



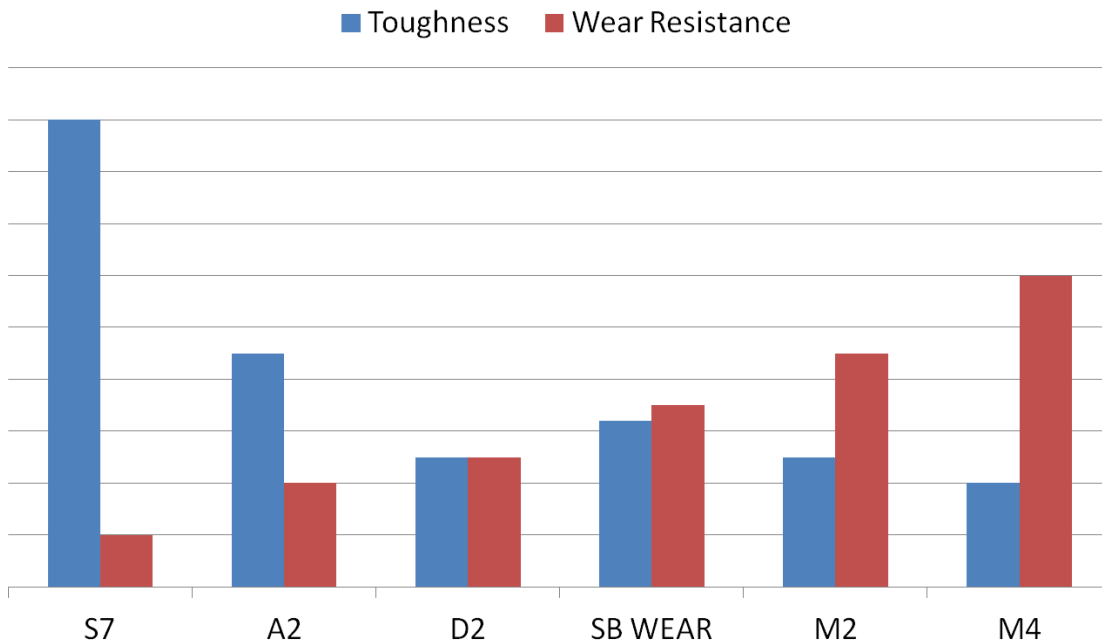
Technical Information: M4

M4 IS A GENERAL PURPOSE HIGH SPEED STEEL
M4 HAS A GOOD BALANCE OF TOUGHNESS, WEAR RESISTANCE, AND RED HARDNESS
M4 IS USED AS AN UPGRADE TO M2 FOR WEAR RESISTANCE.

TYPICAL CHEMICAL COMPOSITION

| | | | |
|------------|-------|-----------|-----------|
| CARBON | 1.35% | CHROMIUM | 4.15% |
| MOLYBDENUM | 5.00% | SILICON | 0.30% |
| VANADIUM | 4.15% | MANGANESE | 0.30% |
| TUNGSTEN | 6.00% | SULFUR | 0.03% MAX |

SBSM TOOL STEEL PROPERTIES COMPARISON



PHYSICAL PROPERTIES

MODULUS OF ELASTICITY.....30 PSI X 10⁶(207 GPa)
 DENSITY.....0.294 LB/IN³
 ANNEALED HARDNESS.....215-255 BRINELL HARDNESS (BHN)
 MACHINABILITY.....SIMILAR TO D2 TOOL STEEL



Technical Information: M4

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)

2150/2250°F FOR 10-15 MINUTES 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 2150°F | HARDENING TEMP 2250°F |
|----------------------|-----------------------------|-----------------------------|
| As QUENCHED | 65 | 65 |
| 1000 | 65 | 65 |
| 1025 | 64 | 65 |
| 1050 | 63 | 64 |
| 1075 | 62 | 63 |
| 1100 | 60 | 62 |

LONGITUDINAL SIZE CHANGE

APPROXIMATELY: PLUS 0.22%