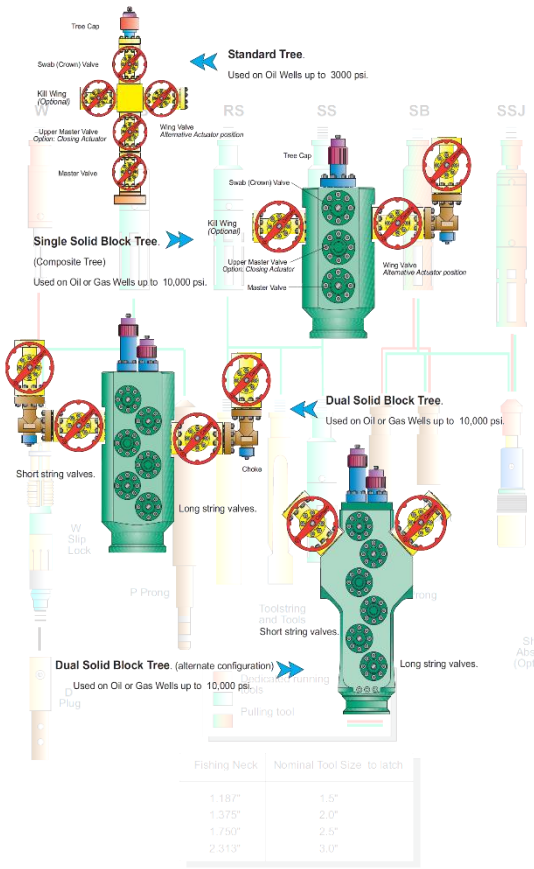
DIMENSION BID

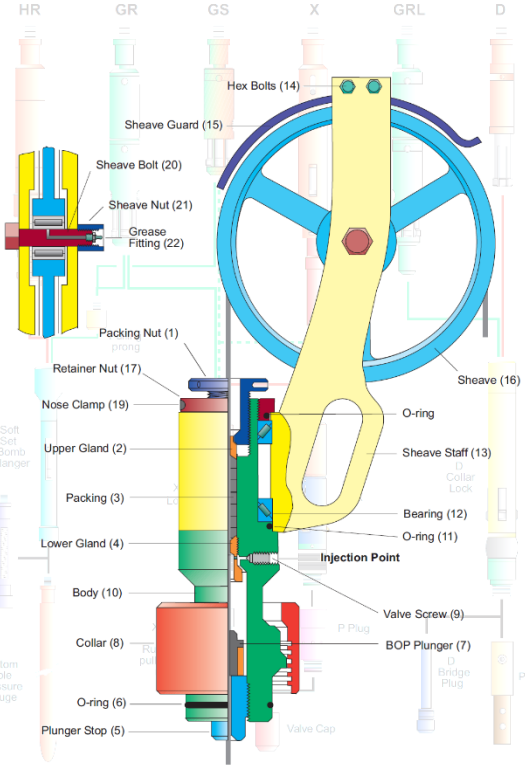
WIRELINE INTERVENTION | PERFORATION SERVICES

BASIC SLICKLINE TRAINING DIAGRAM

VER : 1.1

RELEASE : DEC-2014

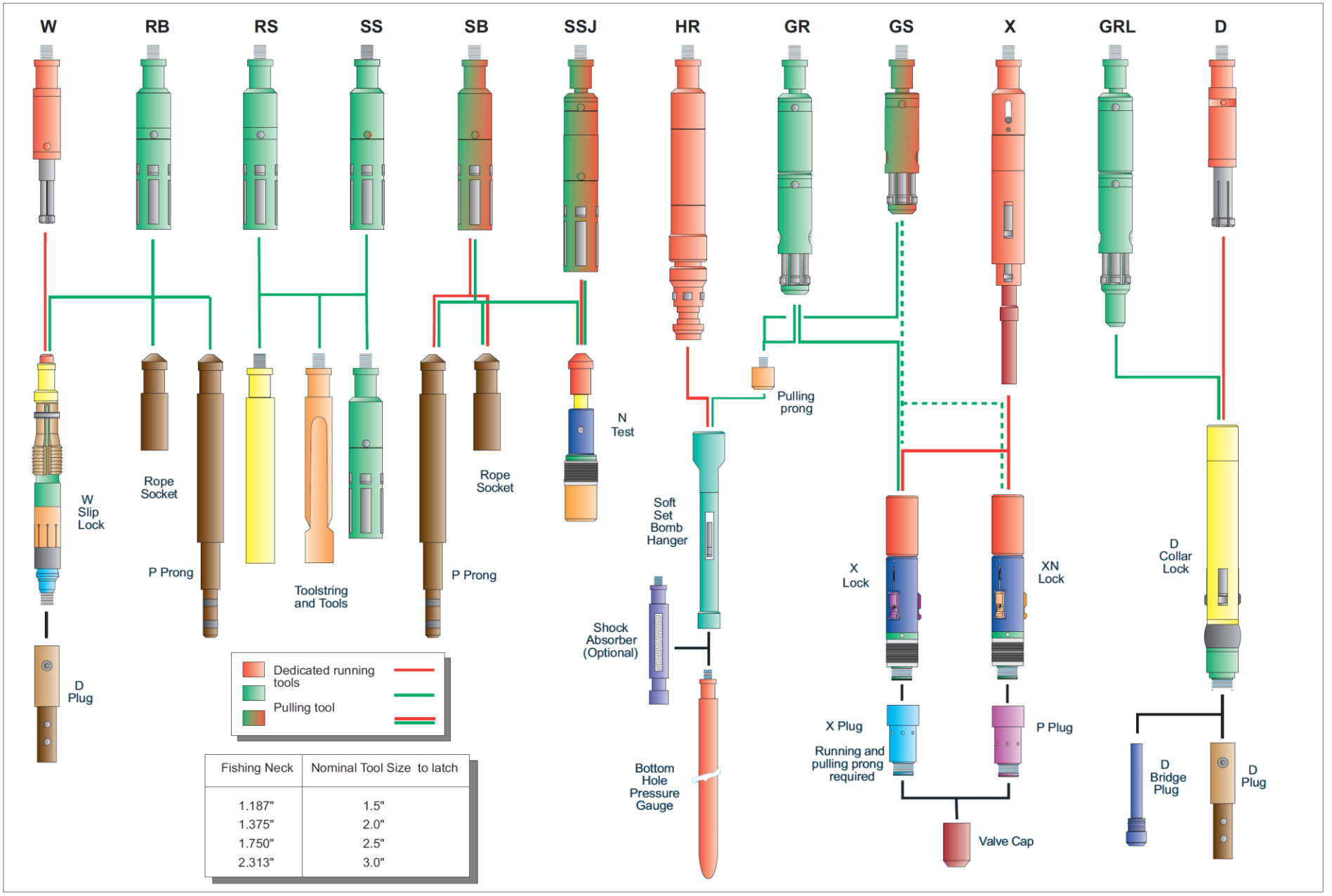




- SL Running/Pulling Tools Chart
- SL Gaslift Tools Chart
- SL Baker Equipment Tools Chart
- SL CAMCO Equipment Tools Chart
- X-Mas Tree Types
- Basic Well Schematic
- SL PCE Stack Up
- SL PCE Stuffing Box
- SL Equipment Weight Indicator
- O-Ring Conditions
- SL FORCE vs LINE SIZE Chart
- SL Powerpack Open Loop System
- SL Basic Downhole Tools
- Sucker Rod Thread (SRT) Introduction
- Fishing Neck Dimensions
- Nipple Locks Introduction
- General Fishing Tools Summary
- Gaslift Principle
- Side Pocket Mandrel (SPM)
- OK-6 Tool Running Sequence

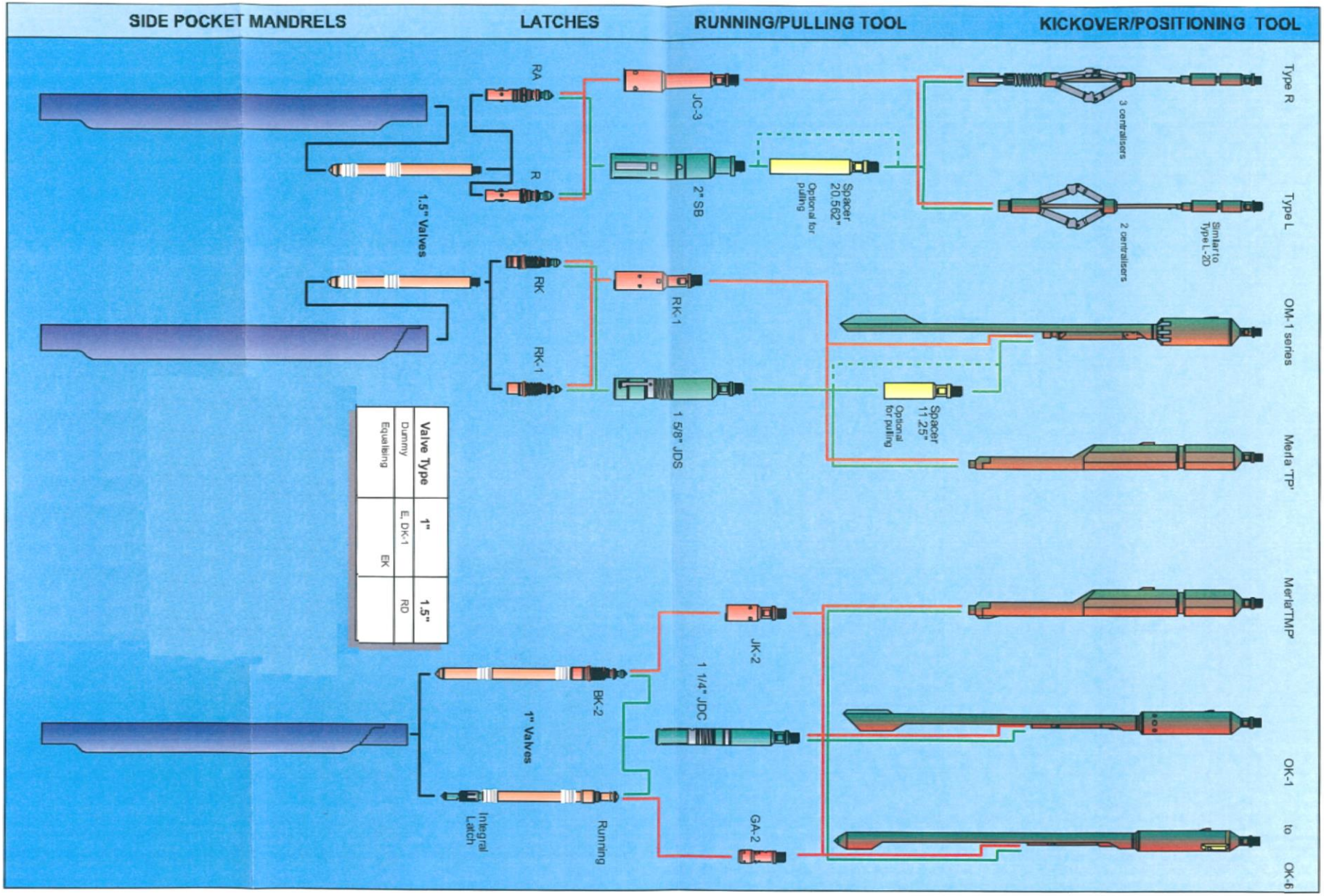
PEXS | CENTER OF TECHNICAL EXCELLENCE [PCTE]

SLICKLINE TOOLCHART : PULLING/RUNNING TOOL

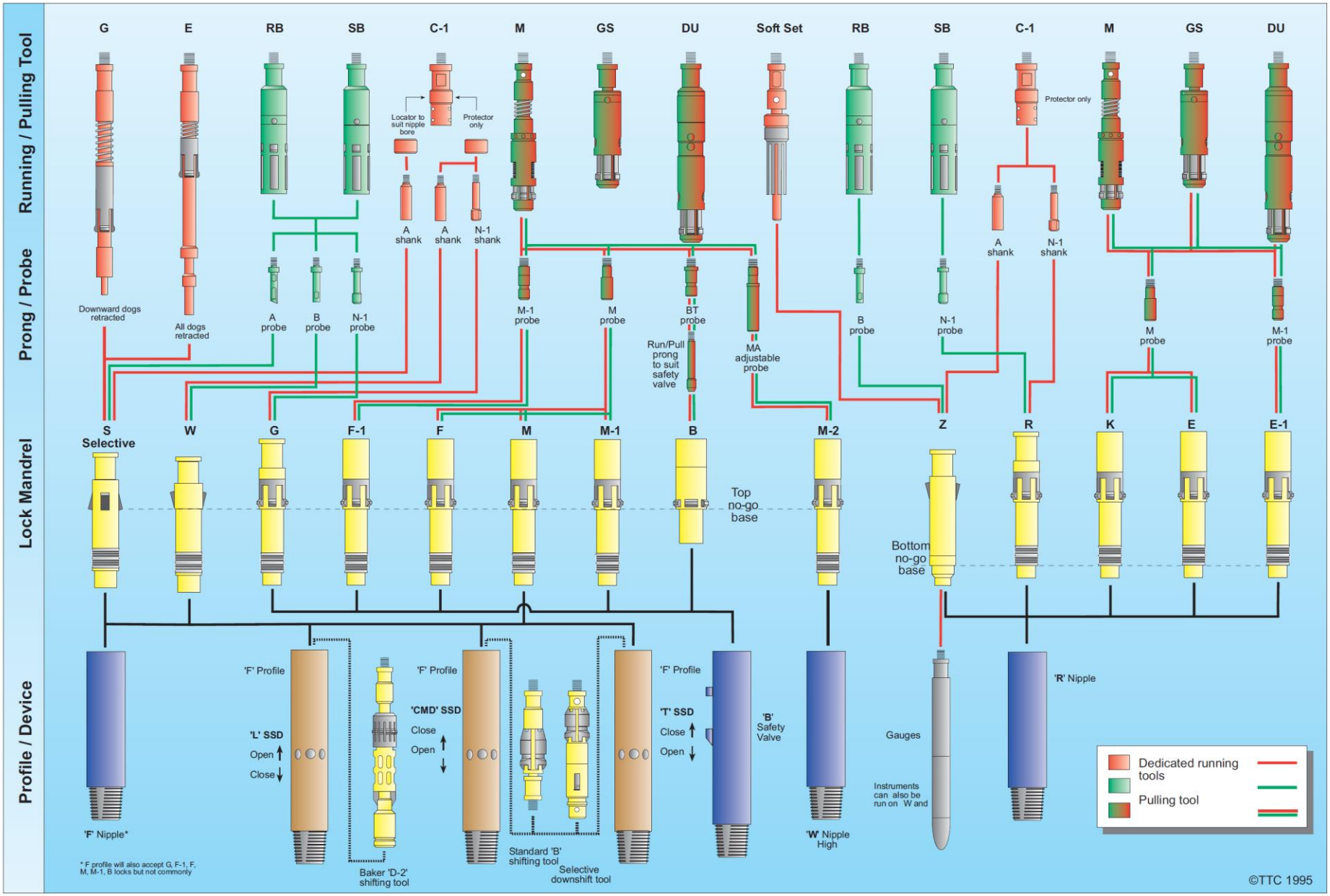


Fishing Neck	Nominal Tool Size to latch
1.187"	1.5"
1.375"	2.0"
1.750"	2.5"
2.313"	3.0"

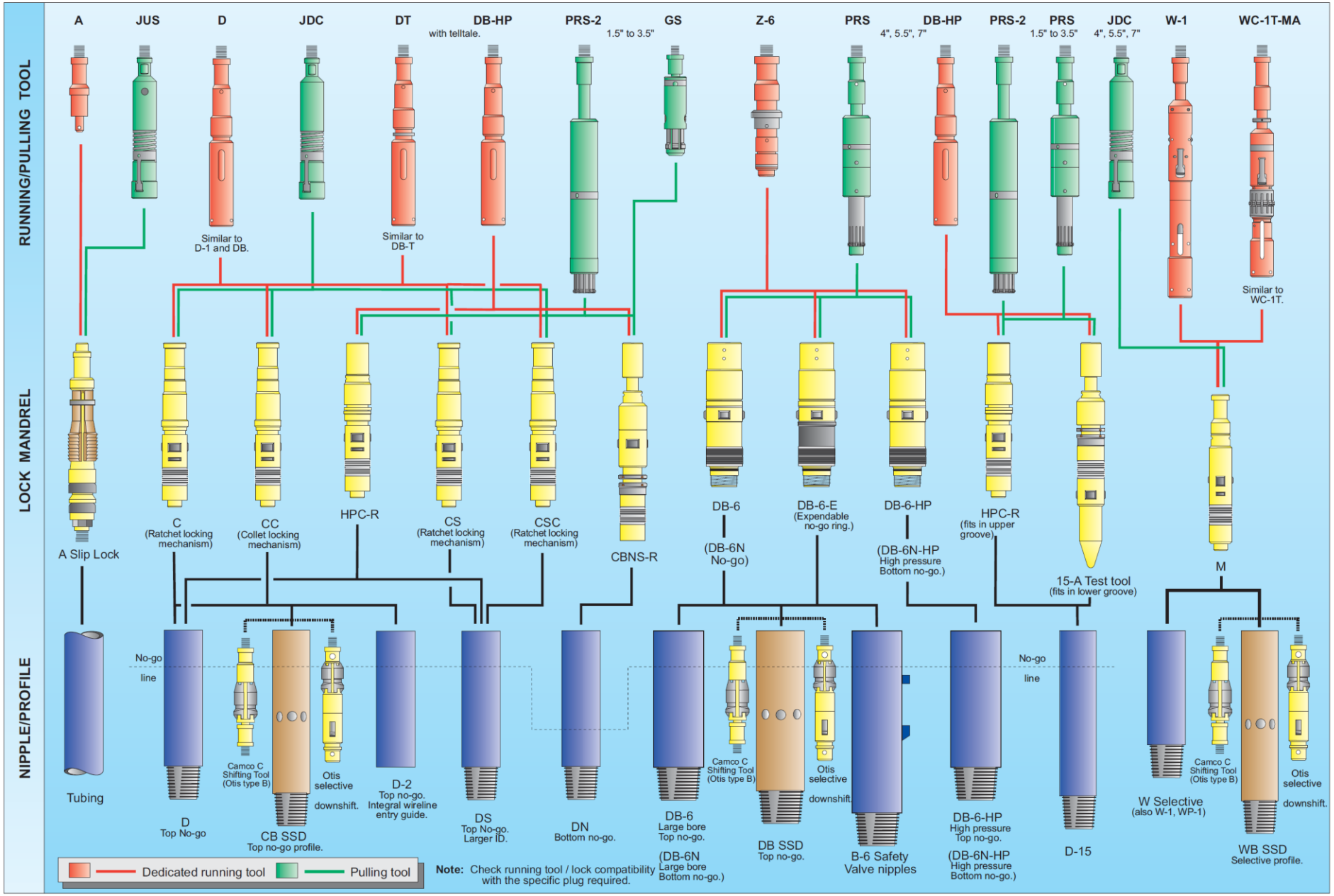
SLICKLINE TOOLCHART : GASLIFT TOOLS



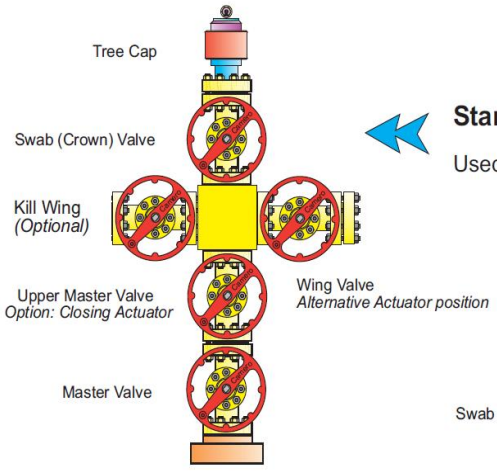
SLICKLINE TOOLCHART : BAKER TOOLS



SLICKLINE TOOLCHART : CAMCO TOOLS



X-MAS TREE TYPES



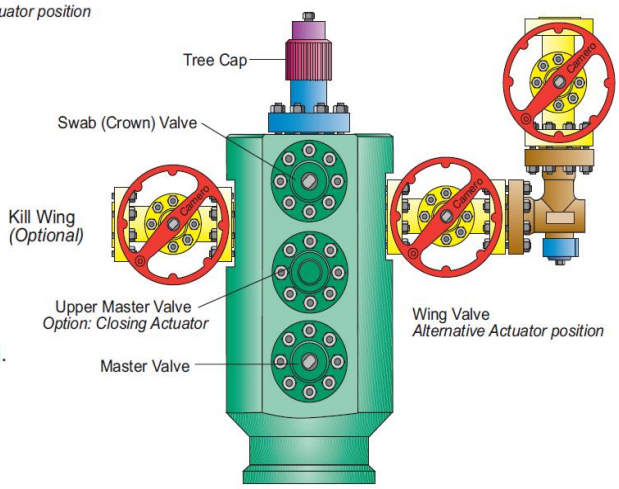
Standard Tree.

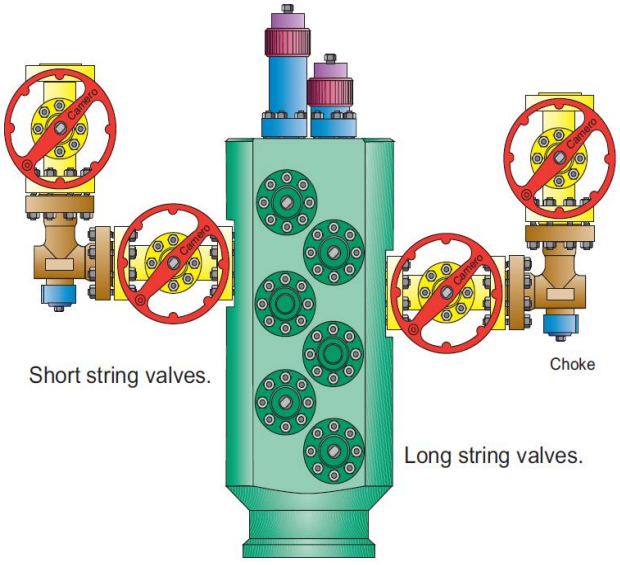
Used on Oil Wells up to 3000 psi.

Single Solid Block Tree.

(Composite Tree)

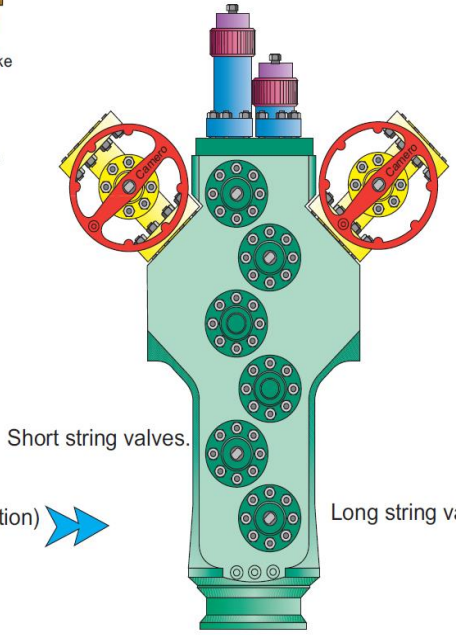
Used on Oil or Gas Wells up to 10,000 psi.





Dual Solid Block Tree.

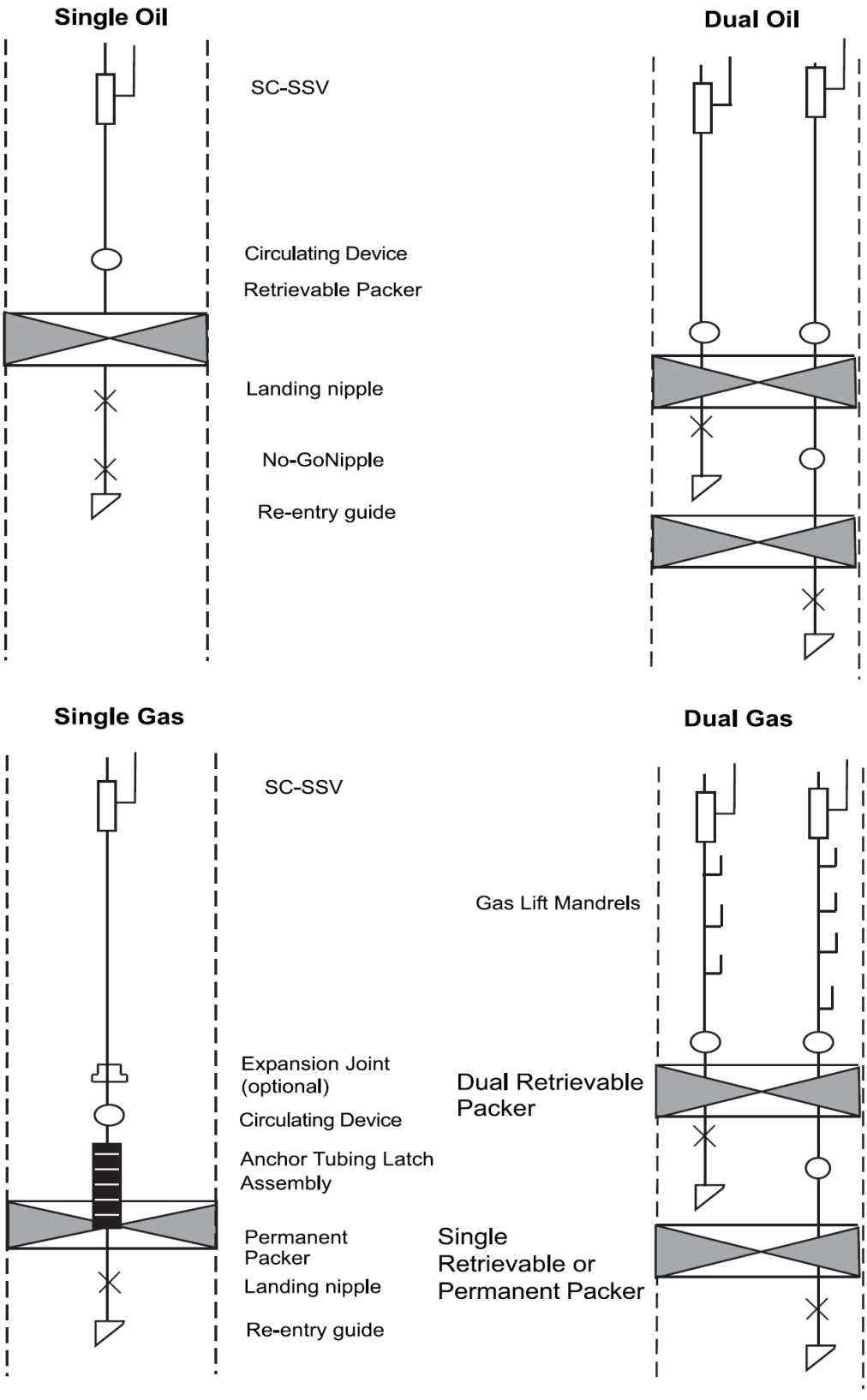
Used on Oil or Gas Wells up to 10,000 psi.



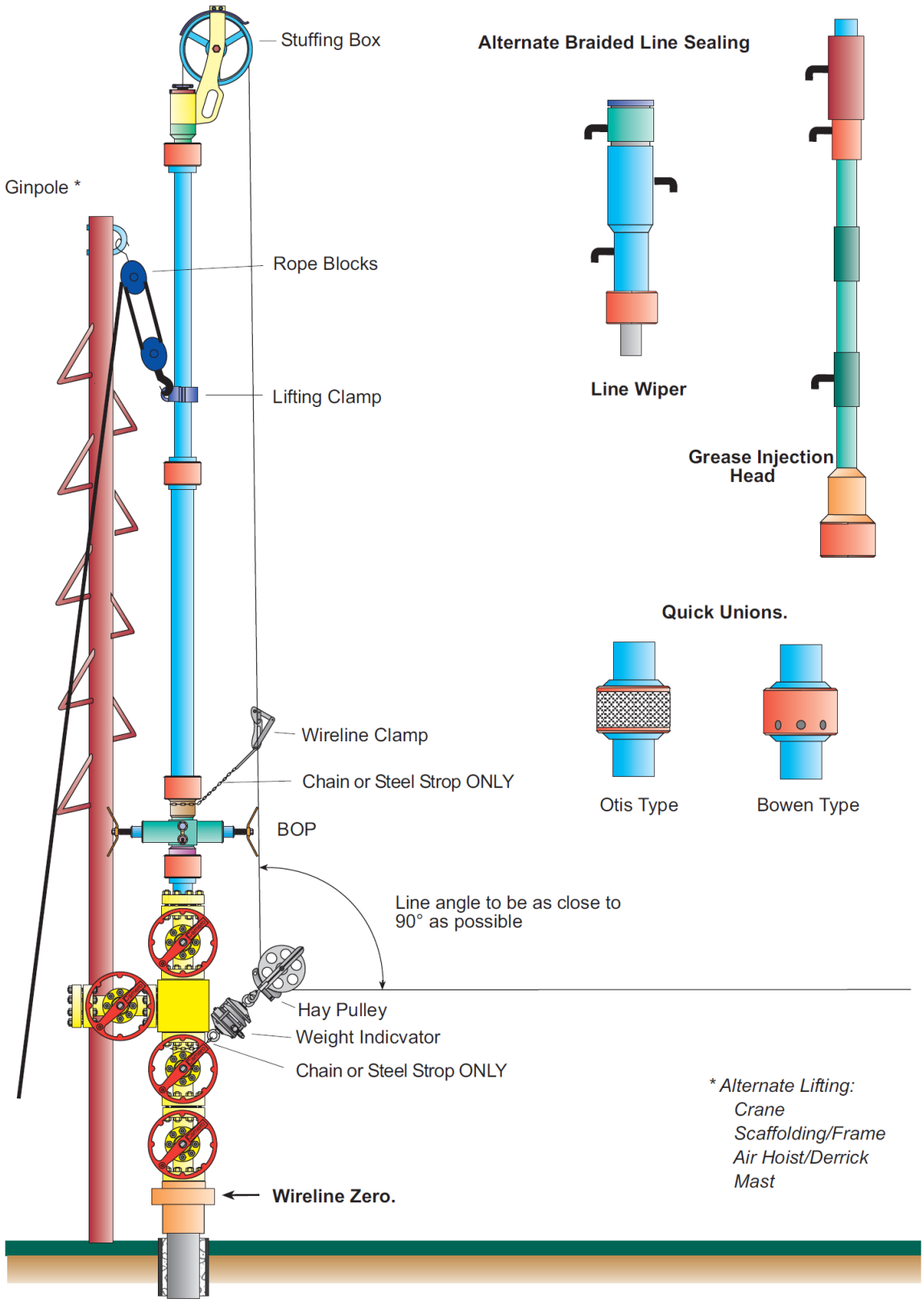
Dual Solid Block Tree. (alternate configuration)

Used on Oil or Gas Wells up to 10,000 psi.

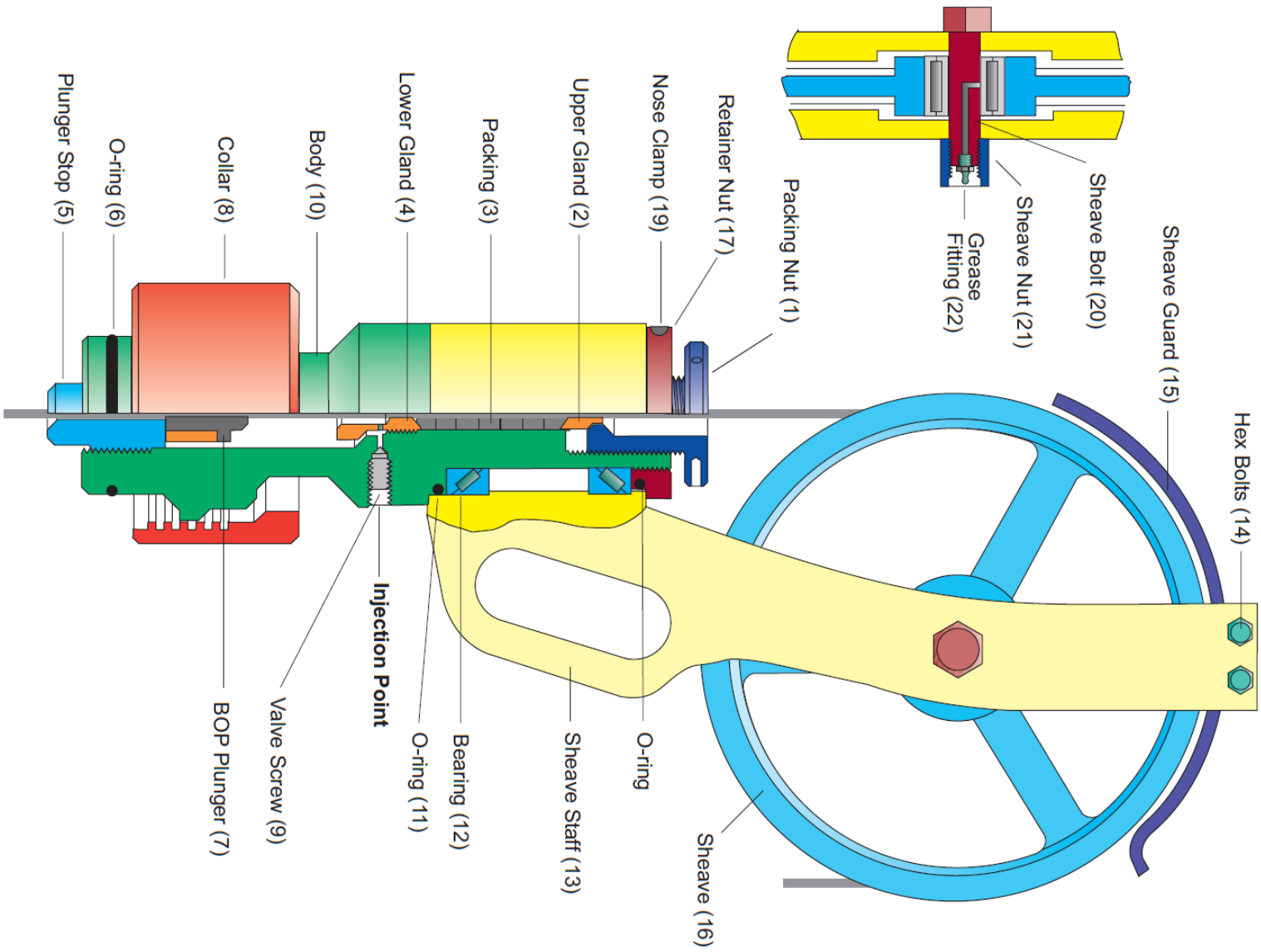
BASIC WELL SCHEMATIC



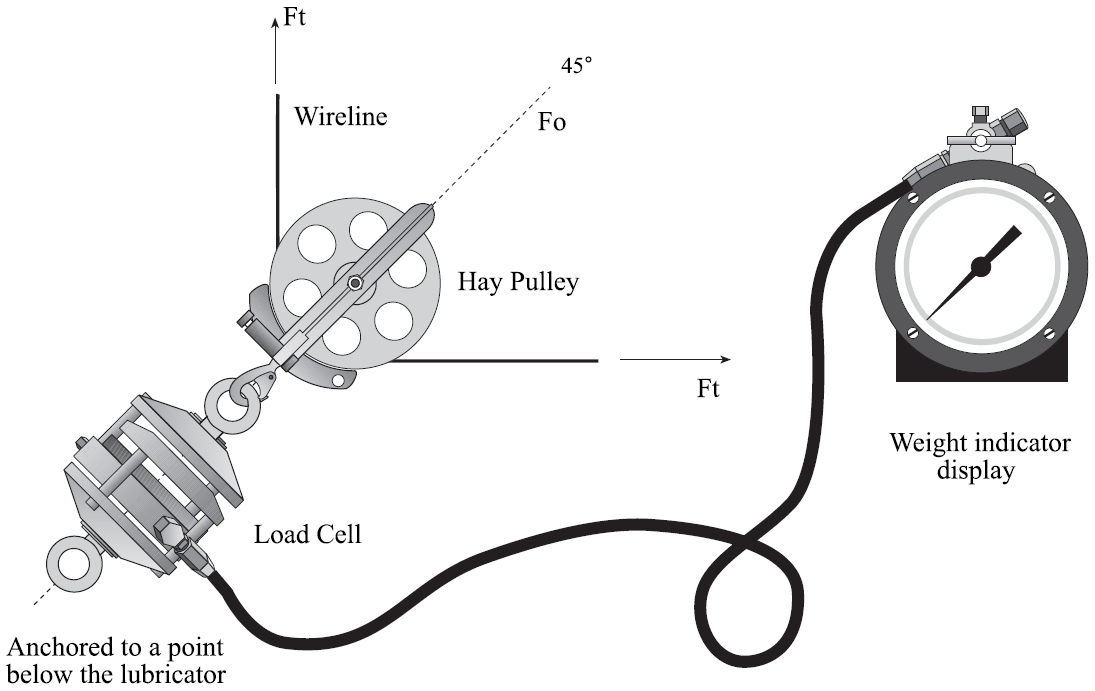
SLICKLINE SURFACE EQUIPMENT - PCE STACK UP

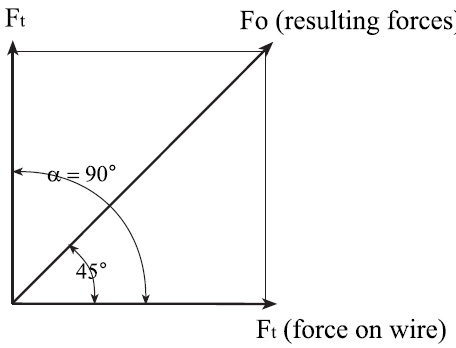


SLICKLINE SURFACE EQUIPMENT - PCE STUFFING BOX DETAILS

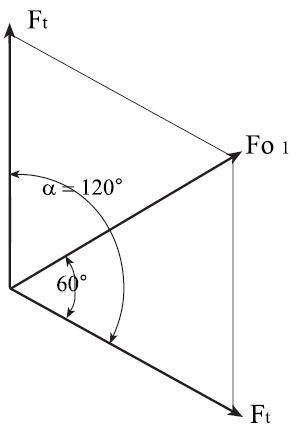


SLICKLINE SURFACE EQUIPMENT - WEIGHT INDICATOR





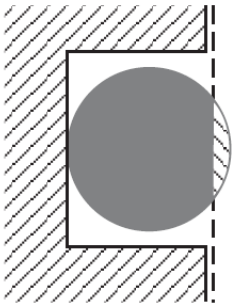
Correct angle of wire at the hay pulley



Incorrect angle of wire at hay pulley.

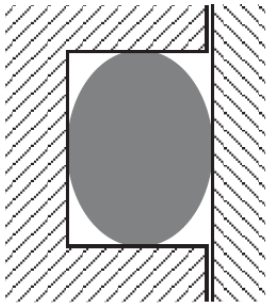
$Fo_1 = 0.7\ Fo$

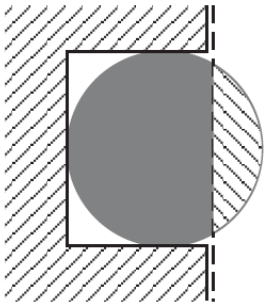
O-RING CONDITIONS



Correct

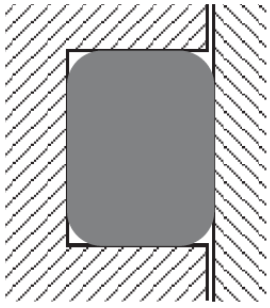
When the volume of the shaded part of the O-ring is displaced a seal is formed where contact is made.

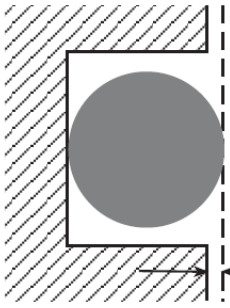




Over-sized O-Ring

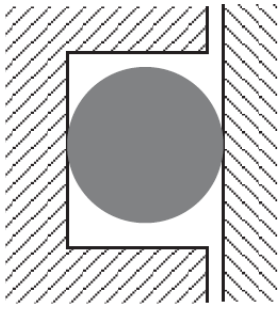
While contact is achieved it would be very difficult to fit the components together without damaging the O-ring.

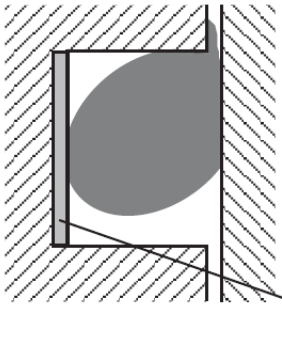




Under-sized O-Ring.

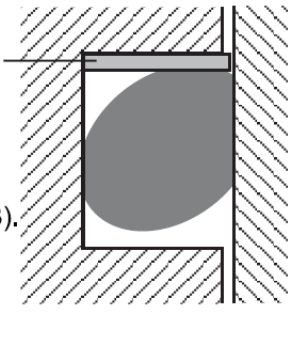
Lack of contact will allow leakage past the O-ring, or allow the O-Ring to roll and twist.
In the case of quick union pins and boxes the increase in clearance (A) from wear, may also cause the connection to leak



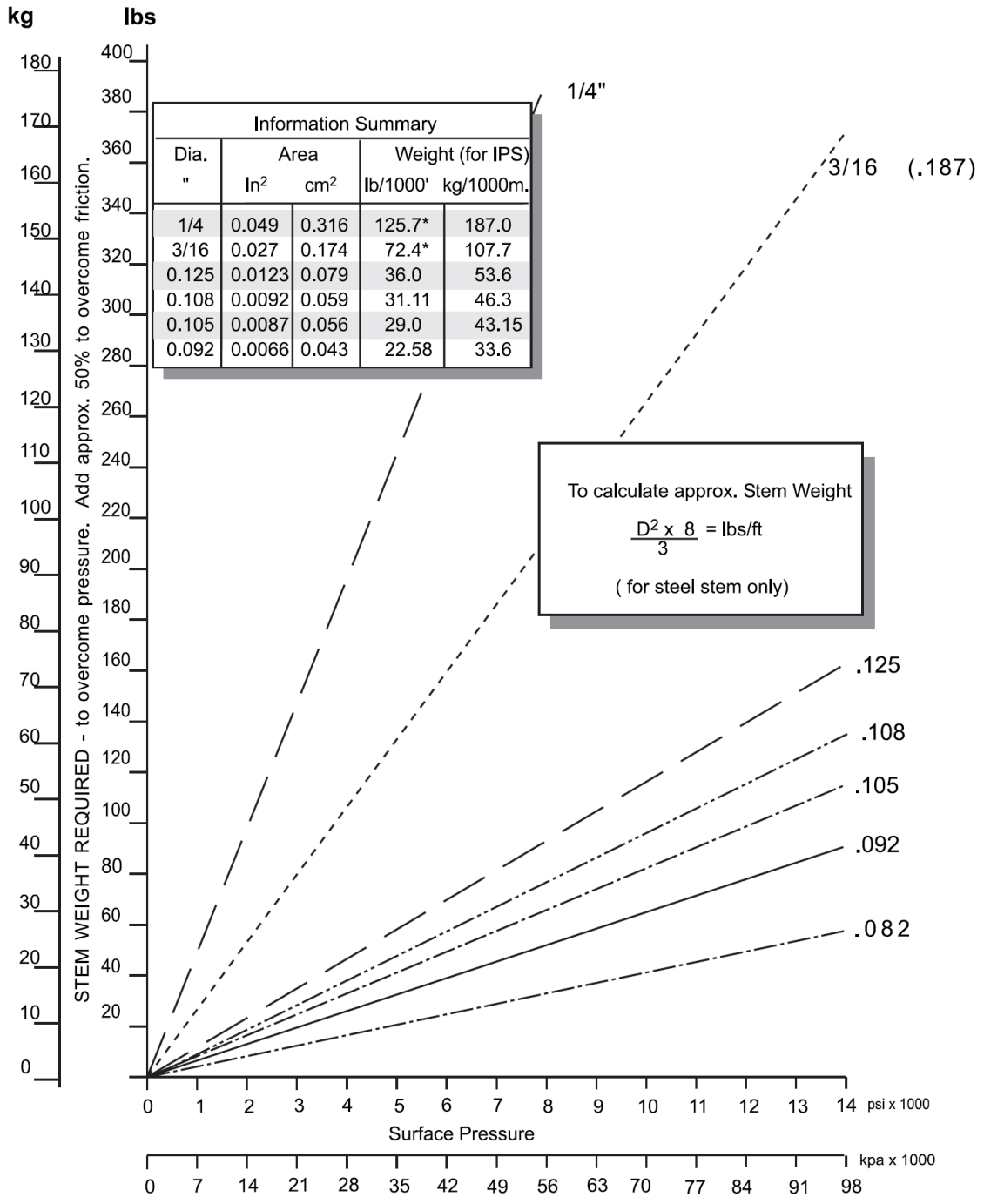


Other possible failures.

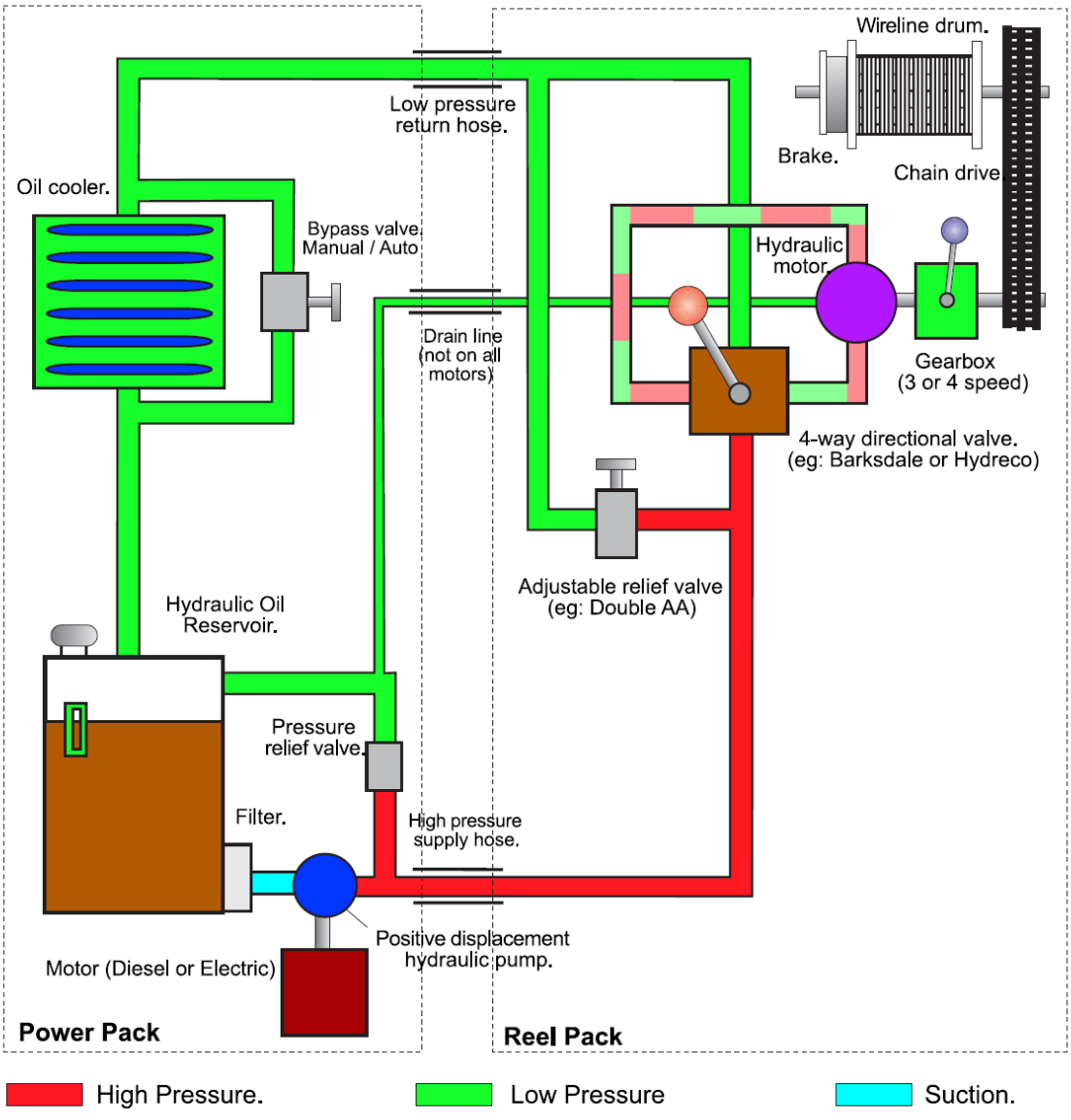
- Increased gap (A).
- Hostile Conditions.
- Incorrect selection of O-Ring material.
- Excessive dynamic movement.
- Excessive Temperature.
- Excessive Pressure / no back up Ring (B).
- Possible Corrosion / Wear increasing clearance (C).



SLICKLINE WIRE : FORCE vs LINE SIZE



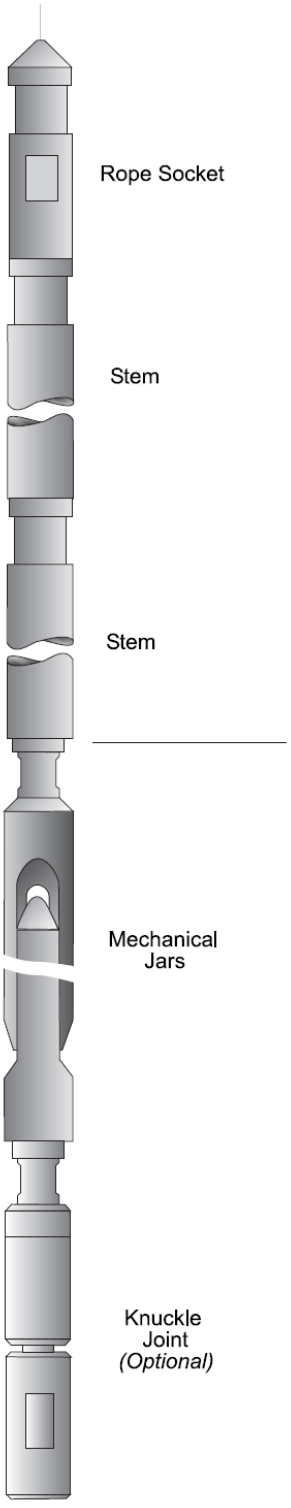
SLICKLINE SURFACE EQUIPMENT - POWERPACK / OPEN LOOP SYSTEM



The Open Loop system has been in use for several decades and provides good control of the line force and speed.
Ideally a unit should be able to pull;

- **Approximately 3,000 lbs (1,500 kgs) in low gear,**
- **Approximately 3,000' / minute (1,000 m / minute) in high gear and low load.**

BASIC SLICKLINE DOWNHOLE TOOLS



The basic toolstring components are shown here.

The diameters in most common use are 1 1/2" and 1 7/8", but toolstring components are also available in 1", 1 1/4", 2 1/8", and 2 1/2" diameters.

Rope Socket Provides a link with the wireline.

Swivel Joint Attached between the rope socket and stem if required.

Stem To add weight / mass to the toolstring to overcome well pressure and friction, and provide impact downhole.

Upstroke Jars Attached here if required.

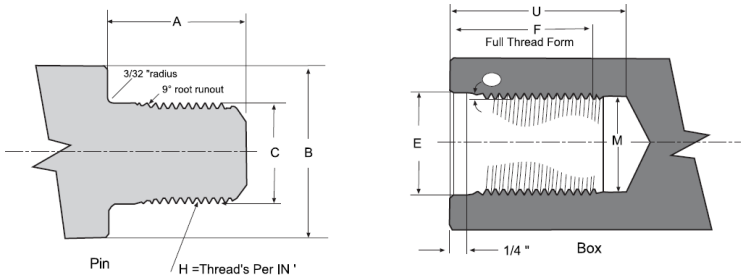
Mechanical Jars To provide a means of generating impact.

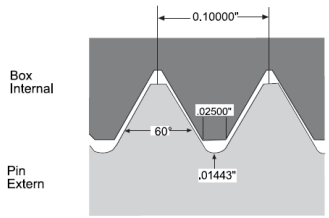
Weight reference chart		
Stem dia	Approx (lbs/ft)	(kgs/ft)
3/4	1.500	0.68
1	2.660	1.21
1 1/4	4.160	1.90
1 1/2	6.000	2.73
1 7/8	9.375	4.26
2 1/8	12.040	5.47
2 1/2	16.660	7.60

Knuckle Joint Attached here if required.

Attach the required tool to the bottom of the jars or knuckle.

SUCKER ROD THREAD (SRT) INTRODUCTION





Size	A	B	C (Nominal)	E	F	M	U
5/8"	1.125"	1.375"	0.9362" (15/16)	0.995"	1.29"	0.830"	1 5/8"
3/4"	1.375"	1.500"	1.0611" (1 1/16)	1.080"	1.54"	0.955"	1 7/8"
1" *	1.750"	2.000"	1.3735" (1 3/8)	1.393"	1.94"	1.267"	2 3/8"
1 1/8"	2.000"	2.250"	1.5609" (1 9/16)	1.580"	2.19"	1.455"	2 5/8"

** Not in common use.*

Petroline Connection Design Strengths			
Thread / QLS	**Design Tensile Yield Strength (lbs)**	**Design Shear Strength (lbs)**	**Ultimate Tensile Strength (lbs)**
15/16" - 10 SRT	46,352	67,684	71,076
1 1/16" - 10 SRT	62,019	78,291	95,100
1 9/16" - 10 SRT	147,661	193,862	226,422
1.00" - 12 UN (1 1/2" QLS Stem Connection)	56,799	119,719	87,096
31.19 mm - 16 UN (1 7/8" QLS Stem Connection) (2 1/8" QLS Stem Connection)	90,290	145,790	138,451
39.80 mm - 12 UN (2 1/2" QLS Stem Connection)	152,222	329,798	233,418
2.00 " - 12 UN (2 11/16" QLS Stem Connection)	256,144	421,472	392,773
1 1/2" QLS	49,718	59,266	76,238
1 7/8" and 2 1/8" QLS	76,783	73,367	117,740
2 1/2" QLS	125,404	137,963	192,295
2 11/16" QLS	154,222	191,260	236,485

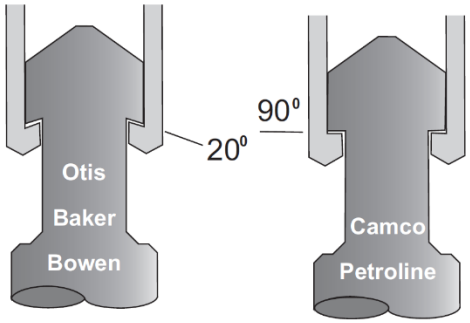
- The traditional means of connecting the toolstring components are the **Sucker Rod Threads (SRT)** used to connect sucker rods in beam pumping wells.
- SRT connections are susceptible to damage from;

  - Direct damage in the toolbox if inadequately protected.
  - Corrosion if not protected.
  - Overtightening with pipe wrenches and 'cheater' pipes.
  - Wrench damage can create stress raisers which can cause hand injuries.
  - Additional damage can occur around the fishing neck and wrench area from the wrench jaws.

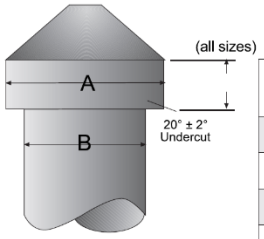
Notes

1. *The information contained in this document has been derived from purely considering theoretical tensile and shear calculations. It takes no account of fatigue or bending stresses, and also has no derivation from test results.*
2. *Material yield value is taken as 91,300 psi. (This results in a 1.2 FOS.)*
3. *Material shear stress is taken as 45,650 psi. (This results in a 1.2 FOS.)*
4. *Material ultimate tensile stress is taken as 140,000 psi.*

FISHING NECK DIMENSIONS

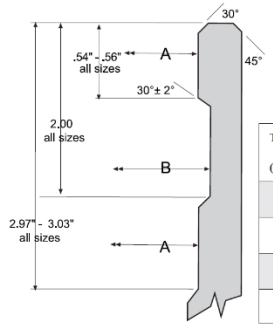


External Fishing Neck Chart (inches)



Toolstring Size (Nominal)	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 (inches)



Tubing Size (Nominal)	Diameter 'A'		Diameter 'B'	
	Maximum	Minimum	Maximum	Minimum
2.062	1.06	1.08	1.22	1.24
2 3/8	1.38	1.40	1.57	1.59
2 7/8	1.81	1.83	2.00	2.02
3 1/2	2.31	2.33	2.50	2.52

- Pulling Tools are designed to remove various subsurface equipment from the well.
- They can only be used to retrieve an item of equipment that has a 'standard' fishing neck.
- If it is impossible to retrieve the equipment, the pulling tool can be released by shearing a pin and returning to the surface.
- Pulling tools may be designed for either **external** or **internal** fishing necks.
- Shearing the pin may be achieved by jarring up or down, depending on the type of tool.

Examples

- **Jar up** - External fishing neck : Otis RB, RS / Camco JUC, JUS
- **Jar down** - External fishing neck : Otis SB, SS / Camco JDC, JDS
- **Jar up** - Internal fishing neck : Otis GR
- **Jar down** - Internal fishing neck : Otis GS / Camco PRS

NIPPLE LOCKS

- The **X** / **XN** lock mandrels designed by Otis set the standard for selective locks and are in common use worldwide. There are 3 types of nipple locks:

1.	Selective	Due to nipple profile	**'S' Locks.**
2.	Selective	Due to running tool	**'X' Locks.**
3.	No-go	Due to restriction in nipple	**XN Locks.**

- The **'S' Lock** system relies on varying profiles in each nipple, starting with the S-1 at the bottom to an S-5 near the surface.
- The operator installs the keys below the lock that match the nipple profile in which the lock was required to be positioned.
- The profile of 'S' nipples used for SOD's is an S-4.
- The **'X' Lock** system uses identical nipples in each respective tubing size.
- The operator can select which nipple the lock is to be set in, by the use of a selective running tool.

Advantages over previous designs of lock are:

- ❑ V-packing seal in the polished bore of the nipple. *Note : This method of sealing also applies to the 'S' lock.*
- ❑ Holds pressure from both directions (high pressure R / RN system available.)
- ❑ Identical nipples simplify installation and ordering.
- ❑ Can be set in the 'X' profile of SSD's.
- ❑ Simple lock designs reduce maintenance.

Running Tool : 'X' **Pulling Tool : GR.**

- The **XN Lock** is an 'X' lock with the keys changed to XN.
- All other components are identical, including the running and pulling tools.
- The OD of the equalising sub is too large to pass the no-go nipple ID, so serves as a positive stop to locate the nipple keys.

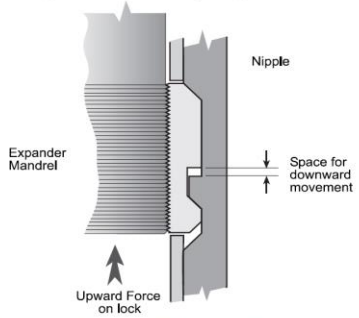
*Note : An **'Interference Lock'** in the 'X' and XN style is now available from Otis. The only difference is a small, slightly raised band on the packing mandrel near the small holes behind the keys.*

'X' keys have a 90° shoulder. **XN have 45° shoulder.**

Prior to running an 'X' (or XN) lock you should check the following:

1. All threads are tight - Note the hole in the expander mandrel for a bar. (DO NOT PLACE A WRENCH ON THIS SURFACE.)
2. Correct profile keys - 'X' or XN.
3. Key spring tension. Keys should be - Fully retracted and firm in SELECTIVE.
   - Sprung forward evenly in NON-SELECTIVE.

   It is recommended that these springs are replaced regularly.
4. Check the internal fishing neck for wear / damage.
5. Check serrations on the expander mandrel and keys. Replace if worn.



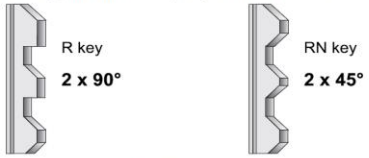
The greater the upward force created by the pressure differential, the greater the 'squeeze' by the keys onto the packing mandrel. This grips the serrations to prevent the expander mandrel moving upwards and unlocking. This can be observed by opening and closing a lock mandrel, and comparing the effort needed to repeat the opening sequence while squeezing the keys inwards by hand.

The R / RN system was developed by Otis as the high pressure version of the X / XN system. While actual pressure ratings vary with the lock diameter, the nominal rating on R / RN locks is 20,000 psi compared to the 10,000 psi rating on X / XN locks.

Check these pressure ratings with your supplier for the sizes of locks and material type in use in your area.

The R / RN locks are of heavier construction with thicker wall sections. The OD is reduced (refer to the chart on page 6-29), which gives a considerable reduction in the ID. This is not of concern unless the well is to be flowed through the lock.

The key profiles have double 90° (R) and double 45° (RN) shoulders as shown below:

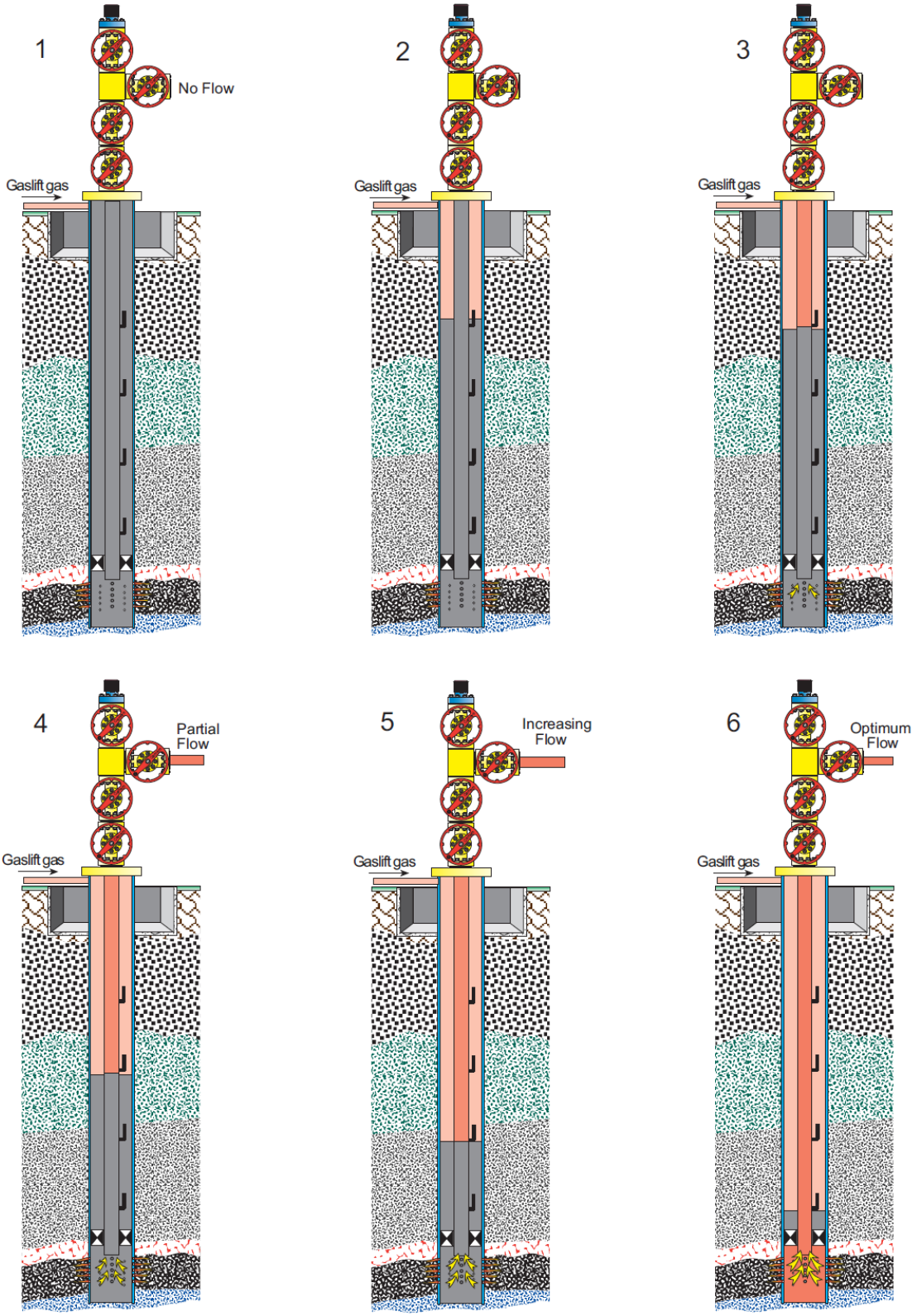


Fishing neck ID's are the same for X / XN and R / RN equipment.

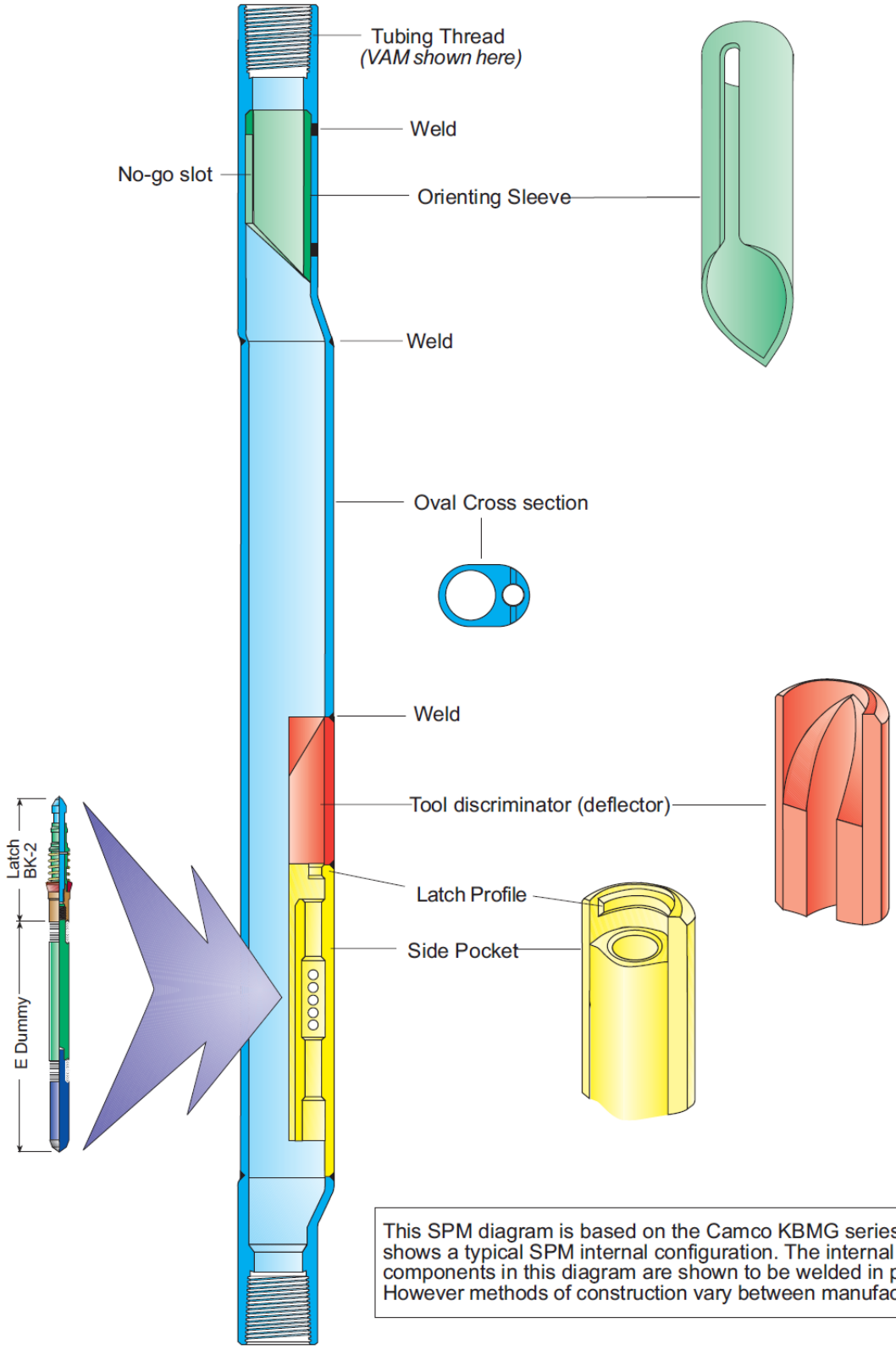
GENERAL FISHING TOOL SUMMARY

Tool	Use	Comment
Bowen wire finder	Locate top of broken wire	Difficult to pass nipple ID
Wire scratcher		Care required near SPM's
Petroline finder		Can pass seal bore restrictions
Wire grab	To latch ball of wire	Run on rope socket + RB
Centre spear	To pierce thick ball of wire	
Tubular jars	When broken wire is in hole	Reduces hazard of fouling jars
Cutter bar	To cut broken wire	Consider blind box size carefully
Go-devil - Bevelled - Flat	To cut wire at rope socket As cutting force for Flopetrol	Do not drop in gas Check sizes
Kinley snepper	To cut wire	Does not return on line usually
Flopetrol cutter	Cuts wire close to rope socket	Returns on line
Sidewall cutter	To cut broken wire	Leaves long piece above rope socket
Magnet	To recover small pieces	Magnetic steel only
Overshot	To latch worn smooth items	Run on the rope socket + SB
Flopetrol overshot		Can be released by jarring DOWN
Broach	To increase tubing ID	Use with care
Impression block	To obtain 'picture'	Smooth before use

GASLIFT PRINCIPLE



SIDE POCKET MANDREL



This SPM diagram is based on the Camco KBMG series and shows a typical SPM internal configuration. The internal components in this diagram are shown to be welded in place. However methods of construction vary between manufacturers.

OK-6 TOOL RUNNING SEQUENCE