
Part 37 Oil and Gas Wells

Highlights

- Section 751 lists minimum competency requirements for supervisors of exploration, drilling, servicing, snubbing, testing and production operations.
- Section 759 allows service rig trucks to exceed their manufacturer-specified load weights if the listed conditions are met.
- Section 760 lists specific requirements for rigging up.
- Section 764 lists requirements for ground anchor pull-testing.
- Sections 779 and 780 present requirements that deal with fluid recovery during darkness.
- Section 837 presents requirements for securing pressurized piping.

Requirements

Section 750 Application

For the purposes of this Part, crude bitumen is considered to be any of the various mixtures of hydrocarbons present in their natural state and unaltered by processing.

Drilling a well is typically carried out by a “drilling contractor” under contract to a well-site owner, also known as the “operator”. The final step in drilling a new well is completion — when fluids start flowing to the surface.

Once a well is completed, the owner begins production, also known as operating, by bringing fluids to the surface and preparing them for delivery to a refinery.

A producing well may require servicing during its active life cycle. This includes routine maintenance activities, repair or replacement of equipment, and “workovers” which are activities intended to stimulate or enhance fluid flow.

This Part also applies to any process that supports and supplements drilling, operating or servicing activities.

Section 751 Competent supervisor

Subsection 751(1)

Work at a well site involves a wide variety of operations that often require a number of contractors, suppliers and technical service providers working together. These operations must be supervised by a qualified and competent person to ensure the safety of workers.

Subsection 751(2)

The operator, or prime contractor if there is one, has overall responsibility for safety at a well site. The on-site supervisor, also known as “consultant”, “company man” or “engineer”, plays a key role in directing and co-ordinating implementation of the planned work program as well as ensuring that all safety requirements are met.

Each employer undertaking a particular job or function at a well site, is responsible for carrying out that job or function in a safe manner. This subsection describes the minimum safety knowledge required by each on-site supervisor within the scope of their job or function at a well site. For activities that are part of drilling, completion or workover, industry requirements are described in Industry Recommended Practice (IRP) No. 7-2002, *Standards for Well Site Supervision of Drilling, Completion and Workover*, published by Enform.



www.enform.ca/publications/IRP

Enform Publications

Section 752 Breathing equipment

Subsection 752(1)

Oil and gas exploration is considered high hazard work. The possibility of encountering flammable atmospheres, hydrocarbons, hydrogen sulphide, and immediately dangerous to life and health (IDLH) situations is present when work is done at the well site. Since well conditions can change rapidly, emergency self-contained breathing apparatus (SCBA) must be present when drilling, servicing, flushby, snubbing, swabbing, workover or other units are used at the well site.

The intent of this section is to ensure that there is enough breathing equipment available to workers at oil and gas well sites in an emergency and when a rescue operation needs to be performed. The number of breathing apparatus required must

be linked to the number of workers that may potentially be affected. This should be determined by completing the hazard assessment required by Part 2, and meeting the requirements of Part 7 and section 244. As well, the employer must ensure that workers required to use this equipment are fit tested and have training to use it properly. Sections 244 to 254 of the OHS Code present the requirements that apply to the use of respiratory protective equipment at the work site.

Subsection 752(2)

In cases where there is only one worker at the work site, an employer may use alternate measures to protect the worker such as a remotely operated system. The alternate measure used must ensure that the worker is not exposed to a harmful substance in excess of its occupational exposure limit.

Section 753 Operating load of derrick or mast

Subsection 753(1)

Drillers must know the limitations of the derrick being used. Weights of objects being lifted must be known.

Exceeding the safe operating load, also known as “derrick lift capacity”, increases the possibility of equipment failure through overloading. The derrick or mast manufacturer should specify

- (a) the maximum hook load,
- (b) the increased dead-load and wind induced load due to accumulation of ice and snow,
- (c) the maximum loading due to fastener prestress,
- (d) the maximum setback load such as amount of pipe the rig floor will hold, and
- (e) the maximum wind speed at which operations will be conducted.

Subsection 753(2)

Repairs must be made only with manufacturer approved and specified materials or as certified by a professional engineer.

Section 754 Derricks and masts

For the purposes of this section, the following recommended practices developed by the Canadian Association of Oilwell Drilling Contractors (CAODC) are considered to be procedures approved by a Director of Inspection:

- (a) Recommended Practice 1.0, *Mast Inspection for Drilling Rigs*, July 2001;
- (b) Recommended Practice 1.0A (Addendum), *Substructure Inspection for Drilling Rigs*, July 2001;
- (c) Recommended Practice 2.0, *Overhead Equipment Inspection for Drilling Rigs*, July 2001;
- (d) Recommended Practice 3.0, *Mast Inspection for Service Rigs*, January 1994;
- (e) Recommended Practice 4.0, *Overhead Equipment Inspection for Service Rigs*, January 1994; and
- (f) Recommended Practice 5.0, *Manual Rotary Tongs for Drilling Applications Inspections*, July 2001.

Section 755


Inspections and repairs must be recorded in a log book issued by the Canadian Association of Oil Well Drilling Contractors (CAODC), or an equivalent log book. Readers are referred to the CAODC Web site for copies of the organization's log book: www.caodc.ca

Section 756

No explanation required.

Section 757 Geophysical operations

For more information about geophysical operations, readers are referred to Workplace Health and Safety Bulletin IS004, Safe Operating Procedures for Seismic Drilling.

 http://employment.alberta.ca/documents/WHS/WHS-PUB_is004.pdf
Safe Operating Procedures for Seismic Drilling

Section 758 Drilling and service rig inspections

Subsection 758(1)

Inspection procedures can be found in the following recommended practices developed by the Canadian Association of Oilwell Drilling Contractors (CAODC):

- (a) Recommended Practice 1.0, *Mast Inspection for Drilling Rigs*, July 2001;
- (b) Recommended Practice 1.0A (Addendum), *Substructure Inspection for Drilling Rigs*, July 2001;
- (c) Recommended Practice 2.0, *Overhead Equipment Inspection for Drilling Rigs*, July 2001;
- (d) Recommended Practice 3.0, *Mast Inspection for Service Rigs*, January 1994;
- (e) Recommended Practice 4.0, *Overhead Equipment Inspection for Service Rigs*, January 1994; and
- (f) Recommended Practice 5.0, *Manual Rotary Tongs for Drilling Applications Inspections*, July 2001.

Subsection 758(2)

The following CAODC inspection report forms are available from CAODC:

- (a) Mast and Overhead Equipment Log Book;
- (b) Rig Inspection Checklist;
- (c) Rig Blowout Prevention/Equipment Checklist;
- (d) Rig Trailer Mounted Pre-Trip Inspection; and
- (e) Rig Trailer Mounted CVIP Inspection.

Section 759 Overloaded service rig trucks

Instead of complying with the manufacturer's specifications requirements of section 12 of the OHS Code, service rig trucks that exceed their manufacturer-specified load weights can be operated if

- (a) a written hazard assessment meeting the requirements of Part 2 has been completed, and
- (b) controls that ensure safe operation of the service rig truck have been implemented.

The assessment and controls do not need to be reviewed by a Director of Inspection prior to being implemented. If an officer inspects a work site and considers the assessment or controls insufficient, then the assessment and controls may need to be reviewed by a Director or Inspection.

Section 760 Safety check

Rigging up involves moving in and preparing the drilling rig for making the hole and installing tools and machinery before drilling is started. One way to ensure that the requirements of this section are followed is to incorporate them into a written safe work practice or safe work procedure.

Section 761 Exits from enclosures

Subsection 761(1)

If a rig floor is enclosed, an exit to ground level must be provided on at least two sides of the enclosure in addition to one from the doghouse.

If a rig floor is enclosed, the exit doors must open outwards in a direction away from the drill hole and must not be held closed with a lock or an outside latch while workers are on the rig floor.

Subsection 761(2)

The pump house must have two doors leading in two different directions to the outside, placed as far apart as practicable.

Subsection 761(3)

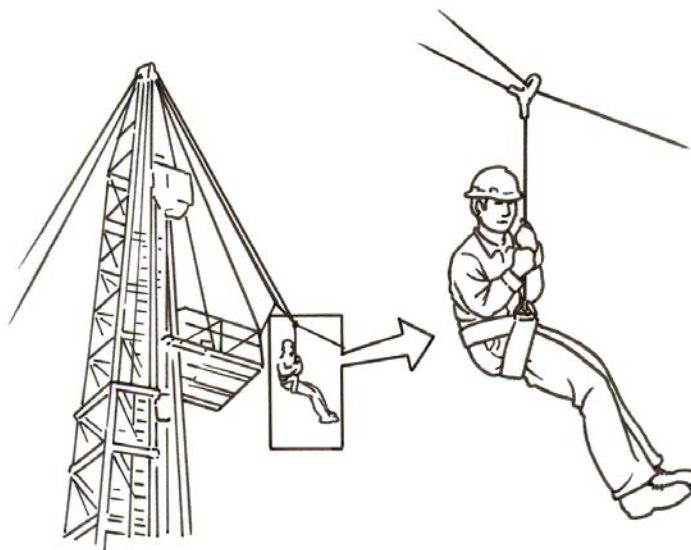
No explanation required.

Section 762 Emergency escape route

Subsection 762(1)

A vertical ladder is the usual means of access to the principal working platform above the rig floor, known as the “monkey board”. In the event of a blowout, wellhead fire, or other emergency situation, the ladder may become blocked or otherwise rendered unusable. In such a case, an emergency means of escape, typically an escape line with a slide of adequate strength, must be installed and maintained so that persons can safely descend to ground level (see Figure 37.1). Every part of the emergency escape device must be inspected at least once every week that the rig is in operation. A record of every inspection should be maintained.

Figure 37.1 Example of emergency escape safety buggy



Subsection 762(2)

Unless otherwise required by the manufacturer's specifications, the escape line should be securely fastened to the girt immediately above the monkey board. The line must be anchored to the ground at a distance specified in the manufacturer's specifications or the specifications certified by a professional engineer. This distance should be the greater of 45 metres from the derrick base or a distance equal to the height of the derrick. Tension on the escape line should be such that a 100 kilogram worker sliding down it will touch the ground at least 6 metres from the anchor.

Ground anchors must be subjected to a static pull test of 13.3 kilonewtons when installed.

Subsection 762(3)

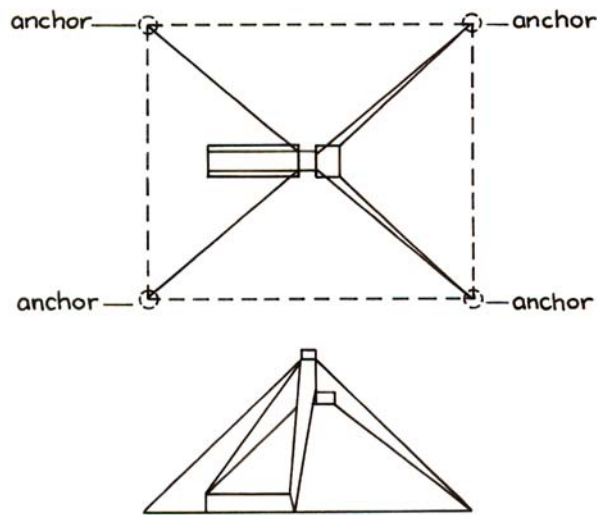
A safety buggy must be installed and maintained according to the manufacturer's specifications and should be checked by a competent worker along with the escape line. The buggy must be kept at the principal working platform when not in use so that it is ready when needed.

Section 763 Guy lines

Subsection 763(1)

All guy lines, as indicated by the manufacturer's diagram, must be in position and properly tensioned prior to commencing any work. In the absence of manufacturer's recommendations, or where the manufacturer's recommendations cannot be implemented, the diagram shown in Figure 37.2 may be used.

Figure 37.2 Example of anchor location diagram



Other guying patterns may be used if certified by a professional engineer. Guy lines should be 6x19 or 6x37 class, regular lay, made of improved plow steel (IPS), or better, with independent wire-rope core (IWRC) and not previously used for any other application. Double saddle clips should be used and wire rope should be installed in accordance with the manufacturer's recommendations.

Table 37.1 may be used as a guide to the pre-tensioning of guy lines. This method is commonly referred to as the Catenary Method or guy line sag method (see Figure 37.3).

Figure 37.3 Example of the Catenary Method

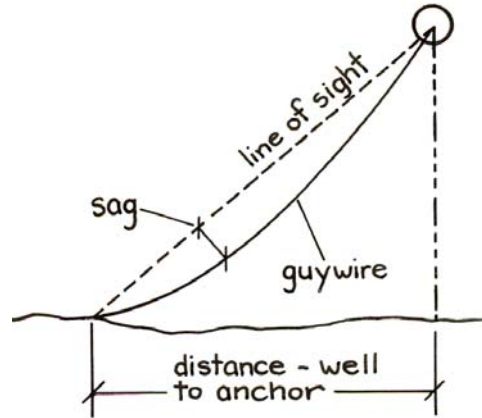


Table 37.1 Guide to pre-tensioning of guy wires

Guywire sag (millimetres)						
Distance well to anchor (metres)	Pole mast		Single mast		Double mast	
	Tubing board guy	Crown - ground guy	Tubing board guy	Crown-ground guy	Tubing board guy	Crown-ground guy
12	-	100	100	100	150	127
18	-	150	203	150	305	203
24		254	380	254	432	280
30	-	356	558	356	660	380
36	-	457	560	457	813	533
Pre-tension (kilonewtons)	2225 (500 lbs- force)	4450 (1000 lbs- force)	2225 (500 lbs- force)	4450 (1000 lbs-force)	2225 (500 lbs-force)	4450 (1000 lbs-force)

Section 764 Ground anchors

Subsection 764(1)

Ground anchors must be pull-tested annually to ensure that they offer solid, stable securement for guy wires. The ground anchors must be tested according to

- (a) API Recommended Practice RP 4G, *Recommended Practice for Maintenance and Use of Drilling and Well Servicing Structures (2004)*,
- (b) the manufacturer's specifications, or
- (c) specifications certified by a professional engineer.

Subsection 764(2)

There are four basic types of manufactured anchors:

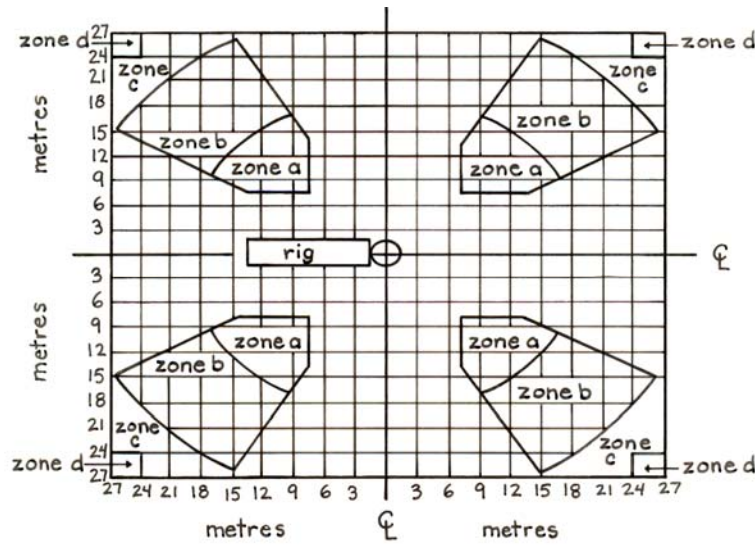
- (1) the screw or helix anchor;
- (2) the expanding plate anchor;
- (3) the flat plate anchor; and
- (4) the pivoting anchor.

Installing anchors according to the manufacturer's specifications satisfies the requirements for individual pull testing. Screw or helix type anchors have a direct correlation between anchor capacity and the torque required to install the anchor. Torquing according to the manufacturer's specifications is an acceptable non-pull test method of determining anchor capacity.

Fabricated anchors should be designed by a professional engineer. Written procedures for installation must be prepared and certified. These anchors should be proof tested for structural integrity and holding capacity. Individual pull testing is not required if anchors are installed in accordance to the written procedures. Proof of installation protocols and proof-tested holding capacities are required.

In the absence of manufacturer's specifications, the location diagram shown in Figure 37.4 may be used.

Figure 37.4 Example of anchor locations



Each zone requires an anchor of different holding capacity. If anchors are located in more than one zone, then all anchors should be of the capacity required for the greater capacity zone. See Table 37.2.

Table 37.2 Anchor capacity requirements for each zone

Anchor capacity (tonnes)			
Zone	Doubles mast	Singles mast	Post mast
A	14.2	6.4	6.4
B	10.5	4.6	4.6
C	8.2	4.6	4.6
D	6.7	4.6	4.6

Anchor capacities shown assume the following:

- adequate foundation support for mast and carrier
- adequate crown-to-carrier internal load guys
- maximum wind load — 120 kilometres per hour

Section 765 Trailer pipe rack

Subsection 765 (1)

Pipe racks must be designed to support any load placed on them. They should be set level on a stable foundation but may slope front to back to facilitate laying down or picking up pipe. Pipe, tubular material or other round material must be prevented from rolling off. No worker must go between pipe racks and a load of pipe during loading, unloading and transferring operations.

Pipe should be loaded and unloaded, layer by layer, with the bottom layer pinned or blocked securely at all four corners of the pipe rack and each successive layer effectively chocked or blocked. Spaces should be used and evenly spaced between the layers of pipe or material on the rack. When pipe is being moved or transferred between pipe racks, truck and trailer, the temporary supports for skidding or rolling should be constructed, placed and anchored to support the load placed on them.

Subsection 765(2)

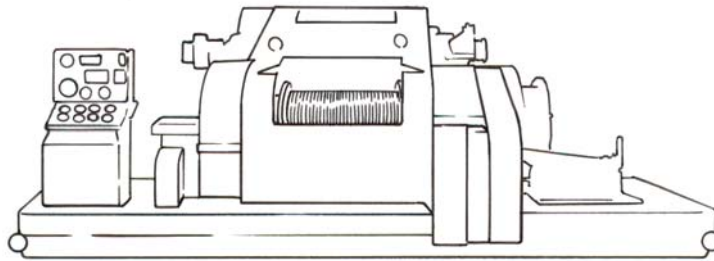
A catwalk is a footway giving access to the rig floor and should be at least 1.2 metres wide and cover the space between the pipe storage racks or trailers. It should be continuous from the derrick or from the lower end of the pipe ramp, connected to the derrick floor, to at least 2.4 metres beyond the outer end of the normal lengths of drill pipe to be handled on the catwalk.

Section 766 Drawworks

Subsection 766(1)

A drawworks on a drilling rig is an assembly of shafts, chains, pulleys, bells, clutches, catheads and/or other mechanical devices for hoisting, operating and handling the equipment used for drilling a well or servicing a producing well. The driller operates the drawworks at the driller's console, with controls for brakes, clutches and a transmission (see Figure 37.5). One set of brakes at each end of the drum holds it stationary and sustains the weight of the travelling block, rotating equipment and drill string.

Figure 37.5 An example of a driller's console



Subsection 766(2)

Workers must be constantly aware of rotating hazards. Work practices must be implemented to avoid contacting moving parts such as hoist cables and rotating drums.

Section 767 Brakes

Subsection 767(1)

Figure 37.6 shows an example of a hold-down mechanism. Figure 37.7 shows an example of a properly constructed chain anchor bracket that will prevent accidental disengagement of the chain.

Figure 37.6 Example of a hold-down mechanism

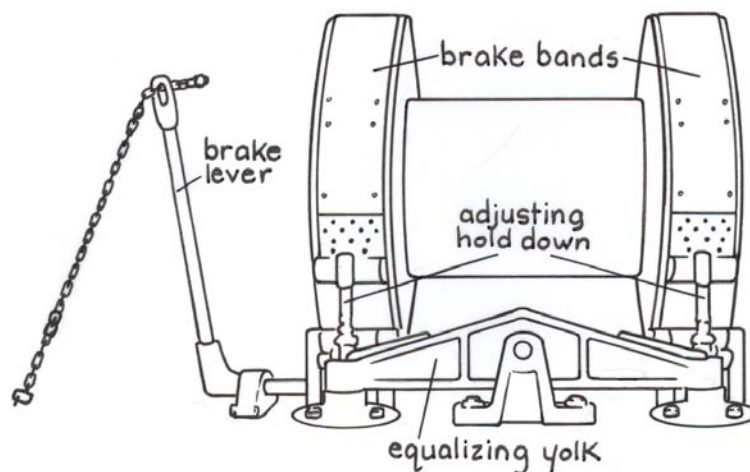
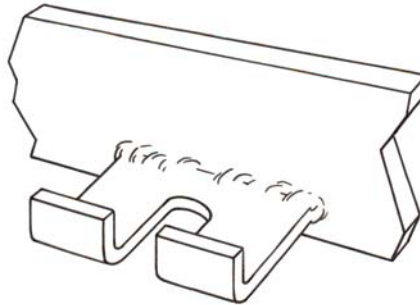


Figure 37.7 Example of a properly constructed chain anchor bracket that will prevent accidental disengagement of the chain



Subsection 767(2)

“Test” means to perform a procedure, including operating the equipment where appropriate, that determines whether the equipment is correctly assembled and functioning and is likely to continue to do so.

“Examine” means to verify by visual and manual examination, including dismantling or cleaning when appropriate, that the equipment is in a condition that will not compromise a worker’s safety.

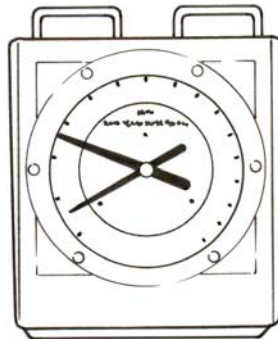
Subsections 767(3) and 767(4)

No explanation required.

Section 768 Weight indicators

A weight indicator is an instrument near the driller’s position that shows the weight of the drill stem that is hanging from the hook (see Figure 37.8). This is the hook load.

Figure 37.8 Example of a weight indicator



Section 769 Travelling blocks

Subsection 769(1)

The hook is attached, often permanently, to the bottom of the travelling block. It carries equipment, called elevators, for grasping and holding pipe while the pipe is being raised or lowered into the well bore. The hook also suspends the swivel and drill string while drilling (see Figure 37.9). It is rated by its load-carrying capacity. The hook latch must be designed to prevent release of the drill string when subjected to a sharp upward blow.

Figure 37.9 Example of a travelling block and hook



Subsection 769(2)

No explanation required.

Subsection 769(3)

An upward travel limiting device, often called a crown saver, prevents the travelling block from contacting the crown structure. Every drilling or service rig must have a crown saver.

Section 770 Tugger or travelling block

Lifting a worker by using the travelling block or a tugger is not permitted unless doing so is permitted in the manufacturer's specifications or in specifications certified by a professional engineer. Lowering is permitted during an emergency situation subject to the rotary table being stopped and a competent worker trained in emergency procedures operating the controls of the travelling block or tugger.

Section 771 Catheads

Catheads are recognized as a potential safety hazard. Many have been removed from rigs on a voluntary basis. The use of rope-operated friction catheads has not been allowed since January 1, 2005. Small air operated hoists, also known as "tuggers", are an acceptable alternative.

Section 772 Racking pipes

Subsection 772(1)

Most of the drilling fluid contained within a pipe stand is drained out through the mud-can when the pipe is tripped out. The drain rack should be connected to the mud flow-back line to capture any fluid that remains.

Subsection 772(2)

Pipe-racking support designed to prevent pipe from falling must be provided near the top of the stands of pipe. This support should be constructed so that it will, with the mast, completely surround the pipe.

Section 773 Rotary table danger zone

Subsection 773(1)

The extent of the danger zone will depend on the particular design of the rig. The limit of the danger zone can be marked by a line painted on the floor or some other equally effective means.

Subsection 773(2)

Loose materials can get caught in rotating equipment. Examples include tools, ropes, chains, clothing and fall protection lanyards.

Subsection 773(3)

Once a hazard assessment is completed as required by Part 2 of the OHS Code, a worker may be permitted within the rotary table danger zone, while the rotary table is in motion, only if it is done during a non-drilling operation e.g. tripping pipe. In that case, the requirements of subsection 773(4) must be met.

Subsection 773(4)

If the requirements of subsection 773(3) are met, a worker may be permitted within the rotary table danger zone, while the rotary table is in motion, subject to the following conditions:

- (a) the table is turning at a slow rate of speed and the Driller is attending to the controls,
- (b) any equipment that may contact the rotating equipment, whether loose or suspended, is kept clear at all times while the rotary table is turning,
- (c) all workers who have positioned slips or tongs are clear of the rotating equipment,
- (d) all tong lines are placed outside of the line of rotating slips,
- (e) any clothing or personal protective equipment worn by the workers is such that there are no loose or trailing pieces that could become entangled in the rotating equipment, and

-
- (f) the worker does not wear any jewellery or similar adornments that could become entangled in the rotating equipment.

Subsection 773(5)

When drilling operations resume and the rotary table is to be returned to a high rate of speed, all workers and all equipment must be positioned outside of the rotary table danger zone.

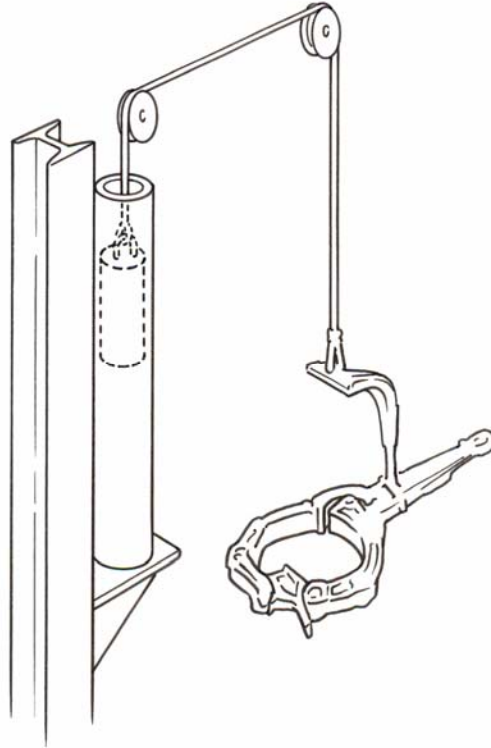
Section 774 Tong safety

Tong safety devices are typically two wire rope lines. Single stand rigs should use lines that are not less than 13 millimetres in diameter. Larger rigs should use lines that are not less than 16 millimetres in diameter.

Section 775 Counterweights

Figure 37.10 shows an example of a tong counterweight enclosure. The enclosure should extend from the working level to at least the midpoint of the counterweight when it is at its highest position. If not enclosed or in guides, the counterweight can be secured by chain or cable to prevent it from coming within 2.3 metres of the floor or working level. As added safety measures, work or pedestrian traffic can be prohibited in the area below the counterweight, or the area below the counterweight can be enclosed or barricaded.

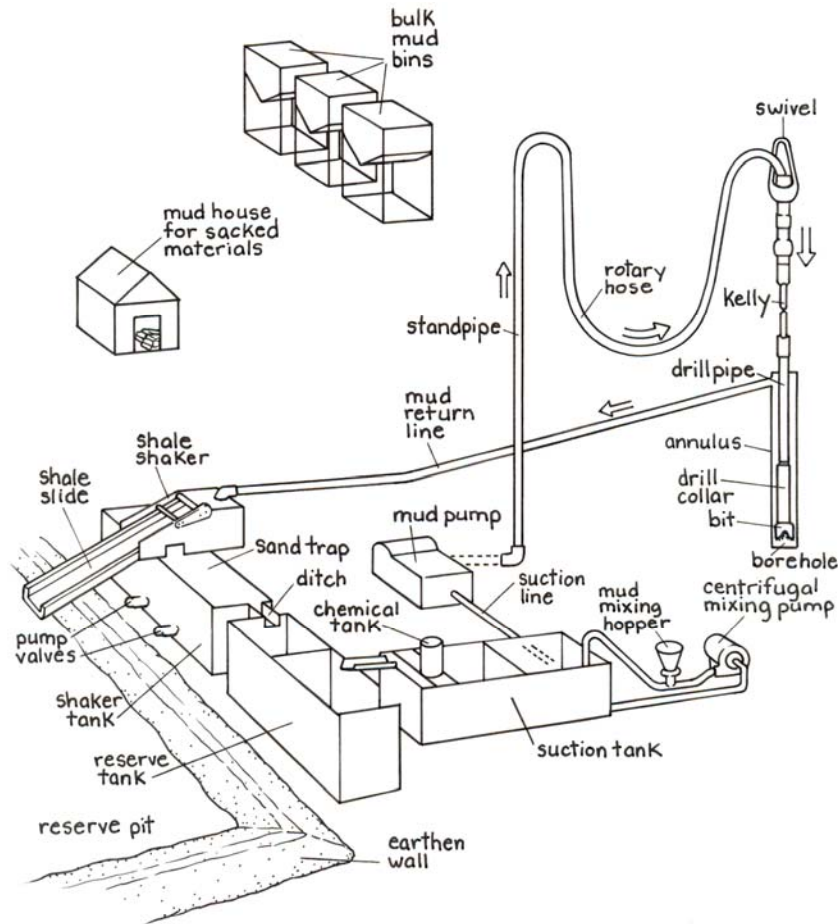
Figure 37.10 Example of a tong counterweight enclosure



Section 776 Drilling fluid

Figure 37.11 shows a typical drilling fluid or mud circulating system on a drilling rig.

Figure 37.11 Example of a typical mud circulating system on a drilling rig



Subsection 776(1)(a)

A system for pumping drilling mud typically operates at high pressure of up to 34,000 kilopascals (4,930 pounds/square inch). To ensure that a component of the system does not fail, all parts of the system must be rated at least equal to the maximum working pressure of the pump. This is also known as the “allowable rated working pressure”. Typically, this is shown on a metal plate affixed to the pump.

Before opening a pumping system or removing any cap, plug, plate or cover from a pump, the pressure within the pump should be bled off to atmospheric or as near atmospheric pressure as is practicable.

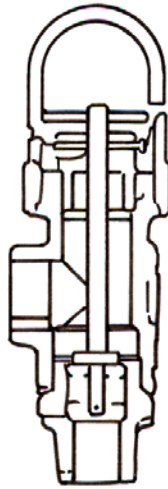
Subsection 776(1)(b)

The pump is the heart of the mud-delivery system and must be operational under all weather conditions.

Subsection 776(1)(c)

Figure 37.12 shows a typical pressure relief device.

Figure 37.12 Example of typical pressure relief device



Subsections 776(1)(d) and 776(1)(e)

No explanations required.

Subsection 776(1)(f)

Pressure relief devices are typically set to relieve at a pressure not in excess of 10 percent above the maximum working pressure of the pump.

Subsection 776(1)(g)

Every shear-pin-set relief device typically has a metal plate attached to it with holes drilled as a gauge for each size of shear pin to be used with the device and a table showing the pressure at which each size shear pin will shear. The shear pin must be of a design and strength specified in the manufacturer's specifications (see Figure 37.13).

Figure 37.13 Example of shear pin sizing gauge

	1 NAIL	NAIL SIZE	2 NAILS	
RELIEF PRESS.	2500 LB.	60 PENNY	5000 LB.	RELIEF PRESS.
	2250 LB.	50 PENNY	4500 LB.	
	1750 LB.	40 PENNY	3500 LB.	
	1500 LB.	30 PENNY	3000 LB.	
	1250 LB.	20 PENNY		
	1000 LB.	16 PENNY		

Every shear-pin-set relief valve should have the valve stem and the shear pin enclosed in a manner that prevents contact with the valve stem and also prevents the shear pin from flying when sheared.

Subsection 776(1)(h)

Adequate drainage should be provided to prevent the accumulation of drilling fluids around pump bases.

Subsection 776(1)(i)

A reduction in piping size would impair the proper operation of the pressure relief device.

Subsection 776(1)(j)

The discharge of a pressure relief device is typically under high pressure. The sudden discharge of the device can result in wide movement of the piping if it is not secured.

Subsections 776(1)(k) and 776(1)(l)

No explanations required.

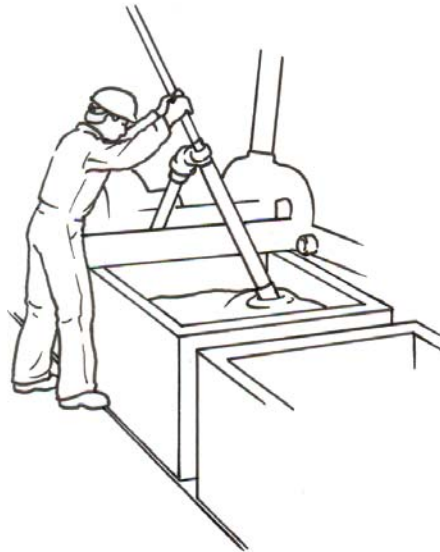
Subsection 776(2)

No explanation required.

Subsection 776(3)

A mud gun is typically used to mix the mud mixture in the rig tanks (see Figure 37.14). This is done to maintain a homogenous mix and ensure an even distribution of mud components. In carrying out this function, the outlet pressure can become high enough that the gun might become unmanageable by workers.

Figure 37.14 Example of a mud gun



Subsections 776(4) and 776(5)

A quick closing valve can produce momentary peak pressures that are beyond the capacity of a relief device to control.

Section 777 Rig tank or pit enclosures

Rig tanks or pits are used to store drilling fluid. Flammable gas might enter the mud from the well bore or a flammable substance might be added to the mud to enhance its drilling properties. This section addresses the handling of a flammable substance and the requirements of Part 10, Fire and Explosion Hazards, should be consulted.

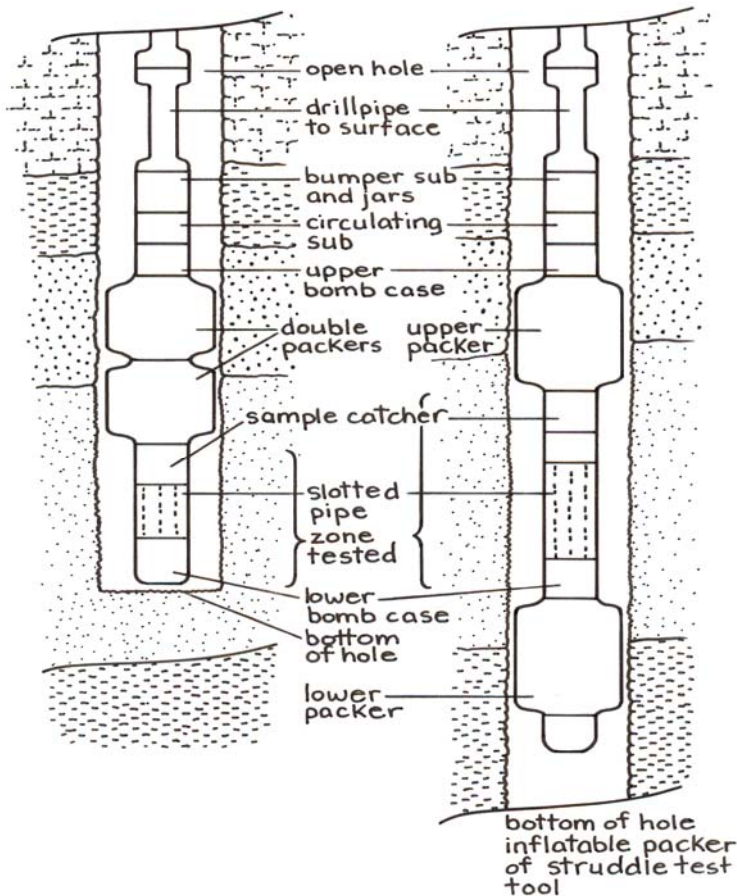
Section 778 Prohibition on fuel storage

Except for diesel fuel used and stored as described in subsection 778(3), fuel must not be stored within 25 metres of a well.

Section 779 Drill stem testing

Drill stem testing (DST) is a method of determining the producing potential of a well. The formation fluids exert pressure that is controlled during drilling by using a dense drilling fluid, known as mud, which exerts its own pressure i.e. hydrostatic head, in excess of the formation pressure (see Figure 37.15). DST is the removal of the drilling fluid so that the formation fluids can flow into the now empty drill string.

Figure 37.15 Example of drill stem testing



DST is one of the most hazardous operations within the industry, presenting a unique set of hazards since control is maintained by mechanical and human systems. Guidelines to minimize the probability of failure of either system during a test should be planned and reviewed before any test starts. This plan should include at least

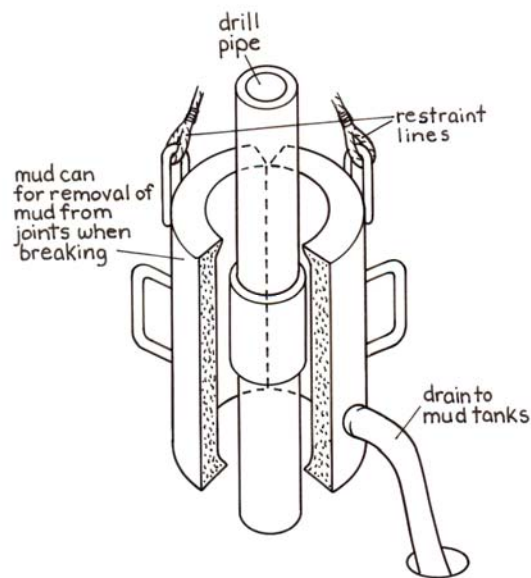
- (a) the zones to be tested,
- (b) the depths of tests,
- (c) the method of testing,
- (d) the type of equipment to be used,
- (e) the duration of the test, and
- (f) a reference to an emergency response plan where applicable.

The emergency response plan should be discussed with all employers and workers involved with the drill stem test. Detailed safe work procedures are described in the Industry Recommended Practice No. 4-2000, *Well-Testing and Fluid Handling*, published by the Canadian Petroleum Safety Council. In addition, the Petroleum Services Association of Canada (PSAC) has developed the *Drill Stem Testing Safety Guideline*, which is available on the PSAC Web site at www.psac.ca/

Subsection 779(2)

A “mud-can” is a device used to contain fluid and direct it away from the drill pipe when breaking connections (see Figure 37.16). A “test plug” is a valve attached to the top of each length of pipe being pulled from the hole to prevent flow up the drill pipe.

Figure 37.16 Example of a mud can



Subsection 779(3)

No explanation required.

Subsection 779(4)

Since DST has the potential to produce ignitable vapours, any potential sources of ignition must be removed. This can include any pumps, boilers and heaters not required for the operation. Locking out should be considered as an additional safety step.

Subsection 779(5)

Readers are referred to section 188 for information about restraining hoses and piping. Securing can include weights adequately installed to prevent pipe movement. Generally, there should be one weight for each pipe joint.

An alternative method of anchoring is to drill anchors near the pipe ends with a restraining cable running the length of the pipe. The cable system should be continuous and secured at both ends and all individual pressure components should be secured. Restraining cables should not be less than 11 millimetres in diameter or chains of equal or greater strength should be used.

Subsection 779(6)

As long as there is adequate lighting, DST may be conducted during darkness until hydrocarbons appear at the surface. At this point the recovery must be reverse-circulated. Reverse circulation is the intentional pumping of fluids down the annulus i.e. area of the well bore that is outside the drill pipe, and back up through the drill pipe. This is the opposite of the normal direction of fluid circulation in a well bore. A pump-out sub is typically in the test string in order to reverse.

Reverse circulation requires proper disposal of the contents of the drill string by pumping to a tank or a vacuum truck. The receiving vessel must be properly grounded and vented with any engines turned off. Extra care must be taken once the pump-out sub has reached the rig floor since hydrocarbons may be present below the pump-out sub.

Section 780 Well swabbing

Swabbing involves pulling a rubber-faced cylinder i.e. a swab, up the well tubing which lifts the column of fluid above it to the surface. This reduces the pressure beneath the swab and sucks fluids out.

This swab is typically run through a pressurized lubricator connected to the top of the well Christmas tree. The process is called “swabbing”. This must be securely anchored to ensure that there is no break at the connection point.

Section 781 Well servicing

Subsection 781(1)

Well servicing includes all the maintenance procedures performed on an oil or gas well after the well has been completed and production has begun. Well service activities are generally conducted to maintain or enhance well productivity, although some applications are performed to assess or monitor the performance of the well. Slickline (wireline units other than for well logging), coiled tubing, snubbing, workover rigs, or rod units are used in well servicing activities.

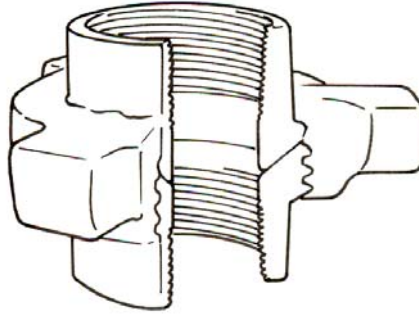
Subsection 781(2)

A well servicing activity can involve the circulation of hydrocarbon fluids and vapours which can create a fire or explosion hazard. To ensure that these vapours are not drawn into a pump motor or ignited by hot exhaust surfaces, the air intake and exhaust of the pump motor must be at least 6 metres away from the rig tank into which the fluids are being circulated.

A tank truck supplying servicing fluid must run its engine to provide power to a pump for unloading or loading these fluids. To avoid the chance of igniting hydrocarbon vapours, the tank truck must be located at least 6 metres away from the rig tank into which the fluids are being circulated.

This subsection requires that the pressure lines supplying carbon dioxide be secured against dislodgment at the supply vehicle and at the pump. Fittings that have a mechanically-locking mechanism such as a hammer union (see Figure 37.17), bolt-up, or camlock with automatic locking arms, are preferable to fittings that must be strapped closed.

Figure 37.17 Cut-away view of a typical hammer union



Subsection 781(3)

The potential danger area is an area circumscribed by an arc the radius of which is equal to the length of the discharge pipeline and centred at either end of the line. Warning signs should also be placed along the perimeter of this area.

Subsections 781(4), 781(5) and 781(6)

No explanation required.

Section 782 Well stimulation

Subsections 782(1) and 782(2)

Stimulation is a treatment to restore or enhance the productivity of a well. Treatments are either hydraulic fracturing treatments or matrix treatments.

Fracturing involves pumping specially engineered fluids at high pressure and at a high rate into the formation, causing a fracture to open. Proppant, such as grains of sand, is mixed with the treatment fluid to keep the fracture open.

Matrix stimulation includes acid, solvent or other chemical treatments to improve or restore the permeability of the formation.

Remedial cementing is performed to repair primary-cementing problems or to treat conditions arising after the well bore has been constructed. This process is carried out at the time of well completion.

Subsection 782(3)

Even if the piping system is restrained in accordance with section 188, no worker is permitted in the danger area unless the pump pressurizing the system is disengaged.

Subsection 782(4)

If liquid carbon dioxide or liquid hydrogen escapes into the atmosphere, it rapidly vapourizes creating a low-temperature hazard and an oxygen-displacement hazard. This subsection addresses that hazard by requiring pump operators to be on the side of the pumping unit away from the discharge line.

Should pressure be lost in the piping system, a check valve near the well head would act to prevent the return of fluids from the well head which could contain hydrocarbon vapours.

In addition to providing fire protection equipment, the following preventive measures should be considered:

- (a) all blending equipment be grounded;
- (b) all equipment unloading sand be bonded to the blending equipment;
- (c) pressurized suction lines be covered so as to deflect fluids in case of leaks;
- (d) lines not be laid under vehicles;
- (e) any flammable fluids spilled be cleaned up before pumping begins; and
- (f) all sources of ignition not necessary for the job be shut down.

The hosing used for a mud line is typically not rated for pressure service and therefore, should not be used.

Section 783 Well site piping system

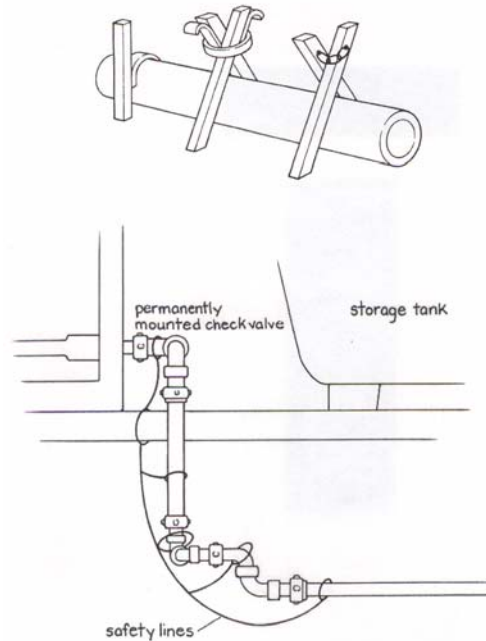
Subsection 783(1)

The manufacturer's specifications or the certified specifications of a professional engineer must be followed.

For threaded connections, the dimensions and gauging of pipe threads must meet the appropriate requirements of ANSI/ASME Standard B1.20.1-1983 (R2006), *Pipe Threads, General Purpose (Inch)*.

Figure 37.18 shows examples of how piping systems can be anchored and restrained.

Figure 37.18 Examples of piping systems being anchored and restrained



Section 784 Gas sample containers

Gas samples are used to determine the physical properties of the gas from a specific well. Because each well has its own unique characteristics, sampling procedures vary from well to well. There are manual methods such as purging at reduced pressure, fluid displacement, air displacement, floating pistons and vacuums and automatic sampling devices that allow gas to flow into a container over a certain period of time at a constant rate.

Regardless of the method, gas sampling involves handling a flammable product under pressure. Consequently, the sampling equipment, which typically consists of a probe inserted into a pipe, must be leak free and able to withstand all expected pressures. The containers must be contaminant free and purged of all other gases and vapours.