String Book

LOGAN OIL TOOLS manufactures a complete line of quality fishing tools and related products. Our own full-time engineering staff can custom design and manufacture virtually any type of downhole tool that may be required.

Since 1971, providing quality fishing tools at a fair price has been our primary goal. These decades of solid sales and service experience with fishing tools enables our sales staff to understand what service means to fishing tool operators, supervisors, and store managers. Our manufacturing facility supports our delivery capabilities and is recognized as a leading source of quality products delivered "stock to dock" for many of the largest fishing and rental tool companies throughout the world.

We invite you to visit our 91,000-square-foot sales, engineering, manufacturing, and warehouse facilities located in Houston, Texas. We look forward to the opportunity to establish a long-lasting, mutually beneficial relationship with you and your company. For more information, contact our Sales and Service Department at:

Tel: (281) 219-6613
sales@loganoiltools.com

String Book

KEEP YOUR STRING TOGETHER!

DISCLAIMER

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5M Rev. 1/1106

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LOGAN SERIES 10 SUCKER ROD OVERSHOTS

CALCULATED STRENGTHS

Bowl No.		Max. Catch Size			Load Capacity @ Yield Point (lbs) Catch Size			Max. Make-up Torque 50% of Yield (ft/lbs)	
Logan	Bowen	Spiral	Basket	O.D. (in)	Spiral Grapple	Basket Grapple (in)	Without Stop	Top Sub to Bowl	Bowl to Guide
B2001	17987	1-1/4	1-1/16	1-7/16	16,500	1-1/16 down	11,500	100	95
B20015	16492	1-3/8	1-3/16	1-21/32	39,100	1-3/16 down to, but not including 1"	28,500	235	145
						1" down	18,000		
B2002	13942	1-1/2	1-5/16	1-25/32	39,500	1-5/16 down to, but not including 1"	28,500	315	170
						1" down	18,000		
B2003	9991	1-1/2	1-5/16	1-29/32	83,800	1-5/16 down	38,200	350	235
B2004	9342	1-5/8	1-7/16	1-29/32	39,500	1-7/16 down to, but not including 1"	28,500	375	225
						1" down	18,000		
B2005	9881	1-5/8	1-7/16	2-5/16	138,100	1-7/16 down to, but not including 1"	93,900	1,750	535
						1" down	59,400		
B20051	36425	1-9/16	1-3/8	2-27/32	39,500	1-3/8 down to, but not including 1"	28,500	…	…
						1" down	18,000		
B20052	27767	1-13/16	1-5/8	2-9/64	55,700	1-5/8 down to, but not including 1"	40,100	575	175
						1" down	25,400		

All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume straight, steady pull and full grapple engagement of a round fish. Anything less than full engagement or straight pulling, will reduce the listed strength.

Tong marks or other damage to the bowl surface will also reduce the listed strength.

All torque calculations are theoretical maximum tightening torques for the threaded connection and do not include clamping force. Clamping force is not considered due to the variety of devices used to tighten these connections.

CAUTION: Due to the amount of torque applied to a connection and the type of device used to apply the torque, damage to the bowl, top sub, or guide may occur.

LOGAN SERIES 10 SUCKER ROD OVERSHOTS

CALCULATED STRENGTHS

Bowl No.		Max. Catch Size			Load Capacity @ Yield Point (lbs) Catch Size			Max. Make-up Torque 50% of Yield (ft/lbs)	
Logan	Bowen	Spiral	Basket	O.D. (in)	Spiral Grapple	Basket Grapple (in)	Without Stop	Top Sub to Bowl	Bowl to Guide
B2006	11482	1-13/16	1-5/8	2-5/16	118,100	1.660 down to, but not including 1-1/8"	85,100	1,050	445
						1-1/8" down	53,800		
B2007	16072	1-15/16	1-3/4	2-1/4	55,700	1-3/4 down to, but not including 1-1/8"	40,100	650	335
						1-1/8" down	25,400		
B2008	9402	2	1-13/16	2-5/16	55,700	1-13/16 down to, but not including 1-1/8"	40,100	740	240
						1-1/8" down	25,400		
B2009	9532	2	1-13/16	2-7/8	200,400	1-13/16 down to, but not including 1-1/8"	144,400	3,200	1,050
						1-1/8" down	91,300		
B2010	15861	2-3/8	2-3/16	2-27/32	70,000	2-3/16 down to, but not including 1-1/8"	51,100	1,850	500
						1-1/8" down	37,700		

All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume straight, steady pull and full grapple engagement of a round fish. Anything less than full engagement or straight pulling, will reduce the listed strength.

Tong marks or other damage to the bowl surface will also reduce the listed strength.

All torque calculations are theoretical maximum tightening torques for the threaded connection and do not include clamping force. Clamping force is not considered due to the variety of devices used to tighten these connections.

CAUTION: Due to the amount of torque applied to a connection and the type of device used to apply the torque, damage to the bowl, top sub, or guide may occur.

SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS

CALCULATED STRENGTHS

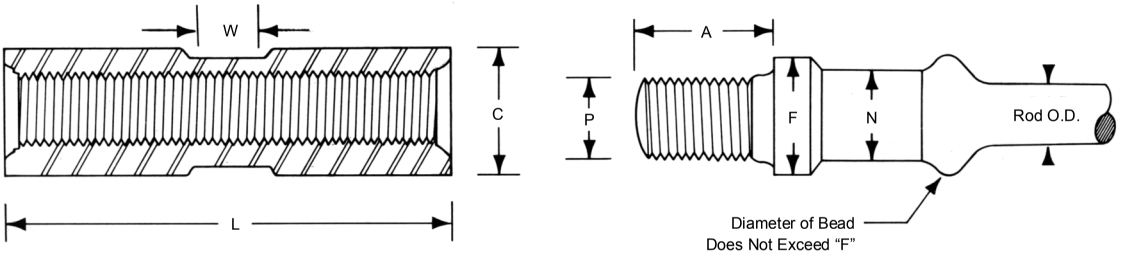
Maximum Catch Size (Basket)		7/8	1	1-1/4	1-3/8	1-1/2	1-3/4	1-13/16
Nominal Overshot O.D. *		1-9/32	1-13/32	1-5/8	1-3/4	1-29/32	2-1/4	2-5/16
Load Capacity @ Yield Point (lbs)		31,500	31,500	42,200	35,100	41,000	50,298	50,400
Bowl	**Logan Part No.**	**B2011**	**B2012**	**B2013**	**B2014**	**B2015**	**B20155**	**B2016**
	Bowen No.	17317	25782	28762	18357	11556	47465	17439
Complete Assembly	**Logan Part No.**	**120-125-D**	**120-138-D**	**120-163-D**	**120-175-D**	**120-191-D**	**120-225-D**	**120-231-D**
	Bowen No.	17315	25780	28760	18355	11555	47464	17438

Maximum Catch Size (Basket)		2-1/8	2-1/8	2-3/8	2-1/2
Nominal Overshot O.D. *		2-25/32	2-7/8	3-1/8	3-1/4
Load Capacity @ Yield Point (lbs)		102,300	101,800	127,000	127,000
Bowl	**Logan Part No.**	**B2017**	**B2018**	**B2019**	**B2020**
	Bowen No.	18307	20171	20647	22272
Complete Assembly	**Logan Part No.**	**120-278-D**	**120-287-A**	**120-313-D**	**120-325-A**
	Bowen No.	18305	20170	20645	22270

Strengths are theoretical yield points that are accurate within 20%.
Strengths assume full grapple engagement of a round fish and a straight, steady pull.
Anything less than full engagement or steady, straight pulling will reduce the listed strength.

** Check the actual tool OD if the tool is to be run through a tight clearance.*

SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS



DIMENSIONS AND CALCULATED STRENGTHS

Rod Size — Inches	1/2	5/8	3/4	7/8	1	1-1/8
A — Pin Length	1	1-1/8	1-3/8	1-3/8	1-3/4	2
C — Full Sized Coupling O.D.	1	1-1/2	1-5/8	1-13/16	2-3/16 or 2 *	2-3/8
F — Shoulder O.D.	1	1-3/8	1-1/2	1-5/8	2	2-1/4
L — Minimum Length	2-3/4	4	4	4	4	4-1/2
N — Wrench Flat	5/8	7/8	1	1	1-5/16	1-1/2
P — Pin O.D.	3/4	15/16	1-1/16	1-3/16	1-3/8	1-9/16
W — Coupling Wrench Flat Width	3/4	1-3/8	1-1/2	1-5/8	1-7/8	2-1/8
Thread	3/4 10 thd	15/16 10 thd	1-1/16 10 thd	1-3/16 10 thd	1-3/8 10 thd	1-9/16 10 thd

** Used when running 1-inch rods in 2-7/8" tubing; 2-3/16" is standard.*

SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS

STRENGTH TABLE

Rod Size — Inches		1/2	5/8	3/4	7/8	1
Rod Area		0.196	0.306	0.442	0.601	0.785
Based On:						
J&L Type 7 with ultimate tensile strength	Yield	16,000	21,400	30,900	42,100	55,000
of 86,000 and yield of 70,000 psi	Ultimate	20,000	26,300	38,000	51,700	67,500
	Torque *	70	140	171	381	570
J&L Type 2 with ultimate tensile strength	Yield	…	19,900	28,700	39,100	51,000
of 100,000 and yield of 65,000 psi	Ultimate	…	30,600	44,200	60,100	78,500
	Torque *	65	130	159	353	530
J&L Type 1 with ultimate tensile strength	Yield	…	20,900	30,300	41,200	53,800
of 100,000 and yield of 65,000 psi	Ultimate	…	30,600	44,200	60,100	78,500
	Torque *	68-1/2	136	168	372	560
J&L Type 12 with ultimate tensile strength	Yield	…	29,400	42,300	57,700	75,300
of 120,000 and yield of 96,000 psi	Ultimate	…	37,700	53,000	72,000	94,200
	Torque *	96	192	235	476	783

** Torque based on rod O.D. @ yield.*

LOGAN SERIES 70 SHORT CATCH OVERSHOTS

CALCULATED STRENGTHS

Maximum Catch Size (Basket)		1-5/8	2-1/2	2-5/8	3-1/16	3-1/16	3-1/16	3-3/8
Overshot O.D.		2-5/16	3-5/8	3-3/4	3-15/16	4-5/8	4-1/8	4-3/8
Complete Assembly	**Logan Part No.**	**170-231-D**	**170-363-D**	**170-375-D**	**170-394-D**	**170-463-A**	**170-413-D**	**170-438-D**
	Bowen No.	38506	17615	13535	63892	11290	10434	C-11023
Bowl	**Logan Part No.**	**C2000**	**C2001**	**C2002**	**C20025**	**C2003**	**C2004**	**C20045**
	Bowen No.	38508	17617	13537	63894	11291	10436	B-11025
Basket Grapple Load Capacity @ Yield Point (lbs):								
Max. Capacity with Stop		…	…	239,800	…	398,100	212,700	…
Min. Capacity Without Stop		85,200	263,600	239,800	224,600	398,100	212,700	250,300
Max. Make-up Torque 50% of Yield (ft/lbs)		600	2,550	2,800	…	…	4,000	4,600

Maximum Catch Size (Basket)		3-21/32	3-21/32	3-3/4	3-3/4	4-1/4	4-3/4	5-1/4
Overshot O.D.		4-11/16	5-5/8	4-3/4	5-1/2	5-3/4	5-7/8	6-1/4
Complete Assembly	**Logan Part No.**	**170-468-D**	**170-563-A**	**170-475-D**	**170-550-A**	**170-575-A**	**170-587-D**	**170-625-D**
	Bowen No.	10543	11297	12645	12785	13065	10560	14805
Bowl	**Logan Part No.**	**C2005**	**C2006**	**C2007**	**C2008**	**C2009**	**C2010**	**C20105**
	Bowen No.	10545	11299	12646	12787	13067	10562	14807
Basket Grapple Load Capacity @ Yield Point (lbs):								
Max. Capacity with Stop		197,600	635,700	267,100	504,500	467,400	306,200	…
Min. Capacity Without Stop		197,600	790,500	267,100	558,100	575,600	348,200	319,700
Max. Make-up Torque 50% of Yield (ft/lbs)		5,000	…	…	…	7,400	…	8,100

Notes:

1) *All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume a straight, steady pull and full grapple engagement of a round fish. Anything less than straight pulling or full engagement will substantially reduce the strength.*
2) *No tong marks should be applied to the bowl. Tong marks and other surface damage to the bowl will also reduce the strength.*
3) *Maximum recommended makeup torque is 50% of yield. Less torque may be used depending upon the situation.*
4) *Jarring may amplify the pull load by a factor of 3 to 10.*

LOGAN SERIES 70 SHORT CATCH OVERSHOTS

CALCULATED STRENGTHS

Maximum Catch Size (Basket)		4-3/4	6	6-1/4	6-1/2	7	7-3/4	8
Overshot O.D.		6-5/8	7-5/8	7-7/8	8-1/4	8-1/2	9-1/4	9-3/4
Complete Assembly	**Logan Part No.**	**170-663-A**	**170-763-A**	**170-787-A**	**170-825-A**	**170-850-A**	**170-925-A**	**170-975-A**
	Bowen No.	11303	11630	16975	38939	20050	25030	20060
Bowl	**Logan Part No.**	**C2011**	**C2012**	**C2013**	**C2014**	**C2015**	**C2016**	**C2017**
	Bowen No.	11305	11632	16977	38941	20052	25032	20062
Basket Grapple Load Capacity @ Yield Point (lbs):								
Max. Capacity with Stop		579,400	358,000	349,200	…	285,100	…	…
Min. Capacity Without Stop		720,600	445,300	445,700	445,100	373,700	391,700	445,100
Max. Make-up Torque 50% of Yield (ft/lbs)		…	12,500	…	22,000	24,200	27,800	30,800

Maximum Catch Size (Basket)		9	13-3/8
Overshot O.D.		11-1/4	16
Complete Assembly	**Logan Part No.**	**170-1125-A**	**170-1600-A**
	Bowen No.	33878	…
Bowl	**Logan Part No.**	**C2018**	**C2019**
	Bowen No.	33880	…
Basket Grapple Load Capacity @ Yield Point (lbs):			
Max. Capacity with Stop		…	…
Min. Capacity Without Stop		874,800	…
Max. Make-up Torque 50% of Yield (ft/lbs)		42,000	55,500

Notes:

1) *All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume a straight, steady pull and full grapple engagement of a round fish. Anything less than straight pulling or full engagement will substantially reduce the strength.*
2) *No tong marks should be applied to the bowl. Tong marks and other surface damage to the bowl will also reduce the strength.*
3) *Maximum recommended makeup torque is 50% of yield. Less torque may be used depending upon the situation.*
4) *Jarring may amplify the pull load by a factor of 3 to 10.*

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

Complete Assembly	Logan Bowl No.	Bowen Bowl No.	Maximum Catch Size w/ Spiral Grapple	Overshot O.D. (in)	Load Capacity @ Yield Point (lbs) Spiral Grapple	Basket Grapple w/o Stop	Basket Grapple w/ Stop
150-231-D	A1950	B-8921	2	2-5/16	50,400	36,300	28,900
150-263-D	A2000	B-10201	2-1/8	2-5/8	101,600	86,400	61,000
150-313-E	A2001	9306	2-3/8	3-1/8	193,500	173,200	118,000
150-350-A	A2002	B-4743	2-3/8	3-1/2	309,000	265,500	167,000
150-412-B	A20025	1446	2-3/8	4-1/8	455,000	390,000	265,000
150-338-D	A2003	B-5088	2-1/2	3-3/8	258,000	213,300	163,500
150-363-A	A2004	B-5082	2-1/2	3-5/8	346,200	307,700	219,800
150-363-E	A2005	9271	2-7/8	3-5/8	193,500	157,400	78,700
150-375-D	A20055	37587	3-1/16	3-3/4	217,700	221,200	179,700
150-388-D	A20056	B-1836	3-1/8	3-7/8	155,100	144,200	98,000
150-376-D	A20057	B-1828	2-7/8	3-3/4	214,000	192,800	121,400
150-400-A	A2006	B-4738	2-7/8	4	304,000	221,500	199,000
150-393-D	A2007	B-5103	3-1/16	3-15/16	265,400	219,000	160,100
150-419-A	A2008	B-5100	3-1/16	4-3/16	291,800	263,000	118,200
150-400-D	A2009	B-5106	3-1/8	4	262,900	217,000	125,100
150-413-A	A2010	9107	3-1/8	4-1/8	310,200	255,000	170,000
150-412-A	A20105	8223	3-1/8	4-1/8	310,200	255,000	170,000
150-425-A	A2011	B-4824	3-1/8	4-1/4	291,800	263,000	118,200
150-413-D	A2012	B-5117	3-1/4	4-1/8	225,000	202,000	127,500
150-438-A	A2013	B-5114	3-1/4	4-3/8	254,000	234,200	147,500
150-388-E	A20135	21302	3-3/8	3-7/8	102,500	97,500	66,500
150-425-D	A2014	B-5128	3-3/8	4-1/4	262,900	217,000	116,800
150-4375-A	A20145	9637	3-3/8	4-3/8	281,500	249,400	167,900
150-450-A	A2015	B-5125	3-3/8	4-1/2	320,000	280,000	176,000
150-438-D	A2016	B-4621	3-1/2	4-3/8	267,400	220,700	144,300
150-482-A	A2017	B-4734	3-1/2	4-13/16	456,000	396,000	286,000

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

Complete Assembly	Logan Bowl No.	Bowen Bowl No.	Maximum Catch Size w/ Spiral Grapple	Overshot O.D. (in)	Load Capacity @ Yield Point (lbs) Spiral Grapple	Basket Grapple w/o Stop	Basket Grapple w/ Stop
150-451-D	A20161	A-3795	3-1/2	4-1/2	271,000	226,000	146,500
150-450-D	A20175	17203	3-21/32	4-17/32	260,400	233,400	170,500
150-456-D	A2018	B-5153	3-21/32	4-9/16	276,400	228,100	157,900
150-469-C	A2019	9111	3-21/32	4-11/16	332,000	279,000	199,500
150-500-A	A2020	B-5150	3-21/32	5	394,000	338,000	210,000
150-463-D	A2021	B-5131	3-3/4	4-5/8	270,600	218,000	150,900
150-468-C	A20215	9121	3-3/4	4-11/16	261,300	233,000	138,000
150-444-D	A20217	B-9775	3-13/16	4-7/16	137,500	118,000	44,800
150-513-A	A2022	B-4688	3-3/4	5-1/8	489,000	447,000	354,000
150-525-A	A2023	9517	3-7/8	5-1/4	451,000	389,500	276,500
150-462-D	A20235	B-6232	3-7/8	4-5/8	186,800	166,700	104,200
150-488-D	A2024	B-5156	4	4-7/8	385,000	241,000	167,000
150-531-A	A2025	B-5144	4	5-5/16	402,000	351,000	273,000
150-500-D	A2026	B-5430	4-1/8	5	296,000	258,500	201,000
150-544-A	A2027	B-5427	4-1/8	5-7/16	547,600	435,500	277,100
150-512-D	A20285	4717	4-1/4	5-1/8	312,500	264,000	196,000
150-513-D	A2028	B-5164	4-1/4	5-1/8	356,800	301,000	232,200
150-556-A	A2029	5898	4-1/4	5-9/16	526,600	494,300	362,500
150-555-A	A20295	B-4821	4-1/4	5-9/16	439,200	396,000	286,000
150-538-D	A2030	B-5167	4-1/2	5-3/8	279,000	258,000	186,200
150-581-A	A2031	B-4816	4-1/2	5-13/16	439,200	396,000	286,000
150-550-D	A20315	B-4971	4-5/8	5-1/2	297,000	258,000	186,200
150-563-A	A2032	5700	4-5/8	5-5/8	420,000	378,500	273,000
150-594-A	A2033	5735	4-5/8	5-15/16	514,100	421,300	297,400
150-563-D	A2034	B-5170	4-3/4	5-5/8	360,400	308,400	234,500
150-575-A	A2035	8977	4-3/4	5-3/4	432,900	411,600	303,275

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

Complete Assembly	Logan Bowl No.	Bowen Bowl No.	Maximum Catch Size w/ Spiral Grapple	Overshot O.D. (in)	Load Capacity @ Yield Point (lbs) Spiral Grapple	Basket Grapple w/o Stop	Basket Grapple w/ Stop
150-606-A	A2036	B-4831	4-3/4	6-1/16	431,000	381,000	275,500
150-575-D	A2037	B-7098	4-7/8	5-3/4	273,500	230,700	178,000
150-613-A	A20375	905	4-7/8	6-1/8	405,000	367,000	298,000
150-619-A	A2038	B-7095	4-7/8	6-3/16	404,500	341,200	282,700
1150-588-D	A2039	B-5173	5	5-29/32	323,500	283,500	218,500
150-612-C	A20395	7788	5	6-1/8	468,000	440,000	322,000
150-663-A	A2040	B-4827	5	6-5/8	637,000	574,300	462,000
150-576-D	A20402	B-11825	5-1/8	5-3/4	135,000	115,000	71,500
150-638-D	A20405	4503	5-1/4	6-3/8	403,000	356,000	256,000
150-650-D	A20407	9205	5-3/8	6-1/2	385,500	325,000	232,000
150-663-D	A2041	8617	5-1/2	6-5/8	386,000	325,000	232,000
150-713-A	A2042	B-2791	5-1/2	7-1/8	637,500	574,300	462,000
150-688-D	A2043	8980	5-3/4	6-7/8	367,000	332,000	253,000
150-738-A	A2044	B-3522	5-3/4	7-3/8	637,500	574,300	462,000
150-763-A	A2045	7574	6	7-5/8	611,300	532,600	404,300
150-725-D	A2046	B-5208	6-1/8	7-1/4	435,000	392,000	298,000
150-775-A	A2047	B-4218	6-1/8	7-3/4	637,000	574,300	462,000
150-738-D	A2048	9694	6-1/4	7-3/8	450,400	427,283	327,900
150-762-C	A20485	1875	6-1/4	7-5/8	542,468	479,044	364,490
150-763-C	A2049	1641	6-1/4	7-5/8	502,100	449,900	363,200
150-777-A	A20495	1657	6-1/4	7-7/8	627,600	542,400	395,000
150-788-A	A2050	B-2109	6-1/4	7-7/8	586,800	515,600	413,700
150-750-D	A2051	9011	6-3/8	7-1/2	479,000	454,000	339,000
150-775-C	A2052	9164	6-3/8	7-3/4	385,500	325,000	232,000
150-763-D	A2053	9862	6-1/2	7-5/8	418,200	396,700	322,900
150-813-A	A2054	B-3711	6-1/2	8-1/8	586,500	515,500	413,500

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

Complete Assembly	Logan Bowl No.	Bowen Bowl No.	Maximum Catch Size w/ Spiral Grapple	Overshot O.D. (in)	Load Capacity @ Yield Point (lbs) Spiral Grapple	Basket Grapple w/o Stop	Basket Grapple w/ Stop
150-775-D	A2055	9134	6-5/8	7-3/4	422,000	400,000	318,000
150-825-A	A2056	B-3034	6-5/8	8-1/4	637,500	574,300	462,000
150-788-D	A2057	B-5224	6-3/4	7-7/8	531,900	467,300	375,000
150-838-A	A2058	277	6-3/4	8-3/8	637,000	542,250	408,250
150-800-D	A20587	M-8997	6-7/8	8	436,000	406,900	350,000
150-814-D	A20590	9817	7	8-1/8	453,000	429,500	329,500
150-813-D	A2059	9219	7	8-1/8	453,000	429,500	329,500
150-812-D	A20595	B-3264	7	8-1/8	439,200	395,800	318,400
150-837-D	A20598	17209	7	8-3/8	587,977	557,764	428,051
150-863-A	A2060	B-3819	7	8-5/8	637,000	574,300	462,000
150-825-D	A20605	9571	7-1/8	8-1/4	422,000	400,000	307,300
150-838-D	A2061	B-5356	7-1/4	8-3/8	430,000	385,000	295,000
150-888-A	A2062	M-1026-1	7-1/4	8-7/8	586,900	515,600	426,500
150-850-D	A2063	9233	7-3/8	8-1/2	422,000	400,000	309,000
150-900-A	A2064	B-5232	7-3/8	9	637,000	574,300	462,000
150-863-D	A2065	B-7103	7-1/2	8-5/8	436,000	385,000	309,000
150-913-A	A2066	B-4516	7-1/2	9-1/8	637,000	574,300	462,000
150-875-D	A2067	9239	7-5/8	8-3/4	458,000	435,000	333,000
150-762-A	A20675	B-5243	7-5/8	9-1/4	657,000	578,000	465,000
150-888-D	A2068	9852	7-3/4	8-7/8	458,000	435,000	333,000
150-889-D	A2069	B-5259	7-3/4	8-7/8	430,000	385,000	295,000
150-937-A	A20695	1283	7-3/4	9-3/8	637,000	542,250	408,250
150-938-A	A2070	B-1501	7-3/4	9-3/8	592,000	520,000	340,000
150-913-D	A2071	B-5267	8	9-1/8	396,000	347,500	236,000
150-963-A	A2072	266	8	9-5/8	602,700	510,750	398,600
150-950-D	A2073	9062	8-3/8	9-1/2	447,500	424,500	325,500

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

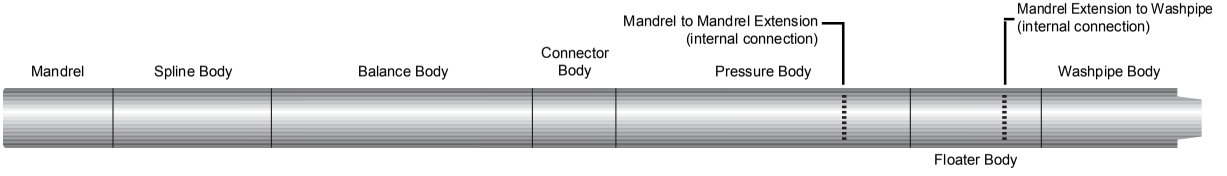
Complete Assembly	Logan Bowl No.	Bowen Bowl No.	Maximum Catch Size w/ Spiral Grapple	Overshot O.D. (in)	Load Capacity @ Yield Point (lbs) Spiral Grapple	Basket Grapple w/o Stop	Basket Grapple w/ Stop
150-1006-A	A2074	B-1231	8-3/8	10-1/16	637,500	574,300	462,000
150-963-D	A2075	B-5286	8-1/2	9-5/8	419,500	376,000	341,000
150-1013-A	A2076	8962	8-1/2	10-1/8	602,700	492,000	391,000
150-1025-D	A2077	B-5299	8-5/8	10-1/4	657,000	578,000	465,000
150-1050-A	A2078	B-5307	8-7/8	10-1/2	586,600	515,400	413,600
150-1063-A	A2079	B-5323	9	10-5/8	586,800	515,600	426,500
150-1125-A	A2080	B-12824	9-5/8	11-1/4	586,800	515,600	413,700
150-1138-A	A2081	26257	9-3/4	11-3/8	565,900	502,900	380,000
150-1175-A	A2082	5331	10-1/8	11-3/4	616,000	528,000	435,000
150-1275-A	A2083	15802	11-1/4	12-3/4	605,000	562,250	444,000
150-1375	A2084	33008	12	13-3/4	1,022,314	745,564	…
150-1600	A2085	68030	14	16	1,164,000	1,175,000	…
150-1675	A2086	64555	14-3/4	16-3/4	1,197,674	1,226,777	…
150-2075	A2087	31655	16-3/4	20-1/4	…	1,479,060	1,344,600

Notes:

1) All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume a straight, steady pull and full grapple engagement of a round fish. Anything less than straight pulling or full engagement will substantially reduce the strength.

2) No tong marks should be applied to the bowl. Tong marks and other surface damage to the bowl will also reduce the strength.

LOGAN SUPERIOR HYDRAULIC FISHING JARS



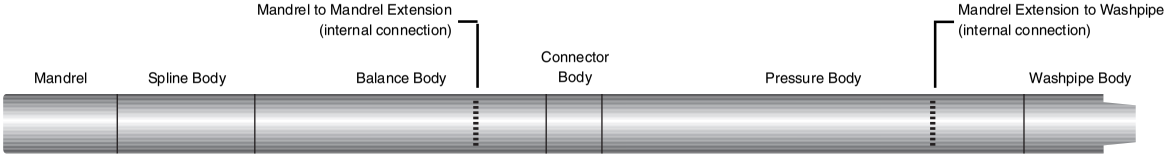
STRENGTH AND TEST DATA

Complete Assembly	611-306	611-312	611-313	611-375	611-376	611-425	611-450	611-475	611-625	611-775
Outside Diameter (in)	3-1/16	3-1/8	3-1/8	3-3/4	3-3/4	4-1/4	4-1/2	4-3/4	6-1/4	7-3/4
Jar Tester Low Test Pull Load — Min (lbs)	7,000	9,000	7,000	12,000	12,000	12,000	12,000	15,000	18,000	18,000
— Max (lbs)	12,000	12,000	12,000	16,000	16,000	16,000	16,000	20,000	26,000	26,000
Jar Tester Standard Pull Test (lbs)	18,000	30,000	18,000	35,000	35,000	35,000	30,000	50,000	100,000	100,000
Field Load — Max Pull Load	36,000	55,000	36,000	72,000	51,000	75,000	60,000	100,000	200,000	275,000
Lift Load After Jarring, Jar Fully Extended Tensile @ Yield (lbs)	185,000	253,000	185,000	330,000	285,000	375,000	360,000	505,000	1,000,000	1,600,000
Torque @ Yield (ft-lbs)	4,200	7,500	4,200	14,500	9,650	18,500	12,000	18,100	40,800	79,000

MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

Spline Body to Balance Body	2,100	2,700	2,100	3,500	3,650	5,000	3,500	9,090	20,000	39,000
Balance Body to Connector Body	2,100	2,700	2,100	3,500	3,650	5,000	3,500	9,090	20,000	39,000
Connector Body to Pressure Body	2,100	2,700	2,100	3,500	3,650	5,000	3,500	9,090	20,000	39,000
Mandrel to Mandrel Extension	700	800	700	800	800	1,700	900	1,800	7,000	12,500
Pressure Body to Floater Body	2,100	2,700	2,100	3,500	3,650	5,000	3,500	9,090	20,000	39,000
Mandrel Extension to Washpipe	600	700	600	700	700	1,500	800	1,000	4,800	10,500
Floater Body to Washpipe Body	2,100	2,700	2,100	3,500	3,650	5,000	3,500	9,090	20,000	39,000

LOGAN SUPERIOR ENERGIZERS



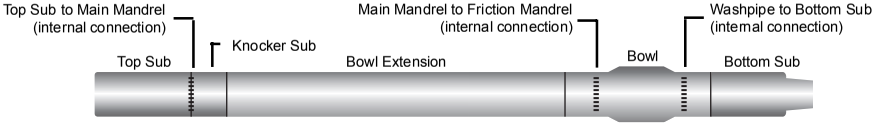
STRENGTH AND TEST DATA

Complete Assembly	614-306	614-312	614-313	614-375	614-376	614-425	614-450	614-475	614-625	614-775
Outside Diameter (in)	3-1/16	3-1/8	3-1/8	3-3/4	3-3/4	4-1/4	4-1/2	4-3/4	6-1/4	7-3/4
Jar Tester Low Test Pull Load — Min (lbs)	7,000	9,000	7,000	12,000	12,000	12,000	12,000	15,000	18,000	18,000
— Max (lbs)	12,000	12,000	12,000	16,000	16,000	16,000	16,000	20,000	26,000	26,000
Jar Tester Standard Pull Test (lbs)	18,000	30,000	18,000	35,000	35,000	35,000	30,000	50,000	100,000	100,000
Field Load — Max Pull Load	36,000	55,000	36,000	72,000	51,000	75,000	60,000	100,000	200,000	275,000
Lift Load After Jarring, Jar Fully Extended, Tensile @ Yield (lbs)	185,000	253,000	185,000	330,000	285,000	375,000	360,000	505,000	1,000,000	1,600,000
Torque @ Yield (ft-lbs)	4,200	7,500	4,200	14,500	9,650	18,500	12,000	18,100	40,800	79,000

MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

Spline Body to Balance Body	2,100	2,700	2,100	3,500	3,500	5,000	5,000	9,090	20,000	39,000
Mandrel To Mandrel Extension	700	800	700	800	700	1,700	1,500	1,800	7,000	12,500
Balance Body to Connector Body	2,100	2,700	2,100	3,500	3,500	5,000	5,000	9,090	20,000	39,000
Connector Body to Pressure Body	2,100	2,700	2,100	3,500	3,500	5,000	5,000	9,090	20,000	39,000
Mandrel Extension to Washpipe	600	700	600	700	700	1,500	1,500	1,000	4,800	10,500
Pressure Body to Washpipe Body	2,100	2,700	2,100	3,500	3,500	5,000	5,000	9,090	20,000	39,000

LOGAN SURFACE BUMPER JARS



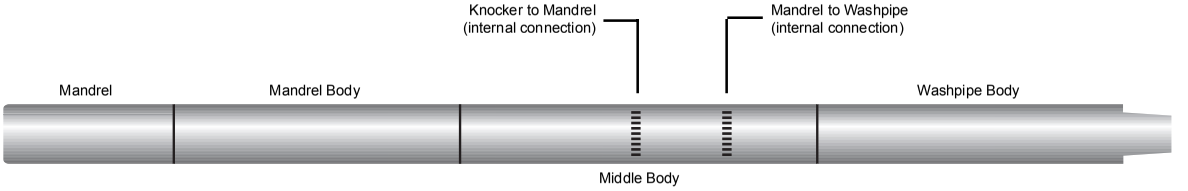
STRENGTH AND TEST DATA

Complete Assembly	609-001
Outside Diameter (in)	7
Bowl Outside Diameter (in)	9
Max Torque @ Yield (ft-lbs)	33,800
Max Tensile Load @ Yield (ft-lbs)	845,000
Max Pump Pressure (psi)	8,000
Setting Load (tons)	0 – 50

MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

Top Sub to Main Mandrel	16,900
Knocker Sub Bowl Extension	16,900
Bowl Extension to Bowl	17,900
Main Mandrel to Friction Mandrel	2,700
Washpipe to Bottom Sub	2,700
Bowl to Bottom Sub	17,900

LOGAN LUBRICATED FISHING BUMPER SUBS



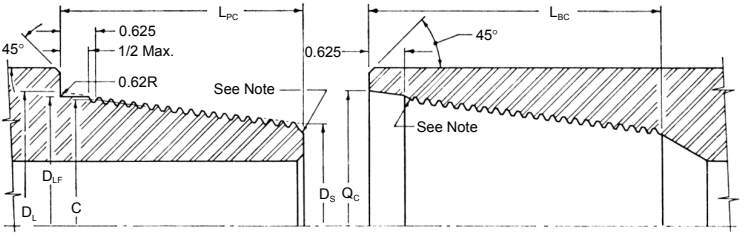
STRENGTH AND TEST DATA

Complete Assembly	607-181	607-225	607-312	607-375	607-376	607-377	607-425	607-450	607-475	607-476	607-600	607-625	607-675	607-775
Outside Diameter (in)	1-13/16	2-1/4	3-1/8	3-3/4	3-3/4	3-3/4	4-1/4	4-1/2	4-3/4	4-3/4	6	6-1/4	6-3/4	7-3/4
Tensile Strength (lbs)	75,400	116,415	239,070	363,780	300,750	291,735	397,650	388,650	484,650	433,000	622,295	777,150	1,130,400	1,276,950
Bumper Sub Yield Torque (ft-lbs)	480	1,740	3,400	7,100	7,100	4,920	9,260	7,100	11,030	15,000	23,000	32,600	43,200	62,400
Max Operating Torque (ft-lbs)	240	870	1,700	3,550	3,550	2,460	4,630	3,550	5,518	7,500	11,500	16,300	21,600	31,200

MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

Mandrel to Mandrel Body	240	…	…	…	…	…	…	…	…	…	…	…	…	…
Mandrel Body to Middle Body	370	870	1,700	3,550	3,550	2,460	4,630	3,550	7,500	7,500	11,500	16,300	21,600	31,200
Knocker to Mandrel	…	90	430	580	410	330	670	370	1,100	1,000	2,270	3,120	3,000	7,690
Mandrel to Washpipe	…	140	660	500	490	1,220	730	1,450	1,690	1,500	3,800	9,750	13,300	21,000
Middle Body to Washpipe Body	370	870	1,700	3,550	3,550	2,460	4,630	3,550	7,500	7,500	13,500	16,300	22,600	31,200

API NUMBERED ROTARY SHOULDERED CONNECTIONS



Note: Extent of bevel on pin and box starting thread is optional with manufacturer.

Conn. No. *	Thread Form, Inch Radius	Thds. Per In	Taper, In/Ft on Dia.	Thread Pitch Dia. @ Gauge Pt. C	Lg. Dia. of Pin, Reference D_L	Flat on Pin D_{LF} ±1/64	Sm. Dia of Pin D_S +0 –3/8	Box Depth L_{BC} +0 –3/8	Pin Length L_{PC} +0 –1/8	Box Counterbore Q_C +1/32 –0
23	0.038	4	2	2.355	2.563	2.437	2.063	3-5/8	3	2-5/8
26 **	0.038	4	2	2.668	2.876	2.750	2.376	3-5/8	3	2-15/16
31 **	0.038	4	2	3.183	3.391	3.266	2.808	4-1/8	3-1/2	3-29/64
35	0.038	4	2	3.531	3.739	3.625	3.114	4-3/8	3-3/4	3-13/16
38 **	0.038	4	2	3.808	4.016	3.891	3.349	4-5/8	4	4-5/64
40 **	0.038	4	2	4.072	4.280	4.156	3.630	5-1/8	4-1/2	4-11/32
44	0.038	4	2	4.417	4.625	4.499	8.875	5-1/8	4-1/2	4-11/16
46 **	0.038	4	2	4.626	4.834	4.709	4.084	5-1/8	4-1/2	4-29/32
50 **	0.038	4	2	5.0417	5.250	5.125	4.500	5-1/8	4-1/2	5-5/16
56	0.038	4	3	5.616	5.876	5.703	4.626	5-5/8	5	5-15/16
61	0.038	4	3	6.178	6.438	6.266	6.063	6-1/8	5-1/2	6-1/2
70	0.038	4	3	7.053	7.313	7.141	6.813	6-5/8	6	7-3/8
77	0.038	4	3	7.741	8.000	7.828	6.376	7-1/8	6-1/2	8-1/16

All dimensions are in inches.

** The connection number is the diameter of the connection at the gauge point rounded to units and tenths of inches.*

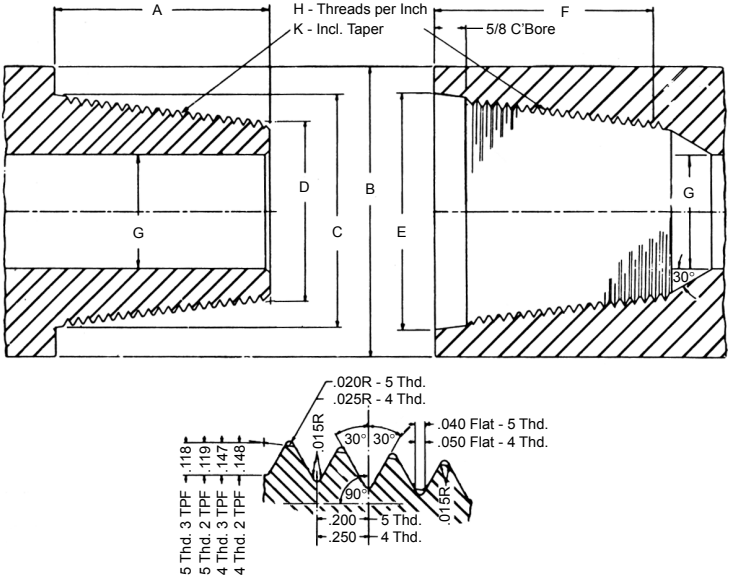
*** See Table 12 below for interchangeability of numbered rotary shouldered connections with rotary shouldered connections of Table 9.1.*

TABLE 12

INTERCHANGEABILITY OF NUMBERED ROTARY SHOULDERED CONNECTIONS WITH TABLE 9.1 ROTARY SHOULDERED CONNECTIONS

Numbered Connection	Equivalent Connection of Table 9.1	
26	2-3/8	IF
31	2-7/8	IF
38	3-1/2	IF
40	4	FH
46	4	IF
50	4-1/2	IF

API REGULAR — UNION TOOL REGULAR



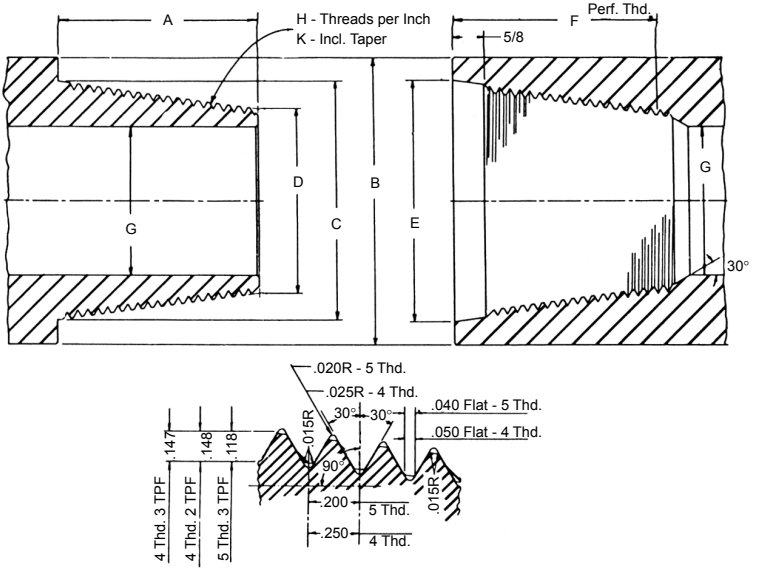
API REGULAR — UNION TOOL REGULAR

Size	A	B	C	D	E	F	G	H	K
2-3/8	3	3-1/8	2-5/8	1-7/8	2-11/16	3-3/8	1	5	3
2-7/8	3-1/2	3-3/4	3	2-1/8	3-1/16	3-7/8	1-1/4	5	3
3-1/2	3-3/4	4-1/4	3-1/2	2-9/16	3-9/16	4-1/8	1-1/2	5	3
4-1/2	4-1/4	5-1/2 *	4-5/8	3-9/16	4-11/16	4-5/8	2-1/4	5	3
5-1/2	4-3/4	6-3/4	5-33/64	4-21/64	5-37/64	5-1/8	2-3/4	4	3
6-5/8 **	5	7-3/4	6	5-5/32	6-1/16	5-3/8	3-1/2	4	2
7-5/8	5-1/4	8-7/8	7	5-11/16	7-1/16	5-5/8	4	4	3
8-5/8	5-3/8	10	7-61/64	6-39/64	8-1/64	5-3/4	4-3/4	4	3

** 5-3/4 O.D. is optional.*

*** Threaded portion same as 5-1/2 Union Tool Full Hole.*

API FULL HOLE — UNION TOOL FULL HOLE



API FULL HOLE — UNION TOOL FULL HOLE

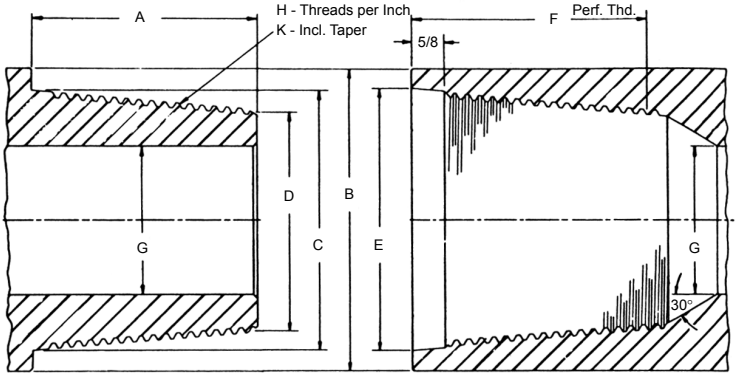
Size	A	B	C	D	E	F	G	H	K
2-7/8 *	3-1/2	4-1/4	3-5/8	2-3/4	3-11/16	3-9/16	2-1/8	5	3
3-1/2	3-3/4	4-5/8	4	3-1/16	4-3/64	4-3/8	2-1/8 **	5	3
4	4-1/2	5-1/4	4-9/32	3-17/32	4-11/32	5-1/8	2-13/16	4 †	2
4-1/2	4	5-3/4	4-51/64	3-51/64	4-7/8	4-5/8	3	5	3
5-1/2	5	7	5-53/64	5	5-29/32	5-5/8	4	4	2
6-5/8	5	8	6-3/4	5-59/64	6-27/32	5-5/8	5	4	2

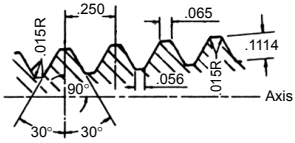
** Not API Standard.*

*** I.D. changed from 2-7/16", May 1979 (API)*

† Thread form same as API-IF joint.

API INTERNAL FLUSH — HUGHES AND REED LF





API INTERNAL FLUSH — HUGHES AND REED LF

Size	A	B	C	D	E	F	G	H	K
2-3/8 ①	3	3-3/8	2-7/8	2-3/8	2-15/16	3-3/8	1-3/4	4	2
2-7/8 ②	3-1/2	4-1/8	3-25/64	2-13/16	3-29/64	3-7/8	2-1/8	4	2
3-1/2 ③	4	4-3/4	4-1/64	3-11/32	4-5/64	4-3/8	2-11/16	4	2
4 ④	4-1/2	5-3/4	4-53/64	4-5/64	4-29/32	4-7/8	3-1/4	4	2
4-1/2 ⑤	4-1/2	6-1/8	5-1/4	4-1/2	5-5/16	4-7/8	3-3/4	4	2
5-1/2	5	7-3/8	6-25/64	5-9/16	6-29/64	5-3/8	4-13/16	4	2

① *Threaded portion same as 2-7/8" Hughes Slim Hole.*

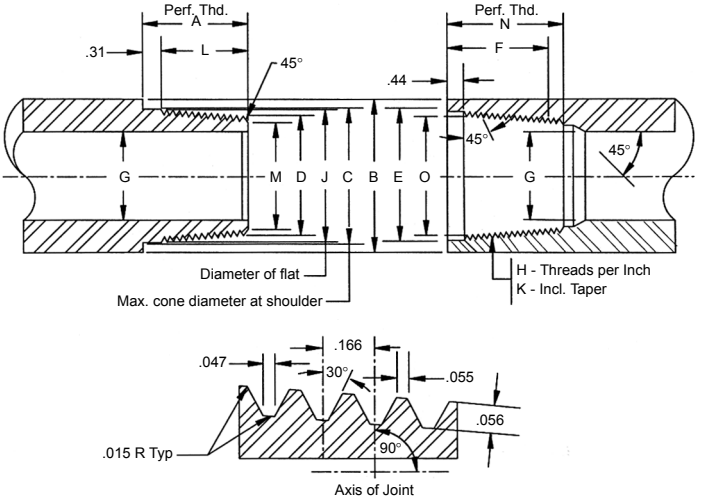
② *Threaded portion same as 3-1/2" Hughes Slim Hole.*

③ *Threaded portion same as 4-1/2" Hughes Slim Hole.*

④ *Threaded portion same as 4-1/2" Hughes Xtra Hole, 5" Reed Double Streamline, and 4-1/2" Reed Xtra Hole.*

⑤ *Threaded portion same as 5-1/2" Reed Double Streamline, 5" Hughes Xtra Hole, and 5" Reed Xtra Hole.*

AMERICAN MT, AMT, AND AMMT *

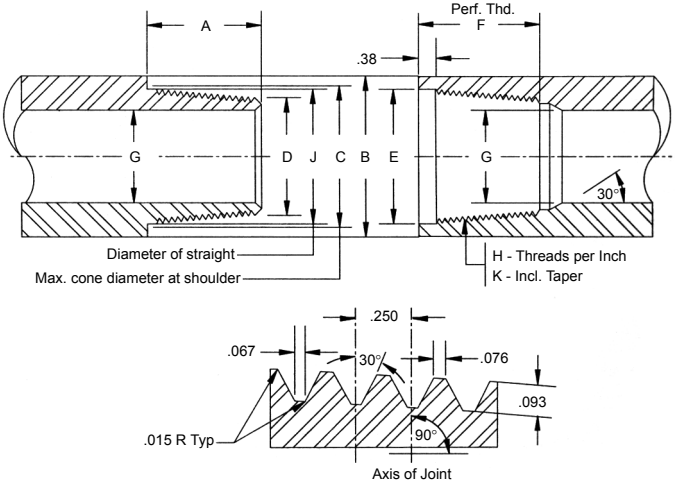


AMERICAN MT, AMT, AND AMMT

Size	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	H (TPI)	J (in)	K (TPF)	L (in)	M (in)	N (in)	O (in)
1	1-1/2	1-9/16	1.281	1.093	1.301	1-1/2	3/4	6	1.233	1-1/2	1-1/8	61/64	2	1.183
1-1/4	2	1-3/4	1.469	1.218	1.489	2	3/4	6	1.421	1-1/2	1-5/8	1-3/32	2-1/2	1.371
1-1/2	2	2	1.668	1.418	1.688	2	1	6	1.621	1-1/2	1-5/8	1-9/32	2-1/2	1.570

** MT is Macaroni Tubing; AMT is American Macaroni Tubing; AMMT is American Mining Macaroni Tubing*

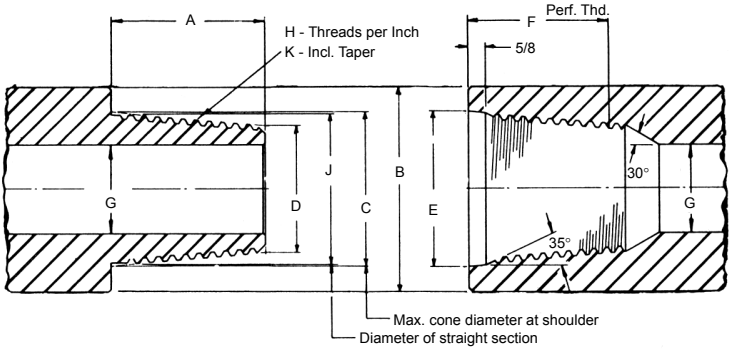
PAC

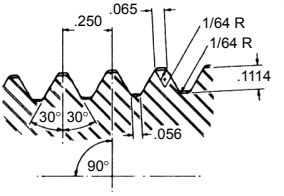


PAC

Size	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	H (TPI)	J (in)	K (TPF)
2-3/8	2-3/8	2-7/8	2-23/64	2-1/16	2-27/64	2-1/2	1-3/8	4	2-5/16	1-1/2
2-7/8	2-3/8	3-1/8	2-17/32	2-15/64	2-19/32	2-1/2	1-1/2	4	2-31/64	1-1/2
3-1/2	3-1/4	3-3/4	3-3/64	2-41/64	3-7/64	3-3/8	2	4	3	1-1/2

HUGHES XTRA HOLE & REED EXTRA HOLE





HUGHES XTRA HOLE & REED EXTRA HOLE

Size	A	B	C	D	E	F	G	H	J	K
2-7/8 ①	3-7/8	4-1/4	3-21/64	2-11/16	3-23/64	4-1/2	1-7/8	4	3-15/64	2
3-1/2 ②	3-3/8	4-3/4	3-13/16	3-1/4	3-7/8	3-15/16	2-7/16	4	…	2
4-1/2 ③	4-3/8	6	4-53/64	4-7/64	4-29/32	4-15/16	3-1/4	4	…	2
5 ④	4-1/2	6-1/4	5-1/4	4-1/2	5-5/16	4-7/8	3-3/4	4	…	2

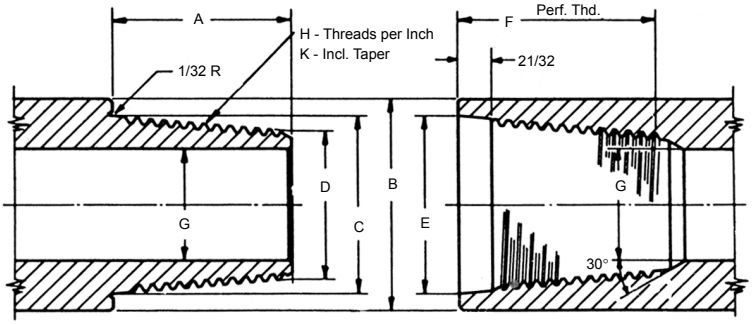
① *Threaded portion same as 2-7/8" Reed Xtra Hole, 3-1/2" Reed Double Streamline, and 3-1/2" Hughes Double Streamline.*

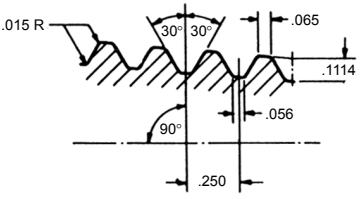
② *Threaded portion same as 4-1/2" Hughes External Flush, 4-1/2" FH Reed External Flush, 4" Hughes Slim Hole, and 3-1/2" Reed Xtra Hole.*

③ *Threaded portion same as 4" API-IF, 5" Reed Double Sreamline, and 4-1/2" Reed Xtra Hole.*

④ *Threaded portion same as 4-1/2" API-IF, 5-1/2" Reed Double Sreamline, and 5" Reed Xtra Hole.*

HUGHES SLIM HOLE





HUGHES SLIM HOLE

Size	A	B	C	D	E	F	G	H	K
2-3/8	2-7/8	2-7/8	2-7/16	1-31/32	2-1/2	3-1/4	1-1/4	4	2
2-7/8 ①	2-7/8	3-3/8	2-7/8	2-25/64	2-15/16	3-1/4	1-3/4	4	2
3-1/2 ②	3-3/8	4	3-25/64	2-53/64	3-29/64	3-3/4	2-1/8	4	2
4 ③	3-3/8	4-1/2	3-13/16	3-1/4	3-7/8	3-3/4	2-9/16	4	2
4-1/2 ④	3-7/8	5	4-1/64	3-3/8	4-5/64	4-1/4	2-11/16	4	2

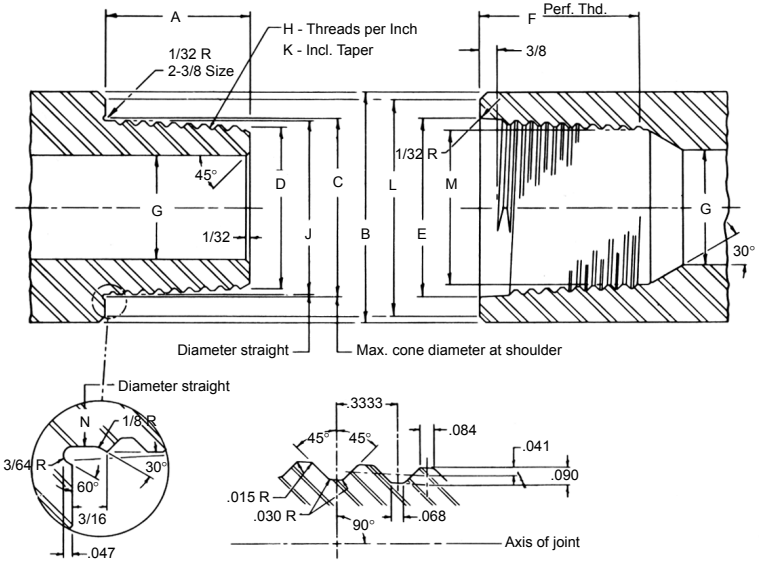
① *Threaded portion same as 2-3/8" API-IF.*

② *Threaded portion same as 2-7/8" API-IF.*

③ *Threaded portion same as 3-1/2" Hughes Xtra Hole, 3-1/2" Reed Xtra Hole, 4-1/2" Hughes External Flush, and 4-1/2" Reed External Flush.*

④ *Threaded portion same as 3-1/2" API-IF.*

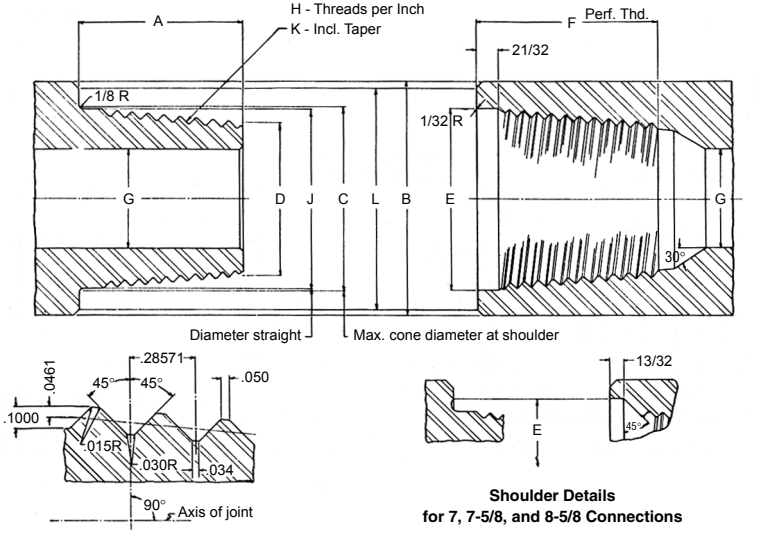
HUGHES SLIMLINE H-90



HUGHES SLIMLINE H-90

Size	A	B	C	D	E	F	G	H	J	K	L	M	N
2-3/8	2-3/4	3-1/8 3-1/4	2.725	2.439	2-49/64	3-1/16	1-1/2	3	2-43/64	1-1/4	3-1/16 3-3/16	2-1/4	2-5/8
2-7/8	2-7/8	3-3/4 3-7/8 4 4 4-1/8 4-1/4	3.196	2.897	3-15/64	3-3/8	2-1/8 – 2-1/4 2-1/8 – 2-1/4 2-1/8 – 2-1/4 2 1-3/4 – 2 1-1/2 – 1-3/4	3	3-5/32	1-1/4	3-5/8 3-23/32 3-13/16 3-13/16 3-29/32 4	2-45/64	3-3/32
3-1/2	3-1/8	4-5/8 4-3/4 4-7/8 4-7/8 5 5-1/8	3.835	3.509	3-7/8	3-3/8	2-3/8 – 2-3/4 2-1/2 – 2-3/4 2-5/8 2-3/8 – 2-1/2 2 – 2-3/8 1-3/4 – 2-1/8	3	3-25/32	3-5/8	4-7/16 4-17/32 4-5/8 4-5/8 4-23/32 4-13/16	3-11/32	3-47/64

HUGHES H-90



Shoulder Details
for 7, 7-5/8, and 8-5/8 Connections

HUGHES H-90

Size	A	B	C	D	E	F	G	H	J	K	L
		5	…	…	…	…	2-5/8 – 2-3/4	…	…	…	4-13/16
		5-1/8	…	…	…	…	2-1/2 – 2-3/4	…	…	…	4-13/16
3-1/2	3-7/8	5-1/4	4-1/8	3-31/64	4-3/16	4-7/16	2 – 2-5/8	3-1/2	3-15/16	2	5
		5-3/8	…	…	…	…	2 – 2-1/4	…	…	…	5
		5-1/2	…	…	…	…	2 – 2-1/8	…	…	…	5
		5-1/2	…	…	…	…	2-7/8 – 3	…	…	…	5-5/16
		5-5/8	…	…	…	…	2-1/2 – 2-7/8	…	…	…	5-5/16
4	4-1/8	5-3/4	4-1/2	3-13/16	4-9/16	4-11/16	2-1/4 – 2-7/8	3-1/2	4-5/16	2	5-1/2
		5-7/8	…	…	…	…	2 – 2-3/4	…	…	…	5-1/2
		6	…	…	…	…	2 – 2-1/2	…	…	…	5-1/2
		6	…	…	…	…	3 – 3-1/4	…	…	…	5-3/4
		6-1/8	…	…	…	…	2-3/4 – 3	…	…	…	5-3/4
4-1/2	4-3/8	6-1/4	4-53/64	4-7/64	4-29/32	4-15/16	2-1/2 – 3	3-1/2	4-41/64	2	6
		6-3/8	…	…	…	…	2 – 3	…	…	…	6
		6-1/2	…	…	…	…	2 – 2-3/4	…	…	…	6

HUGHES H-90

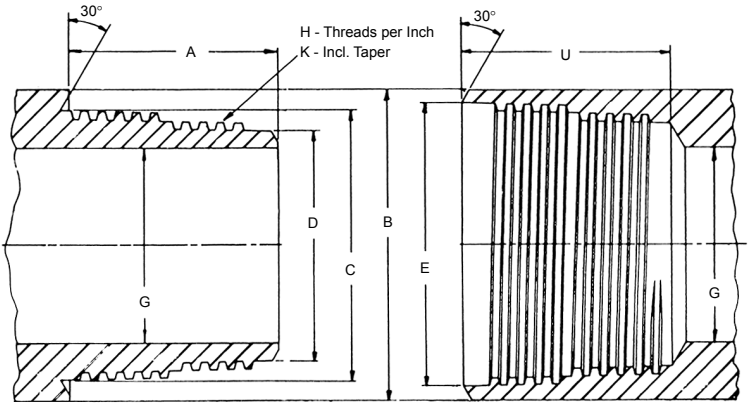
Size	A	B	C	D	E	F	G	H	J	K	L
5	4-5/8	6-1/2 6-5/8 6-3/4 6-7/8 7	5-7/64	4-21/64	5-11/64	5-3/16	2-7/8 – 3-1/4 2-1/2 – 3 2-1/4 – 3 2-1/4 – 2-3/4 2-1/2	3-1/2	4-59/64	2	6-1/8 6-1/8 6-3/8 6-3/8 6-3/8
5-1/2	4-5/8	6-3/4 6-7/8 7 7-1/8 7-1/4 7-3/8 7-1/2	5-3/8	4-29/64	5-7/16	5-3/16	3-1/8 – 3-3/8 3 – 3-1/4 2-3/4 – 3-1/4 2-1/4 – 3-1/4 2-1/4 – 3 2-1/4 – 2-3/4 2-1/4 – 2-1/2	3-1/2	5-3/16	2	6-3/8 6-5/8 6-5/8 6-5/8 6-3/8 6-5/8 6-5/8
6-5/8	4-7/8	7-5/8 7-3/4 7-7/8 8 8-1/8 8-1/4	6	5-3/16	6-1/16	5-11/16	3-3/8 – 3-5/8 3-1/4 – 3-1/2 3 – 3-1/2 2-1/2 – 3-1/2 2-1/2 – 3-1/4 2-1/2 – 3	3-1/2	5-13/16	2	7-1/4 7-1/2 7-1/2 7-1/2 7-1/2 7-1/2
7	5-3/8	8-1/4 8-3/8 8-1/2 8-5/8 8-3/4 9	6-1/2	5-5/32	①	5-15/16	3-1/2 – 3-3/4 2-3/4 – 3-3/4 2-3/4 – 3-3/4 2-3/4 – 3-1/2 2-3/4 – 3-1/4 2-3/4 – 3	3-1/2	6-3/8	3	8 8 8-1/4 8-1/4 8-1/4 8-5/8
7-5/8	6	9-1/2 9-5/8 9-3/4 9-7/8 10 10-1/4	7-25/64	5-57/64	②	6-9/16	3-1/2 – 4 3 – 4 3 – 4 3 – 4 3 – 3-3/4 3 – 3-1/4	3-1/2	7-17/64	3	9-1/4 9-1/4 9-1/4 9-5/8 9-5/8 9-5/8
8-5/8	6-1/2	10-3/4 11 11-1/4 11-1/2	8-17/64	6-41/64	③	1-1/16	3-1/2 – 4 3 – 4 3 – 4 3 – 3-1/4	3-1/2	8-9/64	3	10-1/2 10-1/2 10-3/4 10-3/4

① *For drill collar ODs less than 8-5/8", E = 6.563*
For drill collar ODs 8-5/8" or more, E = 7.125

② *For drill collar ODs less than 9-3/4", E = 7.453*
For drill collar ODs 9-3/4" or more, E = 8.000

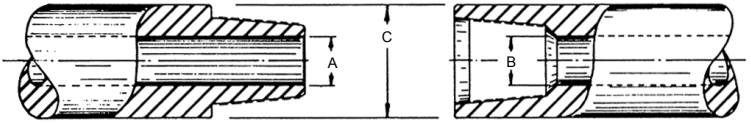
③ *For drill collar ODs less than 10-3/4", E = 8.343*
For drill collar ODs 10-3/4" or more, E = 9.375

HYDRIL JOINTS



Type	Size	A	B	C	D	E	G	H	K	U
IF	2-3/8 – 6.65	3-15/16	3-3/8	2-13/16	2-21/64	2-13/16	1-3/4	3	1/2	3-59/64
IF	2-7/8 – 10.4	3-57/64	3-7/8	2-3/16	2-45/64	3-3/16	2-7/64	3	1/2	3-59/64
IF	2-7/8 – 11.8	3-57/64	3-7/8	2-3/16	2-45/64	3-3/16	2	3	1/2	3-59/64
IF	3-1/2 – 13.3	3-61/64	4-1/2	2-27/32	3-23/64	3-27/32	2-3/4	3	1/2	3-31/32
IF	3-1/2 – 15.5	3-61/64	4-1/2	2-27/32	3-23/64	3-27/32	2-9/16	3	1/2	3-31/32
IF	4-1/2 – 16.6	4	6	2-13/64	4-35/64	5-7/32	3-3/4	3	1/2	4-1/64
IF	4-1/2 – 20.0	4	6	2-13/64	4-35/64	5-7/32	3-3/4	3	1/2	4-1/64
IF	5 – 20.5	4-23/32	6-5/8	5-25/32	5-1/64	5-51/64	4-3/16	2	1/2	4-3/4
F	2-3/8	2-5/8	2-3/8	1-59/64	1-43/64	1-15/16	1	4	1/2	2-15/32
F	2-7/8	3-21/32	2-7/8	2-23/64	1-29/32	2-3/8	1-1/16	4	1/2	3-1/2
F	3-1/2	4-1/16	3-1/2	2-13/16	2-21/64	2-13/16	1-1/2	3	1/2	3-59/64
F	4	3-59/64	4-1/16	3-5/16	2-55/64	3-11/32	2	3	1/2	3-29/32
F	4-1/2	3-61/64	4-1/2	3-27/32	3-23/64	3-27/32	2-3/16	3	1/2	3-31/32
F	5	4-5/16	5	4-3/16	3-35/64	4-13/64	2-5/16	3	1/2	4
F	5-1/2	4-1/4	5-9/16	4-21/32	4-1/64	4-43/64	2-3/4	3	1/2	4-1/32
F	6-5/8	5-5/16	6-5/8	5-11/16	4-29/32	5-45/64	3-1/2	2	1/2	5-1/8
EIU	3-1/2	4-1/4	4-5/8	3-47/64	3-17/64	3-3/4	2-7/16	3	1/2	4
EIU	4	4-5/16	5-9/16	4-21/64	4-1/64	4-43/64	3-1/8	3	1/2	4-1/32
EIU	4-1/2	4-7/16	5-3/4	4-47/64	3-3/32	4-3/4	3-5/32	3	1/2	4-1/8
EIU	5-1/2	5-1/2	7	5-53/64	5-1/16	5-27/32	4	2	1/2	5-1/8
EIU	6-5/8	5-1/2	8	6-7/8	6-7/64	6-57/64	5	2	1/2	5-1/8

TOOL JOINT DIMENSIONS



RECOMMENDED MAXIMUM AND MINIMUM

	Joints	Nom. O.D.	Nom. I.D.	"A" Max.	"B" Max.	"C" Min.	"C" Max.
	API Reg	3-1/8	1	1-1/8	1-5/8	2-15/16	3-1/4
2-3/8	API IF	3-3/8	1-3/4	1-3/4	2	3-3/16	3-5/8
	Hydril IF	3-3/8	1-3/4	1-3/4	1-7/8	3-1/8	3-5/8
	API Reg	3-3/4	1-1/4	1-3/8	1-7/8	3-1/2	4
	FH	4-1/4	2-1/8	2-1/8	2-3/8	4-1/16	4-5/8
2-7/8	API IF	4-1/8	2-1/8	2-1/8	2-1/2	3-7/8	4-3/8
	Hydril IF	3-7/8	2-1/8	2-3/16	2-3/16	3-5/8	4-1/8
	Hughes Xtra Hole	4-1/4	1-7/8	1-7/8	2-1/8	4	4-5/8
3	Union Tool (UT)	4-1/4	1-1/2	1-1/2	2-1/8	3-3/4	4-1/2
	API Reg	4-1/4	1-1/2	1-3/4	2-1/4	4	4-5/8
	API FH	4-5/8	2-7/16	2-7/16	2-3/4	4-1/2	5
3-1/2	API IF	4-3/4	2-11/16	2-11/16	3	4-1/2	5
	Hydril IF	4-1/2	2-3/4	2-3/4	2-13/16	4-3/8	4-7/8
	Hughes Xtra Hole	4-3/4	2-7/16	2-7/16	2-3/4	4-1/2	5
	API FH	5-1/4	2-13/16	2-13/16	3-1/4	5	5-3/8
4	API IF	5-3/4	3-1/4	3-5/16	3-1/2	5-1/2	6
	Union Tool	5-3/4	2-1/4	2-7/8	3-1/2	5-3/8	6
	API Reg	5-3/4	2-1/4	2-5/8	3-1/4	5-3/8	6
	API FH	5-3/4	3	3-5/32	3-1/2	5-1/2	6
4-1/2	API IF	6-1/8	3-3/4	3-3/4	4-1/8	5-7/8	6-1/2
	Hydril IF	6	3-3/4	3-7/8	4	5-13/16	6-1/4
	Hughes Xtra Hole	6	3-1/4	3-1/4	3-3/8	5-5/8	6-1/4
	API Reg or UT	6-3/4	2-3/4	3-1/4	3-7/8	6-3/8	7
5-1/2	API FH	7	4	4	4-1/2	6-1/2	7-1/4
	API IF	7-3/8	4-13/16	4-13/16	5-1/4	7-1/8	7-7/8
	API Reg or UT	7-3/4	3-1/2	4	4-3/4	7-1/8	7-7/8
6-5/8	API FH	8	5	5	5-1/2	7-1/2	8-1/4
	IF	8-1/2	5-29/32	5-29/32	6-1/4	8-3/8	9
7-5/8	Reg	8-7/8	4	4-1/4	5-1/4	8-1/8	9
8-5/8	Reg	10	4-3/4	5-1/4	6-1/4	9	10-1/8

SEAMLESS DRILL PIPE PERFORMANCE PROPERTIES

NEW DRILL PIPE — DIMENSIONAL, TORSIONAL, AND TENSILE DATA

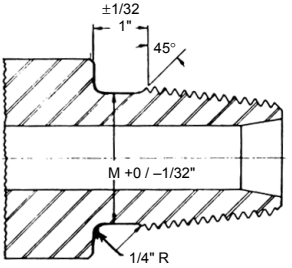
Size O.D. (in)	Nominal Weight Threads & Couplings (lb/ft)	Plain End Weight (lb/ft)	Wall Thick-ness (in)	I.D. (in)	Section Area Body of Pipe (sq in)	Polar Sectional Modulus Z (cu in)	Torsional Data * Torsional Yield Strength (ft-lbs)					Tensile Data Based on Minimum Values Load at the Minimum Yield (lbs)				
							D	E	95	105	135	D	E	95	105	135
2-3/8	4.85	4.43	.190	1.995	1.3042	1.320	...	4760	6020	6660	...	...	97820	123900	136940	176070
	6.65	6.26	.280	1.815	1.8429	1.734	4580	6240	7900	8740	...	101360	138220	175080	193500	248790
2-7/8	6.85	6.16	.217	2.441	1.8120	2.242	...	8070	10220	11300	...	...	135900	172140	190260	244620
	10.40	9.72	.362	2.151	2.8579	3.204	8460	11530	14610	16150	20760	157190	214340	271500	300080	385820
3-1/2	9.50	8.81	.254	2.992	2.5902	3.922	...	14120	17890	19770	25420	...	194260	246070	271970	349680
	13.30	12.31	.368	2.764	3.6209	5.144	13580	18520	23460	25930	33330	199160	271570	343990	380190	488820
	15.50	14.63	.449	2.602	4.3037	5.846	15440	21050	26660	29470	37890	236720	322780	408850	451890	581000
4	11.85	10.46	.262	3.476	3.0767	5.400	...	19440	24620	27220	34990	...	230750	292290	323050	415360
	14.00	12.93	.330	3.340	3.8048	6.458	17050	23250	29450	32550	41840	209280	285360	361460	399500	513650
	15.70	14.69	.380	3.240	4.3216	7.156	18890	25760	32630	36070	46380	237710	324150	410590	453810	583420
4-1/2	13.75	12.24	.271	3.958	3.6004	7.184	...	25860	32760	36210	46550	...	270030	342040	378050	486060
	16.60	14.98	.337	3.826	4.4074	8.542	22550	30750	38950	43050	55350	242380	330560	418700	462780	595000
	20.00	18.69	.430	3.640	5.4981	10.232	27010	36840	46660	51570	66300	302390	412360	522320	577300	742240
5	16.25	14.87	.296	4.408	4.3743	9.718	...	34980	44310	48970	62970	...	328070	415560	459300	590530
	19.50	17.93	.362	4.276	5.2746	11.416	30135	41090	52050	57530	73970	290100	395600	501090	553830	712070
	25.60	24.03	.500	4.000	7.0686	14.490	38250	52160	66070	73030	93900	388770	530140	671520	742200	954260
5-1/2	19.20	16.87	.304	4.892	4.9624	12.222	...	44180	55960	61850	79520	...	372180	471430	521050	669920
	21.90	19.81	.361	4.778	5.8282	14.062	37120	50620	64120	70870	91120	320550	437120	553680	611960	786810
	24.70	22.54	.415	4.670	6.6296	15.688	41410	56470	71530	79060	101650	364630	497220	629810	696110	895000
6-5/8	25.20	22.19	.330	5.965	6.5262	19.572	51740	70550	89360	98770	...	358930	489460	619990	685250	881040

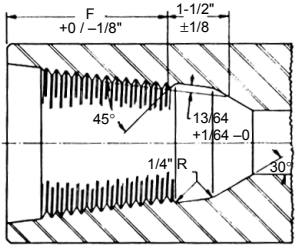
** Based on the shear strength equal to 57.7% of minimum yield strength and nominal wall thickness.*

NEW DRILL PIPE COLLAPSE AND INTERNAL PRESSURE DATA

Size O.D. (in)	Nom. Weight Threads & Couplings (lb)	Collapse Pressure Based on Minimum Values (psi)					Internal Pressure at Minimum Yield Strength (psi)				
		D	E	95	105	135	D	E	95	105	135
2-3/8	4.85	8100	11040	13980	15460	19070	...	10500	13300	14700	18900
	6.65	11440	15600	19760	21840	28080	11350	15470	19600	21660	27850
2-7/8	6.85	7680	10470	12930	14010	17060	...	9910	12550	13870	17830
	10.40	12110	16510	20910	23110	29720	12120	16530	20930	23140	29750
3-1/2	9.50	7400	10040	12060	13050	15780	...	9520	12070	13340	17150
	13.30	10350	14110	17880	19760	25400	10120	13800	17480	19320	24840
	15.50	12300	16770	21250	23480	30190	12350	16840	21330	23570	30310
4	11.85	6590	8410	9960	10700	12650	...	8600	10890	12040	15480
	14.00	8330	11350	14380	15900	20170	7940	10830	13720	15160	19490
	15.70	9460	12900	16340	18050	23210	9140	12470	15790	17460	22440
4-1/2	13.75	5720	7200	8400	8950	10310	...	7900	10010	11070	14230
	16.60	7620	10390	12750	13820	16800	7210	9830	12450	13760	17690
	20.00	9510	12960	16420	18150	23330	9200	12540	15890	17560	22580
5	16.25	5560	6970	8090	8610	9860	...	7770	9840	10880	13990
	19.50	7390	10000	12010	12990	15700	6970	9500	12040	13300	17110
	25.60	9900	13500	17100	18900	24300	9620	13120	16620	18380	23620
5-1/2	19.20	4910	6070	6930	7300	8120	...	7250	9190	10160	13060
	21.90	6610	8440	10000	10740	12710	6320	8610	10910	12060	15510
	24.70	7670	10460	12920	14000	17050	7260	9900	12540	13860	17830
6-5 /8	25.20	4010	4810	5310	5490	6040	4790	6540	1 8280	9150	11770

API DRILL COLLAR AND JOINT SIZES



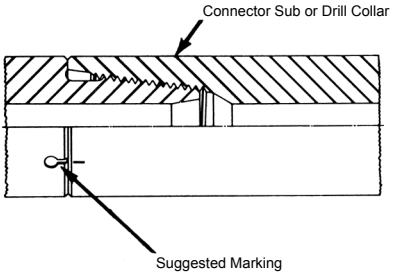


Drill Collar Number *	Outside Dia. D	Bore +1/16 –0 d		Length Ft. ±6 in. L	Bevel Dia. ±1/64 D_F	Bending Strength Ratio	M	F
NC 23–31 (tentative)	3-1/8	1-1/4	…	30	3	2.57:1	†	†
NC 26–35 (2-3/8 IF)	3-1/2	1-1/2	…	30	3-17/64	2.42:1	†	†
NC 31–41 (2-7/8 IF)	4-1/8	2	…	30	3-61/64	2.43:1	†	†
NC 35–47	4-3/4	2	…	30	4-33/64	2.58:1	3-15/64	3-3/8
NC 38–50 (3-1/2 IF)	5	2-1/4	…	30	4-49/64	2.38:1	3-33/64	3-5/8
…	5-3/4	2-1/4	NC 40 (4 FH)	30 or 31	5-13/32	3.10:1	3-25/32	4-1/8
…	5-3/4	2-13/16	4-1/2 FH	30 or 31	5-17/32	2.22:1	4-13/64	3-5/8
NC 44–60	6	2-1/4	…	30 or 31	5-11/16	2.49:1	4-3/16	4-1/8
NC 44–60	6	2-13/16	…	30 or 31	5-11/16	2.84:1	4-3/16	4-1/8
NC 44–62	6-1/4	2-1/4	…	30 or 31	5-7/8	2.91:1	4-3/16	4-1/8
…	6-1/4	2-1/4	NC 46 (4 IF)	30 or 31	5-23/32	2.16:1	2-21/64	4-1/8
NC 41–62 (4 IF)	6-1/4	2-13/16	…	30 or 31	5-29/32	2.63:1	4-21/64	4-1/8
NC 46–65 (4 IF)	6-1/2	2-1/4	…	30 or 31	6-3/32	2.76:1	4-21/64	4-1/8
NC 46–65 (4 IF)	6-1/2	2-13/16	…	30 or 31	6-3/32	3.05:1	4-21/64	4-1/8
NC 46–67 (4 IF)	6-3/4	2-1/4	…	30 or 31	6-9/32	3.18:1	4-21/64	4-1/8
…	6-3/4	2-13/16	NC 50 (4-1/2 IF)	30 or 31	6-25/32	2.35:1	4-3/4	4-1/8
NC 50–70 (4-1/2 IF)	7	2-1/4	…	30 or 31	6-31/64	2.54:1	4-3/4	4-1/8
NC 50–70 (4-1/2 IF)	7	2-13/16	…	30 or 31	6-31/64	2.73:1	4-3/4	4-1/8
NC 50–72 (4-1/2 IF)	7-1/4	2-13/16	…	30 or 31	6-43/64	3.12:1	4-3/4	4-1/8
NC 56–77	7-3/4	2-13/16	…	30 or 31	7-19/64	2.70:1	5-19/64	4-5/8
…	7-3/4	3	6-5/8 Reg	30 or 31	7-21/64	2.37:1	5-27/64	4-5/8
NC 56–80	8	2-13/16	…	30 or 31	7-31/64	3.02:1	5-19/64	4-5/8
6-5/8 Reg	8-1/4	2-13/16	…	30 or 31	7-45/64	2.93:1	5-27/64	4-5/8
NC 61–90	9	2-13/16	…	30 or 31	8-3/8	3.17:1	5-55/64	5-1/8
7-5/8 Reg	9-1/2	3	…	30 or 31	8-13/16	2.81:1	6-13/32	4-7/8
NC 70–97	9-3/4	3	…	30 or 31	9-5/32	2.57:1	6-47/64	5-5/8
NC 70–100	10	3	…	30 or 31	9-11/32	2.81:1	6-47/64	5-5/8
NC 77–110 (tentative)	11	3	…	30 or 31	10-17/64	2.78:1	7-27/64	6-1/8

* *The drill collar number (first column) consists of two parts separated by a hyphen. The first part is the connectlon number in the NC style. The second part, consisting of 2 (or 3) digits, indicates the drill collar outside diameter in units and tenths of inches. The connections shown in parentheses in the first column a not a part of the drill collar number; they indicate interchangeability of drill collars made with the standard (NC) connections as shown. If the connections shown in parentheses in the first column are made with the V-0.038 R thread form (as provided in Par. 9.4) the connections, and drill collars, are identical with those in the NC style. Drill collars with 8-1/4 and 9-1/2 inches outside diameters are shown with 6-5/8 and 7-5/8 Regular connections, since there are no NC connections in the recommended bending strength ratio range.*

† *Insufficient metal to accommodate stress relief grooves.*

RECOMMENDED PROCEDURE FOR MAKING UP DRILL COLLARS WITH NEW JOINTS



1. Thoroughly clean with distillate, pin and box threads and shoulder. After cleaning, the joint must be dried before lubricant is applied.

2. Coat all areas of the pin and box threads and shoulders with a thin even coat of a good grade lubricant from a covered or newly opened can. A molydisulfide lubricant is recommended.

3. Extreme care should be used when stabbing the joints to avoid stabbing wounds. If drill collar connecting subs are used, it is preferred that the subs be applied by hand rather than with lifting equipment.

4. Make up joints manually with chain tongs as far as possible and then use cathead to the full recommended torque as shown on attached chart.

5. Scribe vertical chalk line across joint make-up line of box and pin faces.

6. Break joint, clean and dry threads. Inspect the threads and joint faces carefully for evidence of galling or “hair like” slivers of steel. Stone or file all rough spots and remove slivers. Be careful not to remove chalk line across joint face.

7. Again make up joints manually with chain tongs as far as possible and then with cathead using full recommended torque. The joint must make up to the chalk mark or father. If the joint does not make up to this line, again break the joint, dry and clean. Inspect the threads and joint faces carefully and in general proceed as under 6 above.

8. If the joints make up to the chalk line or farther, a center punch mark shall be made on both the box and pin halves, adjacent to the shoulder, as permanent inspection mark. After each run, these match making spots should be inspected and as long as there is no creep between the two marks, the joints should be left unbroken if possible (nonworking joints). As the drill collars wear, it is recommended that the center punch marks be deepened so that they will always be in evidence. When it is noted that creep has occurred on the nonworking joints, they should be broken apart, inspected and if necessary recut.

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) *

Size	Connection Type	Drill Collar O.D	Drill Collar Bore (in)								Weak Member
			1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-13/16	
		3	2,500 - 2,750	2,500 - 2,750	2,500 - 2,750						Box
API	NC 23	3-1/8	3,300 - 3,630	3,300 - 3,630	2,600 - 2,860						Pin
		3-1/4	4,000 - 4,400	3,400 - 3,740	2,600 - 2,860						Pin
		3		3,800 - 4,180	3,800 - 4,180	2,900 - 3,190					Pin
2-7/8	PAC	3-1/8		4,900 - 5,390	4,200 - 4,620	2,900 - 3,190					Pin
		3-1/4		5,200 - 5,720	4,200 - 4,620	2,900 - 3,190					Pin
2-3/8	API IF	3-1/2		4,600 - 5,060	4,600 - 5,060	3,700 - 4,070					Pin
API	NC 26	3-3/4		5,500 - 6,050	4,700 - 5,170	3,700 - 4,070					Pin
2-7/8	Slim Hole										
2-7/8	Xtra Hole	3-3/4		4,100 - 4,510	4,100 - 4,510	4,100 - 4,510					Box
3-1/2	Dbl. Streamline	3-7/8		5,300 - 5,830	5,300 - 5,830	5,300 - 5,830					Box
2-7/8	Mod. Open	4-1/8		8,000 - 8,800	8,000 - 8,800	7,400 - 8,140					Pin
2-7/8	API IF	3-7/8		4,600 - 5,060	4,600 - 5,060	4,600 - 5,060	4,600 - 5,060				Box
API	NC 31	4-1/8		7,300 - 8,030	7,300 - 8,030	7,300 - 8,030	6,800 - 7,480				Pin
3-1/2	Slim Hole	4-1/4		8,800 - 9,680	8,800 - 9,680	8,100 - 8,910	6,800 - 7,480				Pin
		4-1/2		10,000 - 11,000	9,300 - 10,230	8,100 - 8,910	6,800 - 7,480				Pin
		4-1/2				8,900 - 9,790	8,900 - 9,790	8,900 - 9,790	7,400 - 8,140		Pin
API	NC 35	4-3/4				12,100 - 13,310	10,800 - 11,880	9,200 - 10,120	7,400 - 8,140		Pin
		5				12,100 - 13,310	10,800 - 11,880	9,200 - 10,120	7,400 - 8,140		Pin
		4-1/4				5,100 - 5,610	5,100 - 5,610	5,100 - 5,610	5,100 - 5,610		Box
3-1/2	Xtra Hole	4-1/2				8,400 - 9,240	8,400 - 9,240	8,400 - 9,240	8,200 - 9,020		Pin
4	Slim Hole	4-3/4				11,900 - 13,090	11,700 - 12,870	10,000 - 11,000	8,200 - 9,020		Pin
3-1/2	Mod. Open	5				13,200 - 14,520	11,700 - 12,870	10,000 - 11,000	8,200 - 9,020		Pin
		5-1/4				13,200 - 14,520	11,700 - 12,870	10,000 - 11,000	8,200 - 9,020		Pin
3-1/2	API IF	4-3/4				9,900 - 10,890	9,900 - 10,890	9,900 - 10,890	9,900 - 10,890	8,300 - 9,130	Pin
API	NC 38	5				13,800 - 15,180	13,800 - 15,180	12,800 - 14,080	10,900 - 11,990	8,300 - 9,130	Pin
4-1/2	Slim Hole	5-1/4				16,000 - 17,600	14,600 - 16,060	12,800 - 14,080	10,900 - 11,990	8,300 - 9,130	Pin
		5-1/2				16,000 - 17,600	14,600 - 16,060	12,800 - 14,080	10,900 - 11,990	8,300 - 9,130	Pin

** Adapted from API RP7G*

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) *

Size	Connection Type	Drill Collar O.D.	Drill Collar Bore (in) 1-3/4	2	2-1/4	2-1/2	2-13/16	3	Weak Member
		4-3/4	8,700 - 9,570	8,700 - 9,570	8,700 - 9,570	8,700 - 9,570	8,700 - 9,570		Box
3-1/2	H-90	5	12,700 - 13,970	12,700 - 13,970	12,700 - 13,970	12,700 - 13,970	19,400 - 11,440		Pin
		5-1/4	16,900 - 18,590	16,700 - 18,370	15,000 - 16,500	13,100 - 14,410	10,400 - 11 440		Pin
		5-1/2	18,500 - 20,350	16,700 - 18,370	15,000 - 16,500	13,100 - 14,410	10,400 - 11,440		Pin
4	API Full Hole	5	10,800 - 11,880	10,800 - 11,880	10,800 - 11,880	10,800 - 11,880	10,800 - 11,880		Box
API	NC 40	5-1/4	15,100 - 16,610	15,100 - 16,610	15,100 - 16,610	14,800 - 16,280	12,100 - 13,310		Pin
		5-1/2	19,700 - 21,670	18,600 - 20,460	16,900 - 18,590	14,800 - 16,280	12,100 - 13,310		Pin
4	Mod. Open	5-3/4	20,400 - 22,440	18,600 - 20,460	16,900 - 18,590	14,800 - 16,280	12,100 -13,310		Pin
4-1/2	Dbl. Streamline	6	20,400 - 22,440	18,600 - 20,460	16,900 - 18,590	14,800 - 16,280	12,100 - 13,310		Pin
		5-1/4		12,500 - 13,750	12,500 - 13,750	12,500 - 13,750	12,500 - 13,750		Box
		5-1/2		17,300 - 19,030	17,300 - 19,030	17,300 - 19,030	16,500 - 18,150		Pin
		5-3/4		22,300 - 24,530	21,500 - 23,650	19,400 - 21,340	16,500 - 18,150		Pin
4	H-90	6		23,500 - 25,850	21,500 - 23,650	19,400 - 21,340	16,500 - 18,150		Pin
		6-1/4		23,500 - 25,850	21 500 - 23,650	19,400 - 21,340	16,500 - 18,150		Pin
		5-1/2		15,400 - 16,940	15,400 - 16,940	15,400 - 16,940	15,400 - 16,940		Box
4-1/2	API Regular	5-3/4		20,300 - 22,330	20,300 - 22,330	19,400 - 21,340	16,200 - 17,820		Pin
		6		23,400 - 25,740	21,600 - 23,760	19,400 - 21,340	16,200 - 17,820		Pin
		6-1/4		23,400 - 25,740	21,600 - 23-760	19,400 - 21,340	16,200 - 17,820		Pin
		5-3/4		20,600 - 22,660	20,600 - 22,660	29,600 - 22,660	18,000 - 19,800		Pin
		6		25,000 - 27,500	23,300 - 25,630	21,200 - 23,320	18,900 - 19,800		PIn
API	NC 44	6-1/4		25,000 - 27,500	23,300 - 25,630	21,200 - 23,320	18,000 - 19,800		Pin
		6-1/2		25,000 - 27,500	23,300 - 25,630	21,200 - 23,320	18,000 - 19,800		Pin
		5- 1/2		12,900 - 14,190	12,900 - 14,190	12,900 - 14,190	12,900 - 14,190	12,900 - 14,190	Box
		5-3/4		17,900 - 19,690	17,900 - 19,690	17,900 - 19,690	17,900 - 19,690	17,700 - 19,470	Pin
4-1/2	API Full Hole	6		23,300 - 25,630	23,300 - 25,630	22 800 - 25,080	19,800 - 21,780	17,700 - 19,470	Pin
		6-1/4		27,000 - 29,700	25,000 - 27,500	22,800 - 25,080	19,800 - 21,780	17,700 - 19,470	Pin
		6 -1/2		27,000 - 29,700	25,000 - 27,500	22,800 - 25,080	19,800 - 21,780	17,700 - 19,470	Pin

** Adapted from API RP7G*

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) *

Size	Connection Type	Drill Collar O.D.	Drill Collar Bore (in) 2-1/4	2-1/2	2-13/16	3	3-1/4	Weak Member
4-1/2	Xtra Hole	5-3/4	17,600 - 19,360	17,600 - 19,360	17,600 - 19,360	17,600 - 19,360	…	Box
API	NC 46	6	23,200 - 25,520	23,200 - 25,520	22,200 - 24,420	20,200 - 22,220	…	Pin
4	API IF	6-1/4	28,000 - 30,800	25,500 - 28,050	22,200 - 24,420	20,200 - 22,220	…	Pin
4-1/2	Semi IF	6-1/2	28,000 - 30,800	25,500 - 28,050	22,200 - 24,420	20,200 - 22,220	…	Pin
5	Dbl.StreamIlne	6-3/4	28,000 - 30,800	25,500 - 28,050	22,200 - 24,420	20,200 - 22,220	…	Pin
4-1/2	Mod.Open	…	…	…	…	…	…	…
		5-3/4	17,600 - 19,360	17,600 - 19,360	17,600 - 19,360	17,600 - 19,360	…	Box
		6	23,400 - 25,740	23,400 - 25,740	23,000 - 25,300	21,000 - 23,100	…	Pin
4-1/2	H-90	6-1/4	28,500 - 31,350	26,000 - 28,600	23,000 - 25,300	21,000 - 23,100	…	Pin
		6-1/2	28,500 - 31,350	26,000 - 28,600	23,000 - 25,300	21,000 - 23,100	…	Pin
		6-3/4	28,500 - 31,350	26,000 - 28,600	23,000 - 25,300	21 000 - 23,100	…	Pin
		6-1/4	25 000 - 27,500	25,000 - 27,500	25 000 - 27,500	25 000 - 27,500	…	Box
5	H-90	6-1/2	31,500 - 34,640	31,500 - 34,640	29,500 - 32,450	27,000 - 29,700	…	Pin
		6-3/4	35,000 - 38,500	33,000 - 36,300	29,500 - 32 450	27,000 - 29,700	…	Pin
		7	35,000 - 38,500	33,000 - 36,300	29 500 - 32,450	27,000 - 29,700	…	Pin
4-1/2	API IF	6-1/4	22,800 - 25,080	22,800 - 25,080	22,000 - 25,080	22,800 - 25,080	22,800 - 25,080	Box
API	NC 50	6-1/2	29,500 - 32,450	29 500 - 32 450	29 500 - 32 450	29 500 - 32 450	26,500 - 29,150	Pin
5	Xtra Hole	6-3/4	36,000 - 39,600	35,500 - 39,050	32,000 - 35,200	30,000 - 33,000	26,500 - 29,150	Pin
5	Mod.Open	7	38,000 - 41,800	35,500 - 39,050	32,000 - 35,200	30,000 - 33,000	26,500 - 29,150	Pin
5-1/2	Dbl. Streamline	7-1/4	38,000 - 41,800	35,500 - 39,050	32,000 - 35,200	30,000 - 33,000	26,500 - 29,150	Pin
5	Semi IF		…	…	…	…	…	…
		6-3/4	34,000 - 37,400	34,000 - 37,400	34,000 - 37,400	34,000 - 37,400	…	Pin
5-1/2	H-90	7	41,500 - 45,650	40,000 - 44,000	36,500 - 40,150	34,000 - 37,400	…	Pin
		7-1/4	42 500 - 46,750	40,000 - 44,000	36,500 - 40,150	34,000 - 37,400	…	Pin
		7-1/2	42,500 - 46,750	40,000 - 44,000	36,500 - 40,150	34,000 - 37,400	…	Pin
		6-3/4	31,500 - 34,650	31,500 - 34,650	31,500 - 34,650	31,500 - 34,650	…	Box
5-1/2	API Regular	7	39,000 - 42,900	39,000 - 42,900	36,000 - 39,600	33,500 - 36,050	…	Pin
		7-1/4	42,000 - 46,200	39,500 - 43,450	36,000 - 39,600	33,500 - 36,850	…	PIn
		7-1/2	42 000 - 46 200	39 500 - 43 450	36,000 - 39,600	33,500 - 36,850	…	Pin

**Adapted from API RP7G*

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) *

Size	Connection Type	Drill Collar O.D.	Drill Collar Bore (in) 2-1/2	2-13/16	3	3-1/4	3-1/2	Weak Member
		7	32,500 - 35,750	32,500 - 35,750	32,500 - 35,750	32,500 - 35,750	…	Box
5-1/2	API Full Hole	7-1/4	40,500 - 44,550	40,500 - 44,550	40,500 - 44,550	40,500 - 44,550	…	Box
		7-1/2	49,000 - 53,900	47,000 - 51,700	45,000 - 49,500	41,500 - 45,650	…	Pln
		7-3/4	51,000 - 56,100	47,000 - 51,700	45,000 - 49,500	41,500 - 45,650	…	Pin
		7-1/4	40,000 - 44,000	40,000 - 44,000	40,000 - 44,000	40,000 - 44,000	…	Box
API	NC 56	7-1/2	48,500 - 53,350	48,000 - 52,800	45,000 - 49,500	42,000 - 46,200	…	Pin
		7-3/4	51,000 - 56,100	48,000 - 52,800	45,000 - 49,500	42,000 - 46,200	…	Pin
		8	51,000 - 56,100	48,000 - 52,800	45,000 - 49,500	42,000 - 46,200	…	Pin
		7-1/2	46,000 - 50,600	46,000 - 50,600	46,000 - 50,600	46,000 - 50,600	…	Box
6-5/8	API Regular	7-3/4	55,000 - 60,500	53,000 - 58,300	50,000 - 55,000	47,000 - 51,700	…	Pin
		8	57,000 - 62,700	53,000 - 58,300	50,000 - 55,000	47,000 - 51,700	…	Pin
		8-1/4	57,000 - 62,700	53,000 - 58,300	50,000 - 55,000	47,000 - 51,700	…	Pln
		7-1/2	46,000 - 50,600	46,000 - 50,600	46,000 - 50,600	46,000 - 50,600	…	Box
6-5/8	H-90	7-3/4	55,000 - 60,500	55,000 - 60,500	53,000 - 58,300	49,500 - 54,450	…	Pin
		8	59,500 - 65,450	56,000 - 61,600	53,000 - 58,300	49,500 - 54,450	…	Pin
		8-1/4	59,500 - 65,450	56,000 - 61,600	53,000 - 58,300	49,500 - 54,450	…	Pin
		8	54,000 - 59,400	54,000 - 59,400	54,000 - 59,400	54,000 - 59,400	…	Box
		8-1/4	64,000 - 70,400	64,000 - 70,400	64,000 - 70,400	61,000 - 67,100	…	Pin
API	NC 61	8-1/2	72,000 - 79,200	68,000 - 74,800	65,000 - 71,500	61,000 - 67,100	…	Pin
		8-3/4	72,000 - 79,200	68,000 - 74,800	65,000 - 71,500	61,000 - 67,100	…	Pin
		9	72,000 - 79,200	68,000 - 74,800	65,000 - 71,500	61,000 - 67,100	…	Pin
		8	56,000 - 61,600	56,000 - 61,600	56,000 - 61,600	56,000 - 61,600	56,000 - 61,600	Box
		8-1/4	66,000 - 72,600	66,000 - 72,600	66,000 - 72,600	63,000 - 69,300	59,000 - 64,900	Pin
5-1/2	API IF	8-1/2	74,000 - 81,400	70,000 - 77,000	67,000 - 73,700	63,000 - 69,300	59,000 - 64,900	Pin
		8-3/4	74,000 - 81,400	70,000 - 77,000	67,000 - 73,700	63,000 - 69,300	59,000 - 64,900	Pin
		9	74,000 - 81,400	70,000 - 77,000	67,000 - 73,700	63,000 - 69,300	59,000 - 64,900	Pin
		9 -1/4	74,000 - 81,400	70,000 - 77,000	67,000 - 73,700	63,000 - 69,300	59,000 - 64,900	Pin

** Adapted from API RP7G*

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) *

Size	Connection Type	Drill Collar O.D.	Drill Collar Bore (in)					Weak Member
			2-13/16	3	3-1/4	3-1/2	3-3/4	
		8-1/2	67,000 - 73,700	67,000 - 73,700	67,000 - 73,700	67,000 - 73,700	66,500 - 73,150	Pin
		8-3/4	78,000 - 85,800	78,000 - 85,800	76,000 - 83,600	72,000 - 79,200	66,500 - 73,150	Pin
6-5/8	API Full Hole	9	83,000 - 91,300	80,000 - 88,000	76,000 - 83,600	72,000 - 79,200	66,500 - 73,150	Pin
		9-1/4	83,000 - 91,300	80,000 - 88,000	76,000 - 83,600	72,000 - 79,200	66,500 - 73,150	Pin
		9-1/2	83,000 - 91,300	80,000 - 88,000	76,000 - 83,600	72,000 - 79,200	66,500 - 73,150	Pin
		9	75,000 - 82,500	75,000 - 82,500	75,000 - 82,500	75,000 - 82,500	75,000 - 82,500	Box
		9-1/4	88,000 - 96,800	88,000 - 96,800	88,000 - 96,800	88,000 - 96,800	88,000 - 96,800	Box
API	NC 70	9-1/2	101,000 - 111,100	101,000 - 111,100	100,000 - 110,000	95,000 - 104,500	90,000 - 99,000	Pin
		9-3/4	107,000 - 117,700	105,000 - 115,500	100,000 - 110,000	95,000 - 104,500	90,000 - 99,000	Pin
		10	107,000 - 117,700	105,000 - 115,500	100,000 - 110,000	95,000 - 104,500	90,000 - 99,000	Pin
		10-1/4	107,000 - 117,700	105,000 - 115,500	100,000 - 110,000	95,000 - 104,500	90,000 - 99,000	Pin
		10	…	107,000 - 117,700	107,000 - 117,700	107,000 - 117,700	107,000 - 117,700	Box
		10-1/4	…	122,000 - 134,200	122,000 - 134,200	122,000 - 134,200	122,000 - 134,200	Box
API	NC 77	10-1/2	…	138,000 - 151,800	138,000 - 151,800	133,000 - 146,300	128,000 - 140,800	Pin
		10-3/4	…	143,000 - 157,300	138,000 - 151,800	133,000 - 146,300	128,000 - 140,800	Pin
		11	…	143,000 - 157,300	138,000 - 151,800	133,000 - 146,300	128,000 - 140,800	Pin
		8	53,000 - 58,300	53,000 - 58,300	53,000 - 58,300	53,000 - 58,300	…	Box
7	H-90	8-1/4	63,000 - 69,300	63,000 - 69,300	63,000 - 69,300	60,500 - 66,550	…	Pin
		8-1/2	71,500 - 78,650	68,500 - 75,350	65,000 - 71,500	60,500 - 66,550		Pin
		8-1/2	…	60,000 - 66,000	60,000 - 66,000	60,000 - 66,000	60,000 - 66,000	Box
		8-3/4	…	71,000 - 78,100	71,000 - 78,100	71,000 - 78,100	71,000 - 78,100	Box
7-5/8	API Regular	9	…	83,000 - 91,300	83,000 - 91,300	79,000 - 86,900	74,000 - 81,400	Pin
		9-1/4	…	88,000 - 96,800	83,000 - 91,300	79,000 - 86,900	74,000 - 81,400	Pin
		9-1/2	…	88,000 - 96,800	83,000 - 91,300	79,000 - 86,900	74,000 - 81,400	Pin
		9	…	72,000 - 79,200	72,000 - 79,200	72,000 - 79,200	72,000 - 79,200	Box
7-58	H-90	9-1/4	…	85,500 - 94,050	85,500 - 94,050	85,500 - 94,050	85,500 - 94,050	Box
		9-1/2	…	98,000 - 107,800	98,000 - 107,800	98,000 - 107,800	95,500 - 105,050	Pin

** Adapted from API RP7G*

TORQUE RANGE (FT-LBS)

Size	Connection Type	Drill Collar O.D.	Drill Collar Bore (in) 2-13/16	3	3-1/4	3-1/2	3-3/4	Weak Member
		10	…	108,000 - 118,800	108,000 - 118,800	108,000 - 118,800	108,000 - 118,800	Box
8-5/8	API Reg	10-1/4	…	123,000 - 135,300	123,000 - 135,300	123,000 - 135,300	123,000 - 135,300	Pin
		10-1/2	…	139,000 - 152,900	134,000 - 152,900	129,000 - 152,900	123,000 - 152,900	Pin
8-5/8	H-90	10-1/4	…	112,500 - 123,750	112,500 - 123,750	112,500 - 123,750	112,500 - 123,750	Box
		10-1/2	…	128,500 - 141,350	128,500 - 141,350	128,500 - 141,350	128,500 - 141,350	Box
7	H-90	8-3/4	67,500 - 74,250	67,500 - 74,250	66,500 - 73,150	62,000 - 68,200	…	Pin
With Low-Torque Face		9	74,000 - 81,400	71,000 - 78,100	66,500 - 73,150	62,000 - 68,200	…	Pin
		9-1/4	…	72,000 - 79,200	72,000 - 79,200	72,000 - 79,200	72,000 - 79,200	Box
7-5/8	API Reg	9-1/2	…	85,000 - 93,500	85,000 - 93,500	82,000 - 90,200	77,000 - 84,700	Pin
With Low Torque Face		9-3/4	…	91,000 - 100,100	87,000 - 95,700	82,000 - 90,200	77,000 - 84,700	Pin
		10	…	91,000 - 100,100	87,000 - 95,700	82,000 - 90,200	77,000 - 84,700	Pin
		9-3/4	…	91,000 - 100,100	91,000 - 100,100	91,000 - 100,100	91,000 - 100,100	Box
7-5/8	H-90	10	…	105,000 - 115,500	105,000 -115,500	103,500 - 113,850	98,000 - 107,800	Pin
With Low Torque Face		10-1/4	…	112,500 - 123,750	108,000 - 118,800	103,500 - 113,850	98,000 - 107,800	Pin
		10-1/2	…	112,500 - 123,750	108,000 - 118,800	103,500 - 113,850	98,000 - 107,800	Pin
8-5/8	API Reg	10-3/4	…	112,000 - 123,200	112,000 - 123,200	112,000 - 123,200	112,000 - 123,200	Box
With Low Torque Face		11	…	129,000 - 141,900	129,000 - 141,900	129,000 - 141,900	129,000 - 141,900	Box
8-5/8	H-90	10 3/4	…	92,500 - 101,750	92,500 - 101,750	92,500 - 101,750	92,500 - 101,750	Box
With Low Torque Face		11	…	110,000 - 121,000	110,000 - 121,000	110,000 - 121,000	110,000 - 121,000	Box
		11-1/4	…	128,000 - 140,800	128,000 - 140,800	128,000 - 140,800	128,000 - 140,800	Box

** Adapted from API RP7G*

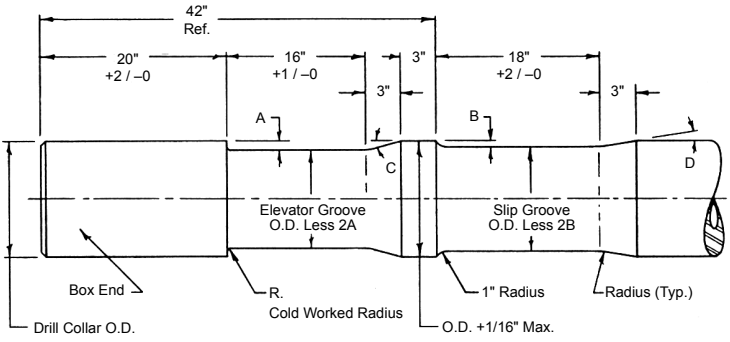
DRILL COLLAR WEIGHTS — POUNDS PER FOOT

Collar	Bore of Collar (in)										
O.D.	1-1/2	1-3/4	2	2-1/4	2-1/2	2-13/16	3	3-1/4	3-1/2	3-3/4	4
3-3/8	24.4	22.2	…	…	…	…	…	…	…	…	…
3-1/2	26.7	24.5	…	…	…	…	…	…	…	…	…
3-3/4	31.5	29.3	…	…	…	…	…	…	…	…	…
3-7/8	34.0	31.9	29.4	26.5	…	…	…	…	…	…	…
4	36.7	34.5	32.0	29.2	…	…	…	…	…	…	…
4-1/8	39.4	37.2	34.7	31.9	…	…	…	…	…	…	…
4-1/4	42.2	40.0	37.5	34.7	…	…	…	…	…	…	…
4-1/2	48.0	45.8	43.3	40.5	…	…	…	…	…	…	…
4-3/4	54.2	52	49.5	46.7	43.5	…	…	…	…	…	…
5	60.1	58.5	55.9	53.1	49.9	…	…	…	…	…	…
5-1/4	67.5	65.3	62.8	59.9	56.8	53.3	…	…	…	…	…
5-1/2	74.7	72.5	69.9	67.2	63.9	60.5	56.7	…	…	…	…
5-3/4	82.1	79.9	77.5	74.6	71.5	67.9	64.1	…	…	…	…
6	89.9	87.8	85.3	82.5	79.3	75.8	71.9	67.8	63.3	…	…
6-1/4	98.1	95.9	93.5	90.6	87.5	83.9	80.1	75.9	71.5	…	…
6-1/2	106.6	104.5	101.9	99.1	95.9	92.5	88.6	84.5	79.9	…	…
6-3/4	115.5	113.3	110.8	107.9	104.8	101.3	97.5	93.3	88.8	…	…
7	124.6	122.5	119.9	117.1	113.9	110.5	106.6	102.5	97.9	93.1	87.9
7-1/4	134.1	131.9	129.5	126.6	123.5	119.9	116.1	111.9	107.5	102.6	97.5
7-1/2	143.9	141.7	139.3	136.5	133.3	129.8	125.9	121.8	117.3	112.5	107.3
7-3/4	154.1	151.9	149.5	146.6	143.5	139.9	136.1	131.9	127.5	122.6	117.5
8	164.6	162.5	159.9	157.1	153.9	150.5	146.6	142.5	137.9	133.1	127.9
8-1/4	175.4	173.3	170.8	167.9	164.8	161.3	157.5	153.3	148.8	143.9	138.8
8-1/2	186.6	184.4	181.9	179.1	175.9	168.6	172.5	164.5	159.9	155.1	149.9
8-3/4	198.1	195.9	193.9	190.6	187.4	183.9	180.1	175.9	171.4	166.6	161.5
9	…	207.8	205.3	202.4	199.3	195.8	191.9	187.8	183.3	178.5	173.3
9-1/2	…	232.4	229.9	227.1	223.9	220.4	216.6	212.4	207.9	203.1	197.9
10	…	…	255.9	253.1	249.9	246.4	242.6	238.4	233.9	229.1	223.9
10-1/2	…	…	283.3	280.4	277.3	273.8	269.9	265.8	261.3	256.4	251.3
11	…	…	…	…	305.9	302.4	298.6	294.4	289.9	285.1	279.9

APPROXIMATE WEIGHTS OF 30' SPIRAL DRILL COLLARS

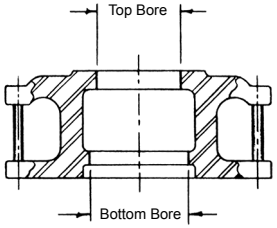
	Bore of Collar (in)									
O.D. (in)	13/16	1-1/2	1-3/4	2	2-1/4	2-1/2	2-13/16	3	3-1/4	3-1/2
3-1/8	654	...	...	...						
3-1/2	...	769	785	...	...	...		...	...	
4-1/8	...	1135	1071	1000	919	...	...	...	...	...
4-1/2	...	1385	1323	1250	1169	...	...	...	...	...
4-3/4	...	1564	1501	1428	1348	1256	...	...	...	...
5	...	1751	1689	1616	1535	1443	...	...	...	...
5-1/4	...	1947	1854	1812	1731	1639	1538	...	...	...
5-1/2	...	2154	2091	2019	1933	1846	1745	1636	...	...
5-3/4	...	2370	2307	2235	2154	2062	1931	1852	...	...
6	...	2595	2531	2460	2379	2257	2166	2076	1956	1326
6-1/4	...	...	2739	2637	2606	2514	2413	2304	2183	2053
6-1/2	...	...	3018	2946	2961	2773	2673	2565	2442	2313
6-3/4	...	...	3277	3205	3125	3033	2932	2822	2701	2572
7	...	...	3537	3465	3384	3292	3191	3082	2961	2831
7-1/4	...	...	...	3724	3643	3551	3430	3341	3220	3090
7-1/2	...	...	...	4012	3931	3859	3733	3629	3508	3378
7-3/4	...	...	...	4300	4219	4127	4026	3917	3796	3660
8	...	...	...	4617	4536	4444	4343	4234	4115	3913
8-1/4	...	...	...	...	4655	4761	4660	4550	4425	4300
8-1/2	...	...	...	...	5170	5077	4977	4867	4746	4617
8-3/4	...	...	...	...	5515	5429	5322	5213	5092	4912
9	...	...	...	...	5832	5740	5639	5530	5409	5214
9-1/4	...	...	...	...	6206	5114	6013	5904	5783	5653
9-1/2	...	...	...	...	6552	6456	6359	6250	6129	5919
9-3/4	...	...	...	...	6926	6634	6733	6674	6503	6375
10	...	...	...	...	7309	7209	7108	6998	6677	6745
10-1/4	...	...	...	...	7704	7612	7511	7402	7281	7151
10-1/2	...	...	...	...	8076	7988	7885	7776	7655	7325
10-3/4	...	...	...	...	8510	8418	8317	8208	8081	7557
11	...	...	...	...	...	8821	8720	8611	8405	8361
11-1/4	...		...	...	...	9253	9153	9043	8922	8793

DRILL COLLAR GROOVES FOR ELEVATORS AND SLIPS



GROOVE DIMENSIONS BASED ON DRILL COLLAR O. D.

Drill Collar O.D. Ranges		Elev Groove Depth A *	R	C † (deg)	Slip Groove Depth B *	D † (deg)
4	4-5/8	7/32	1/8	4	3/16	3-1/2
4-3/4	5-5/8	1/4	1/8	5	3/16	3-1/2
5-3/4	6-5/8	5/16	1/8	6	1/4	5
6-3/4	8-5/8	3/8	3/16	7-1/2	1/4	5
8-3/4	Larger	7/16	1/4	9	1/4	5



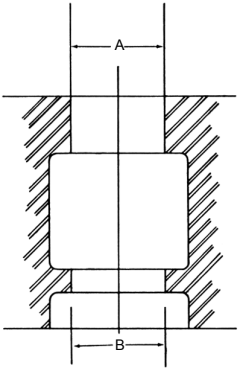
ELEVATOR BORES BASED ON DRILL COLLAR O.D.

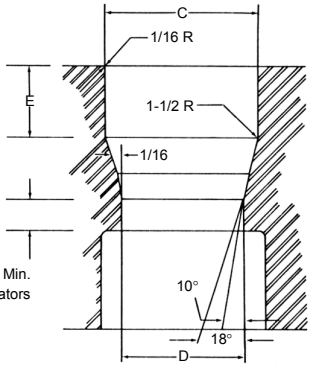
Top Bore * +0 –1/32	Bottom Bore * +1/16 –0
O.D. minus 5/16	O.D. plus 1/8
O.D. minus 3/8	O.D. plus 1/8
O.D. minus 1/2	O.D. plus 1/8
O.D. minus 9/16	O.D. plus 1/8
O.D. minus 5/8	O.D. plus 1/8

** A and B dimensions are from nominal O.D. of new drill collar.*
† Angle C and D dimensions are reference and approximate.

NOTE: These dimensions were worked out by an API task group, but the dimensions are not to be construed as being API standard.

ELEVATOR BORE CHARTS





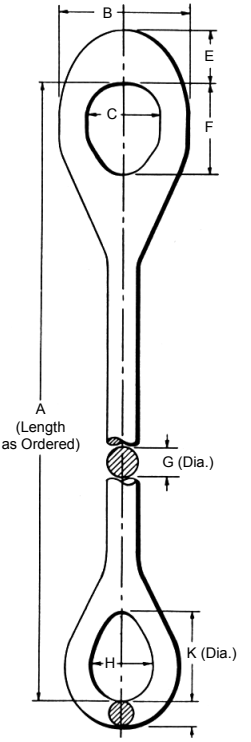
COLLAR-TYPE TOOL JOINTS

Drill Pipe Size		Welded-On Tool Joint			Screwed-On Tool Joint		
		Neck Dia.	A Top Bore	B Bottom Bore	Upset Dia.	A Top Bore	B Bottom Bore
2-3/8	IF	…	…	…	…	…	…
2-7/8	R & FH	3	3-3/16	3-1/8	…	3-3/16	3-1/8
	IF	3-3/16	3-3/8	3-1/8	3.261	3-3/8	3-1/8
3-1/2	R & FH	3-5/8	3-13/16	3-13/16	3.631	3-13/16	3-13/16
	IF	3-7/8	4-1/16	3-3/4	3.970	4-1/16	3-3/4
4	FH	4-1/8	4-5/16	4-5/16	4.188	4-5/16	4-5/16
	IF	4-1/2	4-13/16	4-13/16	4.688	4-13/16	4-13/16
4-1/2	R & FH	4-5/8	4-13/16	4-13/16	…	4-13/16	4-13/16
	IF	5	5-5/16	5-5/16	5.110	5-5/16	5-5/16
5	EIU	5-1/8	5-5/16	5-5/16	…	5-5/16	5-5/16
5-1/2	R & FH	5-11/16	5-7/8	5-7/8	5.750	5-7/8	5-7/8

18° TAPER-TYPE WELDED-ON TOOL JOINTS

Drill Pipe Size		Neck Dia.	C Top Bore	D Center Bore	E T-100	E T-150	E T-250 & T-350	E T-400
2-3/8	IF	2-9/16	4-1/4	2-21/32	…	…	…	…
2-7/8	R & FH	3	4-3/8	3-3/32	…	1-5/8	…	…
	IF	3-3/16	4-3/4	3-9/32	…	1-5/8	…	…
3-1/2	R & FH	3-11/16	5-1/4	3-25/32	…	1-5/8	…	…
	IF	3-7/8	5-1/2	3-31/32	…	1-5/8	3-3/8	3-1/2
4	FH	4-3/16	6-1/2	4-9/32	1-1/2	1-5/8	3-3/8	3-1/2
	IF	4-1/2	6-3/4	4-25/32	1-1/2	1-5/8	3-3/8	3-1/2
4-1/2	R & FH	4-11/16	6-3/4	4-25/32	1-1/2	1-5/8	3-3/8	3-1/2
	IF	5	7-1/8	5-1/4	1-1/2	1-5/8	3-3/8	3-1/2
5	EIU	5-1/8	7-1/8	5-1/4	1-1/2	1-5/8	3-3/8	3-1/2
5-1/2	R & FH	5-11/16	7-7/8	5-13/16	…	1-5/8	3-3/8	3-1/2

WEB WILSON® FORGED LINKS



PRINCIPAL DIMENSIONS

Link Size	1-3/4"	2-1/4"	2-3/4"	3-1/2"
Link Capacity in Tons (Set)	150	250	350	500
A		Length as Ordered		
B	8-1/2	14	14	17
C	5	8	8	9-1/2
E	3-1/2	5	5	6
F	13	10	10	12
G	2-3/8	3	3-9/16	4-1/2
H	4	5-1/2	5-1/2	6-3/4
J	5-1/2	8	8	9-1/2
K	1-3/4	2-1/4	2-3/4	3-1/2

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
	4.85	EU-E	NC26 (IF)	3-3/8	1-3/4	3239	3-5/32b	3/32	1848	3-1/8b	3/32	1625
	…	EU-E	OH	3-1/8	2	2262	3-1/32b	3/32	1848	3b	3/32	1625
	…	EU-E	SLH90	3-1/4	2	2563	2-31/32b	3/32	1848	2-15/16b	3/32	1625
	…	EU-E	WO	3-3/8	2	2267	3-5/64b	3/32	1848	3-3/64b	3/32	1625
	6.65	EU-E	NC26 (IF)	3-3/8	1-3/4	3239	3-7/22b	3/32	2431	3-3/16b	3/32	2139
2-3/8	…	EU-E	OH	3-1/4	1-3/4	3149	3-3/32b	7/64	2431	3-1/16b	3/32	2139
	…	IU-E	PAC	2-7/8	1-3/8	2345	2-51/64b	5/32	2431	2-3/4b	1/8	2139
	…	EU-E	SLH90	3-1/4	2	2563	3-1/32b	3/32	2431	3b	3/32	2139
	6.65	EU-X	NC26 (IF) ②	3-3/8	1-3/4	3239	3-19/64b	9/64	3080	3-1/4b	7/64	2710
	…	EU-X	SLH90	3-1/4	1-13/16	3442	3-7/64b	1/8	3080	3-1/16b	7/64	2710
	6.65	EU-G	NC26 (IF)	3-3/8	1-3/4	3239	3-21/64b	5/32	3404	3-9/32b	1/8	2995
	…	EU-G	SLH90	3-1/4	1-13/16	3442	3-9/64b	9/64	3404	3-3/32b	1/8	2995
	6.85	EU-E	NC31(IF)	4-1/8	2-1/8	5935	3-23/32b	3/32	3135	3-11/16b	3/32	2756
	…	EU-E	OH ②	3-3/4	2-7/16	2794	3-1/2b	7/64	3135	3-15/32b	3/32	2756
	…	EU-E	SLH90	3-7/8	2-7/16	3815	31/2b	3/32	3135	3-29/64b	3/32	2756
	…	EU-E	WO	4-1/8	2-7/16	3756	3-21/32b	3/32	3135	3-5/8b	3/32	2756
	10.40	EU-E	NC31 (IF)	4-1/8	2-1/8	5935	3-27/32b	5/32	4495	3-51/64b	1/8	3956
	…	EU-E	OH	3-7/8	2-5/32	4409	3-41/64b	11/64	4495	3-37/64b	9/64	3956
	…	IU-E	PAC ②	3-1/8	1-1/2	3441	3-1/8P	9/32	3441	3-1/8P	9/32	3441
2-7/8	…	IU-E ①	NC26 (SH) ②	3-3/8	1-3/4	3239	3-3/8B	7/32	3887	3-3/8B	7/32	3887
	…	EU-E	SLH90 ②	2-7/8	2-5/32	5647	3-39/64b	9/64	4495	3-9/16b	1/8	3956
	…	IU-E	XH	4-1/4	1-7/8	6798	3-49/64b	5/32	4495	3-23/32b	9/64	3956
	10.40	EU-X	NC31 (IF)	4-1/8	2	6597	3-15/16b	13/64	5694	3-7/8b	11/64	5011
	…	EU-X	SLH90	4	2	6613	3-45/64b	3/64	5694	3-41/64b	5/32	5011
	10.40	EU-G	NC31 (IF)	4-1/8	2	6597	3-63/64b	7/32	6294	3-59/64b	3/16	5539
	…	EU-G	SLH90	4	2	6613	3-3/4b	7/32	6294	3-11/16b	3/16	5539
	10.40	EU-S	NC31 (IF)	4-3/8	1-5/8	8472	4-3/8b	19/64	8092	4-3/64b	1/4	7122
	…	EU-S	SLH90	4-1/8	1-5/8	8613	3-7/8b	9/32	8092	3-13/16b	1/4	7122

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
3-1/2	9.50	EU-E	NC38 (IF)	4-3/4	2-11/16	9054	4-27/64b	1/8	5486	4-3/8b	7/64	4821
		EU-E	OH	4-1/2	3	5934	4-19/64b	9/64	5486	4-1/4b	7/64	4821
		EU-E	SLH90	4-5/8	3	6323	4-13/64b	1/8	5486	4-5/32b	3/32	4821
		EU-E	WO	4-3/4	3	6667	4-27/64b	1/8	5486	4-3/8b	7/64	4821
	13.30	EU-E	H90	5-1/4	2-3/4	11924	4-37/64b	5/ 32	7212	4-17/32b	1/8	6344
		EU-E	NC38 (IF)	4-3/4	2-11/16	9054	4-17/32b	3/16	7212	4-31/64b	3/32	6344
		EU-E	OH	4-3/4	2-11/16	8652	4-13/32b	3/16	7212	4-23/64b	11/64	6344
		IU-E	DNC31(SH)	4-1/8	2-1/8	5935	4-1/8P	19/64	7212	3-63/64b	7/32	6344
		EU-E	XH	4-3/4	2-7/16	8746	4-3/8b	13/64	7212	4-5/16b	11/64	6344
	13.30	EU-X	H90	5-1/4	2-3/4	11924	4-43/64b	13/64	9135	4-5/8b	11/64	8036
		EU-X	NC38 (IF)	5	2-9/16	10163	4-41/64b	15/64	9135	4-37/64b	13/64	8036
		EU-X	SLH90	4-3/4	2-9/16	10439	4-13/32 b	7/32	9135	4-11/32b	3/16	8036
	13.30	EU-G	NC38 (IF)	5	2-7/16	11106	4-45/64b	17/64	10096	4-5/8b	15/64	8882
		EU-G	SLH90	4-3/4	2-9/16	10439	4-15/32b	1/4	10096	4-25/64b	7/32	8882
	13.30	EU-S	NC38 (IF)	5	2-1/8	13011	4-55/64b	11/32	12981	4-25/32b	5/16	11420
		EU-S	SLH90	5	2-1/8	14039	4-5/8b	21/64	12981	4-17/32b	9/32	11420
		EU-S	NC40 (4FH)	5-3/8	2-7/16	14965	5-1/16b	5/16	12981	4-31/32b	17/64	11420
	15.50	EU-E	NC38 (IF)	5	2-9/16	10163	4-19/32b	7/32	8204	4-17/32b	3/16	7221
	15.50	EU-X	NC38 (IF)	5	2-7/16	11106	4-23/32b	9/32	10392	4-41/64b	15/64	9146
	15.50	EU-G	NC38 (IF)	5	2-1/8	13011	4-25/32b	5/16	11486	4-45/64b	17/64	10109
		EU-G	NC40 (4FH)	5-1/4	2-9/16	13880	4-63/64b	9/32	11486	4-29/32b	15/64	10109
	15.50	EU-S	NC40 (4FH)	5-1/2	2-1/4	16472	5-9/64b	23/64	14768	5-1/16b	5/16	12998
4	11.85	IU-E	H90	5-1/2	2-13/16	17720	4-29/32b	1/8	7547	4-55/64b	7/64	6631
		EU-E	NC46 (IF)	6	3-1/4	16813	5-15/64b	1/8	7547	5-13/64b	7/64	6631
		EU-E	OH	5-1/4	3-15/32	10983	5b	9/64	7547	4-61/64b	1/8	6631
		EU-E	WO	5-3/4	3-7/16	14734	5-15/64b	1/8	7547	5-13/64b	7/64	6631
	14.00	IU-E	NC40 (FH)	5-14	2-13/16	11744	4-27/32b	13/64	9039	4-51/64b	3/16	7946
		IU-E	H90	5-1/2	2-13/16	17720	4-31/32b	5/32	9039	4-59/64b	9/64	7946

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
4	14.00	EU-E	NC46 (IF)	6	3-1/4	16813	5-5/16b	5/32	9039	5-17/64b	9/64	7946
		EU-E	OH	5-1/2	3-1/4	13640	5-1/16b	11/64	9039	5-1/64b	5/32	7946
		IU-E	SH ①	4-5/8	② 2-9/16	7790	4-31/64b	17/64	9039	4-27/64b	15/64	7946
	14.00	IU-X	NC40 (FH)	5-1/4	2-11/16	12836	4-31/32b	17/64	11449	4-29/32b	15/64	10065
		IU-X	H90	5-1/2	2-13/16	17720	5-5/64b	7/32	11449	5-1/64b	3/16	10065
		EU-X	NC46 (IF)	6	3-1/4	16813	5-27/64b	7/32	11449	5-23/64b	3/16	10065
	14.00	IU-G	NC40 (FH)	51/2	2-7/16	15057	5-1/32b	19/64	12654	4-61/64b	17/64	11125
		IU-G	H90	5-1/2	2-13/16	17720	5-9/64b	1/4	12654	5-1/16b	13/64	11125
		EU-G	NC46 (IF)	6	3-1/4	16813	5-15/32b	15/64	12654	5-13/32 b	13/64	11125
	14.00	IU-S	NC40 (FH)	5-1/2	2	18182	5-7/32b	25/64	16270	5-1/8b	11/32	14304
		IU-S	H90	5-1/2	2-13/16	17720	5-9/32b	5/16	16270	5-13/64b	9/32	14304
		EU-S	NC46 (IF)	6	3	19615	5-39/64b	5/16	16270	5-17/32b	17/64	14304
	15.70	IU-E	NC40 (FH)	5-1/4	2-11/16	12836	4-29/32b	15/64	10027	4-27/32b	13/64	8819
		EU-E	H90	5-1/2	2-13/16	17720	5-1/64b	3/16	10027	4-31/32b	5/32	8819
		EU-E	NC46 (IF)	6	3-1/4	16813	5-23/64b	3/16	10027	5-19/64b	5/32	8819
	15.70	IU-X	NC40 (FH)	5-1/2	2-7/16	15057	5-3/64b	5/16	12701	4-31/32b	17/64	11170
		IU-X	H	5-1/2	2-13/16	17720	5-9/64b	1/4	12701	5-5/64b	7/32	11170
		EU-X	NC46 (IF)	6	3-1/4	16813	5-15/32b	15/64	12701	5-13/32b	13/64	11170
	15.70	IU-G	BC40 (FH)	5-1/2	2-7/16	15057	5-7/64b	11/32	14038	5-1/64b	19/64	12346
		IU-G	H90	5-1/2	2-13/16	17720	5-3/16b	17/64	14038	5-1/8b	15/64	12346
		EU-G	NC46 (IF)	6	3-1/4	16813	5-17/32b	17/64	14038	5-29/64b	15/64	12346
	15.70	EU-S	NC46 (IF)	6	3	19615	5-11/16b	11/32	18049	5-19/32b	19/64	15874
4-1/2	13.75	IU-E	H90	6	3-1/4	19510	5-5/16b	5/32	10034	5-1/4b	1/8	8814
		EU-E	NC50 (IF)	6-3/8	3-3/4	18836	5-45/64b	5/32	10034	5-41/64b	1/8	8814
		EU-E	OH	5-3/4	3-31/32	10482	5-25/64b	11/64	10034	5-11/32b	9/64	8814
		EU-E	WO	6-1/8	3-7/8	17220	5-45/64b	5/32	10034	5-41/64b	1/8	8814
	16.60	IEU-E	FH	6	3	17390	5-27/64	15/64	11949	5-23/64b	13/64	10502
		IEU-E	H90	6	3-1/4	19510	5-3/8b	3/16	11949	5-21/64b	11/64	10502

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
4-1/2	16.60	EU-E	NC50 (IF)	6-3/8	3-3/4	18838	549/64b	3/16	11949	5-23/32b	5/32	10502
		EU-E	OH	5-7/8	3-3/4	13636	5-15/32b	13/64	11949	5-27/64b	3/16	10502
		IEU-E	NC38 (SH)	5	2-11/16	9173	5P	27/64	11008	4-23/32b	9/32	10502
		IEU-E	NC46 (XH)	6-1/4	3-1/4	16997	5-7/16b	7/32	11949	5-3/8b	3/16	10502.
	16.60	IEU-X	FH	6	3	17390	5-9/16b	19/64	15136	5-31/64b	17/64	13303
		IEU-X	H90	6	3-1/4	19510	5-1/2b	1/4	15136	5-7/16b	7/32	13303
		EU-X	NC50 (IF)	6-3/8	3-3/4	18838	5-57/64b	19/64	15136	5-13/16b	13/64	13303
		IEU-X	NC46 (XH)	6-1/4	3	19829	5-9/16b	1/4	15136	5-1/2b	1/4	13303
	16.60	IEU-G	FH	6	3	17390	5-41/64b	1/4	16729	5-35/64b	19/64	14703
		IEU-G	H90	6	3-1/4	19510	5-9/16b	9/32	16729	5-31/64b	1/4	14703
		EU-G	NC50 (IF)	6-3/8	3-3/4	18838	5-15/16b	17/64	16729	5-7/8b	15/64	14703
		IEU-G	NC46 (XH)	6-1/4	3	19829	5-41/64b	21/64	16729	5-35/64b	9/32	14703
	16.60	IEU-S	FH	6-1/4	2-1/2	22385	5-53/64b	7/16	21509	5-47/64b	25/64	18904
		IEU-S	H90	6	3	22629	5-47/64b	3/8	21509	5-41/64b	21/64	18904
		EU-S	NC50 (IF)	6-3/8	3-1/2	22336	6-7/64b	23/64	21509	6-1/64b	5/16	18904
		IEU-S	NC46 (XH)	6-1/4	2-3/4	22436	5-53/64b	27/64	21509	5-23/32b	23/64	18904
	20.00	IEU-E	FH	6	3	17390	5-17/32b	9/32	14336	5-29/64b	1/4	12609
		IEU-E	H90	6	3	22629	5-15/32b	15/64	14336	5-13/32b	13/64	12609
		EU-E	NC50 (IF)	6-3/8	3-5/8	20617	5-55/64b	15/64	14336	5-51/64b	13/64	12609
		IEU-E	NC46 (XH)	6-1/4	3	19829	5-17/32b	17/64	14336	5-15/32b	15/64	12609
	20.00	IEU-X	FH	6	2-1/2	21623	5-45/64b	3/8	18160	5-39/64b	2l/64	15971
		IEU-X	H90	6	3	19510	5-5/8b	5/16	18160	5-17/32b	17/64	15971
		EU-X	NC50 (IF)	6-3/8	3-1/2	22336	6b	19/64	18160	5-59/64b	17/64	15971
		IEU-X	NC46 (XH)	6-1/4	2-3/4	22436	5-11/16b	11/32	18160	5-39/64b	5/16	15971
	20.00	IEU-G	FH	6	2-1/2	21623	5-25/32b	13/32	20071	5-43/64b	23/64	17653
		IEU-G	H90	6	3-1/4	19510	5-11/16b	11/32	20071	5-19/32b	19/64	17653
		EU-G	NC50 (IF)	6-3/8	3-1/2	22336	6-1/16b	21/64	20071	5-63/64b	19/64	17653
		IEU-G	NC46 (XH)	6-1/4	2-1/2	24815	5-49/64b	25/64	20071	5-43/64b	11/32	17653

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
	20.00	EU-S	NC50 (IF)	6-5/8	3	27854	6-17/64b	716	25806	6-5/32b	3/8	22696
		IEU-S	NC46 (XH)	6-1/4	2-1/4	26968	5-63/64b	1/2	25806	5-7/8b	7/16	22696
	22.82	EU-E	NC50 (IF)	6-3/8	3-5/8	20617	5-59/64b	17/64	15909	5-27/32b	7/32	13997
		IEU-E	NC46 (XH)	6-1/4	3	19829	5-39/64b	5/16	15909	5-33/64	17/64	13997
4-1/2	22.82	IEU-X	FH	6-1/4	2-1/4	24456	5-25/32b	13/32	20151	5-43/64b	23/64	17730
		EU-X	NC50 (IF)	6-3/8	3-1/2	22336	6-1/16b	21/64	20151	5-63/64b	19/64	17730
		IEU-X	NC46 (XH)	6-1/4	2-3/4	22436	5-49/64b	25/64	21051	5-43/64b	11/32	17730
	22.82	EU-G	NC50 (IF)	6-1/2	3-1/4	25724	6-9/64b	3/8	22272	6-3/64b	21/64	19596
		IEU-G	NC46 (XH)	6-1/4	2-1/2	24815	5-55/64b	7/16	22272	5-3/4b	3/8	19596
	22.82	EU-S	NC50 (IF)	6-3/8	2-3/4	31193	6-23/64b	31/64	28636	6-15/64b	27/16	25195
	19.50	IEU-E	5-1/2 (FH)	7	3-3/4	30676	6-13/32 b	13/64	15964	6-11/32b	11/64	14030
		IEU-E	NC50 (XH)	6-3/8	3-3/4	18838	5-59/64b	17/64	15964	5-27/32b	7/32	14030
	19.50	IEU-X	5-1/2 (FH)	7	3-3/4	30676	6-17/32b	17/64	20221	6-15/32b	15/64	17771
		IEU-X	H90	6-1/2	3-1/4	25935	5-57/64b	5/16	20221	5-13/16b	9/32	17771
		IEU-X	NC50 (XH)	6-3/8	3-1/2	22336	6-1/16b	21/64	20221	5-63/64b	19/64	17771
	19.50	IEU-G	5-1/2 (FH)	7	3-3/4	30676	6-19/32b	19/64	22349	6-33/64b	17/64	19641
		IEU-G	H90	6-1/2	3	29234	5-61/64b	11/32	22349	5-7/8b	5/16	19641
		IEU-G	NC50 (XH)	6-1/2	3-1/4	25724	6-9/64b	3/8	22349	6-3/64b	21/64	19641
5	19.50	IEU-S	5-1/2 (FH)	7-1/4	3-1/2	36241	6-25/32b	25/64	28735	6-11/16b	11/32	25253
		IEU-S	NC50 (XH)	6-5/8	2-3/4	31193	6-23/64b	31/64	28735	6-15/64b	27/64	25253
	25.60	IEU-E	5-1/2 (FH)	7	3-1/2	30676	6-17/32b	17/64	20308	6-15/32b	15/64	17863
		IEU-E	NC50 (XH)	6-3/8	3-1/2	22336	6-5/64b	11/32	20308	5-63/64b	19/64	17863
	25.60	IEU-X	5-1/2 (FH)	7	3-1/2	30676	6-45/64b	23/64	25724	6-39/64b	5/16	22627
		IEU-X	NC50 (XH)	6-1/2	3	27854	6-1/4b	27/64	25724	6-5/32b	3/8	22627
	25.60	IEU-G	5-1/2 (FH)	7-1/4	3-1/2	36241	6-25/32b	25/64	28432	6-43/64b	11/32	25009
		IEU-G	NC50 (XH)	6-5/8	2-3/4	31193	6-11/32b	15/32	28432	6-15/64b	27/64	25009
	25.60	IEU-S	5-1/2 FH	7-1/4	3-1/4	38575	7b	1/2	36555	6-7/8	7/16	32154

WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

RECOMMENDED MINIMUM O.D.* AND MAKE-UP TORQUE BASED ON TORSIONAL STRENGTH OF BOX AND DRILL PIPE

DRILL PIPE DATA			NEW TOOL JOINT DATA			PREMIUM CLASS				CLASS 2		
Nom. Size (in)	Nom. Weight (lb/ft)	Upset Type and Grade	Connection	New O.D. (in)	New I.D. (in)	Make-up Torque (ft-lb)	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③	Min. O.D. Tool Joint (in) ⑥	Min. Box Shoulder w/ Eccentric Wear (in) ④	Min. O.D. Tool Joint Make-up Torque (ft-lb) ③
	21.90	IEU-E	FH	7	4	27966	6-33/64b	17/64	19652	6-29/64b	15/64	17266
	21.90	IEU-X	FH	7	3-3/4	30676	6-43/64b	11/32	24892	6-37/64b	19/64	21870
		IEU-X	H90	7	3-1/2	29593	6-15/64b	23/64	24892	6-9/64b	5/16	21870
	21.90	IEU-G	FH	7-1/4	3-1/2	36241	6-3/4b	3/8	27512	6-21/32b	21/64	24172
5-1/2	21.90	IEU-S	FH	7-1/2	3	43585	6-31/32b	31/64	35373	6-27/32b	27/64	31079
	24.70	IEU-E	FH	7	4	27966	6-19/32b	19/64	21945	6-1/2b	1/4	19288
	24.70	IEU-X	FH	7-1/4	3-1/2	36241	6-3/4b	3/8	27797	6-21/32b	21/64	24432
	24.70	IEU-G	FH	7-1/4	3-1/2	36241	6-27/32b	27/64	30723	6-47/64b	3/8	27003
	24.70	IEU-S	FH	7-1/2	3	43585	7-5/64b	35/64	39501	6-61/64b	31/16	34719

① *The use of outside diameters (O.D.) smaller than those listed in the table may be acceptable on Slim Hole (SH) tool joints due to special service requirements.*

② *Tool joint with dimensions shown has a lower torsional yield ratio than the 0.80 which is generally used.*

③ *Recommended make-up torque for used tool joints is based on 72,000 psi stress. Recommended make-up torque for used tool joints that have not worn to the minimum O.D. can be obtained as described in Par. 2.12.*

④ *In calculation of torsional strengths of tool joints, both new and worn, the bevels of the tool joint shoulders are disregarded. This thickness measurement should be made in the plane of the face from the I.D. of the counterbore to the outside diameter of the box, disregarding the bevels.*

⑤ *Any tool joint with an outside diameter less than the API bevel diameter should be provided with a minimum 1/32" depth x 45° bevel on the outside and inside diameter of the box shoulder and outside diameter of the pin shoulder.*

⑥ *p = pin limited yield. b = box limited yield. P or B indicates that tool joint could not meet 80% of tube torsion yield.*

* *Tool joint diameters specified are required to retain torsional strength in the tool joint comparable to the torsional strength of the attached drill pipe. These should be adequate for all service. Tool joints with torsional strengths considerably below that of the drill pipe may be adequate for much drilling service.*

TUBING SIZES — THREADED AND COUPLED TYPES

NON-UPSET

API Size	Nominal Size	O.D. (in)	O.D. (mm)	I.D.	Weight Per Foot		Threads Per Inch	Taper Per Foot (in)	Male Thread Length	Coupling Length	Coupling Dia.
					Plain End	Thd.& Coupled					
1.050	3/4	1.050	26,7	.824	1.13	1.14	10	3/4	1.094	3-3/16	1.313
1.315	1	1.315	33,4	1.049	1.68	1.70	10	3/4	1.125	3-1/4	1.660
1.660	1-1/4	1.660	42,2	1.380	2.27	2.30	10	3/4	1.250	3-1/2	2.054
1.900	1-1/2	1.900	48,3	1.610	2.72	2.75	10	3/4	1.375	3-3/4	2.200
2-3/8	2	2.375	60,3	2.041	3.94	4.00	10	3/4	1.625	4-1/4	2.875
2-3/8	2	2.375	60,3	1.995	4.43	4.60	10	3/4	1.625	4-1/4	2.875
2-3/8	2	2.375	60,3	1.867	5.75	5.80	10	3/4	1.625	4-1/4	2.875
2-7/8	2-1/2	2.875	73,0	2.441	6.16	6.40	10	3/4	2.063	5-1/8	3.500
2-7/8	2-1/2	2.875	73,0	2.259	8.44	8.60	10	3/4	2.063	5-1/8	3.500
3-1/2	3	3.500	88,9	3.068	7.58	7.70	10	3/4	2.313	5-5/8	4.250
3-1/2	3	3.500	88,9	2.992	8.81	9.20	10	3/4	2.313	5-5/8	4.250
3-1/2	3	3.500	88,9	2.922	9.91	10.20	10	3/4	2.313	5-5/8	4.250
3-1/2	3	3.500	88,9	2.750	12.52	12.70	10	3/4	2.313	5-5/8	4.250
4	3-1/2	4.000	101,6	3.548	9.11	9.50	8	3/4	2.375	5-3/4	4.750
4-1/2	4	4.500	114,3	3.958	12.24	12.60	8	3/4	2.583	6-1/8	5.200

EXTERNAL UPSET

API Size	Nominal Size	O.D. (in)	O.D. (mm)	I.D.	Upset Dia.	Weight Per Foot		Threads Per Inch	Taper Per Foot (in)	Male Thread Length	Coupling Length	Coupling Dia.
						Plain End	Thd.& Coupled					
1.050	3/4	1.050	26,7	0.824	1.315	1.13	1.20	10	3/4	1.125	3-1/4	1.660
1.315	1	1.315	33,4	1.049	1.469	1.68	1.80	10	3/4	1.250	3-1/2	1.900
1.660	1-1/4	1.660	42,2	1.380	1.812	2.27	2.40	10	3/4	1.375	3-3/4	2.200
1.900	1-1/2	1.900	48,3	1.610	2.093	2.72	2.90	10	3/4	1.438	3-7/8	2.500
2-3/8	2	2.375	60,3	1.995	2.593	4.43	4.70	8	3/4	1.938	4-7/8	3.063
2-3/8	2	2.375	60,3	1.867	2.593	5.75	5.95	8	3/4	1.938	4-7/8	3.063
2-7/8	2-1/2	2.875	73,0	2.441	3.093	6.16	6.50	8	3/4	2.125	5-1/4	3.668
2-7/8	2-1/2	2.875	73,0	2.259	3.093	8.44	8.70	8	3/4	2.125	5-1/4	3.668
3-1/2	3	3.500	88,9	2.992	3.750	8.81	9.30	8	3/4	2.375	5-3/4	4.500
3-1/2	3	3.500	88,9	2.750	3.750	12.52	12.95	8	3/4	2.375	5-3/4	4.500
4	3-1/2	4.000	101,6	3.476	4.250	10.46	11.00	8	3/4	2.500	6	5.000
4-1/2	4	4.500	114,3	3.958	4.750	12.24	12.75	8	3/4	2.625	6-1/4	5.563

TUBING MAKE-UP TORQUE

NON-UPSET RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
1.050	1.14	H-40	110	140	180
		J-55	140	180	230
		C-75	170	230	290
		N-80	190	250	310
1.315	1.70	H-40	160	210	260
		J-55	200	270	340
		C-75	270	360	450
		N-80	290	380	480
1.660	2.30	H-40	200	270	340
		J-55	260	350	440
		C-75	350	460	580
		N-80	370	490	610
1.900	2.75	H-40	240	320	400
		J-55	310	410	500
		C-75	410	540	680
		N-80	430	570	700
2.375	4.00	H-40	350	470	590
		J-55	460	610	760
		C-75	600	800	1000
		N-80	640	850	1060
	4.60	H-40	420	560	700
		J-55	550	730	910
		C-75	720	960	1200
		N-80	770	1020	1280
		P-105	960	1280	1600
	5.80	C-75	1040	1380	1730
		N-80	1100	1460	1830
		P-105	1380	1840	2300
2.875	6.40	H-40	600	800	1000
		J-55	790	1050	1310
		C-75	1040	1380	1730
		N-80	1100	1470	1840
		P-105	1390	1850	2310
	8.60	C-75	1570	2090	2600
		N-80	1660	2210	2760
		P-105	2090	2790	3490

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe," Twelfth Edition, March 1981.*

TUBING JOINT MAKE-UP TORQUE

Values shown are applicable to standard couplings with standard box OD and are based on use of an API modified-type thread lubricant according to API Bulletin 5A2. Other thread lubricants might require correction factors for make-up torque. Contact manufacturers of premium threads for their recommendations.

NON-UPSET RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
3.500	7.70	H-40	690	920	1150
		J-55	910	1210	1510
		C-75	1200	1600	2000
		N-80	1280	1700	2130
	9.20	H-40	840	1120	1400
		J-55	1110	1480	1850
		C-75	1460	1950	2440
		N-80	1550	2070	2590
		P-105	1970	2620	3280
	10.20	H-40	980	1310	1640
		J-55	1290	1720	2150
		C-75	1700	2270	2840
		N-80	1810	2410	3010
	12.70	C-75	2270	3030	3790
		N-80	2410	3210	4010
		P-105	3050	4060	5080
4.000	9.50	H-40	710	940	1180
		J-55	930	1240	1550
		C-75	1230	1640	2050
		N-80	1310	1740	2180
4.500	12.60	H-40	990	1320	1650
		J-55	1310	1740	2180
		C-75	1730	2300	2880
		N-80	1830	2440	3050

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe," Twelfth Edition, March 1981.*

TUBING MAKE-UP TORQUE

EXTERNAL UPSET RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
1.050	1.20	H-40	350	460	580
		J-55	450	600	750
		C-75	590	780	980
		N-80	620	830	1040
1.315	1.80	H-40	330	440	550
		J-55	430	570	710
		C-75	560	740	930
		N-80	590	790	990
1.660	2.40	H-40	400	530	660
		J-55	520	690	860
		C-75	680	910	1,140
		N-80	720	960	1,200
1.900	2.90	H-40	500	670	840
		J-55	660	880	1,100
		C-75	860	1,150	1,440
		N-80	920	1,220	1,530
2.375	4.70	H-40	740	990	1,240
		J-55	970	1,290	1,610
		C-75	1,280	1,700	2,130
		N-80	1,350	1,800	2,250
		P-105	1,700	2,270	2,840
	5.95	C-75	1,590	2,120	2,650
		N-80	1,680	2,240	2,800
		P-105	2,120	2,830	3,540
2.875	6.50	H-40	940	1,250	1,560
		J-55	1,240	1,650	2,060
		C-75	1,630	2,170	2,710
		N-80	1,730	2,300	2,880
		P-105	2,180	2,910	3,640
	8.70	C-75	2,140	2,850	3,560
		N-80	2,270	3,020	3,780
		P-105	2,860	3,810	4,760
3.500	9.30	H-40	1,300	1,730	2,160
		J-55	1,710	2,280	2,850
		C-75	2,260	3,010	3,760
		N-80	2,400	3,200	4,000
		P-105	3,040	4,050	5,060

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe," Twelfth Edition, March 1981.*

TUBING MAKE-UP TORQUE

EXTERNAL UPSET RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
3.500	12.95	C-75	3030	4040	5050
		N-80	3220	4290	5360
		P-105	4070	5430	6790
4 .000	11.00	H-40	1460	1940	2430
		J-55	1920	2560	3200
		C-75	2540	3390	4240
		N-80	3420	4560	5700
4 .500	12,75	H-40	1620	2160	2700
		J-55	2150	2860	3180
		C-75	2840	3780	4730
		N-80	3020	4020	5030

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe, "Twelfth Edition, March, 1981.*

INTEGRAL JOINT RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
1.315	1.72	H-40	230	310	390
		J-55	300	400	500
		C-75	390	520	650
		N-80	410	550	690
1.660	2.10 & 2.33	H-40	280	380	480
		J-55	380	500	630
	2.33	C-75	490	650	810
		N-80	520	690	860
1.900	2.40 & 2.76	H-40	340	450	560
		J-55	440	580	730
	2.76	C-75	570	760	950
		N-80	610	810	1010
2 .063	3.25	H-40	430	570	710
		J-55	560	740	920
		C-75	730	970	1210
		N-80	770	1030	1290

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe, "Twelfth Edition, March 1981.*

TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD IJ-MS MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb)
2-3/8	4.7	J-55	1100
		C-75 to N-80	1300
		P-105	1500
2-7/8	6.5	J-55	1600
		C-75 to N-80	1800
		P-105	2200
3-1/2	9.3	J-55	2200
		C-75 to N-80	2600
		P-105	3000
4	11.0	J-55	2400
		C-75 to N-80	2800
		P-105	3200
4-1/2	12.75	J-55	2500
		C-75 to N-80	3000
		P-105	3500

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TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD DSS-HT RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)		
		J-55	C-75 & N-80	P-105
1.315	1.80 & 2.25	200	300	400
1.660	2.40	400	500	600
1.900	2.90	500	600	800
2.063	3.25	600	800	1000
2.375	4.70	1100	1300	1500
	5.30	1300	1500	1700
	5.95	1500	1700	1900
	6.20	1700	1900	2100
	7.70	2000	2200	2400
2.875	6.50	1600	1800	2200
	7.90	2200	2600	3000
	8.70	2600	3000	3500
	9.50	3000	3500	4000
	11.00	3600	4000	4400
	11.65	4000	4500	5000
3.500	9.30	2200	2600	3000
	10.30	2600	3000	3500
	12.95	3000	3500	4000
	15.80	4000	4500	5000
4.000	11.00	2400	2800	3200
	13.40	3200	3600	4000
	22.50	4000	4000	5000
4.500	12.75	2500	3000	3500
	13.50	3000	3500	4000
	15.50	3500	4000	4500
	16.90	4000	4500	5000
	19.20	4500	5000	5500
	21.60	5000	5500	6000

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TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD IJ-3SS MINIMUM MAKE-UP TORQUE *

O.D.	Weight	Grade — Torque (ft-lb)		
(in)	(lb/ft)	J-55	C-75 & N-80	P-105
1.315	1.80	200	300	400
1.660	2.40	400	500	600
1.900	2.90	500	600	800
2.063	3.40	600	800	1000
2.375	4.70	1,100	1,300	1,500
	5.30	1,300	1,500	1,700
	5.95	1,500	1,700	1,900
	6.20	1,700	1,900	2,100
	7.70	2,000	2,200	2,400
2.875	6.50	1,600	1,800	2,200
	7.90	2,200	2,600	3,000
	8.70	2,600	3,000	3,500
	9.50	3,000	3,500	4,000
	11.00	3,600	4,000	4,400
	11.65	4,000	4,500	5,000
3.500	9.30	2,200	2,600	3,000
	10.30	2,600	3,000	3,500
	12.95	3,000	3,500	4,000
	15.80	4,000	4,500	5,000
	16.70	4,500	5,000	5,500
4.000	11.00	2,400	2,800	3,200
	13.40	3,200	3,600	4,000
	22.50	4,000	4,000	5,000
4.500	12.75	2,500	3,000	3,500
	13.50	3,000	3,500	4,000
	15.50	3,500	4,000	4,500
	16.90	4,000	4,500	5,000
	19.20	4,500	5,000	5,500
	21.60	5,000	5,500	6,000

** Data reprinted from 1983 NL Atlas Bradford Tubular Products Catalog.*

TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD TC-4S MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)		
		J-55	C-75 & N-80	P-105
2.375	4.70 & 5.30	1,300	2,000	2,400
	5.95 & 6.20	1,800	2,500	3,000
	7.70	2,600	3,200	3,800
2.875	6.50	1,700	2,600	3,000
	7.90, 8.70 & 9.50	2,000	3,000	3,500
	11.00 & 11.65	2,500	3,600	4,200
3.500	9.30 &10.30	2,300	3,200	4,100
	12.95	2,800	3,700	4,700
	15.80 & 16.70	3,000	4,000	5,000
4.000	11.00	3,000	4,000	4,500
	13.40	3,500	4,500	5,500
4.500	12.75 & 13.50	2,900	4,000	5,000
	15.50	3,500	4,500	5,600
	16.40	4,000	6,000	6,500
	19.20	5,000	6,000	7,200
	21.60	5,000	6,000	7,500

** Data reprinted from 1983 NL Atlas Bradford Tubular Products Catalog.*

TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD IJ-4S MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft/lb)		
		J-55	C-75 & N-80	P-105
2.375	4.7	1,100	1,300	1,500
	5.3	1,300	1,500	1,700
	5.95	1,500	1,700	1,900
	6.2	1,700	1,900	2,100
	7.7	2,000	2,200	2,400
2.875	6.5	1,600	1,800	2,200
	7.9	2,200	2,600	3,000
	8.7	2,600	3,000	3,500
	9.5	3,000	3,500	4,000
	11.0	3,600	4,000	4,400
	11.65	4,000	4,500	5,000
3.500	9.3	2,200	2,600	3,000
	10.3	2,600	3,000	3,500
	12.95	3,000	3,500	4,000
	15.8	4,000	4,500	5,000
	16.7	4,500	5,000	5,500
4.000	11.0	2,400	2,800	3,200
	13.4	3,200	3,600	4,000
	22.5	4,000	4,500	5,000
4.500	12.75	2,500	3,000	3,500
	13.5	3,000	3,500	4,000
	15.5	3,500	4,000	4,500
	16.9	4,000	4,500	5,000
	19.2	4,500	5,000	5,500
	21.6	5,000	5,500	6,000

** Data reprinted from 1983 NL Atlas Bradford Tubular Products Catalog.*

TUBING MAKE-UP TORQUE

NL ATLAS BRADFORD FL-4S MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft/lb)	
		J-55 & K-55	C-75, N-80, & P-105
2.375	4.70 & 5.95	400	500
	6.65	500	600
2.875	6.50 & 7.90	600	800
	8.70 & 10.40	700	900
3.500	7.70, 9.30 & 10.30	1,400	1,600
	12.70, 12.95 & 15.50	1,500	1,700
4.000	9.50	2,000	2,300
	11.00 & 11.60	2,200	2,500
	14.00	2,400	2,700
4.500	9.50 & 10.50	2,500	
	11.60 & 12.60	2,700	3,200
	13.50 & 15.10	3,000	3,500
	16.90 & 18.80	3,200	3,700

** Data reprinted from 1983 NL Atlas Bradford Tubular Products Catalog.*

TUBING MAKE-UP TORQUE

ARMCO IJ NU-LOCK TUBING RECOMMENDED MAKE-UP TOROUE *

O.D. (in)	Torque (ft-lb)		
	Minimum	Optimum	Maximum
2-3/8	1,000	1,500	2,000
2-7/8	1,500	2,000	2,500
3-1/2	2,000	2,500	3,000

Note: IJ Nu-Lock tubing is designed to make up to the external shoulder. Torque values given above are intended to be used as a guideline only and apply to all weights and grades for the listed sizes.

** Data reprinted from Armco Bulletin No. 664, June 1982.*

ARMCO T&C NU-LOCK TUBING RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Torque (ft-lb)		
	Minimum	Optimum	Maximum
2-3/8	1,000	1,200	2,000
2-7/8	1,500	1,800	2,500
3-1/2	2,000	2,500	1,300

Note: External shoulder contact is nominal make-up for T&C Nu-Lock tubing. Torque values given above apply to all weights and grades for the listed sizes.

** Data reprinted from Armco Bulletin No. 664, June 1982.*

TUBING MAKE-UP TORQUE

ARMCO SEAL-LOCK RECOMMENDED MAKE-UP TORQUE *

O.D. (in)		Torque (ft-lb)		
		Minimum	Optimum	Maximum
With Standard O.D. Couplings				
	2-3/8	800	1,000	1,200
	2-7/8	1,000	1,200	1,400
	3-1/2	1,600	1,800	2,000
With Special Clearance Couplings				
2-3/8	J-55	700	800	1,000
2-3/8	L-80 to P105	700	900	1,000
	2-7/8	800	1,000	1,200
	3-1/2	1,400	1,600	1,800

Note: Seal-Lock torque figures apply to all weights and grades for the listed sizes.

** Data reprinted from Armco Bulletin No. 664, June 1982.*

EXTREME LINE RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (ft-lb)	Grade	Torque (ft-lb)	
			Optimum	Maximum
2.375	4.7 & 5.95	J-55	1,700	2,300
		N-80	1,700	2,800
		P-105	1,700	3,300
2.875	6.5 & 8.7	J-55	2,100	2,600
		N-80	2,100	3,100
		P-105	2,100	3,600
3.500	9.3 & 12.95	J-55	2,400	3,000
		N-80	2,400	3,500
		P-105	2,400	4,000

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe," Twelfth Edition, March 1981.*

TUBING MAKE-UP TORQUE

HYDRIL CS AND A-95 MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)	
		J-55	C-75, L-80, N-80, & P-105
1.050	1.2 & 1.5	200	300
1.315	1.8 & 2.25	300	400
1.660	2.4, 3.02 & 3.24	400	600
1.900	2.9, 3.64 & 4.19	600	800
2.063	3.25 & 4.50	700	900
2.375	4.7 & 5.3	1,100	1,500
2.875	6.5	1,500	2,100
3.500	9.3 & 10.3	2,500	3,000
4.000	11.0	3,000	3,500
4.500	12.75 &13.5	3,500	4,500

HYDRIL CS (5" to 7" O.D.) CONNECTION MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)		
		J-55 & K-55	L-80 & N-80	P-110
5	18.0	5,000	6,900	9,200
	20.3	5,200	7,100	9,400
	23.2	6,900	9,500	12,500
	27.0	7,300	9,900	12,900
5-1/2	17.0	4,200	5,800	7,700
	20.0	6,200	8,500	11,200
	23.0	6,500	8,800	11,600
	26.0	8,500	11,500	15,200
	28.4	8,800	11,900	15,600
6-5/8	28.0	9,800	13,600	18,200
	32.0	10,300	14,100	18,700
	35.0	10,700	14,500	19,100
7	29.0	10,800	15,000	20,200
	32.0	11,100	15,400	20,500
	35.0	11,500	15,800	20,900
	38.0	14,500	19,900	26,500
	41.0	14,900	20,400	26,900

Note: Torque for these products should never exceed 15% over minimum.

** Data reprinted from Hydril Company 1984 Catalogue. Hydril recommends using a figure of 12-1/2% over minimum to ensure that minimum torque is obtained, since many factors influence torque application.*

TUBING MAKE-UP TORQUE

HYDRIL PH-6 MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)	
		C-75, L-80, & N-80	P-105
2.375	5.95, 6.20, & 7.70	2,200	2,700
2.875	7.9 & 8.7	3,000	3,500
	9.5 & 10.7	4,500	5,500
3.500	12.95 & 15.8	5,500	7,000
4.000	13.4	5,500	7,000
4.500	15.5	6,000	7,500
	19.2	7,500	9,500

HYDRIL PH-4 MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)	
		C-75, L-80, & N-80	P-105
2.875	11.0 & 11.65	5,000	6,500
3.500	16.7	7,500	9,500
	17.05	8,000	10,000
4.000	19.0	8,500	10,500
	22.5	9,500	11,500
4.500	21.6	9,500	12,000
	24.0	10,000	13,000
	26.5	11,500	14,500

** Data reprinted from Hydril Company 1984 Catalogue. Hydril recommends using a figure of 12-1/2% over minimum to ensure that minimum torque is obtained, since many factors influence torque application. Torque should never exceed 25% over minimum.*

TUBING MAKE-UP TORQUE

HYDRIL FJ TUBING MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb) J-55, L-80 & N-80
2.375	4.6	400
2.875	6.4	600
3.500	9.2,10.2,12.8, 12.95 & 15.5	800
4.000	11.6 & 13.4	1,100
4.500	12.6, 13.5, 15.1 & 18.8	1,500

HYDRIL SUPER FJ TUBING MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb) J-55 & K-55	C-75, L-80 & N-80
2.375	4.6	700	700
2.875	6.4 & 8.7	1,000	1,000
3.500	9.2, 10.2, 12.8, 12.95 & 15.5	1,300	1,300
4.000	11.0, 11.6, & 13.4	1,800	1,800
4.500	12.6 & 13.5	2,000	2,500
	15.1, 16.6, 18.8, & 21.6	2,400	3,200

** Data reprinted from Hydril Company 1984 Catalogue. Hydril recommends using a figure of 12-1/2% over minimum to ensure that minimum torque is obtained since many factors influence torque application. Torque should never exceed 25% over minimum.*

TUBING MAKE-UP TORQUE

HYDRIL CFJ-P TUBING MINIMUM MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade — Torque (ft-lb)	
		J-55	C-75, L-80, N-80 & P-105
2.375	4.7 & 5.3	800	1,100
2.875	6.5	1,100	1,500
3.500	9.3 & 10.3	1,500	1,900
4.000	11.0	2,000	2,700
4.500	12.75	3,000	4,000
5.000	23.2	4,500	6,000

** Data reprinted from Hydril Company 1984 Catalogue. Hydril recommends using a figure of 12-1/2% over minimum to ensure that minimum torque is obtained, since many factors influence torque application. Torque should never exceed 25% over minimum.*

TUBING MAKE-UP TORQUE

MANNESMANN TDS RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Maximum
2.375	4.6	K-55	950	1,100
		C-75, N-80,		1,250
		C-90, C-95,		1,300
		P-105		1,400
	5.8	K-55	1100	1,250
		C-75, N-80,		1,500
		C-90, C-95,		1,650
		P-105		1,800
2.875	6.4	K-55	1400	1,500
		C-75, N-80,		1,800
		C-90, C-95,		2,000
		P-105		2,200
	8.6	K-55	1,600	2,000
		C-75, N-80,		2,500
		C-90, C-95,		2,700
		P-105		2,900
3.500	9.2	K-55	2,200	2,500
		C-75, N-80,		3,000
		C-90, C-95,		3,300
		P-105		3,600
	10.2	K-55	2,400	2,700
		C-75, N-80,		3,500
		C-90, C-95,		3,900
		P-105		4,300
	12.7	K-55	2,900	3,600
		C-75, N-80,		4,600
		C-90, C-95,		5,200
		P-105		5,800
4.000	11.0	K-55	2,300	2,900
		C-75, N-80,		3,600
		C-90, C-95,		4,000
		P-105		4,300
4.500	12.6	K-55	2,300	3,500
		C-75, N-80,		4,300
		C-90, C-95,		4,800
		P-105		5,200
	13.5	K-55	2,500	3,600
		C-75, N-80,		4,600
		C-90, C-95,		5,000
		P-105		5,400
	15.1	K-55	2,700	5,100
		C-75, N-80,	4,000	6,900
		C-90, C-95,	4,700	7,600
		P-105	5,400	8,300

TUBING MAKE-UP TORQUE

VALLOUREC VAM RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nom. Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
2-3/8	4.60	K-55	1,350	1,400	1,600
		C-75, L-80, N-80, & C-95	1,800	1,900	2,000
		P-105	2,000	2,200	2,500
	5.10	K-55	1,400	1,600	1,800
		C-75, L-80, N-80, & C-95	1,800	2,000	2,400
		P-105	2,000	2,200	2,500
	5.80	K-55	1,400	1,800	2,200
		C-75, L-80, N-80, C-95, & P-105	1,800	2,000	2,350
2-7/8	6.40	K-55	2,200	2,400	2,500
		C-75, L-80, N-80, & C-95	2,500	2,700	2,900
		P-105	2,000	2,300	2,900
	7.70	K-55	2,500	2,900	3,300
		C-75, L-80, N-80, C-95, & P-105	2,900	3,100	3,600
	8.60	K-55	2,700	3,100	3,400
		C-75, L-80, N-80, C-95, & P-105	3,100	3,300	3,800
	9.80	C-75, L-80, N-80, & C-95	2,500	2,700	3,300
3-1/2	9.20	K-55	2,500	2,900	3,300
		C-75, L-80, N-80, & C-95	3,300	3,600	4,000
		P-105	4,300	4,700	5,400
	10.20	K-55	3,600	4,000	4,700
		C-75 L-80, N-80, & C-95	4,300	4,700	5,800
		P-105	5,400	5,800	6,500
	12.70	K-55	4,300	5,100	5,800
		C-75, L-80, N-80, & C-95	5,400	5,800	6,900
		P-105	5,100	5,800	6,900

TUBING MAKE-UP TORQUE

VALLOUREC VAM RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nom. Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
3-1/2	13.70	K-55	4,700	5,400	6,100
		C-75, L-80, N-80 C-95 & P-105	5,400	6,100	7,200
	15.50	K-55	4,700	5,400	6,500
		C-75, L-80, N-80, C-95 & P-105	5,400	6,100	7,600
4	9.50	K-55	2,200	2,500	2,900
	10.90	K-55	2,500	3,300	4,000
		C-75, L-80, N-80, C-95 & P-105	3,300	4,000	4,700
	13.00	K-55	3,600	4,300	5,100
		C-75, L-80, N-80 C-95 & P-105	4,300	5,100	6,100
	14.80	K-55	5,100	5,800	6,500
		C-75, L-80, N-80 C-95 & P-105	5,800	6,500	7,600
	16.50	K-55	6,500	7,200	8,700
		C-75, L-80, N-80, C-95 & P-105	7,200	8,000	9,400
4-1/2	12.60	K-55	4,300	4,700	5,100
		C-75, L-80, N-80 & C-95	4,300	4,700	5,800
		P-105	5,100	5,400	6,500

** Data reprinted from Vallourec literature dated October 1982.*

For O.D.s, weights, and grades not listed, special figures may be obtained through Vallourec on request.

TUBING MAKE-UP TORQUE

VALLOUREC VAM AF AND VAM AG RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nom. Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
2-3/8	4.6	K-55 – P-105	950	1,100	1,300
	5.1		1,100	1,250	1,450
	5.8		1,250	1,450	1,650
2-7/8	6.4	K-55 – P-105	1,100	1,250	1,450
	7.7		1,100	1,300	1,800
	8.6		1,450	1,650	2,200
3-1/2	9.2	K-55 – P-105	1,450	1,800	2,500
	10.2 – 12.7		1,800	2,200	2,900
4	10.9	K-55 – P-105	1,800	2,200	2,900
	13.0 – 14.8		2,200	2,500	3,300
4-1/2	12.6 – 13.5	K-55 – P-105	2,200	2,500	3,300
	15.1		2,900	3,300	4,000
	16.9		3,300	3,600	4,300

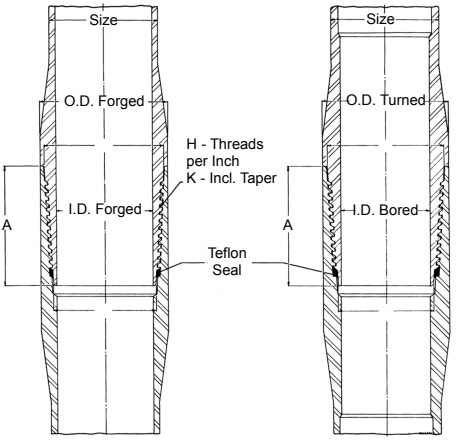
** Data reprinted from Vallourec literature dated October 1982.*

VALLOUREC MINI-VAM RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nom. Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
		J-55	110	150	200
1.050	1.16	C-75 – P-105	150	200	250
		J-55	150	200	350
1.315	1.72	C-75 – P-105	250	300	450
		J-55	250	350	500
1.660	2.33	C-75 – P-105	400	500	650
		J-55	300	450	550
1.900	2.76	C-75 – P-105	450	600	700
		J-55	400	500	650
2.063	3.25	C-75 – P-105	550	650	850

** Data reprinted from Vallourec literature dated October 1982.*

ATLAS BRADFORD TUBING JOINTS



Type HG DS **Type HG DSS**

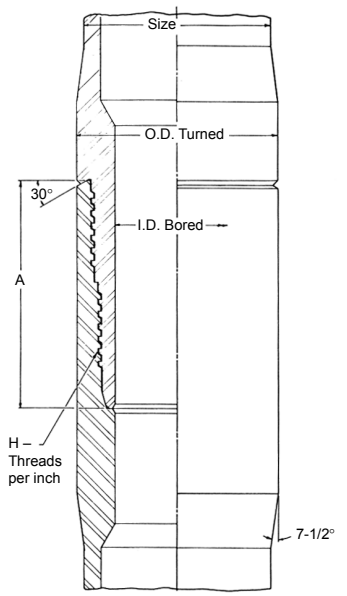
TYPE HG DSS

Size	Joint O.D.	I.D.	A	C	D	H	K
1.315 – 1.80	1.552	0.970	1.562	1.405	1.193	8	1-1/8
1.660 – 2.40	1.883	1.301	1.812	1.749	1.515	8	1-1/8
1.900 – 2.90	2.113	1.531	2.000	1.988	1.737	8	1-1/8
2.000 – 3.30	2.320	1.670	2.188	2.152	1.883	8	1-1/8
2-1/16 – 3.40	2.330	1.700	2.188	2.152	1.883	8	1-1/8
2-3/8 – 4.70	2.700	1.945	2.750	2.469	2.153	8	1-1/8
2-3/8 – 5.30	2.700	1.890	2.750	2.469	2.153	8	1-1/8
2-3/8 – 5.95	2.800	1.805	2.750	2.469	2.153	8	1-1/8
2-7/8 – 6.20	2.800	1.795	2.750	2.469	2.513	8	1-1/8
2-7/8 – 7.70	2.900	1.640	2.750	2.469	2.513	8	1-1/8
2-7/8 – 6.50	3.220	2.375	3.000	2.995	2.636	6	1-1/8
2-7/8 – 7.90	3.360	2.265	3.000	2.995	2.636	6	1-1/8
2-7/8 – 8.70	3.440	2.200	3.000	2.995	2.636	6	1-1/8
2-7/8 – 8.90	3.440	2.180	3.000	2.995	2.636	6	1-1/8
2-7/8 – 9.50	3.500	2.130	3.000	2.995	2.636	6	1-1/8
2-7/8 – 10.40	3.500	2.086	3.000	2.995	2.636	6	1-1/8
2-7/8 – 11.00	3.625	2.000	3.000	2.995	2.636	6	1-1/8
2-7/8 – 11.65	3.625	1.945	3.000	2.995	2.636	6	1-1/8
3-1/2 – 9.30	3.865	2.920	3.375	3.625	3.231	6	1-1/8
3-1/2 – 10.30	3.937	2.878	3.375	3.625	3.231	6	1-1/8
3-1/2 – 13.30	4.050	2.700	3.375	3.625	3.231	6	1-1/8
4 – 9.40	4.325	3.488	3.500	4.631	3.725	6	1-1/8
4 – 10.80	4.375	3.416	3.500	4.631	3.725	6	1-1/8
4 – 11.60	4.420	3.368	3.500	4.631	3.725	6	1-1/8
4 – 13.30	4.500	3.270	3.500	4.631	3.725	6	1-1/8
4-1/2 – 12.60	4.890	3.898	3.625	4.631	4.215	6	1-1/8
4-1/2 – 15.40	5.000	3.766	3.625	4.631	4.215	6	1-1/8
4-1/2 – 16.90	5.050	3.694	3.625	4.631	4.215	6	1-1/8
4-1/2 – 19.20	5.140	3.570	3.625	4.631	4.215	6	1-1/8

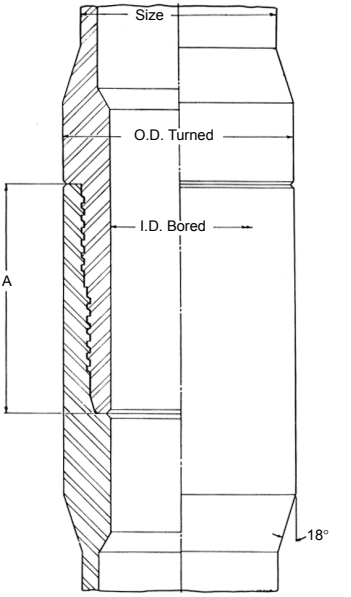
TYPE HG DSS

1.050 – 1.20	1.315	0.824	1.500	1.194	0.995	8	1-1/8
1.315 – 1.80	1.520	1.049	1.562	1.405	1.193	8	1-1/8
1.660 – 2.40	1.858	1.380	1.812	1.749	1.515	8	1-1/8
1.900 – 2.90	2.094	1.610	2.000	1.988	1.737	8	1-1/8
2-1/16 – 3.40	2.260	1.750	2.188	2.152	1.883	8	1-1/8
2-3/8 – 4.70	2.594	1.995	2.750	2.469	2.153	8	1-1/8
2-7/8 – 6.50	3.156	2.441	3.000	2.995	2.636	6	1-1/8
2-1/2 – 9.30	3.813	2.992	3.375	3.625	3.231	6	1-1/8

HYDRIL TUBING JOINTS



CS & A-95



C-100

HYDRIL TUBING JOINTS

Type	Size Nom. O.D.	Wt/Ft (lbs)	A	O.D. CS Joint Std.	O.D. CS Joint Special	O.D. A-95 Joint	I.D.	H
CS and A-95	3/4 (1.050)	– 1.20	2.187	1.327	1.300	…	.687	8
	3/4 (1.050)	– 1.50	2.187	1.327	…	…	.687	8
	1 (1.315)	– 1.80	2.187	1.552	1.525	…	.970	8
	1 (1.315)	– 2.25	2.187	1.600	…	…	.864	8
	1-1/4 (1.660)	– 2.40	2.187	1.883	1.858	1.858	1.300	8
	1-1/4 (1.660)	– 3.02	2.187	1.927	…	…	1.218	8
	1-1/2 (1.900)	– 2.90	2.187	2.113	2.094	2.094	1.530	8
	1-1/2 (1.900)	– 3.64	2.187	2.162	…	…	1.440	8
	2-1/16	– 3.25	2.187	2.330	2.300	2.300	1.700	8
	2-3/8	– 4.70	2.272	2.700	2.630	2.630	1.945	8
	2-3/8	– 5.30	2.272	2.700	…	…	1.890	8
	2-7/8	– 6.50	2.338	3.220	3.155	3.155	2.375	8
	3-1/2	– 9.30	2.787	3.865	3.805	3.805	2.920	8
	3-1/2	– 10.30	2.787	3.915	…	…	2.878	8
	4	– 11.00	2.787	4.343	4.315	4.315	3.395	8
	4-1/2	– 12.75	2.830	4.855	4.825	4.825	3.865	8
	4-1/2	– 13.50	2.824	4.875	…	…	3.840	8
C-100	2-3/8	– 4.70	3.125	2.937 O.D.			1.945	6
	2-7/8	– 6.50	3.187	3.5 O.D.			2.375	6

TUBING PRESSURE RATING

Size					Internal Yield Pressure (psi)								
					J-55			N-80			P-105		
O.D.	Wall	Wt/Ft	Metal Area	Drift		S.F.	Test		S.F.	Test		S.F.	Test
(in)	(in)	(lbs)	(sq in)	(in)	Actual	12-1/2%	80%	Actual	12-1/2%	80%	Actual	12-1/2%	80%
1.050	0.113	1.20	0.333	0.730	10,360	9,200	8,290	15,070	13,400	12,050	…	…	…
1.315	0.133	1.80	0.494	0.955	9,730	8,650	7,780	14,160	12,590	11,330	…	…	…
1.660	0.140	2.40	0.668	1.286	8,120	7,220	6,500	11,810	10,500	9,450	…	…	…
1.900	0.145	2.90	0.799	1.516	7,350	6,530	5,880	10,680	9,490	8,540	…	…	…
2.063 *	0.156	3.25	0.934	1.751	7,280	6,470	5,820	10,590	9,410	8,470	…	…	…
2.375	0.190	4.70	1.304	1.901	7,700	6,840	6,160	11,200	9,960	8,960	14,700	13,070	11,760
2.375	0.254	5.95	1.692	1.773	…	…	…	14,890	13,240	11,910	19,540	17,370	15,630
2.875	0.217	6.50	1.812	2.347	7,260	6,450	5,810	10,570	9,400	8,460	13,870	12,330	11,100
2.875	0.308	8.70	2.483	2.165	…	…	…	14,940	13,280	11,950	19,610	17,430	15,690
3.500	0.254	9.30	2.589	2.867	6,980	6,200	5,580	10,160	9,030	8,130	13,340	11,860	10,670
3.500	0.375	12.95	3.680	2.625	…	…	…	15,000	13,330	12,000	19,690	17,500	15,750
4.000	0.262	11.00	3.075	3.351	6,300	5,600	5,040	9,170	8,150	7,340	…	…	…
4.500	0.271	12.75	3.599	3.833	5,800	5,150	4,640	8 430	7,490	6,740	…	…	…

** Integral joint tubing. All other sizes API threaded and coupled with weights shown for external upset ends.*

TUBING SETTING DEPTHS — TENSION AND COLLAPSE

O.D.	Wall	Min. Yield in Tension (lbs) *			Collapse Pressure (psi) **			Setting Depth (ft) ***						Barrels † per
								J-55		N-80		P-105		
(in)	(in)	J-55	N-80	P-105	J-55	N-80	P-105	Collapse	Tension	Collapse	Tension	Collapse	Tension	100 Feet
1.050	0.113	18,315	26,640	…	10,560	15,370	…	16,900	15,260	24,590	22,200	…	…	0.065
1.315	0.133	27,170	39,520	…	10,000	14,550	…	16,000	15,090	23,280	21,960	…	…	0.107
1.660	0.140	36,740	53,440	…	8,490	12,360	…	13,580	15,310	19,780	22,270	…	…	0.185
1.900	0.145	43,945	63,920	…	7,750	11,280	…	12,400	15,150	18,050	22,040	…	…	0.251
2.063	0.156	51,370	74,720	…	7,690	11,180	…	12,300	15,810	17,890	22,990	…	…	0.297
2.375	0.190	71,720	104,320	136,920	8,100	11,780	15,460	12,960	15,260	18,850	22,200	24,740	29,130	0.386
2.375	0.254	…	135,360	177,660	…	15,280	20,060	…	…	24,450	22,750	32,100	29,860	0.338
2.875	0.217	99,660	144,960	190,260	7,680	11,160	14,010	12,290	15,330	17,860	22,300	22,420	29,290	0.578
2.875	0.308	…	198,640	260,715	…	15,300	20,090	…	…	24,480	22,830	32,140	29,970	0.495
3.500	0.254	142,395	207,120	271,845	7,400	10,530	13,050	11,840	15,310	16,850	22,270	20,880	29,230	0.868
3.500	0.375	…	294,400	386,400	…	15,310	20,090	…	…	24,500	22,730	32,140	29,840	0.734
4.000	0.262	169,125	246,000	…	6,590	8,800	…	10,540	15,370	14,080	22,360	…	…	1.172
4.500	0.271	197,945	287,920	…	5,720	7,500	…	9,150	15,520	12,000	22,580	…	…	1.520

** Integral joint tubing. All other sizes API threaded and coupled with weights shown for external upset ends.*

*** NO SAFETY FACTOR.*

**** NO SAFETY FACTOR. Tension values are in air. Collapse values are in 90 lbs/cu ft (12 lbs/gal) mud.*

† 42 gallons per barrel.

STANDARD STEEL PIPE SIZES

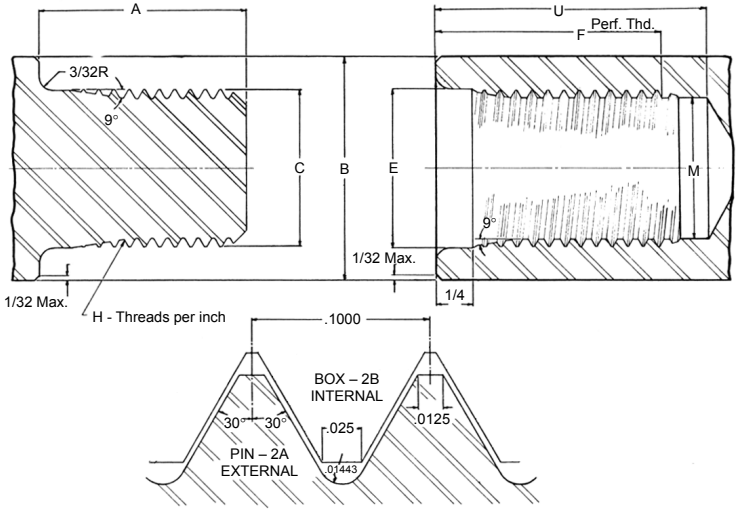
Nom Size	O.D.	Standard Weight I.D.	Standard Weight Wall Thickness	Standard Weight Wt/Ft Plain Ends	Extra Strong I.D.	Extra Strong Wall Thickness	Extra Strong Wt/Ft Plain Ends	Double Extra Strong I.D.	Double Extra Strong Wall Thickness	Double Extra Strong Wt/Ft Plain Ends
1/8	0.405	0.269	0.068	0.24	0.215	0.095	0.31	…	…	…
1/4	0.540	0.364	0.088	0.42	0.302	0.119	0.54	…	…	…
3/8	0.675	0.493	0.091	0.57	0.423	0.126	0.74	…	…	…
1/2	0.840	0.622	0.109	0.85	0.546	0.147	1.09	0.252	0.294	1.71
3/4	1.050	0.824	0.113	1.13	0.742	0.154	1.47	0.434	0.308	2.44
1	1.315	1.049	0.133	1.68	0.957	0.179	2.17	0.599	0.358	3.66
1-1/4	1.660	1.380	0.140	2.27	1.278	0.191	3.00	0.896	0.382	5.21
1-1/2	1.900	1.610	0.145	2.72	1.500	0.200	3.63	1.100	0.400	6.41
2	2.375	2.067	0.154	3.65	1.939	0.218	5.02	1.503	0.436	9.03
2-1/2	2.875	2.469	0.203	5.79	2.323	0.276	7.66	1.771	0.552	13.70
3	3.500	3.068	0.216	7.58	2.900	0.300	10.25	2.300	0.600	18.58
3-1/2	4.000	3.548	0.226	9.11	3.364	0.318	12.51	2.728	0.636	22.85
4	4.500	4.026	0.237	10.79	3.826	0.337	14.98	3.152	0.674	27.54
5	5.563	5.047	0.258	14.62	4.813	0.375	20.78	40.63	0.750	38.55
6	6.625	6.065	0.280	18.97	5.761	0.432	28.57	4.897	0.864	53.16
8	8.625	8.071	0.277	24.70	7.625	0.500	43.39	6.875	0.875	72.42
8	8.625	7.981	0.322	28.55	…	…	…	…	…	…
10	10.750	10.192	0.279	31.20	9.750	0.500	54.74	…	…	…
10	10.750	10.136	0.307	34.24	…	…	…	…	…	…
10	10.750	10.020	0.365	40.48	…	…	…	…	…	…
12	12.750	12.090	0.330	43.77	11.750	0.500	65.42	…	…	…
12	12.750	12.000	0.375	49.56	…	…	…	…	…	…

LINE PIPE SIZES

STANDARD WEIGHT, THREADED

Nom Size	O.D.	I.D.	Weight Per Ft Plain	Weight Per Ft Thd & Cpl	Thds Per In	Taper Per Ft	Male Thd Length	Coupling Length	Coupling Dia
1/8	0.405	0.269	0.24	0.25	27	3/4	0.392	1-1/16	0.563
1/4	0.540	0.364	0.42	0.43	18	3/4	0.595	1-5/8	0.719
3/8	0.675	0.493	0.57	0.57	18	3/4	0.601	1-5/8	0.875
1/2	0.840	0.622	0.85	0.86	14	3/4	0.782	2-1/8	1.063
3/4	1.050	0.824	1.13	1.14	14	3/4	0.794	2-1/8	1.313
1	1.315	1.049	1.68	1.70	11-1/2	3/4	0.985	2-5/8	1.576
1-1/4	1.660	1.380	2.27	2.30	11-1/2	3/4	1.009	2-3/4	2.054
1-1/2	1.900	1.610	2.72	2.75	11-1/2	3/4	1.025	2-3/4	2.200
2	2.375	2.067	3.65	3.75	11-1/2	3/4	1.058	2-7/8	2.875
2-1/2	2.875	2.469	5.79	5.90	8	3/4	1.571	4-1/8	3.375
3	3.500	3.068	7.58	7.70	8	3/4	1.634	4-1/4	4.000
3-1/2	4.000	3.548	9.11	9.25	8	3/4	1.684	4-3/8	4.625
4	4.500	4.026	10.79	11.00	8	3/4	1.734	4-1/2	5.200
5	5.563	5.047	14.62	15.00	8	3/4	1.840	4-5/8	6.296
6	6.625	6.065	18.97	19.45	8	3/4	1.946	4-7/8	7.390
8	8.625	8.071	24.70	25.55	8	3/4	2.146	5-1/4	9.625
10	10.750	10.192	31.20	32.75	8	3/4	2.359	5-3/4	11.750
10	10.750	10.136	34.24	35.75	8	3/4	2.359	5-3/4	11.750
12	12.750	12.090	43.77	45.45	8	3/4	2.559	6-1/8	14.000
14	14.000	13.250	54.57	57.00	8	3/4	2.684	6-3/8	15.000
16	16.000	15.250	62.58	65.30	8	3/4	2.884	6-3/4	17.000
18	18.000	17.250	70.59	73.00	8	3/4	3.084	7-1/8	19.000
20	20.000	19.250	78.60	81.00	8	3/4	3.284	7-5/8	21.000

SUCKER ROD CONNECTIONS



THREAD FORM

Size	A	B	C	E	F	H	M	U
5/8	1.1250	1.375	0.9362	0.995	1.29	10	0.830	1-5/8
3/4	1.3750	1.500	1.0611	1.080	1.54	10	0.955	1-7/8
7/8	1.3750	1.625	1.1861	1.205	1.54	10	1.080	1-7/8
1	1.7500	2.000	1.3735	1.393	1.94	10	1.267	2-3/8
1-1/8	2.0000	2.250	1.5609	1.580	2.19	10	1.455	2-5/8

WRENCH FLATS ON SUCKER RODS

Rod Size	Distance Across Flats	Length of Flats
5/8	7/8	1-1/4
3/4	1	1-1/4
7/8	1	1-1/4
1	1-5/16	1-1/2
1-1/8	1-1/2	1-5/8

THREADED AND COUPLED-TYPE CASING SIZES — 4-1/2" TO 7"

O.D.	I.D.	Weight/Foot		Thd/In		Taper/Ft		Length of MaleThread				Coupling Length				Coupling Diameter	
			Thd. &					Round		"V" Form		Round		"V" Form			
(in)	(in)	Plain	Coupling	Rnd	"V"	Rnd	"V"	Short	Long	Short	Long	Short	Long	Short	Long	Round	"V"
	4.090	9.40	9.50	8	14	3/4	3/8	2.000	…	1.407	…	6-1/4	…	3-5/8	…	5.000	5.021
4-1/2	4.052	10.23	10.50	8	…	3/4	…	2.625	…	…	…	6-1/4	…	…	…	5.000	…
	4.000	11.35	11.60	8	…	3/4	…	2.625	3.000	…	…	6-1/4	…	…	…	5.000	…
	3.920	13.04	13.50	8	…	3/4	…	…	3.000	…	…	6-1/4	7	…	…	5.000	…
	4.560	11.23	11.50	8	…	3/4	…	2.500	…	…	…	6-1/2	…	…	…	5.563	…
	4.494	12.83	13.00	8	10	3/4	3/8	2.750	3.375	2.550	…	6-1/2	7-3/4	6-5/8	…	5.563	5.491
5	4.408	14.87	15.00	8	10	3/4	3/8	2.750	3.375	2.550	3.300	6-1/2	7-3/4	6-5/8	8	5.563	5.750
	4.276	17.93	18.00	8	10	3/4	3/8	…	3.375	2.550	3.300	6-1/2	7-3/4	6-5/8	8	5.563	5.750
	5.012	13.70	14.00	8	10	3/4	3/8	2.875	…	2.750	3.300	6-3/4	…	7-1/8	8	6.050	6.155
	4.950	15.35	15.50	8	…	3/4	…	2.875	3.500	…	…	6-3/4	8	…	…	6.050	…
5-1/2	4.892	16.87	17.00	8	10	3/4	3/8	2.875	3.500	2.750	3.300	6-3/4	8	7-1/8	8	6.050	6.155
	4.778	19.81	20.00	8	10	3/4	3/8	…	3.500	2.750	3.300	…	8	7-1/8	8	6.050	6.155
	4.670	22.54	23.00	8	…	3/4	…	…	3.500	…	…	…	8	…	…	6.050	…
	6.049	19.49	20.00	8	10	3/4	3/8	3.125	3.875	3.000	3.800	7-1/4	8-3/4	7-5/8	9	7.390	7.390
	5.921	23.58	24.00	8	10	3/4	3/8	3.125	3.875	3.000	3.800	7-1/4	8-3/4	7-5/8	9	7.390	7.390
6-5/8	5.791	27.65	28.00	8	10	3/4	3/8	…	3.875	3.000	3.800	…	8-3/4	7-5/9	9	7.390	7.390
	5.675	31.20	32.00	8	…	3/4	…	…	3.875	…	…	…	8-3/4	…	…	7.390	…
	6.538	16.70	17.00	8	…	3/4	…	2.375	…	…	…	7-1/4	…	…	…	7.656	…
	6.456	19.54	20.00	8	10	3/4	3/8	3.125	…	3.000	…	7-1/4	…	7-5/8	…	7.656	7.750
	6.366	22.63	23.00	8	10	3/4	3/8	3.125	4.000	3.000	4.050	7-1/4	9	7-5/8	9-1/2	7.656	7.750
	6.276	25.66	26.00	8	10	3/4	3/8	3.125	4.000	3.000	4.050	7-1/4	9	7-5/8	9-1/2	7.656	7.750
7	6.184	28.72	29.00	8	…	3/4	…	…	4.000	…	…	…	9	…	…	7.656	…
	6.094	31.68	32.00	8	…	3/4	…	…	4.000	…	…	…	9	…	…	7.656	…
	6.004	34.58	35.00	8	…	3/4	…	…	4.000	…	…	…	9	…	…	7.656	…
	5.920	37.26	38.00	8	…	3/4	…	…	4.000	…	…	…	9	…	…	7.656	…

See bottom of page 66 for Drift Mandrel Length and Drift Mandrel Diameter.

THREADED AND COUPLED-TYPE CASING SIZES — 7-5/8" TO 10-3/4"

O.D.	I.D.	Weight/Foot		Thd/In		Taper/Ft		Length of Male Thread				Coupling Length				Coupling Diameter	
			Thd. &					Round		"V" Form		Round		"V" Form			
(in)	(in)	Plain	Coupling	Rnd	"V"	Rnd	"V"	Short	Long	Short	Long	Short	Long	Short	Long	Round	"V"
	7.025	23.47	24.00	8	...	3/4	...	3.250	...	...	...	7-1/2	...	...	...	8.500	...
	6.969	25.56	26.40	8	8	3/4	3/4	3.250	4.125	3.250	4.125	7-1/2	9-1/4	7-1/2	9-1/4	8.500	8.500
7-5/8	6.875	29.04	29.70	8	8	3/4	3/4	...	4.125	3.250	4.125	...	9-1/4	7-1/2	9-1/4	8.500	8.500
	6.765	33.04	33.70	8	8	3/4	3/4	...	4.125	3.250	4.125	...	9-1/4	7-1/2	9-1/4	8.500	8.500
	6.625	38.05	39.00	8	...	3/4	...	...	4.125	...	...	...	9-1/4	...	...	8.500	...
	8.097	23.57	24.00	8	...	3/4	...	3.000	...	...	...	7-3/4	...	...	...	9.625	...
	8.017	27.02	28.00	8	8	3/4	3/4	3.375	...	3.250	...	7-3/4	...	8-1/8	...	9.625	9.625
	7.921	31.10	32.00	8	8	3/4	3/4	3.375	4.500	3.250	4.75	7-3/4	...	8-1/8	10-3/4	9.625	9.625
8-5/8	7.825	35.14	36.00	8	8	3/4	3/4	3.375	4.500	3.250	4.75	7-3/4	10	8-1/8	10-3/4	9.625	9.625
	7.725	39.29	40.00	8	...	3/4	...	...	4.500	...	...	...	10	...	...	9.625	-
	7.625	43.39	44.00	8	8	3/4	3/4	...	4.500	...	4.75	...	10	...	10-3/4	9.625	9.625
	7.511	48.00	49.00	8	...	3/4	...	...	4.500	...	...	...	10	...	...	9.625	...
	9.001	31.03	32.30	8	...	3/4	...	3.375	...	...	...	7-3/4	...	...	...	10.625	...
	8.921	34.86	36.00	8	8	3/4	3/4	3.375	4.750	3.250	5.250	7-3/4	10-1/2	8-1/8	11-3/4	10.625	10.625
9-5/8	8.835	38.94	40.00	8	8	3/4	3/4	3.375	4.750	3.250	5.250	7-3/4	10-1/2	8-1/8	11-3/4	10.625	10.625
	8.755	42.70	43.50	8	8	3/4	3/4	...	4.750	3.250	5.250	...	10-1/2	8-1/8	11-3/4	10.625	10.625
	8.681	46.14	47.00	8	8	3/4	3/4	...	4.750	...	5.250	...	10-1/2	...	11-3/4	10.625	10.625
	8.535	52.85	53.50	8	8	3/4	3/4	...	4.750	...	5.250	...	10-1/2	...	11-3/4	10.625	10.625
	10.192	31.20	32.75	8	...	3/4	...	2.750	...	...	...	8	...	...	...	11.750	...
	10.050	38.88	40.50	8	8	3/4	3/4	3.500	...	3.625	5.375	8	...	8-1/2	12	11.750	11.750
10-3/4	9.950	44.22	45.50	8	8	3/4	3/4	3.500	...	3.625	5.375	8	...	8-1/2	12	11.750	11.750
	9.850	49.50	51.00	8	8	3/4	3/4	3.500	...	3.625	5.375	8	...	8-1/2	12	11.750	11.750
	9.760	54.21	55.50	8	8	3/4	3/4	3.500	...	3.625	5.375	8	...	8-1/2	12	11.750	11.750

See bottom of page 66 for Drift Mandrel Length and Drift Mandrel Diameter.

THREADED AND COUPLED-TYPE CASING SIZES — 11-3/4" TO 20"

O.D.	I.D.	Weight/Foot		Thd/In		Taper/Ft		Length of MaleThread				Coupling Length				Coupling Diameter	
			Thd. &					Round		"V" Form		Round		"V" Form			
(in)	(in)	Plain	Coupling	Rnd	"V"	Rnd	"V"	Short	Long	Short	Long	Short	Long	Short	Long	Round	"V"
11-3/4	11.084	40.60	42.00	8	…	3/4	…	3.500	…	…	…	8	…	…	…	12.750	…
	11.000	45.56	47.00	8	8	3/4	3/4	3.500	…	3.250	5.500	8	…	8-1/8	12-1/4	12.750	12.750
	10.880	52.57	54.00	8	8	3/4	3/4	3.500	…	3.250	5.500	8	…	8-1/8	12-1/4	12.750	12.750
	10.772	58.81	60.00	8	8	3/4	3/4	3.500	…	3.250	5.500	8	…	8-1/8	12-1/4	12.750	12.750
13-3/8	12.715	45.98	48.00	8	8	3/4	3/4	3.500	…	3.875	…	8	…	9	…	14.375	14.375
	12.615	52.74	54.50	8	8	3/4	3/4	3.500	…	3.875	…	8	…	9	…	14.375	14.375
	12.515	59.45	61.00	8	8	3/4	3/4	3.500	…	3.875	5.500	8	…	9	12-1/4	14.375	14.375
	12.415	66.11	68.00	8	8	3/4	3/4	3.500	…	3.875	5.500	8	…	9	12-1/4	14.375	14.375
	12.347	70.60	72.00	8	8	3/4	3/4	3.500	…	3.875	5.500	8	…	9	12-1/4	14.375	14.375
16	15.250	62.58	65.00	8	8	3/4	3/4	4.000	…	3.875	…	9	…	9	…	17.000	17.000
	15.124	72.72	75.00	8	8	3/4	3/4	4.000	…	3.875	…	9	…	9	…	17.000	17.000
	15.010	81.97	84.00	8	8	3/4	3/4	4.000	…	3.875	…	9	…	9	…	17.000	17.000
18-5/8	17.755	84.51	87.50	8	8	3/4	3/4	4.000	…	3.875	…	9	…	9	…	20.000	19.625
20	19.124	91.41	94.00	8	8	3/4	3/4	4.000	5.250	3.875	…	9	11-1/2	9	…	21.000	21.000
	19.000	104.13	106.50	8	…	3/4	…	4.000	5.250	…	…	9	11-1/2	…	…	21.000	…
	18.730	131.33	133.00	8	…	3/4	…	4.000	5.250	…	…	9	11-1/2	…	…	21.000	…

API DRIFT TEST

Casing Size	Drift Mandrel Length	Drift Mandrel Diameter
8-5/8 in and smaller	6 ft	Casing I.D. minus 1/8 in
9-5/8 in to 13-3/8 in, incl.	12 ft	Casing I.D. minus 5/32 in
16 in and larger	12 ft	Casing I.D. minus 3/16 in

CASING MAKE-UP TORQUE — SHORT THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb)		
			Minimum	Optimum	Maximum
4-1/2	9.5	H-40	580	770	960
		J-55	760	1010	1260
		K-55	840	1120	1400
	10.5	J-55	990	1320	1650
		K-55	1100	1460	1830
	11.6	J-55	1160	1540	1930
		K-55	1280	1700	2130
5	11.5	J-55	1000	1330	1660
		K-55	1100	1470	1840
	13.0	J-55	1270	1690	2110
		K-55	1400	1860	2330
	15 .0	J-55	1550	2070	2590
		K-55	1710	2280	2850
5-1/2	14.0	H-40	980	1300	1630
		J-55	1290	1720	2150
		K-55	1420	1890	2360
	15.5	J-55	1520	2020	2530
		K-55	1670	2220	2780
	17.0	J-55	1720	2290	2860
		K-55	1890	2520	3150
6-5/8	20.0	H-40	1380	1840	2300
		J-55	1840	2450	3060
		K-55	2000	2670	3340
	24 .0	J-55	2360	3140	3930
		K-55	2570	3420	4230
7	17.0	H-40	920	1220	1530
	20.0	H-40	1320	1760	2200
		J-55	1760	2340	2930
		K-55	1910	2540	3180
	23 .0	J-55	2130	2840	3550
		K-55	2320	3090	3860
	26 .0	J-55	2510	3340	4180
		K-55	2730	3640	4550
7-5/8	24.0	H-40	1590	2120	2650
	26.4	J-55	2360	3150	3940
		K-55	2570	3420	4280

CASING MAKE-UP TORQUE — SHORT THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
8-5/8	24.0	J-55	1830	2440	3050
		K-55	1970	2630	3290
	28.0	H-40	1750	2330	2910
	32.0	H-40	2090	2790	3490
		J-55	2790	3720	4650
		K-55	3020	4020	5030
	36.0	J-55	3260	4340	5430
		K-55	3510	4680	5850
9-5/8	32.3	H-40	1910	2540	3180
	36.0	H-40	2210	2940	3680
		J-55	2960	3940	4930
		K-55	3170	4230	5290
	40.0	J-55	3390	4520	5650
		K-55	3650	4860	6080
10-3/4	32.75	H-40	1540	2050	2560
	40.5	H-40	2360	3140	3930
		J-55	3150	4200	5250
		K-55	3380	4500	5630
	45.5	J-55	3700	4930	6160
		K-55	3960	5280	6600
	51.0	J-55	4240	5850	7060
		K-55	4550	6060	7580
		C-75	5670	7560	9450
		L-80	5960	7940	9930
		N-80	6030	8040	10050
		C-95	6950	9270	11590
		P-110	8100	10800	13500
	55.5	C-75	6320	8430	10540
		L-80	6630	8840	11050
		N-80	6710	8950	11190
		C-95	7740	10320	12900
		P-110	9020	12030	15040
	60.7	P-110	10040	13380	16730
	65.7	P-110	11040	14720	18400

CASING MAKE-UP TORQUE — SHORT THREAD

RECOMMENDED MAKE-UP TORQUE*

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
11-3/4	42.0	H-40	2300	3070	3840
	47.0	J-55	3580	4770	5960
		K-55	3820	5090	6360
	54.0	J-55	4260	5680	7100
		K-55	4550	6060	7580
	60.0	J-55	4870	6490	8110
		K-55	5200	6930	8660
		C-75	6520	8690	10860
		L-80	6850	9130	11410
		N-80	6930	9240	11550
		C-95	8000	10660	13330
		P-110	9320	12420	15530
13-3/8	48.0	H-40	2420	3220	4030
	54.5	J-55	3860	5140	6430
		K-55	4100	5470	6840
	61.0	J-55	4460	5950	7440
		K-55	4750	6330	7910
	68.0	J-55	5060	6750	8440
		K-55	5390	7180	8980
		C-75	6800	9060	11330
		L-80	7140	9520	11900
		N-80	7220	9630	12040
		C-95	8360	11140	13930
		P-110	9730	12970	16210
	72.0	C-75	7340	9780	12230
		L-80	7720	10290	12860
		N-80	7800	10400	13000
		C-95	9030	12040	15050
		P-110	10520	14020	17530
16	65.0	H-40	4390	…	…
	75.0	J-55	7100	…	…
		K-55	7520	…	…
	84.0	J-55	8170	…	…
		K-55	8650	…	…
18-5/8	87.5	H-40	5590	…	…
		J-55	7540	…	…
		K-55	7940	…	…
20	94.0	H-40	5810	…	…
		J-55	7840	…	…
		K-55	8240	…	…
	106.5	J-55	9130	…	…
		K-55	9600	…	…
	133.0	J-55	11920	…	…
		K-55	12530	…	…

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CASING MAKE-UP TORQUE — LONG THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
4-1/2	11.6	J-55	1220	1620	2030
		K-55	1350	1800	2250
		C-75	1610	2150	2690
		L-80	1670	2230	2790
		N-80	1710	2280	2850
		C-95	1940	2580	3230
		P-110	2270	3020	3780
	13.5	C-75	1950	2600	3250
		L-80	2030	2710	3390
		N-80	2070	2760	3450
		C-95	2350	3130	3910
		P-110	2750	3660	4580
	15.1	P-110	3300	4400	5500
5	13.0	J-55	1370	1820	2280
		K-55	1510	2010	2510
	15.0	J-55	1670	2230	2790
		K-55	1850	2460	3080
		C-75	2220	2960	3700
		L-80	2310	3080	3850
		N-80	2360	3140	3930
		C-95	2670	3560	4450
		P-110	3130	4170	5210
	18.0	C-75	2830	3770	4710
		L-80	2950	3950	4910
		N-80	3000	4000	5000
		C-95	3410	4550	5690
		P-110	3980	5310	6640
	21.4	C-75	3500	4660	5830
		L-80	3650	4860	6080
		N-80	3710	4950	6190
		C-95	4220	5620	7030
		P-110	4940	6580	8230
	24.1	C-75	4040	5390	6740
		L-80	4210	5610	7010
		N-80	4290	5720	7150
		C-95	4880	6500	8130
		P-110	5700	7600	9500
	15.5	J-55	1630	2170	2710
		K-55	1790	2390	2990
5-1/2	17.0	J-55	1850	2470	3090
		K-55	2040	2720	3400
		C-75	2450	3270	4090
		L-80	2560	3410	4260
		N-80	2610	3480	4350
		C-95	2970	3960	4950
		P-110	3470	4620	5780

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CASING MAKE-UP TORQUE — LONG THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
5-1/2	20.0	C-75	3020	4030	5040
		L-80	3150	4200	5250
		N-80	3210	4280	5350
		C-95	3650	4870	6090
		P-110	4270	5690	7110
	23.0	C-75	3550	4730	5910
		L-80	3700	4930	6160
		N-80	3770	5020	6280
		C-95	4290	5720	7150
		P-110	5010	6680	8350
6-5/8	20.0	J-55	2000	2660	3330
		K-55	2180	2900	3630
	24.0	J-55	2550	3400	4250
		K-55	2790	3720	4650
		C-75	3400	4530	5660
		L-80	3550	4730	5910
		N-80	3610	4810	6010
		C-95	4120	5490	6860
		P-110	4810	6410	8010
	28.0	C-75	4140	5520	6900
		L-80	4320	5760	7200
		N-80	4400	5860	7330
		C-95	5020	6690	8360
		P-110	5860	7810	9760
	32.0	C-75	4790	6380	7980
		L-80	5000	6660	8330
		N-80	5080	6770	8460
		C-95	5810	7740	9680
		P-110	6780	9040	11300
	23.0	J-55	2350	3130	3910
		K-55	2560	3410	4260
		C-75	3120	4160	5200
		L-80	3260	4350	5440
		N-80	3320	4420	5530
		C-95	3790	5050	6310
7	26.0	J-55	2750	3670	4590
		K-55	3010	4010	5010
		C-75	3670	4890	6110
		L-80	3830	5110	6390
		N-80	3890	5190	6490
		C-95	4450	5930	7410
		P-110	5200	6930	8660
	29.0	C-75	4220	5620	7030
		L-80	4400	5870	7340
		N-80	4480	5970	7460
		C-95	5120	6830	8540
		P-110	5980	7970	9960

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CASING MAKE-UP TORQUE — LONG THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
7	32.0	C-75	4750	6330	7910
		L-80	4960	6610	8260
		N-80	5040	6720	8400
		C-95	5760	7680	9600
		P-110	6730	8970	11210
	35.0	C-75	5270	7030	8790
		L-80	5510	7340	9180
		N-80	5600	7460	9330
		C-95	6400	8530	10660
		P-110	7470	9960	12450
	38.0	C-75	5750	7670	9590
		L-80	6010	8010	10010
		N-80	6110	8140	10180
		C-95	6980	9310	11640
		P-110	8150	10870	13590
7-5/8	26.4	J-55	2600	3460	4330
		K-55	2830	3770	4710
		C-75	3460	4610	5760
		L-80	3620	4820	6030
		N-80	3680	4900	6130
		C-95	4200	5600	7000
	29.7	C-75	4070	5420	6780
		L-80	4250	5670	7090
		N-80	4310	5750	7190
		C-95	4940	6590	8240
		P-110	5770	7690	9610
	33.7	C-75	4760	6350	7940
		L-80	4980	6640	8300
		N-80	5060	6740	8430
		C-95	5790	7720	9650
		P-110	6760	9010	11260
	39.0	C-75	5630	7510	9390
		L-80	5900	7860	9830
		N-80	5980	7980	9980
		C-95	6860	9140	11430
		P-110	8000	10660	13330
	42.8	C-75	6390	8520	10650
		L-80	6680	8910	11140
		N-80	6800	9060	11330
		C-95	7780	10370	12960
		P-110	9080	12100	15130

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CASING MAKE-UP TORQUE — LONG THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
7-5/8	47.1	C-75	7150	9530	11910
		L-80	7480	9970	12460
		N-80	7600	10130	12660
		C-95	8690	11590	14490
		P-110	10150	13530	16910
8-5/8	32.0	J-55	3130	4170	5210
		K-55	3390	4520	5650
	36.0	J-55	3650	4860	6080
		K-55	3950	5260	6580
		C-75	4860	6480	8100
		L-80	5090	6780	8480
		N-80	5160	6880	8600
		C-95	5920	7890	9860
	40.0	C-75	5570	7420	9280
		L-80	5820	7760	9700
		N-80	5910	7880	9850
		C-95	6780	9040	11300
		P-110	7910	10550	13190
	44.0	C-75	6260	8340	10430
		L-80	6560	8740	10930
		N-80	6650	8870	11090
		C-95	7630	10170	12710
		P-110	8900	11860	14830
	49.0	C-75	7040	9390	11740
		L-80	7370	9830	12290
		N-80	7480	9970	12460
		C-95	8580	11440	14300
		P-110	10010	13350	16690
	36.0	J-55	3400	4530	5660
		K-55	3670	4890	6110
9-5/8	40.0	J-55	3900	5200	6500
		K-55	4210	5610	7010
		C-75	5210	6940	8680
		L-80	5450	7270	9090
		N-80	5530	7370	9210
		C-95	6350	8470	10590
	43.5	C-75	5820	7760	9700
		L-80	6100	8130	10160
		N-80	6190	8250	10310
		C-95	7110	9480	11850
		P-110	8300	11060	13830

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CASING MAKE-UP TORQUE — LONG THREAD

RECOMMENDED MAKE-UP TORQUE *

O.D. (in)	Nominal Weight (lb/ft)	Grade	Torque (ft-lb) Minimum	Optimum	Maximum
9-5/8	47.0	C-75	6390	8520	10650
		L-80	6700	8930	11160
		N-80	6790	9050	11310
		C-95	7800	10400	13000
		P-110	9100	12130	15160
	53.5	C-75	7490	9990	12490
		L-80	7850	10470	13090
		N-80	7970	10620	13280
		C-95	9150	12200	15250
		P-110	10670	14220	17780
20	94.0	J-55	9070	…	…
		K-55	9550	…	…
	106.5	J-55	10570	…	…
		K-55	11130	…	…
	133.0	J-55	13800	…	…
		K-55	14530	…	…

** Data reprinted from API Bulletin RP5C1, "Recommended Practice for Care and Use of Casing, Tubing, and Drill Pipe," Twelfth Edition, March 1981. See Thirteenth Edition dated November 1, 1984 for correct torque values attached.*

DRILL BIT SPECIFICATIONS

Size (in)	Approx. Weight (lbs)	Reg *API Pin Shank Size (in)
3-3/4	10	
3-7/8	10	
4-1/8	11	2-3/8
4-1/4	11	
4-3/8	11	2-3/8
4-1/2	11	
4-5/8	16	2-7/8
4-3/4	16	
4-7/8	16	2-7/8
5-1/8	25	
5-3/8	25	3-1/2
5-5/8	25	
5-3/4	25	
5-7/8	25	
6	28	3-1/2
6-1/8	28	
6-1/4	28	
6-3/8	29	
6-1/2	29	3-1/2
6-5/8	29	
6-3/4	37	
7	42	3-1/2
7-3/8	42	
7-1/2	56	
7-5/8	57	4-1/2
7-3/4	58	
7-7/8	59	
8-1/8	64	…

Size (in)	Approx. Weight (lbs)	Reg *API Pin Shank Size (in)
8-3/8	67	
8-1/2	68	
8-5/8	73	4-1/2
8-3/4	74	
9	75	
9-1/2	102	4-1/2
9-5/8	112	
9-3/4	112	5-1/2 or 6-5/8
9-7/8	112	
10-5/8	140	5-1/2 or 6-5/8
11	145	6-5/8
11-3/4	170	
12	175	6-5/8
12-1/4	179	
13-3/4	245	6-5/8
14-3/4	300	
15	300	6-5/8
16	334	6-5/8
17	497	6-5/8
17-1/2	500	6-5/8
18-1/2	569	6-5/8
20	614	6-5/8
22	758	6-5/8 or 8-5/8
	1039	
23	1065	
24	1165	
26	1190	
	1225	

** Shank sizes shown are regular API tool joint pin threading.*

CASING BIT SIZES AND CLEARANCES

API CASING

Casing Specifications				Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Bit Size (in)	Clearance Thousandths	Clearance Nearest 64th
4-1/2	4.090	9.50	5.000	3-7/8	.215	7/32
4-1/2	4.000	11.60	5.000	3-7/8	.125	1/8
4-1/2	3.920	13.50	5.000	3-3/4	.170	11/64
5	4.560	11.50	5.563	4-1/4	.310	5/16
5	4.494	13.00	5.563	4-1/4	.244	1/4
5	4.408	15.00	5.563	4-1/4	.158	5/32
5	4.276	18.00	5.563	4-1/8	.151	5/32
5-1/2	5.044	13.00	6.050	4-3/4	.294	19/64
5-1/2	5.012	14.00	6.050	4-3/4	.262	17/64
5-1/2	4.950	15.50	6.050	4-3/4	.200	13/64
5-1/2	4.892	17.00	6.050	4-3/4	.142	9/64
5-1/2	4.778	20.00	6.050	4-5/8	.153	5/32
5-1/2	4.670	23.00	6.050	4-1/2	.170	11/64
6	5.524	15.00	6.625	5-3/8	.149	5/32
6	5.424	18.00	6.625	5-1/8	.299	19/64
6	5.352	20.00	6.625	5-1/8	.227	15/64
6	5.240	23.00	6.625	5-1/8	.115	7/64
6-5/8	6.135	17.00	7.390	6	.135	9/64
6-5/8	6.049	20.00	7.390	5-7/8	.174	11/64
6-5/8	5.921	24.00	7.390	5-5/8	.296	19/64
6-5/8	5.791	28.00	7.390	5-5/8	.166	11/64
6-5/8	5.675	32.00	7.390	5-3/8	.300	19/64
7	6.538	17.00	7.656	6-1/4	.288	9/32
7	6.456	20.00	7.656	6-1/4	.206	13/64
7	6.366	23.00	7.656	6-1/4	.116	7/64
7	6.276	26.00	7.656	6-1/8	.151	5/32
7	6.184	29.00	7.656	6	.184	3/16
7	6.094	32.00	7.656	6	.094	3/32
7	6.004	35.00	7.656	5-7/8	.129	1/8
7	5.920	38.00	7.656	5-3/4	.170	11/64
7-5/8	7.125	20.00	8.500	6-3/4	.375	3/8
7-5/8	7.025	24.00	8.500	6-3/4	.275	9/32
7-5/8	6.969	26.40	8.500	6-3/4	.219	7/32
7-5/8	6.875	29.70	8.500	6-3/4	.125	1/8
7-5/8	6.765	33.70	8.500	6-5/8	.140	9/64

CASING BIT SIZES AND CLEARANCES

API CASING

Casing Specifications				Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Bit Size (in)	Clearance	
					Thousandths	Nearest 64th
7-5/8	6.625	39.00	8.500	6-1/4	.375	3/8
8-5/8	8.097	24.00	9.625	7-7/8	.222	7/32
8-5/8	8.017	28.00	9.625	7-7/8	.142	9/64
8-5/8	7.921	32.00	9.625	7-5/8	.296	19/64
8-5/8	7.825	36.00	9.625	7-5/8	.200	13/64
8-5/8	7.725	40.00	9.625	7-5/8	.100	3/32
8-5/8	7.625	44.00	9.625	7-5/8	.250	1/4
8-5/8	7.511	49.00	9.625	7-5/8	.136	9/64
9-5/8	9.063	29.30	10.625	8-3/4	.313	5/16
9-5/8	9.001	32.30	10.625	8-3/4	.251	1/4
9-5/8	8.921	36.00	10.625	8-3/4	.171	11/64
9-5/8	8.835	40.00	10.625	8-5/8	.210	13/64
9-5/8	8.755	43.50	10.625	8-5/8	.130	1/8
9-5/8	8.681	47.00	10.625	8-1/2	.181	3/16
9-5/8	8.535	53.50	10.625	8-3/8	.160	5/32
10-3/4	10.192	32.75	11.750	9-7/8	.317	5/16
10-3/4	10.050	40.50	11.750	9-7/8	.175	11/64
10-3/4	9.950	45.50	11.750	9-3/4	.200	13/64
10-3/4	9.850	51.00	11.750	9-5/8	.225	7/32
10-3/4	9.760	55.50	11.750	9-5/8	.135	9/64
11-3/4	11.150	38.00	12.750	11	.150	5/32
11-3/4	11.084	42.00	12.750	10-3/4	.334	21/64
11-3/4	11.000	47.00	12.750	10-3/4	.250	1/4
11-3/4	10.880	54.00	12.750	10-5/8	.255	1/4
11-3/4	10.772	60.00	12.750	10-5/8	.147	9/64
13-3/8	12.715	48.00	14.375	12-1/4	.465	15/32
13-3/8	12.615	54.50	14.375	12-1/4	.365	23/64
13-3/8	12.515	61.00	14.375	12-1/4	.265	17/64
13-3/8	12.415	68.00	14.375	12-1/4	.165	11/64
13-3/8	12.347	72.00	14.375	12	.347	11/32
16	15.375	55.00	17.000	15	.375	3/8
16	15.250	65.00	17.000	15	.250	1/4
16	15.125	75.00	17.000	14-3/4	.375	3/8
16	15.010	84.00	17.000	14-3/4	.260	17/64
20	19.124	94.00	21.000	17-1/2	1.624	1-5/8

CASING BIT SIZES AND CLEARANCES

NATIONAL SEAMLESS INTERNAL UPSET CASING — LIGHT UPSET, SHORT COUPLING

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance	
						Thousandths	Nearest 64th
5-1/2	5.012	14.00	6.050	4.917	4-3/4	.167	11/64
5-1/2	4.950	15.50	6.050	4.856	4-3/4	.106	7/64
5-1/2	4.892	17.00	6.050	4.799	4-5/8	.174	11/64
5-1/2	4.778	20.00	6.050	4.686	4-1/2	.186	3/16
6	5.424	18.00	6.625	5.330	5-1/8	.205	13/64
6	5.352	20.00	6.625	5.259	5	.259	17/64
6-5/8	6.049	20.00	7.390	5.955	5-5/8	.330	21/64
6-5/8	5.921	24.00	7.390	5.829	5-5/8	.204	13/64
6-5/8	5.791	28.00	7.390	5.701	5-3/8	.326	21/64
7	6.538	17.00	7.656	6.443	6-1/4	.193	3/16
7	6.456	20.00	7.656	6.362	6-1/4	.112	7/64
7	6.366	23.00	7.656	6.273	6-1/8	.148	9/64
7	6.276	26.00	7.656	6.184	6	.184	3/16
7	6.184	29.00	7.656	6.094	6	.094	3/32
8-5/8	8.017	28.00	9.625	7.924	7-5/8	.299	19/64
8-5/8	7.921	32.00	9.625	7.829	7-5/8	.204	13/64
8-5/8	7.825	36.00	9.625	7.735	7-5/8	.110	7/64
8-5/8	7.725	40.00	9.625	7.636	7-3/8	.261	17/64
8-5/8	7.625	44.00	9.625	7.538	7-3/8	.163	5/32
9-5/8	9.001	32.30	10.625	8.877	8-3/4	.127	1/8
9-5/8	8.921	36.00	10.625	8.799	8-5/8	.174	11/64
9-5/8	8.835	40.00	10.625	8.714	8-1/2	.214	7/32
9-5/8	8.755	43.50	10.625	8.635	8-1/2	.135	9/64
10-3/4	10.192	32.75	11.750	10.067	9-7/6	.192	3/16
10-3/4	10.050	40.50	11.750	9.928	9-3/4	.178	11/64
10-3/4	9.950	45.50	11.750	9.829	9-5/8	.204	13/64
10-3/4	9.850	51.00	11.750	9.731	9-1/2	.231	15/64

CASING BIT SIZES AND CLEARANCES

NATIONAL SEAMLESS INTERNAL UPSET CASING — HEAVY UPSET WITH SHORT COUPLING

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance	
						Thousandths	Nearest 64th
5-1/2	5.012	14.00	6.050	4.799	4-5/8	.164	5/32
5-1/2	4.950	15.50	6.050	4.686	4-1/2	.186	3/16
5-1/2	4.892	17.00	6.050	4.686	4-1/2	.186	3/16
5-1/2	4.778	20.00	6.050	4.580	4-1/4	.330	21/64
6	5.424	18.00	6.625	5.259	5	.259	17/64
6	5.352	20.00	6.625	5.149	5	.149	5/32
6-5/8	6.049	20.00	7.390	5.829	5-5/8	.204	13/64
6-5/8	5.921	24.00	7.390	5.701	5-3/8	.326	21/64
6-5/8	5.791	28.00	7.390	5.587	5-3/8	.212	7/32
7	6.456	20.00	7.656	6.273	6-1/8	.148	9/64
7	6.366	23.00	7.656	6.148	6	.184	3/16
7	6.276	26.00	7.656	6.005 ①	5-7/8	.130	1/8
				6.094 ①	6	.094	3/32
7	6.184	29.00	7.656	5.916	5-1/4	.166	11/64
8-5/8	8.017	28.00	9.625	7.735	7-5/8	.110	7/64
8-5/8	7.921	32.00	9.625	7.636	7-3/8	.261	17/64
8-5/8	7.825	36.00	9.625	7.538	7-3/8	.163	5/32
8-5/8	7.725	40.00	9.625	7.538 ②	7-3/8	.163	5/32
9-5/8	8.921	36.00	10.625	8.714	8-1/2	.214	7/32
9-5/8	8.835	40.00	10.625	8.635 ③	8-1/2	.135	9/64
				8.562 ③	8-3/8	.187	3/16
9-5/8	8.755	43.50	10.625	8.562	8-3/8	.187	3/16
10-3/4	10.050	40.50	11.750	9.829	9-5/8	.204	13/64

① *For Grade N-80*
② *Long Coupling*
③ *For Grade J-55*

CASING BIT SIZES AND CLEARANCES

PITTSBURGH SPECIAL ACME THREAD CASING — INTERNAL UPSET

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance	
						Thousandths	Nearest 64th
5	4.494	13.00	5.375	4.295	4-1/8	.170	11/64
5	4.408	15.00	5.375	4.205	3-7/8	.330	21/64
5	4.276	18.00	5.563	4.066	3-7/8	.191	3/16
5-1/2	4.950	15.50	5.875	4.751	4-5/8	.126	1/8
5-1/2	4.892	17.00	5.875	4.691	4-1/2	.191	3/16
5-1/2	4.778	20.00	6.050	4.572	4-1/4	.322	21/64
5-1/2	4.670	23.00	6.050	4.459	4-1/4	.209	13/64
6	5.424	18.00	6.500	5.226	5-1/8	.101	3/32
6	5.352	20.00	6.500	5.151	5	.151	5/32
6	5.240	23.00	6.500	5.035	4-3/4	.285	9/32
6-5/8	6.049	20.00	7.000	5.853	5-5/8	.228	15/64
6-5/8	5.921	24.00	7.250	5.720	5-5/8	.095	3/32
6-5/8	5.791	28.00	7.250	5.586	5-3/8	.211	7/32
6-5/8	5.675	32.00	7.250	5.466	5-1/8	.341	11/32
7	6.366	23.00	7.400	6.170	6	.170	11/64
7	6.276	26.00	7.600	6.076	5-7/8	.201	13/64
7	6.184	29.00	7.600	5.982	5-5/8	.357	23/64
7	6.094	32.00	7.750	5.889	5-5/8	.264	17/64
7	6.004	35.00	7.750	5.796	5-5/8	.171	11/64
7	5.920	38.00	7.750	5.709	5-3/8	.334	21/64
7-5/8	6.969	26.40	8.250	6.774	6-5/8	.149	5/32
7-5/8	6.875	29.70	8.250	6.677	6-3/8	.302	19/64
7-5/8	6.765	33.70	8.250	6.563	6-1/4	.313	5/16
7-5/8	6.625	39.00	8.250	6.419	6-1/4	.169	11/64
8-5/8	7.921	32.00	9.200	7.726	7-5/8	.101	3/32
8-5/8	7.825	36.00	9.200	7.628	7-3/8	.253	1/4
8-5/8	7.725	40.00	9.400	7.526	7-3/8	.151	5/32
8-5/8	7.625	44.00	9.400	7.423	7	.423	27/64
8-5/8	7.511	49.00	9.400	7.306	7	.306	5/16
9-5/8	8.921	36.00	10.250	8.728	8-1/2	.228	15/64
9-5/8	8.835	40.00	10.250	8.640	8-1/2	.140	9/64
9-5/8	8.755	43.50	10.250	8.558	8-3/8	.183	3/16
9-5/8	8.681	47.00	10.250	8.483	8-1/4	.233	15/64
9-5/8	8.535	53.50	10.400	8.333	8-1/8	.208	13/64

CASING BIT SIZES AND CLEARANCES

YOUNGSTOWN SPEED TITE CASING WITH HYDRIL TWO-STEP THREADS

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance	
						Thousandths	Nearest 64th
5-1/2	4.950	15.50	5.825	4.857	4-1/4	.107	7/64
5-1/2	4.892	17.00	5.825	4.832	4-1/4	.082	5/64
5-1/2	4.778	20.00	5.825	4.718	4-5/8	.093	3/32
5-1/2	4.670	23.00	5.825	4.610	4-1/4	.360	23/54
6-5/8	5.921	24.00	6.997	5.795	5-5/8	.170	11/64
6-5/8	5.791	28.00	6.997	5.731	5-5/8	.106	7/64
6-5/8	5.675	32.00	6.997	5.615	5-3/8	.240	15/64
7	6.366	23.00	7.369	6.216	6-1/8	.091	3/32
7	6.276	26.00	7.369	6.216	6-1/8	.091	3/32
7	6.184	29.00	7.369	6.124	6	.124	1/8
7	6.094	32.00	7.369	6.034	5-7/8	.159	5/32
7	6.004	35.00	7.369	5.944	5-5/6	.319	5/16
7	5.920	38.00	7.369	5.860	5-5/8	.235	15/64
7-5/8	6.969	26.40	8.017	6.842	6-3/4	.092	3/32
7-5/8	6.875	29.70	8.017	6.815	6-5/8	.190	3/16
7-5/8	6.765	33.70	8.017	6.705	6-5/8	.080	5/64
7-5/8	6.625	39.00	8.017	6.565	6-1/4	.315	5/16
8-5/8	7.921	32.00	9.060	7.787	7-5/8	.162	5/32
8-5/8	7.825	36.00	9.060	7.765	7-5/8	.140	9/64
8-5/8	7.725	40.00	9.060	7.665	7-3/8	.290	19/64
8-5/8	7.625	44.00	9.060	7.565	7-3/8	.190	3/16
8-5/8	7.511	49.00	9.060	7.451	7-3/8	.076	5/64
9-5/8	8.835	40.00	10.097	8.695	8-1/2	.195	3/16
9-5/8	8.755	43.50	10.097	8.695	8-1/2	.195	3/16
9-5/8	8.681	47.00	10.097	8.621	8-1/2	.121	1/8
9-5/8	8.535	53.50	10.097	8.475	8-3/8	.100	3/32

CASING BIT SIZES AND CLEARANCES

SPANG-CHALFANT EXTREME LINE CASING

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance	
						Thousandths	Nearest 64th
5	4.408	15.00	5.360	4.198	3-7/8	.323	21/64
5	4.276	18.00	5.360	4.198	3-7/8	.323	21/64
5-1/2	4.950	15.50	5.780	4.736	4-5/8	.111	7/64
5-1/2	4.892	17.00	5.780	4.701	4-5/8	.076	5/64
5-1/2	4.778	20.00	5.780	4.701	4-5/8	.076	5/64
5-1/2	4.670	23.00	5.780	4.610	4-1/4	.360	23/64
6	5.424	18.00	6.300	5.248	5-1/8	.123	1/8
6	5.352	20.00	6.300	5.248	5-1/8	.123	1/8
6	5.240	23.00	6.300	5.180	5	.180	3/16
6-5/8	5.921	24.00	6.930	5.781	5-5/8	.156	5/32
6-5/8	5.791	28.00	6.930	5.731	5-5/8	.106	7/64
6-5/8	5.675	32.00	6.930	5.615	5-3/8	.240	15/64
7	6.366	23.00	7.310	6.171	6	.171	11/64
7	6.276	26.00	7.310	6.171	6	.171	11/64
7	6.184	29.00	7.310	6.123	6	.123	1/8
7	6.094	32.00	7.310	6.032	5-7/8	.157	5/32
7	6.004	35.00	7.390	5.940	5-5/8	.315	5/16
7	5.920	38.00	7.390	5.860	5-5/8	.235	15/64
7-5/8	6.969	26.40	7.920	6.770	6-5/8	.145	9/64
7-5/8	6.875	29.70	7.920	6.770	6-5/8	.145	9/64
7-5/8	6.765	33.70	7.920	6.705	6-5/8	.080	5/64
7-5/8	6.625	39.00	7.920	6.565	6-1/4	.315	5/18
8-5/8	7.921	32.00	9.030	7.725	7-5/8	.100	3/32
8-5/8	7.825	36.00	9.030	7.725	7-5/8	.100	3/32
8-5/8	7.725	40.00	9.030	7.663	7-3/8	.288	9/32
8-5/8	7.625	44.00	9.030	7.565	7-3/8	.190	3/16
8-5/8	7.511	49.00	9.030	7.451	7-3/8	.076	5/64
9-5/8	8.835	40.00	10.020	8.665	8-1/2	.165	11/64
9-5/8	8.755	43.50	10.020	8.665	8-1/2	.165	11/64
9-5/8	8.681	47.00	10.020	8.621	8-1/2	.121	1/8
9-5/8	8.535	53.50	10.020	8.475	8-3/8	.100	3/32

CASING BIT SIZES AND CLEARANCES

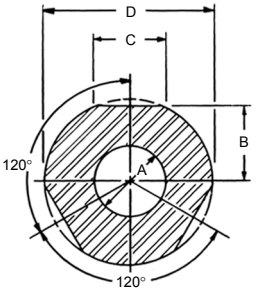
J&L INTEGRAL JOINT SEAMLESS CASING — LIGHT UPSET

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance Thousandths	Clearance Nearest 64th
5-1/2	5.012	14.00	6.050	4.912	4-3/4	.162	5/32
5-1/2	4.950	15.50	6.050	4.850	4-3/4	.100	3/32
5-1/2	4.892	17.00	6.050	4.792	4-5/8	.167	11/64
5-1/2	4.778	20.00	6.050	4.678	4-1/2	.178	11/64
5-1/2	4.670	23.00	6.050	4.570	4-1/4	.320	5/16
7	6.456	20.00	7.656	6.356	6-1/4	.106	7/64
7	6.366	23.00	7.656	6.266	6-1/8	.141	9/64
7	6.276	26.00	7.656	6.176	6	.176	11/64
7	6.184	29.00	7.656	6.084	6	.084	5/64
7	6.094	32.00	7.656	5.994	5-5/8	.369	3/8
7	6.004	35.00	7.656	6.004	5-7/8	.129	1/8
8-5/8	8.017	28.00	9.438	7.917	7-5/8	292	19/64
8-5/8	7.921	32.00	9.438	7.821	7-5/8	.196	13/64
8-5/8	7.825	36.00	9.438	7.725	7-5/8	.100	3/32
8-5/8	7.725	40.00	9.438	7.625	7-3/8	.250	1/4
8-5/8	7.625	44.00	9.438	7.525	7-3/8	.150	5/32
8-5/8	7.511	49.00	9.438	7.411	7	.411	13/32

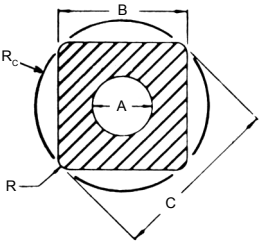
J&L INTEGRAL JOINT SEAMLESS CASING — HEAVY UPSET

Casing Specifications					Bit Size and Diametrical Clearances		
Casing O.D. (in)	Casing I.D. (in)	Wt/Ft (lbs) w/Couplings	Coupling O.D. (in)	Joint I.D. (in)	Bit Size (in)	Clearance Thousandths	Clearance Nearest 64th
5-1/2	5.012	14.00	6.050	4.850	4-3/4	.100	3/32
5-1/2	4.950	15.50	6.050	4.792	4-3/8	.167	11/64
5-1/2	4.892	17.00	6.050	4.678	4-1/2	.178	11/64
5-1/2	4.778	20.00	6.050	4.570	4-1/4	.320	5/16
7	6.456	20.00	7.656	6.266	6-1/8	.141	9/64
7	6.366	23.00	7.656	6.176	6	.176	11/64
7	6.276	26.00	7.656	6.084	6	.084	5/64
7	6.184	29.00	7.656	5.994	5-5/8	.369	3/8
8-5/8	8.017	28.00	9.438	7.821	7-5/8	.196	13/64
8-5/8	7.921	32.00	9.438	7.725	7-5/8	.100	3/32
8-5/8	7.825	36.00	9.438	7.625	7-3/8	.250	1/4
8-5/8	7.725	40.00	9.438	7.525	7-3/8	.150	5/32
8-5/8	7.625	44.00	9.438	7.411	7-3/8	.411	13/32

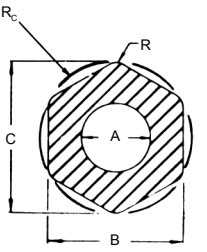
KELLY CROSS-SECTION DIMENSIONS



THREE-SIDED KELLY



SQUARE KELLY



HEXAGONAL KELLY

BAASH-ROSS TRI-KELLY® — THREE-SIDED KELLY

Size	Max. Bore A	GL to Flat B	Flat Width C	O.D. D
3-1/2	1-3/4	1-3/4	1-7/8	3-31/32
4-1/4	2-1/4	2-1/8	2-17/64	4-13/16
5-1/4	3-1/4	2-5/8	2-27/32	5-31/32
6	4	3	3-15/64	6-13/16

SQUARE KELLYS

API Nom. Size	Max. Bore A	Across Flats B	Across Corner C	Radius R	Radius Rc *
2-1/2	1-1/4	2-1/2	3-9/32	5/16	1-5/8
3	1-3/4	3	3-15/16	3/8	1-15/16
3-1/2	2-1/4	3-1/2	4-17/32	1/2	2-7/32
4-1/4	2-3/4	4-1/4	5-9/16	1/2	2-3/4
5-1/4	3-1/2	5-1/4	6-29/32	5/8	3-3/8
6 **	3-1/2	6	7-7/8	3/4	…

** Corner configuration at manufacturer's option*

*** 6" square not API*

HEXAGONAL KELLYS

API Std. Size	Alternate	Max. Bore A	Across Flats B	Across Corner C	Radius R	Radius Rc *
3	…	1-1/2	3	3-3/8	1/4	1-11/16
3-1/2	…	1-3/4	3-1/2	3-31/32	1/4	1-31/32
…	3-1/2	2-1/4	3-3/4	4-1/4	5/16	…
4-1/4	…	2-1/4	4-1/4	4 13/16	5/16	2-25/64
…	4-1/2	2-1/4	4-27/32	5-1/2	5/16	…
5-1/4	…	3-1/4	5-14	5-31/32	3/8	2- 61/64
…	5-916	4	5-31/32	6-3/4	3/8	…
6	…	4	6	6-13/16	3/8	3-13/32
…	6-5/8	4-1/4	6-27/32	7-3/4	1/2	…

** Corner configuration at manufacturer's option*

KELLY WEIGHTS POUNDS PER FOOT

(DRIVE SECTION)

TRI-KELLY® — THREE-SIDED KELLYS

Size	Bore of Tri-Kelly (in)										
	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	2-7/8	3	3-1/4	3-1/2	4
3-1/2	33.04	30.85	…	…	…	…	…	…	…	…	…
4-1/4	51.44	49.27	46.77	43.93	…	…	…	…	…	…	…
5-1/4	…	…	…	…	…	67.86	65.98	64.04	59.86	…	…
6	…	…	…	…	…	…	…	…	…	82.15	72.15

SQUARE KELLYS

Across Flat	Bore of Square Kelly (in)											
	1-1/16	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	2-7/8	3	3-1/4	3-1/2
2-1/2	18.3	17.1	…	…	…	…	…	…	…	…	…	…
3	…	25.8	24.0	21.8	…	…	…	…	…	…	…	…
3-1/2	…	…	35.6	33.5	31.0	28.2	…	…	…	…	…	…
4-1/4	…	…	…	…	…	47.9	44.7	41.3	…	…	…	…
5-1/4	…	…	…	…	…	…	…	73.5	71.6	69.7	65.5	61.0
6	…	…	…	…	…	…	…	…	…	…	…	89.6

HEXAGONAL KELLYS

Across Flat	Bore of Hexagonal Kelly (in)											
	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	2-7/8	3	3-1/4	3-1/2	4
3	22.3	20.5	…	…	…	…	…	…	…	…	…	…
3-1/2	…	30.1	27.9	…	…	…	…	…	…	…	…	…
3-3/4	…	35.3	33.2	30.7	…	…	…	…	…	…	…	…
4-1/4	…	…	…	…	39.6	…	…	…	…	…	…	…
4-27/32	…	…	…	…	56.4	…	…	…	…	…	…	…
5-1/4	…	…	…	…	…	…	60.9	59.0	57.1	52.9	…	…
6	…	…	…	…	…	…	…	…	…	…	73.2	63.2

BUOYANCY FACTOR FOR STEEL PIPE

Fluid (lb/gal)	Buoyancy Factor
6.0	.9083
6.2	.9053
6.4	.9022
6.6	.8991
6.8	.8961
7.0	.8930
7.2	.8900
7.4	.8869
7.6	.8839
7.8	.8808
8.0	.8778
8.2	.8747
8.33 *	.8727
8.4	.8716
8.6	.8686
8.8	.8655
9.0	.8625
9.2	.8594
9.4	.8564
9.6	.8533
9.8	.8502
10.0	.8472
10.2	.8441
10.4	.8411
10.6	.8380
10.8	.8350
11.0	.8319
11.2	.8289
11.4	.8258
11.6	.8227
11.8	.8197
12.0	.8166
12.2	.8136
12.4	.8105
12.6	.8075
12.8	.8044

Fluid (lb/gal)	Buoyancy Factor
13.0	.8013
13.2	.7983
13.4	.7952
13.6	.7922
13.8	.7891
14.0	.7861
14.2	.7830
14.4	.7800
14.6	.7769
14.8	.7738
15.0	.7708
15.2	.7677
15.4	.7647
15.6	.7616
15.8	.7586
16.0	.7555
16.2	.7524
16.4	.7494
16.6	.7463
16.8	.7433
17.0	.7402
17.2	.7372
17.4	.7341
17.6	.7311
17.8	.7280
18.0	.7249
18.2	.7219
18.4	.7188
18.6	.7158
18.8	.7127
19.0	.7097
19.2	.7066
19.4	.7035
19.6	.7005
19.8	.6974
20.0	.6944

** Weight of water @ 68°F (20°C)*

Buoyancy Factor is used to compensate for loss of weight when steel tubulars are immersed in fluid. Applicable only when steel tubulars are completely filled with fluid.

RING JOINT — FLANGE DATA

Old API Designations	Working Pressure (psi)	Ring Gasket	New API Designations
S/600	2,000	R or RX	6B
S/900	3,000	R or RX	6B
S/1500	5,000	R or RX	6B
…	10,000	BX	6BX
…	15,000	BX	6BX

SUMMARY

API has taken all flanges that used an R or RX ring gasket and typed them as 6B. They have taken all connections that use BX ring gaskets and typed them 6BS. Exceptions to this are as follows:

The old S/2900 is considered obsolete by API and is not included in their designations. This series, because it is 10,000 psi working pressure and uses either an R or RX ring gasket, does not conform to the system that API has used to rename flanges. Therefore, for simplicity, and since the R and RX ring gaskets are used in the S/2900, the S/2900 is designated as a type 6B. The other exception is the new 13-5/8" 5,000 psi flange. API has arbitrarily designated these as a 6BX flange, although the working pressure is 5,000 psi and BX ring gaskets are used.

FLANGE DIMENSIONS

STUDS, NUTS, AND RING GASKETS

Nom. Size	Pressure Rating (psi)	Flange		Bolts				API Ring	
		O.D.	Thickness	Dia. Circle	Quantity	Dia.	Length	Pitch Dia.	Ring Number
1-13/16	10,000	7-3/8	1-21/32	5-3/4	8	3/4	5-1/4	3-1/16	BX-151
1-13/16	15,000	8-3/16	1-25/32	6-5/16	8	7/8	5-7/8	3-1/16	BX-151
1-13/16	20,000	10-1/8	2-1/2	8	8	1	7-3/4	3-1/16	BX-151
2-1/16	2,000	6-1/2	1-5/16	5	8	5/8	4-3/4	3-1/4	R-23
2-1/16	3,000	8-1/2	1-13/16	6-1/2	8	7/8	6-3/8	3-3/4	R-24
2-1/16	5,000	8-1/2	1-13/16	6-1/2	8	7/8	6-3/8	3-3/4	R-24
2-1/16	10,000	7-7/8	1-47/64	6-1/4	8	3/4	5-1/2	…	BX-152
2-1/16	15,000	8-3/4	2	6-7/8	8	7/8	6-1/4	…	BX-152
2-1/16	20,000	1-15/16	2-13/16	9-1/16	8	1-1/8	8-1/2	…	BX-152
2-9/16	2,000	7-1/2	1-7/16	5-7/8	8	3/4	5-1/4	4	R-26
2-9/16	3,000	9-5/8	1-15/16	7-1/2	8	1	7	4-1/4	R-27
2-9/16	5,000	9-5/8	1-15/16	7-1/2	8	1	7	4-1/4	R-27
2-9/16	10,000	9-1/8	21/64	7-1/4	8	7/8	6-1/4	…	BX-153
2-9/16	15,000	10	2-1/4	7-7/8	8	1	7	…	BX-153
2-9/16	20,000	12-13/16	3-1/8	10-5/16	8	1-1/4	9-1/2	…	BX-153
3-1/8	2,000	8-1/4	1-9/16	6-5/8	8	3/4	5-1/2	4-7/8	R-31
3-1/8	3,000	9-1/2	1-13/16	7-1/2	8	7/8	6-1/4	4-7/8	R-31
3-1/8	5,000	10-1/2	2-3/16	8	8	1-1/8	7-3/4	5-3/8	R-35
3-1/16	10,000	10-5/8	2-19/64	8-1/2	8	1	7-1/4	…	BX-154
3-1/16	15,000	11-5/16	2-17/32	9-1/16	8	1-1/8	8	…	BX-154
3-1/16	20,000	14-1/16	3-3/8	11-5/14	8	1-3/8	10-1/4	…	BX-154
4-1/16	2,000	10-3/4	1-13/16	8-1/2	8	7/8	6-1/4	5-7/8	R-37
4-1/16	3,000	11-1/2	2-1/16	9-1/4	8	1-1/8	7-1/2	5-7/9	R-37
4-1/16	5,000	12-1/4	2-7/16	9-1/2	8	1-1/4	8-1/2	6-3/8	R-39
4-1/16	10,000	12-7/16	2-49/64	10-3/16	8	1-1/8	8-3/8	…	BX-155
4-1/16	15,000	14-3/16	3-3/32	11-7/16	8	1-3/8	9-13/16	…	BX-155
4-1/16	20,000	17-9/16	4-3/16	14-1/16	8	1-3/4	12-5/8	…	BX-155
5-1/8	2,000	13	2-1/16	10-1/2	8	1	7	7-1/8	R-41
5-1/8	3,000	13-3/4	2-5/16	11	8	1-1/4	8	7-1/8	R-41
5-1/8	5,000	14-3/4	3-3/16	11-1/2	8	1-1/2	10-1/4	7-5/8	R-44
5-1/8	10,000	14-1/16	3-1/8	11-13/16	12	1-1/8	9-1/4	…	BX-169
7-1/16	2,000	14	2-3/16	11-1/2	12	1	7-1/2	8-5/16	R-45
7-1/16	3,000	15	2-1/2	12-1/2	12	1-1/8	8-1/2	8-5/16	R-45
7-1/16	5,000	15-1/2	3-5/8	12-1/2	12	1-3/8	11-1/4	8-5/16	R-46
7-1/16	10,000	18-7/8	4-1/16	15-7/8	12	1-1/2	11-3/4	…	BX-156
7-1/16	15,000	19-7/8	4-11/16	16-7/8	16	1-1/2	13	…	BX-156
7-1/16	20,000	25-13/16	6-1/2	21-13/16	16	2	18	…	BX-156
9	2,000	16-1/2	2-1/2	13-3/4	12	1-1/8	8-1/2	10-5/8	R-49
9	3,000	18-1/2	2-13/16	15-1/2	12	1-3/8	9-1/2	10-5/8	R-49
9	5,000	19	4-1/16	15-1/2	12	1-5/8	12-1/2	10-5/8	R-50
9	10,000	21-3/4	4-7/8	18-3/4	16	1-1/2	13-1/4	…	BX-157
9	15,000	25-1/2	5-3/4	21-3/4	16	1-7/8	16-1/4	…	BX-157

FLANGE DIMENSIONS

STUDS, NUTS, AND RING GASKETS

Nom. Size	Pressure Rating (psi)	Flange		Bolts				API Ring	
		O.D.	Thickness	Dia. Circle	Quantity	Dia.	Length	Pitch Dia.	Ring Number
11	2,000	20	21-3/16	17	16	1-1/4	9-1/4	12-3/4	R-53
11	3,000	21-1/2	3-1/16	18-1/2	16	1-3/8	10	12-3/4	R-53
11	5,000	23	41-1/16	19	12	1-7/8	14-1/2	12-3/4	R-54
11	10,000	25-3/4	5-9/16	22-1/4	16	1-3/4	15-3/8	-	BX-158
11	15,000	32	7-3/8	28	20	2	23	-	BX-158
13-5/8	2,000	22	2-15/16	19-1/4	20	1-1/4	9-1/2	15	R-57
13-5/8	3,000	24	3-7/16	21	20	1-3/8	10-3/4	15	R-57
13-5/8	5,000	26-1/2	4-7/16	23-1/4	16	1-5/6	12-3/4	-	BX-160
13-5/8	10,000	30-1/4	6-5/8	26-1/2	20	1-7/8	17-3/4	-	BX-159
13-5/8	15,000	34-7/8	7-7/8	30-3/8	20	2-1/4	21	-	BX-159
16-3/4	2,000	27	3-5/16	23-3/4	20	1-1/2	10-3/4	18-1/2	R-65
16-3/4	3,000	27-3/4	3-15/16	24-1/4	20	1-5/8	12-1/4	18-1/2	R-66
16-3/4	5,000	30-3/8	5-1/8	26-5/8	16	1-7/8	14-3/4	-	BX-162
16-3/4	10,000	34-5/16	6-5/8	30-9/16	24	1-7/6	17-3/4	-	BX-162
18-3/4	5,000	35-5/8	6-17/32	31-5/8	20	2	18	-	BX-163
18-3/4	10,000	40-15/16	8-25/32	36-7/16	24	2-1/4	22-7/8	-	BX-164
20-3/4	3,000	33-3/4	4-3/4	29-1/2	20	2	15-1/4	23	R-74
21-1/4	2,000	32	3-7/8	28-1/2	24	1-5/8	12-1/4	23	R-73
21-1/4	5,000	39	7-1/8	34-7/8	24	2	19-1/4	-	BX-165
21-1/4	10,000	45	9-1/2	40-1/4	24	2-1/2	25	-	BX-166
26-3/4	2,000	41	4-31/32	37-1/2	20	1-3/4	14-1/2	-	BX-167
26-3/4	3,000	43-3/8	6-11/32	39-3/8	24	2	17-3/4	-	BX-168

BRINELL HARDNESS TABLE

BRINELL (3,000 kg)

Diameter	Number	Diameter	Number	Diameter	Number
2.00	945	3.70	269	5.40	121
2.05	899	3.75	262	5.45	118
2.10	856	3.80	255	5.50	116
2.15	817	3.85	248	5.55	114
2.20	780	3.90	241	5.60	111
2.25	745	3.95	235	5.65	109
2.30	712	4.00	229	5.70	107
2.35	682	4.05	223	5.75	105
2.40	653	4.10	217	5.80	103
2.45	627	4.15	212	5.85	101
2.50	601	4.20	207	5.90	99.2
2.55	578	4.25	201	5.95	97.3
2.60	555	4.30	197	6.00	95.5
2.65	534	4.35	192	6.05	93.7
2.70	514	4.40	187	6.10	92.0
2.75	495	4.45	183	6.15	90.3
2.80	477	4.50	179	6.20	88.7
2.85	461	4.55	174	6.25	87.1
2.90	444	4.60	170	6.30	85.5
2.95	429	4.65	167	6.35	84.0
3.00	415	4.70	163	6.40	82.5
3.05	401	4.75	159	6.45	81.0
3.10	388	4.80	156	6.50	79.6
3.15	375	4.85	152	6.55	78.2
3.20	363	4.90	149	6.60	76.8
3.25	352	4.95	146	6.65	75.4
3.30	341	5.00	143	6.70	74.1
3.35	331	5.05	140	6.75	72.8
3.40	321	5.10	137	6.80	71.6
3,45	311	5.15	134	6.85	70.4
3.50	302	5.20	131	6.90	69.1
3.55	293	5.25	128	6.95	68.0
3.60	285	5.30	126	7.00	66.8
3.65	277	5.35	123	…	…

HARDNESS TESTING CONVERSION TABLE

APPROXIMATE VALUES

Rockwell		Brinell No.	Scleroscope
C	B		
66	…	…	93
65	…	745	91
64	…	712	87
62	…	682	84
60	…	653	81
59	…	627	79
58	…	601	77
57	…	578	75
55	…	555	73
54	…	534	71
52	…	514	70
51	…	495	68
50	…	477	66
49	…	461	65
47	…	444	63
46	…	429	61
45	…	415	59
43	…	401	58
42	…	388	56
40	…	375	54
39	…	363	52
38	…	352	51
37	…	341	50
36	…	331	48
34	…	321	47

Rockwell		Brinell No.	Scleroscope
C	B		
33	…	311	46
32	…	302	45
31	…	293	43
30	…	285	42
29	…	277	41
28	…	269	40
27	…	262	39
25	…	255	38
24	…	248	37
23	100	241	36
22	99	235	35
21	98	229	34
19	97	223	34
18	96	217	33
16	96	212	33
15	95	207	32
14	94	201	31
13	93	197	30
12	92	192	29
10	91	187	29
9	90	183	28
8	89	179	27
6	88	I74	27
5	87	170	26
4	86	167	26

Rockwell C values are determined with conical brale penetrator and 150 kilogram major load.

Rockwell B values are determined with .0623 inch diameter steel ball and 100 kilogram major load.

Brinell hardness values are determined with 10 mm diameter steel ball and 3,000 kilgram pressure.

EQUIVALENCY CHART

FRACTIONS, DECIMALS, AND MILLIMETERS

Fraction	Decimal (in)	Millimeter
1/64	.015625	0.397
1/32	.03125	0.794
…	.03937	1.000
3/64	.046875	1.191
1/16	.0625	1.588
5/64	.078125	1.985
…	.07874	2.000
3/32	.09375	2.381
7/64	.109375	2.779
…	.11811	3.000
1/8	.1250	3.175
9/64	.140625	3.573
5/32	.15625	3.969
…	.15748	4.000
11/64	.171875	4.367
3/16	.1875	4.763
…	.19685	5.000
13/64	.203125	5.161
7/32	.21875	5.556
15/64	.234375	5.955
…	.23622	6.000
1/4	.2500	6.350
17/64	.265625	6.749
…	.27559	7.000
9/32	.28125	7.144
19/64	.296875	7.543
5/16	.3125	7.938
…	.31496	8.000
21/64	.328125	8.337
11/32	.34375	8.731
…	.35433	9.000
23/64	.359375	9.131
3/8	.3750	9.525
25/64	.390625	9.925
…	.3937	10.000
13/32	.40625	10.319
27/64	.421875	10.719
…	.43307	11.000
7/16	.4375	11.113
29/64	.453125	11.513
15/32	.46875	11.906
…	.47244	12.000
31/64	.484375	12.307
1/2	.5000	12.700

Fraction	Decimal (in)	Millimeter
33/64	.515625	13.101
…	.51181	13.000
17/32	.53125	13.494
35/64	.546875	13.895
	.55118	14.000
9/16	.5625	14.288
37/64	.578125	14.689
…	.59055	15.000
19/32	.59375	15.081
39/64	.609375	15.483
5/8	.6250	15.875
…	.62992	16.000
41/64	.640625	16.277
21/32	.65625	16.669
…	.66929	17.000
43/64	.671875	17.071
11/16	.6875	17.463
45/64	.703125	17.865
…	.70866	18.000
23/32	.71875	18.256
47/64	.734375	18.659
…	.74803	19.000
3/4	.7500	19.050
49/64	.765625	19.453
25/32	.78125	19.844
…	.7874	20.000
51/64	.796875	20.247
13/16	.8125	20.638
…	.82677	21.000
53/64	.828125	21.041
27/32	.84375	21.431
55/64	.859375	21.835
…	.86614	22.000
7/8	.8750	22.225
57/64	.890625	22.629
…	.90551	23.000
29/32	.90625	23.019
59/64	.921875	23.423
15/16	.9375	23.813
…	.94488	24.000
61/64	.953125	24.217
31/32	.96875	24.606
…	.98425	25.000
63/64	.984375	25.011
…	1.0000	25.400

LINE PULL x TONG LEVER CHART

TORQUE IN FT-LBS

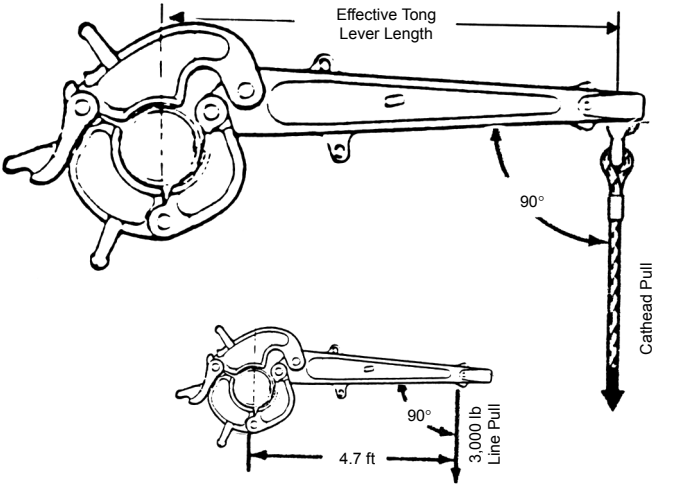
(LEVER LENGTHS APPROXIMATE)

Line Pull (lbs)	24-1/2" WW "D" Tong	31-5/8" WW "B" Short Tong	33-3/8" WW "C" Tong	39-5/8" WW "B" Std. Tong	41-1/2" WW "AAX" Short Tong	49-1/2" WW "AAX" Std. Tong & ST-60	50" WW "H" Short Tong	56-1/2" WW "H" Std. Tong & ST-160
500	1021	1318	1391	1651	1729	2063	2083	2354
1000	2041	2635	2781	3302	3458	4125	4166	4708
1500	3062	3953	4172	4953	5187	6188	6249	7062
2000	4082	5270	5562	6604	6916	8250	8332	9416
2500	5103	6588	6953	8255	8645	10313	10415	11770
3000	6123	7905	8343	9906	10374	12375	12498	14124
3500	7144	9223	9734	11557	12103	14438	14581	16478
4000	8164	10540	11124	13208	13832	16500	16664	18832
4500	9185	11858	12515	14859	15561	18563	18747	21186
5000	10205	13175	13905	16510	17290	20625	20830	23540
5500	11226	14493	15296	18161	19019	22688	22913	25894
6000	12246	15810	16686	19812	20748	24750	24996	28248
6500	13267	17128	18077	21463	22477	26813	27079	30602
7000	14287	18445	19467	23114	24206	28875	29162	32956
7500	15308	19763	20858	24765	25935	30938	31245	35310
8000	16328	21080	22248	26416	27664	33000	33328	37664
8500	17349	22398	23639	28067	29393	35063	35411	40018
9000	18369	23715	25029	29718	31122	37125	37494	42372
9500	19390	25033	26420	31369	32851	39188	39577	44726
10000	20410	26350	27810	33020	34580	41250	41660	47080
10500	21431	27668	29201	34671	36309	43313	43743	49434
11000	22451	28985	30591	36322	38038	45375	45826	51788
11500	23472	30303	31982	37973	39767	47438	47909	54142
12000	24492	31620	33372	39624	41496	49500	49992	56496
12500	25513	32938	34763	41275	43225	51563	52075	58850
13000	26533	34255	36153	42926	44954	53625	54158	61204
13500	27554	35573	35744	44577	46683	55688	56241	63558
14000	28574	36890	38934	46228	48412	57750	58324	65912
14500	29595	38208	40325	47879	50141	59813	60407	68266
15000	30615	39525	41715	49530	51870	61875	62490	70620

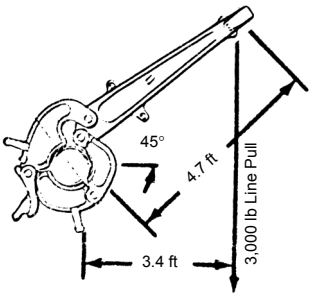
TORQUE OUTPUT WITH MANUAL TONGS

LINE PULL (IN POUNDS) x TONG LEVER LENGTH (IN FEET) = FT-LBS TORQUE

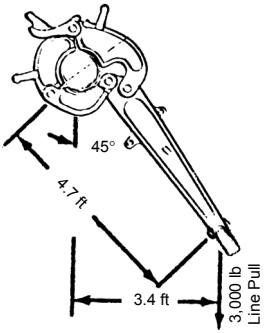
In order to figure the amount of line pull required, always figure on the tong lever being level and at a right angle (90°) to line pull of cathead. Line pull should be a steady pull, do not "jerk" the line since it is too difficult to measure the line pull while it is "jerking."



FULLY EFFECTIVE TONG LEVER TORQUE
4.7 ft x 3,000 lb line pull = 14,100 ft-lbs

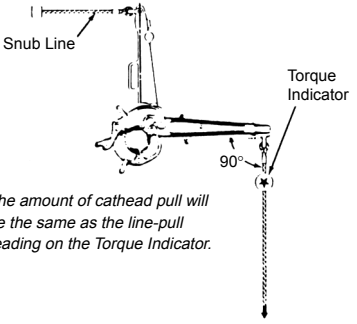


INEFFECTIVE TONG LEVER TORQUE
3.4 ft x 3,000 lb line pull = 10,200 ft-lbs



INEFFECTIVE TONG LEVER TORQUE
3.4 ft x 3,000 lb line pull = 10,200 ft-lbs

PROPER PLACEMENT OF TORQUE INDICATORS

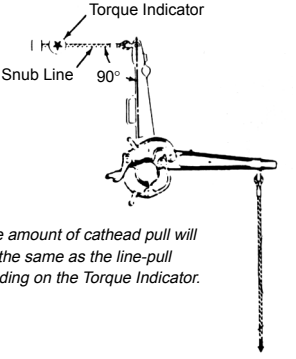


The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

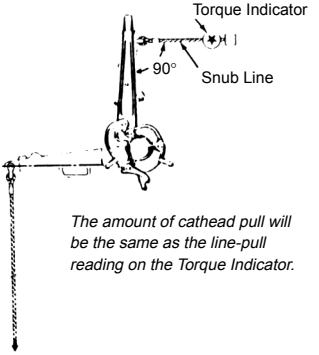


The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

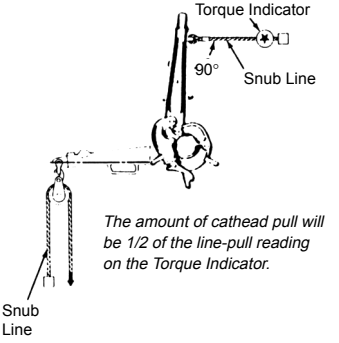


The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.



The amount of cathead pull will be 1/2 of the line-pull reading on the Torque Indicator.

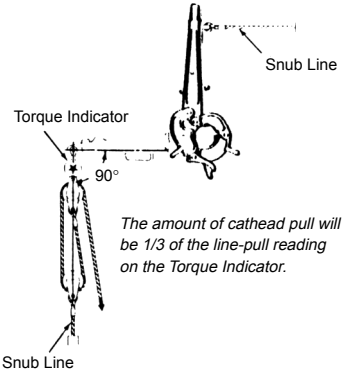
Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

NOTE: The rotary must be unlocked when the Torque Indicator is in the snub line.

PROPER PLACEMENT OF TORQUE INDICATORS

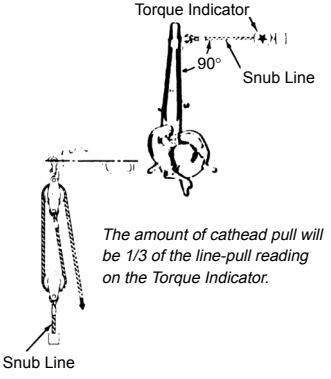


The amount of cathead pull will be 1/3 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

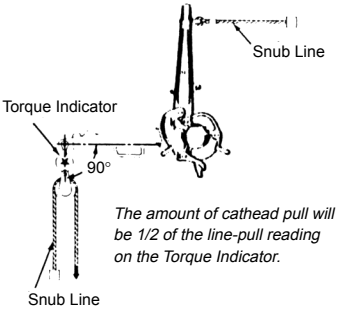


The amount of cathead pull will be 1/3 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

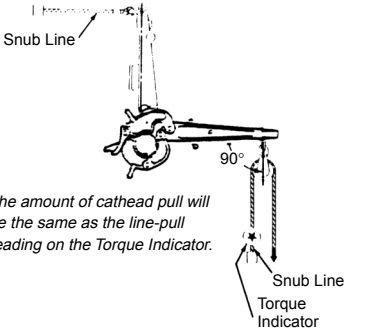


The amount of cathead pull will be 1/2 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.



The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

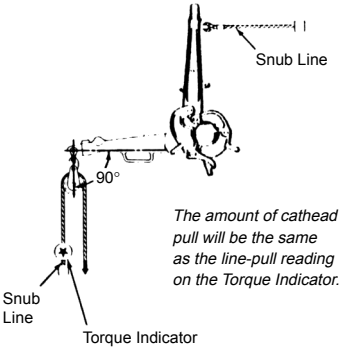
Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 2. This will be the line-pull reading for the line-pull indicator when in this position.

NOTE: The rotary must be unlocked when the Torque Indicator is in the snub line.

PROPER PLACEMENT OF TORQUE INDICATORS

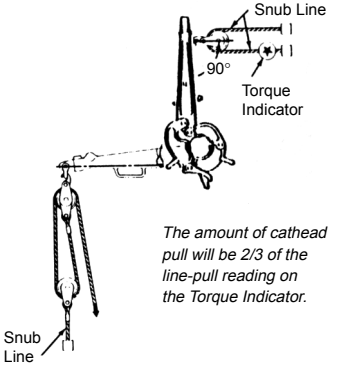


The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 2. This will be the pounds pull reading for the line-pull indicator when in this position.

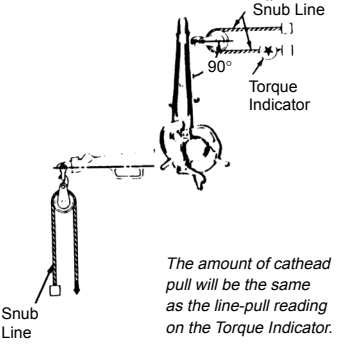


The amount of cathead pull will be 2/3 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 2. This will be the pounds pull reading for the line-pull indicator when in this position.

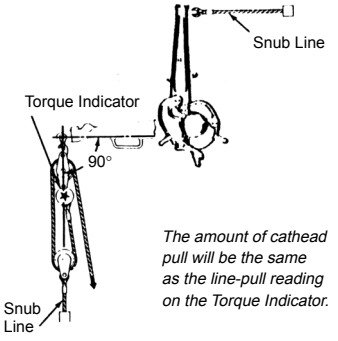


The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 2. This will be the pounds pull reading for the line-pull indicator when in this position.



The amount of cathead pull will be the same as the line-pull reading on the Torque Indicator.

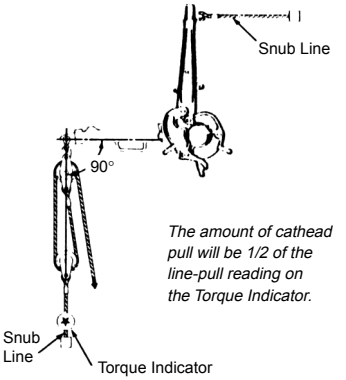
Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 3. This will be the pounds pull reading for the line-pull indicator when in this position.

NOTE: The rotary must be unlocked when the Torque Indicator is in the snub line.

PROPER PLACEMENT OF TORQUE INDICATORS

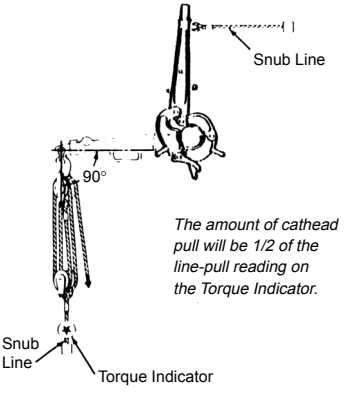


The amount of cathead pull will be 1/2 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 3 and multiply by 2. This will be the pounds pull reading for the line-pull indicator when in this position.

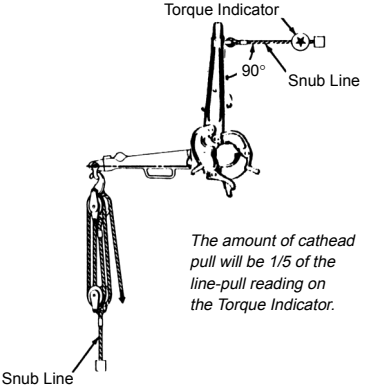


The amount of cathead pull will be 1/2 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

Step 3: Divide this by 5 and multiply by 4. This will be the pounds pull reading for the line-pull indicator when in this position.



The amount of cathead pull will be 1/5 of the line-pull reading on the Torque Indicator.

Step 1: Look up the minimum recommended torque required.

Step 2: Divide this torque value by the effective tong length.

The answer is pounds pull reading for the line-pull indicator when in this position.

Multiple line hookups can provide many times the normal make-up line-pull. Great care should be taken to see that the lines do not become crossed, twisted, or fouled. When it comes time for the “big pull,” be sure everyone is in the clear.

Caution: Know the tong’s rating before the pull is attempted.

The slack in the tong snub line should be sufficient for the tongs to obtain full benefit of the pull from the cathead, but short enough to prevent complete rotation of the tongs.

NOTE: The rotary must be unlocked when the Torque Indicator is in the snub line.

WORN ELEVATORS, TOOL JOINTS, LINK ARMS AND LINK EARS

How to Measure Wear on Elevators and Tool Joints
It is obvious that visual inspection cannot suffice for most elevator checks. To measure link arms it is necessary to use calipers and to read the result on a rule. Since significant wear is restricted to the top link arm, it is here that the measurement is taken.

Hinge pins, latch pins, and socket holes are not normally measured for wear in the field. When it becomes apparent that the hinge or latch pins are loosening, the elevator should be sent to the factory for a general engineering check-up.

For square-shoulder elevators, a rule marked in sixteenths of an inch is adequate. The straight edge of the rule is used to check the squareness of the top bore, and the end is inserted into the worn pockets and ridges. Wear of 1/16 in. or more should require refacing of collar surface. The squareness of tool joints (where collar meets the pipe) may be checked using the right angle formed by the rule end. Joints out of square by 1/16 in. or more should be reconditioned or replaced according to recommendations of manufacturer.

Determining wear of the 18° taper elevator and tool joint is more difficult. As shown in Figure 1, an arm containing a true 18° surface is extended into and matched against the elevator bore. At the top of the bore, the actual angle is read off a protractor attached to a straight edge. The same principle is used for tool joints. In Figure 2, the straight-edge is placed on top of the tool joint and the true 18° surface is placed along the tool joint taper.

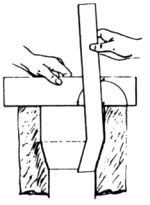


Figure 1

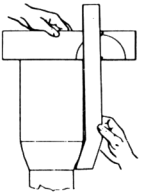


Figure 2

Figure 1. To measure elevator taper, a true 18° surface is inserted on an arm into the elevator bore and matched against the taper. Result is read on a protractor attached to a straight-edge.

Figure 2. To measure tool-joint taper, a true 18° surface is matched against the taper and the result read on a protractor mounted on a straight-edge at the top of the tool joint. Hardbanding should also be checked for violation of this taper.

Since these tapers do not wear evenly, it is necessary to use the smallest angle of contact found.

Inspection Gauge for Elevators and Tool Joints
Recognizing the importance of an accurate measurement and appreciating the difficulty in constructing an instrument as described, Cooper Industries, Inc. has engineered and manufactured a permanent aluminum gauge.

This instrument permits many measurements and calculations without reference to supplementary data.

Evaluation of Wear
Once the degree of wear has been ascertained, the evaluation is conducted as follows:

The effect of wear on 18° taper elevators and tool joints may be determined by using Figure 3. Entering chart at actual angle of taper, read across to diagonal reference line and down to base of chart. The result is the percentage to which an elevator capacity is reduced by such worn tapers. Example: Inspected tool joint was found to have a taper of 13°. As it was to be used with a perfectly sound 250-ton elevator, the elevator capacity was reduced to 78%, or 195 tons.

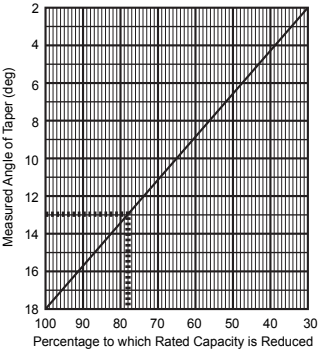


Figure 3

Figure 3. Percentage to which elevator capacity is reduced by wear of elevator and tool-joint tapers is shown in this chart. To use the chart, locate actual angle of taper at left, read across to diagonal reference line and down to percentage at base of chart.

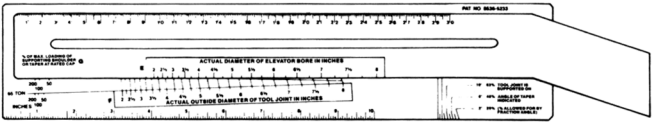
Periodic Inspection (See API RP8B)
This examination, as outlined below, whether conducted in the field or shop, should be made using calibrated instruments to determine any deviations from the manufacturer's technical data for original parts.

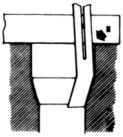
Square Shoulder Collar-Type Drill Pipe, Casing, and Standard Tubing Elevators: Inspect the collars for squareness, and uniformity and depth of wear. Uneven wear, or worn recesses of 1/16 in. or more, requires refacing of collar surface. Hinge pins and springs should be carefully inspected visually for excess wear and obvious weakness.

18° Taper-Type Elevators: Inspection is the same as for square shoulder, except that the conical bore should be observed and measured (in many instances this check should be more frequent.) All tool joints used with these elevators should be measured. Amount of wear should be checked with chart, Figure 3. In addition to the angle of taper, hardbanding should be checked to see if it extends beyond the taper. Any straight-edge may be used for this purpose.

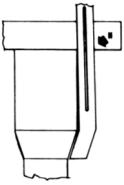
ELEVATOR AND TOOL JOINT INSPECTION GAUGE

Determining if an elevator is safe or unsafe, satisfactory for use or ready for repair, should not be entrusted to the eye! Such determinations require accurate measurements of the critical elevator parts.





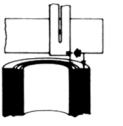
TO MEASURE ANGLE OF 18° TAPER ELEVATORS: Place body of gauge on top of elevator bore, and drop sliding arm into the bore. Bring tapered edge of slide (marked "Elevator Taper") against tapered surface of the bore. Read true taper angle of elevator bore at "H." Percentage of remaining rated capacity is given opposite the reading. Tapers of 13° and less require factory reconditioning, or retirement from service. *NOTE: Bores do not wear evenly. Use the smallest angle found.*



TO MEASURE ANGLE OF 18° TAPER TOOL JOINTS: Place body of gauge on top shoulder of tool joint "box." Sliding arm is adjusted so that the tapered edge (marked "Tool Joint Taper") is in contact with the tapered surface of the tool joint. The true angle is read at "H." Percentage of remaining rated capacity of the elevator is given opposite the reading. Again, use the smallest angle found. Tool joints of less than 13° should be repaired or replaced.

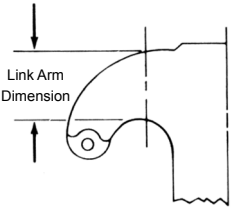
WARNING: Even though the elevator may be in perfect condition, a worn tool joint taper reduces its rated capacity!

While inspecting the tool joint, lay any straight edge of the gauge along the 18° taper to check that the angle of taper has not been violated by hardbanding. Should hardbanding extend onto the taper, such banding should be removed; and the elevator that was used with such a tool joint should be inspected for damaging wear.



TO MEASURE WORN COLLAR SURFACES OF SQUARE SHOULDER ELEVATORS: Place body of gauge on top surface of elevator. Using non-tapered end of sliding arm, drop arm end into the worn area. Depth of wear is read on the "1/4-inch" scale where body and sliding arm cross. Shoulders worn more than 1/16 inch should be refaced by machining. Any rolling of the edge into the bore should be removed so that it will not interfere with the closing of the elevator.

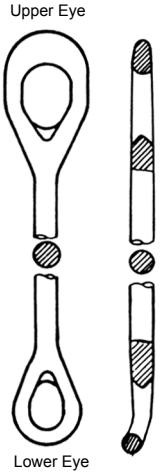
TO CHECK SQUARE SHOULDER TOOL JOINTS: Use end of gauge body marked "90°." Corner has been removed to permit this measurement. Joints out-of-square by more than 1/16 inch should be remachined to 90°.

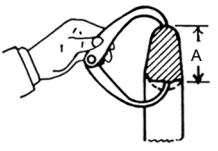


LINK ARM WEAR CHART FOR CHAMPION™ ELEVATORS

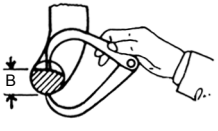
Collar Type			18° Taper Type		
Elevator Size	Link Arm Cap. (ton)	Link Arm Dim. (in)	Elevator Size	Link Arm Cap. (ton)	Link Arm Dim. (in)
C-100	100	3	T-100	100	4
	90	2-3/4		91	3-3/4
	79	2-1/2		82	3-1/2
	69	2-1/4		72	3-1/4
C-150	150	4	T-150	150	4-3/4
	136	3-3/4		138	4-1/2
	122	3-1/2		126	4-1/4
	108	3-1/4		114	4
C-250	250	4-3/4	T-250	250	5
	230	4-1/2		232	4-3/4
	210	4-1/4		214	4-1/2
	190	4		198	4-1/4
C-350	350	5	T-400	400	5-1/4
	322	4-3/4		368	5
	300	4-1/2		338	4-3/4
	276	4-1/4		311	4-1/2
	250	4		286	4-1/4

FORGED LINKS WEAR CHART





Thickness of wear point in Lower Eye Dimension (Dim.) "A"



Thickness of wear point in Upper Eye Dimension (Dim. B)

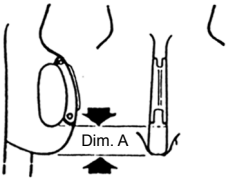
Upper Eye Dim. A	Lower Eye Dim. B	Capacity (per set) Tons
1-3/4 in – 150 Tons		
3-1/2	1-3/4	150
3-3/8	1-5/8	125
3-1/4	1-9/16	110
3-1/8	1-1/2	100
2-1/4 in – 250 Tons		
5	2-1/4	250
4-3/4	2-1/8	210
4-5/8	2-1/2	188
4-1/2	2	175
2-3/4 in – 350 Tons		
5	2-3/4	350
4-3/4	2-5/8	290
4-5/8	2-1/2	262
4-1/2	2-7/16	245
31/2 in – 500 Tons		
6	3-1/2	500
5-5/8	3-1/4	440
5-1/4	3	375
5-3/16	2-7/8	345

To determine the strength of worn links, measure the amount of eye wear with calipers as shown, and compare the figure with the table for the new capacity. Capacity of set is that of weakest eye.

HYDRA-HOOK™ LINK EARS WEAR CHART

Measure the depth of the link ear at the point of the greatest wear (Dim. A). The new capacity of the hook and/or link ears is shown in corresponding chart of hook size.

WEAR LIMITS: It is recommended that any hook showing wear of 1/2" be promptly repaired. Wear should never exceed 3/4". When properly built up to recommended dimensions, the wear pad will prevent further loss in capacity until original wear point is reached. The load capacity will always be that of greatest wear.



Decrease in strength of the hook by wear of link ears is shown for Web Wilson Hooks.

Dim. A (in)	Remaining Capacity (tons)
40-Ton Hook	
3-3/8	40
3-1/8	35
2-7/8	31
2-5/8	25
65-Ton Hook	
3-7/8	65
3-5/8	58
3-3/8	51
3-1/8	40
100-Ton Hook	
4-3/8	100
4-1/8	91
3-7/8	79
3-5/8	64
150-Ton Hook	
4-7/8	150
4-5/8	138
4-3/8	123
4-1/8	112

Dim. A (in)	Remaining Capacity (tons)
250-Ton Hook	
7-3/8	250
7-1/8	230
6-7/8	203
6-5/8	187
350-Ton Hook	
7-3/8	350
7-1/8	318
6-7/8	286
6-5/8	254
500-Ton Hook	
7-7/8	500
7-5/8	450
7-3/8	400
7-1/8	350

Baash-Ross, Web Wilson, Hillman-Kelley, KelCo, Larkin, Hydra-Hook, Champion, Fulgrip, Foster, Thornhill Craver, Tri-Kelly, Pow-R-Seal, Saf-T-Seal, DynaSeal, DynaCentric, Pow-R-Gard, Saf-T-Gard, UNIBOLT, and Ouadbolt are registered trademarks or tradenames of Cooper Industries, Inc., Houston, Texas.

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