

Purpose

This document is intended to serve as a reminder of safe work practices and is not a complete presentation of this topic. It should be used by individuals trained and competent in this subject. It is not intended to replace or supersede company procedures, industry standards and/or applicable governmental laws and regulations.

Scope

Anchors and guywires provide stability and support to rig and well service unit masts when erect. This guideline is intended to provide general information on the installation, maintenance and use of anchors and guywires.

Applications

• Drilling Rigs	• Well Servicing Rigs
• Anchor Installation	• Anchor Testing
• Guyline Evaluation	• Location Soil Bearing Capacity

Hazards

• Anchors Fail	• Guylines Fail
• Anchors/Guys damaged or corroded	• Overhead Power lines
• Failure to use proper thimbles/sheaves or improperly installed wirerope clips.	

Definitions

Fall Lane: A zone on either side of a derrick represented by 2:00 to 4:00 o'clock and 8:00 to 10:00 o'clock on each side of the rig. (See *Figure 1*.)

Ground Anchors (Deadmen): Static holding device installed in the ground separate from the rig structure and to which guyline(s) may be attached.

Guyline: Wire ropes attached to elevated structures, such as derricks or masts and ground anchors for stability.

Derrick/Mast: The steel tower component of a drilling or well servicing rig that supports the crown block, traveling block, and hoisting lines. They may be stationary, requiring dismantling when moved from one location to another, or portable with the capability of being laid down and raised to and from ground level fully assembled.

Qualified Person: A person who, by possession of a recognized degree, certification, or professional standing or who by knowledge, training or experience has successfully demonstrated the ability to solve or resolve problems relating to the subject or work.

Rigging Up: The on-site erection and connection of components in preparation for drilling or well servicing operations.

General Information

Ground anchors should be installed with the rated capacity and in a pattern around the well head so as to support the rig structure(s) that will be used to drill or service the well. Once installed, the anchors are subject to corrosion and damage from use or from being struck. The wellsite owner, rig operator, anchor installer and capacity tester each have responsibilities to ensure that the anchors are capable of withstanding the load applied.

Guylines should be placed on the mast or derrick in accordance with the manufacturer's recommendations, or meet the recommendations of API Recommended Practice, 4G, or be based upon the technical recommendations of a qualified person using accepted engineering practices and the requirements of applicable Federal and State laws.

Guidelines

Fall Zone (Lane)

During operations, all wireline units, other vehicles, or portable houses and equipment should be placed outside the guylines of the well service unit and outside the fall zone (lane) of the derrick represented by 2:00 to 4:00 o'clock and 8:00 to 10:00 o'clock on each side of the rig. (**Figure 1**)

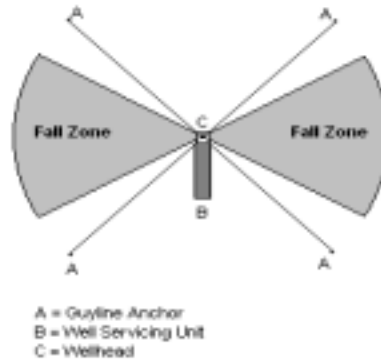


Figure 1

Guylines

- Any mast designed to utilize guylines for mast stability should have all applicable guylines in position prior to commencing work.
- Guylines should be installed to meet the following criteria:
 1. Installed according to the manufacturer's recommendations
 2. The guying pattern from **Figure 2** is recommended, **if** there are no manufacturer's recommendations, or **where** their recommendations cannot be utilized because of obstructions at the wellsite location (such as roads, pits, electric lines, etc.).
 3. Other guying patterns can be utilized provided they meet the recommendations of a "Qualified Person."
 4. Guylines must meet the requirements of applicable Federal or State laws.
- Guylines should be 6x19 or 6x37 class regular lay, IPS, IWRC wire ropes, not previously used in any other application. They should be visually inspected at least monthly and removed from service if the following damage, corrosion or wear exists:
 1. Three (3) broken wires are found within one (1) lay length.
 2. Two (2) broken wires are found at the end connection in the strand valley.
 3. Marked corrosion appears.
 4. Corroded wires at end connections.
 5. End connections are corroded, cracked, bent, worn, or improperly applied.
 6. Evidence of kinking, crushing, cutting, cold working, or bird-caging is found.
- Guyline end terminations should be made in accordance with good guyline practice and the current copy of API RP 9B.
- Never turn guylines back over small radius eyes when making an end termination.
- Wire rope thimbles or appropriately sized sheaves should be used to turn back guyline ends.
- When wire rope clips are used, double saddle type clips are recommended and should be installed in accordance with the manufacturer's recommendations, using proper torque.
(Note: When a sheave is used in place of a thimble for turning back the wire rope, add one

additional clip.)

- When guying patterns other than those recommended by the mast manufacturer are used, the brackets used to attach the guylines to the mast or tubing board should be checked to make sure they have sufficient capacity for the maximum anticipated loads.
- Guyline hardware such as shackles, turnbuckles, walking boomers, chain come-alongs, load binders, etc., that remain in the live guyline system should have a safe working load capacity that meet or exceeds 40% of the breaking strength of the guyline. The handles on walking boomers, come-alongs, etc. should be positively secured to prevent accidental release.
- Guylines should be pretensioned to values shown in *Table 2*.
- The catenary or “SAG” in the guyline may be used to estimate proper pretension. See *Figure 3 and Table 3*.

Recommended Guyline Size and Pretension (Table 2)

Guyline (See Figure 2 for Guylines Locations)	Recommended Size		
	Recommended Pretension		SAG
External Guy (“A” on Fig. 2)	5/8 Inch	1000 Pounds	See

Table 3

External Guy (“B” on Fig.2)	9/16 Inch	500 Pounds	See
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Table 3

Internal Guy (“C” on Fig. 2)	7/8 Inch	1500 Pounds	3
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Inches

Intermediate Guy (“D” on Fig. 2)	5/8 Inch	1000 Pounds	3
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Inches

Notes:

1. All guylines should be 6x9 or 6x37 Class, Regular Lay, IPS, IWRC.
2. Guyline Catenary or SAG may be used to estimate pretension. (See *Table 3*.)
3. See *Figure 4* for Anchor Spacing and Capacity.
4. Intermediate Guylines “D” are recommended at option of manufacturer only.

RECOMMENDED GUYING PATTERN

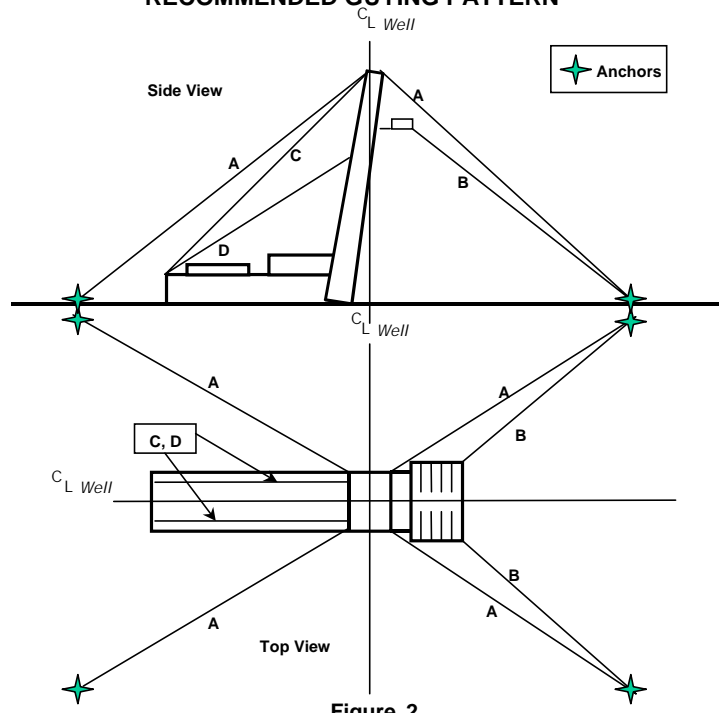


Figure 2

Guywire SAG (Catenary) as a Measure of Guyline Pretension

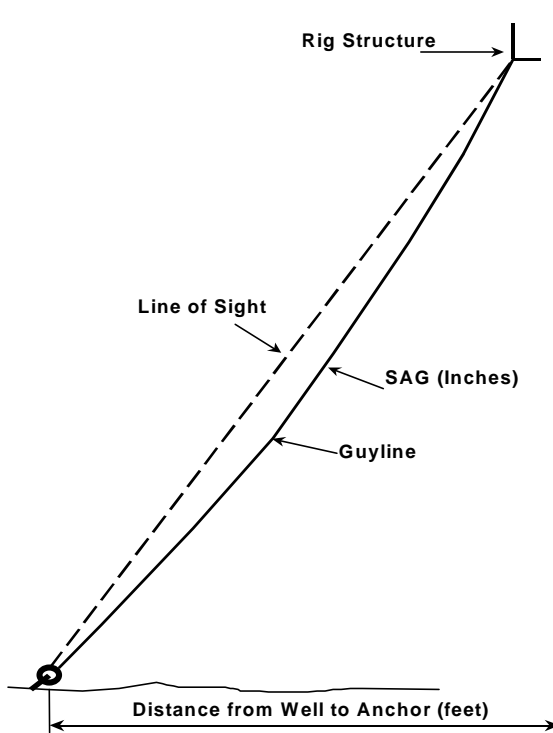


Figure 3

Guywire SAG (Table 3)

	Pole Mast		Single Mast		Doubles Mast	
Distance of Well to Anchor (feet)	Tubing Board Guy (Inches)		Tubing Board Guy (Inches)		Crown to Ground Guy (Inches)	
Ground Guy (Inches)	Tubing Board Guy (Inches)		Crown to Ground Guy (Inches)		Crown to Ground Guy (Inches)	
	Tubing Board Guy (Inches)		Crown to Ground Guy (Inches)		Crown to Ground Guy (Inches)	
40	-	4	4	4	6	5
60	-	6	8	6	12	8
80	-	10	15	10	17	11
100	-	14	22	14	26	15
120	-	18	32	18	32	21

NOTE: The above figures represent pretensions of 1000 pounds in Crown to Ground Guylines and 500 pounds to Tubing Board Guylines.

Anchors

Anchors should meet the following criteria for installation, use, and verification.

- Qualified persons utilizing accepted engineering practices should design anchors.
- Steel components should be protected from corrosion.
- Anchors should meet the requirements of Federal or state laws.
- Anchors should be designed to meet the mast manufacturer’s recommendations or use API recommended anchor values.
- Anchors should have a minimum capacity of at least twice the guyline load.
- Install the anchor so that liquids drain away from the anchor shaft.
- The capacity should be verified every 24 months or immediately prior to use and rechecked if changes occur that would decrease the capacity of the anchor.
- Verify Anchor capacity by pull testing or other appropriate methods that use accepted engineering practices.

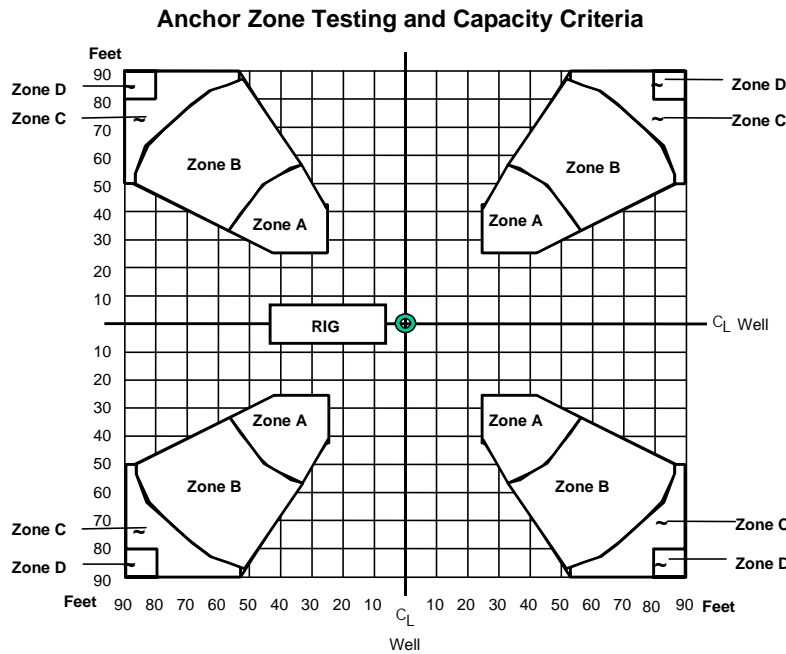


Figure 4

Anchor Capacity (Tons) (Table 4)

Zone	Double Mast	Singles Mast	Pole Mast
A	15.6	7.0	7.0
B	11.5	5.0	5.0
C	9.0	5.0	5.0
D	7.4	5.0	5.0

Anchor Capacities Shown on **Figure 4** and **Table 4** assumes the following:

1. Adequate Foundation Support for Mast and Carrier.
2. Adequate Crown-to-Carrier internal load guylines.
3. Full rod and tubing setback except for Pole Unit, which has to setback.
4. Anchors in the two quadrants on the rig side of the well are located in the same zone and with equal spacing (+/- 10 feet) either side of the Horizontal Centerline and with equal spacing (+/- 10 feet) either side of the Vertical Centerline.
5. Maximum Wind Velocity of 70 MPH, or ,Maximum Hook Load as follows:
 - A. For zone A: 50 % of rated mast capacity.
 - B. For other Zones: Subject to Mast De-rating Criteria in API RP 4G.

Foundations (Well Location) for Portable Masts with Guylines

- Foundation design should consider the safe bearing capacity of local ground conditions, concentrated loads at the mast and rig carrier support points, supplemental footing required to safely distribute concentrated loads to the ground and location preparation. Grade the location so that oil, water and other fluids will drain away from the working area. Wet conditions and drainage ditches around the well head significantly reduce the soil bearing capacity. See **Figure 5**.
- The safe bearing capacity of local soils may be determined from **Table 5** or from appropriate soil core tests, penetrometer test or other suitable test and analysis methods. Where surface soil conditions are used to determine soil bearing capacity, ensure that the soil is homogeneous (uniform) to a depth of at least twice the width of the supplemental footing used to support the concentrated load. Underlying soft soils should be used to determine the safe bearing capacity rather than the firmer surface soil.
- Supplemental footing must be provided to distribute the load from the mast and rig carrier support points to the ground. Follow the manufacturer’s load distribution diagram, or design it to carry the hook load plus the weight of the entire rig during operation and rig up/down. The area and stiffness of the footing must meet the demands of the load. Wood timbers should be free of knots and splits.
- Earthen cellars reduce the soil bearing capacity and have the potential for cave-in. Cellars with wooden lined walls allow fluids to seep into the soil. Large concrete cellars may require steel beams for support. A Qualified person should determine if adequate cellar support is provided.

SAFE BEARING CAPACITY OF SOILS (TABLE 5)

TYPE OF SOILS	Pounds per square foot
Solid ledge of hard rock, such as granite, trap, etc.	50,000
Sound shale and other medium rock requiring blasting for removal	20,000
Hard pan, cemented sand and gravel difficult to remove by picking	16,000
Soft rock, disintegrated ledge; in natural ledge, difficult to remove by picking	10,000
Compact sand and gravel requiring picking for removal	8,000
Hard clay requiring picking for removal	8,000
Gravel, coarse sand, in natural thick beds	8,000
Loose, medium and coarse sand, fine compact sand	8,000
Medium clay, stiff but capable of being spaded	4,000

Fine, loose sand	2,000
Soft Clay	Less than 2,000

Portable Mast Location Preparation

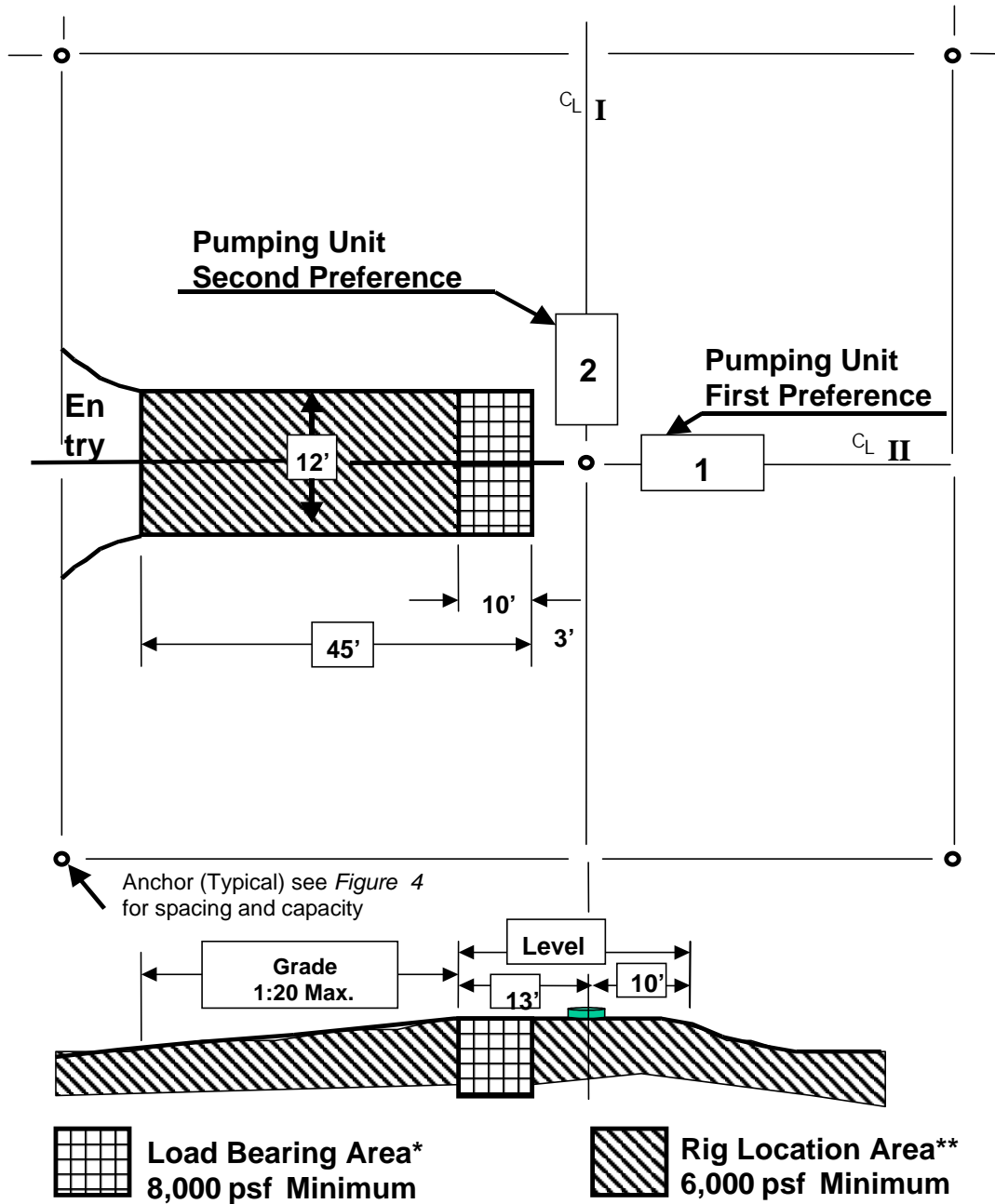


Figure 5

* Load Bearing Area: Compacted sand or gravel requiring picking for removal or better base. Safe bearing capacity desired - Minimum 8,000 psf, level and drained.

** Rig Location Area: May grade away from well along centerline II at maximum drop of 1:20. Should be level across grades parallel to centerline I. Safe bearing capacity desired - 6,000 psf. Allow maneuvering entry for drive in or back in. Drainage of entire area

required.

Working Near Power Lines

- When working within 10 feet of any power line, lines must be de-energized with proper lockout/tagout procedures and grounded with appropriate electrical authority certifying that they are de-energized.
- Where spacing does not provide 10 feet of clearance in the fall radius area for the height of the equipment plus appendages, de-energize or ensure that work crews are trained in recognizing the extraordinary electrical hazards prior to starting work.
- Post a permanent -“**CAUTION---ENERGIZED OVERHEAD POWER LINE**” sign to warn against potential overhead power line hazards or unsafe practices (*see Figure 6*)
- Conduct tailgate safety meeting on electrical and rig safety. Identify hazardous energy sources and proper lockout/tagout procedures.
- Establish rig position as far as possible from power lines with fall line/lane parallel to the power line. Vehicles used for communication or transport should be kept out of the fall line and radius.
- Visually inspect drilling line, guy wires, emergency derrick escape line (Geronimo line), and mast for unsafe condition (clearance to power lines) prior to and during rig up/down.
- Ensure that the Emergency Response Plan includes working near overhead power lines.
- **Figure 7 (Hazard Areas for Rig Operations near Electrical Power Lines)** is provided to clarify requirements. Some areas (guylines, derrick escape line “Geronimo” are not color-coded but are identified with clarifying notes. These areas are - (Dark Gray - 10’ radius from rig structure and guylines, Light Gray - Fall Line/Lane, White - Height of rig [tallest part, include antenna’s, etc.], plus 10’):
- The 10-foot (depending on kV) radius around the guylines and escape path is not shown in Dark Gray, but they should be considered “danger zones” when working or rigging up/down.
- The fall line/lane (Light Gray area) is recognized as a hazardous area and should remain clear of obstacles (tanks, vehicles, etc.). Power lines in this area should be de-energized if possible. If power lines in this area are not de-energized, then employee training to abate electrical hazards is required.

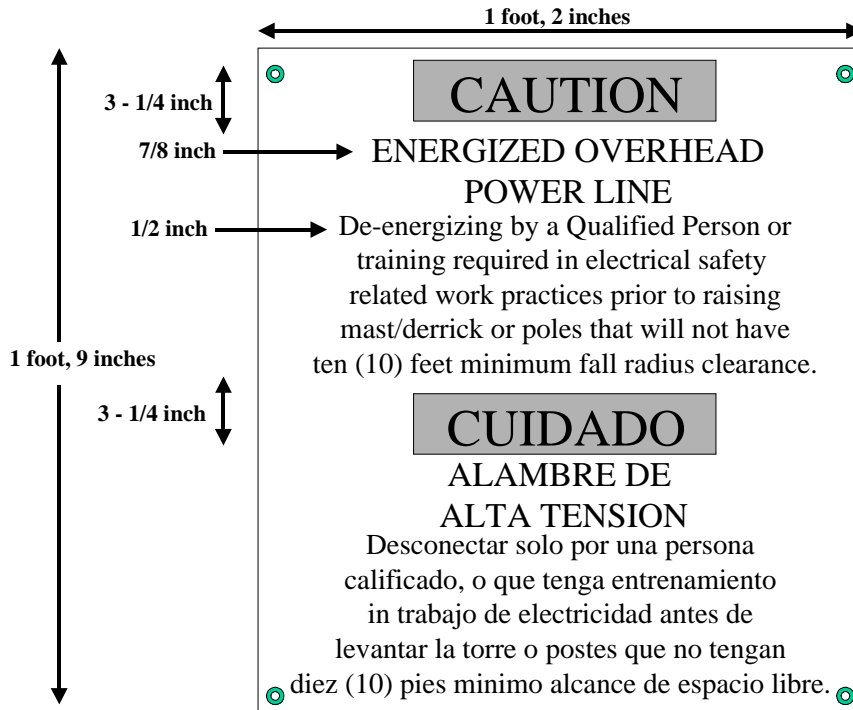
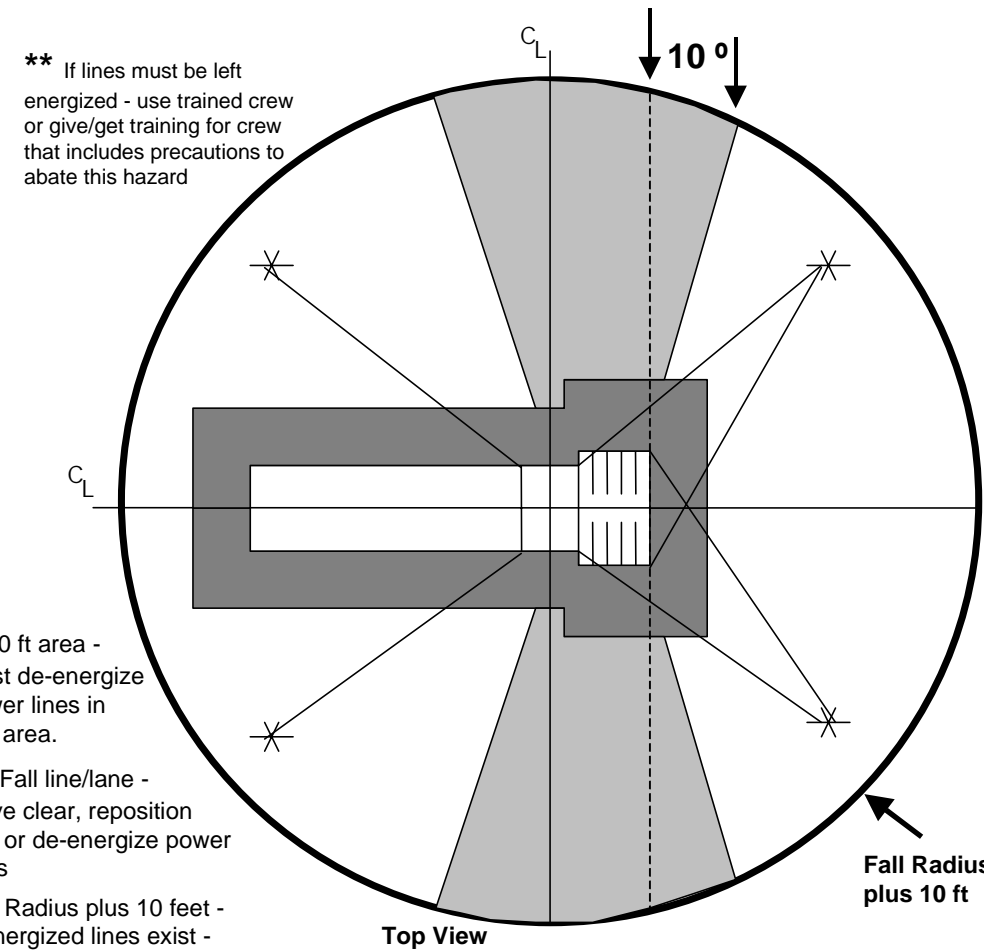
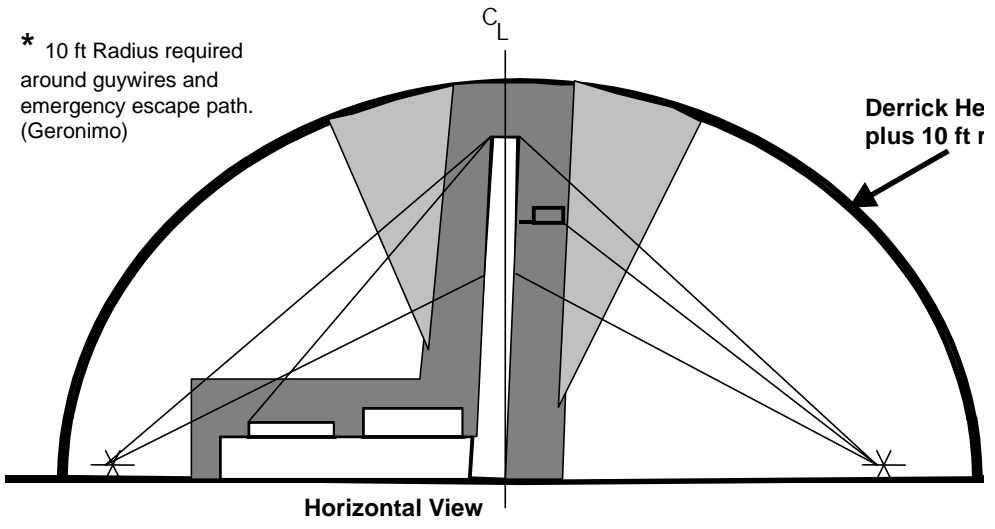


Figure 6

Hazard Areas for Rig Operations Near Electrical Power Line



- * 10 ft area - must de-energize power lines in this area.
- ** Fall line/lane - leave clear, reposition unit or de-energize power lines
- Fall Radius plus 10 feet - If energized lines exist - de-energize or use trained crew or give/get training for crew.

Figure 7

References

API RP 54 - Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations

API RP 4G - Recommended Practice for Maintenance and Use of Drilling and Well Servicing Structures

API RP 9B -Recommended Practice on Application, Care and Use of Wire Rope in Oilfield Service

AESC - American Energy Service Contractors (Was - AOSC) - Recommended Safe Procedures and Guidelines for Oil and Gas Well Servicing