API 11B Sucker Rod Selection Guide

Grade Selection Based on Load, Corrosion and Oil Well Conditions

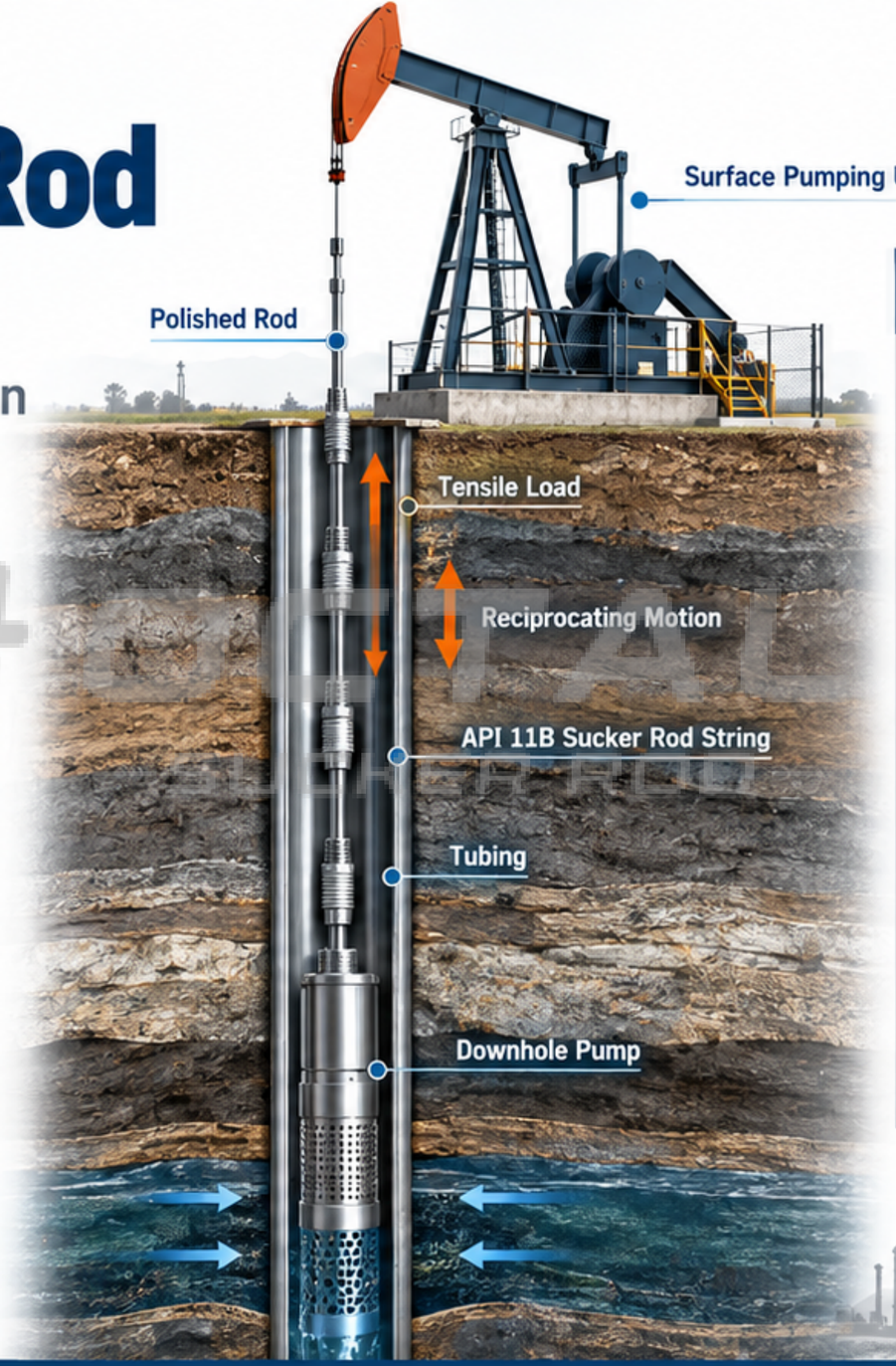
Industrial Engineering Technical Guide

API 11B sucker rods are critical load-transmitting components in rod pumping systems. This guide explains grade selection based on mechanical loading, corrosion exposure, fatigue conditions and different oil well operating environments.

API 11B Standard Overview
Sucker rod classification, structure and application requirements.

Sucker Rod Grade Selection
Grade C, Grade D, Grade K and Grade KD comparison.

Oil Well Application Guide
Selection considerations for deep wells, corrosive wells, deviated wells and extreme environments.



Sucker Rod Selection Factors

Mechanical Load
Tensile & Cyclic Loading

Corrosion Environment
H_2S / CO_2 Exposure

Well Condition
Depth & Deviation

Temperature
Extreme Temperature

RELIABLE WELLS
STRONGER OPERATIONS

1. Sucker Rod Function in Rod Pumping System

Reliable Mechanical Power Transfer for Continuous Production

1.1 What Is an API 11B Sucker Rod?

API 11B sucker rods are steel mechanical components installed inside the tubing string to transfer reciprocating motion from the surface pumping unit to the downhole pump.

Tensile Loading
Sucker rods experience tensile loading during upward movement of the pumping unit.

Compressive Loading
Sucker rods experience compressive loading during downward movement.

Cyclic Stress
Continuous reciprocating motion results in repeated cyclic stress.

Bending / Contact Forces
In deviated wells, sucker rods are subjected to bending and contact forces.

Sucker rod performance depends on fatigue resistance, connection integrity, and manufacturing consistency.



Rod Pumping System Structure

Component	Function
Surface Pumping Unit	Generates reciprocating movement
Polished Rod	Transfers surface movement into rod string
Sucker Rod String	Transmits mechanical load to downhole pump
Tubing String	Provides production flow path
Downhole Pump	Lifts produced fluid to surface

Engineering Consideration

A sucker rod is not only a connecting element but a fatigue-loaded component whose service life influences pumping reliability, workover frequency, production continuity, and operating cost.



2. Factors Affecting API 11B Sucker Rod Selection

Sucker rod selection should be based on the complete operating environment. Different wells create different mechanical and environmental risks, which require different grade considerations.

Key Factors Affecting API 11B Sucker Rod Selection

1. Well Depth

Engineering influence: Increases rod string weight and axial load.

Main risk: Tensile overload.

2. Pump Size

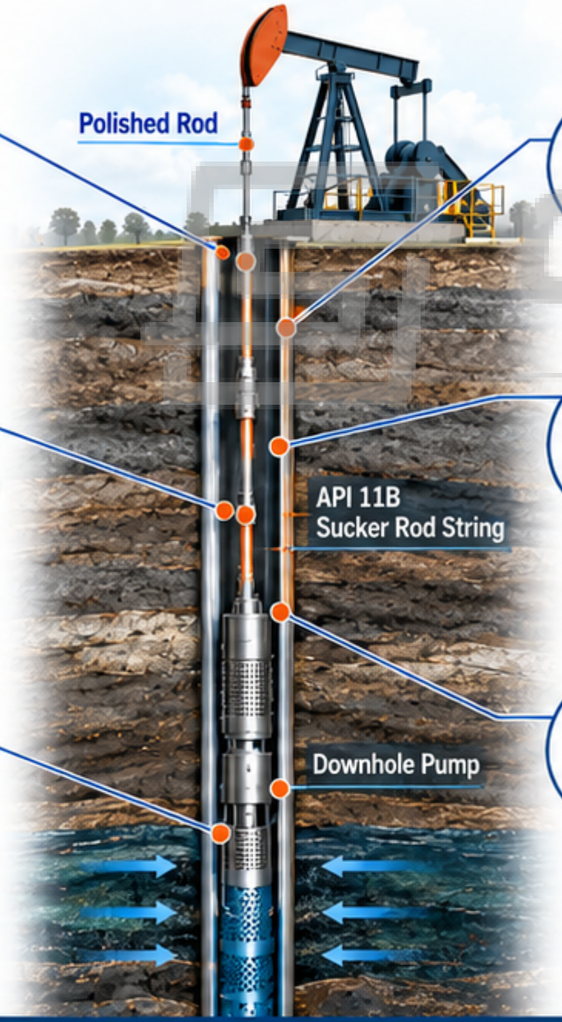
Engineering influence: Increases fluid load transferred through rod string.

Main risk: Higher working stress.

3. Pumping Speed

Engineering influence: Increases loading cycle frequency.

Main risk: Fatigue failure.



4. Fluid Chemistry

Engineering influence: Determines corrosion exposure.

Main risk: Corrosion fatigue.

5. Well Deviation

Engineering influence: Creates tubing contact and bending force.

Main risk: Wear damage.

6. Temperature Condition

Engineering influence: Influences material performance.

Main risk: Fatiability concerns.

Factors Summary for Sucker Rod Selection

Selection Factor	Engineering Influence	Main Risk
Well Depth	Increases rod string weight and axial load.	Tensile overload.
Pump Size	Increases fluid load transferred through rod string.	Higher working stress.
Pumping Speed	Increases loading cycle frequency.	Fatigue failure.
Fluid Chemistry	Determines corrosion exposure.	Corrosion fatigue.
Well Deviation	Creates tubing contact and bending force.	Wear damage.
Temperature Condition	Influences material performance.	Reliability concerns.

Selection Principle

The correct sucker rod grade should be selected according to: **Load Condition + Corrosion Environment + Fatigue Exposure + Service Life Requirement.**

A higher-strength grade is not always the best solution if the dominant failure mechanism is corrosion fatigue or mechanical wear.



3. API 11B Sucker Rod Grade Comparison

API 11B sucker rods are available in different grades to meet different operating requirements. Grade selection depends on mechanical loading, fatigue exposure and service environment.

Grade C Sucker Rod

Typical Application:
Conventional Pumping Conditions

Grade C provides balanced mechanical performance for standard oil well applications where loading conditions remain moderate.

Minimum Yield Strength	60,000 psi (414 MPa)
Tensile Strength	90,000 – 115,000 psi (621 – 793 MPa)
Elongation	≥13%
Reduction of Area	≥50%

Grade D Sucker Rod

Typical Application:
Higher Loading Conditions

Grade D provides higher mechanical strength for applications where rod-string loads and working stress are increased.

Minimum Yield Strength	85,000 psi (586 MPa)
Tensile Strength	115,000 – 140,000 psi (793 – 965 MPa)
Elongation	≥13%
Reduction of Area	≥50%

Grade K / KD Sucker Rod

Grade K
Corrosion-related service conditions

Grade KD
Combined mechanical loading and corrosion requirements



Grade Selection Summary

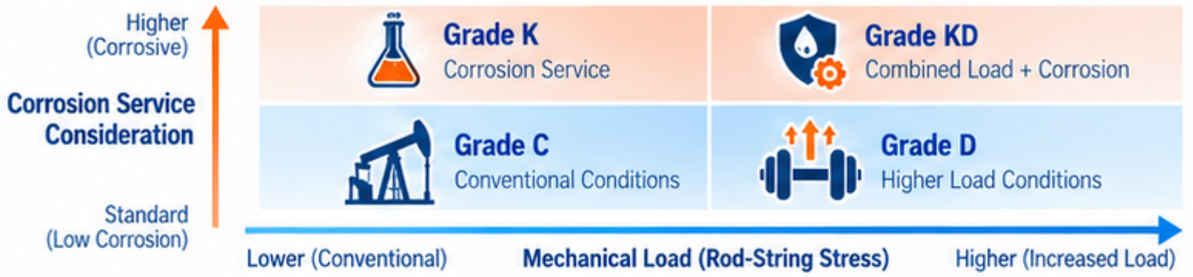
Grade	Main Selection Consideration	Typical Application
Grade C	Balanced mechanical performance	Conventional pumping conditions
Grade D	Higher tensile and yield strength	Deep wells and higher loading conditions
Grade K	Corrosion-related service consideration	Wells with challenging fluid chemistry
Grade KD	Combined load and corrosion requirements	High-demand production environments

Selection Insight

The correct grade should be selected according to the dominant operating risk rather than simply choosing the highest-strength option.

Grade Selection Logic

Match the rod grade to the dominant operating conditions



Selection Considerations

- ✓ Evaluate mechanical loading and well depth
- ✓ Assess fluid chemistry and corrosion risk
- ✓ Consider fatigue loading and pumping speed
- ✓ Select grade based on the dominant operating risk

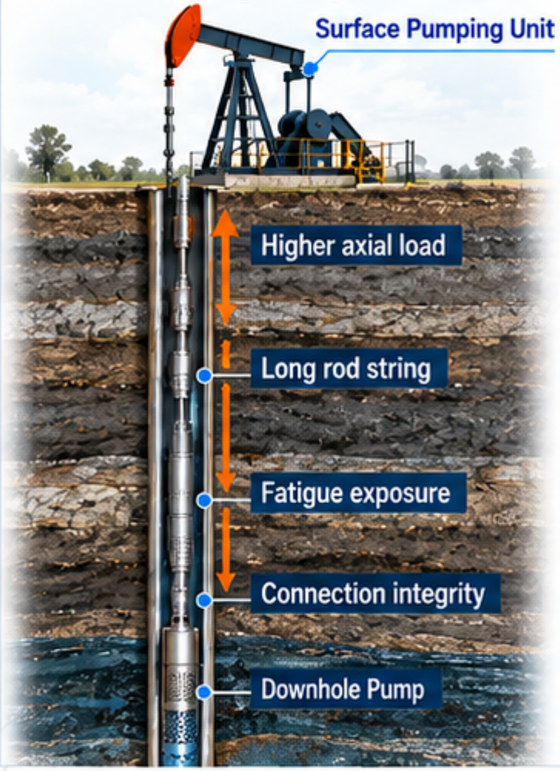


4. Selecting Sucker Rod for Different Oil Well Conditions

Operating environment determines the dominant failure risk and selection priority for API 11B sucker rods.

4.1 Deep Oil Wells

Main Challenge: Higher axial load and fatigue exposure



Deep wells increase the suspended weight of the rod string and result in higher tensile loading. Sucker rod selection should evaluate working load, tensile strength, fatigue resistance, and connection integrity to ensure reliable long-term operation.

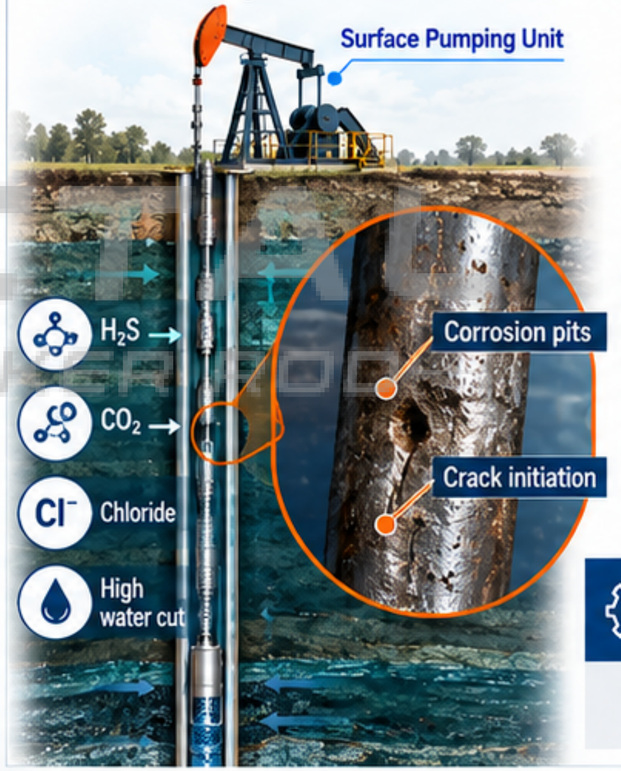
Condition	Risk	Selection Focus
Deep well	High axial load	Strength evaluation
Large pump	Higher fluid load	Load calculation
Long operation	Fatigue exposure	Fatigue resistance

Typical selection direction:

evaluate higher-strength options when operating stress approaches the limit of conventional grades.

4.2 Corrosive Oil Wells

Main Challenge: Combined chemical corrosion and cyclic loading



Corrosion pits can become stress concentration points and accelerate fatigue crack initiation under cyclic service. In corrosive wells, sucker rod selection should consider fluid chemistry, corrosion control, and mechanical loading together.

Condition	Risk	Selection Focus
H_2S	Sulfide damage	Material evaluation
CO_2	Local corrosion	Corrosion control
Chloride	Pitting	Alloy consideration

Typical selection direction:

consider Grade K or Grade KD when corrosion-related service risk becomes significant, while evaluating fluid chemistry and operating stress together.

Selection Priority by Operating Condition

Deep Well

Priority:
Mechanical loading, fatigue resistance, connection integrity

Corrosive Well

Priority:
Fluid chemistry, corrosion fatigue, material evaluation

5. Extreme Operating Environment Considerations

Extreme operating environments create different failure risks and selection priorities for API 11B sucker rods.

5.1 Deviated Oil Wells

Main Challenge: Side loading and tubing contact



Directional wells create side loading because sucker rods may repeatedly contact tubing during movement. This increases bending stress, tubing wear and the risk of connection damage. Rod selection should consider well trajectory, side load severity and wear resistance.

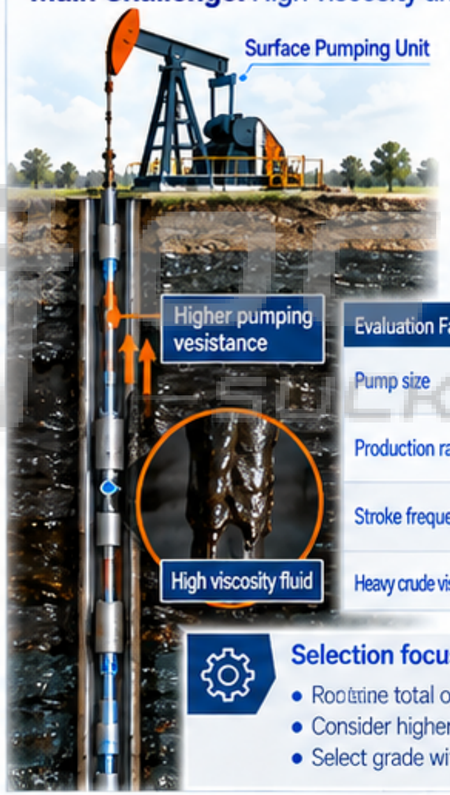
Condition	Main Risk	Selection Focus
Deviated well	Bending stress	Higher fatigue strength
Tubing contact	Tubing wear	Wear resistance
Side loading	Connection damage	Connection performance

Selection focus:

- Rod string design for directional profile
- Wear control (rod and tubing)
- Connection performance under side load

5.2 Heavy Oil Wells

Main Challenge: High viscosity and increased pumping load



High-viscosity fluids increase the pumping resistance and operating load on sucker rods. Heavy oil wells often require larger pump sizes and higher torque, which increases cyclic loading and fatigue exposure. Rod selection should account for the elevated load and longer-term fatigue conditions.

Evaluation Factor	Impact	Selection Focus
Pump size	Higher load	Adequate strength grade
Production rate	Higher friction and load	Fatigue resistance
Stroke frequency	Increased cyclic loading	Endurance and durability
Heavy crude viscosity	Higher resistance	Load evaluation

Selection focus:

- Routine total operating load (pump, fluid, inertia)
- Consider higher fatigue exposure
- Select grade with adequate strength and toughness

5.3 Arctic and Permafrost Oil Wells

Main Challenge: Low temperature and limited accessibility



Cold climate oilfields introduce additional requirements for sucker rod materials and manufacturing quality. Low temperatures can reduce material toughness, and remote operation limits maintenance opportunities. Rod selection should ensure reliable low-temperature performance and consistent manufacturing quality.

- Low temperature
- Remote operation
- Limited maintenance access

Selection Consideration	Key Requirement
Material toughness	Maintain toughness at low temperature
Heat treatment consistency	Stable and uniform mechanical properties
Manufacturing traceability	Full batch traceability and quality control
Long service reliability	Minimize maintenance in remote areas

Selection focus:

- Use materials with verified low-temperature toughness
- Ensure consistent heat treatment and quality control
- Prioritize traceability and long-term service reliability

Selection Priorities in Extreme Environments

Deviated Well

Priority:
- Wear control
- Connection performance
- Rod string design

Heavy Oil Well

Priority:
- Load evaluation
- Cyclic loading
- Adequate strength grade

Arctic / Permafrost Well

Priority:
- Low-temperature toughness
- Manufacturing traceability
- Long-term service reliability

Sucker Rod Grade Selection Summary

Different oil well conditions require different selection priorities.

	Oil Well Condition	Main Challenge	Selection Priority
	**Conventional Well**	Moderate load	**Grade C**
	**Deep Well**	High tensile stress	**Grade D / Higher strength option**
	**Corrosive Well**	Corrosion fatigue	**Grade K / KD consideration**
	**Deviated Well**	Wear and bending	**Grade + connection evaluation**
	**Heavy Oil Well**	High pumping resistance	**Load-based selection**
	**Arctic / Permafrost**	Low temperature and maintenance difficulty	**Toughness + traceability**



The right sucker rod grade improves pumping reliability, reduces workover frequency and supports long-term production performance.

Engineering Selection Flow

Well Condition
Identify well type, depth, deviation, fluid characteristics and operating environment.

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Load Evaluation
Calculate rod string load, pump size, production rate and operating parameters.

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Corrosion Assessment
Evaluate H_2S, CO_2, chloride and other corrosive factors.

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Fatigue Risk Analysis
Assess cyclic loading, stress concentration and service life requirement.

↓

API 11B Grade Selection
Select appropriate grade based on comprehensive evaluation.

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Inspection & Documentation
Verify compliance, material traceability and quality records.

RIGHT SELECTION.
MORE RELIABLE PRODUCTION.

OCTAL SUCKER ROD

Ordering Checklist and Quality Documentation

Confirm key technical information and documentation before ordering API 11B sucker rods.



Reliable Data. Correct Selection. Stable Operation.

Proper ordering information helps ensure the right grade, reliable performance and efficient project execution.

Required Technical Information

Information	Purpose
Well Depth	Evaluate rod string load
Pump Setting Depth	Confirm operating condition
Pump Diameter	Estimate working load
Stroke Length	Evaluate cyclic loading
Pumping Speed	Estimate fatigue exposure
Fluid Chemistry	Assess corrosion risk
H_2S / CO_2 Level	Evaluate corrosion environment
Failure History	Optimize future selection

Quality Documentation

Typical supply documentation may include:

- **Material certificates**
  Chemical composition and mechanical properties
- **Mechanical test records**
  Tensile, yield, elongation and hardness
- **Dimensional inspection records**
  Rod diameter, length and tolerance
- **Thread inspection records**
  Connection dimensions and thread gauge
- **Heat number traceability**
  Material and manufacturing records
- **Packing and shipment records**
  Packing details and quantity information

Octal Support

From technical evaluation to final delivery.

Technical Evaluation → Product Specification Confirmation → Manufacturing Control → Inspection Documentation → Shipment Preparation

