



Technical Information: PM A11

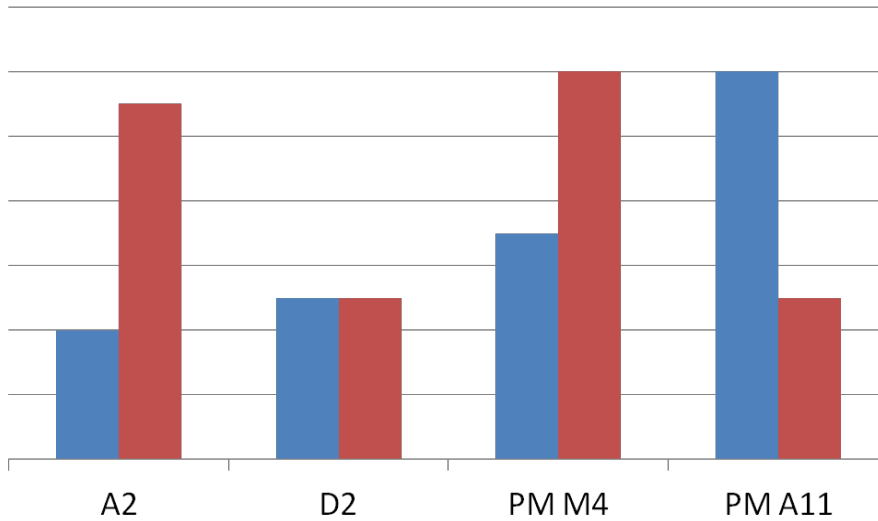
PM A11 IS A HIGH VANADIUM TOOL STEEL PRODUCED USING THE PM (POWDERED METAL) STEEL MAKING PROCESS. THE GRADE HAS EXCELLENT WEAR RESISTANCE AND MODERATE TOUGHNESS MAKING IT IDEAL FOR COLD WORK TOOLING APPLICATIONS.

TYPICAL CHEMICAL COMPOSITION

CARBON	2.45%	CHROMIUM	5.30%
MOLYBDENUM	1.30%	SILICON	0.90%
VANADIUM	9.50%	MANGANESE	0.50%
SULFUR	0.10%		

PM STEEL PROPERTIES COMPARISON

■ Relative Wear Resistance ■ Chipping Resistance



PHYSICAL PROPERTIES

MODULUS OF ELASTICITY 32 PSI X 10⁶(207 GPa)
DENSITY 0.286 LB/IN³
ANNEALED HARDNESS 255-275 BRINELL HARDNESS (BHN)
MACHINABILITYSIMILAR TO T15 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)

1950/2150°F FOR 10 TO 30 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 1200F 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 1950°F	HARDENING TEMP 2050°F
As QUENCHED	64	65
1000	60.5	62
1025	58	60
1050	56	58
1075	54	56
1100	52	54

LONGITUDINAL
SIZE CHANGE

APPROXIMATELY: PLUS 0.10%