

Drill Rod

Chemistry and Specifications

Uniform machining properties and consistent response to heat treatment are obtained through careful control of chemical analysis. Identification of each production lot is carefully maintained, and certified chemical analysis can be supplied upon request.

The very high polish on Precision-Marshall drill rod allows it to be utilized without the need for further expensive grinding or polishing. Because our ground and polished drill rod is **guaranteed** to be 100% **free of decarburization, seams, laps, pits and other surface imperfec-**

tions, heat treatment can be confidently undertaken without further metal removal.

Our modern annealing furnace and instrumentation produces finely-controlled microstructures that are consistent lot-to-lot. Precision-Marshall drill rod has guaranteed 90% minimum spheroidization. This, coupled with closely controlled processes, assures uniform machining and response to heat treatment.

Dimensional accuracy is very closely controlled within narrow limits.

Precision-Marshall drill rod is guaranteed to the limits shown below. Machines can be set up for working to a certain tolerance with confidence that there will be no variation.

All ends of our ground and polished drill rod in 3/8- through 3-inch diameters are saw-cut and chamfered or deburred. This protects other lengths from scratching, facilitates set-ups and ensures safety in handling. Smaller diameters are accurately and precisely cut on automatic die-cutters.

MASTERCAT Annealed High-speed Drill Rod AISI/SAE M-2

MASTERCAT is a tungsten-molybdenum high-speed steel. It has a wider heat treat range than most of the high-speed steels, and has a resistance to decarburization. It offers an excellent combination of good red hardness, toughness and wear resistance.

HEAT TREATMENT Warm slightly before charging into furnace, which should be operating at 1350-1500°F. After thorough preheating, transfer to hardening furnace at 2175-2225°F, depending on the tool size and degree of hardening required for application.

Cool in air, oil or a molten salt bath operating at 1000-1100°F. In case of oil quenching, it is usually good practice to interrupt the quench by removing the tool after it has reached about 1000°F, and allow the cooling to continue in still air. Tools should be allowed to cool to 150°F or when they can be held by the bare hand, then **TEMPERED IMMEDIATELY**. The tempering temperature may be varied according to the desired hardness, but it is usually in the range of 1000-1100°F. Double tempering is **ALWAYS RECOMMENDED**.

TEMPERING DATA

Temper°F	Rockwell C Hardness	
	Oil-quenched	Air-quenched
300	65	65
400	64	63
500	63	62.5
600	62.5	62.5
700	63	62.5
800	63.5	63.5
850	63.5	63.5
900	65	64
950	66	65
1000	66	65.5
1050	66	63.5
1100	64.5	61.5
1150	62	60
1200	53.5	53
1300	43	39.5
1400	33.5	34

Chemical Compositions (%) and Specifications

Grade	A.I.S.I. S.A.E. Type	Carbon	Manganese	Silicon	Phosphorus (max)	Sulphur (max)	Chromium	Vanadium	Tungsten	Molybdenum
WATERCRAT	W-1	.95/1.05	.30/.40	.10/.25	.025	.025	.15 Max	.10 Max	.15 Max	.10 Max
OILCRAT	O-1	.85/1.00	1.00/1.40	.50 Max	.030	.030	.40/.60	.30 Max	.40/.60	—
AIR-TRUE	A-2	.95/1.05	1.00 Max	.50 Max	.030	.030	4.75/5.50	.15/.50	—	.90/1.40
SUPER-7	S-7	.45/.55	.20/.80	.20/1.00	.030	.030	3.00/3.50	.20/.30	—	1.30/1.80
ARISTOCRAT	D-2	1.40/1.60	.60 Max	.60 Max	.030	.030	11.00/13.00	1.10 Max	—	.70/1.20
TRM-2	M-2	.85 Max	.30 Max	.30 Max	—	—	4.00 Max	2.00 Max	6.00 Max	5.00 Max
FIRECHROME44	H-13	.40	—	1.00	—	.100	5.25	1.00	—	1.35

Grade	A.I.S.I. S.A.E. Type	UNS* Designation	S.A.E.	A.S.T.M.	Federal
WATERCRAT	W-1	T72301	J-437	A-686-79	QQT-580 Rev. C.
OILCRAT AIR-	O-1	T31501	J-437	A-681-76	QQT-570 Rev. C.
TRUE	A-2	T30102	J-437	A-681-76	QQT-570 Rev. C.
SUPER-7	S-7	T41907	J-437	A-681-76	QQT-570 Rev. C.
ARISTOCRAT	D-2	T30402	J-437	A-681-76	QQT-570 Rev. C.
TRM-2	M-2	T11302	J-438-b	A-600-79	QQT-570 Rev. C.
FIRECHROME44	H-13	--	--	--	--

*New designation in accordance with ASTM E 527 and SAE J1086. Recommended for numbering metals and alloys (UNS).

Dimensional Tolerances

Diameter	Round Drill Rod		
	Standard Tolerance* (section)	Straightness (max T.I.R. in 12")	Standard Tolerance (length)
3.000" to 0.500"	±.0010"	.005"	+1/8",-.0
0.499" to 0.125"	±.0005"	.005"	+1/8",-.0
0.124" and smaller	±.0003"	.005"	+1/8",-.0

*Closer tolerances than standard can be produced upon inquiry.

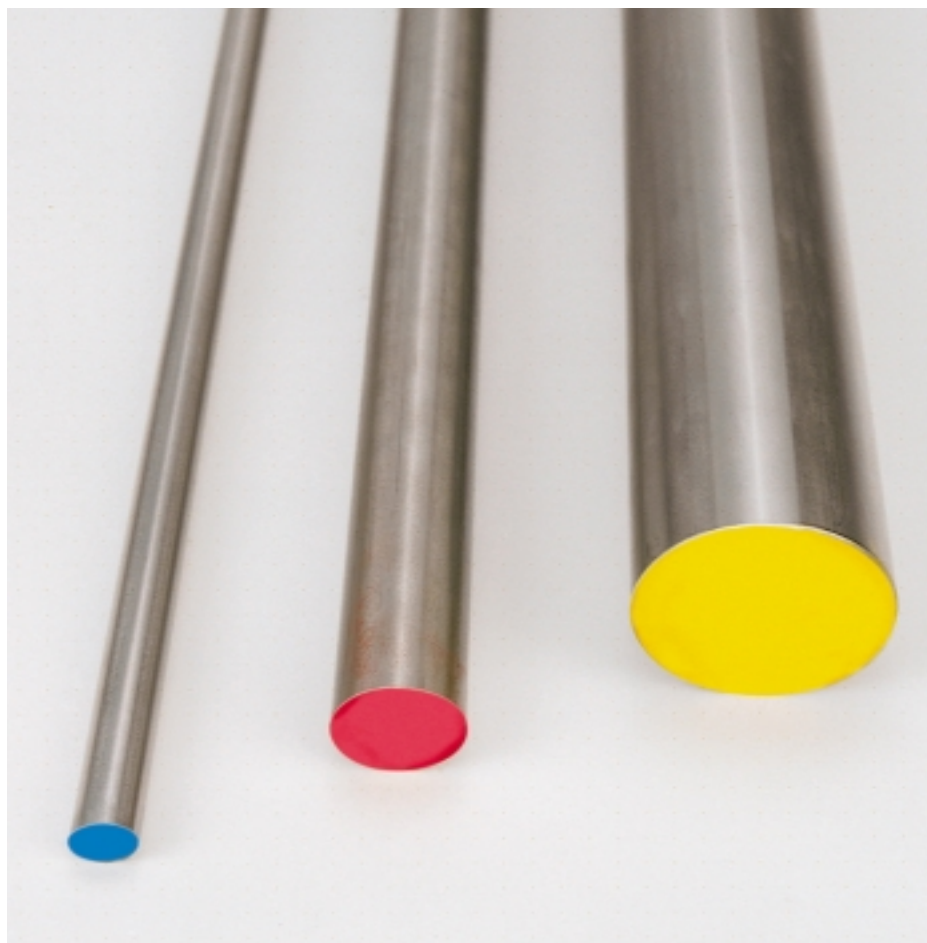
Size	Flat and Square Drill Rod	
	Standard Tolerance* (section)	Standard Tolerance (length)
1.000" through 0.750" (largest dim.)	±.0015"	+1/8",-.0"
0.749" through 0.250" (largest dim.)	±.001"	+1/8",-.0"
0.249" and smaller	±.0005"	+1/8",-.0"

Physical Properties

Size	Hardness (max)		Machinability
	Brinell	Rockwell	
to .125" dia.	341	R _b 110	WATERCRAT = 100
.125" to .250"	275	R _b 104	OILCRAT = 95
.250" to .876"	241	R _b 101	AIR-TRUE = 65
.876" and larger	207	R _b 96	SUPER-7 = 95
			ARISTOCRAT = 50
			TRM-2 = 65
			FIRECHROME44

Surface Finish and Quality

Size	Surface Finish (max)	Surface Quality (max allowable depth of defect)
3.000" to .875" diameter	30 RMS	.000"
.875" to .500" diameter	20 RMS	.000"
.500" to .125" diameter	15 RMS	.000"
.125" and smaller	10 RMS	.000"
Cold drawn squares and flats	50 RMS	.008"/side



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