

# G105 vs S135 Drill Pipe Selection Review

This review expands the grade comparison beyond strength numbers alone. Many competing articles stop at yield strength, while the real selection boundary between G105 and S135 is shaped by tensile load, well profile, torque, fatigue exposure, service condition and documentation.

<b>Standard focus</b> API 5DP / ISO 11961 drill-pipe-body mechanical values	<b>Grades covered</b> G105 and S135	<b>Review logic</b> Strength data should be read together with load path, connection-side review and record-based verification
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## 1. Core Mechanical Difference

G105 and S135 are both high-strength API drill pipe grades, but they do not occupy the same operating window. S135 adds a 30 ksi / 207 MPa increase in minimum yield strength and a 30 ksi / 207 MPa increase in minimum tensile strength over G105, which is why it appears more often in higher-load and more demanding well profiles.

Grade	Minimum Yield Strength	Maximum Yield Strength	Minimum Tensile Strength	Yield Window	Strength Position
<b>G105</b>	105,000 psi / 724 MPa	135,000 psi / 931 MPa	115,000 psi / 793 MPa	30 ksi / 207 MPa	Higher-strength API grade for deeper or directional drilling.
<b>S135</b>	135,000 psi / 931 MPa	165,000 psi / 1138 MPa	145,000 psi / 1000 MPa	30 ksi / 207 MPa	Higher-strength API grade used when load, torque or fatigue demand moves beyond G105 margin.
<b>Delta: S135 vs G105</b>	+30 ksi / +207 MPa	+30 ksi / +207 MPa	+30 ksi / +207 MPa	Same 30 ksi window	The difference is not only numerical; it changes the selection boundary for load path, fatigue review and connection control.

Reading note: these are drill-pipe-body grade values. Final grade selection still needs drill string review, especially when the controlling factor shifts from simple tensile capacity to torque transfer, fatigue behavior, service environment or documentation depth.

## 2. Selection Logic Matrix

The table below places the six most important review factors into one selection framework. This is the part often missing from strength-only comparison articles.

Selection Factor	G105 Review Logic	S135 Review Logic	Why It Changes the Choice
<b>Tensile load</b>	Usually reviewed when a higher pipe-body strength window than X95 is required, but the planned string load still stays below the S135 boundary.	Reviewed when hook load, overpull margin or total string load pushes beyond practical G105 margin.	The strength difference matters first in the axial load path.
<b>Well profile</b>	Common for deeper wells, directional drilling and controlled horizontal sections.	More relevant for long horizontal wells, ERD sections, higher drag and more complex combined loading.	Well profile changes the balance between tension, drag, bending and fatigue.
<b>Torque</b>	Suitable where higher torque is needed but connection-side demand remains controlled.	Often reviewed for high-torque sections where pipe body, connection and shoulder contact all need a stronger operating margin.	Higher torque can move the limiting point from the tube body to the connection system.
<b>Fatigue</b>	Used where cyclic bending and rotation exposure remain within a controlled fatigue window.	Reviewed more closely where long rotation time, severe dogleg or transition-zone fatigue becomes a major life driver.	Fatigue can control service life even when tensile strength looks adequate.
<b>Service condition</b>	Appropriate for standard service when H <sub>2</sub> S, low temperature or cracking-risk qualification is not the governing factor.	Not selected by strength alone in sour or low-temperature service; hardness, toughness and qualification evidence become necessary.	Service environment can override a simple strength-based decision.
<b>Documentation</b>	Should be supported by MTC, tensile test, dimensional inspection and NDT.	Usually needs the same base records plus closer attention to hardness, impact test where required, tool joint inspection and traceability depth.	A higher grade without matching records is only a name, not a verified performance level.

### 3. Typical Review Boundary by Operating Condition

G105 and S135 should be separated by the real drilling condition, not by grade hierarchy alone. The comparison below shows where G105 is commonly sufficient and where S135 becomes more relevant.

Operating Condition	Grade Commonly Reviewed First	Why This Grade Fits	What Can Push the Review Higher
<b>Deep vertical well</b>	G105	Higher tensile capacity than X95 while keeping the review inside a normal high-strength API range.	Higher hook load, heavier BHA or reduced tensile margin can push review toward S135.
<b>Directional drilling</b>	G105	Often adequate when combined tension and torque increase but fatigue exposure remains controlled.	More severe dogleg, longer rotation time or higher torque may justify S135 review.
<b>Long horizontal section</b>	G105 / S135 boundary	Both grades may be reviewed because torque-drag and cyclic bending become more important than simple depth.	Longer lateral, higher drag, repeated bending or tighter fatigue margin often shifts selection to S135.
<b>ERD or high-torque program</b>	S135	Higher load and torque margin become more relevant, but connection-side capability must be checked at the same time.	If the connection system or tool joint does not match, a higher pipe-body grade alone does not solve the load case.
<b>Sour service / H2S exposure</b>	Service route review, not grade alone	Hardness, SSC resistance, impact toughness and service qualification become part of the selection basis.	A direct move from G105 to S135 without service review is not a complete engineering decision.
<b>Low-temperature drilling</b>	Grade plus toughness review	Impact performance at the required test temperature becomes part of the acceptance logic.	If the specified Charpy or low-temperature requirement becomes controlling, the grade name alone is not enough.

Selection summary: G105 is commonly the first high-strength review step for deeper or directional drilling. S135 becomes more relevant when the real load path includes higher hook load, long horizontal rotation, stronger torque demand or tighter fatigue margin. Where sour service or low-temperature requirements govern the design, the review must move beyond a G105 vs S135 strength comparison.

## 4. Record and Verification Logic

Documentation is part of the grade-selection decision because it connects the nominal grade to the delivered product. This is especially important when selecting S135 for a higher-load application or when special service conditions require deeper verification.

Record Item	What It Supports in G105 / S135 Review
<b>Pipe marking</b>	Confirms grade, size, connection and product identity.
<b>Heat number + MTC</b>	Links the delivered drill pipe to chemical analysis and certified mechanical-property basis.
<b>Tensile test</b>	Verifies yield strength, tensile strength and elongation against the specified grade.
<b>Charpy impact test where required</b>	Supports toughness review for project-specific or low-temperature requirements.
<b>Hardness record where required</b>	Important where sour service, cracking sensitivity or heat-treatment consistency is part of the review.
<b>NDT report</b>	Supports pipe body, weld zone and defect-control review.
<b>Dimensional inspection</b>	Confirms OD, wall thickness, upset area and dimensional acceptance that affect drill string fit and load path.
<b>Tool joint / thread inspection</b>	Confirms connection dimensions, thread condition and shoulder quality, which often become more important at S135-level loading.

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

Final reading: many articles compare G105 and S135 only by mechanical strength. A more complete selection logic must place tensile load, well profile, torque, fatigue, service condition and documentation into one review chain. That is the practical boundary between a simple grade comparison and a usable drill pipe selection review.

*Reference basis: publicly available API 5DP grade mechanical values and common technical discussions of G105 and S135 use conditions. Final design and acceptance should be checked against the applicable API 5DP edition, project specification and certified manufacturing records.*