ENERGY WORKFORCE & TECHNOLOGY COUNCIL

WELL SERVICING RECOMMENDED BEST PRACTICES

The Utilization of Base Beams
During Mobile Rig Well Servicing Operations

RP 04 WS

energyworkforce.org

DISCLAIMER

This voluntary industry guideline document is offered as general guidance only. Each Member Company must still use its own independent judgement and discretion to implement its operations successfully and develop specific systems that best fit its management structure, product lines, location, and other factors that are unique to the company and the products and services it provides. These guidelines are not meant to be a substitute for applicable laws and regulations, nor do they alter or enhance the obligation of Member Companies to fully comply with federal, state and local law.

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GENERAL STATEMENT OF PURPOSE

The term "Base Beam" describes a stability and anchoring system which can be employed with well servicing rigs and considered under "accessories to the mast/ derrick" as outlined in API RP4G section 1. Base beam dimensions vary based upon the rig's operating parameters for which it is designed but typically have a dimension of five to eight feet in width and thirty-five to forty-five feet in length and weigh between twenty and thirty thousand pounds. Base beams should be designed by the OEM or a Professional Engineer in accordance with API 4F and 4G as an integrated, purpose-built system unique to a specific rig or make and model of rig.

All base beams shall have a unique serial number, however, if use of the base beam requires lower operational parameters than those noted on the rig's API 4F nameplate, a tag or nameplate must be affixed to the base beam noting the revised de-rated operating parameters. Base beams are used by both well operators and contractors for a variety reasons. First, base beams offer the ability to perform operations over a wide range of soil types. Secondly, they enhance stability near the larger cellars on multiwall pad configurations. Another benefit of base beam utilization is the smaller footprint of a deployed well service rig. Base beams eliminate protracted guywires which would interfere with vehicle traffic and operational activity.

2. REFERENCES

- API Specification 4F *Specification for Drilling and Well Servicing Structures*
- API Recommended Practice 4G *Operation, Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures*
- OSHA Technical Manual (OTM) Section IV

3. DEFINITIONS

- **Anchor Points**
  Attachment points to which the mobile rig's crown and board guys may be anchored. These anchor points may be to ground anchors or engineered points on the base beam.
- **Catenary Sag**
  Sag at the midpoint of a tensioned cable which is a function of cable length, cable weight and tension. Catenary sag is a recommended practice of identifying proper guy line tensioning per API RP4G.
- **Certified**
  A recognized standard per the OEM or Professional Engineer benchmarking applicable and acceptable utilization and practices.
- **Ground Anchors**
  Anchor points on the ground, in predetermined arrangements which ensure stability to the mast via guy lines. Ground anchors must be tested to withstand given pull values per manufacturer specifications or industry recommended practice. Reference API RP 4G.

- **Marsh Anchors**
  A temporary ground anchor sunken by hand.
- **Shock Load**
  A sudden introduction of applied resistance. A shock load may occur, infrequently in the course of pulling tubing, casing or other production tools and equipment from a well.
- **Professional Engineer**
  An individual, who has fulfilled education and experience requirements, and passed state licensure exams that permits them to offer engineering services directly to the public.
- **Shop Made/Employee Fabricated**
  Equipment lacking certification by the OEM or professional engineer familiar with the specific needs, inherent design, competency of the build, and uniform standard of assembly of equipment. Equipment lacking assigned certification from the manufacturer(s).
- **Guy Lines**
  - **Front Guy Lines**
    Guy cables from the crown to the farthest point from the well bore.
  - **Rear Guy Lines**
    Guy cables from the crown to the closest point to the well bore.
  - **Tubing Board Guys**
    Guy cables fixed to the outermost frame of the tubing board to aid in the stability of the board. These cables are typically crossed when ground anchors are used and not crossed while using a base beam.
- **Tag**
  Nomenclature affixed to the base beam identifying applicable standards similar to those outlined in API 4F and stating application to the rig for which the base beam is mated.
- **Turnbuckles**
  Attachment hardware allowing for proper tension to be applied to guy lines when attached to the anchor points of the base beam or ground anchors. Turnbuckles must be rated at or exceeding the working load capacity of the guy lines.

4. ABBREVIATIONS

- API: American Petroleum Institute
- NDT: Non-Destructive Testing
- DOT: Department of Transportation
- OEM: Original Equipment Manufacturer
- OSHA: Occupational Safety and Health Administration

5. CONFERENCE WITH THE CLIENT

Well servicing vendors are dependent upon clients and customers to install and maintain ground anchors. If ground anchors are to be used, they shall be installed, pull tested and certified prior to moving a mobile rig on to location. One of the advantages of using a base

beam is to provide secure footing for the rig and eliminate the need to install and maintain ground anchors. Temporary, manually installed "marsh anchors" should not be used.

6. HAZARD ASSESSMENT

A documented hazard assessment should be performed prior to utilizing a base beam. Of primary consideration are:

- Stability of soil
- Anticipated hook load and tubing storage in the derrick versus the rated mast capacity when paired with the base beam
- Expectation of severe weather. Hurricane, high winds, tornado

7. ALTERNATIVES

Use of ground anchors does not eliminate the option of using a base beam.

8. USE OF BASE BEAMS – INSPECTION

Base beams shall be inspected in accordance with manufacturers' specifications. Certifications by 3rd party NDT inspections shall be retained and available for review. Base beams shall be certified to the rig size and model for which they are intended to be used. Base Beams shall have a legible serial number corresponding to their design registration. Legible nameplates or tags are recommended stating the Manufacturer and/or Professional Engineer's information, and serial number of the base beam. Additionally, the tag shall include design specifications of the Base Beam, i.e. the mating rig/mast combination, derating of mast if applicable, wind tolerance, and the weight of the base beam. Base beams shall be inspected visually before each use and be inspected/recertified at the same intervals specified in API RP 4G for the rig.

9. SPOTTING/SETTING THE BASE BEAM

A JSA/Daily Work Plan should be completed before spotting the base beam. Establish an exclusion zone around the area of travel for setting base beams. In many instances spotting the base beam will require moving it in the proximity of active lines, pumping units and well heads. Use caution in placing it.

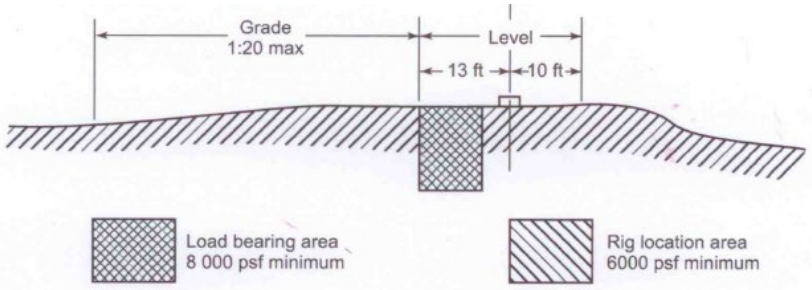
Ensure that soil beneath the beam is level and solidly packed across the entire footprint of the base beam. Ensure that cellars, if present, are reinforced and will not break under load or when saturated with fluids. The base beam should be spaced the distance from the wellhead based on mast type, height and pitch, according to OEM recommendations. Distance to well head must allow for centering over the hole without raising the front tires (tires furthest from the well head).

10. PLACING THE JACKS

Leveling mechanisms and mast bases, either hydraulic or threaded, must have foundation plates or jack stands at the point of contact to the boards or base beam. Weight Indicator Pads are an acceptable base. Ensure that leveling jack stands are set in brackets or on boards. There should be no metal-to-metal contact without framing to keep the jack from sliding under stress or shock load. Ensure that surfaces where jacks and pads make contact are clean and not covered with mud, oil or lease fluids.

11. LEVELING

The stability of the foundation that the rig is set upon is as essential as the foundation for a building. The loads that are transferred to the foundation by working well service rigs can reach 400,000 lbs. The native soil and all-weather topping applied to well pads are variable and the load bearing capacity per square foot can change based on temperature and weather conditions. API RP 4G recommends that the soil load bearing capacity for service rig location be 6,000 psf at minimum and 8,000 psf for the load bearing area below the mast. Where the soil compressive strength does not meet these minimums, additional supplemental footing is required to support the loads.



NOTE 1 Load bearing area: compacted sand or gravel requiring picking for removal or better base. Safe bearing capacity desired—min., 8000 psf, level and drained.

NOTE 2 Rig location area: may grade away from well along centerline II at max. drop of 1:20. Should be level across grades parallel to centerline I. Safe bearing capacity desired—min., 6000 psf. Allow maneuvering entry for drive in or back in. Drainage of entire area required.

Figure 5—Portable Mast Location Preparation

Ensure that footing allows the base beam to be level. Jacks should be used to support not level the carrier. Weight should be removed from all tires. Tires should remain on the ground supporting no more than their own weight. Slight adjustments to the mast angle should be made by adjusting the tail screws but the mast angle cannot exceed the manufacturer's specified mast tilt angle.

12. RIGGING UP/DOWN THE RIG

Discuss wind and weather conditions prior to rig up. Avoid rigging up in high winds or gusts. Ensure foundation and footing as well as leveling of the carrier prior to rig up. Ensure that JSA/Daily Work Plans include barrier zones to eliminate interference which may be present on multipad configurations. Observe stability of the base beam, jacks and jack stand system as the bottom section of the mast is raised and rests its full weight on the jacks and base beam. Continue to monitor stability of the base beam and jack system as the upper section is raised and the traveling block is deployed. If at any time during the rigging up operation, sagging, movement or instability is observed in the base beam, discontinue raising or scoping of the mast and lower it back into transport position on the carrier.

13. GUYING

Follow OEM or engineer specified guidelines for proper guying to the base beam. Front crown guy lines will be attached to the front pad eyes and turnbuckles of the beam. Rear crown guy lines and tubing board guy lines will be attached to the rear pad eyes and turnbuckles of the beam. Turnbuckles should be attached to the pad eyes of the base beam with approved turnbuckle pins with cotter pins. Guy lines will be attached to the turnbuckles with approved turnbuckle pins with cotter pins. Once the guy lines have been attached to the turnbuckles, tighten the lines by turning the turnbuckles. Ensure that turnbuckles are tightened evenly on all sides to avoid overloading one side. Tension the guylines removing all slack and avoid over tensioning and pullling up the base beam corners.

Guying to anchors off of the base beam. Follow the mast manufacturer's guidance for catenary sag in the guy lines to set appropriate pretension.

14. ADDITIONAL GUYING

In certain instances a well operator or contractor might require additional use of ground anchors. These instances may include adverse weather anticipations, anticipated elevated hook loads, drill collars or specialized completion and workover equipment kept in the derrick. Always consult with the OEM concerning the placement of the additional guying when required.

15. PLACING EQUIPMENT ON THE BASE BEAM DURING OPERATIONS

If equipment must be stored or staged for use on the base beam during operations, ensure that there are clear, non-slip pathways. Integrate railing or safe travel systems if foot traffic is going to occur over the base beams. Ensure easy access from the ground to the base beam via steps or platforms.

Base beams offer large spaces which both serve as opportunities for stowage of components and trip hazards. Always consult with the OEM to ensure design integrity is maintained and that design interference does not occur when adding stowage capabilities. Always ensure that any

modifications for stowage do not interfere with the designed use of the base beam. Use only certified welders to perform load bearing structural welding.

16. BOPE PLACEMENT

Base beams may be equipped with a stump or pedestal upon which Blow Out Prevention Equipment is stored and transported. Ensure that all welds and or connections are acceptable and do not interfere with the structural integrity of the base beam. Consultation with the designer/manufacturer is highly recommended. Use caution when raising and lowering BOPE with respect to the distance the traveling block may be pulled off center. The action of the blocks may also place stress on the base beam if the BOPE does not come off the stump smoothly.

17. SPECIAL CONSIDERATIONS

- Transporting the base beam to and from the site

  Ensure that all Department of Transportation and local authority rules and regulations are applied and utilized. Ensure the base beam is free of fluids and debris.

18. MAST SHOCK LOAD AND OVERPULL

Regardless of anchoring system used, the potential for operational events that exceed the rigs operating criteria exists due to shock loading or over pull. Therefore, use caution at all times when running the traveling block. Care should be taken not to shock load the derrick and drill line in the event of tubing or a bottom hole assembly hanging up downhole or in surface equipment. Shock load and sudden release of the tubing string can destabilize the rig carrier. Always anticipate these possibilities and conduct the pulling operations accordingly. Consult company and contractor specific SOPs in the event known well conditions may cause the potential for a shock load.

Consider:

- Size and drift of bottom hole assembly
- Transition point from liner to casing
- Known tight spots in casing
- Use of the highest rig gear possible
- Slowing down at the end of trip when tubing is light making acceleration and sudden deceleration of blocks easier
- Rotating the tubing periodically during the trip out to reduce the potential for packers or tubing anchors setting while pulling out of the hole.

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