



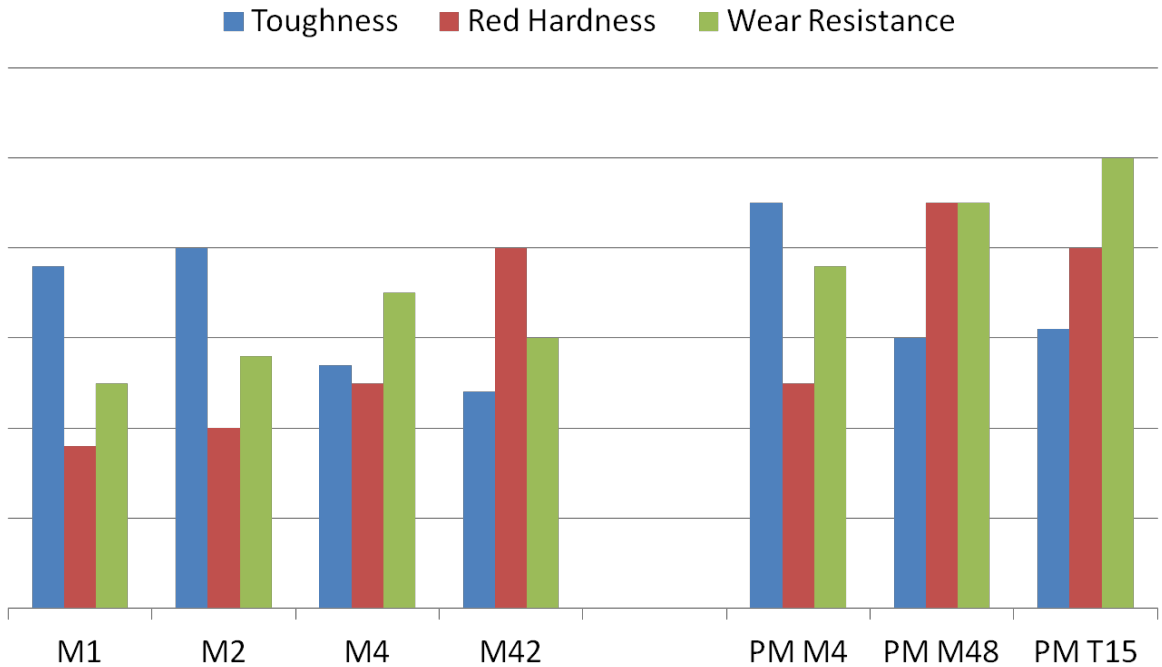
Technical Information: PM M48

PM M48 IS A TUNGSTEN/MOLYBDENUM-COBALT-VANADIUM SUPER HIGH SPEED STEEL
 PM M48 IS PRODUCED USING THE PM (POWDER METALLURGY) PROCESS
 THE GRADE HAS AN EXCELLENT COMBINATION OF HIGH RED HARDNESS AND HIGH WEAR RESISTANCE
 PM STEELS HAVE BETTER GRINDABILITY AND TOUGHNESS VS CONVENTIONALLY PRODUCED STEELS

TYPICAL CHEMICAL COMPOSITION

CARBON	1.50%	CHROMIUM	3.75%
MOLYBDENUM	5.25%	TUNGSTEN	9.75%
VANADIUM	3.10%	COBALT	8.50%

HIGH SPEED STEEL PROPERTIES COMPARISON



PHYSICAL PROPERTIES

MODULUS OF ELASTICITY.....31 PSI X 10⁶(207 GPa)
DENSITY..... 0.298 LB/IN³
ANNEALED HARDNESS.....245-275 BRINELL HARDNESS (BHN)
MACHINABILITY.....SIMILAR TO M42 HIGH SPEED STEEL

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HEAT TREATMENT

ANNEALING

HEAT TO 1600°F, HOLD TWO HOURS
SLOW COOL 20°F/HOUR TO 600°F
THEN AIR OR FURNACE COOL TO ROOM TEMPERATURE

STRESS RELIEVING

PERFORMED PRIOR OR AFTER MACHINING TO MINIMIZE DISTORTION IN HEAT TREATING
1100/1200°F, HOLD TWO HOURS
THEN AIR COOL TO ROOM TEMPERATURE

HARDENING

SALT BATH, PROTECTIVE ATMOSPHERE, OR VACUUM FURNACE EQUIPMENT PREFERRED.

HIGH HEAT (AUSTENITIZING)

2100/2200°F FOR 5 TO 10 MINUTES AT HEAT.
HIGHER AUSTENITIZING TEMPERATURES REQUIRE LESS TIME AT HEAT

QUENCH

SALT BATH QUENCH TO 1000-1100°F, EQUALIZE, THEN AIR COOL TO 150°F.
VACUUM OR ATMOSPHERE QUENCH RATE OF A MINIMUM 50 DEGREES F PER MINUTE DOWN TO 1200°F IS
CRITICAL TO ACHIEVE BEST HEAT TREAT RESPONSE.
TEMPER IMMEDIATELY FOLLOWING QUENCH

TEMPERING

MINIMUM 1000°F TEMPERING TEMPERATURE REQUIRED.
DOUBLE TEMPERING IS REQUIRED, TRIPLE TEMPERING RECOMMENDED.
AIR COOL TO ROOM TEMPERATURE BETWEEN TEMPERS.

TYPICAL HEAT TREAT RESPONSE

TEMPERING TEMP °F	HARDENING TEMP 2100°F	HARDENING TEMP 2150°F	HARDENING TEMP 2200°F
As QUENCHED	68	67	66
1000	67	68	69
1025	66	67	68
1050	65	67	68
1075	64	66	67
1100	63	65	66

LONGITUDINAL
SIZE CHANGE

APPROXIMATELY: PLUS 0.22%