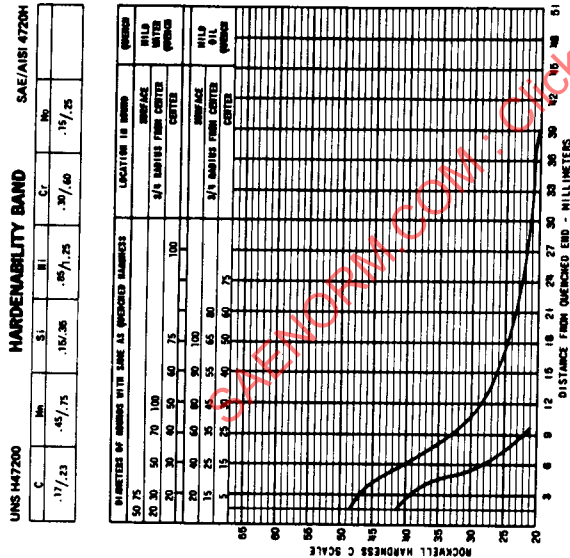


HARDENABILITY BAND									
UNS H46200									
SAE/AISI 4620H									
C	Mn	Si	NI	Cr	Mo				
.17/.23	.35/.75	.15/.35	1.55/2.00	.70/.90	.20/.30				



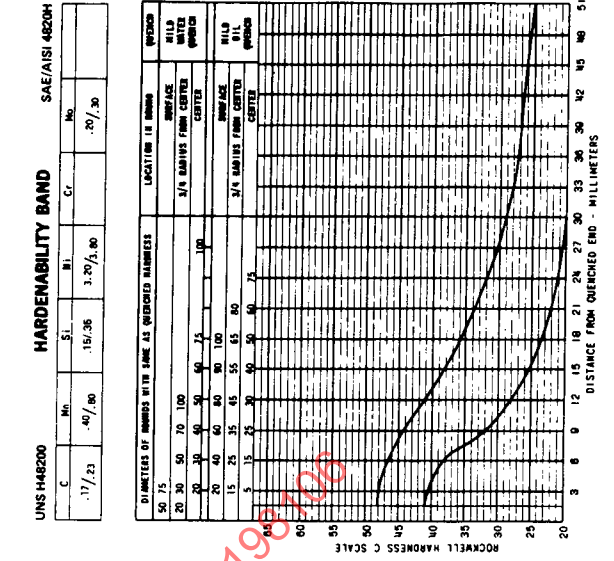
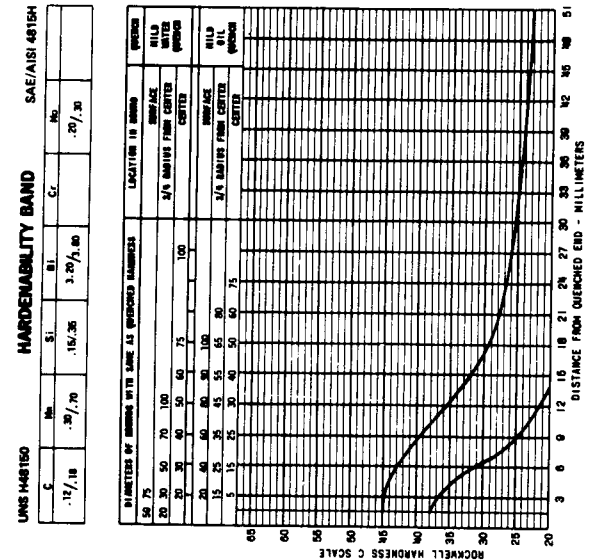
HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/8" DISTANCE MILLIMETERS	HRC		HRA
	MIN.	MAX.	
1.5	40	41	
3	47	38	
6	45	35	
9	44	28	
12	37	24	
15	33	22	
18	31	21	
21	29	20	
24	27	19	
27	25	18	
30	24	17	
33	23	16	
36	22	15	
39	21	14	
42	20	13	
45	19	12	
48	18	11	
51	17	10	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 925 °C
*AUSTENITIZE 845 °C
*For forged or rolled specimens only.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/8" DISTANCE MILLIMETERS	HRC		HRA
	MIN.	MAX.	
1.5	46	38	
3	45	34	
6	43	31	
9	41	27	
12	38	25	
15	36	23	
18	34	21	
21	32	20	
24	31	19	
27	30	18	
30	29	17	
33	28	16	
36	27	15	
39	26	14	
42	25	13	
45	24	12	
48	23	11	
51	22	10	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 925 °C
*AUSTENITIZE 845 °C
*For forged or rolled specimens only.



HARDNESS LIMITS FOR SPECIFICATION PURPOSES			
1/8" DISTANCE MILLIMETERS	HRC		HRA
	MIN.	MAX.	
1.5	46	41	
3	46	40	
6	45	38	
9	44	35	
12	43	32	
15	41	29	
18	39	26	
21	37	24	
24	36	23	
27	35	22	
30	34	21	
33	33	20	
36	32	19	
39	31	18	
42	30	17	
45	29	16	
48	28	15	
51	27	14	

HEAT TREATING TEMPERATURES RECOMMENDED BY SAE
*NORMALIZE 925 °C
*AUSTENITIZE 845 °C
*For forged or rolled specimens only.

