

# Floating Pneumatic Unloaders

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## Summary

The unloading of bulk dry solids from ships is possible in a number of ways. Where fixed dock installations are contra-indicated for one of several reasons a realistic solution is the use of floating unloaders, which can be moved from dock to dock and even port to port. This article describes a system available from REGGIANE and its recent installation.

## 1. Introduction

In order to solve serious problems connected to cereal unloading from ships, REGGIANE designed and supplied, during the first months of 1981, four floating unloaders, each of them equipped with two pneumatic unloading units, for a total capacity of 500 t/h.

The fabrication of the four floating pontoons was carried out by a European company in this branch of production, while REGGIANE took care of the project and fabrication of the pneumatic unloaders.

The floating unloaders are being used for cereal transshipment from bulk carrier ships, of up to 100,000 DWT, to barges. Furthermore, it is possible to unload from oil tankers and loading may take place into hoppers placed on the dock, and then road trucks or railway cars are fed from these.

## 2. Operating Conditions

The whole system is designed for operation from  $-25^{\circ}\text{C}$  up to  $+40^{\circ}\text{C}$ ; it can work also with sea state up to 4 and with wind-force 6 according to Beaufort scale; such conditions correspond to the barge transversal inclination of approximately  $5^{\circ}$ .

## 3. Technical Details

The most important features of the barge are as follows:

— length	40 m
— width	21 m
— height	4 m
— draught	2 m

The body is divided into longitudinal and transverse sections with water-proof bulkheads: suitable accommodation and service rooms for the crew (7 persons), and the generating sets (2 units of 600 kW each) are provided; there are also stores for spare parts, tools, etc.

The pontoon is equipped with all devices and equipment necessary for navigation.

## 4. Pneumatic Unloaders

Each pneumatic unloader consists of two intake pneumatic sections — nominal unit capacity: 125 t/h, referred to grain of  $750\text{ kg/m}^3$ .

Such sections include:

Vertical piping, consisting of:

- one telescopic boom, 11 m travel, operated by a double roped electric winch with self-braking electric motor;
- one set of easy make-up rigid and flexible pipes, at the end of which the suction nozzle is placed.

Horizontal piping, consisting of:

- one telescopic boom, 11 m travel, operated by double roped electric winch with self-braking electric motor. It is supported by a reinforced steel structure, with inspection platform, and is connected to the vertical piping by means of a rectangular section elbow, provided with a replaceable wear-resistant plate.

Cast iron articulated joint, which allows the pneumatic piping vertical and horizontal displacement; the rotation drive is obtained by a reduction gear with pinion coupled directly with the rack which is integral to it; elevation takes place by means of a rope system consisting of a winch (placed on the second floor of the tower) and two groups of sheaves.

Receiver-filter unit, connected to the articulated joint by a sloping tube, for separation of air from the cereal and for dust control. The filter is of the sleeved type, automatic counter-pressure cleaning, and it assures a dust concentration at the outlet of less than  $20\text{ mg/m}^3$ .

Rotary valve, for cereal discharge from the receiver; it is operated by a worm gear reduction unit.

Automatic scale, grab type, with oscillating suspension frame in order to allow its operation with tipping angles up to

5°; it is complete with control scale, dial weight control, totalizer, pre-setting device and printer. Precision 1‰.

Aspirating unit, consisting of a Root blower; operated by a reduction unit, a 270 HP electric motor complete with safety valves, silencers, axial compensators, intake and exhaust tubes.



Fig. 1: Re-erection of central part of unloader onto pontoon

Further, each unloader is provided with:

- Dust control system which intakes dust from the charging hoppers, from the scales and from the elevator boot; this system includes a centrifugal fan, a sleeved filter with a rotary valve and a piping network for dust intake.

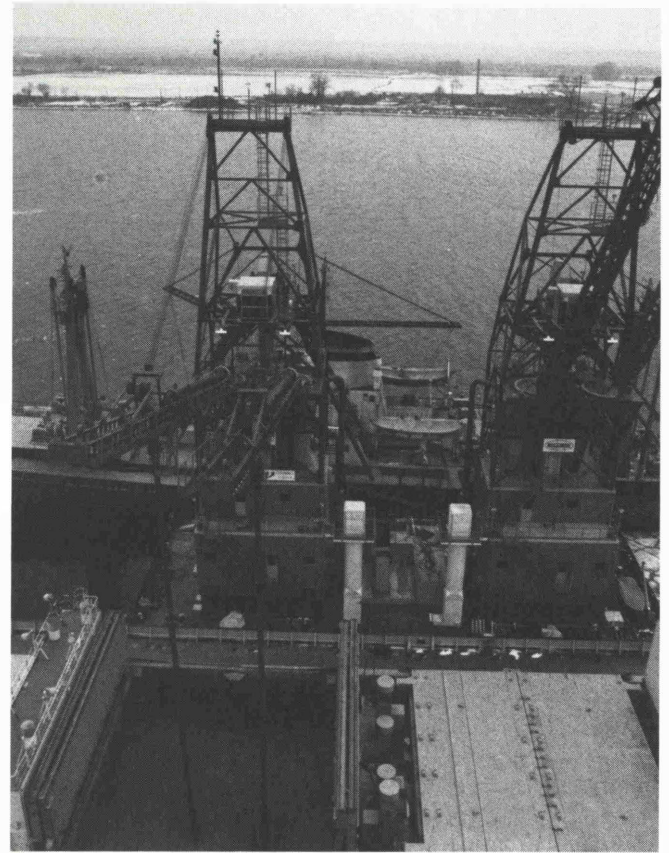


Fig. 2: Detailed view of unloading procedure

The operation of each section takes place in the following way:

Cereal is transported by air through the suction nozzle, the vertical piping, the pneumatic boom and the articulated joint, up to the receiver, where air separation takes place.

The air is filtered by the filter sleeves, gets sucked in by the blower, and then, through the silencer unit, is exhausted.

From the receiver, cereal gets discharged by the rotary valve and weighed on the scale.

The two sections join, thus forming one single line including a bucket elevator for product elevation up to a height suitable for feeding the barge-loading piping.

The elevator, which is specially designed for operation on floating units, is belt type; the steel buckets are fixed onto it.

Each barge loading piping is sized and dimensioned for the whole capacity of the two sections (250 t/h), and is provided with an interception pneumatic gate at the top.

Slewing, luffing and telescopic operation of these pipes are controlled by roped systems, including electric winches with self-braking motors.

- Central compressed air system, with two blade rotating compressors (one as stand-by), air drying and treating equipment for feeding to pneumatic equipment.

- Electrical equipment for operation and control. Protection of the areas where the electrical parts are installed.

For each tower, power is obtained from a power generating set operated by a 600 kW diesel engine.

The following lines are provided:

- motive power: 380 V, 50 Hz, three-phased;
- lighting: 220 V, 50 Hz, single-phased;
- emergency lighting: 24 V DC.

The controls, M.C.C. type, are placed on the first floor. The operator's cab houses the control panels with on-off push-buttons, signal lamps, etc.

A synoptic board is installed for visualisation of the machines "on-duty".

The operation of the intake pneumatic booms may be controlled by pendant push-buttons, i.e., directly from the deck of the ship which is being unloaded; the same procedure is envisaged with regard to the barge loading pipings. These

are controlled by a panel installed on the cab floor, at a level with the elevator head.

The start-up of the system can take place only if the sequences fixed by the cycle are followed; the stop of any one machine automatically stops all the other ones. All motions of the intake piping and of the barge loading pipe are controlled by micro-switches for automatic stopping in the correct positions. The rotating unloaders and the bucket elevator are provided with motion indicators, in order to switch the blowers off in case of their failure.

The motors and the parts forming the electrical equipment are of class IP.55 and, in any case, in accordance with regulations in the country where the installation is carried out.

A telephone system enables communication between the control cabin, the scales room and the deck. Floodlights are provided for the working areas, as well as signal lamps and lamps for the lighting of the various rooms in the unloader.

The unloader structure is made of welded sections, with checkered plate floors; the relevant calculations are carried out following the current Italian regulations and taking into account stresses caused by deck oscillation movements. The first three floors are lined with sandwich panels made of insulated sheet steel, with doors and windows. Ladders assure easy access to the various floors and are in compliance with current safety rules.

## 5. Performance

In "off-duty" conditions, the intake pneumatic booms are arranged perpendicular to the platform slope of 15° to the horizontal and locked in such a position with parking pins.

The telescopic pipes are completely retracted and the rigid and flexible pipes are disassembled and placed in containers situated on the platform of the pontoon. The barge loading pipes are rotated until they are parallel to the pontoon; the telescopic tubes are completely retracted.

When transfer operations take place, the pneumatic booms are elevated longitudinally and rotated so that they lay within the barge overall dimensions.

## 6. A Recent Installation

Four floating unloaders of this type were recently supplied to Morflot (Ministry of Merchant Marine), USSR for the ports of Leningrad, Riga, Odessa, and Ilichevsk.

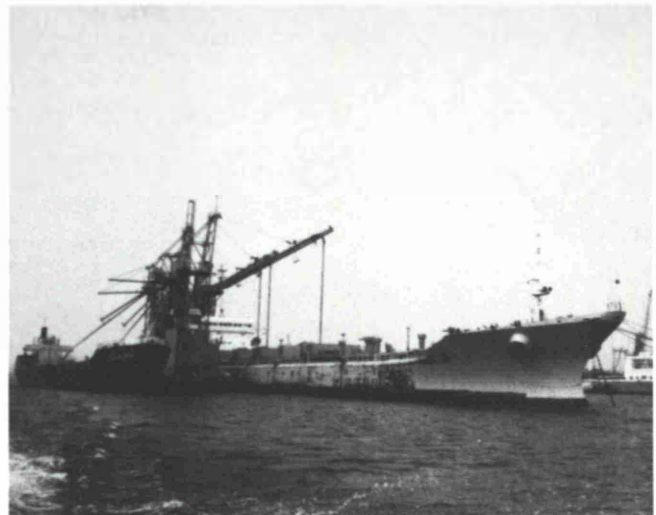


Fig. 3: Unloading of a bulk carrier into barges



Fig. 4: Unloading from barge to dockside installation

Figs. 1 to 4 show details of these unloaders which were mounted in pairs on floating pontoons. The unloaders were completely fabricated in Ravenna harbour on the quay, tested, and dispatched completely erected by ship. Only the pneumatic booms and the loading spouts were disassembled prior to shipment.

Fig. 1 shows the impressive operation of re-erection. Using a floating crane the central part of the unloader (180 t weight) was set on the pontoon and welded in place. The final re-erection required only two weeks for each pair of unloaders, including trial runs using grain.