

Roll-On/Roll-Off by Krupp Fördertechnik

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During the past few years, there has been an increasing request by clients for the delivery of fully-assembled and tested ship unloaders.

There are various reasons for these requests, both technical and economic:

- Often, there is not sufficient room for conventional erection because the latest generation of unloading jetties built today are designed for the final requirement only.
- These jetties are only equipped with reinforced and load-bearing railbeams which are insufficient to bear the weight of the mobile cranes needed for the erection, with their heavy dead weight and support loads.
- New material handling plants tend to have only a short construction time in the overall programme, which does not include for the erection of the handling equipment. The client requires delivery to take place immediately after the jetty and downstream plant have been completed, followed by the shortest possible commissioning period.
- In existing material handling plants, delivery of fully assembled ship unloaders is required in order that production can continue without interruption caused by conventional erection and to keep demurrage costs for ships to an absolute minimum.

Krupp Fördertechnik have been able to meet these requests in many cases and details of how these were achieved, together with photographs of some of these machines being transported, follow below.

The above prerequisites are met by delivering the equipment in a fully-assembled and tested condition. Erection and testing of the unloader away from the site of installation are less of a concern to the supplier than the choice of transport means and the subsequent loading it onto the barge and unloading it onto the jetty, known as 'Roll-on / Roll-off' (RoRo).

A sea-going barge is usually chosen for transportation, with careful consideration being taken of the maximum permissible loads of the deck, the RoRo equipment it has and its ballasting system.

Usually, deck loads between frames and longitudinal members are permissible between 100-150 kN/m² while loads of up to 2,000 kN can be allowed at the crossover points of the frames and the longitudinal members.

One of the most important points to consider when selecting the sea transport is the barge's ballasting system. This is either permanently installed underneath the deck or is a temporary installation, using mobile pumps installed on the outside of the barge. Some barges are equipped with a compressed air ballasting system.



Fig. 1: Loading of a continuous ship unloader by using the 'Air Cushion' skidding system

The pumping capacity of the barge ballasting system is normally in the range of 1,500 m³/h., but this is dependent upon the cargo as well as the tides and the heights of both the loading and unloading piers.

The weights of the unloaders transported by Krupp Fördertechnik in the past have varied between 1,250 and 1,600 t.

RoRo Equipment

There are several systems available for loading and unloading the ship unloaders and Krupp Fördertechnik have gained extensive experience in working with most of them.

Skidding systems

The term 'skidding systems' is used for methods which, by using jacking and skidding equipment, the load to be transported is moved onto and off the barge, with as little friction as possible between the skid paths and their modules.

There are two different types of skidding systems; one moves the load on air cushions (Fig. 1), while the other system uses stainless steel plated skid shoes which slide on oil-lubricated Teflon plates inside the skid paths (Fig. 2).

It is common for both systems to have hydraulic jacks inside the skidding modules (Fig. 3) which lift the load from the temporary rails before skidding it and then lower it onto the permanent rails after unloading it from the barge.

The permissible ground pressures are often limited while skidding the ship unloader and these have to be carefully considered when choosing the skidding system to be used, in order not to require cost-intensive civil works to bring the loads within the allowed range.

Krupp Fördertechnik have gained a wealth of experience using both systems in supplying one continuous ship unloader to Ferrol in Spain, five continuous ship unloaders to Taiwan and two grab-type ship unloader to Sollac in France.

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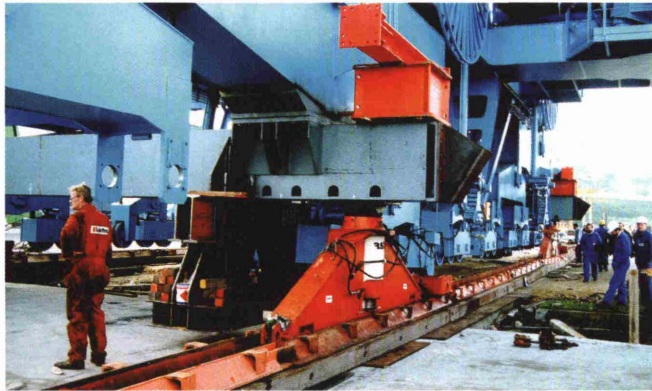


Fig. 2: Skidding modules of the 'Skidshoe' system in operation during offloading of a continuous ship unloader



Fig. 3: Skidding in operation with the 'Air Cushion' system

RoRo Using the Unloader's Own Wheels

This method is also used frequently. It does not use a skidding system as such but uses the unloader's own wheels, which are turned at 90° for this purpose. The bogies are turned to the 90° unloading position at the start of erection and are then turned back to their correct position after the Unloader is on the final jetty.

The unloader is run along temporary rails to its final loading position on the barge (Fig. 4). Moving the Unloader horizontally (carried out by hydraulic cylinders on the skidding systems) is done by multiple reeved winches, with rope attaching points on both sides of the pre-assembly area and on the barge.

This means that, unlike with the other skidding systems, the bogies need to be turned back to their correct positions upon loading onto the final pier; however, the loads caused by the hydraulic jacks are imposed onto the jetty structure. It is not often



Fig. 4: Loading of a continuous ship unloader on own wheels

Fig. 5: The passage: the moment of transfer from the barge to the pier



possible to offer wide load spreading measures because of the geometry of the unloader or the site location and so all loads on the jetty, particularly during this operation, have to be discussed during the bidding stage and then clarified early in the contract stage.

Krupp Fördertechnik accepted the challenge of using this system when recently fulfilling the 'Hoping' contract in Taiwan for three continuous ship unloaders.

With each unloader, the most exacting moment was when moving the load from the land onto the barge and then onto the jetty, as the transfer of these large loads required the greatest attention with regard to the correct trimming of the barge to the pier edge (Fig. 5). For each Unloader, this quite difficult operation was achieved by the skill of the pump engineer on the barge.

The transport insurance company appointed a marine surveyor to assist with the complete unloading- and loading operation, as well as determining the actual sailing date (based on the local and general weather situation) and the actual transportation itself. The surveyor also inspected and approved the seafastening of the cargo, according to the drawings and static calculations and also arranged the sailing route with the weather and sea conditions along this route in mind.

The general weather situation and the sea conditions along the sailing route are important factors for successful transportation, especially in typhoon areas like the south of China or Taiwan and have to be seriously taken into account.

Result

Bearing in mind the above considerations, clients will increasingly request delivery of fully-assembled Unloaders in the future and this will play an important part in deciding where the order is to be placed.

However, economic factors are not the only considerations when selecting the means of sea transport and the skidding system required. The weight of the unloader, together with its geometry, the permissible loads on the unloading and loading jetties, the jetty heights and the harbour tides, must also be taken into consideration.

These parameters have to be investigated and evaluated for each and every delivery, prior to the selection of the appropriate skidding system.

Krupp Fördertechnik have been working to meet these demands and their implications for a long time and, having successfully completed various contracts world-wide, have proved not only to have excellent experience but also highly-trained specialists who are familiar with shipments of this kind and all the related engineering works.