AISI 4130 Sucker Rod Chemical Composition and Alloy Function

API 11B Rod Pumping Reference | Cr-Mo Chemistry, Heat Treatment Response, Fatigue-Relevant Alloy Control

Technical purpose

This reference explains how AISI 4130 chemistry supports sucker rod service. It separates material designation from API 11B finished rod grade and connects composition data with heat treatment, thread fatigue and traceability.

AISI 4130 chemical composition

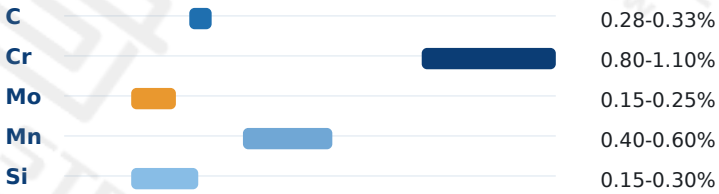
Element	Range	Function
Carbon, C	0.28-0.33%	Strength and hardness response after heat treatment.
Chromium, Cr	0.80-1.10%	Hardenability and through-section strength consistency.
Molybdenum, Mo	0.15-0.25%	Hardenability, temper resistance and strength stability.
Manganese, Mn	0.40-0.60%	Strength contribution and steelmaking control.
Silicon, Si	0.15-0.30%	Deoxidation and strength contribution.
Phosphorus, P	<=0.035%	Residual controlled to protect toughness and fatigue behavior.
Sulfur, S	<=0.040%	Residual controlled to reduce loss of ductility.
Iron, Fe	Balance	Base matrix for the Cr-Mo alloy system.

Composition meaning

AISI 4130 is a chromium-molybdenum low alloy steel. In sucker rods, the useful value is not the name alone; it is the controlled chemistry plus heat treatment response and finished rod grade verification.

Main alloy range

Mass percent window for selected alloying elements



Range bars show composition control only; final rod strength must be verified by API 11B grade records.

Data note: composition values are commonly published AISI 4130 datasheet ranges. Project specification and mill test certificate govern final acceptance.

Alloy Function in a Sucker Rod Load Path

A sucker rod works under repeated tensile loading. For AISI 4130, the chemistry matters because it provides a controllable heat-treatment response and a balanced strength-toughness route for rod body and threaded-end service.

Control Point	Why It Matters for 4130 Sucker Rod
Cr-Mo alloy system	Chromium and molybdenum improve hardenability so the rod can develop more consistent mechanical properties after heat treatment.
Heat treatment response	Final strength is created by material chemistry plus controlled heat treatment; chemistry alone is not the finished rod property.
Cyclic tensile load	Rod pumping creates repeated load cycles. Fatigue performance depends on strength, surface condition, thread quality and coupling fit.
Threaded end and coupling	Fatigue often starts near thread roots, pin shoulder contact, surface marks or poor coupling engagement.
Residual element control	Low phosphorus and sulfur help protect ductility and toughness in fatigue-sensitive rod service.

Material designation vs. API 11B strength grade

AISI 4130 identifies the alloy steel family. API 11B grade identifies the finished sucker rod strength category. These two items should be reviewed together, not treated as the same item.

API 11B Grade	Common Tensile Strength Range	Technical Meaning
Grade C	90,000-115,000 psi	Standard strength range for moderate rod-string load conditions.
Grade K	90,000-115,000 psi	Similar strength range, commonly reviewed where corrosion-related service is a concern.
Grade D	115,000-140,000 psi	Higher strength category for heavier rod-string load conditions; material type must still be verified.

Key interpretation

AISI 4130 is a material designation, not an API 11B grade. A complete sucker rod review links material chemistry, heat treatment, tensile strength, hardness consistency, thread inspection, coupling compatibility and traceability records.

Inspection and Documentation Meaning

Chemical composition becomes useful only when it can be traced to finished rod identity. For 4130 sucker rods, the key technical control is the link between heat chemistry, heat treatment, mechanical result, thread condition and marking records.

Record / Check Item	What It Verifies	Why It Matters
Heat chemistry	C, Cr, Mo, Mn, Si and residual elements	Confirms that the material matches AISI 4130 chemistry.
Heat treatment record	Process route and condition	Connects chemistry to final strength and hardness behavior.
Tensile / yield test	Finished rod strength level	Verifies that the rod meets the specified API 11B grade range.
Hardness review	Local hardness consistency where required	Supports control of heat treatment and rod-end performance.
Thread inspection	Thread profile, pin shoulder and coupling fit	Protects the fatigue-sensitive connection area.
Marking and MTC	Heat number, grade, size, material and inspection data	Links physical rods with documentation and bundle identity.

Practical alloy-function summary

- Carbon provides the base strength response, but toughness must be protected by controlled chemistry and heat treatment.
- Chromium improves hardenability, helping the rod section respond more consistently to heat treatment.
- Molybdenum improves hardenability and strength stability, especially after tempering.
- Manganese and silicon support steelmaking control and strength contribution.
- Phosphorus and sulfur are residuals; lower levels are preferred for fatigue-sensitive sucker rod service.
- API 11B grade, not the AISI 4130 name alone, defines the final strength range of the finished rod.

Reference and use note

Reference basis: AISI 4130 public material datasheets for composition ranges; API 11B sucker rod grade references and public sucker rod specification data for grade-strength and product-scope interpretation. Always follow the applicable project specification, mill test certificate and final inspection documents.

This page is intended as a technical reference for website article support and PDF resource placement. It is not a substitute for the governing API 11B standard, project specification or mill-issued test certificate.