API 5DP Drill Pipe Grade Selection Guide

A technical summary for comparing E75, X95, G105 and S135 drill pipe grades by strength range, drilling condition, fatigue exposure, connection demand and field performance limits.

1. Grade Comparison Table

Grade	Minimum Yield Strength	Maximum Yield Strength	Minimum Tensile Strength	General Application Meaning
E75	75,000 psi / 517 MPa	105,000 psi / 724 MPa	100,000 psi / 689 MPa	Conventional vertical wells, moderate hook load, controlled well profile and lower fatigue exposure.
X95	95,000 psi / 655 MPa	125,000 psi / 862 MPa	105,000 psi / 724 MPa	Transition grade when E75 margin becomes narrow in deeper or moderately directional drilling.
G105	105,000 psi / 724 MPa	135,000 psi / 931 MPa	115,000 psi / 793 MPa	Common high-strength grade for deeper wells, higher working load and directional drilling with fatigue control.
S135	135,000 psi / 931 MPa	165,000 psi / 1138 MPa	145,000 psi / 1000 MPa	High-strength grade for high-tension, high-torque, extended-reach and complex well profiles.

Mechanical strength increases from E75 to S135, but grade comparison is only the first layer of evaluation. Drill pipe in service works under combined tension, torque, internal pressure and bending. In directional or horizontal intervals, repeated bending cycles can become as important as static tensile strength.

2. Why a Higher Grade Is Not Always Better

• Higher yield strength improves tensile margin, not total drill string reliability. Fatigue can still start at the upset transition, weld zone, slip area, tool joint shoulder or thread root.

• Connection capacity can become the limiting point. A stronger pipe body does not compensate for an unsuitable rotary shouldered connection or worn shoulder face.

• Severe dogleg and repeated bending may control service life. In high-cycle zones, fatigue exposure can override a simple grade-strength comparison.

• High-strength grades need tighter verification. Hardness, weld-zone condition, NDT results, thread quality and handling marks become more important as load level increases.

3. Selection Factors

Selection Factor	Technical Meaning
Well depth and hook load	Greater suspended string weight may require X95, G105 or S135 instead of E75.
Torque demand	High rotary torque requires pipe body grade and connection capacity to be evaluated together.
Well profile	Directional and horizontal wells increase drag, bending stress and fatigue exposure.
Dogleg severity	Severe doglegs can shorten fatigue life even when yield strength appears adequate.
Connection type	NC, IF, FH or other rotary shouldered connections must match the operating torque window.
Tool joint condition	Shoulder wear, thread damage, hardbanding condition and handling marks can become failure initiation points.
Drilling environment	H2S, CO2, chloride, temperature and mud chemistry can change material and inspection requirements.
Inspection level	NDT, hardness control, thread inspection and traceability should align with service severity.

4. Well Condition and Grade Range

Drilling Condition	Typical Grade Range	Engineering Meaning
Conventional vertical wells with moderate hook load	**E75 / X95**	Suitable where torque, drag and bending exposure remain controlled and the drill string does not approach a high-load envelope.
Deeper vertical wells or moderate directional wells	**X95 / G105**	Used where suspended weight, mud weight, circulation pressure or directional load demand exceeds conventional service.
Directional wells with build-and-hold sections	**G105**	Often suitable when axial tension, torque and fatigue exposure increase but the well has not reached extreme extended-reach conditions.
Long horizontal or extended-reach sections	**G105 / S135**	Reviewed where torque, drag, axial load and repeated bending act together over a long interval.
High-torque, high-hook-load or complex profiles	**S135**	Applied when tensile and torsional margin become critical and connection / fatigue control is strict.

5. S135 Selection Notes

S135 drill pipe has the highest strength window among the common E75, X95, G105 and S135 group, with a minimum yield strength of 135,000 psi / 931 MPa and a minimum tensile strength of 145,000 psi / 1000 MPa. It is often associated with high-tension, high-torque and complex well profiles, but it still requires full drill-string evaluation.

S135 Review Point	Technical Focus
Deep and ultra-deep wells	High suspended string weight increases tensile demand and overpull exposure.
Long horizontal sections	Torque, drag and axial load increase along the wellbore; fatigue exposure also rises.
Extended-reach drilling	The pipe body works under combined tension, torsion and repeated bending.
Severe dogleg or build-and-hold intervals	Bending cycles can concentrate stress near the upset transition and tool joint shoulder.
High-torque rotary drilling	Pipe body strength and connection capacity must be considered as one system.
Hardness and weld-zone control	API 5DP Addendum 1 includes a 37 HRC limit for Grades E, X, G and S under the stated weld-zone hardness provisions.

6. Quick Grade Selection Summary

Grade	Most Typical Technical Use	Main Caution
E75	Moderate-load vertical drilling and controlled well profiles.	May have limited margin when hook load, torque or fatigue exposure increases.
X95	A transition grade for deeper or moderately directional drilling.	Still needs combined-load evaluation and connection review.
G105	A balanced high-strength option for deeper wells and directional sections.	Fatigue around upset area, slip area and tool joint shoulder remains important.
S135	High-tension, high-torque, extended-reach or complex profiles.	Not automatically the safest grade; stricter fatigue, connection and inspection control is needed.

Technical basis: API 5DP defines steel drill pipe with upset pipe-body ends and weld-on tool joints for PSL-1, PSL-2 and PSL-3. Grade values shown are common API 5DP / ISO 11961 drill-pipe-body mechanical property values. Final engineering use should follow the applicable standard edition and confirmed well design basis.