

A call to arms

Environmental concerns are driving the agenda for marine loading arms. Aside from the need to provide a route for recovered cargo vapours, the provision of a means of emergency shutdown and disconnect on the arm is becoming a key consideration

Although not typical, the new berthing facility at Jose in eastern Venezuela incorporates the operational, safety and environmental protection features now taken as standard on a modern tanker jetty.

Such features in turn highlight the shortcomings of numerous, older jetties still in operation which were built to accommodate a previous generation of much smaller tankers and at a time when environmental concerns did not figure prominently. These shortcomings include relatively slow cargo-handling rates, lack of closed loading and emergency shutdown arrangements and mooring facilities unable to accommodate the full range of berthing forces that may be encountered.

Now in its second year of operation, the Jose jetty serves the export needs of the adjacent Pequiven petrochemical complex and cost \$130m to build. It is the largest such facility in Venezuela and one of the largest in the Western Hemisphere. In fact, Jose is three docks in one, with pipelines for liquid products, an enclosed, tubular conveyor belt for solid bulk goods and cranes for handling containerised plastics such as polyethylene. The jetty is built to handle up to 16 million tonnes per annum (mta) of liquids and gases, such as MTBE, methanol and ammonia; 8 mta of solids such as urea in bulk; and 3 mta of containerised exports.

Safety at Jose

The bulk liquids part of the Jose petrochemical dock is typical of modern tanker jetties in that it is built to relevant design codes and standards to provide a facility which is fit for the purpose. The 2.2 km long jetty is 22 metres wide to allow two-way access for heavy goods vehicles. Tankers in the 6-65,000 dwt range are handled at two dedicated berths where 10 marine loading arms (MLAs), all equipped with emergency release systems, are in place. A total of four ships of various types can be loaded simultaneously at the Jose berths where there is 14 metres of water alongside.

A service platform at the jetty head houses the control room, the firefighting system pumps and air compressors, as well as the electricity, instrumentation and communications systems. Each of the facility's berths is provided with a tower arrangement from which motorised monitors can tackle fires with water and/or foam, as appropriate. These monitors can be operated remotely from the firefighting panel located in the jetty control room.

The pier is also equipped with effluent collection facilities and sophisticated mooring arrangements, while hydraulic control devices enable remote operation of loading and emergency shutdown procedures through programmable logic controllers. A smokeless-type flare stack is installed on land near the jetty entrance.

The jetty has been designed with all future needs of the ambitious Jose complex in mind. Pequiven's development plan anticipates an output at Jose of 14.4 million tonnes (mt) of various petrochemical products in 2009, i.e. some 65 per cent of Venezuela's overall production of 22 mt planned for that year. The country is currently producing one-third of that volume.

MLAs and the environment

Marine loading arm technology has not evolved significantly in recent years. The same basic principles that guided the design of the rigid, articulated arms for connecting jetty lines to ship manifolds 20 years ago still apply today.

That said, the use of MLAs continues to expand slowly, primarily through their spread into the lower volume end of the market, as more operators of jetties handling refined petroleum products switch over from cargo hoses to hard arms. Also, the capabilities of IT have been harnessed to yield improvements in MLA position monitoring; control and handling procedures; and emergency disconnect arrangements.

Environmental concerns currently represent the main force for change in the cargo transfer equipment sector. The initiatives tend to be taken at local level and by individual companies, usually in the developed nations and often within environmentally sensitive areas, as pressures to minimise emissions and spills of harmful hydrocarbons increase. In Norway, for example, the concept of zero spills is taking hold and several terminals are adopting measures with that goal in mind.

Emergency release

Increasing environmental concerns are prompting oil terminal operators to consider the fitting of emergency release devices to their MLAs, both for new jetties and at existing jetties when loading arms are being replaced. Quick disconnect devices most often take the form of a double valve, powered emergency release coupler (PERC), and to date equipment of this type is most commonly fitted on hard arms used for the transfer of liquefied gases due to the highly hazardous nature of such substances.

In an emergency the hydraulically powered PERC unit is activated to close the double valve, thus halting the product flow, and to disconnect the loading arm from the ship. The coupler may be incorporated into an automated alarm and shutdown system. The sensors of the alarm system ensure instantaneous disconnection of the MLA, and the operation can be initiated from either the shipside or shoreside control station.

FMC Corporation, a leading supplier of MLAs for liquids and gases, offers an alternative means of quick disconnect for arms used to transfer crude oil and petroleum product cargoes, i.e. piggable loading arms. FMC first introduced the pigs for hard arms in 1975 but it is only in recent years that interest in the concept from the marine sector has begun to gather momentum.

With this approach the same alarm signals and authorisations are used to activate the pigging devices within the arms as those provided in PERC systems. Following valve closure and prior to the MLA being disconnected, the pig is blown through the arm using air or nitrogen to empty the oil contents of the arm to the ship.

Disconnect times at least as good as PERC times are possible with piggable arms, says FMC. For example, the pigs in the three, 16-inch, 93-foot long loading arms fitted to the floating storage unit Ta' Kuntah operating in the Gulf of Mexico on behalf of Pemex enable a disconnect time of 20-25 seconds.

Numerous advantages

"Piggable loading arms provide several engineering advantages compared to PERC arrangements," according to an FMC spokesperson. With a PERC unit fitted to the end of the arm weighing up to 1,000 kg, the MLA could weigh over 10 tonnes more than a non-PERC arm after counterbalance weights are added.

Piggable arms also enable important cost savings for the terminal operator, especially at facilities handling multiple grades of petroleum products. For example, FMC has just upgraded a three-berth oil-handling terminal in West Africa, replacing the three MLAs on each berth with a single piggable arm. Fewer arms are possible because the pig can be used to clean the arm after each grade of oil is handled, thus minimising the risk of cross contamination.

Mongstad upgrade

FMC also reports a healthy level of interest for its conventional loading arms and another recent upgrade project was the provision of three 18-inch MLAs to replace

three units of an older, smaller design on one of the two crude oil handling jetties at Statoil's Mongstad terminal in Norway. The jetty improvement work included increasing the height of the towers used to house the remote-controlled foam and water firefighting monitors.

Mongstad is now the second busiest crude oil port in Europe after Rotterdam, handling 50 mta. This traffic encompasses both incoming, in North Sea shuttle tankers, and outgoing shipments. The terminal also serves a refinery and, in addition to crude oil, Mongstad also handles a range of refined products and liquefied gases in the port complex which is provided with a total of nine jetties.

Another major recent contract for FMC involved the delivery and installation of 50-plus loading arms in Kuwait. These new arms serve both to replace war-damaged arms and enhance the country's existing tanker loading capabilities.