

Collared Eyebolts as Lifting Equipment

What happened?

MODU crew were replacing the diverter on a MODU facility operating in Australian waters. The new diverter had been placed on its side in a cradle on the main deck for change-out of the flex-joint. Subsequently, the diverter was lifted with the intent of rotating it from the horizontal to its working, vertical axis. When the diverter had been lifted between 1.2 to 1.8 metres above its cradle, one of the two collared eyebolts used for lifting the diverter body sheared, see Figure 1 below. This caused the diverter to rotate and the second eyebolt to become dislodged from the diverter body. The diverter then fell back into the cradle on the main deck. The combined diverter and the running tool weighed approximately 21.7 tonnes and fell a distance of 1.2 to 1.8 metres. No persons were injured in the incident.

The primary immediate causes of the incident were found to be:

- The lifting equipment was configured such that the direction of pull was at an angle to the shaft of the eyebolt, so that a “fleet angle” from the vertical was created. An angular load such as this reduces the Working Load Limit (WLL) of the eyebolt significantly. See Figure 2 below;
- The collar of the eyebolt was not fully flush with the body of the diverter, causing a shearing force due to the fleet angle to be applied to the shaft of the eyebolt, instead of the load being spread across the eyebolt’s collar and the surface of the diverter as per design.

Amongst the root causes of this incident identified by the NOPSEMA investigation was ineffective lift planning.

Lift planning was previously addressed in NOPSEMA Safety Alert 59 in July 2014, which advised the industry that “the detail required in the lifting and rigging plans should be proportional to the complexity and frequency of the operation. Frequent or simple tasks may only require a basic plan while infrequent or complex lifting or rigging operations may require significant engineering.”



Fig. 1: Failed eyebolt

Assembly Safety:

- Never exceed load limits specified in Table 1 & Table 2.
- Never use regular nut eye bolts for angular lifts.
- Always use shoulder nut eye bolts (or machinery eye bolts) for angular lifts.
- For angular lifts, adjust working load as follows:

Direction of Pull (from In-Line)	Adjusted Working Load
45 degrees	30% of rated working load
90 degrees	25% of rated working load

Fig.2: Extract of manufacturer’s Application Instructions (courtesy of The Crosby Group LLC)

What could go wrong?

Failure of lifting equipment can potentially result in a dropped load or dropped object. Although in the example above there were no injuries, it is foreseeable that such an incident could result in serious injury or death. In addition, a dropped load may result in significant property damage, and/or a loss of hydrocarbon containment.

Key lessons

The following recommendations should be considered:

- Lifting plans should be completed in accordance with the facility safety management system;
- The detail required in lifting planning should be proportional to the complexity and frequency of the operation;
- Lifting arrangements such as spreader bars to ensure that the lifting force is applied in line with the axis of the threaded shaft of the eyebolts should be considered when planning lifts;
- All items of lifting equipment should be tested, certified, appropriately marked and inspected by a competent person prior to use;
- Extreme care should be taken to ensure that eyebolts are not screwed into threaded holes of a different size or type of thread;
- Eyebolts should be tightened fully down to the face of the lifted load. It should not be possible to fit a 0.04mm feeler gauge at any position between the collar of an eyebolt and the lifted load. However, eyebolts should not be over-tightened;
- A shim washer might be required to ensure that the direction of the load is aligned with the plane of the eye;
- Where the direction of the lifting force on the eyebolt is at an angle to the axis of the threaded shaft of the eyebolt that exceeds 5 degrees the Working Load Limit of the eyebolt will be significantly reduced. This must be taken into account when planning a lift using eyebolts;
- Collared eyebolts should only be used up to an angle of 45 degrees to the axis.

The legislation

Clause 9 of Schedule 3 to the Offshore Petroleum and Greenhouse Gas Storage Act 2006 requires that, “The operator of a facility must take all reasonably practicable steps to ensure that the facility is safe and without risk to the health of any person at or near the facility.” This includes an obligation to take all reasonable practicable steps to:

- implement and maintain systems of work that are safe and without risk to health [Clause 9(2)(d)]; and
- provide all members of the workforce with the information, training and supervision necessary for them to carry out their activities in a manner that does not adversely affect the safety of persons at the facility [Clause 9(2)(f)].

Contact

For further information email alerts@nopsema.gov.au and quote Alert 64. NOPSEMA safety alerts are published at nopsema.gov.au, on the ‘Safety Alerts’ page under the ‘Safety’ tab.

Reference

The Australian Standard that specifies requirements for forged collared eyebolts for lifting purposes is AS 2317 – 1998 “Collared Eyebolts”.