



D-2

PRODUCT INFORMATION

TYPICAL PARTS

Use D-2 for applications requiring long runs and close tolerances. Use it for tools and dies for blanking, punching, forming, cold-extruding, and other operations requiring high compressive strength and excellent wear resistance.

ADVANTAGES

Air-Hardening: which results in minimum change in size and shape during heat treatment. It is the most stable of all tool steels. Deep hardening, extremely high wear-resistance.

FORGING/ROLLING

Due to the high carbon and high chromium content, special care must be exercised during hot-work. Heat slowly and uniformly to approximately 1250° F and hold this temperature long enough to thoroughly soak the piece. For forging, heat to between 1950° F and 2050° F. Discontinue forging at 1700° F and follow with reheating. When the forging operations are completed, cool slowly, preferably by burying in a dry insulating material.

ANNEALING

Use a controlled-atmosphere furnace of , pack with inert material in a sealed container to prevent decarburization. To anneal, heat slowly to approximately 1600° F to 1650° F and hold at temperature for 1 1/2 hour s per inch of greatest thickness.

Cool slowly at a rate of 20° F per hour to 900° F, after which the steel may be allowed to cool down with the furnace. Resulting hardness will be Brinell 229 Max.

HARDENING

When heating for hardening, protect the steel by packing or wrapping in some inert materials. When available, the use of well regulated salt bath or controlled-atmosphere furnace, or a vacuum furnace is preferred. Pre-heat to 1200° F and hold at this temperature until thoroughly soaked. Heat to 1850 ° F and hold at this temperature for one hour for each inch of greatest cross section. The pieces may then be removed and cooled in still air to a temperature of 150° and tempered immediately. Oil quenching is required on section 6 inches or larger.

TEMPERING

Double tempering is preferable with the second temper 50 degrees lower than the first. The type of tool and service requirements largely determine the tempering temperature. For most applications, the tempering range is 900 F to 960 F. A minimum holding time of two hours for each inch of greatest thickness should be used. To minimize the possibility of cracking, temper immediately after hardening and heat slowly to desired temperature. D-2 normally shows a slight amount of contraction in size, however tempering at 900F or slightly higher usually neutralizes the process and brings the part back to its original size. Occasionally, a second or third attempt at 10 degrees over previous temperature may be used. Hardness produced in the range of Rockwell C 58 to 60. Final temper should be done at 25 to 50 F below previous temper.

Chemical Analysis	
Carbon	1.40/1.60
Phosphorus	.030 Max
Manganese	.60 Max
Sulfur	.030 Max
Silicon	.60 Max
Chromium	11.00/13.50
Vanadium	.80/1.10
Tungsten	-----
Molybdenum	.70/1.20
Cobalt	1.00 Max

Tempering Temperature °f	
As-quenched	64
400	60
500	58
600	58
700	58
800	57
900	58/60
1000	56
1100	58
1200	40

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