

SHEFFIELD™ WEAR PLATE FABRICATION DATA

FIELD-USE (Job-Site) FLAME HARDENING OF SHEFFIELD WEAR BARS

Due to rolling restrictions on Sheffield Hot Rolled Wear Bars, the chemistry may differ from our wear plate chemistry; however, the same technique is usable on Sheffield Wear Plate. Effective technique will be developed by trial and error.

CAUTION: Flame hardening these materials should be conducted by persons familiar with the flame hardening of alloy materials containing .26/.36 carbon. Follow safety precautions appropriate for the handling of hardened alloy steels; to include safety glasses, protective head gear, steel toed shoes, etc. Taking carbon and alloy steels to maximum surface hardness ranges, such as 50 RC, changes the structure and the physical properties of the material. Caution should be exercised when working with materials on which any portion of the item will be hardened to a brittle range.

Heat the local surface rapidly with an oxy/acetylene gas flame, until the edge appears light orange. Cool at a rate appropriate for hardening. Quench medium should be caustic, water, brine, oil, or air. Excellent results have been obtained utilizing a solution that is a plastic solution of oil and water. More rapid cooling will result in the highest hardness.

If possible, use mechanical equipment for proper location and even application of heat. This will insure correct timing of the hardening process.

Flame Temperature 1550F – 1650F (Salmon or light Orange)

Apply flame to the edge to be hardened

Move along the entire edge.

You may use a wax heat crayon (Tempil® stick), to verify temperature. As a general rule, the resulting hardness should be in the range of 50 to 62RC, with a depth of 1/8" to 3/16", depending on the actual carbon and alloy content of the material. Caution is urged regarding thin cross sections, as the hardness will be localized, but throughout the thickness of the cross section. **Caution:** High hardness materials exhibit brittleness and fracture potential is elevated.

Note: The above flame-hardening information is general in nature and does not address subsequent operations, and/or, fitness for purpose, or any safety issues that might develop from materials that have been thermally altered by our customers or their agents. We are pleased to quote "finished" parts made from our materials that may include various hardening methods. We are unable to guarantee the quality or safety and appropriateness of work performed by others.

FORMING - Sheffield Wear Plate 400BHN

Sheffield Wear Plate 400BHN is a field-proven "FORMABLE" wear plate. The carbon equivalency rating (C.E.) is one of the lowest in the industry.

ALWAYS FORM AGAINST THE GRAIN. *If forming is to be done as a subsequent operation at your location, request that the grain direction be marked on each piece prior to shipment from North American Steel.*

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CAUTION: Exercise extreme caution when performing hot and cold work operations on any through hardened wear plate due to the high hardness of the product. Utilize operators experienced in working with hardened alloys. Follow sound procedures, appropriate for the general classifications of those alloys, and wear the appropriate safety attire, such as safety goggles.

DRILLING - Sheffield Wear Plate 400 BHN

Cobalt or carbide drills are excellent resources but not required. Hardened twist drills, or High Speed (M-2 type) drills should be adequate. Flood with generous coolant, (20% soluble oil). Use heavy capacity high quality equipment to minimize chatter and vibration. Increase feed and lower speed to avoid “glazing”. Where possible, use a hand feed as opposed to a power feed. Power feeds tend to over-power and create small chips which may lodge, or jam. Hand feed allows greater control and “feel” to maintain a scraping type of motion, (long chip). We suggest use of a pilot hole, then follow-up with a reamer type of action. “Dubb”, or dull, the edge on the second drill to create a scraping motion, as opposed to a cutting action. For cobalt alloyed high speed tools (example: over-carburized M42), utilize tools with a tapered shank and long helical short bit. Flood with lubricant – 20% diluted soluble oil. Where multiple holes are required you may want to consider tungsten carbide tipped tooling, or solid carbide tools. (ISO K-10 or K-20).

Drill bit preparation. Grind away the metal behind the lip to obtain clearance. (10° is preferred). Most drill failures, that occur when drilling hard plate, are along the land, not at the entry point. Thin the point significantly at the entry point.

TAPPING - Sheffield Wear Plate 400 BHN

Tapped holes are difficult in hardened wear plates. In many cases, where there is a requirement for tapped holes, consider the use of an oversize “drill through hole”. Then insert a plug, and tap the plug. If you are required to tap into the wear plate, ensure that the hole size is as large or larger than the thickness of the plate. Start with a smaller “pilot” hole.

MACHINING - Sheffield Wear Plate 400 BHN

The chemistry is very similar to a 4320 Type alloy. The hardness is furnished at approximately 44RC.

All of the standard precautions observed for machining hardened alloys prevail; Use equipment of sufficient capacity to avoid chatter and vibration. **Increase pressure – decrease speed.** Avoid glazing. (glazing is similar to flame or surface hardening of the immediate work area.). Utilize machine operators familiar with machining hardened alloys and tool steels, to the degree of hardness mentioned above.

The hardness of **Sheffield Wear Plate 400 BHN** will be throughout, and uniform. Which means you should not encounter the hard and soft spots typically found in commercial grade AR wear plate.

MILLING - Sheffield Wear Plate 400 BHN

Use of carburized cobalt alloyed high speed tools has been very successful. (M35). Improved efficiencies may be obtained by utilizing ISO P25 tooling for grooving, or K10 and K20 tooling.

Use C-5 or 6 Carbide tools | 50 to 100SFPM | .001/.003 Chip Load | Flood with coolant

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FORMING – Sheffield Wear Plates (Continued)

Forming any hard plate should only be attempted by persons experienced in forming hard plate, or hardened wear plate. Hand grind edges to remove slag and eliminate potential crack initiation points. Insure plate is at room temp., or slightly warmer. Allow minimum bend radius of 12T, (12 times the thickness of the plate). Best results will be obtained by utilizing multiple hits to form the radius. Utilize a broad radius top die and an “Air-Die”, or open-die for the bottom.

WELDING - Sheffield Wear Plates

Utilize the “**Standard Low-Hydrogen Method**”. (E7018).

Improve your chances for sound welds when welding hardened wear plate products:

**ELIMINATE MOISTURE
MINIMIZE HEAT
AVOID DRAMATIC TEMPERATURE CHANGE**

To minimize dramatic temperature change and evaporate any residual moisture; preheat the weld area. (In instances where pre-heat is not possible, consider use of a 309 Stainless Rod. A preheat and interpass temperature of 150°F to 350°F is generally sufficient. (35°0F to 450°F for 500 BHN Plate). Exact furnace controlled temperature is not required, a heat crayon will give adequate guidance.

If you use a torch to pre-heat, move rapidly and cover a broad to provide a general increase in temperature. Maintain preheat temperature during weld. Allow the assembly to slow-cool.

Select the smallest diameter electrode that will do the job. (Stick welding is preferred simply because of the tendency of the semi-automatic process to apply too great of a deposit). Travel rapidly and use several small stringer beads. Cold work applied prior to welding (machining, forming, etc.), may result in stress build-up. Every attempt to insure proper alignment of the welded sections should be made. “Dogging”, or clamping to correct alignment problems will result in retained stress. To help minimize welding stresses, peen the beads, after each pass, while they are still hot.

ELIMINATE MOISTURE:

Make sure weld rods are completely dry. Use rods from a sealed container, or utilize a portable oven per the directions of the manufacturer of the welding rods. Remember that All Quench and Tempered Wear Plate products are engineered to address severe wear. The Tensile properties of these products are very high (200,000PSI), for that reason structural welds, and welds requiring strengths at those levels are to be avoided. Your adherence to sound welding practice, the employment of **The Standard Low Hydrogen Process**, and attention to surface cleanliness, and awareness of the effect of retained stress, will greatly improve your chances of obtaining exceptional welds.