

# **Guidelines for Tie-downs on Offshore Production Facilities for Hurricane Season**

API BULLETIN 2TD  
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**Upstream Segment**

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## FOREWORD

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The purpose of this bulletin is to raise the awareness of the need to evaluate the tie-downs in use on offshore production facilities for drilling rigs, permanent equipment, and facilities such as quarters, helidecks, etc. The information contained herein is presented as recommendations that a platform owner/operator or drilling rig owner/operator may choose to undertake in the short-term (i.e., the 2006 hurricane season) and intermediate term (i.e., prior to the 2007 hurricane season) in an effort to improve tie-down performance during hurricanes.

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, [standards@api.org](mailto:standards@api.org).



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# Guidelines for Tie-downs on Offshore Production Facilities for Hurricane Season

## 1 Drilling and Workover Drilling Units

### 1.1 BACKGROUND

The oil and gas industry has experienced rig failures and movement of rig components during recent hurricanes in the Gulf of Mexico. Some, if not all, of the failures are attributable to the tie-down components. Occurrences on both fixed and floating platforms have resulted in significant platform damage as well as lost and/or deferred production. Recent experience shows that enhancements to current industry practice can improve tie-down performance during hurricanes.

### 1.2 PHILOSOPHY

#### 1.2.1 Applicability

This document addresses situations where failure of a drilling or workover rig would result in significant damage to the platform or adjacent infrastructure. Generally, this would include any facility designated as having a high or medium consequence of failure as defined by API RP2A. In other situations, a risk-based operational decision process should be followed. Situations that might allow deviation from the recommendations below include drilling operations in the non-hurricane season or the use of light-weight workover masts on shallow water platforms.

#### 1.2.2 Design Conditions

Drilling rig tie-downs to the platform and between drilling components are critical structural components and should have the same, or higher, level of design, material traceability, quality assurance, maintenance, and documentation as other critical structural components.

Primary rig and substructure tie-downs should be designed or assessed for location-specific loading conditions (environmental and dynamic) consistent with those utilized in the facility structural design and should be approved by an engineer experienced and qualified in offshore structural engineering.

For the same design environment, wind gust and height factors appropriate for the derrick and substructure may be higher than those used for designing the topside as a whole, and the short-term extremes will be much higher than the average loadings used in combination with wave forces for jacket or mooring design. Guidance in wind codes supports the use of 5-to 15-second gust factors for the design of such components.

Dynamic accelerations and tilting of the platform topside should also be considered, again at the extreme (not RMS) level. Rigid body (quasi-static) analysis of the rig packages themselves may be used as a first approximation.

### 1.3 SHORT-TERM RECOMMENDATIONS

The following items should be considered for implementation as appropriate by the platform operator and/or rig owner in the short-term timeframe:

- Visually inspect all tie-downs to confirm that they are in good condition and are constructed per the design drawings.
- Verify that all tie-downs can be properly installed and that no obstructions exist that might prevent installation (e.g. stiffeners on plate girders).
- For bolted tie-downs:
  - Verify by visual inspection that the bolts are in good physical condition.
  - Verify that bolts meet the required material specifications and the specifications are suitable for this application.

Note: ASTM 325 or 490 high strength bolts are not recommended, since retorquing of these bolts is not permitted per AISC specifications.

- Verify that the number of bolt torquing cycles does not exceed the design allowable.
  - Verify required bolt torque is defined and required equipment/tools are available to achieve the required torque.
  - New bolts should be installed if the above items cannot be verified.
- For mechanical/hydraulic tie-downs:
  - Verify that the tie-down system is in good working condition.
  - Verify that operating personnel are familiar with the operating procedures of the equipment.

- Verify that equipment is fail safe (tie-down force will be maintained in the event of equipment failure).
- For welded tie-downs:
  - Verify that plans, weld size, welding procedures, and inspection procedures are adequate.
- Verify that welded components of tie-downs have been properly inspected.
- Determine if there is a preferred well position for stowing the rig. If so, verify that this is clearly defined in the platform hurricane evacuation procedures.
- Verify that proper tie-down procedures are part of the platform evacuation procedures and that proper tie-down is verified in writing by the Offshore Installation Manager (OIM) or his designate prior to evacuation.
- Verify that other procedures such as setting down of all drill pipe, handling of setback load, emptying of tanks, etc. are clearly defined in the evacuation procedures and have been considered in engineering of the tie-down procedures.
- Verify that all required tie-down tools, equipment, and labor including all required spares will be available as required prior to evacuation. Any new components should be prefabricated for quickness and ease of connection.
- Verify that hurricane evacuation procedures allow time for proper tie-down prior to evacuation.
- Where feasible, an engineered, welded stop should be installed at the end of skid beams to prevent skid packages from skidding off the end of the beams. Welds should be of structural quality and properly inspected. Stops should be sized to withstand shear associated with wind and platform tilt (on floating structures) in combination with a lower bound friction assumption.
- Verify that all rig packages are properly tied down based on risk appropriate environmental and dynamic loads.
- After each hurricane evacuation, the tie-downs should be visually inspected prior to returning the rig to normal service. Any damage found should be evaluated to determine if any design or procedural modifications are required. Inspection results should be documented. Damage that is repeatedly discovered indicates a need for design and/or procedure change, and should result in more frequent inspections until such inspections indicate that the cause(s) of the fault(s) has been resolved.

The above recommendations are considered the minimum required, and any additional inspections or modifications required to prevent movement or failure of rig package tie-downs during design storm conditions should be completed as soon as possible.

## 1.4 INTERMEDIATE-TERM RECOMMENDATIONS

The following items should be considered for implementation by the platform operator and/or rig owner in the intermediate-term timeframe:

- Review design calculations of all tie-downs with updated site-specific environmental and dynamic loads and document results. Analysis and results should be approved by an engineer experienced and qualified in offshore structures. Clamps should be assessed for all appropriate well positions. Special care should be given to calculations that show either no predicted uplift or only a small uplift when compared to the gravity reaction. In such cases, there may effectively be no reserve against slightly higher wind forces.
- Review fabrication and material records to assure that all tie-down systems are properly documented. Consider replacement of tie-downs if proper documentation is not available. Otherwise, make an assessment based on conservative assumptions of material and weld properties.
- Review derrick or mast and substructure design based on site-specific environmental and dynamic loads and document results. Analysis and results should be approved by an engineer experienced and qualified in this area.

## 2 Permanent Equipment and Facilities

### 2.1 BACKGROUND

Permanent equipment, quarters, and helidecks also suffered severe damage due to tie-down failure during the recent Gulf of Mexico hurricanes. This resulted in a significant amount of damage as well as lost and/or deferred production. Recent experience shows that enhancements to current industry practice can improve tie-down performance during hurricanes.

### 2.2 PHILOSOPHY/DESIGN CONDITIONS

Tie-downs of permanent equipment and facilities to the platform are critical structural components and should have the same, or higher, level of design, quality assurance, maintenance, and documentation as other critical structural components.

Tie-downs should be designed or assessed for location-specific loading conditions (environmental and dynamic) consistent with those utilized in the facility structural design and should be approved by an engineer experienced and qualified in offshore structural engineering.

Wind gust and height factors appropriate for the tie-downs may be higher than those used for designing the topside as a whole, and the short-term extremes will be much higher than the average loadings used in combination with wave forces for jacket or mooring design. Guidance in wind codes supports the use of 5-to 15-second gust factors for the design of such components. Dynamic accelerations and tilting of the platform topside should also be considered, again at the extreme (not RMS) level. Rigid body (quasi-static) analysis of the rig packages themselves may be used as a first approximation.

## **2.3 SHORT-TERM RECOMMENDATIONS**

The following items should be considered for implementation by platform owners in the short-term timeframe:

- Visually inspect all tie-downs to confirm that they are in good condition and are constructed per the design drawings. If any doubts exist, conduct appropriate non-destructive testing (NDT). If no design drawings exist, verify that required tie-down strength exists using appropriate engineering analysis.
- After each hurricane evacuation, the tie-downs should be visually inspected as soon as possible. Any damage found should be evaluated to determine if any design or procedural modifications are required. Inspection results should be documented.

## **2.4 INTERMEDIATE-TERM RECOMMENDATIONS**

The following item should be considered for implementation by platform owners in the intermediate-term time frame:

- Review design calculations of all tie-downs with updated site-specific environmental and dynamic loads and document results. Analysis and results should be approved by an engineer experienced and qualified in offshore structural engineering.





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