OIL-FREE ROTARY-LOBE GAS COMPRESSORS

- GAS BLOWERS
- VACUUM BOOSTERS
- API 619 COMPLIANT
- TURNKEY CUSTOM PACKAGES

Your plant needs Roots...

COMPANY OVERVIEW

Roots Systems is the world's leading manufacturer of gas blower and vacuum booster packages for process industries, using **DURAGAS** API 619 rotary-lobe gas compressors, which are manufactured in our UK factory.

The rotary-lobe compressor is a type of rotary positive displacement compressor, commonly known as a 'roots-type' blower. It is named after brothers Philander Higley Roots and Frances Marion Roots, who brought Isaiah Davies' invention into practical use.

HISTORY

The company's origins can be traced back to the 1930s when one of the early manufacturers of roots-type machines located near Stonehouse in the UK was designing and supplying rotary-lobe machines, particularly to the gas industry.

Following a major re-organization, a team of engineers with many years' experience in blower design and application formed Roots Systems Ltd in 1974 to meet growing demand. Based on original proven designs and with new innovative ideas, the company was soon supplying rotary-lobe compressor packages to many process industries.

In June 1984, Roots Systems Ltd was purchased by Rotolok (Holdings) Ltd and, whilst continuing to operate independently, now has the substantial financial backing of this large engineering group of companies.

THE HISTORY OF ROOTS SYSTEMS

1930
George Waller & Sons

1972
Bryan Donkin

1974
Roots Systems

1984
Acquisition by Rotolok Group

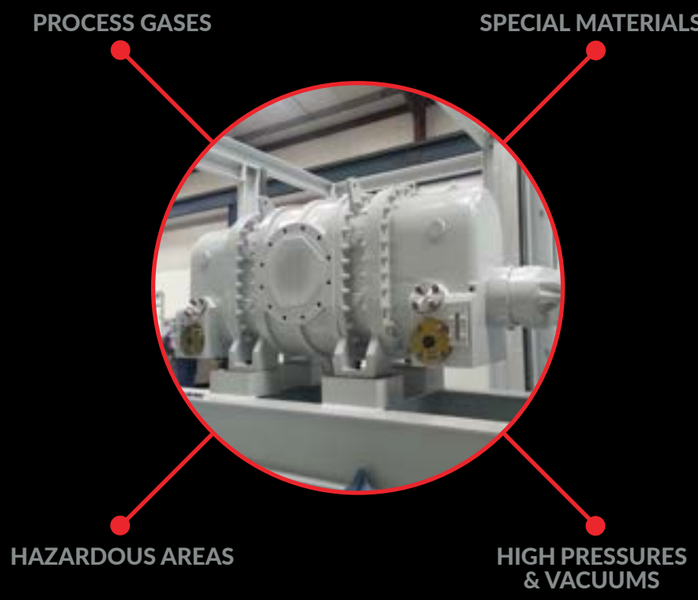
TYPICAL APPLICATIONS

- Air Scouring
- Chemical and Petrochemical Production
  - Production of commodity chemicals (ammonia; chlorine; ethylene; methanol; phenol)
  - Production of fertiliser
  - Production of industrial gases (acetylene; argon; carbon dioxide; helium; hydrogen; nitrogen; oxygen)
    - Vacuum Swing Adsorption (VSA)
    - Pressure Swing Adsorption (PSA)
  - Production of petrochemicals (fuel oil; sulphur; synthetic natural gas; triethylene glycol (TEG); urea formaldehyde; sulphur dioxide; sulphuric acid; wax)
- Drying
- Inert Gas Conveying
- Purging
- Gas and Vapour Recovery
  - Boil-off recovery
  - Mechanical vapour recovery
  - Off-gas recovery
    - Carbon capture
    - Flare-gas recovery
  - Vapour transfer
    - Blanketing (Offshore Tanker Loading)
    - Vapour Transfer Assist (Onshore Tanker Loading and Unloading)
  - Vent gas recovery
- Regeneration of Adsorbent Materials
  - Catalyst regeneration
  - Molecular sieve regeneration
  - Start-up
  - Vacuum boosting
- Stripping
- Energy Storage

PRINCIPLE AREAS OF EXPERTISE

1. Our oil-free DURAGAS machines comply with API Standard 619 and can handle corrosive, flammable, radioactive and toxic gases for process applications both onshore and offshore. Depending on the gas composition and process conditions, various seal system options are available to ensure these machines are gas-tight.

2. We offer a wide range of materials and paint systems which we can recommend according to the corrosiveness of both the process gas and the surrounding atmosphere, combined with your operating temperatures and pressures.



3. We can supply equipment that conforms to the Equipment for Explosive Atmospheres Directive (ATEX), ANSI/NFPA 70 'National Electrical Code', CSA C22 'Canadian Electrical Code' or the IECEx System.

4. We can manufacture machines that can operate at high vacuums, high pressures and high differential pressures.

THE DURAGAS SERIES

OIL FREE
Our DURAGAS machines are splash lubricated as standard but include a wide 'interspace' between the inner gas seals and the bearing lube oil seals. This acts as a catch pot, preventing lube oil from migrating into the process gas stream.

API STANDARD 619
Roots Systems is one of the few manufacturers of rotary-lobe gas compressors in the world that comply with API Standard 619, making our DURAGAS series the first choice for the petrochemical, oil and gas industries, both onshore and offshore.

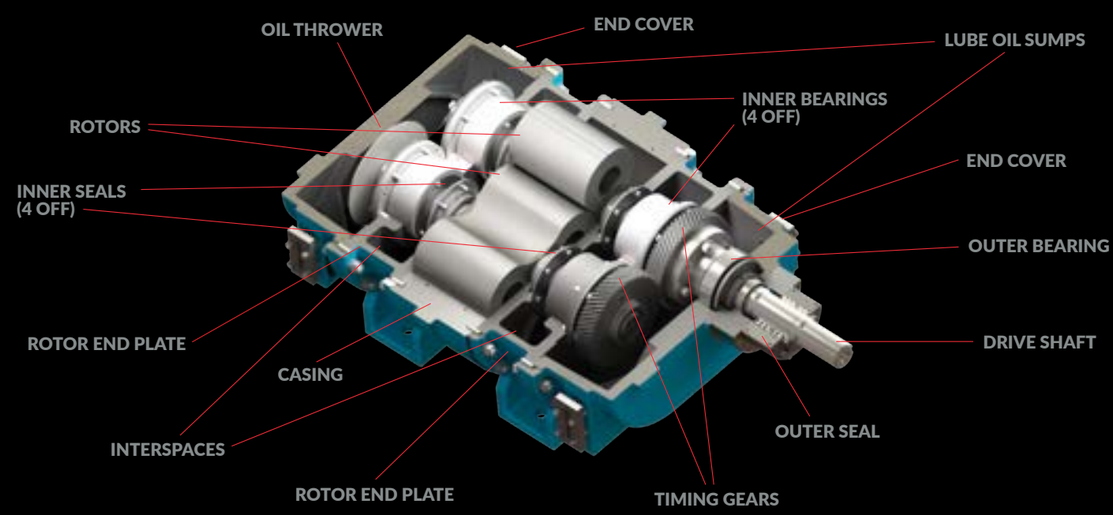
WIDE FLOW RANGE
The DURAGAS series covers a range of flows from 3 to 30 000 cfm (5 to 50 000 m^3/h).

HIGH PRESSURES
DURAGAS machines can operate at elevated inlet pressures up to 5300 psi (365 bar).

HIGH VACUUMS
DURAGAS machines can operate at inlet pressures down to a fraction of a torr (a fraction of a millibar) absolute.

HIGH DIFFERENTIAL PRESSURES
DURAGAS machines can handle differential pressures up to 65 psi (4.5 bar) in a single stage. We supply multi-stage packages for higher differential pressures.

SPLASH LUBRICATED
Our DURAGAS machines are splash lubricated as standard and we can employ API 614 compliant lube oil system as required.



GASES AND VAPORS HANDLED

Our DURAGAS machines can handle any gas, on request. Types of gases handled are shown below.

- Acidic / Sour
- Boil off from liquids (e.g. LNG or LPG)
- Commodity Chemicals
- Corrosive
- Flammable / Potentially Explosive
- Fuel Gases
- Hydrocarbon (Organic)
- Industrial Gases
- Inert
- Inorganic (non-hydrocarbon)
- Low Density
- Low Temperature
- Oxidizing
- Radioactive
- Reducing
- Refrigerants
- Toxic
- Volatile Organic Compounds (VOC)

Fully Hastelloy Wetted Parts Compressor Package

Regeneration Gas Compressor Package

HYDROCARBON (ORGANIC) GASES

Examples include: acetic/ethanoic acid, acetylene / ethyne, acrylonitrile, alkanes (methane, ethane, propane, butane, etc.), benzene, boil-off gas (BOG), but(yl)ene, coke oven gas, ethanol, eth(yl)ene, ethylene glycol, flare gas, formaldehyde, landfill gas, mercaptans, methanol, methyl acetate, natural gas (known as 'LNG' in its liquid form), off gas, petroleum gas (known as 'LPG' in its liquid form), prop(yl)ene, propylene glycol, R-134a, toluene, vent gas, vinyl chloride monomer (VCM), xylenes.

INORGANIC GASES (NON-HYDROCARBONS)

Examples include: ammonia (NH_3), air, argon (Ar), carbon dioxide (CO_2), carbon disulfide vapor (CS_2), carbon monoxide (CO), chlorine (Cl_2), chlorosilanes, fluorine (F_2), helium (He), hydrogen (H_2), hydrogen chloride (HCl), hydrogen sulfide (H_2S), nitrogen (N_2), oxides of nitrogen, oxygen (O_2), steam (H_2O), sulfur dioxide (SO_2), tritium ($^3H_2$), water vapor (H_2O).

SPECIAL MATERIALS

STEEL

- Carbon Steel
- Low-temperature Carbon Steel
- Austenitic Stainless Steels (e.g. 304L, 316L)
- 22% Cr Duplex Stainless Steel
- 25% Cr Superduplex Stainless Steel

NICKEL SUPER ALLOYS

- Alloy C-4, C-22 or C-276 (Hastelloy®)
- Alloy 600 or 625 (Inconel®)
- Alloy 825 (Incoloy®)

OTHER NON-FERROUS

- Aluminum Bronze
- Nickel-Aluminum Alloy
- Nickel-copper Alloy (Monel®)
- Titanium

DUCTILE IRON

- Spheroidal Graphite Iron / Ductile Iron / Nodular Iron

Aluminum Bronze

SAE 316L Stainless Steel

Duplex Stainless Steel

SEALING

We can recommend a sealing system according to your requirements.

Our DURAGAS machines can be fitted with a combination of the following seals. Seals can generally be either single or dual.

Two independent sealing systems can be deployed for hazardous gases.

WET MECHANICAL SEAL (Water or Oil Lubricated)
Our DURAGAS machines include a wide 'interspace' between the inner gas seals and the bearing lube oil seals. This acts as a catch pot, preventing lube oil from migrating into the process gas stream. We can accommodate a seal support system in accordance with API Standard 682, piping plan 53B.

MAGNETIC DRIVE COUPLING
A hermetic seal is formed by the containment shell (can/membrane/shroud) of the magnetic drive coupling. The machine is said to be 'sealless' at the drive shaft. Compliance with API Standard 685 is available.

DRY MECHANICAL SEAL (Gas Lubricated)
We can offer a pressurized barrier system in accordance with API Standard 682, piping plan 74.

SEGMENTED CARBON RING SEAL

LABYRINTH SEAL

LIP SEAL

PISTON RING

Seal Oil Supply System to API Standard 682, Plan 53B

Monoblock Magnetic Coupling During FAT

CUSTOM-MADE, SKID-MOUNTED BLOWER PACKAGES

Roots Systems excels in the design and assembly of custom packages for challenging environments. Our packages are designed with the protection of your process, personnel and equipment in mind. We can supply you with all the necessary safety features and instrumentation for monitoring, control, alarm and shut-down.

OPTIONS

- Recycle (for flow control)
- Insulation
- Fire and gas detection
- Spreader bar / Lifting beam
- Sound attenuation
  - Silencers - Acoustic enclosures
- Seal fluid systems
  - Gas purge
  - Gas barrier (Piping Plan 74)
  - Liquid barrier (Piping Plan 53B/54)
- Pumped lubrication
- Heat exchangers
  - Air-blast coolers (fin fan)
  - Plate heat exchangers
  - Tubular heat exchangers
- Instrumentation
- Condition Monitoring
- Local Operator Panel (LOP)
- Mounting plates and other structures
- Painting and other surface treatments
- Fire-suppression Systems (FSS)
- Classification Society
  - American Bureau of Shipping (ABS)
  - Bureau Veritas (BV)
  - DNV GL
  - Lloyd's Register (LR)
- Winterization
  - Electric trace heating of pipework
  - Lube oil sump electric immersion heaters

CUSTOM-MADE, SKID-MOUNTED BLOWER PACKAGES

We are conversant with the standards and practices of all major EPCs and operators, satisfactory details for specific requirement and past experiences can be provided upon request.

Flare-gas Recovery Package

H_2S Acid-gas Blower Package with Fire-suppression System

STANDARDS AND LEGISLATION

- American Welding Society (AWS)
- American Petroleum Institute (API)
  - Std 614 (Oil Systems)
  - Std 619 (PD Compressors)
  - Std 671 (Couplings)
  - Std 682 (Seal Plans)
  - Std 685 (Magnetic Drives)
  - Std 692 (Dry Gas Sealing Systems)
- ASME Boiler and Pressure Vessel Code
  - Section II (Materials)
  - Section III (Nuclear)
  - Section V (NDE)
  - Section VIII (Vessels)
  - Section IX (Welding)
- Canadian Standards Associations (CSA)
- CE Marking
- Euro-Asian Council for Standardization, Metrology and Certification (EASC)
- European Union Directives
  - Explosive Atmospheres Directive (ATEX)
  - Pressure Equipment Directive (PED)
- GOST
- IECEx System
- ANSI/NFPA 70 National Electrical Code (NEC)
- Motor Standards
  - ANSI/NEMA MG 1
  - API Standard 541
  - API Standard 547
  - IEC 60034
  - IEEE 841
- NACE
  - MR 0103 (ISO 17945)
  - MR 0175 (ISO 1516)
- Norsok
- Tubular Exchangers Manufacturers' Association (TEMA)

FACILITIES

MACHINE SHOP

Modern CNC machine tools produce components for the compressors.

FABRICATION AREA

Our qualified MIG and TIG welders fabricate skids and other structures, pipework, silencers and pressure vessels.

PAINT SHOP

We can provide coating systems to meet international standards and project-specific requirements.

PACKAGE ASSEMBLY AREA

Packages are assembled in our up-to-date workshops.

PRESERVATION AND PACKING

We can preserve equipment for storage and build sturdy packing to provide protection during transit to your site.

SHIPPING

Handling heavy and large skid packages.

INDUSTRIES

CHEMICAL & PETROCHEMICAL

NUCLEAR

OIL & GAS

ENERGY GENERATION & STORAGE

PREVIOUS PROJECTS

TRITIUM VACUUM CIRCULATOR
(Nuclear Fusion Prototype - Attested by ITER for leak rate of 10^{-8} mbarL/s)

AIR-SCOUR BLOWER
In corrosion-resistant material

HIGH PRESSURE BOOSTER
> 2175 psi (150 bar)

BROWN COAL GAS DEGASIFICATION
Inlet 437°F (225°C); Design 536°F (280°C)

NITROGEN START-UP BLOWER

OFFSHORE FLARE-GAS RECOVERY

INSPECTION AND TESTING

We have full inspection capabilities using 3D co-ordinate measuring equipment and manual inspection equipment.

We carry out a wide range of mechanical and electrical testing in our test bay. All compressors are tested in accordance with ASME PTC 9. All instruments are calibrated to nationally accepted standards.

OPTIONS

- API Standard 619 tests
- Positive material identification (PMI)
- Type 3.2 Inspection of Materials (EN 10204)
- Non-destructive testing (NDT)
  - Radiography
  - Magnetic Particle
  - Ultrasound
  - Liquid Dye Penetration
- Frosio coating inspection
- NACE coating inspection
- Helium leak testing
- High-vacuum leak testing
- Endurance testing
- Third-party inspection agency (TPIA)
- Ship Classification Society

QUALITY ASSURANCE

As would be expected from a leading manufacturer supplying many companies worldwide, we have established rigorous quality controls. Regular audits ensure that products supplied are of a high quality and every compressor is performance tested before despatch.

Our quality management system is certified to **ISO 9001** for the design and manufacture of blowers and custom-built packages.

AFTER SALES

SPARES

Our well-stocked spare parts department is ready to process your order with the minimum of delay thereby ensuring rapid turnaround. Requests for emergency supply of parts can often be fulfilled within one working day (subject to availability).
Contact: spares@roots-blowers.com

REPAIRS

Repairs and routine overhauls can be carried out on site, at our extensive manufacturing workshops and testing facilities or at the premises of one of our worldwide after-sales partners.
Contact: services@roots-blowers.com

ON-SITE SUPPORT, WORLDWIDE

Our qualified, experienced team of service and commissioning engineers are also available to travel worldwide to your site. Routine service visits to site to ensure maximum efficiency of your plant are available and we also offer individual service contracts to suit the particular requirements of your site and process. As well as on-site servicing, our engineers can assist with installation and commissioning and support you with your program of operator training. Our growing network of worldwide agents and associated companies provides local backup and knowledge.
Contact: services@roots-blowers.com

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