

About Transpetro

Transpetro stores and transports oil and derivatives, biofuel and natural gas to the farthest points in Brazil. Also, the Company is considered the Country's greatest natural gas processor, with processing capacity of approximately 15 million m³/day. These paramount operations make Transpetro the greatest shipping company of Latin America, leader in the fuel transportation logistic sector. Annually, billions of liters of fuel flow through a 7 thousand km network of oil pipelines, 3 thousand km of gas pipelines, 20 onshore terminals, 26 water terminals and a fleet of 54 oil tankers. Transpetro moves the energy indispensable to the development of Brazil and also contributes with its international experience. In Argentina, for instance, it provides consulting services in terminal, pipeline and offshore transportation, by means of an agreement entered into with Petrobras Energia S.A. (Pesa). Also, in the international market, Transpetro operates through Fronape International Company (FIC) in fuel transportation and storage.

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South American shipping ties up with mooring lines made with Dyneema®

The Brazilian company *Petróleo Brasileiro S.A. (Petrobras)* is an integrated company that is involved in oil and gas exploration, production, refining, marketing and transportation throughout Brazil and South America. It is one of the region's largest operators. It produces, refines and distributes oil and gas over a network of 11.000 km that interconnects and supplies even the most remote parts of Brazil.

Storing and transporting that oil and gas for Petrobras is the primary (but not exclusive) activity of Petrobras Transporte S.A. (Transpetro), a wholly owned subsidiary of Petrobras. Transpetro handles oil and derivatives, biofuel

and natural gas. It is also considered the country's largest natural gas processor, with processing capacity of approximately 15 million m³/day. These operations make Transpetro the premier shipping company of Latin America, a leader in the fuel transportation logistic sector. Quite simply, Transpetro moves the energy indispensable to the development of Brazil and the entire region. Transpetro, one of the major players in transport, currently has a fleet of 54 crude oil tankers and supply ships which use a combination of steel wire rope and nylon rope as mooring lines. It also is involved in a major new-build program, one that will require specifying new mooring lines. The company, therefore, was an ideal candidate to evaluate mooring lines made with Dyneema®.



Vessel berthed at the Angra dos Reis Terminal. Cable with Dyneema® integrated into the ship mooring, along with the steel cables.

Background

In 2006, Transpetro and DSM Dyneema agreed to evaluate the efficiency of mooring lines made with Dyneema®. Transpetro's Nordic Rio, a Shuttle Tanker vessel of the Suezmax class, was chosen for this evaluation as it was recently incorporated into the company's fleet and its steel mooring lines had only been used for a short period. With the consent of the São Sebastião Terminal at Campos Bay, where the ship stops at least three times a month, the evaluation took place. One of the conventional steel wire mooring lines was replaced by a mooring line with Dyneema® fiber, manufactured by Cordoaria São Leopoldo (CSL). This synthetic fiber cable was to operate in conjunction with existing steel cables on board.



Cable with Dyneema® on the mooring winch.

Mooring line preparation and installation

Before the mooring line made with Dyneema® could be installed, the Nordic Rio needed to comply with the recommendations made by DSM Dyneema and CSL to ensure a fair evaluation. This included treating all contact points that might have been roughed up by steel cables and would adversely affect the performance of the lines made with Dyneema®. Therefore the winch, rollers and fairleads were thoroughly cleaned, polished and painted before the line was brought on board.



Cable with Dyneema® on the mooring winch.

The mooring line made with Dyneema® was installed on the Nordic Rio in December 2006. Then, over a period of 14 months, the mooring line was used on a regular basis for berthing maneuvers. During that period the line showed no operational abnormality related to its performance in combination with existing steel lines. Furthermore, during this evaluation period, 47 loading and unloading operations were performed and the rope was used in actual mooring operations for 1400 hours.

"Infinitely better than wire," says the captain

The Nordic Rio's Captain Albuquerque was initially skeptical with the idea of using a mooring line made with Dyneema®. "However," he says "I have to admit that when it came to handling, maintenance, cleanliness and safety, I would have



Cable with Dyneema® on the mooring winch.

to give this mooring line a rating of 10 on a scale of 1 to 10. It is infinitely better than wire. I was particularly impressed with the high safety factor when transferring the end of the mooring line to the terminal for hooking.

Also, because this mooring line doesn't need greasing, there's none of the grease spillage and oily residues on hot days that a winch drum holding a steel mooring line would produce. That means there's no oil residue on the ship's deck on rainy days, so that in itself is an added safety bonus for my crew."

Easy to operate, low-maintenance and safe

Captain Albuquerque wasn't alone. The ship's crew also found the mooring line made with Dyneema® to be very easy to handle. It didn't present a risk to their hands during handling, and because it was so lightweight, compared to steel mooring lines, crew members didn't have to drag it or risk back injuries by lifting it. In addition, unlike steel lines, the mooring line made with Dyneema® required no brushing, cleaning or greasing. It didn't scrape the guide supports on the deck, nor did it cut grooves in the fairleads.

The choice is clear

All of the officers and crew who handled the mooring line made with Dyneema® were satisfied with its performance and ease of operation. Their opinions regarding the advantages of using mooring lines made with Dyneema® can be summed up as follows:

- Less time required to transfer the mooring line made with Dyneema® to the mooring boat and terminal in comparison with the steel mooring line
- Much easier to handle and maneuver
- Reduced berthing and cast-off time
- Reduced maintenance
- Improved personal safety thanks to the light weight and elimination of grease or oil on the deck

In addition, to evaluate the operating trials of the mooring line, the ship was visited by DSM Dyneema representative Dirceu Feijó, who says: "I was on board the Nordic Rio three times during the trial period. In all my visits I had the impression that everyone - crew and Captain - would switch immediately to mooring lines made with Dyneema® and replace all the existing steel mooring lines."

Follow-up

After the evaluation period, the mooring line made with Dyneema® was removed from the Nordic Rio and sent to the manufacturer, Cordoaria São Leopoldo for inspection. Visual inspection revealed no abnormalities. Furthermore, the residual break strength of the rope was determined and found to be > 95%. The rope was still in excellent shape.



Fairlead used for the passage of cables during the period the vessel is in the pier.



Special protection for the cable with Dyneema®.

Excellent prospects for the future

Transpetro is currently involved with a new build program. The type of mooring lines for the new fleet has yet to be specified. Due to the outstanding performance of the mooring line made with Dyneema® during the evaluation period aboard the Nordic Rio, there is a good chance that the Transpetro management will choose for ropes made with Dyneema®. Not just mooring lines for the new fleet. But also for retrofitting the existing SWR of the entire fleet. Clearly, mooring lines made with Dyneema® have made a difference for Transpetro. Now see how they can improve your operation.

For more information, visit www.dyneema.com