Astralloy
a NUCOR company

Astralloy 600 Pipe

A 600 BHN Abrasion Resistant Pipe

High-performance Astralloy 600 pipe stands up to abrasive particles and slurries, keeps your processes online, and delivers significant lifecycle cost savings versus ordinary steel pipe. Astralloy Steel Products utilizes the industry's most advanced induction heat-treating and quenching system to produce consistent, long-wearing "super pipe" with extra-hard inner walls, yet ductile and highly workable outer surfaces. In addition, our complete range of laterals, wyes, tees, elbows and reducers ensure total system performance, with no weak links.

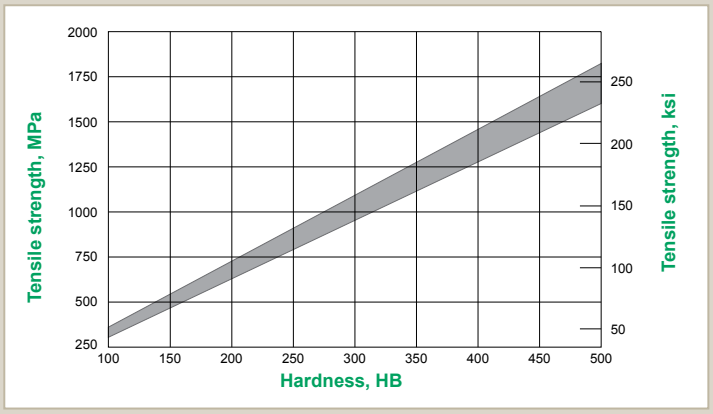
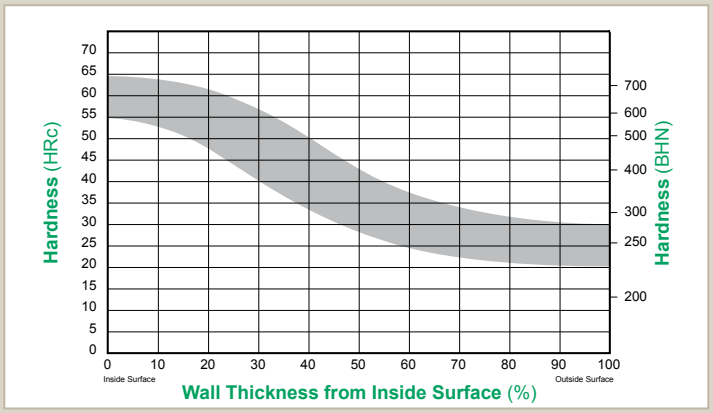


Fig.5 Relation between tensile strength and Brinell hardness for steels in the as-rolled, normalized, or quenched and tempered condition. The tensile strength in ksi is approximately one-half the Brinell hardness number and in MPa is approximately 3½ times the Brinell hardness number.

MECHANICAL PROPERTIES

Astralloy 600 induction hardened pipe properties:

* ID hardness 55 – 65 HRc
* OD hardness 20 – 30 HRc
* Chemical properties as specified in UT100 Specification
* Dimensional properties: Induction-hardening alters the microstructure of steeland may result in an outside diameter up to 1% larger than that specified by ASTM A53 Grade B
* Tensile strengths are increased by the heat treating process to a level approximated by figure 5 from ASM Handbook Volume 1 Properties and Selection: Irons, Steels, and High-Performance Alloys (1990) page 457



Note: The data contained in this document is accurate at time of printing, and intended for use as a general guide.
* Typical maximum values. Mill certifications are available upon request.

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THE PROCESS

In the hardening process, the raw pipe, a medium carbon, low alloy steel is heated to a fully austenitic temperature, typically above 1550 degrees F. At this temperature, the steel is transformed to a large face-centered cubic structure. The inside diameter is then rapidly quenched with a treated coolant. This procedure alters the microstructure, abundant with carbon atoms, to a body-centered tetragonal configuration. This needle-like structure, called martensite, is tightly packed and interlocked, leaving very little movement within the steel. This structure gives the steel its high hardness level that extends into the pipe wall. As the distance from the inner pipe wall increases, the effect of the quench is progressively less, as is the packing of the crystal structure. Correspondingly, the hardness tapers and the ductility increases to the outer surface of the pipe wall.

THE RESULT

This results in a wall profile with a tapering hardness. It leaves a hard, abrasion resistant surface on the inside and a ductile outer surface to accommodate handling and welding.

ABRASION-RESISTANT PIPE SYSTEMS FOR REDUCED DOWNTIME, LIFECYCLE SAVINGS

Astralloy's abrasion-resistant piping systems are manufactured to meet specific applications for operations moving highly abrasive materials, making Astralloy your ideal solution for the most challenging applications:

Mining

Mineral, phosphate and coal mining; fee, waste and debris lines; in-plant piping; tailing lines, backfill; waste disposal; slurry transport; raw ore streams; in-process streams; paste; shotcrete.

Product Conveyance

Dilute and dense phase pneumatic movement operations for powder and bulk materials such as grain and cement; coal combustion by-products; slurry transport; biomass feedback; glass, frit and plastics; food products.

Fossil Fuel Power Plants

FGD reagents (wet or dry); pulverized fuel; fly ash; bottom ash; economizer ash; coal combustion by-products.

Mills and Foundries

In-plant piping; blow lines; storage; waste disposal; slag; sand lines.

SYSTEM COMPONENTS

Astralloy supplies a complete line of system components. Our abrasion resistant pipe and fittings keep your system operating longer with reduced maintenance and longer system life.

Straight Spools

Straight spools are available in 2-1/2"NPS to 40"O.D. in standard lengths from 20' up to 50' long. Custom cut and fabricated to meet system requirements.

Bends

Custom bending capabilities to tailor changes of direction to meet system requirements while reducing flow restrictions and energy loss. Large radius sweeps reduce the deterioration effects of abrasive transport materials.

Laterals, Tees and Wyes

Laterals, Tees and Wyes are designed to split or blend flow streams, these custom fabrications are made using Astralloy 600 pipe to provide superior abrasion resistance.

Reducers

Flow velocity increases at reducers, increasing wear rate due to abrasive transport media. Astralloy 600 pipe reducers are hardened to the same level as Astralloy 600 pipe and bends to provide superior abrasion resistance.

Custom Fabrication

Astralloy also produces custom spools and fabrication like manifolds, hopper to pipe transitions and cleanout spools. These custom pieces also provide the abrasion resistant qualities found in other Astralloy system components.

CUTTING

Cutting of Induction Hardened products can be accomplished with the following:

* Plasma cutting equipment
* Abrasive cut-off wheel (water-cooled)
* Oxy-fuel cutting equipment (not recommended)

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When using plasma or abrasive cut-off equipment, the heat imparted to the material should be minimal and no special precautions are required. Avoid excessive temperature when using abrasive wheels. When using oxy-fuel equipment, the cut must be made in increments of 5 or 6 inches (127 or 152mm) and the pipe allowed to cool between cuts. Where possible, preheat the material for the initial cut, away from the cut line. Once the material is pierced, traverse the torch to the cut line and proceed.

This will minimize heat input to the portion to be retained for use. Much less energy is required to restart the cutting process once the pipe wall is pierced. Oxy-fuel cutting is not recommended and should only be used if plasma cutting equipment or an abrasive cut-off wheel are not available.

BENDING & FABRICATION

Astralloy offers a complete range of bending and fabrication services for piping and structural applications. Astralloy will meet your application needs, delivery schedule and budget.

Induction Bending Capabilities

* Pipe and tube diameters from 2-1/2" NPS to 26" O.D.
* Any angle to 180˚
* Minimum radius of 20" - 3D for diameters greater than 6"
* with a maximum radius of 180"
* Astralloy 600 pipe induction-hardened bends
* Complete range of materials: carbon steel, alloys and stainless steels together as well as structural shapes
* Tangents available at bend ends
* Up to 3" maximum wall thickness

Cold Bending Capabilities

* Cold-formed bends from 2" to 7" I.D.
* Any angle to 180˚
* Bend radii of 7" to 40"
* .25" wall thickness standard; additional thicknesses available upon request

END ATTACHMENT OPTIONS

In addition to the range of available standard end connection options, Astralloy can provide customized sizes and configurations to meet the requirements of your system. Selection of the appropriate option, or combination of options, is dictated by maintenance considerations, performance expectations, life cycle, and other variables. While end options can, in most cases, be installed in the field utilizing proper procedures, improved performance will result when factory fitted. Care must be taken to cool the inner surface of the pipe wall to prevent tempering, thus softening, of the martensitic microstructure.

AVAILABLE OPTIONS

* Standard flanges - 150#, 300# or 600#, single or double-drilled, raised face or flat, slip-on or butt-weld (butt welding not recomended for hardened pipe), fixed or rotating
* Weld rings - conventional or self aligning
* Wear bands or collars to counter downstream turbulence after each connection
* Astralloy's heavy duty or high pressure male/female style ends
* Victaulic® system end styles
* Custom ends available upon request

PROCESS

For each welded attachment, the inner surface is water-cooled to avoid tempering and loss of hardness. End options can be applied to all spools, bends and components.

WELDING

Joint Preparation

* Remove all slag and discolored material after cutting
* Inspect surfaces to be welded -avoid welding areas that have tears, cracks and other discontinuities
* Clean joint area at least 1/2" (12.7mm) from welding joint; remove all loose scale, rust moisture, grease, etc.

Field welding is not recommended due to stringent weld procedures that are not conducive for field application. Flanged pipe spools are the preferred method of joint connection. Astralloy Steel Products can provide general field welding procedures upon request.





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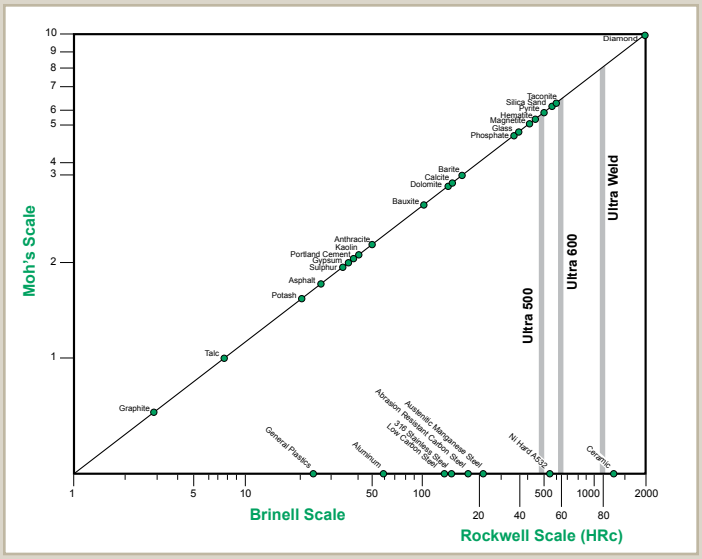
Raw Materials

Steel to be a medium carbon steel suitable for achieving the required through-wall hardness gradient for Astralloy 600 Pipe chemical requirements for raw steel shall be in accordance with UT100 Specification for carbon steel pipe suitable for induction hardening. Steel practice for material to be used for Astralloy 600 Pipe shall be in accordance with UT100 Specification Dimensional properties of raw pipe (UT 100 Pipe) shall fully conform to the requirements of ASTM A53 Grade B for ERW piping Minimum tensile and yield strength in accordance with UT100 Specification

APPLICATIONS

* Coal mining
* Phosphate mining
* Mineral mining
* Fossil fuel power plants
* Grain handling
* Cement industry
* Pulp and paper
* Steel making and foundries

RELATIVE MATERIAL HARDNESS



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Astralloy a NUCOR company
LONGER SERVICE LIFE
THROUGH BETTER METALLURGY