Sealing in the Nuclear Power sector

Issue 1.3

- World class materials & sealing products
- Custom designed & manufactured
- Fully researched, developed & tested
- With nuclear standards & certifications
- Global support to OEMs, contractors & utilities
Introduction

James Walker is a dynamic global manufacturer and distributor that supplies a large range of highly specialised sealing related products and services to the nuclear power generation sector.

With over 35 years of service to the nuclear sector, our client base covers:
- Fuel processing & handling.
- Power generation.
- Waste processing.
- Transportation & storage.

Our world-leading areas of technical excellence embrace:
- High-integrity sealing.
- Bolting technology.
- Innovative problem solving.

Plus the development and custom manufacture of precision components in:
- High-performance elastomers.
- Engineering plastics.
- High-strength alloys.

A background in materials technology, backed by top-level design, development and test laboratory capabilities, positions us as a leader in these particular fields.

We work with a number of clients on a confidential basis. Therefore, we fully appreciate and respect the security issues involved.

Nuclear industry support

This is emphasised by our willingness to solve sealing problems in active areas and general plant for OEMs, operators and contractors in the nuclear sector.

Our philosophy is to liaise very closely with operators and OEMs during plant design and operation. This way we can advise on high-integrity sealing, and gain an in-depth understanding of a specific nuclear facility and its exact requirements during scheduled outages and refuelling.

We appreciate that the project management of such events starts many months, even years, in advance. Again, we like to be involved very early in the planning stage, so that a manufacture and supply programme can be prioritised for the seals and related products required.

Products will be precision manufactured in advance, then packaged and labelled to match the exact requirements of the outage schedule.

Where appropriate, delivery to site will be phased on a JIT basis to coincide precisely with maintenance demands.

In addition, with our ‘lean’ manufacturing systems and Express Service, we can readily meet urgent demands for components needed to undertake any unscheduled work that may arise during the outage.

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To order or for further details, call your local contact shown on rear cover or listed at www.jameswalker.biz
Our capabilities in the nuclear sector are firmly based on our knowledge of the processes involved, their highly specialised sealing requirements, and the need for exacting quality control and assurance regimes.

We fully appreciate our customers' high expectations and inherent need for a top quality service — with dedicated design and development capabilities, precision manufacturing expertise, and total traceability of all products and materials.

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### Capabilities

- **Nuclear safety awareness**
- **Materials development**
- **Test facilities**
- **Technical support**
- **On-site support**
- **Quality assurance**
- **Extensive manufacturing capability**
- **Strategic focus**
James Walker supplies only the highest integrity products to the nuclear industry. We work to the exacting specifications of our customers, together with relevant national and international standards, to achieve the required level of operational safety for plant, equipment and personnel.

Industry awareness, training & support
We maintain full awareness of the sector’s latest sealing product and quality requirements through our team of nuclear industry specialists in liaison with operators and design authorities.

In addition, this team provides operators, plant specifiers and equipment manufacturers with full technical support and advice on a worldwide basis regarding custom and standard sealing systems, plus products and materials for applications in both active and inactive areas.

On-site training in the application and installation of our products, for maximum sealing integrity and service life, is provided to customers’ maintenance staff and contractors on request.
Quality assurance

Material development

James Walker Technology Centre is expert at the development and verification of new elastomeric compounds to meet our clients’ specific operating parameters.

In the development of materials for applications in active areas, we work closely with a number of third-party laboratories that specialise in the irradiation and subsequent evaluation of our materials.

Innovation & Skills

We are innovators in the fields of high performance sealing technology and the application of elastomers and engineering thermoplastics.

Our success is founded on the technical expertise and support we give customers with advice, specialised materials and product designs.

Applications engineers and materials specialists at James Walker Technology Centre are highly skilled at the creation of new sealing components and assemblies to overcome problems at equipment design stage and on operational plant.

This work is carried out in liaison with plant operators, equipment manufacturers and regulatory authorities.

Knowledge base

Our corporate knowledge base stretches back to the 1880s, when we first developed new fluid sealing techniques to match the performance of high efficiency steam engines.

We have maintained our lead ever since by the constant creation and production of sealing systems and components to meet industry’s current and future needs.

For over 35 years we have been working with the nuclear sector, advising operators and plant manufacturers on sealing related subjects. Operating under partnering agreements, or one-off problem solving contracts, we have custom-designed sealing systems and components, and supplied ranges of highly specialised as well as standard items.

Record keeping

We maintain meticulous records of all materials and products supplied for nuclear duties, as required by the plant operator and/or design authority. These are kept for seven or ten years, or longer, depending on requirements.

Typical records include:
• Raw material supplier and certification.
• Product supplier and certification.
• In-house mixing procedure for the compound.
• In-house test results for the compounded elastomer.
• Mould tool inspection record.
• Product moulding procedure.
• Test of material properties after moulding.
• Product inspection including dimensional report.
• Packaging and delivery records.
• Customer’s certificate of acceptance.

Certification & data

Our Quality System is third-party certified to BS EN ISO 9001 and BS EN 9100.

In addition, we are regularly assessed and quality approved by a wide range of industry bodies and individual customers, including utilities, multinational corporations and governmental organisations.

A BS ISO 2230 compliant package is offered as standard, providing data on the inspection, recording procedures, packaging and storage of products made from vulcanized or thermoplastic rubber.

Nuclear approvals

We hold PMUC material approvals for five elastomers (EP18/H/75, EP21/E/80, PB70, PB80, Shieldseal® 663: see pages 10-11) and Metaflex® NS200 spiral wound gasket, for use at French nuclear sites.

Performance testing

Our product test regimes frequently start with finite element analysis (FEA) — either linear or non-linear, as appropriate to the sealing material — when design specialists mathematically model the behaviour of a seal under operational conditions. This enables us to fine-tune the design before a prototype is made.

Prototypes are subjected to extensive testing in our laboratories under closely simulated operational conditions. Our vast range of state-of-the-art facilities, with full data recording, includes:
• Rotary seal testing at up to 40m/s with different fluid media, and with friction/torque monitoring as standard.
• Cartridge seal testing.
• Static seal and gasket testing at up to 160MPa with gaseous or liquid media.
• Hydraulic seal testing (piston and rod/gland seals) to 42MPa and 0.5m/s.

Radiation resistance evaluation is undertaken by specialist third-party test laboratories.
To order or for further details, call your local contact shown on rear cover or listed at www.jameswalker.biz

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See pages 14-21 for more information on James Walker’s products.
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See pages 14-21 for more information on James Walker’s products.
Transportation & storage — areas of expertise

There are now numerous designs of flasks and containers in use worldwide for the transportation and storage of nuclear fuels, as well as the high, medium and low-level wastes resulting from decommissioning programmes.

When considering sealing products for such duties, safety is the paramount requirement, followed closely by reliability and longevity under specific environmental conditions — especially for waste storage.

We have been involved in the custom design and manufacture of sealing products for the transportation and storage of radioactive materials since the 1970s.

### James Walker products

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See pages 14-21 for more information on James Walker’s products.
James Walker is at the forefront in the development and application of high performance elastomers and engineering plastics.

Our Materials Technology Centre is constantly creating new elastomer formulations to meet customers’ specific operational parameters and to advance our own product ranges.

The result is materials for sealing related products that work efficiently and for longer at extremes of temperature and pressure, with improved resistance to chemicals, abrasion, or ionising radiation.

We are always willing to partner with equipment manufacturers and operators of nuclear facilities to develop, prototype and evaluate materials and/or specific components for radiation resistant or shielding duties.

**In-house compounding**

We compound over 300 grades of high-performance and general elastomers — under rigorous process control — for the production of seals or other components.

By formulating and compounding the vast majority of the elastomers we use, we can ensure quality, and provide our customers with the exact materials they need for their specific applications.

**Precision moulding**

This is our preferred method of production for elastomeric components. We compression mould up to 2.2m diameter with one of the largest precision presses in Europe. We also vacuum mould up to 2m diameter in a single operation, and injection mould up to 500mm diameter.

Precision items greater than 2.2m diameter are produced using our special mould-joining technique.

**Extrusion**

We use the elastomeric extrusion process for inflatable seals, door seals, and pond gate seals.

**Rubber-to-metal bonding**

Optimum bond strength is achieved with composite elastomeric/metal components by acid etching, phosphating and chemical cleaning of metal surface prior to the bonding operation.

We regularly compound and/or mould the following elastomers for nuclear duties. A number of these materials are specific to particular customers, as indicated, and cannot otherwise be supplied without their authority.

**Fluoroelastomers (FKM)**

- Daisy range — fluoroelastomer (FKM): EDF materials.
- FR10/70(V) — DuPont Viton® based fluoroelastomer (FKM) of nominal 70 IRHD.
- LR5602/65 — fluoroelastomer (FKM) of nominal 65 IRHD.
- Shieldseal® 641 — fluoroelastomer (FKM) with excellent radiation resistance and enhanced high temperature capabilities. Nominal hardness 55 IRHD.

**Ethylene-propylene (EPM/EPDM)**

- EP18/H/75 — ethylene propylene elastomer (EPM) of nominal 75 IRHD: PMUC approved for use in French nuclear power plants.
Materials technology

- **EPDM 30H** — ethylene propylene elastomer (EPDM): a Sellafield Ltd material.
- **Shieldseal® 561** — lead-free flexible material for radiation shielding duties, based on an EPDM elastomer. Nominal hardness 70 IRHD.
- **Shieldseal® 661** — EPDM-based elastomer for liquid and gas sealing in the presence of ionising radiation, where only low closing forces are available. Nominal hardness 55 IRHD.
- **Shieldseal® 662** — EPDM-based elastomer for general applications where ionising radiation is present. Nominal hardness 70 IRHD.
- **Shieldseal® 663** — a highly-developed EPDM-based elastomer of nominal 80 IRHD for moulded components such as ‘O’ rings. This material has been subjected to extensive radiation/ageing testing to replicate a 40-year lifespan. PMUC approved for use in French nuclear power plants.

Nitrile (NBR)

- **18L** — nitrile elastomer (NBR): a Sellafield Ltd material.
- **Foxglove** — nitrile elastomer (NBR): an EDF material designation.
- **LR6657/80** — nitrile elastomer (NBR): see Foxglove.
- **PB70** — nitrile elastomer (NBR) of nominal 70 IRHD. PMUC approved for use in French nuclear power plants.
- **PB80** — nitrile elastomer (NBR) of nominal 80 IRHD. PMUC approved for use in French nuclear power plants.
- **Shieldseal® 621** — nitrile elastomer (NBR) designed for radiation resistance. Also excellent resistance to mineral oils, water/glycol hydraulic fluids, and a wide range of chemicals. Nominal hardness 60 IRHD.

Silicone (VMQ)

- **Lily** — silicone elastomer (VMQ): an EDF material.
- **LR6920** silicone elastomer (VMQ) for critical applications: a JW material used for products for EDF.
- **LR6935** — silicone elastomer (VMQ) for non-critical applications: a JW material used for products for EDF.
- **Poppy range** — silicone elastomer (VMQ): EDF materials.
- **SIL80/5** — silicone elastomer (VMQ).

Chloroprene (CR)

- **Shieldseal® 551** — lead-free flexible material for radiation shielding duties, based on a polychloroprene elastomer (CR). Nominal hardness 70 IRHD.
- **PB70** — nitrile elastomer (NBR) of nominal 70 IRHD. PMUC approved for use in French nuclear power plants.

Engineering plastics

James Walker is a leading force in the development and application of advanced thermoplastics and thermosets. Based on over 40 years’ experience, we precisely match materials, product design and component manufacture to meet customers’ exact specifications.

Manufacturing capabilities

Our in-house facilities cover extruding, moulding, monomer casting, hot casting, injection moulding, and precision machining. Using these we can produce runs of one-off to batches of thousands.

Component sizes range from a few millimetres, to in excess of 2.5m diameter, with large items weighing up to 1000kg.

Materials

- **ABS.**
- **Acetal** — homopolymer and copolymer.
- **PEEK**™.
- **Polyamides/nylons** — including plain, filled, reinforced and high molecular weight grades.
- **Polycarbonate.**
- **Polystyrene** — foam and high density.
- **Polyurethanes** — including thermoset.
- **PTFE** — virgin and filled.
- **PVC.**
- **Rubber** — thermoplastic grades.
- **UHMWPE** — plain and filled grades of ultra-high molecular weight polyethylene.
James Walker combines a vast array of expertise in:

- Fluid sealing technology.
- Complex machining of exotic alloys.
- Bolting technology.

The amalgamation of these disciplines enables us to create engineered solutions and specialised components for use in every area of nuclear activity.

Fluid sealing technology

At James Walker, we make best use of all our fluid sealing capabilities to help the nuclear power sector maintain its safety and environmental record, and protect against costly unscheduled outages.

Problem solving

Our nuclear industry specialists, applications engineers and materials technologists can solve virtually any fluid sealing problem.

If we do not have a suitable product or sealing system readily available, we have the in-house skills and facilities to custom design, develop, prototype and test new ones.

One of our greatest benefits in problem solving is the totality of sealing product coverage within James Walker. This gives us the greatest selection of seal types and special expertise to apply on your behalf:

- Gaskets, ring joints, and sheet jointings.
- Rotary lip seals.
- Mechanical and cartridge seals.
- Compression packings.
- Static seals, for doors, hatches, dam gates and tank lids.
- Hydraulic seals, wipers and bearing strips.
- ‘O’ rings.
- Expansion joints and bellows.

See pages 14-21 for more detailed information on our sealing products.

High-precision machining

With a state-of-the-art machine shop in the UK and highly skilled personnel, we are expert at the precision machining of complex parts in high-performance alloys that are notoriously difficult to work and control.

Thin-wall machining

We have developed special expertise in the machining of thin-wall annular components.

For this, we perfected a method that prevents items being crushed, whilst allowing precise profiles to be achieved repeatedly to tight tolerances with absolute concentricity.

Machining capabilities

Our range of fully-automated machining centres include 5-axis and 3-axis machines, plus 3-axis models with multiple tool stations.

In addition, a vast array of CNC lathes gives us flexibility to manufacture components up to 2.3m OD. We also use vertical and horizontal milling and CNC routing machines.

Materials

Our inventory of materials regularly includes Inconel® 600, 625, 716, 718, 800, 825 and X-750, as well as Hastelloy® B2 and C275. All materials are fully certified, and tested for physical and chemical qualities when they arrive.
Quality standards in machining
Total traceability of every machined part is guaranteed back to the original mill billet.

Our Inspection Department employs the most up-to-date equipment and techniques to ensure dimensional accuracy is achieved constantly to the required specifications.

All machining work is undertaken in a tightly controlled QA environment to API Spec 6A-0038 with PSL4 accreditation.

Our RotaBolt® range of tension control fasteners provides either finger-tip or visual monitoring of tension throughout the life of a bolted joint. The pre-set bolt loads can therefore be swiftly checked and maintained.

RotaBolts have been specified in the nuclear sector for many years, on a wide variety of flange joints and structural assemblies subject to fatigue, vibration, pressure containment or slippage.

The inclusion of RotaBolt tension control at plant design stage will help to ensure the integrity of bolted joints where safety, reliability, security and ease of maintenance are essential at a nuclear site.

Trouble-shooting
These safety bolts are often used, along with our gasket products, in trouble-shooting projects where flange joint leakage is a problem on critical and high temperature, high pressure plant.

In such cases we work closely with the plant operator or equipment supplier to design a new or modified flange jointing arrangement that will operate efficiently under the temperature/pressure cycling involved for the required maintenance period.

This flange arrangement is then tested and approved by the relevant inspectorate before operational use.

Tension versus torque control
The RotaBolt tension control system surpasses traditional tightening methods such as hydraulic tensioners, flogging, and torque systems. Such techniques have severe control limitations that can result in unpredictable bolt tension and joint failure.

With RotaBolt® types 1 and 2, tension is easy to finger-check, even when wearing protective clothing.

RotaBolt® Vision is readily monitored at a distance, and in many locations where access is difficult.

We manufacture RotaBolts in alloy steels up to 12.9 strength grade, stainless steels, cupro-nickel, nickel and titanium alloys. Customers’ existing fasteners can also be modified.

For further information, please ask for the RotaBolt® Tension Control guide, or download a pdf copy from www.jameswalker.biz.
Our vast ranges of sealing products cater for virtually every sector of industry, with power generation being one of our major areas of activity.

A number of our products have been developed specifically for use in nuclear environments (see pages 10-11).

‘O’ rings

We provide a complete service in ‘O’ ring manufacture and/or supply, with thousands of types and sizes in stock ready for same-day despatch. Non-stocked items can be precision manufactured within hours to meet urgent demands.

The versatile ‘O’ ring is used for a wide range of applications in the nuclear sector, including pumps, valves, hydraulic and pneumatic systems, hatch seals, blanking plates, flask lid seals, etc…

‘O’ ring materials

Include grades of:
• Acrylic (ACM).
• Butyl (IIR).
• Chloroprene/Neoprene (CR).
• Chlorosulphonyl polyethylene (CSM).
• Elast-O-Lion® hydrogenated nitrile (HNBR).
• Epichlorohydrin (ECO).
• Ethylene propylene (EPM/EPDM).
• Fluolion® (PTFE), virgin and filled.
• Fluoroelastomer (FKM).
• Fluorosilicone (FMQ/FVMQ).
• Kairez® perfluoroelastomer (FFKM).
• Natural rubber (NR).
• Nitrile (NBR).
• Polyurethane (AU/EU).
• Silicone (VMQ/MQ).
• Tetrafluoroethylene/propylene (FEPM), eg, Atlas®.

‘O’ ring operating capabilities

Maximum operating pressure (typical): 10MPa/100bar, depending on specific application. When used in conjunction with back-up rings, the pressure limit can be extended to at least 35MPa/350bar.

Temperature ranges:
• Elastomeric rings from -60°C to +315°C according to material grade. PTFE rings can operate down to -200°C.

‘O’ ring size ranges

• BS ISO 3601-1 (metric & inch sizes).
• SAE AS 568 (inch sizes).
• BS 1806 (inch sizes) — now superseded by BS ISO 3601-1 Class A.
• BS 4518 (metric sizes).

Non-standard rings are precision moulded to order, including endless rings up to 2.2m OD.

Back-up rings

These are supplied In Fluolion® (virgin or filled PTFE), and PEEK™. Standard design is a spiral of two turns.

For our full range of ‘O’ ring products, please ask for James Walker’s ‘O’ Ring Guide, or download a pdf copy from www.jameswalker.biz.
Sealing products

Metallic gaskets

**Metaflex® spiral wound gaskets**

Metaflex® gaskets will seal flanges where temperature, pressure, vibration or flow rate are beyond the capability of conventional jointing materials. Nuclear applications include pressure vessels, steam lines, heat exchangers and condensers.

**Specific features**

These gaskets are wound in V-section metal strip with a soft filler material, so that flange faces are presented with a spiral of alternate metal/filler layers.

Filler materials include nuclear grade graphite, and PTFE. Metal support rings, inside and/or outside of the spiral winding, make the gasket suitable for high line pressure on flat or raised flange surfaces.

**Operating capabilities**

*System pressures:* high vacuum to in excess of 35MPa/350bar.

*Operating temperatures (graphite filler):*
- from cryogenic, up to +650°C in steam,
- +600°C in inert/reducing media, or
- +500°C in oxidising media.

*Operating temperatures (PTFE filler):* from cryogenic up to +260°C.

**PMUC approval**

Metaflex® NS200 with nuclear grade graphite filler is PMUC approved for use in French nuclear power plants.

**Compression test rig**

We have the in-house ability to undertake sacrificial tests on spiral wound gaskets for the nuclear industry (see photograph above).

This test facility proves invaluable when a set number of gaskets within a production run for a nuclear customer must be compression tested.

**Metakamm® Kammprofile gaskets**

Metakamm® Kammprofile-type gaskets are for flange joints on high-pressure pipework and vessels where operating conditions fluctuate. They are recommended for heat exchangers and condensers.

**Specific features**

These gaskets comprise a metal core with concentric grooves on either side. They usually have a soft layer of sealing material bonded to both grooved faces. Sealing face materials include nuclear grade graphite, and PTFE.

**Operating capabilities**

*Max system pressure:* 25MPa/250bar.

*Operating temperature (graphite faces):*
- up to +650°C in steam; or +500°C in oxidising media.

For our full gasket range, please ask for James Walker’s Gaskets & Jointings Guide, or download a pdf copy from www.jameswalker.biz.
Sealing products

Cut gaskets & jointings

Supagraf® plain graphite gaskets

Nuclear grade gaskets are precision-cut from ultra high purity (99.8%) exfoliated graphite sheet. Standard purity is a minimum of 98%.

Specific features
These gaskets have excellent chemical resistance. They provide high levels of flange joint stability and sealing integrity over extended periods. Leachable chlorine ion content is exceptionally low.

Operating capabilities
Temperature range: -200°C to +400°C in oxidising media; or to +2500°C in inert/reducing media.

Supagraf® gaskets with stainless steel foil or nickel foil inserts are readily available.

Chieftain® carbon fibre-based gaskets

Chieftain® is our premium grade universal sheet jointing, from which we precision-cut gaskets to any shape, size and quantity. It comprises an advanced carbon fibre material and nitrile rubber (NBR) binder, with an anti-stick finish on both sides supplied as standard.

Specific features
Chieftain offers high strength and stability with outstanding chemical and steam resistance. It surpasses BS 7531 Grade X requirements. Chieftain is suitable for ASME Class 300 flanges to at least +260°C.

Other calendered non-asbestos fibre (CNAF) jointings in our range are approved for gaseous oxygen or potable water duties.

PTFE gaskets

We supply gaskets and/or gasket tape in a wide variety of virgin PTFE, filled PTFE and expanded-PTFE, plus modified-PTFE materials with creep resistance.

Specific features
Offering high levels of purity, plus almost universal chemical resistance, many of these gaskets are used on acid lines and with other aggressive chemicals. Grades of expanded-PTFE are recommended for glass and ceramic flanges.

PTFE gaskets include James Walker Fluolion®, Gylon®, GORE®, and Teadit®.

Operating capabilities
Typical temperature range: -200°C to +260°C. Specific PTFE grades vary.
Sealing products

GORE® Series 300 & 600 Gasket Tape

These tapes comprise WL Gore & Associates’ 100% virgin PTFE in tape form. A strong multi-directional orientated structure minimises creep, and an adhesive backing allows gaskets to be formed quickly in place.

In the nuclear sector they are often used to form door and hatch seals, and blanking plate gaskets where chemical resistance is needed.

Specific features
• Soft and conformable materials that compress to form a tight seal.
• Chemically resistant to all media in the range pH 0-14, except molten alkali metals and elemental fluorine.

Operating capabilities
**Maximum temperature:** +260°C, with short excursions to +315°C.

**Minimum temperature:** -268°C.

**Pressure ranges:**
- Series 300, vacuum to 4MPa/40bar, depending on application.
- Series 600 (expanded PTFE): vacuum to 600kPa/6bar.

**Series 300:** supplied in widths from 10mm to 30mm, and thicknesses of 2mm and 3mm.

**Series 600:** supplied in widths of 40mm, 55mm and 60mm, and thicknesses of 6mm and 9mm.

Cork-elastomer gaskets

Five of our Nebar® cork-elastomer jointings are manufactured specifically for gaskets on switchgear, transformers and other heavy electrical plant in power generation and distribution.

Specific features
• Nebar® Black: Hi-performance Electrical, is our top grade with a minimum resistivity of $10^{10}$ ohm.cm at 100V dc. It is recommended for applications on hydrogen coolers and plant containing SF6 gas.

• Nebar® White: Premium Neoprene Electrical, is our top grade for heavy plant containing mineral-based transformer oils.

• Nebar® Grey: Premium Nitrile Electrical, meets ABB specifications for switchgear and transformers.

• Nebar® Purple: Nitrile Electrical, offers the highest resistance to over-compression of all Nebar® grades.

• Nebar® Orange: Neoprene Electrical, is our economically priced, high-quality cork-elastomer jointing for switchgear and transformers.

Operating capabilities depend on specific grade.

Elastomeric gaskets

These gaskets are precision cut from a wide range of specification grade and high performance grade elastomers.

Specific features
Of particular value to the nuclear power sector are specific grades of:
• Chloroprene/Neoprene (CR).
• Ethylene-propylene (EPM/EPDM).
• Fluoroelastomer (FKM), eg, DuPont™ Viton®.
• Fluorosilicone (FMQ/FVMQ).
• Elast-O-Lion hydrogenated nitrile (HNBR).
• Kalrez® perfluoroelastomer (FFKM).
• Nitrile (NBR).
• Tetrafluoroethylene/propylene (FEPM), eg, Aflas®.
• Silicone (VMQ/MQ).

Operating capabilities depend on material type and specific grade.

For our full gasket range, please ask for James Walker’s Gaskets & Jointings Guide, or download a pdf copy from www.jameswalker.biz.
Sealing products

Cartridge seals

Cartridge seals are available to match virtually any application. Typical duties in the nuclear power sector include giant cooling pumps and fans, as well as many smaller items of rotary equipment.

We are expert at the custom-design of cartridge seals to provide the total solution to rotary shaft sealing problems — particularly where standard methods and products are unlikely to succeed.

Our service includes all, or any, of the following operations — undertaken in close liaison with the customer’s engineering staff:

• On-site assessment of specific fluid sealing requirements.
• Custom design of a tailored solution based on a metal cartridge housing one or more sealing elements, and includes liquid or gas flush facilities as required.
• Manufacture, assembly, test and supply the complete cartridge sealing system.
• Perform on-site installation, or assist and supervise installation by customer’s personnel or contractors.
• Maintain and refurbish the custom-designed cartridge sealing system, as required to ensure efficient operation.

Radial lip seals

Walkersele® is our exceptionally well proven family of radial lip seals for rotating shafts and rotary plant. Duties in the nuclear power sector include rotary kilns in fuel processing plant, mixers, and gearboxes in transmission systems.

Specific features

• Protect bearings, to extend bearing life and improve plant reliability.
• Ultraglide® version greatly extends seal life in hot and abrasive environments.
• Prevent ingress of external media that contaminate bearing lubricants.
• Prevent oil and grease from escaping to contaminate process media.
• Provide efficient sealing in both directions when used in back-to-back configuration or manufactured with a secondary lip.
• Reduce maintenance costs and plant downtime, especially when fitted using our OSJ-2 On-Site Joining technique.
• Sizes to unlimited diameter.
• Wide range of materials and designs.

For nuclear industry applications we usually manufacture Walkersele® in fluoroelastomer (FKM), to give the following operational characteristics;

Operating capabilities

Maximum under-lip temperature: +200°C.

Maximum surface speed (typical): 25m/s, dependent on Walkersele® design.

For our full range of rotary lip seals, please ask for James Walker’s guide to Walkersele® Radial Lip Seals, or download a pdf copy from www.jameswalker.biz.
Compression packings

**Supagraf® RibbonPak**

High-performance compression packing of pure exfoliated graphite ribbons, plaited into a flexible length-form product.

Recommended as a valve stem packing for steam and chemical media, and for high speed rotary pumps handling water, condensate and slurries.

**Specific features**
- Chemically inert in the range pH 0-14, excluding strong oxidising agents.
- Wide temperature range.
- Negligible volatile content.
- Low in extractable trace impurities, such as chloride and sulphur.

**Operating capabilities**
- **Maximum temperatures:**
  - Steam: +550°C.
  - Oxidising conditions: +450°C.
  - Non-oxidising: +850°C.
- **Minimum temperature:** -200°C.
- **Maximum system pressures:**
  - Valve stems: 25MPa/250bar.
  - Rotary duties: 2.5MPa/25bar.
- **Maximum shaft speed:** 25m/s.

Supplied in all popular square sections from 3mm upwards, in boxes containing 8m. Also split preformed rings and sets.

**Supagraf® Moulded Rings**

These high efficiency graphite sealing rings are moulded to precise density and dimensions. For nuclear valves they are manufactured in high-purity Grade 998 or Passivated expanded graphite foil with no binders or fillers. We also supply rings in NS200 graphite that is PMUC approved for use in French nuclear power plants.

Our rings are recommended for systems handling high-temperature steam, demineralised water, heat transfer media, inorganic and organic acids, and alkalis.

**Specific features**
- Chemically inert in the range pH 0-14.
- No loss of volatiles.
- Outstanding sealing performance over long adjustment-free periods.
- Fire safe capability.

**Operating capabilities (valve stems)**
- **Maximum temperatures:**
  - Steam: +650°C.
  - Oxidising conditions: +500°C.
  - Non-oxidising: +1000°C.
- **Minimum temperature:** -200°C.
- **Maximum system pressure:** 25MPa/250bar.

Supplied as precision-moulded rings in endless form, or with single split, or as matched scarf-split halves, Sections 1.5mm to 40mm; diameters 2mm to over 1100mm.

**Fluolion® Filament L**

This high-performance packing is made from tough thermally stable PTFE fibre yarn, impregnated with densified particles of PTFE to generate additional lubrication.

Recommended for duties where its high purity is required in valves, rotary equipment and reciprocating plant.

**Specific features**
- High chemical resistance: pH 0-14, including corrosive acids and alkalis.
- High integrity sealing with long working life in valves and pumps.
- Clean and conformable for easy fitting.

**Operating capabilities**
- **Maximum temperature:** +250°C.
- **Minimum temperature:** -100°C.
- **Maximum system pressures:**
  - Valve stems: 15MPa/150bar.
  - Rotary duties: 2.5MPa/25bar.
  - Reciprocating duties: 10MPa/100bar.
- **Maximum shaft/rod speeds:**
  - Rotary duties: 10m/s.
  - Reciprocating duties: 1m/s.

Supplied in all popular square sections from 3mm to 60mm, in boxes containing 8m. Also split preformed rings and sets.

For our full range of packings, please ask for James Walker’s Compression Packings Guide or download a pdf copy from www.jameswalker.biz.
Sealing products

Extruded profiles

Pool/pond & dam gate seals

These are custom-designed and manufactured to meet the required specifications. Features such as moulded corners and a single join are readily accommodated.

Elastomeric materials of construction will vary to meet the operational demands. Silicone (VMQ/MQ), fluoroelastomer (FKM) or nitrile (NBR) are typically used for applications in the nuclear sector.

Inflatable seals

These are also custom-designed and manufactured to meet the stated specifications. They are typically used in dome valves on powder handling plant, and as seals on personnel locks and hatches. Custom products include large rectangular inflatable seals with round moulded corners.

Activated by pressurised gas or liquid, these hollow-centred seals have their inflation valves securely moulded in situ.

We manufacture these in numerous elastomers, to meet operational demands, including ethylene propylene (EPDM), silicone (VMQ/MQ), fluoroelastomer (FKM), nitrile (NBR), hydrogenated nitrile (HNBR) and chloroprene (CR).

Expansion joints & protector bellows

Our standard ranges and custom-designed expansion joints and bellows are used for many nuclear power industry applications. A complete service from site survey to on-site installation is available.

Comflex® expansion joints

We have BPO seals for the low pressure steam turbine/condenser interface, as well as expansion joints for gas turbine inlet and high-temperature exhaust ducts on CHP plant.

In addition, our PTFE expansion joints are suitable for harsh chemical conditions, whereas our elastomeric joints and multi-layered fabric wraps are recommended for fan ducts of all sizes.

Comflex® bellows

Metal bellows are ideal for stem sealing applications on nuclear valves, as well as pumps and valves in non-active areas.

Powder plant, mixers, and hopper weighing machines are other applications where flexible bellows prove invaluable.

Our bellows in fabric-reinforced elastomer or polyurethane act as highly efficient ram protectors on hydraulic systems. In PVC or elastomer, they provide long-term protection on robotic arms.

For full details of our expansion joints and protector bellows, please ask for James Walker Townson’s guide to Comflex Expansion Joints and Bellows together with its two Engineering Guides, or download pdf copies from www.jameswalker.biz.
We manufacture an all-embracing family of hydraulic sealing products that includes:
• Rod/gland seals.
• Piston seals.
• Wipers and scrapers.
• Bearing strips.
• Protector bellows.

From the heaviest presses down to small control actuators, we have products specifically developed to give:
• Optimum equipment performance.
• Reduced leakage.
• Low-friction operation.
• Long trouble-free working life.

In the nuclear power sector, we recommend products for applications on flasks, gamma gates, compaction plant and encapsulation plant.

For details of our full family of hydraulic sealing products, please ask for James Walker’s Hydraulic Sealing Guide or download a pdf copy from www.jameswalker.biz.
These technical guides give details on many of the sealing products and services supplied by James Walker. Please ask for your copies, or visit our website www.jameswalker.biz where they can be downloaded in pdf format.

Gaskets & jointings

Compression packings

Hydraulic sealing products

‘O’ rings

RotaBolt+ tension control fasteners

Walkersele+ radial lip seals

Expansion joints & bellows

Custom-designed cartridge seals

Shieldseal® elastomers for use with ionising radiation

Shieldseal® 663 radiation resistant elastomer

Walkersele® Radial Lip Seals

Comflex Expansion Joints and Bellows

Custom designed cartridge seals
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PEEK™ Victrex plc
Teadit® Teadit International
Viton® E I du Pont de Nemours and Company or its affiliates

General information

Health warning: If PTFE or fluoroelastomer (eg, FKM, FFKM, FEPM) products are heated to elevated temperatures, fumes will be produced which may give unpleasant effects, if inhaled. Whilst some fumes are emitted below 250°C from fluoroelastomers or below 300°C from PTFE, the effect at these temperatures is negligible. Care should be taken to avoid contaminating tobacco with particles of PTFE or fluoroelastomer, or with PTFE dispersion, which may remain on hands or clothing. Material Safety Data Sheets (MSDS) are available on request.

Information in this publication and otherwise supplied to users is based on our general experience and is given in good faith, but because of factors which are outside our knowledge and control and affect the use of products, no warranty is given or is to be implied with respect to such information. Unless governed by type approval or contract, specifications are subject to change without notice. Statements of operating limits quoted in this publication are not an indication that these values can be applied simultaneously.

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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