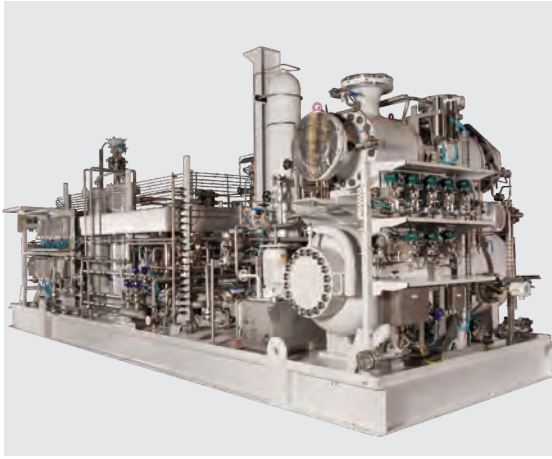
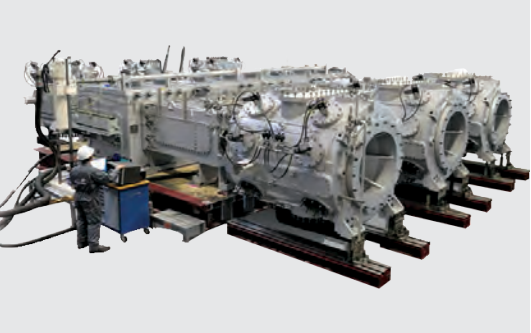
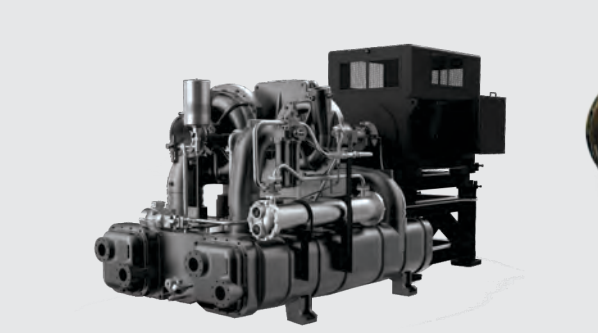


Havayar Turbo Machinery

Always Try The Best



Our Business

Havayar as a pioneer in the design and manufacture of rotary equipment, with more than 20 years' experience in Iranian industry market has strategy to develop the products and services market, in a method that the quality of the product promotes simultaneously. Honesty, respect, security, and order are the Havayar's organizational codes of behavior. We also make our best efforts by doing our social responsibilities to turn into a good sample in the country.

Our machinery in continuous operation anywhere with full 100% service and high efficiency.

Our Products has been registered on below vendor list:

NPC, NIGC, NIOEC, POGC, NISOC, MOP and etc

Integrally Geared Compressor

1

Single Shaft Centrifugal Compressor

2

Reciprocating Compressor

3

Turbo Expander

4

Screw Compressor

5

Our Responsibility

We design and manufacture all major compressor technologies, so can give impartial advice on their suitability for specific situations.

We take a systems approach and have amassed considerable expertise in virtually every compressor application, enabling us to alert customers to issues and avoid pitfalls.

We offer an unequivocal commitment to support, spares and service for the lifetime of every compressor we sell.

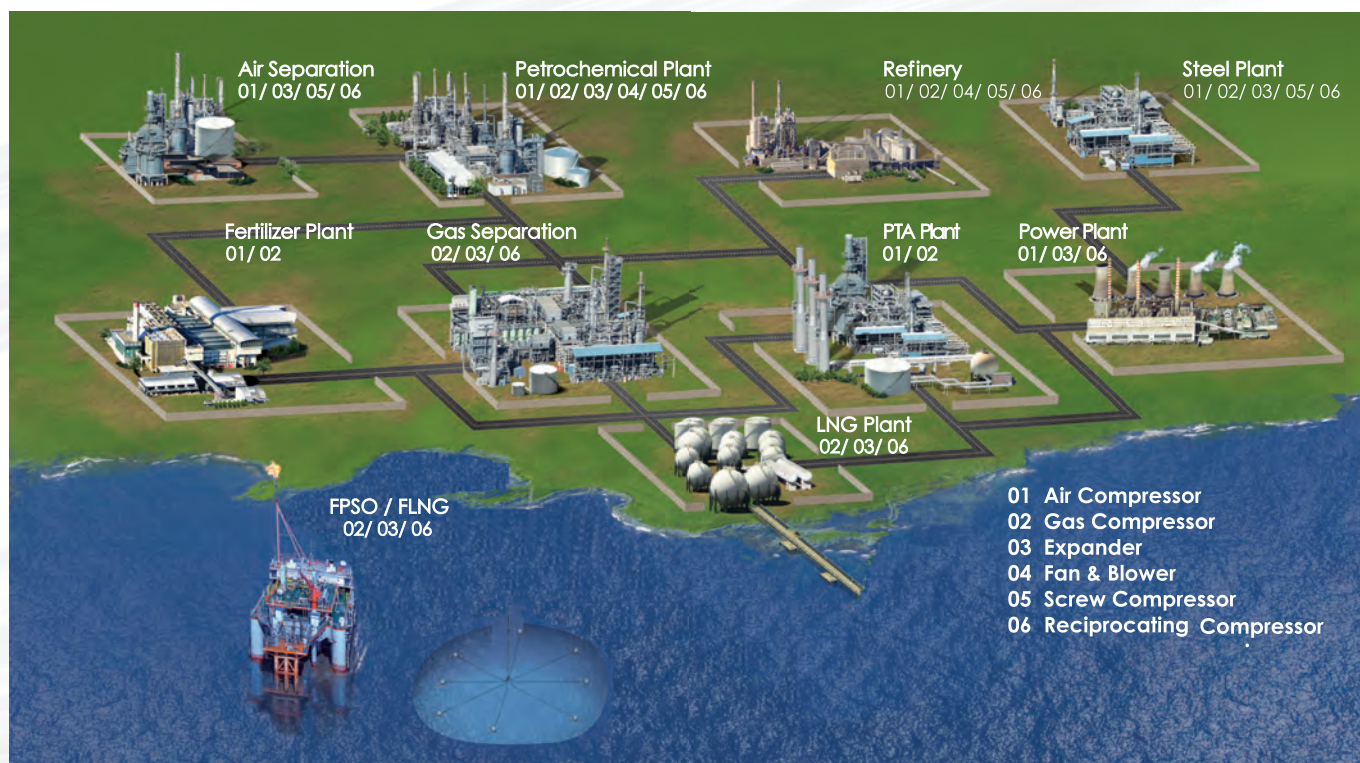
Our others of providing the best possible lifetime value, introducing new technology through retrofit and enhancements where appropriate, offers security and pace of mind.







Our Vision Values

- Innovate
- Take up challenges
- Have a passion for excellence
- Be generous in what we do
- Respect and empower our people
- Act with integrity

Applications & Solutions

With more than a century of applications experience and a range that covers every major technology, we can advise on, design and supply the right range of compressor for virtually any situation.



Market	Application	 Air Compressor (API672)	 Gas compressor (API617)	 Expander (API617)	 Fan, Blower (API673)	 Screw (API619)	 Reciprocating (API618)
Upstream / Offshore	Flash Gas, LP, MP		•				
	Vapor Recovery		•			•	
Oil Refinery	Instrument Air	•				•	
	Make-up, Recycle, Booster (H ₂ , Wet)		•				•
	Process Air	•	•			•	
	Instrument Air	•				•	•
	Hydrogen Reformer				•		•
LNG	Sulfur Recovery				•		
	Boil Off Gas (Terminal, LNG Plant)		•				•
	High Pressure Terminal		•				
	Low/ High duty (LNGC, LNG FPSO)		•				
Petro-chemical	Thermal Oxider Air Blower				•		
	Recycle, Booster (PE, PP)		•				•
	Refrigeration (Propane, Propylene)		•	•		•	
	PTA	•	•	•			
	Boil Off Gas		•				•
Power Plant	Instrument Air	•				•	•
	Fuel Gas Booster		•				•
	N ₂ booster (IGCC)		•				•
	Syngas		•				
Air Separation	Main Air	•	•			•	•
	Booster Air or N ₂		•				•
	Cryogenic Expansion			•			
Fertilizer / Gas Processing	Process Air	•	•			•	
	Process Gas (NG, NH ₃ , Co ₂)		•				•
	N ₂ Booster		•				•
	Instrument Air	•					•
	Urea Plant		•			•	•
Others	NGL	•	•	•			•
	Mechanical Vapor Recompression		•				

Integrally Geared Centrifugal Compressors

API 672 , 617

1

A wide range of centrifugal compressors according to **API 617** and **API 672** are supplied. These compressors with high degree of reliability and low maintenance cost are used in petrochemical and refinery industries, natural gas, steel and cement plants, food industries as well as transportation.

Our centrifugal compressors could be supplied with electro motors as well as turbines, equipped with complex control systems in order to meet projects requirements in various pressures, capacities and powers.

International Spec: Compliance with API617, API672, API614

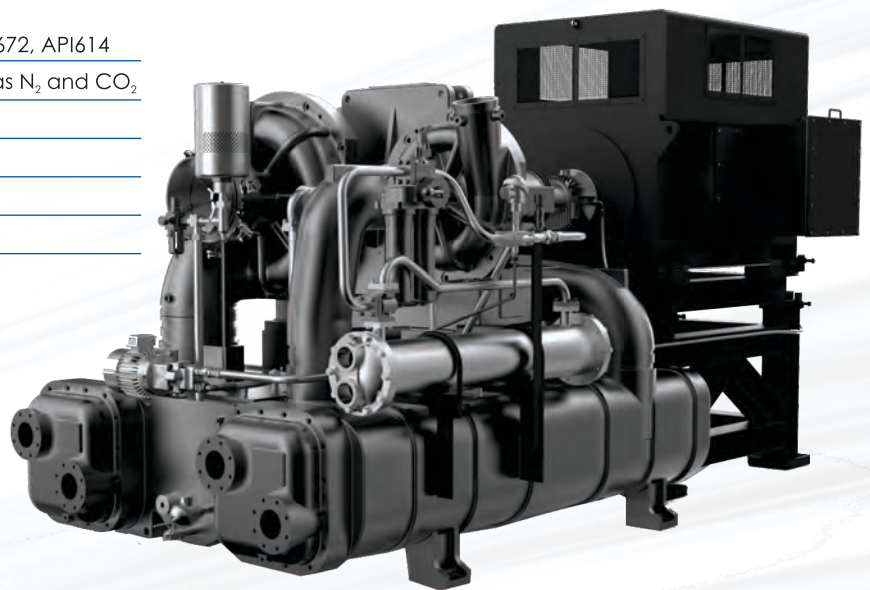
Gases: Air, Hydrocarbons and other gases such as N₂ and CO₂

Stage: Single and multi-stage (1–6 stages)

Range: up to 550,000 m³/h, 75bar

Power: up to 20 MW

Drive: Turbine/ Electromotor



Key Technical Features

Master Impellers & Inlet Guide Vanes

The master impellers are conceptual parent impellers from which various child impellers can be produced using aerodynamic scaling techniques.

- Allows for scaling design over a range of size and applications
- Realize high efficiency, state-of-the-art performance.

Inlet guide vanes (or Variable Geometry Diffuser) offer a wide operating range and excellent part load performance.



High Reliability Bearing & Seals

5 Tilting pad journal bearing for high speed pinion, sleeve journal and taper land thrust combined bearing for bull shaft. Thrust collars on pinion gear are designed to manage thrust loads and provide high reliability in a variety of applications.

The type of seal (Labyrinth/ Carbon Ring/ Dry gas Seal) applied depends upon the process requirements.

Key Design Features

- Designed to API code requirements as well as customer specifications
- Completely packaged, self-contained water to air cooling circuit
- The use of water-cooled heat exchangers and closed-circuit water to air cooling system
- Maintain high efficiency for operating economy
- Meet client's recognized high standard of design and engineering
- Low noise level of core design to allow uninterrupted access to the full skid without using sound canopy

Single-Shaft, Multi-Stage Centrifugal Compressors

2

API 617

From standard processes to high-pressure applications, our single-shaft compressors are the ideal solution for a wide range of industries and process applications. They are designed to customer specifications and **API 617** standards. Compression solutions can be supplied in a variety of configurations from skid mounted, combining the compressor with its driver and auxiliaries, to single lift process modules where we can fully integrate compressors, drivers and process equipment such as coolers, scrubbers, separators, piping, and wiring.

International Spec: Compliance with API617, API614

Mass flow: Up to 300,000 m³/h

Discharge pressure: Up to 150 bar(a)

Power input: Up to 25 MW

Drive: Turbine/ Electromotor



Key Technical Features

Horizontal split centrifugal compressor

Multiple impellers are attached to a single rotating shaft, for a multi-stage structure. The gas enters through the intake nozzle, and is compressed and pressurized by centrifugal force as it passes through the impellers, which are rotating at high speed, before being ejected through the ejection nozzle. With this type of compressor, the outer casing can be split in the horizontal direction, facilitating the maintenance of internal parts. The red parts are the critical shaft and impellers.



Vertical split centrifugal compressor

With this type of compressor, the outer casing is a single continuous cylinder, for a structure which is capable of withstanding high pressures of approximately 50 – 700 barg, or 1000 barg in trials. The internal bundle (diaphragm and shaft) can be pulled out in the axial direction for maintenance.



Key Design Features

Features

- Dry gas sealing systems
- Up to four process stages
- Up to 10 impellers per casing
- Ultra-low temperature service
- Intercooling, side streams & extractions
- Optional adjustable inlet guide vanes (IGV)
- Standard oil lubricated or active magnetic bearings

Applications

- On- and offshore oil and gas Plant
- Natural gas distribution & storage
- Liquefied natural gas (LNG)
- Petrochemicals
- Olefins and PDH
- Refineries
- Methanol

Reciprocating Compressors

API 618

Reciprocating compressors are the most widely used compressors in petrochemical complexes, refineries, natural gas and design base on **API 618** standard with two types of oil free and lubricated compressors.

API STANDARD 618

All compressors have been design accordance to API standard 618, the latest edition, recommendation. They also comply with many guidelines and international construction codes and customer requirements in customers.

International Spec: Compliance with API 618

Gases: Hydrocarbons, Syngas, H₂S & others (Air, CO₂, N₂, O₂, Ar)

Stage: Single & multi-stage with Scrubber & Inter After Coolers

Range: up to 450,000 m³/h, 600bar

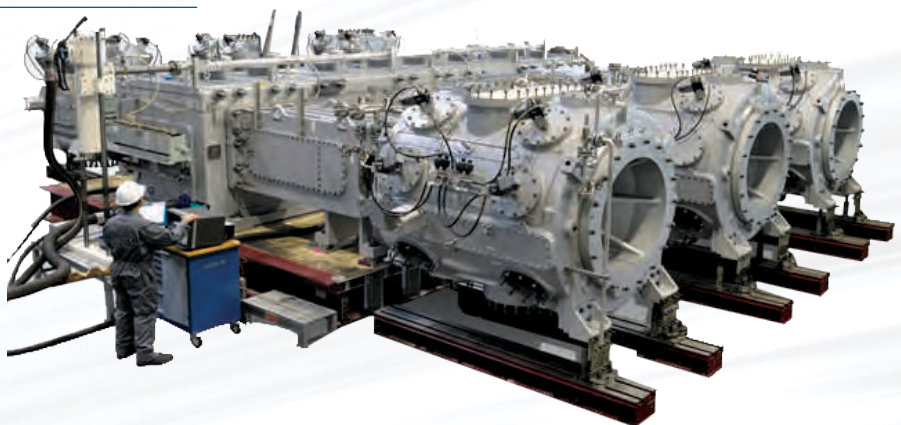
Power: up to 2 MW

Rigid Construction

The compressor crankcase is of the rigid type construction, and spacer blocks and cylinders are strongly bolted each other and auxiliary pressure vessels and heat exchanger are designed and locked strong angel and supported.

Minimized Vibration

The arrangement of compressor cylinders arranged on opposite sides of the crankshaft provides for mutual balancing of the reciprocation inertia forces, to ensure minimized vibration generated by the reciprocating masses.



Key Technical Features

CRANK SHAFT

The crank shaft designed without bearing between the opposed crank throws, which are moment applying on the shaft. The shaft is rugged one-piece forged steel.



CONNECTING ROD

The forged steel connecting rods are also subjected to ultrasonic and magna-flux inspections. The big end bolts are of high tensile steel with polished stem.



PISTON & PISTON ROD

Piston/rider rings of highly wear resistant filled teflon permitting no lube oil are provided to ensure correct straight-line motion of the piston.



VALVES

For non-lubricated, the suction and discharge valves which determine the compressor performance operate with disc valve plates entirely devoid of any sliding part.

For lubricated, the sliding valve plate is guided by a uniquely arranged center collar.



Key Design Features

NON-LUBRICATED TECHNOLOGY

The customer may require non-lubricated compressors where no lube oil is allowed in the process gas for reasons of taste, catalyst fouling or risk of explosion. PTFE (Polytetrafluoroethylene) is used for piston/rider rings, and also for the piston rod packings.

HydroCOM Capacity Control

HydroCOM Capacity Control follows an intelligent concept: just the required amount of gas needed is being compressed (stable stepless control over a broad control range from (0) 10%* to 100%)

Turbo Expander Process Gas/Air

API 617

4

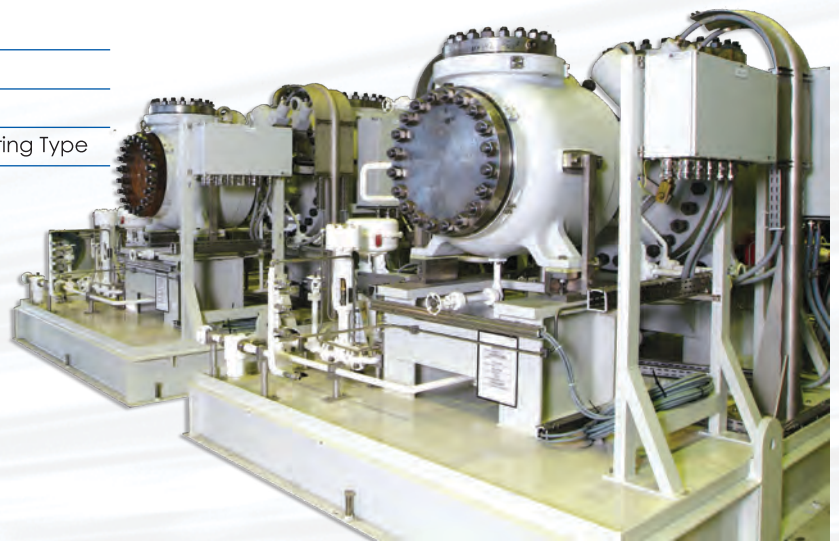
Turbo-expanders, also referred to as expansion turbines, provide a way to capture the energy lost in several industries. Turbo-expanders have a range of applications, but this template focuses on the use of turbo expanders for energy recovery and power generation. Virtually any high-temperature or high-pressure gas is a potential resource for energy recovery.

International Spec: Compliance with API617

Gases: Air, Hydrocarbons and other gas

Power: up to 10 MW

Configuration: Oil lubricated/ Active Magnetic Bearing Type



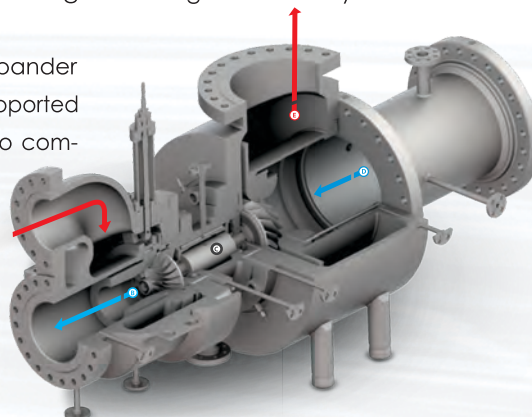
How Turbo Expander Works?

Expander Side

- A** Gas enters through inlet guides vanes creating initial pressure drop and high-velocity vortex.
- B** Additional expansion takes place in expander wheel. A conical defuser is often used to recover remaining velocity.
- C** Extracted power from the expander is transmitted through rotor, supported by oil or magnetic bearings to compressor wheel

Compressor Side

- D** Process gas enters the compressor where the pressure and temperature are raised by the compressor wheel.
- E** Process gas exits the wheel through a vaneless diffuser for enhanced operating range and reliability.



Main Parts

- Variable Inlet Guide Vanes (IGV)
- Wheels
- Shaft
- Sealing
- Bearing
- Labyrinth Seal
- Floating Carbon Seal
- Dry Gas seal
- Oil Seal
- Bearing
- Lub Oil System (for oil lubricated mechanical)
- AMB Panel (for magnetic type machine)
- UCP

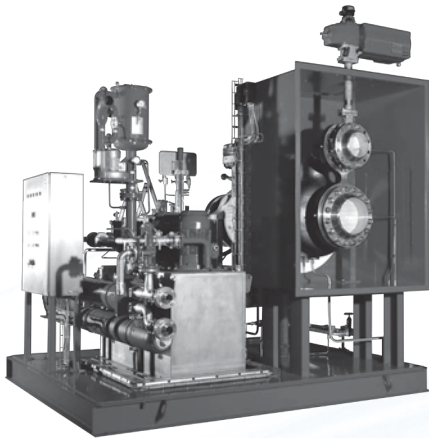
Turbo Expander Process Gas/Air

API 617

Industrial Gas

These types of expander, uses in Air Separation Unit (ASU) with low distillation temperature allowing the bulk production of O₂, N₂ and Ar. Types are as below

- Expander with Oil brake
- Expander with Compressor brake
- Expander with Generator brake



Oil and Gas

Customer-engineered solutions for the oil and gas industry are designed to meet a wide variety of customer requirements and provide many years of reliable service.

Applications:

- Liquefied Petroleum Gas (LPG)
- Natural Gas Liquid (NGL)
- Dew-point Control (DPC)
- Liquefied Natural Gas (LNG)
- FPSO - FLNG
- Regasification
- Nitrogen rejection

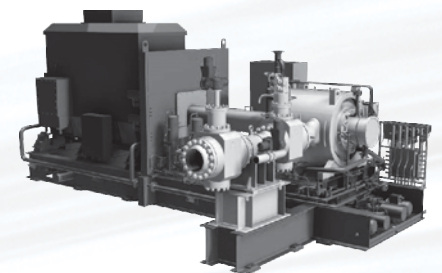


Energy Recovery

Driven by our integral-gear expertise, our turbo expanders can be configured with one to four stages on a single gear-box to achieve the lowest cost- per-kilowatt power-train solution. Power generation reaches up to 10 per unit.

Application:

- Geothermal
- Organic Rankine Cycle
- Kalina Cycle
- Pressure letdown
- Heat recovery
- Waste-heat recovery

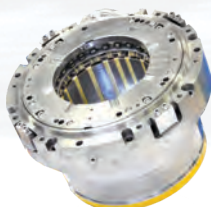


Key Technical Features

Active Magnetic Bearings

Active Magnetic Bearings (no oil system) Compressor loaded Expander customized to fulfill customers' requirements in terms of standards: API standards, local standards or customers' best practice standard can be applied when requested.

- No risk of process contamination by oil
- Elimination of vibration: the active bearings cancel synchronous vibrations by letting the shaft free to rotate around its inertia axis.
- No maintenance concept



Oil Bearing

We offer horizontally-split, high-speed pinion bearings featuring five self-centering pads that ensure stable radiation. Horizontally-split bearings are especially easy to inspect and maintain.

Tilting-pad bearings, which are used on high-speed shafts, and sleeve bearings, used on low-speed shafts, ensure reliable performance, efficiency and optimal speeds for each process.



AMB Machines Parts

- AMB Cartridge
Equipped with Radial and Axial Bearing
- Auxiliary Landing Bearing
- Control Loop
AMB control panel is equipped with a 14kHz digital control unit, 5 axis amplifiers, 3 x 50 % AC / DC convertes

MB Scope of Software

- Live Monitoring / Snapshots
- Date logging
- Advance Graphics

Gas Screw Compressors

API 619

5

Screw gas compressors according to **API 619** standard are designed especially for the high safety requirements of gas compression and process cooling in the chemical, oil and gas industries. These compressors can be equipped with cast steel casings, maintenance-free tilting-pad thrust bearings, and double shaft seals. Rotor position and sleeve bearing temperature monitoring systems ensure enhanced operational reliability.

International Spec: Compliance with API 619

Flow rate: Up to 24,000 m³/hr (20.5 mmScfd)

Pressures: Up to 15 bar a (218 psia)

Power: Up to 4,000 kW (5,364 hp)

Speed: Up to 5,000 rpm



Key Technical Features

They are designed for the compression of natural and synthetic refrigerants in process cooling as well as for the compression of process gases. Further applications are the compression of natural gas and gas mixtures: e.g., as compression stations in natural gas and biogas plants.

Gases with low molecular weight:

A screw compressor is a positive displacement compressor and, therefore, ideal for handling light hydrogen gases. The problem of an increasing number of stages required for low molecular weight -as is the case with centrifugal compressors- does not apply to screw compressors.

Gases with varying molecular weight:

As molecular weight has only a small impact on the achievable pressure ratio-different to centrifugal compressors-the screw compressor is ideal for use in processes with fluctuating molecular weights.

Dirty and polymerizing gases:

Screw compressors have low rotor tip speeds and a very rigid rotor and casing design. They can even handle dirty and dusty gases.

Key Design Features

Process gas screw compressor systems are custom designed for process-critical applications. We produce a range of oil injected units as skid-mounted packages which offer a number of advantages a cross orange of applications that demand high efficiency and high discharge pressures.

Also we offer oil free screw compressors as bespoke designed, complete packaged systems. Oil free screw compressor are capable of handling gases with high levels of liquid or particulate matter, and are eminently suitable for hazardous gases or in applications where contamination is an issue.

EPC Project

Havayar has since taken major steps to become capable of rendering a complete range of EPC services in our products of all industries. Today Havayar incorporated with the sole objective of having an active and comprehensive works, training of customers personnel, warranty and post warranty service and at the end maintenance, overhaul and revamping and spare part service. We have achieved and intend to keep this position with the help of employing high caliber professional staff, utilizing state of-the-art technologies and striving rigorously to render excellent services to our clients.

Engineering

Havayar includes certified and expert engineers to design, prepare and submit technical documents based on international standards.

Activities: Feasibility Study, Conceptual Design, Basic Design Front End Engineering & Design (FEED) Detail Engineering Field Engineering Services (FES).

Procurement

Construction team is basically responsible for defining and monitoring the construction works execution procedures, quality standards and quantity measurement requirements as well as defining HSE requirements. For construction Contracts sub-contracted, Construction team mobilizes/ hires and assigns qualified people for implementing the Construction Management tasks (in distinction from the Site Management that oversees not only Construction per se but also material receiving/control/issue, HSE, Field Engineering, QA/QC, Site Administration, Planning and Control, Pre-com./Commissioning).



Construction

Havayar procurement team within HY Iran Office and affiliated Offices will carry out procurement of goods services for a Project, supervising all phases of activities such as: solicitation of quotation, purchase order, expediting, inspection and shipping.



After Sales Services

- Installation, Commissioning and startup
- Overhaul & Emergency Repair
- Inspection & Maintenance
- Supply of Spare Parts



Installation, Commissioning and Startup

Our goal is to ensure that your new machine is working perfectly. We monitor the installation of your compressors. However, even more important than this is professional commissioning. That is why you should place your trust in our trained and experienced service engineers from the very start. After all, they know what is important during commissioning. This enables you to achieve a performance-oriented machine function in continuous operation.

Inspection & Maintenance

Compressors always have to give their best performance. Who could take better care of your Havayar compressors than our service technicians?

We offer one-time or recurring maintenance. Maintenance contracts with individually agreed terms and conditions, maintenance intervals and revision periods for your system have proven useful. We make any necessary adjustments and replacements to wearing parts on schedule in order to increase the operational safety of your system.



Repair & Overhaul

In our modern manufacturing plant, we repair or overhaul your compressors, bearings, couplings, wheels, casing and etc. as required. With cutting-edge technology, our experienced professionals make sure your machine is returned to a safe operating condition.

Joint planning thereby ensures fast, timely handling. You need repairs or professional maintenance?

Get in touch with us!

Spare Parts

The availability of your machines is influenced significantly by the quality of the components used. Benefit from Havayar original parts. This provides you with maximum performance and service life.

We guarantee the ability to deliver spare parts for our machines and equipment for decades to come. We supply the original parts you need quickly and reliably.

Call us: we will also be happy to advise you on a demand-oriented and reliable provision of spare parts.

HAVAYAR

Industrial Group

We believe that partnership and transparency is the best and shortest path to customer satisfaction.

Head Office: Havayar Bldg, No. 12, 14th St. (Gandhi St.), Before Vanak Sq., Tehran, Iran
Tel.: +98(21) 88202424 Fax.: +98(21) 88202425
Ext.: 1510

Factory: Havayar Factory, West 5th Golestan St., Baharestan Industrial Complex, 5th Km of Karaj-Qazvin Freeway, Karaj, Iran.
Tel.: +98(26) 34760145-151

www.havayar.com

