

# LOGAN

OIL TOOLS



String Book  
Keep Your String Together!

LOGAN OIL TOOLS manufactures a complete line of quality fishing tools and related products.

Providing quality downhole fishing tools at a fair price has been our primary goal since 1971. Decades of solid sales and service experience with fishing tools enables our staff to understand what service means to fishing tool operators, supervisors, and store managers.

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In addition to our eleven sales offices/stores located in California, Louisiana, Mississippi, North Dakota, Oklahoma, Pennsylvania, Texas, and Utah, we have four international stocking point facilities established in strategic locations around the globe — Edmonton, Canada; Aberdeen, Scotland; Dubai, United Arab Emirates; and Singapore — to maximize delivery needs.

For more information about our extensive line of fishing tools and related products, please contact our Sales and Service Department at:

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# String Book

KEEP YOUR STRING TOGETHER!

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# LOGAN SERIES 10 SUCKER ROD OVERSHOTS

## CALCULATED STRENGTHS

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

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

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

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

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

# LOGAN SERIES 10 SUCKER ROD OVERSHOTS

## CALCULATED STRENGTHS

| Bowl No. | Bowen | Max. Catch Size |         | O.D.<br>(in) | Spiral<br>Grapple | Load Capacity @ Yield Point (lbs)         |                 |            | Max. Make-up Torque<br>50% of Yield (ft/lbs) |                  |
|----------|-------|-----------------|---------|--------------|-------------------|-------------------------------------------|-----------------|------------|----------------------------------------------|------------------|
|          |       | Spiral          | Basket  |              |                   | Basket<br>Grapple (in)                    | Without<br>Stop | Catch Size | Top Sub<br>to Bowl                           | Bowl<br>to Guide |
| B2006    | 11482 | 1-13/16         | 1-5/8   | 2-5/16       | 118,100           | 1-660 down to, but not including 1-1/8"   | 85,100          |            | 1,050                                        | 445              |
|          |       |                 |         |              |                   | 1-1/8" down                               | 53,800          |            |                                              |                  |
| B2007    | 16072 | 1-15/16         | 1-3/4   | 2-1/4        | 55,700            | 1-3/4 down to, but not including 1-1/8"   | 40,100          |            | 650                                          | 335              |
|          |       |                 |         |              |                   | 1-1/8" down                               | 25,400          |            |                                              |                  |
| B2008    | 9402  | 2               | 1-13/16 | 2-5/16       | 55,700            | 1-13/16 down to, but not including 1-1/8" | 40,100          |            | 740                                          | 240              |
|          |       |                 |         |              |                   | 1-1/8" down                               | 25,400          |            |                                              |                  |
| B2009    | 9532  | 2               | 1-13/16 | 2-7/8        | 200,400           | 1-13/16 down to, but not including 1-1/8" | 144,400         |            | 3,200                                        | 1,050            |
|          |       |                 |         |              |                   | 1-1/8" down                               | 91,300          |            |                                              |                  |
| B2010    | 15861 | 2-3/8           | 2-3/16  | 2-27/32      | 70,000            | 2-3/16 down to, but not including 1-1/8"  | 51,100          |            | 1,850                                        | 500              |
|          |       |                 |         |              |                   | 1-1/8" down                               | 37,700          |            |                                              |                  |
|          |       |                 |         |              |                   |                                           |                 |            |                                              |                  |

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

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

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

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



# SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS

## CALCULATED STRENGTHS

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

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

Strengths are theoretical yield points that are accurate within 20%.

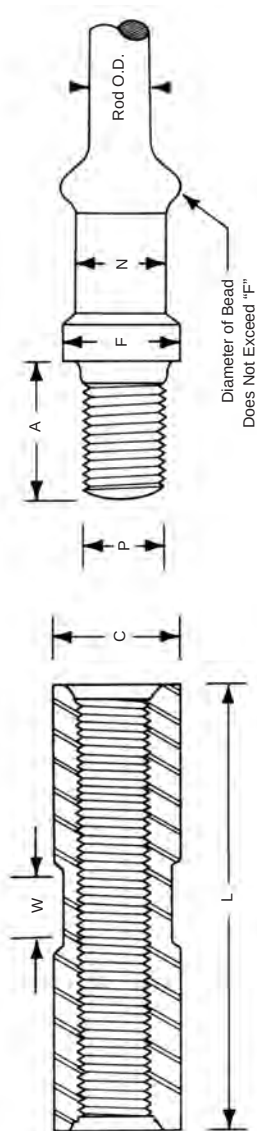
Strengths assume full grapple engagement of a round fish and a straight, steady pull.

Anything less than full engagement or steady, straight pulling will reduce the listed strength.

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



# SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS



## DIMENSIONS AND CALCULATED STRENGTHS

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

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

SERIES 20 SHORT CATCH SUCKER ROD OVERSHOTS

STRENGTH TABLE

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

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

# LOGAN SERIES 70 SHORT CATCH OVERSHOTS

## CALCULATED STRENGTHS

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

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

### Notes:

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

# LOGAN SERIES 70 SHORT CATCH OVERSHOTS

## CALCULATED STRENGTHS

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

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

### Notes:

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

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

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

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

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

LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

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



LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

CALCULATED STRENGTHS

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

# LOGAN SERIES 150 RELEASING & CIRCULATING OVERSHOTS

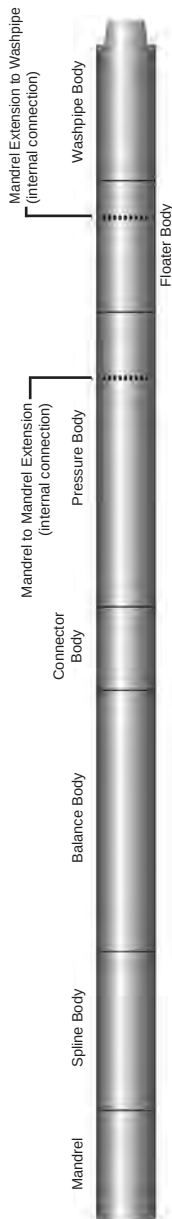
## CALCULATED STRENGTHS

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

Notes:

- 1) All strengths are calculated theoretical yield points and are accurate within 20%. All strengths assume a straight, steady pull and full grapple engagement of a round fish. Anything less than straight pulling or full engagement will substantially reduce the strength.
- 2) No tong marks should be applied to the bowl. Tong marks and other surface damage to the bowl will also reduce the strength.

# LOGAN SUPERIOR HYDRAULIC FISHING JARS



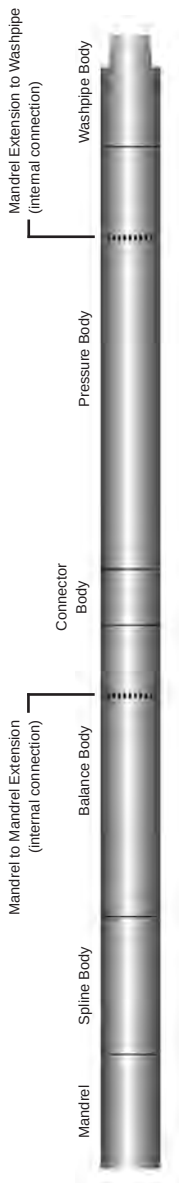
## STRENGTH AND TEST DATA

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

## MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

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

# LOGAN SUPERIOR ENERGIZERS



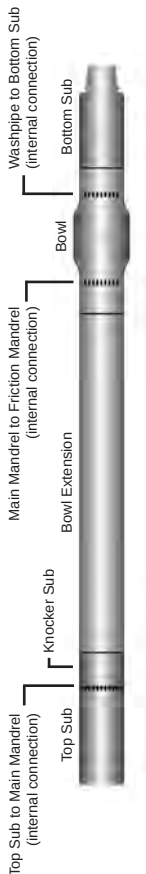
## STRENGTH AND TEST DATA

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

## MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

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

# LOGAN SURFACE BUMPER JARS



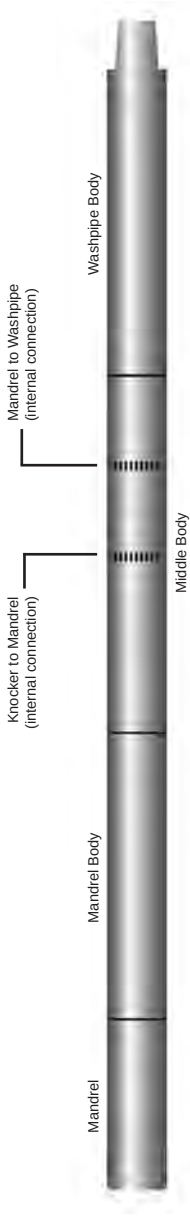
## STRENGTH AND TEST DATA

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

## MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

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

# LOGAN LUBRICATED FISHING BUMPER SUBS



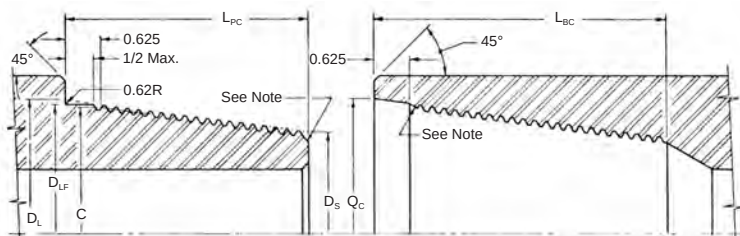
## STRENGTH AND TEST DATA

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

## MAXIMUM RECOMMENDED TIGHTENING TORQUES (FT-LBS)

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

# API NUMBERED ROTARY SHOULDERS CONNECTIONS



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

| Conn.<br>No. * | Thread<br>Form,<br>Inch<br>Radius | Thds.<br>Per In | Taper,<br>In/Ft<br>on Dia. | Thread<br>Pitch Dia.<br>@ Gauge Pt.<br>C | Lg. Dia.<br>of Pin,<br>Reference<br>DL | Flat<br>on Pin<br>DLF<br>± 1/64 | Sm. Dia<br>of Pin<br>Ds<br>+0 -3/8 | Box<br>Depth<br>Lbc<br>+0 -3/8 | Pin<br>Length<br>Lpc<br>+0 -1/8 | Box<br>Counterbore<br>Qc<br>+1/32 -0 |
|----------------|-----------------------------------|-----------------|----------------------------|------------------------------------------|----------------------------------------|---------------------------------|------------------------------------|--------------------------------|---------------------------------|--------------------------------------|
| 23             | 0.038                             | 4               | 2                          | 2.355                                    | 2.563                                  | 2.437                           | 2.063                              | 3-5/8                          | 3                               | 2-5/8                                |
| 26 **          | 0.038                             | 4               | 2                          | 2.668                                    | 2.876                                  | 2.750                           | 2.376                              | 3-5/8                          | 3                               | 2-15/16                              |
| 31 **          | 0.038                             | 4               | 2                          | 3.183                                    | 3.391                                  | 3.266                           | 2.808                              | 4-1/8                          | 3-1/2                           | 3-29/64                              |
| 35             | 0.038                             | 4               | 2                          | 3.531                                    | 3.739                                  | 3.625                           | 3.114                              | 4-3/8                          | 3-3/4                           | 3-13/16                              |
| 38 **          | 0.038                             | 4               | 2                          | 3.808                                    | 4.016                                  | 3.891                           | 3.349                              | 4-5/8                          | 4                               | 4-5/64                               |
| 40 **          | 0.038                             | 4               | 2                          | 4.072                                    | 4.280                                  | 4.156                           | 3.630                              | 5-1/8                          | 4-1/2                           | 4-11/32                              |
| 44             | 0.038                             | 4               | 2                          | 4.417                                    | 4.625                                  | 4.499                           | 3.875                              | 5-1/8                          | 4-1/2                           | 4-11/16                              |
| 46 **          | 0.038                             | 4               | 2                          | 4.626                                    | 4.834                                  | 4.709                           | 4.084                              | 5-1/8                          | 4-1/2                           | 4-29/32                              |
| 50 **          | 0.038                             | 4               | 2                          | 5.0417                                   | 5.250                                  | 5.125                           | 4.500                              | 5-1/8                          | 4-1/2                           | 5-5/16                               |
| 56             | 0.038                             | 4               | 3                          | 5.616                                    | 5.876                                  | 5.703                           | 4.626                              | 5-5/8                          | 5                               | 5-15/16                              |
| 61             | 0.038                             | 4               | 3                          | 6.178                                    | 6.438                                  | 6.266                           | 5.063                              | 6-1/8                          | 5-1/2                           | 6-1/2                                |
| 70             | 0.038                             | 4               | 3                          | 7.053                                    | 7.313                                  | 7.141                           | 6.813                              | 6-5/8                          | 6                               | 7-3/8                                |
| 77             | 0.038                             | 4               | 3                          | 7.741                                    | 8.000                                  | 7.828                           | 6.376                              | 7-1/8                          | 6-1/2                           | 8-1/16                               |

All dimensions are in inches.

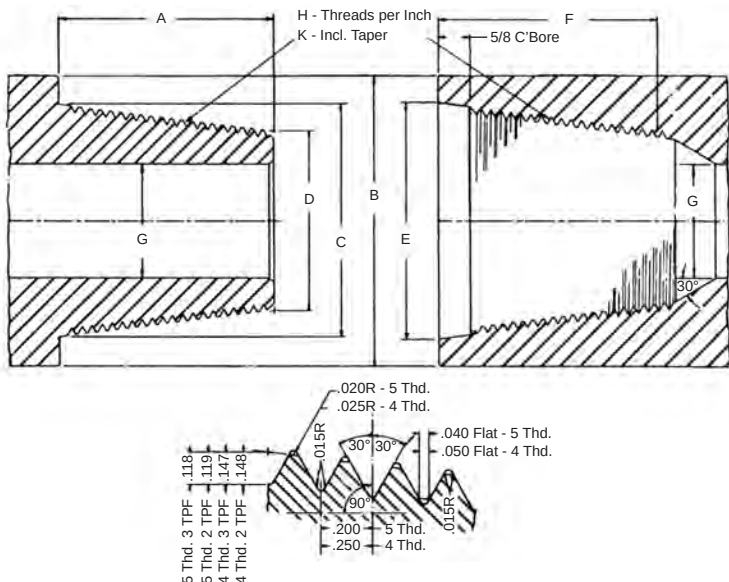
\* The connection number is the diameter of the connection at the gauge point rounded to units and tenths of inches.

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

**TABLE 12**  
**INTERCHANGEABILITY OF NUMBERED ROTARY SHOULDERS CONNECTIONS**  
**WITH TABLE 9.1 ROTARY SHOULDERS CONNECTIONS**

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

# API REGULAR — UNION TOOL REGULAR



## API REGULAR — UNION TOOL REGULAR

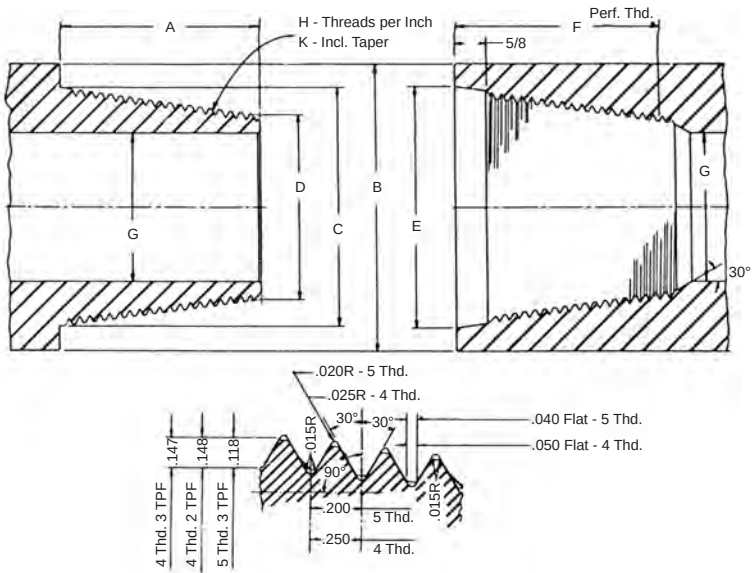
| Size     | A     | B       | C       | D       | E       | F     | G     | H | K |
|----------|-------|---------|---------|---------|---------|-------|-------|---|---|
| 2-3/8    | 3     | 3-1/8   | 2-5/8   | 1-7/8   | 2-11/16 | 3-3/8 | 1     | 5 | 3 |
| 2-7/8    | 3-1/2 | 3-3/4   | 3       | 2-1/8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

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

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



## API FULL HOLE — UNION TOOL FULL HOLE



### API FULL HOLE — UNION TOOL FULL HOLE

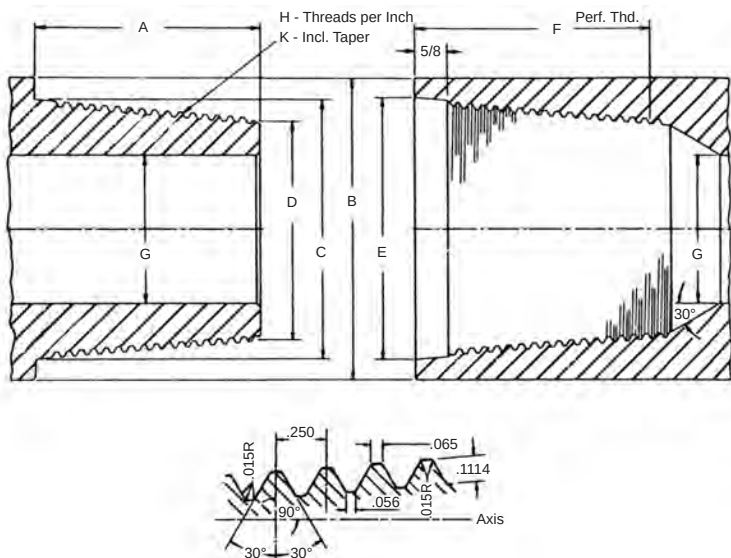
| Size    | A     | B     | C       | D       | E       | F      | G        | H   | K |
|---------|-------|-------|---------|---------|---------|--------|----------|-----|---|
| 2-7/8 * | 3-1/2 | 4-1/4 | 3-5/8   | 2-3/4   | 3-11/16 | 3-9/16 | 2-1/8    | 5   | 3 |
| 3-1/2   | 3-3/4 | 4-5/8 | 4       |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

\* Not API Standard.

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

† Thread form same as API-IF joint.

# API INTERNAL FLUSH — HUGHES AND REED LF



API INTERNAL FLUSH — HUGHES AND REED LF

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

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

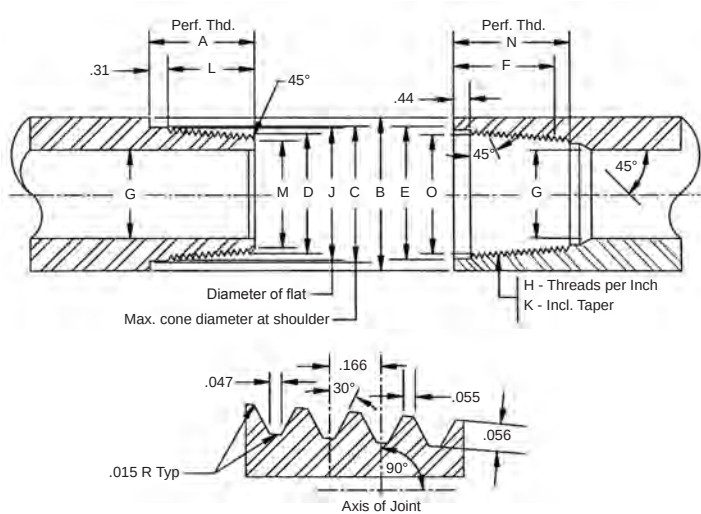
② Threaded portion same as 3-1/2" Hughes Slim Hole.

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

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

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

AMERICAN MT, AMT, AND AMMT \*

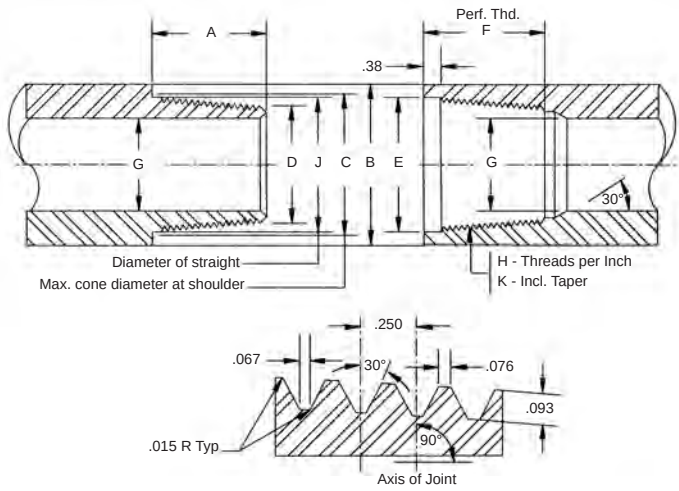


AMERICAN MT, AMT, AND AMMT

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

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

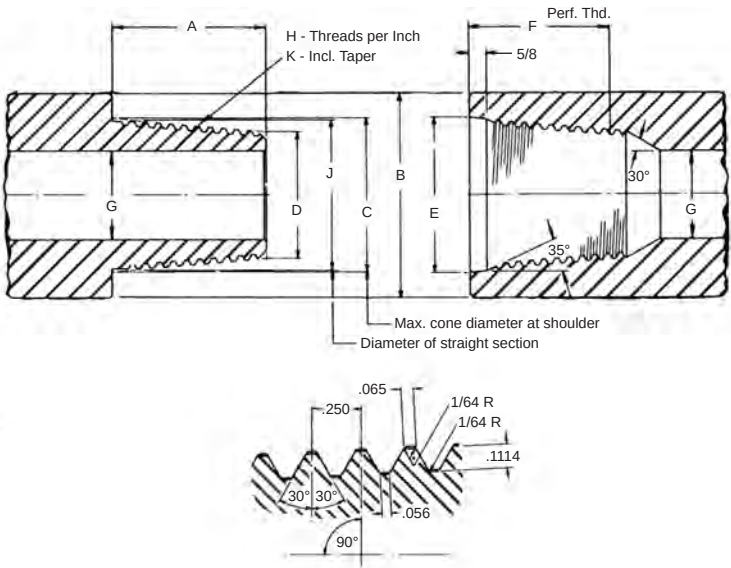
PAC



PAC

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

# HUGHES XTRA HOLE & REED EXTRA HOLE

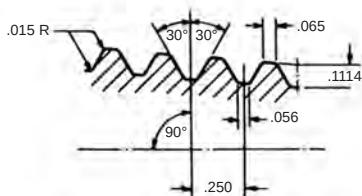
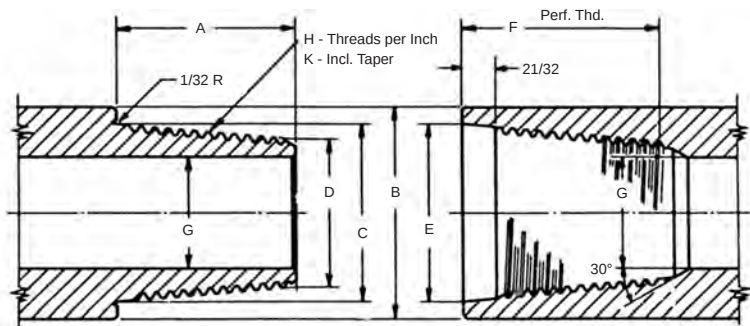


HUGHES XTRA HOLE & REED EXTRA HOLE

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

- ① Threaded portion same as 2-7/8" Reed Xtra Hole, 3-1/2" Reed Double Streamline, and 3-1/2" Hughes Double Streamline.
- ② Threaded portion same as 4-1/2" Hughes External Flush, 4-1/2" FH Reed External Flush, 4" Hughes Slim Hole, and 3-1/2" Reed Xtra Hole.
- ③ Threaded portion same as 4" API-IF, 5" Reed Double Sreamline, and 4-1/2" Reed Xtra Hole.
- ④ Threaded portion same as 4-1/2" API-IF, 5-1/2" Reed Double Sreamline, and 5" Reed Xtra Hole.

# HUGHES SLIM HOLE



## HUGHES SLIM HOLE

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

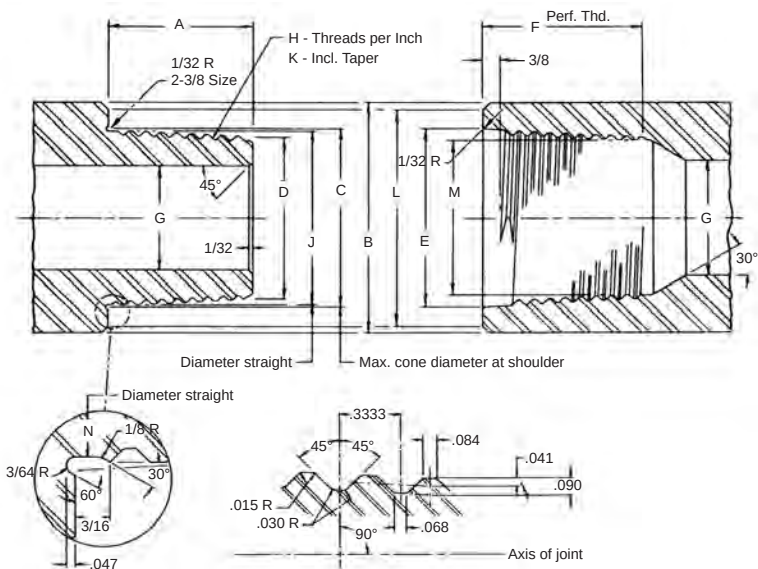
① Threaded portion same as 2-3/8" API-IF.

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

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

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

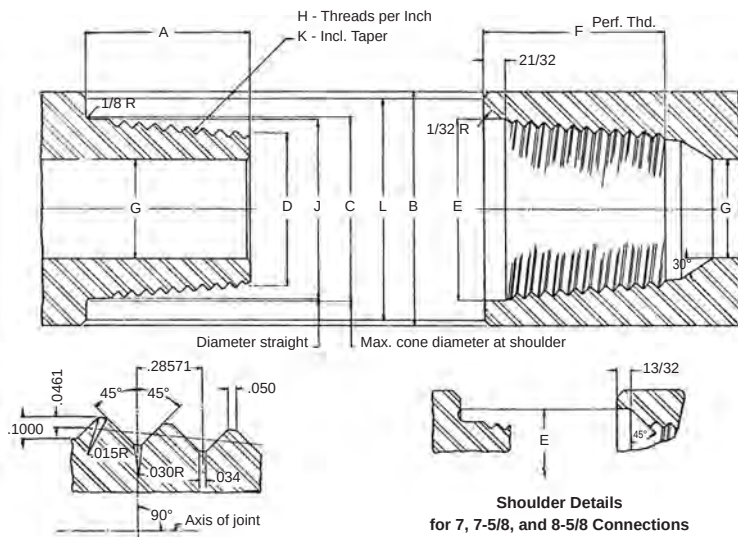
# HUGHES SLIMLINE H-90



## HUGHES SLIMLINE H-90

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

# HUGHES H-90



## HUGHES H-90

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



# HUGHES H-90

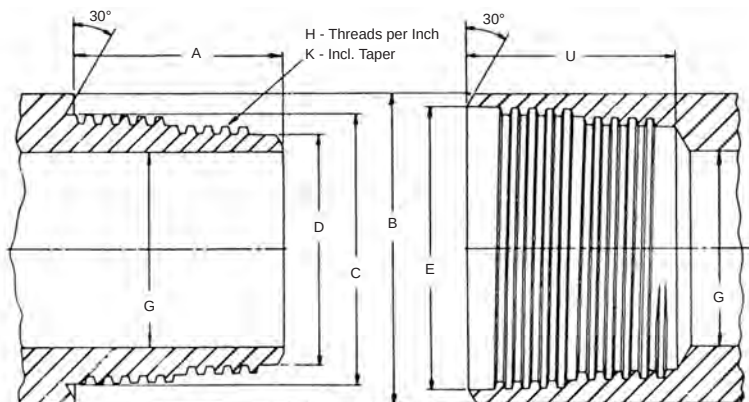
| Size  | A     | B                                                       | C       | D       | E       | F       | G                                                                                                           | H     | J       | K | L                                                  |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

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

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

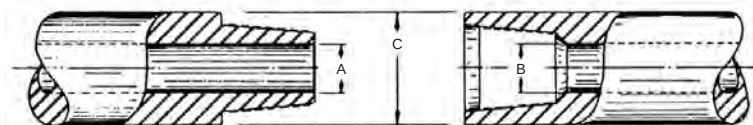
③ For drill collar ODs less than 10-3/4",  $E = 8.343$   
For drill collar ODs 10-3/4" or more,  $E = 9.375$

# HYDRIL JOINTS



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

## TOOL JOINT DIMENSIONS



**RECOMMENDED MAXIMUM AND MINIMUM**

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

# SEAMLESS DRILL PIPE PERFORMANCE PROPERTIES

NEW DRILL PIPE — DIMENSIONAL, TORSIONAL, AND TENSILE DATA

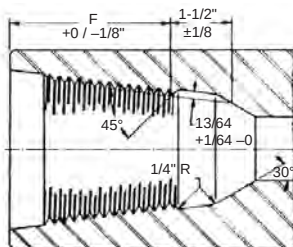
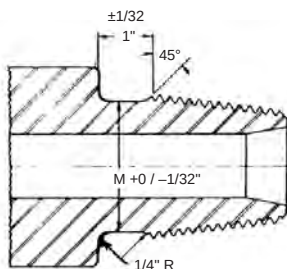
| Size<br>O.D.<br>(in) | Nominal<br>Weight<br>Threads &<br>Couplings<br>(lb/ft) | Plain<br>End<br>Weight<br>(lb/ft) | Wall<br>Thick-<br>ness<br>(in) | I.D.<br>(in) | Section<br>Area<br>Body of<br>Pipe<br>(sq in) | Polar<br>Sectional<br>Modulus<br>Z<br>(cu in) | Torsional Data *                  |   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

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

NEW DRILL PIPE COLLAPSE AND INTERNAL PRESSURE DATA

| Size<br>O.D.<br>(in) | Nom. Weight<br>Threads &<br>Couplings<br>(lb) | Collapse Pressure Based on<br>Minimum Values (psi) |       |       |       |       | Internal Pressure at<br>Minimum Yield Strength (psi) |       |       |       |       |
|----------------------|-----------------------------------------------|----------------------------------------------------|-------|-------|-------|-------|------------------------------------------------------|-------|-------|-------|-------|
|                      |                                               | D                                                  | E     | 95    | 105   | 135   | D                                                    | E     | 95    | 105   | 135   |
| 2-3/8                | 4.85                                          | 8100                                               | 11040 | 13980 | 15460 | 19070 | ...                                                  | 10500 | 13300 | 14700 | 18900 |
|                      | 6.65                                          | 11440                                              | 15600 | 19760 | 21840 | 28080 | 11350                                                | 15470 | 19600 | 21660 | 27850 |
| 2-7/8                | 6.85                                          | 7680                                               | 10470 | 12930 | 14010 | 17060 | ...                                                  | 9910  | 12550 | 13870 | 17830 |
|                      | 10.40                                         | 12110                                              | 16510 | 20910 | 23110 | 29720 | 12120                                                | 16530 | 20930 | 23140 | 29750 |
| 3-1/2                | 9.50                                          | 7400                                               | 10040 | 12060 | 13050 | 15780 | ...                                                  | 9520  | 12070 | 13340 | 17150 |
|                      | 13.30                                         | 10350                                              | 14110 | 17880 | 19760 | 25400 | 10120                                                | 13800 | 17480 | 19320 | 24840 |
| 4                    | 15.50                                         | 12300                                              | 16770 | 21250 | 23480 | 30190 | 12350                                                | 16840 | 21330 | 23570 | 30310 |
|                      | 11.85                                         | 6590                                               | 8410  | 9960  | 10700 | 12650 | ...                                                  | 8600  | 10890 | 12040 | 15480 |
| 4                    | 14.00                                         | 8330                                               | 11350 | 14380 | 15900 | 20170 | 7940                                                 | 10830 | 13720 | 15160 | 19490 |
|                      | 15.70                                         | 9460                                               | 12900 | 16340 | 18050 | 23210 | 9140                                                 | 12470 | 15790 | 17460 | 22440 |
| 4-1/2                | 13.75                                         | 5720                                               | 7200  | 8400  | 8950  | 10310 | ...                                                  | 7900  | 10010 | 11070 | 14230 |
|                      | 16.60                                         | 7620                                               | 10390 | 12750 | 13820 | 16800 | 7210                                                 | 9830  | 12450 | 13760 | 17690 |
| 5                    | 20.00                                         | 9510                                               | 12960 | 16420 | 18150 | 23330 | 9200                                                 | 12540 | 15890 | 17560 | 22580 |
|                      | 16.25                                         | 5560                                               | 6970  | 8090  | 8610  | 9860  | ...                                                  | 7770  | 9840  | 10880 | 13990 |
| 5                    | 19.50                                         | 7390                                               | 10000 | 12010 | 12990 | 15700 | 6970                                                 | 9500  | 12040 | 13300 | 17110 |
|                      | 25.60                                         | 9900                                               | 13500 | 17100 | 18900 | 24300 | 9620                                                 | 13120 | 16620 | 18380 | 23620 |
| 5-1/2                | 19.20                                         | 4910                                               | 6070  | 6930  | 7300  | 8120  | ...                                                  | 7250  | 9190  | 10160 | 13060 |
|                      | 21.90                                         | 6610                                               | 8440  | 10000 | 10740 | 12710 | 6320                                                 | 8610  | 10910 | 12060 | 15510 |
| 6-5/8                | 24.70                                         | 7670                                               | 10460 | 12920 | 14000 | 17050 | 7260                                                 | 9900  | 12540 | 13860 | 17830 |
|                      | 25.20                                         | 4010                                               | 4810  | 5310  | 5490  | 6040  | 4790                                                 | 6540  | 18280 | 9150  | 11770 |

# API DRILL COLLAR AND JOINT SIZES

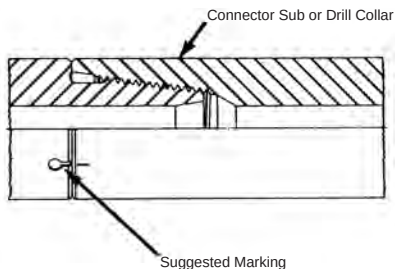


| Drill Collar Number * | Outside Dia. D | Bore +1/16 -0 d |                  | Length Ft. ± 6 in. L | Bevel Dia. ± 1/64 D <sub>F</sub> | Bending Strength Ratio | M       | F     |
|-----------------------|----------------|-----------------|------------------|----------------------|----------------------------------|------------------------|---------|-------|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

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

† Insufficient metal to accommodate stress relief grooves.

## RECOMMENDED PROCEDURE FOR MAKING UP DRILL COLLARS WITH NEW JOINTS



1. Thoroughly clean with distillate, pin and box threads and shoulder. After cleaning, the joint must be dried before lubricant is applied.
2. Coat all areas of the pin and box threads and shoulders with a thin even coat of a good grade lubricant from a covered or newly opened can. A molydisulfide lubricant is recommended.
3. Extreme care should be used when stabbing the joints to avoid stabbing wounds. If drill collar connecting subs are used, it is preferred that the subs be applied by hand rather than with lifting equipment.
4. Make up joints manually with chain tongs as far as possible and then use cathead to the full recommended torque as shown on attached chart.
5. Scribe vertical chalk line across joint make-up line of box and pin faces.
6. Break joint, clean and dry threads. Inspect the threads and joint faces carefully for evidence of galling or "hair like" slivers of steel. Stone or file all rough spots and remove slivers. Be careful not to remove chalk line across joint face.
7. Again make up joints manually with chain tongs as far as possible and then with cathead using full recommended torque. The joint must make up to the chalk mark or father. If the joint does not make up to this line, again break the joint, dry and clean. Inspect the threads and joint faces carefully and in general proceed as under 6 above.
8. If the joints make up to the chalk line or farther, a center punch mark shall be made on both the box and pin halves, adjacent to the shoulder, as permanent inspection mark. After each run, these match making spots should be inspected and as long as there is no creep between the two marks, the joints should be left unbroken if possible (nonworking joints). As the drill collars wear, it is recommended that the center punch marks be deepened so that they will always be in evidence. When it is noted that creep has occurred on the nonworking joints, they should be broken apart, inspected and if necessary recut.

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) \*

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

\* Adapted from API RP7G



# DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) \*

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

\* Adapted from API RP7G

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) \*

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

\* Adapted from API RP7G

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) \*

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

\* Adapted from API RP7G

DRILL COLLAR TORQUE RECOMMENDATIONS (FT-LBS) \*

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

\* Adapted from API RP7G

# TORQUE RANGE (FT-LBS)

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

\* Adapted from API RP7G

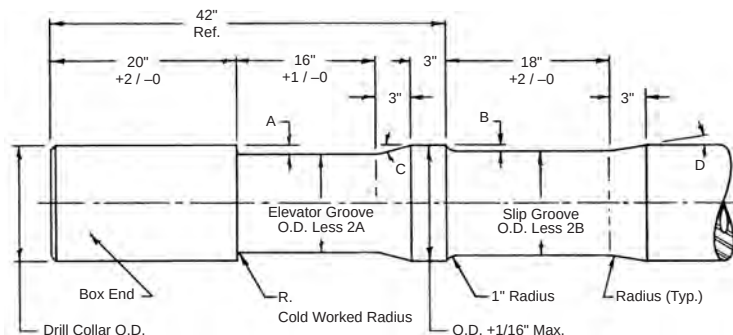
DRILL COLLAR WEIGHTS — POUNDS PER FOOT

| Collar<br>O.D. | Bore of Collar (in) |       |       |       |       |         |       |       |       |       |       |
|----------------|---------------------|-------|-------|-------|-------|---------|-------|-------|-------|-------|-------|
|                | 1-1/2               | 1-3/4 | 2     | 2-1/4 | 2-1/2 | 2-13/16 | 3     | 3-1/4 | 3-1/2 | 3-3/4 | 4     |
| 3-3/8          | 24.4                | 22.2  | ...   | ...   | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 3-1/2          | 26.7                | 24.5  | ...   | ...   | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 3-3/4          | 31.5                | 29.3  | ...   | ...   | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 3-7/8          | 34.0                | 31.9  | 29.4  | 26.5  | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 4              | 36.7                | 34.5  | 32.0  | 29.2  | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 4-1/8          | 39.4                | 37.2  | 34.7  | 31.9  | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 4-1/4          | 42.2                | 40.0  | 37.5  | 34.7  | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 4-1/2          | 48.0                | 45.8  | 43.3  | 40.5  | ...   | ...     | ...   | ...   | ...   | ...   | ...   |
| 4-3/4          | 54.2                | 52    | 49.5  | 46.7  | 43.5  | ...     | ...   | ...   | ...   | ...   | ...   |
| 5              | 60.1                | 58.5  | 55.9  | 53.1  | 49.9  | ...     | ...   | ...   | ...   | ...   | ...   |
| 5-1/4          | 67.5                | 65.3  | 62.8  | 59.9  | 56.8  | 53.3    | ...   | ...   | ...   | ...   | ...   |
| 5-1/2          | 74.7                | 72.5  | 69.9  | 67.2  | 63.9  | 60.5    | 56.7  | ...   | ...   | ...   | ...   |
| 5-3/4          | 82.1                | 79.9  | 77.5  | 74.6  | 71.5  | 67.9    | 64.1  | ...   | ...   | ...   | ...   |
| 6              | 89.9                | 87.8  | 85.3  | 82.5  | 79.3  | 75.8    | 71.9  | 67.8  | 63.3  | ...   | ...   |
| 6-1/4          | 98.1                | 95.9  | 93.5  | 90.6  | 87.5  | 83.9    | 80.1  | 75.9  | 71.5  | ...   | ...   |
| 6-1/2          | 106.6               | 104.5 | 101.9 | 99.1  | 95.9  | 92.5    | 88.6  | 84.5  | 79.9  | ...   | ...   |
| 6-3/4          | 115.5               | 113.3 | 110.8 | 107.9 | 104.8 | 101.3   | 97.5  | 93.3  | 88.8  | ...   | ...   |
| 7              | 124.6               | 122.5 | 119.9 | 117.1 | 113.9 | 110.5   | 106.6 | 102.5 | 97.9  | 93.1  | 87.9  |
| 7-1/4          | 134.1               | 131.9 | 129.5 | 126.6 | 123.5 | 119.9   | 116.1 | 111.9 | 107.5 | 102.6 | 97.5  |
| 7-1/2          | 143.9               | 141.7 | 139.3 | 136.5 | 133.3 | 129.8   | 125.9 | 121.8 | 117.3 | 112.5 | 107.3 |
| 7-3/4          | 154.1               | 151.9 | 149.5 | 146.6 | 143.5 | 139.9   | 136.1 | 131.9 | 127.5 | 122.6 | 117.5 |
| 8              | 164.6               | 162.5 | 159.9 | 157.1 | 153.9 | 150.5   | 146.6 | 142.5 | 137.9 | 133.1 | 127.9 |
| 8-1/4          | 175.4               | 173.3 | 170.8 | 167.9 | 164.8 | 161.3   | 157.5 | 153.3 | 148.8 | 143.9 | 138.8 |
| 8-1/2          | 186.6               | 184.4 | 181.9 | 179.1 | 175.9 | 168.6   | 164.5 | 160.5 | 155.9 | 151.1 | 145.9 |
| 8-3/4          | 198.1               | 195.9 | 193.9 | 190.6 | 187.4 | 183.9   | 180.1 | 175.9 | 171.4 | 166.6 | 161.5 |
| 9              | ...                 | 207.8 | 205.3 | 202.4 | 199.3 | 195.8   | 191.9 | 187.8 | 183.3 | 178.5 | 173.3 |
| 9-1/2          | ...                 | 232.4 | 229.9 | 227.1 | 223.9 | 220.4   | 216.6 | 212.4 | 207.9 | 203.1 | 197.9 |
| 10             | ...                 | ...   | 255.9 | 253.1 | 249.9 | 246.4   | 242.6 | 238.4 | 233.9 | 229.1 | 223.9 |
| 10-1/2         | ...                 | ...   | 283.3 | 280.4 | 277.3 | 273.8   | 269.9 | 265.8 | 261.3 | 256.4 | 251.3 |
| 11             | ...                 | ...   | ...   | ...   | 305.9 | 302.4   | 298.6 | 294.4 | 289.9 | 285.1 | 279.9 |

# APPROXIMATE WEIGHTS OF 30' SPIRAL DRILL COLLARS

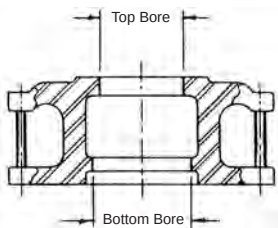
| O.D. (in) | Bore of Collar (in) |       |       |      |       |       |         |      |       |       |
|-----------|---------------------|-------|-------|------|-------|-------|---------|------|-------|-------|
|           | 13/16               | 1-1/2 | 1-3/4 | 2    | 2-1/4 | 2-1/2 | 2-13/16 | 3    | 3-1/4 | 3-1/2 |
| 3-1/8     | 654                 | ...   | ...   | ...  | ...   | ...   | ...     | ...  | ...   | ...   |
| 3-1/2     | ...                 | 769   | 785   | ...  | ...   | ...   | ...     | ...  | ...   | ...   |
| 4-1/8     | ...                 | 1135  | 1071  | 1000 | 919   | ...   | ...     | ...  | ...   | ...   |
| 4-1/2     | ...                 | 1385  | 1323  | 1250 | 1169  | ...   | ...     | ...  | ...   | ...   |
| 4-3/4     | ...                 | 1564  | 1501  | 1428 | 1348  | 1256  | ...     | ...  | ...   | ...   |
| 5         | ...                 | 1751  | 1689  | 1616 | 1535  | 1443  | ...     | ...  | ...   | ...   |
| 5-1/4     | ...                 | 1947  | 1854  | 1812 | 1731  | 1639  | 1538    | ...  | ...   | ...   |
| 5-1/2     | ...                 | 2154  | 2091  | 2019 | 1933  | 1846  | 1745    | 1636 | ...   | ...   |
| 5-3/4     | ...                 | 2370  | 2307  | 2235 | 2154  | 2062  | 1931    | 1852 | ...   | ...   |
| 6         | ...                 | 2595  | 2531  | 2460 | 2379  | 2257  | 2166    | 2076 | 1956  | 1326  |
| 6-1/4     | ...                 | ...   | 2739  | 2637 | 2606  | 2514  | 2413    | 2304 | 2183  | 2053  |
| 6-1/2     | ...                 | ...   | 3018  | 2946 | 2961  | 2773  | 2673    | 2565 | 2442  | 2313  |
| 6-3/4     | ...                 | ...   | 3277  | 3205 | 3125  | 3033  | 2932    | 2822 | 2701  | 2572  |
| 7         | ...                 | ...   | 3537  | 3465 | 3384  | 3292  | 3191    | 3082 | 2961  | 2831  |
| 7-1/4     | ...                 | ...   | ...   | 3724 | 3643  | 3551  | 3430    | 3341 | 3220  | 3090  |
| 7-1/2     | ...                 | ...   | ...   | 4012 | 3931  | 3859  | 3733    | 3629 | 3508  | 3378  |
| 7-3/4     | ...                 | ...   | ...   | 4300 | 4219  | 4127  | 4026    | 3917 | 3796  | 3660  |
| 8         | ...                 | ...   | ...   | 4617 | 4536  | 4444  | 4343    | 4234 | 4115  | 3913  |
| 8-1/4     | ...                 | ...   | ...   | ...  | 4655  | 4761  | 4660    | 4550 | 4425  | 4300  |
| 8-1/2     | ...                 | ...   | ...   | ...  | 5170  | 5077  | 4977    | 4867 | 4746  | 4617  |
| 8-3/4     | ...                 | ...   | ...   | ...  | 5515  | 5429  | 5322    | 5213 | 5092  | 4912  |
| 9         | ...                 | ...   | ...   | ...  | 5832  | 5740  | 5639    | 5530 | 5409  | 5214  |
| 9-1/4     | ...                 | ...   | ...   | ...  | 6206  | 6114  | 6013    | 5904 | 5783  | 5653  |
| 9-1/2     | ...                 | ...   | ...   | ...  | 6552  | 6456  | 6359    | 6250 | 6129  | 5919  |
| 9-3/4     | ...                 | ...   | ...   | ...  | 6926  | 6834  | 6733    | 6674 | 6503  | 6375  |
| 10        | ...                 | ...   | ...   | ...  | 7309  | 7209  | 7108    | 6998 | 6877  | 6745  |
| 10-1/4    | ...                 | ...   | ...   | ...  | 7704  | 7612  | 7511    | 7402 | 7281  | 7151  |
| 10-1/2    | ...                 | ...   | ...   | ...  | 8076  | 7988  | 7885    | 7776 | 7655  | 7525  |
| 10-3/4    | ...                 | ...   | ...   | ...  | 8510  | 8418  | 8317    | 8208 | 8081  | 7957  |
| 11        | ...                 | ...   | ...   | ...  | ...   | 8821  | 8720    | 8611 | 8405  | 8361  |
| 11-1/4    | ...                 | ...   | ...   | ...  | ...   | 9253  | 9153    | 9043 | 8922  | 8793  |

# DRILL COLLAR GROOVES FOR ELEVATORS AND SLIPS



**GROOVE DIMENSIONS BASED ON DRILL COLLAR O. D.**

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



**ELEVATOR BORES BASED ON DRILL COLLAR O.D.**

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

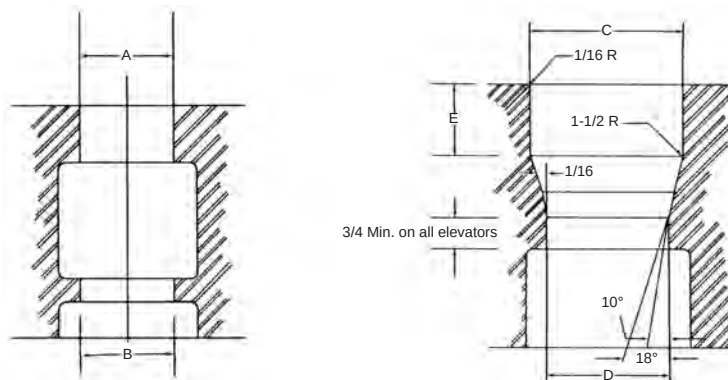
\* A and B dimensions are from nominal O.D. of new drill collar.

† Angle C and D dimensions are reference and approximate.

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



# ELEVATOR BORE CHARTS



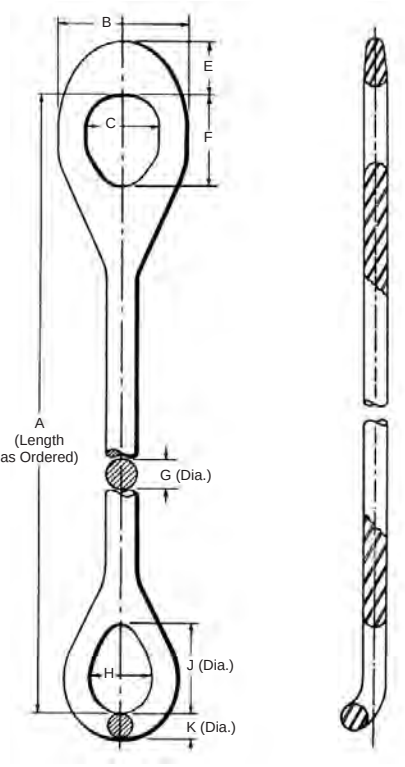
**COLLAR-TYPE TOOL JOINTS**

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

**18° TAPER-TYPE WELDED-ON TOOL JOINTS**

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

WEB WILSON® FORGED LINKS



PRINCIPAL DIMENSIONS

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

# WELD-ON TYPE TOOL JOINTS MAKE-UP TORQUE

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

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

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

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

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

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

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

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

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



# TUBING SIZES — THREADED AND COUPLED TYPES

## NON-UPSET

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

## EXTERNAL UPSET

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

# TUBING MAKE-UP TORQUE

## NON-UPSET RECOMMENDED MAKE-UP TORQUE \*

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

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

## TUBING MAKE-UP TORQUE

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

### NON-UPSET RECOMMENDED MAKE-UP TORQUE \*

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

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

# TUBING MAKE-UP TORQUE

## EXTERNAL UPSET RECOMMENDED MAKE-UP TORQUE \*

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

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# TUBING MAKE-UP TORQUE

## EXTERNAL UPSET RECOMMENDED MAKE-UP TORQUE \*

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

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

## INTEGRAL JOINT RECOMMENDED MAKE-UP TORQUE \*

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

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

# TUBING MAKE-UP TORQUE

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

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

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

# TUBING MAKE-UP TORQUE

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

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

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

# TUBING MAKE-UP TORQUE

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

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

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



# TUBING MAKE-UP TORQUE

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

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

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

# TUBING MAKE-UP TORQUE

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

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

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

# TUBING MAKE-UP TORQUE

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

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

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

# TUBING MAKE-UP TORQUE

## ARMCO IJ NU-LOCK TUBING RECOMMENDED MAKE-UP TORQUE \*

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

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

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

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

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

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

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

# TUBING MAKE-UP TORQUE

## ARMCO SEAL-LOCK RECOMMENDED MAKE-UP TORQUE \*

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

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

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

## EXTREME LINE RECOMMENDED MAKE-UP TORQUE \*

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

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

# TUBING MAKE-UP TORQUE

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

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

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

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

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

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

# TUBING MAKE-UP TORQUE

## HYDRIL PH-6 MINIMUM MAKE-UP TORQUE \*

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

## HYDRIL PH-4 MINIMUM MAKE-UP TORQUE \*

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

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

# TUBING MAKE-UP TORQUE

## HYDRIL FJ TUBING MINIMUM MAKE-UP TORQUE \*

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

## HYDRIL SUPER FJ TUBING MINIMUM MAKE-UP TORQUE \*

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

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



# TUBING MAKE-UP TORQUE

## HYDRIL CFJ-P TUBING MINIMUM MAKE-UP TORQUE \*

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

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

# TUBING MAKE-UP TORQUE

## MANNESMANN TDS RECOMMENDED MAKE-UP TORQUE \*

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

# TUBING MAKE-UP TORQUE

## VALLOUREC VAM RECOMMENDED MAKE-UP TORQUE \*

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

# TUBING MAKE-UP TORQUE

## VALLOUREC VAM RECOMMENDED MAKE-UP TORQUE \*

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

\* Data reprinted from Vallourec literature dated October 1982.

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

# TUBING MAKE-UP TORQUE

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

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

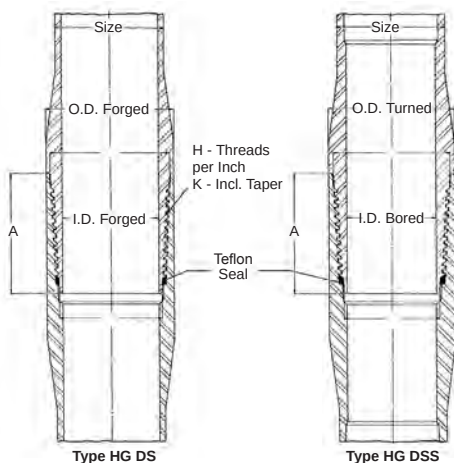
\* Data reprinted from Vallourec literature dated October 1982.

## VALLOUREC MINI-VAM RECOMMENDED MAKE-UP TORQUE \*

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

\* Data reprinted from Vallourec literature dated October 1982.

# ATLAS BRADFORD TUBING JOINTS



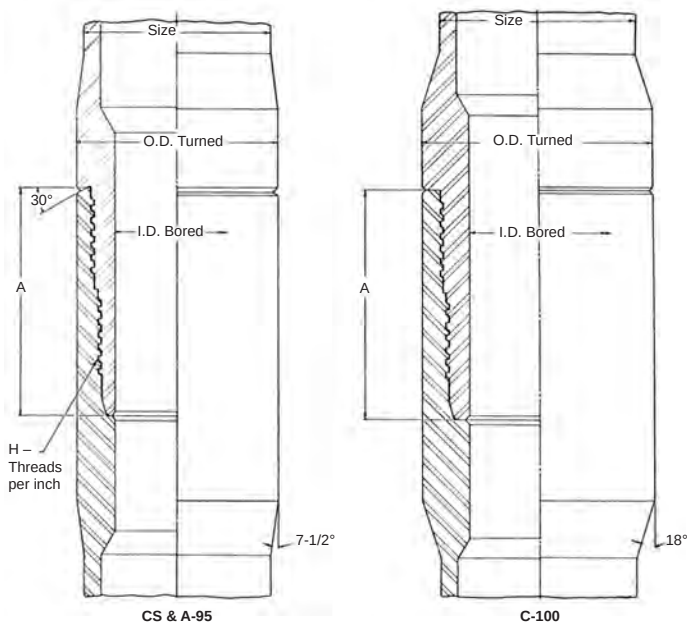
**TYPE HG DSS**

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

**TYPE HG DSS**

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

# HYDRIL TUBING JOINTS



HYDRIL TUBING JOINTS

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

TUBING PRESSURE RATING

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

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



# TUBING SETTING DEPTHS — TENSION AND COLLAPSE

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

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

\*\* NO SAFETY FACTOR.

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

† 42 gallons per barrel.

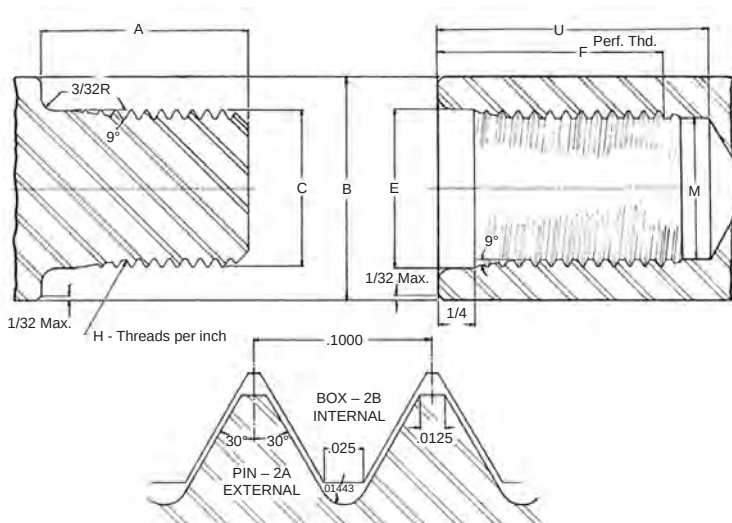
## STANDARD STEEL PIPE SIZES

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

## LINE PIPE SIZES STANDARD WEIGHT, THREADED

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

## SUCKER ROD CONNECTIONS



### THREAD FORM

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

### WRENCH FLATS ON SUCKER RODS

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

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

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

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

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

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

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

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

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

API DRIFT TEST

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

# CASING MAKE-UP TORQUE — SHORT THREAD

## RECOMMENDED MAKE-UP TORQUE \*

| O.D.<br>(in) | Nominal<br>Weight (lb/ft) | Grade | Torque (ft-lb) |         |         |
|--------------|---------------------------|-------|----------------|---------|---------|
|              |                           |       | Minimum        | Optimum | Maximum |
| 4-1/2        | 9.5                       | H-40  | 580            | 770     | 960     |
|              |                           | J-55  | 760            | 1010    | 1260    |
|              |                           | K-55  | 840            | 1120    | 1400    |
|              | 10.5                      | J-55  | 990            | 1320    | 1650    |
|              |                           | K-55  | 1100           | 1460    | 1830    |
|              | 11.6                      | J-55  | 1160           | 1540    | 1930    |
| 5            | 11.5                      | J-55  | 1000           | 1330    | 1660    |
|              |                           | K-55  | 1100           | 1470    | 1840    |
|              | 13.0                      | J-55  | 1270           | 1690    | 2110    |
|              |                           | K-55  | 1400           | 1860    | 2330    |
|              | 15.0                      | J-55  | 1550           | 2070    | 2590    |
|              |                           | K-55  | 1710           | 2280    | 2850    |
| 5-1/2        | 14.0                      | H-40  | 980            | 1300    | 1630    |
|              |                           | J-55  | 1290           | 1720    | 2150    |
|              |                           | K-55  | 1420           | 1890    | 2360    |
|              | 15.5                      | J-55  | 1520           | 2020    | 2530    |
|              |                           | K-55  | 1670           | 2220    | 2780    |
|              | 17.0                      | J-55  | 1720           | 2290    | 2860    |
| 6-5/8        | 20.0                      | K-55  | 1890           | 2520    | 3150    |
|              |                           | H-40  | 1380           | 1840    | 2300    |
|              |                           | J-55  | 1840           | 2450    | 3060    |
|              | 24.0                      | K-55  | 2000           | 2670    | 3340    |
|              |                           | J-55  | 2360           | 3140    | 3930    |
|              |                           | K-55  | 2570           | 3420    | 4230    |
| 7            | 17.0                      | H-40  | 920            | 1220    | 1530    |
|              | 20.0                      | H-40  | 1320           | 1760    | 2200    |
|              |                           | J-55  | 1760           | 2340    | 2930    |
|              |                           | K-55  | 1910           | 2540    | 3180    |
|              | 23.0                      | J-55  | 2130           | 2840    | 3550    |
|              |                           | K-55  | 2320           | 3090    | 3860    |
| 7-5/8        | 26.0                      | J-55  | 2510           | 3340    | 4180    |
|              | 24.0                      | K-55  | 2730           | 3640    | 4550    |
|              |                           | H-40  | 1590           | 2120    | 2650    |
|              |                           | J-55  | 2360           | 3150    | 3940    |
| 7-5/8        | 26.4                      | K-55  | 2570           | 3420    | 4280    |

# CASING MAKE-UP TORQUE — SHORT THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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



# CASING MAKE-UP TORQUE — SHORT THREAD

## RECOMMENDED MAKE-UP TORQUE\*

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

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# CASING MAKE-UP TORQUE — LONG THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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

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# CASING MAKE-UP TORQUE — LONG THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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

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# CASING MAKE-UP TORQUE — LONG THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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

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# CASING MAKE-UP TORQUE — LONG THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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

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# CASING MAKE-UP TORQUE — LONG THREAD

## RECOMMENDED MAKE-UP TORQUE \*

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

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

# DRILL BIT SPECIFICATIONS

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

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

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

# CASING BIT SIZES AND CLEARANCES

## API CASING

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



# CASING BIT SIZES AND CLEARANCES

## API CASING

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

# CASING BIT SIZES AND CLEARANCES

## NATIONAL SEAMLESS INTERNAL UPSET CASING — LIGHT UPSET, SHORT COUPLING

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

# CASING BIT SIZES AND CLEARANCES

## NATIONAL SEAMLESS INTERNAL UPSET CASING — HEAVY UPSET WITH SHORT COUPLING

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

① For Grade N-80

② Long Coupling

③ For Grade J-55

# CASING BIT SIZES AND CLEARANCES

## PITTSBURGH SPECIAL ACME THREAD CASING — INTERNAL UPSET

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

# CASING BIT SIZES AND CLEARANCES

## YOUNGSTOWN SPEED TITE CASING WITH HYDRIL TWO-STEP THREADS

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

# CASING BIT SIZES AND CLEARANCES

## SPANG-CHALFANT EXTREME LINE CASING

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

# CASING BIT SIZES AND CLEARANCES

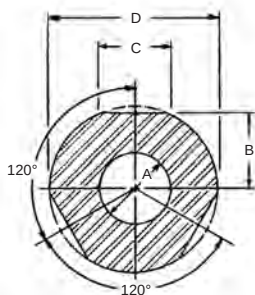
## J&L INTEGRAL JOINT SEAMLESS CASING — LIGHT UPSET

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

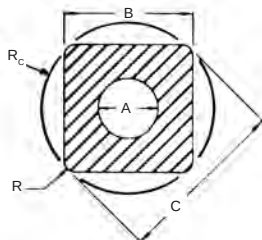
## J&L INTEGRAL JOINT SEAMLESS CASING — HEAVY UPSET

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

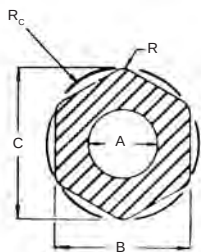
## KELLY CROSS-SECTION DIMENSIONS



THREE-SIDED KELLY



SQUARE KELLY



HEXAGONAL KELLY

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

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

### SQUARE KELLYS

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

\* Corner configuration at manufacturer's option

\*\* 6" square not API

### HEXAGONAL KELLYS

| API<br>Std. Size | Alternate | Max.<br>Bore A | Across<br>Flats B | Across<br>Corner C | Radius R | Radius Rc * |
|------------------|-----------|----------------|-------------------|--------------------|----------|-------------|
| 3                | ...       | 1-1/2          | 3                 | 3-3/8              | 1/4      | 1-11/16     |
| 3-1/2            | ...       | 1-3/4          | 3-1/2             | 3-31/32            | 1/4      | 1-31/32     |
| ...              | 3-1/2     | 2-1/4          | 3-3/4             | 4-1/4              | 5/16     | ...         |
| 4-1/4            | ...       | 2-1/4          | 4-1/4             | 4-13/16            | 5/16     | 2-25/64     |
| ...              | 4-1/2     | 2-1/4          | 4-27/32           | 5-1/2              | 5/16     | ...         |
| 5-1/4            | ...       | 3-1/4          | 5-14              | 5-31/32            | 3/8      | 2- 61/64    |
| ...              | 5-9/16    | 4              | 5-31/32           | 6-3/4              | 3/8      | ...         |
| 6                | ...       | 4              | 6                 | 6-13/16            | 3/8      | 3-13/32     |
| ...              | 6-5/8     | 4-1/4          | 6-27/32           | 7-3/4              | 1/2      | ...         |

\* Corner configuration at manufacturer's option



# KELLY WEIGHTS — POUNDS PER FOOT (DRIVE SECTION)

## TRI-KELLY® — THREE-SIDED KELLYS

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

## SQUARE KELLYS

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

## HEXAGONAL KELLYS

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

## BUOYANCY FACTOR FOR STEEL PIPE

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

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

\* Weight of water @ 68°F (20°C)

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

## RING JOINT — FLANGE DATA

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

### SUMMARY

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

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

# FLANGE DIMENSIONS

## STUDS, NUTS, AND RING GASKETS

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

# FLANGE DIMENSIONS

## STUDS, NUTS, AND RING GASKETS

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

# BRINELL HARDNESS TABLE

BRINELL (3,000 kg)

| Diameter | Number | Diameter | Number | Diameter | Number |
|----------|--------|----------|--------|----------|--------|
| 2.00     | 945    | 3.70     | 269    | 5.40     | 121    |
| 2.05     | 899    | 3.75     | 262    | 5.45     | 118    |
| 2.10     | 856    | 3.80     | 255    | 5.50     | 116    |
| 2.15     | 817    | 3.85     | 248    | 5.55     | 114    |
| 2.20     | 780    | 3.90     | 241    | 5.60     | 111    |
| 2.25     | 745    | 3.95     | 235    | 5.65     | 109    |
| 2.30     | 712    | 4.00     | 229    | 5.70     | 107    |
| 2.35     | 682    | 4.05     | 223    | 5.75     | 105    |
| 2.40     | 653    | 4.10     | 217    | 5.80     | 103    |
| 2.45     | 627    | 4.15     | 212    | 5.85     | 101    |
| 2.50     | 601    | 4.20     | 207    | 5.90     | 99.2   |
| 2.55     | 578    | 4.25     | 201    | 5.95     | 97.3   |
| 2.60     | 555    | 4.30     | 197    | 6.00     | 95.5   |
| 2.65     | 534    | 4.35     | 192    | 6.05     | 93.7   |
| 2.70     | 514    | 4.40     | 187    | 6.10     | 92.0   |
| 2.75     | 495    | 4.45     | 183    | 6.15     | 90.3   |
| 2.80     | 477    | 4.50     | 179    | 6.20     | 88.7   |
| 2.85     | 461    | 4.55     | 174    | 6.25     | 87.1   |
| 2.90     | 444    | 4.60     | 170    | 6.30     | 85.5   |
| 2.95     | 429    | 4.65     | 167    | 6.35     | 84.0   |
| 3.00     | 415    | 4.70     | 163    | 6.40     | 82.5   |
| 3.05     | 401    | 4.75     | 159    | 6.45     | 81.0   |
| 3.10     | 388    | 4.80     | 156    | 6.50     | 79.6   |
| 3.15     | 375    | 4.85     | 152    | 6.55     | 78.2   |
| 3.20     | 363    | 4.90     | 149    | 6.60     | 76.8   |
| 3.25     | 352    | 4.95     | 146    | 6.65     | 75.4   |
| 3.30     | 341    | 5.00     | 143    | 6.70     | 74.1   |
| 3.35     | 331    | 5.05     | 140    | 6.75     | 72.8   |
| 3.40     | 321    | 5.10     | 137    | 6.80     | 71.6   |
| 3.45     | 311    | 5.15     | 134    | 6.85     | 70.4   |
| 3.50     | 302    | 5.20     | 131    | 6.90     | 69.1   |
| 3.55     | 293    | 5.25     | 128    | 6.95     | 68.0   |
| 3.60     | 285    | 5.30     | 126    | 7.00     | 66.8   |
| 3.65     | 277    | 5.35     | 123    | ...      | ...    |

# HARDNESS TESTING CONVERSION TABLE

## APPROXIMATE VALUES

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

| Rockwell |     | Brinell No. | Scleroscope |
|----------|-----|-------------|-------------|
| C        | B   |             |             |
| 33       | ... | 311         | 46          |
| 32       | ... | 302         | 45          |
| 31       | ... | 293         | 43          |
| 30       | ... | 285         | 42          |
| 29       | ... | 277         | 41          |
| 28       | ... | 269         | 40          |
| 27       | ... | 262         | 39          |
| 25       | ... | 255         | 38          |
| 24       | ... | 248         | 37          |
| 23       | 100 | 241         | 36          |
| 22       | 99  | 235         | 35          |
| 21       | 98  | 229         | 34          |
| 19       | 97  | 223         | 34          |
| 18       | 96  | 217         | 33          |
| 16       | 96  | 212         | 33          |
| 15       | 95  | 207         | 32          |
| 14       | 94  | 201         | 31          |
| 13       | 93  | 197         | 30          |
| 12       | 92  | 192         | 29          |
| 10       | 91  | 187         | 29          |
| 9        | 90  | 183         | 28          |
| 8        | 89  | 179         | 27          |
| 6        | 88  | 174         | 27          |
| 5        | 87  | 170         | 26          |
| 4        | 86  | 167         | 26          |

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

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

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

# EQUIVALENCY CHART

## FRACTIONS, DECIMALS, AND MILLIMETERS

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

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



# LINE PULL x TONG LEVER CHART

## TORQUE IN FT-LBS

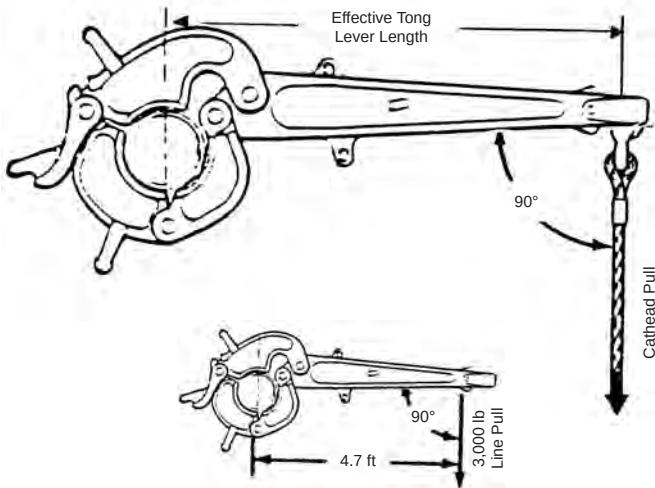
(LEVER LENGTHS APPROXIMATE)

| Line Pull<br>(lbs) | 24-1/2"        | 31-5/8"              | 33-3/8"        | 39-5/8"             | 41-1/2"                | 49-1/2"                          | 50"                  | 56-1/2"                         |
|--------------------|----------------|----------------------|----------------|---------------------|------------------------|----------------------------------|----------------------|---------------------------------|
|                    | WW "D"<br>Tong | WW "B"<br>Short Tong | WW "C"<br>Tong | WW "B"<br>Std. Tong | WW "AAX"<br>Short Tong | WW "AAX"<br>Std. Tong<br>& ST-60 | WW "H"<br>Short Tong | WW "H"<br>Std. Tong<br>& ST-160 |
| 500                | 1021           | 1318                 | 1391           | 1651                | 1729                   | 2063                             | 2083                 | 2354                            |
| 1000               | 2041           | 2635                 | 2781           | 3302                | 3458                   | 4125                             | 4166                 | 4708                            |
| 1500               | 3062           | 3953                 | 4172           | 4953                | 5187                   | 6188                             | 6249                 | 7062                            |
| 2000               | 4082           | 5270                 | 5562           | 6604                | 6916                   | 8250                             | 8332                 | 9416                            |
| 2500               | 5103           | 6588                 | 6953           | 8255                | 8645                   | 10313                            | 10415                | 11770                           |
| 3000               | 6123           | 7905                 | 8343           | 9906                | 10374                  | 12375                            | 12498                | 14124                           |
| 3500               | 7144           | 9223                 | 9734           | 11557               | 12103                  | 14438                            | 14581                | 16478                           |
| 4000               | 8164           | 10540                | 11124          | 13208               | 13832                  | 16500                            | 16664                | 18832                           |
| 4500               | 9185           | 11858                | 12515          | 14859               | 15561                  | 18563                            | 18747                | 21186                           |
| 5000               | 10205          | 13175                | 13905          | 16510               | 17290                  | 20625                            | 20830                | 23540                           |
| 5500               | 11226          | 14493                | 15296          | 18161               | 19019                  | 22688                            | 22913                | 25894                           |
| 6000               | 12246          | 15810                | 16686          | 19812               | 20748                  | 24750                            | 24996                | 28248                           |
| 6500               | 13267          | 17128                | 18077          | 21463               | 22477                  | 26813                            | 27079                | 30602                           |
| 7000               | 14287          | 18445                | 19467          | 23114               | 24206                  | 28875                            | 29162                | 32956                           |
| 7500               | 15308          | 19763                | 20858          | 24765               | 25935                  | 30938                            | 31245                | 35310                           |
| 8000               | 16328          | 21080                | 22248          | 26416               | 27664                  | 33000                            | 33328                | 37664                           |
| 8500               | 17349          | 22398                | 23639          | 28067               | 29393                  | 35063                            | 35411                | 40018                           |
| 9000               | 18369          | 23715                | 25029          | 29718               | 31122                  | 37125                            | 37494                | 42372                           |
| 9500               | 19390          | 25033                | 26420          | 31369               | 32851                  | 39188                            | 39577                | 44726                           |
| 10000              | 20410          | 26350                | 27810          | 33020               | 34580                  | 41250                            | 41660                | 47080                           |
| 10500              | 21431          | 27668                | 29201          | 34671               | 36309                  | 43313                            | 43743                | 49434                           |
| 11000              | 22451          | 28985                | 30591          | 36322               | 38038                  | 45375                            | 45826                | 51788                           |
| 11500              | 23472          | 30303                | 31982          | 37973               | 39767                  | 47438                            | 47909                | 54142                           |
| 12000              | 24492          | 31620                | 33372          | 39624               | 41496                  | 49500                            | 49992                | 56496                           |
| 12500              | 25513          | 32938                | 34763          | 41275               | 43225                  | 51563                            | 52075                | 58850                           |
| 13000              | 26533          | 34255                | 36153          | 42926               | 44954                  | 53625                            | 54158                | 61204                           |
| 13500              | 27554          | 35573                | 37544          | 44577               | 46683                  | 55688                            | 56241                | 63558                           |
| 14000              | 28574          | 36890                | 38934          | 46228               | 48412                  | 57750                            | 58324                | 65912                           |
| 14500              | 29595          | 38208                | 40325          | 47879               | 50141                  | 59813                            | 60407                | 68266                           |
| 15000              | 30615          | 39525                | 41715          | 49530               | 51870                  | 61875                            | 62490                | 70620                           |

# TORQUE OUTPUT WITH MANUAL TONGS

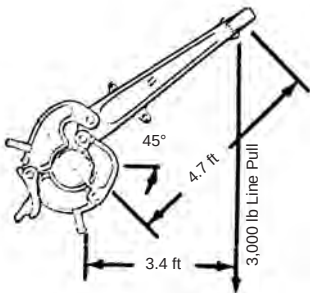
$$\text{LINE PULL (IN POUNDS)} \times \text{TONG LEVER LENGTH (IN FEET)} = \text{FT-LBS TORQUE}$$

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



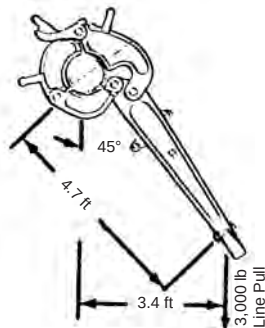
## FULLY EFFECTIVE TONG LEVER TORQUE

$$4.7 \text{ ft} \times 3,000 \text{ lb line pull} = 14,100 \text{ ft-lbs}$$



## INEFFECTIVE TONG LEVER TORQUE

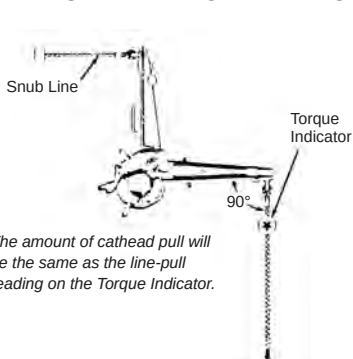
$$3.4 \text{ ft} \times 3,000 \text{ lb line pull} = 10,200 \text{ ft-lbs}$$



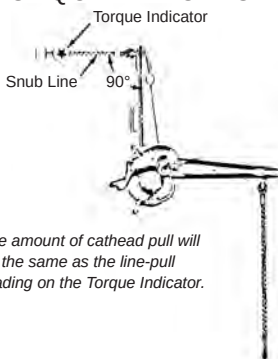
## INEFFECTIVE TONG LEVER TORQUE

$$3.4 \text{ ft} \times 3,000 \text{ lb line pull} = 10,200 \text{ ft-lbs}$$

# PROPER PLACEMENT OF TORQUE INDICATORS



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



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

**Step 1:** Look up the minimum recommended torque required.

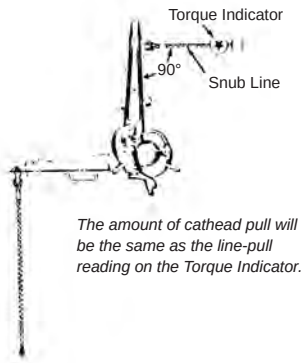
**Step 2:** Divide this torque value by the effective tong length.

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

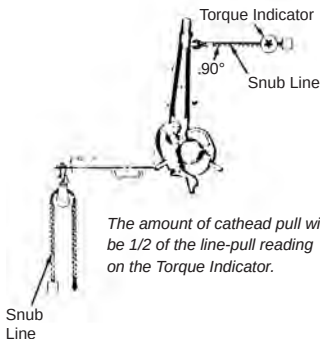
**Step 1:** Look up the minimum recommended torque required.

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

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



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



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

**Step 1:** Look up the minimum recommended torque required.

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

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

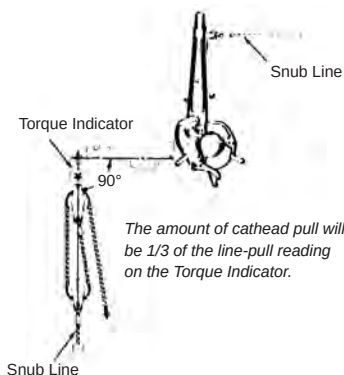
**Step 1:** Look up the minimum recommended torque required.

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

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

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

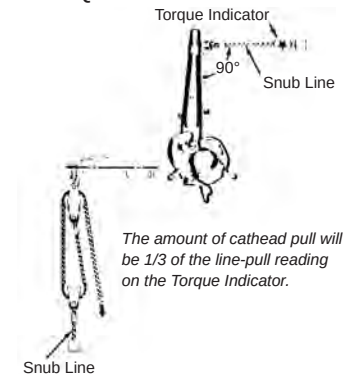
## PROPER PLACEMENT OF TORQUE INDICATORS



**Step 1:** Look up the minimum recommended torque required.

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

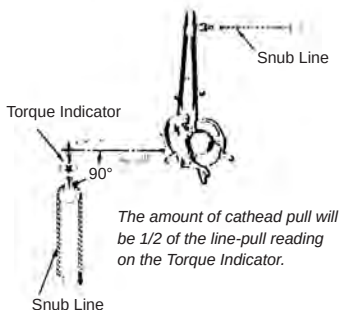
The answer is pounds pull reading for the line-pull indicator when in this position.



**Step 1:** Look up the minimum recommended torque required.

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

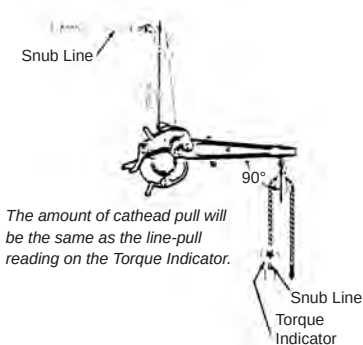
The answer is pounds pull reading for the line-pull indicator when in this position.



**Step 1:** Look up the minimum recommended torque required.

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

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



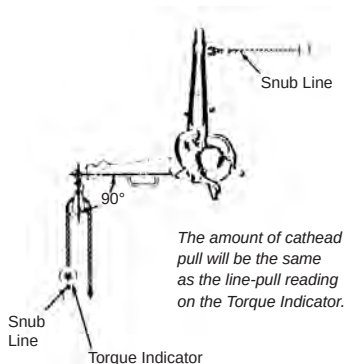
**Step 1:** Look up the minimum recommended torque required.

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

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

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

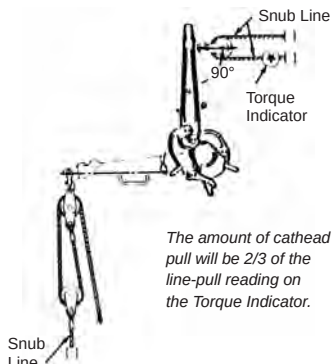
# PROPER PLACEMENT OF TORQUE INDICATORS



**Step 1:** Look up the minimum recommended torque required.

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

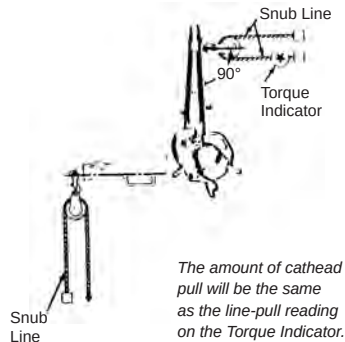
**Step 3:** Divide this by 2. This will be the pounds pull reading for the line-pull indicator when in this position.



**Step 1:** Look up the minimum recommended torque required.

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

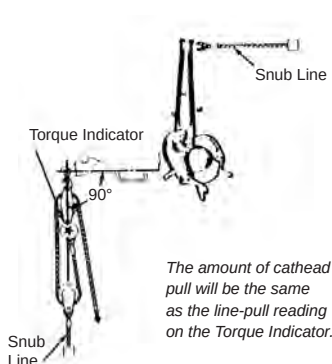
**Step 3:** Divide this by 2. This will be the pounds pull reading for the line-pull indicator when in this position.



**Step 1:** Look up the minimum recommended torque required.

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

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



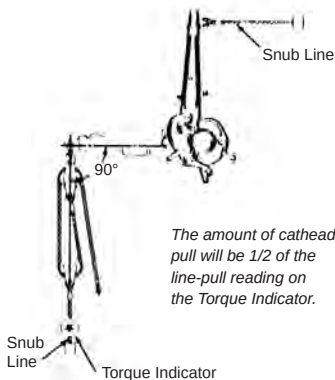
**Step 1:** Look up the minimum recommended torque required.

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

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

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

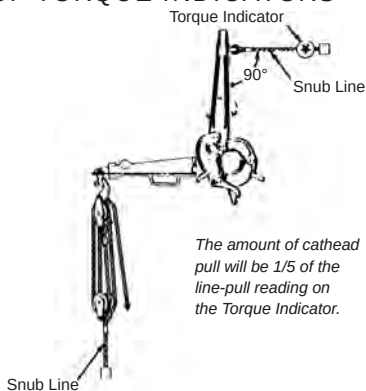
## PROPER PLACEMENT OF TORQUE INDICATORS



**Step 1:** Look up the minimum recommended torque required.

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

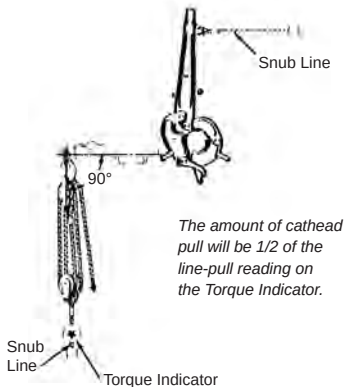
**Step 3:** Divide this by 3 and multiply by 2. This will be the pounds pull reading for the line-pull indicator when in this position.



**Step 1:** Look up the minimum recommended torque required.

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

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



**Step 1:** Look up the minimum recommended torque required.

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

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

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

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

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

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

# WORN ELEVATORS, TOOL JOINTS, LINK ARMS AND LINK EARS

## How to Measure Wear on Elevators and Tool Joints

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

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

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

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



Figure 1

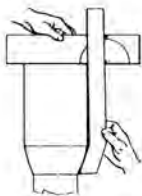


Figure 2

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

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

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

## Inspection Gauge for Elevators and Tool Joints

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

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

## Evaluation of Wear

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

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

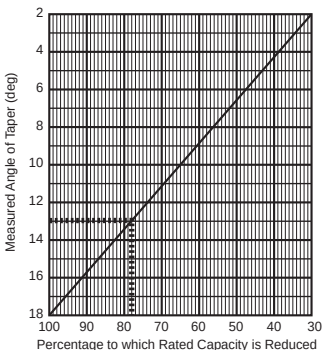


Figure 3

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

## Periodic Inspection (See API RP8B)

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

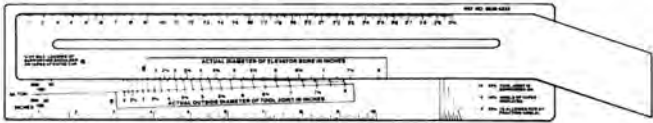
## Square Shoulder Collar-Type Drill Pipe, Casing, and Standard Tubing Elevators:

Inspect the collars for squareness and uniformity and depth of wear. Uneven wear, or worn recesses of 1/16 in. or more, requires re-facing of collar surface. Hinge pins and springs should be carefully inspected visually for excess wear and obvious weakness.

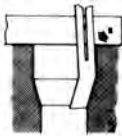
**18° Taper-Type Elevators:** Inspection is the same as for square shoulder, except that the conical bore should be observed and measured (in many instances this check should be more frequent.) All tool joints used with these elevators should be measured. Amount of wear should be checked with chart,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

# ELEVATOR AND TOOL JOINT INSPECTION GAUGE

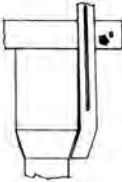
Determining if an elevator is safe or unsafe, satisfactory for use or ready for repair, should not be entrusted to the eye! Such determinations require accurate measurements of the critical elevator parts.



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



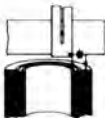
**TO MEASURE ANGLE OF 18° TAPER TOOL JOINTS:** Place body of gauge on top shoulder of tool joint "box." Sliding arm is adjusted so that the tapered edge (marked "Tool Joint Taper") is in contact with the tapered surface of the tool joint. The true angle is read at "H." Percentage of remaining rated capacity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



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

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

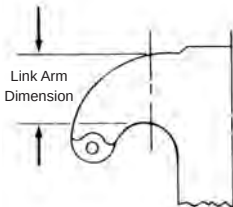
**TO MEASURE WORN COLLAR SURFACES OF SQUARE SHOULDER ELEVATORS:** Place body of gauge on top surface of elevator. Using non-tapered end of sliding arm, drop arm end into the worn area. Depth of wear is read on the "1/4-inch" scale where body and sliding arm cross. Shoulders worn more than 1/16 inch should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



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

LINK ARM WEAR CHART FOR CHAMPION™ ELEVATORS

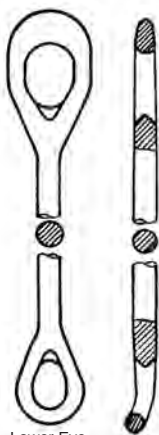
| Collar Type   |                     |                    | 18° Taper Type |                     |                    |
|---------------|---------------------|--------------------|----------------|---------------------|--------------------|
| Elevator Size | Link Arm Cap. (ton) | Link Arm Dim. (in)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





## FORGED LINKS WEAR CHART

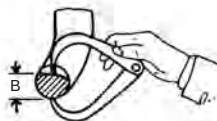
Upper Eye



Lower Eye



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



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

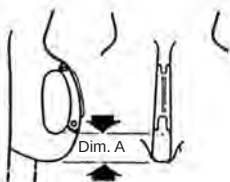
| Upper Eye<br>Dim. A        | Lower Eye<br>Dim. B | Capacity<br>(per set)<br>Tons |
|----------------------------|---------------------|-------------------------------|
| <b>1-3/4 in – 150 Tons</b> |                     |                               |
| 3-1/2                      | 1-3/4         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

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

### HYDRA-HOOK™ LINK EARS WEAR CHART

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

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



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

| Dim.<br>A<br>(in)   | Remaining<br>Capacity<br>(tons) | Dim.<br>A<br>(in)   | Remaining<br>Capacity<br>(tons) |
|---------------------|---------------------------------|---------------------|---------------------------------|
| <b>40-Ton Hook</b>  |                                 | <b>250-Ton Hook</b> |                                 |
| 3-3/8               | 40                              | 7-3/8               | 250                             |
| 3-1/8               | 35                              | 7-1/8               | 230                             |
| 2-7/8               | 31                              | 6-7/8               | 203                             |
| 2-5/8               | 25                              | 6-5/8               | 187                             |
| <b>65-Ton Hook</b>  |                                 | <b>350-Ton Hook</b> |                                 |
| 3-7/8               | 65                              | 7-3/8               | 350                             |
| 3-5/8               | 58                              | 7-1/8               | 318                             |
| 3-3/8               | 51                              | 6-7/8               | 286                             |
| 3-1/8               | 40                              | 6-5/8               | 254                             |
| <b>100-Ton Hook</b> |                                 | <b>500-Ton Hook</b> |                                 |
| 4-3/8               | 100                             | 7-7/8               | 500                             |
| 4-1/8               | 91                              | 7-5/8               | 450                             |
| 3-7/8               | 79                              | 7-3/8               | 400                             |
| 3-5/8               | 64                              | 7-1/8               | 350                             |
| <b>150-Ton Hook</b> |                                 |                     |                                 |
| 4-7/8               | 150                             |                     |                                 |
| 4-5/8               | 138                             |                     |                                 |
| 4-3/8               | 123                             |                     |                                 |
| 4-1/8               | 112                             |                     |                                 |

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

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