INTERNATIONAL STANDARD

ISO 10405

First edition
1993-08-01

Petroleum and natural gas industries – Care and use of casing and tubing

Industries du pétrole et du gaz naturel – Entretien et utilisation des tubes de cuvelage et de production

Reference number
ISO 10405:1993(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10405 was prepared by the American Petroleum Institute (API) (as RP 5C1) and was adopted, under a special "fast-track procedure", by Technical Com-mittee ISO/TC 67, *Materials and equipment for petroleum and natural gas industries*, in parallel with its approval by the ISO member bodies.

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Introduction

International Standard ISO 10405:1993 reproduces the content of API RP 5C1, 16th edition, 1988. ISO, in endorsing this API document, recognizes that in certain respects the latter does not comply with all current ISO rules on the presentation and content of an International Standard. Therefore, the relevant technical body, within ISO/TC 67, will review ISO 10405:1993 and reissue it, when practicable, in a form complying with these rules.

This International Standard is not intended to obviate the need for sound engineering judgement as to when and where this International Standard should be utilized and users should be aware that additional or differing requirements may be needed to meet the needs for the particular service intended.

Standards referenced herein may be replaced by other international or national standards that can be shown to meet or exceed the requirements of the referenced standards.

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Petroleum and natural gas industries – Care and use of casing and tubing

1 Scope

This International Standard contains guiding principles for care and use of casing and tubing for the petroleum and natural gas industries.

2 Requirements

Requirements are specified in:

"API Recommended Practice 5C1 (RP 5C1), Sixteenth Edition, May 31, 1988, *Recommended Practice for Care and Use of Casing and Tubing*",

which is adopted as ISO 10405.

For the purposes of international standardization, however, modifications shall apply to specific clauses and paragraphs of API RP 5C1. These modifications are outlined below.

NOTE – A wavy line in the margin indicates the location of a modification to the text of the API publication.

Page 3

Information given in the POLICY statement is relevant to the API publication only.

Page 6

Subclause 1.1, item b

Second line: delete "API" before "tubular goods".

Subclause 1.7, item c

Second sentence shall read: "A steel tape calibrated in millimetres should be used."

Page 7

Subclause 1.13

17th line from bottom shall read: "All values are rounded to the nearest 10 N·m."

6th line from bottom: Delete the asterisk after the parenthesis and the corresponding footnote.

Subclause 1.14

Subheading above item a shall read: "**Round thread, 114 mm through 340 mm OD**"

Subheading above item g shall read: "**Buttress thread, 114 mm through 340 mm OD**"

Item g, 2nd line shall read: "... sizes 114,3 mm through 339,7 mm OD..."

Page 8

Subheading on 1st line shall read: "**Round thread and buttress thread, 406 mm, 473 mm and 508 mm OD**"

Item h, 1st line shall read:

"Make-up of 406,4 mm, 473 mm and 508 mm OD shall be to a..."

Item h, second paragraph, first sentence shall read:

"On 8-round thread casing a 9,5 mm equilateral triangle is die stamped at a distance of L_1 + 1,6 mm from each end."

Item h, third paragraph, 4th line shall read: "(67 800 N·m)"

Subclause 1.15

Second sentence shall read:

"The joint should be made up beyond the hand-tight position at least three turns for sizes 114,3 mm through 177,8 mm and at least three and a half turns for sizes 193,7 mm and larger, except 244,5 mm and 273,1 mm grade P-110 and 508 mm grade J-55 and K-55 which should be made up for turns beyond hand-tight position."

Page 9

Subclause 1.28

Delete the first sentence starting "When thorough..." and ending "... Dallas, Texas."

Pages 11 to 18, inclusive

Replace part of the existing tables by new table 1.1 and table 1.2.

Page 19

Subclause 2.1, item b

2nd line: Delete "API" before "tubular goods".

Subclause 2.3

2nd line: Delete "API" before "drift mandrel".

Subclause 2.9, item c

Second sentence shall read: "A steel tape calibrated in millimetres should be used."

Page 20

Subclause 2.15

Last line shall read: "... coupling is made up with a torque of 68 N·m."

Subclause 2.16

13th line from bottom shall read: "All values are rounded to the nearest 10 N·m."

6th and 3rd lines from bottom: Delete the asterisk after the parenthesis (twice), and the corresponding footnote.

Subclause 2.24

Second sentence shall read:

"Tubing 60 mm OD and larger, preferably should be pulled in stands approximately 18 300 mm long or in doubles of range 2. Stands of tubing 48,3 mm OD or smaller and stands longer than 18 300 mm, should have intermediate support."

Page 21

Subclause 2.33

Delete the third sentence starting "When thorough..." and ending "... Dallas, Texas."

Pages 22 to 24, inclusive

Replace the existing table by new table 2.1.

Page 25

Subclause 3.1

1st line: Delete "API" before "tubular goods".

Subclause 3.3

2nd line: Delete the words "..., in addition to I.C.C. requirement, ..."

Subclause 3.6, item a

3rd line shall read: "less than 500 mm from the ground."

Subclause 3.6, item g

3rd line shall read: "higher than 3 000 mm."

Page 26

Subclause 4.4

2nd line below table 4.1: Delete "API" before "specified pipe wall thickness".

Page 27

Subclause 6.3

1st line: Substitute "should" for "shall".

Subclause 6.5

3rd and 7th lines: Substitute "should" for "shall".

Page 28

Subclause 6.10

3rd line: Replace "1 200 F" by "650 °C".

Subclause 6.11

Replace the present wording with the following:

"When using the metal arc process, low hydrogen electrodes should be used. These include all electrodes with the AWS classifications Exx15, Exx16, and Exx18 in AWS Specification A5.1, "*Covered Carbon Steel Arc Welding Electrodes*" (latest edition*). Low-hydrogen electrodes should not be exposed to the atmosphere until ready for use. Electrodes must be stored in holding ovens at 65 °C to 150 °C immediately after their containers have been opened. Once removed from the holding oven, electrodes must be used within 30 min. Electrodes not used within this time limit must be discarded or re-conditioned by baking at 315 °C to 370 °C for 1 h. After re-conditioning, electrodes must be placed into the holding oven."

Subclause 6.13

2nd line: Replace "3 in" by "75 mm".

3rd line: Replace "400 to 600 F" by "205 °C to 315 °C".

Subclause 6.14

3rd line from bottom: Replace "205 F" by "121 °C".

Subclause 6.16

2nd line shall read: "4,8 mm diameter or smaller should be used."

Subclause 6.22

Second sentence shall read:

"If the top side of the float collar and casing collars are welded while the casing is in the rotary or if the practice is not to make a complete weld, three 75 mm welds should be placed at 120° intervals around 244,5 mm casing, three 100 mm welds should be placed on larger casing, and three 50 mm welds on smaller casings."

Subclause 6.23

1st line shall read: "If welds longer than 100 mm to 150 mm are made,"

2nd line shall read: "For example: If 150 mm..."

5th line shall read: "...150 mm to the left of the weld..."

Subclause 6.26

2nd line shall read: "... welds should be a minimum length of 50 mm at 50 mm intervals."

Subclause 6.27

End of 2nd line shall read: "..., with 19 mm welds at two equal spacings on the front edge and on 19 mm weld ..."

New tables

1.1 Recommended casing make-up torque 8-round-thread casing

1.2 Torque values for extremeline casing

2.1 Recommended tubing make-up torque round thread tubing

NOTE – In tables 1.1 and 2.1, the values expressed in pounds per foot (column 2) must be multiplied by 1,488 to determine the linear density ρ_l.

TABLE 1.1

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
4.500	(114,3)	9.50	H-40	ST&C	770	(1040)	570	(780)	960	(1300)
4.500	(114,3)	9.50	J-55	ST&C	1010	(1380)	760	(1030)	1270	(1720)
4.500	(114,3)	10.50	J-55	ST&C	1320	(1790)	990	(1350)	1650	(2240)
4.500	(114,3)	11.60	J-55	ST&C	1540	(2090)	1150	(1560)	1920	(2610)
4.500	(114,3)	9.50	K-55	ST&C	1120	(1520)	840	(1140)	1400	(1900)
4.500	(114,3)	10.50	K-55	ST&C	1460	(1980)	1100	(1490)	1830	(2480)
4.500	(114,3)	11.60	K-55	ST&C	1700	(2310)	1280	(1730)	2130	(2890)
4.500	(114,3)	11.60	J-55	LT&C	1620	(2200)	1210	(1650)	2020	(2750)
4.500	(114,3)	11.60	K-55	LT&C	1800	(2430)	1350	(1830)	2240	(3040)
4.500	(114,3)	11.60	C-75	LT&C	2150	(2910)	1610	(2180)	2680	(3640)
4.500	(114,3)	13.50	C-75	LT&C	2600	(3530)	1950	(2640)	3250	(4410)
4.500	(114,3)	11.60	L-80	LT&C	2230	(3030)	1670	(2270)	2790	(3780)
4.500	(114,3)	13.50	L-80	LT&C	2710	(3670)	2030	(2750)	3380	(4590)
4.500	(114,3)	11.60	N-80	LT&C	2280	(3090)	1710	(2310)	2850	(3860)
4.500	(114,3)	13.50	N-80	LT&C	2760	(3740)	2070	(2810)	3450	(4680)
4.500	(114,3)	11.60	C-90	LT&C	2450	(3320)	1840	(2490)	3060	(4150)
4.500	(114,3)	13.50	C-90	LT&C	2970	(4030)	2230	(3020)	3710	(5040)
4.500	(114,3)	11.60	C-95	LT&C	2580	(3500)	1940	(2630)	3230	(4380)
4.500	(114,3)	13.50	C-95	LT&C	3130	(4240)	2350	(3180)	3910	(5310)
4.500	(114,3)	11.60	P-110	LT&C	3020	(4100)	2270	(3070)	3780	(5120)
4.500	(114,3)	13.50	P-110	LT&C	3660	(4960)	2750	(3720)	4580	(6200)
4.500	(114,3)	15.10	P-110	LT&C	4400	(5960)	3300	(4470)	5500	(7450)
4.500	(114,3)	15.10	Q-125	LT&C	4910	(6650)	3680	(4990)	6130	(8320)
5.000	(127,0)	11.50	J-55	ST&C	1330	(1810)	1000	(1350)	1660	(2260)
5.000	(127,0)	13.00	J-55	ST&C	1690	(2290)	1260	(1710)	2110	(2860)
5.000	(127,0)	15.00	J-55	ST&C	2070	(2800)	1550	(2100)	2580	(3500)
5.000	(127,0)	11.50	K-55	ST&C	1470	(1990)	1100	(1490)	1830	(2490)
5.000	(127,0)	13.00	K-55	ST&C	1860	(2520)	1390	(1890)	2320	(3150)
5.000	(127,0)	15.00	K-55	ST&C	2280	(3090)	1710	(2320)	2850	(3860)
5.000	(127,0)	13.00	J-55	LT&C	1820	(2470)	1360	(1850)	2270	(3080)
5.000	(127,0)	15.00	J-55	LT&C	2230	(3020)	1670	(2270)	2790	(3780)
5.000	(127,0)	13.00	K-55	LT&C	2010	(2730)	1510	(2040)	2510	(3410)
5.000	(127,0)	15.00	K-55	LT&C	2460	(3340)	1850	(2500)	3080	(4170)
5.000	(127,0)	15.00	C-75	LT&C	2960	(4010)	2220	(3010)	3690	(5010)
5.000	(127,0)	18.00	C-75	LT&C	3770	(5110)	2830	(3830)	4710	(6390)
5.000	(127,0)	21.40	C-75	LT&C	4660	(6320)	3500	(4740)	5830	(7900)
5.000	(127,0)	24.10	C-75	LT&C	5390	(7310)	4040	(5480)	6740	(9140)
5.000	(127,0)	15.00	L-80	LT&C	3080	(4170)	2310	(3130)	3850	(5220)
5.000	(127,0)	18.00	L-80	LT&C	3930	(5320)	2940	(3990)	4910	(6650)
5.000	(127,0)	21.40	L-80	LT&C	4860	(6590)	3640	(4940)	6070	(8230)
5.000	(127,0)	24.10	L-80	LT&C	5610	(7610)	4210	(5710)	7020	(9520)
5.000	(127,0)	15.00	N-80	LT&C	3140	(4250)	2350	(3190)	3920	(5320)
5.000	(127,0)	18.00	N-80	LT&C	4000	(5420)	3000	(4070)	5000	(6780)
5.000	(127,0)	21.40	N-80	LT&C	4950	(6710)	3710	(5030)	6190	(8390)
5.000	(127,0)	24.10	N-80	LT&C	5720	(7760)	4290	(5820)	7150	(9700)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
5.000	(127,0)	15.00	C-90	LT&C	3380	(4590)	2540	(3440)	4230	(5730)
5.000	(127,0)	18.00	C-90	LT&C	4310	(5850)	3240	(4390)	5390	(7310)
5.000	(127,0)	21.40	C-90	LT&C	5340	(7240)	4000	(5430)	6670	(9050)
5.000	(127,0)	23.20	C-90	LT&C	5880	(7980)	4410	(5980)	7350	(9970)
5.000	(127,0)	24.10	C-90	LT&C	6170	(8370)	4630	(6270)	7710	(10460)
5.000	(127,0)	15.00	C-95	LT&C	3560	(4830)	2670	(3630)	4460	(6040)
5.000	(127,0)	18.00	C-95	LT&C	4550	(6160)	3410	(4620)	5680	(7700)
5.000	(127,0)	21.40	C-95	LT&C	5620	(7630)	4220	(5720)	7030	(9530)
5.000	(127,0)	24.10	C-95	LT&C	6500	(8810)	4880	(6610)	8130	(11020)
5.500	(139,7)	14.00	H-40	ST&C	1300	(1760)	970	(1320)	1620	(2200)
5.500	(139,7)	14.00	J-55	ST&C	1720	(2330)	1290	(1750)	2150	(2920)
5.500	(139,7)	15.50	J-55	ST&C	2020	(2730)	1510	(2050)	2520	(3420)
5.500	(139,7)	17.00	J-55	ST&C	2290	(3110)	1720	(2330)	2860	(3880)
5.500	(139,7)	14.00	K-55	ST&C	1890	(2560)	1420	(1920)	2360	(3200)
5.500	(139,7)	15.50	K-55	ST&C	2220	(3000)	1660	(2250)	2770	(3750)
5.500	(139,7)	17.00	K-55	ST&C	2520	(3410)	1890	(2560)	3150	(4260)
5.500	(139,7)	15.50	J-55	LT&C	2170	(2940)	1630	(2210)	2710	(3680)
5.500	(139,7)	17.00	J-55	LT&C	2470	(3340)	1850	(2510)	3080	(4180)
5.500	(139,7)	15.50	K-55	LT&C	2390	(3240)	1790	(2430)	2990	(4050)
5.500	(139,7)	17.00	K-55	LT&C	2720	(3680)	2040	(2760)	3390	(4600)
5.500	(139,7)	17.00	C-75	LT&C	3270	(4440)	2460	(3330)	4090	(5550)
5.500	(139,7)	20.00	C-75	LT&C	4030	(5460)	3020	(4100)	5040	(6830)
5.500	(139,7)	23.00	C-75	LT&C	4730	(6410)	3550	(4810)	5910	(8020)
5.500	(139,7)	17.00	L-80	LT&C	3410	(4630)	2560	(3470)	4270	(5790)
5.500	(139,7)	20.00	L-80	LT&C	4200	(5700)	3150	(4270)	5250	(7120)
5.500	(139,7)	23.00	L-80	LT&C	4930	(6690)	3700	(5020)	6170	(8360)
5.500	(139,7)	17.00	N-80	LT&C	3480	(4710)	2610	(3530)	4340	(5890)
5.500	(139,7)	20.00	N-80	LT&C	4280	(5800)	3210	(4350)	5350	(7250)
5.500	(139,7)	23.00	N-80	LT&C	5020	(6810)	3770	(5110)	6280	(8510)
5.500	(139,7)	17.00	C-90	LT&C	3750	(5090)	2820	(3820)	4690	(6360)
5.500	(139,7)	20.00	C-90	LT&C	4620	(6270)	3470	(4700)	5780	(7830)
5.500	(139,7)	23.00	C-90	LT&C	5430	(7360)	4070	(5520)	6780	(9190)
5.500	(139,7)	17.00	C-95	LT&C	3960	(5360)	2970	(4020)	4950	(6710)
5.500	(139,7)	20.00	C-95	LT&C	4870	(6600)	3650	(4950)	6090	(8250)
5.500	(139,7)	23.00	C-95	LT&C	5720	(7750)	4290	(5810)	7150	(9690)
5.500	(139,7)	17.00	P-110	LT&C	4620	(6270)	3470	(4700)	5780	(7840)
5.500	(139,7)	20.00	P-110	LT&C	5690	(7720)	4270	(5790)	7110	(9650)
5.500	(139,7)	23.00	P-110	LT&C	6680	(9060)	5010	(6790)	8350	(11320)
5.500	(139,7)	23.00	Q-125	LT&C	7470	(10120)	5600	(7590)	9330	(12650)
6.625	(168,3)	20.00	H-40	ST&C	1840	(2490)	1380	(1870)	2300	(3120)
6.625	(168,3)	20.00	J-55	ST&C	2450	(3320)	1830	(2490)	3060	(4150)
6.625	(168,3)	24.00	J-55	ST&C	3140	(4250)	2350	(3190)	3920	(5320)
6.625	(168,3)	20.00	K-55	ST&C	2670	(3620)	2000	(2710)	3340	(4520)
6.625	(168,3)	24.00	K-55	ST&C	3420	(4640)	2570	(3480)	4280	(5800)
6.625	(168,3)	20.00	J-55	LT&C	2660	(3600)	1990	(2700)	3320	(4500)
6.625	(168,3)	24.00	J-55	LT&C	3400	(4620)	2550	(3460)	4250	(5770)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
6.625	(168,3)	20.00	K-55	LT&C	2900	(3940)	2180	(2950)	3630	(4920)
6.625	(168,3)	24.00	K-55	LT&C	3720	(5050)	2790	(3780)	4650	(6310)
6.625	(168,3)	24.00	C-75	LT&C	4530	(6140)	3390	(4600)	5660	(7670)
6.625	(168,3)	28.00	C-75	LT&C	5520	(7480)	4140	(5610)	6890	(9350)
6.625	(168,3)	32.00	C-75	LT&C	6380	(8650)	4780	(6490)	7970	(10810)
6.625	(168,3)	24.00	L-80	LT&C	4730	(6410)	3550	(4810)	5910	(8010)
6.625	(168,3)	28.00	L-80	LT&C	5760	(7810)	4320	(5860)	7200	(9760)
6.625	(168,3)	32.00	L-80	LT&C	6660	(9030)	5000	(6780)	8330	(11290)
6.625	(168,3)	24.00	N-80	LT&C	4810	(6520)	3600	(4890)	6010	(8150)
6.625	(168,3)	28.00	N-80	LT&C	5860	(7940)	4390	(5960)	7320	(9930)
6.625	(168,3)	32.00	N-80	LT&C	6780	(9190)	5080	(6890)	8470	(11480)
6.625	(168,3)	24.00	C-90	LT&C	5210	(7060)	3910	(5300)	6510	(8830)
6.625	(168,3)	28.00	C-90	LT&C	6350	(8610)	4760	(6450)	7930	(10760)
6.625	(168,3)	32.00	C-90	LT&C	7340	(9950)	5510	(7470)	9180	(12440)
6.625	(168,3)	24.00	C-95	LT&C	5490	(7440)	4120	(5580)	6860	(9300)
6.625	(168,3)	28.00	C-95	LT&C	6690	(9070)	5020	(6800)	8360	(11340)
6.625	(168,3)	32.00	C-95	LT&C	7740	(10490)	5800	(7870)	9670	(13110)
6.625	(168,3)	24.00	P-110	LT&C	6410	(8690)	4810	(6520)	8010	(10860)
6.625	(168,3)	28.00	P-110	LT&C	7810	(10590)	5860	(7940)	9760	(13240)
6.625	(168,3)	32.00	P-110	LT&C	9040	(12250)	6780	(9190)	11290	(15310)
6.625	(168,3)	32.00	Q-125	LT&C	10110	(13710)	7580	(10280)	12640	(17130)
7.000	(177,8)	17.00	H-40	ST&C	1220	(1650)	910	(1240)	1520	(2070)
7.000	(177,8)	20.00	H-40	ST&C	1760	(2380)	1320	(1790)	2200	(2980)
7.000	(177,8)	20.00	J-55	ST&C	2340	(3170)	1750	(2380)	2920	(3960)
7.000	(177,8)	23.00	J-55	ST&C	2840	(3850)	2130	(2890)	3550	(4820)
7.000	(177,8)	26.00	J-55	ST&C	3340	(4530)	2500	(3400)	4170	(5660)
7.000	(177,8)	20.00	K-55	ST&C	2540	(3450)	1910	(2590)	3180	(4310)
7.000	(177,8)	23.00	K-55	ST&C	3090	(4190)	2320	(3150)	3870	(5240)
7.000	(177,8)	26.00	K-55	ST&C	3640	(4930)	2730	(3700)	4540	(6160)
7.000	(177,8)	23.00	J-55	LT&C	3130	(4240)	2350	(3180)	3910	(5300)
7.000	(177,8)	26.00	J-55	LT&C	3670	(4980)	2760	(3740)	4590	(6230)
7.000	(177,8)	23.00	K-55	LT&C	3410	(4630)	2560	(3470)	4270	(5780)
7.000	(177,8)	26.00	K-55	LT&C	4010	(5440)	3010	(4080)	5010	(6800)
7.000	(177,8)	23.00	C-75	LT&C	4160	(5640)	3120	(4230)	5200	(7050)
7.000	(177,8)	26.00	C-75	LT&C	4890	(6630)	3670	(4970)	6110	(8280)
7.000	(177,8)	29.00	C-75	LT&C	5620	(7620)	4220	(5720)	7030	(9530)
7.000	(177,8)	32.00	C-75	LT&C	6330	(8580)	4750	(6440)	7910	(10730)
7.000	(177,8)	35.00	C-75	LT&C	7030	(9530)	5270	(7140)	8780	(11910)
7.000	(177,8)	38.00	C-75	LT&C	7670	(10400)	5750	(7800)	9580	(12990)
7.000	(177,8)	23.00	L-80	LT&C	4350	(5890)	3260	(4420)	5430	(7370)
7.000	(177,8)	26.00	L-80	LT&C	5110	(6930)	3830	(5190)	6380	(8660)
7.000	(177,8)	29.00	L-80	LT&C	5870	(7960)	4410	(5970)	7340	(9960)
7.000	(177,8)	32.00	L-80	LT&C	6610	(8970)	4960	(6720)	8270	(11210)
7.000	(177,8)	35.00	L-80	LT&C	7340	(9950)	5510	(7470)	9180	(12440)
7.000	(177,8)	38.00	L-80	LT&C	8010	(10860)	6010	(8150)	10010	(13580)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
7.000	(177,8)	23.00	N-80	LT&C	4420	(5990)	3310	(4490)	5520	(7490)
7.000	(177,8)	26.00	N-80	LT&C	5190	(7040)	3890	(5280)	6490	(8800)
7.000	(177,8)	29.00	N-80	LT&C	5970	(8100)	4480	(6070)	7460	(10120)
7.000	(177,8)	32.00	N-80	LT&C	6720	(9110)	5040	(6840)	8400	(11390)
7.000	(177,8)	35.00	N-80	LT&C	7460	(10120)	5600	(7590)	9330	(12650)
7.000	(177,8)	38.00	N-80	LT&C	8140	(11040)	6110	(8280)	10180	(13800)
7.000	(177,8)	23.00	C-90	LT&C	4790	(6500)	3590	(4870)	5990	(8120)
7.000	(177,8)	26.00	C-90	LT&C	5630	(7630)	4220	(5730)	7040	(9540)
7.000	(177,8)	29.00	C-90	LT&C	6480	(8780)	4860	(6590)	8100	(10980)
7.000	(177,8)	32.00	C-90	LT&C	7290	(9880)	5470	(7410)	9110	(12360)
7.000	(177,8)	35.00	C-90	LT&C	8090	(10970)	6070	(8230)	10120	(13720)
7.000	(177,8)	38.00	C-90	LT&C	8830	(11970)	6620	(8980)	11040	(14970)
7.000	(177,8)	23.00	C-95	LT&C	5050	(6850)	3790	(5140)	6310	(8560)
7.000	(177,8)	26.00	C-95	LT&C	5930	(8050)	4450	(6030)	7420	(10060)
7.000	(177,8)	29.00	C-95	LT&C	6830	(9250)	5120	(6940)	8530	(11570)
7.000	(177,8)	32.00	C-95	LT&C	7680	(10420)	5760	(7810)	9600	(13020)
7.000	(177,8)	35.00	C-95	LT&C	8530	(11560)	6400	(8670)	10660	(14460)
7.000	(177,8)	38.00	C-95	LT&C	9310	(12620)	6980	(9470)	11640	(15780)
7.000	(177,8)	26.00	P-110	LT&C	6930	(9390)	5200	(7050)	8660	(11740)
7.000	(177,8)	29.00	P-110	LT&C	7970	(10800)	7980	(8100)	9960	(13510)
7.000	(177,8)	32.00	P-110	LT&C	8970	(12160)	6730	(9120)	11210	(15200)
7.000	(177,8)	35.00	P-110	LT&C	9960	(13500)	7470	(10130)	12450	(16880)
7.000	(177,8)	38.00	P-110	LT&C	10870	(14730)	8150	(11050)	13580	(18420)
7.000	(177,8)	35.00	Q-125	LT&C	11150	(15110)	8360	(11340)	13930	(18890)
7.000	(177,8)	38.00	Q-125	LT&C	12160	(16490)	9120	(12370)	15210	(20620)
7.625	(193,7)	24.00	H-40	ST&C	2120	(2870)	1590	(2150)	2640	(3590)
7.625	(193,7)	26.40	J-55	ST&C	3150	(4270)	2360	(3200)	3940	(5340)
7.625	(193,7)	26.40	K-55	ST&C	3420	(4640)	2570	(3480)	4280	(5800)
7.625	(193,7)	26.40	J-55	LT&C	3460	(4690)	2600	(3520)	4330	(5870)
7.625	(193,7)	26.40	K-55	LT&C	3770	(5110)	2820	(3830)	4710	(6380)
7.625	(193,7)	26.40	C-75	LT&C	4610	(6250)	3460	(4690)	5760	(7810)
7.625	(193,7)	29.70	C-75	LT&C	5420	(7340)	4060	(5510)	6770	(9180)
7.625	(193,7)	33.70	C-75	LT&C	6350	(8610)	4760	(6460)	7940	(10760)
7.625	(193,7)	39.00	C-75	LT&C	7510	(10190)	5640	(7640)	9390	(12730)
7.625	(193,7)	42.80	C-75	LT&C	8520	(11560)	6390	(8670)	10660	(14450)
7.625	(193,7)	47.10	C-75	LT&C	9530	(12920)	7150	(9690)	11910	(16150)
7.625	(193,7)	26.40	L-80	LT&C	4820	(6530)	3610	(4900)	6020	(8170)
7.625	(193,7)	29.70	L-80	LT&C	5670	(7680)	4250	(5760)	7080	(9600)
7.625	(193,7)	33.70	L-80	LT&C	6640	(9000)	4980	(6750)	8300	(11250)
7.625	(193,7)	39.00	L-80	LT&C	7860	(10650)	5890	(7990)	9820	(13320)
7.625	(193,7)	42.80	L-80	LT&C	8910	(12090)	6690	(9060)	11140	(15110)
7.625	(193,7)	47.10	L-80	LT&C	9970	(13520)	7480	(10140)	12460	(16890)
7.625	(193,7)	26.40	N-80	LT&C	4900	(6640)	3670	(4980)	6120	(8300)
7.625	(193,7)	29.70	N-80	LT&C	5750	(7800)	4320	(5850)	7190	(9750)
7.625	(193,7)	33.70	N-80	LT&C	6740	(9140)	5060	(6860)	8430	(11430)
7.625	(193,7)	39.00	N-80	LT&C	7980	(10820)	5990	(8120)	9980	(13530)
7.625	(193,7)	42.80	N-80	LT&C	9060	(12280)	6790	(9210)	11320	(15350)
7.625	(193,7)	47.10	N-80	LT&C	10130	(13730)	7590	(10300)	12660	(17160)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
7.625	(193,7)	26.40	C-90	LT&C	5320	(7210)	3990	(5410)	6650	(9010)
7.625	(193,7)	29.70	C-90	LT&C	6250	(8470)	4690	(6360)	7810	(10590)
7.625	(193,7)	33.70	C-90	LT&C	7330	(9930)	5490	(7450)	9160	(12420)
7.625	(193,7)	39.00	C-90	LT&C	8670	(11750)	6500	(8820)	10840	(14690)
7.625	(193,7)	42.80	C-90	LT&C	9840	(13330)	7380	(10000)	12290	(16670)
7.625	(193,7)	45.30	C-90	LT&C	10450	(14160)	7840	(10620)	13060	(17710)
7.625	(193,7)	47.10	C-90	LT&C	11000	(14910)	8250	(11180)	13750	(18640)
7.625	(193,7)	26.40	C-95	LT&C	5600	(7600)	4200	(5700)	7010	(9500)
7.625	(193,7)	29.70	C-95	LT&C	6590	(8930)	4940	(6700)	8230	(11160)
7.625	(193,7)	33.70	C-95	LT&C	7720	(10470)	5790	(7850)	9650	(13090)
7.625	(193,7)	39.00	C-95	LT&C	9140	(12390)	6850	(9290)	11420	(15480)
7.625	(193,7)	42.80	C-95	LT&C	10370	(14050)	7770	(10540)	12960	(17570)
7.625	(193,7)	47.10	C-95	LT&C	11590	(15720)	8690	(11790)	14490	(19640)
7.625	(193,7)	29.70	P-110	LT&C	7690	(10420)	5770	(7820)	9610	(13030)
7.625	(193,7)	33.70	P-110	LT&C	9010	(12220)	6760	(9160)	11260	(15270)
7.625	(193,7)	39.00	P-110	LT&C	10660	(14460)	8000	(10840)	13330	(18070)
7.625	(193,7)	42.80	P-110	LT&C	12100	(16400)	9070	(12300)	15120	(20510)
7.625	(193,7)	47.10	P-110	LT&C	13530	(18340)	10150	(13760)	16910	(22930)
7.625	(193,7)	39.00	Q-125	LT&C	11940	(16190)	8960	(12150)	14930	(20240)
7.625	(193,7)	42.80	Q-125	LT&C	13550	(18370)	10160	(13780)	16940	(22970)
7.625	(193,7)	45.30	Q-125	LT&C	14390	(19520)	10800	(14640)	17990	(24390)
7.625	(193,7)	47.10	Q-125	LT&C	15150	(20540)	11360	(15410)	18940	(25680)
8.625	(219,1)	28.00	H-40	ST&C	2330	(3150)	1740	(2370)	2910	(3940)
8.625	(219,1)	32.00	H-40	ST&C	2790	(3780)	2090	(2840)	3490	(4730)
8.625	(219,1)	24.00	J-55	ST&C	2440	(3310)	1830	(2480)	3050	(4140)
8.625	(219,1)	32.00	J-55	ST&C	3720	(5050)	2790	(3790)	4660	(6310)
8.625	(219,1)	36.00	J-55	ST&C	4340	(5880)	3250	(4410)	5420	(7350)
8.625	(219,1)	24.00	K-55	ST&C	2630	(3570)	1970	(2680)	3290	(4460)
8.625	(219,1)	32.00	K-55	ST&C	4020	(5460)	3020	(4090)	5030	(6820)
8.625	(219,1)	36.00	K-55	ST&C	4680	(6350)	3510	(4760)	5850	(7940)
8.625	(219,1)	32.00	J-55	LT&C	4170	(5660)	3130	(4240)	5220	(7070)
8.625	(219,1)	36.00	J-55	LT&C	4860	(6590)	3640	(4940)	6070	(8230)
8.625	(219,1)	32.00	K-55	LT&C	4520	(6130)	3390	(4600)	5650	(7660)
8.625	(219,1)	36.00	K-55	LT&C	5260	(7140)	3950	(5350)	6580	(8920)
8.625	(219,1)	36.00	C-75	LT&C	6480	(8780)	4860	(6590)	8100	(10980)
8.625	(219,1)	40.00	C-75	LT&C	7420	(10060)	5560	(7540)	9270	(12570)
8.625	(219,1)	44.00	C-75	LT&C	8340	(11310)	6260	(8490)	10430	(14140)
8.625	(219,1)	49.00	C-75	LT&C	9390	(12730)	7040	(9550)	11730	(15910)
8.625	(219,1)	36.00	L-80	LT&C	6780	(9190)	5090	(6900)	8480	(11490)
8.625	(219,1)	40.00	L-80	LT&C	7760	(10530)	5820	(7900)	9710	(13160)
8.625	(219,1)	44.00	L-80	LT&C	8740	(11840)	6550	(8880)	10920	(14800)
8.625	(219,1)	49.00	L-80	LT&C	9830	(13320)	7370	(9990)	12280	(16650)
8.625	(219,1)	36.00	N-80	LT&C	6880	(9330)	5160	(7000)	8600	(11660)
8.625	(219,1)	40.00	N-80	LT&C	7880	(10680)	5910	(8010)	9850	(13360)
8.625	(219,1)	44.00	N-80	LT&C	8870	(12020)	6650	(9020)	11080	(15030)
8.625	(219,1)	49.00	N-80	LT&C	9970	(13520)	7480	(10140)	12470	(16900)
8.625	(219,1)	36.00	C-90	LT&C	7490	(10150)	5620	(7620)	9360	(12690)
8.625	(219,1)	40.00	C-90	LT&C	8580	(11630)	6430	(8720)	10720	(14530)
8.625	(219,1)	44.00	C-90	LT&C	9650	(13080)	7240	(9810)	12060	(16350)
8.625	(219,1)	49.00	C-90	LT&C	10850	(14710)	8140	(11040)	13570	(18390)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
8.625	(219,1)	36.00	C-95	LT&C	7890	(10700)	5920	(8030)	9870	(13380)
8.625	(219,1)	40.00	C-95	LT&C	9040	(12260)	6780	(9190)	11300	(15320)
8.625	(219,1)	44.00	C-95	LT&C	10170	(13790)	7630	(10340)	12710	(17230)
8.625	(219,1)	49.00	C-95	LT&C	11440	(15510)	8580	(11630)	14300	(19390)
8.625	(219,1)	40.00	P-110	LT&C	10550	(14300)	7910	(10720)	13180	(17870)
8.625	(219,1)	44.00	P-110	LT&C	11860	(16090)	8900	(12060)	14830	(20110)
8.625	(219,1)	49.00	P-110	LT&C	13350	(18100)	10010	(13570)	16680	(22620)
8.625	(219,1)	49.00	Q-125	LT&C	14960	(20280)	11220	(15210)	18700	(25350)
9.625	(244,5)	32.30	H-40	ST&C	2540	(3440)	1900	(2580)	3170	(4300)
9.625	(244,5)	36.00	H-40	ST&C	2940	(3990)	2210	(2990)	3680	(4990)
9.625	(244,5)	36.00	J-55	ST&C	3940	(5340)	2950	(4000)	4920	(6670)
9.625	(244,5)	40.00	J-55	ST&C	4520	(6120)	3390	(4590)	5650	(7660)
9.625	(244,5)	36.00	K-55	ST&C	4230	(5740)	3180	(4310)	5290	(7180)
9.625	(244,5)	40.00	K-55	ST&C	4860	(6590)	3640	(4940)	6070	(8240)
9.625	(244,5)	36.00	J-55	LT&C	4530	(6140)	3400	(4610)	5660	(7680)
9.625	(244,5)	40.00	J-55	LT&C	5200	(7050)	3900	(5290)	6500	(8810)
9.625	(244,5)	36.00	K-55	LT&C	4890	(6630)	3670	(4970)	6110	(8290)
9.625	(244,5)	40.00	K-55	LT&C	5610	(7610)	4210	(5710)	7020	(9510)
9.625	(244,5)	40.00	C-75	LT&C	6940	(9410)	5200	(7060)	8670	(11760)
9.625	(244,5)	43.50	C-75	LT&C	7760	(10530)	5820	(7890)	9700	(13160)
9.625	(244,5)	47.00	C-75	LT&C	8520	(11550)	6390	(8660)	10650	(14440)
9.625	(244,5)	53.50	C-75	LT&C	9990	(13540)	7490	(10160)	12490	(16930)
9.625	(244,5)	40.00	L-80	LT&C	7270	(9860)	5450	(7390)	9090	(12320)
9.625	(244,5)	43.50	L-80	LT&C	8130	(11030)	6100	(8270)	10170	(13790)
9.625	(244,5)	47.00	L-80	LT&C	8930	(12100)	6690	(9080)	11160	(15130)
9.625	(244,5)	53.50	L-80	LT&C	10470	(14190)	7850	(10640)	13080	(17740)
9.625	(244,5)	40.00	N-80	LT&C	7370	(10000)	5530	(7500)	9220	(12500)
9.625	(244,5)	43.50	N-80	LT&C	8250	(11190)	6190	(8390)	10310	(13980)
9.625	(244,5)	47.00	N-80	LT&C	9050	(12270)	6790	(9200)	11320	(15340)
9.625	(244,5)	53.50	N-80	LT&C	10620	(14390)	7960	(10790)	13270	(17990)
9.625	(244,5)	40.00	C-90	LT&C	8040	(10900)	6030	(8170)	10050	(13620)
9.625	(244,5)	43.50	C-90	LT&C	8990	(12190)	6740	(9140)	11240	(15240)
9.625	(244,5)	47.00	C-90	LT&C	9870	(13380)	7400	(10030)	12330	(16720)
9.625	(244,5)	53.50	C-90	LT&C	11570	(15690)	8680	(11770)	14460	(19610)
9.625	(244,5)	40.00	C-95	LT&C	8470	(11490)	6360	(8620)	10590	(14360)
9.625	(244,5)	43.50	C-95	LT&C	9480	(12850)	7110	(9640)	11850	(16060)
9.625	(244,5)	47.00	C-95	LT&C	10400	(14100)	7800	(10580)	13000	(17630)
9.625	(244,5)	53.50	C-95	LT&C	12200	(16540)	9150	(12400)	15250	(20670)
9.625	(244,5)	43.50	P-110	LT&C	11050	(14980)	8290	(11240)	13810	(18730)
9.625	(244,5)	47.00	P-110	LT&C	12130	(16440)	9090	(12330)	15160	(20550)
9.625	(244,5)	53.50	P-110	LT&C	14220	(19280)	10670	(14460)	17780	(24100)
9.625	(244,5)	47.00	Q-125	LT&C	13600	(18440)	10200	(13830)	17000	(23050)
9.625	(244,5)	53.50	Q-125	LT&C	15950	(21620)	11960	(16220)	19940	(27030)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
10.750	(273,1)	32.75	H-40	ST&C	2050	(2790)	1540	(2090)	2570	(3480)
10.750	(273,1)	40.50	H-40	ST&C	3140	(4250)	2350	(3190)	3920	(5320)
10.750	(273,1)	40.50	J-55	ST&C	4200	(5700)	3150	(4270)	5250	(7120)
10.750	(273,1)	45.55	J-55	ST&C	4930	(6680)	3700	(5010)	6160	(8360)
10.750	(273,1)	51.00	J-55	ST&C	5650	(7660)	4240	(5750)	7070	(9580)
10.750	(273,1)	40.50	K-55	ST&C	4500	(6100)	3380	(4580)	5630	(7630)
10.750	(273,1)	45.55	K-55	ST&C	5280	(7160)	3960	(5370)	6600	(8960)
10.750	(273,1)	51.00	K-55	ST&C	6060	(8210)	4540	(6160)	7570	(10270)
10.750	(273,1)	51.00	C-75	ST&C	7560	(10250)	5670	(7690)	9450	(12810)
10.750	(273,1)	55.50	C-75	ST&C	8420	(11420)	6320	(8560)	10530	(14270)
10.750	(273,1)	51.00	L-80	ST&C	7940	(10760)	5950	(8070)	9920	(13450)
10.750	(273,1)	55.50	L-80	ST&C	8840	(11990)	6630	(8990)	11050	(14980)
10.750	(273,1)	51.00	N-80	ST&C	8040	(10900)	6030	(8170)	10050	(13620)
10.750	(273,1)	55.50	N-80	ST&C	8950	(12140)	6710	(9100)	11190	(15170)
10.750	(273,1)	51.00	C-90	ST&C	8790	(11920)	6590	(8940)	10990	(14890)
10.750	(273,1)	55.50	C-90	ST&C	9790	(13270)	7340	(9950)	12240	(16590)
10.750	(273,1)	51.00	C-95	ST&C	9270	(12560)	6950	(9420)	11580	(15700)
10.750	(273,1)	55.50	C-95	ST&C	10320	(13990)	7740	(10490)	12900	(17490)
10.750	(273,1)	51.00	P-110	ST&C	10790	(14630)	8090	(10970)	13490	(18290)
10.750	(273,1)	55.50	P-110	ST&C	12020	(16300)	9020	(12220)	15030	(20370)
10.750	(273,1)	60.70	P-110	ST&C	13370	(18130)	10030	(13600)	16720	(22660)
10.750	(273,1)	65.70	P-110	ST&C	14710	(19950)	11030	(14960)	18390	(24930)
10.750	(273,1)	60.70	Q-125	ST&C	15020	(20360)	11260	(15270)	18770	(25460)
10.750	(273,1)	65.70	Q-125	ST&C	16520	(22400)	12390	(16800)	20650	(28000)
11.750	(298,5)	42.00	H-40	ST&C	3070	(4170)	2310	(3130)	3840	(5210)
11.750	(298,5)	47.00	J-55	ST&C	4770	(6460)	3570	(4850)	5960	(8080)
11.750	(298,5)	54.00	J-55	ST&C	5680	(7700)	4260	(5770)	7100	(9620)
11.750	(298,5)	60.00	J-55	ST&C	6490	(8800)	4870	(6600)	8110	(11000)
11.750	(298,5)	47.00	K-55	ST&C	5090	(6900)	3820	(5180)	6360	(8630)
11.750	(298,5)	54.00	K-55	ST&C	6060	(8220)	4550	(6170)	7580	(10280)
11.750	(298,5)	60.00	K-55	ST&C	6930	(9400)	5200	(7050)	8660	(11750)
11.750	(298,5)	60.00	C-75	ST&C	8690	(11780)	6520	(8830)	10860	(14720)
11.750	(298,5)	60.00	L-80	ST&C	9130	(12370)	6840	(9280)	11410	(15470)
11.750	(298,5)	60.00	N-80	ST&C	9240	(12420)	6930	(9390)	11550	(15650)
11.750	(298,5)	60.00	C-90	ST&C	10110	(13710)	7590	(10290)	12640	(17140)
11.750	(298,5)	60.00	C-95	ST&C	10660	(14460)	8000	(10840)	13330	(18070)
11.750	(298,5)	60.00	P-110	ST&C	12420	(16830)	9310	(12630)	15520	(21040)
11.750	(298,5)	60.00	Q-125	ST&C	13950	(18920)	10470	(14190)	17440	(23650)
13.375	(339,7)	48.00	H-40	ST&C	3220	(4370)	2420	(3280)	4030	(5460)
13.375	(339,7)	54.50	J-55	ST&C	5140	(6970)	3860	(5230)	6430	(8710)
13.375	(339,7)	61.00	J-55	ST&C	5950	(8070)	4460	(6050)	7440	(10090)
13.375	(339,7)	68.00	J-55	ST&C	6750	(9160)	5070	(6870)	8440	(11450)

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
13.375	(339,7)	54.50	K-55	ST&C	5470	(7410)	4100	(5560)	6840	(9270)
13.375	(339,7)	61.00	K-55	ST&C	6330	(8580)	4750	(6440)	7910	(10730)
13.375	(339,7)	68.00	K-55	ST&C	7180	(9740)	5390	(7300)	8980	(12170)
13.375	(339,7)	68.00	C-75	ST&C	9060	(12280)	6790	(9210)	11320	(15350)
13.375	(339,7)	72.00	C-75	ST&C	9780	(13260)	7340	(9950)	12230	(16580)
13.375	(339,7)	68.00	L-80	ST&C	9520	(12910)	7140	(9680)	11900	(16140)
13.375	(339,7)	72.00	L-80	ST&C	10290	(13950)	7720	(10460)	12860	(17440)
13.375	(339,7)	68.00	N-80	ST&C	9630	(13060)	7220	(9790)	12040	(16320)
13.375	(339,7)	72.00	N-80	ST&C	10400	(14110)	7800	(10580)	13010	(17630)
13.375	(339,7)	68.00	C-90	ST&C	10570	(14330)	7930	(10750)	13210	(17910)
13.375	(339,7)	72.00	C-90	ST&C	11420	(15480)	8560	(11610)	14270	(19350)
13.375	(339,7)	68.00	C-95	ST&C	11140	(15110)	8360	(11330)	13930	(18880)
13.375	(339,7)	72.00	C-95	ST&C	12040	(16320)	9030	(12240)	15050	(20400)
13.375	(339,7)	68.00	P-110	ST&C	12970	(17580)	9720	(13190)	16210	(21980)
13.375	(339,7)	72.00	P-110	ST&C	14010	(18990)	10510	(14240)	17510	(23740)
13.375	(339,7)	72.00	Q-125	ST&C	15770	(21370)	11820	(16030)	19710	(26720)
16.000	(406,4)	65.00	H-40	ST&C	4390	(5950)	3290	(4460)	5490	(7440)
16.000	(406,4)	75.00	J-55	ST&C	7100	(9630)	5330	(7220)	8880	(12040)
16.000	(406,4)	84.00	J-55	ST&C	8170	(11080)	6130	(8310)	10220	(13850)
16.000	(406,4)	75.00	K-55	ST&C	7520	(10190)	5640	(7640)	9390	(12740)
16.000	(406,4)	84.00	K-55	ST&C	8650	(11730)	6490	(8800)	10810	(14660)
18.625	(473,0)	87.50	H-40	ST&C	5590	(7580)	4200	(5690)	6990	(9480)
18.625	(473,0)	87.50	J-55	ST&C	7540	(10220)	5660	(7670)	9430	(12780)
18.625	(473,0)	87.50	K-55	ST&C	7940	(10770)	5960	(8080)	9930	(13460)
20.000	(508,0)	94.00	H-40	ST&C	5810	(7870)	4360	(5910)	7260	(9840)
20.000	(508,0)	94.00	J-55	ST&C	7830	(10620)	5870	(7960)	9790	(13270)
20.000	(508,0)	106.50	J-55	ST&C	9130	(12370)	6850	(9280)	11410	(15470)
20.000	(508,0)	133.00	J-55	ST&C	11920	(16160)	8940	(12120)	14900	(20200)
20.000	(508,0)	94.00	K-55	ST&C	8230	(11160)	6170	(8370)	10290	(13950)
20.000	(508,0)	106.50	K-55	ST&C	9590	(13000)	7190	(9750)	11990	(16260)
20.000	(508,0)	133.00	K-55	ST&C	12520	(16980)	9390	(12740)	15660	(21230)
20.000	(508,0)	94.00	J-55	LT&C	9070	(12290)	6800	(9220)	11330	(15360)
20.000	(508,0)	106.50	J-55	LT&C	10560	(14320)	7920	(10740)	13210	(17900)
20.000	(508,0)	133.00	J-55	LT&C	13790	(18700)	10350	(14030)	17240	(23380)
20.000	(508,0)	94.00	K-55	LT&C	9550	(12950)	7160	(9710)	11940	(16180)
20.000	(508,0)	106.50	K-55	LT&C	11130	(15090)	8350	(11310)	13910	(18860)
20.000	(508,0)	133.00	K-55	LT&C	14530	(19700)	10900	(14770)	18160	(24620)

TABLE 1.2
TORQUE VALUES FOR EXTREMELINE CASING

The torque values listed below are recommended for use in conjunction with close visual examination to be sure the shoulder closes and to avoid excessive box swelling.

TORQUE, ft·lbf (N·m)

Size Outside Dia.	J-55 & K-55			C-75, L-80, N-80, C-90			C-95, P-110			Q-125		
In. (mm)	Min.	Aim	Max.	Min.	Aim	Max.	Min.	Aim	Max.	Min.	Aim	Max.
5 (127)	2500 (3390)	2700 (3660)	3000 (4070)	3000 (4070)	3200 (4340)	3500 (4750)	3500 (4750)	3700 (5020)	4000 (5420)	4000 (5420)	4200 (5690)	4500 (6100)
5 1/2 (139,7)	2500 (3390)	2700 (3660)	3000 (4070)	3000 (4070)	3200 (4340)	3500 (4750)	3500 (4750)	3700 (5020)	4000 (5420)	4000 (5420)	4200 (5690)	4500 (6100)
6 5/8 (168,3)	3000 (4070)	3200 (4340)	3500 (4750)	3500 (4750)	3700 (5020)	4000 (5420)	4000 (5420)	4200 (5690)	4500 (6100)	4500 (6100)	4700 (6370)	5000 (6780)
7 (177,8)	3000 (4070)	3200 (4340)	3500 (4750)	3500 (4750)	3700 (5020)	4000 (5420)	4000 (5420)	4200 (5690)	4500 (6100)	4500 (6100)	4700 (6370)	5000 (6780)
7 5/8 (193,7)	3500 (4750)	3700 (5020)	4000 (5420)	4000 (5420)	4200 (5690)	4500 (6100)	4500 (6100)	4700 (6370)	5000 (6780)	5000 (6780)	5200 (7050)	5500 (7460)
8 5/8 (219,1)	4000 (5420)	4200 (5690)	4500 (6100)	4500 (6100)	4700 (6370)	5000 (6780)	5000 (6780)	5200 (7050)	5500 (7460)	5500 (7460)	5700 (7730)	6000 (8130)
9 5/8 (244,5)	4500 (6100)	4700 (6370)	5000 (6780)	5000 (6780)	5200 (7050)	5500 (7460)	6000 (8130)	6200 (8410)	6500 (8810)	6500 (8810)	6700 (9080)	7000 (9490)

NOTES:

(1) The outside shoulder is not a sealing surface; serves as a stop only.
(2) Torque values higher than those listed above may be considered under certain conditions, providing box swelling does not occur.
(3) Increased axial tension stress due to higher torque values could be excessive for sulfide service.
(4) If the connection does not shoulder when maximum torque is applied, it should be treated as a questionable joint as provided under Par. 1.16.
(5) Recommended make-up torque values for 273,1 mm (10 ¾") are not available due to lack of data.

TABLE 2.1

RECOMMENDED TUBING MAKE-UP TORQUE
ROUND THREAD TUBING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
1.050	(26,7)	1.14	H-40	NU	140	(190)	100	(140)	170	(240)
1.050	(26,7)	1.14	J-55	NU	180	(240)	130	(180)	220	(300)
1.050	(26,7)	1.14	C-75	NU	230	(320)	180	(240)	290	(400)
1.050	(26,7)	1.14	L-80	NU	240	(330)	180	(240)	300	(410)
1.050	(26,7)	1.14	N-80	NU	250	(340)	190	(250)	310	(420)
1.050	(26,7)	1.14	C-90	NU	260	(350)	200	(260)	330	(440)
1.050	(26,7)	1.20	H-40	EUE	460	(630)	350	(470)	580	(780)
1.050	(26,7)	1.20	J-55	EUE	600	(810)	450	(610)	750	(1020)
1.050	(26,7)	1.20	C-75	EUE	780	(1060)	590	(800)	980	(1330)
1.050	(26,7)	1.20	L-80	EUE	810	(1090)	610	(820)	1010	(1370)
1.050	(26,7)	1.20	N-80	EUE	830	(1130)	620	(840)	1040	(1410)
1.050	(26,7)	1.20	C-90	EUE	880	(1190)	660	(890)	1100	(1480)
1.315	(33,4)	1.70	H-40	NU	210	(280)	160	(210)	260	(350)
1.315	(33,4)	1.70	J-55	NU	270	(370)	200	(280)	340	(460)
1.315	(33,4)	1.70	C-75	NU	360	(480)	270	(360)	440	(600)
1.315	(33,4)	1.70	L-80	NU	370	(500)	270	(370)	460	(620)
1.315	(33,4)	1.70	N-80	NU	380	(510)	280	(380)	470	(640)
1.315	(33,4)	1.70	C-90	NU	400	(540)	300	(400)	500	(670)
1.315	(33,4)	1.80	H-40	EUE	440	(590)	330	(440)	550	(740)
1.315	(33,4)	1.80	J-55	EUE	570	(770)	430	(580)	710	(960)
1.315	(33,4)	1.80	C-75	EUE	740	(1010)	560	(750)	930	(1260)
1.315	(33,4)	1.80	L-80	EUE	760	(1040)	570	(780)	960	(1300)
1.315	(33,4)	1.80	N-80	EUE	790	(1070)	590	(800)	980	(1330)
1.315	(33,4)	1.80	C-90	EUE	830	(1130)	620	(840)	1040	(1410)
1.315	(33,4)	1.72	H-40	IJ	310	(410)	230	(310)	380	(520)
1.315	(33,4)	1.72	J-55	IJ	400	(540)	300	(400)	500	(670)
1.315	(33,4)	1.72	C-75	IJ	520	(700)	390	(530)	650	(880)
1.315	(33,4)	1.72	L-80	IJ	530	(720)	400	(540)	670	(900)
1.315	(33,4)	1.72	N-80	IJ	550	(740)	410	(560)	690	(930)
1.315	(33,4)	1.72	C-90	IJ	580	(780)	430	(590)	720	(980)
1.660	(42,2)	2.30	H-40	NU	270	(360)	200	(270)	340	(450)
1.660	(42,2)	2.30	J-55	NU	350	(470)	260	(360)	440	(590)
1.660	(42,2)	2.30	C-75	NU	460	(620)	340	(470)	570	(780)
1.660	(42,2)	2.30	L-80	NU	470	(640)	350	(480)	590	(800)
1.660	(42,2)	2.30	N-80	NU	490	(660)	360	(490)	610	(820)
1.660	(42,2)	2.30	C-90	NU	510	(700)	390	(520)	640	(870)
1.660	(42,2)	2.30	H-40	EUE	530	(720)	400	(540)	660	(900)
1.660	(42,2)	2.40	J-55	EUE	690	(940)	520	(700)	860	(1170)
1.660	(42,2)	2.40	C-75	EUE	910	(1230)	680	(920)	1130	(1540)
1.660	(42,2)	2.40	L-80	EUE	940	(1270)	700	(950)	1170	(1590)
1.660	(42,2)	2.40	N-80	EUE	960	(1300)	720	(980)	1200	(1630)
1.660	(42,2)	2.40	C-90	EUE	1020	(1380)	760	(1040)	1270	(1730)
1.660	(42,2)	2.10	H-40	IJ	380	(520)	290	(390)	480	(650)
1.660	(42,2)	2.33	H-40	IJ	380	(520)	290	(390)	480	(650)
1.660	(42,2)	2.10	J-55	IJ	500	(680)	370	(510)	620	(850)
1.660	(42,2)	2.33	J-55	IJ	500	(680)	370	(510)	620	(850)
1.660	(42,2)	2.33	C-75	IJ	650	(890)	490	(670)	820	(1110)
1.660	(42,2)	2.33	L-80	IJ	680	(920)	510	(690)	840	(1140)
1.660	(42,2)	2.33	N-80	IJ	690	(940)	520	(710)	870	(1180)
1.660	(42,2)	2.33	C-90	IJ	730	(1000)	550	(750)	920	(1240)

TABLE 2.1 (cont.)

RECOMMENDED TUBING MAKE-UP TORQUE
ROUND THREAD TUBING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
1.900	(48,3)	2.75	H-40	NU	320	(430)	240	(320)	400	(540)
1.900	(48,3)	2.75	J-55	NU	410	(560)	310	(420)	520	(700)
1.900	(48,3)	2.75	C-75	NU	540	(730)	410	(550)	680	(920)
1.900	(48,3)	2.75	L-80	NU	560	(760)	420	(570)	700	(950)
1.900	(48,3)	2.75	N-80	NU	570	(780)	430	(580)	720	(970)
1.900	(48,3)	2.75	C-90	NU	610	(830)	460	(620)	760	(1030)
1.900	(48,3)	2.90	H-40	EUE	670	(910)	500	(680)	840	(1130)
1.900	(48,3)	2.90	J-55	EUE	880	(1190)	660	(890)	1090	(1480)
1.900	(48,3)	2.90	C-75	EUE	1150	(1560)	860	(1170)	1440	(1950)
1.900	(48,3)	2.90	L-80	EUE	1190	(1610)	890	(1210)	1490	(2010)
1.900	(48,3)	2.90	N-80	EUE	1220	(1650)	910	(1240)	1520	(2060)
1.900	(48,3)	2.90	C-90	EUE	1300	(1760)	970	(1320)	1620	(2200)
1.900	(48,3)	2.40	H-40	IJ	450	(600)	330	(450)	560	(750)
1.900	(48,3)	2.76	H-40	IJ	450	(600)	330	(450)	560	(750)
1.900	(48,3)	2.40	J-55	IJ	580	(790)	440	(590)	730	(990)
1.900	(48,3)	2.76	J-55	IJ	580	(790)	440	(590)	730	(990)
1.900	(48,3)	2.76	C-75	IJ	760	(1030)	570	(780)	950	(1290)
1.900	(48,3)	2.76	L-80	IJ	790	(1070)	590	(800)	990	(1340)
1.900	(48,3)	2.76	N-80	IJ	810	(1100)	610	(820)	1010	(1370)
1.900	(48,3)	2.76	C-90	Ij	860	(1160)	640	(870)	1070	(1450)
2.063	(52,4)	3.25	H-40	IJ	570	(770)	430	(580)	710	(960)
2.063	(52,4)	3.25	J-55	IJ	740	(1010)	560	(750)	930	(1260)
2.063	(52,4)	3.25	C-75	IJ	970	(1320)	730	(990)	1220	(1650)
2.063	(52,4)	3.25	L-80	IJ	1010	(1370)	760	(1020)	1260	(1710)
2.063	(52,4)	3.25	N-80	IJ	1030	(1400)	770	(1050)	1290	(1750)
2.063	(52,4)	3.25	C-90	IJ	1100	(1490)	820	(1120)	1370	(1860)

TABLE 2.1 (cont.)

RECOMMENDED TUBING MAKE-UP TORQUE
ROUND THREAD TUBING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
2.375	(60,3)	4.00	H-40	NU	470	(630)	350	(480)	580	(790)
2.375	(60,3)	4.60	H-40	NU	560	(760)	420	(570)	700	(950)
2.375	(60,3)	4.00	J-55	NU	610	(830)	460	(620)	760	(1040)
2.375	(60,3)	4.60	J-55	NU	730	(990)	550	(740)	910	(1240)
2.375	(60,3)	4.00	C-75	NU	800	(1090)	600	(820)	1010	(1360)
2.375	(60,3)	4.60	C-75	NU	960	(1300)	720	(980)	1200	(1630)
2.375	(60,3)	5.80	C-75	NU	1380	(1860)	1030	(1400)	1720	(2330)
2.375	(60,3)	4.00	L-80	NU	830	(1130)	620	(850)	1040	(1410)
2.375	(60,3)	4.60	L-80	NU	990	(1350)	750	(1010)	1240	(1680)
2.375	(60,3)	5.80	L-80	NU	1420	(1930)	1070	(1450)	1780	(2410)
2.375	(60,3)	4.00	N-80	NU	850	(1160)	640	(870)	1070	(1450)
2.375	(60,3)	4.60	N-80	NU	1020	(1380)	760	(1040)	1270	(1730)
2.375	(60,3)	5.80	N-80	NU	1460	(1980)	1090	(1480)	1820	(2470)
2.375	(60,3)	4.00	C-90	NU	910	(1230)	680	(920)	1140	(1540)
2.375	(60,3)	4.60	C-90	NU	1080	(1470)	810	(1100)	1360	(1840)
2.375	(60,3)	5.80	C-90	NU	1550	(2110)	1160	(1580)	1940	(2630)
2.375	(60,3)	4.60	P-105	NU	1280	(1740)	960	(1300)	1600	(2170)
2.375	(60,3)	5.80	P-105	NU	1840	(2490)	1380	(1870)	2290	(3110)
2.375	(60,3)	4.70	H-40	EUE	990	(1340)	740	(1000)	1230	(1670)
2.375	(60,3)	4.70	J-55	EUE	1290	(1750)	970	(1310)	1620	(2190)
2.375	(60,3)	4.70	C-75	EUE	1700	(2310)	1280	(1730)	2130	(2880)
2.375	(60,3)	5.95	C-75	EUE	2120	(2870)	1590	(2150)	2650	(3590)
2.375	(60,3)	4.70	L-80	EUE	1760	(2390)	1320	(1790)	2200	(2990)
2.375	(60,3)	5.95	L-80	EUE	2190	(2970)	1640	(2230)	2740	(3710)
2.375	(60,3)	4.70	N-80	EUE	1800	(2450)	1350	(1830)	2260	(3060)
2.375	(60,3)	5.95	N-80	EUE	2240	(3040)	1680	(2280)	2800	(3800)
2.375	(60,3)	4.70	C-90	EUE	1920	(2610)	1440	(1960)	2410	(3260)
2.375	(60,3)	5.95	C-90	EUE	2390	(3250)	1800	(2430)	2990	(4060)
2.375	(60,3)	4.70	P-105	EUE	2270	(3080)	1710	(2310)	2840	(3850)
2.375	(60,3)	5.95	P-105	EUE	2830	(3830)	2120	(2870)	3530	(4790)
2.875	(73,0)	6.40	H-40	NU	800	(1080)	600	(810)	1000	(1360)
2.875	(73,0)	6.40	J-55	NU	1050	(1420)	790	(1070)	1310	(1780)
2.875	(73,0)	6.40	C-75	NU	1380	(1880)	1040	(1410)	1730	(2350)
2.875	(73,0)	7.80	C-75	NU	1850	(2500)	1390	(1880)	2310	(3130)
2.875	(73,0)	8.60	C-75	NU	2090	(2830)	1570	(2120)	2610	(3540)
2.875	(73,0)	6.40	L-80	NU	1430	(1940)	1080	(1460)	1790	(2430)
2.875	(73,0)	7.80	L-80	NU	1910	(2590)	1440	(1950)	2390	(3240)
2.875	(73,0)	8.60	L-80	NU	2160	(2930)	1620	(2200)	2710	(3670)
2.875	(73,0)	6.40	N-80	NU	1470	(1990)	1100	(1490)	1830	(2490)
2.875	(73,0)	7.80	N-80	NU	1960	(2650)	1470	(1990)	2450	(3320)
2.875	(73,0)	8.60	N-80	NU	2210	(3000)	1660	(2250)	2770	(3750)
2.875	(73,0)	6.40	C-90	NU	1570	(2130)	1180	(1590)	1960	(2660)
2.875	(73,0)	7.80	C-90	NU	2090	(2840)	1570	(2130)	2620	(3550)
2.875	(73,0)	8.60	C-90	NU	2370	(3210)	1770	(2410)	2960	(4010)
2.875	(73,0)	6.40	P-105	NU	1850	(2510)	1390	(1880)	2310	(3140)
2.875	(73,0)	7.80	P-105	NU	2470	(3350)	1850	(2510)	3090	(4190)
2.875	(73,0)	8.60	P-105	NU	2790	(3790)	2100	(2840)	3490	(4730)
2.875	(73,0)	6.50	H-40	EUE	1250	(1700)	940	(1270)	1570	(2120)
2.875	(73,0)	6.50	J-55	EUE	1650	(2230)	1230	(1670)	2060	(2790)
2.875	(73,0)	6.50	C-75	EUE	2170	(2940)	1630	(2210)	2710	(3680)
2.875	(73,0)	7.90	C-75	EUE	2610	(3540)	1960	(2660)	3270	(4430)
2.875	(73,0)	8.70	C-75	EUE	2850	(3860)	2130	(2890)	3560	(4820)
2.875	(73,0)	6.50	L-80	EUE	2250	(3050)	1690	(2290)	2810	(3820)
2.875	(73,0)	7.90	L-80	EUE	2710	(3680)	2030	(2760)	3390	(4600)
2.875	(73,0)	8.70	L-80	EUE	2950	(4000)	2210	(3000)	3690	(5000)

TABLE 2.1 (cont.)

RECOMMENDED TUBING MAKE-UP TORQUE
ROUND THREAD TUBING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
in.	(mm)	lbs/ft	Grade	Thread	Optimum		Minimum		Maximum	
2.875	(73,0)	6.50	N-80	EUE	2300	(3120)	1730	(2340)	2880	(3900)
2.875	(73,0)	7.90	N-80	EUE	2770	(3760)	2080	(2820)	3470	(4700)
2.875	(73,0)	8.70	N-80	EUE	3020	(4090)	2260	(3070)	3770	(5110)
2.875	(73,0)	6.50	C-90	EUE	2460	(3340)	1850	(2510)	3080	(4180)
2.875	(73,0)	7.90	C-90	EUE	2970	(4020)	2230	(3020)	3710	(5030)
2.875	(73,0)	8.70	C-90	EUE	3230	(4380)	2420	(3280)	4040	(5470)
2.875	(73,0)	6.50	P-105	EUE	2910	(3940)	2180	(2960)	3640	(4930)
2.875	(73,0)	7.90	P-105	EUE	3500	(4750)	2630	(3560)	4380	(5940)
2.875	(73,0)	8.70	P-105	EUE	3810	(5170)	2860	(3880)	4760	(6460)
3.500	(88,9)	7.70	H-40	NU	920	(1250)	690	(930)	1150	(1560)
3.500	(88,9)	9.20	H-40	NU	1120	(1520)	840	(1140)	1400	(1900)
3.500	(88,9)	10.20	H-40	NU	1310	(1770)	980	(1330)	1630	(2220)
3.500	(88,9)	7.70	J-55	NU	1210	(1640)	910	(1230)	1510	(2050)
3.500	(88,9)	9.20	J-55	NU	1480	(2010)	1110	(1500)	1850	(2510)
3.500	(88,9)	10.20	J-55	NU	1720	(2330)	1290	(1750)	2150	(2920)
3.500	(88,9)	7.70	C-75	NU	1600	(2170)	1200	(1630)	2000	(2710)
3.500	(88,9)	9.20	C-75	NU	1950	(2650)	1470	(1990)	2440	(3310)
3.500	(88,9)	10.20	C-75	NU	2270	(3080)	1710	(2310)	2840	(3850)
3.500	(88,9)	12.70	C-75	NU	3030	(4100)	2270	(3080)	3780	(5130)
3.500	(88,9)	7.70	L-80	NU	1660	(2250)	1240	(1690)	2070	(2810)
3.500	(88,9)	9.20	L-80	NU	2030	(2750)	1520	(2060)	2540	(3440)
3.500	(88,9)	10.20	L-80	NU	2360	(3200)	1770	(2400)	2950	(4000)
3.500	(88,9)	12.70	L-80	NU	3140	(4260)	2360	(3200)	3930	(5330)
3.500	(88,9)	7.70	N-80	NU	1700	(2300)	1270	(1720)	2120	(2870)
3.500	(88,9)	9.20	N-80	NU	2070	(2810)	1550	(2110)	2590	(3510)
3.500	(88,9)	10.20	N-80	NU	2410	(3270)	1810	(2450)	3010	(4090)
3.500	(88,9)	12.70	N-80	NU	3210	(4350)	2410	(3260)	4010	(5440)
3.500	(88,9)	7.70	C-90	NU	1820	(2460)	1360	(1850)	2270	(3080)
3.500	(88,9)	9.20	C-90	NU	2220	(3010)	1670	(2260)	2780	(3770)
3.500	(88,9)	10.20	C-90	NU	2590	(3510)	1940	(2630)	3230	(4380)
3.500	(88,9)	12.70	C-90	NU	3440	(4670)	2580	(3500)	4300	(5830)
3.500	(88,9)	9.20	P-105	NU	2620	(3550)	1970	(2670)	3280	(4440)
3.500	(88,9)	12.70	P-105	NU	4060	(5510)	3050	(4130)	5080	(6880)
3.500	(88,9)	9.30	H-40	EUE	1730	(2340)	1300	(1760)	2160	(2930)
3.500	(88,9)	9.30	J-55	EUE	2280	(3090)	1710	(2320)	2850	(3860)
3.500	(88,9)	9.30	C-75	EUE	3010	(4080)	2260	(3060)	3770	(5110)
3.500	(88,9)	12.95	C-75	EUE	4040	(5480)	3030	(4110)	5050	(6850)
3.500	(88,9)	9.30	L-80	EUE	3130	(4240)	2350	(3180)	3910	(5310)
3.500	(88,9)	12.95	L-80	EUE	4200	(5700)	3150	(4270)	5250	(7120)
3.500	(88,9)	9.30	N-80	EUE	3200	(4330)	2400	(3250)	4000	(5420)
3.500	(88,9)	12.95	N-80	EUE	4290	(5820)	3220	(4360)	5360	(7270)
3.500	(88,9)	9.30	C-90	EUE	3430	(4650)	2570	(3490)	4290	(5820)
3.500	(88,9)	12.95	C-90	EUE	4610	(6250)	3450	(4680)	5760	(7810)
3.500	(88,9)	9.30	P-105	EUE	4050	(5490)	3040	(4120)	5060	(6860)
3.500	(88,9)	12.95	P-105	EUE	5430	(7370)	4070	(5520)	6790	(9210)
4.000	(101,6)	9.50	H-40	NU	930	(1260)	700	(940)	1160	(1570)
4.000	(101,6)	9.50	J-55	NU	1220	(1660)	920	(1240)	1530	(2070)
4.000	(101,6)	9.50	C-75	NU	1620	(2200)	1210	(1650)	2020	(2740)
4.000	(101,6)	9.50	L-80	NU	1680	(2280)	1260	(1710)	2100	(2850)
4.000	(101,6)	9.50	N-80	NU	1720	(2330)	1290	(1750)	2150	(2910)
4.000	(101,6)	9.50	C-90	NU	1850	(2500)	1390	(1880)	2310	(3130)
4.000	(101,6)	11.00	H-40	EUE	1940	(2630)	1450	(1970)	2420	(3290)
4.000	(101,6)	11.00	J-55	EUE	2560	(3470)	1920	(2600)	3200	(4340)

TABLE 2.1 (cont.)

RECOMMENDED TUBING MAKE-UP TORQUE
ROUND THREAD TUBING

1		2	2	4	5		6		7	
Size Outside Diameter		Nominal Weight, Threads and Coupling			Torque, ft-lbs (N·m)					
					Optimum		Minimum		Maximum	
in.	(mm)	lbs/ft	Grade	Thread						
4.000	(101,6)	11.00	C-75	EUE	3390	(4600)	2540	(3450)	4240	(5750)
4.000	(101,6)	11.00	L-80	EUE	3530	(4780)	2650	(3590)	4410	(5980)
4.000	(101,6)	11.00	N-80	EUE	3600	(4880)	2700	(3660)	4500	(6100)
4.000	(101,6)	11.00	C-90	EUE	3870	(5250)	2900	(3940)	4840	(6560)
4.500	(114,3)	12.60	H-40	NU	1320	(1780)	990	(1340)	1640	(2230)
4.500	(114,3)	12.60	J-55	NU	1740	(2360)	1300	(1770)	2170	(2950)
4.500	(114,3)	12.60	C-75	NU	2300	(3120)	1730	(2340)	2880	(3900)
4.500	(114,3)	12.60	L-80	NU	2400	(3250)	1800	(2440)	3000	(4060)
4.500	(114,3)	12.60	N-80	NU	2440	(3310)	1830	(2490)	3060	(4140)
4.500	(114,3)	12.60	C-90	NU	2630	(3570)	1980	(2680)	3290	(4460)
4.500	(114,3)	12.75	H-40	EUE	2160	(2930)	1620	(2190)	2700	(3660)
4.500	(114,3)	12.75	J-55	EUE	2860	(3870)	2140	(2900)	3570	(4840)
4.500	(114,3)	12.75	C-75	EUE	3780	(5130)	2840	(3850)	4730	(6410)
4.500	(114,3)	12.75	L-80	EUE	3940	(5340)	2960	(4010)	4930	(6680)
4.500	(114,3)	12.75	N-80	EUE	4020	(5450)	3010	(4080)	5020	(6810)
4.500	(114,3)	12.75	C-90	EUE	4330	(5870)	3250	(4400)	5410	(7340)

Recommended Practice for Care and Use of Casing and Tubing

API RECOMMENDED PRACTICE 5C1 (RP 5C1)
SIXTEENTH EDITION, MAY 31, 1988

American Petroleum Institute
1220 L Street, Northwest
Washington, DC 20005

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Note

This edition supersedes the 15th edition dated May 31, 1987. It includes recommendations and revisions adopted at the 1987 Standardization Conference.

This recommended practice was originally adopted in 1928 and issued in 1929. Revised editions were issued in 1938, 1948, 1949, 1951, 1956, 1957, 1963, 1971, 1973, 1980, 1981, 1984, 1986 and 1987.

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Attention Users: Portions of this publication have been changed from the previous edition. The locations of changes have been marked with a bar in the margin, as shown to the left of this paragraph. In some cases the changes are significant, while in other cases the changes reflect minor editorial adjustments. The bar notations in the margins are provided as an aid to users as to those parts of this publication that have been changed from the previous edition, but API makes no warranty as to the accuracy of such bar notations.

SCOPE

a. This recommended practice is under the jurisdiction of the API Committee on Standardization of Tubular Goods.

1. *Shall* is used to indicate that a provision is mandatory.
2. *Should* is used to indicate that a provision is not mandatory, but recommended as good practice.
3. *May* is used to indicate that a provision is optional.

NOTE: *No provision of this recommended practice shall be cause for rejection of casing or tubing provided the threads are in accordance with the requirements of the latest edition of API Std 5B.*

b. The statements on corrosion of casing and tubing as given herein, were developed with the cooperation of the Technical Practices Committee on Corrosion of Oil and Gas Well Equipment, National Association of Corrosion Engineers.

c. It is suggested that the selection of a thread compound for casing and tubing be given careful consideration by the user, bearing in mind that a satisfactory compound should possess certain properties, the major of which are (1) to lubricate the thread surfaces to facilitate joint make-up and break-out without galling, and (2) to seal voids between the mating thread surfaces and effectively prevent leakage. Compounds which have given outstanding service for casing and tubing under both laboratory and field conditions are described in the latest edition of API Bul 5A2: *Bulletin on Thread Compounds.*

NOTE: *Thread Compounds described in the latest edition of Bul 5A2 should not be used on rotary shouldered connections.*

d. Some generalized suggestions on prevention of damage to casing and tubing by corrosive fluids are given herein (Par. 1.30-p and 2.34-o). It is not, however, within the scope of this bulletin to provide detailed suggestions for corrosion control under specific conditions. Many variables may be involved in a specific corrosion problem and inter-related in such a complex fashion as to require detailed attention to the specific problem. For more complete technical information on specific corrosion problems, the user should consult the official publication of the National Association of Corrosion Engineers, CORROSION, or contact: Chairman, Technical Practices Committee on Corrosion of Oil and Gas Well Equipment, T-1, NACE, 2400 West Loop South, Houston, Texas 77027.

e. This recommended practice may be used by anyone desiring to do so, and every effort has been made by the Institute to assure the accuracy and reliability of the data obtained. However, the Institute makes no representation, warranty, or guarantee in connection with the publication of any API recommended practice and hereby expressly disclaims any liability or responsibility for loss or damage resulting from their use, for any violation of any federal, state, or municipal regulation with which an API recommended practice may conflict, or for the infringement of any patent resulting from the use of an API recommended practice.

f. **Referenced Standards**

1. **General.** This specification includes by reference, either in total or in part, other API, industry and government standards listed in Table A.
2. **Requirements.** Requirements of other standards included by reference in this specification are essential to the safety and interchangeability of the equipment produced.
3. **Equivalent Standards.** Other nationally or internationally recognized standards shall be submitted to and approved by API for inclusion in this specification prior to their use as equivalent standards.

TABLE A
REFERENCED STANDARDS

1. API Spec 5CT:	*Specification for Casing and Tubing*	Latest Edition
2. API Bul 5A2:	*Bulletin on Thread Compounds*	Latest Edition
3. API Bul 5C2:	*Bulletin on Performance Properties of Casing and Tubing*	Latest Edition
4. API Std 5B:	*Specification for Threading, Gaging, and Thread Inspection of Casing, Tubing and Line Pipe Threads*	Latest Edition
5. API Bul 5C3:	*Bulletin on Formulas and Calculations for Casing, Tubing Drill Pipe and Line Pipe Properties*	Latest Edition
6. API RP7G:	*Recommended Practice for Drill Stem Design and Operating Limits*	Latest Edition
7. ASTM A233:	*Mild Steel Arc-Welding Electrodes*	Latest Edition
8. ASTM A316:	*High Tensile and Low Alloy Steel Covered Arc-Welding Electrodes*	Latest Edition

SECTION 1
RUNNING AND PULLING CASING

Preparation and Inspection before Running

1.1 New casing is delivered free of injurious defects as defined in API Spec 5CT and within the practical limits of the inspection procedures therein prescribed. Some Users have found that, for a limited number of critical well applications, these procedures do not result in casing sufficiently free of defects to meet their needs for such critical applications. Various nondestructive inspection services have been employed by Users to assure that the desired quality of casing is being run. In view of this practice, it is suggested that the individual user:

a. Familiarize himself with inspection practices specified in the standards and employed by the respective mills, and with the definition of "injurious defect" contained in the standards.

b. Thoroughly evaluate *any* nondestructive inspection to be used by him on API tubular goods to assure himself that the inspection does in fact correctly locate and differentiate injurious defects from other variables which can be and frequently are sources of misleading "defect" signals with such inspection methods.

1.2 All casing, whether new, used, or reconditioned, should always be handled with thread protectors in place. Casing should be handled at all times on racks or on wooden or metal surfaces free of rocks, sand, or dirt other than normal drilling mud. When lengths of casing are inadvertently dragged in the dirt, the threads should be recleaned and serviced again as outlined in Par. 1.7.

1.3 Slip elevators are recommended for long strings. Both spider and elevator slips should be clean and sharp and should fit properly. Slips should be extra long for heavy casing strings. The spider must be level.

NOTE: *Slip and tong marks are injurious. Every possible effort should be made to keep such damage at a minimum by using proper up-to-date equipment.*

1.4 If collar-pull elevators are used, the bearing surface should be carefully inspected for (1) uneven wear which may produce a side lift on the coupling with danger of jumping it off, and (2) uniform distribution of the load when applied over the bearing face of the coupling.

1.5 Spider and elevator slips should be examined and watched to see that all lower together. If they lower unevenly, there is danger of denting the pipe or badly slip-cutting it.

1.6 Care shall be exercised, particularly when running long casing strings, to insure that the slip bushing or bowl is in good condition. Tongs should be examined for wear on hinge-pins and hinge-surfaces. The back-up line attachment to the back-up post should be corrected if necessary to be level with the tong in the back-up position, so as to avoid uneven load distribution on the gripping surfaces of the casing. The length of the back-up line should be such as to cause minimum bending stresses on the casing and to allow full stroke movement of the make-up tong.

1.7 The following precautions should be taken in the preparation of casing threads for make up in the casing strings:

a. Immediately before running, remove thread protectors from both field and coupling ends and clean the threads thoroughly, repeating as additional rows become uncovered.

b. Carefully inspect the threads. Those found damaged, even slightly, should be laid aside unless satisfactory means are available for correcting thread damage.

c. The length of each piece of casing shall be measured prior to running. A steel tape calibrated in decimal feet to the nearest 0.01 ft should be used. The measurement should be made from the outermost face of the coupling or box to the position on the externally threaded end where the coupling or the box stops when the joint is made up powertight. On round-thread joints, this position is to the plane of the vanish point on the pipe; on buttress-thread casing, this position is to the base of the triangle stamp on the pipe; and, on extreme line casing, to the shoulder on the externally threaded end. The total of the individual lengths so measured will represent the unloaded length of the casing string. The actual length under tension in the hole can be obtained by consulting graphs which are prepared for this purpose and which are available in most pipe handbooks.

d. Check each coupling for make-up. If the stand-off is abnormally great, check the coupling for tightness. Tighten any loose couplings after thoroughly cleaning the threads and applying fresh compound over entire thread surfaces, and before pulling the pipe into the derrick.

e. Before stabbing, liberally apply thread compound to the entire internally and externally threaded areas. It is recommended that high pressure modified thread compound as specified in the latest edition of API Bul 5A2: *Bulletin on Thread Compounds* be used, except in special cases where severe conditions are encountered, it is recommended that high pressure silicone thread compound as specified in the latest edition of Bul 5A2 be used.

f. Place a clean thread protector on the field end of the pipe so that the thread will not be damaged while rolling pipe on the rack and pulling into the derrick. Several thread protectors may be cleaned and used repeatedly for this operation.

g. If a mixed string is to be run, check to determine that appropriate casing will be accessible on the pipe rack when required according to program.

h. Connectors used as tensile and lifting members should have their thread capacity carefully checked to assure that the connector can safely support the load.

i. Care should be taken when making up pup joints and connectors to assure that the mating threads are of the same size and type.

1.8 **Drifting of Casing.** It is recommended that each length of casing be drifted for its entire length just before running, with mandrels conforming to Par. 5.20b of the latest edition of Spec 5CT. Casing which will not pass the drill test should be laid aside.

1.9 Lower or roll each piece of casing carefully to the walk without dropping. Use rope snubber if necessary. Avoid hitting casing against any part of derrick or other equipment. Provide a hold-back rope at window. For mixed or unmarked strings, a drift or "jack rabbit" should be run through each length of

casing when it is picked up from the catwalk and pulled onto the derrick floor, to avoid running a heavier length or one with a lesser inside diameter than called for in the casing string.

Stabbing, Making Up, and Lowering

1.10 Do not remove thread protector from field end of casing until ready to stab.

1.11 If necessary, apply thread compound over entire surface of threads just before stabbing. The brush or utensil used in applying thread compound should be kept free of foreign matter and the compound should never be thinned.

1.12 In stabbing, lower casing carefully to avoid injuring threads. Stab vertically, preferably with assistance of a man on the stabbing board. If the casing stand tilts to one side after stabbing, lift up, clean, and correct any damaged thread with three-cornered file, then carefully remove any filings and reapply compound over the thread surface. After stabbing, the casing should be rotated very slowly at first to insure that threads are engaging properly and not cross-threading. If spinning line is used, it should pull close to the coupling.

NOTE: *Recommendations in Par. 1.13 and 1.14 for casing makeup apply to the use of power tongs. For recommendations on makeup of casing with spinning lines and conventional tongs, see Par. 1.15.*

1.13 The use of power tongs for making up casing made desirable the establishment of recommended torque values for each size, weight, and grade of casing. Early studies and tests indicated that torque values are affected by a large number of variables, such as variations in taper, lead, thread height and thread form, surface finish, type of thread compound, length of thread, weight and grade of pipe, etc. In view of the number of variables and the extent that these variables, alone or in combination, could affect the relationship of torque values versus made-up position, it was evident that both applied torque and made-up position must be considered. Since the API joint pullout strength formula in the latest edition of API Bul 5C2: *Bulletin on Performance Properties of Casing and Tubing*, contains several of the variables believed to affect torque, the use of a modification of this formula to establish torque values was investigated. Torque values obtained by taking 1% of the calculated pull-out value were found to be generally comparable to values obtained by field make-up tests using API modified thread compound in accordance with the latest edition of API Bul 5A2. This procedure was therefore used to establish the optimum make up torque values listed in Table 1.1. Minimum torque values listed are 75% of optimum values and maximum values listed are 125% of optimum values. All values are rounded to the nearest 10 foot pounds. These values shall be considered a guide only, due to the very wide variations in torque requirements that can exist for a specific connection. Because of this, it is essential that torque be related to made-up position as outlined in Par. 1.14, following. The torque values listed in Table 1.1 apply to casing with zinc plated or phosphate coated couplings. When making up connections with tin plated couplings, 80% of the listed value can be used as a guide. The listed torque values are *not* applicable for making up couplings with PTFE (Polytetrafluoroethylene)* rings. When making up round thread connections with PTFE (Polytetrafluoroethylene) rings, 70% of the listed values are recommended. Buttress connections with PTFE (Polytetrafluoroethylene) seal rings may make up at torque values different from those normally observed on standard buttress threads.

*Teflon™ or equivalent.

NOTE: *Thread galling of gall-prone materials (martensitic chromium steels—9Cr and 13Cr) occurs during movement — stabbing or pulling and make-up or breakout. Galling resistance of threads is primarily controlled in two areas — surface preparation and finishing during manufacture and careful handling practices during running and pulling. Threads and lubricant must be clean. Assembly in the horizontal position should be avoided. Connections should be turned by hand to the hand-tight position before slowly power tightening. The procedure should be reversed for disassembly.*

Field Make-Up

1.14 The following practice is recommended for field make-up of casing.

Round Thread, 4½ through 13⅜ in. OD

a. It is advisable when starting to run casing from each particular mill shipment to make up sufficient joints to determine the torque necessary to provide proper make-up. See Par. 1.15 for proper number of turns beyond hand-tight position. *These values may indicate that a departure from the recommended optimum values listed in Table 1.1 is advisable.* If other optimum values are chosen, the minimum torque should be not less than 75 percent of the optimum selected. The maximum torque should be not more than 125 percent of the optimum torque.

b. The power tong should be provided with a reliable torque gage of known accuracy. In the initial stages of make-up, any irregularities of make-up or in speed of make-up should be observed, since these may be indicative of crossed threads, dirty or damaged threads, or other unfavorable conditions. To prevent galling when making up connections in the field, the connections should be made up at a speed not to exceed 25 rpm.

c. Continue the make-up, observing both the torque gage and the approximate position of the coupling face with respect to the thread vanish point position.

d. The optimum torque values shown in the following tabulation have been selected to give optimum make-up under normal conditions and should be considered as satisfactory providing the face of the coupling is flush with the thread vanish point or within two thread turns plus or minus of the thread vanish point.

e. If the make-up is such that the thread vanish point is buried two thread turns and the minimum torque shown in Table 1.1 is not reached, the joint should be treated as a questionable joint as provided under Par. 1.16.

f. If several threads remain exposed when the optimum torque is reached, apply additional torque up to the maximum shown in Table 1.1. If the stand-off (distance from face of coupling to the thread vanish point) is greater than three thread turns when the maximum torque is reached, the joint should be treated as a questionable joint as provided under Par. 1.16.

Buttress Thread, 4½ through 13⅜ in. OD

g. Make-up torque values for buttress thread casing connections is sizes 4½ through 13⅜ in. OD should be determined by carefully noting the torque required to make up each of several connections to the base of the triangle, then using the torque value thus established, make up the balance of the pipe of that particular weight and grade in the string.

Round Thread and Buttress Thread, 16, 18⅝ and 20 in. OD

h. Make-up of 16, 18⅝ and 20 in. OD shall be to a position on each connection represented by the thread vanish point on 8-round thread and the base of the triangle on buttress thread using the minimum torque shown in Table 1.1 as a guide.

On 8-round thread casing a ⅜ in. equilateral triangle is die stamped at a distance of $L_1 \pm \frac{1}{16}$ in. from each end. The base of the triangle will aid in locating the thread vanish point for basic power tight make-up, however, the position of the coupling with respect to the base of the triangle shall not be a basis for acceptance or rejection of the product.

Care shall be taken to avoid cross-threading in starting these larger connections. The tongs selected should be capable of attaining high torques (50,000 ft-lbs) for the entire run. Anticipate that maximum torque values could be five times the minimum experienced in make-up to the recommended position.

i. Joints that are questionable as to their proper make-up in Paragraph e or f should be unscrewed and laid down to determine the cause of improper make-up. Both the pipe thread and mating coupling thread should be inspected. Damaged threads, or threads which do not comply with the specification should be repaired. If damaged or threads out-of-tolerance are not found to be the cause of improper make-up, then the make-up torque should be adjusted to obtain proper make-up (see Paragraph a). It should be noted that a thread compound with a coefficient of friction substantially different from common values may be the cause of improper make-up.

1.15 When conventional tongs are used for casing make-up, tighten with tongs to proper degree of tightness. The joint should be made up beyond the hand-tight position at least 3 turns for sizes 4½ through 7 ins., and at least 3½ turns for sizes 7⅝ in. and larger, except 9⅝ in. and 10¾ in. grade P-110 and 20 in. grade J-55 and K-55 which should be made up 4 turns beyond hand-tight position. When using a spinning line it is necessary to compare handtightness with spin-up tightness. In order to do this, make up the first few joints to the handtight position, then back off and spin up joints to the spin-up tight position. Compare relative position of these two make-ups and use this information to determine when the joint is made up the recommended number of turns beyond handtight.

1.16 Joints that are questionable as to their proper tightness should be unscrewed and the casing laid down for inspection and repair. When this is done, the mating coupling should be carefully inspected for damaged threads. Parted joints should never be re-used without shopping or regaging, even though the joints may have little appearance of damage.

1.17 If casing has a tendency to wobble unduly at its upper end when making up, indicating that the thread may not be in line with the axis of the casing, the speed of rotation should be decreased to prevent galling of threads. If wobbling should persist despite reduced rotational speed, the casing should be laid down for inspection. Serious consideration should be given before using such casing in a position in the string where a heavy tensile load is imposed.

1.18 In making up the field joint it is possible for the coupling to make up slightly on the mill end. This does not indicate that the coupling on the mill end is too loose, but simply that the field end has reached the tightness with which the coupling was screwed on at the Manufacturer's Facility. .

1.19 Casing strings should be picked up and lowered carefully, and care exercised in setting slips to avoid shock loads. Dropping a string even a short distance may loosen couplings at the bottom of the string. Care should be exercised to prevent setting casing down on bottom, or otherwise placing it in compression because of the danger of buckling, particularly in that part of the well where hole enlargement has occurred.

1.20 Definite instructions should be available as to the design of the casing string, including the proper location of the various grades of steel, weights of casing, and types of joint. Care should be exercised to run the string in exactly the order in which it was designed. If any length cannot be clearly identified, it should be laid aside until its grade, weight, or type of joint can be positively established.

1.21 To facilitate running and to assure adequate hydrostatic head to contain reservoir pressures, the casing should be periodically filled with mud while being run. A number of things govern the frequency with which filling should be accomplished: weight of pipe in the hole, mud weight, reservoir pressure, etc. In most cases, filling every 6-10 lengths should suffice. In no case should the hydrostatic balance of reservoir pressure be jeopardized by too infrequent filling. Filling should be done with mud of the proper weight, using a conveniently located hose of adequate size to expedite the filling operation. A quick opening and closing plug valve on the mud hose will facilitate the operation and prevent overflow. If rubber hose is used, it is recommended that the quick-closing valve be mounted where the hose is connected to the mud line, rather than at the outlet end of the hose. It is also recommended that at least one other discharge connection be left open on the mud system to prevent build-up of excessive pressure when the quick-closing valve is closed while the pump is still running. A copper nipple at the end of the mud hose may be used to prevent damaging of the coupling threads during the filling operation.

NOTE: *The foregoing mud fill-up practice will be unnecessary, if automatic fill-up casing shoes and collars are used.*

Casing Landing Procedure

1.22 Definite instructions should be provided for the proper string tension, also on the proper landing procedure after the cement has set. The purpose is to avoid critical stresses or excessive and unsafe tensile stresses at any time during the life of the well. In arriving at the proper tension and landing procedure, consideration should be given to all factors such as well temperature and pressure, temperature developed due to cement hydration, mud temperature, and changes of temperature during producing operations. The adequacy of the original tension safety factor of the string as designed will influence the landing procedure and should be considered. If, however, after due consideration it is not considered necessary to develop special landing procedure instructions (and this probably applies to a very large majority of the wells drilled), then the procedure should be followed of landing the casing in the casing head at exactly the position in which it was hanging when the cement plug reached its lowest point or "as cemented."

Care of Casing in Hole

1.23 Drill pipe run inside casing should be equipped with suitable drill-pipe protectors.

Recovery of Casing

1.24 Break-out tongs should be positioned close to the coupling but not too close since a slight squashing effect where the tong dies contact the pipe surface cannot be avoided especially if the joint is

tight and/or the casing is light. Keeping a space of ⅛ to ¼ of the diameter of the pipe between the tong and the coupling should normally prevent unnecessary friction in the threads. Hammering the coupling to break the joint is an injurious practice. If tapping is required, use the flat face, never the peen face of the hammer, and **under no circumstances** should a sledge hammer be used. Tap lightly near the middle and completely around the coupling, never near the end nor on opposite sides only.

1.25 Great care should be exercised to disengage all of the thread before lifting the casing out of the coupling. Do not jump casing out of coupling.

1.26 All threads should be cleaned and lubricated or should be coated with a material that will minimize corrosion. Clean protectors should be placed on the tubing before it is laid down.

1.27 Before casing is stored or re-used, pipe and thread should be inspected and defective joints marked for shopping and regaging.

1.28 When casing is being retrieved because of a casing failure, it is imperative to future prevention of such failures that a thorough metallurgical study be made. Every attempt should be made to retrieve the failed portion in the "as-failed" condition. When thorough metallurgical analysis reveals some facet of pipe quality to be involved in the failure, the results of the study should be reported to the API office in Dallas, Texas.

1.29 Casing stacked in the derrick should be set on a firm wooden platform and without the bottom thread protector since the design of most protectors is not such as to support the joint or stand without damage to the field thread.

Causes of Casing Troubles

1.30 The more common causes of casing troubles are as follows:

a. Improper selection for depth and pressures encountered.
b. Insufficient inspection of each length of casing or of field-shop threads.
c. Abuse in mill, transportation, and field handling.
d. Non-observance of good rules in running and pulling casing.
e. Improper cutting of field-shop threads.
f. The use of poorly manufactured couplings for replacements and additions.
g. Improper care in storage.
h. Excessive torquing of casing to force it through tight places in the hole.
i. Pulling too hard on a string (to free it). This may loosen the couplings at the top of the string. They should be retightened with tongs before finally setting the string.
j. Rotary drilling inside casing. Setting the casing with improper tension after cementing is one of the greatest contributing causes of such failures.
k. Drill pipe wear while drilling inside casing is particularly significant in drifted holes. Excess dog legs in deviated holes or occasionally in straight holes where corrective measures are taken, result in concentrated bending of the casing which in turn results in excess internal wear, particularly when the dog legs are high in the hole.
l. Wire-line cutting, by swabbing or cable-tool drilling.
m. Buckling of casing in an enlarged, washed-out uncemented cavity if too much tension is released in landing.
n. Dropping a string, even a very short distance.
o. Leaky joints, under external or internal pressure, are a common trouble, and may be due to:
   1. Improper thread compound.
   2. Undertonging.
   3. Dirty threads.
   4. Galled threads, due to dirt, careless stabbing, damaged threads, too rapid spinning, overtonging, or wobbling during spinning or tonging operations.
   5. Improper cutting of field-shop threads.
   6. Pulling too hard on string.
   7. Dropping string.
   8. Excessive making and breaking.
   9. Tonging too high on casing, especially on breaking out. This gives a bending effect which tends to gall the threads.
   10. Improper joint make-up at mill.
   11. Casing ovality or out-of-roundness.
   12. Improper landing practice which produces stresses in the threaded joint in excess of the yield point.
p. Corrosion. Both the inside and outside of casing can be damaged by corrosion which can be recognized by the presence of pits or holes in the pipe. Corrosion on the outside of casing can be caused by corrosive fluids or formations in contact with the casing, or by stray electric currents flowing out of the casing into the surrounding fluids or formations. Severe corrosion may also be caused by sulphate reducing bacteria. Corrosion damage on the inside is usually caused by corrosive fluids produced from the well, but the damage can be increased by the abrasive effects of casing and tubing pumping equipment, and by high fluid velocities such as those encountered in some gas-lifted wells. Internal corrosion might also be due to stray electrical currents (electrolysis) or to dissimilar metals in close contact (bimetallic galvanic corrosion). Because corrosion may result from so many different conditions, no simple or universal remedy can be given for its control. Each corrosion problem must be treated as an individual case and a solution attempted in the light of the known corrosion factors and operating conditions. The condition of the casing can be determined by visual or optical-instrument inspections. Where these are not practical, a casing-caliper survey can be made to determine the condition of the inside surfaces. No tools have yet been designed for determining the condition of the outside of casing in a well. Internal casing-caliper surveys indicate the extent, location, and severity of corrosion. On the basis of the industry's experience to date, the following practices and measures can be used to control corrosion of casing.

   1. Where external casing corrosion is known to occur or stray electrical current surveys indicate that relatively high currents are entering the well, the following practices can be employed.
      a. Good cementing practices, including the use of centralizers, scratchers, and adequate amounts of cement to keep corrosive fluids from contact with the outside of the casing.
      b. Electrical insulation of flow lines from wells by the use of nonconducting flange assemblies to reduce or prevent electrical currents from entering the well.
      c. The use of highly alkaline mud or mud treated with a bactericide as a comple-

tion fluid will help alleviate corrosion caused by sulfate-reducing bacteria.

d. A properly designed cathodic protection system similar to that used for line pipe can alleviate external casing corrosion. Protection criteria for casing differs somewhat from the criteria used for line pipe. Literature on external casing corrosion or persons competent in this field should be consulted for proper protection criteria.

2. Where internal corrosion is known to exist, the following practices can be employed.
   a. In flowing wells, packing the annulus with fresh water or low-salinity alkaline muds. (It may be preferable in some flowing wells to depend upon inhibitors to protect the inside of the casing and the tubing.)
   b. In pumping wells, avoiding the use of casing pumps. Ordinarily, pumping wells should be tubed as close to bottom as practical, regardless of the position of the pump, to minimize the damage to the casing from corrosive fluids.
   c. Using inhibitors to protect the inside of the casing against corrosion.
3. To determine the value and effectiveness of the above practices and measures, cost and equipment-failure records can be compared before and after application of control measures. Inhibitor effectiveness may be checked also by means of caliper surveys, visual examinations of readily accessible pieces of equipment, and by water analyses for iron content. Coupons may also be helpful in determining whether sufficient inhibitor is being used. When lacking previous experience with any of the above measures, they should be used cautiously and on a limited scale until appraised for the particular operating conditions.
4. In general, all new areas should be considered as being potentially corrosive and investigations should be initiated early in the life of a field, and repeated periodically, to detect and localize corrosion before it has done destructive damage. These investigations should cover: (a) a complete chemical analysis of the effluent water, including pH, iron, hydrogen sulfide, organic acids, and any other substances which influence or indicate the degree of corrosion. An analysis of the produced gas for carbon dioxide and hydrogen sulfide is also desirable; (b) corrosion rate tests by using coupons of the same materials as in the well; and (c) the use of caliper or optical-instrument inspections. Where conditions favorable to corrosion exist, a qualified corrosion engineer should be consulted. Particular attention should be given to mitigation of corrosion where the probable life of subsurface equipment is less than the time expected to deplete a well.
5. When H_2S is present in the well fluids, casing of high yield strength may be subject to sulfide corrosion cracking. The concentration of H_2S necessary to cause cracking in different strength materials is not yet well defined. Literature on sulfide corrosion or persons competent in this field should be consulted.

TABLE 1.1

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
4½	9.50	H-40	770	580	960	—	—	—
	9.50	J-55	1010	760	1260	—	—	—
	10.50	J-55	1320	990	1650	—	—	—
	11.60	J-55	1540	1160	1930	1620	1220	2030
	9.50	K-55	1120	840	1400	—	—	—
	10.50	K-55	1460	1100	1830	—	—	—
	11.60	K-55	1700	1280	2130	1800	1350	2250
	11.60	C-75	—	—	—	2150	1610	2690
	13.50	C-75	—	—	—	2600	1950	3250
	11.60	L-80	—	—	—	2230	1670	2790
	13.50	L-80	—	—	—	2710	2030	3390
	11.60	N-80	—	—	—	2280	1710	2850
	13.50	N-80	—	—	—	2760	2070	3450
	11.60	C-90	—	—	—	2450	1840	3060
	13.50	C-90	—	—	—	2970	2230	3710
	11.60	C-95	—	—	—	2580	1940	3230
	13.50	C-95	—	—	—	3130	2350	3910
	11.60	P-110	—	—	—	3020	2270	3780
	13.50	P-110	—	—	—	3660	2750	4580
	15.10	P-110	—	—	—	4400	3300	5500
	15.10	Q125	—	—	—	4910	3680	6140
5	11.50	J-55	1330	1000	1660	—	—	—
	13.00	J-55	1690	1270	2110	1820	1370	2280
	15.00	J-55	2070	1550	2590	2230	1670	2790
	11.50	K-55	1470	1100	1840	—	—	—
	13.00	K-55	1860	1400	2330	2010	1510	2510
	15.00	K-55	2280	1710	2850	2460	1850	3080
	15.00	C-75	—	—	—	2960	2220	3700
	18.00	C-75	—	—	—	3770	2830	4710
	21.40	C-75	—	—	—	4660	3500	5830
	24.10	C-75	—	—	—	5390	4040	6740
	15.00	L-80	—	—	—	3080	2310	3850
	18.00	L-80	—	—	—	3950	2950	4910
	21.40	L-80	—	—	—	4860	3650	6080
	24.10	L-80	—	—	—	5610	4210	7010
	15.00	N-80	—	—	—	3140	2360	3930
	18.00	N-80	—	—	—	4000	3000	5000
	21.40	N-80	—	—	—	4950	3710	6190
	24.10	N-80	—	—	—	5720	4290	7150
	15.00	C-90	—	—	—	3380	2540	4230
	18.00	C-90	—	—	—	4310	3240	5390
	21.40	C-90	—	—	—	5340	4000	6670
	23.20	C-90	—	—	—	5880	4410	7350
	24.10	C-90	—	—	—	6170	4630	7710
	15.00	C-95	—	—	—	3560	2670	4450
	18.00	C-95	—	—	—	4550	3410	5690
	21.40	C-95	—	—	—	5620	4220	7030
	24.10	C-95	—	—	—	6500	4880	8130

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	15.00	P-110	—	—	—	4170	3130	5210
	18.00	P-110	—	—	—	5310	3980	6640
	21.40	P-110	—	—	—	6580	4940	8230
	24.10	P-110	—	—	—	7600	5700	9500
	18.00	Q125	—	—	—	5930	4450	7410
	21.40	Q125	—	—	—	7340	5510	9180
	23.20	Q125	—	—	—	8090	6070	10110
	24.10	Q125	—	—	—	8490	6370	10610
5½	14.00	H-40	1300	980	1630	—	—	—
	14.00	J-55	1720	1290	2150	—	—	—
	15.50	J-55	2020	1520	2530	2170	1630	2710
	17.00	J-55	2290	1720	2860	2470	1850	3090
	14.00	K-55	1890	1420	2360	—	—	—
	15.50	K-55	2220	1670	2780	2390	1790	2990
	17.00	K-55	2520	1890	3150	2720	2040	3400
	17.00	C-75	—	—	—	3270	2450	4090
	20.00	C-75	—	—	—	4030	3020	5040
	23.00	C-75	—	—	—	4730	3550	5910
	17.00	L-80	—	—	—	3410	2560	4260
	20.00	L-80	—	—	—	4200	3150	5250
	23.00	L-80	—	—	—	4930	3700	6160
	17.00	N-80	—	—	—	3480	2610	4350
	20.00	N-80	—	—	—	4280	3210	5350
	23.00	N-80	—	—	—	5020	3770	6280
	17.00	C-90	—	—	—	3750	2820	4690
	20.00	C-90	—	—	—	4620	3470	5780
	23.00	C-90	—	—	—	5420	4070	6780
	26.80	C-90	**	**	**	**	**	**
	29.70	C-90	**	**	**	**	**	**
	32.60	C-90	**	**	**	**	**	**
	35.30	C-90	**	**	**	**	**	**
	38.00	C-90	**	**	**	**	**	**
	40.50	C-90	**	**	**	**	**	**
	43.10	C-90	**	**	**	**	**	**
	17.00	C-95	—	—	—	3960	2970	4950
	20.00	C-95	—	—	—	4870	3650	6090
	23.00	C-95	—	—	—	5720	4290	7150
	17.00	P-110	—	—	—	4620	3470	5780
	20.00	P-110	—	—	—	5690	4270	7110
	23.00	P-110	—	—	—	6680	5010	8350
	23.00	Q125	—	—	—	7460	5600	9330
6⅝	20.00	H-40	1840	1380	2300	—	—	—
	20.00	J-55	2450	1840	3060	2660	2000	3330
	24.00	J-55	3140	2360	3930	3400	2550	4250
	20.00	K-55	2670	2000	3340	2900	2180	3630
	24.00	K-55	3420	2570	4280	3720	2790	4650

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	24.00	C-75	—	—	—	4530	3400	5660
	28.00	C-75	—	—	—	5520	4140	6900
	32.00	C-75	—	—	—	6380	4790	7980
	24.00	L-80	—	—	—	4730	3550	5910
	28.00	L-80	—	—	—	5760	4320	7200
	32.00	L-80	—	—	—	6660	5000	8330
	24.00	N-80	—	—	—	4810	3610	6010
	28.00	N-80	—	—	—	5860	4400	7330
	32.00	N-80	—	—	—	6770	5080	8460
	24.00	C-90	—	—	—	5210	3910	6510
	28.00	C-90	—	—	—	6350	4760	7930
	32.00	C-90	—	—	—	7340	5510	9180
	24.00	C-95	—	—	—	5490	4120	6860
	28.00	C-95	—	—	—	6690	5020	8360
	32.00	C-95	—	—	—	7740	5810	9680
	24.00	P-110	—	—	—	6410	4810	8010
	28.00	P-110	—	—	—	7810	5860	9760
	32.00	P-110	—	—	—	9040	6780	11300
	32.00	Q125	—	—	—	10110	7580	12640
7	17.00	H-40	1220	920	1530	—	—	—
	20.00	H-40	1760	1320	2200	—	—	—
	20.00	J-55	2340	1760	2930	—	—	—
	23.00	J-55	2840	2130	3550	3130	2350	3910
	26.00	J-55	3340	2510	4180	3670	2750	4590
	20.00	K-55	2540	1910	3180	—	—	—
	23.00	K-55	3090	2320	3860	3410	2560	4260
	26.00	K-55	3640	2730	4550	4010	3010	5010
	23.00	C-75	—	—	—	4160	3120	5200
	26.00	C-75	—	—	—	4890	3670	6110
	29.00	C-75	—	—	—	5620	4220	7030
	32.00	C-75	—	—	—	6330	4750	7910
	35.00	C-75	—	—	—	7030	5270	8790
	38.00	C-75	—	—	—	7670	5750	9590
	23.00	L-80	—	—	—	4350	3260	5440
	26.00	L-80	—	—	—	5110	3830	6390
	29.00	L-80	—	—	—	5870	4400	7340
	32.00	L-80	—	—	—	6610	4960	8260
	35.00	L-80	—	—	—	7340	5510	9180
	38.00	L-80	—	—	—	8010	6010	10010
	23.00	N-80	—	—	—	4420	3320	5530
	26.00	N-80	—	—	—	5190	3890	6490
	29.00	N-80	—	—	—	5970	4480	7460
	32.00	N-80	—	—	—	6720	5040	8400
	35.00	N-80	—	—	—	7460	5600	9330
	38.00	N-80	—	—	—	8140	6110	10180
	23.00	C-90	—	—	—	4790	3590	5990
	26.00	C-90	—	—	—	5630	4220	7040
	29.00	C-90	—	—	—	6480	4860	8100
	32.00	C-90	—	—	—	7290	5470	9110
	35.00	C-90	—	—	—	8090	6070	10110

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	38.00	C-90	—	—	—	8830	6620	11040
	42.70	C-90	**	**	**	**	**	**
	46.40	C-90	**	**	**	**	**	**
	50.10	C-90	**	**	**	**	**	**
	53.60	C-90	**	**	**	**	**	**
	57.10	C-90	**	**	**	**	**	**
	23.00	C-95	—	—	—	5050	3790	6310
	26.00	C-95	—	—	—	5930	4450	7410
	29.00	C-95	—	—	—	6830	5120	8540
	32.00	C-95	—	—	—	7680	5760	9600
	35.00	C-95	—	—	—	8530	6400	10660
	38.00	C-95	—	—	—	9310	6980	11640
	26.00	P-110	—	—	—	6930	5200	8660
	29.00	P-110	—	—	—	7970	5980	9960
	32.00	P-110	—	—	—	8970	6730	11210
	35.00	P-110	—	—	—	9960	7470	12450
	38.00	P-110	—	—	—	10870	8150	13590
	35.00	Q125	—	—	—	11150	8360	13940
	38.00	Q125	—	—	—	12160	9120	15200
7⅝	24.00	H-40	2120	1590	2650	—	—	—
	26.40	J-55	3150	2360	3940	3460	2600	4330
	26.40	K-55	3420	2570	4280	3770	2830	4710
	26.40	C-75	—	—	—	4610	3460	5760
	29.70	C-75	—	—	—	5420	4070	6780
	33.70	C-75	—	—	—	6350	4760	7940
	39.00	C-75	—	—	—	7510	5630	9390
	42.80	C-75	—	—	—	8520	6390	10650
	47.10	C-75	—	—	—	9530	7150	11910
	26.40	L-80	—	—	—	4820	3620	6030
	29.70	L-80	—	—	—	5670	4250	7090
	33.70	L-80	—	—	—	6640	4980	8300
	39.00	L-80	—	—	—	7860	5900	9830
	42.80	L-80	—	—	—	8910	6680	11140
	47.10	L-80	—	—	—	9970	7480	12460
	26.40	N-80	—	—	—	4900	3680	6130
	29.70	N-80	—	—	—	5750	4310	7190
	33.70	N-80	—	—	—	6740	5060	8430
	39.00	N-80	—	—	—	7980	5980	9980
	42.80	N-80	—	—	—	9060	6800	11330
	47.10	N-80	—	—	—	10130	7600	12660
	26.40	C-90	—	—	—	5320	3990	6650
	29.70	C-90	—	—	—	6250	4690	7810
	33.70	C-90	—	—	—	7330	5500	9160
	39.00	C-90	—	—	—	8670	6500	10840
	42.80	C-90	—	—	—	9840	7380	12300
	45.30	C-90	—	—	—	10450	7840	13060
	47.10	C-90	—	—	—	11000	8250	13750
	51.20	C-90	**	**	**	**	**	**
	55.30	C-90	**	**	**	**	**	**
	26.40	C-95	—	—	—	5600	4200	7000
	29.70	C-95	—	—	—	6590	4940	8240
	33.70	C-95	—	—	—	7720	5790	9650
	39.00	C-95	—	—	—	9140	6860	11430
	42.80	C-95	—	—	—	10370	7780	12960
	47.10	C-95	—	—	—	11590	8690	14490

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	29.70	P-110	—	—	—	7690	5770	9610
	33.70	P-110	—	—	—	9010	6760	11260
	39.00	P-110	—	—	—	10660	8000	13330
	42.80	P-110	—	—	—	12100	9080	15130
	47.10	P-110	—	—	—	13530	10150	16910
	39.00	Q125	—	—	—	11940	8960	14930
	42.80	Q125	—	—	—	13550	10160	16940
	45.30	Q125	—	—	—	14390	10790	17990
	47.10	Q125	—	—	—	15150	11360	18940
7¾	46.10	C-75	—	—	—	—	—	—
		L-80	—	—	—	—	—	—
		N-80	—	—	—	—	—	—
		C-90	—	—	—	—	—	—
		C-95	—	—	—	—	—	—
		P-110	—	—	—	—	—	—
		Q125	—	—	—	—	—	—
8⅝	28.00	H-40	2330	1750	2910	—	—	—
	32.00	H-40	2790	2090	3490	—	—	—
	24.00	J-55	2440	1830	3050	—	—	—
	32.00	J-55	3720	2790	4650	4170	3130	5210
	36.00	J-55	4340	3260	5430	4860	3650	6080
	24.00	K-55	2630	1970	3290	—	—	—
	32.00	K-55	4020	3020	5030	4520	3390	5650
	36.00	K-55	4680	3510	5850	5260	3950	6580
	36.00	C-75	—	—	—	6480	4860	8100
	40.00	C-75	—	—	—	7420	5570	9280
	44.00	C-75	—	—	—	8340	6260	10430
	49.00	C-75	—	—	—	9390	7040	11740
	36.00	L-80	—	—	—	6780	5090	8480
	40.00	L-80	—	—	—	7760	5820	9700
	44.00	L-80	—	—	—	8740	6560	10930
	49.00	L-80	—	—	—	9830	7370	12290
	36.00	N-80	—	—	—	6880	5160	8600
	40.00	N-80	—	—	—	7880	5910	9850
	44.00	N-80	—	—	—	8870	6650	11090
	49.00	N-80	—	—	—	9970	7480	12460
	36.00	C-90	—	—	—	7490	5620	9360
	40.00	C-90	—	—	—	8580	6440	10730
	44.00	C-90	—	—	—	9650	7240	12060
	49.00	C-90	—	—	—	10850	8140	13560
	36.00	C-95	—	—	—	7890	5920	9860
	40.00	C-95	—	—	—	9040	6780	11300
	44.00	C-95	—	—	—	10170	7630	12710
	49.00	C-95	—	—	—	11440	8580	14300
	40.00	P-110	—	—	—	10550	7910	13190
	44.00	P-110	—	—	—	11860	8900	14830
	49.00	P-110	—	—	—	13350	10010	16690
	49.00	Q125	—	—	—	14960	11220	18700
9⅝	32.30	H-40	2540	1910	3180	—	—	—
	36.00	H-40	2940	2210	3680	—	—	—
	36.00	J-55	3940	2960	4930	4530	3400	5660
	40.00	J-55	4520	3390	5650	5200	3900	6500

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	36.00	K-55	4230	3170	5290	4890	3670	6110
	40.00	K-55	4860	3650	6080	5610	4210	7010
	40.00	C-75	—	—	—	6940	5210	8680
	43.50	C-75	—	—	—	7760	5820	9700
	47.00	C-75	—	—	—	8520	6390	10650
	53.50	C-75	—	—	—	9990	7490	12490
	40.00	L-80	—	—	—	7270	5450	9090
	43.50	L-80	—	—	—	8130	6100	10160
	47.00	L-80	—	—	—	8930	6700	11160
	53.50	L-80	—	—	—	10470	7850	13090
	40.00	N-80	—	—	—	7370	5530	9210
	43.50	N-80	—	—	—	8250	6190	10310
	47.00	N-80	—	—	—	9050	6790	11310
	53.50	N-80	—	—	—	10620	7970	13280
	40.00	C-90	—	—	—	8040	6030	10050
	43.50	C-90	—	—	—	8990	6740	11240
	47.00	C-90	—	—	—	9870	7400	12340
	53.50	C-90	—	—	—	11570	8680	14460
	59.40	C-90	**	**	**	**	**	**
	64.90	C-90	**	**	**	**	**	**
	70.30	C-90	**	**	**	**	**	**
	75.60	C-90	**	**	**	**	**	**
	40.00	C-95	—	—	—	8470	6350	10590
	43.50	C-95	—	—	—	9480	7110	11850
	47.00	C-95	—	—	—	10400	7800	13000
	53.50	C-95	—	—	—	12200	9150	15250
	43.50	P-110	—	—	—	11060	8300	13830
	47.00	P-110	—	—	—	12130	9100	15160
	53.50	P-110	—	—	—	14220	10670	17780
	47.00	Q125	—	—	—	13600	10200	17000
	53.50	Q125	—	—	—	15950	11960	19940
10¾	32.75	H-40	2050	1540	2560	—	—	—
	40.50	H-40	3140	2360	3930	—	—	—
	40.50	J-55	4200	3150	5250	—	—	—
	45.50	J-55	4930	3700	6160	—	—	—
	51.00	J-55	5650	4240	7060	—	—	—
	40.50	K-55	4500	3380	5630	—	—	—
	45.50	K-55	5280	3960	6600	—	—	—
	51.00	K-55	6060	4550	7580	—	—	—
	51.00	C-75	7560	5670	9450	—	—	—
	55.50	C-75	8430	6320	10540	—	—	—
	51.00	L-80	7940	5960	9930	—	—	—
	55.50	L-80	8840	6630	11050	—	—	—
	51.00	N-80	8040	6030	10050	—	—	—
	55.50	N-80	8950	6710	11190	—	—	—
	51.00	C-90	6920	5190	8650	—	—	—
	55.50	C-90	7710	5780	9640	—	—	—
	59.40	C-90	**	**	**	**	**	**
	64.50	C-90	**	**	**	**	**	**
	73.20	C-90	**	**	**	**	**	**
	79.20	C-90	**	**	**	**	**	**
	85.30	C-90	**	**	**	**	**	**

TABLE 1.1 (cont.)

RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	51.00	C-95	9270	6950	11590	—	—	—
	55.50	C-95	10320	7740	12900	—	—	—
	51.00	P-110	10800	8100	13500	—	—	—
	55.50	P-110	12030	9020	15040	—	—	—
	60.70	P-110	13380	10040	16730	—	—	—
	65.70	P-110	14720	11040	18400	—	—	—
	60.70	Q125	15020	11270	18780	—	—	—
	65.70	Q125	16520	12390	20650	—	—	—
11¾	42.00	H-40	3070	2300	3840	—	—	—
	47.00	J-55	4770	3580	5960	—	—	—
	54.00	J-55	5680	4260	7100	—	—	—
	60.00	J-55	6490	4870	8110	—	—	—
	47.00	K-55	5090	3820	6360	—	—	—
	54.00	K-55	6060	4550	7580	—	—	—
	60.00	K-55	6930	5200	8660	—	—	—
	60.00	C-75	8690	6520	10860	—	—	—
	60.00	L-80	9130	6850	11410	—	—	—
	60.00	N-80	9240	6930	11550	—	—	—
	60.00	C-90	10110	7580	12640	—	—	—
	60.00	C-95	10660	8000	13330	—	—	—
	60.00	P-110	12420	9320	15530	—	—	—
	60.00	Q125	13950	10460	17440	—	—	—
13⅜	48.00	H-40	3220	2420	4030	—	—	—
	54.50	J-55	5140	3860	6430	—	—	—
	61.00	J-55	5950	4460	7440	—	—	—
	68.00	J-55	6750	5060	8440	—	—	—
	54.50	K-55	5470	4100	6840	—	—	—
	61.00	K-55	6330	4750	7910	—	—	—
	68.00	K-55	7180	5390	8980	—	—	—
	68.00	C-75	9060	6800	11330	—	—	—
	72.00	C-75	9780	7340	12230	—	—	—
	68.00	L-80	9520	7140	11900	—	—	—
	72.00	L-80	10290	7720	12860	—	—	—
	68.00	N-80	9630	7220	12040	—	—	—
	72.00	N-80	10400	7800	13000	—	—	—
	68.00	C-90	10570	7930	13210	—	—	—
	72.00	C-90	11420	8570	14280	—	—	—
	68.00	C-95	11140	8360	13930	—	—	—
	72.00	C-95	12040	9030	15050	—	—	—
	68.00	P-110	12970	9730	16210	—	—	—
	72.00	P-110	14020	10520	17530	—	—	—
	72.00	Q125	15760	11820	19700	—	—	—

TABLE 1.1 (cont.)
RECOMMENDED CASING MAKE-UP TORQUE
8-ROUND-THREAD CASING

1	2	3	4	5	6	7	8	9
Size: Outside Diameter in.	Nominal Weight, Threads and Coupling lb. per ft.	Grade	Torque, ft-lb					
			Short Thread			Long Thread		
			Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
*16	65.00	H-40	—	4390	—	—	—	—
	75.00	J-55	—	7100	—	—	—	—
	84.00	J-55	—	8170	—	—	—	—
	75.00	K-55	—	7520	—	—	—	—
	84.00	K-55	—	8650	—	—	—	—
*18⅝	87.50	H-40	—	5590	—	—	—	—
	87.50	J-55	—	7540	—	—	—	—
	87.50	K-55	—	7940	—	—	—	—
*20	94.00	H-40	—	5810	—	—	—	—
	94.00	J-55	—	7840	—	—	9070	—
	106.50	J-55	—	9130	—	—	10570	—
	133.00	J-55	—	11920	—	—	13800	—
	94.00	K-55	—	8240	—	—	9550	—
	106.50	K-55	—	9600	—	—	11130	—
	133.00	K-55	—	12530	—	—	14530	—

*See Par. 1.14h for make-up instructions
**End finish not yet specified

TABLE 1.1
TORQUE VALUES FOR EXTREMELINE CASING

The torque values listed below are recommended for use in conjunction with close visual examination to be sure the shoulder closes and to avoid excessive box swelling.

TORQUE, FT.-LBS.

Size Outside Diameter	J-55 & K-55			C-75, L-80, N-80, C-90			C-95, P-110			Q-125		
Inches	Min.	Aim	Max.	Min.	Aim	Max.	Min.	Aim	Max.	Min.	Aim	Max.
5	2500	2700	3000	3000	3200	3500	3500	3700	4000	4000	4200	4500
5½	2500	2700	3000	3000	3200	3500	3500	3700	4000	4000	4200	4500
6⅝	3000	3200	3500	3500	3700	4000	4000	4200	4500	4500	4700	5000
7	3000	3200	3500	3500	3700	4000	4000	4200	4500	4500	4700	5000
7⅝	3500	3700	4000	4000	4200	4500	4500	4700	5000	5000	5200	5500
8⅝	4000	4200	4500	4500	4700	5000	5000	5200	5500	5500	5700	6000
9⅝	4500	4700	5000	5000	5200	5500	6000	6200	6500	6500	6700	7000

NOTES:

(1) The outside shoulder is not a sealing surface; serves as a stop only.
(2) Torque values higher than those listed above may be considered under certain conditions, providing box swelling does not occur.
(3) Increased axial tension stress due to higher torque values could be excessive for sulfide service.
(4) If the connection does not shoulder when maximum torque is applied, it should be treated as a questionable joint as provided under Par. 1.16.
(5) Recommended make-up torque values for 10¾" are not available due to lack of data.

SECTION 2
RUNNING AND PULLING TUBING

Preparation and Inspection before Running

2.1 New tubing is delivered free of injurious defects as defined in the latest edition of API Spec 5CT and within the practical limits of the inspection procedures therein prescribed. Some Users have found that, for a limited number of critical well applications, these procedures do not result in tubing sufficiently free of defects to meet their needs for such critical applications. Various nondestructive inspection services have been employed by users to assure that the desired quality of tubing is being run. In view of this practice, it is suggested that the individual User:

a. Familiarize himself with inspection practices specified in the standards and employed by the respective Manufacturers, and with the definition of "injurious defect" contained in the standards.

b. Thoroughly evaluate *any* nondestructive inspection to be used by him on API tubular goods to assure himself that the inspection does in fact correctly locate and differentiate injurious defects from other variables which can be and frequently are sources of misleading "defect" signals with such inspection methods.

CAUTION: *Due to the permissible tolerance on the outside diameter immediately behind the tubing upset, the user is cautioned that difficulties may occur when wrap-around seal-type hangers are installed on tubing manufactured on the high side of the tolerance; therefore, it is recommended that the user select the joint of tubing to be installed at the top of the string.*

2.2 All tubing, whether new, used, or reconditioned, should always be handled with thread protectors in place. Tubing should be handled at all times on racks or on wooden or metal surfaces free of rocks, sand, or dirt other than normal drilling mud. When lengths of tubing are inadvertently dragged in the dirt, the threads should be recleaned and serviced again as outlined in Par. 2.9.

2.3 Before running in the hole for the first time, tubing should be drifted with an API drift mandrel to insure passage of pumps, swabs and packers.

2.4 Elevators should be in good repair and should have links of equal length.

2.5 Slip type elevators are recommended when running special clearance couplings, especially those beveled on the lower end.

2.6 Elevators should be examined to note if latch fitting is complete.

2.7 Spider slips which will not crush the tubing should be used. Slips should be examined before using to see that they are working together.

NOTE: *Slip and tong marks are injurious. Every possible effort should be made to keep such damage at a minimum by using proper up-to-date equipment.*

2.8 Tubing tongs which will not crush the tubing should be used on the body of the tubing and should fit properly to avoid unnecessary cutting of the pipe wall. Tong dies should fit properly and conform to the curvature of the tubing. The use of pipe wrenches is not recommended.

2.9 The following precautions should be taken in the preparation of tubing threads:

a. Immediately before running, remove protectors from both field end and coupling end and clean threads thoroughly, repeating as additional rows become uncovered.

b. Carefully inspect the threads. Those found damaged, even slightly, should be laid aside unless satisfactory means are available for correcting thread damage.

c. The length of each piece of tubing shall be measured prior to running. A steel tape calibrated in decimal feet to the nearest 0.01 ft should be used. The measurement should be made from the outermost face of the coupling or box to the position on the externally threaded end where the coupling or the box stops when the joint is made up powertight. The total of the individual lengths so measured will represent the unloaded length of the tubing string. The actual length under tension in the hole can be obtained by consulting graphs which are prepared for this purpose and which are available in most pipe handbooks.

d. Place clean protectors on field end of the pipe so that thread will not be damaged while rolling pipe onto the rack and pulling into the derrick. Several thread protectors may be cleaned and used repeatedly for this operation.

e. Check each coupling for make-up. If the stand-off is abnormally great check the coupling for tightness. Loose couplings should be removed, the thread thoroughly cleaned, fresh compound applied over the entire thread surfaces, then the coupling replaced and tightened before pulling the tubing into the derrick.

f. Before stabbing, liberally apply thread compound to the entire internally and externally threaded areas. It is recommended that high pressure modified thread compound as specified in the latest edition of API Bul 5A2: *Bulletin on Thread Compounds* be used, except in special cases where severe conditions are encountered, it is recommended that high pressure silicone thread compound as specified in the latest edition of Bul 5A2 be used.

g. Connectors used as tensile and lifting members should have their thread capacity carefully checked to assure that the connector can safely support the load.

h. Care should be taken when making up pup joints and connectors to assure that the mating threads are of the same size and type.

2.10 For high-pressure or condensate wells, additional precautions should be taken to insure tight joints as follows:

a. Couplings should be removed, and both the mill-end pipe thread and coupling thread thoroughly cleaned and inspected. To facilitate this operation, tubing may be ordered with couplings handling tight, which is approximately one turn beyond hand-tight, or may be ordered with the couplings shipped separately.

b. Thread compound should be applied to both the external and internal threads and the coupling should be reapplied handling tight. Field-end threads and the mating coupling threads should have thread compound applied just before stabbing.

2.11 When tubing is pulled into the derrick, care should be taken that the tubing is not bent, or couplings or protectors bumped.

Stabbing, Making Up, and Lowering

2.12 Do not remove thread protector from field end of tubing until ready to stab.

2.13 If necessary, apply thread compound over entire surface of threads just before stabbing. The brush or utensil used in applying thread compound should be kept free of foreign matter and the compound should never be thinned.

2.14 In stabbing, lower tubing carefully to avoid injuring threads. Stab vertically, preferably with assistance of man on stabbing board. If the tubing tilts to one side after stabbing, lift up, clean, and correct any damaged thread with three-cornered file, then carefully remove any filings and reapply compound over thread surface. Care should be exercised, especially when running doubles or triples, to prevent bowing and resulting errors in alignment when the tubing is allowed to rest too heavily on the coupling threads. Intermediate supports may be placed in the derrick to limit bowing of the tubing.

2.15 After stabbing, start screwing by hand or apply regular or power tubing tongs slowly. To prevent galling when making up connections in the field, the connections should be made up at a speed not to exceed 25 rpm. Power tubing tongs are recommended for high-pressure or condensate wells to insure uniform make-up and tight joints. Joints should be made up tight, approximately two turns beyond the hand-tight position, with care being taken not to gall the threads. When the additional preparation and inspection precautions for high-pressure or condensate wells are taken, the coupling will "float" or make up simultaneously at both ends until the proper number of turns beyond the hand-tight position have been obtained. The hand-tight position may be determined by checking several joints on the rack and noting the number of threads exposed when a coupling is made up with a torque of 50 ft-lb.

Field Make-Up

2.16 Joint life of tubing under repeated field make-up is inversely proportional to the field make-up torque applied. Therefore, in wells where leak resistance is not a great factor, minimum field make-up torque values should be used to prolong joint life. The use of power tongs for making up tubing made desirable the establishment of recommended torque values for each size, weight, and grade of tubing. Table 2.1 contains recommended optimum make-up torque values for non-upset, external upset, and integral joint tubing, based on 1% of the calculated joint pullout strength determined from the joint pullout strength formula for 8-round-thread casing in the latest edition of Bul 5C3: *Bulletin on Formulas and Calculations for Casing, Tubing, Drill Pipe and Line Pipe Properties.* Minimum torque values listed are 75% of optimum values and maximum torque values listed are 125% of optimum values. All values are rounded to the nearest 10 foot pounds. The torque values listed in Table 2.1 apply to tubing with zinc plated or phosphate coated couplings. When making up connections with tin plated couplings, 80% of the listed value can be used as a guide. When making up round thread connections with PTFE (Polytetrafluoroethylene)* rings, 70% of the listed values are recommended. As with standard couplings, make-up position shall govern. Buttress connections with PTFE (Polytetrafluoroethylene)* seal rings may make up at torque values different from those normally observed on standard buttress threads.

NOTE: *Thread galling of gall-prone materials (martensitic chromium steels—9Cr and 13Cr) occurs during movement — stabbing or pulling and make-up or breakout. Galling resistance of threads is primarily controlled in two areas — surface preparation and finishing during manufacture and careful handling practices during running and pulling. Threads and lubricant must be clean. Assembly in the horizontal position should be avoided. Connections should be turned by hand to the hand-tight position before slowly power tightening. The procedure should be reversed for disassembly.*

2.17 Spider slips and elevators should be cleaned frequently and slips should be kept sharp.

2.18. Finding bottom should be accomplished with extreme caution. Do not set tubing down heavily.

Pulling Tubing

2.19 A caliper survey prior to pulling a worn string of tubing will provide a quick means of segregating badly worn lengths for removal.

2.20 Break-out tongs should be positioned close to the coupling. Hammering the coupling to break the joint is an injurious practice. When tapping is required, use the flat face, never the peen face, of the hammer, and tap lightly at the middle and completely around the coupling, never near the end or on opposite sides only.

2.21 Great care should be exercised to disengage all of the thread before lifting the tubing out of the coupling. Do not jump tubing out of the coupling.

2.22 Tubing stacked in the derrick should be set on a firm wooden platform and without the bottom thread protector since the design of most protectors is not such as to support the joint or stand without damage to the field thread.

2.23 Protect threads from dirt or injury when the tubing is out of the hole.

2.24 Tubing set back in the derrick should be properly supported to prevent undue bending. Tubing 2⅜-in. OD and larger, preferably should be pulled in stands approximately 60 ft long or in doubles of range 2. Stands of tubing 1.900-in. OD or smaller, and stands longer than 60 ft, should have intermediate support.

2.25 Before leaving location, always firmly tie a set-back of tubing in place.

2.26 Make sure threads are undamaged, clean and well coated with compound before re-running.

2.27 Distribute joint and tubing wear by moving a length from the top of the string to the bottom each time the tubing is pulled.

2.28 In order to avoid leaks, all joints should be retightened occasionally.

2.29 When tubing is stuck, the best practice is to use a calibrated weight indicator. Do not be misled, by stretching of the tubing string, into the assumption that the tubing is free.

2.30 After a hard pull to loosen a string of tubing, all joints pulled on should be retightened.

2.31 All threads should be cleaned and lubricated or should be coated with a material that will minimize corrosion. Clean protectors should be placed on the tubing before it is laid down.

2.32 Before tubing is stored or re-used, pipe and threads should be inspected and defective joints marked for shopping and regaging.

*Teflon™ or equivalent