



SB Specialty Metals LLC

Your **First Choice** for Specialty Metals

D2 ESR- Technical Data

General Description:

D2 ESR is an upgrade to conventional D2. The Electro Slag Remelt (ESR) process provides higher toughness and better cleanliness.

D2 ESR is a high carbon, high chromium cold work tool steel characterized by very good wear resistance and is used in a variety of cold work applications.

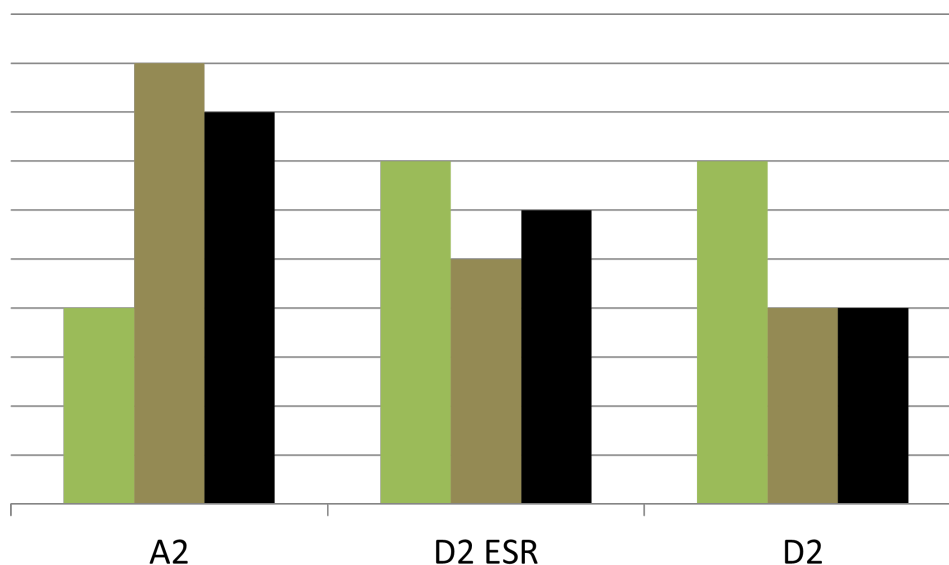
Example of applications:

Rotational cutting dies, forming rolls and dies, thread roll dies, blanking dies and punches, industrial knives and cutlery knives.

Chemical Composition

Carbon	Molybdenum	Vanadium	Chromium	Silicon	Manganese
1.40 - 1.60%	0.70 - 1.20%	0.50 - 1.10%	11.00 - 13.0%	0.10 - 0.60%	0.25 - 0.45%

Comparison Chart ■ Wear Resistance ■ Chipping Resistance ■ Toughness



Typical Heat Treat Response

Hardening Temp °F	Tempering Temp °F	Hardness HRC	Charpy C-Notch Toughness - Ft.-lbs
1850	As Quenched	63/64	
	300	62	17
	400	61	21
	500	60	23
	600	59	22
	700	58	22
	800	58	21
	900	58	21
	1000	55	19

Size Changes During Hardening

Hardening Temp °F	Tempering Temp °F	HRC	Longitudinal Size Change %
1850	400	61	+0.03%
1850	700	58	+0.02%
1850	950	56	+0.05%

Surface Treatment

Standard surface treatments such as nitriding, titanium-nitride coating, or hard chrome plating can be used. Prior to nitriding or PVD treatment, must double temper at or above process temperature.



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Heat Treatment

Annealing

Heat to 1600°F, hold for two hours.
Slow cool 25°F/hour to 1000°F.
Then air or furnace cool to room temperature.

Stress Relieving

Normally performed after machining to minimize distortion in heat treating.
1200°F, hold two hours.
Then air cool to room temperature.

Hardening

Protective atmosphere or vacuum furnace equipment preferred.

High Heat (Austenitizing)

Preheat to 1400-1450°F - let part equalize.
Then austenitize at 1825-1875°F, holding time at austenitizing temperature is 30-45 minutes.
Longer holding times may e required depending upon overall cross section of part being heat treated.

Quench

Vacuum or atmosphere quench rate of a minimum 50 °F per minute down to 1200 °F, then continue quench to room temperature.
Temper immediately following quench.

Tempering

Minimum 400°F tempering temperature required.
Double tempering is required, triple tempering recommended. Each temper for a minimum of two hours at tempering temperature. Air cool to room temperature between tempers.

Physical Properties

Modulus of Elasticity	30 PSI x 10 ⁶(207GPa)	Density	0.280 lb/In ³
Annealed Hardness	220-235 Brinell Hardness (BHN)	Machinability	65% of O1