COSSD

PRODUCT CATALOGUE

for

SNUBCO
PRESSURE CONTROLS LTD.

About Us

Snubco Pressure Control Ltd., a pressure control service company, was formed in 1996 in Alberta by four partners with extensive experience in the techniques of hydraulic rig assist snubbing – expertise that sets Snubco apart from any other company in Canada. Our highly motivated, experienced crews operate the most innovative snubbing equipment available in the industry today – built and developed by Snubco.

Since its inception, Snubco has strategically grown from a single small snubbing unit to a fleet of small to large equipment for a variety of snubbing, freeze and hot-tap services. To better supply our customers with oilfield servicing solutions, we have added “Self-contained” snubbing units to our fleet. With our unique expertise, Snubco is also able to provide support to well control specialists by supplying equipment and personnel on many well control events within the oil and gas industry.

The Snubco Group has diversified its existing suite of services by adding three new services in 2006 which very much compliment their existing snubbing services. The Snubco Group has added nitrogen pumping units, coil tubing units and the Snubsmart safety system. Please follow the links to check out our new services.

Snubco continues to grow both domestically and internationally and leads the way in snubbing innovation. We are proud to manufacture and supply the toughest snubbing equipment available to the oil and gas industry in Canada and Worldwide.

History

1996
Snubco Pressure Control Ltd. was established in Edmonton, Alberta by a team of seasoned veterans in the snubbing industry. The company rapidly expanded from one snubbing unit to two. By the end of the first year of operation, Snubco completed over 200 snubbing jobs for more than two dozen oil companies on projects ranging from simple completions to high pressure work overs to under balanced drilling situations.

1998
Fleet was doubled to four units**.**

1999
Growth continues with plans for a new fabrication facility to manufacture rig assist snubbing equipment. Fleet was expanded to seven rig assist units and one freeze unit.

2000
A head office, fabrication, and maintenance facility was built at the Nisku, Alberta location. Snubco currently dispatches equipment out of the Nisku and Grande Prairie locations and maintains a sales and customer service office in Calgary.

2002
Snubco Pressure Control International Ltd. was formed to offer new innovative snubbing technology and expertise to the ever-expanding needs of the global marketplace. Snubco International closed the first international deal with a company from China for equipment and personnel.

2003
Two additional new customers from China have signed deals to purchase snubbing equipment. Snubco Domestic builds its first "Self-Contained" Snubbing Unit.

The domestic operations center in Nisku, Alberta is doubled in size to accommodate the growth of the company.

Snubco International forms a joint venture with the Australian company Eastern Well Service. The two companies form Eastern Pressure Control Ltd and bring rig assist snubbing, freeze services and hot-tap technology to the Australian market.

2004
Snubco's Domestic fleet has expanded to ten snubbing units operating throughout Canada.

Snubco Manufacturing Inc is formed and completes the sale of one rig assist unit to a Canadian customer.

Snubco International completes the sale of the fourth rig assist style unit to the Chinese market. Additionally, the company signs a contract to provide rig assist units to a customer in Romania.

2005
Diversification continues at Snubco with the purchase of four cryogenic nitrogen pumpers, and two coil tubing units. Additionally, a contract is signed to secure storage and supply of cryogenic nitrogen in strategic locations within Alberta. One bulk transport unit is purchased to support the nitrogen pumping equipment.

The overall company is reorganized into several divisions under the leadership of Snubco Group Inc.

Snubco Manufacturing sells another rig assist to a Canadian customer.

A joint venture is signed between Snubco International and StassCo Pressure Control LLC. in the United States. Two Rig assist snubbing units are built for operations throughout the mountain states region.

Snubco International ships a rig assist snubbing unit to its Romanian customer.

A joint venture is signed between Crane Smart shareholders and Snubco's shareholders to form a company called "Rig Smart". This company's mandate is to bring computer automation and safety systems targeted at snubbing units and work over rigs.

The Snubco Group now includes the following corporations:

- **Snubco Group Inc.** Parent corporation
- **Snubco Pressure Control Ltd.** – Responsible for all Canadian snubbing, freeze and hot-tap services.
- **Snubco Well Services Ltd.** – Responsible for all Canadian nitrogen pumping and coil tubing operations.
- **Snubco Manufacturing Ltd.** – Responsible for all engineering, manufacturing, research and development of The Snubco Group.
- **Snubco Pressure Control International Ltd.** – Responsible for all international operations outside of North America.
- **Snubco USA Inc and StassCo Pressure Control LLC.** - Responsible for snubbing services in the lower 48 states in the US.
- **Rig Smart Inc.** - Responsible for computer automation and safety systems for snubbing units and workover rigs.

2006

A 14,000 square foot facility is leased in Grande Prairie, Alberta to accommodate the Nitrogen, Coil and Snubbing service divisions.

Snubco Manufacturing completes the sale of a third rig assist unit to a Canadian customer.

The first "Rig Smart" Systems are installed on work over rigs in Alberta. 12 snubbing units are now equipped with the "Snub Smart" safety system developed by Rig Smart.

The Snubco Group forms an alliance with StrataEnergy Services to promote snubbing and under balanced drilling technology worldwide.

Health & Safety

“Snubco Pressure Control is committed to providing highly trained personnel and specialized equipment to meet the customer’s needs. We will strive to provide a consistent high standard of service and job quality for our customers on a daily basis”
~John Taskinen, President, Snubco Pressure Control Ltd.

Snubco believes in having a strong safety and incident control program to ensure the health, safety and well being of employees, customers and the public. Our safety record is one of the best in the industry with no serious injuries, accidents or incidents in our history. We achieve this by working together to sustain the safest work environment possible.

Snubco has received the “Certificate of Recognition from the Alberta Association for Safety Partnerships with an average score of 95% for each audit year.

Our Experience

Snubco is one of the most experienced rig assist snubbing contractors in the world. Our management and supervisory team offer more than 270 years combined experience in the field. In fact, even today all of Snubco’s management team still participates in the day-to-day field operations when needed – a level of service that is greatly valued by our customers.

Snubco currently employs a team of highly skilled equipment operators – considered the best in the industry – that have built SNUBCO’s reputation for quality service and safety. Our customers ask for our operators by name!

As an industry leader, Snubco has completed over 6000 snubbing jobs for over 275 oil companies Worldwide. Domestically, we have successfully tackled projects throughout Western Canada, Quebec, Yukon and the North West Territories. On the International front, Snubco's team has worked in from the frozen tundra of the Arctic, to the burning sands of the Middle East to various countries in Asia and Europe.

Our skilled team has worked in dangerous situations involving pressures up to 13,000 Psi and H2S concentrations of up to 45% on projects ranging from simple completions to high-pressure workovers and under balanced drilling projects.

Snubco's Training Program

Snubco's reputation for excellence in training has allowed the company to create and retain an extremely experienced and versatile workforce. As an industry leader, Snubco's management team recognizes the value of experience in the field. Therefore, we have a comprehensive training program that combines classroom training and field experience under strict supervision, to continually produce highly skilled professional operators.

The philosophy of Snubco is that our operators achieve a high level of competency and have proven field skills. That's why it takes 2-3 years to train our operators. First they must complete an intensive 2-year training program with ongoing mentoring and supervision in the field on "real" rigs (90% percent of the training is in the field). In conjunction, formal accredited class training is supplied including (but not limited to):

- Well Control
- Well Servicing Blow-Out Prevention
- H2S Training
- Fall Arrest
- Confined Space Entry
- First Aid
- Off Road Driving
- Transportation of Dangerous Goods
- Crane Operation
- WHMIS
- PST
- High Angle Rescue
- Advance Employee Training – Core Procedures
- Hand Signals
- Fire Extinguisher Training
- Off Road Driving, GODI, PDI
- Fork Lift Training

Snubco's believes in "life-long" training related to our industry and also provides specialized workshops on an ongoing basis on the latest topics related to the industry such as:

- Hydraulics Trouble-shooting and Pneumatic Design
- Packer Fundamentals
- Wireline
- Diesel Engine Basics

Our People

Snubco's success is a combination of our highly experienced management team and our dedicated seasoned field professionals, who have built a strong reputation in the oil and gas industry. We are pioneers in the snubbing industry through our innovations in the design and manufacturing of snubbing equipment used today in Canada and around the world. Many of our innovations and new technologies are possible because of Snubco's corporate environment

Services

Snubco is world renowned for providing innovative technologies and professional services to the oil and gas industry. Intensive research and development combined with our custom manufacturing process helps Snubco stay at the leading edge of snubbing, freeze and hot-tap technologies. Our main services are Snubbing (rig assist or self-contained), Hot-Tap and Freeze Application, Nitrogen Pumping and Coil Tubing. Snubco also provides Well Control support to well control specialists and oil companies, by supplying equipment and personnel to assist on incidents.

Freeze Applications

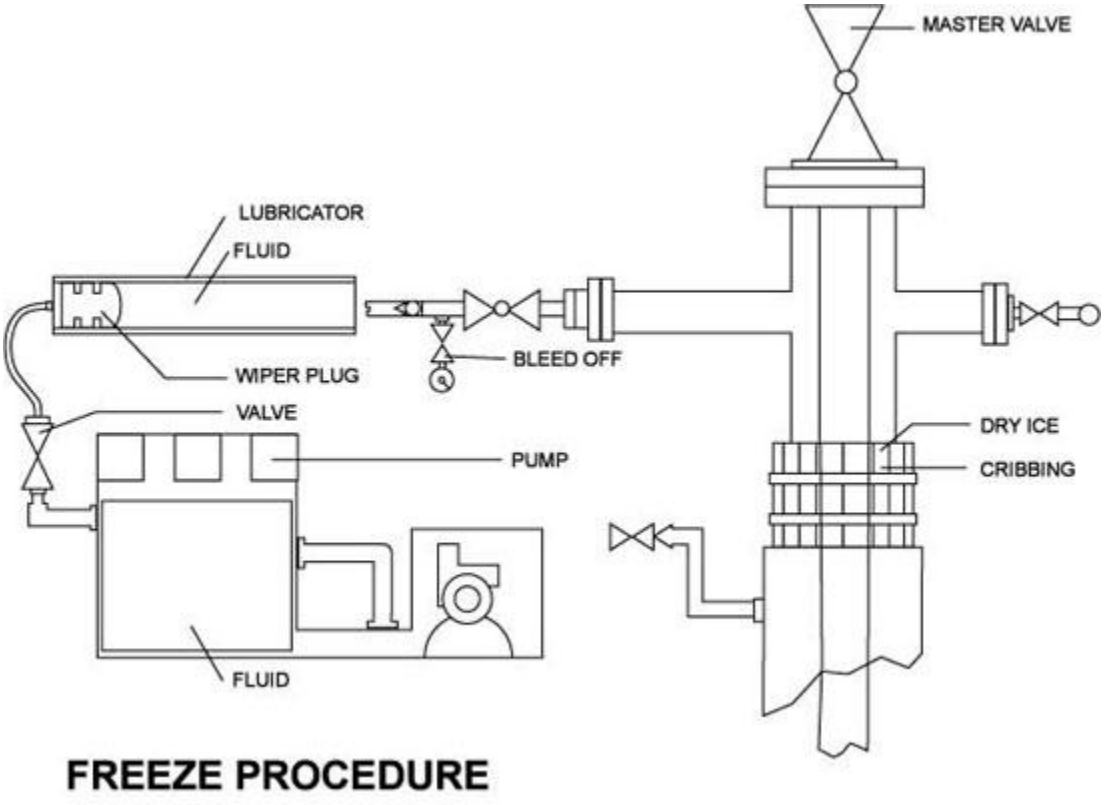
Trust your Freeze Applications to the Snubco professionals. We have years of experience in Freeze Applications for a wide range of situations with pressures of up to 7,500 Psi. Snubco knows that safety of any freeze application is directly related to experience – our team is the most highly trained and skilled you will find in the industry.

Freeze Applications are commonly used in situations no other practical means of containing pressure to replace damaged equipment or to allow access without killing the well. It is an inexpensive and safe way to control well pressures during regular well maintenance where removal of the wellhead, pipeline or auxiliary equipment is required.

Typical Freeze Application Process:

- An area is displaced with a “plug” of uncontaminated bentonite gel mixed to a thick slurry.
- The gel plug is frozen in place by use of dry ice (solid CO2) contained with a cribbing and tamped manually to keep in contact with the area to be frozen at all time.
- The methods used depend on what the area to be frozen contains or has contained or whether there is a leak to atmosphere from the area to be froze.
- Pressure testing is always done to 1 ½ times the surface pressure of the well, or to the maximum well head pressure rating.

Diagram of Freeze Application

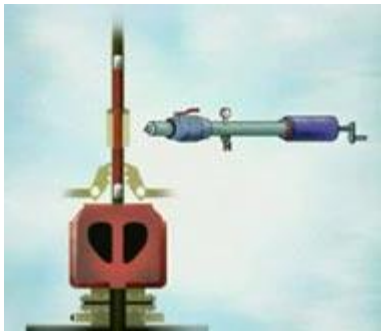


Snubco Freeze Unit Specifications:

- 1997 International 4900 Series 466E with positive shutdown diesel engine c/w 22’ insulated heating van. Pumping capabilities to 7500 Psi. Fully self contained.
- All equipment meets NACE specifications.
- Proheat and intrinsically safe electric heating system for maintaining thaw at pumping and pressure monitoring area.

Hot-Tap-Operations





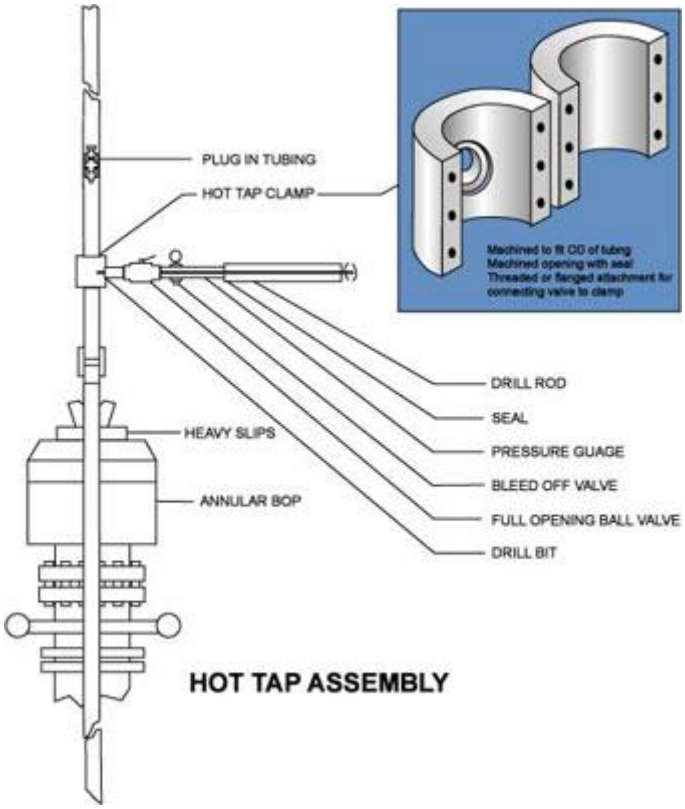
Hot Tap operations are used in the following situations:

- an obstruction in tubulars during tripping operations and trapped pressure is suspected
- the need to enter an existing production line in a plant without depressurizing the line
- a valve that needs replacing on a producing well where killing or depressurizing the well is not wanted
- re-entry into an abandoned or suspended well
- in conjunction with Freeze

The Hot-Tapping Process:

- Blockage is located and tubing is lifted until blockage is clear of well
- A Hot Tap clamp is secured on the tubing below the blockage and above the next coupling
- A full opening valve is attached to the Hot Tap clamp
- A drill is installed and the distance from fully retracted to extended touching tubing is measured
- The drill, valve and clamp assemblies are pressure tested to a minimum of 1.5 times the anticipated pressure or up to the maximum working pressure of the equipment being used
- The pressure on the drill is decreased to slightly less than anticipated tubing pressure. During this procedure, an increase in pressure on the drill side indicates penetration
- Once the hole is drilled, the shaft of the drill is retracted past the valve allowing the valve to close. The pressure is then bled off the drill allowing the drill to be removed
- Depressurize, freeze or pumping operations can commence

Diagram of Hot-Tap Operation:



Hot Tap Unit Specifications:

- 5000 Psi working pressure manual drill for added control, with an air drill adapter.
- Comes with a pump for pressure testing and equalizing drill.
- Stroke: 24”, 30”, 36” (longer stroke units available upon request)
- Bit size: ½” – 2” hole saw adapter available; 2” – 6” diameter
- Saddle clamps: from 1” to 9 5/8 ” – other sizes available upon request
- All equipment meets NACE specifications
- Helli-portable for use in remote locations

Nitrogen Pumping

The Snubco Group is proud to introduce Nitrogen pumping services to its current fleet of oilfield service and well control equipment. The first Nitrogen pumper came on line in January 2006. Nitrogen is an inert gas which is non-corrosive, non-explosive making it environmentally friendly. Nitrogen pumping is an ideal match with Snubco Group’s existing fleet. Nitrogen pumping is used to perform sand clean outs, displace well bore fluids, purge pipeline, provide a blanket of inert gas on wells with H2S content, pressure test pipelines and pressure test vessels.

The Snubco Group now has a total of 3 truck mounted, non fired Nitrogen pumpers with a capacity of 7000 m3. One trailer mounted non fired nitrogen pumper also with a capacity of 7000 m3. One truck mounted Nitrogen transport bulker with a capacity of 10000 m3. All Nitrogen units will have flow rates from 5 to 85 m3 with pump pressures to 69 mpa.

Nitrogen Equipment

On location in Drayton Valley, Alberta.

Snubco Nitrogen trucks can be used independently or utilized in conjunction with our Coil Tubing Units, Snubbing Units or can even be used with other Nitrogen Units to produce a higher delivery rate. Each Nitrogen unit features a holding capacity of 7000 m3, with an operating temperature range of -40C to +40C. Snubco can offer low rate units capable of 5-85 m3/min. All of our units are Glycol heated, ensuring that no flame is present to increase the risk in volatile environments. Additionally, each unit is also equipped with a 1” treating iron. Every truck incorporates a cab and electronic data recording system to inform both the customer and our personnel of the treating pressure, discharge temperature, pump rate, total volume pumped and boost pump pressure readings.

100% Electric Nitrogen Unit

The Electric Nitrogen Unit is unique as it features self contained heating versus using the motor or truck engine to generate the heat required. This unit can be powered by a plant electrical supply or stand alone with its own generator. The end result is safer and more efficient operation.

Nitrogen Pumpers

Snubco can provide reliable Nitrogen Pumpers that are capable of working in the most demanding conditions. All of our units are low rate, non-fired, tri-axle, body job units.

Mini Bulker

The Nitrogen Mini Bulker can be used in applications where the location is difficult to access due to substandard conditions such as steep, rocky terrain or muddy areas, etc.

Nitrogen Bulker

Rig Assist Snubbing

Snubco's Rig Assist services use the safest and most efficient equipment available in the highly competitive Canadian market. Our equipment can be used with a wide variety of rig set-ups from a small single workover rig to a large triple drilling rig. The majority of the components on our rig-assist units are designed by Snubco, then field proven by our experienced personnel who work closely with our designers and fabricators to constantly ensure Snubco equipment is the best available for our customers.

"SNUBCO – known worldwide as the best in innovation and quality in the oilfield"

Rig Assist Snubbing Process

As its name implies, the "rig assist" process requires a workover or drilling rig to accomplish its task. All of the normal equipment associated with the workover or drilling rig is still used during the snubbing/stripping procedure. The rigs draw works supplies the lifting force when in the stripping mode. The rigs BOP stack provides the backup to the snubbing units stripping BOPs. Depending on the job parameters, additional BOPs may be needed in the primary BOP stack that is controlled by the rigs accumulator system. In higher-pressure situations, or wells with H2S content, supplemental equipment such as choke manifolds, gas separators, and flare stacks may be necessary.

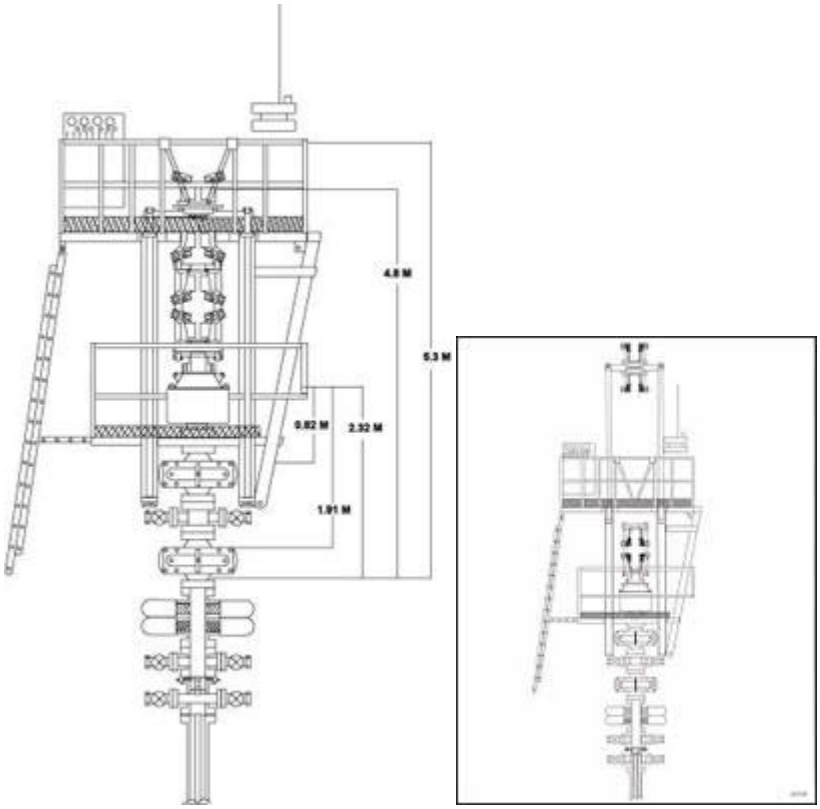
Hydraulic Rig Assist installed on top of workover rig BOP stack. Well pressure is controlled by surface BOPs. Click the image to view at a larger size.

Rig Assist Unit Specifications:

- Truck mounted and mobile to get to even the most isolated locations.
- Built tough to withstand the most extreme weather – operates in temperature ranges of -35°C to +50°C
- BOP system meets API 6a standards
- Pressure containing equipment meets NACE TRIM specification for H2S service
- Oilfield proven for the most rugged terrain conditions found in the oil patch
- Continuous research, development and maintenance to ensure the latest in innovative technologies

All load bearing and pressure containing components of the equipment have engineered ratings and certification documentation – Snubco has been a leader in this area.

Diagrams of Rig Assist and Workover BOPs:



Self-Contained Snubbing

Due to changes in customer demand and industry regulations self-contained snubbing has become a major component in today's workover and completions market. Demands for a safer, more efficient and environmentally friendly snubbing operation has been the major factor in the development of this industry. The ability to work on live or under balanced wells gives our customers many advantages for a safer and more cost effective operation. Extra charges such as rig, well control fluids, transportations and disposal of fluids can be greatly reduced or eliminated with the use of a self- contained snubbing unit. Many of our customers are utilizing self-contained snubbing units for abandonment operations, eliminating many unnecessary costs. Wells with short vertical and long horizontal sections are ideal for self-contained snubbing operations. All major operations (I.e. pipe movement and well control) are controlled by the snubbing crew while utilizing less equipment, no anchors and very little ground disturbance for a smaller environmental footprint.

Snubco has taken our many years of rig assist experience and used it to develop our self-contained equipment and operations. The Snubsmart and Slipsmart safety systems were key components in the development and construction of our self-contained equipment and operations. Click on the supplied links to check out our self-contained operations.

SCU#1 Self-Contained Unit Specifications

Jack

- 5” bore x 3” rod [127mm x 76mm] Cylinders
- Lift force: 90,000 lb [41,000 daN]
- Snub force: 50,000 lb [23,000 daN]
- Stroke: 126” [3.2 m]
- Jack bore 7.1/16” [179mm] this includes all slip bodies.
- Integral Passive Rotary
- Over all height of unit is 210” [5.33m]
- Jack secured to lifting mast and requires no ground anchors

Slips

- Four sets of Snubco Model NMCSS 165,000 lbs [62 daN]
- Die range size from 1.135” to 5.5” [28.8mm to 139.7mm]
- Slip through bore 7.1/16” [179mm]
- All slips hydraulically activated

Work Baskets

- Main work platform 8’ x 8’ [243cm x 243 cm] with limited pipe racking capabilities
- Secondary work platform 76” x 73” [193cm x 185cm]
- Four egress stations from basket
- Two counter-balance pipe handling winches control stations
- 5 Basket mounted Bop station controls

Jack Truck/Power – Pack

- 2004 Kenworth T800B
- Tandem Axle c/w fully lockable differentials
- Caterpillar C-12 400 Hp
- Hydraulic pumps mounted on 550 Hp driveline split box
- Stripping Bop Accumulator 33 gallon [125 L] c/w nitrogen backup
- Hydraulic tank c/w heating and cooling systems
- Mobile heating system for keeping Bops system warm during transit

Primary Bob Stack

- Unity Rig U-5 double gate ram 5000 Psi wp [35mpa]
- Kill spool c\w working valve 5000 Psi [35 Mpa]
- Optional Kill spool c\w working valve and base flange drilled 2000/3000 psi (600/900 series)
- Class 2 accumulator c\w 22 gallon [84 L] capacity and nitrogen backup
- Primary Bop controlled by stations on Mast Truck with remote controls ability from work basket on jack

Mast Truck

- 75’ [23 m] Telescopic Mast mounted on 2002 Volvo VHD64B tandem axle
- Free standing mast requires no anchors
- Class 1 Division 2 lighting system mounted to mast and carrier
- Class two accumulator system for primary Bop stack
- 2 – 500 lb [230 kg] pipe handling counter balance winches (controlled from snubbing basket)
- 1 – 50,000 lb [23 ton] heavy block for lifting jack and facilitating tool lubricating operations
- 1 – 5,000 lb [2,300 kg] tugger winch c/w remote control from snubbing basket
- 1 – 2500 tong hanging winch c/w remote control from snubbing basket
- Hydraulic wire line draw works with 4 speed funk transmission c/w 2000 m of 5/16” wire line for light swabbing and lubricating tools
- 7” [177mm], 5½” [139.9mm] and 3½” [89mm] – 3000 psi [21mpa} wp lubricator c/w pack off

Support Equipment

Dog House:

- Tri-axle pintel hitch style trailer
- With change/lunch room, office, washroom
- 45 kw light plant
- Pressure testing pump with capabilities to 3000 psi and on board environmentally friendly glycol holding tank to facilitate testing of Bops.
- Electric heating system for wellhead and Bop systems

Pipe Trailer:

- Doubles as both pipe transport and pipe rack with fold down catwalk
- Transport system for primary Bop system

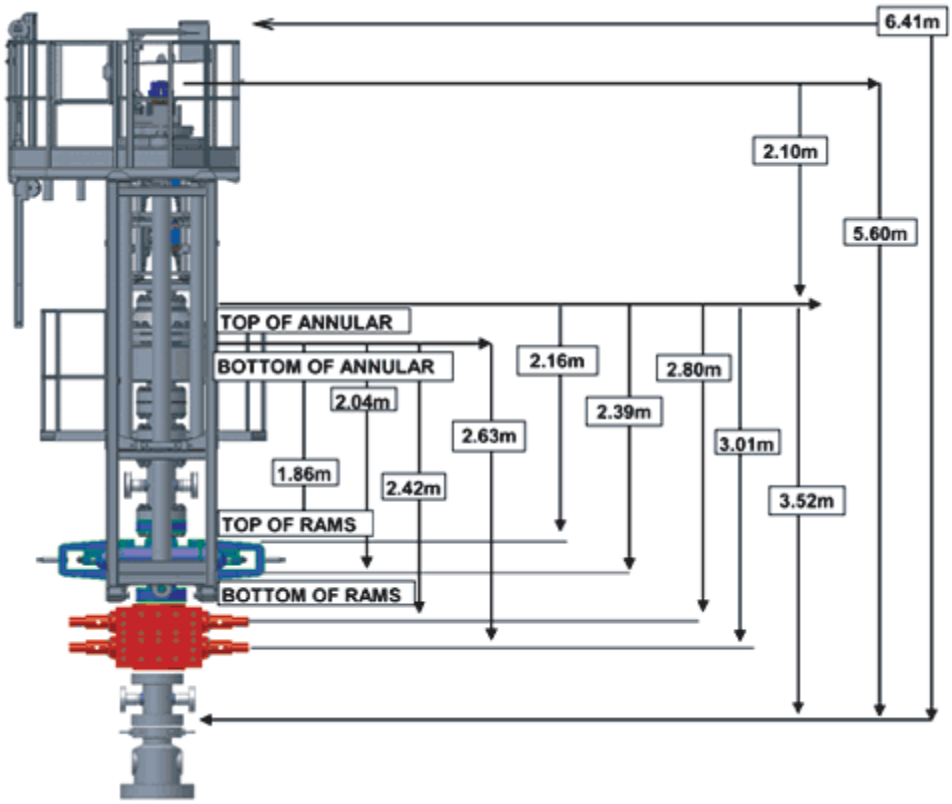
Picker/Winch Tractor

- 6 Ton tractor will handle matting, Bop’s and other equipment as needed

Pump Truck:

- 2007 Freightliner Conventional
- JES-300 5X6 Triplex Plunger Pump: 240 HP, 5000 psi
- 11 cubic meter 2 compartment tank

Self-Contained Schematics



SCU#3

100% certified: The unit has engineering and material certifications for all structural or pressure containing components. All wellbore pressure containing components meet N.A.C.E. specifications.

BOPs: 5000 Psi [35 Mpa] x 7.062" [179mm] stripping stack; consisting of one Shaffer annular preventer and two Academy Type "A" BOP's. The two stripping BOP's are separated by a bleed off/equalize spool that has hydraulically operated plug valves and integrally mounted BAP chokes. The unit structure allows the option of installing a 7.062 [179mm] x 10,000 Psi [70 Mpa] stripping stack in place of the standard 5M [35 Mpa] stack.

Jack: 141" [3.6 m] stroke with 6″ [152mm] by 3.5″ [89mm] cylinders to produce a snub force of 93,000 lb. [42 daN], complete with hydraulic brake for added safety when pulling pipe c/w 4½" [114mm] tubing tongs with hydraulic backup.

Self-Contained Unit Specifications

- Motorized rotary table 6000 ft lbs torque
- 25 ton mobile picker
- 45 ton mobile picker
- Serva TPD 600 3.5 X 6 Triplex Pump, 600 HP, 70 mPa, 23 cubic meter single compartment tank.
- 7 1/16″ x 5k class 3 primary BOP's comes with class 3 accumulator capable of running 10k BOP's
- Anchorless spider stabilizer for "O" ground disturbance
- Catwalk & Pipe Racks
- Doghouse/light plant
- Pickup elevators for 2 3/8″, 2 7/8″ and 3 1/2″ tubing
- 4.5 power tongs (5.5 tongs available)
- Winch in snubber's basket
- Capable of travel to 90% road bans
- Self-contained raising ram for tongs
- 4 – slip unit
- 1″ 5000 lbs equalize line
- Aluminum stairs with handrails from snubbing basket to ground
- 2 – Pole Egress System
- 2 – Self-retractable Lifelines

Well Control Support Services

In well control situations, Snubco's seasoned professionals can be an integral part of your company's well control team. We offer your team our "hands-on" expertise in working with wells under pressure – we work with it daily. Our skilled team has worked in dangerous situations involving pressures up to 13,000 Psi and H2S concentrations of up to 45%.

Let us assist you in the wise implementation of your emergency response plan. Snubco has developed strategic relationships with numerous companies across Canada who understand the value of our expertise when dealing with critical emergency situations.

Well Control Support Process:

- **Pre-Planning Session:** initial meeting with company to determine situation and action plan required
- **Field Evaluation:** next a field evaluation is conducted to determine extent of the well control incident
- **Equipment and Personnel Assistance:** based on the field evaluation, Snubco assists the well control team in determining what equipment and personnel are needed to bring the situation under control in the safest way possible
- Work hand in hand providing appropriate services to the team as needed

Training Programs

Classroom Training in Nisku, Alberta, Canada

Included in the sale of each piece of specialized pressure control equipment we are pleased to offer a complete training program that consists of three levels of training. This proven system allows for the maximum amount of training to be conducted in the shortest amount of time. The three tiers of training are:

1. Classroom training at Snubco facility
2. Underbalanced simulations at Snubco facility
3. Underbalanced operations on site in the customers country of origin

Training is conducted at the Snubco facility in Nisku, Canada. Training begins by educating the customer on the snubbing equipment. Certified snubbing supervisors conduct this training ensuring that the equipment is fully understood and all operation questions can be answered fully.

Customers receive training on Snubco Operation Procedures and underbalanced workover calculations, all needed for the successful operation of a snubbing jack or other pressure control equipment.

Classroom Training in Nisku, Alberta, Canada

Because of excellent cooperation with existing International customers most documents are available in a translated version of the end users language, which allows for a quicker understanding of the job procedure.

Utilizing our state of the art on site engineering department Snubco is able to produce 3D models for the purpose of training and understanding the various components of the snubbing jack. These models are taken directly from the engineered drawings of the unit so are exact in every detail.

Applying what was learned in the classroom to a real world environment is crucial to the training process. Each procedure that is conducted in the classroom is duplicated on the test well. The same personnel that will operate on site in the end users country perform the training operation of the snubbing equipment in Canada. We believe that proper training can only occur in a “hands on” training environment.

After the jack is successfully shipped to the end users country of origin, a two-man Snubco crew will arrive to commission the jack (crew size will depend on the scope of the work or 12 or 24 hour operation).
The two-man team will break into two (2) groups to assist the training process. The first step is training the snubbing crew.

Site Visit to Canadian Well Site

This involves “hands on” operations of the snubbing equipment. Procedures that where discussed and preformed in Canada are repeated in the end users country of origin for the benefit of the crew.

The second man will remain on the ground to assist the ground crew in the operations that must occur for live well operations. Because procedures are different for live well operations some training must be provided for all personnel on the ground. These procedures are just as important as the snubbing procedure being conducted on the jack.

The training that is provided with Snubco equipment is second to none. We have a proven success rate with training international personnel to operate and maintain the equipment that they have obtained from Snubco. This proven method off training has allowed Snubco to maintain the highest reputation in customer satisfaction.

Coil Tubing & Nitrogen Pumping Case Histories

Coil tubing and Nitrogen Pumping Case History #1

Objective: Sand cleanouts

Well Information: 8000kPa, Sweet gas and 1500 meters

Procedure: Performed 67 cleanouts through out the whole project. Rig in coil unit. Pressure test. Run in the hole and cleanout sand from perforations to plug back. Out of the 67 wells completed only 2 wells required further cleanouts due to sand entering the well from the perforations.

Time on location: 4 hours per well.

Coil tubing and Nitrogen Pumping Case History #2

Objective: Spot acid

Well Information: 300kPa, sweet gas, 1700m

Procedure: Rig up and pressure test CT unit. Run in the hole pumping nitrogen. Stop at 1600 meters. Pump acid to end of tubing and start pulling out of hole. Flush coil with 3% KCL. Pull up to 300 meters and start to pump nitrogen to purge coil. POOH. Rig out unit.

Time on location: 6.5 hours

Coil tubing and Nitrogen Pumping Case History #3

Objective: Chemical wash

Well Information: 0kPa, heavy crude, 1700 meters horizontal

Procedure: Rig up and pressure test. RIH while pumping 3% KCL fluid. Clean out sand in horizontal section. Pump chemical to end of tubing. POOH till kick off point. Repeat wash over same section of well 3 times. POOH and purge coil. Bleed off and rig out.

Time on location: 8.5 hours

Coil tubing and Nitrogen Pumping Case History #4

Objective: Sand cleanout using mill and motor

Well Information: 8700kPa, sweet gas well, 2170 meters

Procedure: Rig up CT unit with mill and drilling motor. Pressure test and function test. RIH> Tag sand top and mill thru to plug back using commingled fluid. Insure returns are clean and fluid is lifted from well. POOH and rig out.

Time on location: 13 hours

Coil tubing and Nitrogen Pumping Case History #5

Objective: Land velocity string

Well information: 9200kPa, sweet gas, 2100 meters

Procedure: Rig up CT unit with spooler and pressure test. RIH and land at predetermined depth. Isolate well bore pressure and cut and land coil. Rig out.

Time on location: 9.5 hours

Coil tubing and Nitrogen Pumping Case History #6

Objective: Land velocity string

Well Information: 9200kPa, sweet gas, 2100 meters

Procedure: Rig up CT unit with spooler and pressure test. RIH and land at predetermined depth. Isolate well bore pressure and cut and land coil. Rig out.

Time on location: 9.5 hours

Coil tubing and Nitrogen Pumping Case History #7

Objective: Pump nitrogen blanket

Procedure: Rig up nitrogen unit and pressure test. Pump hole volume into well to hold down H2S. Rig out unit.

Time on location: 1.5 hours

Coil tubing and Nitrogen Pumping Case History #8

Objective: Unload fluid from well

Well information:

Procedure: Rig up nitrogen and cool down. Pressure test surface equipment to 32mPa. Pump nitrogen and unload well. Rig out unit.

Time on location: 10.5 hours

Coil tubing and Nitrogen Pumping Case History #9

Objective: Unload well bore fluid

Procedure: Rig in nitrogen pumper and cool down. Pressure test surface equipment. Pump down tubing and unload fluid up casing, stop pumping. Flow well for 3 hours. Rig out unit.

Time on location: 5.5 hours

Coil tubing and Nitrogen Pumping Case History #10

Objective: Pressure up well to run wireline log

Well information: Cavern well

Procedure: Rig up pumper and pressure test to 21mPa. Pump 1000 SCM down casing. Pump 500 SCM down tubing. Rig in wireline and begin logging. Pump nitrogen at predetermined depths while logging. Rig out wireline. Rig out pumper.

Time on location: 13 days

Coil tubing and Nitrogen Pumping Case History #11

Objective: Coil cleanout

Procedure: Rig in CT unit and nitrogen pumper. Pressure test surface equipment and coil to 14mPa. RIH with coil to predetermined depth and begin to pump nitrogen. Cleanout fluid from wellbore. POOH and rig out equipment.

Time on location: 6 hours

Coil tubing and Nitrogen Pumping Case History #12

Objective: Pressure up well

Procedure: Rig in nitrogen pumper and cool down. Pressure test surface equipment to 17mPa. Pump nitrogen into well until well bore pressure is 15mPa. Rig out unit.

Time on location: 1 hour

Coil tubing and Nitrogen Pumping Case History #13

Objective: Pump nitrogen blankets on 2 wells

Well Information: 5% H2S

Procedure: Rig up pumper and cool down. Pressure test surface equipment to 24mPa. Pump 100 SCM for a blanket. Rig out and complete pumping operations on next well.

Time on location: 4 hours total to pump on both wells

Coil tubing and Nitrogen Pumping Case History #14

Objective: Purge pipeline with pig

Well information: 5400 meters of 139mm pipe line

Procedure: Rig in nitrogen pumper and cool down. Pressure test surface equipment to 14mPa. Start pumping down pipeline at 30 SCM. Decrease rate to hold pipeline pressure at 10mPa. Pig

would not move. Operator checked pipeline files and determined there were 2 pigs from a previous operation still in pipeline. Pressure was increased behind first pig to 11.5mPa and then shut in. Pressure slowly pushed all 3 pigs to end of pipeline to catcher.

Time on location: 13 hours. Pigs into catcher after 72 hours

Coil tubing and Nitrogen Pumping Case History #15

Objective: Utilize Mayperf drilling tool to perforate multiple zones in a well.

Procedure: Rig up and deploy Mayperf drilling tool utilizing 33 meters of lubricator. A total of 5 sets of perforations were opened up using the Mayperf drilling tool and 50.8mm coil tubing.

Time on location: 30 hours over 3 days

Coil tubing and Nitrogen Pumping Case History #16

Objective: Recover 3600m braided wireline / perforating BHA, and tractor

Well Information: 14mpa WHP, sweet gas, 4000m with 1400m horizontal section, 114mm casing to PBTD, perforating tool stuck at 3600m, wireline had parted at surface and fell down hole.

Procedure: MIRU 50.8mm coil tubing unit with injector extension hoses to accommodate 22m of lubricator required for tool recovery. Rig Injector, lubricator, and coil tubing BOP on to wireline BOP, and pressure test. Run in hole with “spear” fishing assembly to hook wireline and bring to surface. Once back at surface, secure wireline with BOPs, and strip off coil lubricator to expose wireline. Feed wireline through packoff, and strip additional cable through packoff using crane, causing cable to shear off cable head down hole. Once enough cable has been exposed, secure to wireline truck and spool on to drum. Repeat procedure as required until all wireline has been removed from well. Once wireline is out of well, rig on with coil and “overshot” fishing assembly and using jars, dislodge and recover perforating tool string and tractor.

Results: Job completed successfully. Total trips in hole 7 – 5 to recover wireline, 1 impression block run, and 1 run to recover tool string. Job spanned 3 days utilizing 24 hour operations. After fishing operations were concluded, the remaining plugs were set, and perforations shot without further incident using Snubco coil tubing.

Coil tubing and Nitrogen Pumping Case History #17

Objective: Remove scale buildup on tubulars – 2 wells on same pad

Well Information: 7-10mpa WHP, Sweet gas, 4200m with 1100m horizontal section, 114mm casing to PBTD. Casing was plugged, and a camera run indicated that scale buildup was the problem.

Procedure: MIRU 50.8mm coil tubing with 70mpa BOP. Rig up and pressure test. Run in hole pumping water until obstruction is tagged. Once depths and string weight have been confirmed, alternate slugs of 15% HCL acid and water, and work coil to bottom. Once at bottom, perform acid wash to heel, then cleanout run back to bottom and unload well with nitrogen.

Results: PBTD reached on both wells in 48 hours utilizing 24 hour crews.

Freeze & Hot Tap Case Histories

Freeze and Hot Tap Case History #1

Objective: Replace 4 ½" Demco with broken stem.

Well Information: Sweet Gas Well Approximately 6000 KPA

Procedure: Hold JHA and safety meeting with all personnel. Rig up x/o nipple back to 2" Nitric in 2" x 5K ball valve. Fill valve cavity with fluid. Rig in Hot tap drill c/w ¾" drill bit. Pressure test equipment to 21 MPA. Hold 7 MPA on drill and valve. Rig in N2 drive to Drill. Drill through gate which is about 2 ½" thick. Once verified that bit hole is reamed clean, retract bit

into drill and close 2” ball valve. Remove drill. Rig in pump line and start pumping fluid to kill well.

Time on location: 2 hours

Freeze and Hot Tap Case History #2

Objective: Freeze wellhead to remove damaged top section.

Well Information: 3,700kPa sweet gas well with damaged master valve not allowing access into tubing.

Procedure: Warm up wellhead to prevent gel from prematurely freezing. Install pumping equipment and pressure test. Inject gel into tubing. Install dry ice cribbing across tubing spool to produce plug in tubing hanger and tubing bellow hanger. Pressure test plug and replace damaged equipment.

Time on Location: 8.5 hours

Freeze and Hot Tap Case History #3

Objective: Freeze wellhead to remove plunger lift equipment stuck across master valves.

Well Information: 8MPa sweet gas well with high LPG production with plunger lift mandrel stuck in top section.

Procedure: Remove piping downstream from wing valve. Install pumping equipment and pressure test. Inject gel into wellhead freeze gel and mandrel in top section. Pressure test plug, remove cap, and install wireline lubricator with line attached to mandrill. Pressure test lubricator, bleed down to well pressure and thaw plug. Retrieve mandrel.

Time on location: 17 hours

Freeze and Hot Tap Case History #4

Objective: Freeze tubing to remove joint with plug.

Well Information: Tubing bridge plug set prematurely in tubing while being run for snubbing operations. 89 mm tubing, 18Mpa sweet gas well with high LPG production.

Procedure: Pull tubing through snubbing unit and position joint with plug above working floor. Install saddle clamp and hot-tap drill above tool joint, and pressure test. Drill 19mm hole into tubing and remove drill. Clean tubing by pumping solvent into clamp. Inject gel and freeze below tool joint, pressure test plug, remove top joint and install valve. Pressure up to well pressure and thaw plug.

Time on location: 8.5 hours

Freeze and Hot Tap Case History #5

Objective: Freeze casing to replace damaged casing below orbit valve.

Well Information: Low pressure (2,000kPa) sweet gas well; 114mm mono-bore completion with the pipe below the bell nipple bent.

Procedure: fill surface casing will water. Install cribbing and dry ice around casing. Install pumping equipment and pressure test, inject gel into production tubing and maintain dry ice until freeze plug is generated. Pressure test plug, replace tubing and install new valve. Pressure test, maintain pressure above plug, and thaw.

Time on location: 14.5 hours

Freeze and Hot Tap Case History #6

Objective: Hot tap damaged gate valve using 2 ½ “hole saw to enable slick line to set a plug in profile and change out gate valve.

Well Information: 8600Kpa sweet gas well with a depth of 1500m.

Procedure: Check for pressure, remove wellhead flow tee and install work valve. Assemble hot tap drill with ¾” bit and centralizer, fill with oil to the top of the work valve and rig in drill. Pressure test to 13000kpa then bleed off to 5000Kpa. Spin the bit using air drive w/ nitrogen and advance drill till through the gate. Retract the drill and close work valve, bleed off pressure in drill and remove. Install coupon catcher and 2 ½” hole saw, rig in drill. Pressure up to 8600Kpa and open work valve, spin the hole saw with air drive and advance the drill till through the gate. Retract the drill, close the work valve and bleed off pressure in the drill. Rig out the drill and remove the coupon from the hole saw and turn the well over to slick line.

Time x on location: 3 hours

V w3oFreeze and Hot Tap Case History #7

Objective: Freeze wellhead to replace malfunctioning top section valve.

Well Information: 5,000kPa sweet gas well with malfunctioning master valve.

Procedure: Install cribbing and dry ice. Install pumping equipment and pressure test. Inject gel into tubing and freeze across tubing hanger. Pressure test ice plug, replace top section. Pressure test top section, maintain pressure above plug, and thaw.

Time on location: 11 hours

Freeze and Hot Tap Case History #8

Objective: Hot-tap tubing to ensure no pressure is present when breaking connections.

Well Information: 35MPa sour gas well. Rig pulling production tubing, annulus dead, but tubing plugged with sulfur precipitant.

Procedure: Pull to top of sulfur plug. Install safety valve, pull to next connection. Install saddle clamp and drill, pressure test, drill 12.5mm hole, check for pressure and presence on H2S. bleed off to testers as necessary. Process repeated 35 times until BHA out of hole.

Time on location: 21 hours

Freeze and Hot Tap Case History #9

Objective: Hot tap 3 ½ tubing full of scale plugs to safely remove tubing from well.

Well information: 2600 Meter sour well pressure between shale plugs unknown. Casing pressure zero mPa.

Procedure: All operations performed masked up. Install 3 ½ inch tubing clamp, working ball valve and hot tap drill with ¾ inch bit. Pressure test with baker pump to 15 mPa based on well history. Leave 10 mPa on assembly drill ¾ inch hole, once hole drilled pressure dropped to zero. Rig out hot tap equipment and tie into testers, bleed off. Tie in to rig pump and attempt to pump fluid to determine if any more shale plugs in tubing. Unable to break circulation- bleed off pressure, rig out pumping equipment, confirm no pressure between hot tapped joint above collar of next joint. Break out joint and install a TIW valve in next joint in well. Continue above procedure until circulation obtained and tubing clear of shale plugs. In all 33 hot taps were performed with pressures of up to 3000 kPa and 16% sour gas to be found.

Time on location: 36 hours

Freeze and Hot Tap Case History #10

Objective: Re-enter access to abandon wells' wellbore.

Well Information: Well was abandon to Alberta E.U.B. standards. Re-entry is required.

Procedure: Well located, uncovered to visual with hydrovac, and then excavated with backhoe. Hot-tap equipment installed on surface casing, pressure tested and 19mm hole drilled into casing. Check for pressure or hydrocarbons. Bleed off and fill with water. Cut off surface casing to gain access to production casing. Install hot-tap equipment, pressure test and drill 19mm hole in casing. Check for pressure or hydrocarbons. Bleed off and fill with water to produce a safe situation for customer to cut off cap and install appropriate risers and wellhead equipment for re-entry.

Time on location: 4.5 hours

Freeze and Hot Tap Case History #11

Objective: Re-enter access to abandon wells' wellbore.

Well Information: Well was abandon to Alberta E.U.B. standards. Re-entry is required.

Procedure: Well located, uncovered to visual with hydro-vac, and then excavated with backhoe. Hot-tap equipment installed on surface casing, pressure tested and 19mm hole drilled into casing. Check for pressure or hydrocarbons. Bleed off and fill with water. Cut off surface casing to gain access to production casing. Install hot-tap equipment, pressure test and drill 19mm hole in casing. Check for pressure or hydrocarbons. Bleed off and fill with water to produce a safe situation for customer to cut off cap and install appropriate risers and wellhead equipment for re-entry.

Time on location: 4.5 hours

Freeze and Hot Tap Case History #12

Objective: Remove malfunctioning orbit valve and install rig BOPs.

Well Information: 5,600kPa sweet gas well. After rigless fracture stimulation orbit valve does not open properly.

Procedure: Install cribbing and dry ice on casing. Rig up pumping equipment and pressure test. Inject gel into casing and produce a freeze plug. Pressure test plug, remove orbit valve and install BOPs. Pressure test BOPs, maintain well pressure above plug and thaw.

Time on location: 12 hours

Freeze and Hot Tap Case History #13

Objective: Freeze tubing to remove obstruction in tubing during snubbing operations

Well Information: 27MPa sweet gas well. During snubbing operations, obstruction in 89mm tubing did not allow running a wireline plug to bottom. A bridge plug was set above obstruction and tubing was pulled to position first tool joint below obstruction at working height in snubbing basket.

Procedure: Hot-tap clamp and drill installed above tool joint, pressure tested and 19mm hole drilled in tubing. Drill removed, pumping equipment installed and pressure tested. Inject gel and provide dry ice contact to tubing below tool joint. Pressure test plug, break connection and install valve. Pressure test valve and maintain well pressure above plug during thaw. Flow gel to testers and rig up wireline to run plug to bottom of string.

Time on location: 8.5 hours

Freeze and Hot Tap Case History #14

Objective: Hot tap 2 7/8” master valve to gain access in order to kill well and replace damaged valve.

Well information: 15 Mpa sour gas well.

Procedure: Erect scaffolding; confirm no pressure above seized master valve, rig out wellhead equipment. Install correct crossover flange, working valve and hot tap drill. Pressure test connections and hot tap equipment to 30 Mpa. Bleed pressure back to 17 Mpa and commence drilling through gate. Advance drills through both halves of gate and confirm based on measurements and pressure equalization as well as drill torque. Retract bit above working valve and close. Tie bleed off into testers and bleed off sour gas above work valve. Rig out hot tap drill, hand over well for kill operations.

Time on location: 3 hours

Freeze and Hot Tap Case History #15

Objective: Remove malfunctioning slim-hole valve.

Well Information: 8,000kPa sweet gas well. Approximately 35m of sand was cleaned off a bridge plug after a fracture stimulation using a snubbing unit and slim-hole safety valves. The bridge plug was released. The first valve in the well bore was brought to working height and closed. Clean out package was removed hose connected to tubing above valve. Joint pulled and next valve positioned and closed. Top valve equalized but would not open.

Procedure: Hot-tap clamp and drill installed above lower valve and pressure tested. 12.5mm hole drilled in tubing, drill removed, and pressure vented to testers.

Time on location: 1 hour

Freeze and Hot Tap Case History #16

Objective: Freeze tubing to replace damaged master valve to gain entrance into tubing.

Well Information: 12.4MPa sour gas well shut in for several years, master valve seized.

Procedure: Heat wellhead, expose surface casing install cribbing around surface casing and fill with dry ice. Inject gel into surface casing. While frost is transferring through gel in surface casing, scaffolding is built and hot-tap equipment is rigged up. Rig up pumping equipment to production casing, pressure test and inject gel. While frost is penetrating gel in production casing, the hot-tap drill is pressure tested and a 19mm hole is drilled in the seized master valve. The drill is removed and pumping equipment installed, pressure tested, and gel is injected to the production tubing. Due to the well conditions the dry ice maintained overnight. At daylight, the plug is pressure tested, the top section is dismantled, and the new valve is installed and pressure tested. Well pressure is applied above the ice plug and turned over to the thaw crew.

Time on location: 27.5 hours

Freeze and Hot Tap Case History #17

Objective: Freeze well to remove top section and tubing hanger on well which was suspended.

Well Information: A low pressure gas well (3,000kPa) was suspended and left with no tubing in the hole, tubing hanger in the tubing spool and top section installed. Over time gas pressure developed in the casing. When our customer acquired the well, they wanted to re-complete the well to produce gas without introducing any more kill fluids.

Procedure: Expose surface casing and install cribbing and dry ice. Inject gel into surface and production casings. When freeze plug is achieved, the plug is pressure tested and the top section and tubing hanger is removed and BOPs are installed and pressure tested. Well pressure is applied to the top of the plug and turned over to the thaw crew.

Time on location: 15.5 hours

Freeze and Hot Tap Case History #18

Objective: Freeze tubing to remove lost wireline tools in completion tubing.

Well Information: 16.5MPa sweet gas well. During wireline operations, tools became stuck approximately 300m from the bottom of the tubing. Subsequently, slickline fishing tools were lost. Total length of lost wire line tools is approximately 31m.

Procedure: A bridge plug was set in the tubing above the wireline tools; the tubing was snubbed out to the bridge plug. The tubing was capped. A crane was rigged up with the crown 20m above the crown of the rig. The winch was attached to the tubing and 4 joints were snubbed out. The tubing was hot-taped and gel injected into the tubing and froze. The 4 joints were removed, laid down and hot tapped to check for trapped pressure. A valve was installed into the tubing, pressure tested and thawed. The gel was blown out and wireline rigged up to set a plug on bottom.

Time on location: 11 hours

Freeze and Hot Tap Case History #19

Objective: Hot tap Lower Master Valve To provide access to Tubing in order to freeze well and replace faulty valve.

Well Information: Sweet Gas Well Drilled in 1993. CSG is full of inhibited fluid with packer set 2334 meters from surface. Estimated SITP = 4000 KPA

Procedure: Perform JHA and Safety meeting with all personnel. Take measurements and ensure hot tap equipment is suitable for task. (Enough stroke to get through valve and can still retract back enough to get behind safety valve. Confirm valve is holding pressure. Remove all wellhead equipment above faulty valve. Install x/o flange onto valve, 2 9/16 x 2", c/w 2 9/16"x 2" threaded nipple. Install 2" x 5K ball valve. Fill valve up with fluid. Install hot tap drill. Rig in pressure pump and pressure test all connections and drill to 21 MPA. Estimated SITP is 4 MPA. Bleed pressure back, maintaining 10 MPA. Start drilling through valve monitoring pressure above valve at all times. Pressure dropped to approximately 4.3MPA.Continue drilling until ¾" hole has been reamed clean, and the bit can pass through un hindered without rotating. Retract bit into drill housing and close 2" ball valve. Bleed off drill and remove. Hook up flow back line and flow tubing to ensure good access. Remove flow back line. Build Ice cribbing around surface casing and inject freeze gel into surface and production casings as well as tubing. Add dry ice and wait allotted time for gel to freeze. Pressure test freeze plug on the tubing side and when verified plug is holding, remove faulty master valve and install new valve and the rest of the well head components. Pressure test well head against freeze plug. Remove ice from well and let thaw.

Time on Location: 24 hours

Freeze and Hot Tap Case History #20

Objective: Hot tap 2 7/8" gate valve to gain access to tubing in order to freeze and remove damaged gate valve.

Well information: 32 Mpa water injections well

Procedure: Confirm damaged valve is holding, remove all wellhead equipment above faulty valve, use appropriate crossover over flange and rig in hot tap drill. Pressure test equipment to 35 Mpa as restricted by wellhead rating. Bleed off drill to 30 Mpa drill ¾ inch hole completely through gate making sure to go through both halves-pressure equalizes at 32 Mpa when completed. Retract drill close working valve, bleed off drill assembly and rig out drill. Build cribbing, inject gel into surface casing and production casing to transfer freeze. Rig in gel injection equipment to tubing and inject gel into tubing, fill cribbing with dry ice and maintain through the night. Maintain and monitor freeze operation overnight. After sufficient freeze time, pressure test freeze plug, tested OK, bleed off pressure and replace damaged valve. Apply equal pressure above freeze plug and hand over well for thawing.

Time on location: 28 hours

Freeze and Hot Tap Case History #21

Objective: Re abandonment

Well Information: Well was previously abandoned but the bank where the well was located had eroded away leaving 8 meters of abandoned casing exposed in an environmentally sensitive area.

Procedure: Well was only accessible via helicopter. Crew and equipment were flown into location. Climbing crew prepared and shored bank with a wire mesh. Hot tap crew repelled down bank and inspected casing stump. A hole was discovered in casing stump already. Welding equipment was lowered down and an automatic feeder was installed below hole and casing was cut off. A new cap with ball valve was welded onto new casing stump.

Time on location: 8 hours

Freeze and Hot Tap Case History #22

Objective: Freeze casing to replace full opening 7" orbit valve

Well Information: While functioning gate valve the stem had been twisted off with the valve half closed. Well was secured with blind rams on the 70mPa BOP stack… Surface casing pressure was 42mPa.

Procedure: Hole volume of fluid was pumped down the casing to lower working pressure to 10 mPa. Gel was then injected by the freeze crew into the surface and production casings. Gel was then frozen using dry ice and freeze was held on for 24 hours. Freeze plug was then pressure tested to 84 mPa, tested OK. Pressure was then bleed off above freeze plug and monitored. Atmospheric test was good. A crane was then used to lift 70 mPa stack and malfunctioning orbit valve off of well. New orbit valve was then installed along with 70 mPa stack. New orbit valve and BOP stack was then pressure tested. Thawing operations were performed by rig crew.

Time on location: 24 hours

Freeze and Hot Tap Case History #23

Objective: Hot tap 114.0mm gate valve.

Well information: 3500 Kpa sweet gas well

Procedure: Assemble hot tap drill with ¾" bit and centralizer. Fill wellhead with oil and tie on hot tap drill. Pressure test to 5500Kpa then bleed off to 2000Kpa. Start drilling gate valve while monitoring pressures and adjust to stay under 5500Kpa. Drill through both halves of the valve and the pressure drops downs to 3500Kpa once through. Retract drill and close the top valve, bleed off pressure from the drill and rig out equipment.

Time on location: 1.5 hours

Freeze and Hot Tap Case History #24

Objective: Freeze casing to install primary seal on intermediate casing.

Well Information: 51 mPa Bottom hole pressure. Failed cement job was allowing pressure to surface on intermediate casing side where there was no primary seal installed. Invert mud was being pushed thru failed cement to surface.

Procedure: Fresh water was pumped to push invert down away from surface. One cube of drilling mud was then pumped to ensure area to be frozen was clear of invert. Freeze gel was then pumped down surface, intermediate and productions casing. Dry ice was applied and freeze was held for 24 hours and pressure tested. Freeze plug tested OK. Drilling rig was then rigged out. Freeze was then held for another 48 hours. Crane was then brought in and drilling rigs BOP

stack was removed. Primary seals were then installed in casing. 7 1/16" Gate valve and 70 mPa stack were installed and pressure tested. Well was turned over to rig crew for thawing operations.

Time on location: 5 days of 24 hour operations.

Freeze and Hot Tap Case History #25

Objective: Freeze well to install another 7 1/16" gate valve.

Well Information: 30 mPa BHP. Wire line tools were hydrated in the hole approximately 150 meters down and braided line was across existing gate valve. Wireline lubricator rated for 21mPa with a 14mPa equalize loop with leaking 35mPa ball valve.

Procedure: Attempted to inject gel thru casing valves but pressure ratings of wireline surface equipment limited pumping pressures and gel could not be injected. Hot tap was performed on 14mPa equalize loop and gel was injected thru leaking 35mPa valve. Gel sealed leaking 35mPa valve, equalize loop was rigged out and installed new 35mPa ball valve behind failing 35mPa valve. Gel was then injected into well thru lubricator valve and casing valve. Gel was also injected into surface casing. Freeze plug was then formed and freeze was held thru the night. Plug was pressure tested from above in the morning and held. Pressure was bleed off above freeze plug and monitored. Once freeze plug had been verified the wireline lubricator was broken apart and the braided line was cut and wireline equipment was rigged out and another orbit valve was installed and pressure tested. Well was turned over to steamer truck crew to thaw.

Time on location: 28 hours

Freeze and Hot Tap Case History #26

Objective: Hot tap and Freeze tubing to replace damaged master valve to gain entrance into tubing.

Well Information: 12.4MPa sour gas well shut in for several years, master valve seized.

Procedure: Heat wellhead, expose surface casing install cribbing around surface casing and fill with dry ice. Inject gel into surface casing. While frost is transferring through gel in surface casing, scaffolding is built and hot-tap equipment is rigged up. Rig up pumping equipment to production casing, pressure test and inject gel. While frost is penetrating gel in production casing, the hot-tap drill is pressure tested and a 19mm hole is drilled thru the seized master valve. The hot tap drill is rigged out and pumping equipment installed, pressure tested, and gel is injected into the production tubing. Due to the well conditions the dry ice maintained overnight. At daylight, the plug is pressure tested, the top section is dismantled, and the new valve is installed and pressure tested. Well pressure is applied above the ice plug and turned over to the thaw crew.

Time on location: 27.5 hours\

Freeze and Hot Tap Case History #27

Objective: Hot tap and mill out a damaged gate valve 90% closed and freewheeling.

Well information: 4,200kpa sweet gas well on an offshore platform with damaged gate valve not allowing access into tubing. Top gate valve functioning.

Procedure: Assemble hot tap equipment and function. Bleed off gas pressure above top valve and remove wireline flange install hot tap equipment pressure test.Equalize pressure and open top operating gate valve hot tap a ¾ inch hole in bottom valve pull above top valve close bleed off well gas remove drill bit. Install mill and reconnect flange equalize with well gas and open top valve mill out damaged bottom valve pull above top valve and close bleed off well gas and remove mill. Install reamer to open bore to 3 1/8 reconnect flanges and equalize with well gas and open top valve ream bottom gate valve to full drift. Pull above top valve and bleed off well gas remove reamer. Install wire brush reconnect flange equalize with well gas open top valve clean tubing hanger threads with wire brush pull up above top valve and close. Bleed off well gas and remove hot tap equipment.

Time on off shore platform: 33 hrs over three days

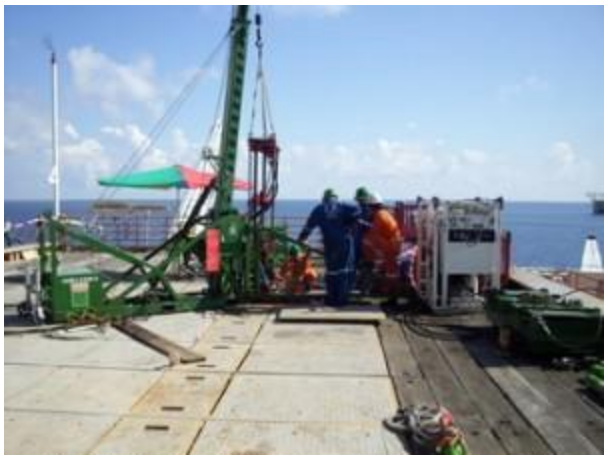
Freeze and Hot Tap Case History #28

Objective: Mill out gate to 3 1/8 diameter on top master valve that is seized closed and freewheeling to accommodate wireline tools and installation of back pressure valve in tubing hanger. Bottom master Valve previously milled out.

Well information: 3 Mpa water injection well

Procedure: Assemble hot tap equipment, start power pack and check all functions. Confirm no pressure above damaged valve, remove wireline cap and install crossover-work valve-Bop and hot tap equipment. Pressure test all components and connections to 7 Mpa. Bleed pressure back to 5 mPa drill ¾ inch pilot hole. Retract drill above work valve, close, bleed off pressure, and change out bit to 3 inch cone mill. Rig up new assembly, equalize above work valve and open valve. Advance mill to gate, record measurements and confirm depth is correct. Commence milling, noting time for advancement gained. After advancing 2 inches through 2 ½ inch gate advancement slowed considerably. Retract cone mill above work valve, close valve and bleed off. Change out cone mill to 2 7/8 outside-in aggressive mill. Rig up hot tap equipment, equalize above work valve and open valve. Advance drill to gate, check measurements and resume milling. Monitor torque and distance traveled, double check measurements to confirm through gate. Retract mill above working valve, close valve and bleed off. Change out mill to 3 1/8 reamer re-install hot tap equipment, equalize and open work valve. Ream out gate valve, retract above work valve, close and bleed off. Change out reamer to wire brush, re-install equipment, equalize above work valve and open. Advance brush to threads in tubing hanger, check measurements and clean threads in hanger. Retract brush above work valve and close valve, bleed off and rig out hot tap equipment. Hand over well to wireline.

Time on location: 27 hours over three days



Freeze and Hot Tap Case History #29

Objective: Replace master valve on well. No vehicle access.

Well Information: 18mPa surface pressure with 2% H2S content.

Procedure: All personnel and equipment were flown into location from staging area. Portable lubricators filled with gel were flown into location. Wiper plug was installed in one end of lubricator and a portable 35mPa pressure washer was used to inject the freeze gel. Freeze plug was formed and pressure tested and master valve changed. Freeze plug was thawed by mother nature.

Time on location: 24 hours.

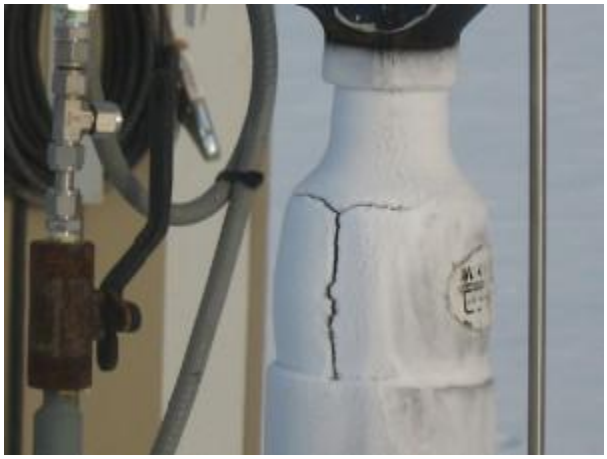
Freeze and Hot Tap Case History #30

Objective: Replace split 4 by 2 inch swedge below master valve on a coil tubing completion.

Well Information: Well gas blowing out of swedge that is split vertically from threads to top of the neck and split horizontally half way around neck. Shut in casing and tubing pressure is 7 mPa, flowing pressure of 3.5 mPa. Casing size of 4 ½ inches with 1800 meters of 2 inch coil tubing landed in coil tubing hanger above 4 ½ demco valve and below 4 by 2 inch swedge with 2 inch master valve. No vehicle access, temperatures ranging from minus 20 degrees centigrade to minus 30 degrees.

Procedure: All personnel and equipment were flown into location from staging area. A small shelter using scaffolding, tarps and Herman nelson heater erected for purpose of shelter and keeping lubricators of freeze gel, pumping equipment and water needed for pumping purposes thawed. Installed a dog collar around the vertical crack of the damaged swedge to keep from blowing out sideways and chained top of swedge to bottom of demco valve to keep from blowing off from the top. Cribbing for dry ice was built between demco valve and damaged swedge on the coil tubing hanger and connecting nipple. Casing was left flowing to compressor station to lessen stress on damaged swedge. A mixture of freeze gel and sealing material were pumped into the coil tubing through side wing valve on the flow line using portable lubricators with wiper plugs and gas powered pressure washer. Once flow of gas was sealed sufficient gel was pumped to ensure that freeze plug would form where cribbing was built. Maintained dry ice and monitored pressures through evening. Intrinsically safe heat tape powered by portable gen-set was used to keep pumping areas and equipment to be changed from freezing. In a.m. pressure test revealed freeze plug was not holding. Flowed out failed freeze plug, swedge remained sealed. Moved cribbing down below demco valve, shut in casing , pumped sufficient freeze gel into 4 ½ casing and down 2 inch coil to form freeze plug in the area of the cribbing using the methods mentioned above. Maintained ice and monitored pressure through the evening. In morning performed positive pressure test of 12 mPa using baker pump on freeze plug and a negative test. Damaged swedge was removed and new swedge with new master valve installed. New equipment was pressure tested using baker pump. Well was thawed using Herman nelson heaters with sufficient duct tubing to keep ignition source away from well. The freeze plug was then flowed out and the well was then tied back into the production flow lines. All equipment and personnel were then flown back to staging area.

Time on location: 3 days-due partly to helicopter restrictions and cold weather problems.



Freeze and Hot Tap Case History #31

Objective: Freeze well below coil tubing b.o.ps in order to remove damaged 2 inch coil tubing in lubricator and re-attach to good coil tubing.

Well Information: 20 mpa sweet gas well with frac tool,overshot,jars, and crossover to 2 inch coil tubing stuck across master valves and coil tubing b.o.ps. Stack configuration from bottom to top consisting of two 4 1/16 master valves, flow cross with two 2 in wing valves, two foot 4 1/16 10,000 psi spool, 4 1/16 flow cross with one outlet and valve, quad coil tubing b.o.ps and twenty ft of 4 1/16 lubricator attached to injector.

Procedure: Build cribbing between bottom flow tee and upper flow tee on 2ft spool below b.o.ps. Pump freeze gel into lower and upper flow tees add ice to cribbing. Maintained ice and monitored pressure throughout evening. Wrapped steam line on lubricator to keep thawed, and kept heat on above freeze plug to allow access for pumping to pressure test and monitor. Pressure test with nitrogen to 30 mpa on top of freeze plug, do negative test and monitor for venting. Remove lubricator from top of coil tubing b.o.ps and lifted 3 ft exposing damaged coil and crossover to the jars-found that coil was collapsed from crossover to the top of the lubricators. Performed hot tap on coil just below injector pack-off as this was the closest good tubing to attach hot tap clamp. Confirmed no pressure in coil before cutting damaged coil above crossover. Re-positioned lubricator, ran out all flattened coil and cut off. Installed crimp on coil connector on good coil. Replaced crossover above jars then repositioned lubricators and reattached the good coil to the crossover, lowered lubricator and re-secured. Pressure test all connections against freeze plug with nitrogen. Removed ice and cribbing, kept positive pressure above freeze plug and handed well over to coil tubing operations for thawing.

Time on location: 36 hours.

Freeze and Hot Tap Case History #32

Well information: 45MPA gas well. Wire line tools stuck across wellhead valves with 2 sets of wire line bops on top of well head with 80' of lubricator on top and 2 X 2 1/16th gate valves on top of lubricator closed maintaining well control.

Objective: Inject freeze gel and freeze the three well head valves enabling the safe removal of all equipment above the well head valves and install a 4 1/16th 10K bop dressed with slip rams and pipe rams to fit the 1 ½" weight bar which is across the well head. Then add sufficient riser spool and another gate valve on top to regain proper well control and give the ability to be able to rig in proper equipment to fish out the stuck tool string.

Procedure: Upon arrival to the well site a pre job inspection occurred. The ice cribbing was assembled. The equipment above where the freeze plug was to be was wrapped with steam and heat trace as well as insulation to prevent the equipment to be removed from freezing. Utilizing 10K 3 1/16" 10'sections of lubricator filled with freeze gel and a wiper plug we used a 10K pump truck to push the wiper plug in turn pushing the freeze gel into the well bore. Once sufficient freeze gel was injected Dry Ice was added to the ice cribbing and a pressure gauge installed above where the freeze was actually going occur. The gel was then allowed to freeze for approximately 36hrs while monitoring pressure above the plug and maintaining a solid ice pack. After allowing sufficient time for the freeze to occur, a positive pressure test to 65mPa was held for 1 hour. Once the positive pressure test was confirmed a success a negative pressure test was performed at 0 mPa and held for 1 hour and was completed successfully. Another safety meeting was held involving all parties on site and ensured that all required equipment was available. Ensure good line of communication between the well control crew and the 2 picker operators involved. One picker to remove the lubricator from the well head and the other with the new set of 4 1/16th bops ready to position on to the well head. The lubricator was then unbolted from the top of the well head and swung clear of the area. The tool string was then disassembled to the lowest point above the well head, and a new fish neck installed, for future fishing operations. The 4 1/16th bop was then positioned onto the well head and tightened down and closed, and a 4' section of 4 1/16th riser spool and two 4 1/16th gate valves was then installed on top of the bop. The BOP's were then pressure tested and once all connections were tested, there was 50 MPA left above the freeze plug and the cribbing and ice removed allowing the thawing process to begin.

Total Time on location: 5 days.

Freeze and Hot Tap Case History #33

Objective: Hot tap the tubing below the bridge plug and inject gel to freeze the well to allow for the removal of the drill collars.

Well information: 12MPa gas well. After success UBD operations to deepen a well, the floats did not hold pressure to allow for the trip out with the drill string. After several attempts to set a plug in the "Q" nipple just above the float sub, a bridge plug was set in the last joint of pipe above the drill collars and the drill string was snubbed out to the drill collars.
BHA: bit, bit sub with duel floats, 3m drill collar, "Q" nipple, 6 drill collars, 73mm tubing to surface.

Procedure: Confirm location of bridge plug in the last joint of tubing with plumb bob on trip out of the hole. Install safety valve in tubing and set first drill collar in slips. Install hot tap clamp and drill assembly on tubing below bridge plug. Pressure test and drill ¾" hole in tubing. Rig out drill and install gel injection equipment. Pump twice the volume of the drill collars capacity. Install cribbing and supply dry ice to area below the tubing to drill collar crossover. Freeze the gel, pressure test and break out the tubing. Install 2'pup and safety valve swivel joint and Kelly hose. Pull 2 drill collars, set ice cribbing, thaw top ice plug while freezing next plug. Pressure test through Kelly hose. Break connection and lay down double stand. Install crossover, 2'pup, safety valve, swivel joint and Kelly hose. Pull 2 drill collars and repeat freeze procedure. Repeat total procedure unit the bit is clear of the blind rams. Secure well with blind rams.

Time on location: Spot equipment and set up 2 hours, next day 13 hours of execution of freeze plugging procedure.

Snubbing Case Histories

Snubbing Case History #1

Objective: Completion of multi-zone sweet gas well

Well Information: 31 Mpa sweet multi–zone gas well. Workover Rig pulled fracturing string (114mm Hydril) took kick with 100m in hole. Depth: 2,900m

Procedure: Strip on riser spool to bring connection above substructure. Strip on snubbing unit. Snub out 10 joints and BHA. RIH scraper and condition perforations. Rig in e-line and run gauge ring through perforations. RIH: TEP, BHA of profiles and spacing pups, 19joints 73mm tubing. Hang off pipe in rams, rig up e-line, and lubricate in packer assembly. RIH with 89mm tubing to bottom. Rig up e-line and log on depth. Space out BHA set packer; come off, set test packer, and pressure test permanent packer. Rig up wireline, set plug at bottom, and POOH with 89mm work string. RIH with seal assembly, blast joints profiles and spacing pups, frac packer, and 114mm tubing. Pull plug, sting into packer and pressure test. Pull out of packer reset plug, space out, latch into permanent, set packer, and land tubing. Pull plug pressure test seals and packer. Rig out snubbing unit. Stand-by for Fracture stimulation. Rig up riser spools and snubbing unit and pressure test. Release frac packer strip out tubing hanger, and POOH 114mm string and BHA. Rig up e-line to set bridge plug and perforate. RIH: frac packer BHA and 114mm tubing. Strip in tubing hanger, set packer, land tubing, pressure test packer, rig out snubbing unit and stand-by for fracture. Rig up riser spools and snubbing unit, pressure test and POOH with frac string. Change over to 73mm handling equipment and RIH with bridge plug retrieving skirt. Tag sand, pull plug, clean off sand, and latch onto bridge plug and release. Run plugs on wireline and POOH. Strip in completion BHA and RIH to bottom, space out tubing, latch into permanent packer, set upper packers, and land tubing. Pull plug, pressure test seals, and rig out snubbing unit and release.

Time on location: 18 days working 24s over a 32 day period

Snubbing Case History #2

Objective: Remove frac string and install completion system.

Well Information: 11 Mpa sour gas well was fractured through 89mm tubing. Depth: 1,800m

Procedure: Rig up snubbing unit, and pressure test. Release packer, strip out tubing hanger and POOH with frac string. With one joint left, land tubing hanger and install enough riser spool to accept the BHA. Snub out tubing hanger, 1 joint, and BHA. Remove riser spool and change over handling equipment to 73mm. Strip in BHA, and 73mm tubing. Strip in tubing hanger, set packer, land tubing and rig out.

Time on location: 19 hours over 2 days

Snubbing Case History #3

Objective: Remove 114mm frac string and install 73mm completion system.

Well Information: 28 Mpa sweet gas well, depth: 3,400m.

Procedure: Rig up required riser spool and snubbing unit, and pressure test. Release frac packer, strip out tubing hanger and POOH and lay down114mm tubing and BHA. Change over handling equipment to 73mm. Strip in BHA, and RIH 73mm tubing. Space out BHA, strip in tubing hanger, latch into permanent packer, set top packer, and land tubing. Pull plugs and pressure test seals. Rig out snubbing unit.

Time on location: 73 hours over 4 days

Snubbing Case History #4

Objective: Abandon lower zone and complete upper zones.

Well Information: 8,500 Kpa sweet gas well, no longer interest in lower zone. Completion required on upper zones. Depth: 1,450m

Procedure: Rig up snubbing unit and pressure test. Come off on/off tool, strip out tubing hanger, and POOH tubing and strip out BHA. Strip in packer and BHA, RIH tubing to below top perforations. Set packer pull plug and pressure test lower packer. Re-run plug, POOH tubing, and strip out BHA. Rig up wireline, bail cement onto packer, re-perforate upper zone, set packer bleed off casing, dump bail sand onto packer, and perforate upper zone. RIH on/off skirt, BHA, and tubing. Tag sand, pull plug and flow out sand. Come off packer, set plug, space out tubing, strip in tubing hanger, latch onto packer, and land tubing. Pull plug pressure test on/off tool and rig out snubbing unit.

Time on location: 54 hour over 6 days

Snubbing Case History #5

Objective: Remove production tubing to Fracture top zone. Retrieve bridge plug and re-run production tubing.

Well Information: 15 Mpa sweet gas well. Depth: 2,200m

Procedure: Rig up snubbing unit and pressure test. Come off packer and strip out tubing hanger, tubing and BHA. Rig out snubbing unit for frac. After frac, RIH retrieving tool, BHA and tubing to top of sand. Install slim hole safety valve and pull plugs. Clean down 160m onto bridge plug using slim hole safety valves, and release. Run plugs and POOH same. RIH completion BHA and tubing, latch onto packer and land tubing. Pull plugs and pressure test on/off tool. Rig out snubbing unit.

Time on location: 88 hours over 8 days

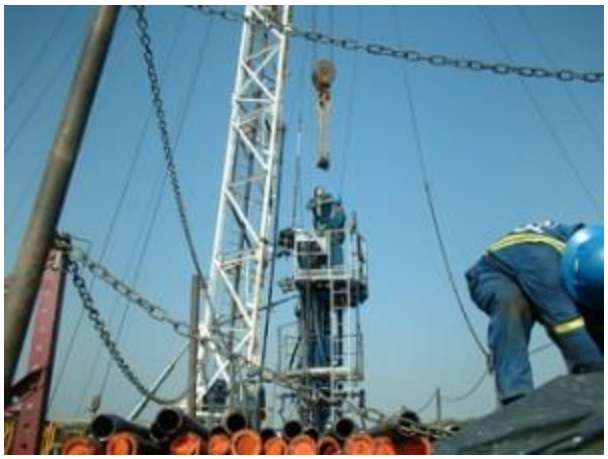
Snubbing Case History #6

Objective: Replace 73mm tubing with 60.3mm tubing for better fluid lift, company acquired permission to co-mingle zones, so packer will be removed.

Well Information: 5,500 Kpa gas well, 1,600m deep.

Procedure: Rig up snubbing unit and pressure test. Try to unset packer but cannot. Free point and cut tubing. Set bridge plug and POOH. RIH overshot, wash over pipe floats bumper sub and jars. Latch onto fish and work free. POOH fishing string and fish. Change over handling equipment to 60.3mm. RIH slick string.

Time on location: 55hours over 8 days



Snubbing Case History #7

Objective: Run in the hole simple completion string.

Well Information: 4,000 Kpa sweet gas well, 1,400m deep.

Procedure: Rig up snubbing unit and pressure test. RIH Snubco Tubing End Plug, BHA and 1,400m tubing, strip in tubing hanger and land tubing. Rig out snubbing unit.

Time on location: 6 hours

Snubbing Case History #8

Objective: Run simple completion string.

Well Information: 3,000 Kpa sweet gas well, 580m deep.

Procedure: Rig up snubbing unit and pressure test. RIH Snubco tubing end plug, 1 joint, profile, 1.24m pup, and 60 joints. Strip in tubing hanger, land tubing rig out snubbing unit.

Time on location: 3.5 hours

Snubbing Case History #9

Objective: Install completion packer and tubing in dual zone gas well.

Well Information: 4,000 Kpa sweet gas well, two producing zones with no authority to co-mingle. Depth: 650m.

Procedure: Rig up snubbing unit and pressure test. RIH Re-entry guide, .6m pup, profile, 3m pup, packer with on/off, 11 joints, blast joints, port sub, pup, and 59 joints. Strip in tubing hanger, set packer, land tubing. Rig out snubbing unit.

Time on location: 4 hours

Snubbing Case History #10

Objective: Retrieve bridge plug and install production tubing.

Well Information: 5,500 Kpa sweet gas well, 800m deep.

Procedure: Rig up snubbing unit and pressure test. RIH retrieving skirt, pup profile with plug in place, pup and 79 joints. Latch onto bridge plug and release. POOH same. RIH tubing end plug, 1 joint, profile, pup, and 76 joints. Strip in tubing hanger and land tubing. Rig out snubbing unit.

Time on location: 7 hours

Snubbing Case History #11

Objective: Change production tubing and BHA to 60.3mm

Well Information: 18.5 Mpa sweet gas well, 3,100m deep

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger and POOH, swabbing tubing as required. With 1 joint left, land tubing hanger and install 2.5m riser spool and strip out BHA. Change over handling equipment to 60.3mm and pressure test. Snub in packer assembly and 3,100m 60.3mm tubing. Strip in tubing hanger, set packer and land tubing. Rig out snubbing unit.

Time on location: 28 hours over 4 days.

Snubbing Case History #12

Objective: Remove tubing and packer assembly from well.

Well Information: 22 Mpa sweet gas well, 3,230m deep.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger and POOH, swabbing tubing as necessary. Land BHA in rams, rig wireline and lubricate out BHA. Lay down BHA and rig out wireline and snubbing unit.

Time on location: 32 hours over 4 days.

Snubbing Case History #13

Objective: Snub in 33.4mm siphon string.

Well Information: 6 Mpa sour gas well, 2,050m deep.

Procedure: Rig up 179mm to 281mm cross over flange and offset DSA. Rig up snubbing unit and pressure test. Snub in mule-shoe w/ tubing end plug, pup, "Q" nipple, pup, and 209 joints 3.4mm tubing through primary tubing hanger. Strip in secondary tubing hanger and land tubing. Rig out snubbing unit and spools.

Time on location: 10 hours

Snubbing Case History #14

Objective: Snub out drill string and run completion string.

Well Information: 7,200 Kpa sour gas well (725ppm), 1,400m deep.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger, and POOH and stand tubing in derrick. Change over to handle drill collars and pull and lay down drill collars and BHA. Change over to 60.3mm handling equipment and snub in BHA and 1,400m tubing. Rig out snubbing unit.

Time on location: 8 hours

Snubbing Case History #15

Objective: RIH simple completion string.

Well Information: 11 Mpa sweet gas well, 2,700m deep.

Procedure: Rig up Snubbing unit and pressure test. RIH tubing end plug, pup, profile, pup, and 286 joints tubing. Strip in tubing hanger, land tubing and rig out snubbing unit.

Time on location: 10 hours

Snubbing Case History #16

Objective: Fish dropped coil tubing and run production tubing.

Well Information: 12 Mpa sour (1500ppm) gas well, 1,700m. During coil operations, well control was lost and shear rams on coil unit were closed and coil was dropped. Well was subsequently secured with a bridge plug above the lost coil.

Procedure: Rig up and pressure test snubbing equipment. RIH with retrieving tool, pup, profile with plug, pup, and 2 joints tubing. Pressure up above plug with N2, latch onto plug and release. Snub out same. RIH fishing tools and latch onto coil. POOH fishing string, strip out over shot, and hang coil in slip rams. Remove snubbing unit jack plate and slips, rig up riser spool adequate to extend above snubbing unit work floor, and rig up coil BOPs and injector. Connect coil fish to coil in injector, and retrieve lost coil. Close blind rams bleed of system and rig out coil equipment. Install slips and jack plate, change over to 60.3 handling equipment. Strip in BHA and 173 joints. Strip in tubing hanger, set packer and land tubing. Rig out snubbing unit.

Time on location: 61 hours over 7 days

Snubbing Case History #17

Objective: Install dual string completion.

Well Information: Low pressure (4,500kPa) shallow gas well (550m). With 2 zones not co-mingled, Customer needs tubing for fluid lift on upper zone.

Procedure: Install stripping rams dressed with offset rams orientated to long string side on tubing spool. Rig up workover rig BOP stack. Pressure test casing, swab dry and perforate required zones. Rig up snubbing unit and pressure test. Strip in long string BHA with appropriate tail pipe, packer and blast joints. RIH tubing strip in primary tubing hanger with 1.2m pup above. Set packer, orientate hanger and land long string. Close lower offset rams on 1.2m pup, bleed off above and remove landing joint. Secure well with blind rams and change upper offset rams to short string side. Make up short string BHA and locate into secondary hanger receiver in primary hanger. RIH short string tubing, strip in secondary hanger, land tubing and pressure test hanger assemblies. Rig out snubbing unit and BOPs, install top section, pull plugs and prove segregation.

Time on location: 9.5 hours

Snubbing Case History #18

Objective: Install dual zone completion.

Well Information: 3,500 Kpa gas well, 450m, two zones

Procedure: Pick up snubbing unit, place on rig BOPs, split stack above rams, install spool to house packer, and pressure test. RIH re-entry guide, pup, profile with plug in place, pup, and 4 joints. Strip in packer, pup, blast joints, pup, port sub, pup, and 43 joints. Strip in tubing hanger, set packer, land tubing and rig out snubbing unit and spools.

Time on location: 6 hours

Snubbing Case History #19

Objective: Utilize Snubco low pressure unit to install production tubing.

Well Information: 1,300 Kpa gas well, 300m.

Procedure: Rig up unit and pressure test. RIH tubing end plug, 1joint, profile, 1.2m pup, 29 joints, install tubing hanger in work window, land tubing and rig out.

Time on location: 3 hours

Snubbing Case History #20

Objective: Install dual string completion.

Well Information: 9 Mpa 1,500m gas well, 2 zones. Lower zone already perforated and producing.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger and POOH tubing. Strip in BHA with packer and RIH to place packer above perforations. Come off packer, pull 1 joint, land tubing and pressure test packer, and rig out snubbing unit. Install striping rams offset to long string side above tubing spool. After top zone is perforated and stimulated, rig up snubbing unit and pressure test. Strip out center bore tubing hanger, RIH to tag fill on packer. Strip in primary tubing hanger, pull plug and clean off on/off tool. Latch onto packer, orientate and land tubing hanger. Close offset rams on 1.2m pup above hanger. RIH short string and land. Pressure tubing hanger, rig out snubbing unit and BOPs.

Time on location: 27.5 hours

Snubbing Case History #21

Objective: Change out 73mm tubing to 60.3mm for better fluid lift.

Well Information: 9 Mpa gas well, 2360m deep. Packer fluid in annulus.

Procedure: Rig up snubbing unit and pressure test. Come off packer, pull out tubing hanger, and roll well over to N2, latch onto packer and release. POOH tubing and BHA. Change over handling equipment to 60.3mm. Strip in BHA and tubing. Land tubing and rig out snubbing unit.

Time on location: 28 hours over 3 days

Snubbing Case History #22

Objective: Convert dual completion to dual string completion with 33.4mm siphon string

Well Information: 4,000 Kpa gas well, 600m waters its self out.

Procedure: Set plug in tubing and remove top section. Install full bore dual string tubing spool. Install stripping rams offset to long string side, service rig BOPs, and snubbing unit. Pressure test. Come off packer, strip out tubing hanger and strip in .3m nipple, primary dual string tubing hanger and 1.2m pup. Latch onto packer, orientate hanger and land tubing. Close offset rams on 1.2m pup, bleed off stack and remove landing joint. Secure well with blind rams. Change over handling equipment to 33.4mm, lay down snubbing unit and install offset flange assembly. Pressure test. RIH 550m siphon string and land. Pressure test hangers. Rig out snubbing and BOP equipment.

Time on location: 16.5 hours

Snubbing Case History #23

Objective: Retrieve 7 bridge plugs and run completion string.

Well Information: Sweet well with 7 zones ranging from 14 Mpa to 31Mpa between 2,600m and 3,000m. All zones have been fractured with a bridge plug set above the perforations before the next zone is perforated and fractured. A permanent packer is set above the lowest perforations. When snubbing unit arrived the tubing was landed above the upper set of perforations.

Procedure: Rig up snubbing unit and pressure test. Pull tubing hanger and run down to sand. Pull tubing plugs circulate clean and release bridge plug. Strip out slim hole valves, rig up wireline and set plugs. POOH with tubing and bridge plug. RIH with retrieving skirt and tubing and repeat sequence 6 times to retrieve all bridge plugs. Make up and strip in BHA to allow for segregation of all zones. RIH tubing, latch onto packer, come off and space out tubing. Strip in tubing hanger latch onto packer, set hydraulic set packers and land tubing. Rig out snubbing unit.

Time on location: 96.5 hours over 9 days

Snubbing Case History #24

Objective: Remove completion tubing

Well Information: 8 Mpa gas well, 2,200m deep, .4% H2S

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger, 2,200m tubing, and BHA.

Time on location: 4.5 hours

Snubbing Case History #25

Objective: Retrieve bridge plug and install completion tubing.

Well Information: 13 Mpa sweet gas well, 2,350m deep

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger and run in 3 joints to tag sand. Pull wireline plug and wash clean onto bridge plug and release. Set wireline plug and POOH tubing and BHA. RIH re-entry guide, pup, profile with plug in place, pup, and tubing. Tag fill. Pull wireline plug and clean out cellar. Set plug and pull 4 joints, strip in tubing hanger and land tubing. Rig out snubbing unit.

Time on location: 22.5 hours

Snubbing Case History #26

Objective: Perform acid selective stimulation and completion.

Well Information: 8 Mpa gas well, 2,400m deep.

Procedure: Rig up snubbing unit and pressure test. Strip in acid tools and 225 joints tubing, space out tubing and correlate to logs. Rig up slick line and pull plugs. Perform acid job, close valve, pull 1 joint and land tubing. Rig out snubbing unit. Rig performs tasks. Rig up snubbing unit and pressure test. Strip out tubing hanger, tubing and acid tools. RIH completion BHA and tubing, tag fill, rig up wireline and pull plug. Clean out to packer, pull slim hole valves set plug space out tubing strip in tubing hanger, latch onto packer and land tubing.

Time on location: 29.5 hours

Snubbing Case History #27

Objective: Gain control of well, replace tubing spool. RIH completion string.

Well Information: Workover rig took kick, no tubing hanger in place.

Procedure: Strip on snubbing unit and pressure test. Strip out safety valve, 2,620m and BHA. RIH on/off tool, BHA and 2,500m tubing, pressure test tubing strip in packer and 2 joints. Set packer and pressure test. Come off packer lay down 2 joints rig out snubbing unit and Bops to inspect tubing spool. Replace tubing spool. Rig up Bops and snubbing unit and pressure test. Run in latch onto packer, pressure up above and release. Strip out 2 joints and packer. Run to bottom, space out tubing, strip in tubing hanger, latch onto packer, and land tubing. Rig out snubbing unit.

Time on location: 35 hours over 4 days

Snubbing Case History #28

Objective: Drill out surface plug.

Well Information: Re-entry is required into abandoned well.

Procedure: Rig up snubbing unit and pressure test. Run in hole: bit, bit sub c/w floats, mud motor, and drill string to 20m drill through plug, run into 140m, and drill down 500m. Break through. Run in 700m circulate dead. Land tubing and rig out snubbing unit.

Time on location: 17 hours

Snubbing Case History #29

Objective: To mill out sulfur plugs out of 88.9 production tubing

Well Information: 21% sour gas well, 3,800m deep, 47MPa. Solid sulfur precipitated out during production resulted in the tubing being plugged at about 1,700m.

Procedure: A self-contained snubbing unit was used on this well. 1.66 tubing was the drill string. Fill hole with water. Rig up 4-1/16 10K primary BOPs and stripping BOPs. RIH with mill, bit sub, double float assembly, "Q" profile nipple, drill collars, Profile nipple, and drill pipe to plug. Establish circulation and dill through sulfur bridge. Circulate to bottom to ensure well tubing is clear to bottom. POOH and rig out.

Time on Location: 10 days

Snubbing Case History #30

Objective: Recover lost perforating gun and wire, install completion assembly.

Well Information: 8.6 Mpa gas well, 1,300m deep. Packer set segregating lower zone with 2m sand on it. Perforated upper zone, lost gun and 600m wire. Workover rig blind rams closed on wire and leaking.

Procedure: Rig up shear rams and snubbing unit. Run in wire spear to below tubing spool and rotate onto wire. Pull up, close shear rams and lay down recovered wire. Run spear down 1 joint and rotate onto wire. Pull up close shear rams and lay down recovered wire. Snub in tubing hanger, land, replace blind rams and pressure test. Snub out tubing hanger. Strip in wire spear, BHA and 600m tubing rotating onto wire. POOH, land fishing assembly in rams, rig up 15m lubricator and lubricate out fishing BHA. Lay down BHA and recovered wire. RIH wash over pipe and grapple assembly. Tag fish, rotate over and run to bottom. POOH fishing string and land in rams. Rig up wireline and lubricate out. RIH on/off tool and completion BHA, tag bottom, pick up to next tool joint and rig up wireline and pull plug. Clean out to packer, come off and pick up to first connection. Set plug, space out tubing, strip in tubing hanger, latch onto packer, and land tubing. Rig out snubbing unit and rams.

Time on location: 36.5 hours over 4 days

Snubbing Case History #31

Objective: Install packer between two zones.

Well Information: 4,000 Kpa gas well, 550m deep, 3 zones, and required segregation between upper zones.

Procedure: Rig up snubbing unit and pressure test. Un-seat seal assembly, strip out tubing hanger, tubing and BHA. Make up seal assembly BHA, 12 joints, packer c/w on/off, pup, port sub, blast joints, pups, and 40 joints. Locate seals, come out, space out tubing, and strip in tubing hanger, land seals, set packer and land tubing.

Time on location: 6.5 hours.

Snubbing Case History #32

Objective: Fish lost perforating gun and run production tubing.

Well Information: 3,500 Kpa gas well, 500m deep. Perforating gun stuck in tubing spool.

Procedure: Rig up and pressure test spools and snubbing unit. Run fishing tools latch onto fish and POOH. Lay down recovered fish. Strip in on/off skirt, BHA and 500m tubing. Latch onto packer, come off and space out tubing, strip in tubing hanger latch onto packer, land tubing and rig out.

Time on location: 7.5 hours

Snubbing Case History #33

Objective: Pull production tubing, perforate new zone and re-install w/ packer.

Well Information: 6 Mpa gas well, 900m deep.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger and tubing. Rig out snubbing unit to perforate. Rig up snubbing unit and pressure test. Strip in BHA and 900m tubing, strip in tubing hanger, set packer, land tubing and rig out snubbing unit.

Time on location: 15 hours.

Snubbing Case History #34

Objective: POOH with production tubing, clean out fill, install production tubing.

Well Information: 6,000 Kpa, 1,400m deep

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger, tubing and BHA. RIH bit float sub, tubing to bottom. Rig up power swivel and clean out to TD. POOH same. RIH BHA and production tubing. Rig out snubbing unit.

Time on location: 13 hours.

Snubbing Case History #35

Objective: POOH frac string and install production system.

Well Information: 25 Mpa gas well, 2880m deep.

Procedure: Rig up snubbing unit and pressure test. Unset Packer, run in 2 joints and latch onto bridge plug and release. POOH and lay down frac string and BHA. RIH with retrieving tool and tubing, latch onto bridge plug and release. POOH with same. RIH with BHA and production tubing, tag fill. Pull wireline plug, clean out utilizing slim hole valves to TD. Pull 4 joints. Set plug, space out tubing, strip in tubing hanger, land tubing, and rig out snubbing unit.

Time on location: 55 hours over 5 days

Snubbing Case History #36

Objective: Move tubing up hole 300m

Well Information: 9 Mpa, 1.5% H2S gas well.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger, and 30 joints tubing. Strip in tubing hanger, set packer land tubing and rig out snubbing unit.

Time on location: 7 hours

Snubbing Case History #37

Objective: Drill into productive zone, install completion

Well Information: 4,500 Kpa gas well 700m deep

Procedure: Rig up snubbing unit and pressure test. POOH production tubing. RIH bit, motor, floats, and tubing to bottom. Drill down to required depth. POOH same. RIH production tubing. Rig out snubbing unit.

Time on location: 19.3 hours

Snubbing Case History #38

Objective: Complete gas well

Well Information: 14Mpa sweet gas, 2,600m deep.

Procedure: Rig up snubbing unit and pressure test. Strip in BHA and 269 joints tubing. Strip in tubing hanger, land tubing and rig out.

Time on location: 9.5 hours

Snubbing Case History #39

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<p/sstrongtrong/strong>**Objective:**Change out BHA.

Well Information: 16Mpa gas well, 2,900m deep.

Procedure: Rig up and pressure test snubbing unit. Release packer, strip out tubing hanger, and POOH tubing and BHA. Strip in new BHA and production tubing. Strip in tubing hanger set packer and land tubing. Rig out snubbing unit.

Time on location: 20.5 hours.

Snubbing Case History #40

Objective: POOH frac string and run production system.

Well Information: 12mPa gas well, 2600m deep. No tubing hanger landed, strip on snubbing unit.

Procedure: Strip on riser spool and snubbing unit. Strip out safety valve and strip in tubing hanger. Pressure test. Strip out tubing hanger. Strip out and lay down frac string, and BHA. Strip in production BHA, pick up and snub in production tubing. Strip in tubing hanger, set packer and land tubing. Rig out snubbing unit.

Time on location: 32.5 hours over 3 days

Snubbing Case History #41

Objective: Recover sanded in 60.3mm completion string

Well information: 9mPa sweet well 2300 meters deep.

Procedure: A 60.3mm tubing string had become stuck in sand. Coil tubing was brought in the clean out sand but operation was unsuccessful. A service rig and E-line was rigged up to free point and cut the tubing with a chemical cutter. Tubing cut was made and permanent tubing bridge plug was set. Rig assist unit was rigged in and tubing string was then snubbed out. Wash over pipe was snubbed in and fish was retrieved. New 60.3mm tubing completion string was then snubbed in and landed at required depth.

Time on location: 3 days.

Snubbing Case History #42

Objective: Rig up Snubbing unit. Drill out surface plug.

Well Information: Surface plug set in 114.3mm casing at surface. Unknown pressure below.

Procedure: Rig up Snubbing unit. Pressure test flanges. Lower BHA (Bit, motor, float sub) plus one joint plus tubing into stack. (Tubing swivel head installed above) Tag plug, start circulating fluid. Wait for returns at tank. Start drilling surface plug using traveling slips to hold tubing. Once through plug, pick up one joint and circulate down. Circulate until clean. Remove swivel head. Install tubing hanger and land string in casing bowl. Rig out snubbing unit.

Time on location: 7 hours

Snubbing Case History #43

Objective: Remove drill string. Install multi-zone production string.

Well Information: 18 mPa sweet well, Multiple zones. Depth: 3400

Procedure: Strip on snubbing unit. Install tubing hanger. Land string and pressure test. Pull hanger, 350 joints 60.3mm plus BHA. (Bit, motor, dual float subs) Snub in multiple blast joints and sliding sleeves (configured accordingly) with a packer. Set packer, bleed off annulus for a negative pressure test. Come off packer, fill with fluid and do a positive pressure test. Pull 24 joints, install tubing hanger. Land string and rig off snubbing unit. Zones above packer perforated, fractured, and bridge plugs drilled. Rig up snubbing unit. Run in On/Off skirt plus multiple blast joints with sliding sleeve. Tag sand above packer. Wireline out tubing plugs. Clean out sand. Wireline in tubing plugs. Space out, install tubing hanger. Latch onto packer and land string. Rig out snubbing unit.

Time on location: 83 hours over 7 days.

Snubbing Case History #44

Objective: Remove packer from completion BHA.

Well Information: 6 Mpa gas well. Depth: 1,300m.

Procedure: Rig up snubbing unit and pressure test. Strip out tubing hanger, 1,300m tubing and BHA with packer. RIH re-entry guide, pup, flow sub, pup, “X” profile c/w plug in place, pup, and 130 joints of tubing. Strip in tubing hanger and land tubing.

Time on location: 10.5 hours

Snubbing Case History #45

Objective: To fish out coiled tubing lost in 88.9mm production tubing.

Well Information: 19% sour gas well, 4,600m (14,720") deep, 60.7MPa (8,800psi). Coiled tubing was performing a cleanout and chemical spot operation. The tubing became stuck and was subsequently parted leaving about 2,700m of tubing in the well.

Procedure: Used workover rig and rig assist snubbing unit. Rigged up 4-1/16, 10K slip rams for coil and shear rams on top of master valve. Rigged up 4-1/16, 10K Primary BOP stack. Rigged up 4-1/16, 10K stripping stack on top of primary stack. Fill the hole with appropriate kill fluid and use lubricate and bleed kill method to reduce the tubing pressure. RIH with 1.66 tuning and fishing assembly. Circulate kill fluid as necessary. Latch on to fish and pull to recover a portion of the lost coil. Bring to surface and close slip rams on fish, shear coil, move fish up to clear blind rams to recover section of coil and repeat until the entire section was recovered. Repeat fishing process until all that is practical is recovered. RIH with mill to remove bent up remaining coil and clean off fish. RIH with fishing tools to recover coiled tubing tools.

Time on Location: 44 days

Snubbing Case History #46

Objective: Install production string.

Well Information: 9 mPa sweet gas well, single zone. Depth: 1750m

Procedure: Rig up snubbing unit, and pressure test. Snub in "slick string". Install tubing hanger. Land string. Rig out snubbing unit.

Time on location: 11 hours

Snubbing Case History #47

Objective: Snub in BHA consisting of packer, blast joints, pup joints and sliding sleeves, upper dual string packer and 2 strings of 60.3mm tubing.

Well Information: 14mPa, sour 2000 meter gas well.

Procedure: Pre job meeting was held and snubbing stack was designed and built using offset equipment, spacer spools and hanger flange for this job. Lower packer was snubbed in with assorted blast joints, sliding sleeves, tubing blanking plugs and required amount of tubing for spacing. At this point tubing was still pipe light. Tubing was secured in well using lower stripping rams and hanger flange. At this point the snubbing unit was rigged down and upper dual string packer installed in tubing string and spacer spool to cover packer was added to stack. Snubbing jack was rigged back up and pressure texted. Tubing string was then snubbed down to required depth and packer were spaced out and set. Snubbing unit was then rigged out and extra

spacer spools were rigged out and offset spools were rigged in. Snubbing unit was once again rigged up and pressure tested. Short string of completion was then snubbed in and dual string packer was latched and short string tubing mandrel was landed. Snubbing unit was then rigged out.

Time on location: 18 hours

Snubbing Case History #48

Objective: Utilize rig assist snubbing unit to drill out multiple bridge plugs on high pressure gas wells

Well Information: Surface pressures up to 60mPa.

Procedure: Pre job meeting was held and job parameters were discussed with customer. Tubing string with drilling BHA were run into dead well. BOP configuration was discussed and designed around well parameters. Rig assist snubbing unit was rigged up utilizing a 70mPa stripping stack. Multi bridge plugs drilled out, tubing raised to required depth, tubing hanger landed and snubbing unit rigged out and drilling BHA separated from production string and dropped into cellar.

Time on location: 3 days – 1 partial day to rig up, 1 day to drill out and 1 partial day to rig out.

Snubbing Case History #49

Objective: Snub out and replace 228mm packer utilizing a 177mm snubbing stack.

Well Information: 5mPa 670 meter horizontal water injection well with 228mm casing and 88.9mm coated tubing.

Procedure: Rig in 279mm primary BOP, 279mm spacer spool, 270mm single gate pipe ram, 279mm to 177mm x/o spool and 177mm snubbing unit. Snub in with retrieving tool BHA and latch onto 228mm packer. Unset packer and snub to surface. Hang off BHA utilizing upper 279mm single gate. Rig out 177mm equipment and rig in electric line with 279mm lubricator. Lubricate 228mm packer up and close blind rams. Make up new 228mm BHA and lubricate back into well hanging off with upper 279mm single gate. Rig in 177mm snubbing unit and pressure test, snub BHA into well and space out. Close primary annular and bleed off snubbing stack. Unbolt snubbing unit and walk snubbing jack up and install heavy slips below connection. Set string into heavy slips, secure snubbing unit and spin out joint and install tubing hanger. Secure snubbing unit on tubing string again and pick up out of heavy slips. Remove heavy slips and walk snubbing unit down and bolt back onto BOP stack. Pressure test, set packer and land tubing hanger. Rig out snubbing unit.

Time on location: 16 hours over 2 days

Snubbing Case History #50

Objective: Service rig took a kick when pulling 88.9mm frac string, pipe was only part way out of the hole and no tubing hanger was landed.

Well information: 25mPa, 3700 meter gas well.

Procedure: Strip on rig assist snubbing jack and pressure test. Snub out remaining 2500 meters of 88.9mm frac string and BHA. Change over handling equipment to 60.3mm. Snub in retrieving tool, TKX plug and 60.3mm tubing and tag sand at 3400 meters. Rig in nitrogen pumper and circulate sand out and latch onto packer. Snub out 60.3mm tubing and packer. Snub in 60.3mm slick string. Rig out snubbing unit.

Time on location: 6 days

Snubbing Case History #51

Objective: Retrieve stuck perforating guns

Well information: 21mPa, 2800 meter gas well

Procedure: Rig up snubbing unit and pressure test. Make and fishing string consisting of wash over pipe, floats, bumper sub, hydraulic jars and 73mm tubing. Snub in the hole and latch onto fish. Jar fish free and snub out of hole until BHA is at surface. Hang off in snubbing rams. Rig in wireline and lubricate BHA out of hole. Rig out wireline and snubbing jack.

Time on location: 3 days

Snubbing Case History #52

Objective: Retrieve multiple WR bridge plugs and snub in production

Well information: 3000 meter, 24mPa multi zone gas well

Procedure: Rig up snubbing unit. Make up retrieving tool BHA and snub into hole until sand top is tagged. Rig in wireline and pull slip stop and plug. Use formation gas to perform a 50 meter sand clean out using slim hole valves. Latch onto WR and rig in wireline to set plug and slip stop. Snub out of hole. Repeat process for the next 4 WR plugs. Make up production BHA consisting of 4 hydraulic set packers, multiple sets of blast joints, 4 sliding sleeves and pups, and tubing to surface. Snub in requirement amount of tubing and rig in wireline to log tubing into place. Space out tubing and land tubing hanger. Set packers and rig out snubbing unit.

Time on location: 14 days

Snubbing Case History #53

Objective: Sweet well completion/ multiple wells.

Well information: 1700m, 6 mPa. Self contained equipment.

Procedure: Rig up self contained equipment on top of gate valve, pressure test primary BOP's and snubbing stack. Snub in packer assembly, blast joints, and tubing to surface. Land tubing, and set packer, rig out equipment, ready unit for travel, and convoy to next location. Rig up equipment, pressure test, and secure well for night. Tally tubing for following day.

Length of time worked, including travel: approximately 10 hours.

Snubbing Case History #54

Objective: Snub in seal assembly, 2 hydraulic set packers, 3 sliding sleeves, blast joints and 73mm tubing.

Well information: 18mPa, 3400 meter multi zone gas well

Procedure: Rig in rig assist snubbing unit according to customer and IRP 15 egress requirements. Snub in the hole with seal assembly, packers, sliding sleeves, blast joints and tubing to surface. Tubing was inspected and pressure test on the way in the hole. Threads also were inspected and perfect torque used to make connections. Space out, sting into permanent packer and set hydraulic packers. Rig out snubbing unit.

Time on location: 36 hours over 3 days

Snubbing Case History #55

Objective: Retrieve stuck perforating guns

Well information: 21mPa, 2800 meter gas well

Procedure: Rig up snubbing unit and pressure test. Make and fishing string consisting of wash over pipe, floats, bumper sub, hydraulic jars and 73mm tubing. Snub in the hole and latch onto fish. Jar fish free and snub out of hole until BHA is at surface. Hang off in snubbing rams. Rig in wireline and lubricate BHA out of hole. Rig out wireline and snubbing jack.

Time on location: 3 days

Snubbing Case History #56

Objective: Retrieve multiple WR bridge plugs and snub in production

Well Information: 3000 meter, 24mPa multi zone gas well

Procedure: Rig up snubbing unit. Make up retrieving tool BHA and snub into hole until sand top is tagged. Rig in wireline and pull slip stop and plug. Use formation gas to perform a 50 meter sand clean out using slim hole valves. Latch onto WR and rig in wireline to set plug and slip stop. Snub out of hole. Repeat process for the next 4 WR plugs. Make up production BHA consisting of 4 hydraulic set packers, multiple sets of blast joints, 4 sliding sleeves and pups, and tubing to surface. Snub in requirement amount of tubing and rig in wireline to log tubing into place. Space out tubing and land tubing hanger. Set packers and rig out snubbing unit.

Time on location: 14 days

Snubbing Case History #57

Objective: clean out sand latch on to packer
Well Information: 2200 m , 12Mpa , Multi-zone gas well

Procedure: Rig up snubbing stack stage out tubing hanger add 1 joint, rig in cleanout kit . Lower joint to sand top, pick up tubing string, flow tubing through cleanout swivel watch returns start lowering tubing string monitor string weight. Clean out casing to joint top, pick up tubing string flow tubing for 10 min shut in tubing side, rig in second tubing joint equalize joint and cleanout assembly, open tubing and continue cleanout monitor tubing string weight, touch packer top clean packer top for 30 min. Shut in tubing latch on to packer bleed off tubing negative test on/off seal assembly, equalize tubing come off packer, rig out cleanout kit latch back on to packer, release packer pull out of hole, stage out packer. Run back in hole with final production string.

Time on location: 3 days

Snubbing Case History #58

Objective: Remove and install new production string

Well information:2100m, 10 Mpa Multi-zone gas well

Procedure: Rig up 11 inch spool & 11 inch stripping rams/ pressure test spool and rams. Rig up snubbing stack pressure test stack. Equalize stack, bring 11" tubing hanger into spool close rig bag bleed off stack disconnect snubbing unit from stack, including bleed off and equalize line walk jack up pipe place c-plate and rig slips on rig annular BOP, set tubing string in slips walk jack down set weight on boards placed on rig slips chain snubbing unit into rig and break landing joint from tubing hanger, walk jack up landing joint after releasing from derrick then break tubing hanger from tubing string. Walk jack back down landing joint and chain in to derrick then stab landing joint and make connection to tubing string grab hold of landing joint with snubbing jack release jack from derrick walk jack back joint. Pick up tubing string with rig blocks , remove rig slips and c-plate, walk snubbing stack back down bolt on flanges, re-equalize stack open annular BOP. Stage out of hole 214 joints of 3 ½ Hydril pipe, locate 10 ft pup joint in stripping rams, pull into rams, bleed off stack walk jack up joint break connection with pipe wrenches in desired location holding onto pipe with travelling snubbing slips and rotary bearing unlocked once connection is broken walk jack back down remove joint from stack, and rig out snubbing stack. Once jack was laid over we then rigged in linker and lubricated out the 9 5/8 packer and bottom hole assembly. While lubricating out BHA snubbing unit was changed over to 2 3/8 as was the primary stack once the BHA was out and lubricator was laid down. We then snubbed in the production string consisting of a TEP ,4 ft pup, XN , 1 joint, X , 8ft pup and tubing to surface added a 10 ft pup 1 joint, we then staged in some methanol to clean the casing bowl and stripped in our 11' tubing hanger in the same method as previously described only in reverse. Once tubing hanger was landed we pull tested and tested for leaks. The snubbing stack was then rigged out.

Time on location: 5 days

Snubbing Case History #59

Objective: Mill out BP at surface

Well Information: 2800m Sweet multi zone gas well. 43MPa

Procedure: Rig up 10k stripping rams on well, pick up snubbing unit and rig out 5K stripping rams. Rig up unit on 10K stripping rams. Place concrete anchors and chain down the unit. Rig up scaffold to the unit. Pressure test 10K primary and stripping rams to 50MPa. RIH overshot, x/o, 2 floats, x/o, 3m pup, 1jt of 60.3mm latch onto the setting tool and pull 7Dan to shear off of the bridge plug. RIH mill, 2 floats, motor, jars, x/o, 1jt and rig up selective iron to circulate. Pressure test iron to 50Mpa and begin milling out bridge plug. Once plug is drilled run in 2jts to ensure annulus is clear, pull out of the hole and rig down the unit.

Time on location: 28 hours

Snubbing Case History #60

Objective: Wellhead upgrade on horizontal CO2 injection well: reposition permanent packer

Well Information: CO2 injection well, 1300 meters vertical and 1000 meters horizontal 5000 kPa

Procedure: Rig up and pressure test self-contained snubbing unit. Attempt to unset packer – unable to, attempt to come off packer with on / off – unable to. Rig in eline and cut off string at bottom of vertical section. Packer was supposedly set in compression but was actually set in tension, once cut was made 101 joints of tubing and packer fell into horizontal section of well. Set plug in permanent plug at bottom of remaining tubing string and snub out. Snub back in with fishing string and latch onto fish. Snub out fish until packer is back in cased hole and started to pull over string weight. Spot acid to remove packer elements. Continue to snub out of hole until 20 joints remain. Rig in wireline and pull tubing plugs. Pressure test on top of plug in packer, pressure test OK. Set permanent bridge plug in joint above packer. Snub out to BHA at surface, and hang off in QRC. Rig out travelling plate and slips. Rig in eline and lubricate out 21 meter fish. Lubricate in 18 meter permanent plug and set. Pressure test permanent plug and rig out self-contained snubbing unit.

Time on location: 20 days on location

Snubbing Case History #61

Objective: Snub out 3 ½" coil string and set permanent packer for future completion.

Well Information: 1500 meter 1000kPa injection well

Procedure: Rig up and pressure test self-contained snubbing unit. Make up spear and go it and retrieve coil tubing hanger. Snub out 3 ½" coil in 7 – 8 meters sections, cutting each section with casing cutter. Tally each section of coil tubing pulled to ensure location of tubing plug. Continue to snub out until tubing plug is found inside tubing with plum bob. Snub up BHA and close blind rams. Bleed off and lay down BHA. Changeover to 2 7/8" handling equipment and make a

scraper run. Run in permanent packer and set. Pressure test packer and snub out. Rig out self-contained snubbing unit.

Time on location: 6 days on location

3 1/2” coil

International

State of the art manufacturing facility

Snubco Pressure Control International Ltd. (Snubco International) is a sister corporation to Snubco Group Inc. the parent corporation of Snubco Pressure Control Ltd. with its head office in Nisku, Alberta. Established in 2000, Snubco International offers snubbing technology, equipment and expertise as well as other pressure control services to the global marketplace. Our international customers benefit from Snubco's years of experience in this field and the technological advancements made in Canada.

Canadian cliental has seen the benefits of snubbing technology and it has become one of the fastest growing industries in the Canadian Oil and Gas sector. Recognized not only for it immediate impact on the production of the formation but for its long term environmental benefits as well. Snubbing equipment has reduced the need to flare the wellbore to atmosphere, which reduces greenhouse gases, and also uses little to no water to control wellbore pressures leaving this valuable resource untouched. See our article featured in "Upstream Petroleum" here and our feature in "World Oil" here. These reasons and more have made this proven technology highly sought after by our International cliental.

Another reason our International clients have requested our services is our superior commitment to safety. Snubco is constantly improving on our underbalanced equipment to improve on board features that make it the safest equipment in the industry. Personnel are also constantly provided with the highest level of training to ensure we surpass industry standard. Snubco is proud to be a part of the "Assessor Training Program" and has the highest percentage of assessed personnel in the industry. This level of training is being recognized globally and is being demanded by customers worldwide.

Snubco International is a world leader in design, production and utilization of specialized equipment for the pressure control industry. Be sure to check out Snubco Manufacturing's international builds here.

Snubco's professionals have experience on projects around the world. In countries in the Middle East, Asia, Europe and throughout North America. Contact us today to find out what we can do for you.

Training seminar onsite in Northern China

Snubco International offers Customers:

- Snubbing equipment featuring the latest technology – Snubco has the ability to design, engineer, manufacture and ultimately operate any snubbing platform required
- Intensive training on snubbing on an ongoing basis
- The support of experienced, highly trained personnel for our customers
- An analysis of our customers needs on the viability of using snubbing in the area of operations
- Recommend potential designs to accomplish snubbing services
- Support with engineering, hazardous-operations studies, auxiliary equipment procurement and other services required
- Emergency Response Planning

Advanced Snubbing Technologies

The Snubco Group is proud to introduce a complete new line of safety systems. These systems are state of the art, wireless and an intrinsically safe method to improve safety during snubbing operations. Each system is built on the core system which is the Snubco DAS. This system can either be used as a standalone monitoring system or combined with a host of other components to create entirely new safety systems. Some of these systems are:

- SnubSmart
- SlipSmart
- Pressure management kits

- BOP management kits
- Snubco Snubbing Simulator

Virtually any service line or task that service line can perform can be monitored or in some cases controlled by one of our wireless systems and sensors.

DAS

The Snubco DAS system consists of one basket mounted touch screen for data input and setup and the Snubco base station. The base station is located at ground level and is normally mounted in a doghouse or data cab. The base station incorporates four CPU panels/receivers that house the control system software. The system communicates through a Class 1 Division 2 router to all of the wireless sensors (transducers, proximity sensors and pressure sensors). The wireless devices are used to monitor the operation of the Hydraulic Workover Unit, Snubbing Unit or rig. The basket mounted touch screen station is a slave station that replicates the base station display. This is a wireless connection to the control center that operates on a web server for ease of access. The wireless network allows for communication from a remote laptop or any wirelessly enabled device. Access can be granted to other personnel from any laptop and permissions can be set for different user access. Snubco DAS Components:

Base Station
Snubco SnubSmart (DAS) base station is the central point of the management system. This base station is located outside the hazardous zone and once initial setup is complete the system can be locked out so that no tampering can take place. The unique feature of this base station is that other than power and a few magnetic mount antennas the entire system is wireless. Power supply to the system can be customer specific but 24 volt is the default specification. This station can also be customized to fit into a package not much bigger than standard luggage or can be customized into a single offshore skid that contains all the data management and control systems for easy transport.

Operators Panel (Slave Station)
The operators control station or slave terminal is mounted in the work basket. This station allows the operator to view all relevant information that is being captured by the system. The entire enclosure is Class 1 Division2. This station retains some functions that can be controlled by the operator such as:

- Changing the display units (psi, torr, barr, etc.)
- Ability to zero snub and lift force for calibration
- Ability to zero string weight for weight on bit
- Remote view of battery lift of each transducer
- Remote view of signal status of each component
- System alarms
- Calibration screens
- Management of change permissions
- Tank levels and fluid pumping

SlipSmart

The SlipSmart system was designed to demonstrate that the system would meet and could in fact exceed the guidelines set forth in industry for a lockout system. The guidelines to be followed were as follows:

1. Snubbing equipment shall incorporate design features such that a positive, measureable and recordable transfer of load can be made between slips.
2. Snubbing equipment shall be designed with (electro/hydraulic) interlock(s) that will not allow accidental release of pipe, at any time, in either heavy or light mode of operation.
3. Ergonomic features shall be considered in relation to visual confirmation of slip function, load transfer and with respect to dropped object protection.
4. Bypass of the interlock(s) to enable operations such as running BHA assemblies shall be possible, but controlled by PTW, adequate procedure and supervision.

Components:

SlipSmart Control Box
Each control box that is utilized for the SlipSmart system is able to control two (2) sets of slips. This box communicates wirelessly to the base station and houses the control valves for the slips. These valves monitor the flow of the fluid for slip position as well as allowing or not allowing the flow of hydraulic fluid to the slips. These valves have a self-diagnostic function that will report to the base station if a valve begins to malfunction. These valves operate and receive instructions in milliseconds after the go or no-go signal is received from the base station which means that the operator will have no interruption with the normal flow and rhythm of the job unless the system receives a negative signal and at that time the operator will have the error displayed on the display in the basket mounted monitor.

SlipSmart Imbedded Sensors
Snubco Manufacturing's patent pended load transfer cells are imbedded into the installed sets of Snubco Cavin style slips. Snubco Manufacturing has been manufacturing these slips for eight (8) years and the design allowed for the sensors to be fully integrated with the slips. Snubco realized that this system must be able to bolt on to any existing snubbing unit or HWU so it designed these sensors to be accepted into a plate that can be fixed below or above any slips as long as there was at least 1 ¼" of space. These sensors could be calibrated to measure a load within +/- 150 lbs of neutral during the testing.

Snubsmart

The Oil and Gas industry is constantly faced with a shortage of sufficiently experienced personnel and incidents seem to be on the rise. Several such incidents involve ram type preventers and or stripping rams. Snubco is able to virtually prevent all of these incidents with the SnubSmart system.
Inexperienced and/or inattentive personnel were able to pull pipe directly into these rams even

though they were in the closed position. This had caused pipe to part and in some cases tragic events occurred. Snubco's commitment to our employees' safety and the safety of the other service lines we work with meant that a solution needed to be found.

While some companies focused on hydraulic sensors to detect ram position Snubco went to wireless proximity switches. Hydraulic sensors were easy to trick but our wireless proximity sensors need to have the rams 100% in the open position before the green light was given for personnel to move pipe.

Snubco used this point in time to design the system to be free of wires and 100% intrinsically safe. The wireless communication eliminates the need for inconvenient rig up of hoses or wires that would otherwise clutter the work area or wellhead. Once we began incorporating these wireless capabilities into our rigs the potential for expansion into other systems was endless.

In conjunction with the ram transducers an early goal was to limit the throttle output of a unit if the rams were closed. Communication between wireless ram transducers and a wireless throttle transducer allowed for this with ease.

This system became known as SnubSmart.

Snubco Virtual Snubbing Simulator

The Snubco Snubbing Simulator development began in 2009. A development team from Snubco contacted an Edmonton based simulation company, 3Di Edmonton to co-develop the world's only snubbing simulator. We the unique combination of skill sets we were able to develop a truly realistic simulation. This simulator has since been used by well control schools in the U.S as an IADC approved training simulator (Well Control School in Houston, Texas). It has been utilized as a method of rehabilitation by the Workers Compensation Board in Alberta and as a training simulator for major oil companies (Shell, Devon, EnCana, Conoco, Etc.)
What can the simulator do that makes it a competency based solution?
It can:

- Simulate all well conditions
- Simulate actual jack operating functions
- Complete physics based operations
- Provides user with an exact duplicate of an actual operation panel
- All audio mimics actual operating conditions
- Allows the user to operate in conditions that may be considered too dangerous for training applications
- Allows user to log hundreds of hours in simulated field time
- Allow users to complete training of any Snubco procedures for competency based training
- Records simulation in two video formats for later viewing
- Tracks operational trends to see where the student is weak so additional training can be customized

- Input well programs to complete job in a virtual environment to pre plan for actual job
- Incident re-creation

This is a key component of the Snubco Competency Assessor Program

Manufacturing

Snubco Manufacturing Inc. operates as a division within the Snubco Group of companies. This division is responsible for all design, engineering and construction of the Snubco Group's pressure control equipment. Snubco units are now working on four different continents in the world. All equipment is fully engineered to relevant API and ASME specifications. Each unit is fully documented with all certifications and operational information. Using this equipment, Snubco Pressure Control Ltd. has performed thousands of snubbing jobs throughout the world.

Engineering

Snubco's Engineering department uses modern technical tools to ensure their designs are "fit for purpose". All engineering work is done in 3D which generates clear, accurate and detailed drawings, making manufacturing more efficient and repeatable. Snubco's engineering team also uses 3D finite elemental analysis to minimize over design, verify designs and certify equipment. Another valuable asset to our project team is our vendor's expertise. In addition, the engineering department also maintains Snubco's fleet records to ensure that all certifications are up to date and that the equipment is properly maintained.