PILGRIM INTERNATIONAL

Power

PIONEERING COUPLING TECHNOLOGY
The world's most advanced coupling concepts

PILGRIM INTERNATIONAL

Pilgrim International Limited
Southlink, Oldham OL4 1DE, UK
Tel: +44 (0) 161 785 7700
Fax: +44 (0) 161 785 7777
Email: sales@pilgrim-international.co.uk
www.pilgrim-international.co.uk

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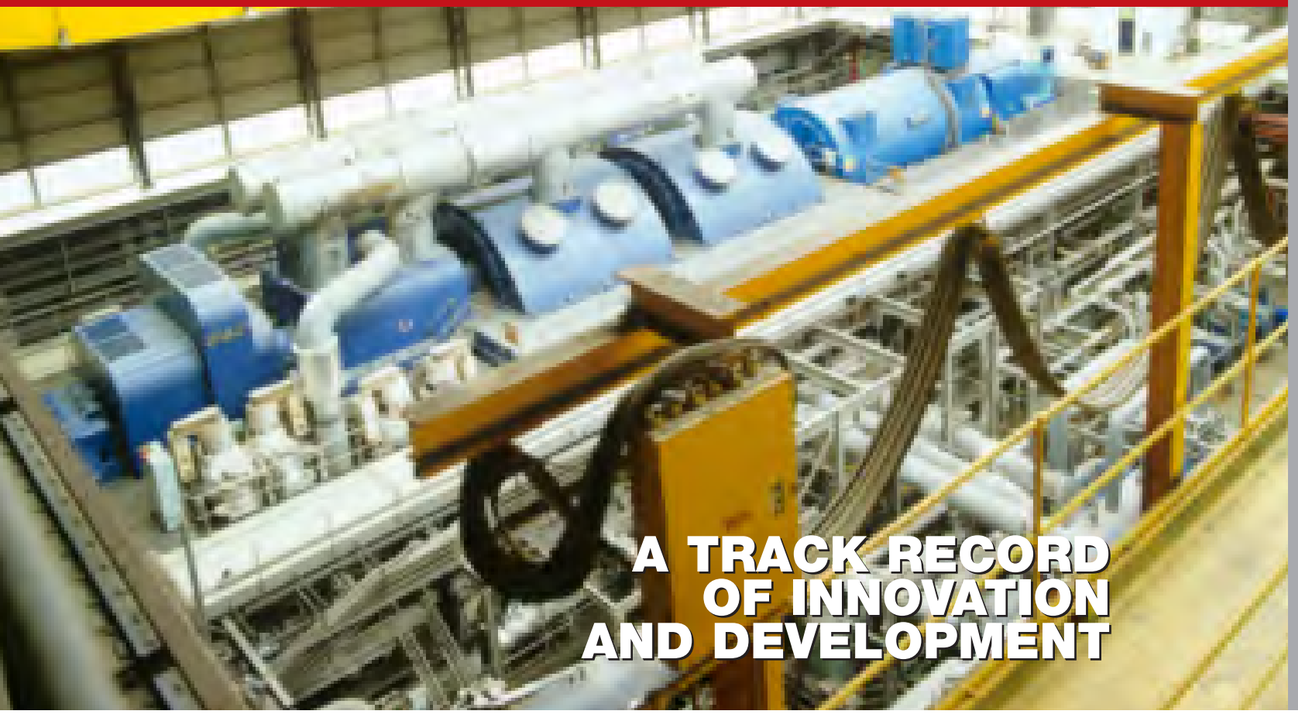
COMPANY HISTORY



Pilgrim was established over sixty years ago in the UK. In the proceeding years it has developed into an innovative and worldwide leading supplier of bolting solutions primarily to the Power and Marine industries, as well as a number of other industries such as Oil, Steel and Mining.

The company has expanded rapidly during the last ten years as these industries have recognised the time and cost savings associated with the use of the Radial Fit Bolt. It has also provided a safe installation and removal procedure, which meets ever increasing health and safety requirements.

In the Power Industry, Pilgrim is a major supplier to all the turbine OEM's and leading Utilities with the concept of the hydraulic Radial Fit Bolt now being truly accepted worldwide. The product is now installed in all five continents.

The company continues both to develop the product and the manufacturing process. This development has further cemented the company's worldwide reputation for outstanding quality and performance. This is recognised by the company gaining ISO 9001, 14001 and 18001 accreditation as well as technology agreements with a number of Turbine OEM's.

HYDRAULIC RADIAL FIT BOLTS

Challenging tradition with innovative coupling concepts

With a track record of more than sixty years of innovation, Pilgrim is a world leader in the design, manufacture and supply of specialist hydraulically-tensioned fastener products for use in all major industries worldwide.

Through a combination of the latest technology, proven manufacturing techniques and exceptional quality we consistently exceed the expectations of both our OEM partners and customers. Underpinning everything we do is a total commitment to on-time delivery, customer care and after-sales support.

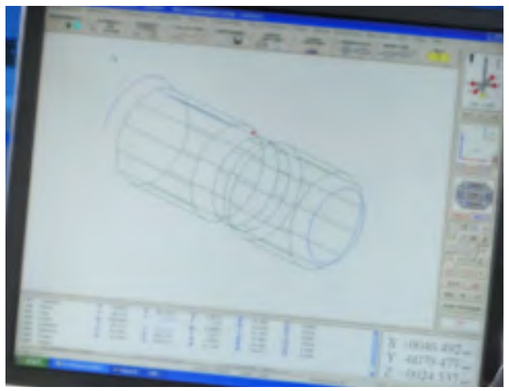
Accredited with both ISO 9001 OHSAS No. 18001 and ISO 14001 Environmental Systems, we are focused on building upon our success in global markets by challenging conventional bolting systems and advancing innovative new coupling concepts.

- Hydraulic Radial Fit Bolts
- Clamp Bolts
- Closure Bolts
- Coupling Hole Alignment Tools
- Pilgrim Nut
- Datum Plugs
- High Pressure Pumps
- Tensioning Equipment
- Training Kits

Full range of support services including site supervision, refurbishment, training, on-site machining and installation

ENGINEERING

With a strong engineering bias Pilgrim designs its products to meet the specific application, taking into account the operating parameters and environment. All materials subsequently used are fully tested and certified according to the design requirements.



> Carbon alloy steels
> Stainless steel
> High nickel alloys
> Customer specified material

MANUFACTURING CAPABILITY

We have a wide range of machines specifically available to manufacture our product range. These cover turning, milling, boring, drilling and grinding.

Main equipment includes:

- CNC lathes
- CMM machine
- UDDM machine
- Deep hole boring machine
- Grinding machines
- Milling machines

BENEFITS THAT CONVENTIONAL BOLTING SYSTEMS CAN'T MATCH

An innovative alternative to conventional fitted bolts

Faster and easier to install and remove

No more costly outage delays caused by bolts getting stuck in-situ

Reduced turbine vibration

Coupling slippage eliminated

Significantly lower life cycle costs

Direct retrofit

Reliability means more effective planning

No re-machining

Concentricity re-established

OEM approval

Safe and reliable

The Hydraulic Radial Fit Bolt is made up of a tapered body, a matching tapered bored sleeve and two round nuts. The bolts are re-usable, reduce maintenance downtimes and are a direct retrofit replacement for conventional coupling bolts.

Specially designed to suit specific coupling geometry, the Hydraulic Radial Fit Bolt offers turbine operators a number of significant benefits.

Because they are installed and removed faster than conventional bolts, less time is required to split and re-build turbine couplings, bringing down outage time and costs.

Thanks to their precise and repeatable location, the bolts can potentially reduce the turbine vibration and coupling slippage often associated with conventional systems.

Moreover, the problems of bolt seizure and surface pick-up are avoided, concentricity is established and maintained even under extreme operating conditions and once fitted there is no need for re-machining.

And finally, the reliability of the Pilgrim Hydraulic Radial Fit Bolt installation and removal means that outage planning can be based on extremely predictable outcomes – a major factor as all sectors seek to minimise downtime schedules.

A re-occuring problem in many power plants is the damage to coupling holes using standard conventional bolts as shown opposite. This damage may be caused due to poor installation or coupling movement whereas by installing a Hydraulic Radial Fit Bolt the problem is eliminated as the Hydraulic Radial Fit Bolt is assembled to an interference condition. With full contact achieved between the sleeve OD and the coupling ID coupling movement is prevented.

LIFE CYCLE COST COMPARISON

Offering faster installation than conventional bolts, faster removal, longer product life and reduced maintenance downtime, Hydraulic Radial Fit Bolts give Power Plants a significant return on their investment.

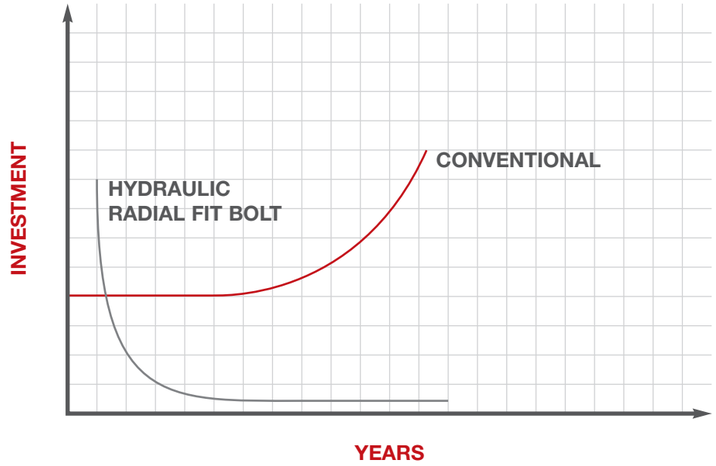
Moreover, it is a return that becomes even greater when electricity generating prices are taken into account. As the following example shows, the time gained during overhauls by Hydraulic Radial Fit Bolts translates into major potential monetary savings in generating costs.

Example: 500MW/16 hole Coupling

Type	Hydraulic Radial Fit Bolt	Conventional fitted bolt
Installation	10 mins/assembly	20 mins/assembly
Removal	10 mins/assembly	45 mins/assembly
Total number of hours per coupling	5.33	17.33

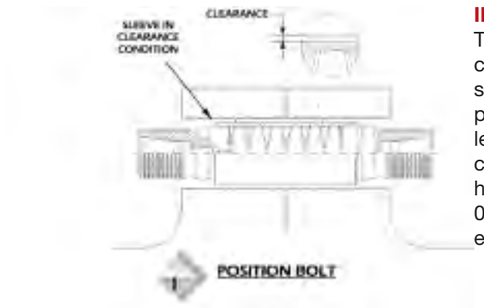
If we assume a kw/hr tariff rate of six cents, the potential saving in generation costs based on a 10-hour working day would be approximately $800,000.

This figure will vary of course depending on the number of couplings, added time should a conventional fitted bolt be stuck during installation/removal, variations in regional tariffs and differences in plant maintenance downtimes.



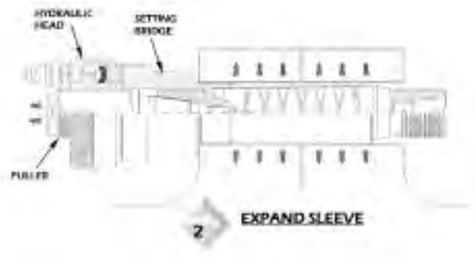
PILGRIM RADIAL FIT BOLTS

INSTALLATION SUMMARY



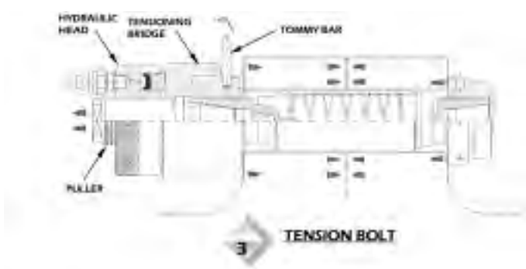
INSERTION OF THE BOLT

The Pilgrim Hydraulic Radial Fit Bolt assembly is composed of a tapered bolt, an internally tapered sleeve, and two securing nuts. When the sleeve is placed over the tapered bolt, the resulting OD is less than that of the coupling hole (clearance condition). For a coupling hole dia 100.00mm hole, a typical clearance condition would be 0.12mm making the Hydraulic Radial Fit Bolt very easy to insert into the coupling hole.



SETTING THE SLEEVE

The setting bridge is placed over the end of the bolt and is firstly used to locate the position of the sleeve within the coupling hole. The setting bridge then holds the sleeve in position whilst the hydraulic head 'draws/pulls' the bolt into the sleeve. As the bolt is drawn into the sleeve, the OD of the sleeve is forced to increase. Firstly occupying the clearance condition within the hole and then exerting a pressure inside the coupling hole along the entire contact area between the sleeve and the hole.

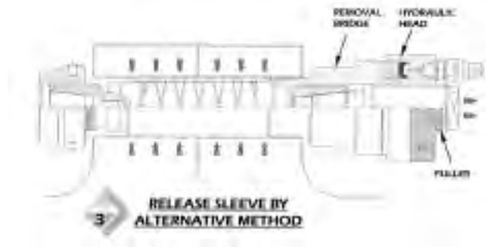


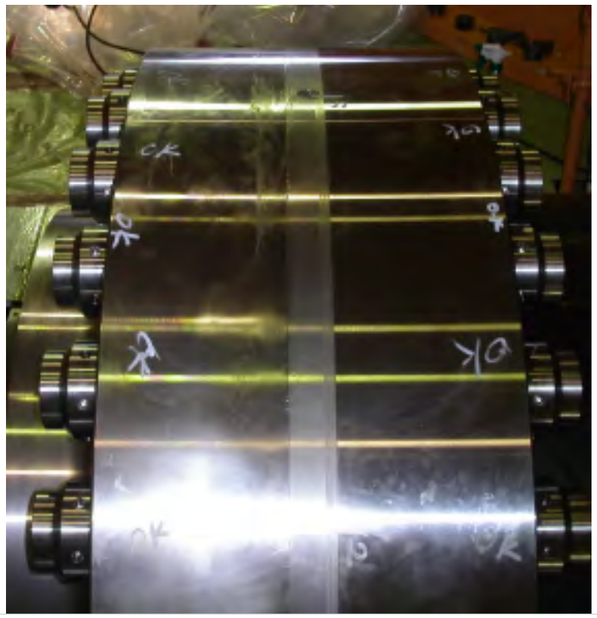
TENSIONING THE BOLT

After setting the sleeve, the securing nuts are fitted to both ends of the Hydraulic Radial Fit Bolt assembly, and tightened firmly by hand. A tensioning bridge is then used to bridge over the nut, from the same end at which the sleeve was set. Applying pressure through using a hydraulic head whilst under load the nut under the tensioning bridge is tightened using a tommy bar. Once tightened, the pressure can be released and both the tensioning bridge and hydraulic head are removed, and the Hydraulic Radial Fit Bolt assembly is now fully installed.

The interference fit of the bolt assembly ensures that the coupling concentricity is easily achieved, maintained and that all bolts transmit effectively the applied torque. The coupling halves are securely held together and coupling slippage is eliminated.

REMOVAL SUMMARY





DE-TENSIONING THE BOLT

The axial load is released by reversing the tensioning procedure.The tensioning bridge is fitted over the same nut, which was tightened during the tensioning of the bolt. Reapplying pressure through using a hydraulic head and whilst under load, the nut under the tensioning bridge is released 2 full turns using the tommy bar. After which, the pressure can be released and both the tensioning bridge and hydraulic head can be removed.

SLEEVE REMOVAL

Two methods are available:

First preference

Oil injection adaptor
The oil injection adaptor is screwed into the oil injection port of the Hydraulic Radial Fit Bolt and tightened. The hose is directly attached to the adaptor and pressure is applied until release of the sleeve occurs. Following release the hose, adaptor and nuts can be removed and cleaned.

Alternatively

Removal bridge
We must first remove the nut at the slotted end of the bolt before the removal bridge can be fitted, At no time should the opposite nut be removed it should however be two turns back from the coupling face as stated. With the removal bridge and hydraulic head fitted apply pressure. As you continue to pump, the pressure will drop until you reach zero to ensure release of the sleeve from the bolt, Once completed remove the bridge, hydraulic head and nuts.

Both methods allow the sleeve to return to its original clearance condition.

Depending upon the coupling geometry, space restrictions etc Pilgrim will design the hydraulic bolt assembly and tensioning equipment to fit the specific coupling geometry.

GENERAL TECHNICAL INFORMATION

Helical oil grooves
To facilitate easy removal by oil injection, the body of the Pilgrim Hydraulic Radial Fit Bolt is machined with twin helical grooves. These allow the oil to distribute freely and quickly between the mating surfaces of the bolt and the sleeve to achieve efficient separation – the most effective way of producing an even interface pressure that ensures the bolts can be taken out smoothly and quickly.

Hardened taper sleeve
The tapered sleeves are surface hardened to provide a predictable coefficient of friction between both components, improving resistance to corrosion and allowing the sleeve to be removed from the bolt more efficiently.

The non-metallic nature of the compound zone formed on the surface of the sleeve eliminates pick-up and prevents bolt seizure. When oil is introduced during the removal process, the coefficient of friction is reduced to ensure fast and efficient separation of bolt and sleeve.

Bolt tensioning kit
These can be single or dual operated. They include all of the necessary components for fast installation and removal. The dual kit allows two bolts to be pressurised simultaneously, further reducing the assembly and removal time.

Internal taper thread
The internal taper threads at each end of the bolt are necessary to facilitate the use of hydraulic tensioning equipment without increasing the bolt length. A specially heat treated taper threaded puller is assembled into the bolt end during bolt installation and removal.

Bolt removal by oil injection
This entails injecting oil under pressure between the interface of the bolt and the sleeve by means of an adaptor that locates into the bolt end. The oil injection adaptor is supplied with a lens ring, hardened for maximum life, ensuring the high pressure connection is sealed effectively and with the minimum physical effort. The lens also eliminates the possibility of damage to both the adaptor and injection port.

Mechanical removal
An alternative mechanical removal facility is provided for all bolts. Its design is such that it provides the option for both the oil injection and the mechanical removal to be performed simultaneously or individually.

Robust ancillary equipment
All Pilgrim equipment is designed for ease of use and robustness in the on-site environment. Pilgrim have many years experience of product design to suit the harsh needs of turbine maintenance.

Material specification
All standard components of Pilgrim Hydraulic Radial Fit Bolts and bolt tensioning kits are manufactured from Ni Cr Mo alloy steels.

Weight Tolerance
The Hydraulic Radial Fit Bolts are supplied as complete assemblies to a specific weight tolerance. All components are supplied as a matched set.

Sizes
All Hydraulic Radial Fit Bolts are on a ‘made to order’ basis, designed to the exact bespoke requirements of the coupling flanges into which they will be installed.

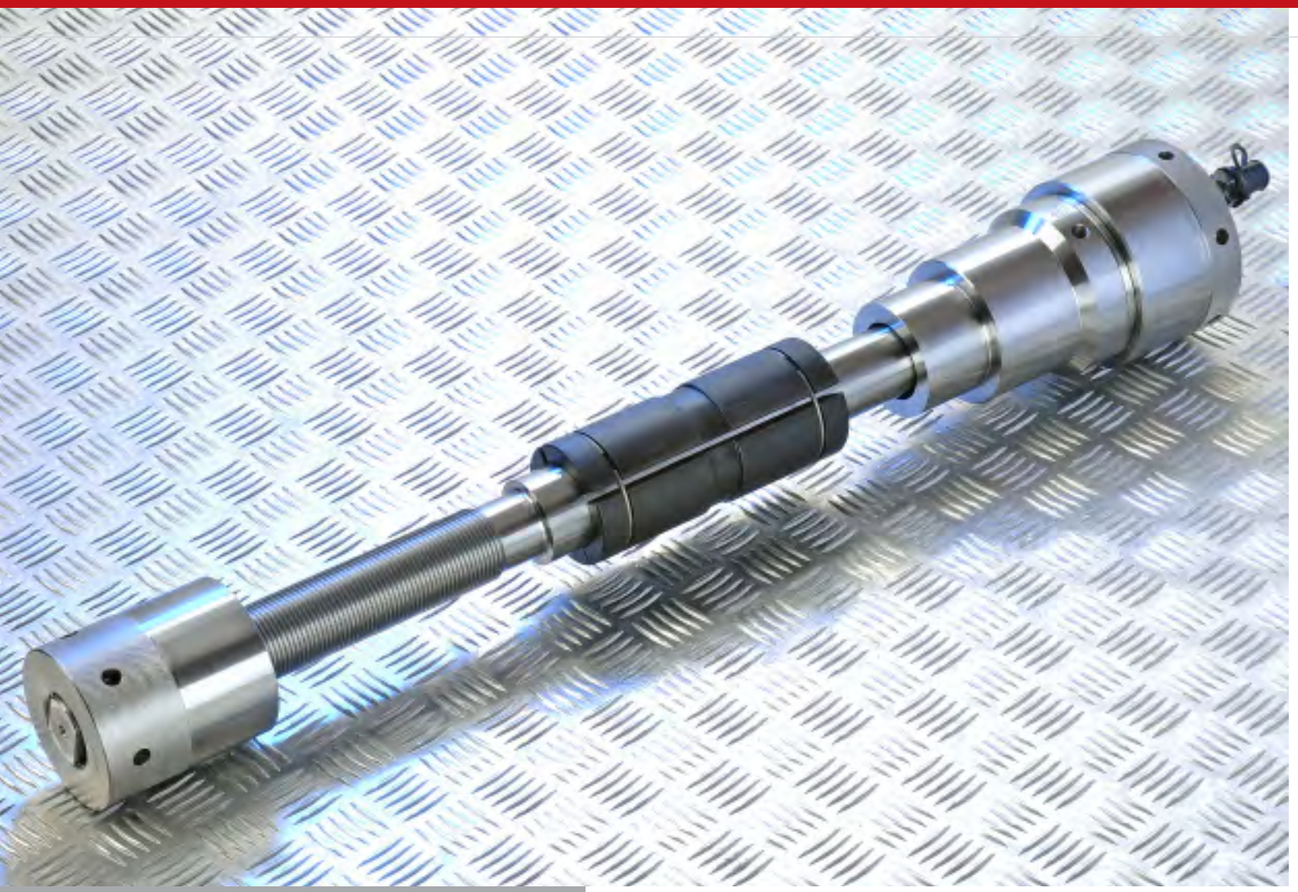
Quality
Pilgrim International Limited operates a quality control system that conforms to BS-EN-ISO 9001:2008. The system is regularly audited by an approved accreditation company.

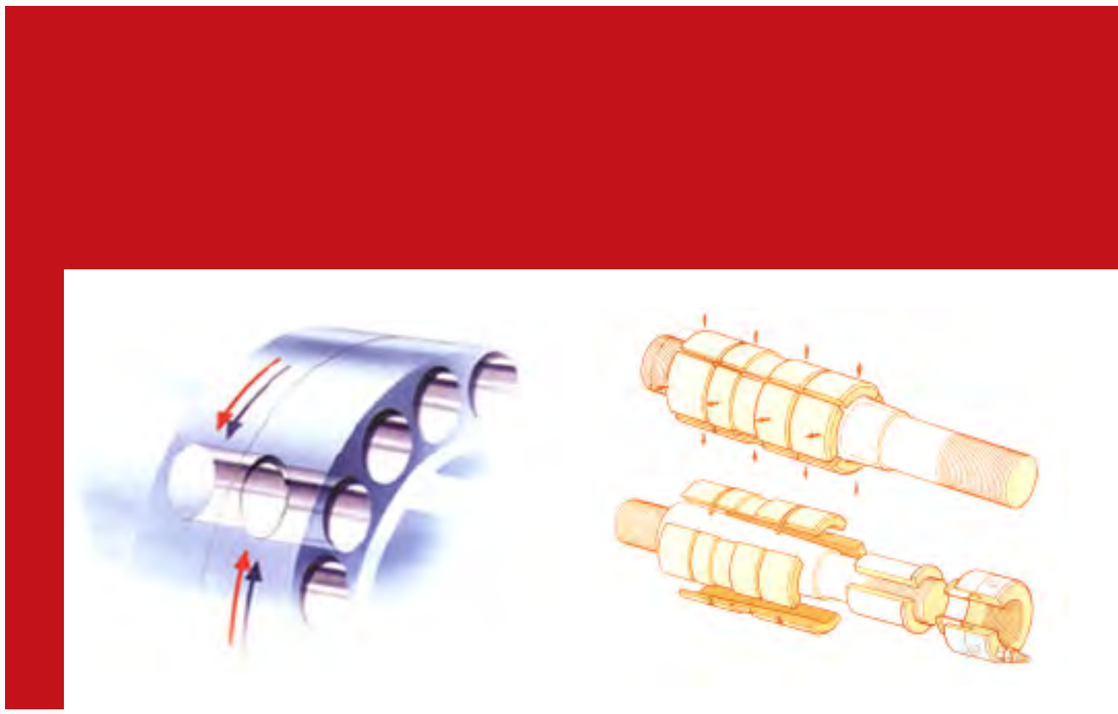
Inspection and testing
The design, materials and finished product are comprehensively tested and proven by our engineers. Indepedent witnessing can be undertaken on request before despatch.

Safety
All Pilgrim Hydraulic Radial Fit Bolts and ancillary equipment are designed for safe and simple use. The ease of bolt installation and removal eliminates many of the traditional, unsafe working practices often undertaken when using conventional bolts.

Technical support
Pilgrim will undertake bolting, loading and torque calculations and liaise with turbine manufacturers on behalf of our customers. Service engineers can be provided to assist in the installation and removal of the Pilgrim Hydraulic Radial Fit Bolts and to provide on-site training in the correct use of
Pilgrim equipment.

COUPLING HOLE ALIGNMENT TOOLING (CHAT)





- Saves time
- Reduces cost
- Aligns and closes couplings
- Accurate and reliable
- Quick and efficient
- Versatile
- Powerful and safe
- Easy to handle
- Spigotted or plain couplings

The Coupling Hole Alignment Tool (CHAT) is a further development from the Pilgrim product portfolio, designed in response to OEM maintenance and end user companies' requirements. It achieves coupling hole alignment quickly and to a tolerance that permits effective bolt installation or removal.

The CHAT system is simple, accurate and reliable in operation and can greatly improve the effectiveness of outage planning. The system is based on the same basic principles as the Pilgrim Hydraulic Radial Fit Bolts, utilising hydraulic equipment through specifically designed tools to expand or remove the sleeve.

The sleeve itself is segmented into four pieces, allowing a considerable range of expansion. This in turn allows the tool to rotate the coupling flanges with several millimetres misalignment, close and hold turbine couplings aligned whilst the Pilgrim Hydraulic Radial Fit Bolts are either installed or removed.

Should the conventional coupling bolts become seized in the holes due to coupling slippage, the CHAT system can re-establish coupling alignment once the bolts have been removed.

Depending upon the complexity, size and design of the coupling, Pilgrim will supply a sufficient number of CHAT tools to effect safe and accurate alignment.

Each tool is located loosely into the bolt holes and coupling hole alignment achieved as the units are expanded simultaneously. The coupling faces are then closed using the CHAT in preparation for installing the bolts. Once sufficient Radial Fit Bolts have been fitted to hold the coupling aligned, the CHAT tools can be removed and the remaining bolts installed.

MK10 MORPRESS AIRDRIVEN PUMP

Lightweight, efficient, compact and easy to operate, the Morpress 10 provides instant and totally reliable hydraulic power.

The Morpress utilises a low pressure air input to generate a high pressure output. This is achieved by means of a simple differential area system in which a large area piston at low pressure produces high hydraulic pressure on a small area piston. The standard Morpress comprises an air pressure regulator, air pressure gauge, air filter, air lubricator, on/off control valve, oil reservoir, SC Air/Oil intensifier unit, oil return to tank valve, pressure relief safety valve and oil pressure gauge with damping facility. The Morpress can also be built to customer specifications. Lower or higher pressure models, special outlet arrangement and customised gauges can all be accommodated.

Both oil and air are filtered prior to entering the systems. The Morpress requires only two connections, one to the air supply and one to the hydraulic output. Simple and safe self-sealing quick release couplings are used to connect the equipment being pressurised.

BENEFITS

- Lightweight
- Easy operation
- Robust construction
- Safe and reliable
- Well proven for use in all major industries

TECHNICAL SPECIFICATION:

	Model 525	Model 535	Model 620	Model 640
Hydraulic Output Pressure	0-1700 bar 0-25000psi	0-3000 bar 0-40000 psi	0-1700 bar 0-25000 psi	0-3500 bar 0-50000 psi
Pressure gauge rating will vary according to customer requirements.				
Approx weight with empty oil tank	21.0 kg	21.25 kg	25.2 kg	27.0 kg
Overall dimensions	380mm x 360mm x 440mm		15ins x 14.2 ins x 17.3 ins	
Reservoir capacity	8 litres	1.8 gallons (imp)		

BOLT TENSIONING KIT

Customised for the application, the Pilgrim Tensioning Kit can be supplied in different configurations to meet the specific needs of the customer.

The kits are supplied with all components to ensure that the engineer can fully operate the system. They are designed to be user friendly and can be either of the single or dual type. The latter enables two bolt assemblies to be pressurised simultaneously, thus reducing further the maintenance downtime during major or minor shutdowns. The hydraulic heads supplied as part of the bolt tensioning kit meet the requirements of the European Pressure Equipment Directive and are therefore CE marked thus providing further confidence that the Pilgrim product meets the required International safety standards.

DATUM PLUGS

BENEFITS

Accuracy

Operator confidence

Repeatability

Improve QA records

Confirm bolt extension

Pilgrim's Datum Plug provides a simple aid in measuring the length of the Hydraulic Radial Fit Bolt.

The Datum Plug provides an accurate and consistent reference point for your measuring system. The bolt length measurement can be taken before and after hydraulic tensioning to verify that the installation and loading has been undertaken correctly.

QUALITY ASSURANCE

Pilgrim International are fully accredited to ISO 9001 standard. Over many years we have developed different Quality Assurance Programmes to meet the stringent demands of the turbine manufacturers by way of providing comprehensive documentation packages that can fully detail the complete traceability of all materials used during manufacturing.

Services available:

> Ultrasonic inspection
> Hardness testing
> Mechanical tests
> Material identification
> MPI inspection
> Visual & dimensional checks
> Pressure tests
> Functional Testing

Prior to despatch all products are etched, suitably packed and sprayed with an anti-corrosive fluid for transportation purposes.

TECHNICAL SUPPORT

Pilgrim provide a complete range of technical and training services. These include on-site installation support, line-boring, comprehensive operation and maintenance manuals and spare parts either from stock or on an emergency basis with extremely fast lead times.

Our reputation for safety and reliability, built up over many years, is the result of the integrity of our bolts and components and the thoroughness of the assistance and guidance we offer to both managers and installers. At every stage of a project we ensure that you have all of the help you need.

Pilgrim's technical and commercial personnel can be contacted by telephone, facsimile or e-mail to discuss any issue relating to the Hydraulic Radial Fit Bolt.

To maintain the smooth and continuous operation of essential equipment, we recommend and undertake in-house refurbishment of all tooling including complete bolt tensioning kits, hydraulic heads and air-operated pump units.

TRAINING KIT

The training kit is lightweight, safe and easy to handle and can be used in either a workshop or training facility without the need to access the turbine itself.

The kit is both visual and practical in its use in providing engineers the ability to develop their understanding in both installation and removal techniques. By providing engineers such a training opportunity time savings during turbine overhauls are fully maximised.

The kit comprises of a Hydraulic Radial Fit Bolt assembly, steel block that is used to simulate the coupling hole and comprehensive bolt tensioning kit.

High pressure Hand pump can be supplied on request.

DIVERSE APPLICATIONS

The Pilgrim Hydraulic Radial Fit Bolt and the company's related products are used extensively by the power industry worldwide.

Our innovative coupling technology is also used in many other industrial applications including steel production, mining, aluminium smelting, shipping and onshore/offshore oil production.

The ability of Pilgrim to provide customers with solutions to engineering problems has further enhanced its reputation to supply bespoke specialist products. Our engineering and sales teams are available should you require assistance with any specific enquiry.

Examples of the specialist products and solutions supplied to industry include:

> Pilgrim Hydraulic Nuts
> Hydraulic Bolt Tensioning
> Rotor Bore Plugs
> Pilgrim Bolts
> Mini Fit Bolts
> Generator Through Bolt Nuts
> Morgrip Bolts
> Dowel Pins
> Studs and Nuts
> High Pressure Oil Injection
> Hydraulic Pumps

Pilgrim Hydraulic Radial Fit Bolts have been supplied for 50HZ and 60HZ rated machines in the nuclear, hydro electric and fossil plants throughout the world.

Typical turbine arrangements:

> Alstom
> Ansaldo
> Fuji
> GE
> Hitachi
> MAN
> MHI
> Siemens
> Toshiba

CONTACT

Pilgrim are represented in a number of countries by territorial agent/distributors. Please refer to the Pilgrim website for the relevent local contact details.

INSTALLATION REFERENCES

Pilgrims safety and reliability have been proven over many years in countless nuclear, hydro electric and fossil plants throughout the world being supplied on steam and gas turbines

T: +44 (0) 161 785 7700
F: +44 (0) 161 785 7777
E: sales@pilgrim-international.co.uk
www.pilgrim-international.co.uk