

# Multi-stage steam jet vacuum pumps

in porcelain/graphite

## DESIGN AND MODE OF OPERATION

Multi-stage steam jet vacuum pumps in porcelain/graphite are used to extract corrosive gases and vapours, particularly where halogen compounds are present, if stainless steels are not sufficiently resistant.

### FOUR-STAGE STEAM JET VACUUM PUMP FOR 2 mbar, (FIG. 1)

**STAGE 1:** extracts the vapours and gases from the process to be kept under vacuum; final vacuum e.g. 2 mbar

**STAGE 2:** compresses the motive steam and the extracted vapour and gases of stage 1 to 75 mbar

**SURFACE CONDENSER CHAMBER I:** is designed for a condensation pressure level which is as low as possible to keep the steam consumption as low as possible. The suction flow load of the downstream-arranged stages and their steam requirements are thereby reduced.

**STAGE 3:** extracts all gases and vapours which were not condensed in the upstream condenser chamber I for compression to a pressure of approx. 320 mbar

**SURFACE CONDENSER CHAMBER II:** reduces the suction flow in order to relieve the downstream arranged stages

**STAGE 4:** extracts all non-condensable gases and vapour from condenser chamber II and compresses them to atmospheric pressure.

**SURFACE CONDENSER CHAMBER III:** will only be required if the exhaust gases are not allowed to reach the open air. The inert gases are discharged silently and without steam trailing.

The condensate lines can be made in plastic, porcelain or glass tubes.

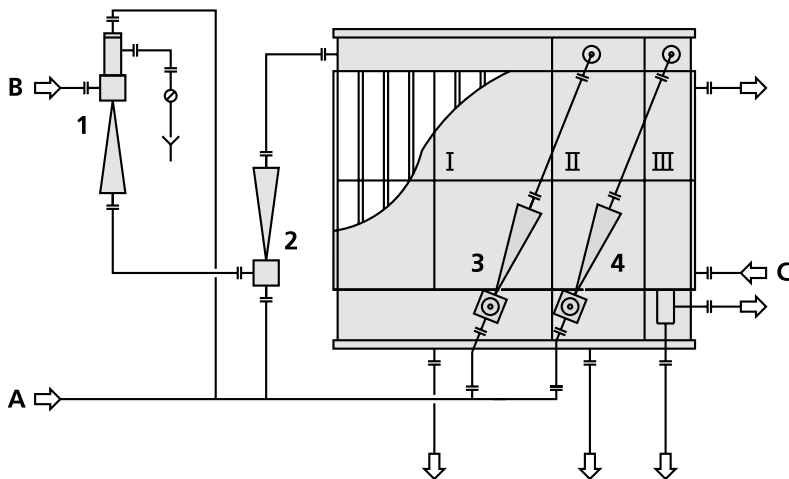
In the here described steam jet vacuum pump the extracted medium does not come into contact with the cooling water.

If the extracted medium is allowed to get into contact with the cooling water, we recommend the use of our multi-stage porcelain steam jet vacuum pumps, where mixing condensers of temperature-change resistant porcelain are used for inter-condensation.



Steam jet vacuum pump with block condenser made of graphite  
Suction capacity: 2.5 kg/h of air from 1.3 mbar

FIG. 1



- |   |                    |      |                                 |
|---|--------------------|------|---------------------------------|
| A | Motive steam       | 1-4  | Jet pumps, stages 1 to 4        |
| B | Suction connection | I-II | Intermediate condenser chambers |
| C | Cooling water      | III  | After-condenser chamber         |

4-stage steam jet vacuum pump with compact block condenser

#### MATERIALS AND CONSTRUCTION

**PORCELAIN** has been used by us for the construction of jet pumps (and mixing condensers) for many years. It is insensitive to temperature changes and hydrofluoric acid is virtually the only material that will attack it. With wall thicknesses of 10-30 mm, the risk of breakage is negligible, if used correctly.

**GRAPHITE** is used for the construction of surface condensers and jet pumps in all cases where the usual corrosion and acid proof materials are not resistant enough. On account of its excellent thermal conductivity and its high resistance to temperature change, graphite is ideal for heat exchangers and jet pumps. Gas-tightness is achieved by means of impregnation. Jet pumps made of graphite and operated in vacuum below 3 mbar can be heated to eliminate ice formation.

As surface condensers, block heat exchangers, shell-and-tube heat exchangers or also plate heat exchangers from graphite of all commercial makes are used which are suitable to condense vapours under vacuum.

**STANDARD CONSTRUCTIONS** are supplied for suction capacities of 1 kg/h to 10 kg/h at suction pressures from 1 to 10 mbar; thereby meeting most requirements. Pumps are constructed as modular units from standard elements.

**SPECIAL CONSTRUCTIONS** can easily be built as modular units from standard parts. By using different combinations of standard parts, most intermediate duties are attainable.

**SPARE PARTS** for porcelain jet pumps and connection lines are mainly constituent parts of our standard types and are, therefore, generally available from stock.



Fig. 2  
5-stage steam jet vacuum pump in corrosion-resistant design  
Materials: jet pump in porcelain, mixing condensers in C-steel enamelled  
Suction capacity: 5 kg/h of air from 2.5 mbar abs.



Fig. 3  
4-stage steam jet vacuum pump with surface condenser  
Materials: porcelain and graphite  
Suction capacity: 22.7 kg/h from 16 mbar abs.