

# ••• O-1 Cold Work Die Steel

## (AISI O1)

**WM O-1** belongs to that class of oil hardening tool steels known as “non-deforming” steels. It will develop full hardness on oil quenching from a relatively low temperature, with minimum volume change. The high manganese content imparts good non-deforming properties, and the addition of chromium and tungsten increases the wear resistance over the straight manganese oil hardening tool steel.

**WM O-1** shows minimum size change when quenched from the proper hardening temperature. If over heated, this steel will exhibit shrinkage after tempering. When properly hardened it will expand slightly, but after tempering will return very close to its original size.



### Chemical Composition

<b>Carbon</b>	<b>0.90</b>
<b>Manganese</b>	<b>1.20</b>
<b>Silicon</b>	<b>0.25</b>
<b>Chromium</b>	<b>0.50</b>
<b>Tungsten</b>	<b>0.50</b>
<b>Vanadium</b>	<b>0.20</b>

### Typical Applications

Blanking dies, plastic mold dies, drawing dies, trim dies, paper knives, shear blades, taps, reamers, master tools, gauges.

### Physical Properties

Critical temperature - (on heating) 1370°F	
Specific gravity - 7.86	
Coefficient of Thermal Expansion	
100 - 500°F	5.98 x 10 <sup>-6</sup> in/in/°F
100 - 800°F	7.14
100 - 1000°F	7.84
100 - 1200°F	8.02

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## Forging

Heating for forging must be done slowly and uniformly. Soak through at 1800-1900°F, and reheat as often as necessary, stopping work when the temperature drops below 1600°F. After forging cool slowly in lime, mica, dry ashes or furnace. **WM O-1** should always be annealed after forging.

## Quenching

Quench in warm oil and allow to cool in the oil until a temperature of 125-150°F has been reached, or to where the tool can be held in the bare hand, and temper immediately. Care should be taken to prevent an accumulation of water in the oil quenching tank.

## Annealing

Heat slowly to 1400-1450°F, hold until the entire mass is heated through, and cool slowly in the furnace (40°F per hour) to about 1000°F, after which the cooling rate may be increased. Suitable precautions must be taken to prevent excessive carburization or decarburization.

## Tempering

**WM O-1** is generally tempered in the range of 300-600°F. The following curve may be used as a guide to the hardness that may be expected after tempering.

## Strain Relieving

When desirable to relieve the strains of machining, heat slowly to 1050-1250°F, allow to equalize, and then cool in still air.

### Oil Quenched from 1475°F

#### As Quenched Tempered

65.5 RC

250 °F	65.0
300 °F	65.0
350 °F	63.5
400 °F	62.5
450 °F	61.5
500 °F	60.0
550 °F	58.5
600 °F	57.5
700 °F	54.0
800 °F	51.5

## Preheat for Hardening

Warm slightly before charging into the preheat furnace, which should be operating at about 1100-1200°F.

## Hardening

After thorough preheating, transfer to the hardening furnace, operating from 1450-1500°F, depending on the degree of hardening desired for the application, and the size of the tool.

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