DRILCO

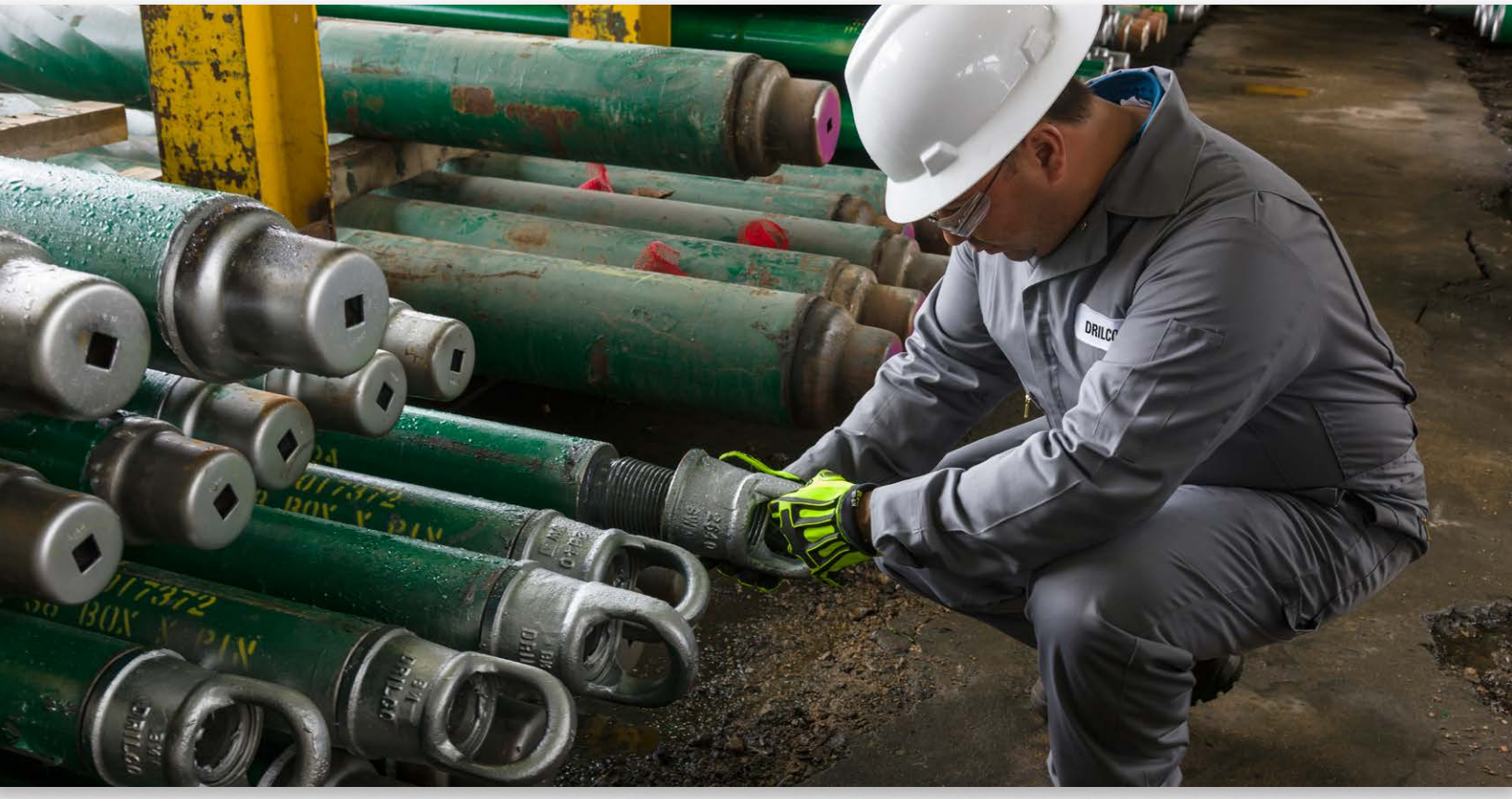
Premium Tubulars

Manufactured in Accordance with API, NS-1™, or Customer Guidelines

60 YEARS

Drill Collars Customized for Trouble-Free BHA Performance

Because drill collars are the most common components of BHAs and the most essential to overall performance, DRILCO manufactures them to specifications more stringent than API requirements. The care that DRILCO takes in materials specification, heat treatment, machining, and inspection is reflected in the performance of every DRILCO drill collar. In addition, DRILCO technical representatives can help in the selection of optimum connections and optional features for trouble-free BHA performance.



Advantages of standard features

- Materials conform to standard industry specifications, including API Specification 7-1, NS-1™, and individual customer specifications, as required.
- Surface finishes are rolled, milled, or machined.
- Critical threaded section has a hardness range of 285 to 341 BHN and a guaranteed Charpy impact value of 40 lbf.ft at room temperature, 1-in below the surface.
- Rotary-shouldered connections are manufactured to API Specification 7-1 or DRILCO premium connection specifications.
- Rigorous quality assurance checks during manufacturing include ultrasonic testing after heat treating.
- Phosphate-coated connections protect from the elements after machining and help prevent galling at initial makeup.
- Cold-rolled thread roots on API and H-90 connections (excluding the 2⅜- and 2⅞-in Reg and Slim-Line H-90) compress the fibers in the thread root and make this area of the connection more fatigue resistant.
- Pressed steel thread protectors are supplied for all drill collars equipped with standard connections.

Advantages of optional features

Slip and elevator recesses, which can be provided together or separately, eliminate lift subs and safety clamps to reduce drill collar handling time. DRILCO takes extreme care to machine smooth radii free of tool marks. Cold rolling the radii at the upper shoulder of each recess extends the fatigue life of the drill collar.

An API stress-relief groove on the pin and an API bore back box are recommended for all downhole tools where fatigue can occur as a result of bending. Unengaged threads are removed in highly stressed areas of the drill collar connection so that bending occurs in areas with smooth surfaces that are free of stress concentrations. Consequently, the connection is less likely to crack because of fatigue.

Note: Stress relief features are not common for connections on drill collar sizes NC 38 and smaller.

When differential sticking is a problem, spiral drill collars reduce the area of contact between the drill collar and the borehole wall.

Drill collar hardbanding is the most effective means of retarding the wear of the collar OD that occurs during normal openhole drilling. Standard hardbanding material consists of granular tungsten carbide that is added to the molten weld puddle to obtain uniform distribution of tungsten carbide particles. The resulting deposit is flush to 1/32 in beyond the collar OD. Hardbanding should not be applied to the box end unless the drill collar has been equipped with a slip recess because hardbanding will cover the normal slip area.

Note: The 4¾-in OD drill collar is the smallest diameter that can be hardbanded.

Drill collar weight, sizing, and stiffness

Drilling weight is the primary application of drill collars. The buoyed weight of a typical drill collar string is approximately 15% more than the maximum weight on bit (WOB) required for optimum bit performance, ensuring that enough drill collars are run in compression to maintain the neutral point within the drill collar string.

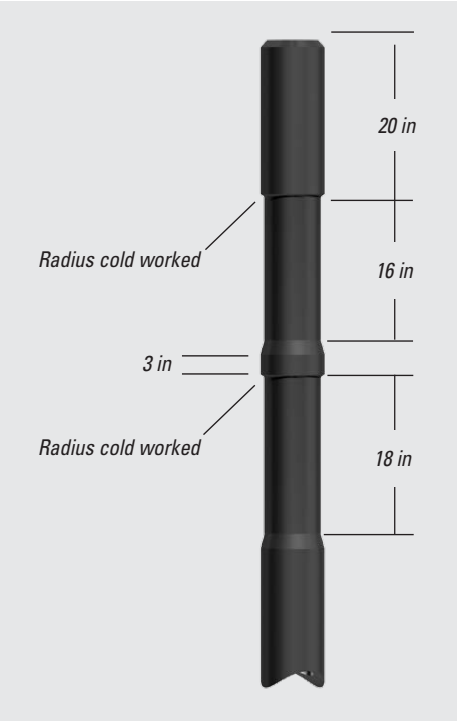
Proper drill collar sizing results in improved borehole integrity to run the desired casing size to bottom. The drill collar limits the lateral movement of the drill bit in the absence of larger diameter drilling tools.

Drill collar stiffness is important for drilling and maintaining a straight wellbore, with the highest impact at the first 90 ft of BHA above the bit where drill collar stiffness should be optimized. Please refer to the *DRILCO Drilling Assembly Handbook* for more information.

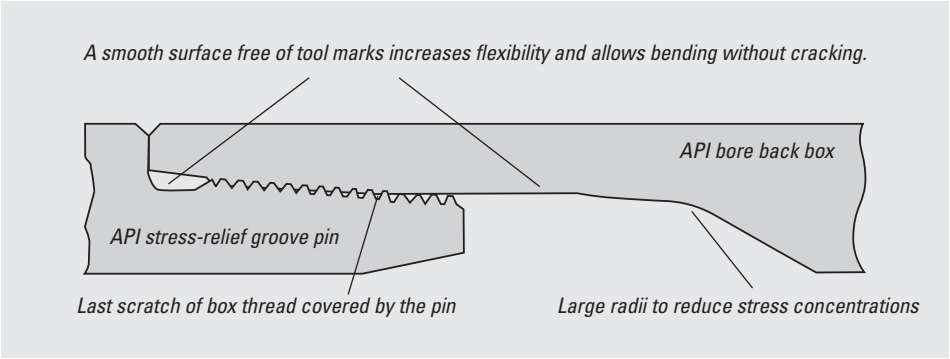
Note: Drill collars are available in both standard and spiral designs.

Standard drill collar.

Spiral drill collar.



Slip- and elevator-recess option. Note: Slip and elevator recesses may be used together or separately.



Stress-relief option.

Drill Collar Specifications

Drill Collar Connection Size and Type, in	Minimum OD, in	Bore, in	Length, ft	Bending Strength Ratio†	Drill Collar Weight, lbm
NC 26 (2⅜ IF)	3½	1½	30	2.42:1	801
NC 31 (2⅞ IF)	4⅛	2	30	2.43:1	1,041
NC 38 (3½ IF)	4¾	2¼	31	1.85:1	1,451
NC 38 (3½ IF)	5	2¼	31	2.38:1	1,652
NC 44	6	2¼	31	2.49:1	2,561
NC 44	6	2 13/16	31	2.84:1	2,353
NC 44	6¼	2¼	31	2.91:1	2,806
NC 46 (4 IF)	6¼	2 13/16	31	2.63:1	2,598
NC 46 (4 IF)	6½	2¼	31	2.76:1	3,085
NC 46 (4 IF)	6½	2 13/16	31	3.05:1	2,877
NC 46 (4 IF)	6¾	2¼	31	3.18:1	3,364
NC 50 (4½ IF)	7	2¼	31	2.54:1	3,643
NC 50 (4½ IF)	7	2 13/16	31	2.73:1	3,434
NC 50 (4½ IF)	7¼	2 13/16	31	3.12:1	3,714
NC 56	8	2 13/16	31	3.02:1	4,675
6⅝ Reg	8	2 13/16	31	2.60:1	4,675
6⅝ Reg	8¼	2 13/16	31	2.93:1	5,016
7⅝ Reg	9½	3	31	2.81:1	6,727
7⅝ Reg‡	9¾	3	31	3.09:1	7,130
8⅝ Reg‡	11	3	30	2.78:1	8,970

† Ratio of box-to-pin section modulus. See API RP7G for explanation.

‡ Low-torque face

Notes: Other sizes and connections are available. Optional features are available upon request. The 4¾-in OD drill collar is the smallest diameter that can be hardbanded. The weight of a round drill collar will be reduced by approximately 4% by spiral conversion.

When ordering, please specify

- drill collar OD
- drill collar bore ID
- drill collar length
- size, type and location of connections (e.g., NC 50 box up × NC 50 pin down)
- cast or pressed steel thread protectors
- hardbanding (see the hardbanding section in this catalog for available options).

Hevi-Wate Transition Drillpipe Designed and Built for Easy Handling

DRILCO Hevi-Wate* transition drillpipe—the industry standard for an intermediate-weight drillstem member—is available in standard, spiral, and nonmagnetic designs for use in a number of applications. Designed and built for easier handling by the rig crew, Hevi-Wate drillpipe uses a unique center upset wear pad or spiral to increase tube life while reducing hole drag and differential sticking problems.

Advantages of standard features

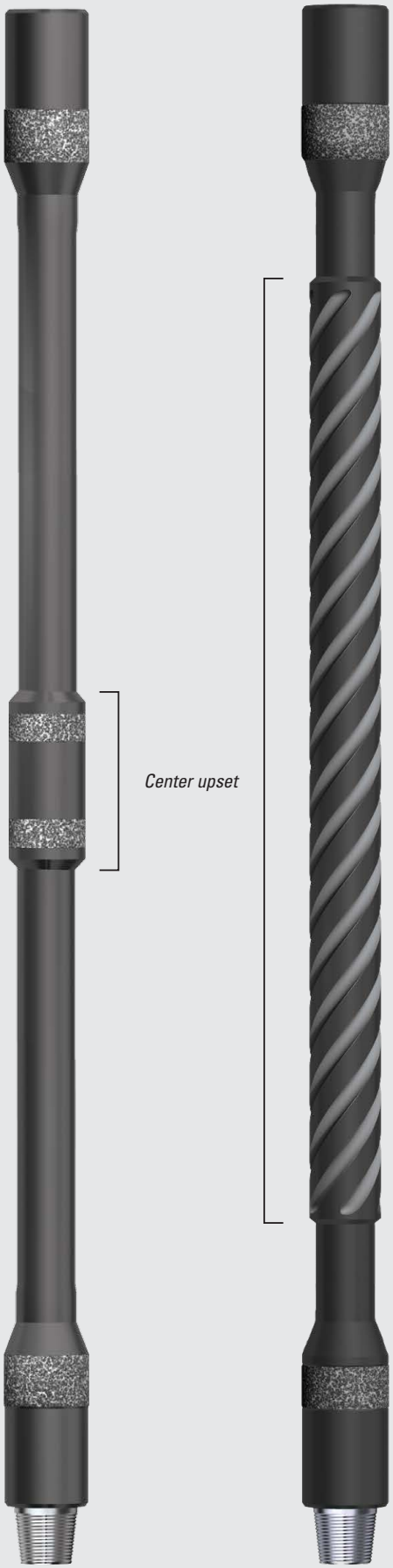
- Materials conform to standard industry specifications, including API Specification 7-1, NS-1™, and individual customer specifications, as required.
- Long tool joints provide ample space to recut connections, reduce OD wear rate, and extend service life.
- Unique center upset or wear pad protect the tube from OD wear and increase its life by keeping it away from the borehole wall, while reducing hole drag and the risk of differential sticking.
- Standard API bore back box for the box connection on 4-in Hevi-Wate drillpipe—and larger—extends the service life of connections.
- Cold-rolling of the thread roots on all connections increases the ability to resist fatigue cracking.
- Drillpipe can be picked up with the drillpipe elevators for fast, efficient handling on the rig floor.

Advantages of optional features

Hardbanding placed on the tool joints and center wear pad increases abrasion resistance and extends service life. An API stress-relief groove can be placed on the pin connections for 4-in joints and larger.

Applications

- Directional drilling
- Vertical drilling
- Transition zone drilling
- Tapered drillstrings
- Remedial operations
- Jar placement
- Hydraulic improvements



Spiral Hevi-Wate transition drillpipe.

Designs for a variety of applications

Hevi-Wate transition drillpipe is designed for use in a variety of applications, providing many benefits for operators.

In extended-reach, horizontal, and conventional directional wells, Hevi-Wate drillpipe can serve as an effective WOB member. It improves directional control because of reduced torque and drag, and the center upset helps reduce the risk of differential sticking.

Hevi-Wate drillpipe can serve as an active WOB member in place of a portion of the drill collar string to reduce torque and shorten trip time when drilling vertical wells. It can also provide part of the anticipated drilling weight when using soft-formation PDC bits. Note that Hevi-Wate drillpipe is not recommended to provide WOB in vertical holes larger than specified in the following table.

Running 18 to 21 joints of Hevi-Wate drillpipe above drill collars reduces the risk of drillpipe fatigue failure in transition zones.

Hevi-Wate drillpipe is recommended for use in the crossover area of a drillstring when the bending strength ratio (ratio of I/C or section modulus) between the drill collars and the drillpipe exceeds 5.5. It provides a gradual transition in stiffness between the drill collars and drillpipe, reducing fatigue damage to the drillpipe. Refer to the table, "Hevi-Wate Transition Drillpipe Bending Strength Ratios," to find the maximum drill collar size that can be run directly below Hevi Wate drillpipe and to the *DRILCO Drilling Assembly Handbook* for additional information.

Hevi-Wate drillpipe provides the weight required in milling, underreaming, and hole-opening operations.

Well-suited for jar placement, Hevi-Wate drillpipe uses a sufficient number of joints below the jar to ensure that the jar is not in the transition zone and that 20% of the recommended jar overpull is above the jar in areas where differential sticking is a problem. Consult a DRILCO representative for additional information and placement recommendations.

Hevi-Wate drillpipe can reduce drillstring pressure losses when it replaces part of the drill collar string in hole sizes ranging from 6 in to 8¾ in and where drill collar bore size is relatively small.

A variety of abrasion-resistant materials are available for standard hardbanding applications, including

- pin—5 in of hard metal applied flush with the OD at the pin end
- box—4 in of hard metal applied flush with the OD and 1 in on the taper at the box end
- center upset—two 3-in bands applied to each end at upset OD.

Nonmagnetic Hevi-Wate transition drillpipe enables isolating MWD tools from the undesirable effects of drillstring magnetic interference. This intermediate-weight drillstring member is manufactured with stringent material specifications to ensure the low magnetic permeability required for nonmagnetic downhole drilling tools. It has corresponding drillpipe dimensions and can be picked up with the drillpipe elevators for fast, efficient handling on the rig floor. Nonmagnetic Hevi-Wate drillpipe is a special-order product that meets specific requirements. Consult your local DRILCO representative for more details.

Hevi-Wate Transition Drillpipe Specifications, Standard and Spiral

Nominal Size, in	Tube					Mechanical Properties Tube Section		Tool joint			
	Nominal Tube Dimensions			Center Upset OD, in	Elevator Upset OD, in	Tensile Yield, lbm	Torsional Yield, ft.lbm	Connection Size and Type	OD, in	ID, in	Tensile Yield, lbm
	ID, in	Wall Thickness, in	Area, in^2								
3½	2¼	0.625	5.645	4	3⅝	310,475	18,460	NC 38 (3½ IF)	4¾	2⅜	675,045
4	2⁹⁄₁₆	0.719	7.410	4½	4⅛	407,550	27,635	NC 40 (4 FH)	5¼	2¹¹⁄₁₆	711,475
4½	2¾	0.875	9.965	5	4⅝	548,075	40,715	NC 46 (4 IF)	6¼	2⅞	1,024,500
5	3	1.000	12.566	5½	5⅛	691,185	56,495	NC 50 (4½ IF)	6⅝	3¹⁄₁₆	1,266,000
5½	3⅜	1.063	14.812	6	5⅝	814,660	74,140	5½ FH	7	3½	1,349,365
6⅝†	4½	1.063	18.567	7⅛	6¾	1,021,185	118,845	6⅝ FH	8	4⅝	1,490,495

†OD size 6⅝-in references API only. The NS-1™ qualification references OD sizes less than 6⅝-in.

Hevi-Wate Transition Drillpipe Specifications, Standard and Spiral (Continued)

Nominal Size, in	Tool Joint			Approximate Overall Length, ft
	Torsional Yield, ft.lbm	Makeup Torque, ft. lbm	Approximate Overall Length of Pin/Box, in	
3½	17,575	10,000	30/27	31
4	23,525	13,300	30/27	31
4½	38,800	21,800	30/27	31
5	51,375	29,200	30/27	31
5½	53,080	32,800	30/27	31
6⅝†	73,215	45,800	30/27	31

†OD size 6⅝-in references API only. The NS-1™ qualification references OD sizes less than 6⅝-in.

Hevi-Wate Transition Drillpipe Bending Strength Ratios

Hevi-Wate Transition Drillpipe Size, in	Maximum Drill Collar Size,‡ in	Bending Strength Ratios
3½	5¾ × 2¼	18.2/3.5 = 5.2 : 1
4	6½ × 2¼	26.5/5.2 = 5.1 : 1
4½	7½ × 2¹³⁄₁₆	36.5/7.7 = 4.7 : 1
5	8¼ × 2¹³⁄₁₆	54.3/10.7 = 5.1 : 1
5½	9 × 2¹³⁄₁₆	70.8/14 = 5.1 : 1
6⅝†	10½ × 3	113/22.4 = 5.0 : 1

†OD size 6⅝-in references API only. The NS-1™ qualification references OD sizes less than 6⅝-in.

‡Indicates the largest size of drill collar that can be run directly below the Hevi-Wate transition drillpipe. If drill collars larger than the maximum size shown above are used, run at least three collars of the maximum size between the large drill collar and the Hevi-Wate transition drillpipe.

Hevi-Wate Transition Drillpipe Weight and Center Upset Specifications

Nominal Size, in	Spiral Hevi-Wate Transition Drillpipe			Standard Hevi-Wate Transition Drillpipe		
	Approximate Weight, Including Tube and Joints, lbm		Center Upset Length, ft	Approximate Weight, Including Tube and Joints, lbm		Center Upset Length, in
	lbm.ft	lbm.Jt 31 ft		lbm.ft	lbm.Jt 31 ft	
3½	27.5	849	18.5	23.4	721	24
4	34.3	1,057	18.5	29.9	920	24
4½	46.5	1,431	18.5	41.1	1,265	24
5	55.4	1,706	18.5	50.1	1,543	24
5½	63.8	1,962	18.5	57.6	1,770	24
6⅝†	77.7	2,389	18.5	71.3	2,193	24

†OD size 6⅝-in references API only. The NS-1™ qualification references OD sizes less than 6⅝-in.

Hevi-Wate Transition Drillpipe Versus Maximum Hole Size

Drillpipe Size, in	Maximum Hole Size, in
3½	7
4	8⅛
4½	9¹⁄₁₆
5	10¹⁄₁₆
5½	11
6⅝†	13½

†OD size 6⅝-in references API only. The NS-1™ qualification references OD sizes less than 6⅝-in.

Premium Tubulars

For more information about DRILCO premium tubulars, visit DRILCO.com.

- For more than 60 years, DRILCO has provided premium tubular products and services to the drilling industry.
- DRILCO also offers specialized services such as field inspection, machine shop, field hardbanding, and other tubular management services to provide expert maintenance for essential BHA tools and equipment.

DRILCO Inspection Services
Qualified DRILCO personnel provide a full range of inspection services, which include third-party and customer-defined standards.

DRILCO Machine Shop Services
For a common tubular connection or a proprietary connection requiring licensing, DRILCO recuts and repairs tubulars, 24/7.

DRILCO Tubular Management Services
DRILCO tubular management services provide tubular inventory visibility, storage location management, and centralized maintenance to reduce repair time.

Fearnley Procter NS-1 FACILITY LEVEL 3

Drilling Tools & Remedial Facility—Schlumberger Technology Corporation and Smith International, Inc., Houston, Texas, 77073.

Services: Assembly of HWDP with weld on tool joints.

Fearnley Procter NS-1 FACILITY LEVEL 5

Drilling Tools & Remedial Facility—Schlumberger Technology Corporation and Smith International, Inc., Houston, Texas, 77073.

Services: Heat Treatment, Machining, Threading, Inspection & Testing of HWDP (integral) and Drill Collars.

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