COPPER DATA
TEMPER AND HOW IT IS SPECIFIED

The temper of hardness of a metal or an alloy is a condition produced by mechanical or thermal treatment. This treatment imparts a characteristic structure and mechanical properties. Temper ranges from annealed, or fully soft, to spring temper, or very hard. Annealed temper is achieved by thermal application; spring tempers—and intermediate tempers—by cold-working (rolling or drawing). Rolling and drawing of a metal reduce its thickness, but increase its hardness.

In standard mill practice, the reduction by rolling is figured on the basis of thickness, only because the metal does not widen very much during the rolling operation. The degree of rolling is expressed in Brown and Sharpe gauge numbers, which were developed many years ago and which have a definite relationship to each other. For example, in the Brown and Sharpe gauge system, the gauges are reduced by 50 percent every six numbers as shown below:

No. 2 B&S is .2576 inch
No. 8 B&S is .1285 inch
No. 14 B&S is .06408 inch

Specifying Temper. The strength and degree of hardness of the metal is of the utmost importance. The fabricator should supply definite specifications concerning his requirements on temper to avoid misunderstandings.

When forming or bending operations are to be made, the material must not be too hard. As large a bending radius as practical should be used to favor the hard metal. It should be understood that bends made perpendicular to the direction of rolling are less liable to fracture than those made parallel to the direction of rolling. Generally, half hard temper is satisfactory, but there are some instances where quarter hard temper should be used. Ultra Fine Grain, which approximates regular quarter hard temper but with greater ductility and better polishing characteristics, may be preferred.

Strip and Sheet Tempers. The following standards for hard-rolled flat metals have been universally adopted for strip and sheet by the brass industry and given in ASTM specifications:

Temper	Rolled B&S	% Reduction In Thickness
Quarter hard	1 B&S number hard	10.95%
Half hard	2 B&S numbers hard	20.7%
Three quarter hard	3 B&S numbers hard	29.4%
Hard	4 B&S numbers hard	37.1%
Extra hard	6 B&S numbers hard	50.15%
Spring	8 B&S numbers hard	60.5%
Extra spring	10 B&S numbers hard	68.65%