AISI 4130 Sucker Rod

Engineering Data and Load Selection Reference

API Grade DA properties, nominal rod sizes, axial-stress calculations, tapered-string example and manufacturing acceptance controls.

Straight rod bodies, forged ends and machined pins - product photograph supplied by Octal Sucker Rod

AISI 4130 CHEMISTRY - HEAT ANALYSIS BASIS

C	0.28-0.33%	mass fraction
Cr	0.80-1.10%	mass fraction
Mo	0.15-0.25%	mass fraction

Chemistry identifies the alloy. Finished Grade DA release still requires tensile, ductility, dimensional, connection and inspection evidence.

MATERIAL

AISI 4130 / UNS G41300

Chromium-molybdenum low-alloy steel

FINISHED PRODUCT LEVEL

API Grade DA

85 ksi minimum yield; 115-140 ksi tensile

NOMINAL SUPPLY RANGE

5/8-1 1/8 in.

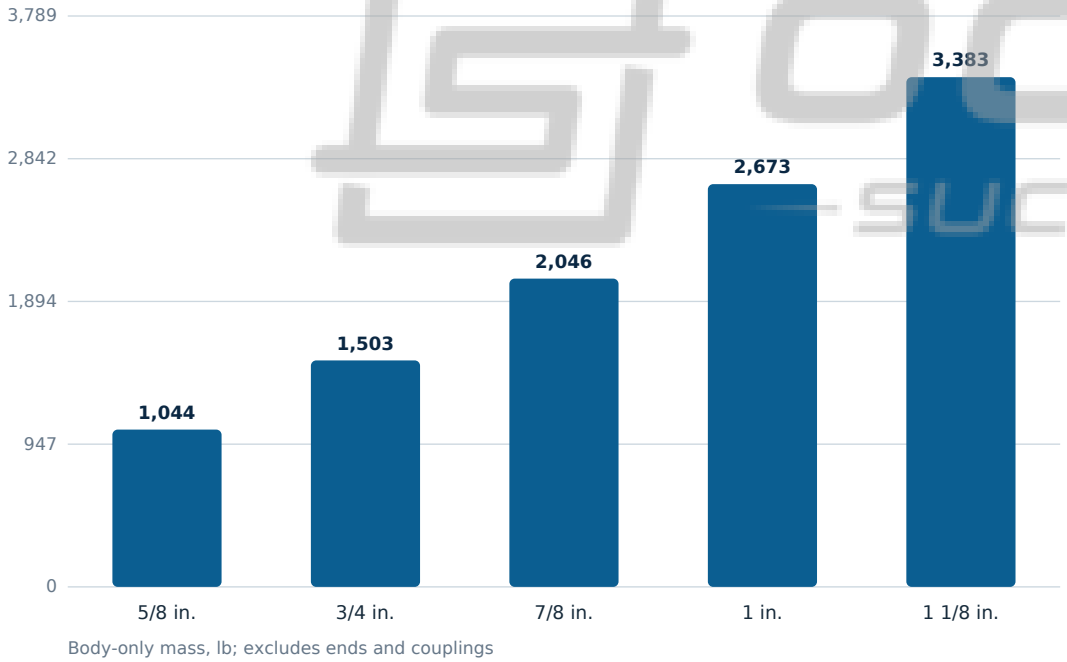
Common full lengths: 25 ft and 30 ft

Rod Sizes and Section Properties

Values use the nominal round body diameter and a steel density of 7.85 g/cm3. Calculated mass excludes forged upsets, pins, couplings, coatings and manufacturing tolerances.

Nominal diameter	Metric	Body area	kg/m	lb/ft	25 ft body	30 ft body	1,000 ft body
5/8 in.	15.875 mm	0.3068 in2	1.554	1.044	26.1 lb	31.3 lb	1,044 lb
3/4 in.	19.050 mm	0.4418 in2	2.237	1.503	37.6 lb	45.1 lb	1,503 lb
7/8 in.	22.225 mm	0.6013 in2	3.045	2.046	51.1 lb	61.4 lb	2,046 lb
1 in.	25.400 mm	0.7854 in2	3.978	2.673	66.8 lb	80.2 lb	2,673 lb
1 1/8 in.	28.575 mm	0.9940 in2	5.034	3.383	84.6 lb	101.5 lb	3,383 lb

THEORETICAL BODY MASS PER 1,000 FT



Body-only mass, lb; excludes ends and couplings

NOMINAL BODY DIAMETER COMPARISON

5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
15.88 mm	19.05 mm	22.23 mm	25.40 mm	28.57 mm

Selection effect

A larger diameter increases metal area and rod-string mass while reducing nominal body stress under the same axial load.

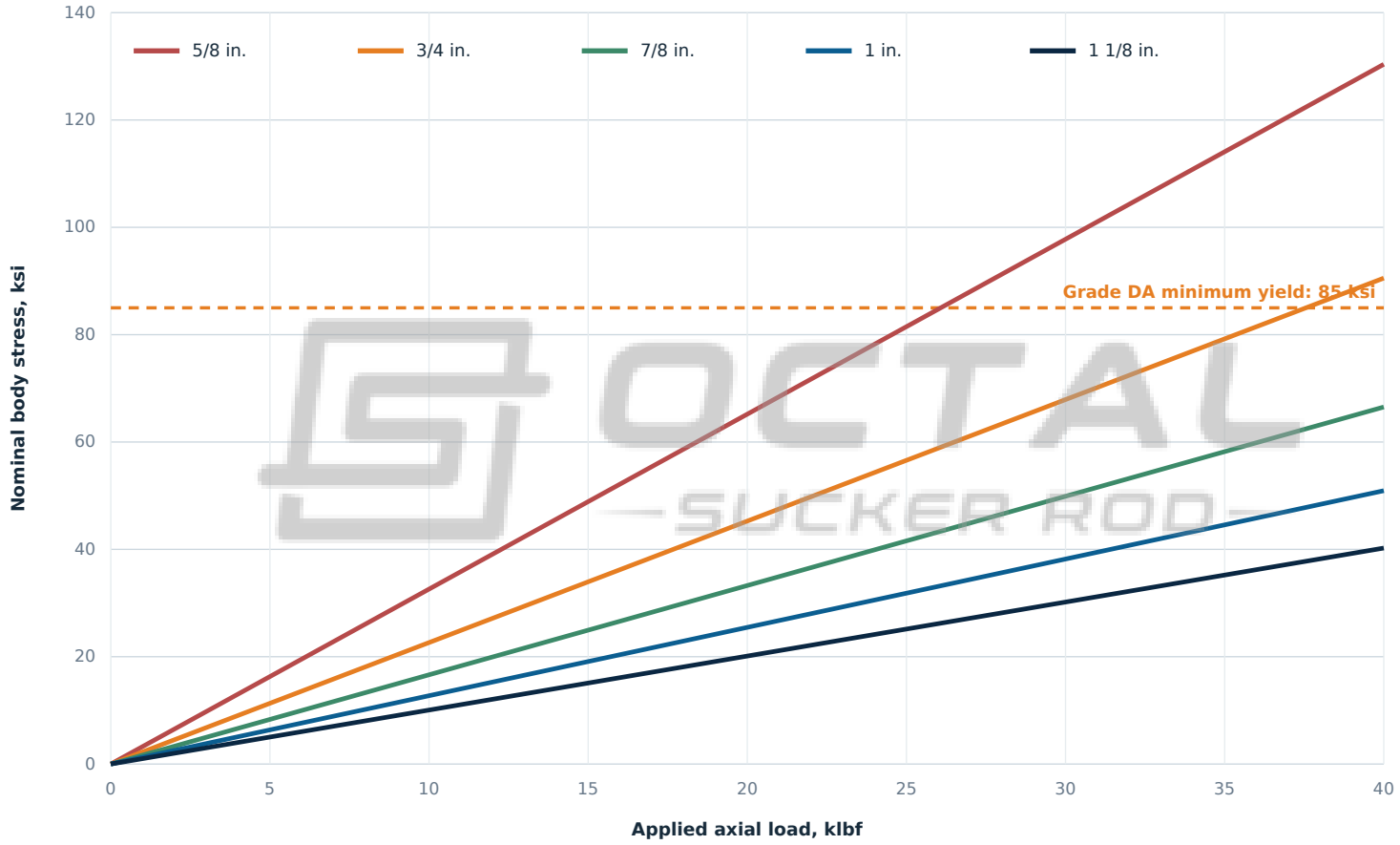
Axial Load and Nominal Body Stress

sigma = P / A

P = applied axial load
A = nominal round-body area

If P is in klbf and A is in in2, sigma is in ksi.
The result describes uniform body stress only.

LOAD-STRESS CURVES BY NOMINAL BODY DIAMETER



READING THE CURVES

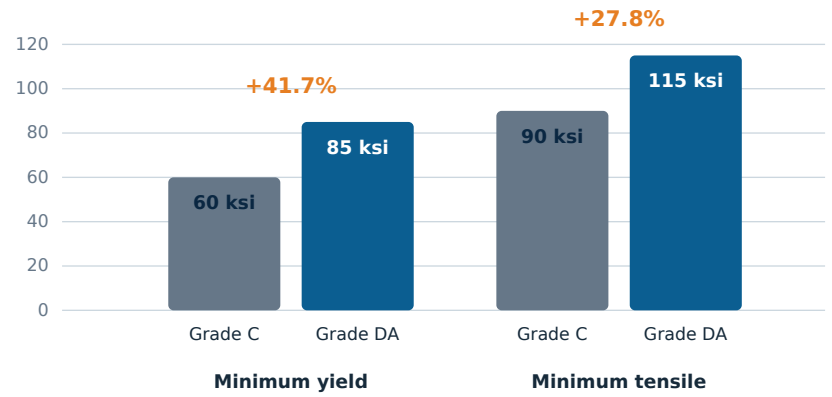
1. At the same load, a smaller body diameter carries higher nominal stress.
2. The 85 ksi line is a finished-product yield minimum, not an allowable stress.
3. Connections, upsets, bending, wear, corrosion and fatigue can govern first.
4. Use maximum and minimum cycle loads for every taper section.

Calculated reference only. Do not publish these curves as rated capacity or safe working load.

Grade DA Strength and Nominal Body Thresholds

AISI 4130 can support the higher API Grade DA minimum level after qualified processing. The comparison below describes finished-product acceptance thresholds, not service capacity.

GRADE C VS GRADE DA - MINIMUM STRENGTH



WHERE 4130 HAS A PRACTICAL ADVANTAGE

A Grade DA 4130 sucker rod occupies the middle position between standard-strength carbon-steel rods and higher-cost special-alloy routes.

LOAD-DRIVEN UPGRADE

Useful when calculated cyclic demand has moved beyond the comfortable Grade C range.

NOT A UNIVERSAL SOLUTION

Higher strength cannot replace fatigue, corrosion, contact-wear or connection checks.

Strength increase is a selection input - not permission to increase load without a rod-string analysis

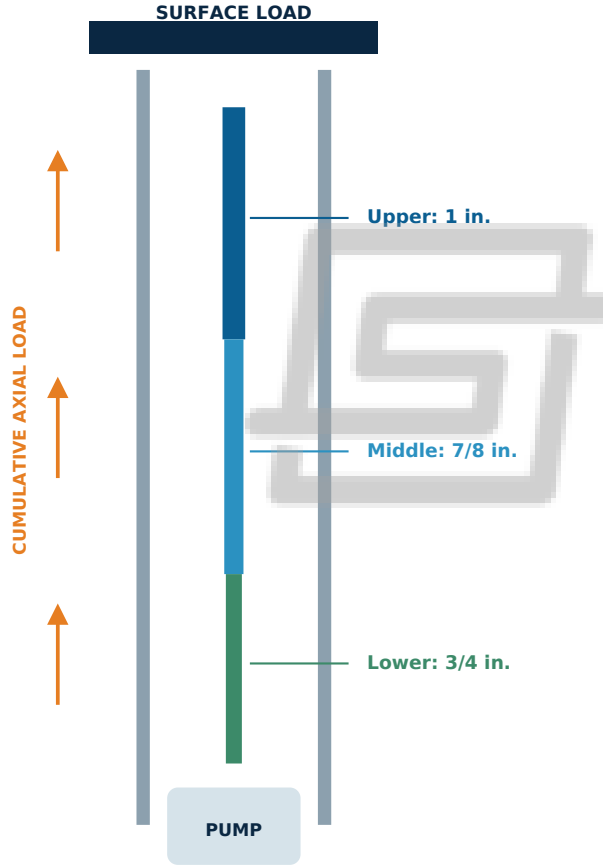
Nominal diameter	At 85 ksi body stress	At 115 ksi body stress	Interpretation
5/8 in.	26.1 klbf	35.3 klbf	Nominal body calculation only
3/4 in.	37.6 klbf	50.8 klbf	Nominal body calculation only
7/8 in.	51.1 klbf	69.1 klbf	Nominal body calculation only
1 in.	66.8 klbf	90.3 klbf	Nominal body calculation only
1 1/8 in.	84.5 klbf	114.3 klbf	Nominal body calculation only

LIMITATION The table converts uniform body stress into force. It excludes pin stress area, upset geometry, tolerances, cyclic fatigue, bending, wear, corrosion and service factors; it is not a safe-working-load table.

Worked Taper Example

This example maps assumed maximum and minimum axial loads into nominal body stresses. It demonstrates the calculation sequence only and is not a field design for a stated well.

ILLUSTRATIVE THREE-SECTION TAPER



Section	Body	Pmax	Pmin	sigma max	sigma min	Mean	Amplitude
Upper	1 in.	30 klbf	12 klbf	38.2 ksi	15.3 ksi	26.7 ksi	11.5 ksi
Middle	7/8 in.	20 klbf	8 klbf	33.3 ksi	13.3 ksi	23.3 ksi	10.0 ksi
Lower	3/4 in.	10 klbf	4 klbf	22.6 ksi	9.1 ksi	15.8 ksi	6.8 ksi

CALCULATION SEQUENCE

1. Resolve Pmax and Pmin for each taper section.
2. Calculate sigma max and sigma min from P/A.
3. Calculate mean stress and alternating amplitude.
4. Check fatigue method, connection, wear, deviation and environment.

EXAMPLE BOUNDARY

- Loads are assumed inputs; they are not derived from a specific pump or well.
- Nominal round-body area is used; pins and upset transitions are not checked.
- Buoyancy, acceleration, tubing contact, corrosion and service factors are excluded.
- A complete design requires the approved fatigue criterion and connection limits.

OCTAL SUCKER ROD

Heat Treatment and Finished-Product Release

Process temperatures are development references for 4130 steel. Finished-product release depends on qualified procedures, furnace and lot traceability, tensile results, geometry, connection gauging and inspection evidence.

Hot forging

954-1,204 C

1,750-2,200 F

Normalizing*

871-927 C

1,600-1,700 F

Austenitizing*

871-899 C

1,600-1,650 F

Tempering*

399-566 C

750-1,050 F

*Where used in the qualified manufacturing route; actual set points, holding time, quench and transfer controls are manufacturer-specific.

Release item	Grade DA basis	Verification evidence
Material family	UNS G41XX0; AISI 4130 is UNS G41300	Heat-linked chemical analysis
Minimum yield strength	85 ksi / 586 MPa	Finished-condition tensile test
Tensile-strength range	115-140 ksi / 793-965 MPa	Finished-condition tensile test
Minimum elongation	10%	Specified tensile specimen result
Minimum reduction of area	40%	Specified tensile specimen result
Identification color	Yellow	Final marking and visual inspection

STOCTAL SUCKER ROD

TRACEABILITY CHAIN

HEAT / MTC → FORGING LOT → FURNACE LOT → TENSILE TEST → GAUGE / NDT → MARKING / PACKING

JOINTED SUCKER-ROD END - 3D ENGINEERING MODEL