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Cover story:

Orion Valves enters Guinness Book of Records with world's biggest wedge gate valve

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2025 was a remarkable year for Orion Valves, the specialist manufacturer of severe service valves based in Trieste, Italy. In addition to celebrating the company's 75th anniversary, it also successfully entered the Guinness World Records by producing the largest Wedge Gate Valve ever manufactured. It was an astonishing achievement which highlights the exceptional level of technical expertise of the Orion team.

By Joanne McIntyre, Valve World

Orion Valves enters Guinness Book of Records with world's biggest wedge gate valve

Over the past 30 years, Orion's direction has been consistently driven by engineering advancement. It began developing its severe-service product range three decades ago, initially concentrating on downstream applications. From there, Orion expanded into midstream and, later, upstream services.

The record-breaking project reflects Orion's strong and growing presence in the Middle East. Today the company employs approximately 300 people and operates two manufacturing plants in Italy and one in Saudi Arabia, with a further production facility currently under construction in Abu Dhabi. The company also maintains a regional office in the United Arab Emirates.

Company President, Mr Farina explains: "Orion Valves has been actively involved in Saudi Vision 2030 since its launch in 2016 by Crown Prince Mohammed bin Salman, which aims to diversify the Kingdom's economy beyond oil, drive social and industrial development, and position Saudi Arabia as a global investment hub. Under this programme, Orion' saudi plant is now the largest valve manufacturer approved by Saudi Aramco in KSA."

In 2017, Orion established an international partnership with SPSV (Specialized Steel Valves) to support the growing demand for locally manufactured, world-class valve solutions in Saudi Arabia and across the Gulf region. SPSV manufactures both forged and cast steel valves, including gate, globe, check, rising-stem ball, axial on-off, axial check, dual plate check and butterfly valves.

"The valves we produce in Saudi Arabia are not only supplied to Saudi Aramco, but are also used in water infrastructure and power generation projects. The new facility we are opening in Abu Dhabi, scheduled for mid-2026, will respond to ADNOC's requirement for locally manufactured HIPPS products."

Focus on HIPPS

Orion maintains a strong focus on severe-service applications across a wide range of demanding

See how the world's biggest valve was manufactured by Orion Valves in Trieste, Italy.

environments, including seawater injection, corrosive and sour services, LNG, cryogenic duties, and other critical process conditions. A key area of development for Orion has been HIPPS (High Integrity Pressure Protection System) valves. "These fast-acting, fail-safe systems form the final protective element in a HIPPS, a critical safety system used in oil & gas and chemical plants to prevent dangerous overpressure events by rapidly isolating the high-pressure source when conventional relief systems are not sufficient," explains Mr Farina.

Last year, Orion delivered its latest HIPPS system to ADNOC for installation at the Habshan oil and gas processing complex in the UAE. It is the largest HIPPS system Orion has supplied to date and represents a major milestone for the company.

The project reflects Orion's long-term investment in fast-acting, high-integrity isolation technology and reinforces its position as a leading supplier of safety-critical valve systems for high-risk process environments.

Nuclear sector

Orion is also making strong in-roads into the new build nuclear sector, developing specialised valves for molten-lead applications in collaboration with the Italian company Newcleo, within the field of small modular reactors (SMRs).

Chief Operating Officer Mr Alberto Rossi explains: "This project presented a significant engineering challenge: molten lead is used as the reactor coolant and operates at temperatures of around 650 °C, while also being highly corrosive."

"Because nickel-based alloys are not suitable for this service, we developed a solution based on a special grade of stainless steel protected by an aluminium oxide coating. The prototype valve has already been successfully certified and placed into operation." Today, Orion has a strong and well-established technical department, with nuclear-sector activities

The President of Orion Valves, Luca Farina (left) receives the certification from Guinness World Records.

Focus on severe service

Orion was founded in 1950, then went through several major management changes over the following decades, culminating in its acquisition by the Farina Group in 1996.

Following the acquisition, it invested heavily in strengthening its technical department with a clear objective: to achieve qualification by as many end users as possible. Today, Orion Valves is qualified by virtually all major operators. At the same time, the company deliberately shifted its strategic focus toward severe-service applications, an area in which it has built a strong reputation. Its world-record-breaking valve is a clear demonstration of that capability.

dating back to the first generation of reactors and evolving steadily over the decades. While the company remains active across the broader nuclear industry, SMRs are now a major strategic focus, and Orion is working with several leading technology developers.

"Nuclear power is viewed as a critical pillar of future energy supply. As global demand for clean, reliable baseload power continues to grow, nuclear remains one of the most efficient large-scale decarbonised energy sources," continues Mr Rossi.

"In particular, fourth-generation reactor concepts are highly attractive from an environmental perspective, as they are designed to use waste from second- and third-generation reactors as fuel. MOX (Mixed Oxide) technology converts spent nuclear fuel into a new form of reactor fuel, reducing the need for fresh uranium mining while simultaneously consuming existing radioactive waste. Countries such as France, which hold significant inventories of spent fuel, are investing heavily in MOX technology to establish a strategic, domestically sourced nuclear fuel cycle."

Technical expertise and R&D

"For over a decade, Orion has been active within the API as a member of the Committee on Refining Equipment, and in particular the Subcommittee on Piping and Valves," explains Mr Rossi. "We meet twice a year in the United States to review and update downstream and upstream API specifications. Only a limited number of manufacturers are invited to participate in these committees, and our involvement reflects the depth of in-house expertise that is recognised by the wider valve industry.

Watch the award ceremony where Orion was presented with the Guinness World Record for manufacturing the world's largest valve.

"Our R&D department, based in Italy, works closely with external research institutes and universities. In close proximity, we have Elettra Sincrotrone Trieste, an international multidisciplinary research centre providing synchrotron and free-electron laser (FEL) radiation for advanced research in materials science and life sciences."

> *"The technical specification for this valve was exceptionally demanding"*

"We collaborate with Elettra on the development and qualification of new materials, carrying out advanced characterisation and testing of properties such as hardness, microstructure, and suitability for protective coatings."

This collaboration reflects Orion's ongoing mission to produce exceptionally high quality, innovative products for the most demanding severe service applications.

Each component of the massive valve was made with extreme care and precision.

World-record wedge gate valve

The remarkable journey to produce the world's biggest wedge gate valve began with a request for quotation issued by Hyundai for a 114-inch wedge valve for the AMIRAL petrochemical complex currently under construction in Jubail, Saudi Arabia, by Saudi Aramco and TotalEnergies. While Orion had never previously manufactured a valve of this size, its long-standing relationship with Saudi Aramco and proven track record in severe-service applications led Hyundai to entrust Orion with the development, engineering, and qualification of the design.

During the early feasibility phase, Orion confirmed that no valve of this size had ever been manufactured. The Guinness World Records organisation verified that the existing record stood at 108 inches. On successful completion, the 114-inch valve was formally recognised as the largest wedge gate valve ever produced.

"Producing and handling a component of this scale required extensive benchmarking and the development of new manufacturing and logistics processes. It remains the largest valve ever manufactured within the global valve industry," says Mr Farina proudly.

"The technical specification for this valve was exceptionally demanding," continues Mr Rossi. "It is installed on a flare header and operates at very low pressure, which makes reliable metal-to-metal sealing critical. The valve weighs approximately

120 tonnes and is designed to operate in a fail-open configuration. In normal service the valve remains closed, but in the event of an overpressure scenario it must open automatically. The 16-tonne wedge is therefore designed to move under its own weight in a failure condition.
Because the valve operates inverted in service, it was mandatory to test it in the same orientation. This introduced a further layer of complexity to both assembly and testing."

Engineering and execution challenges

The first major challenge was designing the valve body. "The combination of extremely large dimensions and low-pressure service imposed unusually thin wall thickness requirements, making casting particularly demanding," explains Mr Rossi. "The Orion team worked closely with specialist Italian foundries to develop a geometry that provided the necessary mechanical strength and deformation resistance while remaining castable without defects."
More than twenty companies located in the region were involved in the construction process to ensure full control over quality and lead time. The final design had to meet strict structural criteria while also being optimised for manufacturability.
"The second challenge was logistics because every component required dedicated handling procedures," Mr Rossi continues. "Transporting the stem, wedge, body sections, and bonnet demanded exceptional lifting and transport arrangements. Even moving individual components within the factory required bespoke handling equipment and carefully planned routes."
The third challenge was testing. "The valve had to be assembled and tested in the same inverted orientation in which it would operate in the field. This requirement dictated the selection of the manufacturing site, which had to accommodate not only assembly but also a deep test pit more than five metres in depth. The fully assembled valve, fitted with blind flanges and filled with water, exceeded 200 tonnes, requiring specially designed fixtures to support and stabilise the valve during testing."
Despite these constraints, the valve was successfully tested at both full hydrostatic pressure and at the extremely low operating pressure of five psi, in line with the process requirements.

The Orion Valves team celebrates the culmination of their efforts: the Guiness World Records certificate.

Quality assurance and delivery

Given the scale and complexity of the project, there was no margin for rework. Mr Farina: "Transportation permits and logistics planning were fixed well in advance, leaving no room for delays. Every operation, from machining to welding, coating, and final assembly, was executed to the highest quality standards."
The project was subject to continuous inspection by representatives from Saudi Aramco, TotalEnergies, Hyundai, and independent third-party inspectors. The valve remained in the inverted configuration throughout assembly and testing and was only rotated into the upright position after final painting.
From contract award to completion, the full project duration was approximately one year. The valve will be installed in Saudi Arabia later this year, where it will function as a flare header collector.
The official presentation of the completed valve took place on 11 December, and was attended by 600 people, including representatives from Saudi Aramco and Hyundai, all Orion Valves staff past and present, and the Guinness World Records staff.
The project demonstrates Orion's ability to deliver highly complex, safety-critical equipment at the very limits of current valve engineering. It reinforces the company's position as a long-term technical partner capable of executing exceptional projects in the most demanding operating environments. ■

Company President Luca Farina is presented with an award from the Mayor of Trieste, Roberto Dipiazza.