

MATERIAL SPECIFICATION SHEET FOR COLD WORKING TOOL STEELS D2 (1.2379) & D3 (1.2080)

1.0 Scope / Characteristics / Uses :

These tool steels are characterized by high carbon and high chromium content, and exhibit high resistance to abrasion. The type containing molybdenum may be hardened in air and offer a high degree of dimension stability in heat treatment. Of these, the most popular is D-2 the deep hardening, with low distortion and high safety in hardening. They are high resistant to softening and medium resistant to decarburizing, and they can be nitrided.

Their applications are for spindles, bobs, cold rolls, slitting cutters, blanking dies, forming dies, coining dies, bushings, taps, broaches, sandblast nozzles, bricks moulds, plug and ring gauges etc.

2.0 Steel Making Process :

These steels are manufactured by melting selected Scraps & Ferro Alloys in Electric furnace, followed by Ladle Furnace Refining and then Vacuum Degassing, finally bottom poured into Ingot moulds.

The ingots are subsequently press-forged into rounds or rectangular blocks using flat or 'V' or swage dies under high pressure hydraulic presses. These bars or blocks are annealed or heat treated and ground or machined before final supply.

3.0 Equivalent Grades in some well known international standards :

Popular Designations	D 2	D 3
UNS	T 30402	T 30403
GERMAN (DIN)	W. No. 1.2379 X 155 Cr Mo V12	W. No. 1.2080 X 210 Cr12
US (ASTM)	A 681 Type D2	A 681 Type D3
INDIAN (IS)	XT 160Cr12	XT T215Cr12

4.0 Chemical Composition (As per ASTM) :

Grade	C	Mn	P	S	Si	Cr	V	Mo
D 2	1.4 / 1.6	0.2 / 0.6	0.30 max	0.30 max	0.10/ 0.60	11.00 13.00	0.50/ 1.10	0.70/ 1.20
D 3	2.00 / 2.35	0.20 / 0.60	0.30 max	0.30 max	0.10/ 0.60	11.00 13.50	—	—

5.0 Supply / Surface Condition :

Fully annealed/ Spot or Fully Ground, or Proof Machined.

- 6.0 Heat treatment :**
Full annealing at temp 890 to 910°C, (or air hardening & tempering)
- 7.0 Hardness in annealed condition :** **255 BHN Max.**
(Hardness variation from surface to core : 15 BHN Max.)
- 8.0 Decarburisation :**
Depth of Decarburisation from surface : 0.5 mm maximum.
- 9.0 Inclusion Rating :**
Guaranteed Values : A, B, C, D 1.5 Thin / 1.5 Heavy as per ASTM E45.
Typical values achieved : A, B, C, D 1.0 Thin / 0.5 Heavy.
- 10.0 Grain Size**
6 or finer as per ASTM 112
- 11.0 Tensile Strength in Annealed condition :**
Not relevant, as not required for end use.
- 12.0 Macrostructure :**
Seen in annealed condition - As per ASTM - A561 or (ASTM - A - 381) will show freedom from unacceptable excessive porosity, segregation, slag / dirt or other non - metallic inclusions, pipes, flakes, cracks or other injurious defects.
- 13.0 Microstructure :**
(At application stage) After austenitized at 1010°C, air cooled & double tempered at 540°C, carbide particles in a matrix of tempered martensite are obtained.
- 14.0 Ultrasonic soundness :**
Testing as per ASTM A388;
Satisfactory as per acceptance standard 4 mm FBH
Equivalent German Standard of above : C/c of SEP 1921
- 15.0 Size Tolerance :**
Rounds : on dia :- -0, +2 mm (For rough turned / proof machined)
Squares & Rectangles : on width & thickness : -0, + 10 mm (As Forged)
- 16.0 Length :**
Rounds : 2.5 to 5.5 meters , with max 20% short length upto 1 meter
Squares & Rectangles : 2.0 to 4.0 meters with max 20% short length upto 1 meter.