



## Technical Information: H13 ESR

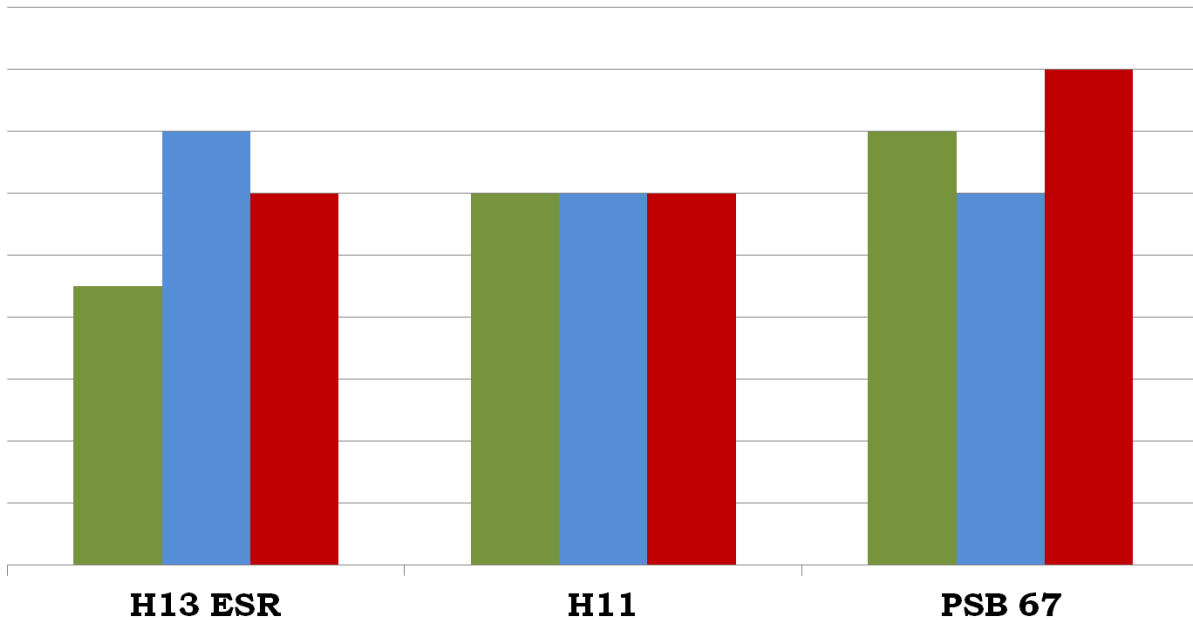
H13 ESR IS A HOT WORK TOOL STEEL WITH A GOOD COMBINATION OF HOT HARDNESS, HOT TOUGHNESS, AND TEMPER RESISTANCE  
 H13 ESR IS USED AS AN UPGRADE TO STANDARD H13  
 H13 ESR WILL HAVE HIGHER TOUGHNESS AND BETTER POLISHABILITY THAN STANDARD H13

**TYPICAL CHEMICAL COMPOSITION**

CARBON	0.40%	CHROMIUM	5.20%
MOLYBDENUM	1.40%	SILICON	1.00%
VANADIUM	0.95%	MANGANESE	0.40%

### SBSM TOOL STEEL PROPERTIES COMPARISON

■ High Temperature Toughness ■ High Temperature Wear Resistance ■ Temper Resistance



### PHYSICAL PROPERTIES

MODULUS OF ELASTICITY.....30 PSI X 10<sup>6</sup> .....(207 GPa)  
 DENSITY..... 0.283 LB/IN<sup>3</sup>  
 ANNEALED HARDNESS.....200-229 BRINELL HARDNESS (BHN)  
 MACHINABILITY.....SIMILAR TO H11 TOOL 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 TO 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)

1850°F FOR 30 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

HARDENING TEMP	TEMPERING TEMP		HARDNESS HRC	
	°F	°C		
1940 1060	1000	555	53	
	1050	570	50	
	1100	595	47	
	1150	620	30	
THERMAL CONDUCTIVITY	Room T	660 F 350 C	1262 F 700 C	
W/M*K	30.8	33.5	35.1	
THERMAL EXPANSION	Room T-100C	Room T-300C	Room T-500C	Room T-700C
10 <sup>-6</sup> M/M*K	11.9	12.6	13.1	13.5