Development of New UST Inspection for UOE Pipe Mill

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ABSTRACT

This document discusses the development of a new UST inspection technique for UOE linepipe. There are two newly developed techniques, which are applied to inspect the submerged arc weld (SAW) seam of UOE linepipe for the first time. One technique is the phased array probe, which is designed and developed to have 16 angles in a probe and is used for inspection of longitudinal direction defect in the SAW seam. Another technique is an exclusive probe to inspect concentrically the internal weld toe area. Using these probes, this document also discusses the In-line UST inspection system in the Sumitomo Metals Industries, Kashima UOE pipe mill. The requirements of Ultrasonic Testing for longitudinal SAW seam have become more severe in order to assure the quality of the weld. These requirements include, probe setting, signal evaluation and detection of various kinds of defects in the weld and HAZ area. The new inspection technique, mentioned above, is effective and useful not only to detect the natural defect present in the weld and Heat Affected Zone (HAZ) but also to satisfy all the requirements, which are specified in the international specification.

KEY WORDS: UOE; SAW; UST (Ultrasonic Testing); phased array; probe.

INTRODUCTION

High strength and heavy wall thickness steel pipes have been developed for high-pressure gas transmission system. The UOE pipes, which are essential to produce high strength such as X70 grade or higher, have been improved and successfully developed for application. Meanwhile, the requirements of Ultrasonic Testing, such as DNV, ISO specifications etc., for longitudinal SAW seam of UOE pipe have become more severe for inspection. These requirements include probe setting and signal evaluation. This means increasing the number of probes to detect the many reference standard defects, depending on the material wall thickness. as well as detecting various kinds of shape and direction of defects in the weld area, especially to the offshore heavy wall steel linepipe usage.

Furthermore, the internal weld toe area of high strength and heavy wall thickness UOE pipe has high sensitivity to fracture initiation, because of HAZ softening and stress concentration during the pipeline operation with internal high pressure.

Although the conventional multi-probe technique is generally applied in this field in order to meet specified requirements and to assure the quality of the weld area, the authors have developed and applied the new inspection technique with an applicable ultrasonic phased array probe for longitudinal SAW seam in the UOE pipe mill. This latest technique is now being applied in the large SAW pipe production world for the first time.

Secondarily, we have also developed and applied the exclusive probe units to inspect concentrically the internal weld toe area and to detect the theoretically smallest size of defect by ultrasonic system in addition to the general requirements.

This document presents the results of our original designed array probe and exclusive probe for internal weld toe area including equipment details and the control system to the data in the UST equipment. It also compares the inspection results to those obtained on the conventional multi-probe and our developed array probe in the UOE pipe mill.

THE PURPOSE OF DEVELOPMENT FOR UST INSPECTION

Figure 1 shows the typical weld defects found in the weld area. There are many cases for shape, position, direction, and size. Basically it is important to detect all defects present in the weld and HAZ area.

Fig.1 Typical SAW seam defects