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This helps owners to extend their vessel's drydock interval and eliminates the loss of time and production brought about by drydocking. Since Hydrex divers first carried out an underwater face seal replacement 15 years ago, the company has constantly worked to advance the techniques used for all kinds of seal repairs. This led to the development of the flexible mobdock (mobile mini drydock) technique which allows Hydrex teams to create a dry underwater working environment around a seal assembly. The technique makes it possible to replace stern tube seals in their entirety underwater.

Five years ago Hydrex started working together with seal specialists AEGIR-Marine, providing it with the capability to repair or replace all the major seal types. Since then Hydrex has continued to develop the mobdock technique to adapt it to all possible situations, and has received full class acceptance from several major classification societies to perform underwater stern tube seal repairs.

The following case studies give an account of some of the more important recent seal repairs performed by the company.

Repairs in France

The Hydrex flexible mobdock technique was used to reposition the aft stern tube seal assembly of a 210m long container ship in Le Havre. A Hydrex diver/technician team performed this operation to stop an oil blockage that occurred just after the vessel came out of drydock.

Every Hydrex office has a fast response centre equipped with all the latest facilities, lightweight equipment and tools, and this made it possible to immediately mobilise a diver/technician team to Le Havre from the headquarters in Antwerp.

After the rope guard was removed the diver/technicians discovered that the oil flow through the stern tube seal assembly

ON SITE STERN SEAL REPAIRS

Around the world the Belgian specialist Hydrex has carried out repairs and replacements on all types of seals in-situ, and in most cases underwater, for a number of years

was blocked because part of the assembly had been positioned 180° the wrong way. After the flexible mobdock was installed, the assembly was opened and all parts were closely examined and cleaned. This inspection revealed that all seals were in good condition but that the bonding was faulty. The seals were re-bonded and the seal assembly refitted correctly.

The job was completed after four days, including full re-welding of the rope guard and shifting of the vessel to another berth.

Rudder and stern tube in Belgium

A Hydrex diver/technician team performed a crack repair on the pintle area of the rudder of a 181m long tanker and carried out a detailed inspection of the stern tube seal assembly of the vessel while it was berthed in Ghent, Belgium. Following this inspection the team replaced the worn seals and installed a spacer ring, thus creating a new running area for the seals.

Prior to the operation the vessel was trimmed as much as possible. The Hydrex team then built a scaffolding around the rudder pintle and the stern tube seal assembly. Next they removed the rope guard and the damaged areas of the outer plating of the rudder. This allowed an inspection of the stern tube seal assembly to be undertaken and a start made to the repairs to the

rudder.

While the team prepared a first insert plate on shore, the inspection of the seal assembly revealed that the seals were worn and needed replacement. Next they installed the first insert and secured it while the second plate was prepared. Simultaneously another part of the team opened the stern tube seal assembly and it became clear that they needed to renew the running area of the seals as well. The team did this by installing a new spacer ring on the stern tube flange after which they replaced and bonded the three seals.

Hydrex performed all operations under DNV requirements which were verified by an attending surveyor. The diver/technician team rotated in shifts to finish both repairs in the shortest possible time and avoid any unnecessary delays for the vessel.

Fast response in the USA

When oil was leaking from the stern tube seals of a general cargo vessel, Hydrex mobilised a certified diver/technician team to the vessel's location in Mobile, Alabama, to perform underwater stern tube seal repairs before the ship was transferred to a new chartering party.

Hydrex had already performed a similar operation on one of the customer's other vessels so it was aware of Hydrex's



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well-trained diving teams and ability to handle this kind of situation without loss of quality or time for the customer.

Because the US Coast Guard has very strict policies concerning environmental risks, it would not allow the vessel to sail to a different location before the oil leak had been permanently fixed.

A team immediately left from the Hydrex office in Clearwater, Florida, together with the needed equipment, and set up a diving station at the berthing location of the ship. After the flexible mobdock was installed around the stern tube seal assembly and a dry underwater environment created, the damaged seals could be replaced.

In order to provide the customer with the fastest possible response, flexibility was essential throughout the entire operation. Hydrex was able to perform the repairs in a very tight timeframe and made sure that the new charterer could sail the vessel free of oil leaks.

Typhoon does not stop repairs

When an oil leak prevented a 225m long bulker from continuing its sailing schedule, a Hydrex diver/technician team mobilised to Manila together with one of the company's flexible mobdocks to perform emergency underwater repairs at anchorage.

A typhoon was crossing over the Philippines at the time the team arrived. The storm grew to a climax just after preparations had been made for the repair. Unfortunately this delayed the underwater operation by a day, which began when the weather had improved slightly and full safety could be guaranteed for the divers.

Still under severe sea conditions, the rope guard was removed and an inspection



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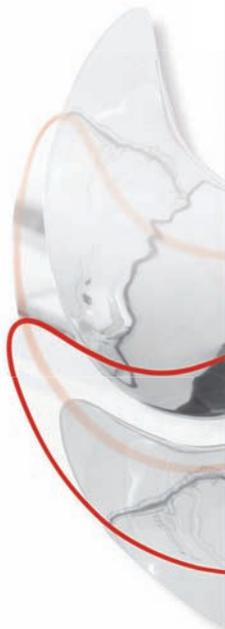
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revealed that a fishing net had been caught in the assembly and was tangled up around the entirety of the seals. The flexible mobdock was then installed. This created a dry working environment for the divers at a depth of 12m in which they could replace the damaged seals.



Even though they were forced to halt the repair briefly during the peak of the typhoon, the team worked through the rest of the storm to make sure that the delay for the customer was kept to an absolute minimum.

Underwater repair in Nigeria

Recently a Hydrex diver/technician team performed an in-situ underwater stern tube seal repair on the mechanical seal of a 150m long general cargo vessel in Lagos. A rope was caught in the seal assembly causing an oil leak.

The owner asked Hydrex to assist the vessel in Lagos because a similar operation had been performed on another of the company's vessels and it knew the repair would be carried out in-situ within a very short time frame.

As the ship was equipped with a mechanical seal assembly there was no need to use a flexible mobdock as the repair could be performed in the wet. This allowed the underwater team to arrive at the location at the same time as the vessel and only days after the enquiry was made.

The repair started with the removal of the rope that had caused the oil leak. With the aid of special tools the spring unit was compressed and a small opening was created between the different parts of the assembly. The team could then remove the remains of the rope and clean the area. Next the spring unit was repositioned. The repair was completed in less than a day.

Underwater repair in Panama

When a 295m long container ship developed an oil leak from its stern tube seal assembly, caused by an entangled fishing net, Hydrex sent a diver/technician team to Panama where underwater repairs were carried out using the mobdock technique.

Working closely together with a local support base, three seals were replaced in one smooth operation while the vessel was anchored at the entrance to the Panama Canal. Corrosion on the running area of the seals prevented the new stern tube seals from completely closing off the inside of the ship, so the decision was made to remove the spacer ring. This adjustment brought the seals beyond the corroded area.

Hydrex special lightweight equipment allows for an almost immediate mobilisation to the location of a vessel. This, combined with a worldwide network of offices and service stations, enables the company to rapidly service its customers, giving them the opportunity to have damaged seals replaced without having to change the sailing schedule of the vessel or to take it into drydock, saving valuable time and money. **MER**