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WELLINGTON HOT-ROLLED WELLINGTON TG & P Shafting Material

Wellington Hot-Rolled and TG & P is a tough dependable high alloy shafting steel designed to resist fatigue, shock and abrasion. Wherever repeated trouble occurs in shafting, gears, and allied applications, install Wellington Hot-Rolled and TG & P and achieve maximum results in long wear.



Wellington Hot-Rolled and TG & P offer these advantages:

In most cases this is up to one-third higher than your generic 4140/4150 grades.

Heat Treated to a 28-32 Rockwell "C"

Wellington Hot-Rolled and TG & P will give high wear resistance while still allowing good machinability. For most applications it may be put into service without additional heat treatment.

Wellington Hot-Rolled Sizes:

Furnished in Rounds from 1/4" – 20 inch diameter. Larger sizes are forged to order.

All sizes of Flats, Hexagon, Squares are carried in stock.

High Fatigue and Wear Resistance

Wellington Hot-Rolled and TG & P gives maximum life in high torsion applications such as fan shafts, crane shafts, etc. where fatigue is often a cause of premature failure.

Wellington TG & P Sizes:

Furnished from 1/4"- 8 inch diameter in 1/16" increments. Special sizes made to order.

Metric Sizes also available

Stress Relieved and Machine Straightened

Wellington Hot-Rolled and TG & P is stress relieved and machine straightened to remove residual stresses in order to minimize danger of machine deformation and failures cause by these stresses. This allows for easier machining.

Wellington TG & P Accuracy:

1/4" diameter to 4" diameter----- +.000 - -.002

4 1/16" diameter to 8" diameter-----+.002- -.003

High Tensile and Yield Strengths

Wellington Hot-Rolled and TG & P with a tensile strength of 155,000 p.s.i. And yield strength of 135,000 p.s.i.

SQUARES, FLATS AND PLATES ALSO AVAILABLE



Shafting

WELLINGTON HOT-ROLLED WELLINGTON TG & P Applications & Heat Treating

Applications

Agricultural Equipment
 Armature Shafts
 Automatic Equipment
 Axles
 Boring Bars
 Car Axles
 Cement Mill Shafts
 Chain Pins
 Crank Shafts
 Drive Shafts
 Drive Gears
 Fans
 Feed Screws
 Generator Shafts
 Grinder Spindles
 Hoist Shafts
 Impeller Shafts
 Journals
 Lead Screws
 Locomotive Axles
 Magneto Shafts
 Mine Car Axles
 Motor Shafts
 Paper Processing Machinery
 Pinions
 Piston Rods
 Printing Presses
 Propeller Shafts
 Pumps
 Railroad Axles
 Rings
 Sleeves
 High Speed Gears
 Spindles
 Springs
 Steering Axles
 Textile Looms
 Textile Machines
 Turbine Shafts
 Valve Stems



HEAT TREATING

Heat treating instructions are as follows:

.505 Diameter quenched from f, and drawn:

400° F Rockwell "C" 56	700° F Rockwell "C" 51	1000° F Rockwell "C" 43
500° F Rockwell "C" 55	800° F Rockwell "C" 47	100° F Rockwell "C" 39
600° F Rockwell "C" 53	900° F Rockwell "C" 46	1200° F Rockwell "C" 35
To anneal: 1525° F, furnace cool 20° per hour to 1190° F, air cooled. To harden: 1500/1550° F, oil quench		

PHYSICAL PROPERTIES

Typical bar 2" Round-minimum

Tensile Strength	Minimum 155,000 PSI at C-30
Yeild Point	Minimum 135,000 PSI at C-30
Elongation	Approx.-21%
R. in A	approx.-60%

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Plate Products



WELLBRAZE 400 WELLBRAZE 500

Wellington 400 and 500 is a heat-treated, alloy steel, specifically developed to resist abrasion and shock. Its high hardness and shock resistance reduces wear.

Advantages:

Though Brinell hardness is an important factor in determining wear, MANGANESE and NICKEL give a better indication on the longevity of wear while in service.

Wellbraze 400 & 500 wear plates provide you with not only a high manganese content for wear but also a good content of nickel for the depth of hardness through out the plate.

Wellbraze 400 & 500 also has a 17-20% working hardening factor. The longer Wellbraze is in service, the tougher it gets.

Working Instructions:

Welding:

Wellbraze 400 & 500 is easily welded by all low

hydrogen production welding processes using E7018, E9018, 11018, and 12018 manual type electrodes..

Preheat is necessary only in extreme cold or highly restrained weldments.

Machining:

Wellbraze 400 & 500 can be drilled with ordinary high speed drills, Grinding can be accomplished easily. Because of its high hardness, planning and milling is limited to simple procedures.

Forming:

Suggested minimum bending radii:

Up to and including 3/8" thick the minimum inside radius is 2T

Above 3/8" thick thru 1" thick the minimum inside radius is 4T

Size Range

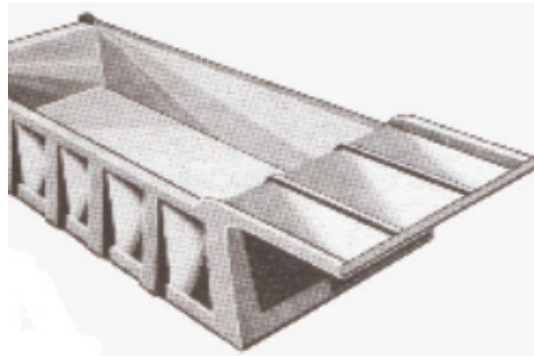
Thickness; 1/8" to 6"

Widths; 48", 72", 96"

Lengths; 144", 240", 288"

Spec sizes are available.

Wellbraze 400 & 500 Wear Strips also available



APPLICATIONS

Wheelabrators
Chute Liners
Truck Beds
Dragline Buckets
Shovels
Scrapers
Screens

Conveyers
Grader Blades
Bang Boards
High Lifts
Structural Uses
Tynes
I.D. Fans & Blades
Hoppers

Soil Discs
Tractor Shoes
Crusher Hammers
Logging Skids
Dipper Sticks
Refractory Uses
Baffle Plates
Fabricated Parts

Concrete Block Liners
Railroad Equipment
Dredges
Impellor Fan Blades
Exhaust Fan Blades
Scraper Blades
Pancake Dies
Blanking Dies



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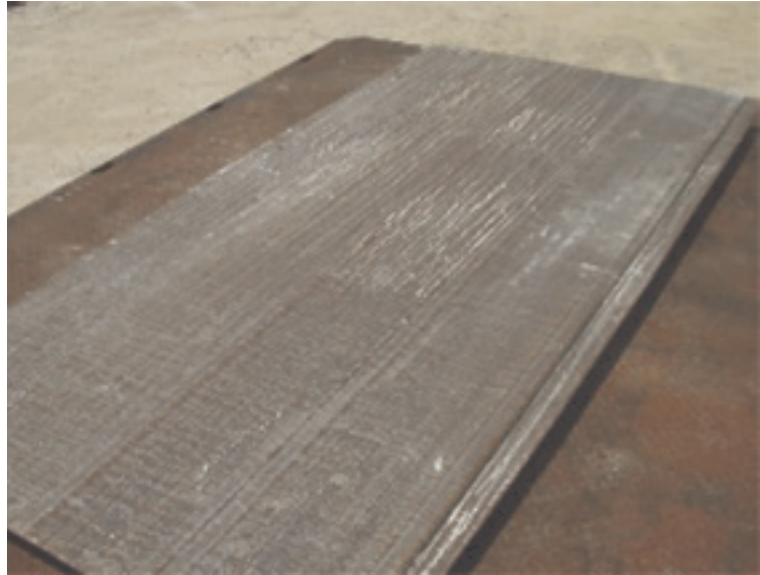
Plate Products

WELLINGTON CCO

Wellington CCO is an abrasion resistant, chromium-carbide wear surface for fan blades, and scrolls, blast cabinets, sintering machine parts, rock and ore chute, many other heavy wear applications.

Wellington CCO hardfacing is applied to a very ductile, easy-to-weld, low carbon steel selected to absorb much of the impact shock resulting from heavy service.

This mild steel plate is an American mill product of .12 maximum carbon rolled to our specifications. It can be rolled or otherwise formed by press-breaking. The mild steel backing and the arc-welded overlay bend readily when proper fabrication methods are applied.



Fabrication in our plant meets commercial tolerances. Special rolling and forming of **Wellington CCO** are available.

Wellington CCO has proved its durability and value through years of punishing use in taconite plants, iron mines, steel mills, coke plants, cement and asphalt plants, power utilities and pulp plants. We stand ready to serve you in your very complex maintenance problems, in order to eliminate your excessive down time.



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WELL-MANG High Impact Wear Plates



Applications:

Chute Liners
Buckets and Trays
Dump Truck Bed Liners
Pedestal and Journal Box Liners
Crusher Liners
Relining old buckets
Foundry Shot Cleaning Room Liners.

Wellmang is an 11-14% Manganese Nickel Plate, not harmed by heat, that has been designed for use where impact and wear are problems.

It can be easily welded, cut and cold formed, but can only be drilled with special drills.



Plate Products

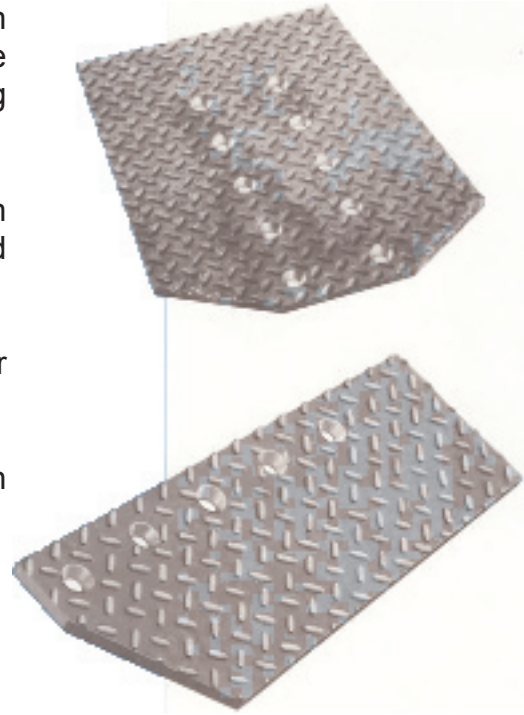
Wellington Tred Plate

Wellington Tred Plate is identical to Wellington abrasion resistant wear plates in analysis and heat treatment. The patterns are designed to eliminate locationalized tracking and wear.

4-Way Grid Pattern: Designed for maximum dispersion of air-borne particles and fine solids as well as shot and rock.

Easily Weldable: With low hydrogen welding rod-preheat or post heating of the weld is not required.

Machinable: This grade can be drilled and tapped with ordinary high-speed tools.



WELLINGTON 600 BRINELL WEAR PIPE

WELLINGTON 600 BRINELL WEAR PIPE

Wellington's 600 Brinell Wear Pipe is a tough abrasion resistant product manufactured from a special analysis steel. It is available in nominal pipe sizes from 3" to 40" and up to 50 foot lengths.

Advantages:

A special heat treatment process produces a hardness of 600 BHN on the pipe's inner surface for extremely tough wear resistant properties.

Because of the high degree of wear resistance achieved by the I.D. hardness it is possible to use standard wall in applications where double or heavier wall pipe was previously required.

Ease of Installation;

Handles similar to standard steel pipe. Request ends prefitted with weld rings, flanges, or plain ends. Note: Request welding instructions and precautions if you will be welding.

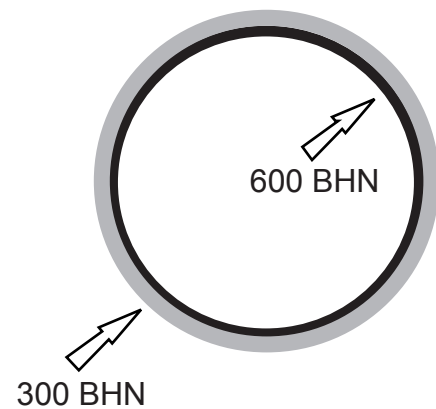
Cutting:

Cutting can be done in two ways:

- 1) Fixed mount or hand held gasoline powered commercial abrasive disc saw (Done in shop or field).
- 2) Plasma Arc cutting.

Welding:

Standard Low Hydrogen Method 7018 rod. Note: Request welding instructions and precautions if you will be welding.



CUSTOM SWEEPS AND BENDS ARE ALSO AVAILABLE

Flanges available on request



Pipe & Hollow Bar

WELLINGTON HOLLOW BAR

WELLINGTON HOLLOW BAR

Wellington Hollow Bar is available in two grades:

- 1) Alloy Hollow Bar
- 2) Tool Steel Tubing

Wellington Hollow Bar is designed to minimize machining time. Instead of taking a solid alloy or tool steel bar and machining the I.D., consider Wellington Hollow Bar for your next choice. This will save your company time and money.

Wellington Hollow Bar is available in most standard tubing sizes as well as heavy wall custom bored sections.

Specify heat treatment if required.

How To Order:

In addition to the obvious quantity, sizes, etc., it is helpful to inquire about surface conditions and thermal treatment.

Typical Applications:

Gears, bushings, sleeves, spacers, rolls, drill collars, tool joints, spindles, cylinders, etc.

Sizes change depending on usage. Please indicate finished sizes.



WELLBLADE

WELL-BLADE High strength cutting and shearing knives

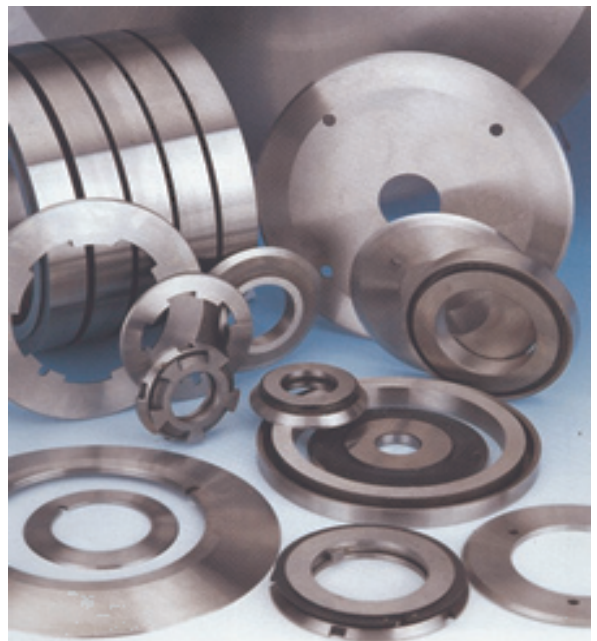
Well-Blade is standard INLAID Carbon Alloy Tool Steel or High-Speed Tool Steel designed to give maximum life in any industrial knife application.

Well-Blade can be made to conform to any of the well-known brand names of machinery in the market as well as the different grades available.

Circular Slitting and Perforating Knives are also available.

How to order:

Please provide the brand name of the knife used in your facility and the part number and Wellington Alloys will be able to cross-reference in order to make the correct part or you may provide a print for that part.





Specialty Products

WELLGLIDE Self Lubricating UHMW

WELLGLIDE- Developed for those applications where its lubricity, water and chemical resistance weight advantage and noise dampening effect will help eliminate problems commonly encountered in industry today.

WELLGLIDE-The UHMW engineered to protect your plant and equipment. Easy to install and maintain. It keeps your material on the move without bridging, even in cold temperatures.

Machining:

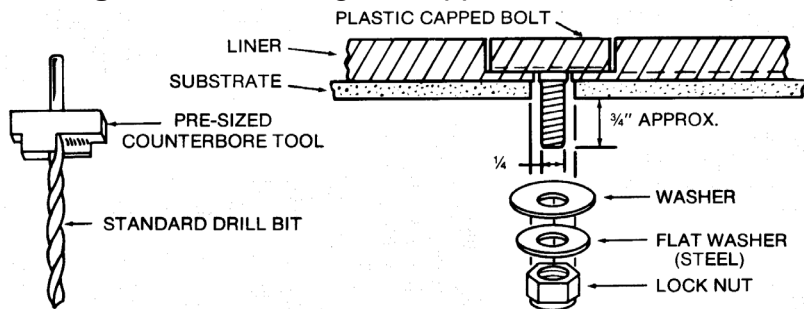
Can be machined and fabricated using common woodworking and metalworking tools. It can be saw cut, drilled, planed, turned, and tapped. However, due to greasing effect producing by overheating, do not grind.



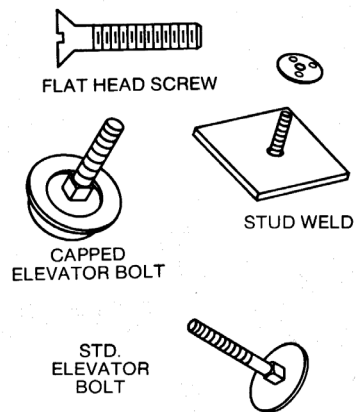
Stock Sizes:

Sheet 1/8" to 3 1/2" thick 4ft x 10ft
Rounds 1/2" Dia. thru 8" Dia.

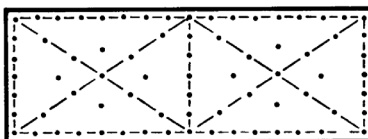
Fastening Methods: Wellglide capped elevator bolts (order as bolt sets w/ counterbore tools.)



UNIVERSAL DRILL & COUNTERBORE TOOL
(TO HANDLE MULTIPLE SHEET THICKNESS)



SHEET THICKNESS	TYPICAL SPACING OF FASTENERS AROUND PERIMETER OF SHEET:	
1/4"	6"	8"
3/8"	8"	10"
1/2", 5/8", 3/4"	10"	12"
1" and over	12"	15"



TYPICAL PATTERN OF FASTENERS FOR ALL LININGS

Fasteners should be spaced no more than 2" from the edge of the liner.

Forming

Pressbrake, roll, or hand form. Overbend up to 90% due to memory. Forming is generally limited to 3/8" or lighter.

Drilling - Drill holes 1/8" larger than bolt to allow for expansion.



Wellington Piston Rods

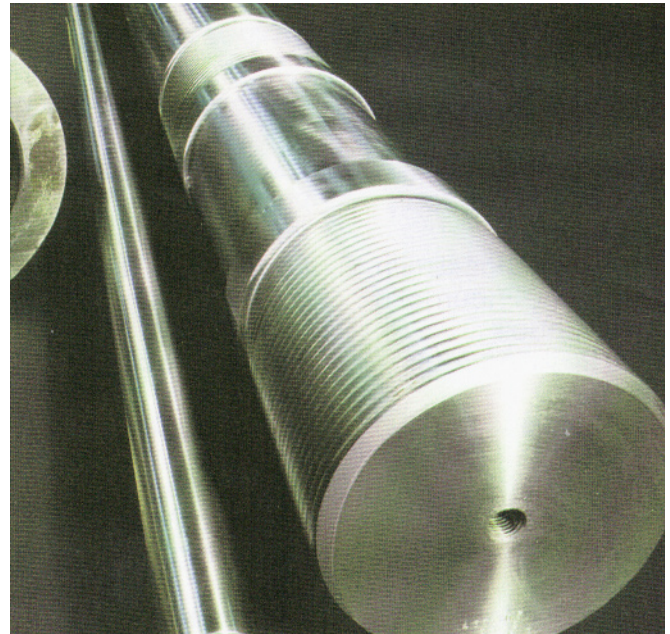
Drop Forge Hammer Piston Rods, machined complete per your drawing and specifications from Wellington shafting material.

SIZES

2 1/4" diameter through 6" diameter.

1500 lb - 7000lb hammers.

Larger size rods can also be furnished for steam hammers.



Wellington Tie Bars

Tie Bars are used in die-casting machines, hydraulic presses and other four column presses requiring rigid construction for rugged use. Acme and V threaded Tie Bars machined complete per your drawing.

SIZES

2" Diameter to 10" diameter. Lengths up to 20'



WELLINGTON KEYSTOCK

Wellington Keystock is a close tolerance cold finished steel designed to provide the high shear strength required in key applications.

Tolerances:

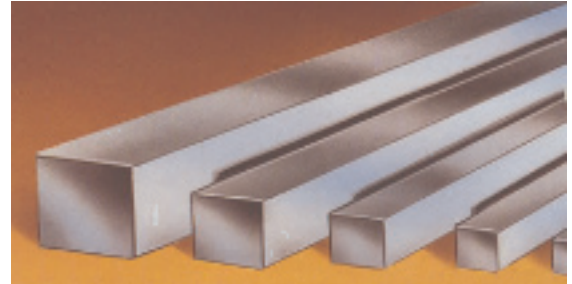
Manufactured to plus tolerances. 12 ft standard lengths.

Applications:

Keys, Fixtures, Jigs, Tool Shanks

Size Range: (Squares) Available from 1/8" to 2"

METRIC SIZES AVAILABLE – 60 FT minimum per size



APPLICATIONS

Drill Rod Pins

Dies

Jigs

Fixtures



Miscellaneous Products

WELLINGTON THREADED ROD

Wellington Stud Stock is a fully threaded, heat treated alloy bar, produced with an all rolled - thread in standard 12 foot lengths.

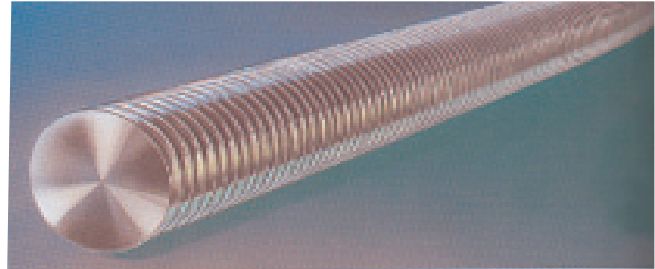
Advantages:

Strengths:

Wellington Stud Stock is heat treated to a tensile of 141,000 p.s.i. minimum, ideally suited for applications requiring toughness and strength. Resists stretching, pressure, and shock like most common threads.

Safety:

Conforms to A.S.T.M. A 193 Grade B-7.
Heat Treated to a 28-32 RC



Alternatives:

- Acme Thread
- Left-Handed Thread
- Stainless Steel
- Metric Thread

THREADED PITCH		HI TENSILE METRIC
NATIONAL COURSE	NATIONAL FINE	DIAMETER & PITCH
NC-USS	NF-SAE	
1/4"-20	1/4"-28	
5/16"-18	5/16"-24	M6 x 1.0
3/8"-16	3/8"-24	M8 x 1.25
7/16"-14	7/16"-20	M10 x 1.50
1/2"-13	1/2"-20	M12 x 1.75
9/16"-12	9/16"-18	M14 x 2.0
5/8"-11	5/8"-18	M16 x 2.0
3/4"-10	3/4"-16	M18 x 2.5
7/8"-9	7/8"-14	M20 x 2.5
1"-8	1"-14	M22 x 2.5
1 1/8"-7	1 1/8"-12	M24 x 3.0
1 1/4"-7	1 1/4"-12	M30 x 3.5
1 3/8"-6	1 3/8"-12	M33 x 3.5
1 1/2"-6	1 1/2"-12	M36 x 4.0
1 5/8"-5.5	1 5/8"-12	M39 x 4.0
1 3/4"-5	1 3/4"-12	
1 7/8"-5	1 7/8"-12	
2"-4.5	2" -12	
2 1/4"-4.5	2 1/4"-12	
2 1/2"-4	2 1/2"-12	
2 3/4"-4	2 3/4"-12	
3"-4	3"-12	
3 1/4"-4	3 1/4"-12	
3 1/2"-4	3 1/2"-12	
4"-4	4"-12	

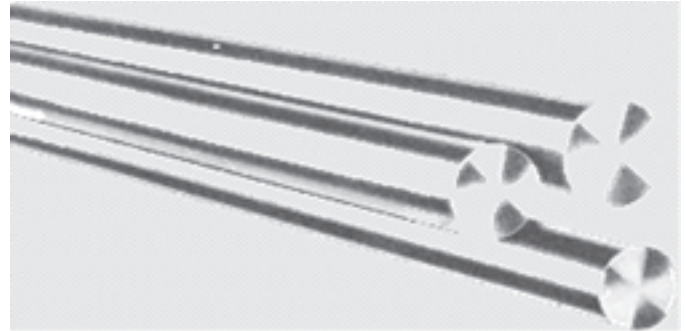


WELLINGTON DRILL ROD

An oil-hardening tool steel drill rod offering extended service life when compared to commercial grades of carbon drill rod.

WEAR RESITANCE AND TOUGHNESS

Exhibits the good wear characteristics and toughness required in most tooling drill rod requirements.



HARDENING

Easily hardened with low deformation on heat treatment.

TOLERANCES

Furnished ground to size with all surface decarburization removed to the following standard tolerances:

.124 and smaller plus or minus .0003"

.125 to .499 plus or minus .0005"

.500 to 2.00 plus or minus .001"

HEAT TREATMENT

Hardening: 1475 F oil quench until hand warm and immediately temper.

Tempering: 400 F provides 60-62 rockwell "C" 500 provides 58 Rockwell "C."

SIZE RANGE

Sizes from 1/16" to 2" round in 1/16 increments. Standard length is 3'. Some sizes available in 32nds of an inch.

APPLICATIONS

Drill Rod Pins

Dies

Jigs

Fixtures



Miscellaneous Products

WELLINGTON GROUND FLAT STOCK

Ground Flat Stock available in oil and air-hardening grades. Other grades available on application. Precision ground surface reduces machining time, saves tool and labor costs. Ground Flat Stock is VIP packaged and labeled at the mill to assure perfect ready-to-use stock on delivery. Furnished annealed.

TOLERANCES

Thickness: .001. Width: +.005, -.000. Slices square and parallel. Finish: 10-35 micro-inches. Closer tolerances available on request. Special oversize tolerances, such as +.020" to .035" and non-standard sizes available on request.

SPHEROIDIZED ANNEALED

Provides a homogenous fine grain structure for toughness and excellent machability.

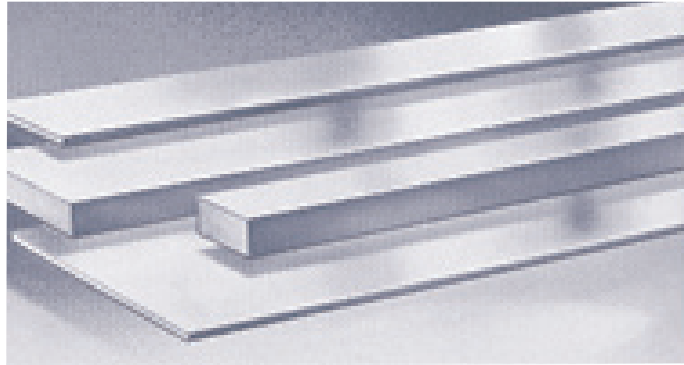
HEAT TREATMENT

Oil Hardening Grade
Annealing: 1450 F
(Hold 2 to 3 hours). Furnace cool to 900 F
Hardening:
Preheat to 1200 F, then heat to 1450 F - 1500 F and quench in agitated oil until hand warm. Temper immediately after quench.

TEMPERING

Temper for a minimum of 2 hours.

Tempering Temp	Rockwell C
As Quenched	64 to 65
300	63 to 64
400	61 to 63
500	58 to 60
600	56 to 58
700	53 to 55



HEAT TREATMENT

Air Hardening Grade (AH)
Annealing: 1650 F (Holds 2 Hours).
Furnace cool.
Hardening: Preheat to 1500 F, then heat to 1750 F-1800 F. Use controlled atmosphere furnace or pack harden. Air cool until hand warm and then temper immediately.

SIZE RANGE

Lengths - 18 and 36" (special lengths on request)
Thickness - 1/64" to 4" (larger thickness on request)
Widths - 1/2" to 16" (special widths on request)
Squares - 1/8" to 4"
Length on 0 Carbon is 24"



WELLINGTON #1 (01)

The most versatile of tool steels. Often referred to as the “General Purpose Tool Room Steel.” Excellent safety in hardening, little distortional change in heat treatment.

HEAT TREATMENT

Forging: Slowly to 1850F-1950F
Cool slowly on ashes, dry lime or other insulating material.

Normalizing: Do not normalize.

Annealing: Heat slowly to: 1450 F
Furnace cool 20 per hour to 900 F, then air cool.
Average brinell hardness 202.

Hardening: 1475 F (Quench in oil) Temper immediately after quench.

Tempering Temperature F As quenched	Rockwell C
400	64
500	62
600	58
700	56

Forging Slowly To: 1850 F to 1950 F	Annealing Heat Slowly To: 1450 F
--	---

Hardening

1475 F (Quench in Oil) for Minimum Decarburization Pack or Heat in Atmosphere Furnace.
Quench at 150-300 F Temper Immediately



Medium Shock Resistance

Medium Wear Resistance

Medium Deformation Expands Slightly

SIZE RANGE

Rounds 1/4" to 14"
Squares 1/4" to 10"
Flats 1/2" to 4" thickness 1/2" to 12"
Width
Forgings Available to custom specifications

APPLICATIONS

Dies
Rolls
Punches
Shear Blades
Bushings
Knives
Spindles



Tool Steels

WELLINGTON AH (A-2)

Wellington AH (A-2) An air-hardening tool steel offering safer hardening with less deformation than oil hardening grades. Wellington AH is an economical grade of air hardening tool steel which provides excellent wear characteristics, low deformation and anneals "dead soft" for ease of machining.

SHOCK RESISTANT

Temper at 350 F. to 400 F for applications requiring high wear and shock resistance. For unusually high shock resistance, draw at 900 F., however some wear resistance will be sacrificed at this draw temperature. Equal in toughness to some shock resisting grades.

NON-DEFORMING

Low deformation minimizes cracking and warping in heat treatment.

GOOD MACHINABILITY

Spheroidized annealing at the mill assures homogeneous grain structure, reduces "hard spots", removes residual rolling stresses and imparts excellent machining qualities.

HEAT TREATMENT

Forging: 2000 F

Preheat to 1250 F and then raise to final forging temperature. Hold until evenly heated. To minimize possibility of cooling cracks, bury in insulation material immediately after forging.

Annealing: Pack at 1650 F

Heat slowly to annealing temperature. Furnace cool approximately 20 F per hour to 1000 F. Then air cool. Resulting hardness will be approximately 210 Brinell. To prevent decarburization a controlled atmosphere furnace should be used or the steel should be packed in a sealed container



with ashes or some other inert material. Normalizing is not required because of the air-hardening properties.

HARDENING: (Air Cool 1775 F to 1800 F)

Slowly preheat to 1200 F and hold for one hour per inch of diameter. Then transfer to furnace at 1775 to 1850 F until heated through (approximately one hour per inch of thickness after final temperature has been reached). Use controlled atmosphere furnace or pack in inert material. Air cool after removal from furnace until hand warm then temper immediately. Best wear to toughness ratio is achieved at 400.

SIZE RANGE

Rounds	1/4" to 12"
Flats	3/8" to 4" thickness 1" to 12" width
Squares	1/2" to 6"
Forgings	to Specifications

Forging

2000 F to 2050 F
Preheat to 1250 F
Soak Thoroughly

Annealing

Pack at:
1650 F (Furnace Cool)

Hardening: 1750 F to 1800 F (Air Cool)
Preheat at 1250 F Soak Thoroughly

Lower Shock Resistance, Better Wear Resistance, Lower Deformation

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WELLINGTON DH (D-2)

Wellington Deepest Hardening higher chrome air hardening tool steel provides the best air hardening tool steel available for long run die applications. High resistant properties are combined with very low distortion in heat treatment and with fair toughness properties.

BEST WEAR RESISTANCE

Wellington DH exhibits the highest wear resistance available in an air hardening tool steel, making it an excellent steel for long run die applications.

LOWEST DEFORMATION

Retains its size better than other types of tool steel. To avoid almost all size changes during heat-treatment temper between 900 and 950 F.

DEEP HARDENING

Depth of hardness penetration provides longer die life in high wear applications.

HEAT TREATMENT

Forging: 1900 F to 1950 F

Preheat to 1200 F cool on dry insulating material.

Annealing: 1625 F 1650 F

Hold at annealing temperature approximately 1 1/2 hours per inch of maximum cross section. Reduce furnace temperature 25 F per hour to 900 F and then allow to cool to room temperature in furnace. Approximate hardness will be 230 Brinell.

Hardening: 1850 F Air Cool

Preheat to 1200 F and hold approximately 1 hour per inch of greatest thickness before increasing to final hardening temperature. Hold



at final hardening temperature approximately 1 1/2 hours per inch of greatest thickness. Air cool until hand warm, temper immediately. Do not cool down to room temperature before tempering.

TEMPERING:

Based on 1" square, minimum 2 hours per inch of greatest thickness.

SIZE RANGE

Rounds	1/4" to 24"
Flats	1/2" to 8" thickness 3/4" to 18" width
Squares	1/2" to 6"
Forgings	To specifications

APPLICATIONS

Tools
Dies
Forming Rolls
Drawing Dies

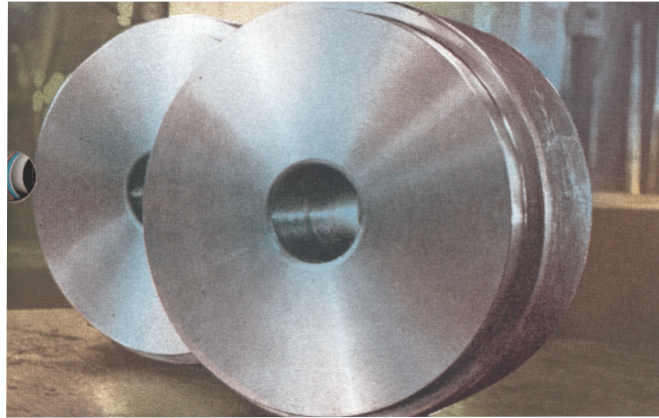
An outstanding tool steel for maximum production.



Tool Steels

WELLINGTON Hot Work Steel (H-13)

Wellington Hot Work Steel is best general purpose tool steel grade for Hot Work applications. Furnished with a "soft Anneal". Wellington Hot Work Steel is delivered at approximately 207 BHN. This grade offers excellent "Red Hardness", i.e. retains hardness at elevated temperatures. Displays excellent shock resistance and abrasion resistance. Wellington Hot Work Steel can withstand drastic temperature changes while in service.



WELLINGTON HOT WORK STEEL (H-13)

Heat is a formidable enemy of any alloy or tool steel. Alternating temperatures or severe temperature change in service are the worst. Wellington Hot Work Steel withstands "Thermal Shock" and retains toughness and wear resistance in the most severe of these circumstances.

APPLICATIONS

- Hot Work Applications
- Hot Shear Blades
- Extrusion Press Tooling
- Zinc and Aluminum Die Casting Dies
- Punches
- Piercers
- Mandrels
- Shear Blades

SIZE RANGE

Rounds to 36" dia
Heavy plate and flat sections.

HEAT TREATING

Forging
2050 F to 2150 F
Stop at 1850, Cool Slowly Preheat Slowly
1300-1500 F

Annealing

1600 F Furnace Cool, average 207 BHN
Furnace Cool 30 /hr. to 900 Then Air Cool

Hardening

1850 F Air Quench Temper 1050 to 1150
Average RC-40-50 (Recommended for die casting dies; 44-48RC)

ADVANTAGES

Ease of Machining
No special precautions. Machine at the annealed hardness of 207 BHN. Machine rated at 75% that of carbon steel.
Consistent response to heat treatment.

Retains hardness at elevated temperatures.
Resists thermal shock
Highly impact resistant
Resists sudden torque
High thermal conductivity
Non Deforming

Die Casting Dies should be hardened to 4-48 RC. Do not use higher than RC.

Tempering Temperature	Rockwell
F	C
400	54
1000	52
1100	48
1200	37



WELLINGTON Well Shock Shock Resistant, Non-Tempering Tool Steel

Wellington Well-Shock

A first quality air hardening, shock resisting tool steel. Because this grade is quenched in still air it displays similar non-deforming deep hardening characteristics as other air hardening grades, and delivers higher shock resisting properties.

EASILY MACHINED

Because of its ability to anneal "dead soft", Well-Shock displays ease of machining within 95% of carbon steel range.

DISTORTIONAL PROPERTIES - SAFE HARDENING

Well-Shock is an air hardening shock resisting tool steel, as opposed to a water hardening tool steel, greatly reducing the hazards of quench cracking and deformation.

APPLICATIONS

Short Run Dies
Chisels
Plastic Mold Dies

ADVANTAGES

Deep Hardening in Air
Low Distortion
Highly Resistant to Shock
Safe Hardening

THERMAL TREATMENT

Forging
1850 F to 1950 F
Stop forging at 1650 F
Annealing
1425 to 1475 F (Furnace cool to Max 229 BHN) Cool Slowly to 1000 F



Hardening

1625 F (Water Quench at 1550 F)

Hold at temp no longer than 1/2 hour per inch of thickness

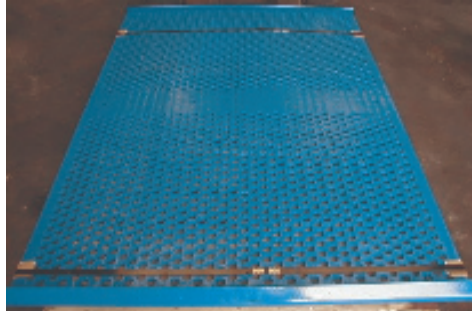
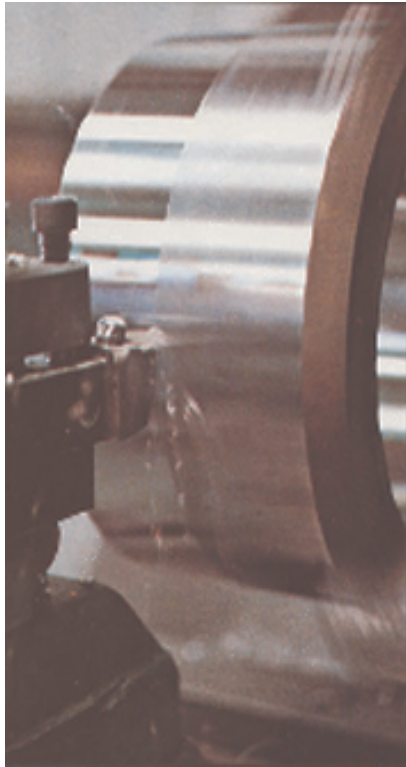
Better hardenability of any shock steel. Toughest of all shock steel. For cold work and medium hot work applications requiring high resistance to shock. Best machinability. Anneals to 197 BHN.

Tempering Temperature F	Rockwell
As quenched	C
500	58
700	55
1000	47

Finished Products



Forming Machining Drilling



Wellington Alloys is able to provide you with custom fabricating and machining services.

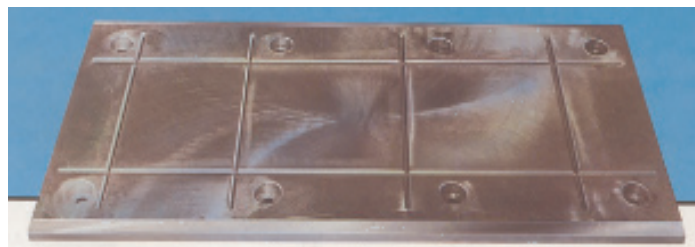
We are able to provide the following:

Forming
Machining
Drilling

Whether it is hard alloy plate, mild steel, alloy shafting or any other types of material, Wellington Alloys can do the job for you.

Please provide a sketch or print or send us a spare part.

We will do the job right, to your specifications, and will ship to you ready for installation.



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Charts



Metric Conversion Table

MM = INCHES	MM = INCHES	MM = INCHES	MM = INCHES
1 = 0.0394	26 = 1.0236	51 = 2.0079	76 = 2.9921
2 = 0.0787	27 = 1.0630	52 = 2.0472	77 = 3.0315
3 = 0.1181	28 = 1.1024	53 = 2.0866	78 = 3.0709
4 = 0.1575	29 = 1.1417	54 = 2.1260	79 = 3.1102
5 = 0.1968	30 = 1.1811	55 = 2.1653	80 = 3.1496
6 = 0.2362	31 = 1.2205	56 = 2.2047	81 = 3.1890
7 = 0.2756	32 = 1.2598	57 = 2.2441	82 = 3.2283
8 = 0.3150	33 = 1.2992	58 = 2.2835	83 = 3.2677
9 = 0.3543	34 = 1.3386	59 = 2.3228	84 = 3.3071
10 = 0.3937	35 = 1.3779	60 = 2.3622	85 = 3.3464
11 = 0.4331	36 = 1.4173	61 = 2.4016	86 = 3.3858
12 = 0.4724	37 = 1.4567	62 = 2.4409	87 = 3.4252
13 = 0.5118	38 = 1.4961	63 = 2.4803	88 = 3.4646
14 = 0.5512	39 = 1.5354	64 = 2.5197	89 = 3.5039
15 = 0.5905	40 = 1.5748	65 = 2.5590	90 = 3.5433
16 = 0.6299	41 = 1.6142	66 = 2.5984	91 = 3.5827
17 = 0.6693	42 = 1.6535	67 = 2.6378	92 = 3.6220
18 = 0.7087	43 = 1.6929	68 = 2.6772	93 = 3.6614
19 = 0.7480	44 = 1.7323	69 = 2.7165	94 = 3.7008
20 = 0.7874	45 = 1.7716	70 = 2.7559	95 = 3.7401
21 = 0.8268	46 = 1.8110	71 = 2.7953	96 = 3.7795
22 = 0.8661	47 = 1.8504	72 = 2.8346	97 = 3.8189
23 = 0.9055	48 = 1.8898	73 = 2.8740	98 = 3.8583
24 = 0.9449	49 = 1.9291	74 = 2.9134	99 = 3.8976
25 = 0.9842	50 = 1.9685	75 = 2.9527	100 = 3.9370



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Charts

Rounds

Size In Inches	Est. Wt., Lbs		Size In Inches	Est. Wt., Lbs		Size In Inches	Est. Wt., Lbs	
	Per Foot	20-Ft. Bar		Per Foot	20-Ft. Bar		Per Foot	20-Ft. Bar
1/8	.0418	.8353	1 13/16	8.781	175.6	4 3/8	51.16	1023
5/32	.0653	1.305	7/8	9.397	187.9	7/16	52.63	1053
3/16	.0940	1.879	15/16	10.03	200.7	1/2	54.13	1083
7/32	.1279	2.558	2	10.69	213.8	9/16	55.64	1113
1/4	.1671	3.341	1/16	11.37	227.4	5/8	57.18	1143
9/32	.2114	4.229	1/8	12.07	241.4	11/16	58.73	1175
5/16	.2610	5.220	3/16	12.79	255.8	3/4	60.31	1206
11/32	.3158	6.317	1/4	13.53	270.6	7/8	63.52	1270
3/8	.3759	7.517	5/16	14.29	285.9	15/16	65.16	1303
13/32	.4411	8.822	3/8	15.08	301.5	5	66.82	1336
7/16	.5116	10.23	7/16	15.88	317.6	1/8	70.21	1404
15/32	.5873	11.75	1/2	16.71	334.1	1/4	73.67	1473
1/2	.6682	13.36	9/16	17.55	351.0	5/16	75.44	1509
17/32	.7544	15.09	5/8	18.42	368.4	3/8	77.22	1544
9/16	.8457	16.91	11/16	19.31	386.1	7/16	79.03	1581
19/32	.9425	18.85	3/4	20.21	404.3	1/2	80.86	1617
5/8	1.044	20.88	13/16	21.14	422.9	5/8	84.57	1691
11/16	1.263	25.27	7/8	22.09	441.9	3/4	88.37	1767
23/32	1.381	27.62	15/16	23.06	461.3	7/8	92.26	1845
3/4	1.504	30.07	3	24.06	481.1	15/16	94.23	1885
49/64	1.567	31.34	1/16	25.07	501.4	6	96.22	1924
13/16	1.765	35.29	1/8	26.10	522.0	1/8	100.3	2005
7/8	2.046	40.93	3/16	27.16	543.1	1/4	104.4	2088
15/16	2.349	46.98	1/4	28.23	564.6	3/8	108.6	2172
1	2.673	53.46	5/16	29.33	586.6	1/2	112.9	2259
1/64	2.757	55.14	3/8	30.45	608.9	3/4	121.8	2436
1/32	2.843	56.85	7/16	31.58	631.7	7	131.0	2619
1/16	3.017	60.35	1/2	32.74	654.8	1/4	140.5	2810
1/8	3.383	67.66	9/16	33.92	678.4	1/2	150.4	3007
3/16	3.769	75.38	5/8	35.12	702.5	3/4	160.5	3211
1/4	4.176	83.53	11/16	36.35	726.9	8	171.1	3421
5/16	4.604	92.09	3/4	37.59	751.7	1/2	193.1	3862
3/8	5.053	101.1	7/8	40.14	802.7	9	216.5	4330
7/16	5.523	110.5	15/16	41.44	828.8	1/2	241.2	4824
1/2	6.014	120.3	4	42.77	855.3	10	267.3	5346
9/16	6.526	130.5	1/8	45.48	909.6	1/2	294.7	5804
5/8	7.058	141.2	3/16	46.87	937.4	11	323.4	6468
11/16	7.612	152.2	1/4	48.28	965.6	1/2	353.5	7070
3/4	8.186	163.7	5/16	49.71	994.2	12	384.9	7698

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Charts



Hardness Conversion Table

Diam. 3000 Kg. 10 mm. Ball	BRINELL		ROCKWELL				Shore Scleroscope	Tensile Strength (approx.) Ksi
	Hardness BHN	"C" Scale	"B" Scale	Superficial				
				15-N Scale	30-N Scale			
2.25	745	65.3	-	-	-	91	-	
2.30	772	63.4	-	91.6	81.5	87	-	
2.35	682	61.7	-	91.0	79.0	84	-	
2.40	653	60.0	-	90.2	77.5	81	-	
2.45	627	58.7	-	89.6	76.3	79	323	
2.50	601	57.3	-	89.0	75.1	77	309	
2.55	578	56.0	-	88.3	73.9	75	297	
2.60	555	54.7	-	87.8	72.7	73	285	
2.65	534	53.5	-	87.2	71.6	71	274	
2.70	514	52.1	-	86.7	70.8	70	263	
2.75	495	51.0	-	86.2	69.9	68	253	
2.80	477	49.6	-	85.6	68.7	66	243	
2.85	461	48.5	-	84.9	67.4	65	235	
2.90	444	47.1	-	84.0	66.0	63	225	
2.95	429	45.7	-	83.4	64.6	61	217	
3.00	415	44.5	-	82.8	63.6	59	210	
3.05	401	43.1	-	82.0	62.3	58	202	
3.10	388	41.8	-	81.4	61.1	56	195	
3.15	375	40.4	-	80.6	59.9	54	188	
3.20	363	39.1	-	79.9	58.7	52	182	
3.25	352	37.9	(110.0)	79.4	57.6	51	176	
3.30	341	36.6	(109.0)	78.6	56.5	50	170	
3.35	331	35.5	(108.5)	78.0	55.4	48	166	
3.40	321	34.3	(108.0)	77.3	54.4	47	160	
3.45	311	33.1	(107.5)	76.6	53.3	46	155	
3.50	302	32.1	(107.0)	76.1	52.2	45	150	
3.55	293	30.9	(106.0)	75.6	51.2	43	145	
3.60	285	29.9	(105.5)	75.0	50.3	-	141	
3.65	277	28.8	(104.5)	74.4	49.3	41	137	
3.70	269	27.6	(104.0)	73.7	48.3	40	133	
3.75	262	26.6	(103.0)	73.1	47.4	39	129	
3.80	255	25.4	(102.0)	72.6	46.3	38	126	
3.85	248	24.2	(101.0)	71.7	45.2	37	122	
3.90	241	22.8	100.0	70.8	43.7	36	118	
3.95	235	21.7	99.0	70.3	42.9	35	115	
4.00	229	20.5	98.2	69.7	42.0	34	111	
4.05	223	(18.8)	97.3	-	-	-	108	
4.10	217	(17.5)	96.4	-	-	33	105	
4.15	212	(16.0)	95.5	-	-	-	102	
4.20	207	(15.2)	94.6	-	-	32	100	
4.25	201	(13.8)	93.8	-	-	31	98	
4.30	197	(12.7)	92.8	-	-	30	95	
4.35	192	(11.5)	91.9	-	-	29	93	
4.40	187	(10.0)	90.7	-	-	-	90	
4.45	183	(9.0)	90.0	-	-	28	89	
4.50	179	(8.0)	89.0	-	-	27	87	
4.55	174	(6.4)	87.8	-	-	-	85	
4.60	170	(5.4)	86.8	-	-	26	83	
4.65	167	(4.4)	86.0	-	-	-	81	
4.70	163	(3.3)	85.0	-	-	25	79	
4.80	156	(0.9)	82.9	-	-	-	76	
4.90	149	-	80.8	-	-	23	73	
5.00	143	-	78.7	-	-	22	71	
5.10	137	-	76.4	-	-	21	67	
5.20	131	-	74.0	-	-	-	65	
5.30	126	-	72.0	-	-	20	63	
5.40	121	-	69.8	-	-	19	60	
5.50	116	-	67.6	-	-	18	58	
5.60	111	-	65.7	-	-	15	56	

This is adapted from a joint SAE-ASM-ASTM Committee Report on Hardness Conversion. Values in parentheses are beyond normal range; and are presented for information only.



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