PREMIUM SOLUTIONS FOR NUCLEAR APPLICATIONS

Nuclear

Ingersoll Rand®

Enhancing Performance in the Nuclear Industry

As the world pursues sustainable energy solutions, nuclear power emerges as a key environmentally responsible option, driving the transition to net-zero emissions and supporting a more secure energy future. Ingersoll Rand offers a comprehensive portfolio of vacuum pumps, blowers, compressors and ejectors that play a critical role in optimizing nuclear operations and improving process efficiency.

Steam Cycle & Vacuum Management

Nuclear power generation depends on the controlled fission of uranium atoms to produce heat, which is then converted into steam to drive turbines. Ensuring optimal vacuum conditions in the condenser is crucial for maximizing turbine efficiency and preventing air from entering the system.

Mechanical Steam Recompression – EPR/PWR Process

The EPR (European Pressurized Reactor) is deployed in countries including France, Finland, the UK, and China. It advances nuclear technology with higher power output, enhanced efficiency, and state-of-the-art safety features.

Hibon exhausters are integrated into key systems such as the Coolant Storage and Treatment System (TEP), where they extract and compress steam (mechanical vapour compression) used to separate water from boric acid.

Steam recompression is also possible using special steam ejectors called Steam Thermocompressors. Where abundant motive steam is available, robust steam recompression is achieved with no moving parts or parasitic load.

Radioactive Wastes Removal and Handling Processes

Managing nuclear waste is essential for safe, sustainable energy. Modern treatment processes stabilize radioactive materials, secure them in engineered storage, and, when possible, recover reusable fuel through reprocessing.

Advanced vacuum, blower and ejector technologies ensure safe handling, protect the environment, and minimize risks, allowing nuclear power to remain a reliable, low-carbon energy source.

Gas/Helium cooled reactors and SMRs

Small Modular Reactors and High-Temperature Gas Reactors use inert gases—mainly helium, argon, or nitrogen—for cooling and shielding, making efficient recovery and purification essential for safe and reliable operation. Haskel provides key compression technologies that support gas recovery, purification, recirculation, and supercritical testing of nuclear components.

Transvac ejectors can also compress helium and other gases. As motive fluid the system can use Helium (requires higher pressure) or water (requires subsequent gas–liquid separation and drying).

Detailed Process Flow

Ingersoll Rand can serve Nuclear processes through all many of the steps of the Nuclear value chain.

Value

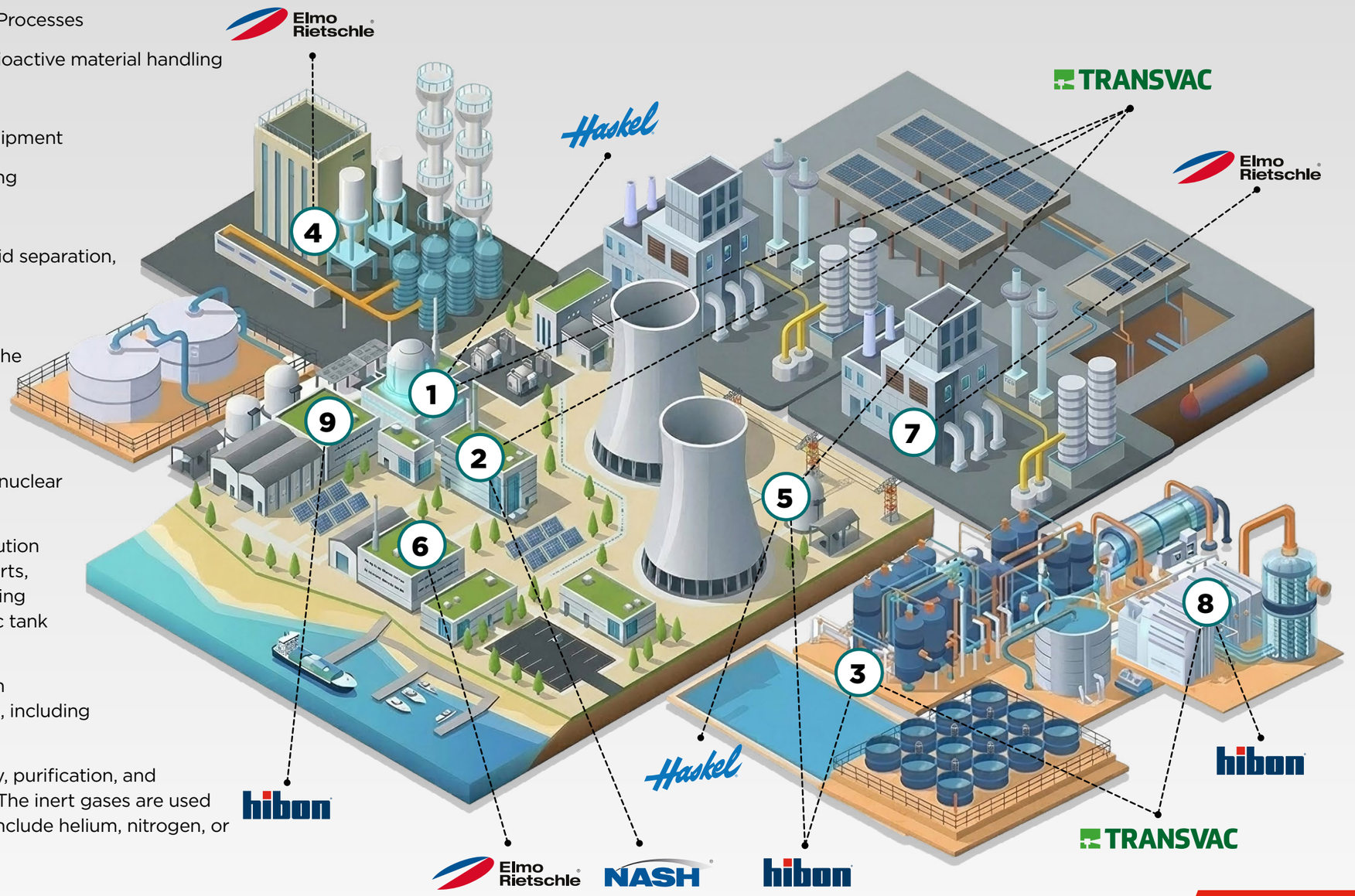
1. Nuclear Reactor Building - Jet pumps and gas coolant purification
2. Turbine building - Condenser aeration and evacuation
3. Radioactive Wastes/Slurry Removal and Handling Processes
4. Nuclear Fuel Cycle - Vacuum safety system for radioactive material handling
5. Small Modular Reactor
6. Conventional building - Breathing air to Geiger equipment
7. Nuclear Fuel Cycle - UF6 bottles cleaning and drying
8. Mechanical vapour recompression
9. Coolant Storage and Treatment building – Boric acid separation, auxiliary gas compression

Nash Liquid ring pumps sustain the vacuum needed in the main steam and condensate loop for efficient turbine performance, while **Hibon** blowers manage gas and vapor flows in auxiliary processes like wastewater treatment and steam recompression. These systems ensure reliable, safe, and low-maintenance operation in nuclear environments.

Transvac ejectors offer a durable, maintenance-free solution for pumping or mixing nuclear slurry with no moving parts, enabling dilution for transport and customizable jet-mixing designs—supported by CFD validation—to meet specific tank requirements.

Elmo Rietschle supports several vacuum systems within theRadioprotection and Nuclear Fuel Cycle applications, including UF6 bottles cleaning and drying.

Haskel's compression technology supports the recovery, purification, and recirculation of inert gases for Small Modular Reactors. The inert gases are used as a primary coolant or a shielding gas which typically include helium, nitrogen, or argon.



Comprehensive Nuclear Solutions

Ingersoll Rand's range of vacuum liquid ring pumps, exhausters, ejectors, vacuum pumps and boosters are carefully designed to serve the multifaceted needs of the Nuclear industry, ensuring optimal performance and durability.

In complying with some of highest standards of the industry, we guarantee you top level of:

- **Traceability of material**
- **Technical expertise**
- **Quality execution**
- **Nuclear Safety**
- **Performance validation including CFD simulation**
- **Follow up of equipment during plant lifetime**

	LIQUID RING VACUUM PUMPS (NASH)	EXHAUSTERS BLOWERS (hibon)	EJECTORS (TRANSVAC)	DRY VACUUM PUMPS (Elmo Rietschle)	HIGH-PRESSURE COMPRESSION TECHNOLOGY (Haskel)
STEAM CYCLE & VACUUM MANAGEMENT					
Condenser evacuation (condenser vacuum creation)	●		●		
Air removal					
RADIOACTIVE WASTES REMOVAL PROCESS					
Maintain Negative Pressure					
Containment		●	●		
Transfer of radio-active gases					
RADIOACTIVE WASTES HANDLING PROCESS					
Nuclear slurry handling (mixing, pumping, transfer, etc.)					
Nuclear tank mixing, agitation and fluidization			●	●	
Decommissioning and clean-up activities					
EPR/PWR PROCESSES					
Mechanical Steam Recompression		●	●		
SPECIALIZED AND GAS-COOLED REACTOR PROCESSES					
Gas recirculation / purification systems					
Auxiliary gas compression			●		●
Venting, purging or inerting applications					
RADIOPROTECION APPLICATIONS					
Breathing air to Geiger equipment				●	
NUCLEAR FUEL CYCLE					
UF6 bottles cleaning and drying					
Vacuum safety system for radioactive material handling				●	
SMALL MODULAR REACTORS APPLICATIONS	●	●	●		●

Ingersoll Rand features an additional extended portfolio of products for high pressure compression, gas treatment, fluid and slurry handling, maintenance agreement and IIOT solutions. This gives the opportunity to have a one-stop supplier for many kinds of nuclear installation.

Partner with Ingersoll Rand Engineered Solutions for Tailored ETO Expertise

At Ingersoll Rand, we deliver the most reliable Engineered-to-Order (ETO) solutions by prioritizing your specific needs at every step:

GLOBAL REACH
No matter where your project is, we deliver engineered systems to any corner of the world, backed by a commitment to excellence.

TECHNOLOGY FOR YOU
We select the most suitable and advanced technologies, customized to meet your precise specifications.

END-TO-END SUPPORT
From concept to installation, we offer innovative, safe, and meticulously engineered solutions, partners throughout the entire project lifecycle.

UNMATCHED EXPERTISE
With over 300 years of combined experience, we ensure reliable, repeatable quality on every project.

MULTI-BRAND EXPERTISE
Our portfolio of brands enables us to confidently manage even the most complex projects, providing a broad range of innovative solutions tailored to your needs.

GUARANTEED PERFORMANCE
Our in-house testing facilities ensures each design solution meets your highest standards for performance and quality. CFD simulation techniques including vibration analysis and erosion-performance lifetime prediction and validation studies.

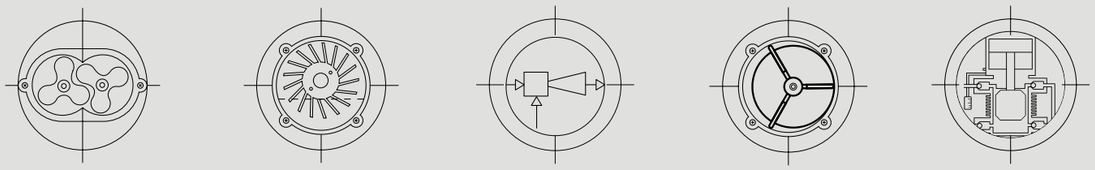
UNIQUE REQUIREMENTS
We take the time to fully understand your application through comprehensive research, ensuring the best-fit solution for your project. We can provide Pre-FEED and FEED technology integration planning and support backed up with process validation and qualification techniques.

Ingersoll Rand

Offering

Our offering of exhausters, liquid ring pumps, ejectors, vacuum and high-pressure booster solutions: a comprehensive portfolio of brands for nuclear applications.

Our Technologies



ROTARY LOBE | LIQUID RING | EJECTORS | ROTARY VANE | HIGH-PRESSURE BOOSTER

Our Brands

NASH | hibon | Haskel | TRANSVAC | Elmo Rietschle

NASH

Nuclear plants depend on controlled uranium fission to generate steam and drive turbines. Maintaining strong condenser vacuum is essential for efficiency and preventing air ingress. Nash liquid ring pumps provide:

- Stable vacuum
- Effective steam condensation
- Lower parasitic losses
- Safe radioactive off-gas handling

Nash systems are engineered for harsh nuclear environments, featuring ATEX-certified, leak-free designs that meet strict facility safety standards.

TRANSVAC

Ejectors (jet pumps/eductors) offer a simple, maintenance-free solution for mixing and pumping nuclear slurry. With no moving parts and optional abrasion-resistant construction, they are ideal for radioactive applications.

Using high-pressure motive liquid, they entrain and pump slurry to downstream processes such as dewatering. They can also dilute slurry, support tank jet mixing, and be customized per tank using CFD for performance validation, erosion modelling, and lifetime prediction.

In nuclear power plants, ejectors also provide condenser vacuum, air evacuation, gas compression (gas/gas or liquid/gas), and steam recovery via thermocompressors.

HIBON

Hibon pioneered rotary lobe blowers for third-generation PWRs (EPR). Their exhausters serve key systems like coolant storage/treatment (TEP) where they extract and compress steam from evaporation columns used to separate water from boric acid, and non-recycled Liquid Waste Processing System (TEU/LWPS), compressing vapors and handling radioactive waste streams to reduce contamination.

Compliant with RCCM/RCCE standards, Hibon units operate in next-generation plants (e.g., Flamanville, Hinkley Point). By maintaining negative pressure in cells and contaminated zones, they ensure safe ventilation, containment, and controlled gas transfer.

ELMO RIETSCHLE

Dry rotary vane and claw pumps support multiple nuclear processes:

- Radioprotection: air capture and sampling for monitoring purposes
- Site decontamination: cleanup before decommissioning
- Fuel cycle: cleaning/drying UF_6 cylinders
- Worker safety: emergency vacuum for gloveboxes at sites such as Cadarache and Orano

HASKEL

For 80 years, Haskel gas compression has supported mission-critical applications. In Small Modular Reactors, Haskel systems recover, purify, and recirculate inert gases. They already supply custom helium compressors for high-temperature-gascooled reactor projects in California.
Haskel solutions support:

- High-temperature-gas cooled reactors
- Liquid-metal cooled reactors
- Molten salt reactors

They compress, recover, and recirculate helium, argon, and nitrogen used as coolant or shielding gases.

Ingersoll Rand

RANGE

Operating range

We provide the broadest range of vacuum and compression technologies, delivering secure, compliant solutions designed for mission-critical reliability in nuclear environments.

TECHNOLOGY	VACUUM mbar(a)	FLOW RATE (m3/h)
Liquid Ring	33	39.000
Rotary Vane	0.5	1.300
Claw	30	1.000
Rotary Lobe	100	65.000
Ejector	Fully custom, based on motive fluid conditions	

TECHNOLOGY	PRESSURE bar(g)	FLOW RATE (m3/h)
Liquid Ring	15.0	10.000
Rotary Vane	17.0	3.000
Claw	2.0	500
Rotary Lobe	1.0	65.000
Ejector	Fully custom, based on motive fluid conditions	
Haskel gas compression	1034	1.062

ADVANCED SERVICE

Our dedication to excellence goes beyond delivering high-quality solutions. We recognize that continuous support is vital for maximizing uptime, maintaining reliability, and extending the longevity of your equipment. That's why we offer a range of advanced services, customized to address your specific needs:

- **Inventory Checks and Equipment Audits**
- **Pre-commissioning Activities**
- **Commissioning and Start-Up**
- **Genuine Spare Parts**
- **Preventive and Corrective Maintenance**
- **Material Traceability**

Partner

Your Partner in Nuclear Excellence

Ingersoll Rand is a trusted partner in the nuclear applications, renowned for our high-quality products and custom-engineered solutions.

Rigorous testing ensures that each product meets exacting standards, reflecting our dedication to quality and reliability. Working in close collaboration with customers, Ingersoll Rand develops tailored solutions that boost both the efficiency and sustainability of nuclear operations.

Ingersoll Rand's global footprint ensures that customers receive unparalleled service and expertise, no matter where you are. Choosing Ingersoll Rand means more than just purchasing a product; it's entering a partnership with a sustainable energy leader committed to improving the performance and environmental impact of nuclear operations.

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