

# 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.

## AIR-TRUE Air-hardening Ground and Polished Drill Rod AISI/SAE A-2

**AIR-TRUE** drill rod is made from fine grain, electric furnace air-hardening 5% chrome tool steel. It is a superior quality steel which has excellent wear and abrasion resistant properties. AIR-TRUE is furnished with a fully-spheroidized structure and is 100% free of decarb and other surface imperfections.

**HEAT TREATMENT** Preheat thoroughly at 1450°F, then raise to hardening temperature of 1725-1800°F and soak uniformly. For larger sections, use high side; for thin or smaller sections, use low side. Quench in still air or dry air blast at 125-175°F, then **TEMPER IMMEDIATELY.**

| TEMPERING DATA |                     |
|----------------|---------------------|
| Temper°F       | Rockwell C Hardness |
| As Hardened    | 62-65               |
| 300            | 61-64               |
| 400            | 59-62               |
| 500            | 58-61               |
| 600            | 57-60               |
| 800            | 56-59               |
| 900            | 55-58               |
| 1000           | 56-59               |

## Chemical Compositions (%)

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

## Specifications

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

| 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"                  |

\*Closer tolerances than standard can be produced upon inquiry.

## Physical Properties

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

## 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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