

James Walker

RotaBolt®

Accurate measurement of bolt tension



High Performance Sealing Technology

Precision performance

Since the earliest days of our company, innovative James Walker products have won respect for their excellent performance and value.

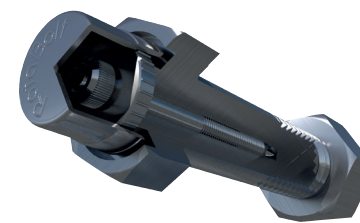
Over
1.5 million
RotaBolts monitoring and maintaining joint integrity around the world

Delivering the very best performance is at the heart of everything we do.

Our expertise extends beyond our products. Through our commitment to rigorous testing and continuous improvement, we stay at the forefront of bolting technology and offer our customers a unique and customised service tailored to their requirements. Whether that be an extensive proof-test loading programme, an audit and evaluation of on-site joints or a complete flange management service, our experts work in partnership with customers to solve any bolting related issues in a wide range of applications.

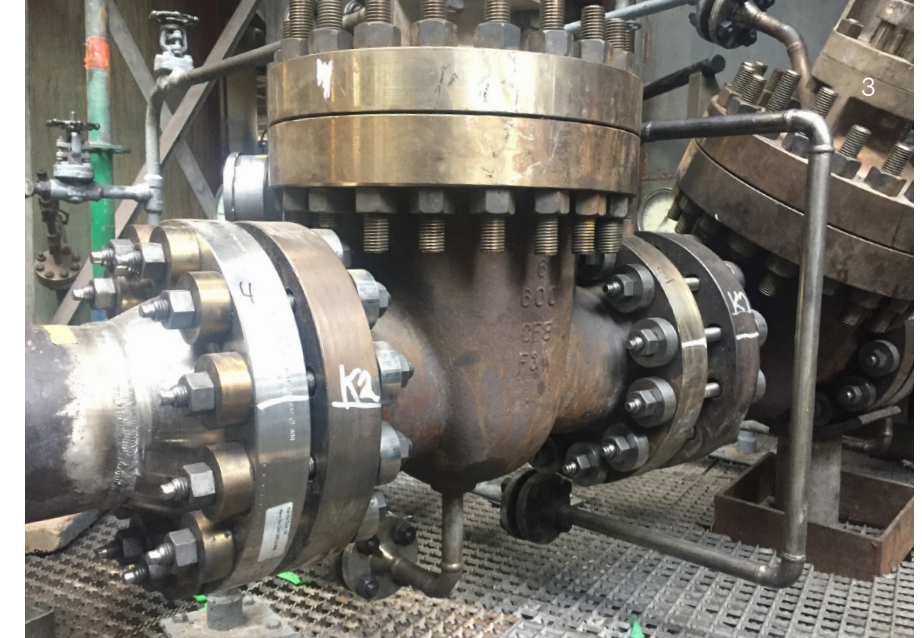
Our RotaBolt® technology has been helping to ensure bolted joint integrity for over 30 years. Built on the science of measurement, RotaBolt accurately measures tension so that it can be correctly achieved, maintained and monitored. The technology continues to evolve, with the latest development offering real-time precision monitoring to give remote access to bolted connections in the most critical applications.

We ensure the highest levels of product performance and value through a proven approach of engaging directly with our customers' experts. In this way the solutions and products we develop are focused on addressing the root cause of issues and delivering results such as improved productivity and safety whilst helping to control maintenance and operational costs.



Behind the brand

James Walker has a long history of working on bolting projects in many industry sectors, ranging from offshore oil and gas, to nuclear power, wind turbines, petrochemical plant, military equipment and transport infrastructure.





Bolting first principles

90% of all bolted joint failures can be attributed to inaccurate bolt tension.

The behaviour of a bolted joint, whether it is in an aircraft, pressure vessel or a wind turbine assembly, is governed by the same science.

The reliability of a bolted joint is dependent on three parameters:

- Joint design
- Component quality
- Achievement of the designed clamp load

By measuring and assuring all three factors, bolted joint reliability is guaranteed. Achieving and maintaining the correct installed design tension will eliminate failures from fatigue, vibration loosening and structural slip.

Bolted joint reliability is an established science but the vast majority of bolted joints are tightened in an uncontrolled manner; the bolt tension achieved at the end of the tightening cycle is unmeasured and unknown.

Traditional tightening practice measures tightening power or the effort applied.

The belief is that there is a reliable correlation between the equipment tightening power and the residual bolt tension achieved - however, there is no reliable correlation.

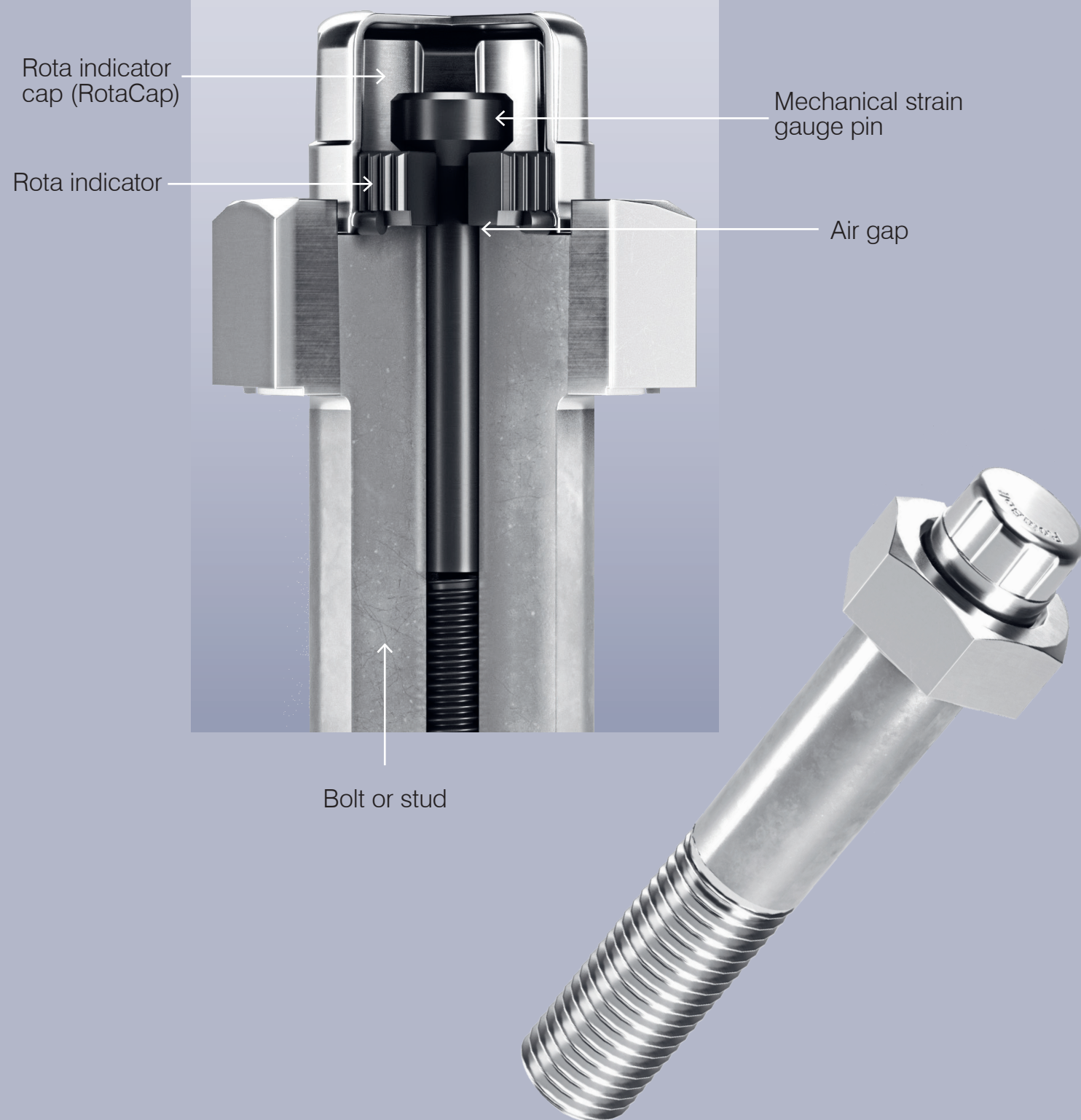
Factors including friction from interfaces such as head/nut bearing face and threads, as well as the inclusion of protective coatings for

example, have a huge impact on exactly how much of the applied force translates into actual bolt tension.

To guarantee that all bolts are installed to the correct design tension requires a different measuring principle - the principle at the heart of RotaBolt® technology.

Behind the brand

The RotaBolt® took its name from the rotating cap on the head of each stud or bolt which provides a visual or tactile indication that the desired design tension has been achieved and is being maintained.



How it works

The RotaBolt® principle

When a RotaBolt® is installed and tightened, the bolt extends fractionally under the applied load.

The mechanical strain gauge pin within the body of the bolt however does not extend as it is only anchored at one end.

As a result, as load is applied to the bolt, the datum face of the indicator disc, positioned under the head of the strain gauge pin, is drawn closer to the machined datum face on the head of the bolt, closing the air gap.

Initially the RotaCap, attached to the indicator disc, can be rotated easily between finger and thumb.

However, when the strain gauge pin is drawn down into the body of the bolt to a point where the datum faces on both the indicator disc and the bolt head are forced into contact, the RotaCap is prevented from being rotated.

When the RotaCap 'locks' in this way it indicates the calibrated pre-set tension of the RotaBolt has been reached and the joint is now clamped to within $\pm 5\%$ of the required design load.

Should tension be lost across the bolted joint - for example, due to deterioration of a gasket or relaxation after thermal cycling - then the two datum faces will move apart re-creating the air gap and making it possible again to rotate the RotaCap by finger-and-thumb.

This indicates that remedial action is required and the bolt in question needs re-tightening until the RotaCap locks off and the required tension is once again achieved.

Behind the brand

Conversion of a bolt or stud into a RotaBolt® tension measuring fastener involves the drilling and tapping of a small diameter hole along the neutral axis of the fastener. A mechanical strain gauge pin is inserted and positively anchored in the thread.

Unrivalled expertise in joint integrity for the oil and gas industry

RotaBolt's impressive offshore track record, coupled with a comprehensive proof-test loading programme, was a major influencing factor in the decision by TechnipFMC to use the technology in recent projects for Maersk Oil. Fasteners ranging in size from M36 to M58 with minimum proof loads of 490 kN to 1459 kN were manufactured, tested and supplied for the Valdemar and Roar gas lift projects in the Tyra field, on the Danish Continental Shelf.

RotaBolt® RB1 Touch

Instant precision monitoring

The RotaBolt® RB1 Touch range is the foundation of bolted joint tension control technology from James Walker

The original RotaBolt® design has been in operation in a broad range of critical applications for over 30 years. Serving customers in industries such as offshore oil & gas, quarrying & mining and wind power, RotaBolt® RB1 Touch ensures each bolt is installed to the correct tension and then continues to offer a simple tactile check that this tension is being successfully maintained.

Each RotaBolt® RB1 Touch is calibrated to lock the RotaCap at the desired preload tension value on installation with an accuracy of $\pm 5\%$.

The RotaBolt® RB1 Touch is available as a bolt from M12 upwards and as a stud from M14 upwards.



Safely assuring bolt integrity in offshore wind developments

Over 4,000 Hex head bolts converted to RotaBolt® RB2 Touch tension control system for use in approximately 50 turbines generating 3.3 mW each, located 46 km offshore from Belgium on the Bligh Bank. Accurate control during the tightening process was a key factor for the Nobelwind Offshore Wind Farm, with 100% specified RotaBolt® RB2 Touch providing total assurance of the overall bolted joint design objective.

RotaBolt® RB2 Touch

Instant precision monitoring

RotaBolt® RB2 Touch features two tension settings within a single sensor for even greater control and monitoring.

The dual load indicator has an outer cap for high tension setting and an inner cap for low tension, giving the choice of an operational tension range, either for overload or maintenance control.

Ideal for use in critical applications where a large amount of settlement is expected, the dual load indicator confirms the correct tension on installation, as well as ensuring the design load is maintained after the initial settlement period.

The RotaBolt® RB2 Touch is available as a bolt from M20 upwards and as a stud from M30 upwards.





Clear precision monitoring is demonstrated by the success of RotaBolt® Vision in lifting applications, such as on the boom of both onshore and offshore cranes. Replacing standard bolts with RotaBolt technology, operators have reported the ease with which bolt tension can be verified by the operator from within the cab. The bolt head markings are easy to identify, using binoculars if necessary, confirming all structural bolts are at their desired tension and that the structure is therefore safe for operating without the need to venture out onto the boom with tools to manually check each bolt.

RotaBolt®

Vision

Clear precision monitoring

Using the same technology as the RotaBolt® Touch range, the RotaBolt® Vision gives a clear, visual indication of maintenance or loss of tension across a bolted joint.

Designed with critical yet hard to access applications in mind, RotaBolt® Vision uses a specially developed indicator which appears as an unbroken yellow line across the head of the fastener that can be seen from a distance even in poor visibility situations such as a subsea environment.

Ideally suited for installations where access is restricted and close inspection difficult, the indicator instantly rotates by ninety degrees should tension be lost, creating a distinct right angle break in the yellow line that is easily identifiable.

The RotaBolt® Vision is available as a bolt from M22 upwards and as a stud from M33 upwards.





Flange management

Our Flange Management Service is a fully project managed implementation of products, maintenance and technical support on critical flanges to ensure leak free bolted connections from turnaround to turnaround.

Over 30 years of involvement with our customers' most important bolted connections has allowed us to offer a service that ensures that once joints have been formed, they stay that way; maximising uptime, reducing leaks and keeping expensive product loss to a minimum.

James Walker experience and expertise helps to optimise

operational performance and meet the most challenging application conditions using a proven four stage process involving limit analysis software. This process allows us to calculate the operational stresses of the gasket, fasteners and flanges throughout the operational cycle to create a detailed picture of the most stressed areas and provide a fastener load optimal for the bolted joint in its entirety.

Evaluate

- Historical data collection
- Pressure/temperature media data
- Flange, bolt and gasket details
- Bolted joint evaluation
- Analysis of design in accordance with International Standards (EN 1591-1)

Design

- Product combination and selection
- Determination of optimal sealing parameters
- Recommendations of any flange modifications required
- Accurate establishment of required sealing loads

Apply

- On-site inspection
- Joint dismantling, installation and re-build
- Joint integrity monitoring

Benefits Delivered

- Improved safety
- Reduced downtime
- Assured reliability
- Reduction of lost product
- Leak and emission containment
- Elimination of repetitive maintenance costs



On-site services

James Walker offers on-site services across a wide range of industries and applications around the world, both on and offshore.

Our experts use data derived from calculations and analysis, as well as their vast expertise built over many years working in close collaboration with customers, to provide solutions for critical and problematic bolted joints. Support for our clients' most critical applications is provided by offering professional advice on International Standards and Industry Best Practices at every stage of construction, installation and maintenance.

James Walker can supply highly trained, competent and certified engineers to oversee the works and ensure that all processes are completed to the highest standards expected of a leading integrity business. We also supply senior engineers to manage an entire project and if required, provide a turnkey service from initial evaluation to sign-off using industry leading software programs to ensure total traceability from start to completion of the project.

The service provision covers all aspects of Joint Integrity Management, including but not limited to:

- Inspection
- Evaluation
- Installation
- Supervision
- Joint Integrity Monitoring
- Project Management

and covers all bolted flange connections including:

- Pressure Vessels
- Heat Exchangers
- Pipework
- Valves
- Gearboxes
- Pumps
- Wind Turbines

For further information on any of the products or services detailed within this brochure, please contact your local James Walker office, shown on the rear cover or listed at jameswalker.biz.

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To ensure you are working with the very latest product specifications, please consult the relevant section of the James Walker website: www.jameswalker.biz.

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