Subsea manifolds & connection systems
Complete technologies and services for long-term reliability and safety
Subsea manifolds & connection systems

Manifolds and connection systems are the key building blocks for subsea infrastructure, connecting wells to export pipelines and risers, and onwards to receiving floaters, platforms and onshore facilities. Subsea manifolds are used to merge the flow from multiple subsea wells for transfer into production flowlines and to manage distribution of injected water, gas and chemicals. Subsea connection systems are used to provide diverless links between subsea wells, manifolds, pipelines, risers and control umbilicals.

In an environment that is both harsh and fragile, key challenges for these technologies are long-term reliability and safety – with the flexibility to meet each field’s unique characteristics and enable expansion over time.

GE Oil & Gas solutions

Our subsea manifolds and connection systems are designed to accommodate a wide range of configuration needs and service requirements, while providing a high degree of versatility for pipelay vessel interfaces and installation scenarios. With over 20 years of experience in this product category and more than 100 GE Oil & Gas manifolds now operating, our portfolio spans some of the most challenging subsea developments in the world – including the largest deepwater fields, demanding large-bore gas delivery projects, long step-out developments and critical flow-assurance applications.

Our expertise covers everything from FEED, detailed design, sourcing and manufacturing to global installation campaigns and life-of-field optimization support and maintenance. Our evolutionary approach to engineering design ensures that all our new products are based on a combination of field-proven systems and rigorously tested new technologies – so that each new offering achieves the dual purpose of mitigating risk while optimizing production.

Solutions for subsea infrastructure development

GE Oil & Gas maintains an extensive line of subsea manifolds and connection system products that enable a flexible range of system configurations. We also provide a suite of specialized flowline products, tooling and pigging equipment, for a true full-system solution for every stage of subsea infrastructure development.

Innovation Now

GE Oil & Gas is a leading provider of advanced solutions for the entire oil and gas industry – from drilling and production, LNG, pipelines and storage to industrial power, generation, refining, petrochemicals and pipeline integrity services. We are able to benefit from the vast technological resources and expertise of the entire global GE organization.

By combining our own developments with the most advanced technologies from other GE business such as Aviation, Healthcare, Energy and Telecommunications, our products continue to reach higher levels of reliability, availability, efficiency and performance. As the industry faces continually greater challenges, we believe that technology is the key to overcoming each one – safely and efficiently. We are fully committed to providing that Innovation Now – and paving the way for a bright future in oil and gas.

Environmental health & safety (EHS)

All our facilities and personnel operate to the highest EHS standards. We employ rigorous test, audit and review procedures in everything we do – minimizing risk at all stages of our product and service lifecycles from development through to delivery and ongoing support.

We have received many customer awards and recognitions for our EHS performance and we are extremely proud of every one because safety is something we take seriously in all aspects of our business.

Quality & reliability

In today’s highly competitive global environment, there is no room for error – and nowhere is this more certain than in the subsea oil and gas industry. That is why everything we do is guided by maximizing the reliability and system availability of the equipment. That focus on quality translates directly into reliability for our customers.

GE Oil & Gas technologies have proven capabilities in the most extreme conditions. Our systems have been used to first surpass the 10,000-ft drilling milestone, enable the longest subsea tieback, and deliver field-proven availability of 99.9% for one of the largest subsea projects ever delivered. To be of real value to our customers, quality and reliability must go hand in hand.

Compliance & governance

In a time of rigorous regulation and enforcement, strong compliance and governance processes are more important than ever for global organizations. Merely having internal policies in place is not enough – companies must devote significant attention and resources to ensure such rules are truly embedded in employees’ actions every day.

For more than 125 years, GE has demonstrated an unwavering commitment to performance with integrity and we have built a worldwide reputation for lawful and ethical conduct. We seek to go beyond simply obeying the law – we embrace the spirit of integrity. The Spirit & The Letter, our integrity policy, helps ensure that our employees conduct our affairs with unyielding integrity. Processes are in place for executive and employee accountability, training, continuous improvement and an open reporting environment to set the tone for a culture of integrity everywhere, every day and by all our employees.
Subsea manifolds and foundation systems

Our subsea manifold systems are based on pre-engineered, modular building blocks that accommodate a wide variety of configuration requirements and design options. The manifold systems are used in combination with a variety of foundation solutions to match diverse soil properties and seabed conditions.

Subsea connection systems

Our subsea connection systems are based on extensive connector product portfolios using our well-proven metal sealing technology and a suite of connection tooling systems. Our portfolio covers both vertical and horizontal configurations and includes proven solutions for pipe sizes up to 42”.

Subsea connectors

Our subsea flowline connectors are used for single, dual and multibore applications, using high-integrity metal sealing technology. The portfolio includes clamp, mandrel and collet connector configurations for a wide range of different applications and service requirements.

Jumpers and tie-in spools

We employ a total-system approach in designing jumpers and tie-in spools – ensuring optimized system functionality where the connector capacity envelope is considered in tandem with external load profiles and other requirements such as thermal insulation and fatigue performance.

Pipeline and riser solutions

Our solutions cover applications for in-line tees, PLETs/pipeline sleds, integrated pipeline-end manifolds (IPM) and compact riser-base systems. Designs enable swift and efficient installation of pipelines and risers, and accommodate demanding in-place service requirements.

Pigging equipment

Our connection-system portfolio is complemented by a full suite of solutions for pipeline inspection operations, including pig launchers and receivers in temporary, fixed or subsea re-installable configurations – designed for initial commissioning or for integrity management during field operation.
Since 1987 we have supplied more than 1,200 subsea connections and 100 subsea manifolds in all major development areas worldwide. Our comprehensive range of systems has the functional flexibility and modular versatility to meet the specific performance needs of any subsea application.

How do we ensure in-service reliability of connector products?
All our connector products undergo rigorous qualification testing, and system applications are functionally tested to validate performance envelopes. Our sealing systems are based on proven VetcoGray metal sealing technology and extensive experience. Each project is executed with extensive quality and process control measures for in-house activities as well as any work performed by our approved suppliers and subcontractors.

How do we ensure flexibility to cover a wide variety of applications?
We use a modularized design approach, drawing on a range of pre-engineered and standardized building blocks that can be combined in a wide range of application-specific configurations. For subsea manifolds, our configurations cover both cluster and template manifolds, as well as special-purpose applications such as HIPPS manifolds. For subsea connection systems, our portfolio covers pipe sizes of 2-42" and a wide variety of installation scenarios.

How do we ensure a robust project execution process?
The same product structuring approach used for product configuration flexibility also helps to pre-define standard interfaces and allows for use of standardized and proven project execution models, including use of pre-approved suppliers and a closely integrated supply chain.

How do we ensure that flow-assurance aspects are addressed?
Our subsea manifolds and connection systems are designed with close attention to flow assurance requirements, employing our system engineering expertise and advanced computational fluid dynamics (CFD) modeling capabilities on the design process. Combined with advanced insulation materials and application techniques, our patented GE Heat Bank systems manage cold spot issues to enable extended cool down times and superior thermal management.

How do we accommodate different soil conditions for subsea manifolds?
We offer a wide range of pre-engineered foundation systems for various soil conditions, from suction anchors for soft soil conditions via false seabed systems for sloping seabeds and skirted mudmat systems, to piled foundations for hard soil properties. The different foundation systems can be combined with active-floating features to allow for in-place adjustment of the as-installed condition.

How do we address HPHT requirements?
Our designs include options with piping systems and valve configurations specifically for high-pressure and high-temperature (HPHT) requirements – all tested and qualified to the required service level. The connection systems are sized to accommodate the required hub-separation loads by ensuring sufficient preload margin for any given bore size through a parametric design approach based on the VetcoGray metal sealing technology and experience.

How do we ensure that flow-assurance aspects are addressed?
Installation ease is a key factor of our design process. Our manifold systems accommodate a number of installation options, including rig deployment and midwater tow, to minimize the need for heavy lift vessels and to accommodate large installation tolerances for foundation systems. Connection systems accommodate efficient installation and maximized versatility and flexibility for pipeline vessel requirements, for either reel, J or S-lay installation. For large trunk-line connections, we have developed the patented Lift & Shift system that enables large bore pipelines to be installed from S-lay vessels without the need for large pipeline end termination structures (PLETs) to be deployed through tensioners and over stingers.

How do we ensure a total-system approach?
Our subsea manifolds and connection systems are complemented by a full suite of products and solutions for pipeline end terminations and manifolds, inline tees and riser bases, inspection-tool launchers and receivers, installation equipment and connection tooling systems.
Reliable designs, Enabling growth

**ICARUS connection system**

ICARUS is a fully ROV-operated, pull-in and connection system for tie-in of flexible flowlines, umbilicals and rigid spools up to 18” ID. An integrated subsea winch and powerful alignment system provides high operational efficiency and ability to cover a wide range of tie-in applications, including patented mini riser base connections.

**Horizontally clamp connection system (HCCS)**

This is configured as a simple and robust horizontal stroking system for rigid pipe spools and flexible flowlines. A short nominal stroking distance, high alignment capacity and high-in-place connector load capacity combine to make our HCCS well suited for large-bore pipe-spool connections. For large pipelines, the patented Lift & Shift deployment configuration can be used to eliminate the need for large PLET/pipeline sleds through the pipelay vessel’s tensioners. Our HCCS design includes a swivel feature to accommodate multibore hub applications. The HCCS is configured with a robust funnel based alignment system, integral soft landing features and a gooseneck interface to the flexible flowline. A special funnel system forming part of the connector assembly provides passive alignment, and an ancillary stroking tool can be used to provide additional alignment capacity if needed. Just as with our HCCS, the HCCS utilizes our standard range of clamp connectors and can thereby be used for a wide range of connection sizes.

**Vertical clamp connection system (VCCS)**

This system is designed for simple and reliable vertical connections of flexible flowlines and rigid pipe spools. A gooseneck configuration with integral lifting features is used for flexible flowlines. A special funnel system forming part of the connector assembly provides passive alignment, and an ancillary stroking tool can be used to provide additional alignment capacity if needed. Just as with our HCCS, the VCCS utilizes our standard range of clamp connectors and can thereby be used for a wide range of connection sizes.

**Vertical connection module (VCM)**

This connection system is used for direct lay-away connections of flexible flowlines. It utilizes well-proven collet connectors with integral hydraulics, configured with a robust funnel based alignment system, integral soft landing features and a gooseneck interface to the flexible flowline. A special metal sealing swivel system allows for easy orientation during deployment and connection operations.

**DG and DG-2 mandrel connector system**

Mandrel connectors resemble collet connectors, but generate the sealing principle where seawater is trapped around the connector, providing a cold spot that needs attention during design of the thermal-insulation system. This is of particular importance in deepwater applications where high ambient water pressure contributes to increased hydrate-formation risk. The traditional response to the cold-spot issue is to retrofit a “doghouse” cover outside the connector, insulating it from the ambient seawater. As a supplement to traditional syntactic foam-based doghouse covers, GE has developed and patented the Heat Bank system that employs a wetsuit principle where seawater is trapped around the connector, providing improved thermal properties. An added benefit of the Heat Bank system is that it can be installed with the connector to eliminate need for a separate retrofit doghouse installation.
Center of Excellence

Located in Sandvika, Norway, our Center of Excellence (COE) for subsea manifolds and connections systems is the primary location for product development, project management, engineering and execution of projects around the globe.

The Sandvika site employs more than 200 skilled professionals and is supported by the multi-disciplinary expertise of additional teams in Trondheim and Stavanger, Norway; Florence, Italy; Warsaw, Poland; and key project development locations worldwide.

All these personnel and sites are further supported by the wide-reaching key project-development locations worldwide.

Center of Excellence capabilities include:

- Front and engineering and design (FEED)
- System design
- Detail design
- Project management
- Materials engineering
- Foundation design
- Structural engineering and advanced FEA modeling
- Tie-in spool and jumper design
- Flow assurance and computational fluid dynamics (CFD) modeling
- Pressure, temperature and load testing
- Thermal insulation testing

Delivering reliability

Throughout all aspects of system definition, engineering design and project execution, we employ rigorous processes that support a systematic approach to quality assurance, production follow-up and product qualification testing. Our overall objective and overriding priority is to ensure that the delivered equipment meets the highest standards of reliability and safety.

Excellence in execution

Each customer project is managed by a dedicated team with a highly-experienced manager and all necessary support personnel. This project-management team works in close alignment with the customer and with full support from our Center of Excellence to ensure that delivery commitments are honored, that technical requirements are met and that performance envelopes are validated.

A complete range of subsea production systems

GE Oil & Gas continually invests in its network of world-class repair and service facilities in over 30 countries— with highly experienced and certified field service personnel strategically located to provide timely support in every region. We cover all aspects of supply and support with advanced tools, skills and solutions, whether and whenever are needed. We understand that true reliability must extend beyond the quality of any single product to the support provided throughout its service life. Our approach is based on dynamic monitoring, analysis and planning—to ensure effective application of technologies and efficient allocation of site-specific resources. Our people are knowledgeable, proactive and responsive, and know how to get the best performance from our products.

Worldwide service capabilities

GE Oil & Gas continually invests in its network of world-class repair and service facilities in over 30 countries—with highly experienced and certified field service personnel strategically located to provide timely support in every region. We cover all aspects of supply and support with advanced tools, skills and solutions—whether and whenever are needed. We understand that true reliability must extend beyond the quality of any single product to the support provided throughout its service life. Our approach is based on dynamic monitoring, analysis and planning—to ensure effective application of technologies and efficient allocation of site-specific resources. Our people are knowledgeable, proactive and responsive, and know how to get the best performance from our products.

Subsea Power & Processing

Solutions for increasing production rates and/or recovery from subsea wells
- Subsea gas-boosting systems – BlueC wet-gas compressor, qualified for Ormen Lange
- Subsea separation and pumping systems – Troll C, the world’s first subsea separation system in operation
- Power-supply systems - surface, umbilical and subsea equipment with MECON Wet Mate and Dry Mate technology

Controls & informatics

Over 30 years of experience and 1,000 modules operating worldwide
- Installations include the world’s largest subsea subfield, the liquefied deepwater fields, large-bore gas delivery projects and high pressure/high temperature applications
- Portfolio includes ultra-reliable VetcoGray ModPod equipped with the award-winning SEMStar subsea electronics module for unrivaled flexibility and reliability.
The information contained herein is general in nature and is not intended for specific construction, installation or application purposes. GE reserves the right to make changes in specifications or add improvements at any time without notice or obligation.