API 5DP Drill Pipe Grade Chart: E75, X95, G105 and S135

Technical comparison of common API 5DP drill-pipe-body grades by yield strength, tensile strength, application meaning and grade selection logic.

Standard focus	Grades covered	Selection principle
API 5DP / ISO 11961 drill-pipe-body grade values	E75, X95, G105, S135	Strength should be read together with torque, fatigue exposure, well profile and connection condition

1. Grade Comparison Table

The main mechanical difference between E75, X95, G105 and S135 drill pipe is the specified yield and tensile strength of the drill pipe body. These values are the core data points used when comparing API 5DP drill pipe grades.

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 drilling, 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 strength margin is limited but extreme high-strength performance is not required.
G105	105,000 psi / 724 MPa	135,000 psi / 931 MPa	115,000 psi / 793 MPa	Common high-strength option for deeper wells, higher tensile load and directional sections with controlled fatigue management.
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.

Strength reading: E75 begins at 75 ksi yield strength, X95 at 95 ksi, G105 at 105 ksi and S135 at 135 ksi. The higher number increases pipe-body tensile margin, but field suitability still depends on the whole drill string system, not the pipe body alone.

2. Strength Ladder and Grade Meaning

The strength ladder is useful because it shows how much the minimum yield level changes from one grade to the next, while the engineering meaning explains what that increase usually changes in field review.

Grade Step	Strength Change	Engineering Meaning
E75 → X95	+20 ksi minimum yield / +138 MPa	Used when baseline E75 load margin becomes limited, but the operating condition still remains below G105 demand.
X95 → G105	+10 ksi minimum yield / +69 MPa	A smaller numerical step, but often important for deeper or directional drilling where combined torque, tension and bending increase.
G105 → S135	+30 ksi minimum yield / +207 MPa	A major strength jump. This step needs closer review of tool joint matching, fatigue-sensitive zones, connection torque and service environment.

3. Grade Meaning and Typical Review Boundary

API 5DP Grade	Grade Meaning	Typical Review Condition	Main Control Point
E75	Baseline grade for moderate tensile load and normal rotary torque.	Conventional vertical wells or moderately directional sections with controlled load path.	Hook load, OD / wall thickness, connection match and basic inspection records.
X95	Intermediate grade between E75 and G105.	Medium-depth wells and controlled directional sections where E75 margin is limited.	Tensile margin, torque demand, bending load and connection compatibility.
G105	Higher-strength grade for deeper or directional drilling.	Deeper wells, controlled horizontal sections and higher combined torque / tension.	Torque-drag, dogleg severity, cyclic bending, tool joint strength and traceability records.
S135	Common high-strength API grade for high load conditions.	Deep wells, long horizontal sections, ERD or high-torque drilling.	Fatigue exposure, connection torque, shoulder contact, tool joint matching and hardness / toughness review.

4. Grade-to-Grade Selection Triggers

The comparison below is not a fixed rule table. It summarizes the typical point where the review usually stays within the current grade, and the point where the next grade level needs to be checked.

Current Grade Review	Keep This Grade When…	Move to the Next Review Step When…
E75	Vertical or moderately directional drilling remains controlled by moderate tensile load and normal torque.	Tensile margin becomes limited, directional load increases, or torque demand starts to exceed E75 comfort range.
X95	E75 margin is limited but the well profile still does not require the higher G105 window.	Medium-depth or directional drilling creates higher tension, torque or bending load than X95 can comfortably support.
G105	Higher strength is needed while fatigue, connection and service-environment risks remain controlled.	High hook load, long horizontal rotation or bending fatigue approaches the G105 margin.
S135	The load case needs a high-strength API grade and the connection / fatigue review supports the selection.	Sour service, low-temperature toughness, severe fatigue or special connection control moves beyond normal API grade review.

5. Selection Notes by Load and Failure-Sensitive Area

Grade selection should separate the load level from the area that is most likely to limit drill string performance. A stronger pipe body does not remove the need to check the connection, shoulder, tool joint bore or upset transition.

Review Area	What to Check	Why It Affects Grade Selection	Grades Where Review Becomes More Critical
Tensile load	Hook load, string weight, overpull margin, planned well depth.	Defines whether E75 / X95 has enough margin or whether G105 / S135 needs review.	All grades; especially G105 / S135 in deeper wells.
Torque transfer	Make-up torque, rotary torque, connection rating, shoulder contact.	Connection or shoulder performance can limit the string before pipe body strength is reached.	G105 / S135; high-torque sections.
Cyclic bending	Dogleg severity, rotation time, lateral length, bend cycle exposure.	Fatigue damage often concentrates near the upset transition, thread shoulder or tool joint area.	G105 / S135; long horizontal and ERD wells.
Internal clearance	OD / wall thickness, upset type, tool joint ID, drift path.	A grade with enough strength can still be unsuitable if tool passage or hydraulic clearance is restricted.	All grades; smaller OD sizes need closer review.
Service environment	H2S exposure, low temperature, cracking risk, project-specific qualification.	When environment controls the decision, hardness, toughness and material route become more important than grade number alone.	S135 and special material route review.

6. Unit Reference and Calculated Ratios

Reference	Value / Method	Use in This PDF
1 ksi	6.895 MPa approx.	Used for ksi-to-MPa conversion. MPa values are rounded to whole numbers.
Yield window	Maximum yield - minimum yield	All four grades shown have a 30 ksi yield window.
Minimum tensile / minimum yield ratio	Minimum tensile strength divided by minimum yield strength	A calculated comparison indicator, not a separate API acceptance parameter.

Grade	Min Tensile / Min Yield Ratio	Interpretation
E75	100 / 75 = 1.33	Largest separation between minimum tensile and minimum yield in this group.
X95	105 / 95 = 1.11	Intermediate grade with smaller tensile-to-yield separation.
G105	115 / 105 = 1.10	Higher-strength grade; selection should include torque, fatigue and connection review.
S135	145 / 135 = 1.07	High-strength grade; toughness, hardness and connection-side review become more important.

7. Quick Review Sheet

Grade	Core Strength Data	Typical Role	Key Caution
E75	75–105 ksi yield window; 100 ksi min tensile.	Baseline grade for moderate drilling load.	Do not use when tensile margin, directional load or torque demand moves beyond the controlled range.
X95	95–125 ksi yield window; 105 ksi min tensile.	Intermediate step between E75 and G105.	Does not solve fatigue or connection limitation if the controlling factor is not pipe-body strength.
G105	105–135 ksi yield window; 115 ksi min tensile.	Higher-strength grade for deeper / directional conditions.	Needs review of torque-drag, dogleg severity, tool joint strength and traceability records.
S135	135–165 ksi yield window; 145 ksi min tensile.	Common high-strength API grade for high-load wells.	Higher strength requires closer review of fatigue, shoulder contact, hardness, toughness and service environment.

8. Record-Based Verification Checklist

Grade strength values become useful only when they are tied to the delivered drill pipe. The records below help connect grade, heat, test data and final release.

Record Item	What It Confirms
Pipe marking	Grade, size, connection and product identity.
Heat number + MTC	Chemical analysis and mechanical-test traceability for the production heat.
Tensile test	Yield strength, tensile strength and elongation for the grade basis.
Charpy / hardness where required	Toughness, hardness and cracking-risk review where required by grade, PSL, service condition or project specification.
NDT + dimensional inspection	Pipe body, weld zone, OD / wall thickness, straightness, upset area and dimensional acceptance.
Tool joint / thread inspection	Connection dimensions, shoulder contact, thread condition and torque-transfer basis.

Traceability chain: Pipe marking -> Heat number -> MTC -> Tensile test -> Charpy / hardness where required -> NDT -> Dimensional inspection -> Tool joint / thread inspection -> Final release record.

Reference basis: publicly available API 5DP grade mechanical values widely reflected in technical summaries for E75, X95, G105 and S135. Final use should be checked against the applicable API 5DP edition, project specification and certified MTC.