Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations

API RECOMMENDED PRACTICE 54
THIRD EDITION, AUGUST 1999

REAFFIRMED, JANUARY 2013

AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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FOREWORD

This recommended practice was prepared by the API Subcommittee on Occupational Safety for Oil and Gas Well Drilling and Servicing Operations. It represents the combined contributions of industry representatives from the oil and gas well drilling, production, and well servicing segments who served on this subcommittee. This Third Edition supersedes and replaces the Second Edition, May 1992. This publication is under the jurisdiction of the American Petroleum Institute Upstream Department's Executive Committee on Drilling and Production Operations.

The goal of this recommended practice is to assist the oil and gas industry in promoting personnel and public safety. This publication has intentionally stressed recommended safe operating practices concentrating on personnel and public safety as differentiated from equipment safety and operations efficiency. THE PUBLICATION DOES NOT, HOWEVER, PURPORT TO BE SO COMPREHENSIVE AS TO PRESENT ALL OF THE RECOMMENDED SAFE OPERATING PRACTICES THAT CAN AFFECT SAFETY IN OIL AND GAS WELL DRILLING AND SERVICING OPERATIONS.

It is intended that this voluntary recommended practice will promote and maintain safe working conditions for personnel engaged in well drilling and servicing operations, including special services as they relate to the operation of drilling and well servicing rigs. Every effort has been made by API to assure the accuracy and reliability of data contained in this document. However, the Institute makes no representation, warranty, or guarantee in connection with the publication of this recommended practice and hereby expressly disclaims any liability or responsibility for loss or application hereunder or for any violation of local, state, or federal laws with which the contents may conflict. INFORMATION CONCERNING SAFETY AND HEALTH RISKS AND PROPER PRECAUTIONS WITH RESPECT TO PARTICULAR MATERIALS AND CONDITIONS SHOULD BE OBTAINED FROM THE EMPLOYER, THE MANUFACTURER OR SUPPLIER OF THAT MATERIAL, OR THE MATERIAL SAFETY DATA SHEET (MSDS).

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The publication is available for review by federal and state agencies or authorities and possible use as a model safe practice to assist in preparation or revision of occupational safety codes or regulations. Recommendations set forth in this publication are viewed as one satisfactory method for accomplishing a desired result. They should not be considered as the only method for achieving the desired results. This publication includes usage of the verbs "shall" and "should," whichever is deemed most applicable for the specific situation. For the purposes of this publication, the following definitions are applicable:

Shall: Denotes that the recommended practice has universal application to that specific activity.

Should: Denotes a recommended practice: (1) where a safe comparable alternative practice is available; (2) that may be impractical under certain circumstances; or (3) that may be unnecessary for personnel safety under certain circumstances.

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1 General

1.1 PURPOSE

The purpose of this document is to recommend practices and procedures for promotion and maintenance of safe working conditions for personnel engaged in drilling operations and well servicing operations, including special services.

1.2 SCOPE

These recommendations apply to rotary drilling rigs, well servicing rigs, and special services as they relate to operations on location. The recommendations are not intended to cover seismic drilling or water well drilling operations. These recommendations do not apply to site preparation and site abandonment operations.

1.3 RESPONSIBILITY

These recommendations are made recognizing that owners, operators, contractors, and their personnel have separate responsibilities that may be contractual in nature. In the safe performance of work covered by these recommendations, each employer should provide training and instruction for its personnel. It is not the intent of these recommendations to alter the contractual relationship(s) between the parties. The well owner or operator should provide and the contractor should seek pertinent information that is known or assumed and that the contractor may need to assure a safe operation. At all times, the specific work activity being performed should be under the immediate supervision of an authorized person who has the authority to commence, modify, or cease the work methods or operations, as necessary, to ensure the safety of affected personnel. The authorized person should observe changing conditions and improve, whenever required, the work methods to promote increased protection for the personnel.

2 References

The most recent editions of the following documents are referenced in this publication.

API

RP 2D	*Operation and Maintenance of Offshore Cranes*
RP 4A	*Steel Derricks (Including Standard Rigs)* [out of print]*
RP 4D	*Guyed Portable Masts* [out of print]*
RP 4E	*Drilling and Well Servicing Structures* [out of print]*
Spec 4F	*Drilling and Well Servicing Structures*
RP 4G	*Maintenance and Use of Drilling and Well Servicing Structures*
Spec 6A	*Wellhead and Christmas Tree Equipment*
Spec 8A	*Drilling and Production Hoisting Equipment*
RP 8B	*Inspection, Maintenance, Repair, and Remanufacture of Hoisting Equipment*
Spec 8C	*Drilling and Production Hoisting Equipment (PSL 1 and PSL 2)*
RP 9B	*Application, Care, and Use of Wire Rope for Oilfield Service*
RP 14F	*Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1 and Division 2 Locations*
Spec 16A	*Drill Through Equipment*
RP 49	*Safe Drilling of Wells Containing Hydrogen Sulfide* [out of print]*
RP 53	*Blowout Prevention Equipment Systems for Drilling Operations*
RP 55	*Conducting Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide*
RP 67	*Oilfield Explosives Safety*
RP 68	*Well Servicing and Workover Operations Involving Hydrogen Sulfide*
RP 500	*Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Division 1 and Division 2*
RP 505	*Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1 and Zone 2*
API 510	*Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair and Alteration*
RP 2003	*Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*
Std 2015	*Safe Entry and Cleaning of Petroleum Storage Tanks*
Publ 2201	*Procedures for Welding or Hot Tapping on Equipment in Service*

ACGIH[1]

Threshold Limit Values and Biological Indices for 1997–1998

Industrial Ventilation, A Manual of Recommended Practice, 22nd Edition

ANSI[2]

B15.1	*Safety Standard for Mechanical Power Transmission Apparatus*

[1]American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Suite 600, Cincinnati, Ohio 45240-1634.
[2]American National Standards Institute, 11 West 42nd Street, New York, New York 10036.

S1.13-1995 *Measurement of Sound Pressure Levels in Air*
S12.6-1997 *Methods for Measuring the Real-Ear Attenuation of Hearing Protectors*
S12.19-1996 *Measurement of Occupational Noise Exposure*
S12.36 *Survey Methods for the Determination of Sound Power Levels of Noise Sources*
Z41.1-1979 *Men's Safety-Toe Footwear*
Z87.1 *Standard Practice for Occupational and Educational Eye and Face Protection*
Z87.2 *Safety Requirements for Industrial Protective Helmets for Electrical Workers, Class B*
Z88.2-1992 *Respiratory Protection*
Z89.1 *Safety Requirements for Industrial Head Protection*
Z117.1-1995 *Safety Requirements for Confined Space*
Z358.1 *Emergency Eyewash and Shower Equipment*
Z359.1 *Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components*

ANSI/IES[3]
RP7-1988 *Industrial Lighting*

ASME[4]
ASME Boiler and Pressure Vessel Code, Sections VIII and IX

ASNT[5]
Recommended Practice No. ASNT-TC-1A

CGA[6]
C-7 *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers*

IME[7]
Safety Publ No. 20 *Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electrical Detonators (Blasting Caps)*

IP[8]
Recommended Practice for Radio Silence When Conducting Wireline Services Involving the Use of Explosives

NACE[9]
Std MR0175 *Requirements for Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment*

NFPA[10]
NFPA 9 *Portable Fire Extinguishers*
NFPA 30 *Flammable and Combustible Liquids Code (1993)*
NFPA 70 *National Electrical Code*
NFPA 77 *Static Electricity*

*Out-of-print publications are available from:
Global Engineering Documents
15 Inverness Way East, Englewood, Colorado 80150
Telephone (800) 854-7179

3 Definitions

3.1 GENERAL DEFINITIONS

The following definitions are provided to help clarify and explain use of certain terms in this publication. Users should recognize that some of these terms could be used in other instances where the application or meaning may vary from the specific information provided herein.

3.1.1 acidizing: The act of pumping an acidic solution into a wellbore to remove materials from the perforations, pipe, and walls of the producing formation or pumping the solution into formations to improve permeability.

3.1.2 adequate ventilation: Adequate ventilation, as used in this document, is for the prevention of fire and explosions. Adequate ventilation is ventilation (natural or artificial) that is sufficient to prevent the accumulation of significant quantities of vapor-air mixtures in concentrations above 10% of their lower explosive limit (LEL).

3.1.3 annular space: Space surrounding pipe in the wellbore. The outer wall of the annular space may be open hole or pipe.

3.1.4 ANSI: American National Standards Institute.

3.1.5 API: American Petroleum Institute.

3.1.6 approved: Sanctioned, endorsed, accredited, certified, or accepted by a duly constituted and recognized authority or agency.

3.1.7 ASTM: American Society for Testing and Materials.

[3]Illuminating Engineering Society of North America, 120 Wall Street, New York, New York 10005-4001.
[4]ASME International, 3 Park Avenue, New York, New York 10016-5990.
[5]American Society of Nondestructive Testing, 1711 Arlington Lane, Columbus, Ohio 43228.
[6]Compressed Gas Association, 1725 Jefferson Davis Highway, Suite 1004, Arlington, Virginia 22202-4102.
[7]Institute of Makers of Explosives, 1120 19th Street, NW, Washington, D.C. 20036.
[8]Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, United Kingdom.
[9]NACE International, 1440 South Creek Drive, P.O. Box 218340, Houston, Texas 77218-8340.
[10]National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, Massachusetts 02269-9101.

3.1.8 authorized person: A person assigned by an employer to perform or supervise the performance of a specific type of duty or duties at the work site.

3.1.9 back up: Refers to the act of "backing up" or preventing rotation of one section of pipe or rods while another is screwed out of or into it. Also applied to screwing nuts on or off bolts. A backup wrench refers to any wrench being used to hold the pipe, rods, or bolt. Backup tongs refers to the pipe tongs suspended in the derrick and used to hold a section of pipe while another section is screwed out of or into it by use of other tongs. The backup man is the crew member who operates the backup tongs. The backup position refers to the workstation of the backup man.

3.1.10 blocks, crown, and traveling: The fixed upper and movable lower blocks, respectively, of the block and tackle assembly on a rig that raises and lowers the drill string or tubing.

3.1.11 blowout: An uncontrolled flow of well fluids and/or formation fluids from the wellbore or into lower pressured subsurface zones (underground blowout).

3.1.12 blowout preventer (BOP): A device attached to the wellhead or Christmas tree that allows the well to be closed in with or without a string of pipe or wireline in the borehole.

3.1.13 blowout preventer remote control: A set of control tools that can be used to actuate the blowout preventer from a position some distance away from the blowout preventer, usually the rig floor or accumulator.

3.1.14 breaking out pipe: Operation of unscrewing a pipe section.

3.1.15 bypass: Usually refers to a pipe connection around a valve or other control mechanism. A bypass is installed in such cases to permit passage of fluid through the bypass line while adjustments or repairs are made on the control that is bypassed.

3.1.16 casing: Pipe installed in the wellbore and usually cemented in place to retain the borehole dimension and seal off hydrocarbon and water-bearing formations.

a. surface casing: The outside and first pipe string installed in the wellbore, except for drive pipe or conductor pipe, to seal off surface sands; provide support for blowout prevention equipment and blowout protection; prevent loss of circulation while drilling deeper; and to protect fresh water sources. This casing is normally run to a depth below the base of the fresh water zones and cemented in place.
b. protective (intermediate) casing: A pipe string extending to the wellhead and installed inside of surface casing in wells of such depth without which drilling fluid cannot be balanced because of simultaneous lost circulation and high pressure entry of another zone, or in regions where abnormal pressure gradients are encountered.
c. production casing: The full length pipe string extending between the wellhead and an elevation at or below the producing formation, inside of protective or surface casing, and cemented in place to seal off productive zones and water-bearing formations.
d. liner: The partial length pipe string extending between the bottom of the borehole to an elevation above the bottom of the previous casing string. The liner may perform the same function as protective or production casing in sealing off producing zones and water-bearing formations. Liner may or may not be cemented in place. This term can also refer to a partial length pipe string set inside casing as a patch string.
e. tubing: Pipe installed in the wellbore inside casing strings and extending from the wellhead to a depth below, at, or above a producing, disposal, or injection formation. This is the pipe through which the produced or injected fluids flow.

3.1.17 catline, cathead: Catline is a line powered by the cathead, which is a concave, rotating, pulley-type device mounted on the end of the cat shaft of the drawworks. Catlines are used to lift or pull equipment around a rig.

3.1.18 catwalk: Elongated platform adjacent to the rig floor where pipe is laid out and lifted into the derrick. The catwalk is connected to the rig floor by a pipe ramp.

3.1.19 cellar: Excavation around the wellhead to provide space for items of equipment at the top of the wellbore.

3.1.20 cementing: Making cement into a slurry and pumping it into a wellbore to perform functions such as supporting casing, isolating formations behind casing, protecting fresh water sands, and sealing perforations in casing.

3.1.21 Christmas tree: The valves and fittings assembled at the top of a completed well to control the flow of hydrocarbons and other fluids.

3.1.22 circulate: Cycling fluid from the surface through the pipe and back to the surface through the annular space.

3.1.23 combustible liquid: Any liquid having a flashpoint at or above 100°F (37.8°C).

3.1.24 conductor pipe: A relatively short string of large diameter pipe that is set to keep the top of the hole open and provide a means of returning the upflowing drilling fluid from the wellbore to the surface drilling fluid system until the first casing string is set in the well. Conductor pipe may also be used in well control. Conductor pipe is usually cemented.

3.1.25 contractor: Any person or company that contracts to perform all or any part of oil and gas well drilling or servicing.

3.1.26 critical equipment: Equipment and other systems determined to be essential in preventing the occurrence

of, or mitigating the consequences of an uncontrolled event. Such equipment may include vessels, machinery, piping, blowout preventers, wellheads and related valving, flares, alarms, interlocks, fire protection equipment, and other monitoring, control, and response systems.

3.1.27 deadline: The end of the drilling line that is not reeled onto the hoisting drum of the rig. This end of the drilling line is anchored (usually to the derrick substructure) and does not move as the traveling block is hoisted, hence the term deadline.

3.1.28 derrick (mast): The steel lower component of a drilling or well servicing rig that supports the crown block, traveling block, and hoisting lines. Derricks and masts may be stationary structures normally requiring dismantling and disassembly when moved from location to location, or may be portable with the capability of being laid down and raised to and from ground level fully assembled.

3.1.29 derrickman: Person whose work station is usually up in the derrick while pipe or rods are being hoisted or lowered into the hole.

3.1.30 driller: First line supervisor whose main duties are to control the activities of his crew and to train those crew members in the proper way to perform their assigned tasks. The driller is responsible for operation of the drilling and hoisting equipment. This person is also referred to as the "crew chief" or "rig operator" in well servicing operations.

3.1.31 drilling (hoisting) line: The wire rope used in the rig's main hoisting system.

3.1.32 drilling out: Refers to drilling and removal of material that normally remains in the casing or wellbore after cementing.

3.1.33 drilling rig: Equipment and machinery assembled primarily for the purpose of drilling or boring a hole in the ground.

3.1.34 drill pipe: The heavy seamless tubing used to rotate the drill bit and circulate the drilling fluid. Usually in 30-ft lengths, the joints of drill pipe are coupled together with special threaded connections called tool joints.

3.1.35 drill stem: The entire drilling assembly from the swivel to the bit composed of the kelly, drill string (work string), subs, drill collars. and other downhole tools such as stabilizers and reamers. This assembly is used to rotate the bit and carry the drilling fluid to the bit.

3.1.36 drill stem test: A test taken by means of special testing equipment run into the wellbore on the drill string (work string) to determine the producing characteristics of a formation.

3.1.37 drill string: Several sections or joints of drill pipe joined together. May also refer to sections or joints of threaded tubing or casing joined together to be used for drilling.

3.1.38 drive pipe: A relatively short string of large diameter pipe driven or forced into the ground to function as conductor pipe.

3.1.39 electrical classification of areas: For the purpose of this document, locations are classified according to API RP 500: *Classification of Locations for Electrical Installations at Petroleum Facilities*; or API RP 505: *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2*.

3.1.40 elevators: A mechanical device attached to the traveling block that latches around and supports the pipe during hoisting or lowering operations

3.1.41 external guylines: Lines which provide stability and run from some point in the derrick, mast, or pole to ground anchors, or to a special substructure or derrick base that provides a substitute for ground anchors.

3.1.42 flammable liquid: Any liquid having a flashpoint below 100°F (37.8°C).

3.1.43 floorman: Member of the rig crew whose work station during hoisting is on the rig floor. Also performs numerous other operating and maintenance duties as directed by the supervisor. May also be referred to as rotary helper, roughneck, driller's helper, or well puller.

3.1.44 freezing operation: Creation of a plug by freezing a liquid in a pipe or fitting to confine the pressure while removing defective or inadequate equipment downstream of the plug.

3.1.45 full body harness: Straps which may be secured about a person in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders, with means for attaching it to other components of a personal fall arrest system.

3.1.46 ground anchor (deadman): Static holding device installed in the ground separate from the rig structure and to which guyline(s) may be attached.

3.1.47 guarded: Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers or casings, barrier rails, or screens to eliminate the possibility of accidental contact with or dangerous approach by persons, animals, or objects.

3.1.48 guyline: Wire rope(s) that is attached to elevated structures, such as derricks or mast, and ground anchors for stability. See API Recommended Practices 4A, 4D, 4E, 4F, 4G, and 9B.

3.1.49 guyline anchors: The ground components of the guyline system to which the wire rope(s) is attached.

3.1.50 hazardous substance: Any substance that, by reason of being explosive, flammable, toxic, corrosive, oxidizing, irritating, or otherwise harmful, has the potential to cause injury, illness, or death.

3.1.51 hole: Common term that usually refers to the wellbore.

3.1.52 hot oil treatment: The act of heating oil and pumping it into the piping, tubing, casing, or formation to remove paraffin and asphaltines.

3.1.53 hot tapping (pipe tapping): The act of drilling a hole through the wall of pipe that is under pressure. A special saddle is used to attach a valve and lubricator to the pipe.

3.1.54 hydraulic fracturing: The act of pumping fluid(s) into a wellbore and into a specific formation to induce fractures. The fluid usually carries some type of proppant material, such as sand, to keep the fracture open after pumping ceases.

3.1.55 kelly: The square, hexagonal or other shaped steel pipe connecting the swivel to the drill pipe. The kelly moves through the kelly bushings, rotary table and rotates the drill string.

3.1.56 kelly swivel valve (kelly cock or upper kelly valve): A valve located between the kelly swivel and the kelly, used for well control when the kelly is in the hole. It works like a check valve when engaged.

3.1.57 lanyard: A flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline or anchorage.

3.1.58 liner: See *casing*.

3.1.59 load guylines: Stabilizing guylines that run from a point on the mast, derrick, or pole to a point at or near the base supporting the mast or pole or to ground anchors. (Sometimes referred to as "internal guylines" when attached to the base.)

3.1.60 location: The point at which a well is to be drilled. Also referred to as "wellsite."

3.1.61 lockout/tagout: A process to specify that equipment is out of service until locks and/or tags are removed by the authorized person.

3.1.62 lubricator: A fabricated length of tubular pipe equipped with a packoff and bleed valve that is installed to provide access while working on a well under pressure with wireline or other tools and equipment.

3.1.63 making a connection: Act of screwing a section of pipe or rods onto the string suspended in the wellbore.

3.1.64 making a trip: Consists of hoisting (pulling) the pipe or rods to the surface and lowering (running) the pipe or rods into the wellbore.

3.1.65 making up a joint: Act of screwing a joint of pipe into another joint.

3.1.66 mast: See *derrick (mast)*.

3.1.67 mobile offshore drilling unit (MODU): A vessel capable of engaging in drilling or well workover operations for the exploration or exploitation of subsea resources.

3.1.68 monkey board: Platform on which the derrickman works during the time a trip is being made. Also referred to as the tubing board or racking board on well servicing rigs.

3.1.69 mud bucket (mud box): Device used to enclose pipe connections to deflect fluid released when a joint or stand of pipe containing liquid (wet string) is unscrewed.

3.1.70 NFPA: National Fire Protection Association.

3.1.71 operator: Lease owner or his designated agent who is responsible for the overall operation of the lease.

3.1.72 open hole: Uncased part of the wellbore.

3.1.73 perforating: Making holes in pipe, cement, or formation at desired depths usually performed with an explosive device utilizing bullets or shaped charges.

3.1.74 personal fall arrest system (PFAS): A system designed to provide protection to a person from falls. The PFAS should consist of an anchorage, connector and a synthetic webbing full body harness which may include a lanyard and a deceleration device.

3.1.75 pipe racking board guylines (tubing board guylines): Lines (guylines) which run from the racking board to ground anchors; or a special substructure or base that provides a substitute for ground anchors.

3.1.76 pole mast: Structure consisting of one or more tubular sections, telescoping or not telescoping, that are the load-bearing members. The structure, when erected to working position, usually requires guylines. It may be attached to a carrier, skid base, or substructure.

3.1.77 production casing: See *casing*.

3.1.78 protective (intermediate) casing: See *casing*.

3.1.79 pumping unit: Surface equipment used for the purpose of mechanically lifting fluids from a well.

3.1.80 qualified person: A person who, by possession of a recognized degree, certificate, or professional standing, or who by knowledge, training, or experience, has success-

fully demonstrated the ability to solve or resolve problems relating to the subject matter or the work.

3.1.81 rabbit: An instrument or device that is dropped, pulled, or pushed through a section of pipe to ensure that it is free of obstruction.

3.1.82 racking pipe or rods: Act of placing stands of pipe or rods in an orderly arrangement in the derrick.

3.1.83 rated working pressure: The maximum internal pressure that equipment is designed to contain and/or control. Working pressure is not to be confused with test pressure.

3.1.84 reverse circulation: Reverse circulation occurs when fluid is pumped down an annular space and returns to the surface through the tubular forming the inner wall of the annular space. This is opposite of normal circulation wherein fluid is pumped down the inner tubular pipe and returns up the annular space.

3.1.85 rigging up: The on-site erection and connection of the components in preparation for drilling or well servicing operations.

3.1.86 rod (sucker rod): A length of steel, aluminum, fiberglass, or other suitable material, a number of which are screwed together to make up the mechanical link (rod string) from the surface pumping unit to the pump in the well.

3.1.87 safety valve (stabbing valve): A full opening valve available for quick installation in the pipe string to prevent flow.

3.1.88 shall: For the purpose of this document, *shall* indicates that the recommended practice(s) has universal application to that specific activity.

3.1.89 should: For the purpose of this document, *should* denotes a recommended practice(s) (a) where a safe comparable alternative practice(s) is available; (b) that may be impractical under certain circumstances; or (c) that may be unnecessary for personnel safety under certain circumstances.

3.1.90 simultaneous operations: Two or more of the following activities: production, drilling, completion, workover, wireline (except routine operations), and major construction operations.

3.1.91 single: One joint of drill pipe, rod, or other tubular goods.

3.1.92 snubbing: Pulling or running pipe under pressure through a sealing element where special equipment is used to apply external force to push the pipe into the well, or to control the pipe movement out of the well.

3.1.93 special services: Those operations utilizing specialized equipment and personnel to perform work processes to support well drilling and servicing operations.

3.1.94 stabbing board: A platform in the derrick on which personnel work while casing is being run to aid in guiding a tubular joint into another tubular joint for makeup.

3.1.95 stabbing a valve: Aligning and screwing a valve onto the end of a pipe.

3.1.96 stand of pipe: One, two, or three joints of pipe screwed together, and sometimes referred to as a single, double, or triple, respectively.

3.1.97 strand: Several round or shaped wires helically laid about an axis.

3.1.98 stuck pipe: A condition in which the pipe sticks or hangs while in the hole and cannot be moved.

3.1.99 substructure: Structure on which the derrick sits. The substructure may provide space for wellhead and well control equipment.

3.1.100 supervisor: Person who has been given the control, direction, or supervision of work performed by one or more personnel.

3.1.101 surface casing: See *casing*.

3.1.102 swabbing: Lifting of well fluids to the surface using a piston-like device installed on a wireline. Swabbing may inadvertently occur due to piston action as pipe or assemblies are pulled from the well.

3.1.103 swingrope (swingline): A vertically suspended rope knotted on the lower end to provide hand grips, hung above the boat landing on an offshore platform, and used to facilitate personnel transfer between boat and platform and vice versa.

3.1.104 swivel: Device at top of the drill stem that permits simultaneous circulation and rotation.

3.1.105 tour: Designates the work period of a rig crew and is usually pronounced as if it were spelled "t-o-w-e-r."

3.1.106 tubing: See *casing*.

3.1.107 tugger line: Tugger line is a wire rope powered by a winch and used for the controlled moving of light loads around a rig.

3.1.108 valve drilling operation: Drilling of a hole through the blocking element of a valve that is stuck in the closed position with pressure on the well side of the valve. The drilling is accomplished through a lubricator assembly that confines the pressure after the blocking element is penetrated.

3.1.109 V-door: The opening in the derrick leading from the derrick floor to the catwalk and pipe rack area.

3.1.110 V-door ramp: A slide-like ramp used to pick up and lay down tools to and from the catwalk/pipe rack area. Also used to pick up drill pipe, drill collars or any other heavy

equipment that could not be done safely because of the height of the substructure and close proximity to the blowout preventers, electric and hydraulic lines, and other equipment in the area.

3.1.111 well servicing rig: Equipment and machinery assembled primarily for the purpose of any well work involving pulling or running tubulars or sucker rods, to include but not be limited to redrilling, completing, recompleting, workover, and abandoning operations.

3.1.112 wire line: A special wire, strand, or wire rope of high strength steel used to convey a tool(s) into a hole (also called "well measuring wire" and "well measuring strand"). An electromechanical cable that is an electrical cable armored with high strength steel wires is also called a wire line.

3.1.113 wire rope: Several wire strands helically laid about an axis.

4 Injuries and First Aid

4.1 GENERAL

4.1.1 Every occupational injury or illness shall be immediately reported to the supervisor. The supervisor shall arrange for any necessary medical or first aid treatment.

4.1.2 A report should be prepared as soon as practical, to record information (or the circumstances) surrounding the injury or illness. Additional reports to regulatory agencies and others may be required.

4.1.3 The cause of the injury or illness should be investigated and steps taken to prevent a recurrence.

4.2 MEDICAL SERVICES

4.2.1 Telephone numbers, location, and other relative information pertaining to availability of medical personnel, transportation, and medical facilities shall be available at all drilling and well servicing sites.

4.2.2 Prior to commencement of work in an area, provisions should be made for prompt medical attention in case of serious injury.

4.3 FIRST AID

4.3.1 An individual trained in first aid and cardiopulmonary resuscitation (CPR) techniques shall be available at the worksite to render aid. This individual should be trained using approved courses of the American Red Cross, American Heart Association, or equivalent training.

4.3.2 A first aid kit shall be maintained at the worksite. The kit should contain appropriate materials for the potential injuries, and should be inspected at frequent intervals, replenished as necessary, and be immediately available at all times.

4.4 EMERGENCY EYE OR BODY WASH STATIONS

4.4.1 Where the eyes or body of personnel may be exposed to injurious materials, eyewash and shower equipment for emergency use should be provided. For information on emergency eyewash and shower equipment, see ANSI Z358.1.

5 Personal Protective Equipment (PPE)

5.1 GENERAL

Personnel should wear personal protective clothing and should use personal protective equipment (PPE) when at the work site where there is reasonable potential for injury, illness, or death that may be prevented by use of such equipment. PPE should be used only when it is impractical to reduce a hazard to acceptable levels by administrative or engineering controls.

5.2 WEARING APPAREL

5.2.1 A safety hard hat should be worn by each person in the work area. The safety hard hat should meet the requirements of ANSI Z89.1: *Safety Requirements for Industrial Head Protection*; or ANSI Z89.2: *Safety Requirements for Industrial Protective Helmets for Electrical Workers, Class B*.

5.2.2 Eye protection equipment appropriate for the work being done should be worn by personnel where there is a reasonable probability of injury to the eyes from flying objects, chemicals, or injurious light or heat that can be prevented by such equipment. This protective equipment should meet the requirements of ANSI Z87.1: *Practice for Occupational and Educational Eye and Face Protection*.

5.2.3 Safety shoes, safety boots, or toe guards should normally be worn by all personnel assigned to the work area. Safety-toe footwear should meet the requirements of ANSI Z41.1: *Men's Safety-Toe Footwear*. Extremely cold temperatures may require an alternative practice.

5.2.4 Gloves, apron, boots, or other protective equipment, as appropriate, should be worn by personnel handling chemicals that may irritate or be absorbed through the skin.

5.2.5 Appropriate clothing should be worn at all times. Loose or poorly fitted clothing should not be worn.

5.2.6 Personnel should not work in clothing that is saturated with any flammable, hazardous, or irritating substance(s). Such clothing should be immediately removed and replaced with suitable clothing after the affected skin area has been thoroughly washed and, if necessary, treated.

5.2.7 Personnel should not wear jewelry or other adornments subject to snagging or hanging and causing injury while in the work area.

5.2.8 Personnel with hair of such length as to be a hazard in work areas should keep it contained in a suitable manner while performing their duties. Hair and beard styles shall not interfere with the effective functioning of head, eye, face, or respiratory protective equipment, if such equipment is required at the work site.

5.3 HEARING PROTECTION

5.3.1 Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table 1. For guidance on measuring sound levels, see ANSI S12.19-1996: *Measurement of Occupational Noise Exposure*; ANSI S1.13-1995: *Measurement of Sound Pressure Levels in Air*; and ANSI S12.36-R1997 Table 1. For guidance on measuring sound levels, see ANSI S12.19-1996.

5.3.2 When personnel are subjected to sound levels exceeding those listed in Table 1, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of Table 1, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. For guidance on hearing protection equipment, see ANSI S12.6-1997: *Methods for Measuring the Real-Ear Attenuation of Hearing Protectors*.

5.3.3 Employers should consider the elements of a hearing conservation program as appropriate to protect the hearing of personnel.

5.4 RESPIRATORY PROTECTION

5.4.1 An industrial hygiene assessment of the work area should be done to identify the potential hazards that may require respiratory protection.

5.4.2 For respiratory protection practices, including equipment selection, use, medical surveillance, fit testing, storage, inspection, maintenance, and training, see ANSI Z88.2-1992, *Respiratory Protection*.

5.4.3 Tight-fitting air purifying respirators shall be used only in areas where sufficient oxygen exists and where no toxic materials or vapors are present in hazardous concentrations.

5.4.4 Approved self-contained or supplied-air breathing equipment shall be used for those atmospheres where tests indicate toxic or hazardous gases are present in quantities immediately dangerous to life or health (IDLH) or oxygen content is less than necessary to sustain life. Air from the rig utility system shall not be used as the source for breathing air supply.

Table 1—Maximum Permissible Noise Exposures[a]

Duration per day, hours	Sound level[b] dBA slow response
12	85
8	90
6	92
4	95
3	97
2	100
$1\frac{1}{2}$	102
1	105
$\frac{1}{2}$	110
$\frac{1}{4}$ or less	115

[a]When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect shall be considered rather than the individual effect of each. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.
[b]Measured on the A scale of a standard sound level meter at slow response.

5.4.5 Cartridge type respirators shall not be used in drilling and well servicing operations when a hydrogen sulfide or sulfur dioxide environment may be encountered. Self-contained or supplied air positive pressure breathing apparatus should be used for these applications.

5.4.6 Personnel should be trained in the use and operation of breathing equipment available at the work site. Personnel shall be advised of the potential dangers of flammable, hazardous, and insufficient oxygen atmosphere. See API RP 49: *Recommended Practice for Safe Drilling of Wells Containing Hydrogen Sulfide*; API RP 68: *Recommended Practice for Well Servicing and Workover Operations Involving Hydrogen Sulfide*; and API RP 55: *Conducting Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfides*.

5.5 FALL PROTECTION

5.5.1 All personnel, when engaged in work ten feet above the rig floor or other working surfaces, shall be protected at all times from falling by guardrail systems, safety net systems, or personal fall arrest systems (PFAS). When the employer can demonstrate that it is unfeasible or creates a greater hazard to use these systems, the employer shall develop and implement an alternative fall protection plan that provides for personnel safety. When PFAS are used, the following shall apply:

a. Personnel shall use a full body harness manufactured in accordance with ANSI Z359.1.

b. PFAS shall be inspected prior to each use.

c. The full body harness shall be attached by means of a lanyard with double-locking snap-hooks, an anchor or structural member capable of supporting a minimum dead weight of 5,400 pounds.
d. A separate lanyard shall be used by each person requiring a lanyard. The lanyard shall be adjusted to permit a maximum drop of five (5) feet in case of a fall.
e. Manufacturer's instructions for inspection and replacement should be followed.

6 Operations

6.1 GENERAL

6.1.1 Well control shall be maintained at all times. Consideration shall be made to ensure appropriate equipment and materials are on location and operational before work commences.

6.1.2 The rig drill floor shall be attended by a person qualified in well control procedures at all times during operations.

6.1.3 Personnel should be trained in basic well control, as needed, in relation to their job duties.

6.1.4 Horseplay and careless acts shall not be permitted.

6.1.5 Personnel should be familiarized with these recommended practices as they relate to their function in the job at hand and should abide by the pertinent recommendations.

6.1.6 Personnel should receive instruction in correct work methods to reduce chance of injury to themselves or fellow personnel.

6.1.7 A safety program should be established and maintained. Such safety programs should include, but not he limited to, the following:

a. Instruction of the driller's or crew chief's responsibility for the safety of the crew and equipment during normal operations and possible emergencies.
b. Indoctrination of new personnel. New rig personnel, regardless of prior experience, should have the job outlined, explained, and demonstrated by the driller, crew chief, or another designated crew member. Observation of new personnel work performance should be maintained until the applicable supervisor is satisfied that the personnel can fill the position in a safe and effective manner.
c. Instruction of crew members on work procedures and safe practices.
d. Regularly scheduled and impromptu meetings of the crew, in which the probable hazards, problems of the job, and related safe practices are emphasized and discussed.
e. Good housekeeping practices.
f. Availability of and instruction in the use and maintenance of personal protective equipment.
g. General safety education through safety meetings, company publications, and other educational media.

6.1.8 Unsafe and potentially dangerous conditions should be eliminated or reported immediately to the supervisor in charge for corrective action.

6.1.9 The offgoing tour supervisor shall inform the incoming supervisor of any known special hazards or work in progress that may affect the safety of the crew. Incoming tour personnel shall be alerted to work in progress that could affect their safety.

6.1.10 To prevent incidents of finger wounds from sharp pipe threads or wickers, pipe threads should be cleaned with a brush.

6.1.11 Hazardous substances shall be stored in proper containers that are properly labeled. Hazardous waste materials shall be appropriately stored, labeled, and disposed. Hazardous waste materials should not be mixed with nonhazardous wastes because the entire mixture is then considered hazardous and subject to hazardous waste disposal requirements.

6.1.12 Personnel required to handle or use hazardous substances shall be instructed regarding their safe handling and use, and be made aware of the potential hazards and personnel protection measures required. For additional information, consult with the employer and/or hazardous substance manufacturer and research the material safety data sheets (MSDSs). These MSDSs shall be available to the personnel at the workplace prior to and during chemical usage.

6.1.13 When there is any indication that a well will flow, whether through prior records, present well conditions, or the planned well work, blowout prevention equipment shall be installed. Crews should conduct well control drills.

When drilling or well servicing operations are in progress on a well where there is any indication the well will flow, the rig shall have on the rig floor a safety valve (stabbing valve) with connections suitable for use with each size and type tool joint or tubing connection being used on the job. See API RP 53: *Recommended Practices for Blowout Prevention Equipment for Drilling Operations*.

6.1.14 Field welding shall not be permitted on tongs, elevators, bails, or heat treated rig equipment.

6.1.15 On land locations, vehicles not involved in the immediate rig operations should be located a minimum distance of 100 feet (30.5 m) from the wellbore or a distance equal to the height of the derrick or mast (including attachments), whichever is greater. Appropriate safety measures should be taken where terrain, location, or other conditions do not permit this spacing.

6.1.16 The rig substructure, derrick, mast, and other equipment as appropriate, shall be grounded to prevent accumulation of a static charge.

6.2 OVER WATER OPERATIONS

6.2.1 For over water operations, simultaneous operations shall be conducted according to operator guidelines.

6.2.2 When work is to be performed over water on a barge, work boat, MODU, or platform, personnel should be instructed in abandonment procedures, emergency signals, abandonment stations, and water entry procedures.

6.2.3 A minimum of two emergency escape means from platforms to the water should be provided.

6.2.4 Personnel working over or near water where a danger of drowning exists shall be provided with approved personal flotation devices in serviceable condition.

6.2.5 Ring buoys should be provided and be readily available for use in emergency rescue operations.

6.2.6 Each continuously manned platform shall be provided with at least two approved life floats or alternatives for life floats. The life floats or alternatives shall have sufficient capacity to accommodate all persons present at any one time.

6.2.7 Approved cold water survival attire should be provided when operations are conducted in cold water areas where anticipated personnel rescue times are such that water immersion survival capability in normal work clothing would be questionable in the event of an emergency evacuation. Crew members should be instructed in the donning and proper use of this equipment.

6.2.8 A basket stretcher or other appropriate litter capable of being hoisted safely with an injured person shall be provided and maintained in an accessible place and appropriate personnel should be instructed in its correct use.

6.2.9 When a crane is being used to transfer personnel over water, personnel shall wear approved personal flotation devices and should not ride on anything other than a personnel net or other device specifically designed for that purpose. The crane operator should avoid lifting or lowering personnel directly over a vessel, except to clear or land personnel. Load shall not exceed basket manufacturer's specifications. Personnel baskets shall be inspected at frequent intervals. Personnel baskets should be used only for the transfer of personnel. Equipment, materials, or supplies should not be lifted in personnel baskets.

6.2.10 The manufacturer's rated load capacity shall not be exceeded on cranes. Offshore pedestal cranes should be operated and maintained in accordance with API RP 2D: *Operation and Maintenance of Offshore Cranes*. When helicopter landings and takeoffs are in progress, crane operations should cease and the boom be safely positioned.

6.2.11 When personnel use a swingrope for transferring from boat to landing platform and vice versa, they shall wear approved personal flotation devices during such transfer operations.

6.2.12 Tag lines should be used to guide and steady all loads being lifted.

6.3 PRELIMINARY RIG-UP OPERATIONS

6.3.1 Prior to commencing rig-up operations, the planned arrangement of all equipment to be placed on the location should be reviewed to eliminate potentially hazardous conditions. For example, the location of rig equipment in relation to pipelines and overhead and underground utility lines should be carefully checked prior to placing equipment on the drilling site.

6.3.2 Well operations involving the rig shall not be commenced until the rig is rigged up in a safe manner.

6.3.3 Change rooms and outbuildings should not be located immediately in front of or to the rear of boilers, nor in the near vicinity of rig fuel tanks.

6.3.4 Prior to initiating well servicing operations, the well shall be checked for pressure. If pressure is indicated, the operator's authorized person should be notified; then proper steps should be taken to remove pressure or to operate safely under pressure before commencing operations.

6.3.5 Personnel shall be out of the derrick, or mast, and cellar, and stand clear when a subsurface pump is being unseated or when initial pull on the tubing is made.

6.4 BLOWOUT PREVENTION EQUIPMENT FOR DRILLING AND WELL SERVICING OPERATIONS

6.4.1 When drilling or well servicing operations are in progress on a well where there is any indication the well will flow, either through prior records, present well conditions, or the planned well work, blowout prevention equipment shall be installed and tested.

6.4.2 When drilling or well servicing operations are in progress on a well where there is any indication the well will flow, the rig shall have on the rig floor a safety valve (stabbing valve) with connections suitable for use with each size and type tool joint or tubing connection being used on the job.

6.4.3 Blowout prevention equipment, when required, should be installed, operated, and maintained in accordance with API RP 53. Also see API Spec l6A: *Drill Through Equipment*.

6.4.4 Designated rig personnel shall have adequate understanding of and be able to operate the blowout preventer system. New personnel should be trained in the operation of the blowout preventer system as soon as practicable.

6.4.5 The use of BOP controls, including remote control stations, shall be discussed in the pre-job meeting.

6.4.6 BOP drills should be conducted under a variety of conditions.

6.4.7 While in service, blowout prevention equipment should be inspected daily and a preventer actuation test should be performed on each round trip, but not more than once per 24-hour period. Notation of actuation tests performed should be made on the daily report. Annular blowout preventers should be tested in accordance with the manufacturer's recommendations.

6.4.8 When heavy weighted drilling fluids are in use, choke and kill lines should be flushed as needed to prevent plugging.

6.4.9 During cold weather conditions, choke and kill lines should be flushed to prevent freezing.

6.4.10 All pipe fittings, valves, and unions placed on or connected with blowout prevention equipment, well casing, casinghead, drill pipe, or tubing and exposed to well pressure shall have a working pressure rating equal to or greater than the maximum anticipated well surface pressure. The BOP stack and related riser connections should not be short bolted (not less than three threads showing) and should be checked for properly torqued bolts.

6.4.11 All blowout preventer control lines and valves should be clearly identified.

6.4.12 When ram-type blowout preventers are being used, at least one ram preventer should be of proper size to fit the tubulars in use.

6.4.13 Pressure testing of the blowout prevention equipment system shall be conducted prior to drilling out any string of casing except conductor pipe or drive pipe. Drilling operations shall not proceed until blowout prevention equipment is tested and determined to be serviceable.

6.4.14 Personnel should stay clear of BOPs when BOPs are under well or testing pressures.

6.4.15 Personnel should stay clear of the rotary table when the BOP is operated.

6.4.16 If the blind ram preventer is closed for any purpose, the valves on the choke lines or relief lines located below the blind rams should be opened to bleed off any pressure prior to opening the rams.

6.4.17 Blowout prevention equipment that utilizes remote control systems should be installed so that failure of one set of controls does not affect the operation of the backup system.

6.4.18 The choke line(s) and kill line(s) should be anchored, tied, or otherwise secured to prevent whipping resulting from pressure surges.

6.4.19 BOP equipment shall never be heated or welded on by rig personnel.

6.4.20 Unnecessary engines and motors that are not critical to the operation should be shutdown during kill operations.

6.5 HOUSEKEEPING

6.5.1 Work areas should be maintained clean and free of debris and tripping hazards.

6.5.2 Means should be provided to convey any fluids away from the rig floor while pulling wet strings of pipe.

6.5.3 Leaks or spills should be promptly cleaned up to eliminate personnel slipping and fire hazards.

6.5.4 If personnel are required to work in a cellar, it should be kept reasonably clear of water, oil, or drilling fluid accumulation. No loose equipment or materials should be in the cellar except those in use or about to be used.

6.5.5 When placing equipment and tools around the rig floor and location, care should be taken to leave egress routes open. Tools and equipment should be securely placed and stored in a position or manner so they will not fall. Fire fighting equipment shall be accessible and free of obstructions.

6.6 HYDROGEN SULFIDE ENVIRONMENT

6.6.1 Safety guidelines and recommendations for use in drilling operations where hydrogen sulfide or sulfur dioxide gas may be encountered are contained in API RP 49. Also see API RP 55; and API RP 68. These recommended procedures should be utilized, as appropriate, in applicable operations to enhance safety of personnel and the general public.

6.7 CONFINED SPACE, EXCAVATIONS, OR HAZARDOUS ENVIRONMENTS

6.7.1 Where hydrogen sulfide, sulfur dioxide, or other unusually hazardous gas is known or suspected to exist, the operator shall ensure that personnel, contractor, and service company supervisors are advised of the potential hazards.

6.7.2 When it is not necessary to maintain a cellar, the cellar should be filled to eliminate a possible confined space hazard.

6.7.3 A confined space is one that:

a. Has limited openings for entry and/or exit.
b. Could contain known or potential hazards.
c. Is not intended for continuous occupation.
d. Has insufficient natural ventilation.

6.7.4 Any confined space that is going to be entered shall be isolated and entry prohibited until the following conditions are met:

a. Completion of internal atmospheric testing, prior to entry to determine:

1. Oxygen content.
2. Acceptable level of flammable gases/vapors.
3. Potential toxic air contaminants.

Note: Entry to conduct tests shall comply with atmospheric testing procedures for confined space testing requirements.

b. Activation of a Confined Space Entry Permit System where hazardous atmospheres exist or have the potential to exist. The system should include the following:

1. Posting procedures.
2. Evaluation of permit space conditions.
3. Procedures for safe entry.
4. Equipment required (i.e., respiratory protection).
5. Assignment of attendants and entry supervisors.
6. Emergency procedures.
7. Permit system.
8. Multi-employer coordination.
9. Permit cancellation procedures.
10. Review practices.

c. Declassification of confined space based on removal of all hazards or control of hazards through adequate ventilation.

Note: To maintain nonpermitted space requirements, tests shall be conducted and the results documented to demonstrate why the space is non-permitted.

See ANSI Z117.1-1995, *Safety Requirements for Confined Spaces*; and API Publ 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks*, for additional safety guidelines for working in confined spaces.

6.7.5 Excavations:

a. When an excavation deeper than four feet contains, or is reasonably expected to contain, a hazardous atmosphere, the atmosphere shall be tested for oxygen, flammable gases/vapors, and potential toxic air contaminants.

b. If the requirements of a confined space are met, then procedures for confined space permit requirements shall be followed.

c. Procedures shall be in place, however, to eliminate potential hazards and precautions taken to prevent exposures to hazardous atmospheres. Where conditions do exist, proper emergency procedures shall be in place along with safe practices.

6.8 MACHINERY AND TOOLS

6.8.1 Personnel shall only operate machinery that they are qualified to operate.

6.8.2 All belts, drive chains, gears, and drives (excluding rotary table, catheads, and kelly) shall have guards installed to prevent all personnel from coming in contact with moving parts. See ANSI B15.1: *Safety Standard for Mechanical Power Transmission Apparatus*, for construction specifications and clearances for such equipment guards.

6.8.3 Machinery shall not be operated unless all guards are in position and are in properly maintained condition. During maintenance or repair work limited testing may be performed by qualified personnel without guards in place.

6.8.4 Maintenance personnel should report to the rig supervisor prior to beginning repairs. They should report hazards that may be introduced. They should report when repairs are completed.

6.8.5 No personnel shall clean, lubricate, or repair any machinery where there is a hazard of contact with moving parts until such machinery has been stopped or such parts have been properly guarded.

6.8.6 Hand power tools and similar equipment, whether furnished by the employer or personnel, should be maintained in a safe condition.

6.8.7 Electrical hand tools shall be double insulated or grounded as required by NFPA 70: *National Electrical Code*. Ground fault circuit interruption protection should be used.

6.8.8 Electric or pneumatic hand tools shall have a deadman switch or be arranged so that the starting switch cannot be locked in.

6.8.9 When personnel are climbing rig ladders, any tools or other such materials they are carrying should be secured to the person's body.

6.9 LOCKOUT/TAGOUT

6.9.1 A lockout/tagout program should be established as follows:

a. Locks and/or tags should be placed to plainly identify the equipment or circuits being worked on. Critical systems locked or tagged should include the identity or job title of person installing the lock or tag.

b. Personnel should be trained and disciplined in the use of this system to prevent unexpected operation of any equipment that stores any type of energy that might inflict injury to personnel.

c. The lock or tag should be removed by the person who installed it or by that person's authorized replacement. In the event neither individual is available, the lock or tag may be removed by the rig supervisor after ensuring that no hazard will be created by energizing the locked or tagged equipment or circuit(s).

6.10 AUXILIARY ESCAPE

6.10.1 On all land rigs, the derrick or mast shall have an auxiliary means of escape installed prior to personnel working in the derrick. The auxiliary escape route should use a specially rigged and securely anchored escape line attached to the derrick or mast so as to provide a ready and convenient means of escape from the derrickman's working platform. The escape line route should be kept clear of obstructions.

a. The escape line on masts or derricks should be a $^{7}/_{16}$-in. (11.5-mm) minimum diameter wire rope in good condition. A safety buggy equipped with an adequate braking or controlled descent device should be installed on the wire rope, kept at the derrickman's working platform, and secured in a manner that will release when weight is applied.

Tension on the escape line should be periodically checked and adjusted to enhance safe landing of the user. Tension should be set with six to twelve feet of sag in the middle, depending upon the length of cable run. It is recommended that the ground anchor point of the escape line should be located a minimum lateral distance from the derrick or mast equal to two times the height of the work platform. The ground anchor point should be able to withstand a pull of at least 3,000 lb. If the rig configuration or location configuration will not permit use of the escape system, an alternate means of fast emergency exit from the derrickman's working platform to a safe place should be provided.

6.10.2 Personnel shall not ride the safety buggy or escape equipment except in an emergency. Personnel shall be trained in the proper procedure(s) for escaping the derrick or mast.

6.11 PERSONNEL LIFTING SYSTEMS

6.11.1 Personnel engaged in drilling or servicing operations shall not ride the elevators.

6.11.2 Exceptions for extreme emergency conditions are permitted when in the judgment of the supervisor, riding the elevators with appropriate personnel fall protection equipment in use is necessary. In this instance, the elevators shall be empty of pipe and other equipment when personnel are riding.

6.11.3 A bosun's chair (boat-swain/full body harness) or equivalent, attached to the traveling block or tugger line, may be used to reach an otherwise inaccessible location. Hydraulic or air winch lines with proper rating capacity are permissible as a personnel lift device if they meet the following:

a. Self centering, that when released returns to the center position and has locking/braking capability.

b. Control lever shall be attended at all times while lifting, stabilizing or lowering of personnel.

c. Lifting cable will be a minimum of $^{3}/_{8}$-in. diameter, and all hoisting equipment shall have a minimum workload of 4,000 pounds.

d. All connections shall meet ANSI standards.

6.12 RACKING TUBULARS AND DRILL COLLARS

6.12.1 Any rods, tubulars, drill pipe, and drill collars racked or hung in the derrick or mast should be secured to prevent them from falling across the derrick or mast.

6.12.2 Safety clamps used on drill collars, flush-joint pipe, or similar equipment to prevent them from falling into the well when not held by the elevators shall be removed from such equipment before hoisting continues.

6.12.3 Precautions should be taken to prevent pipe, drill collars, or similar round-shaped equipment pieces from accidentally rolling off the storage rack. Stops, pins, or chocks should be used.

6.12.4 When there is a possibility of an ice plug forming in the bottom of racked tubular goods stands, provisions should be made to allow good drainage from the racked tubulars. When going in the hole, an unsuspected ice plug in the tubulars may be blown upward and endanger the crew member. When environmental factors and/or conditions are conducive to ice plug formation, the use of a rabbit is recommended to verify that tubular stands are free of ice plugs before pipe is run in the hole.

6.13 HANDLING DRILLING FLUID CHEMICALS AND ADDITIVES

6.13.1 Asbestos shall not be used as a drilling fluid additive. Certain adverse personnel health effects are associated with asbestos. Other materials should be substituted for asbestos in the drilling fluid system. See the Foreword, and Asbestos warning page, in the front section of this publication for additional information concerning use of asbestos and alternate materials.

6.13.2 Personnel handling drilling fluid and additives should be instructed in the proper handling and disposal methods and personnel protection procedures. Guidance for proper handling and disposal of these materials is available from several sources, including the manufacturer's Material Safety Data Sheets (MSDS), and appropriate regulatory agencies.

7 Fire Prevention and Protection

7.1 FIRE PREVENTION

7.1.1 Safe storage and location of combustible and flammable materials and the prevention of accumulation of rubbish are important to fire prevention.

7.1.2 Smoking shall be prohibited at or in the vicinity of operations that constitute a fire hazard. Such locations should be conspicuously posted with a sign, "NO SMOKING OR OPEN FLAME," or equivalent.

7.1.3 Smoking shall be permitted only in areas designated for smoking.

7.1.4 Change rooms and other buildings where smoking is permitted should be located in areas designated safe for smoking.

7.1.5 Matches and all smoking equipment should be left in areas designated safe for smoking.

7.1.6 No source of ignition should be permitted in an area where smoking has been prohibited, unless it is first determined safe to do so by the supervisor in charge or his designated representative.

7.1.7 Potential sources of ignition should be permitted only in designated areas located at a safe distance from the wellhead or flammable liquid storage areas.

7.1.8 Only safety-designed (nonopened flame) heaters shall be permitted on or near the rig floor, substructure, or cellar. The safety features of these heaters shall not be altered.

7.1.9 Equipment, cellars, rig floor, and ground areas adjacent to the well should be kept free from oil and gas accumulations that might create or aggravate fire hazards.

7.1.10 Combustible materials such as oily rags and waste should be stored in covered metal containers and the covers kept in place.

7.1.11 Natural gas or liquefied petroleum gas shall not be used to operate spray guns or pneumatic tools.

7.1.12 Material used for cleaning should have a flash point of not less than 100°F (38°C).

7.1.13 Metal or other conductive material containers should be used in handling, storing, or transporting flammable liquids. The handling of flammable liquids in plastic containers is potentially dangerous due to static charge buildup. Metal parts on any plastic containers used in such service should be bonded to the fill connection. If plastic containers are used, the conductive fill connection or a grounded rod should be inserted prior to filling the container with any flammable liquid. See NFPA 77: *Static Electricity*; and API RP 2003: *Protection Against Ignition Arising Out of Static, Lightning, and Stray Currents*.

7.2 FIRE PROTECTION

7.2.1 Fire fighting equipment shall not be tampered with and shall not be removed for other than fire protection, fire fighting purposes, and services. A fire fighting water system may be used for wash down and other utility purposes so long as its fire fighting capability is not compromised.

7.2.2 Fire extinguishers and other fire fighting equipment shall be suitably located, readily accessible, and plainly labeled as to their type and method of operation.

7.2.3 Fire protection equipment shall be periodically inspected and maintained in operating condition at all times. A record of the most recent equipment inspection shall be maintained.

7.2.4 Drilling rigs shall have readily accessible, in good operating condition, not less than four (4) 20-pound capacity fire extinguishers with a Class BC rating (see NFPA 10: *Portable Fire Extinguishers*). This is a minimum requirement and operations may dictate use of more equipment or larger sized equipment.

7.2.5 Well servicing rigs shall have readily accessible, in good operating condition, a minimum of two (2) 20 pound capacity fire extinguishers with a Class BC rating (see NFPA 10). This is a minimum requirement and operations may dictate use of more equipment or larger size equipment.

7.2.6 Fire fighting equipment shall be readily available near all welding operations. When welding or cutting operations are performed in locations other than the designated welding area, a person shall be designated as a fire watch. Welding or cutting operations should be coordinated with other activities at the location.

7.2.7 Portable fire extinguishers shall be tagged with a durable tag showing the date of the last inspection, maintenance, or recharge. Inspection and maintenance procedures shall comply with NFPA 10.

7.2.8 Crew members shall be familiarized with the location of fire control equipment (such as drilling fluid guns, water hoses, and fire extinguishers) and selected personnel trained in the use of such equipment.

8 Flammable Liquids

8.1 CONTAINERS

8.1.1 Hand portable containers for storing flammable liquids should be Underwriters Laboratories (UL) or Factory Mutual (FM) approved, or equivalent.

8.1.2 Tanks, drums, and other containers containing flammable liquids should be properly labeled to denote their contents. See API Publ 2003: *Protection Against Ignition Arising Out of Static, Lightning, and Stray Currents*.

8.2 FUEL AND OIL TRANSFERS AND REFUELING

8.2.1 Fuel oil transfer procedures should be followed for over water transfers or refueling.

8.2.2 Hydrocarbon-fueled engines should be shut down during refueling operations unless such shutdown poses a greater danger to integrity of well operations, such as during well control procedures, tripping, or casing handling operations.

8.2.3 One person should be designated to gauge or monitor fuel tanks while they are being filled to prevent overfill and spillage.

8.2.4 During refueling operations, the filling nozzle should be kept in contact with the intake pipe to ensure grounding and prevent fuel spillage.

8.2.5 Equipment being refueled shall be grounded. See API RP 2003.

8.3 LIQUEFIED PETROLEUM GAS (LPG)

8.3.1 Handling, connecting, and transfer operations involving liquefied petroleum gas (LPG) shall conform to NFPA 58: *Standard for the Storage and Handling of Liquefied Petroleum Gases*, and NFPA 55, *Compressed and Liquefied Gases in Portable Cylinders*.

8.3.2 Ignition Source Control. Smoking or open flames shall not be permitted within 20 ft. (6.1 m) of any area where flammable, oxidizing, pyrophoric, or toxic compressed gases are stored or used.

8.3.3 Protective Caps. Where compressed gas cylinders are designed to accept valve protective caps, the user shall keep such caps on compressed gas cylinders at all times except when being filled or connected for use.

8.3.4 Where gas-tight valve outlet caps or plugs are provided, the user shall keep such devices on the valve outlet at all times except when compressed gas cylinders are being filled or connected for use.

8.3.5 Compressed or liquefied gas cylinders in use or in storage shall be secured to prevent them from falling or being knocked over.

8.3.6 Compressed gas cylinders should be transported, stored and used in an upright position.

8.3.7 Compressed gas cylinders exposed to fire shall not be used until they are requalified in accordance with the pressure vessel code under which they were manufactured.

8.3.8 Containers that show denting, bulging, gouging, or excessive corrosion shall be removed from service.

8.3.9 Repair or alteration of containers shall comply with the regulations, rules, or code under which the container was fabricated. Other welding shall be permitted only on saddle plates, lugs, or brackets attached to the container by the container manufacturer.

8.3.10 Compressed gas cylinders shall be marked or labeled in accordance with CGA C-7, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers*. Such markings or labels should not be removed.

8.3.11 Compressed gas cylinders shall not be placed where they could become a part of an electrical circuit.

8.3.12 Compressed gas cylinders shall not be exposed to temperatures exceeding 125°F (38°C). Cylinders shall not be subjected to direct heating to increase vapor pressure.

8.3.13 Stoves and heaters used with LPG fuel should only be used in well-ventilated areas. Personnel shall ensure proper ventilation exists before lighting the heater/stove. All hoses and connections on LPG stove or heater systems shall be checked frequently to ensure they don't leak.

8.3.14 Only qualified personnel should be allowed to fill LPG bottles. Protective gloves should be worn when refilling or replacing LPG bottles. There is a possibility of freeze burns if propane comes in contact with skin.

8.4 STORAGE

8.4.1 Flammable liquids storage areas within any building or shed should:

a. Be adequately ventilated to the outside air.
b. Have unobstructed exit(s) leading from the building.
c. Be maintained with due regard to fire potential with respect to housekeeping and materials storage.
d. Be identified as a hazard and appropriate warning signs posted.
e. Have a Class BC fire extinguisher (see NFPA 10) readily available.
f. Be properly classified for electrical installations in accordance with API RP 500 or API RP 505. If dispensing is done within the area, it shall be classified Class 1, Division 1.

8.4.2 Paint and solvents should be stored in an adequately ventilated area safely away from heat and ignition sources. Containers that are labeled "flammable" should be properly stored when not in use.

8.4.3 On land locations, flammable liquids should not be stored within 50 ft (15.2 m) of the wellbore, except for fuel in the tanks of operating equipment. Where terrain and location configuration do not permit maintaining this distance, equivalent safety measures should be taken. At offshore locations where this recommendation may be impractical, appropriate precautions should be taken.

8.4.4 On land locations, liquefied petroleum gas (LPG) tanks larger than 250 gal (0.95 m^3) should be placed at least 150 ft (45.7 m) from and parallel to the closest side of the rig, if terrain and location configuration permit. LPG tanks should be labeled to denote their flammable contents.

9 Drilling and Well Servicing Rig Equipment

9.1 GENERAL

9.1.1 Openings in the rotary table should be kept properly covered when not occupied by kelly drive bushing, pipe, or other equipment. The rathole and mousehole openings should be covered when the kelly or other equipment is not in the respective hole(s).

9.2 DERRICKS AND MASTS

9.2.1 Derricks, masts, and their auxiliary parts shall be substantially constructed to conform to good engineering practice and maintained in safe condition.

9.2.2 Derricks and masts should have a permanent name plate attached to the structure indicating the following:

a. Name of manufacturer.
b. Model number and serial number.
c. Rating including static hook load capacity with number of lines.
d. Whether guying is applicable and the recommended guying pattern.

If the manufacturer's guying requirements are not denoted on the name plate, the derrick or mast should be guyed in conformance with recommendations of API RP 4G.

9.2.3 Carrier-mounted masts should not be moved while in a raised position. This does not apply to skidding of a drilling rig or pole mast well-servicing rig.

9.2.4 A visual inspection of the raising and lowering mechanism shall be made by the person in charge prior to raising or lowering the mast.

9.2.5 Prior to raising or lowering any mast, all tools and materials not secured shall be removed from the mast.

9.2.6 The mast base should be level and properly positioned before raising, lowering, or telescoping the mast structure, and before tightening guylines.

9.2.7 A person qualified in procedures for raising and lowering the mast shall be in charge of raising or lowering operations. During raising or lowering operations, checks shall be made to assure that wire rope does not hang up on the braces or any other portion of the mast.

9.2.8 Bolts, nuts, and pins on elevators, wire rope, and catlines, as well as sheave and other anchor bolts in the derrick or mast, should be secured.

9.2.9 Only personnel required to carry out the operation shall be allowed in or under the mast unless it is in the fully raised or lowered position. No one other than the operator should be allowed on the carrier platform in the derrick or under the mast until well servicing units are fully scoped, raised, or lowered.

9.2.10 Prior to imposing any load on a derrick or mast, all required load guylines shall be properly tensioned.

9.2.11 During instances of unusual loading of the derrick or mast, such as when making any unusually hard pull, only the driller or other essential supervisory personnel should be on the rig floor, and no one should be in the derrick, mast, or cellar.

9.2.12 All derrick and mast platforms above the rig floor shall be constructed, maintained, and secured to the structure to withstand the weight of personnel and other stresses which may be placed on them.

9.2.13 Tools, parts, and other materials shall not be kept in the derrick or mast above the rig floor unless they are in use and precautions are taken to prevent them from falling.

9.2.14 Personnel should not work on the rig floor under the derrick or mast while repair work is in progress overhead unless their help is necessary for accomplishing the overhead job.

9.2.15 Except for the ladder opening, no unguarded openings large enough to permit a person to fall through should exist between the beams or main supports of the crown block.

9.2.16 If bumper blocks are used under the crown block beams, a safety cable or strap should be fastened along their full length with both ends secured to the derrick or mast. If bumper blocks are made of wood, they should be enclosed with a protective screen to prevent wood fragments from falling to the work floor area.

9.2.17 All counterweights above the rig floor, if not fully encased or running in permanent guides, shall have a safety chain or wire rope safety line anchored to the derrick or mast. Travel of tong counterweights should be limited to that necessary to provide optimum working elevations for the tongs.

9.2.18 Load-bearing, hydraulic-leveling jacks shall have a safety lock device, double valves, or equivalent.

9.3 LADDERS, STAIRWAYS, AND PLATFORMS

9.3.1 Each derrick and mast shall be equipped with a fixed ladder(s) providing access from the rig floor to the crown block platform and to each intermediate platform

9.3.2 Permanent ladders fastened to a derrick or mast shall be securely held in place at the top, bottom, and other points in between in accordance with manufacturer's specifications.

9.3.3 Permanently mounted ladders shall not lean back from the vertical.

9.3.4 The distance from the centerline of fixed ladder rungs, cleats, or steps to the nearest object behind the ladder should not be less than 7 in. The distance between ladder rungs should be uniform throughout the length of the ladder including the landing(s) and no more than 12 in. The minimum rung clear length should be 16 inches. When unavoidable obstructions are encountered, minimum clearances for the two rungs on either side of the obstruction should be measured vertically from the obstruction no less than 1.5 in. (3.8 cm) to the upper rung, and 4.5 in. (11.4 cm) to the lower rung.

9.3.5 Side rails of all fixed ladders should extend a minimum of 42 in. (106.7 cm) above any platform or landing. The ladder opening should be provided with a swinging gate or similar restraining device or offset so that a person can not walk directly into the opening.

9.3.6 Cages and landing platforms shall not be required where a personal fall arrest system is used.

9.3.7 Platforms shall be provided wherever fixed ladders are offset laterally, unless a personal fall arrest system is utilized.

9.3.8 All open stairways of four (4) or more risers shall be securely fastened and equipped with handrails and midrails extending the entire length of the stairway.

9.3.9 The width of tread and height of rise should be uniform throughout the length of a stairway and the treads should be level.

9.3.10 A minimum of two (2) stairways shall be installed on drilling rigs to provide alternate exits from the rig floor to ground level.

9.3.11 All personnel stairways, ladders, ramps, runways, and platforms should be kept free of objects and substances that may create a slipping or tripping hazard and hinder or prevent emergency egress of personnel. The rig floor should be kept in an orderly manner and free of such objects.

9.3.12 With the exception of the stabbing board, all platforms erected on the inside of the derrick or mast should completely cover the space from the platform working edge back to the legs and girts of the structure.

9.3.13 All derrick or mast platforms above the rig floor shall be secured, inset, or otherwise adequately protected against accidental dislodging during operations.

9.3.14 When personnel cannot perform necessary duties from ground level well servicing rigs should use a working platform around the wellhead. The platform should be of sufficient size and be so constructed that at least two (2) persons can work from it.

9.3.15 When a wellhead level working platform is in the folded (storage) position, the platform shall be secured with no less than two (2) fasteners of a safety type that will not vibrate loose or come loose accidentally. Safety hooks or other equivalent devices shall be used for this purpose.

9.3.16 Each finger of a finger board shall be bolted, welded, hinged-and-pinned, or attached by other equivalent means to its support beam.

9.3.17 Guardrails, consisting of 42 in. (106.7 cm) high (nominal) top rail, intermediate rail, and posts, should be installed at the outer edge of any floor, platform, or walkway, that is 4 ft (1.2 m) or more above ground level or another floor or working level. A runway of 4 ft (1.2 m) or more above ground level shall be equipped with a guardrail. Exceptions are as follows:

a. Personnel egress (exit and entrance) openings.
b. Catwalk and V-door opening when being used.
c. Work station being used to rack tubulars.
d. Alternate arrangements providing equivalent safety are acceptable.

9.3.18 Toeboards shall be provided in addition to handrails on open-sided floors, platforms, walkways, and runways under which persons can pass, or there is machinery or equipment into which falling materials can cause damage or create a hazard.

9.3.19 Standard toeboards should be a minimum of 4 in. (10.2 cm) in vertical height from the top edge to the level of the floor, platform, walkway, or runway. Toe boards should be securely fastened in place and have not more than $^1/_4$ in. (0.64 cm) vertical clearance between the bottom of the toeboard and the floor level. They may be constructed of any substantial material, either solid or with openings not to exceed one in. (2.54 cm) in greatest dimension.

9.3.20 Floor and deck openings should not be left unguarded.

9.3.21 Every floor hole into which persons might accidentally walk (on account of fixed machinery, equipment, or walls) should be protected by a cover that leaves no openings more than 1 in. wide. The cover should be securely held in place.

9.4 DRAWWORKS

9.4.1 A visual inspection of the drawworks and its easily visible moving parts should be made at least once each day.

9.4.2 The drawworks guard shall remain in place and in good condition when in operation.

9.4.3 Moving drawworks machinery shall not be lubricated while it is in operation.

9.4.4 The equipment operator shall not leave the drawworks brake without tying down the brake or securing it with

a catch lock, unless the drawworks is equipped with an automatic driller.

9.4.5 Shut-down switches for drawworks engines should be installed at the drawworks drum control console.

9.4.6 Brake systems on the drawworks should be inspected and properly maintained according to the manufacturer's recommendations.

9.4.7 A double (auxiliary) braking system should be installed on the drawworks of all drilling rigs.

9.4.8 Drilling rig drawworks should be equipped with a safety device which is designed to prevent the traveling block from striking the crown block. The device should be tested before each trip and after each drill-line slipping/cutting operation. The results of the operational test should be entered in the operations log.

9.5 CATHEADS AND LINES POWERED BY THE CATHEAD

9.5.1 If a cathead is mounted on the end of a shaft that projects beyond the guard for other moving parts of machinery, the shaft end, key, or other device for securing the cathead to the shaft shall be covered with a smooth thimble. The thimble cover shall be of such design that a rope cannot wind around it.

9.5.2 A cathead on which a rope is manually operated shall have a rope guide to hold the on-running rope in alignment with its normal running position against the inner flange. Clearance of the rope guide from the cathead should be based on size of the rope in use. Consult the equipment manufacturer for recommended rope guide clearance for the specific rope size being used.

9.5.3 Catheads shall be checked for grooves and rebuilt and turned when necessary to prevent fouling. Cathead groove depth should not exceed $^1/_4$ in. (0.64 cm).

9.5.4 Precautions shall be taken to prevent entanglement of other lines with a line in use on the cathead.

9.5.5 When a cathead is unattended, no rope or line shall remain wrapped on, or in contact with, the cathead.

9.5.6 The drawworks control shall be attended while a manually operated cathead is in use.

9.5.7 No rope splice shall be allowed to contact the cathead friction surface, with the exception of endless rope properly spliced.

9.5.8 A headache post or guard shall be provided for protection of the personnel at the drawworks control when the line is in close proximity to the operator during operation of lines powered by the cathead.

9.5.9 Personnel shall not be permitted to operate the cathead or lines powered by the cathead without receiving instruction in the use of this equipment.

9.5.10 Lines powered by the cathead should be of proper length and maintained in safe working condition.

9.5.11 Automatic catheads and their mechanism should be maintained in safe working condition.

9.5.12 When tubulars are being lifted using a pickup line or sling attached to hoisting lines or the traveling block (hook), care should be exercised that appropriate elevators, wire rope line(s), or sling(s) are used that will not slip off of the tubulars. On flush joint tubulars, lift nubbins should be used; and for sizes smaller than 7 in. (17.8 cm) outside diameter, the lines or slings should be double wrapped and hand tightened before the tubulars are lifted.

9.6 HOISTING LINES AND OTHER WIRE ROPE

9.6.1 All hoisting lines should be visually inspected at least once each day when in use. Hoisting lines should be thoroughly inspected once each month and a record made of the monthly inspection, designating any noted defects. See API RP 2D, for recommendations for wire rope inspection. See API RP 9B, for recommendations on application, care, and use of wire rope.

9.6.2 Wire rope used as running ropes should be removed from service when any of the following conditions exist:

a. Three (3) broken wires are found within one (1) lay length of 6 x 7 wire rope.
b. In other six (6) and eight (8) strand constructions:
   1. Six (6) randomly distributed broken wires are found within one (1) lay length.
   2. Three (3) broken wires are found in one strand within one (1) lay length.
c. In rotation-resistant constructions:
   1. Four (4) randomly distributed broken wires are found within one (1) lay length.
   2. Two (2) broken wires are found in one (1) strand within one (1) lay length.

9.6.3 Wire rope used as standing ropes, such as guylines, escape lines, and pendant lines should be removed from service when any of the following conditions exist:

a. Three (3) broken wires are found within one (1) lay length.
b. Two (2) broken wires are found at the end connection in the strand valley.

Other conditions to consider for removal of wire rope from service are:

a. Marked corrosion appears.
b. Corroded wires are observed at end connections.

c. End connections are corroded, cracked, bent, worn, or improperly applied.

d. Evidence of kinking, crushing, cutting, cold working, or bird-caging is observed.

9.6.4 When the hoisting line is wrapped on the hoisting drum, the end shall be securely fastened and there should be a sufficient number of line wraps remaining on the drum to eliminate strain on the fastening devices.

9.6.5 Deadline anchors for hoisting lines should be so constructed, installed and maintained that their strength equals or exceeds the working strength of the hoisting line.

9.6.6 When calculations indicate ton-mile limits have been reached, or visual inspection shows breaks, crushing, or damage, the wire rope shall be slipped, cut, or replaced. See API RP 9B, or the manufacturer's cutoff system for computation procedures.

9.6.7 A moving hoisting line under load shall not be allowed to come in contact with any part of the derrick or mast or other stationary equipment except at the crown block sheaves and traveling block sheaves.

9.6.8 The hoisting line should not be removed from the hoisting drum until the traveling block is rested on the rig floor or held suspended by a separate wire rope or chain.

9.6.9 Slings should have permanently affixed durable identification stating size, grade, rated capacity and reach.

9.7 HOISTING TOOLS, HOOKS, BAILS, ELEVATORS, AND OTHER RELATED EQUIPMENT

9.7.1 All hoisting tools and their component parts shall be substantially constructed to conform with good engineering practice and maintained in safe condition. Equipment specifications are contained in API Spec 8A: *Drilling and Production Hoisting Equipment*; and API Spec 8C: *Drilling and Production Hoisting Equipment (PSL 1 and PSL 2)*. Suggested inspection and maintenance procedures for hoisting tools are contained in API RP 8B: *Inspection, Maintenance, Repair, and Remanufacture of Hoisting Equipment*. Equipment manufacturers' specifications and recommended maintenance procedures should be consulted.

9.7.2 No element in the hoisting tool system should be subject to any load in excess of its design limitations.

9.7.3 The hoisting hook shall be equipped with a safety latch or other equivalent device to prevent accidental release of the load being hoisted or lowered.

9.7.4 Traveling blocks shall be properly guarded and shall not be operated unless guards are in place.

9.7.5 Crown block assemblies shall be adequately secured to prevent the sheaves from jumping out of bearings.

9.7.6 Traveling blocks should not be moved while the crown block is being lubricated.

9.7.7 The pump end of the rotary hose should be securely fastened to the derrick or mast by a cable or by a chain clamped to the hose and to the derrick or mast leg. The swivel end of the hose should be secured by a similar cable or chain, with the other end of the cable or chain affixed to the swivel.

9.7.8 Elevators, latches, latch locks, pins, and springs should be carefully inspected by rig crews and worn or damaged parts replaced so as to reduce the possibility of elevator malfunction and inadvertent release of the load (see API RP 8B for recommendations on inspection and maintenance of hoisting tools).

9.8 ROTARY

9.8.1 The operator shall not engage the power to begin rotation until the rotary table is clear of all personnel and materials.

9.8.2 Rotary table power shall not be used to accomplish initial breakout of tool joints. The rotary table can be used for spinning out joints once initial breakout is effected.

9.8.3 The kelly bushing shall be of smooth design to prevent catching or snagging of personnel, clothing, or material.

9.9 DRILL STRING HANDLING EQUIPMENT

9.9.1 Manual drill pipe slip handles and drill collar slip handles should be the original manufacturer's handles or equivalent. They should be short enough so they will not project beyond the master bushing when the slips are in position to hold pipe in the rotary table.

9.9.2 The tapered side of drill pipe slips should be lubricated to facilitate slip setting and removal. Slip dies should be clean and sharp.

9.9.3 Slips should not be kicked into place.

9.9.4 All tongs should be securely attached to a suitable fixed structure using wire rope or a stiff arm.

9.9.5 Fittings used to attach a back-up line to the back-up post or other fixed structure shall have a minimum breaking strength at least equal to the breaking strength of the cable attached to the fitting.

9.9.6 Tong safety lines should be of sufficient length to obtain full benefit of the pull from the breakout cathead, but short enough to prevent complete rotation of the tongs. Tong snub lines should be of such length that when securing pipe in the rotary table, a 90-degree angle is formed between the tong body and the snub line.

9.9.7 Tongs should be properly maintained. All tongs and tong heads including dies should be inspected for size and condition. Parts to be lubricated should be greased prior to every trip. Tong dies should be properly pinned in die slots.

9.9.8 Power tongs with front openings for putting the tongs on and off the pipe shall have front doors in proper working order.

9.9.9 Power tong pressure systems (hydraulic or air) should be equipped with a safety relief valve and operating pressure shall never be set higher than the manufacturer's specifications for any component of the system. The pressure should be set to apply the correct make-up to the pipe being run.

9.9.10 When working on power tongs, the power input pressure line should be disconnected.

9.10 WEIGHT INDICATORS

9.10.1 A weight indicator should be installed and used on all operating drilling rigs and well servicing rigs intended to manipulate tubulars. The indicator should be so constructed, installed, and maintained that it will register a close indication of the hook load suspended (within 5% of the maximum hook loading).

9.10.2 The weight indicator system should be checked periodically for calibration by comparing its reading with the calculated drill string or tubing string weight, with adjustments made as necessary.

9.10.3 The weight indicator should be mounted so that the gauge is easily visible to the operator standing at the brake position.

9.10.4 When the weight indicator is installed above the rig floor, it should be securely fastened to prevent it from falling. The load cell should be secured by a separate safety line.

9.11 DRILLING FLUID TANKS

9.11.1 On land locations, pits and tanks used to circulate flammable materials should be located a minimum distance of 100 ft (30.5 m) from the well. Equivalent safety measures should be taken where terrain and location conditions do not permit maintaining such distance.

9.11.2 All fixed drilling fluid guns used for jetting shall be pinned or hobbled when in use and unattended.

9.11.3 When necessary for personnel to enter a drilling fluid tank that may contain hazardous or toxic substances, applicable provisions for entering confined space shall be followed.

9.11.4 Electric motor driven blowers used for ventilation should be of an appropriate electrical classification for the area in which they are located (see API RP 500 and API RP 505).

9.11.5 Enclosed mud pit rooms should have adequate ventilation, ventilation alarms, and gas detectors.

9.12 PIPE RACKS AND PIPE TUBS

9.12.1 Pipe should be handled at the ends during manual pipe loading and unloading operations and transfer between pipe racks or pipe tubs.

9.12.2 Personnel should not pass between the pipe rack or pipe tub and a pipe truck or trailer during loading, unloading, or transfer operations.

9.12.3 Provisions should be made to prevent pipe from accidentally rolling off pipe racks or pipe trucks. Pipe should be loaded and unloaded layer-by-layer, with each completed layer pinned or blocked securely on all four (4) corners of the pipe rack.

9.12.4 During transfer operations between the truck and pipe racks, temporary supports for skidding or rolling pipe should be constructed, placed, and anchored to support the load to be placed on them.

9.12.5 On all pipe racks, all layers of pipes should be stripped with 2 x 4 board or equivalent.

9.13 PRESSURE EQUIPMENT

9.13.1 Air receivers shall be designed, installed, and used in accordance with Section VIII of the *ASME Boiler and Pressure Vessel Code*.

9.13.2 Pressure relief valve discharges should be located and anchored so as to prevent a hazardous condition due to sudden discharge or piping movement.

9.13.3 Each section of a high pressure rigid line should be secured using appropriate means to prevent movement should the line fail. Flexible high pressure hoses should be properly secured to prevent unsafe movement. Other suspended hydraulic, air, or electrical lines should be appropriately secured.

9.13.4 In normal operations, pumps, piping, hoses, valves, and other fittings shall not be operated at pressures greater than their rated working pressure and shall be maintained in good operating condition. Test pressures shall not exceed the design test pressure. Pumps, piping, hoses, and pressure relief devices shall be designed to meet the requirements of the operating conditions to be encountered.

9.13.5 Hammer unions shall be made up of like halves with the same pressure ratings and thread type. Many connecting threads look alike, but will fail under working conditions.

9.13.6 Pressure relief devices shall be set to discharge at a pressure equal to or less than the rated working pressure of any pump, piping, hose, or fitting that the devices protect.

9.13.7 The inside diameter (ID) of piping on the pressure and discharge side of pressure relief devices shall at least equal the ID of the pressure relief devices. The piping shall be such as to prevent obstructions and minimize restrictions to flow.

9.13.8 Positive displacement pumps shall be equipped with pressure relief devices that discharge to the circulation system or other acceptable location.

9.13.9 Automatic air pressure controls should be provided for operations such as air cleaning, sandblasting, etc.

9.13.10 All pump houses should be equipped with two (2) exit doors that lead in different directions to the outside.

9.13.11 Shear-pin pressure relief valves shall have the valve stem and shear pin enclosed to prevent accidental contact and to prevent the shear pin from flying when sheared. The enclosure shall be so designed and attached that it cannot fly off. Only the correct shear pin shall be used when replacement is necessary.

9.14 GENERATORS, MOTORS, AND LIGHTING

9.14.1 All electrical conductors and switch gear shall be sized in accordance with NFPA 70.

9.14.2 Rig generators on land locations should be located at least 100 ft (30.5 m) from the wellhead upwind considering the prevailing wind direction to isolate a possible source of ignition. Equivalent safety or protection measures should be taken where terrain, location, or rig configuration conditions do not permit maintaining such distance.

9.14.3 All generators should have an overload safety device that will provide protection from shorting and burnout.

9.14.4 When adequate illumination cannot be made available by other means, safe portable lights should be provided. Where possible, floodlights in use should be placed in positions so as not to impair vision of persons in the work area. Operations should not be performed using vehicle headlights as a substitute for rig lighting.

9.14.5 All electrical extension cords shall be properly insulated and plugs shall be in good condition.

9.14.6 Rig lighting and fixtures shall be of appropriate electrical classification for the area in which they are located. See API RP 500 and API RP 505.

9.14.7 Light fixtures should be placed and maintained to provide illumination for work areas in conformance with ANSI/IES RP7 1988: *Industrial Lighting*.

9.14.8 The shale shaker motor and area within 5 ft (1.5 m) shall have Class 1, Division I safeguards as described in API RP 500. The shale shaker motor shall be a type approved for Class I Division I service (see API RP 500) and maintained in accordance with the requirements of this classification.

9.14.9 Repairs to electrical equipment shall not be performed unless the power source has been isolated and the control has been locked out/tagged out, and the person making the repairs is authorized to do so.

9.14.10 Rig lighting equipment in the derrick or mast, tanks, and on the rig floor, not specifically addressed in API RP 500 or API RP 505 should be enclosed and gasketed.

9.14.11 Electric motors, generators, and control panels shall be grounded.

9.15 INTERNAL COMBUSTION ENGINES

9.15.1 Emergency shut-down devices that will close off the combustion air should be installed on all diesel engines.

9.15.2 Rig power emergency shut down devices should be actuation checked no less than once weekly to determine that they are in proper working condition. All other internal combustion engine shutdown devices should be actuation-checked no less than once each thirty (30) days.

9.15.3 Spark arrestors or equivalent equipment shall be provided on all internal combustion engine exhausts located within 100 ft (30.5 m) of the wellbore.

9.16 INSPECTION OF CRITICAL EQUIPMENT

9.16.1 Critical equipment should be periodically inspected as recommended by the manufacturer or in accordance with recognized engineering practices.

9.16.2 When using nondestructive testing (NDT) methods, certified inspectors per API 510 should conduct the tests in accordance with recognized methodology and acceptance criteria. Certified NDT inspectors shall be trained per ASNT RP No. STN-TC-1A.

9.16.3 Other types of inspection should be conducted by qualified personnel.

10 Drilling and Well Servicing Rig Electrical Systems

10.1 WORK IN PROXIMITY TO EXPOSED ENERGIZED POWER SOURCES

10.1.1 Neither equipment nor machines on rigs (includes guylines) should be operated closer to power lines than the recommended minimum clearances shown in Table 2, except when such lines have been deenergized and visibly grounded or when barriers are present to prevent physical contact with the lines.

Table 2—Recommended Minimum Clearances Between Power Lines and Derricks, Masts, or Guylines

Rig Status	Line Voltage, Volts	Minimum Clearance, ft.
Operating rigs	All	10 ft plus 4 in. for each additional 10 kV over 50 kV
In transit (lowered mast)	less than or equal to 50 kV	4 ft (1.2 m)
	greater than 50 kV	4 ft plus 4 in. for every additional 10 kV

10.1.2 An individual should be designated to observe equipment clearance as defined in Table 2. The operator should notify the observer if he is having any difficulty in determining the clearance. The observer should sound a warning at any time the clearance is not maintained.

10.1.3 When cage-type boom guards, insulating guylines, insulating links, or proximity warning devices on rigs or guylines are used, the recommendations of Table 2 are applicable.

10.1.4 Overhead wires should be considered energized (live) unless either the electrical system owner reports them to be non-energized, or a qualified electrical person tests and finds them to be non-energized.

10.2 RIG ELECTRICAL SYSTEMS EQUIPMENT

10.2.1 Electrical equipment used in hazardous locations should be designed for such locations, and listed by a nationally recognized testing laboratory. All wiring components and electrical equipment should be maintained in accordance with the manufacturer's recommendation.

10.2.2 Because of exposure to vibration and frequent rig moves, maximum use should be made of flexible electrical cord. Such cord should be of a type designed for industrial use, and resistant to dampness and petroleum products.

10.2.3 Rig wiring should be installed so as to protect it from abrasion, being subjected to vehicular and foot traffic, burns, cuts, and damage from other sources.

10.2.4 Wiring should be replaced or properly repaired and sealed as necessary when insulation damage is detected. Because of fire and other hazards, makeshift wiring components and installations shall not be used.

10.2.5 Wiring on drilling and workover rigs used on platforms in offshore waters should be in accordance with API RP 14F.

10.3 CLASSIFICATION OF AREAS

10.3.1 Area classifications determine the type of and maintenance requirements for electrical equipment on drilling and well servicing rigs under normal operating conditions. When special service operations are being performed, the recommendations for electrical installations under the conditions of service should be followed. See API RP 500 and RP 505 for details of various area classifications.

Note: Adequate ventilation as used in this section is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentrations over 10% of the lower explosive limit. See NFPA 30: *Flammable and Combustible Liquids Code (1993)*, for additional details. See API RP 500 for discussion of methods for achieving adequate ventilation. Enclosed areas (rooms, buildings, or spaces) that are provided at least one (1.0) cubic foot of air volume flow per minute per square foot of floor area, but at least six (6) air changes per hour, can be considered as adequately ventilated. The ventilation rate can be accomplished by either natural or mechanical means. See API RP 500 for additional information on ventilation verification and classification of areas.

11 Pumping Units

11.1 WELL PUMPING UNITS

11.1.1 Electric power to the pumping unit should be deenergized a sufficient distance from the wellhead to eliminate potential electrical hazards during well servicing operations. In confined locations, overhead electric power to the pumping unit control panel should be deenergized. Where necessary, electric power service should be deenergized while moving the rig in or out and during rig-up and rig-down operations.

11.1.2 When well servicing operations are to be performed, the pumping unit should be turned off, the brake set, and where applicable, the power source locked out/tagged out.

11.1.3 If the pumping unit is stopped with counterweights in other than the down position, additional means to secure the beam to a fixed member of the pumping unit shall be used to prevent any unintended movement of the counterweights or beam.

11.1.4 Chain or wire rope sling of suitable strength should be used to handle the horsehead if removal or installation operations are necessary. On installation, the horsehead should be bolted or latched in accordance with the manufacturer's specifications.

11.1.5 Upon completion of well servicing operations and before energizing the power source, precautions shall be taken to ensure that all personnel and equipment are clear of the weight and beam movement.

11.1.6 Brake systems on all pumping units in service should be maintained in safe working order.

11.1.7 After well servicing operations are completed all pumping unit guards and enclosure guards (belt and motor sheaves) should be reinstalled prior to startup. Guards need not be in place until all final adjustments (pump, spacing, etc.) are made, so long as the safety of personnel is not compromised.

12 Special Services

12.1 GENERAL

12.1.1 The supervisor of the special service should hold a pre-job meeting with his crew, and others if applicable, to review responsibilities for the operation(s) to be performed.

12.1.2 On multiple-completion wellheads, extreme caution should be taken to eliminate the chances of errors in opening and closing valves. Each tubing string of multiple completion wellheads shall be identified by marking.

12.1.3 Fire extinguishers should be placed in accessible positions.

12.1.4 Welding operations should not be performed in the immediate wellhead area during wireline operations.

12.1.5 Wherever possible, the service unit(s) should be located on the upwind side of the wellhead and spotted where the crew has optimum visibility and can work unobstructed.

12.1.6 Precaution(s) should be taken to prevent personnel or vehicles from crossing under or over wirelines or pressurized lines.

12.1.7 No personnel should be permitted between the wireline unit and the wellhead at a distance closer than 6 ft (1.8 m) to the line when the wireline is moving.

12.1.8 Discharges of oil or gas to the atmosphere should be to a safe area, preferably on the downwind side of the well and a minimum of 100 ft (30.5 m) from the wellhead, open flame, or other sources of ignition. At locations where this recommendation may be impractical, appropriate safety measures should be implemented.

12.1.9 A frozen, plugged, or pressurized flow line should not be flexed or hit.

12.1.10 Wireline wipers should be adequately secured.

12.1.11 Oil savers should be adjusted only by remote control while the wireline is in motion.

12.1.12 When tubing is being hydrostatically tested above the rig floor, slips should be set and personnel should stand clear while pressure is applied.

12.2 EQUIPMENT

12.2.1 Service unit engines should be equipped with an emergency shutdown device that is conspicuously labeled and easily accessible.

12.2.2 Tanks for flammable materials should be set so that if tanks leak or a spill occurs, fluid will drain away from the well and equipment. Provisions should be made to contain any leaked fluid.

12.3 COMMUNICATIONS

12.3.1 All equipment should be located so that equipment operators can see the personnel involved in the operation; or alternate specific arrangements should be made to assure adequate communication.

12.3.2 Signals between supervisors, personnel, and other involved persons should be agreed upon and fully understood prior to initiation of operations.

12.3.3 Communications equipment should be in good working order before commencing operations.

12.4 DISCHARGE LINE (TEMPORARY TREATING OR CEMENTING LINES)

12.4.1 Discharge lines should not be placed under any mobile equipment.

12.4.2 Discharge lines (pressure lines) should include sufficient flexible joints to avoid line rigidity and minimize vibration at the wellhead.

12.4.3 When using an open-ended flow line to flow or bleed-off a well, the line should be secured at the wellhead, at the end of the flow line, and at intermediate intervals along the line to secure each joint. The flow line should be anchored prior to opening the wellhead control valve.

12.4.4 All pressure should be bled from line(s) prior to breaking out or rigging down the line(s).

12.4.5 After hazardous substances have been pumped, prior to rigging down, all lines should be flushed.

12.5 LUBRICATOR OPERATIONS

12.5.1 Lubricators, swages, and unions shall be visually inspected for defects prior to use. Any defects that may affect safe operations (i.e., cuts, corrosion, thread damage) shall be corrected prior to installation.

12.5.2 Prior to the job, all lubricator equipment, swages, unions, and valves should be pressure tested to the maximum

anticipated pressure, but not to exceed the rated working pressure of the equipment with the lowest rated working pressure.

12.5.3 Each lubricator should be equipped with one or more bleed valve(s).

12.5.4 All valves and gauges should be checked to determine if there is pressure on the lubricator before working on or removing it.

12.5.5 When a lubricator is installed on a wellhead, an outlet below the lubricator should be provided for well control operations.

12.5.6 When downhole tools are being run on a wire line into wells, a lubricator or other control device should be used to permit isolation of tools from well pressure and allow removal of tools.

12.5.7 Only personnel essential to the conduct of ongoing operations should be permitted near the pressurized lubricator, flow lines, and wellhead.

12.5.8 All wellhead adapters, wireline valves, and lubricating equipment should be operated within their working pressure rating.

12.5.9 Hammering or otherwise striking a lubricator or connection should not be permitted while they are subjected to pressure.

12.5.10 Threaded connections or unions on lubricators should not be loosened or tightened while they are subjected to pressure.

12.5.11 Lubricator bleed valves should be cycled (open, close, open) after the pressure has been bled down to determine that ice or some other foreign matter is not plugging the valve openings.

12.5.12 When handling the lubricator with a rig catline, air hoist, or other type hoisting equipment, the line should be snug against a union. The catline or hoist line should not be tied in the middle of a section of lubricator.

12.5.13 When breaking a quick-thread union that is secured with a single bolt, the bolt shall be left in place with at least one full nut of threads engaged until after the union has been knocked loose. Before removing the nut, the connection should be moved to determine that the ring seal is broken and pressure has been released.

12.5.14 Due to the nature of wireline operations and where the lubricator shall support the wireline load, relatively high loads can be placed on an unsupported (free standing) lubricator assembly. The stress resulting from side loading is normally highest at the point where the lubricator assembly is connected to the well. The lubricator assembly should be adequately supported and/or properly guyed to reduce the side loading effect of wireline operations.

13 Wireline Service

13.1 GENERAL

13.1.1 All applicable recommended practices of other Sections of this publication, in addition to the practices under Section 13, apply to wireline service operations.

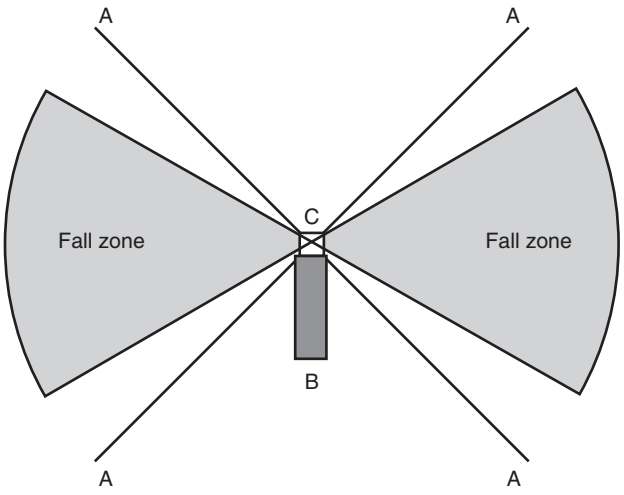
13.2 PLACEMENT AND HANDLING OF WIRELINE SERVICE UNITS

13.2.1 If fracturing or hot oil units are on the location, wireline units should be spotted as far away from them as practicable. The wireline unit should be spotted so a path of emergency exit from the operating compartment faces away from the fracturing or hot oil units. During land operations, all wireline units, other vehicles, or portable houses should be placed outside the guywires of the well service unit and outside the fall lane of the derrick represented by 2:00 o'clock to 4:00 o'clock, and 8:00 o'clock to 10:00 o'clock on each side of the rig. (see Figure 1).

13.2.2 Mobile wireline service units working on land locations shall be chocked or secured to prevent movement.

13.2.3 Portable or skid-mounted wireline service units should be secured to prevent any unwanted movement of the unit when a load is taken on the lines.

13.2.4 A wireline service unit should be spotted in such manner that it will not interfere with the entrance or exit of personnel from that unit or other service units.



Note: Not to scale.

Figure 1—Guyline Anchor Locations Outside the Fall Zones

13.3 GIN POLES (TELESCOPING AND SINGLE POLES)

13.3.1 A gin pole should be attached to the wellhead or Christmas tree with a chain and ratchet load binder or other suitable device in such a manner that it will not move when the load is being handled. Devices used to attach the gin pole to the wellhead or Christmas tree should be of such size and strength to support the anticipated load to be handled.

13.3.2 When the gin pole and rope falls (block and tackle) are being used to lift the lubricator or any other heavy object(s), the load should be pulled from as near a vertical position as practicable.

13.4 ROPE FALLS (BLOCK AND TACKLE)

13.4.1 Rope and blocks should be of such size and strength to support the anticipated load to be handled.

13.4.2 Splices should not be used in the entire length of rope except where the dead end is tied off.

13.4.3 The rope should be inspected at the beginning of each job to determine that it has not been damaged or weakened. Damaged or weakened rope should be replaced.

13.4.4 The blocks should be inspected at the beginning of each job for shaft wear, condition of bearings, and damaged or worn sheaves that might cause rope damage. Blocks showing excess wear or damage should be replaced.

13.4.5 The lower wireline sheave should be secured by a wire rope sling or equivalent. (The wire rope sling should be inspected for defects prior to use.) The sheave should be attached to primary rig beams, blowout preventer, wellhead, or other permanent stable fixtures. Pinch points on lower sheaves should be guarded.

13.4.6 Pins used in makeup of sheave wheels should be mechanically secured.

13.5 WELLHEADS, WELLHEAD CONNECTIONS, AND ADAPTERS

13.5.1 Wireline equipment should not be rigged up on any wellhead if the surface pressure exceeds or is expected to exceed the maximum rated working pressure of the wellhead and wellhead equipment.

13.5.2 In wireline operations where the weight and pull of the tools are to be supported by the lubricator, the adapter from the wellhead to the lubricator equipment should be constructed for the intended service.

13.6 LUBRICATORS AND WIRELINE BLOWOUT PREVENTER EQUIPMENT

13.6.1 All lubricator equipment should be manufactured and fabricated in accordance with the test/ working pressure of the equipment to which it is attached, using a reasonable safety factor (see API Spec 6A: *Wellhead and Christmas Tree Equipment*). Should the anticipated surface pressure be considerably less than the rated working pressure of the equipment to which a lubricator is being attached, the test/working pressure ratios should be maintained and equipment rated to the maximum anticipated surface pressure, provided a reasonable design safety factor has been considered. If welding is employed in the fabrication of the lubricator, all welding procedures, welders, and welding operators should be qualified in accordance with the procedures and testing methods of Section IX, *ASME Boiler and Pressure Vessel Code*. Metals used in welding operations that are not presently classified under the ASME number base metal groupings should be qualified under methods shown in Section IX. The manufacturer is responsible to justify any base metal and/or filler metal groupings that are not classified in Section IX.

13.6.2 A periodic drift, visual, and pressure test check of all sections of the lubricator shall be made at intervals not to exceed twelve (12) months. The equipment pressure test shall be effected using ambient temperature water or other suitable fluid to a minimum of the lubricator rated working pressure. The wireline blowout preventer shall be tested in the open and closed positions.

13.6.3 All pressure tests should consist of three parts: (a) a primary pressure holding period; (b) reduction of pressure to zero; and (c) a second pressure holding period. Both pressure holding periods should be a minimum of three (3) minutes, with the time starting when the test pressure has been reached stabilized and the external surfaces have been thoroughly dried. Each periodic test shall be documented.

13.6.4 The rated working pressure of all sections of the lubricator, including stuffing box, wireline valve connections, and adapters should not be exceeded.

13.6.5 Each high pressure [over 5,000 psi (34.5 MPa) rated working pressure] lubricator, wireline valve, oil saver, and stuffing box should conform to the following:

a. Lubricators should have a minimum of two (2) bleed valves located on the main body on the lower end of the bottom section. Two (2) bleed valves should be opened when bleeding pressure from the lubricator.

b. Nondestructive testing, such as surface nondestructive examination and visual inspection, shall be effected on lubricators, stuffing boxes, valves, connections, and adapters at intervals not to exceed every twelve (12) months. A copy of the inspection certificate(s) shall be kept on file for future reference.

c. Each section of a lubricator shall be marked for identification purposes with a permanent serial number and its maximum rated working pressure. Marking shall be done in a manner that will not reduce the maximum rated working pressure of the lubricator.

13.6.6 Materials to be used in a service that could cause sulfide stress cracking shall meet the requirements of NACE Standard MR0175: *Requirements for Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment.*

13.7 WIRELINE OPERATIONS

13.7.1 When handling a wireline that will recoil when released, the loose end should not be left unsecured.

13.7.2 If slack line occurs while tools are in the hole, the wireline should be clamped off at the wellhead prior to working with the slack line.

13.7.3 Wire rope or chain should be used to tie off the wireline clamp. The clamp should be held with a device capable of withstanding any load to which it may be subjected.

13.7.4 Hands, rags, and other objects should be kept clear of sheaves while the line is in motion.

13.7.5 Mast or gin pole truck(s) used in wireline operations should be moved from one location to another and driven on public roads with the mast or pole(s) in a stored and properly secured position.

13.7.6 Gin poles mounted on trucks shall be secured when the poles are in a vertical or semi-vertical position.

13.7.7 If a top or side-opening compartment door on a wireline service truck is left open during operations, it should be latched or fastened so that wind or vibration of the truck cannot cause it to close or fall.

13.7.8 Use, storage, and transportation of radioactive materials shall comply with applicable standards and regulations.

13.8 PERFORATING

13.8.1 The special service supervisor should hold a pre-job meeting with the special service crew and other involved persons to review responsibilities for the operation(s) to be performed.

13.8.2 While perforating operations are being conducted, all engines, motors and any other source of ignition not essential to the operation should be shut down until the explosive device has been lowered into the well to a depth of 200 feet or more.

13.8.3 All equipment should be located so that equipment operators can see the personnel involved in the operation, or alternate specific arrangements should be made to assure adequate communications. Signals between supervisor, perforating personnel, and other involved persons should be agreed on and fully understood prior to initiation of operations. Communications equipment to be used should be in good working order before commencing operations.

13.8.4 A lubricator should be used during perforating operations whenever pressure at the wellhead may be anticipated. The lubricator shall allow removal of the perforating device when the master valve or blowout preventer is closed.

13.8.5 During wellbore operations, devices containing explosives (perforating guns, line cutters, etc.) shall be handled only by or at the direction of personnel of the service contractor performing the operations.

13.8.6 Electrical grounding between the wellhead, service unit, and rig structure shall be made prior to operating tools using explosives with electric blasting caps. Periodic checks shall be made to determine that all units are grounded.

13.8.7 Assemble the guns (without arming them) in a suitable area, such as on the catwalk or end of the piperack. Establish a restricted area for arming the guns which is free of potential activation sources such as electrical devices, stray current, etc., and post "DANGER—EXPLOSIVE" signs around the area.

All unnecessary personnel shall be kept away from perforating guns and other devices containing explosives while they are being armed, placed in the well, removed from the well, and disarmed. See API RP 67, *Oilfield Explosives Safety.*

13.8.8 Guns shall always be electrically armed before being ballistically armed.

13.8.9 Precautions should be exercised in explosive operations to prevent radio frequency radiation hazards. Warning signs should be posted or other appropriate measures taken so that radio and radar frequency units will be shut off when within hazardous distances of explosive operations. See IME Safety Publication No. 20: *Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electrical Detonators (Blasting Caps)*; and IP's *Recommended Practice for Radio Silence When Conducting Wireline Services Involving the Use of Explosives*, for recommended distances for posting signs and shutting off radio, radar, and cellular telephone frequency transmitting units.

Transmitter Power	Minimum Safe Distances
1 – 50 watts	250 feet
51 – 250 watts	500 feet
251 – 1,000 watts	1,000 feet
1,001 – 10,000 watts	2,500 feet
10,001 – 50,000 watts	5,000 feet
50,001 – 10,000 watts	7,500 feet

Note: If the detonator used by the service company is a safe detonating type, industrial microwave telephone and data communication equipment using directional dish or grid antennae that face away from the explosive operation may, with the concurrence of the service company representative on site, remain in service.

13.8.10 Perforating operations using electric blasting caps should be suspended, or loaded guns safely isolated, if electrical storms or sand storms are imminent in the job area.

13.8.11 Instruments used for testing detonators, electric blasting caps or blasting circuits shall be specifically designed for this work. These instruments are specifically labeled by their manufacturers as "Blasting Ohmmeter," "Blaster's Ohmmeter," "Blaster's Multimeter," "Blasting Galvanometer," etc. For more specific detailed technical information, contact the Institute of Makers of Explosives.[6]

13.8.12 Shortcuts such as circuit jumpers or wired-around switches should not be used on perforating equipment.

13.8.13 Circuit alterations should not be made while the perforating gun is attached to the cable head, unless the gun is two hundred (200) feet or more down the wellbore.

13.8.14 When checking cable continuity using service unit electric current (AC or DC) or multimeter, the cable head or end of the cable should be located in the vicinity of the unit where the person applying the current can see the cable head or cable end.

13.8.15 Prior to arming any type of perforating gun, the conductor wire and armor should be temporarily shorted to eliminate any capacitance charge that may exist in the cable.

13.8.16 Detonating cord should be separated from blasting caps prior to assembly on location. Caps and boosters should be crimped only with an approved crimper. Detonating cord should be cut with a sharp blade and should not be cut with diagonal or shearing-type cutters.

13.8.17 Blasting caps and boosters shall be transported in approved cap boxes for all modes of transportation (highway, water, rail, and air). Only caps and boosters for immediate use should be removed from the cap box. The cap leg wires should remain shunted until the time the cap is wired into the circuit.

13.8.18 When checking and/or arming an electrical blasting cap, it shall be enclosed in a safety tube.

13.8.19 Upon completion of perforating operations, all explosive materials and scraps should be removed from the site by the perforating service company personnel.

13.9 SWABBING

13.9.1 While swabbing operations are being conducted, all engines, motors, and any other possible sources of ignition not essential to the operation should be shut down.

13.9.2 When swabbing, the swabbing line should be packed off at the surface so that fluids are routed through a closed flow system to the maximum extent possible.

13.9.3 Swabbing operations should be conducted during daylight hours.

13.9.4 The swabbing unit should be positioned upwind of any swab tanks or pit.

13.10 BAILING

13.10.1 Hydrostatic bailers should be secured prior to dumping. Sudden release of high pressure may cause the bailer to whip.

13.10.2 Hydrostatic bailers should not be opened until all personnel are clear of the discharge orifice.

14 Stripping and Snubbing

14.1 GENERAL

14.1.1 All applicable recommended practices of other sections of this publication, in addition to the practices under Section 14, apply to stripping and snubbing operations.

14.2 OPERATIONS

14.2.1 The special service supervisor should hold a pre-job meeting with the special service crew and other involved persons to review responsibilities for the operation(s) to be performed.

14.2.2 An individual escape line should be rigged and available for each person working atop hydraulic snubbing equipment.

14.2.3 Gasoline engines and other possible sources of ignition should be located at least 100 ft (30.5 m) from the wellbore during snubbing operations. At locations where this recommendation may be impractical, appropriate safety measures should be implemented.

14.2.4 Prior to commencing snubbing operations, the snubbing work platform shall be guyed if not otherwise supported.

14.2.5 Pumps, power packs, tool boxes. doghouses, etc., should be located away from flow lines or bleed-off lines in the event one of these lines should burst

14.2.6 Pump units should be located where the pump operator can be seen by the snubbing operator. When this is impossible, two-way voice communications should be established.

14.2.7 Well pressure should be monitored at all times.

14.2.8 All pipe snubbed into the wellbore should have at least one back pressure valve or blanking plug installed in the pipe string. A back pressure valve or blanking plug installed in a landing nipple, preferably located near the lower end of the pipe string, is one means of meeting this practice.

14.2.9 Snubbing operations should not be performed while welding is being done in the immediate vicinity of the wellhead.

14.2.10 The volume of all fluids pumped into or bled from the well during any snubbing or stripping operations should be measured.

14.2.11 All personnel should be made aware of the established maximum pressure limit under which safe stripping procedures are permissible.

14.2.12 All tool joints or other connections should be lubricated as they go into the hole.

15 Drill Stem Testing

15.1 GENERAL

15.1.1 All applicable recommended practices of other sections of this publication, in addition to the practices under Section 15, apply to drill stem testing operations.

15.2 PRELIMINARY TO DRILL STEM TEST

15.2.1 The operator's representative in charge should hold a pre-job meeting with the crew and other involved personnel to review responsibilities for the operations to be performed.

15.2.2 Any engine within 100 ft (30.5 m) of the well (within 35 ft of the well for offshore) should not be operated during the drill stem testing operations without having a heat and spark arresting system for the exhaust.

15.2.3 Measures should be taken to exclude unauthorized personnel from the area during drill stem testing operations.

15.2.4 Drilling fluid density and viscosity should be checked and maintained within specified limits to minimize blowout possibilities.

15.2.5 A fill-up line should be installed to keep the casing full of drilling fluid, and should be used only for this purpose. Provisions for the kill line should be made separately.

15.2.6 Test line connections to the control head should be secured.

15.2.7 Every test head used above the rig floor should be attached to the elevator links by safety cable or chain.

15.2.8 One or more reversing valve(s) should be incorporated in the test tool assembly.

15.2.9 The swivel/top drive and kelly hose should not be used as part of the test line.

15.2.10 A safety valve of proper size and thread configuration to fit the test string and a properly sized wrench should be readily available on the rig floor for emergency use.

Note: A safety valve should not be used in the test string as a pressure control device.

15.2.11 A test line should be laid to a reserve pit or test tank and anchored. If the drill stem test recovery is to be flared as produced, more than one pilot light may be needed to assure that ignition is achieved under both high velocity and low velocity discharge conditions.

15.2.12 If hydrogen sulfide is suspected or known to be present in the area, the applicable recommendations of API RP 49, and API RP 68.

15.3 PERFORMING THE DRILL STEM TEST

15.3.1 Fluid volume in the casing should be monitored while going in and coming out of the hole to assure that the well remains under hydrostatic control.

15.3.2 The mud bucket (mud box) should be hooked up and ready for use before the drill stem test tool is pulled out of the hole.

15.3.3 The rig floor should not be left unattended during the drill stem test.

15.3.4 Test tools should be initially opened only in daylight hours. The drill stem test tool should not be pulled out of the hole after dark unless all test fluids have been pumped out of the test string.

15.3.5 The fluid level in the annulus should be checked regularly throughout the test to ensure the packer is holding and gas is not leaking into the annulus from the test string.

16 Acidizing, Fracturing, and Hot Oil Operations

16.1 GENERAL

16.1.1 The operator's representative in charge should hold a pre-job meeting with the crew and other involved personnel to review the operations to be performed.

16.1.2 All applicable recommended practices of other sections of this publication, in addition to the practices under Section 16, apply to acidizing, fracturing, and hot oil operations.

16.1.3 All trucks and tanks should be located a minimum of 100 ft (30.5 m) upwind from the wellhead, or equivalent safety measures should be taken where terrain, location, or other conditions do not permit. At locations where this recommendation may be impractical, appropriate safety measures should be implemented.

16.1.4 All lines connected from the pumping equipment to the Christmas tree or wellhead should have a check valve installed as close to the well as practicable. In addition, when a multi-pump manifold is used, a check valve should be placed in each discharge line as close to the manifold as possible.

16.1.5 When used, recording equipment should be located a safe distance from the wellhead and discharge line.

16.1.6 When pumping flammable fluids, all blending equipment used should be grounded and all equipment unloading sand into the hopper should be bonded to the blending equipment.

16.1.7 When pumping flammable fluids, all charged suction hoses should be covered with hose covers to deflect fluids in case of rupture.

16.1.8 Lines containing flammable fluids should not be laid under any vehicle.

16.1.9 A pre-treatment pressure test on the pump and discharge lines should be made at a pressure no less than the maximum expected treating pressure specified by the operator, but not to exceed the rated working pressure of the equipment with the lowest rated working pressure.

16.1.10 Personnel not directly involved in the operations should remain beyond a designated minimum distance during all pressure testing and pumping operations.

16.1.11 The special services supervisor or the person he designates should check to see that all valves in discharge lines are open prior to pumping.

16.1.12 Unguarded openings in the top of covered frac tanks or other covered service tanks should be too small to allow personnel entry. Any opening large enough to permit personnel entry shall be covered by a hatch or bars mechanically secured to prevent personnel entry while the tank is on location. If securing the opening is not feasible, appropriate warning signs shall be prominently posted near the tank opening.

16.2 PUMPING OPERATIONS

16.2.1 Pump operators should remain at the controls while the pump is in operation, unless relieved as directed by the special services supervisor. Pump operators should remain alert for communications from the special services supervisor.

16.2.2 While pumping flammable fluids, electrical equipment, and internal combustion equipment not used in performance of the job should be shut down (shut off), and all fires should be extinguished. At locations where this recommendation may be impractical, appropriate safety measures should be implemented.

16.2.3 Flammable fluids should not be bled back into open measuring tanks on equipment designed for pumping.

16.2.4 All spilled oil, chemicals, or acid should be promptly cleaned up and disposed of properly.

17 Cementing Operations

17.1 GENERAL

17.1.1 The special service supervisor should hold a pre-job meeting with the special service crew and other involved persons to review responsibilities for the operation(s) to be performed.

17.1.2 All applicable recommended practices of other sections of this publication, in addition to the practices under this section, apply to cementing operations.

17.1.3 Personnel not directly involved in the operations should remain beyond a designated minimum distance during all pressure testing and pumping operations.

17.1.4 Prior to commencing operations, the pump and discharge lines should be tested to a pressure no less than the maximum cementing pressure specified by the operator, but not exceeding the rated working pressure of the equipment.

17.1.5 The special services supervisor or the person he designates should check to see that all valves in the pump discharge lines are open prior to pumping.

17.1.6 The lead-off connection to the cementing head should be secured prior to pumping operations.

17.1.7 The valve and any sections of cementing line left after completion of cementing operations should be secured to prevent whipping when pressure is bled off.

17.1.8 Consideration should be given to personnel safety when releasing cement wiper plugs under pressure.

17.1.9 When cementing at shallow depths, the casing should be secured to prevent pumping the casing from the hole.

17.2 PUMPING OPERATIONS

17.2.1 Pump operators should remain at the controls while the pump is in operation, unless relieved as directed by the special services supervisor.

18 Gas, Air, or Mist Drilling Operations

18.1 GENERAL

18.1.1 All applicable recommended practices of other sections of this publication in addition to the practices under this section, apply to gas, air, or mist drilling operations.

18.2 TRAINING

18.2.1 Personnel directly involved in gas, air, or mist drilling operations should be trained in the use of emergency shutoff, blowout preventer, and fire fighting equipment.

18.2.2 Personnel should be familiarized with the air or gas supply and circulating system.

18.3 EQUIPMENT

18.3.1 Where terrain permits, compressors should be located at least 100 ft (30.5 m) from the wellbore.

18.3.2 If practicable, compressors should be placed so as to be visible from the driller's position.

18.3.3 Compressors should have such safety features as pressure relief valves, discharge temperature and pressure gauges, engine governors, and engine shut off valves.

18.3.4 Kill switches should be provided for the drilling engines and should be conveniently mounted near the driller's console for immediate emergency use.

18.3.5 The discharge line from each compressor should be equipped with a check valve and a block valve.

18.3.6 To minimize the possibility of explosion that could result from accumulation of air cylinder lubricants in the air supply line, it is important that proper lubricants be used. Additionally, for this reason, scrubbers should be used after each stage of compression to remove entrained oil.

18.3.7 Compressors should be equipped with after-coolers designed to maintain temperatures within the limitations of the downstream piping system.

18.3.8 A rotating head may be used on the blowout preventer assembly of low pressure wells (less than 500 psi surface pressure). Wells in higher pressure ranges should use a rotating blowout preventer.

18.3.9 The blooey and bleed-off lines should be a minimum of 150 ft (45.8 m) in length or equivalent safety measures shall be taken. The blooey and bleed-off line should be located downwind of the rig for the prevailing wind direction at the location. Equivalent safety measures should be taken for other wind conditions. These lines should be laid from the wellbore as straight and free of sags as practicable and be securely anchored.

18.3.10 The blooey line should be as large as or larger than the rotating head outlet into the blooey line.

18.3.11 The blooey and bleed-off lines should be securely anchored to prevent movement when pressure surges occur. This is particularly applicable in mist drilling.

18.3.12 A full-opening, quick-closing valve (stopcock) should be installed at the top of the kelly to contain formation pressures in the drill string.

18.3.13 There should be two valves installed in the standpipe, one accessible on the rig floor and one at ground level below the rig floor, to control the air or gas supply to the borehole.

18.3.14 In gas drilling operations, a shutoff valve should be installed on the main feeder line a minimum of 150 ft (45.8 m) from the wellhead. In air drilling operations, the shut-off valve should be installed in the main feeder line near the compressors.

18.3.15 Geological sample catchers attached to the blooey line should be of design to protect personnel from deflected solids in the air or gas flow (see Figure 2).

18.3.16 Sample catching by manual means at the end of the blooey line should not be permitted.

18.3.17 When drilling with natural gas, a spinning rope instead of chain should be used in making up drill pipe (tool joint) connections to minimize the danger of ignition caused by mechanical sparks.

18.3.18 A float valve should be installed in the drill string directly above the bit. Either a heavy-duty dart or flapper-type float valve is satisfactory.

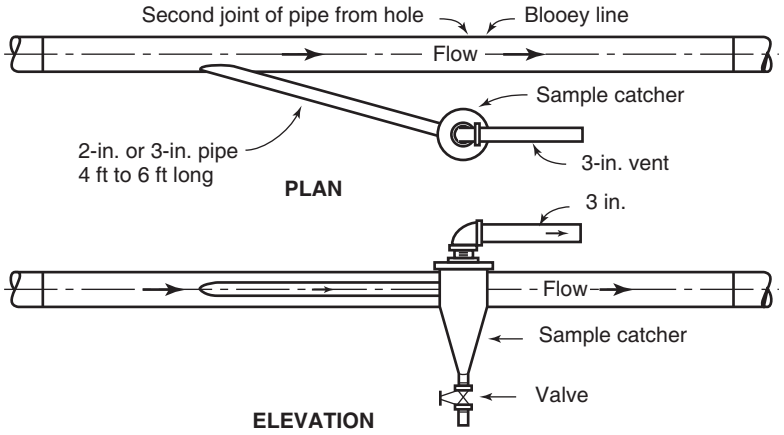


Figure 2—Example of Sample Catcher Recommended to Protect Personnel from Deflected Solids

18.3.19 Float valves installed in drill strings should be inspected each time the bit is pulled and, if damaged, should be replaced.

18.3.20 Fuel and oil storage should be located at least 50 ft (15.2 m) from the compressor location.

18.3.21 Liquid or LPG fuel supply lines should be equipped with shut-off valves at storage tanks and at engines.

18.3.22 Natural gas fuel should have a master valve located on the main fuel line at least 50 ft (15.2 m) upstream from any compressor.

18.3.23 One fire extinguisher of at least 150 lb Class BC rating dry chemical capacity, or equivalent, should be stationed on the job in addition to the normal minimum of four 20-pound capacity fire extinguishers with a Class BC rating (see NFPA 10).

18.4 PROCEDURES

18.4.1 The stripper rubber in the circulating head should be inspected at least once each tour. If any leaks are found, remedial action should be taken.

18.4.2 All pipe connections carrying gas or air to or from the wellbore should be made up and maintained leak free.

18.4.3 Equipment and materials for killing the well with drilling fluid should be on hand and operational before drilling commences. If sub-freezing weather is anticipated, precautions should be taken to ensure the drilling fluid system will not become inoperable.

18.4.4 During trips, any change in flow through the blooey line should be investigated before proceeding or before removing the stripper rubber.

18.4.5 A pilot light shall be kept burning at the end of the flow line at all times except when making trips during gas drilling operations. More than one pilot light may be needed to assure that ignition is achieved under both high velocity and low velocity discharge conditions.

18.4.6 For air drilling operations, an air compressor should be kept operating during trips with a discharge of air through the blooey line.

18.4.7 When making a connection, the standpipe valve should be closed and the bleed-off line should be opened prior to breaking out the tool joint.

18.4.8 Upon returning to the bottom of the hole at the conclusion of a trip in gas drilling operations, gas should be circulated to assure that all air is out of the circulating system prior to lighting the flare.

18.4.9 To prevent or minimize objectionable quantities of dust permeating areas surrounding the blooey line discharge, an appropriate amount of water should be introduced into the blooey line to wet cuttings.

18.5 MINIMIZING SOURCES OF IGNITION

18.5.1 Unauthorized personnel should be excluded from the location.

18.5.2 The rig substructure should be adequately ventilated either by dependable natural circulation or by use of fans.

18.5.3 Generator houses, bunk houses, and the clothing change house should be located at least 100 feet (30.5 m) from the wellbore or equivalent safety measures should be taken.

18.5.4 All automobiles should be parked at least 100 ft (30.5 m) from the wellbore or equivalent safety measures should be taken.

18.5.5 Rig engine(s) should have a heat and spark arresting system for the exhaust.

18.5.6 Each gas or gasoline-fueled engine used in gas drilling operations should be equipped with a low-tension ignition system.

18.5.7 Possible sources of ignition (electric power tools, appliances, open fires, two-way radios, etc.) should be permitted only in designated areas. Only safety-designed heaters should be permitted on or near the rig floor.

19 Hot Tapping and Freezing Operations

19.1 GENERAL

19.1.1 The operator's representative in charge should hold a pre-job meeting with the crew and other involved personnel to review responsibilities for the operations to be performed.

19.1.2 All applicable recommended practices of other sections of this publication, in addition to the practices under this section apply to hot tapping and freezing operations. Additionally, any hot tapping operation should be conducted in accordance with API Publ 2201: *Procedures for Welding or Hot Tapping on Equipment in Service*.

19.2 HOT TAPPING OPERATIONS

19.2.1 Hot tapping operations should be under the direct supervision of a qualified person.

19.2.2 The rated working pressure of all equipment used in hot tapping operations should be equal to or greater than the rated working pressure of the equipment to which it is being attached.

19.2.3 After necessary equipment has been rigged up to perform hot tapping operations, it should be pressure tested for a minimum of three minutes to a level not exceeding the rated working pressure of either the equipment being tapped or the tapping equipment and not to exceed 1.5 times the expected maximum pressure. The possibility of carrier or

untapped pipe collapse from external pressure may dictate a reduction in test pressure.

19.2.4 During the hot tapping operation, pressure inside the lubricator should not exceed the pressure inside the equipment penetrated.

19.2.5 Hot taps are not permitted on the roof of a tank or within the gas vapor space of the tank.

19.3 FREEZING OPERATIONS

19.3.1 Freezing operations should be under the direct supervision of a qualified person.

19.3.2 All frozen plugs should be allowed to set a minimum of one hour per inch of pipe diameter being frozen.

19.3.3 When possible, frozen plugs should be tested by a staged reduction in pressure, utilizing proportional increments. After pressure is bled to zero, hold for a minimum of five (5) minutes. Any ice plug movement indicated by this pressure test should constitute a valid reason to restart the plug freezing process.

19.3.4 After installing the new valve, void space between the frozen plug and valve should be filled with fluid and pressured to the anticipated pressure on the string, based on noted pressure prior to freezing operations. This will minimize pressure surges as the ice plug dissipates.

19.3.5 Frozen plugs should be allowed to thaw at a normal rate. Steam or hot water should not be used to thaw plugs. Because of fracture problems of steel at cold temperature, striking or hammering cold metal surfaces should be avoided.

20 Hotwork, Welding, and Flame Cutting Operations

20.1 GENERAL

20.1.1 A written safety work permit system covering welding and flame cutting operations shall be observed on all drilling and service rigs. In general, a safety work permit system should consist of the following:

a. Pre-Work Stage Communications meetings:
   1. Simultaneous operations.
   2. Air/gas testing.
   3. Equipment isolation.
   4. Equipment preparation.
   5. Identification of hazards.
   6. Emergency procedures.
b. Work-in-Progress Stage:
   1. Air/gas testing.
   2. Personal protective equipment requirements.
   3. Fire watch.
   4. Special procedures/precautions.
c. Return to Service Stage:
   1. Authorization and turnover signatures
   2. Posting of permit

20.1.2 The special service supervisor should hold a pre-job meeting with the special service crew and other involved persons to review responsibilities for the operation to be performed.

20.1.3 Welding and flame cutting operations shall not be permitted close to flammable liquids, accumulations of crude oil, escaping gas, or locations where sparks, flames, heat, or hot slag could be sources of ignition.

20.1.4 Certified welders shall perform welding or flame cutting operations on surface facilities, piping, and equipment for which the primary function is to contain hydrocarbons.

20.2 PERSONAL PROTECTION EQUIPMENT (PPE)

20.2.1 Proper helmets and face shields shall be used during all arc welding or arc cutting operations. Proper clear eye protection may be worn for submerged arc welding operations.

20.2.2 Goggles with proper shade selection shall be worn during arc welding or cutting operations.

20.2.3 Goggles or other suitable eye protection shall be used during all gas welding, oxygen cutting, or brazing operations.

20.2.4 Helpers or attendants shall be provided with and shall use proper eye protection.

20.2.5 All filter lenses and plates used in helmets and goggles shall meet the test for transmission of radiant energy prescribed in ANSI Z87.1-1979.

20.2.6 All welders shall wear appropriate protective attire for welding and cutting operations.

20.3 FIRE PROTECTION

20.3.1 If the object to be cut or welded cannot readily be moved, all movable fire hazards in the vicinity shall be taken to a safe place.

20.3.2 If the object to be welded or cut cannot be moved, and if all the fire hazards cannot be removed, guards shall be used to confine the heat, sparks, and slag and to protect the immovable fire hazards.

20.3.3 On offshore rigs, a safe welding area shall be designated. In this area, routine welding and flame cutting operations can be conducted with minimal concern of providing an ignition source for flammable hydrocarbons or combustible materials. A safety work permit is not normally required for routine welding operations in an approved safe welding area.

20.3.4 Properly maintained fire extinguishing equipment shall be available for immediate use. A minimum of at least one 30-lb multi-purpose (Class BC rating), dry chemical fire extinguisher, shall be immediately available during welding or cutting operations. This equipment is in addition to the general fire protection equipment.

20.3.5 Fire watches with extinguishing equipment shall be required whenever welding or cutting is performed in locations where a written safety work permit is required. In general, this would be whenever combustibles are located within 35 ft (10.7 m) of the welding or cutting operation.

20.3.6 A fire watch shall be maintained for at least one-half hour after completion of welding or cutting operations.

20.3.7 Before cutting or welding is permitted in areas outside a designated safe welding area, the area shall be inspected by the individual responsible for authorizing cutting or welding operations. The responsible individual shall designate the precautions to be followed in granting authorization to proceed and issuing the safety work permit.

20.3.8 Cutting or welding shall not be permitted in the following situations:

a. In areas not authorized by the supervisor.

b. In the presence of an explosive atmosphere or where such atmospheres may develop. This does not preclude the use of hot tapping when proper precautions are taken.

c. In areas near storage of large quantities of exposed readily-ignitable materials.

d. Where ignition can be caused by heat conduction, such as on metal walls or pipes in contact with combustibles on the other side.

e. On used containers such as drums.

20.4 EQUIPMENT

20.4.1 Apparatus such as torches, regulators, hoses and arc welding machines shall be in good operating condition and repair. Only approved oxygen and acetylene cylinders shall be used.

20.4.2 Oxygen and acetylene torches should be equipped with flash-back arrestors.

20.4.3 All cylinders with a water weight capacity of over 30 pounds shall be equipped with a valve protection cap, a collar, or recess to protect the valve. Valve caps shall be in place except when cylinders are connected for use.

20.4.4 Cylinders shall be stored in assigned places away from elevators, stairs, or walkways. They shall be secured to prevent accidental overturning.

20.4.5 Cylinders shall not be kept in unventilated enclosures, such as lockers and cupboards.

20.4.6 Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials a minimum distance of 20 ft (6.1 m) or by a noncombustible barrier at least 5 ft (1.5 m) high.

20.4.7 Acetylene cylinders shall be stored valve end up with protective caps affixed and properly secured. When a job using acetylene devices is completed or prior to transporting acetylene cylinders, the valve on the acetylene cylinder shall be closed and pressure on the hoses bled to zero.

20.4.8 When transporting cylinders by a crane or derrick, a cradle, bin, or other suitable platform shall be used. Slings shall not be used. Also, cylinders shall not be dropped, struck, or permitted to strike each other.

20.4.9 On arc welding machines, the control apparatus shall be enclosed except for the operating wheels, levers, or handles.

20.4.10 Input power terminals, top charge devices, and electrically energized metal parts shall be completely enclosed and accessible only by means of tools.

20.4.11 Terminals from welding leads shall be protected from accidental contact by personnel or metal objects.

20.4.12 The frame or case of an electrically driven arc welding machine shall be grounded.

20.4.13 Cables with splices within 10 ft (3.1 m) of the holder shall not be used. The welder should not coil or loop welding electrode cables around parts of his body.

20.5 WELDING FUMES AND VENTILATION

20.5.1 Toxicity depends on the composition and concentration of the fumes. The composition and quantity of fumes depends on the materials being welded, the composition of the welding rods, any coatings or paints encountered in the welding operations, the process used, and the circumstances of use. Toxic fumes can be generated from welding on metals coated with or containing alloys of lead, zinc, cadmium, beryllium, and certain other metals. Some paints and cleaning compounds may also produce toxic fumes when heated. The potential health effects range in type and severity, depending on these factors; and some effects can be extremely serious.

20.5.2 For more information on the toxicity and health hazards of welding fumes and the appropriate protective measures, contact the employer, or consult the following references: *Industrial Ventilation, A Manual of Recommended Practice, 22nd Edition*[1]*; Threshold Limit Values and Biological Indices for 1997–98*[1]; and API Publication 2201.

20.5.3 Mechanical ventilation at the minimum rate of 2,000 ft^3/min (94.4 dm^3/s) per welder shall be provided when welding is done:

a. In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.
b. Where the nature of the welding, cutting, or brazing work is such that the release of toxic fumes or gases is possible. This includes work on stainless steel, zinc, lead, and degreasing or cleaning compounds containing hydrocarbons.

20.5.4 Adherence to confined space entry procedures shall be followed prior to any re-entries. For example, releases from acetylene cutting equipment could change the atmosphere within the confined space.

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National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101

Association of Energy Service Companies
6060 North Central Expressway
Dallas, Texas 75206

International Association of Drilling Contractors
P.O. Box 4287
Houston, Texas 77210-4287

American National Standards Institute
11 West 42nd Street
New York, New York 10036

American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

ASME International (formerly American Society of Mechanical Engineers)
Three Park Avenue
New York, New York 10016-5990

NACE International
1440 South Creek Drive
P.O. Box 218340
Houston, Texas 77218-8340

Institute of Makers of Explosives
1120 Nineteenth Street NW, Suite 310
Washington, D.C. 20036

U.S. Department of the Interior
Minerals Management Service
MS 2200, Atrium Building
Herndon, Virginia 22070

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Occupational Safety and Health Administration
200 Constitution Avenue, NW
Washington, D.C. 20210

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Research and Special Programs Administration
400 Seventh Street, SW
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