EDRO #8™

color code: brown

Premium 420 Stainless Mold Steel

EDRO #8™ is a chromium-alloyed stainless tool steel with the following properties:

- Excellent corrosion resistance
- Superior polishability
- Good wear resistance
- Good machinability
- Stability in hardening

These properties combine to give a steel with outstanding production performance. The practical benefits of good corrosion resistance in a plastics mold can be summarized as follows:

- Lower mold maintenance costs
- The surfaces of cavity impressions retain their original finish over extended running periods
- Molds stored or operated in humid conditions require no special protection
- Lower production costs
- Since water cooling channels are unaffected by corrosion (unlike conventional mold steels), heat transfer characteristics, and therefore cooling efficiency is constant throughout the mold life, ensuring consistent cycle times.

These benefits, coupled with the high wear resistance of EDRO #8™, offer the molder low-maintenance, long-life molds for the greatest overall molding economy.

EDRO #8™ is produced using the Electro-Slag-Refining (ESR) technique, resulting in an extremely fine and consistent micro-structure with superior cleanliness.

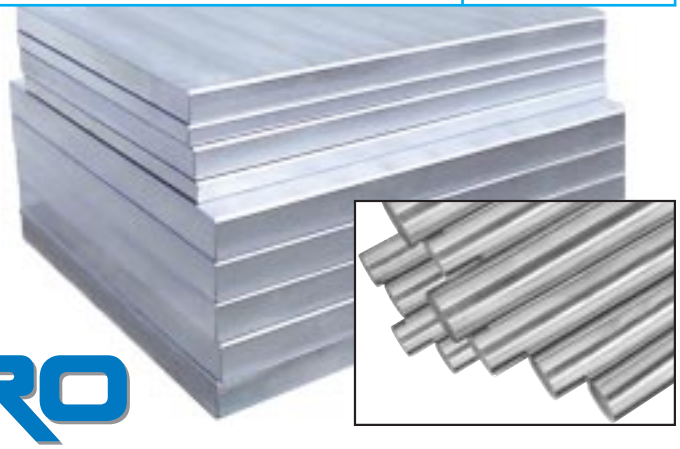
Applications

While EDRO #8™ is recommended for all types of molding tools, its special properties make it particularly suitable for molds with the following demands:

- Corrosion/staining resistance, i.e. for molding of corrosive materials, e.g. PVC, acetates, and for molds subjected to humid working/storage conditions.
- Wear resistance, i.e for molding abrasive/filled materials, including injection-molded thermosetting grades. Also for molds with exceptionally long production runs, e.g. electrical/electronic parts; disposable cutlery and containers.
- High surface finish, i.e. for production of optical parts, such as camera and sunglass lenses, and for medical containers, e.g. syringes, analysis phials.

Typical analysis %	C	Si	Mn	Cr	V
	0.38	0.8	0.5	13.6	0.3
Standard spec.	AISI 420 Improved (W.-Nr. 1.2083)				
Delivery condition	Soft annealed to approximately 215 HB				
Color code	Brown				

Type of mold	Recommended hardness HRC
Injection molds for:	
— Thermoplastic materials	50—54
— Thermosetting materials	52—56
Compression/transfer molds	50—56
Blow molds for PVC, PET, etc.	50—56
Extrusion, pultrusion dies	48—54



EDRO

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PROPERTIES

PHYSICAL DATA

Hardened and tempered to 50 HRC. Data at room and elevated temperatures.

Temperature	68˚F (20˚C)	390˚F (200˚C)	750˚F (400˚C)
Density lbs/in^3 kg/m^3	0.282 7800	0.280 7750	0.277 7700
Coefficient of thermal expansion			
per ˚F from 68˚ per ˚C from 20˚	— —	6.1 x 10^{-6} 11.0 x 10^{-6}	6.4 x 10^{-6} 11.4 x 10^{-6}
Thermal conductivity			
Btu in/ft^{2}h˚F W/m ˚C	159 23.0	166 24.0	173 25.0
Modulus of elasticity			
psi N/mm^2	31.1 x 10^6 215000	30.4 x 10^{-6} 210000	27.5 x 10^{-6} 190000
Specific heat			
Btu /lb˚F J/kg ˚C	0.110 460	— —	— —

TENSILE STRENGTH

The tensile strength values are to be considered as approximate only. All samples were taken from a bar (in the rolling direction) 25mm (1") diameter. Hardened in oil from 1880 ± 20˚F (1025 ± 10˚ C) and tempered twice to the hardness indicated.

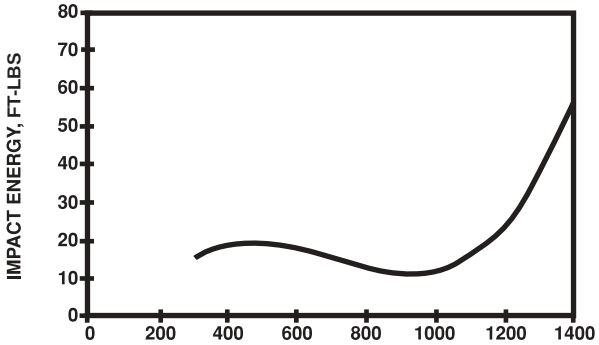
Hardness	55 HRC	50 HRC	45 HRC
Tensile strength psi N/mm^2	 300000 2050	 256000 1780	 206000 1420
Yield strength psi N/mm^2	 234000 1610	 213000 1460	 185000 1280
Reduction of Area	27%	30%	40%
Elongation in 2"	8%	10%	12%

TEMPERING

Temperature ˚C	Temperature ˚F	Soaking* time minutes	Hardness before tempering (HRC)
980	1800	40	52 ± 2
390	200	2	56 ± 2
570	300	2	57 ± 2

*Soaking time = time at hardening temperature after the tool is fully heated through.

IMPACT STRENGTH



Samples were Izod impact specimens austenitized at 1875 ˚F.

Corrosion Resistance

EDRO #8™ is resistant to corrosive attack by water, water vapor, weak organic acids, dilute solutions of nitrates, carbonates and other salts.

A tool made from EDRO #8™ will have good resistance to rusting and staining due to humid working and storage conditions and when molding corrosive plastics under normal production conditions.

EDRO #8™shows the best corrosion resistance when tempered at about 480˚F (250˚C) and polished to a mirror finish.

Heat Treatment

Soft Annealing

Protect the steel and heat through to 1440˚F (780˚C). Then cool in the furnace at 20˚F (10˚C) per hour to 1200˚F (650˚C), then freely in air.

Stress-Relieving

After rough machining the tool should be heated through to 1200˚F (650˚C), holding time 2 hours. Cool slowly to 930˚F (500˚C), then freely in air.

Hardening

Pre-heating temperature: 1110˚F-1560˚F (600-850˚C).
Austenitizing temperature: 1800-1920˚F (980-1050˚C) but usually 1880˚F (1025˚C).

Protection against decarburization

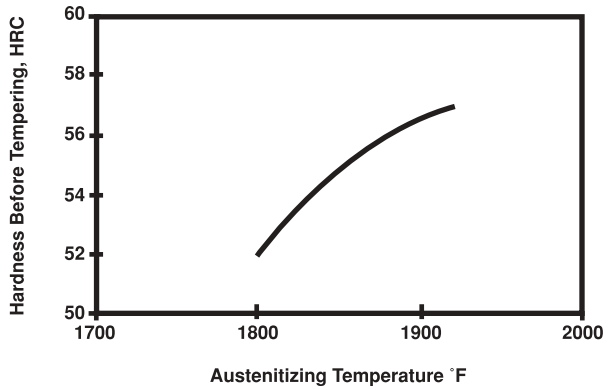
Protect the tool against decarburization and oxidation during the hardening process.

Quenching Media

- Oil
- Martempering bath 390-1020˚F (200-550˚C), 1-100 minutes, then cool in air.
- Air blast
- Circulating air or atmosphere

Temper the tool as soon as its temperature reaches 120-160˚F (50-70˚C).

HARDENING CURVE

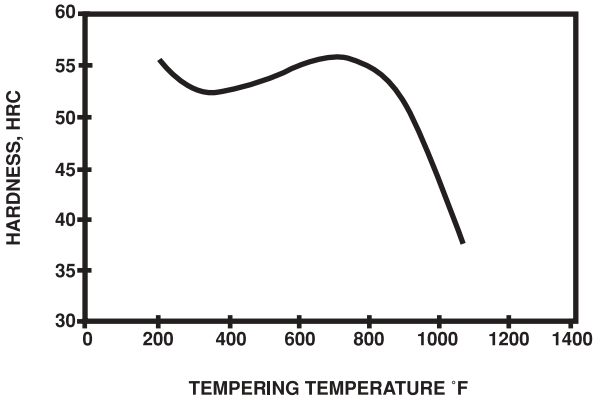


All samples heated to austenitizing temperature and held for 30 minutes.

Tempering

Choose the tempering temperature according to the hardness required by reference to the tempering graph. Temper twice with intermediate cooling to room temperature. Lowest tempering temperature 350˚F (180˚C). Holding time at temperature minimum 2 hours.

TEMPERING CURVE



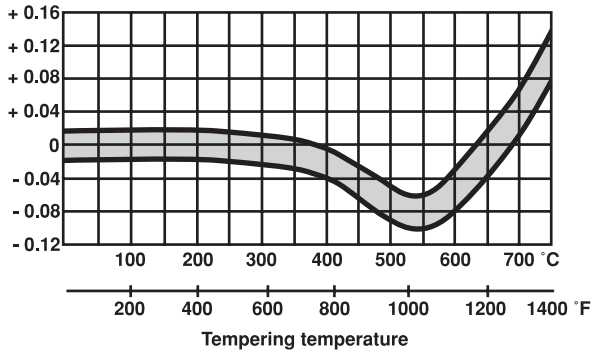
Samples were tempered twice and held at the tempering temperature a minimum of 2 hours. All samples were tested at room temperature.

Dimensional Changes

During hardening
Sample plate, 100 x 100 x 25 mm, 4” x 4” x 1”

Hardening from 1020˚C (1870˚F)		Width %	Length %	Thickness %
Oil hardened	min. max.	±0.02 -0.05	+0.02 -0.03	+0.04
Martempered	min. max.	+0.02 -0.03	+0 +0.03	-0.04
Air hardened	min. max.	-0.02 +0.02	±0 -0.03	±0
Vacuum hardened	min. max.	+0.01 -0.02	±0 +0.01	-0.04

During tempering



Note: Dimensional changes during hardening and tempering should be added together.

Machining

Turning	Turning with carbide tools		
	Rough turning	Medium turning	Finish turning
Depth of cut (t) in. mm	min. 0.4 min. 10	0.08-0.4 2-10	max. 0.08 max. 2
Feed (s) in/tooth mm/tooth	min. 0.04 min. 1	0.12-0.04 0.3-1	max. 0.012 max. 0.3
ISO machining group	P30-P40	P20-P30	P10
Cutting speed (v) f.p.m. m/min.	260-395 80-120	330-490 100-150	460-690 140-210

Milling	Rough milling	Finish milling
Depth of cut (t) in. mm	max. 0.08 max. 2	max. 0.08 max. 2
Feed (s) in./tooth mm/tooth	max. 0.008 max. 0.2	max. 0.008 max. 0.2
ISO machining group	Carbide tools P30-P40	 P10-P20
Cutting speed (v) f.p.m. m/min.	180-280 55-85	230-330 75-95
	High speed steel tools	
Cutting speed (v) f.p.m. m/min.	65-130 20-40	100-165 30-50

Grinding

Correct grinding technique will avoid grinding cracks and improve tool life. Tools that have been tempered at low temperatures are especially sensitive during grinding. Only properly dressed, soft, open-grained grinding wheels should be used. Restrict the peripheral speed and use plenty of coolant.
More detailed instructions can be obtained from the grinding wheel manufacturer.

Photo-etching

EDRO #8™ has a very homogeneous structure with a very low non-metallic inclusion content making it suitable for photo-etching. The special photo-etching process that might be necessary because of EDRO #8™ has good corrosion resistance and is familiar to all the leading photo-etching companies.

Polishing

EDRO #8™ has very good polishability in the hardened and tempered condition. Example of a typical procedure:

1. Use a grinding wheel or stone with a grain size of 180-320 for initial grinding or stoning.
2. Use abrasive paper or powder with a grain size of 400-800.
3. Polish with diamond paste grade of a grain size between 12.6 and 3mm using a polishing tool of soft wood or fiber.
4. When a very high surface finish is demanded use diamond paste of 1mm grain size with a fibre polishing pad.

Welding

Welding of tool steel should generally be avoided, due to the risk of cracking. Where repair welding is necessary, however, it is essential to pre-heat the part concerned prior to welding. Immediately after the welding operation:

1. Stress-relieve material that has been welded in the soft annealed state.
2. Temper material twice that has been welded in the hardened and tempered condition.

EDRO #8™

Edro will be pleased to provide additional information on our full line of quality mold steels, machining capabilities, and special mold bases.

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