



An Ingersoll Rand Business

COMPRESSORS & SYSTEMS FOR THE

# OIL & GAS Industry





# Proven Solutions. Unparalleled Expertise.

DELIVERING ROBUST & RELIABLE COMPRESSORS SINCE 1947.

For more than 70 years, Garo has been a global leader in liquid ring technology, providing:

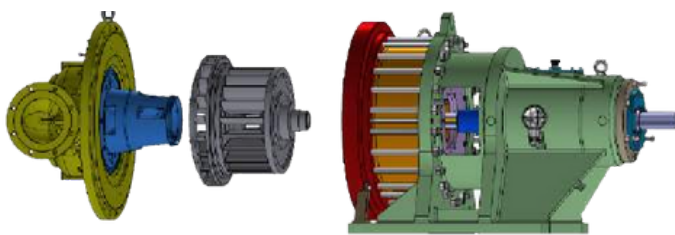
- Reliable compressors and systems to the global Oil & Gas industry
- Customized solutions designed to meet unique project specifications and customer requirements
- GARO CERTIFIED™ Service & Support built to deliver immediate solutions

Manufacturing compressors is the core of what we do, and assisting clients is our vocation. From the very first steps, we guide you to select the right equipment, system and solution for your process application.



# GARO® Liquid Ring Technology for Oil & Gas Applications

Garco offers reliable liquid ring compressors and systems for the most demanding Oil & Gas applications. Not only are we highly specialized and experienced in the most challenging applications, we are the leaders in high discharge pressure. We have proven experience in dealing efficiently with pressures up to 12 bar g (174 psig).

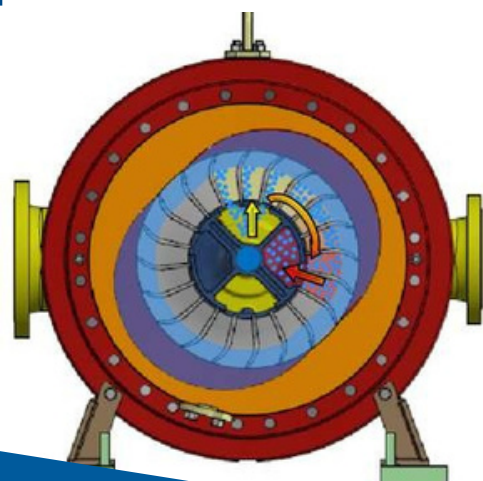


*Overhung Impeller Design*

- Highest Reliability - design life of 40+ years
- Reduced Maintenance - no internal lubricant
- Wear-free Performance - no metal to metal contact
- Minimal process upset - handles carryover even in severe applications
- Cool running - ideal for handling explosive gases, vapor recovery and other temperature-sensitive applications
- Near to isothermal compression
- Low maintenance and easy to service with an overhung impeller design
- Intrinsically safe
- Low working speed
- Low vibration and noise
- Oil-free service
- Available in standard and exotic materials

## Liquid Ring Working Principles

- Seal liquid is fed into the machine and, by centrifugal acceleration, forms a moving cylindrical ring, which takes the shape of the double lobe eccentric casing.
- This liquid ring creates a series of seals in the space between the impeller vanes forming compression chamber.
- The gas is fed into the machine by a distribution cone.
- Gas compression is achieved by the rotation of the impeller inside the seal liquid.



**API 681 COMPLIANT**

### QUALITY SUSTAINABLE SOLUTIONS

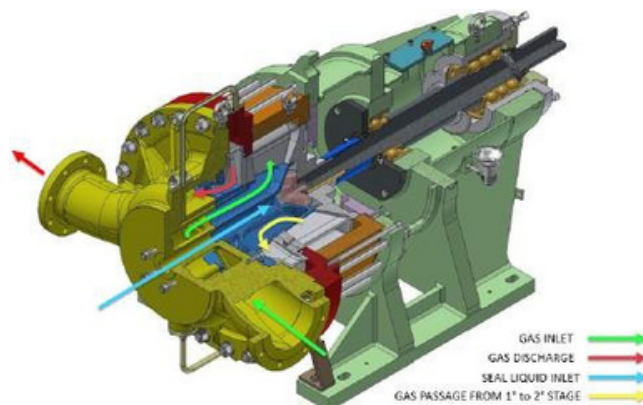
Garco is committed to providing sustainable solutions that help your company comply with environmental regulations while lowering total cost of ownership. Our products and systems reduce resource consumption & emissions, while operating reliably with minimal maintenance requirements. Together we build more sustainable and profitable oil & gas refineries and plants.

### API COMPLIANT

GARCO products comply with API 681 requirements. The isothermal compression characteristic of our compressors enable GARCO products to operate in cooler conditions compared to other technologies.

### ISO CERTIFICATIONS

In our ongoing effort to provide quality, sustainable solutions, our manufacturing & service facilities are ISO 9001:2015, ISO 14001:2015, and OHSAS 18001 certified.



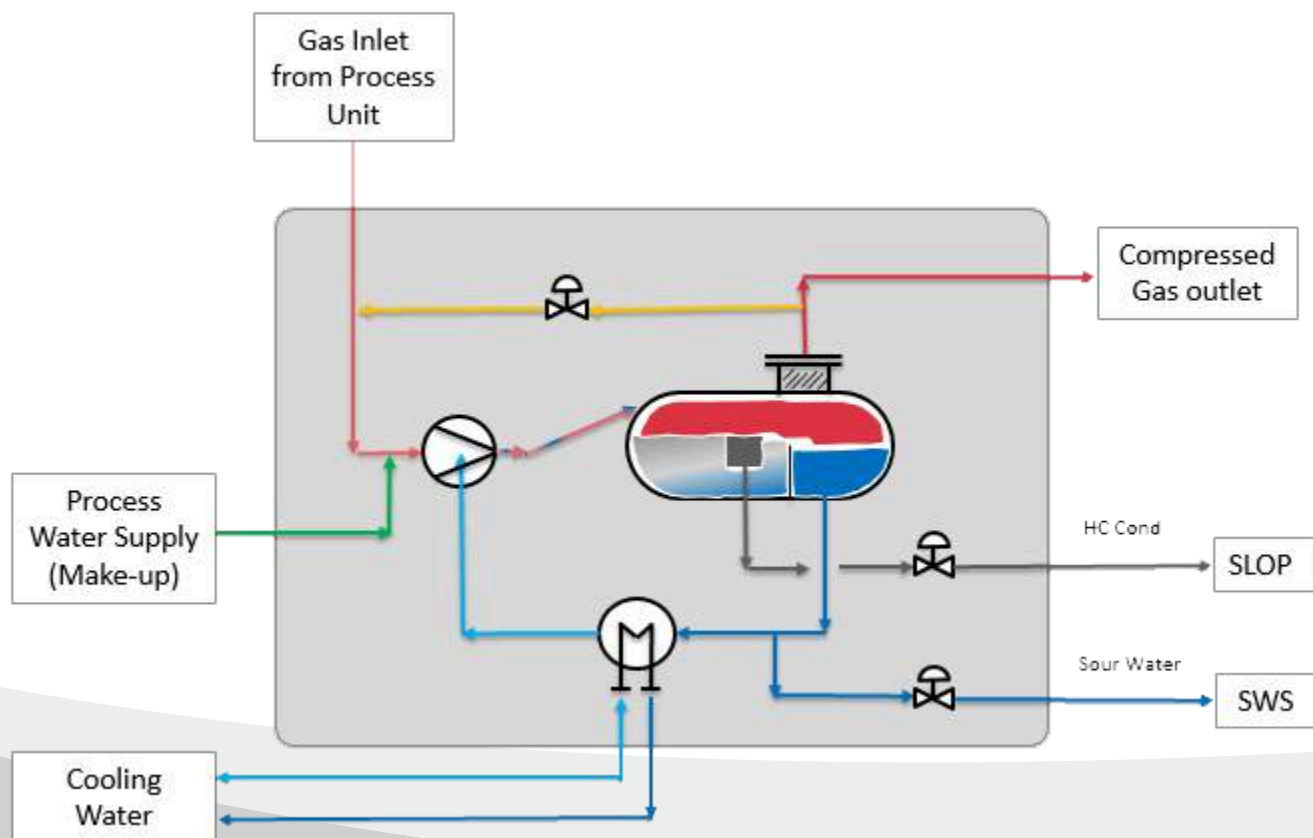


# Oil & Gas Application Expertise

GARO® has a history of reliable installations in oil & gas applications including:

	APPLICATIONS	EQUIPMENT
<b>OFFSHORE</b> -Platforms -FPSO	• Well Head Gas	• GARO Custom Designed Compression Package
	• Vent Gas Compression	
	• Flare Gas Recovery	• GARO Flare Gas Recovery Systems - FGRS
	• Vapor Recovery	• GARO Vapor Recovery Units - VRU
<b>UPSTREAM</b>	• Well Head Gas	• GARO Custom Designed Compression Package
<b>MIDSTREAM</b>	• Flare Gas Recovery	• GARO Flare Gas Recovery Systems - FGRS
	• Tank Vapor Recovery	• GARO Vapor Recovery Units - VRU
<b>DOWNSTREAM</b>	• Coker	• GARO Custom Designed Compression Package
	• Fluid Catalytic Cracking (FCC)	
	• Off Gas Recovery	
	• Vacuum Distillation	• GARO Vacuum Distillation Units - VDU
	• Gas Sweetening	• GARO WAIS Patented Amine Treating
	• Flare Gas Recovery	• GARO Flare Gas Recovery Systems - FGRS
		• GARO WAIS Patented Amine Treating

## Typical Oil & Gas Process Scheme



# GARO® Liquid Ring Compressors for Flare Gas Recovery

Key to the safe operation of refineries, FPSOs, or Offshore Platforms, Flare Gas Recovery (FGR) is the process of recovering and repurposing gasses and reducing emissions, such as carbon dioxide, methane/LPGs, hydrogen sulfide, and sulfur dioxide, which would normally be burned during the flaring process.

At a high level, the process involves capturing the gas from the flare knock-out vessel and recompressing it using liquid ring compressors. The compressed gas is then separated from the seal liquid and cycled back to the refineries fuel gas system.

## IMMEDIATE RESULTS

- **Near-zero flaring** reducing emissions, and giving environmental control with an immediate return on investment
- Flare operation limited to **emergency release** and scheduled maintenance
- Captured gas can be reused as **valuable fuel or feedstock**



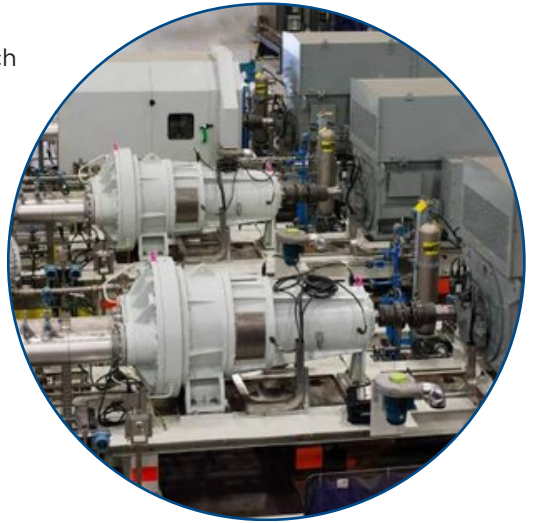
## BENEFITS

- **Lower Emissions:** Recovering waste hydrocarbons allows refineries to reduce the amount of toxic gases, such as hydrogen sulfide (H<sub>2</sub>S), which are burned and released into the environment during the flaring process.
- **Reduced Operating Costs:** Refineries can re-use recovered gasses, composed mainly of low molecular weight hydrocarbons (LPGs), resulting in a reduction in fuel gas cost for the facility.
- **Social & Environmental Responsibility:** Lowering CO<sub>2</sub> emissions generated by facilities not only help organizations meet environmental regulations, but also demonstrate an awareness and commitment to social responsibility, and build goodwill within the surrounding community.

# GARO® Liquid Ring Compressors for Vapor Recovery

A Vapor Recovery Unit (VRU) is an engineered compression package, which aims to lower emissions levels, while recovering valuable hydrocarbons to be sold or reused as fuel onsite. A package for vapor recovery can capture about 95% of Btu-rich vapors, generating many benefits, guaranteeing less air pollution, and recovering vapors to be used as fuel.

Garo is specialized in designing and engineering Tank Vapor Recovery Systems, using liquid ring compressors as the means of compression.



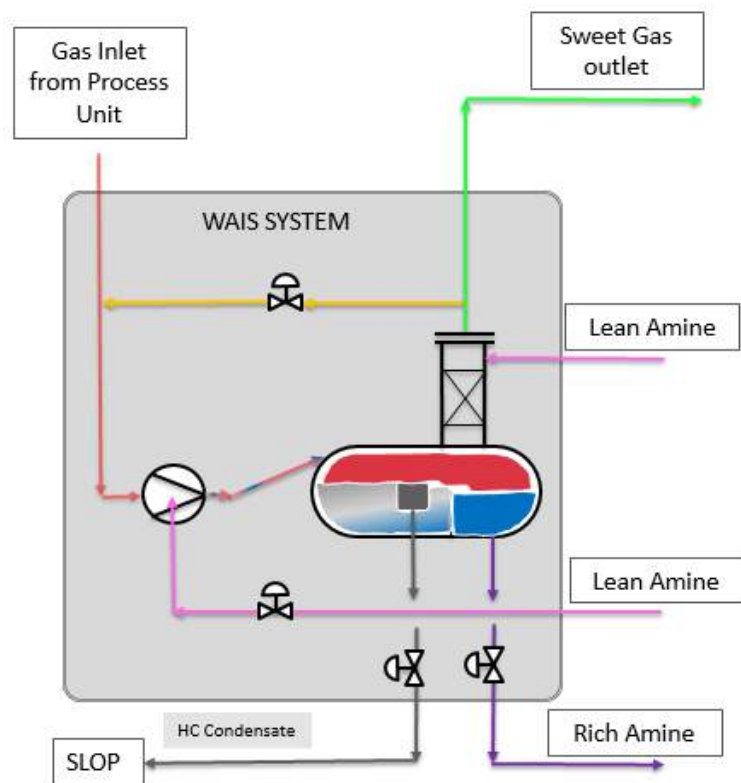
## GARO® WAIS

Garo's patented Washing Amine Integrated System (WAIS) uses amine solution as a service liquid in the compression phase of the Flare Gas Recovery.

Compared to traditional systems, WAIS simplifies the Flare Gas Recovery process by removing the need for a gas treating unit; in addition to the need for cooling and treatment water, while allowing the system to produce a sweet gas with a residual content of sulphur related compounds without the need to further scrub the gas. Closed loop system can be provided to minimize amine consumption.

### BENEFITS

- No SWS treatment
- No need for amine washing unit
- No cooling water
- No process water
- Reduced operating costs





# GARO® Customized & Packaged Solutions

Founded as a liquid ring compressor manufacturer in 1947, we quickly became experts in the engineering, configuration and design of custom packaged solutions. Every day we use our extensive knowledge of liquid ring technology to support customers throughout every step of the project: from the concept/FEED study to the start-up of the system. We also provide customer care and assistance on the long term basis through our global network of GARO CERTIFIED™ Service & Support.



1. From the concept & FEED study, we provide estimates and possible process reevaluation to help end-users and consultancy companies to choose the right technology.



5. Before the products leave our facility, we take all necessary tests, including, if required, a complete unit running test to demonstrate the full integrity of the compression package.



2. During the project definition with EPC, we sustain the clients in the choice and comprehension of the best solutions. We are not suppliers; we are part of your team.



6. GARO Service & Support not only takes care of the erection, commissioning and start-up supervision of the system, but also trains the customer how to run the package.



3. In the detailed engineering phase, our qualified engineers design customized systems based on project requirements, to create a tailor made product.



7. We never forget our customers after the sale phase: guarantees and warranties are always included. Moreover, GARO Service & Support is always ready to help you to protect your investment by maintaining performance and reliability.



4. We take care of the package manufacturing choosing only the best suppliers and providing scrupulous quality controls.



# Garó Products & Systems



## GARO® Liquid Ring Compressors

GARO Liquid Ring Compressors are ideal for demanding process applications in petroleum refining and chemical plants and reach pressures up to 12 Bar g (174 psig).



## GARO® Centrifugal Compressors

GARO Centrifugal Compressors are custom designed for special applications that handling critical gases. GARO Centrifugal Compressors reach pressures from 1 up to 12 Bar g.



## GARO® Packaged Solutions

Every industry has unique challenges - and Garo is ready to solve them. Our customized package solutions offer complete systems designs, built around reliable GARO liquid ring technology.



## GARO® Service & Support

Our team of factory-trained technicians, global service centers, and available inventory of OEM parts are available to restore performance and efficiency



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