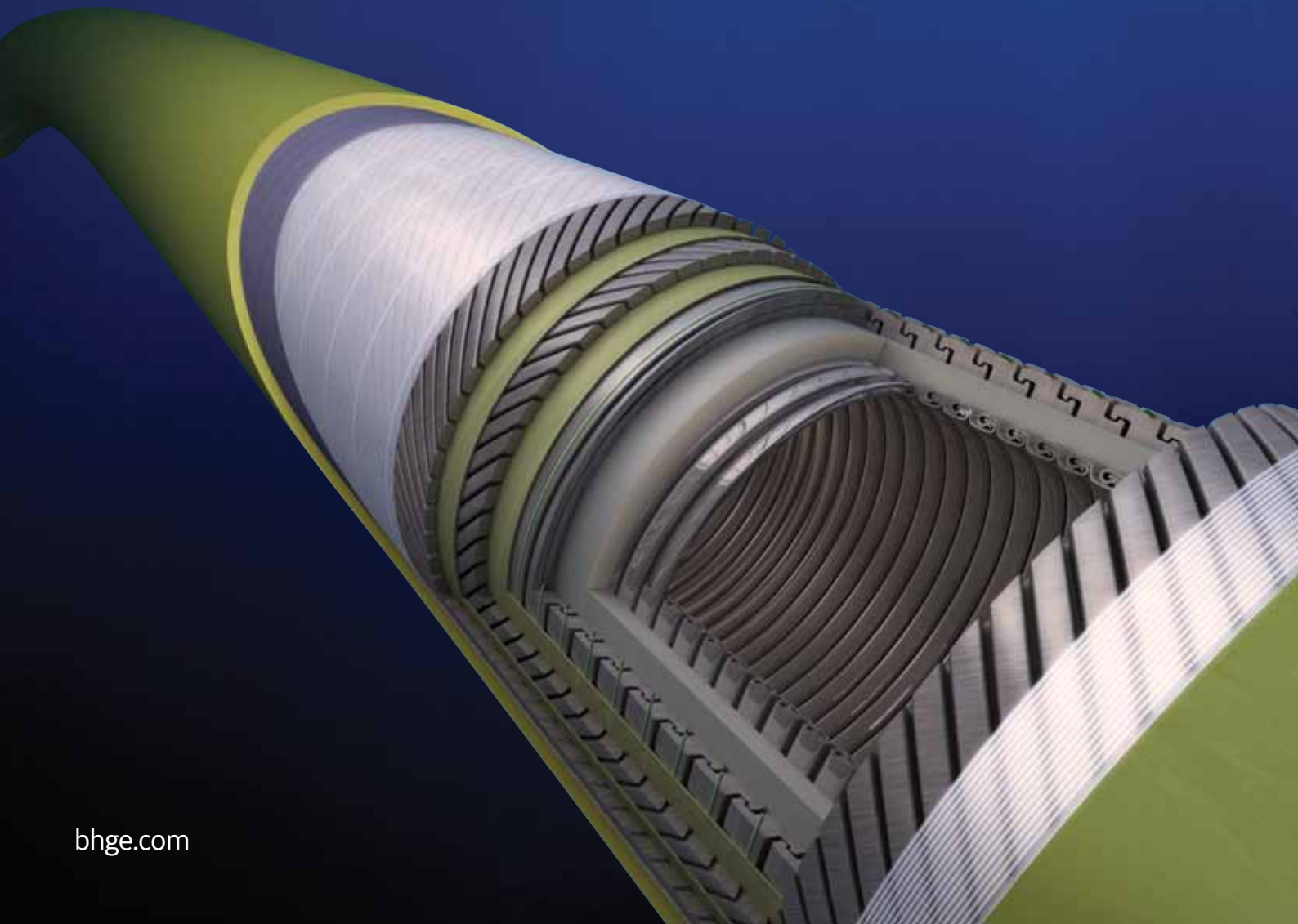




Flexible Pipe Systems (FPS)

Highly adaptable, reliable, and
cost-effective pipeline solutions
for offshore and subsea projects



Flexible pipe

Dynamic risers, flowlines, static and dynamic fluid transfer lines, and jumpers are critical to offshore oil and gas production, injection, and export systems. They are subject to extreme temperatures, pressures, physical stresses, and movement while carrying hot, highly pressurized corrosive materials—yet must still ensure reliable connections and optimal product flow. As offshore developments move into deeper waters and even more challenging environments, flexible pipe is a highly versatile fluid transportation solution, often it is the only suitable technology to enable floating production.

BHGE solutions

Our portfolio of flexible pipe solutions draws on more than 25 years of research and development, material science, and installation experience in some of the harshest conditions the industry offers—particularly in environments where water depth and seabed conditions impose unusual restrictions. Our products are robust, highly flexible, and adaptable to unique project requirements, and offer cost-effective and proven reliability for corrosive reservoirs.

The performance value of our flexible pipe is further enhanced by BHGE's Fullstream industry capability and track record, which ranges from high-pressure/high-temperature and extremely corrosive applications, to the deepest water drilling record, the longest subsea tieback, and the offer of complete systems design for some of the world's most ambitious offshore and subsea projects.

The next generation of flexible pipe

Flexible pipe is highly versatile in meeting the demands of subsea and FPSO-based production. In some environments, it's the only suitable technology for a production system.

Flexible pipe systems (FPS) products can be found in every major offshore production basin worldwide and are engineered to withstand the harshest operating conditions. Our systems are currently operating in depths well beyond 2300 m and are being qualified up to 3000 m.

Baker Hughes, a GE company (BHGE), products are unbonded products are unbonded flexible pipes constructed from multiple layers of helically wound metallic wires and extruded thermoplastic barriers. Each layer is designed to address specific duty requirements, including, for example:

- High temperature
- High pressure
- Corrosivity including CO₂ and H₂S in conveyed fluids
- Dynamic marine environments such as floating production in shallow tidal zones
- Water depths to 3000 m
- Pipe inner diameter from 2 in. to 16 in.
- Required service life
- Flow assurance challenges such as thermal no-touch time
- Robust structure to cater for routing issues such as subsea canyons, or unstable geo-hazards such as mudslides or slopes

In dynamic applications, such as risers and export systems, we optimize designs to accommodate the motion of the production facility. In static environments, our flexible flowlines are ideal for connecting remote wellheads to riser bases and accommodating situations where there is uneven seabed topography or congested seabed architecture. Flexible pipe is often the preferred solution due to the varied installation offerings available, making it a cost-effective solution which can meet the most demanding of project needs.

We design and manufacture a complete range of proven flexible pipe products for reliable offshore and subsea field development. Every product is customized to meet the specific requirements for each project and employ proven technology that is validated by many years of qualification testing, to ensure the most efficient and cost-effective delivery.

We are qualified to ISO 13628-2 and -11, API 17J specification, and our products hold Lloyds Register Type Approval. Our EHS and Quality management systems comply with OHSAS 18001:2007 and we are certified to ISO 14001:2004, ISO 9001:2008.

We are continually overcoming the frontier challenges presented to the industry with the development of high-pressure, large diameter risers for use on FLNG facilities, proprietary lightweight carbon fiber solutions, high-temperature materials, and integrity management systems.

We have a portfolio of differentiated technologies for polymer science, metallurgy, mathematical modeling, and analysis. We also invest significant resources and apply our infield experience into the development of advanced analytical modeling tools for material and product testing.

Key benefits

- Proven track record in all water depths:
 - More than 650 risers installed globally
 - Operational in ultra deepwaters of 2140 m
- Competitive economics on an as-installed basis
- Pipe is fully tested onshore prior to delivery
- Re-usable
- Promotes flexibility infield architecture
- Rapid installation and retrieval

An established portfolio

Risers: dynamic lines suspended in the water column connecting production facilities to subsea infrastructure

Flowlines: static pipelines used to carry fluids on the seabed

Fluid transfer lines: typically large diameter pipelines connecting two structures which are often dynamic

Jumpers: short lengths of pipe connecting two fixed structures either above or below water

Integrity management

With decades of experience in the design, testing, and manufacturing of flexible risers and flowlines, we have established a unique position in the understanding of how these pipe systems perform in operation.

We provide a comprehensive range of products and services to assist in the integrity management of these important assets.

Our proven solutions include the MAPS wire stress and wire break monitoring and inspection systems, integrated leak-detection cables, and fibre optic-based sensors embedded in the pipe structure, and topsides equipment for the monitoring of polymer and pipe annulus condition. In many cases, our monitoring

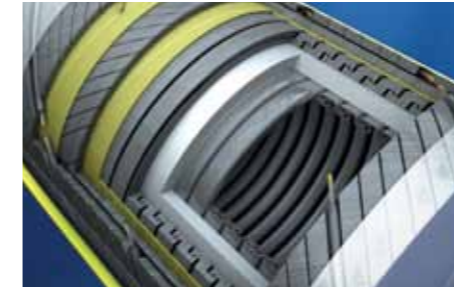
systems can be retrofitted to existing infrastructure, regardless of the original equipment manufacturer.

In all cases, our approach is underpinned by a risk-based methodology developed specifically to address the attributes of the flexible pipe construction that govern lifecycle performance. This level of expertise enables solutions that are customized to meet the particular needs of an installation and its operator.

A recent independent industry study (Sureflex) published by Wood in 2017, showed the BHGE integrity management technology to be the highest-performing, and most value-adding option from over 20 available solutions evaluated in the JIP.

Key benefits

- Reduced operational, safety, and environmental risk
- Improved asset availability
- Reduced costs through a predictable maintenance regimen
- Potential for life extension from the acquisition of service data



Solutions that span the water column

Installation excellence

Our pipe products are all manufactured to the highest standards. But that would be of little value without the same rigorous approach to installation, ensuring the highest levels of quality and reliability when it comes to deployment and—most importantly—connection to topside and subsea infrastructure.

In keeping with our design philosophy, our installation solutions can also be tailored

to suit each customer's unique needs. We own a fleet of pipe-lay spreads that can be accommodated on a wide range of construction vessels. We also have well-established relationships with major SURF contractors. These installation resources enable FPS to develop innovative and cost-effective solutions to meet the most demanding project challenges.



Our commitment to HSE



Our corporate culture is one of “doing it right” and always striving to do it better, not only by applying the best processes and technologies, but by conducting our operations and relationships with the utmost honesty and integrity no matter what challenges may arise.



We mitigate risk and consider the effects on people, communities, and natural environments in everything we do. EHS is paramount every day, from the layout of our workshops, all the way through to the ecomagination program—a global initiative dedicated to delivering products that are better for both business and the environment.



Every BHGE innovation is driven by a specific and practical industry requirement. We carefully evolve product designs with proven technologies, rigorous testing, and qualification processes. Our objective is to continually deliver measurable increases in efficiency, reliability, availability, and performance.

FPS PRODUCTS, SERVICE AND SUPPORT

We take a comprehensive approach to flexible pipe technology and products—providing custom design and manufacturing, as well as expert installation and integrity management services to ensure optimized safety, efficiency, and productivity over the full life of the field.

Our primary engineering design and manufacturing facilities are located in Newcastle, UK, and Niterói, Brazil. These sites are supported by service teams in the US, France, Western Australia and Malaysia—with additional support capabilities available through the extensive resources of the BHGE network.



At a glance

FPS resources and capabilities include:

- 1,500 employees worldwide
- 2 major manufacturing facilities
- 7 dedicated regional support teams worldwide
- 570 nkm* annual production capacity
- 3,500 nkm manufactured to date
- 2 to 19 inch internal diameter product range
- 3000 m water depth capability
- 15,000-psi pressure capability

* normalized km of 8-inch ID pipe





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