

Safe mooring and jetty management at oil/gas marine terminals

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Introduction

In oil and gas terminals the use of quick release hooks to moor vessels during cargo handling is recommended by the Oil Companies International Marine Forum (OCIMF), as they form the basis of a safe mooring system. In addition to the hooks, the instrumentation to monitor and control the speed of approach of a vessel during berthing (especially during contact with the jetty), the drift-off of the vessel whilst moored during cargo transfer, the tensions in the mooring lines, the status of each hook, and the meteorological and oceanographic conditions, can all be incorporated to provide a fully integrated safe mooring and monitoring system (see Figure 1).

Quick release hooks

As stated above the basis of a safe mooring system is the quick release hook. The Strainstall quick release hooks are based on the well respected Stevens design, and are unique as they have been designed to provide full mechanical protection to the release mechanisms and to incorporate load monitoring. Strainstall offer electric, hydraulic, and pneumatic remote release systems for the hooks, with the activation devices completely integrated into the hook assembly. There are no protruding parts that can be damaged by the mooring lines, and there is also a direct connection between the hook release mechanism and the release activation device. Other hooks on the market differ in that they offer release activation devices mounted on top of the hook, on the side of the hook, or at the back of the mooring units with a steel wire connection to the release mechanism. All these types of systems carry a high risk of mechanical damage from the mooring lines or horizontal and vertical swivelling of the mooring hooks.

When using mooring load monitoring, most of the quick release hooks currently available tend to have a load shown when no mooring line is attached, or is attached at slack load. This residual load is caused by the 'offset load value', and is induced by the weight of the hook and/or slack mooring line. Strainstall use a 'vertical active only' support within the design that compensates for the weight and prevents 'offset load value', which can be as much as 16 – 20te in severe conditions. This is particularly important if the slack rope situation is being monitored, as this 'offset load value' will be interpreted as a rope tension load, even though the rope may be slack.

The normal configuration for petrochemical installations involve multiple hooks on a common base, generally 2, 3 or 4, with an integrated capstan to assist heaving in the mooring lines from the vessel. Each hook is proof tested to 150% of its rated load, and the release mechanism is tested at full load rating at our own test facility, and is witnessed by a surveyor from an independent classification society. They are supplied with complete material certification and traceability (see Figure 2).

If remote release is incorporated, the hooks can be released from a remote location – generally the control room or jetty office – as well as by activating a button on the hook motor starter enclosure mounted on the rear of the hook. Local displays of the mooring load tensions and audible and visual alarms can also be incorporated into the hooks.



Figure 1. Two berth oil receiving terminal with QRH & BerthManager.

DockAlert – Speed of approach

DockAlert provides protection of the jetty infrastructure during approach of the vessel to the berth. Experience has shown that controlling the speed of impact of the vessel onto the fenders prevents damage to the berth. Once the vessel is safely moored to the berth, the system will monitor any drift-off of the vessel and provide warning to the operators.

The system uses two eye-safe laser units installed on the jetty and aimed perpendicular to the berthing line. These measure the distances and the speeds of the bow and stern from the jetty. The relative angle of the vessel to the berth is also calculated, and the data displayed in a number of ways:

- On large digit displays mounted on the jetty and visible from the vessel at 200+ metres so that the pilot can monitor his approach, and certified for use in hazardous areas
- On handheld pagers/PDA's carried onto the ship or used on the jetty, both safe area and intrinsically safe types
- On jetty repeat displays generally installed local to the loading arms, and certified for use in hazardous areas



Figure 2. Quad hook with hydraulic release.



Figure 3. Quick release hook load measuring pin.

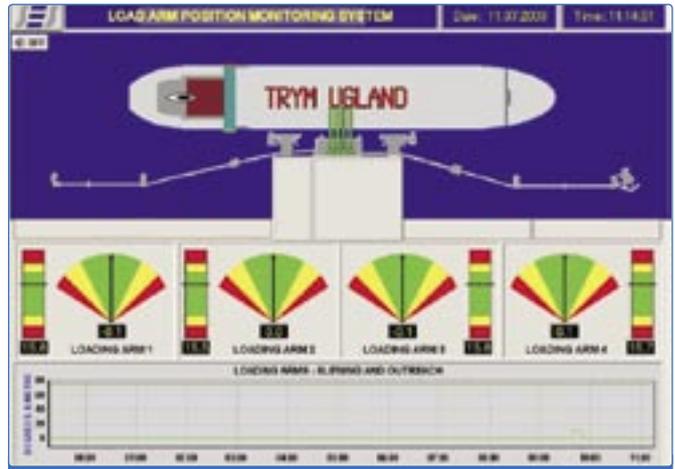


Figure 4. Screen shot showing ArmAlert display.

- ‘Traffic lights’ can be installed on the jetty to provide simple alarms.

MoorAlert – Mooring load monitoring

Strainstall load measuring pins are designed and installed into the quick release hooks to provide constant real-time monitoring of the loads on the hooks, that are directly due to the tensions in the mooring lines.

Strainstall have been designing and manufacturing load measuring pins for nearly 40 years, and the design utilises the unique experience gained over this period to provide a reliable, totally environmentally sealed unit, that will perform for the life of the installation (see Figure 3).

The signals from the load pins, together with any other sensors on the hooks, are conditioned by a network interface mounted in a suitable enclosure on the rear of the hook. This then allows the digital signals from all the hook sensors, along with all other system sensors, to be transmitted over a simple two wire loop back to the control room.

ArmAlert – Loading arm monitoring

Sensors incorporated into the loading arms monitor their position to ensure that they are used within their operational envelopes. Should the loading arms be operated outside their scope it is possible that the seals may be damaged and allow spillage of the cargo (see Figure 4). Fender deflection and/or load can be monitored.

BerthManager

Integrated system for approach monitoring, mooring load monitoring, loading arm monitoring, environmental monitoring and ship/shore communication.



Quick Release Mooring Hooks



Intuitive Software



Large Digit Display

Strainstall
The world of load measurement and stress analysis



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MetOcean monitoring

Sensors to monitor many meteorological and oceanographic parameters can be incorporated into the system. Typical parameters measured include wind speed, air pressure and temperature, visibility, rainfall, current speed and direction, tidal level wave height and water temperature.

Remote displays

In addition to the displays described earlier, Strainstall can also supply a PC suitable for use in Zone 1, which can be installed into the jetty office on the loading platform. It is linked to the main workstation in the control room to provide the operator on the jetty head with full graphic displays and control (see Figure 5).

BerthManager – Integrated jetty management

With reliable sensors gathering data on and around the jetty a user-friendly interface is required to provide the operators with clear displays, an alarm facility and data recording. This comprises of a DeskTop or rack mount PC running Strainstall's BerthManager software, usually located in the facility control room.

This user-friendly software package is configured to suit the jetty and allows the operator to store and recall mooring configurations and alarm levels for all sensors, log all data on the PC hard disc, view trends of any measured parameter, output reports, alarm logs, etc to a printer, and control remote release of the hooks. In addition to the functions above many systems provide outputs in a number of formats and protocols to enable easy seamless interfacing. This allows the BerthManager system to integrate to facility management networks, ESD and ship/shore communication systems.

The Strainstall approach has been selected by a number of clients for recent projects including:

- Three LNG jetties in Europe
- Three oil jetties in Turkey
- One oil terminal in Italy
- One oil project in Saudi Arabia
- One new oil project in Singapore for a VLCC berth and three small coastal ones
- A refurbishment of two oil jetties for a further project in Singapore
- An extension to an oil facility in Singapore
- Two ore terminals in Brazil
- A refurbishment of a jetty in Philadelphia, USA.



Figure 5. Zone 1 compliant PC.

The total order value is US \$6 million, and there are a number of other projects pending.

Strainstall are one of the unique companies who are able to design, manufacture, supply, install and commission complete integrated jetty management systems using in-house facilities. Strainstall:

- a) Design and manufacture quick release hooks
- b) Design and manufacture hook sensors for load/tension monitoring
- c) Design and manufacture speed of approach systems
- d) Design and manufacture large digit displays
- e) Customise Strainstall software packages to provide full system specification requirements.

Strainstall have supplied well over 100 systems worldwide, including all mooring monitoring systems in gas import facilities in Japan.

ABOUT THE AUTHOR

Sandy Thomas is Marine Director at Strainstall UK. An Engineer by profession, with a qualification in Mechanical and Production Engineering, Sandy has been involved in the design and implementation of advanced Berth Manager Systems for over 20 years.

ABOUT THE COMPANY

Strainstall, originally formed in 1966, are a specialist designer and manufacturer of load monitoring systems and quick release mooring hooks, and in addition to those described here, they also supply systems for Tendon and Riser Tension Monitoring for offshore oil and gas structures, Crane & Winch Load Monitoring and Silo Content Monitoring for both on and offshore use, and the StressAlert II Hull Stress Monitoring System for vessel monitoring.

The company's experience, expertise, and application skills have made them world leaders and they are constantly striving to improve, enhance and develop their systems. Strainstall are registered to ISO 9001:2000.

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