

## **An Application of Bottom Pull Method to Bundled Submarine Pipelines**

*P. C. Andrew Ngiam*

Kvaerner R J Brown Pte Ltd, Singapore

*C.H. Jo*

Inha University, Incheon, Korea

*Surasakdi Uthachalandond*

Petchburi Terminal Company, Thailand

*K.K. Yong*

Kvaerner R J Brown Pte Ltd, Singapore

### **ABSTRACT**

This paper describes the pipeline design and construction engineering of a submarine pipeline bundle pulled from an onshore stringing yard to a new jetty in the Gulf of Thailand. The jetty is located approximately 6.5 km from the coast off Petchburi, in a water depth of 10.7 m Chart Datum. The pipeline bundle system comprises of three 16-inch diameter pipelines coated externally with corrosion protection coating and concrete weight coating as well as the associated risers. Two of the three pipelines are used to transport diesel and the third is used to carry mogas. The engineering design of the pipelines and risers is discussed, followed by key aspects of the pipeline installation. Design and field results are presented.

### **KEY WORDS**

Submarine pipeline, bottom pull, bundled pipelines, Petchburi, Thailand.

### **INTRODUCTION**

The pulling of a submarine pipeline or a bundle of pipelines from shore to a location offshore often adopts the Bottom-Pull Installation Technique. Using this method, individual pipe joints are aligned and welded into continuous pipe strings and pulled into the water using a pull winch or a pull vessel. The pipeline stringing operation can be carried out either at a fabrication yard onshore near the landfall area or on board a lay vessel. The method is especially useful in areas with logistics problems or in shallow water regions where the vessel approach to shore is limited by its draught.

The first bundled pipelines bottom pull in Asia took place in Singapore in 1981 where the Caltex/PCS bundled six lines were pulled across Jurong Fairway between Singapore and Pulau Merlimau (RJBA 1980). Since then there have been a number of single line and bundle pulls in the region, especially in Malaysia, Indonesia and Hong Kong.

This paper describes the bottom pull design and installation of the Petchburi Terminal Company's (PTC) bundled pipelines in the Gulf of Thailand (see Figure A). The bundle consists of three submarine pipelines, each having 16-inch diameter and 6.5 km long, which were successfully installed in 1996. The bottom pull of such long bundled submarine pipelines is believed to be the first of its kind in the Gulf of Thailand.

The submarine pipeline route runs almost due east towards the jetty and the bundled pipelines are parallel to one another at a close spacing of slightly less than one metre (pipe centre to centre). Prior to the bottom pull operation, the pipelines are secured in position onshore using a series of bundling cross beams spaced at regular intervals.

The pipelines are externally coated with asphalt enamel and concrete weight coating. The later is required to achieve negative buoyancy and on-bottom stability in accordance with Det Norske Veritas, Rules for Submarine Pipeline Systems, 1981. The submarine Pipeline cathodic protection system is designed based on DnV RP B401 (DNV 1993).

The engineering design activity took place in Singapore between March 1996 and June 1996. The line pipe was procured from a mill in Korea and was coated externally with asphalt enamel and concrete in a line pipe coating yard in Kuantan, Peninsular Malaysia. The construction activity of the pipelines and the new jetty began in September 1996 and was completed in May 1997.

The entire pipeline/jetty system is owned and operated by Petchburi Terminal Company (PTC), Thailand. The EPC Contractor is Hyundai Heavy Industries (HHI), Korea and the engineering consultant is Kvaerner R J Brown Pte Ltd (KRJB), Singapore.