FATOR
TORNILLERIA INDUSTRIAL

TurnaSure LLC

SONATRACH / SAIPEM PROJECT
AMMONIA OFFLOADING PIER
ARZEW ALGERIA 2010

We particularly wish to thank the SAIPEM/Algeria and SAIPEM/Paris teams for their trust and contributions that made this report possible.

DTI CASE STUDY

(Specific performance study of Direct Tension Indicators)

PROJECT: A 1.0 MILE LONG STEEL COLUMN PIER, 36 FEET ABOVE SEA LEVEL, ON COLUMNS REACHING UP TO 72 FEET IN DEPTH.

The SAIPEM engineering team was constantly challenged by extreme conditions such as: strong winds and tides, the corrosive environment, and acommodating large truck traffic with heavy loads over the length of the pier.

Deadlines committed to by SAIPEM were plagued by supply delays, equipment breakage, work force problems, safety problems and potential tool and hardware losses in the ocean below.

In order to comply with these challenging deadlines, structural concerns and the implications of extensive geological sub-sea site studies, it was imperative to select only the best steel assembly tools, components and hardware.

FATOR and TURNASURE were chosen by SAIPEM to provide the high strength steel bolting components and Direct Tension Indicators (DTIs), to optimize speed of bolt installation without sacrificing installation performance. This meant achieving specified tensions in every bolt while minimizing assembly delays.

Key engineering and construction personnel attended an on-site FATOR/TURNASURE high strength bolting and DTI seminar. After a day of bolting and DTI installation instructions, Mr. Dragon, SAIPEM's head Project Engineer, offered the comments appearing on the next page.

Moving construction crane platform

FATOR TORNILLERIA INDUSTRIAL
C/ Catalunya No.11 – Pol. Ind. Can Oller
08130 Santa Perpètua de Mogoda BARCELONA
Tel. + 34 93 544 63 36 Fax. + 34 93 592 03 31
www.fator.es • info@fator.es

(Extracts of interview with Mr. Dragon)

QUESTION ASKED BY FATOR REPRESENTATIVE:
"We thank you for your participation during the Turnasure bolting presentation. During the seminar It was clear that that you are knowledgeable and familiar with the function and use of DTIs. Your project is nearing completion and we would like to know if you could have met your strict assembly deadlines without using DTIs to assure you of proper bolt tensions?"

MR. DRAGON'S REPLY:
"The answer is simply no, it would not have been possible. Thanks to the use of DTIs to quickly, visually verify required bolt tensions, we were able to complete the flanged steel column and beam substructure, and overlay the pre-stressed concrete road sections, all within prescribed time deadlines. And that's including all verification and inspection operations. DTIs made all this possible.

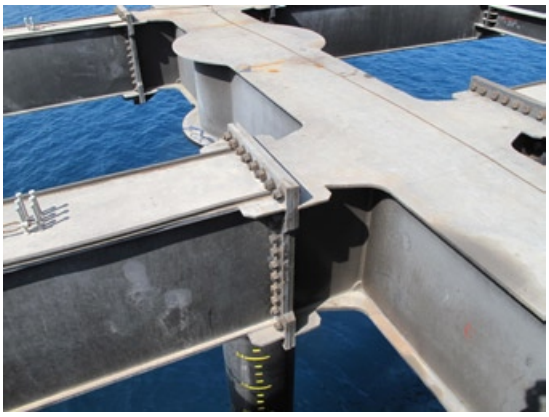
Using hydraulic tools it takes close to three hours to tighten each rectangular flanged steel connection. Considering that we must tighten 10 flanges per crossbeam, we are talking about close to 30 hours per crossbeam. Additionally, we were operating with a local, unskilled workforce that has little, if any, experience with hydraulic tools. Without DTIs to quickly and precisely verify the tension of each installed bolt, we would have incurred severe delays and would have missed our deadline.

Bolt/DTI assemblies were pre-tightened with impact tools, then road sections were put into place. Having pre-lubricated all bolt assemblies, we proceeded with final tightening of the bolts. Feeler gauges were used to spot check DTI residual protrusion gaps.

Finished assembly photos were taken to show the end customer how visual DTI inspection verified the required bolt tensioning.

Support structure under construction

Installed concrete road modules



View of bolted flanges using DTIs

FATOR TORNILLERIA INDUSTRIAL
C/ Catalunya No.11 – Pol. Ind. Can Oller
08130 Santa Perpètua de Mogoda BARCELONA
Tel. + 34 93 544 63 36 Fax. + 34 93 592 03 31
www.fator.es • info@fator.es

DTI BENEFITS ON THIS PROJECT:

- **An unskilled labor force quickly learned to assemble, tighten and visually check DTIs to verify bolt tension.**
- **Time constraints for job completion were easily met. Bolt installers were able to do their own inspection as well. Post-assembly visual bolt tension checks were quick and could be done at any time.**
- **Consistent bolt tensions were achieved easily, in spite of the dusty and windy salt spray environment.**

The SAIPEM / SONATRACH project provides an excellent example of how the use of DTIs provides bolt tightening certainty and major time and cost savings.

We at FATOR believe that nothing speaks more strongly about the quality and benefits of a product than the voices of satisfied customers. We are happy to share this project and we would be glad to assist you in your future projects.

Before tighening the DTI is not flattened

Tightening is complete and the DTI is flattened

FATOR TORNILLERIA INDUSTRIAL
C/ Catalunya No.11 – Pol. Ind. Can Oller
08130 Santa Perpètua de Mogoda BARCELONA
Tel. + 34 93 544 63 36 Fax. + 34 93 592 03 31
www.fator.es • info@fator.es