Vacuum Solutions for Furnace and Metallurgy Processes
Principal Areas of Applications for Systems with TRIVAC Rotary Vane Vacuum Pumps

- Use in the laboratory or research and development areas
- Processes:
  - Hardening
  - Brazing
  - Plasma nitriding
  - Annealing
  - Special surface refinement processes in production areas involving small quantities
- Products with normal surface contamination
- An adaptation to many applications is possible through smart accessories
- Operating pressures:
  - Medium vacuum
  - High vacuum
    (with additional high vacuum stage)

Application Example

Task:
- Hardening, brazing, tempering and plasma nitriding of, for example cleaned seat rails from the automotive industry or shafts for small electric motors

The load on the vacuum pumps caused by the process is relatively light. Maintenance and service intervals are hardly influenced by the process.

Solution:
- RUTA pump system with rotary vane vacuum pumps from the TRIVAC or SOGEVAC line

With regard to the load conditions, oil-sealed pumps offer the best price-to-performance ratio and can easily be combined with roots blowers from different performance categories.

Principal Areas of Applications for Systems with SOGEVAC Rotary Vane Vacuum Pumps

Application Example

Task:
- Hardening and tempering of shafts and toothed wheels (gears) or brazing processes

The size of the furnace requires usually the use of larger pump systems. Small quantities of impurities evaporate from the product surface. In the case of brazing processes some of the flux used enters the backing pump.

Solution:
- RUTA pump system with rotary vane vacuum pumps from the SOGEVAC line

For this application the use of oil-sealed rotary vane pumps is economically viable since the pumps are not subjected to any major loads.
Principal Areas of Applications for Systems with E- and DK- Rotary Piston Vacuum Pumps

- **Applications:**
  - Hardening
  - Brazing
  - Plasma nitriding
  - Sintering
  - Melting
  - Electron beam melting
  - Special surface refinement processes in all production areas

- Suited for processes involving particles and with increased requirements regarding the vacuum system

- Products with moderate surface contamination

- An adaptation to many applications is possible through smart accessories

- Operating pressures:
  - Medium vacuum
  - High vacuum (with additional high vacuum stage)

**Application Example**

**Task:**
- Manufacture of sintered ceramic products, in casting furnace systems for steel degassing or electron beam welding systems

  In these processes larger quantities of abrasive dust occur. In spite of the commonly used upstream filters the dust loads to which the backing pumps are exposed are high.

**Solution:**
- **RUTA pump system with rotary piston vacuum pumps from the E and DK line**
  
  Rotary piston pumps are relatively insensitive with respect to particles. Benefit: the expected maintenance and service intervals are prolonged.

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**Your Applications**

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<th>Application</th>
<th>Requirements regarding the vacuum</th>
<th>Rotary van pump TRIVAC</th>
<th>Rotary van pump SOGEVAC</th>
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<th>Roots pump WA(U) / WS(U)</th>
<th>Oil diffusion pump DIP</th>
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RUTA WAU 1001/DK 200/G and RUTA RA 9001/RA 3001 /2x E 250/G
Dry Compressing Vacuum Pumps and Pump Systems

Principal Areas of Applications for Systems with Dry Compressing Vacuum Pumps SCREWLINE

- For use in production where oil-sealed vacuum pumps are likely to fail, or can only be operated with a significant amount of maintenance
- Applications:
  - Hardening
  - Brazing
  - Plasma nitriding
  - Sintering
  - Annealing
  - Melting (types of melting include: electron beam, vacuum induction, vacuum arc re-melting, electro slag re-melting)
  - Special surface refinement processes in all production areas
  - Carburizing (modifications/accessories necessary)
- Suited for processes with a high particle count and increased requirements regarding the backing pump
- Contaminated products which, owing to their geometry, cannot or can only be insufficiently cleaned
- Adaptation to many applications is possible through smart accessories
- Operating pressures:
  - Medium vacuum
  - High vacuum (with additional high vacuum stage)

Application Example

1st task:
- Sintering of carbide indexable inserts
  In the production of sintered metals first a metal powder is mixed with binders (polymers like PEG and PP). In the first process step in the furnace the binder is removed at an increased temperature causing the binder to decompose and evaporate. These vapors then enter into the connected vacuum pump system and in the case of oil-sealed systems result in a significant contamination of the oil, wear as well as frequently unexpected failures.
  Oil change intervals are necessary within a few days typically, therefore maintenance and service works and expenses are disproportionately high.

2nd task:
- Brazing processes in the automotive industry
  In this industry a high system uptime is extremely important. The flux evaporating during the brazing process as well as oil vapors from the commonly used diffusion pump enter into the backing pump.
  In the case of oil-sealed vacuum pumps this necessitates an oil change within regular intervals thereby not only increasing the amount of general maintenance and service work but also the downtime of the system. An oil change can also become necessary without visible contamination when the ultimate pressure of the vacuum pump has been reduced by the condensation of binders.

1st solution:
- RUTA pump system with SCREWLINE dry compressing backing pump
  The vapors entering into the backing pump do produce deposits within the pump, however, these can be removed as required by simple on-location cleaning or by a purging process. The monitoring system of the SCREWLINE permits the detection of forming deposits at an early stage and enables the operator to plan convenient cleaning schedules for the pump. Moreover, in comparison with oil-sealed systems, the cost of ownership is significantly reduced.

2nd solution:
- RUTA pump system with SCREWLINE dry compressing backing pump
  The SCREWLINE is insensitive to taken in flux vapors and oil vapors coming from the diffusion pump. The use in connection with a brazing application does not involve any increased maintenance or servicing complexity.
  The standard maintenance interval of one year for the SCREWLINE is entirely sufficient for this kind of application.
The Benefits of Vacuum Technology in Furnace Processes

Vacuum technology has become indispensable in many processes and used in industry and research, vacuum pump systems must be adapted to varying application requirements. Oerlikon Leybold Vacuum offers a comprehensive line of vacuum pumps permitting, in connection with corresponding accessories, the design of optimum pump systems for most applications.

The use of vacuum technology in the area of furnace manufacturing and metallurgy processes offers users the following benefits:

- Avoiding reactions between metal and atmosphere
- No oxidation
- No decarburization
- No surface discolorations
- Attaining of the highest purities
- Opening up of new material properties
- Homogeneous material structure through degassed melting
- Environment-friendly dry compression heat treatment

RUTA Vacuum Systems for Furnace Manufacturers

Vacuum pump systems of the RUTA type have been designed for applications in the rough and medium vacuum range, i.e. for a pressure range from atmospheric pressure down to $10^{-2}$ mbar. In connection with a high vacuum stage, operating pressures down to the $10^{-5}$ mbar range can be implemented.

The design criteria for RUTA vacuum pump systems include:

- the cut-in and operating pressures,
- the pump downtime,
- the prospective process conditions, media properties and gas throughputs as well as branch- and product-specific standards and regulations.

Benefits of the RUTA Vacuum Pump Systems

- Pumping speed and ultimate pressures adapted to the process
- Reduction in the cost of ownership, through energy-savings, for example
- Reduction of investment costs
- Space-saving due to compact design
- Service-friendliness
- Reliability

Vacuum Solutions for every Application

Oerlikon Leybold Vacuum offers a full line of vacuum components for furnace processes:

- Oil-sealed rotary vane pumps, type TRIVAC B and SOGEVAC SV
- Oil-sealed rotary piston pumps, type E and DK
- Dry compressing screw vacuum pumps, type SCREWLINE SP
- Roots pumps (boosters), type RUVAC WA(U), WS(U) and RA
- Diffusion pumps, type DIP
- Turbomolecular pumps, type TURBOVAC with conventional and magnetic bearings
- Cryogenic pumps, type COOLVAC, supplementing these types of pumps, standard and custom vacuum systems are available according to customers specifications:
  - Dry compressing and oil-sealed pump systems, type RUTA
  - High vacuum pump systems
  - Leak detection instruments

Further Services and Accessories Covering the Area of Vacuum Technology:

- Vacuum engineering and application support
- Comprehensive world-wide after market services
- Customer specific service and maintenance contracts
- Decontamination and waste disposal of your old vacuum system
- Exchange and backup pool
- Measurement and control equipment, including calibrations
- Filtration systems
- Frequency converters for Roots pumps
- Valves and flange components
Fax Reply

Make use of our Know-how!

Simply fax the filled-in checklist to us. Our process engineers will then come up with a proposal for a pump system which matches your requirements. You will shortly receive our offer.

To: Vacuum Solutions
Fax No.: +49 (0)221 347 - 31206
E-mail: vacuum.solutions@oerlikon.com

Please answer the following questions:

1. In which process shall the pump system be used?

2. What is the volume of the furnace?

3. Which operating pressures shall be attained (max./min./norm.)?

4. What pump downtime and which cut-in pressure is required?

5. For which temperature has the furnace been designed?

6. How high is the intake temperature at the pump flange?

7. Are partial pressures >1 mbar at high temperatures implemented whereby the vacuum pumps operate with opened valves?

8. How high is the ambient temperature?

9. What leak rate is to be expected for the furnace?

10. Is gas admitted during the process?

11. Type of gas?

12. Quantity of gas?

13. Pressure at which the gas is admitted?

14. Is the gas flammable?

15. Batch duration?

16. Is vapor to be expected coming from the furnace?

17. Are particles to be expected coming from the furnace?

18. Description of the product to be treated:

19. Cast component, forged component or sintered metal component?

20. Surface contaminated?

(with cleaning agents, drawing compounds or cooling media, for example)

21. Which electric connection data are available?

- Mains voltage?
- Mains frequency?
- Control voltage AC/DC?

22. Which mechanical connection data are planned?

- Length of the intake line?
- Diameter of the intake line?

23. Which cooling media are present?

24. Type of cooling medium (water, brine etc.)?

25. Temperature of the cooling medium (max./min.)?

26. Do special regulations have to be observed?

27. Is a certain type of pump desired, respectively preferred?

28. ATEX

Was a classification of explosion hazard zones run in accordance with the ATEX guideline? (inside/outside)

- Zone __________________________
- Temperature class ___________________
- Gas group __________________________