

## Steel making

Stainless Steel Drill Collars require specific non-magnetic properties, physical properties, resistance to stress corrosion, pitting and galling. These requirements are taken into consideration when we select the chemical composition and heat treatment process of our steels.

The resultant stainless steel drilling tools form tough and reliable components of the drill string.

## Forging

The correct forging is a key aspect in the manufacturing process of high quality stainless steel drilling tools. There is a requirement for tight control on time/temperature cycles and a need for adequate forging capacity to warm work these steels. This requirement is accomplished with purpose built hammer forging systems where the bars are turned and advanced by computer controlled manipulators.

## General product specifications

Our non-magnetic steels meet the requirements of API Spec.7-1 and NS-1.

Dimensional tolerances follow API specification 7-1 and 7-2. The bore eccentricity follows NS-1 specifications. The mechanical properties are measured according to the requirements of ASTM A 370. The relative magnetic permeability is guaranteed to be less than 1.010.

Field gradient measurements are taken on each bored non-magnetic bar and guaranteed to deviate no more than  $\pm 0.05$  microtesla from a uniform magnetic field. Resistance to intergranular stress corrosion is measured by the ASTM A 262 practice E test. Subjecting the exposed surfaces to compressive treatments reduces transgranular stress corrosion tendencies. Material integrity is controlled by ultra-sonic inspection per API Spec.7-1 and NS-1.

## Stainless steel grade AMAGNIT 501

Design for most drill string components such as drill collars, MWD and LWD housings, compressive service drill pipe (flex collars) subs, stabilisers, etc. this material meets the stringent requirements of today's drilling and directional drilling industry.

Typical chemical composition in %

| C        | Mn      | Cr    | Mo    | Ni    | N <sub>2</sub> |
|----------|---------|-------|-------|-------|----------------|
| 0.05 max | 18.5-22 | 13-15 | 1 max | 2 max | 0.25-0.50      |

Mechanical properties (room temperature, ASTM A 370)

| OD range       | Minimum yield strength | Minimum tensile strength | Minimum elongation | Minimum reduction of area |
|----------------|------------------------|--------------------------|--------------------|---------------------------|
| 3 1/2 to 6 7/8 | 120 000 Psi            | 135 000 Psi              | 25 %               | 50 %                      |
| 7 to 11        | 112 000 Psi            | 130 000 Psi              | 25 %               | 50 %                      |
| Over 11"       | 100 000 Psi            | 120 000 Psi              | 25 %               | 50 %                      |

Surface hardness: 277-350 HB

## Stainless steel grade AMAGNIT 601

Design specifically for the increased requirements of MWD Directional Tools and LWD formation evaluation tools.

Typical chemical composition in %

| C        | Mn    | Cr        | Mo    | Ni    | N <sub>2</sub> |
|----------|-------|-----------|-------|-------|----------------|
| 0.05 max | 18-22 | 16.5-19.5 | 1 max | 2 max | 0.45-0.80      |

Mechanical properties (room temperature, ASTM A 370)

| OD range    | Minimum yield strength | Minimum tensile strength | Minimum elongation | Minimum reduction of area |
|-------------|------------------------|--------------------------|--------------------|---------------------------|
| Up to 9 1/4 | 140 000 Psi            | 150 000 Psi              | 20 %               | 50 %                      |
| Above 9 1/4 | 130 000 Psi            | 150 000 Psi              | 20 %               | 50 %                      |

Surface hardness: minimum 300 HB