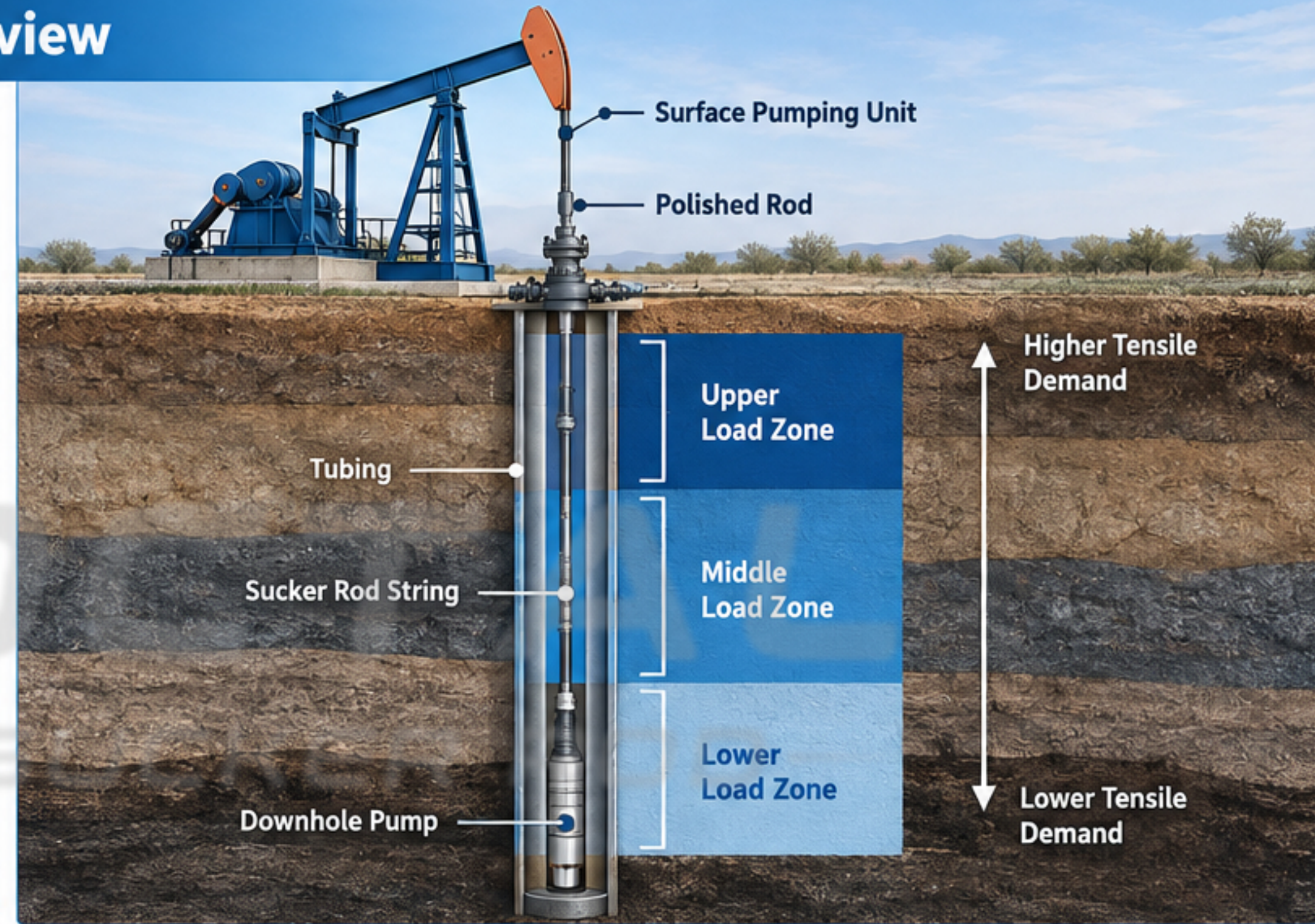


High Strength Sucker Rod Selection Overview

Selection Starts with the Complete Rod String

High strength sucker rod selection begins with the operating requirements of the complete rod string rather than with grade designation alone. Well depth, rod-string load distribution, tubing dimensions, pump conditions and connection requirements determine where additional strength is required.

The final configuration may use one uniform rod size and grade or combine different diameters and strength levels along the string. The objective is to provide sufficient capacity in heavily loaded sections without adding unnecessary rod-string weight or reducing tubing clearance.



01

Well Data



Depth, tubing and pump conditions

02

Rod Load



Maximum and sectional load demand

03

Rod Size



Diameter and tubing clearance

04

Rod Grade



Required strength margin

05

String Layout



Uniform or tapered configuration



Rod selection should match the strength, diameter and connection configuration to the load carried by each section of the rod string.

Well Data Required Before Rod Selection

Well Input Data Map

The following well, pump and tubing data should be affecting the sucker rod grade, size and string configuration.

04 Stroke Length

Affects reciprocating travel and dynamic loading condition

02 Tubing ID

Limits rod and coupling envelope

03 Pump Size

Affects transmitted pumping load

05 Pumping Speed

Affects cyclic loading frequency

01 Well Depth

Determines rod-string length and accumulated weight

06 Fluid / Service Environment

Affects corrosion, wear and material requirements

Key Engineering Inputs

Input Data	What It Defines
Well depth	Rod-string length and accumulated weight
Tubing inside diameter	Available rod and coupling clearance
Pump size / plunger load	Mechanical load transmitted through the rod string
Stroke length	Reciprocating travel and dynamic loading condition
Pumping speed	Number of load cycles during operation
Fluid condition	Corrosion, wear and material requirements
Existing rod-string design	Diameter, grade and connection constraints

Each input must define a specific engineering constraint before rod grade and diameter are finalized.

Missing Data Can Change the Final Configuration

Incomplete well or equipment data may lead to an improper rod string design.



Tubing ID unknown
→ Clearance cannot be verified



Pump load unknown
→ Rod capacity cannot be checked



Existing connection unknown
→ Coupling compatibility cannot be confirmed



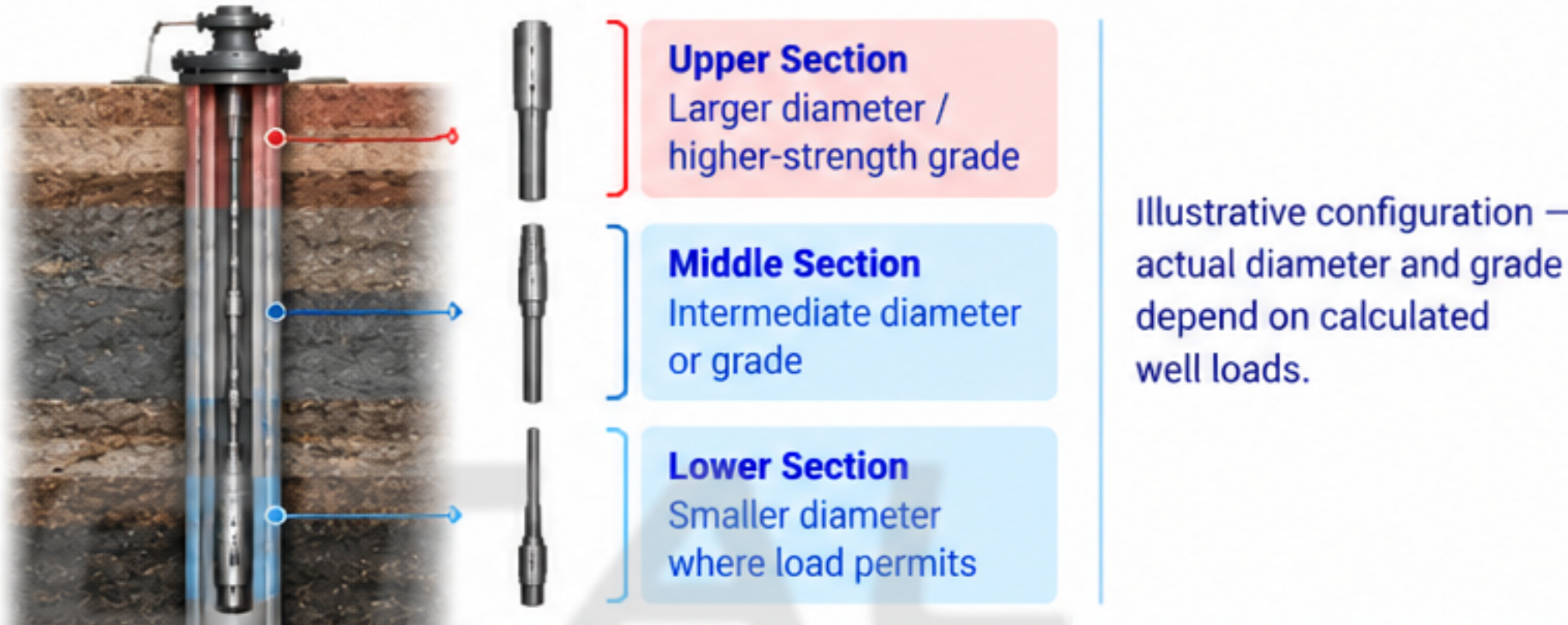
Rod grade and diameter should not be finalized until the well, pump, tubing and existing connection data are defined.

Uniform and Tapered Rod String Configuration

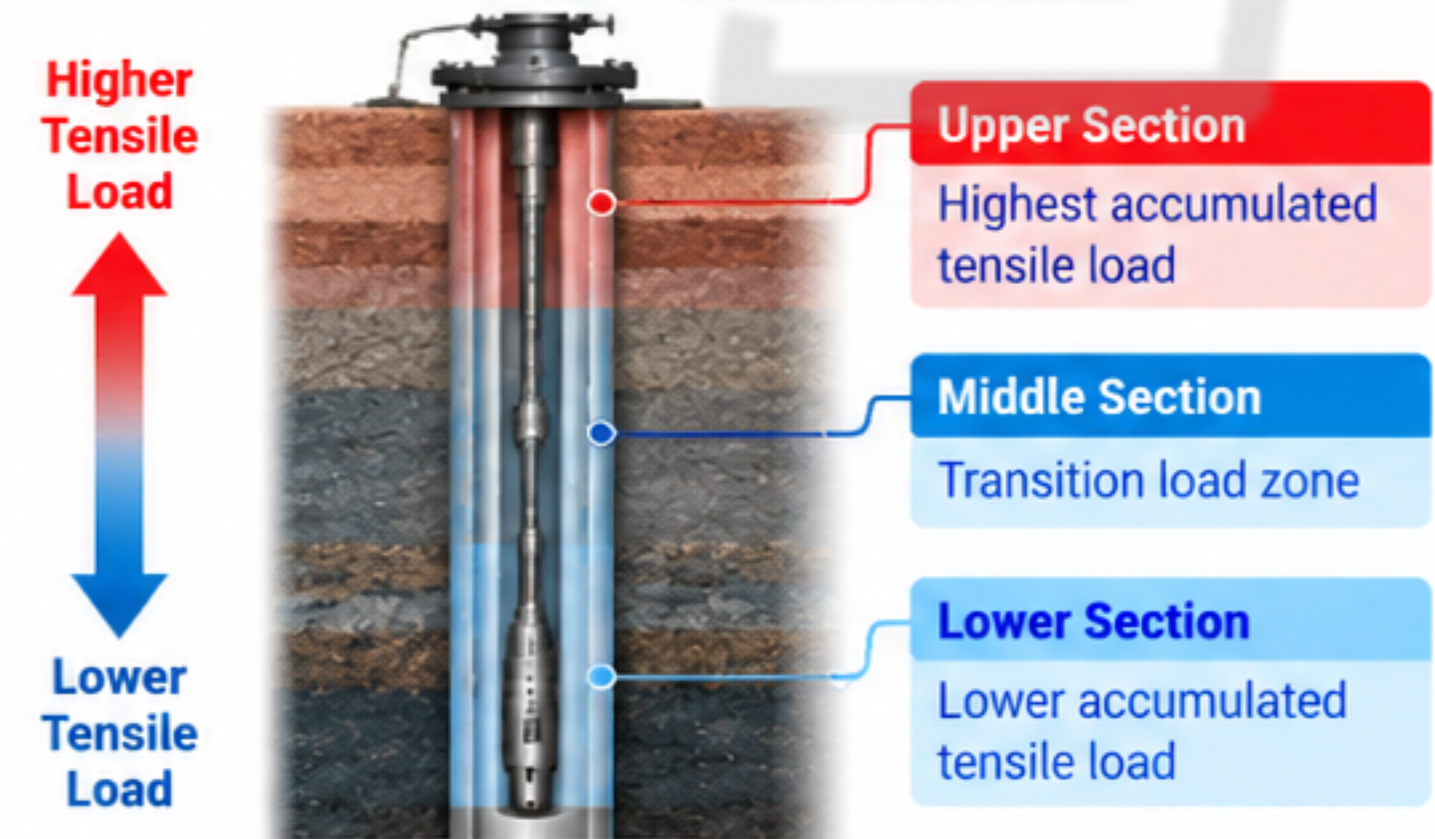
Uniform Rod String



Tapered Rod String



Load Distribution



Configuration Comparison

Design Factor	Uniform String	Tapered String
Rod diameter	Same throughout the string	Changes by string section
Rod grade	Normally consistent	May vary with sectional load
Rod-string weight	Depends on selected uniform size	Can be reduced in lower-load sections
Load matching	One specification covers all zones	Rod size/grade matched to sectional demand
Tubing clearance	Based on one maximum rod/coupling envelope	Checked at each diameter transition
Engineering use	Simpler load profile	Useful where load varies significantly with depth



A tapered rod string allows rod diameter and strength grade to follow the actual load distribution instead of applying the same specification to every section.

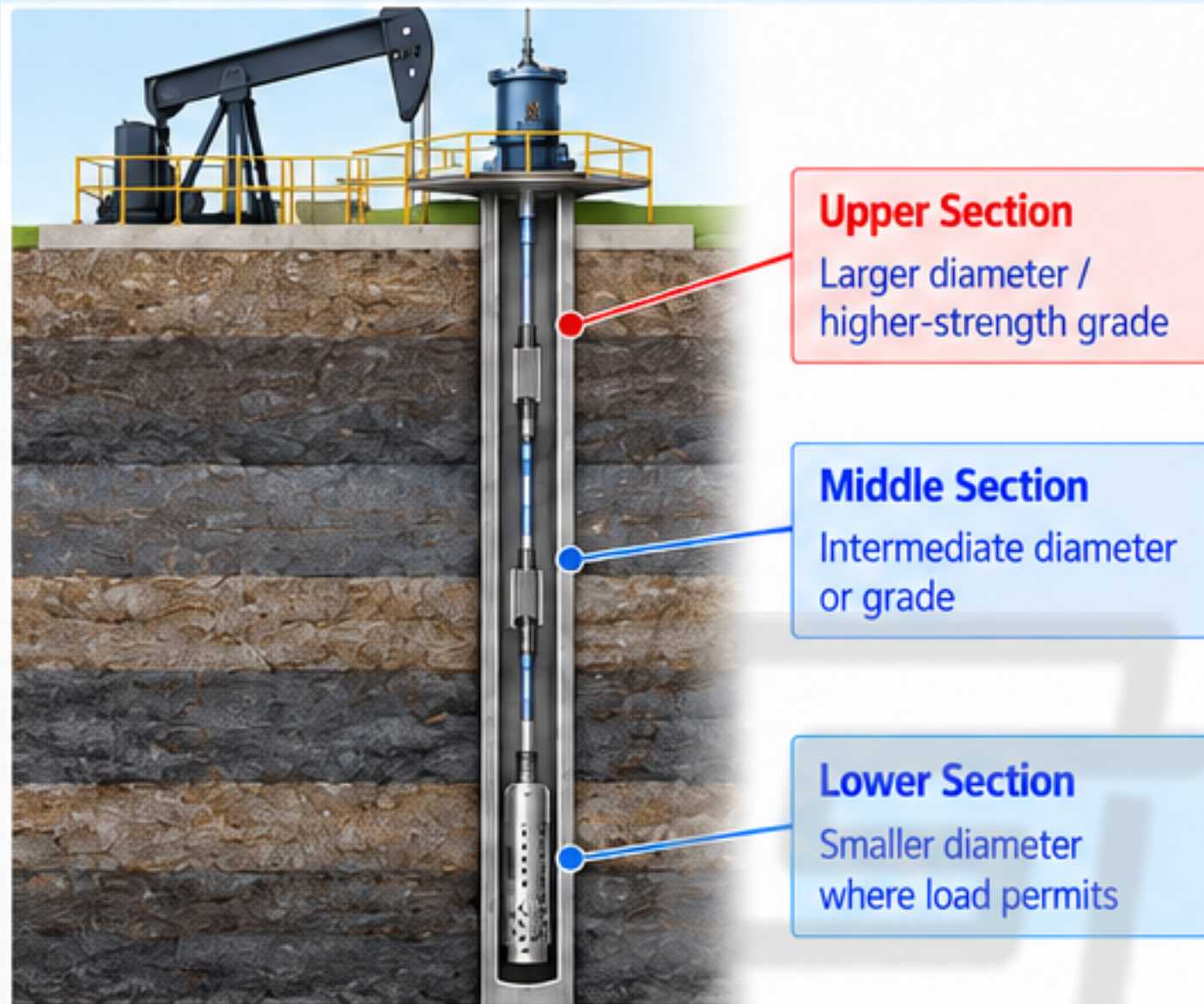
Rod Grade and Diameter Allocation by String Position

Matching Rod Size and Grade to Actual Load Conditions for a Reliable and Efficient Rod String

04 / 06

Sucker Rod Selection Guide

Complete Rod String – Three-Section Configuration



Rod Section Details



Upper Section

- Larger diameter
- Higher-strength grade
- Withstands highest tensile load



Middle Section

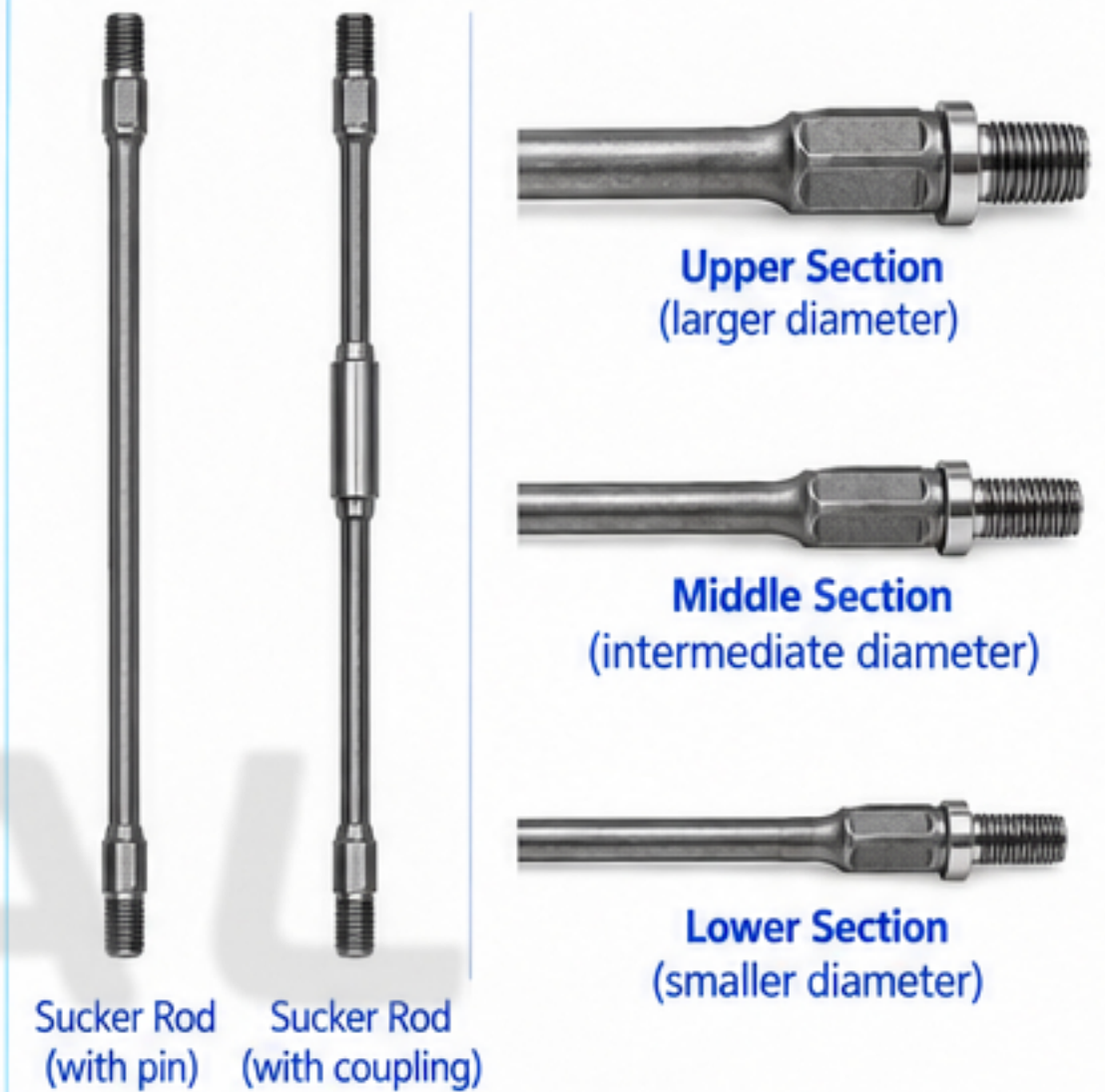
- Intermediate diameter
- Grade adjusted to load
- Transition between rod sizes



Lower Section

- Smaller diameter
- Lower load condition
- Selected based on pump and tubing clearance

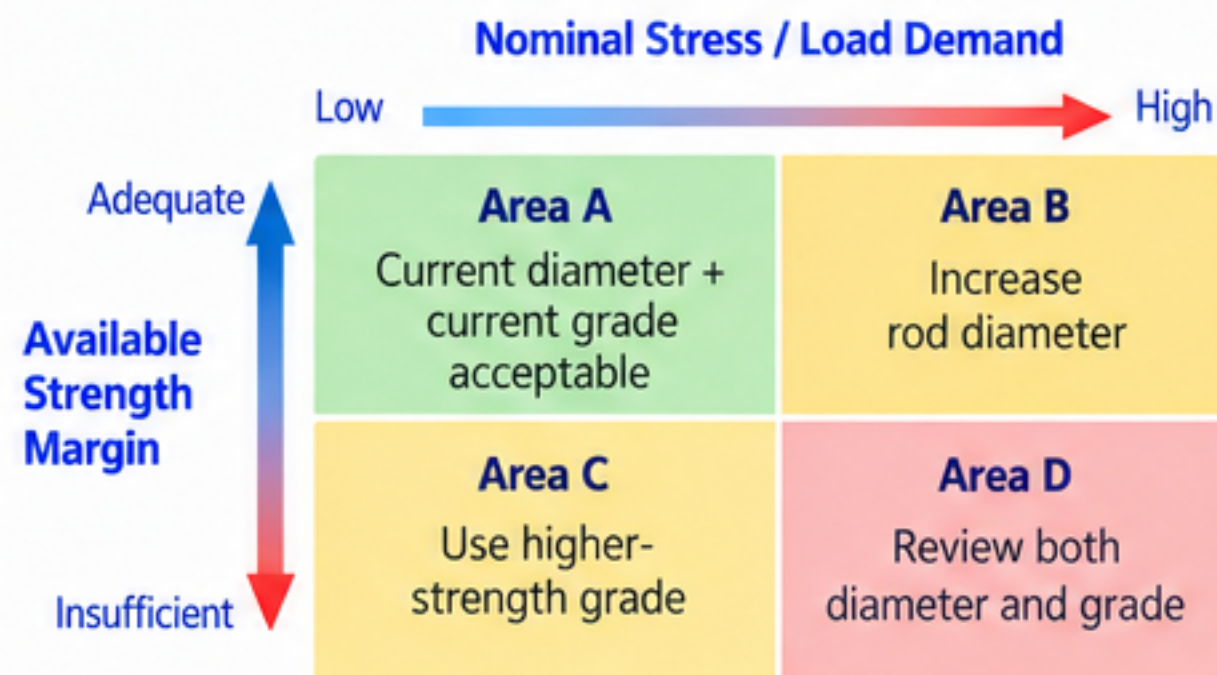
Typical Rod String Components



Key Checks by Section

Section	Main Check Items	Typical Response
Upper Section	• Maximum tensile demand • Rod-string weight below • Connection capacity	Larger diameter, higher-strength grade, or both may be required.
Middle Section	• Sectional load • Transition between rod sizes • Coupling compatibility	Balance rod capacity with total string weight.
Lower Section	• Pump-end motion • Required connection • Tubing clearance	Smaller rod sizes may be possible where calculated load permits.

Diameter and Grade Decision Matrix

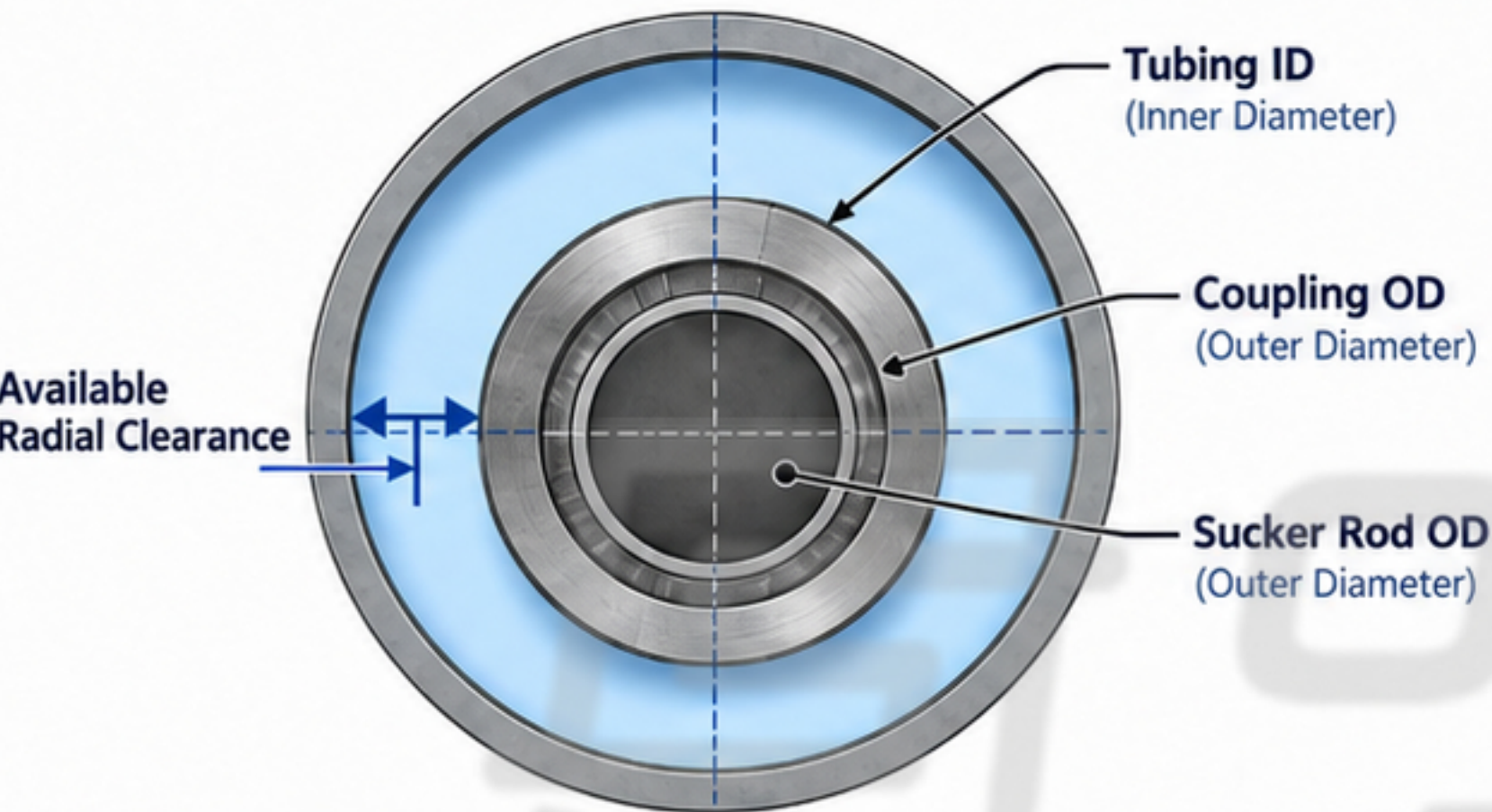


Key Takeaways

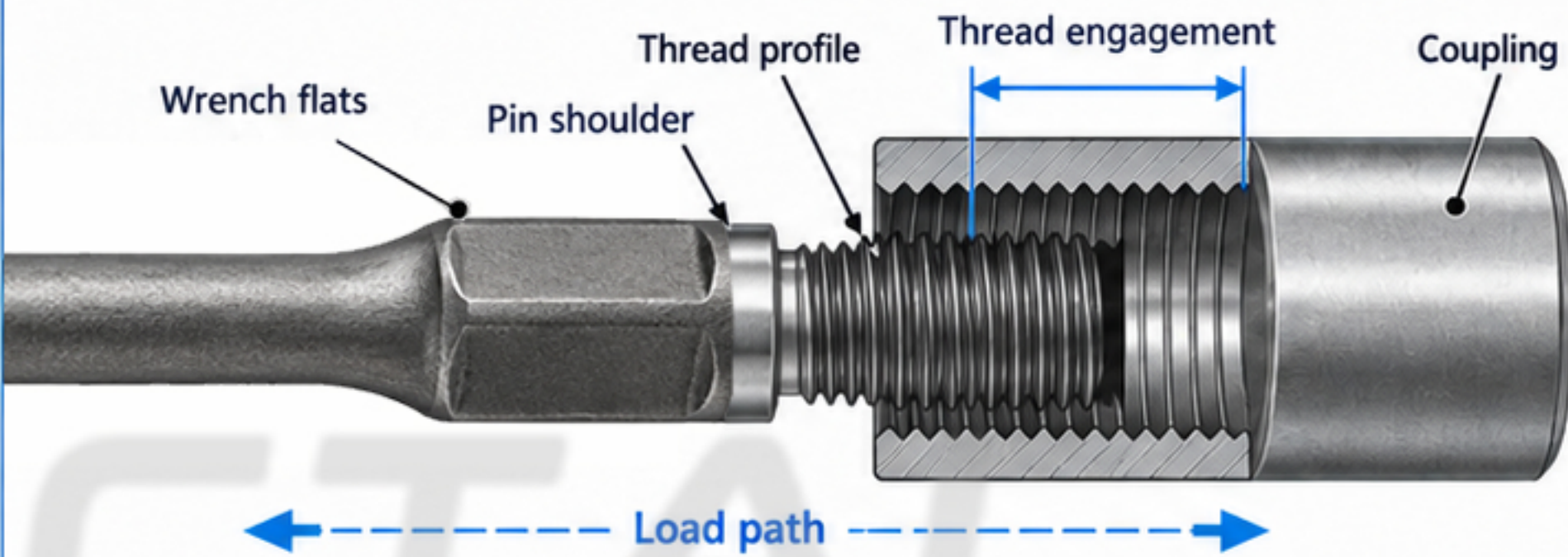
- 1 Upper / Middle / Lower sections should be considered separately when configuring the rod string.
 - 2 Check diameter and grade together based on actual load demand and available strength margin.
 - 3 A tapered rod string allows rod diameter and grade to follow the actual load distribution instead of applying the same specification to every section.
- ✓ **Diameter controls the stress created by a given load, while grade determines the strength margin available to carry that stress.**

Tubing Clearance and Connection Compatibility

Tubing Clearance Cross-Section



Connection Matching



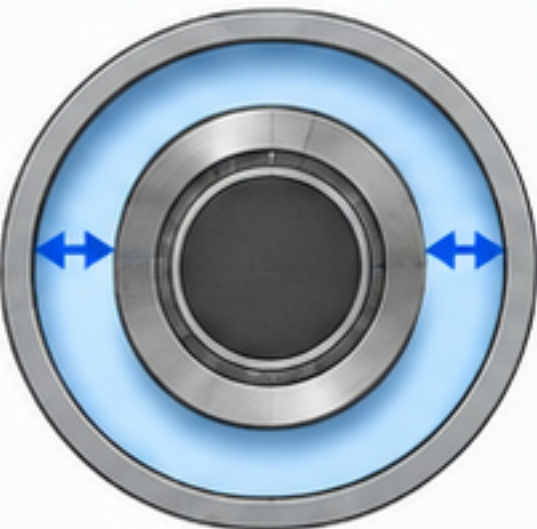
Compatibility Verification

Check Item	What Must Be Confirmed
Rod nominal diameter	Matches required rod-string section
Coupling OD	Fits available tubing clearance
Thread type	Rod pin and coupling connection are compatible
Connection capacity	Suitable for the load carried by the rod section
Rod-end geometry	Matches specified connection configuration
Grade transition	Adjacent rod sections and couplings remain compatible



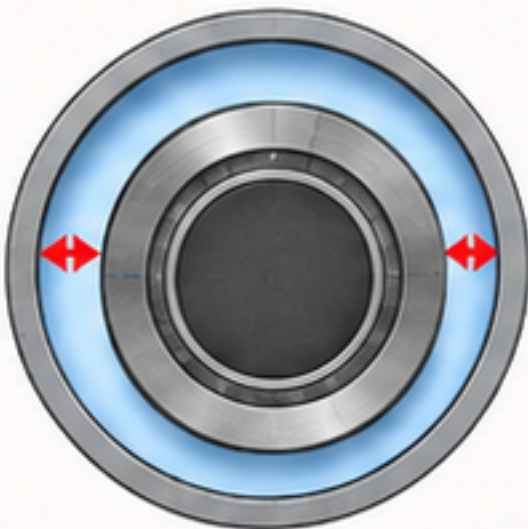
Important
Increasing rod diameter or coupling size may improve mechanical capacity but can reduce available tubing clearance.

Adequate Clearance



Coupling centered, sufficient annular space

Limited Clearance



Coupling envelope approaches tubing wall

Rod selection is not complete until rod diameter, coupling envelope, thread connection and tubing clearance are verified together.

Final Rod String Configuration Review

From Well Conditions to a Complete, Verified Rod String

1. Selection Workflow

- 01

Define Well Conditions
Well depth, tubing, pump and service environment.
- 02

Establish Load Distribution
Identify upper, middle and lower sectional demand.
- 03

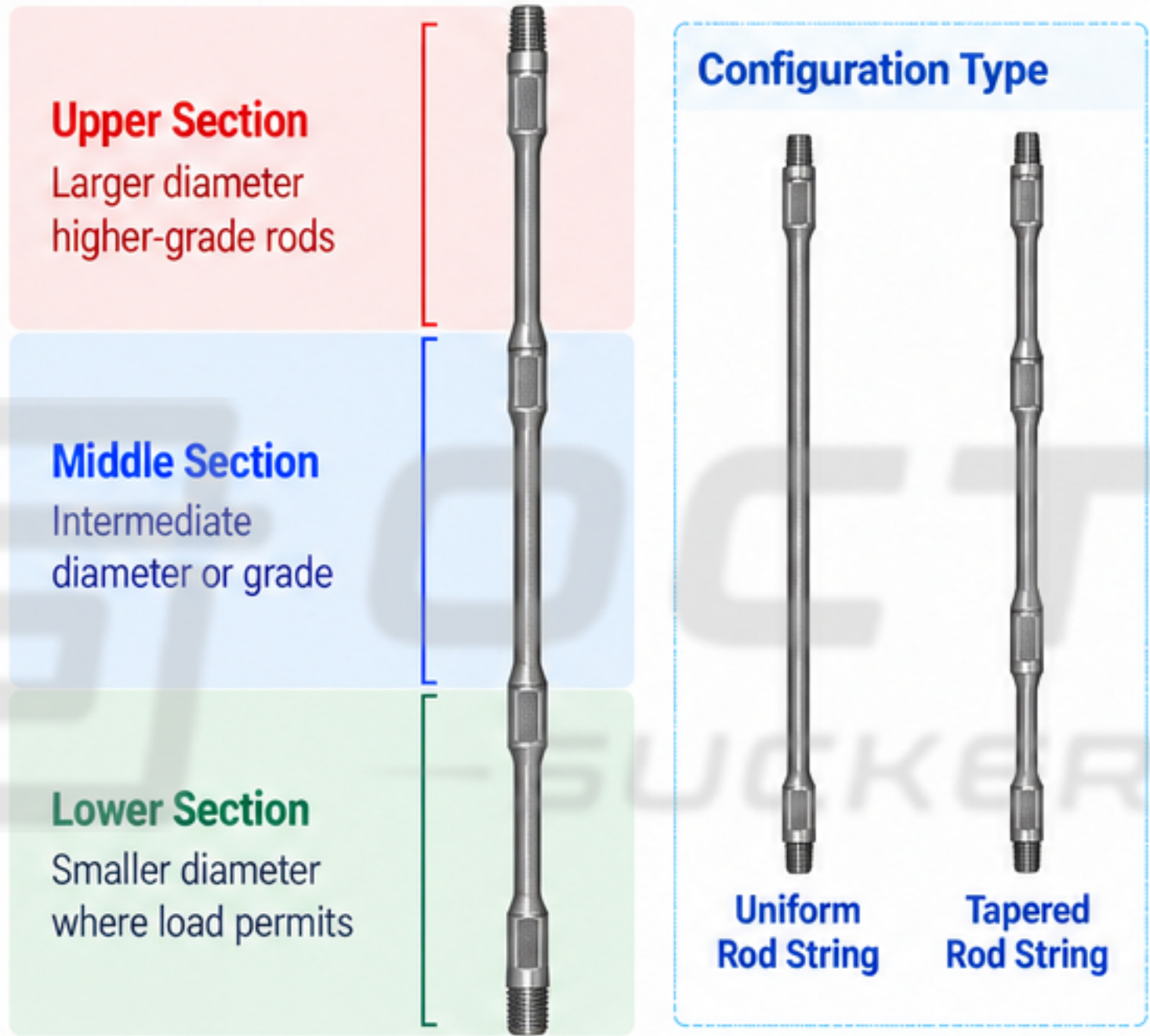
Select Rod Diameter
Match cross-sectional area to load demand and clearance.
- 04

Select Rod Grade
Provide required mechanical margin.
- 05

Configure Rod String
Uniform or tapered layout.
- 06

Verify Connections
Confirm coupling compatibility and tubing clearance.

2. Final Rod String Configuration (Example)



3. Engineering Data for Final Specification

Configuration Item	Information to Confirm
Well depth	Design / operating depth
Rod string layout	Uniform or tapered
Rod diameter by section	Upper / middle / lower section sizes
Rod grade by section	Required grade for each load zone
Rod length	25 ft, 30 ft or specified combination
Connection type	Thread specification and rod-end configuration
Coupling	Type, OD and grade
Tubing	ID and available clearance
Pump data	Pump size and expected operating load
Service environment	Fluid, corrosion and wear conditions

4. Key Engineering Decisions

- Increase Diameter When**
Calculated stress is too high and tubing clearance permits.
- Use Higher Grade When**
The current diameter is suitable but strength margin is insufficient.
- Use Tapered Configuration When**
Load demand changes significantly along the rod string.

5. Final Takeaway

- A complete high strength sucker rod configuration should define not only the rod grade, but also the diameter, string position, connection, coupling and tubing compatibility for each section of the well.