Add the following definitions to Section 3.1

**braking element**
Those parts of the brake that directly or indirectly absorb the energy of the braking action.

**main drum**
A drum for spooling rope which is used to hoist, position the operating drilling or casing load, during normal operating situations.

**Emergency brake**
A brake used to stop and maintain the load on the main drum in a fixed position when in the event that the primary brake is not capable.

**Primary main drum brake**
The brake used to retard or stop motion and or maintain the main drum in a fixed position during normal operating situations.

**Secondary Auxiliary main drum brake**
An ancillary brake used to stop or maintain a fixed position of the main drum, or to assist the primary main drum brake. This brake is not a part of the primary brake.

**Drawworks**
Drawworks is a machine with one or more large diameter spool, brakes, power transmission, power source and associated auxiliary devices. The primary function of a drawworks is to reel in and out the fast line in a controlled fashion.

Revise 4.6.2 The minimum DSF - - rotary tables and drawworks shall be 1.67.

## 9.8 Drawworks

### 9.8.1 Primary load

The primary load is that induced by the fast line.

### 9.8.2 Static Fast Line load rating

The static load rating shall be the fast line pull on the main drum based on the rated wire rope diameter at the second layer.

The fast line load rating shall be the fast line load on the main drum based on the specified nominal rope diameter at the second layer. The value cannot exceed one half of the minimum breaking force F_{min} specified in API 9A, Annex C.

### 9.8.3 Primary load path
The primary load-path components for a drawworks shall be limited to those components that are mechanically loaded by the fast-line load when the emergency primary or emergency main drum brakes are engaged.

The secondary auxiliary load-path components for a drawworks are those components that are mechanically loaded by the fast-line load when the secondary main drum auxiliary brake is engaged.

Emergency load path components for a drawworks shall be limited to those components that are mechanically loaded by the fast-line load when the emergency brakes are engaged.

9.8.2 Requirements

The requirements of 5.4, 5.5, 5.6, 8.4.7, and 8.4.8 shall not apply, except as noted in this section. For antifriction bearing design and manufacturing requirements, see 9.12.19.

The manufacturer/designer shall use accepted design practices and shall apply appropriate factors of safety, except as otherwise specified within this standard.

9.8.4.1 Gear Drive

Gears used as primary load path components shall be designed and manufactured in accordance with a recognized gear-industry code or standard. The requirements of 4.2, 5.4, 5.5, 5.6, 5.7, 6.3 and 8 shall not apply. Fatigue analysis shall be based on a time period of not less than 20 years. Mechanical properties shall be established in accordance with the recognized industry code or standard chosen for the gear design.

9.8.3 Line-shaft extension for cathead

Line-shaft extensions for catheads shall be furnished as specified on the purchase order unless the drawworks is furnished with integrated catheads.

9.8.4 Quality Control

All castings and welds located in the primary load path shall be inspected in accordance with the requirements of 8.4.7.

9.8.5 Brakes
9.8.5.1 Capability

The braking capacity of a primary main drum brake relying on mechanical friction shall be no less than 200% of the torque required to produce the static load rating nominal maximum fast line pull. The braking capacity of a primary main drum brake relying on the motors used to hoist the load shall have a short term, 2 minute, capacity of no less than 125% of the torque required to produce the nominal fast line pull and a continuous capacity no less than 100%.

The braking capacity of a primary main drum brake relying on a combination of hoisting motors and mechanical friction brakes shall be no less than 200% of the torque required to produce the nominal maximum fast line pull. The portion of the braking torque produced by the hoisting motors shall be no more than the continuous rated torque of the motors.

9.8.5.2 Emergency Brake

A drawworks equipped with a primary main drum brake requiring power to maintain capability shall be equipped with a readily identifiable and easily accessible emergency brake for use in the event of primary brake failure. The emergency brake shall be independent of the drawworks control system and have functional capabilities to both stop and safely lower the load in the event of primary brake failure. The braking capacity of an emergency brake relying on mechanical friction shall be no less than 200% of the torque required to produce the nominal maximum fast line pull.

9.8.5.3 Temporary Fixing (Parking) Brake

The emergency stop device may be used as to maintain the hoisting system in a temporary fixed (park) position provided the following conditions are met:

1. The emergency stop device shall include a condition monitoring device which will signal the operator when the capability of the emergency stopping device has been reduced to 50% of rated capability. When the emergency stop capability is provided by several devices, each providing a portion of the total capability, each device shall be monitored individually and the signal provided when the capability of that device is reduced to 50% of rated capability.

2. The rated capacity rating of the temporary fixing device shall be equal to the static load rating no more than 50% of the rated capacity of the emergency stop device and must use no more than 50% of the capability of the emergency stop device.

3. The hoisting system must be stopped before the temporary fixing device is engaged.

4. The hoisting system operator must be in attendance at the hoist control while the temporary stopping device is in use.

9.8.5.4 Brake Bands for Main Drum

9.8.5.4.1 The minimum DSF for the structural strength of main drum brake bands shall be 3.0, based on the drawworks rated design fast-line pull at the median working radius, or the second layer of working rope, whichever is greater.

9.8.5.4.2 All accessible surfaces of the band shall be visually inspected after all manufacturing operations are completed. Indications with a length less than three times the width are acceptable,
provided the major dimension is less than 4mm (1/8 in) and they meet other criteria established in 8.4.7 for wrought material. No indications with length greater than three times the width are acceptable. No indications at the edges, including hole edges of the band, are acceptable.

9.8.5.4.3 The inside radius on a band, between tangent points, shall not deviate more than ±0.5% from the design radius. The inside radius measured at the edges of the band at any circumferential point on the band shall not vary more than ±0.5% of the band width at that point.

9.8.5.4.4 Maximum allowable weld undercut shall be in accordance with AWS D1.1, except that there shall be none for any transverse welds.

9.8.5.5 Braking elements

The maximum temperature of all components in the load path of a brake shall not exceed the manufacturers’ recommendation when stopping the rated load at the maximum acceleration capability of the brake system.

Note: Clutches may be employed to disengage driving components from the drum, in order to reduce the required brake element capacity.

9.8.6 Control & Monitoring

9.8.6.1 Over-travel Protection

Means shall be provided as necessary to prevent the hoisting equipment (traveling block or top drive) from being run into the crown block or drilling floor where:

- Hoisting and related operations are automated
- The hoist operator and other personnel operating the equipment do not have an adequate overview of the operation from the place of operation.
- The speed of operation is too high for the operator to react in time.

When a possible collision is detected, the hoisting system shall be stopped automatically.

9.8.6.2 System Failure

For automatic hoisting operation, any system failure shall initiate an alarm and automatically place the drawworks in a fail-safe mode relevant for each particular mode of operation.

In case of brake activation system failure (including operator error) the drawworks shall be stopped automatically.

Guidance Note: the operation may be by means of an operating handle which will return automatically to the stop position during manual operation. The stop position should be clearly marked.

9.8.6.3 Condition Monitoring
A condition monitoring system shall be provided for drawworks with automated control. A monitor of abnormal conditions that may lead to critical failure shall be available at the operator’s console. Alarms shall be initiated for abnormal situations.

**Guidance Note:**
Monitoring of the following should be considered, as applicable:
- Anti-collision
- Slack-wire detection
- Failure in the hoisting system
- Loss or reduction of cooling capability
- Failure of batteries or other emergency power sources
- Primary power supply status
- Activation of emergency stop

### 9.8.6.4 Information Display
The following parameters shall be displayed on the operators console for drawworks with automated control:
- Vertical position of the hoisting device (i.e. traveling block or top drive)
- Weight supported by the hoist
- Rate of penetration while drilling
- Drilling depth

### 9.8.7 Design
The nominal maximum fast line pull and nominal maximum fast line speed shall be based on the working radius of the second layer of rope on the main drum.

#### 9.8.7.1 Drum Stress
The maximum hoop stress for design shall be the stress caused by the combined pressure of the first two layers of rope on the drum. The combined maximum hoop, bending and torsional stresses shall be considered when calculating the stress in the drum spool. The drum flanges shall be designed for the outward pressure corresponding to the necessary lateral support of the rope wound on the drum with the maximum allowable number of rope layers on the drum.

#### 9.8.7.2 Antifriction and Plain Bearings
The requirements of Section 9.19 shall apply to all primary load path bearings. The design life of bearings shall be equal to or greater than 20,000 hours of normal operation.