

AISI 4140

Grade: AISI 4140 (UNS G41400, ASTM A29)

Type: Cr-Mo Steel usually supplied in the hardened, quenched and tempered condition.

Nominal Composition	
Element	Weight %
Carbon	0.38 – 0.43
Silicon	0.15 – 0.35
Manganese	0.75 – 1.00
Phosphorus	0.025 max *
Sulphur	0.025 max *
Molybdenum	0.15 – 0.25
Chromium	0.8 – 1.1
Nickel	0.5 max

Notes

Various other hybrid analysis available in order to enhance hardenability and mechanical properties.

* S and P values conform with API 6A, PSL 3 requirements. Higher values may be permitted if delivered to alternative specifications

Mechanical Properties Condition:

Hardened followed by oil, polymer or water quenching and tempering

Typical tempering range is 620 – 680° C, depending on properties required

Property	Values
Ultimate Tensile Strength	100 min Ksi (689 Mpa)
0.2 % Yield Strength	80 min Ksi (551 Mpa)
Elongation	17 % min
Reduction of Area	35 % min
Hardness	197 – 237 BHN

Notes:

Low alloy steel similar to 4130 with improved strength and through hardenability due to increased Carbon value typically containing 0.4% Carbon and alloyed with 1% Chromium and 0.2% Molybdenum to give enhanced mechanical properties, several hybrid analysis are available based on the AISI chemistry to further improve and enhance through hardenability and mechanical properties with diameters above 6" benefiting from increased Molybdenum value up to 0.35% which improves the through hardenability of the grade considerably.

The grade has poor through hardenability with a typical ruling section of around 8 inches (at 75 Ksi) depending on the chemical composition, and it is critical that the hardenability of the grade must be taken into account when designing and selecting it for specific equipment.

Impact toughness is generally good to temperatures as low as -46 Deg C with typically 27J average and 20J single achieved, this is limited though dependent on a number of factors such as ruling section, chemical composition and heat treatment condition, with impact toughness achieved decreasing with higher strength, increased ruling section and at lower test temperatures due to the materials Ductile / Brittle transition temperature.

Minimum hardness is based on API 6A requirements. Maximum hardness shown is based on compliance with NACE MR0175 / ISO 15156. Higher hardness may be specified for non sour service.

Grade can be used at higher strength designations such as 105 Ksi min yield but is not NACE MR0175 approved at these strength levels.

It is used for applications such as valve gates, stems and casing and tubing hangers and in tubular form for downhole tools.

The grade has poor weldability due to the higher carbon level. It may be welded, however care is required to avoid cracking and to ensure low hardness in the weld region. If the grade is welded it does require a post weld heat treatment at 620° C min, in order to meet sour service (NACE MR017/ ISO 15156) requirements. However due to its poor weldability it is frequently used in applications where welding is not required.