

Grade C Sucker Rod Engineering Selection and Inspection Guide

Structure, Mechanical Properties, Service Conditions, Connections and Quality Control

FROM SURFACE TO RESERVOIR

RELIABLE ROD-LIFT PERFORMANCE
THROUGH PROVEN ENGINEERING



Grade C Mechanical Position

Minimum Yield Strength:	60,000 psi / 414 MPa
Tensile Strength:	90,000–115,000 psi / 621–793 MPa
Elongation:	≥13%
Typical Position:	Standard-strength rod-lift service

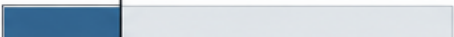
Engineering Service Statement

Designed for conventional reciprocating rod-lift service where rod loading remains moderate and corrosion is non-severe or effectively controlled.

Mechanical Properties (Grade C)

Minimum Yield Strength  60,000 psi / 414 MPa

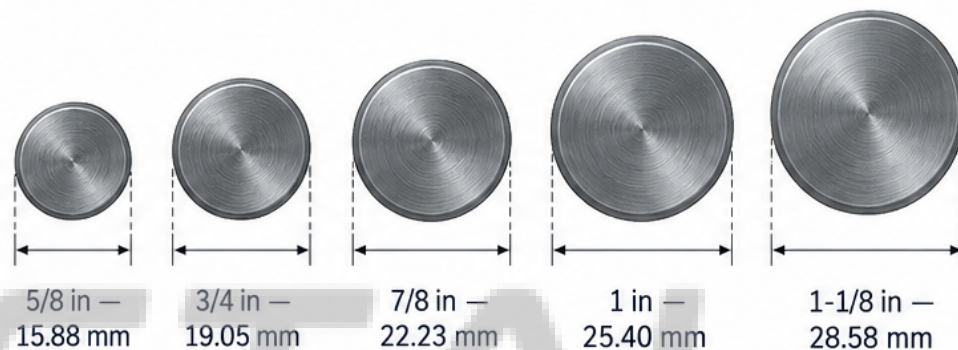
Tensile Strength  90,000–115,000 psi / 621–793 MPa

Elongation  $\geq 13\%$

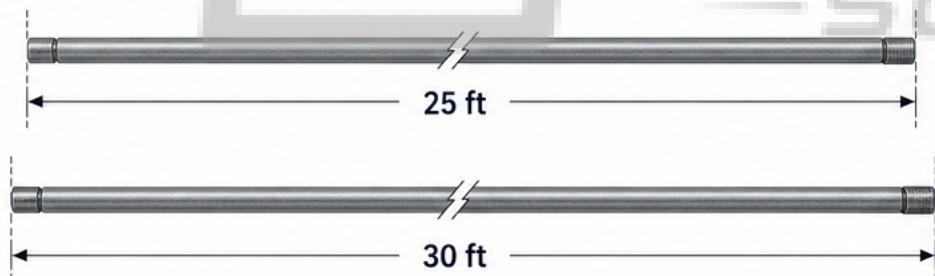
Reduction of Area  $\geq 50\%$

Octal manufacturing reference

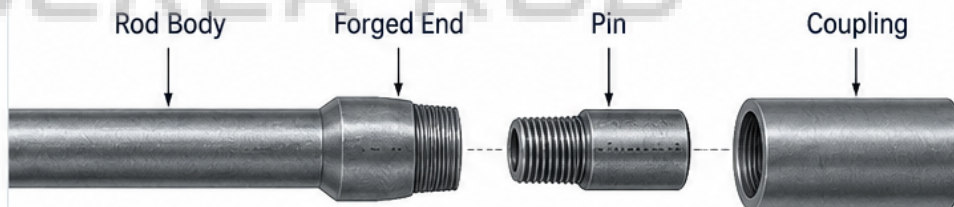
Common Rod Sizes (Rod Body Diameter)



Common Nominal Lengths



Rod Connection Components



Note: Nominal rod size refers to the rod body. Connection and coupling dimensions must be checked separately for replacement work.

Grade C

Standard Strength

Minimum Yield:
414 MPa

Tensile Strength:
621–793 MPa

Primary Focus:
Moderate rod loading



Grade K

Service / material-route selection

Often selected with greater attention to corrosion behavior and service environment.

Strength position may be similar to Grade C in many specifications.



Grade D

Higher Mechanical Strength

Minimum Yield:
approximately 586 MPa

Tensile Strength:
approximately 793–965 MPa

Primary Focus:
Higher rod-string mechanical load



General Mechanical Strength Position (Typical)



Note: Positioning is based on typical mechanical properties. It is a general guide and not an absolute ranking of overall suitability.

Increasing strength grade can increase mechanical load margin

A higher strength grade does not automatically solve the following common problems:

Corrosion



Corrosion can reduce effective cross-sectional area and fatigue life.

Incorrect thread make-up



Improper make-up can lead to connection failure, regardless of grade.

Misalignment



Misalignment increases bending stress and accelerates fatigue.

Well deviation



Well deviation increases side loading, bending and wear on the rod string.

Rod-to-tubing wear



Friction and wear can lead to reduced diameter, high spots and early failure.

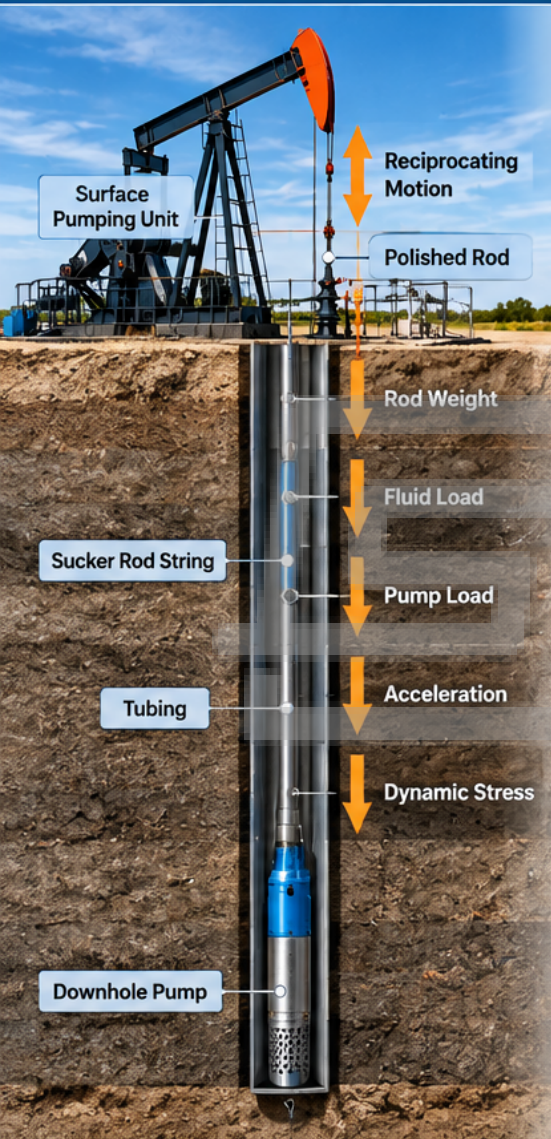


Grade selection must follow the dominant service risk, not grade name alone.

Grade C Load and Service Condition Selection

Evaluate well conditions, rod loading and service environment to select the appropriate sucker rod grade.

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Service Condition Selection for Grade C



Suitable

Standard-strength Grade C service

- Shallow to moderate well depth
- Moderate pump / fluid load
- Non-corrosive produced fluid
- Effective corrosion inhibition
- Conventional rod-lift operation



Engineering Review Required

Check design and operating conditions

- Higher calculated rod stress
- Higher dynamic loading
- Highly deviated well
- Increased rod-to-tubing contact
- Variable fluid conditions
- Consider grade, connection and corrosion control together



Deviated Well Section



Special-Service Evaluation

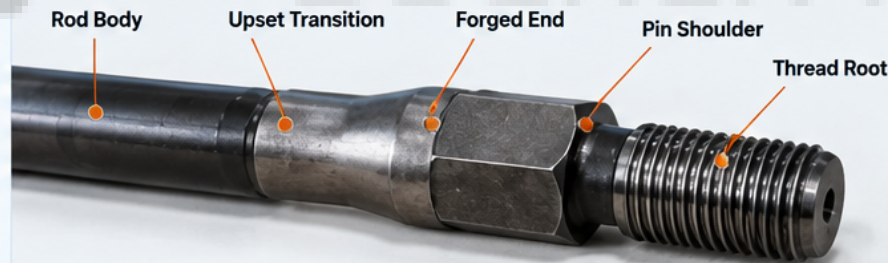
Consider higher grade or special material

- Severe corrosion or aggressive fluids
- Severe rod-tubing wear
- High rod-string load beyond Grade C design margin
- Highly deviated or horizontal well
- Complex operating conditions
- Material route and corrosion resistance should be evaluated



Corrosion and Rod-to-Tubing Wear

Critical Fatigue Locations on Sucker Rod



Sucker rods operate under cyclic tensile loading rather than a single static tensile load. Fatigue control at the upset transition, forged end, pin shoulder and thread root is critical for long-term service performance.

Key Factors Affecting Rod Load



Rod Weight

Total string weight in air and in fluid



Fluid Load

Produced fluid acting on the rod string



Pump Load

Load from the downhole pump



Acceleration

Dynamic load from the surface unit



Dynamic Stress

Cyclic tension and compression effects

Grade selection must follow the dominant service risk, not grade name alone.

WELL CONDITIONS | ROD DESIGN | RELIABLE OPERATION

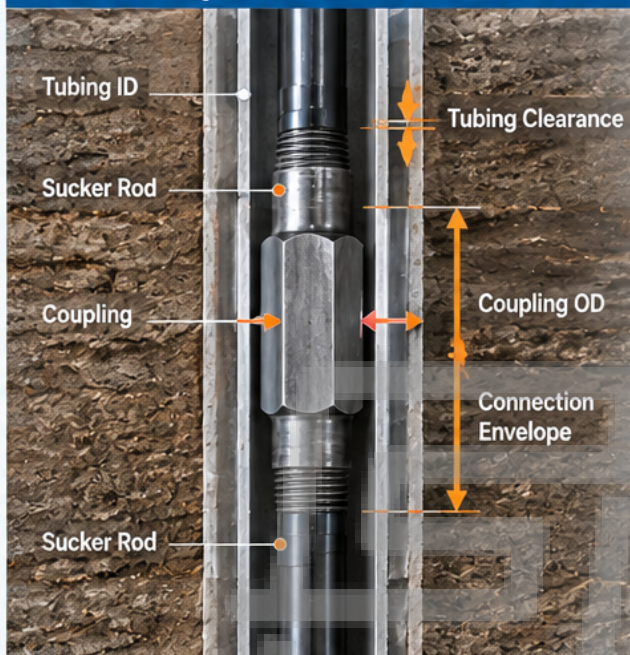
Grade C Sucker Rod Connection and Coupling Compatibility

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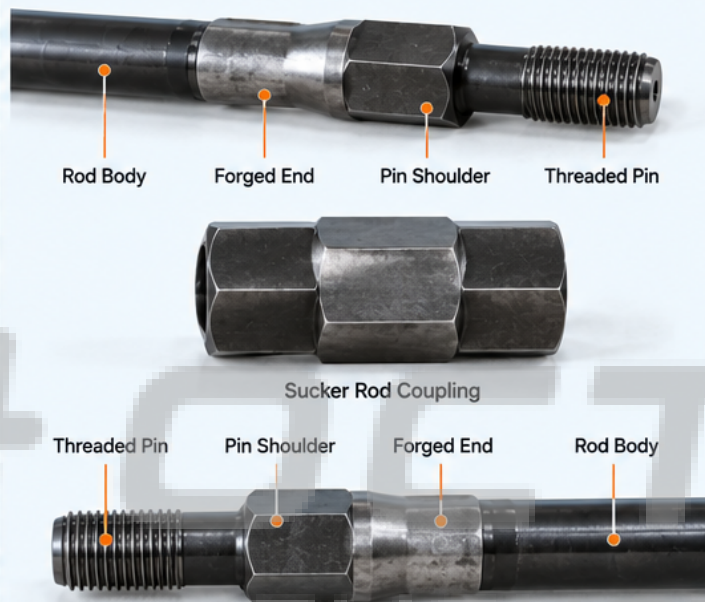
Connection design, coupling type and tubing clearance must be considered together for reliable operation.

Full-Size Coupling (Standard)

Common configuration for conventional rod-lift service

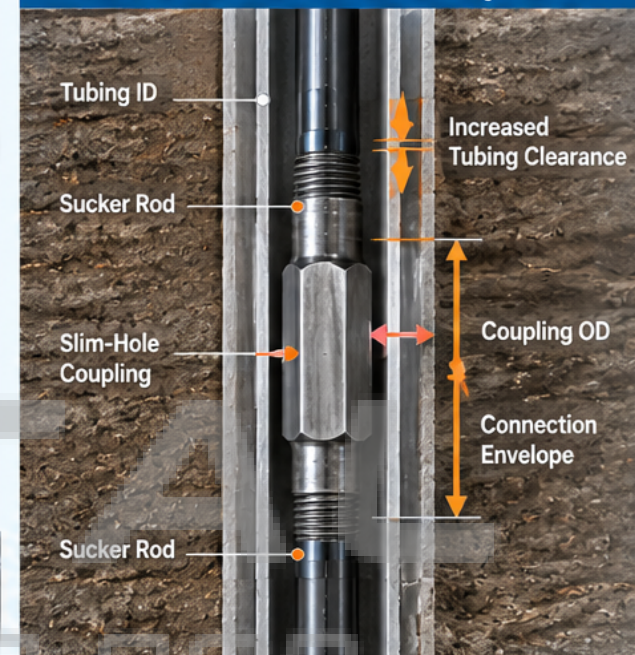


Connection Components

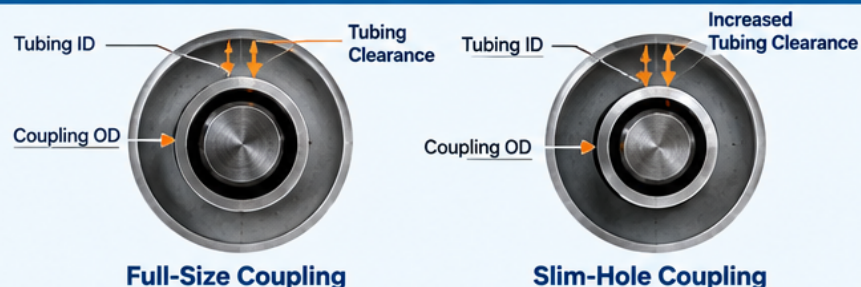


Slim-Hole Coupling

Smaller outside diameter for reduced tubing clearance



Connection Envelope Comparison



Replacement Compatibility Check



Matching rod-body diameter alone does not establish replacement compatibility.

Rod size, grade, nominal length, pin and thread geometry, coupling type and rod-string position must all be confirmed before ordering replacement rods.

Material, Heat Treatment and Manufacturing Control

Controlled manufacturing and heat treatment ensure consistent mechanical properties and reliable service performance.

Raw Material



Qualified carbon-steel materials are selected to achieve the required Grade C mechanical properties after the approved manufacturing and heat-treatment route.

Exact steel chemistry may be manufacturer-specific.



Raw Material Release

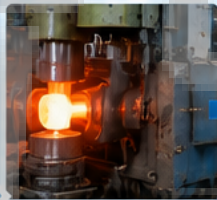


Forging / Upsetting

Heat Treatment Process



Manufacturing Route



Heat Treatment



Straightening



Machining



Threading



Threading



Inspection



Marking

Key Manufacturing Controls

- ✓ Qualified raw materials
- ✓ Consistent forging and upsetting
- ✓ Controlled heat treatment
- ✓ Straightness control
- ✓ Accurate machining and threading
- ✓ Dimensional and thread inspection
- ✓ Mechanical property testing
- ✓ Heat and lot traceability
- ✓ Final marking and packing
- ✓ Manufactured to approved specification

Heat Treatment and Performance



Heat-treatment consistency influences strength distribution, ductility, straightness and fatigue consistency along the finished rod.

Grade C Sucker Rod Inspection and Traceability

Comprehensive inspection and full traceability ensure reliable quality and consistent performance.

1 Inspection

Key inspections for dimensional accuracy, connection quality and mechanical properties.

Dimensional Inspection



Rod-body OD



Forged-end geometry

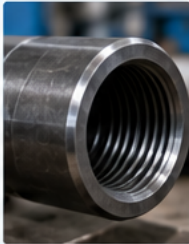


Straightness

Thread Inspection



Thread geometry



Pin / coupling fit

Mechanical Testing



Tensile testing

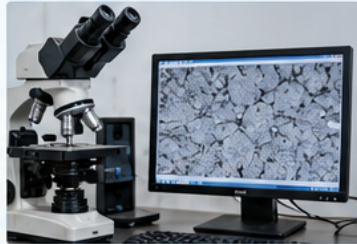


Hardness testing



Impact testing
(where applicable)

Metallographic Examination



Microstructure verification
(where required by the manufacturing
/ inspection plan)

2 Traceability Chain

Complete records from raw material to finished product for full traceability.



Material Heat Number



Chemical
Composition Record



Production Lot



Heat-Treatment
Record



Mechanical
Test Results



Dimensional /
Thread Inspection



Product Marking



Packing List

3 Grade C Order Verification

Confirm the following items before placing an order.



- ✓ Rod nominal diameter
- ✓ Nominal length
- ✓ Grade
- ✓ Pin / connection requirement
- ✓ Coupling type

- ✓ Full-size or slim-hole configuration where applicable
- ✓ Replacement compatibility
- ✓ Inspection requirement
- ✓ Documentation requirement
- ✓ Required traceability level

The supplied rod should be verified as a complete mechanical and connection system rather than by strength grade alone.