Calculations

Stem Force

To calculate the force to be overcome to enter the well use the following formula, remember this will give you the balance point, your weight needs to exceed this amount.

Force = Pressure x Area

Force - what we have to exceed using stem bar

Pressure – the Well Head Pressure

Area – cross sectional area of the wireline being used (see table below)

SIZE AND CROSS SECTION AREA

Wire Size	Cross Section Area
0.072”	0.0037
0.082”	0.0053
0.092”	0.0066
0.108”	0.0092
0.125”	0.0123
3/16”	0.027
7/32”	0.037
1/4”	0.049
5/16”	0.077

To calculate standard stem weight per foot use the formula: $\frac{OD^2 \times 8}{3}$

Pressure

$P_T = P_A + P_H$

P_T - Pressure (total)

P_A - Pressure (Applied) - WHP or Annulus observed on a tree gauge

P_H - Pressure (Hydrostatic) - result of fluid gradient and depth

Hydrostatic pressure = Fg (fluid gradient - psi/ft) x TVD (true vertical depth - feet)

Standard fluid gradient Fg (psi/ft) = lbs/gal x 0.052

Refer to standard fluid gradient tables.

Calculations

SLICKLINE / BRAIDED CABLE DATA

		Minimum Breaking Load	Sheave Diameter	Weight lb / 1000'	Stretch 1" / 100' / 100lb	Corrosion Resistance	
API 9A	0.092"	1547	11	22.66	0.70	H2S & CO2	Very poor, may be used in low H2S - 2 or3 ppm
	0.108"	2110	13	31.11	0.51	Chlorides	Good, wire must be cleaned after use to avoid pitting
	0.125"	2840	15	41.84	0.38	All Above	Extremely poor due to H2S & CO2 being present
UHT Bright	0.092"	2050	11	22.66	0.70	H2S & CO2	Extremely poor – not to be used in any concentrations
	0.108"	2730	13	31.23	0.51	Chlorides	Good, wire must be cleaned after use to avoid pitting
	0.125"	3665	15	41.84	0.38	All Above	Extremely poor due to H2S & CO2 being present
Supa 70	0.092"	1600	11	23.29	0.79	H2S & CO2	Excellent in all concentrations
	0.108"	2100	13	32.10	0.58	Chlorides	Excellent
	0.125"	2600	15	43.00	0.43	All Above	May be used, risk of stress corrosion cracking
Supa 75	0.092"	1550	11	23.29	0.79	H2S & CO2	Excellent in all concentrations
	0.108"	2030	13	32.10	0.58	Chlorides	Excellent
	0.125"	2560	15	43.00	0.43	All Above	Good, superior to SUPA 70
GD31 MO	0.108"	2150	14	32.10	0.52	H2S & CO2	Excellent in all concentrations
	0.125"	2850	16	43.00	0.34	Chlorides	Excellent

Types of wire testing for API9A / UHT & stainless/special alloy

Recommended test for API9A / UHT wireline is the torsion test, the minimum amount of rotations before fatigue must be achieved along with a clean flat break to indicate good wire.

0.092" minimum of 23 turns achieved
0.108" minimum of 19 turns achieved
0.125" minimum of 17 turns achieved

Stainless and special alloy wires should be tested by the ASEP Wire tester or wrap test method, new wire should test at a minimum of 8 wraps.

Calculations

BRAIDED CABLE					
Braided		Minimum Breaking Load	Sheave Diameter	Weight lb / 1000’	Type
3/16”	0.187”	4960	14	71	Galvanised
3/16”	0.187”	4320	14	71	SUPA 70/75
7/32”	0.228”	6610	14	96	Galvanised
7/32”	0.228”	5842	14	96	SUPA 70/75
5/16”	0.330”	17550	20	96	Galvanised
5/16” Mono	0.330”	5500	20	196	Mono-conductor
Slammer	0.472”	11100	20	379	Slammer Cable

To test braided cable, one of the outer armours should be removed. This should be bent to form a 90 deg angle then twisted around itself. Achieving a minimum of 5 rotations indicates good cable.

Before tying a new rope socket cut off 1ft for every 1000ft that was ran in the hole.

A swivel joint must always be placed below the rope socket.

If running in hole with new cable, pull back 200ft for every 1000ft run in hole.

H_2S and Partial Pressure Calculations

The damage to the wire is not caused directly by the % of CO2 or H_2S but is more a function of the "Partial Pressure"

To determine the Partial Pressure for H_2S:

PH_2S = PPM H_2S in gas x BHP/1,000,000

Example: In a well with 3ppm H_2S and a BHP of 6,000psi

PH_2S = 3 x 6,000/1,000,000

PH_2S = 18,000/1,000,000

PH_2S = 0.018psi

Under NACE regulations a PH2S of 0.05psi or greater would determine that you need to choose an alloy wire or seek to protect/inhibit you wire (Alloy wire is by far the safest option).

To determine the Partial Pressure for CO2:

PCO2 = CO2 % x BHP/100

Example: In a well with 3% CO2 and a BHP of 2,000psi

PCO2 = 3(%) x 2000/100

PCO2 = 3(%) x 20

PCO2 = 60psi

Under NACE regulations a PCO2 of 32psi or greater would determine that you need to choose an alloy wire or seek to protect/inhibit you wire (Alloy wire is by far the safest option).

Hay Pulley Angle Correction Factor

Example 1

Angle below 90º then WT indicator dial reads higher than actual resultant.

E.g. Angle between entry and exit line = 70º
WT indicator reads 1000 lbs.

= 1000 ÷ 1.63830 (constant for 70º from Chart) x 1.41422 (constant for 90º from Chart)

= 1000 ÷ 1.63830

= 610.3888 x 1.41422

= Actual tension being pulled is 863 lbs

Example 2

Angle above 90º then weight indicator dial reads lower than actual resultant.

E.g. Angle between entry and exit line = 110º
WT indicator reads 811 lbs.

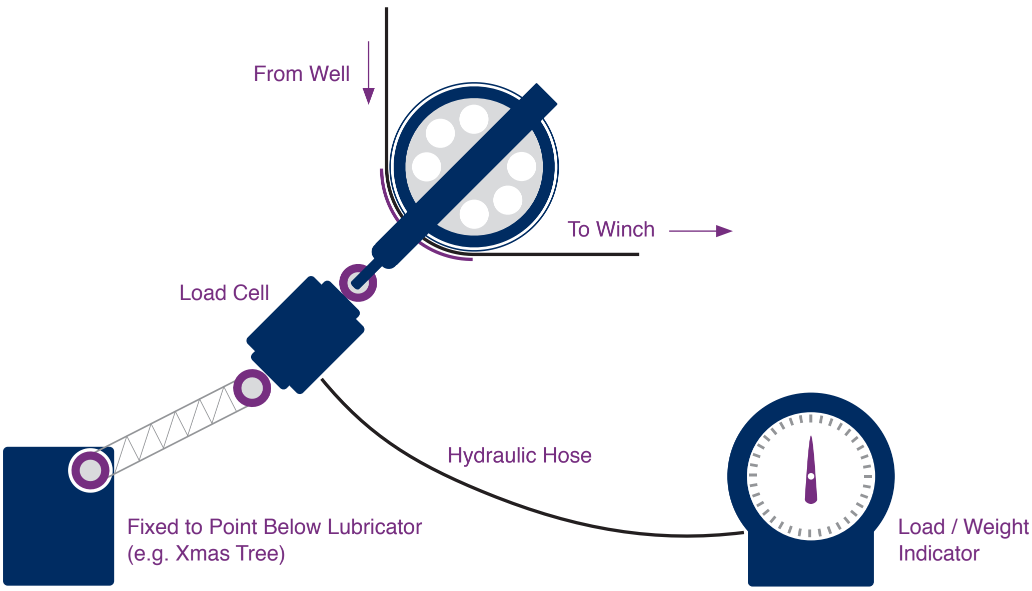
= 811 ÷ 1.14716 (constant for 110º from chart) x 1.41422 (constant for 90º from chart)

= 811 lbs ÷ 1.14716

= 706.963. X 1.41422

= Actual tension being pulled is 1000 lbs

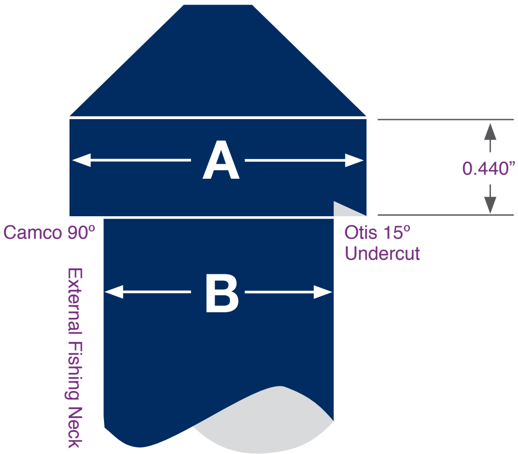
Use chart on the following page for constants



Hay Pulley Angle Correction Factor

HAY ANGLE PULLEY CORRECTION FACTOR							
Included Angle of	Line Load	By Constant	Resultant	Included Angle of	Line Load	By Constant	Resultant
0		2.00000		92		1.38932	
2		1.99970		94		1.36400	
4		1.99878		96		1.33826	
6	**Multiply**	1.99726		98	**Multiply**	1.31212	
8	**Line**	1.99512	**To Get**	100	**Line**	1.28558	**To Get**
10	**Load**	1.99238	**Resultant**	102	**Load**	1.25864	**Resultant**
12	**By**	1.98904		104	**By**	1.23132	
14		1.98510		106		1.20362	
16		1.98054		108		1.17556	
18		1.97538		110		1.14716	
20		1.96962		112		1.11838	
22		1.96326		114		1.08928	
24		1.95630		116		1.05984	
26		1.94874		118		1.03008	
28		1.94058		120		1.00000	
30		1.93186		122		0.96962	
32		1.92252		124		0.93894	
34		1.91260		126		0.90798	
36		1.90212		128		0.87674	
38		1.89104		130		0.84524	
40	**Multiply**	1.87938		132	**Multiply**	0.81348	
42	**Line**	1.86716	**To Get**	134	**Line**	0.78146	**To Get**
44	**Load**	1.85436	**Resultant**	136	**Load**	0.74922	**Resultant**
46	**By**	1.84100		138	**By**	0.71674	
48		1.82708		140		0.68404	
50		1.81262		142		0.65114	
52		1.79758		144		0.61804	
54		1.78202		146		0.58474	
56		1.76590		148		0.55128	
58		1.74924		150		0.51764	
60		1.73206		152		0.48384	
62		1.71434		154		0.44990	
64		1.69610		156		0.41582	
66		1.67734		158		0.38162	
68		1.65808		160		0.34730	
70		1.63830		162		0.31286	
72		1.61804		164		0.27834	
74		1.59726		166		0.24374	
76	**Multiply**	1.57602		168	**Multiply**	0.20906	
78	**Line**	1.55430	**To Get**	170	**Line**	0.17430	**To Get**
80	**Load**	1.53208	**Resultant**	172	**Load**	0.13952	**Resultant**
82	**By**	1.50942		174	**By**	0.10468	
84		1.48626		176		0.06980	
86		1.46270		178		0.03490	
88		1.43868		180		0.00000	
90		1.41422					

Fishing Neck Data

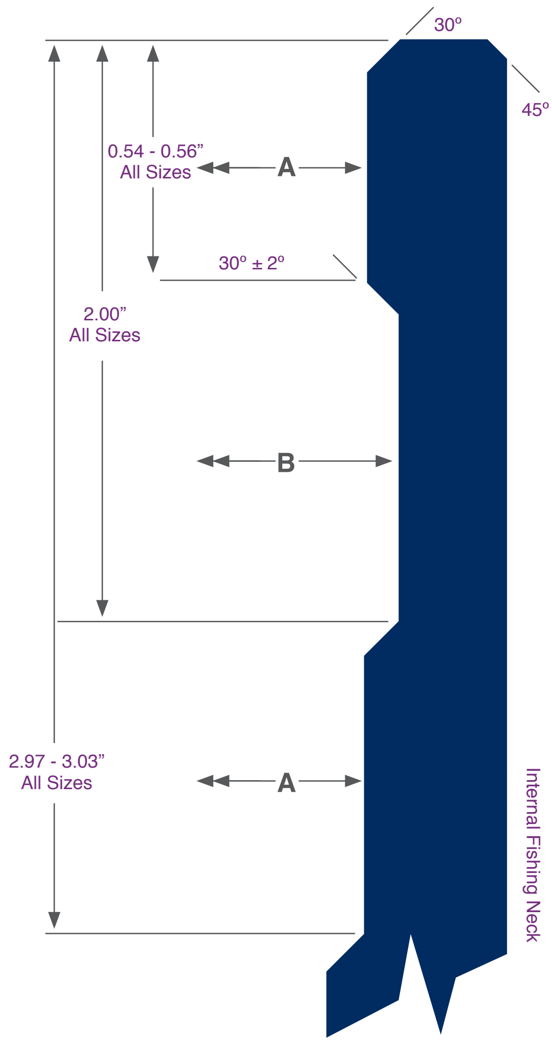


EXTERNAL FISHING NECK CHART

Toolstring Size	Diameter A		Diameter B	
	Maximum	Minimum	Maximum	Minimum
3/4"	0.750"	0.740"	0.630"	0.620"
1"	1.000"	0.990"	0.880"	0.870"
1 1/4"	1.187"	1.177"	1.060"	1.030"
1 1/2"	1.375"	1.365"	1.190"	1.160"
1 7/8"	1.750"	1.740"	1.500"	1.470"
2 1/8"	1.750"	1.740"	1.500"	1.470"
2 1/2"	2.313"	2.303"	2.060"	2.030"

INTERNAL FISHING NECK CHART

GS used to Latch Profile	Diameter A		Diameter B	
	Maximum	Minimum	Maximum	Minimum
1 1/2 & 1 3/4"	1.06"	1.08"	1.22"	1.24"
2"	1.38"	1.40"	1.57"	1.59"
2 1/2"	1.81"	1.83"	2.00"	2.02"
3"	2.31"	2.33"	2.50"	2.52"
4"	3.12"	3.14"	3.31"	3.33"
5"	4.00"	4.02"	4.19"	4.21"



Wireline Fallback

WIRELINE FALLBACK CHART		
Tubing Size	Slickline OD	Fall (ft/1000ft)
2 3/8”	0.092”	10
2 7/8”	0.092”	12
3 1/2”	0.092”	16
3 1/2”	0.108”	15
3 1/2”	0.125”	8
3 1/2”	3/16”	20
3 1/2”	7/32”	25
4 1/2”	0.092”	29
4 1/2”	0.108”	27
4 1/2”	0.125”	12
4 1/2”	3/16”	35
4 1/2”	7/32”	45
5 1/2”	0.108”	40
5 1/2”	0.125”	20
5 1/2”	3/16”	50
5 1/2”	7/32”	65
5 1/2”	1/4”	83
5 1/2”	5/16”	100
7”	0.108”	90
7”	0.125”	45
7”	3/16”	100
7”	7/32”	125
7”	1/4”	130
7”	5/16”	135

Once a fishing job has occurred the objective is to rectify the situation as safely and efficiently as possible, to meet these criteria here are some guidelines:

- **Check the well files for previous problems**
- **Always run slowly observing odometer and weight indicator closely**
- **Record length of wire recorded**
- **Always run wire grab on jar up to release pulling tool**
- **Keep careful record of toolstring lengths and O.D’s**
- **Function test all tools**
- **Test wire frequently**
- **Avoid ‘kinking’ the wire**
- **Always ensure the largest OD on the toolstring is below the mechanical jars**
- **Plan, execute then evaluate constantly**
- **Stay focused and take your time**