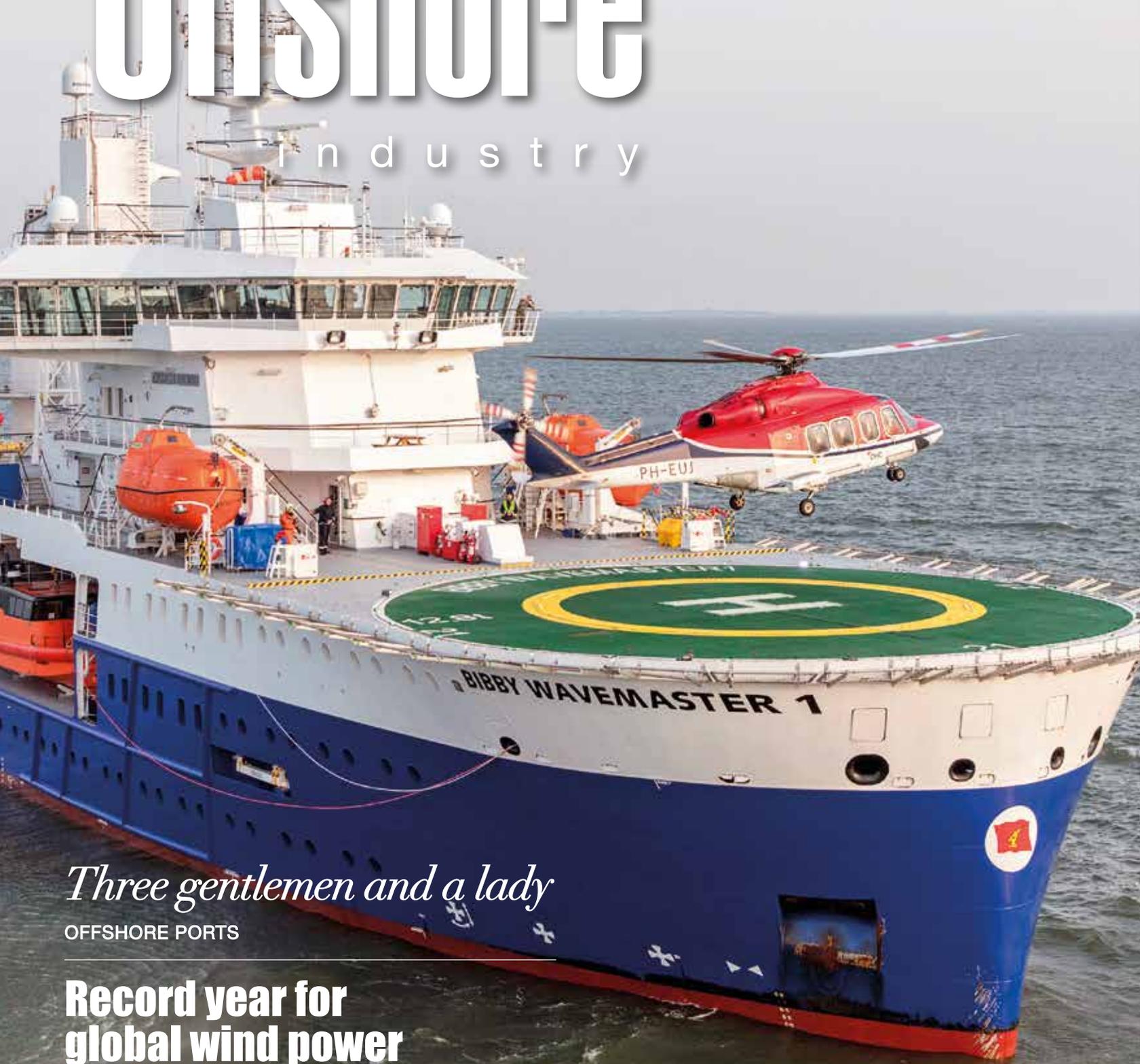


Offshore

Industry



Three gentlemen and a lady

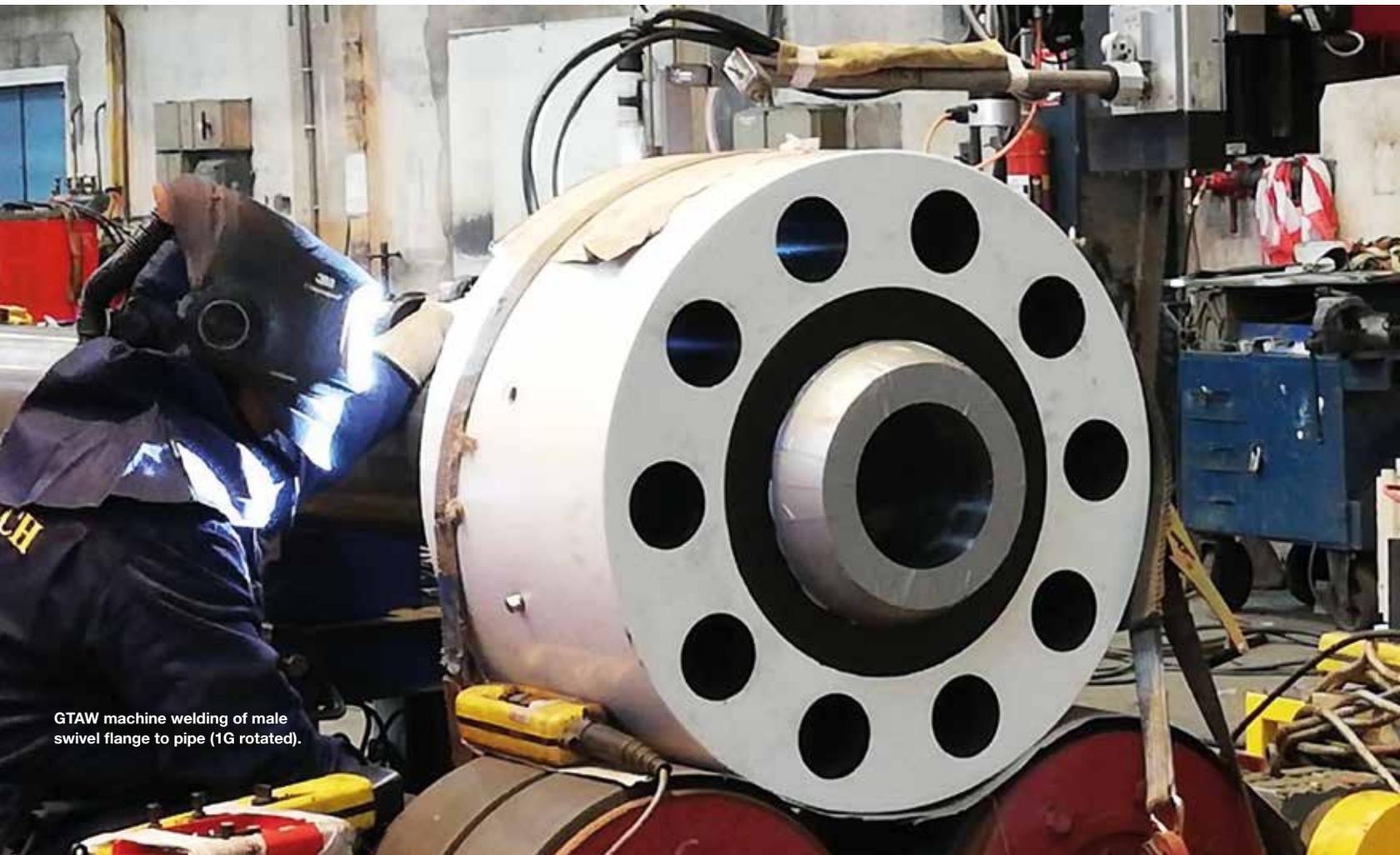
OFFSHORE PORTS

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HEAVY LIFTING & TRANSPORT



GTAW machine welding of male swivel flange to pipe (1G rotated).

A challenging fabrication of an ID clad piping system

EXOTECH RECENTLY FABRICATED A HIGH-PRESSURE PIPING SYSTEM FOR ITS CLIENT PM PIPING. THE SYSTEM IS INTENDED FOR INSTALLATION ON AN OIL & GAS MAJOR'S SEMI-SUBMERSIBLE PRODUCTION PLATFORM IN THE GULF OF MEXICO. PURPOSE OF THE SYSTEM IS TO INJECT WATER INTO THE FIELD TO STIMULATE PRODUCTION.

WORDS BY ALFRED VAN AARTSEN, MATERIAL & WELDING ENGINEER AT EXOTECH.
ALL PHOTOS COURTESY OF EXOTECH.

The piping system will lead from the deck along the leg across the semi-submersible's pontoon to the tapered stress joint. The welding code for fabrication was ASME B31.3. The base material used was A694 F65. ID clad with 3.2mm ER NiCrMo-3 (Inconel 625), size 10" (273mm), minimum 37mm CS base material wall thickness. Pressure testing of all the spools lies close to 1,300bar. PM Piping purchased 450t of forged billets in various diameters, used for the fabrication of pipes, misalignment flanges, hub-connector's, and 3D bends. Thanks to the limited number of batches and the narrow chemical composition of all these batches, only a limited number of Procedure Qualification Records (PQRs) had

to be qualified under code (ASME B31.3) and end-client's specifications.

[Extensive programme](#)

During the start of the project, the COVID-19 pandemic began to spread with serious consequences for the north of Italy, which is where the base metal forging took place. As for many other projects, the virus certainly also had an impact on the forging. The lengths of the batches were supplied to Exotech for the procedure qualification, and the welding for the PQRs began. An extensive programme of tests regarding Non-Destructive Examination (NDE) and welding commenced. The weldments for the PQRs achieved very good test results, both chemically and mechanically, as well as for

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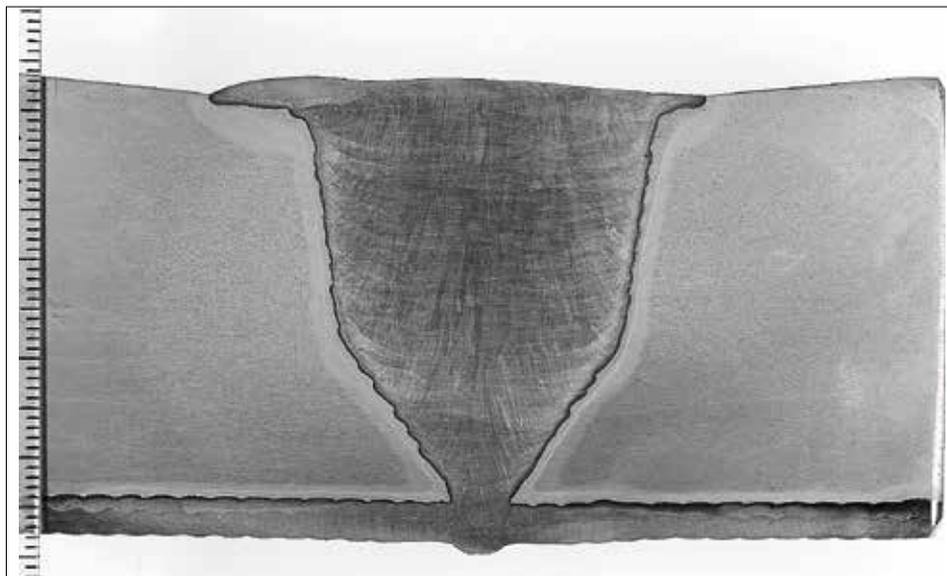
the Crack Tip Opening Displacement (CTOD) of weld metal and Heat Affected Zone (HAZ), which resulted in the approval to start production.

Meanwhile, fabrication of the ID clad base material components was in full progress, and delivery to Exotech subsequently took place. The piping components consisted of compact flanges, fixed and swivel flanges, anchor flanges, and bends. To provide some insight: one male swivel flange weighed approximately 1,200kg. Production of the spools for the water injection system began. A total of 63 welds were made, of which eight welds were manually kept in position. All of these welds were 100% visually inspected and underwent liquid penetrant testing and radiographic testing.

Zero indications

As the reader might know, unacceptable welding indications detected with NDE require reparations, and repairs would have a serious impact on the dimensional tolerance. Additionally, welding of this type of ferritic base material using the required type of fully austenitic welding consumable is susceptible to hot cracks, which is why the end client stipulated that a root repair PQR had to be qualified prior to production. During production, NDE testing revealed zero indications in rotated and manually positioned welded joints. This yields a big compliment to the fitters and welders involved. Given the circumstances, they were able to stay focused to achieve an excellent result. Because of this and the team's effort in organising the entire fabrication, Exotech was able to deliver the project well within the original schedule, which can be considered a huge achievement in times with lots of challenges in global delivery times.

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Testing of PQRs. Macro of PQR T9139-01. GTAW, manual/machine: 1G rotated butt welding of F65 ID clad.



Spool 7, welding completed, awaiting NDE and hydrotesting.



Welder during root welding. Given the circumstances, the welders were able to stay focused to achieve an excellent result.