OCTAL STEEL / TECHNICAL REFERENCE

Grade K Sucker Rod

Engineering Data & Selection Guide

Mechanical properties, chemical composition, dimensions, pulling references, corrosion-fatigue criteria and acceptance checks.

API 11B GRADE COLOR: BLUE

414 MPa	621-793 MPa	13%	25 / 30 ft
minimum yield	tensile range	minimum elongation	nominal lengths

Core engineering position

Grade K is not mechanically halfway between Grade C and Grade D. Its API strength envelope is the same as Grade C; the practical difference is a Ni-Mo alloy route used for improved resistance in corrosive production environments. Load, chemistry, inhibition and rod-string stress must still be checked together.

Data classes used: API baseline | Published manufacturer data | Factory technical target | Engineering interpretation

Revision: 2026-09 | Verify purchase-order edition, material certificate and project-specific service conditions before release.

Grade Selection: C vs K vs D

Select rod grade from the combined load and environment envelope. Grade K is a corrosion-oriented medium-strength choice; Grade D carries a higher strength envelope but is not automatically the best answer for uninhibited corrosive service.

Decision factor	Grade C	Grade K	Grade D / DA example
Minimum yield strength	414 MPa (60 ksi)	414 MPa (60 ksi)	586 MPa (85 ksi) factory D; 655 MPa (95 ksi) in one published DA product
Tensile strength	621-793 MPa (90-115 ksi)	621-793 MPa (90-115 ksi)	793-965 MPa (115-140 ksi)
Minimum elongation	13%	13%	13% factory D; published DA products may specify 10%
Metallurgical emphasis	Carbon / Mn steel; economical baseline	Ni-Mo alloy; corrosion-oriented metallurgy	Higher-strength alloy steel; composition varies by D subtype
Best fit	Low-to-moderate load with effective corrosion inhibition	Shallow-to-moderate depth where corrosion is a controlling risk	Moderate-to-deep / higher-load wells with controlled corrosion
Primary limitation	Lower corrosion margin if inhibition is weak	Same API strength envelope as C; not a high-load upgrade	Higher strength does not replace corrosion control or fatigue design

Engineering interpretation

1 CHECK LOAD

Calculate polished-rod load, taper loading, stress range and peak dynamic load. Do not select from well depth alone.

2 CHECK FLUID

Use produced-water chemistry, H2S and CO2 partial pressure, chloride, pH, temperature and inhibition history.

3 CHECK DAMAGE MODE

Separate axial fatigue, corrosion fatigue, rod-on-tubing wear, connection damage and overload evidence.

Selection rule

Choose Grade K when corrosion resistance is the differentiator and the Grade C/K strength envelope is adequate. Choose Grade D only when calculated rod-string stresses require its higher strength - then apply a separate corrosion-control plan.

Sources: API Spec 11B Grade K baseline; ChampionX/Norris application matrix; Tenaris SRAPI R01; cooperative factory data for Grade D target values.

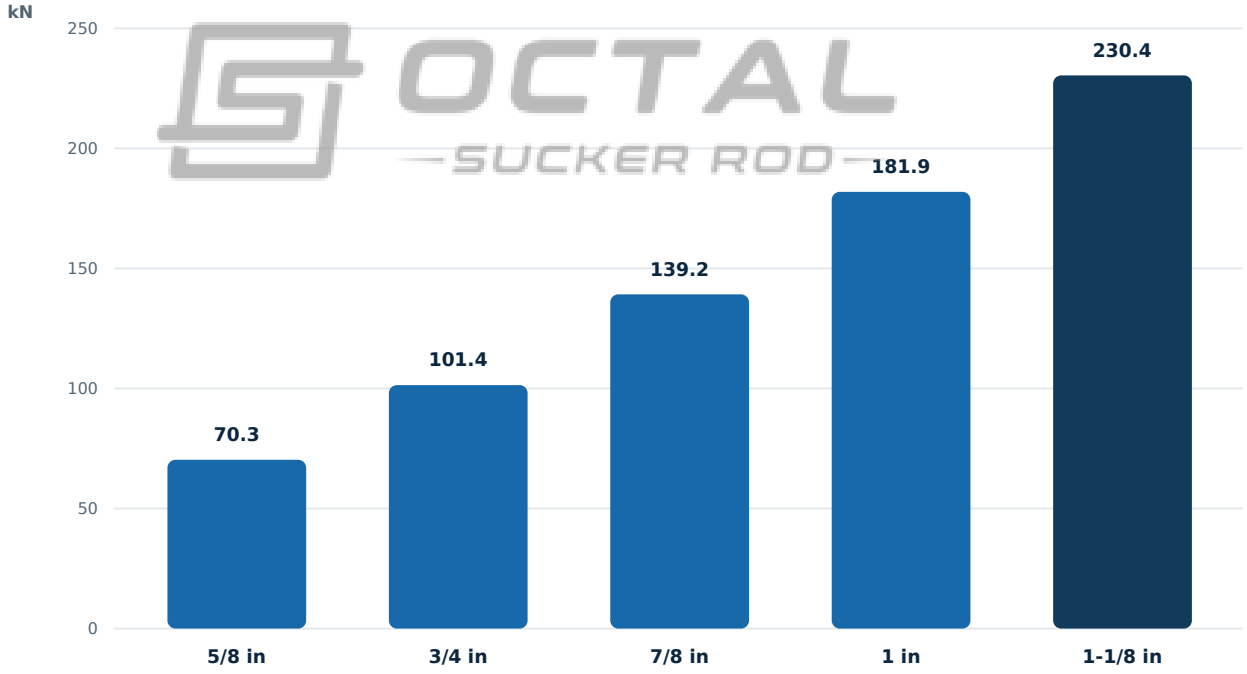
Mechanical Properties & Pulling Reference

Declared mechanical values

Grade	Yield min.	Tensile range	Elongation min.	Reduction of area	Fatigue reference
C	414 MPa 60 ksi	621-793 MPa 90-115 ksi	13%	>=50% factory target	Not declared
K	414 MPa 60 ksi	621-793 MPa 90-115 ksi	13%	>=50% factory target	>=1.0 x 10^6 cycles factory target
D	586 MPa 85 ksi	793-965 MPa 115-140 ksi	13%	>=50% factory target	Not declared

Qualification note: yield/tensile/elongation values follow the stated grade envelopes. The >=50% reduction-of-area and >=1.0 x 10^6 cycle values are cooperative-factory technical targets and must be tied to an agreed specimen, stress range, stress ratio, environment and test method before contractual use.

Reference pulling force by nominal rod size



How to use these values

- **Basis**

  Published reference calculated at 90% of minimum yield at the smallest effective section of a like-new rod.

- **Not a working load**

  Do not treat the chart as permissible cyclic load, fishing load or polished-rod load.

- **Derating inputs**

  Stress range, corrosion, pitting, wear, bending, connection condition, temperature and uncertainty reduce usable margin.

- **String design**

  Evaluate every taper and connection: the smallest effective section can

Acceptance: review mill test report, tensile test and dimensional record for each released heat/lot.

Sources: API Spec 11B Grade K limits; Tenaris SRAPI R01 pulling references; cooperative factory mechanical-property table. Pulling values are reference only.

Chemical Composition & Alloy Function

Chemistry is a grade-control input, not a standalone corrosion guarantee. The comparison below uses published manufacturer examples for Grade C, Grade K and a Grade DA product; API Grade D can be supplied through multiple alloy routes.

Element, wt.%	Grade C example	Grade K example	Grade DA example	Engineering relevance
C	0.30-0.36	0.18-0.25	0.40-0.45	Strength/hardenability; excess can reduce weldability and toughness margin
Mn	1.30-1.60	0.70-0.90	0.75-1.00	Deoxidation, hardenability and strength
Si	0.20-0.40	0.15-0.35	0.15-0.35	Deoxidation and strength contribution
S, max.	0.035	0.035	0.025	Lower sulfur reduces inclusion-related crack initiation risk
P, max.	0.035	0.035	0.025	Controlled to protect ductility and toughness
Cr	<=0.20	<=0.30	0.80-1.10	Hardenability and strength; contribution depends on heat treatment
Ni	<=0.15	1.65-2.00	<=0.25	Key Grade K differentiator; improves toughness/corrosion response
Mo	<=0.05	0.20-0.30	0.15-0.25	Hardenability and resistance to temper softening; supports Ni-Mo route

Ni 1.65-2.00%

Primary published Grade K chemistry differentiator in this example.

Mo 0.20-0.30%

Supports hardenability and temper resistance in the Ni-Mo route.

C 0.18-0.25%

Lower carbon than the compared C and DA examples; strength still depends on processing.

Optical-emission chemistry verification - factory R&D laborator

What the chemistry means in service

K vs C Both share the same API strength range, but K adds substantial Ni and Mo. That is why K is positioned for corrosive wells rather than as a higher-load grade.

K vs D D/DA raises load capacity through a higher strength envelope. Its chemistry is product-route dependent and should not be inferred from grade name alone.

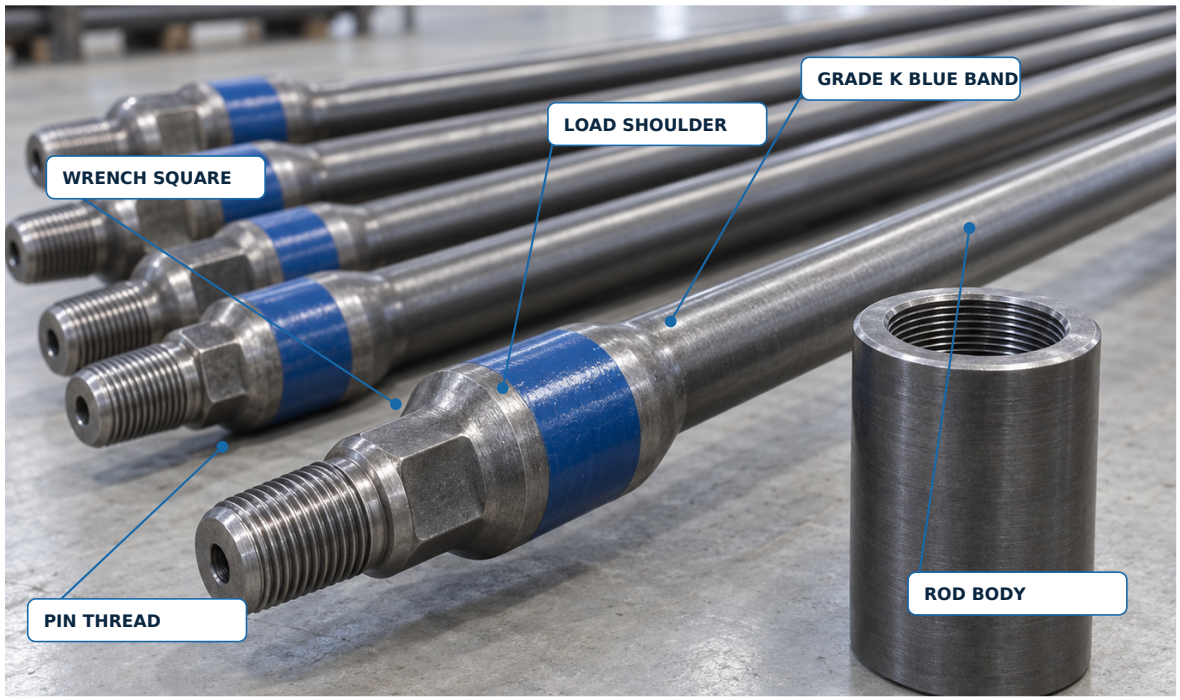
MTR control Accept the ordered grade against heat-specific MTR chemistry and mechanical results. Confirm heat/lot traceability from bar to finished rod.

Do not use a generic web chemistry table as purchase acceptance criteria unless the exact material route and limits are incorporated into the PO/specification.

Source: Tenaris SRAPI R01 published chemistry examples. Values illustrate specific C, K and DA material routes and are not a universal chemistry table for every API Grade D subtype.

Dimensions, Tolerances & Connection Checks

Nominal body	Body diameter tolerance	External shoulder OD	Wrench-square width	Wrench-square length	Nominal rod length	Length tolerance
5/8 in / 15.88 mm	+0.18 / -0.36 mm	31.75 +0.13/-0.25 mm	22.23 +/-0.79 mm	31.75 mm	25 or 30 ft	+/-50 mm / +/-2.0 in
3/4 in / 19.05 mm	+0.20 / -0.41 mm	38.10 +0.13/-0.25 mm	25.40 +/-0.79 mm	31.75 mm	25 or 30 ft	+/-50 mm / +/-2.0 in
7/8 in / 22.23 mm	+0.20 / -0.41 mm	41.30 +0.13/-0.25 mm	25.40 +/-0.79 mm	31.75 mm	25 or 30 ft	+/-50 mm / +/-2.0 in
1 in / 25.40 mm	+0.23 / -0.46 mm	50.80 +0.13/-0.25 mm	33.34 +/-0.79 mm	38.10 mm	25 or 30 ft	+/-50 mm / +/-2.0 in
1-1/8 in / 28.58 mm	+0.25 / -0.51 mm	57.15 +/-0.38 mm	38.10 +/-0.79 mm	41.28 mm	25 or 30 ft	+/-50 mm / +/-2.0 in

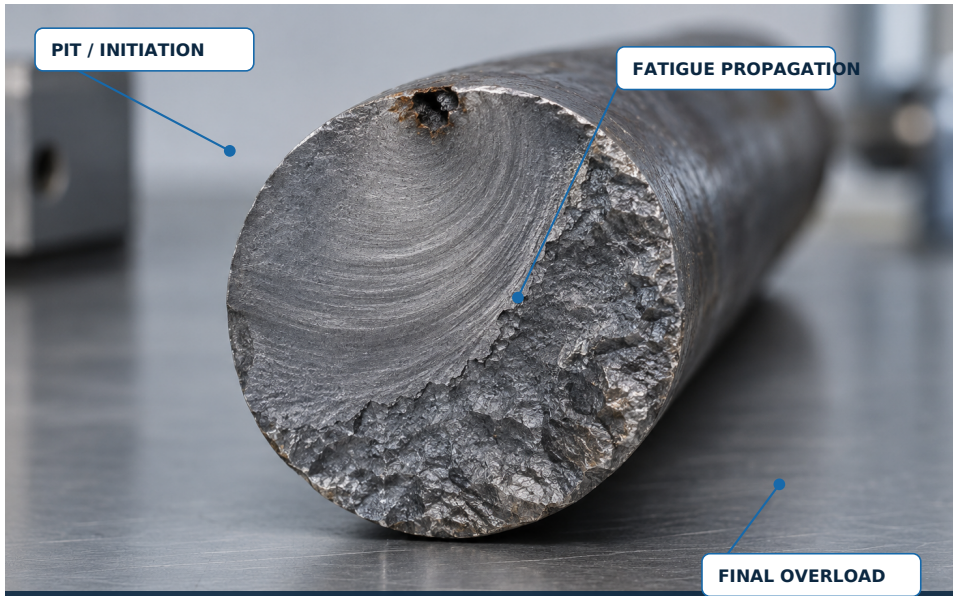


Receiving and pre-run connection checks

THREAD	Protector intact; no dents, rolled crests, rust scale or embedded grit.
SHOULDER	Clean, flat contact face; no paint, burrs or mechanical damage.
BODY	No deep handling marks, bending, local necking or rod-on-steel gouges.
COUPLING	Confirm size, thread form, material/grade compatibility and clean bore.
TRACEABILITY	Match heat/lot and package ID to MTR, inspection record and packing list.

Sources: cooperative factory dimensional table; Tenaris SRAPI R01 nominal lengths. Confirm ordered connection and current API drawing/PO tolerances before manufacture.

Corrosion-Fatigue Risk: Inputs, Mechanism & Controls



Illustrative morphology - not a test specimen or failure-analysis conclusion

Failure mechanism

1 Corrosion pit

Local metal loss creates a notch and raises surface stress.

2 Cyclic crack growth

Pump cycles extend the crack; bending and rod-on-tubing contact accelerate growth.

3 Final fracture

The remaining ligament can no longer carry the instantaneous load.

Grade K value: the Ni-Mo metallurgy improves suitability for corrosive service, but does not remove the need for chemical monitoring, inhibition, stress control and failure analysis.

Minimum data set before grade selection

Input	Why it matters	Action if risk is elevated
H2S / CO2 partial pressure	Controls sour/acid-gas corrosion and cracking risk	Run materials/corrosion review; verify sour-service requirements separately
Chloride, pH, water cut, temperature	Sets aqueous corrosion severity and inhibitor demand	Use representative produced-water analysis, not a single startup sample
Inhibitor residual and availability	Determines whether “effectively inhibited” is credible	Track residual, dosage interruptions and coupon/probe trend
Stress range and cycles	Fatigue life depends on alternating stress, not tensile strength alone	Calculate taper loads and dynamic stress; investigate fluid pound and tagging
Deviation / tubing contact	Adds bending and fretting to axial cycling	Use rod guides, centralization and wear surveillance where justified

Manufacturing Controls & Acceptance Matrix

Machining and straightening area

Automated handling / processing

Continuous heat-treatment line

BAR / HEAT ID → END FORGING → HEAT TREATMENT → STRAIGHTENING → THREADING → SURFACE / BAND → FINAL INSPECTION

Control point	Verification	Minimum record / release evidence	Status
Raw material	Heat number, grade route, chemistry	Mill test report linked to heat/lot	Hold
Heat treatment	Furnace recipe, speed/temperature trace, quench/temper control	Batch chart and operator sign-off	Review
Mechanical properties	Yield, tensile, elongation; agreed RA/fatigue targets if ordered	Accredited or approved lab report	Hold
Dimensions	Body, shoulder, wrench square, length and straightness	Dimensional inspection record by sampling plan	Review
Threads / ends	Profile, pitch diameter, lead, effective length, shoulder condition	Gauge calibration plus thread inspection report	Hold
Surface / NDT	Visual condition and agreed magnetic-particle or other NDT	Lot NDT record and disposition of rejects	Review
Marking / packing	Grade blue band, traceability, thread protectors, package ID	Final release checklist and packing photographs	Release

Release gates

01 GRADE VERIFIED

Heat-specific chemistry and material route match the purchase order.

02 PROPERTIES PASSED

Tensile and ordered supplemental targets are accepted.

03 ENDS ACCEPTED

Thread gauges, shoulders and dimensions meet the agreed limits.

04 TRACEABILITY CLOSED

Rod, bundle, MTR and inspection records remain linked.

Source hierarchy used in this guide

API baseline: API Spec 11B, 28th Edition Addendum 1 (2025-09-15). Published manufacturer data: Tenaris API Sucker & Pony Rod SRAPI R01 (effective 2025-10-31); ChampionX/Norris grade application matrix. Factory technical targets and images: Octal Steel cooperative manufacturing base capability deck supplied for this project. Engineering interpretation: explanatory content in this guide; it does not replace well-specific rod-string design or purchase-order requirements.