OPTICAL METROLOGY SERVICES

OMS Paper

Round pipes - an engineer's pipe dream!

OMS's achievements have won the Company a whole host of awards including in 2008 the Pipeline Industries Guild "Significant Contribution to Subsea Rigid Pipeline Installation Technology" and in 2007 a Queens Awards for Enterprise (Innovation).

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2007

A common assumption made by those who have never measured the dimensions of a pipe is that pipes are round and have a constant wall thickness. You would think that in order to fit pipes together you would just need to locate pipes of a similar size and join them together.

Unfortunately, the reality is very different. Most pipes give fit up problems. In fact the only time pipes approach being round is when they are machined internally and externally and that isn't always possible.

Why wouldn't manufacturers make pipes to the right shape in the first place? Dr Tim Clarke, Director of OMS says "Manufacturers try to make pipes as accurately as they can but they cannot be formed precisely enough. There will always be a necessity to take further steps to meet the most demanding applications found in the oil and gas industry".

The list of requirements are so critical that just half a millimetre can mean the difference between success and ecological disaster. A fatigue sensitive steel catenary riser is subject to dynamic stresses as it descends a mile from a vessel (or a spar) to the sea floor, for example: the topside structures are subject to extreme weather conditions (e.g. hurricanes) while the pipe itself can be buffeted by underwater currents that are so strong that strakes are typically fitted to pipes to stop them vibrating.

Why pipes are not round

The shape of a pipe is largely dependent on the method of manufacture and, for each method there will be variability that is typical for that process. Further shape variations will occur depending on the size of the pipe and the specific equipment used to manufacture the pipe. One type of manufacture is the UOE process. These pipes are called "UOE" pipe as they are first formed into a **U**, then an **O** and finally **E**xpanded to their final size. Each part of the process leaves its "signature" on the pipe. The Expander is a tool that is made up of a number of segments. The pipe is enlarged by the expander in order to attempt to create a uniformly round pipe. While it may be successful in taking out some features left behind from the **U** ing and **O** ing process, it leaves behind its own imprint in the pipe.

When the **E** ing process is not successful in creating a circular pipe a variety of shapes are possible. Sometimes the pipes are oval or are not circular in the weld region, an effect known as "Peaking", but this term does not do justice to the variety of shape abnormalities in the region of the weld.

UOE pipe is used in the oil and gas industry at the point when Seamless pipe become difficult to manufacture to the desire standards. Unlike UOE pipe, Seamless pipes are manufactured red hot. It is difficult to describe the manufacturing process. A solid cylinder of red hot steel is pierced through the centre with a rod which resembles a large knitting needle.

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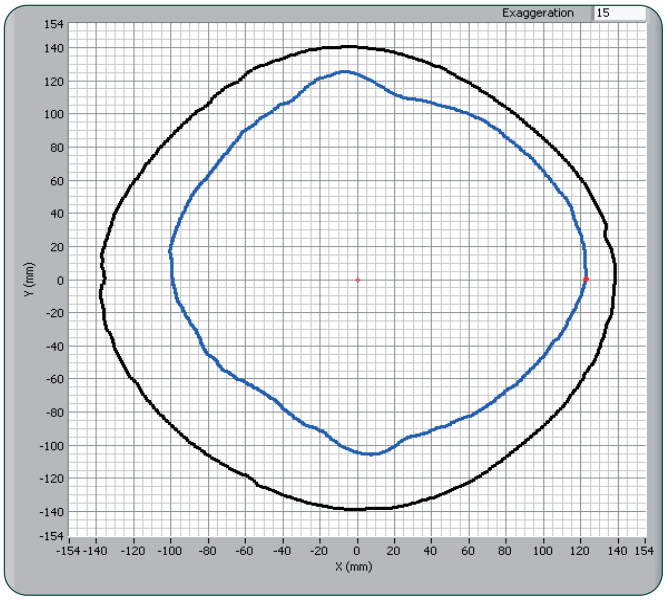
Then the red hot tube goes through further stages where it is rolled into shape against an internal mandrel. Eventually the pipe is far longer than the original ingot.

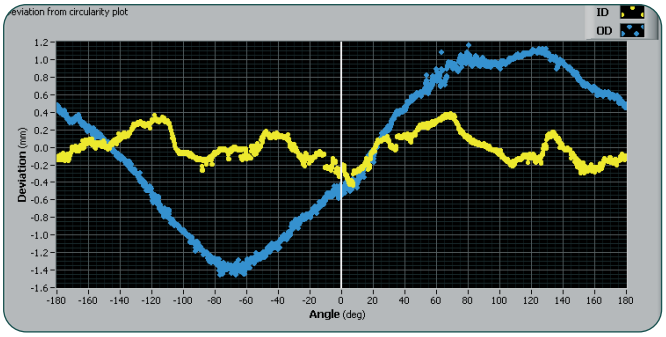


Seamless pipes have a variety of shapes which can vary between mills and during production runs. In some cases the pipes are made in double lengths and cut in half. The ends of these pipes can be more out of shape than the middle due to the closeness of the end to the piercing.

OK, pipes are not round - is this a problem? Why measure?

Pipes that will be used in deep water (more than a mile under the sea) must be given extra attention, particularly the steel catenary risers (SCR's), which are the ones that bend up from the sea bed and lead up to a platform or FPSO. Weather extremes and sea currents can cause serious problems if they are not welded to an exact specification. Clarke says "If the pipes don't match any closer than 0.5mm a bad weld can occur which could lead to a failure of a 'Riser' which would be an environmental disaster". Better fit up of pipes leads to better welds and this can prevent such problems occurring. OMS also measures pipes quicker, easier and more accurately than has been possible before, taking a matter of seconds for 2000 measurements of both the internal diameter and wall thickness of the pipe.

One of the Company's latest devices, the award winning Automatic Pipe Checker™, uses Lasers to measure internal and external dimensions. The device is placed inside the end of the pipe so that an arm with Lasers attached can encircle the pipe taking accurate measurements to build up a map of the pipe shape both on the inside and the outside. The information from the tool is sent to a computer using Bluetooth™ technology, which displays all the points of the circle, in a line, as though the pipes circumference has been unwrapped.



The software devised by the company is then able to perform a number of tasks that solve the problems posed by out-of-shape pipes.

One scheme is to find the pipes that fit together exactly. Clarke says "Sometimes the pipes we get are difficult to use. We have to find pipes with the right diameter and then find pipes that are the right shape. It can be an extraordinarily complex thing to do".

In other cases OMS will assist in creating a counterbore plan in order to create pipes that are good enough to be used without matching them together in a specific order. Counterboring is a process of removing material from the inside of the pipe to obtain a smooth circular inside which is good for welding and easy to fit together in any order. Either way, OMS is able to deliver pipe joints to the client that are as good as they would be if the pipes were round.

Using the OMS tools saves a lot of time - being able to measure as many as 400 pipe ends in one day is at least three times quicker than using regular measurement tools that only measure at a few discrete locations around the pipe. Companies are able to keep their project schedules on track and as some projects involve measuring more than 2,500 pipes, this time saving is hugely valuable.

Project engineers also have the security of knowing that the dimensional part of their project is being managed by experts who have acquired skills and experience over many years on a wide range of projects. Clarke says "Offering our clients the complete solution to their problems is our aim, we know we can deliver that, in fact we do."

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