



# SB Specialty Metals LLC

Your **First Choice** for Specialty Metals

## A2 ESR- Technical Data

### General Description:

A2 ESR is an upgrade to standard A2. The Electro Slag Remelt (ESR) process provides improved toughness and polishability. A2 ESR is well suited to a wide variety of tooling applications plus molding and processing of abrasive plastics.

### Example of applications:

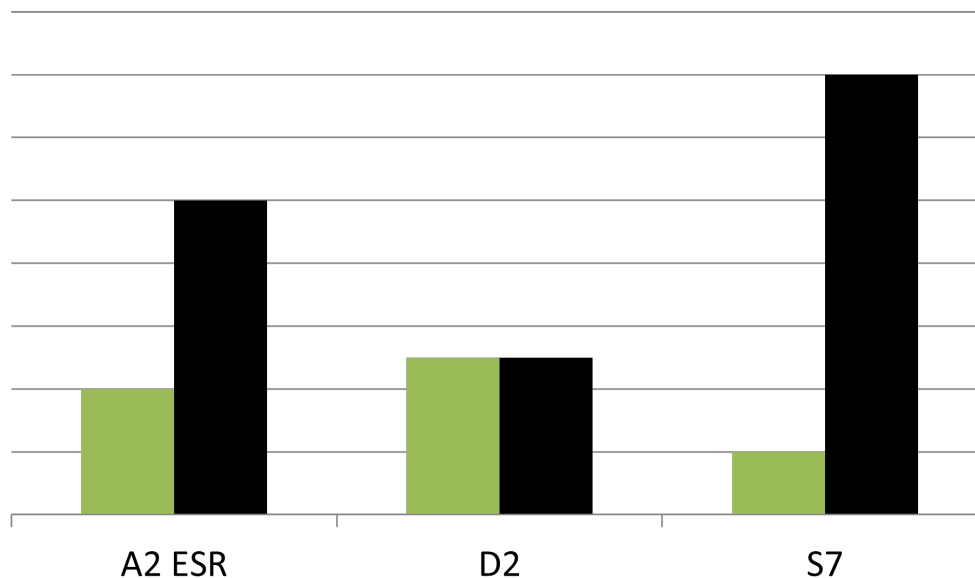
Blanking dies, thread roll dies, forming tools, trim dies, punches, shear blades, gauges, wear inserts and plastic molding applications.

### Chemical Composition

Carbon	Molybdenum	Vanadium	Chromium	Silicon	Manganese
0.95-1.05%	0.90 - 1.40%	0.15 - 0.50%	4.75 - 5.50%	0.10-0.50%	0.40 - 1.00%

### Comparison Chart

■ Wear Resistance ■ Toughness



### Typical Heat Treat Response

Hardening Temp °F	Tempering Temp °F	Temp °F	Hardness HRC	Charpy C-notch Toughness - Ft-lbs
1775	As quenched		64	--
	300		62	--
	400		61	31
	500		60	41
	600		59	37
	700		58	33
	800		58	31
	900		58	29
	1000		57	41
	1100		51	--

### Size Changes During Hardening

Hardening Temp °F	Tempering Temp °F	HRC	Longitudinal Size Change %
1775	500	61	0.10%
1775	600	59	0.09%

### Surface Treatment

A2 ESR can be given standard surface treatments such as nitriding, titanium nitride coating, or hard chrome plating if desired. When gas nitriding, harden from the high side of the temperature range and single temper at 1000 °F; then use standard nitriding procedures.



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### Heat Treatment

#### Annealing

Heat to 1600°F, hold two hours, slow cool (50 °F/hour maximum) to 1200 °F, air cool.

Typical annealed hardness:197/241 BHN.

#### Stress Relieving

Annealed material: Heat to 1200-1250 °F, hold two hours, cool in still air. Normally done after rough machining.

Hardened material: Heat to 25 °F below original tempering temperature, hold two hours, cool in still air. Normally referred to as stress tempering.

#### Hardening

Preheat: 1350-1450 °F, let part equalize.

#### High Heat (Austenitizing)

1750-1800 °F, 30-45 minutes holding time at temperature.

#### Quench

Air, positive pressure vacuum to 150 °F.

#### Tempering

400-1000 °F, hold 2 hours at temperature, air cool to room temperature between tempers. Temper twice. Cryogenic Treating may improve long term dimensional stability by transforming retained austenite. Refrigeration treatments should generally be performed after the first temper, and must be followed by a temper.

### Physical Properties

<b>Modulus of Elasticity</b>	30 PSI x 10 <sup>6</sup> .....(207GPa)	<b>Density</b>	0.284 lb/In <sup>3</sup>
<b>Annealed Hardness</b>	197/241 Brinell Hardness (BHN)	<b>Machinability</b>	80% of O1