

Monobuoy Reference Project for



Societe de recherche et d'exploitation des Petrole en Tunisie



... Ifrikia Overhaul Project

Ifrikia Hinge replacement



Ifrikia Hinge Replacement

Clients:
SEREPT

Location
Tunisia

Project Characteristics:
Design
Procurement
Maintenance
Supervision

Project Size
Undisclosed

Dates:
2006

Monobuoy Scope:

- Inspection of articulation between SBS Yoke and tanker
- Design, supply and installation supervision of new stainless steel shaft, polymeric bearing and associated items
- Design, supply and installation supervision of lifting gantry
- Design supply and installation supervision of automatic greasing system for articulations



Project Highlights

1 General

The starboard hinge has been reported to be giving problems for several years. It has always been noisy and been subject to vibrations when moving in either the rotational or axial directions. The noise was the worst when the axial hinge had excessive play which allowed the radial hinge to be moving excessively in an axial direction. There are a series of previous reports, which describe the problem, and the different stages of material coming out of the hinge, and bolts breaking etc which sufficiently document these problems.

It had been assumed that the problem was coming from excessive wear or damage to the Tufnol bush, and the recommended remedy had been to change this bush.



The contract for the engineering, fabrication, procurement, and supervision of the hinge replacement was awarded to The Monobuoy Company in 2004. The contract was awarded too late for the installation to take place during a good weather period, and the offshore works took place in two stages in 2005.

The first stage was to install a temporary hinge, and this took place in the period 1st of February until 16th of February 2005. The work was not completed during this time as it was found that the machining of the main yoke lifting / pivot lug had been mis-aligned during the original fabrication. This problem required to be corrected to complete the temporary hinge assembly. A rectification procedure was formulated, reviewed and approved by ABS, new parts were fabricated and shipped to Tunisia.

The second stage was to carry out the full repair, and this took place in the period 20th of June 2005 to 6th of July 2005. The initial step was to dismantle the temporary hinge, which had been left in place from February, and correct the misalignment. The temporary hinge was then assembled completely, tested, and put into service. The components of the Main Radial Hinge were then removed, inspected, and replaced with new components.

The Main Radial Hinge was returned to service on 1st of July, and the temporary hinge was removed and stored.

2 Offshore Stage 1 - 1st of February until 16th of February 2005.

2.1 Install Monorail and Scaffolding

A monorail was installed above the axis of the main and auxiliary hinge starboard. This monorail extended over the side of the barge to allow items to be lifted directly from a supply boat below. The monorail assembly was a bolted unit and had a SWL of 2.5 Tonne.

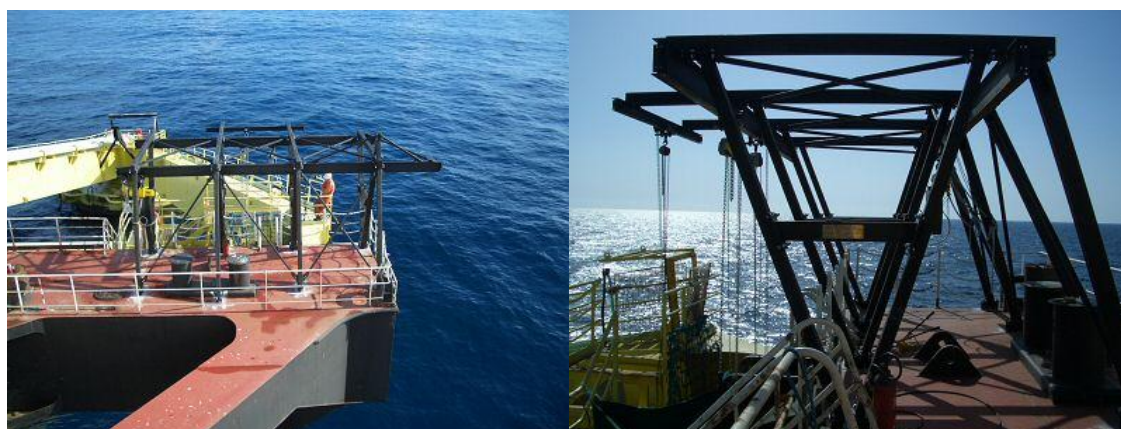


The heaviest component of the auxiliary hinge was the shaft at 1000 kgs.



Later, the monorail was used for the full hinge repair, where the heaviest component is the main shaft, which weighs 1800 kgs. A small pneumatically powered 2T hoist and trolley was supplied, in addition to 2 other manual chain-blocks and trolleys.

The monorail was designed in order to be used for the starboard hinge as well as for the onboard hinge if needed at a later stage. Prior to use, the monorail was tested in the presence of BV on 05.02.2005. The nameplate was stamped by BV to show the different load tests which were performed.



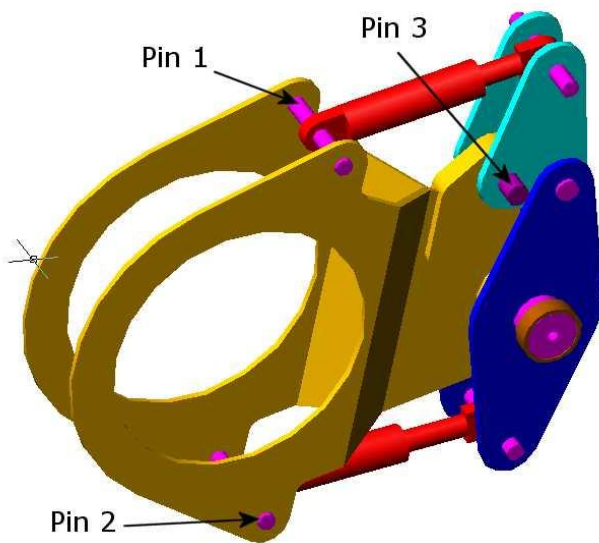
A lower access platform had previously been installed by SEREPT to the underside of the yoke and tanker beam to allow access for the installation of the lower hydraulic cylinder and for ease in the installation of the auxiliary hinge components

2.2 Install Auxiliary Hinge Alignment Linkage

The linkage for aligning the starboard shafts was installed on the auxiliary hinge.

The linkage consists of:

- 2 triangle links (shown in light blue)
- 2 diamond links (shown in dark blue)
- 1 special auxiliary shaft (shown in brown)
- 2 bronze bushes (shown in red), complete with hydraulic
- 2 hydraulic jacks (shown in yellow), complete with hydraulic
- 6 pivot pins (shown in purple)
- Hydraulic power pack (pneumatic supply)



2.2 a Removal of the Existing Auxiliary

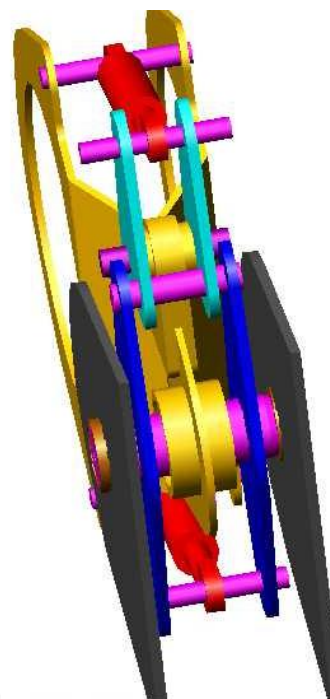
Burn off the welds holding the large “C” washers in the

Weld on a pulling flange to the head of the shaft. With

Weld eight jacking bolt nuts to the structure to be able with of the shaft

Tighten all jacking bolts equally with the air driven torque

The shaft required a large force to free the shaft from the welded by rust. The total force required was in the region removing this shaft



Hinge

shaft

eight jacking bolts

the aid of a blind flange, push the other end

wrench

two supports where it had been firmly of 380 to 400 tons. Nearly 2 days were spent

2.2 b Installation of the Upper Linkage

The bore of the yoke pivot bush was carefully cleaned and prepared by grinding such that the new shaft would be a tight fit.



The machined shaft was installed into the yoke pivot lug and 2 triangle plates on the shaft.



The upper cylinder was installed, only connecting the triangular plate end of the cylinder. The other end is left free to allow the triangular plate to rotate forwards sufficiently to be able to insert the connecting pin triangular plates / diamond plate.



The triangular plates were rotated towards the ship until the pin holding the shaft end could be inserted and locked into place with the bushes and cotter pins.

2.2 c Installation of the lower linkage

One diamond plate was onto the triangle plate shaft

The lower cylinder was installed, only onto the lower side of the installed diamond plate. The free end of the cylinder was suspended with a sling from the underside of the yoke to allow for free movement of the cylinder.

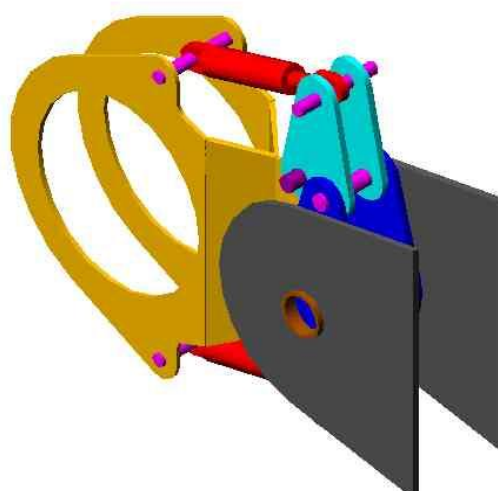


The second diamond plate was then installed onto the upper triangular plate shaft and the lower cylinder.



With a chain block, the diamond plates were pulled towards the tanker to allow for the installation of the auxiliary hinge shaft.

The new bearing shaft was lowered down and the tanker beam lugs. The shaft was fixed to the 2 diamond plates by bolting the two collars.



were pulled towards the tanker to allow for

and slid through the bore of diamond plates fixed to the 2 diamond plates by bolting the

3 Offshore Stage 2 - 20th of June 2005 to 6th of July 2005

3.1 Installation of the Auxiliary Hinge, including correcting the misalignment

Unfortunately in order to correct the misalignment, it was necessary to fully dismantle the auxiliary hinge linkage. The procedure for carrying out the rectification work was formulated by TMC, and verified and approved by ABS. The procedure along with the ABS certificate was submitted to BV in Sfax prior to carrying out the work. The correction of the misalignment and installation of the resin was witnessed offshore by BV. The ABS certificate is attached to this report as an addendum.

3.1 a Removal of the Auxiliary Hinge

The auxiliary hinge was removed in the reverse order to the installation

3.1 b Installation of the Upper Linkage, with revised shaft

The shaft was installed into the yoke pivot lug. The shaft was installed with a bronze centre pivot to allow the shaft to be re-aligned in the bore. Special washers with O-rings and seals were installed on the two ends of the shaft (to allow for the resin injection after final alignment)



Install the 2 triangle plates on the lugs on shaft

Install the upper cylinder, only connecting the triangular plate end of the cylinder. The other end is left free to allow the triangular plate to rotate forwards sufficiently to be able to insert the connecting pin triangular plates / diamond plate.

The triangular plates were rotated towards the ship until the pin holding the shaft end could be inserted and locked into place with the bushes and cotter pins.

3.1 c Installation of the lower linkage

Install one diamond-plate onto the triangle plate shaft

Install the lower cylinder, only onto the lower side of the installed diamond plate. The free end of the cylinder was suspended with a sling from the underside of the yoke to allow for free movement of the cylinder.

The second diamond plate was then installed onto the upper triangular plate shaft and the lower cylinder.

With a chain block, the diamond plates were pulled towards the tanker to allow for the installation of the auxiliary hinge shaft.

The new bearing shaft was lowered down and slid through the bore of diamond plates and the tanker beam lugs. The shaft was fixed to the 2 diamond plates by bolting the two collars.

The shaft was then aligned in the bore of the Tanker Beam Lugs with the use of the chain block to control horizontal position, and the hydraulic system on the upper cylinder to control the vertical position.



The two bronze Traxl bushes were fitted to the ends of the shafts, and inserted into the tanker beam lugs. This stage fixes the orientation of the Tanker Beam machining to the yoke pivot lug.

3.1 d Resin Pouring

The special washers on the ends of the triangular plate pivot shaft were then sealed with neoprene and the tubing installed to be able to inject the resin.

The resin was injected until clean resin could be seen coming out of the upper vent pipes.



Test pieces were made. The test pieces (6 Samples) were tested periodically until such time that it could be assured that the resin was sufficiently cured to support the full load.

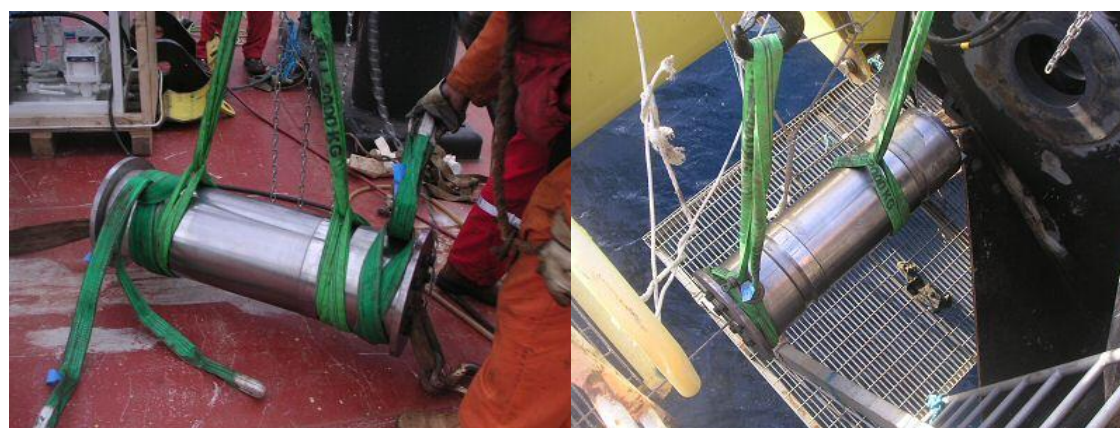


When resin was cured (44 hours after the injection), the lower cylinder was extended until the pin could be inserted, and installed with the bushes and cotter pins. The jack was then in 'Free' mode.

3.1 e Auxiliary Hinge Trial & Adjustment

The vertical and horizontal cylinders were in 'Free' Mode and the mechanical locking devices were wound off to be able to have free travel of the cylinders.

The hydraulic motors were run to be able to have motor pressure to be to actuate the cylinders if required. The motor pressure was steady at 130 bars for both motors.



It was noted that the horizontal cylinder was moving in and out with the motion of the tanker pulling and pushing. This motion is an indication of the play caused by wears in the radial hinge.

The horizontal cylinder was put into 'Locked' position when the cylinder play was noted to be in the mid position. Pressures were noted

It was noted that with a sea state of 1.5 to 2.0 m wave and 10-knot wind, the pressure was varying between 70 to 90 bars. The temporary hinge was inspected. Mechanically, there were no anomalies noted. There was a slight click heard when the hinge was moving axially.

The vertical cylinder was then placed in 'Locked' mode, and the yoke was lifted. It was noted that the weight of the yoke corresponded to 62 bars pressure on the jack.

By measurement on the Merriman to shaft position, the yoke was lifted until the main shaft was centralized in the Merriman. The horizontal position was also verified. The wear on the tufnol bush was checked and found to be around 7 mm. (daily report 26.06.2005).

The temporary hinge was left in this position for three hours, pressures were recorded, and the components inspected. At the end of this time, the mechanical locks were tightened down to prevent any movement, and as an additional security, the hydraulic pressures were maintained.



The test was found to be satisfactory both structurally and for the sea state encountered. The actual pressures required for adjustment of the position of the radial hinge being significantly lower than the working pressure of the hydraulic system meant that:

- The hinge could be adjusted in any direction using the hydraulic power available without being close to the limits of the system.
- The actual forces being applied were low in comparison to the mechanical strength of the temporary hinge.



The decision was taken to dismantle the Radial Hinge with the present weather state and complete the hinge repair.

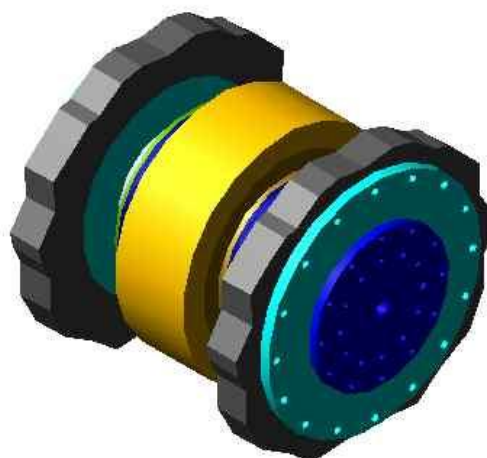
3.2 Replacement of the Existing Bush

3.2 a Scope

The shaft will be withdrawn from the bush The Monobuoy Company. Once the shaft Tufnol can be removed and the shaft fully be installed and the shaft replaced.

The various components referred to in SBM Drawing 0000.701.4.01295 Radial

Note that there is a mistake on this wrong component.



and supported in a cradle specially designed by is safely supported, the broken pieces of inspected for damage. A new plastic bush will

this section can be crossed-referenced to the Hinge General Assembly.

drawing. The arrow on Item 5 points to the



3.2 b Dismantling the Existing System

3.2 b(i) Removal of the Shaft

All holding bolts on the centralizing rings except for 2 were removed and replaced by specially made jacking bolt assemblies (both inboard & outboard).

All holding bolts between the shaft cover plate and the ends of the shaft were removed, and the cover plates were removed (both inboard & outboard).



All jacking bolts were installed into the centralizing rings (well greased with Moly-slip or equivalent).

All of the jacking bolts were tightened until one of the cones moved outwards.

The shaft was examined to see which cone is free from the shaft, and which is still tight.



It was noted that the cones on both sides were moving freely on the shaft, so both cones were retracted equally simultaneously.



The shaft was supported on two slings held from the monorail to maintain it level at the moment of the final removal of the cones.

At the time of the final removal of the cones, a small problem arose where one cone was disengaged from the shaft whilst the other cone was still on the end of the shaft. The shaft tilted in the remaining cone and jammed. As it was not easy to unjam the shaft in the present

position, the shaft and cone were removed together and placed on the deck where a separate team were able to work on separating the two parts whilst work progressed on cleaning and inspecting the existing bush in internal parts.

3.3 Automatic Greasing System

The system was installed and tubed by a SEREPT instrument technician without the presence of TMC personnel.

The Monobuoy engineer checked the work and commissioned the system. The timers and counters were set and the stroke of the distributors set.

On start-up of the system, a small problem occurred with a control valve in the cabinet, which required the valve to be dismantled and checked. As this valve was under guarantee, it was decided to return it to the manufacturer for verification and replacement. The commissioning was postponed until a later date.



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