



Assured Joint Integrity



All leaks cost

Loss of containment can have catastrophic results and negatively impact brand image, facilities, employees, and the environment. Unplanned shutdowns at hydrocarbon processing facilities regularly feature in the news; and globally, reports of major fires exceed, on average, one a week. It is unquestionably true that all leaks cost the industry but it is also true that all leaks are preventable.

All leaks from bolted joints can be avoided

This is a true statement that Hydratight emphatically believes in and drives our people and our processes... all leaks from bolted joints can be avoided.

No matter where the leak occurs, the media type released, or the volume that escapes, the resultant leak will have a cost to the facility. According to ASME, bolted joint leakage contributes to a loss of life and costs industry \$100m in any given year. Hydratight's assured Joint Integrity programs are designed to make sure facilities operate with the safest bolted connections possible preventing leakage during commissioning and operation.

A proven approach to preventing leaks

Our joint integrity process stems from industry best guidelines and parallels the regional legislative frameworks our customers operate with. Hydratight's proven Joint Integrity approach ensures assets and installations have the safest bolted joints possible. Our philosophy is to prevent leaks. A one-of-a-kind, holistic approach ensures leak-free start-ups and operations.

Only Hydratight provides:

- **Joint Integrity Assurance** for bolted flange joints via the provision of:
 - Technical Consultancy
 - On Site Compliance, QA and QC
- **Joint Integrity Execution** for bolted flange joints, via the provision of:
 - On-site controlled bolting, on-site machining, and flange management services
 - Bolting and machining equipment for rental or sale

Our people underpin the Hydratight Joint Integrity approach. Everyone, from our field service personnel, to our technical and engineering support teams, to our operations and sales staff, possesses levels of training, competency, skills and experience unrivalled in this highly specialized safety conscious industry.

Industry pioneer in
Joint Integrity

1ST

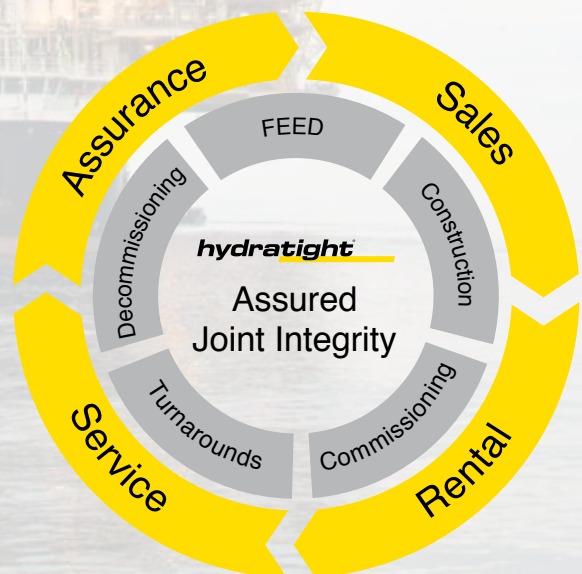
Technical authority
on bolted joints



A holistic approach to
safety, time & costs



Hydratight's Assured
Joint Integrity



Why is Joint Integrity so important?

Irrespective of location or whether onshore or offshore, studies show that the majority of flange leaks are attributable to procedural, process or operational failings. Surprisingly, few are due to technical reasons. Fundamentally, it's people and their competencies that prevent leaks. These fundamentals are the heart of Hydratight's joint integrity services.

Environmentally responsible and safety focused installations commonly record leaks and report leak size and frequency as a metric. The intent is to demonstrate improvement both to stakeholders and legislative bodies, and ultimately eliminate leaks completely.

Hydratight understands these leak investigations and the need to demonstrate year after year leak reductions. Our process is wholly compliant; we meet the requirements for safety and environmental management systems, ageing and life extension provisions; and provide permanent databases with traceable and easily retrieved joint data.

Joint Integrity allows organisations to fully meet the demanding safety, environmental, and external compliance standards. Only Hydratight has a proven track record for delivering assured joint integrity.

Nearly all process plants depend on either welded or bolted joints. A welded joint must comply with numerous mandated procedures and competency requirements to assure quality. But a bolted flange joint has historically had few such requirements, even though it serves the same purpose—pressurised process containment.

Welded Joint

Material Control
Coded Welder
Documented Procedure
NDT Verification
Hydro-tested
Records

Bolted Joint

Material Control
Competent Personnel
Documented Procedure
Hydro-tested
Integrity Tested
Records

Only Hydratight treats the bolted joint like a weld

Hydratight's Joint Integrity approach is dedicated to ensuring the design, assembly, tightening, inspection, and management of a bolted flange joint meets the same quality control and assurance requirements as a welded joint.

Essentials of assured Joint Integrity

A Joint Integrity program based on these essentials will deliver a leak-free startup and operation, provide long term assurance, and ensure that any organisation operates Joint Integrity best in class procedures. Our joint integrity process stems from industry best guidelines and parallels the regional legislative frameworks our customers operate with.



Ownership, Support and Structure

A defined Joint Integrity owner should be appointed. This provides an unambiguous reporting structure, aids in solving issues and ensures that the Joint Integrity program is effectively communicated to all levels of an organisation.



Management Process and Strategy

An overall Joint Integrity strategy should be in place to drive leak-free intent, integrate seamlessly, and ensure the Joint Integrity philosophy is embedded throughout the organisation.



Technology and Best Practice

Procedures and technical standards should represent best practice, providing a 'single source of truth', minimising delays and avoiding rework.



Criticality Assessment

Define and implement a joint criticality assessment policy to ensure resources allocated to each joint are balanced with risk.



Vendor Packages

A system should be in place to ensure that vendor suppliers work to mandated client procedures.



Training and Competence Management

All field service personnel should have a proven level of competency, ensuring work is executed 'Right First Time', providing long term integrity of bolted joints.



Joint Identification, Status Control and Tagging

Implement joint identification protocols, format, and technology to provide permanent records and minimize ambiguity.



Records and Data Management

Implement a Data Management system to provide a permanent, comprehensive, and searchable record of every joint.



Inspection and Compliance

Implement a program of on-site inspection and compliance to ensure procedures are followed, verify workmanship, drive down operational costs, and avoid unplanned shutdowns.



Management of Leaks

Establish a robust leak investigation process to ensure leaks are addressed, resolved, eliminated, and lessons learned.



Reporting, Analysis and KPI's

Clear reporting structure and metrics should be in place, providing visibility on progress and performance, and demonstrating that schedule are being met.

These essentials are based on industry best practice, including:

- ASME 'Guidelines for Pressure Boundary Bolted Flange Joint Assembly' (PCC-1-2013)
 - European Standard 'Design Rules for Gasketed Circular Flange Connections' (EN1591-4-2013)
 - UK Energy Institutes 'Guidelines for the Management of Integrity of Bolted Joints in Pressurised Systems' (2007)
 - Step Change in Safety Mechanical Joint Integrity Route to Competence Guidance
 - Engineering Construction Industry Training Board (ECITB) Mechanical Joint Integrity Standards
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How we can work with you

While we would always recommend a bundled package of services, our approach is designed to be highly flexible, and we offer a number of different contracting models at different stages of a projects lifecycle to meet any client requirements.

All of our services fall within three broad contracting models, linked to our Business Model.

Engineering and Technical Consultancy

During the preparation and planning of any construction or maintenance activity, we provide technical consultancy to assist with the development of a best practice Joint Integrity program. This includes the review and development of procedures, troubleshooting and engineering support, and expert guidance on Joint Integrity related issues, drawing on our position as an industry leading technical authority. We perform Technical Consultancy at any phase of a projects lifecycle—from initial FEED to Turnaround planning during operations.

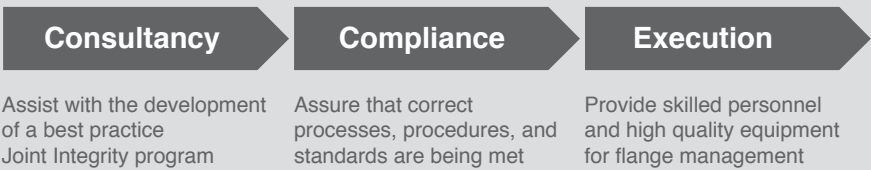
On-site QA/QC Compliance

During any on site construction or maintenance activities, we perform a full QA/QC service of any Joint Integrity activities. Teams of specialist Joint Integrity personnel drive and monitor the implementation of a client’s Joint Integrity program, ensuring compliance, and providing full traceability that clients mandated procedures and standards have been met.

On site compliance is provided as a distinct service to the direct execution of any controlled bolting, helping to avoid conflicts of interest, or can be bundled with a broader package of Joint Integrity services to meet any client requirements.

On-site Execution: Service/Sale/Rental

We supply skilled field service personnel to directly execute any controlled bolting, on site machining, or flange management activity. Hydratight is an original equipment manufacturer (OEM) and provides a comprehensive range of in-house manufactured equipment, either for sale or rental. Where standard tools are unsuitable, Hydratight is able to design and manufacture special tooling to order. We also offer a centralised tool trailer for rental to ensure tools are calibrated properly for safe and accurate use, reducing rental cost and the amount of duplication.



Services we offer

Our Joint Integrity offer is made up of a number of distinct services, which can be provided standalone or as a package of services combined within the different contracting models we offer.

| Hydratight Offer | Description |
|---|---|
| Gap Analysis | Technical Authority review (at client offices or on site) of all existing Joint Integrity procedures, processes, and management systems, benchmarking against industry best practice, and producing a detailed reporting identifying 'gaps' and recommendations for improvement. |
| Procedure Development | Remote review and development of any client technical or operational procedures, whether task, control, or management based. |
| Engineering Support | Ongoing access to Hydratight's global team of Technical Authorities to provide expert guidance, troubleshooting, and support on any Joint Integrity related technical or engineering issue. |
| Flange Management Software | Bespoke Integrity Data Management System (iDMS) for any asset / plant / site to record data, plan, manage, and provide a project delivery tool for the on site execution of any Joint Integrity workscope. |
| Bolt Load Calculations | Informate bolt load calculation engine, which provides optimised bolt load values and torque/tension values for any joint application, whether coded or not. Informate contains an extensive range of joint types, flanges, gaskets, lubricants, and bolting materials. |
| Joint Integrity Engineers | (On Site) management of any Joint Integrity program, providing supervision, technical resource, training, and management reporting, coordinating the introduction of Flange Management Software, and ensuring full compliance with a clients Joint Integrity program by any personnel involved in Joint Integrity activity. |
| Joint Integrity Inspectors | Perform (on site) flange joint inspection, along with supervision and witness of joint assembly and tightening, providing full and traceable QA/QC documentation, and ensuring mandated procedures are followed by all involved in controlled bolting activity. |
| Training & Compliance Management | Supply training and compliance management to any client, contractor, or sub contractor involved in controlled bolting, onsite machining, or flange management activity. |
| Field Service Technicians | Supply uniquely qualified field service technicians to client sites to directly perform any controlled bolting, on site machining, or flange management activity. |
| Equipment Rental & Sale | Supply of a comprehensive range of in-house calibrated hydraulic bolt tightening, on site machining, and associated ancillary equipment to support the execution of controlled bolting, on site machining, or flange management worksopes. |
| Bolt Load Verification and Assurance | Measure, adjust and record the bolt load induced by the chosen bolt tightening methodology. Follow up with periodic non-invasive bolt load checks. |
| Equipment Modification & Design Engineering | Where standard tooling is unsuitable, tool modification and bespoke equipment solutions can be provided by Hydratight's global team of Design Engineers, from one of our global technical centers of excellence. |

| Benefits | Contracting Model | | |
|---|-------------------------|--------------------------|-------------------|
| | Engineering Consultancy | On-site QA/QC Compliance | On-site Execution |
| Independent assurance that all client processes, procedures, and management systems represent industry best practice. | Yes | Yes | Optional |
| Client can remain in line with industry best practices through the development of a proper joint integrity program. | Yes | Yes | Optional |
| Expert support wherever and whenever the client needs it. | Yes | As Required | As Required |
| Provides a permanent, searchable record of every joint's history, along with a means to manage, track and control the status of every bolted joint during the planning / execution of a bolting workscope, helping to avoid errors, improve efficiency, and ensure a client's procedures are being correctly applied. | Yes | Yes | Yes |
| Ensures access to a source of bolt load calculations that is controlled, independently verified, and is in line with industry best practice. | Yes | Yes | Yes |
| Provides independent assurance that a client's Joint Integrity processes, procedures, and mandated mechanical engineering standards are being correctly implemented. | Optional | Yes | Yes |
| Reduce re-work costs, remove rework delays, eliminate the risk of needing second tests, and significantly reduce operational issues in relation to bolted joints, along with providing independent assurance of compliance to a client's Joint Integrity program. | No | Yes | Optional |
| Bolting is a specialised skill where training is not a guarantee of competency. Controlling the competence of personnel involved in the assembly and controlled tightening of joints has consistently been proven to be a key factor in preventing leaks. | No | No | Yes |
| The use of specialised bolting personnel minimises rework, with all bolting executed 'right first time'. No 'search & repair'. No 'leak & fix'. | No | No | Yes |
| The use of high quality, calibrated bolting equipment is a key means by which control is applied to the process of bolting, ensuring the correct bolt load, and hence Joint Integrity is achieved. | Optional | Optional | Yes |
| Verify the correct bolt load has been achieved within the specified tolerance. Prevent subsequent joint failure due to vibration, material yielding, cyclic load. | Optional | Optional | Optional |
| The ability to customise allows for needed flexibility and assurance in difficult conditions. | Optional | As Required | As Required |

Our key strengths

We offer a number of different services to assist clients with the development and implementation of a best practice Joint Integrity program. This specialised approach is underpinned by the training, competency, skills, and experience of our people, combined with our technical and engineering expertise.

Our Training and Competency

All field service personnel pass through our IMPACT (Integrity, Management, Process, Assurance, Competence, Training) program, implemented via a global network of Joint Integrity Colleges. The IMPACT program enables us to provide qualified bolted flange joint assembly personnel in accordance with renowned global regulations and guidelines. We are proud to be the only organisation to make that claim. And our focus on our people is not just limited to our field service staff; all employees have the opportunity to attend modules at our Joint Integrity College.

Our Technical Leadership

Hydratight's Technical Authorities have long term involvement with the professional organisations that drive global standards in Joint Integrity, and we also work closely with major operators, contractors and OEM's to develop procedures that meet industry best practices. As a measure of our technical credibility, Hydratight became the world's only ASME PCC-1: Appendix A qualifying organisation, certified by Lloyd's Register Energy (LRE) in September 2014. This confirms that our operational procedures, and Joint Integrity Assurance Manual meet ASME PCC-1: Appendix A, a benchmark industry guideline.

Our technical expertise is further demonstrated in the development of our two market leading software packages: Informate Bolt Load Calculation Engine and Integrity Data Management System (iDMS). Informate provides optimised bolt load values and torque/tension values for any joint application, whether coded or not. It contains an extensive range of joint types, flanges, gaskets, lubricants and bolting materials.

iDMS can build a database of flange joints and joint data needs using a project or plant's 3D model, drawings, piping specifications and bolting manual. Databases can range from a few hundred joints, to complex oil and gas projects in excess of 100,000 joints.

Our unique combination of capabilities—equipment manufacturer, training and competence assessor, field service provider, and industry technical authority—are unique within our specialised industry and unrivalled by our peers.



Hydratight are the world's first ASME PCC-1-2013 qualifying organization, following an independent audit by Lloyd's Register Energy in 2014.

A history of establishing standards

Hydratight has long been involved with the professional organisations that drive global standards in Joint Integrity, including the Engineering Construction Industry Training Board (ECITB), City and Guilds, OLF, the Energy Institute, and Step Change in Safety.

2014

Launched a Hydratight Joint Integrity College to deliver training and qualification that meets or exceeds the requirements of ASME PCC-1-2013 guidance to our own technicians, engineers and managers.

Hydratight becomes the world's first ASME PCC-1-2013 qualifying organisation, following an independent audit by Lloyds Register Energy.

2013

Hydratight involved in the publication of CEN republished EN1591, *Flanges and their Joints - Part 4: Qualification of Personnel Competency in the Assembly of the Bolted Connections of Critical Service Pressurised Systems*.

2011

Hydratight worked with the ECITB and Step Change in Safety to establish an approved route to technical competence in Mechanical Joint Integrity.

2007

Hydratight a key member of the working party which reviewed the UKOOA Guidelines and produced the *UK Energy Institute's Guidelines for the Management of Integrity of Bolted Joints in Pressurised Systems (2007)*.

2002

Hydratight a key member of the working party which established the UK Offshore Operators Association (UKOOA) *Guidelines for the Management of Integrity of Bolted Pipe Joints (2002)*.

2000

Hydratight pioneered the Joint Integrity Management Service and flange management software system.

1994

Hydratight worked with the UK Engineering Construction Industry Training Board (ECITB) to establish an industry benchmark training program for bolting technicians.

Our Results

- **200,000+ joints**, flawlessly executed Joint Integrity program on world scale, multi-site, LNG construction project
- **30,000+ joints**, flawlessly executed Joint Integrity program on major USA refinery construction

Hydratight leak-free guarantee

Hydratight has been tracking the outcome of implementing Assured Joint Integrity since 2000. The data collected demonstrates that obtaining a leak free start-up is very achievable provided that the joint integrity work-scope is competently executed and fully assured.

To stand by our Joint Integrity Assurance program, current processes, procedures, and people, Hydratight offers a Leak Free Guarantee for every joint assigned to Hydratight under an assemble and tighten and/or Assurance Services contract. We guarantee, subject to the mutually agreed upon terms and conditions, that every joint will pass its respective integrity test the first time.

The Guarantee is valid for new construction, repair or maintenance contracts, and is equally applicable to very small and extremely large work-scopes. Any joint type can be guaranteed, subject to a review by one of our global Subject Matter Experts.

It is an industry expectation that Bolted Flange Joint Assemblies (BFJA's) must pass integrity tests the first time; it is no longer acceptable that joints are subject to repeated testing. Repeated tests add cost, threaten schedules, raise concerns about workmanship quality, and create doubt among those charged with managing the plant once in service. With Hydratight's Joint Integrity program, plant start-ups can occur with the confidence that assured joint integrity is no longer a wish, but a reality.

No leak and fix, rework or second tests.
Just right the first time, every time.
Guaranteed.

Refer to the Hydratight general terms & conditions at hydratight.com for more details about the Leak Free Guarantee.

**LEAK FREE
GUARANTEE**

It has to be Hydratight

A century after developing the technology behind hydraulic bolt tightening, Hydratight is at the forefront of bolted flange joint safety with our Joint Integrity approach. It is the cornerstone of a leak-free operation, flawless startups and cost savings. We are able to support clients worldwide through our extensive network of global locations.

Work with Hydratight and you can take advantage of the industry's most qualified support and highly trained competent people. Our proven, comprehensive Joint Integrity approach is critical to a safe, productive, and profitable process operation.

Our comprehensive Joint Integrity approach provides the following benefits:

- Create a flawless startup
- Achieve planned schedules
- Improved plant and personnel safety
- Provide long term assurance
- Identify problems in joints/materials
- Provide fully traceable records
- Realize cost savings
- Comply with industry best practice

Only Hydratight combines the benefits of an industry technical authority, expert service provider and equipment manufacturer. Offering manufacturing facilities on two continents, offices in 35 countries and an extensive network of agents, we can provide the local support you need.

Hydratight's Joint Integrity offering is not a single product or service line, it is the combination of everything we do. Contact your local Hydratight representative today, email us at jointintegrityenquiries@hydratight.com, or visit hydratight.com for more information.





Our global network means that you can rely on the right people, products, and services wherever you are in the world.

Email us at: solutions@hydratight.com

Or find your local representative at:

hydratight.com/contact

Hydratight provides support through service centers (●) and authorised representatives (◆)

