

Grade C, Grade D and Grade K Sucker Rod Overview

RELIABLE LIFT
EFFICIENT OPERATIONS
STRONGER TOMORROW

Surface Pumping Unit

Rod Weight

Tensile load from weight of rod string in air and fluid.

Fluid Load

Additional tensile load from column of produced fluids acting on the pump and rods.

Pump Load

Load from pump operation including friction and fluid forces on the pump plunger.

Dynamic Load

Cyclic loading due to reciprocating motion, acceleration and deceleration.

Rod String

Reciprocating Motion

Downhole Pump

Grade C

60,000 psi / 414 MPa
Minimum Yield Strength

90,000–115,000 psi /
621–793 MPa
Tensile Strength

Moderate
Mechanical Loading

Grade D

85,000 psi / 586 MPa
Minimum Yield Strength

115,000–140,000 psi /
793–965 MPa
Tensile Strength

Higher Calculated
Mechanical Loading

Grade K

60,000 psi / 414 MPa
Minimum Yield Strength

90,000–115,000 psi /
621–793 MPa
Tensile Strength

Corrosion-Related
Service Selection

Same nominal geometry and diameter
(different performance and service focus).

Rod body diameter, upset geometry, wrench flats and connections are the same for Grades C, D and K. Grade designation reflects material properties and intended service focus.

Grade is selected by operating requirement, not by a simple C-D-K ranking.

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Mechanical Strength and Ductility Comparison

API 11B
Sucker Rod Grades

Minimum Yield Strength

HIGHER YIELD STRENGTH
DELAYS PERMANENT DEFORMATION

Grade C / Grade K
60,000 psi / 414 MPa



60,000 psi
414 MPa

+25,000 psi
≈ +42%

Grade D
85,000 psi / 586 MPa



85,000 psi
586 MPa



Higher resistance before permanent deformation becomes a concern.
Yield strength indicates the stress level at which permanent (plastic) deformation begins.

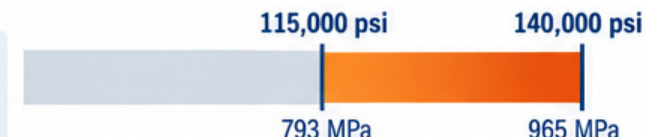
Tensile Strength

STRENGTH RANGE
UNDER TENSILE LOADING

Grade C / Grade K
90,000 – 115,000 psi



Grade D
115,000 – 140,000 psi



Grade D shifts the tensile strength range upward.
Tensile strength represents the maximum stress the rod can withstand in tension before failure.

Ductility

ADEQUATE DUCTILITY HELPS MAINTAIN TOUGHNESS
AND RESIST BRITTLE FAILURE

Elongation over 200 mm ≥13%

Before Test
(200 mm gauge length)



After Test
(≥13% elongation)



Current Octal manufacturing reference.
Minimum elongation over 200 mm shall be ≥ 13% and reduction of area shall be ≥ 50%.

Reduction of Area ≥50%

Before Test



Original Area
 A_0

After Test
(at neck)



Final Area
 $A_f \leq 0.50 A_0$

≥50%
reduction

Hardness

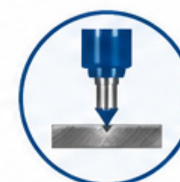
INFLUENCED BY MATERIAL
AND HEAT TREATMENT



Material
(Chemistry)



Heat Treatment
(Process Control)



Hardness
Verification
(Testing)



No single universal hardness value should be assigned from grade name alone.

Hardness varies with material, heat treatment and product form.
Verify by testing to applicable specifications.

Grade D provides additional mechanical strength; ductility and heat-treatment consistency must still be verified.

RELIABLE LIFT.
EFFICIENCY IN OPERATIONS.
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Same Sucker Rod Size, Different Grade

API 11B
Sucker Rod Grades

Same Nominal Size, Different Grades

IDENTICAL DIMENSIONS. DIFFERENT MATERIAL PROPERTIES.
DIFFERENT PERFORMANCE.

7/8 in
Grade C



7/8 in
Grade D



7/8 in
Grade K



Same nominal diameter $\neq$ same grade performance

Purchasing Example

DIAMETER ALONE IS NOT ENOUGH
TO SPECIFY THE PRODUCT.



Wrong

7/8 in Sucker Rod

Diameter alone does not define the grade, length, connection, coupling or service requirement.



Correct

**Grade + Size + Length +
Connection + Coupling +
Service Requirement**

A complete specification ensures the right product is supplied for the intended application.

Common Rod-Body Sizes

SAME NOMINAL SIZE ACROSS GRADES.
MULTIPLE SIZES AVAILABLE.



5/8 in
15.88 mm



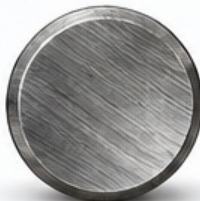
3/4 in
19.05 mm



7/8 in
22.23 mm



1 in
25.40 mm



1-1/8 in
28.58 mm

Engineering Takeaway

USE THE RIGHT INFORMATION
FOR SELECTION AND PROCUREMENT.



**A 7/8 in rod can be Grade C,
Grade D or Grade K.**

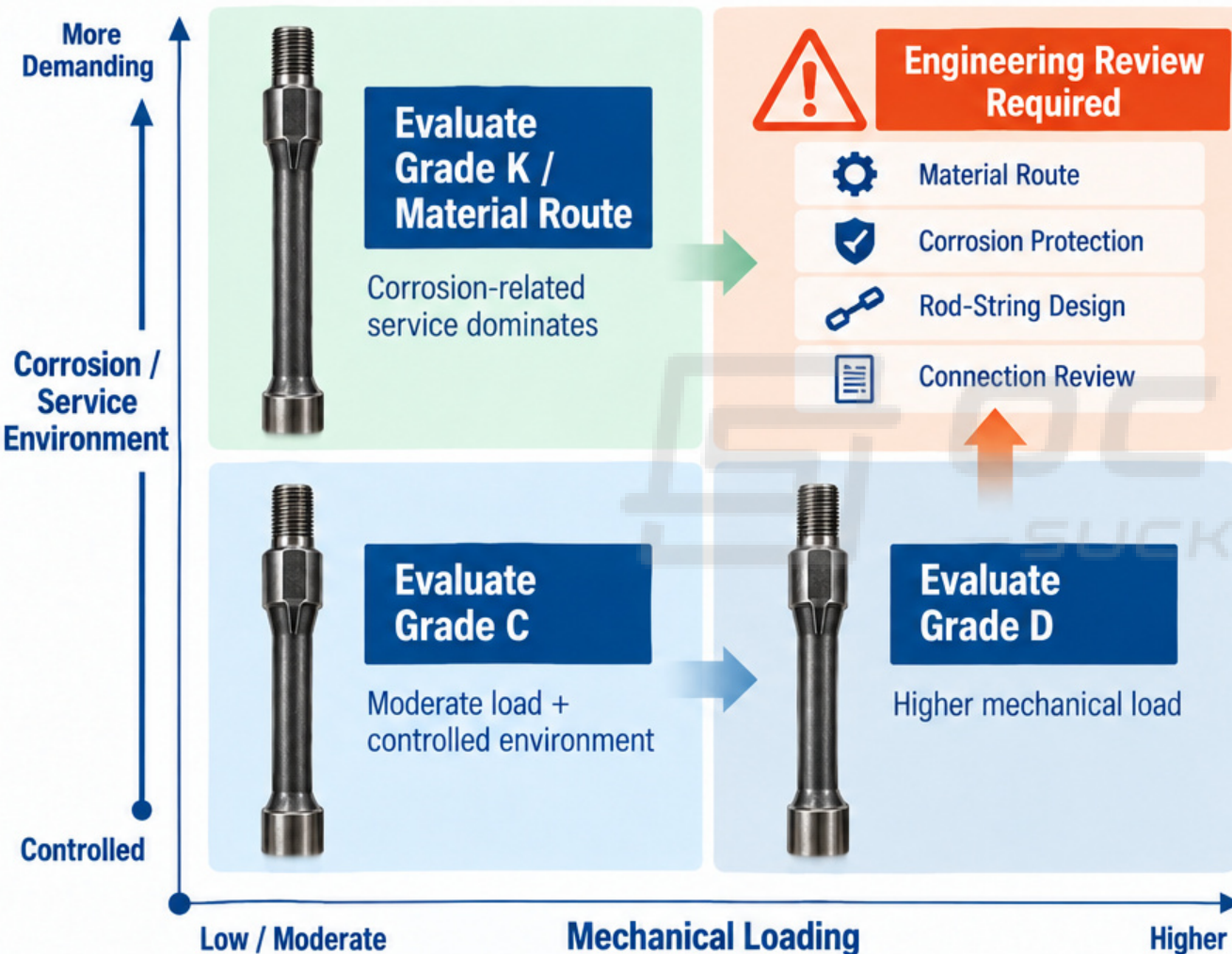
Diameter defines rod-body size;
grade defines the required
mechanical or service-performance level.

Sucker Rod Grade Selection by Operating Condition

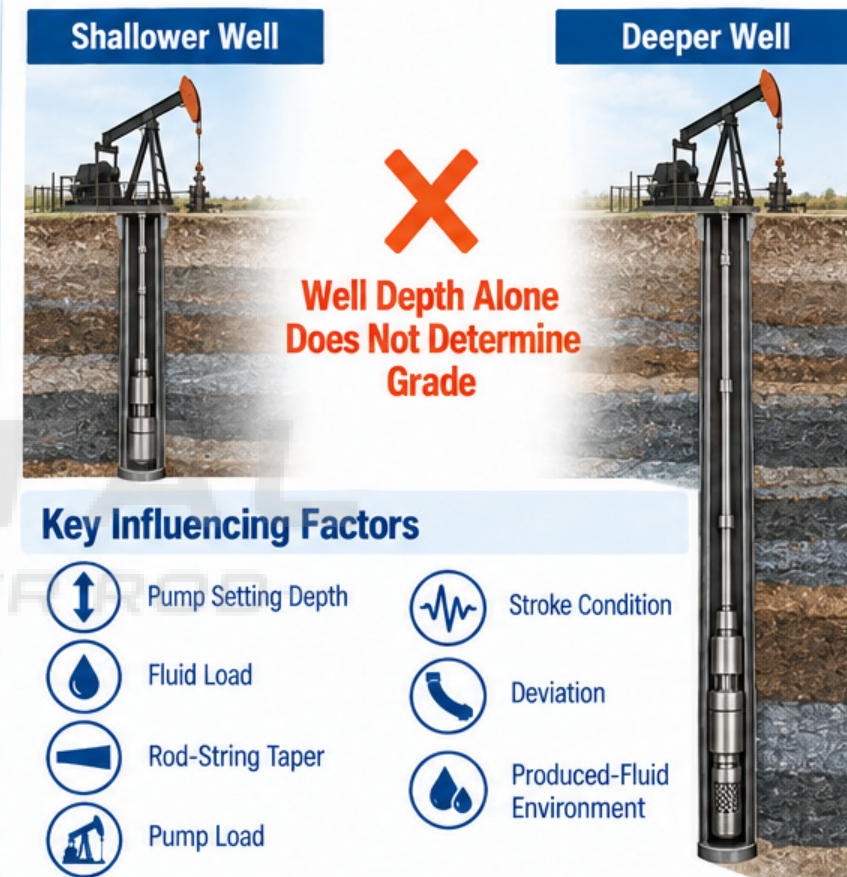
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EFFICIENT OPERATIONS
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Grade Selection Decision Matrix

MATCH GRADE TO OPERATING CONDITIONS,
NOT A SINGLE FACTOR.



Well Depth Comparison and Key Influencing Factors



Calculated mechanical loading and service environment control grade selection.

Well depth contributes to loading, but grade selection still depends on the full operating condition review.

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Grade Selection and Purchase Verification

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Selection Flow from Requirement to Specification

Selection should move from operating requirement to detailed specification.



Rod-String Requirement

Define well conditions and service requirements.



Calculated Mechanical Loading

Determine tensile, compressive and dynamic loading.



Corrosion / Fluid Environment

Evaluate produced fluids, corrosivity and temperature.



Rod Grade

Select Grade C, Grade D or Grade K based on service.



Rod Size

Select nominal rod body diameter.



Connection / Coupling

Specify pin/thread and coupling type.



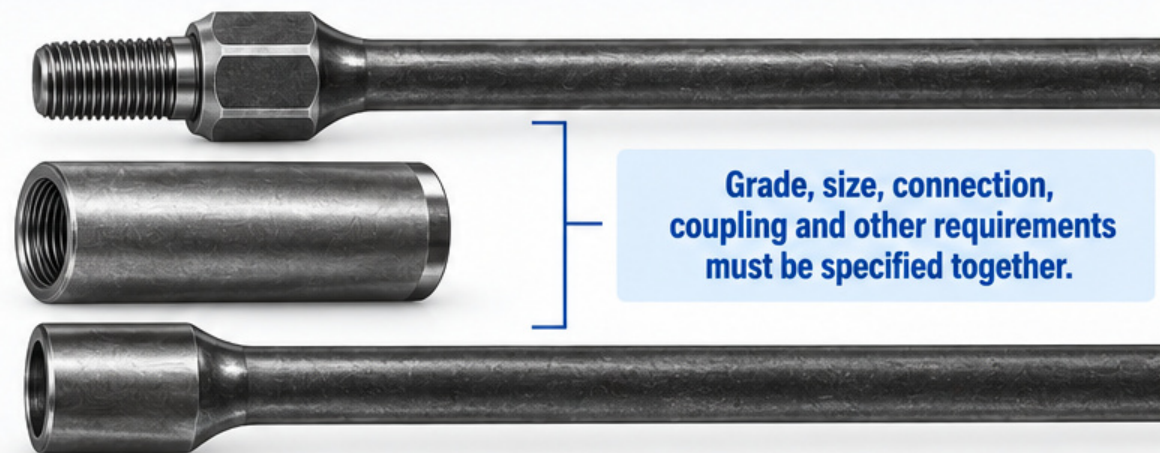
Inspection Requirement

Define inspection, testing and documentation needs.

Purchase Specification Items

THE FOLLOWING ITEMS MUST BE SPECIFIED TO ENSURE THE RIGHT PRODUCT.

Grade:	C / D / K — Project Selected
Nominal Size:	5/8 / 3/4 / 7/8 / 1 / 1-1/8 in as specified
Length:	Project specified
Pin / Thread:	Specified connection
Coupling:	Full-Size / Slim-Hole / Project specified
Inspection:	Project specified
Documentation:	Material and inspection records as required



Grade, size, connection, coupling and other requirements must be specified together.



“7/8 in sucker rod” alone is not a complete purchase specification.

Grade, size, connection, coupling, inspection, and documentation must be defined together.

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