



WHITE PAPER

**EFFECTIVE
FLARE TIP
REPLACEMENT**

THE POWER OF PREPARATION



INTRODUCTION

Flare tip replacement is a challenging operation which exerts pressures across the entire project team. Extremely tight shutdown windows are necessary to minimise impact on productivity, but present a level of complexity and risk that demands excellence in engineering skill and safety standards.

This is why major offshore operators such as ExxonMobil trust Conbit to undertake flare tip replacement work. This white paper combines decades of Conbit's engineering expertise and customer feedback to provide an overview of the flare tip replacement process, selecting the right supplier and the benefits that mechanical handling can offer.

SAFETY

Safety is paramount with multiple aspects regarding personnel, equipment, infrastructure and the environment to consider in delivering a safe project.

The flare tip is sited above the plant or above water and so the possibility of the unit itself or parts of the handling equipment dropping presents a significant risk, as does the need for rope access work.

Time pressure, which is always present during shutdowns, increases the risk a hazardous situation occurring, and that is why offshore operators frequently look to a specialist contractor to ensure the work is carried out safely.

The key criteria to consider when selecting a specialist contractor are:



- The power of preparation. Detailed method statements and 3D renderings of procedures allow all those involved to have the best view of the planned work and can prove invaluable in identifying required precautions during the Hazard Identification (HAZID) stage.
 - The quality and condition of equipment. A supplier with their own inventory and strong equipment management processes can be critical to project safety.
 - The safety record of the supplier. Strong safety records provide assurance that you are working with a conscious supplier who prioritises safety.
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TIME CHALLENGE

Flare tip replacement can be on the critical path during maintenance shutdowns, which means delays or time savings in the replacement work can have a direct impact on plant performance.

Operators of offshore assets require confidence that schedules will run to time, so selecting not just the right supplier but also the best working methods is essential.

- Repetition and routine in flare tip replacement can make a major difference in the time required to safely and accurately finish the work. Selecting a supplier with a strong track record in similar work is the best way to achieve this.
 - Communication lines should be kept as short as possible. The offshore team can make decisions independently, which can save valuable time. The offshore team is able to determine the impact of their decisions and can consider whether further consultation with the engineering team is required.
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ENGINEERING CHALLENGE

There are three ways in which offshore flare tip replacements are more challenging than onshore lifting projects.

First, the job must be completed in a harsh, fast changing environment.

Second, the lifting is done high above the deck of the offshore asset, which makes mobilisation challenging.

Third, the temporary lifting system has to be erected from below without any lifting aids above.

These challenges demand both strong engineering skills and well trained offshore teams to ensure a smooth transfer from planning to implementation.

The combination of these facets is highly valued by many offshore operators, and Conbit has found the following factors are often crucial when assessing engineering capabilities.

- Strong structural engineering and analysis experience. The dynamic factors of the lifting operation require detailed structural analysis. Flare tip lifting to and from supply vessels are engineered without the use of motion compensated systems. The use of high speed winches in combination with light weight lifting material demands detailed feasibility analysis by qualified structural engineers.

- Offshore operators demand engineering that can be verified. The reporting style of Conbit allows for third party checks, which is like a breath of fresh air for the project team of the client.
- In our operation, we have more and more interactions with third party Marine Warranty Surveyors. Offshore operators feel confident that they are able to convince these parties of the feasibility of the engineered solution with the engineering documents provided by Conbit. Often, our clients let Conbit take control of the MWS process and be in direct contact, which increases the project's efficiency.

FLARE TIP REPLACEMENT PROCEDURE

Shutdowns for flare tip maintenance and replacement are typically planned well in advance as they require cessation of production at the facility. They are therefore kept to a minimum, limited to unavoidable repairs and replacement. The flare is the last part of the plant that is shut off and the first to be turned on, which puts pressure on the team completing the flare scope.

DIFFERENT METHODS

There are a number of different methods to replace flare tips, which are laid out as follows. The selection of the most appropriate solution depends on safety requirements, budget, and the availability of crane vessels or jack up barges and bed spaces.

ExxonMobil often chooses to replace their flare tips with a mechanical handling method. This requires a small team of 4 – 6 persons and only a few days of shutdown. It allows for easy planning and preparation, and for the lifting to be done in a controlled manner with unnecessary risks mitigated during the preparation phase.



	HELICOPTER	CRANE OR JACK UP VESSEL	MECHANICAL
Safety at flare tip access platform	The flare tip access platform is small and there are no rapid escape possibilities if the load starts to swing.	Standard riggers at the flare tip access platform.	Crew is used to working at this altitude.
Exposure	Limited in time. The operation will draw attention.	Minimum exposure.	Operation will take 3-5 days at the top of the flare.
Visibility on the load	From the cockpit, the pilot usually cannot see where the hook is – even with plexiglass side-bubbles or removable doors. The pilot must rely on the signaller's communication to manoeuvre into position.	Line of sight depends on the positioning of the jack up vessel, which depends on soil conditions and other jack-up barge activities.	Clear line of sight from winch to load.
Load positioning	Hovering with a load is a difficult, fatiguing and potentially dangerous activity that requires a high level of pilot concentration and should therefore be limited in time.	The long line of the crane might cause some swinging of the load.	The load can be controlled from within arm's reach.
Flexibility	Flexible. Needs to be booked well in advance. Dedicated mobilisation	Spot market availability.	Just in time mobilisation.
Standby	Full spread rate applies.	Full spread rates apply.	Limited cost impact.
Associated services	Different crew required to perform rigging below the flare tip access platform, and for mechanical works	Additional lifting equipment required for lifting below the flare tip access platform. Additional crew required for mechanical works.	Equipment can be used for lifting below the flare tip access platform. The same crew can perform mechanical works and repair and modification services.
Duration	Pre-S/D: 2 days S/D: 1 day Post-S/D: 1 day No option for additional works.	Pre-S/D: 2 days S/D: 1 day Post-S/D: 2 days	Pre-S/D: 2 days S/D: 3-4 days Post-S/D: 2 days
Persons on Board	4-5	3-4	5-6
Costs	High – often outweighs any saving in duration.	Depending on availability..	Moderate.

In some flare structures, a davit or other permanent lifting structure is incorporated. Many offshore operators integrate this permanent lifting solution into the design during the construction of the offshore facility, because they feel that they need to take precautions for the future. The main disadvantage of permanently installed lifting systems is that you need to inspect and test them before use. These activities need to take place within the shutdown period. If the system does not pass the tests, you cannot complete the flare tip replacement as planned. It will either jeopardise the shutdown duration and/or the budget, or the flare tip cannot be replaced.

MECHANICAL HANDLING – THE MOST EFFECTIVE SOLUTION

Conbit advocates the use of handling flare tips with temporary lifting equipment. The lifting equipment is installed at the flare tip access platform and is operated by winches, which remain at deck level.

WHY?

The mechanical flare tip handling method provides the maximum control of the load. Your lifting system is based on a fixed platform, so you can position the flare tip smoothly. Methods based on floating or helicopter crane capacity have the risk of bumping the flare tip when positioning it.

Testing of the temporary lifting system can be done before mobilization. This advantage results in fewer project risks during the operation. The last thing you want to happen during your shutdown is that you are unable to perform the lift, because the lifting system is not fit for purpose. Permanently installed davit systems do not provide this advantage.

The use of temporary lifting systems can be planned better. For other lifting methods (eg a helicopter or crane vessel) the operator depends on the availability of expensive equipment. Although the operation might be shortened, the standby costs for contingencies are very high. Temporary lifting systems can be mobilised well in advance with lower costs.

METHOD

The flare tip replacement project starts with a period of engineering and project preparation, which results in a load tested system packed into an offshore container. This container is transported to the offshore facility and brought onboard. The crew soon follows and arrives at the offshore facility a few days prior to the shutdown.

Before the shutdown, Conbit's crew unpacks the container and starts preparing at deck level. For a typical flare tip replacement project, the crew installs two winches on deck level. These winches are used for setting up the flare tip handling system and they will perform the actual lifting. The winches are connected to their power source and are then ready to commence the lifting operations.

When all flanges of the flare system are spaded and the system is flushed, the works inside the flare structure start. This part of the job is considered to be within the shutdown and is kept to a minimum. The first operative climbs up in the flare tower and brings a rope and a sheave, which is used to pull up one of the winch wires. Once this winch wire is reeved through the sheave, all other components are lifted to the flare tip access platform by the winch. At the flare tip access platform, the lifting configuration is assembled and load tested.

Once load tested, the old flare tips are lifted overboard. They can either be lifted to a supply vessel or can be lowered and retrieved from the platform. The new flare tip is lifted and connected to its flange at the top.

After the flare tips are replaced, the lifting configuration is disassembled and lowered to deck level. The shutdown period can end after the flare tip access platform is cleared, the flare tips are commissioned, and all crew have safely departed the flare structure.

After the shutdown, the winches and all flare tip handling equipment are packed into the container, and demobilisation of crew and equipment commences.



THE POWER OF PREPARATION



FLARE TIP REPLACEMENT – MALAMPAYA

Shell Philippines contracted Conbit to replace the flare tip on their Malampaya offshore facility, in the West Philippine Sea.

The flare tip (weighing 4160 kg) was replaced during the 2017 shutdown.

Shell approached Conbit because of our specialized flare tip replacement service. Our highly experienced rope-access technicians and riggers have proved themselves to be readily adaptable to changing situations and weather conditions offshore.



Photo: Execution of flare tip replacement with temporary lifting equipment

PROJECT

✓ ENGINEERING

✗ PROCUREMENT

✓ INSTALLATION

Client

Shell Philippines Exploration BV

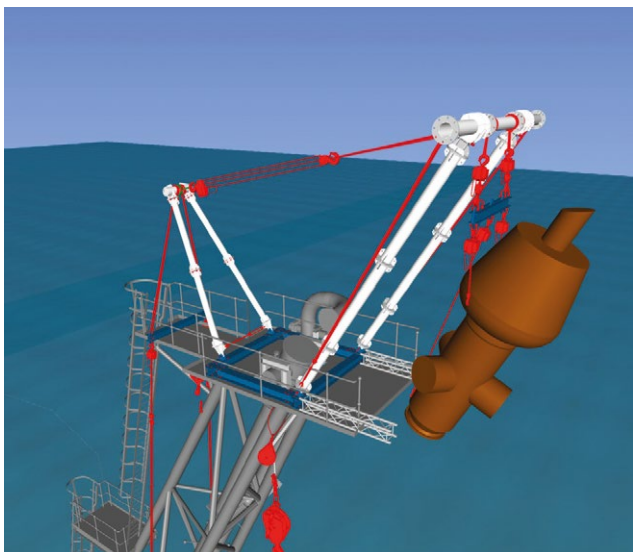
Project Name

Malampaya flare tip replacement



FLARE TIP REPLACEMENT MALAMPAYA

01SD058-A



Picture: Engineered flare tip replacement handling system. Featuring Conbit's adjustable modular equipment

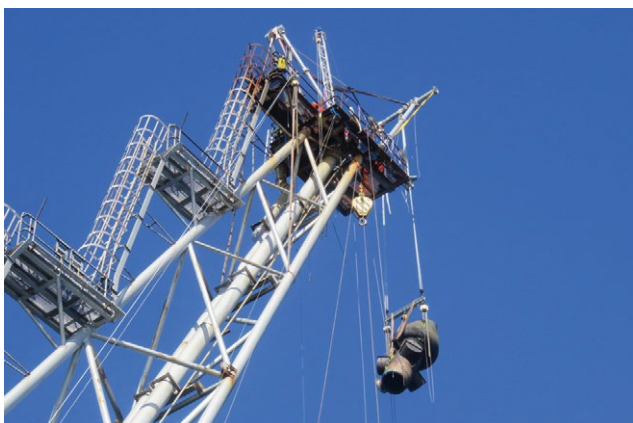


Photo: During lifting operation



Photo: New flare tip



Photo: Old flare tip

PREPARATION AND TESTING

Because flare tip replacement is such a critical activity during a shutdown, the Conbit team is always well prepared and the handling systems are thoroughly tested in advance.

SAFE AND RELIABLE

Conbit's mechanical flare tip replacement method has several advantages over the helicopter lifting method. The risks are better controlled because Conbit's method consists of a series of small, easily manageable steps. Furthermore, bringing in mechanical handling tools is relatively easy, and the team required is smaller than in the case with helicopter lifting. In short, Conbit's mechanical flare tip replacement method is safer, more reliable and less costly.

PERFORMANCE

The client's management was delighted with Conbit's execution of this project, because this highly critical activity was completed on time, within budget and safely.

The client complimented the Conbit team not only on their excellent safety measures and good safety observations during the project, but also on their thorough equipment preparation at the Conbit warehouse and the load test execution.

"TO MINIMIZE SHUTDOWN TIME, CONBIT'S FLARE TIP HANDLING SERVICES ARE WELL PREPARED AND SYSTEMS ARE THOROUGHLY TESTED"

THE POWER OF PREPARATION



West Kingfish Flare tip replacement, Australia

ExxonMobil contracted Conbit for the offshore flare tip replacement project West Kingfish (WKF) platform.

ExxonMobil requested Conbit to offer its specialist service in the field of flare tip replacements. They were chosen because of their well-established handling methodology and reputation for many flare tip replacements all over the world.

Conbit explained the handling method, which is used for many flare tip replacements all over the world as a more favourable method due to its cost-effectiveness and flexibility.

After reviewing the available information, Conbit was confident of the feasibility to use a mechanical handling method for the replacement of the flare tip.

The flare tip access platform has sufficient strong points to carry the loads of the lifting system, and the flare tip. However, to be sure and to convince all stakeholders, a client visit was carried out and the engineering phase was initiated.



Photo: Disconnecting the Rigging line from the load that is attached to the offshore lift line.

PROJECT

- ✓ ENGINEERING
- ✓ INSTALLATION

Client

ExxonMobil

Project Name West Kingfish Flare tip replacement project

ExxonMobil

Flare tip replacement, Australia

01SD080A

The flare tip at the flare tip access platform (FTAP) required replacement during the shutdown. A base frame and lift boom were utilised to perform the mechanical handling in the removal of a pre-existing flare tip and replacement with a new one weighing 442kg and measuring 3.747m x 819mm. A supply vessel was used to move the existing and new flare tip to and from the platform.

It was completed within four days.

The Kingfish A (KFA), Kingfish B (KFB) and West Kingfish (WKF) platforms are located within Production Area VIC/L07 approximately 72 to 77 km off the Gippsland coast in approximately 77 to 78 m of water depth. The KFA platform is connected to the KFB platform by the KFA-KFB400 pipeline; the KFB platform is connected to the Halibut (HLA) platform by the KFB-HLA500 pipeline; and the WKF platform is connected to the KFA platform by the WKF-KFA300 pipeline.



Photo: Dismantling lift boom



Photo: Preparation for rotating new flare tip.

THE POWER OF PREPERATION

Conbit prepared for the manoeuvre with a thorough engineering plan and ensured all operators were well-trained and were expertise in flare-tip operations. Conbit monitored the sea state and the wind speed. The flare tip access platform had a sufficient amount of strong points to carry the loads of the lifting system and the flare tip. To assure all stakeholders involved, factory acceptance test (FAT) took place during the engineering phase at the Conbit warehouse, with the client witnessing it.

CHALLENGES

Conbit was required to mobilise the equipment in a very short timeframe, which tested the logistics team's ability. With expert planning and shipping of equipment, Conbit could negotiate this challenge.

BAD WEATHER

Conbit monitored the weather prior and during operations as bad weather was anticipated which had the potential to limit access to the platform and disrupt the overall operation. The staffing schedule had to be adjusted to ensure that the work would be completed before the weather impacted on the operation and had to dismantle the equipment after the weather had passed, three days later.

"The handling method is more favourable alternative due to its cost-effectiveness and equipment's flexibility."



Flare tip replacement, Australia

ExxonMobil contacted Conbit for the offshore flare tip replacement project at the Snapper (SNA) platform. They were chosen because of their well-established handling methodology and reputation for many flare tip replacements all over the world.

A base frame and lift boom were utilised to perform the mechanical handling in the removal of a pre-existing flare tip and replacement with a new flare tip weighing 731kg.

Using this lightweight equipment, compared to a helicopter, this offered a more cost effective and flexible method that was more favourable to the client.

It was completed within three days – less than the given timeframe.

The SNA platform is located in Production License Area VIC/L10, approximately 32 km off the Gippsland coast of Australia in a water depth of 55m. The Snapper EP covers all activities relating to hydrocarbon production from the Snapper facilities and transport of hydrocarbons in the associated pipelines.



Photo: Lifting new elbow part

PROJECT

✓ ENGINEERING

✓ INSTALLATION

Client

ExxonMobil

Project Name

Snapper - Flare tip replacement project

ExxonMobil

Flare tip replacement, Australia

01SD079A

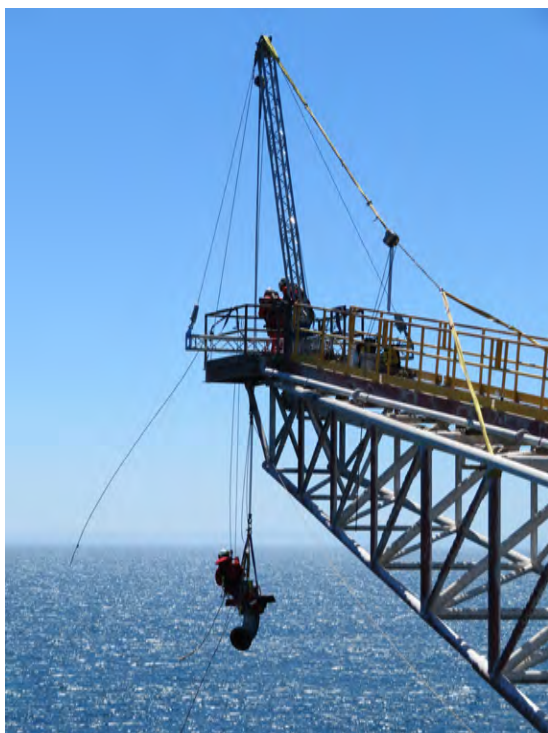


Photo: Disconnecting the rigging line from the load



Photo: Load ready for lifting to the supply vessel

THE POWER OF PREPERATION

Conbit prepared for the manoeuvre with a thorough engineering plan. The flare tip access platform had a sufficient amount of strong points to carry the loads of the lifting system and the flare tip. To assure all stakeholders involved, a load-test took place at the engineering phase at the Conbit warehouse, with the client witnessing it. After this, the primary lifting equipment was sent via air cargo.

CHALLENGES

Conbit faced the unexpected challenge of performing the offshore lift to a supply vessel with no dynamic positioning. This impacted the timing and created further challenges of keeping the vessel level and finding the critical moment for the touch-down. As a result, Conbit devised an action plan to minimise this impact.

Furthermore, Conbit was required to mobilise the equipment in a very short timeframe, which tested the logistics team's ability. With expert planning and shipping of equipment, Conbit could negotiate this challenge.

ADDITIONAL SCOPE

Conbit were also tasked with removing existing piping using their lightweight rigging equipment and changing out the elbow from underneath the flare-tip, weighing 350kg. By remaining flexible and adaptable, Conbit could easily take on this additional scope for the client.

ABOUT CONBIT

We believe that in our business preparation is key. We prepare our projects so thoroughly that they always run smoothly and efficiently. This is how we make a difference for our clients.

Our people are what make Conbit the leader in our field. For us, project preparation is all about teamwork in an open and transparent atmosphere. We challenge ourselves to go beyond limiting boundaries to find better and more creative solutions and to design, supply, install and maintain projects perfectly, safely and on time. Our clients rely on us not only because of our strong team that works with them in close consultation but also because we invest in the latest technologies and equipment to meet their needs, so that they can excel in their industry.

With over 20 years of experience, we have a proven track record in special lifting and structural engineering. Clients come to us for our full-service approach and our innovative customized solutions. In preparing our projects so thoroughly we create a reliable, safe and sustainable base, from which we have a powerful impact in our clients' benefit.

Conbit

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