API 5DP Drill Pipe vs HWDP vs Drill Collar

Quick Comparison Guide - Function, Standards, Load Path and Inspection Focus

This technical quick guide compares three drill string components by working position, load state, stiffness behavior and inspection focus. It is intended as a reference for understanding why API 5DP drill pipe, heavy weight drill pipe (HWDP) and drill collars are not interchangeable parts in a drill string.

Data Point	API 5DP Drill Pipe	HWDP	Drill Collar
Standard boundary	API 5DP - steel drill pipe with upset pipe-body ends and welded-on tool joints; PSL-1 / PSL-2 / PSL-3 delivery levels.	API 7-1 rotary drill stem element; HWDP used in BHA / transition zone; not the same as heavy-wall API drill pipe.	API 7-1 rotary drill stem element; standard steel, non-magnetic, slick / spiral collars are covered in drill stem element scope.
Typical position	Main length of the drill string above the BHA.	Between regular drill pipe and the drill collar section.	Lower BHA near the bit.
Primary function	Transmit torque, circulate drilling fluid and carry suspended string weight under tension.	Smooth stiffness transition, add intermediate weight and reduce fatigue concentration above collars.	Provide concentrated weight on bit (WOB), stiffness and bit stability.
Main load state	Tension + torsion + cyclic bending; also internal pressure from fluid circulation.	Mixed transition loading: tension / compression overlap, bending, shock load and fatigue control.	Compression-dominant BHA member; high stiffness, bit loading and stabilizing function.
Selection driver	Depth, torque, tensile load, connection capacity, dogleg severity and fatigue exposure.	Transition-zone stress, high deviation, shock / vibration control and collar quantity reduction.	Required WOB, hole size, BHA stiffness, bit stability and anti-deviation requirement.

Load / Design Question	Most Relevant Component	Reason
Need long-string tensile margin and circulation path?	API 5DP Drill Pipe	It forms most of the drill string and carries tensile load while maintaining the fluid bore.
Need to reduce stiffness jump above collars?	HWDP	It acts as a transition member and helps control fatigue concentration.
Need concentrated WOB and bit stability?	Drill Collar	It places heavy, stiff mass near the bit in the BHA.

Practical reading: drill pipe carries the long string; HWDP controls the stiffness step above the collars; drill collar concentrates WOB near the bit. Comparing only by weight misses the main engineering difference.

1. API 5DP Drill Pipe - Grade and Load Data

API 5DP drill pipe is selected by more than grade strength. The hollow pipe body provides the drilling fluid flow path, while tool joints and rotary shouldered connections transmit torque. Tensile load increases with well depth, overpull risk and string length. The table below summarizes common API 5DP pipe body grade data used for quick comparison.

Grade	Min Yield	Max Yield	Min Tensile	Engineering Meaning
E75	75,000 psi / 517 MPa	105,000 psi / 724 MPa	100,000 psi / 689 MPa	Moderate load; more ductility margin than higher-strength grades.
X95	95,000 psi / 655 MPa	125,000 psi / 862 MPa	105,000 psi / 724 MPa	Higher tensile margin for deeper or more demanding string loads.
G105	105,000 psi / 724 MPa	135,000 psi / 931 MPa	115,000 psi / 793 MPa	Common high-strength review grade for directional / deeper wells.
S135	135,000 psi / 931 MPa	165,000 psi / 1138 MPa	145,000 psi / 1000 MPa	High load; connection fatigue and inspection discipline become more sensitive.

API 5DP Drill Pipe Reference Item	Common / Typical Value or Review Point
Common size range	Often 2-3/8 in to 6-5/8 in depending on table / program reference.
Length ranges	R1: 18-22 ft; R2: 27-31 ft; R3: 38-45 ft are widely used length classifications.
Upset types	IU, EU and IEU; affects transition geometry and tool joint compatibility.
Connections	NC / IF / FH / REG families are common; thread design and gauging are handled under rotary shouldered connection requirements.
Not solved by grade alone	Higher yield strength does not remove bore restriction, tool joint wear, connection fatigue or poor transition design.

Drill Pipe Review Point	Why It Affects Comparison
Bore / fluid path	A restricted ID can affect circulation even when grade strength is acceptable.
Connection capacity	Torque limit and shoulder condition may control performance before pipe-body yield strength is reached.
Dogleg severity	Repeated bending can drive fatigue damage in pipe body, upset and tool joint transition areas.

Inspection focus: OD, wall thickness, length, straightness, upset transition, tool joint condition, bore / drift clearance, NDT results, MTC and heat / lot traceability.

2. HWDP and Drill Collar - Function and Dimensional Data

HWDP and drill collars are closer to API 7-1 rotary drill stem element scope. HWDP is used as a transition and fatigue-control component, while drill collars provide WOB and BHA stiffness. The data below separates the two functions to avoid treating them as simple weight grades.

HWDP Data Point	Reference Data / Inspection Meaning
Standard role	Manufacturing specification for HWDP commonly utilized in bottom-hole assemblies; not to be confused with heavy-wall drill pipe made to API drill pipe scope.
Length reference	31 ft +/- 6 in shown in API 7-1 addendum HWDP figure reference.
Tool joint alignment	Max angular misalignment: 0.010 in/in for 4 in tube OD and smaller; 0.008 in/in for larger sizes. Max parallel misalignment: 0.125 in.
Bore / drift control	Welded and integral HWDP bores should be gauged with a drift mandrel at least 10 ft long; diameter should meet specified minimum drift.
Core function	Reduces stiffness jump between flexible drill pipe and rigid drill collars; helps control transition-zone fatigue.

Drill Collar Data Point	Reference Data / Engineering Meaning
Common length range	Often 30-32 ft for Range 2 and 42-43 ft for Range 3 in field references.
Mechanical property example - 4145H modified	For 3-1/8 in thru 6-7/8 in OD: min yield 110,000 psi, min tensile 140,000 psi, min elongation 13%, impact 40 ft-lb, hardness 285-341 HB.
Mechanical property example - larger OD	For 7 in thru 11 in OD: min yield 100,000 psi, min tensile 135,000 psi.
Common types	Slick drill collar, spiral drill collar, non-magnetic drill collar, square drill collar for selected anti-deviation applications.

Component	Key Inspection Focus
HWDP	Center upset, tool joint alignment, bore drift, wear pad / hardbanding, surface defects and traceability.
Drill collar	OD / ID, straightness, bore / drift, connection shoulders, thread gauging, hardness / impact data where required.

3. Quick Selection and Inspection Reference

The following tables are designed for quick technical comparison. Drill collar dimensional examples are manufacturer reference values, not universal design ratings. Final selection should be checked against the current standard, BHA design and project ITP.

Drill Collar OD x ID	Unit Weight	Weight in Air	Typical End Connection
4-3/4 in x 2-1/4 in	46.7 lb/ft	1,447.0 lb	NC38 thru 47
6-1/2 in x 2-13/16 in	91.6 lb/ft	2,839.1 lb	NC46 thru 65
7 in x 2-13/16 in	109.6 lb/ft	3,397.2 lb	NC50 thru 70
8-1/4 in x 2-13/16 in	160.4 lb/ft	4,973.4 lb	6-5/8 Regular
9-1/2 in x 3 in	216.7 lb/ft	6,718.0 lb	7-5/8 Regular

Standard / Reference	Where It Fits	Main Inspection Focus
API 5DP	Drill pipe delivery condition	Pipe body, upset ends, welded-on tool joints, grades, PSL level, MTC/NDT/marking.
API 7-1 / ISO 10424-1	HWDP and drill collars as rotary drill stem elements	Dimensions, alignment, drift, material properties, inspection and marking.
API 7-2	Rotary shouldered connection	Threading, gauging and connection inspection basis.
API RP 7G-2	Used drill stem inspection reference	Used pipe / BHA element inspection and classification; not a manufacturing replacement.

Selection Mistake	Likely Risk	Better Technical Review
Choosing drill pipe only by grade	Tensile margin may improve but connection fatigue or bore restriction may remain.	Review torque, dogleg severity, connection capacity and inspection history.
Treating HWDP as normal drill pipe	Transition fatigue and stiffness jump may be missed.	Review HWDP placement above collars and BHA stiffness balance.
Using excessive collars in high-angle wells	Higher drag, sticking risk and tripping difficulty.	Balance WOB with torque / drag and trajectory requirement.
Mixing API 5DP and API 7-1 scope	Wrong document or inspection basis.	Separate drill pipe, HWDP/drill collar and thread gauging references.

Source notes: API 5DP / API Spec 7-1 / API 7-1 Addendum 1 / API 7-2 / NOV HWDP technical reference / drill collar manufacturer dimension and mechanical-property references. Data shown here is a technical quick guide, not a substitute for current standard purchase, licensed standard review or project-specific engineering calculation.