



TUBING ANCHOR CATCHERS

"BA" TUBING ANCHOR CATCHER

The Weatherford "BA" acts as a tubing anchor to maintain tension in the tubing string and as a tubing catcher to prevent parted pipe from falling to the bottom of the well.

Applications:

Most rod pumping applications where it is important to maintain tension in the tubing.

Features:

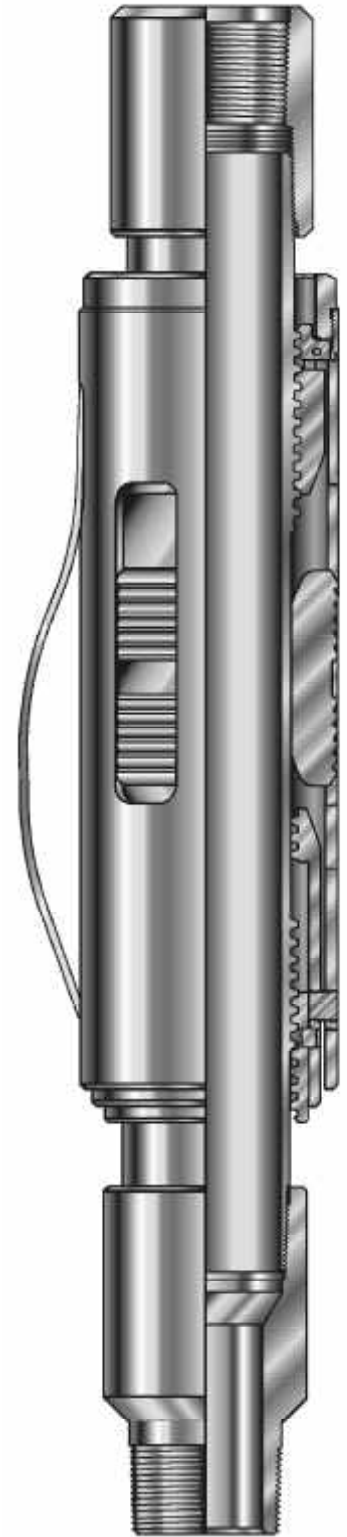
- Rotate left to set, right to release
- Straight pull emergency shear release
- Increases pump efficiency
- Improves operating costs by reducing maintenance and down time caused by tubing or sucker rod wear
- Parts interchangeable with other manufacturers

SETTING PROCEDURE

At the desired setting depth, rotate the tubing to the left with hand wrenches until the slips contact the casing (approximately five to eight turns). Maintain left-hand torque while alternately pulling strain and setting down several times to work all the slack out of the tool.

RELEASING PROCEDURE

With tubing in slight compression, rotate the tubing to the right (five to eight turns at the tool) to retract the cones from the slips and allow the slips to move back into the housing. To insure a complete release, reciprocate the tubing string a few feet while rotating a few more turns to the right before starting out of the hole. If normal release is not possible, an upstrain greater than the total shear strength of the shear pins plus the weight of the tubing.



"BA" Tubing Anchor Catcher

"BA" TUBING ANCHOR CATCHER SPECIFICATION GUIDE						
CASING				ANCHOR		BASE PRODUCT NUMBER
O.D. in/mm	WEIGHT lb/ft	MIN. I.D. in/mm	MAX. I.D. in/mm	MAX O.D. in/mm	STANDARD THREAD CONNECTIONS	
4-1/2 114,30	9.5 - 13.5	3.920 99,57	4.090 103,89	3.750 95,25	2-3/8 EU 8RD	43BA-A
5 127,00	11.5 - 18.0	4.276 108,61	4.560 115,82	4.000 101,60	2-3/8 EU 8RD	43BA-B
5-1/2 139,70	13.0 - 23.0	4.670 118,62	5.044 128,12	4.500 114,30	2-3/8 EU 8RD or 2-7/8 EU 8RD	45BA-A
6 152,40	18.0 - 23.0	5.240 133,10	5.424 137,77	4.812 122,22	2-3/8 EU 8RD or 2-7/8 EU 8RD	45BA-B
6-5/8 168,28	17.0 - 32.0	5.675 144,15	6.135 155,83	5.500 139,70	2-3/8 EU 8RD or 2-7/8 EU 8RD	47BA-A
7 177,80	20.0 - 38.0	5.920 150,37	6.456 163,98	5.500 139,70	2-3/8 EU 8RD or 2-7/8 EU 8RD	47BA-A
7 177,80	17.0 - 20.0	6.456 163,98	6.538 166,07	6.250 158,75	2-3/8 EU 8RD or 2-7/8 EU 8RD	47BA-B
7-5/8 193,68	20.0 - 39.0	6.625 168,28	7.125 180,98	6.250 158,75	2-3/8 EU 8RD or 2-7/8 EU 8RD	47BA-B
6-5/8 168,28	17.0 - 32.0	5.675 144,15	6.135 155,83	5.500 139,70	3-1/2 EU 8RD	47BA X 3.00
7 177,80	17.0 - 38.0	5.920 150,37	6.538 166,07	5.500 139,70	3-1/2 EU 8RD	47BA X 3.00
8-5/8 219,08	24.0 - 49.0	7.511 190,78	8.097 205,66	7.000 177,80	3-1/2 EU 8RD	49BA
9-5/8 244,48	32.3 - 47.0	8.681 220,50	9.001 228,63	8.000 203,20	3-1/2 EU 8RD	51BA



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"BA" TUBING ANCHOR CATCHER

The Weatherford "BA" acts as a tubing anchor to maintain tension in the tubing string and as a tubing catcher to prevent parted pipe from falling to the bottom of the well. Applications include most rod pumping applications where it is important to maintain tension in the tubing.

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NOTE: DO NOT use the drag springs as a carrying handle for this tool. Permanent distortion of the spring is possible, causing difficulty during running-in.

OPERATING

RUNNING IN

To prevent the slips from becoming dulled before reaching setting depth, it is advisable to rotate the tubing to the right every 5 or 10 stands while running in the well.

SETTING

At the desired setting depth, rotate the tubing to the left with hand wrenches until the slips contact the casing (approximately 5 to 8 turns). Maintain left-hand torque while alternately pulling strain and setting down several times to work all play out of the tool. During this slip setting operation, the strain pulled should be at least equal to the final strain that will be applied when the tubing is landed, and full tubing set-down weight should be applied. Release the torque and continue working the tubing to remove any residual torque. Apply the required amount of tubing tension as determined from the calculations section of this tech unit.

NOTE: Tubing tension should always be applied in inches of stretch rather than in pounds of pull because of probable friction between the tubing and the casing.

NORMAL RELEASE PROCEDURE

The Weatherford "BA" Tubing Anchor Catcher should be released with the tubing in slight compression as the upper cone is spaced so that the lower cone will be completely retraced when the slips lose their grip on the casing. This feature prevents dulling of the slips, due to incomplete retraction of the lower cone, during retrieving. If this is not possible, however, the tool can be released without compression or even with the tubing string in tension. Rotate the tubing to the right (5 to 8 turns at the tool) to retract the cones from the slips and allow the slips to move back into the housing. To ensure a complete release, reciprocate the tubing string a few feet while rotating a few more turns to the right before starting out of the hole. It is a good practice to take an occasional right hand turn while coming out to ensure against dulling the slips.

EMERGENCY RELEASE

If it is impossible to release the "BA" Tubing Anchor Catcher in the above manner, an upstrain greater than the total shear strength of the shear pins, plus the weight of the tubing, will shear, the shear pins and release the Anchor Catcher.

ASSEMBLY

1. Apply a heavy coat of stiff grease to body threads, cone threads, and between the bottom cone and its cone sleeve.
2. Screw the upper cone (9) onto the upper end of the body (2).
3. Screw the body nut (8) on the body above the upper cone. Secure it in place so that the top of the nut is flush with the top of the body threads. Tighten the screw (6) in the body nut **VERY TIGHT!**

7" and Larger: Lock nuts are held by set screws (7) tightened into a groove of the body.

4. Attach the coiled springs to the slips and bend the ends closed with pliers.
5. Stand the body sub-assembly upside down on floor. Insert the slip sub-assembly (11) into the lower end of the housing (10) and align with milled windows. Slide top of housing over the body from the bottom end. Match up the internal splines at the top of the housing with the grooves in the upper cone. Turn the housing to back the cone up against the lock nut.

4-1/2" Only: Cone is not grooved, but is tapped for pipe plugs.

6. Screw the cap (3) into the top of the housing by hand until it bottoms. Insert the cap pipe plug (5) into the split of the cap, and tighten.

4-1/2" Only: Uses a set screw (4).

7. Grease the outside of the lower cone sleeve (15). Line it up inside the lower cone (12), and insert the required number of shear pins (14), (5,000 lb. per pin).

NOTE: Shear pins should be equally spaced around the cone.

8. Screw the lower cone unit into the lower end of the body. Line up the tapped holes in the cone with the slots in the housing. The plugs should clear the bottom of the slots by approximately 1/8". Tighten the cone pipe plugs (13) securely, so the tops of the plugs are below the outer surface of the housing.

4-1/2" Only: Uses plugs in the upper cone also.

9. Install drag springs (19) and drag spring screws (17).

5-1/2" and Larger: Drag springs attach to the housing above the slips.

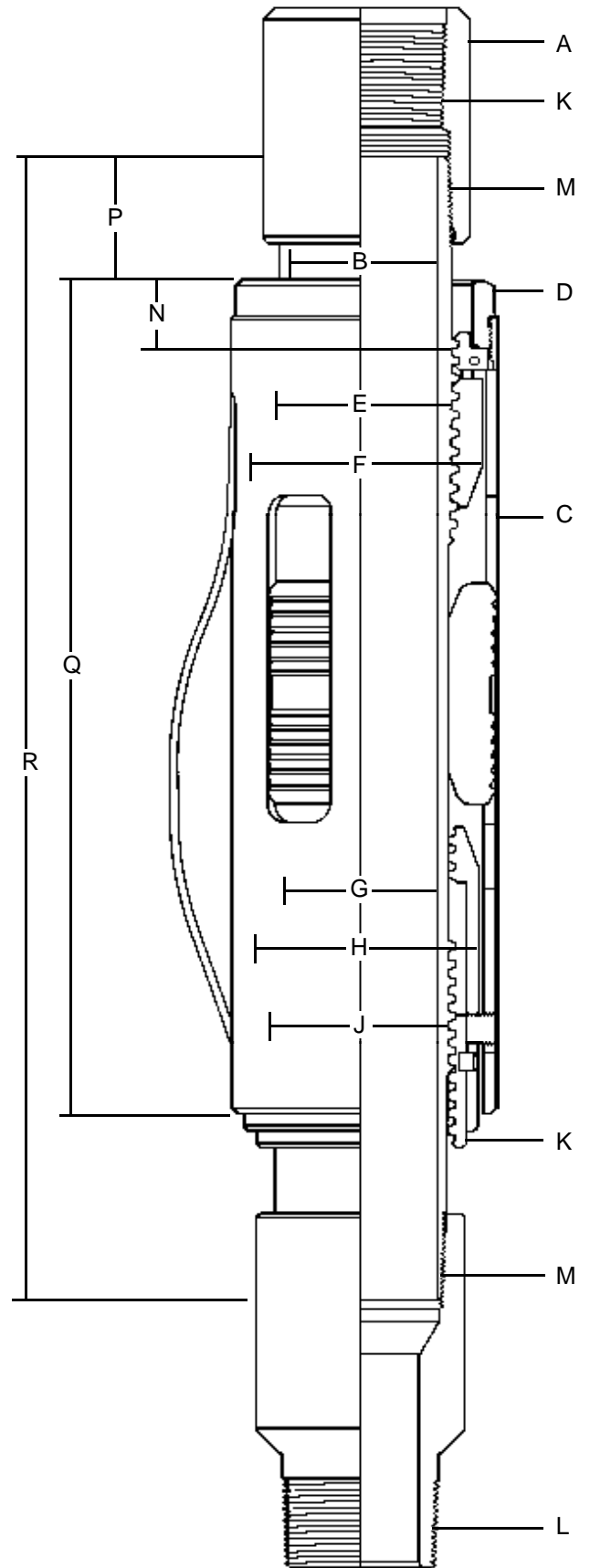
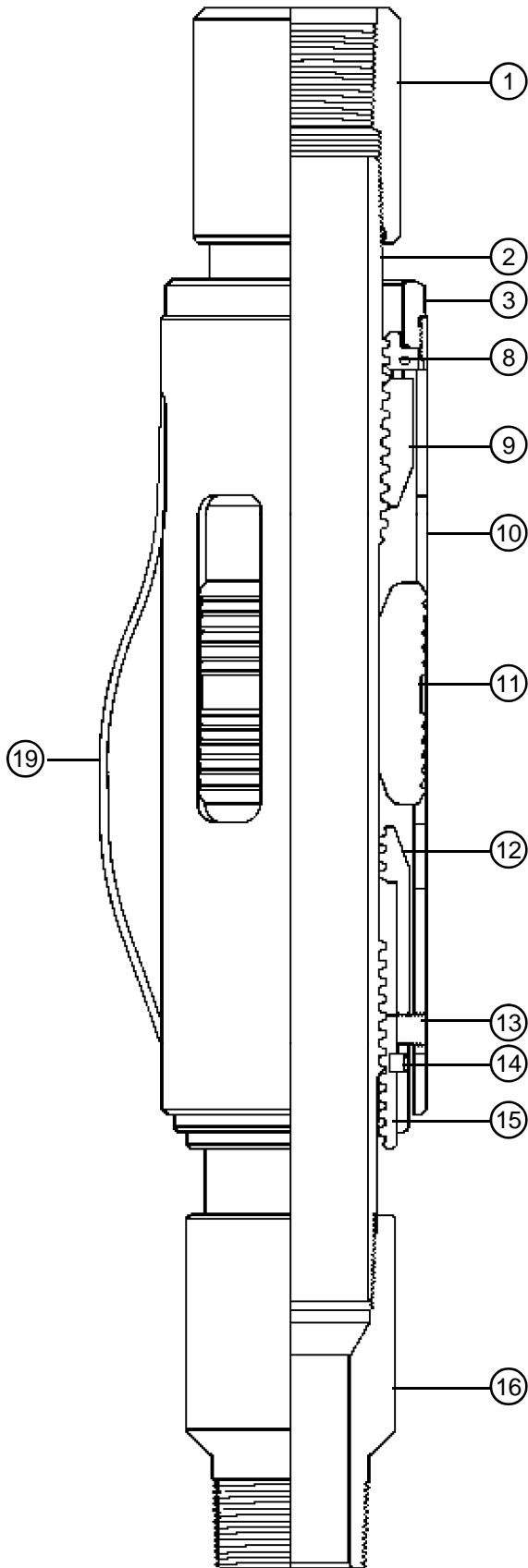
4-1/2" and 5" Sizes: Drag springs attach to the lower cone, and requires lock washers.

NOTE: When the anchor is to be used 8,000 ft. or deeper, two springs, one atop the other is recommended.

10. Install the top and bottom subs (1 and 16) and tighten.
11. Turn the housing in the direction of release, and slam it into the stop several times to be certain the body nut won't move.



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Weatherford®

Completion Systems

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ITEM	DESCRIPTION	4-1/2	5-1/2	7	7 X 3.00	8-5/8	9-5/8
	COMPLETE ASSEMBLY	43BA.10★★	45BA.10★★	47BA.10★★	47BA.10★★	49BA.10★★	51BA.10★★
1	TOP SUB	23E23NC	27E27NC	27E27EC	35E35NC	35E35EC	35E35EC
2	BODY	43BA03	45BA03	47BA07	47BA07LB	49BA03	49BA03
3	CAP	43BA04	45BA04	47BA04	47BA04	49BA04	49BA04
4	SOC. SET SCREW (NOT SHOWN)	HA1020 (2) 1/4-20 X 5/16	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.	HA1007 (3) 1/4-20 X 1/4	HA1007 (3) 1/4-20 X 1/4
5	CAP PIPE PLUG (NOT SHOWN)	NOT REQ'D.	HM1008 1/16 NPT	HM1009 1/8 NPT	HM1009 1/8 NPT	NOT REQ'D.	NOT REQ'D.
6	SOC. CAP SCREW (NOT SHOWN)	HC1010 1/4-28 X 3/4	HC1010 1/4-28 X 3/4	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.
7	SOC. SET SCREW, HALF DOG (NOT SHOWN)	NOT REQ'D.	NOT REQ'D.	HA1011HD (3) 3/8-24 X 3/8	HA1011HD (3) 3/8-24 X 3/8	HA1028HD (3) 1/2-13 X 1/2	HA1028HD (3) 1/2-13 X 1/2
8	BODY NUT	43BA05	45BA05	47BA05	47BA05LB	49BA05	49BA05
9	UPPER CONE	43BA06	45BA06	47BA06	47BA06LB	49BA06	49BA06
10	HOUSING	43BA07	45BA07	47BA07	47BA07LB	49BA07	51BA07
11	SLIP SPRING SUB-ASSEMBLY (CONSIST OF) :	43BA19	45BA19	47BA19	47BA19LB	49BA19	51BA19
	SPRING	43BA17 (12)	45BA17 (12)	47BA17 (12)	47BA17 (12)	49BA17 (24)	51BA17 (24)
	SLIP	43BA12 (3)	45BA12 (3)	47BA12 (3)	47BA12LB (3)	49BA12 (4)	51BA12 (4)
12	LOWER CONE	43BA08	45BA08	47BA08	47BA08LB	49BA08	49BA08
13	CONE PIPE PLUG	HM1005 (6) 3/8 NPT	HM1005 (6) 3/8 NPT	HM1005 (6) 3/8 NPT	HM1010 (3) 1/2 NPT	HM1010 (4) 1/2 NPT	HM1010 (4) 1/2 NPT
14	SHEAR PINS	43BA11	43BA11	47BA11	47BA11LB	47BA11	47BA11
15	LOWER CONE SLEEVE	43BA09	45BA09	47BA09	47BA09LB	49BA09	49BA09
16	BOTTOM SUB	23N23EX	27N27EX	23N23EX	35N35EX	NOT REQ'D.	NOT REQ'D.
17	BUTTON HEX SCREW (NOT SHOWN)	HM1011 (6) 3/8-16 X 1/2	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.	NOT REQ'D.
18	FLAT HEAD SCREW (NOT SHOWN)	NOT REQ'D.	HB1002 (6) 5/16-18 X 1/2	HB1002 (6) 5/16-18 X 1/2	HB1002 (6) 5/16-18 X 1/2	HB1002 (8) 5/16-18 X 1/2	HB1002 (8) 5/16-18 X 1/2
19	DRAG SPRING	43BA13 (6)	45BA13 (3)	47BA13 (3)	45BA13 (3)	45BA13 (4)	51BA13 (4)

DIMENSIONAL DATA

SIZE	43	45	47	47 X 3.00	49	51
A	3.062	3.687	3.687	4.500	4.500	4.500
B	1.978	2.375	2.437	3.000	3.000	3.000
C	3.750	4.500	5.500	5.500	7.000	8.000
D	3.625	4.375	5.375	5.375	7.000	7.000
E	2.500	3.062	3.344	3.687	3.968	3.968
F	3.375	4.000	5.000	5.000	6.281	6.281
G	2.375	2.875	3.156	3.500	3.968	3.968
H	3.343	3.937	4.937	4.937	4.937	6.188
J	2.546	3.062	3.344	3.687	3.687	3.968
K	3.000	3.500	3.812	4.188	4.750	4.750
L	2-3/8 EU 8RD	2-7/8 EU 8RD	NOT APPLICABLE	3-1/2 EU 8RD	AS ORDERED	
M	2-3/8 NU 10RD	2-7/8 NU 10RD	2-7/8 EU 8RD	3-1/2 NU 10RD	3-1/2 EU 8RD	3-1/2 EU 8RD
N	2.00	1.50	1.31	1.31	1.81	1.81
P	3.43	3.31	4.25	4.88	4.50	4.50
Q	23.25	18.87	18.25	18.75	23.50	23.50
R	31.00	26.87	26.87	29.00	34.00	34.00



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CALCULATIONS

Calculations and data needed before running the tubing anchor.

To obtain maximum advantage from the tubing anchor, it is necessary to calculate, and apply, the correct amount of tension to the tubing string.

- Calculations are necessary to determine:
 - Required Tubing Tension
 - Shear Release Value
 - Maximum Tensile Load on the Tubing

Sample calculations are provided.

Charts (Page 8) are supplied to determine the forces and loads involved, and to convert tension into inches of stretch.

Well Information Needed	Example Data
Tubing size	2-3/8"
Depth of Anchor & Pump	4,000 ft.
Fluid level at time Anchor is Set	3,000 ft.
Operating Fluid Level (from Surface)	4,000 ft.
Fluid Temperature at Surface	90°F
Mean Yearly Temperature for Area	60°F
Tubing String Weight	18,500 lb.
Rod String Weight	8,000 lb.
Pump Plunger Size	1-1/2"
Weight of fluid in tubing (est)	5,500 lb.

SAMPLE CALCULATION

- Tension calculation from force tables:
 - Force 1 Temperature 4,100 lb. (plus)
 - Force 2 Breathing 6,200 lb. (plus)
 - 10,300 lb.
 - Force 3 Buckling 1,300 lb. (minus)
 - Total Tension Required 9,000 lb.

Interpolating the stretch chart for 2-3/8 tubing, the inches of stretch required to give 9,000 lb. is 11".

HOW TO CALCULATE TUBING STRETCH (without using the table)

Multiply the length of tubing (in thousands of feet) times a stretch constant. This will tell you how much the pipe will stretch for each 1,000 lb. of tension applied.

Stretch Constants:

2-3/8" - 4.7#	= 0.310
2-7/8" - 6.5#	= 0.220
3-1/2" - 9.3#	= 0.154

Example: We wish to pull tension on 4,000 (4 units) of 2-3/8" tubing = Stretch constant is 0.31.

- 4 x 0.341 = 1.24" stretch for 1,000 lb. of pull.
- We wish to pull 9,000 lb. 9 x 1/24 = 11.16" stretch.



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SELECTING SHEAR VALUE

The Weatherford "BA" Tubing Anchor Catcher is shipped from the factory with a 30,000 lb. shear release value. This is adequate for the majority of well conditions. Shear value may be adjusted as indicated in the chart below. Each shear pin has a value of 5,000 lb.

SAMPLE SHEAR VALUE CALCULATION

Using the shear pin selection table, the shear value should be 25,000 lb. This is obtained by assembling the Tubing Anchor with five (5) shear pins.

SHEAR PIN CHART

TENSION REQUIRED (FROM CALCULATIONS)	RECOMMENDED SHEAR VALUE	NUMBER SHEAR PINS REQUIRED
0 - 10,000 lb.	25,000 lb.	5
10,000 - 20,000 lb.	30,000 lb.	6
20,000 - 30,000 lb.	40,000 lb.	8
30,000 - 40,000 lb.	50,000 lb.	10
40,000 - 50,000 lb.	60,000 lb.	12

CALCULATING MAXIMUM TENSILE LOADS

The maximum tensile load must be calculated to avoid exceeding the yield strength and damaging the tubing.

NORMAL RELEASE

Condition A: Rods, pump & standing valve are removed;

Tubing Weight = 18,500 lb.
 Applied Tension = 9,000 lb.
 Maximum Load = 27,000 lb.

Condition B: Rods can't be removed, when the anchor is released, the tubing must support;

Rod Weight = 8,000 lb.
 Fluid Weight = 5,500 lb.
 Tubing Weight = 18,500 lb.
 Maximum Load = 32,000 lb.

EMERGENCY RELEASE

Condition C: Rods, pump & standing valve removed;

Tubing Weight = 18,500 lb.
 Shear Value = 25,000 lb.
 Maximum Load = 43,500 lb.

Condition D: Rods removed, pump or standing valve and fluid remain in the tubing;

Fluid Weight = 5,500 lb.
 Tubing Weight = 18,500 lb.
 Shear Value = 25,000 lb.
 Maximum Load = 49,000 lb.



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Condition E: The most extreme condition; rods stuck and fluid trapped in the tubing;

Rod Weight	=	8,000 lb.
Fluid Weight:	=	5,500 lb.
Tubing Weight	=	18,500 lb.
Shear Value	=	25,000 lb.
Maximum Load	=	57,000 lb.

NOTE: If calculations show inadequate tubing strength, higher strength tubing may be substituted at the upper end of the tubing string.

ALTERNATIVE: You can gamble that a normal release is achievable, accepting the remote possibility of a fishing job.

LESS THAN OPTIMUM TENSION

It may be impractical to pull the full amount of calculated tension, because of the poor condition of the tubing or where the tubing is likely to deteriorate from highly corrosive well conditions. Tension may be reduced by the amount of the fluid load exerted on the rods (only). More reduction than this will cause the load to transfer from cone to cone on each pump stroke.

TABLE OF FLUID LOAD ON RODS (POUNDS)

OPERATING FLUID LEVEL (Ft.)	PUMP PLUNGER SIZE			
	1-1/4"	1-1/2"	1-3/4"	2"
1,000	615	885	1,200	1,570
2,000	1,230	1,770	2,400	3,140
3,000	1,845	2,655	3,600	4,710
4,000	2,460	3,540	4,800	6,280
5,000	3,075	4,425	6,000	7,850
6,000	3,690	5,310	7,200	9,420
7,000	4,305	6,195	8,400	10,990
8,000	4,920	7,080	9,600	12,560
9,000	5,535	7,965	10,800	14,130
10,000	6,150	8,850	12,000	15,700



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TABLES FOR DETERMINING TENSION & STRETCH
 TUBING SIZES: 2-3/8" - 4.7 lbs., 2-7/8" - 6.5 lbs., 3-1/2" - 9.3 lbs.

CHART A Temperature Difference: Subtract the mean annual temperature of well site (60 Mid-Continent, 70 Gulf Coast) from the temperature of well fluid when it reaches surface.

TEMPERATURE DIFFERENCE		10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F	130°F	140°F	150°F	160°F	170°F	180°F	190°F	200°F
TUBING SIZES:	2-3/8"	1400	2700	4100	5400	6800	8100	9500	10800	12200	13500	14900	16200	17600	18900	20300	21600	23000	24500	25700	27000
	2-7/8"	1900	3800	5700	7500	9400	11300	13200	15000	16900	18800	20700	22500	24400	26300	28200	30000	31900	33800	35700	37500
	3-1/2"	2700	5400	8100	10800	13400	16100	18800	21500	24200	26800	29500	32200	34900	37600	40200	42900	45600	48300	51000	53700

Enter Value selected from **Chart A**
(Temperature)

4100

CHART B Operating Fluid Level is the fluid from the surface in the annulus after well is pumped down.

OPERATING FLUID LEVEL		500'	1,000'	1,500'	2,000'	2,500'	3,000'	3,500'	4,000'	4,500'	5,000'	5,500'	6,000'	6,500'	7,000'	7,500'	8,000'	8,500'	9,000'	9,500'	10,000'
TUBING SIZES:	2-3/8"	800	1600	2400	3100	3900	4700	5500	6200	7000	7800	8600	9300	10100	10900	11700	12400	13200	14000	14800	15550
	2-7/8"	1200	2300	3400	4600	5700	6800	8000	9100	10300	11400	12500	13700	14800	15900	17100	18200	19300	20500	21600	22800
	3-1/2"	1700	3400	5100	6800	8500	10100	11800	13500	15200	16900	18600	20200	21900	23600	25300	27000	28700	30300	32000	33700

Enter Value selected from **Chart B**
(Operating Fluid Level)

+

6200

10300

Sub Total

CHART C Initial Fluid Level is the fluid level from Surface in the annulus at the time anchor is set.

INITIAL FLUID LEVEL		500'	1,000'	1,500'	2,000'	2,500'	3,000'	3,500'	4,000'	4,500'	5,000'	5,500'	6,000'	6,500'	7,000'	7,500'	8,000'	8,500'	9,000'	9,500'	10,000'
TUBING SIZES:	2-3/8"	200	400	600	900	1100	1300	1500	1800	2000	2200	2500	2700	2900	3100	3400	3600	3800	4100	4300	4500
	2-7/8"	300	600	900	1200	1500	1900	2200	2500	2800	3100	3400	3800	4100	4400	4700	5000	5300	5700	6000	6300
	3-1/2"	400	900	1300	1800	2200	2700	3100	3600	4000	4500	4900	5400	5800	6300	6700	7200	7700	8100	8600	9000

Enter Value selected from **Chart C**
(Initial Fluid Level)

1300

9000

Total Tension Required

CHART D Stretch Chart

TENSION REQUIRED =		6,000 lbs.			8,000 lbs.			10,000 lbs.			12,000 lbs.			14,000 lbs.			16,000 lbs.			18,000 lbs.		
ANCHOR DEPTH =	2,000'	4"	3"	2"	5"	4"	3"	6"	4"	3"	7"	5"	4"	9"	6"	4"	10"	7"	5"	11"	8"	6"
	4,000'	7"	5"	4"	10"	7"	5"	12"	9"	6"	15"	11"	7"	17"	12"	9"	20"	14"	10"	22"	16"	11"
	6,000'	11"	8"	6"	15"	11"	7"	18"	13"	9"	22"	16"	11"	26"	19"	13"	29"	21"	15"	33"	24"	17"
	8,000'	15"	11"	7"	20"	14"	10"	25"	18"	12"	29"	21"	15"	34"	25"	17"	39"	28"	20"	44"	32"	22"
	10,000'	18"	13"	9"	25"	18"	12"	31"	22"	15"	37"	26"	19"	43"	31"	22"	49"	35"	25"	55"	40"	28"
12,000'	22"	16"	11"	29"	21"	15"	37"	27"	19"	44"	32"	22"	51"	37"	26"	59"	42"	30"	66"	48"	33"	
TUBING SIZES:		2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2
TENSION REQUIRED =		20,000 lbs.			22,000 lbs.			24,000 lbs.			26,000 lbs.			28,000 lbs.			30,000 lbs.					
ANCHOR DEPTH =	2,000'	12"	9"	6"	14"	10"	7"	15"	11"	7"	16"	11"	8"	17"	12"	9"	18"	13"	9"			
	4,000'	25"	18"	12"	27"	19"	14"	29"	21"	15"	32"	21"	16"	34"	25"	17"	37"	26"	19"			
	6,000'	37"	26"	19"	41"	29"	20"	44"	32"	22"	48"	32"	24"	52"	37"	26"	55"	40"	28"			
	8,000'	49"	35"	25"	54"	39"	27"	59"	42"	30"	64"	42"	32"	69"	49"	35"	74"	53"	37"			
	10,000'	61"	44"	31"	68"	49"	34"	74"	53"	37"	80"	53"	40"	86"	62"	43"	92"	66"	46"			
12,000'	74"	53"	37"	81"	58"	41"	88"	64"	45"	96"	64"	48"	103"	74"	52"	110"	80"	56"				
TUBING SIZES:		2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2	2-3/8	2-7/8	3-1/2			

Enter Inches of Stretch from **Chart D**
(Stretch Chart)

Stretch Constraints:
 2-3/8 - 4.7# = 0.310
 2-7/8 - 6.5# = 0.220
 3-1/2 - 9.3# = 0.154