# VRN LIQUID RING VACUUM PUMPS

## Industrial applications :

- Automatic priming installation for pumping stations
- Filtration under vacuum (Chemical & petrochemical industry, mining industry,..)
- Vacuum condensers (power plants,...)
- Crystallization (sugar mills, ...)
- Concentration, evaporation

## Benefits :

- The handled fluids remain free from any grease or oil traces
- Sealing system : available with packing gland or mechanical seal
- Dust- and liquid-proof
- It is possible to pump great amounts of condensable vapours
- This construction produces less noise than any other solution
- Heavy duty design and low maintenance.

**ISO 9001 CERTIFIED GROUP**

Ensival Moret
A Moret Industries Company

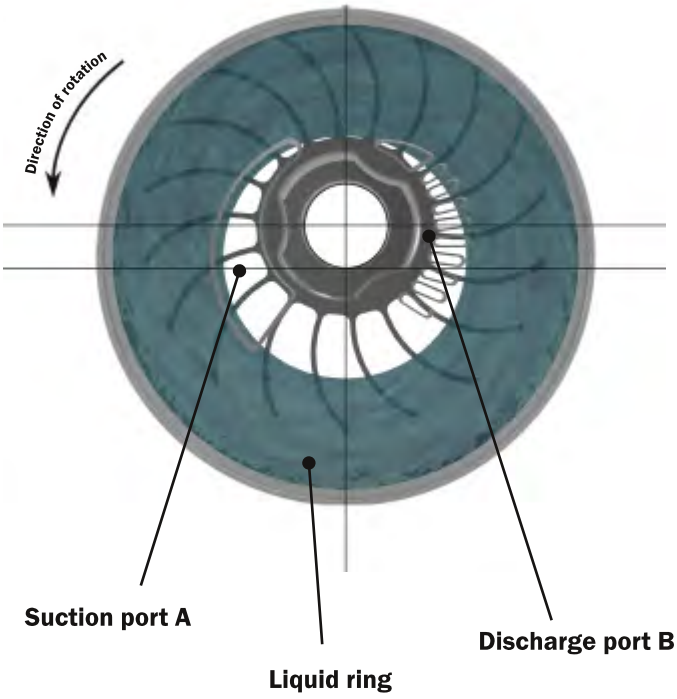
## PRINCIPLE OF OPERATION :

/ The vacuum pumps type VRN are composed of a cylindrical casing and of a rotor with blades of which the centerline is in eccentric position in relation to the cylindrical casing. The rotor drives along in its rotating motion a liquid ring which is pushed against the wall of the pump casing by centrifugal force.

/ The impeller being eccentric in relation to the pump casing, its blades dip more or less deeply into the liquid ring depending on their position in the rotating motion. Swept along with the impeller, the liquid acts as a piston by creating variations of the free space between two blades.

/ The figure opposite shows that it is sufficient to position the ports in A and B to obtain a gas pump.

/ The operating characteristics of liquid ring vacuum pumps are thus very similar to those of positive displacement pumps. The shape of the liquid is in theory supposed to be circular. In practice, it appears that such is not the case, but this does not influence the working principle described hereinabove.




/ Liquid ring vacuum pumps require a constant make-up liquid supply for the three following reasons:

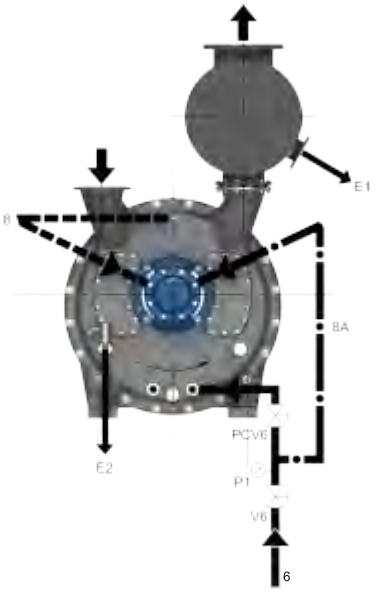
1 - the heat generated during operation of the pump must be evacuated
2 - a hydraulic sealing must be provided on the packing to prevent air entry
3 - the losses of liquid carried away by the sucked-up gas must be compensated in order to maintain an optimum thickness of the liquid ring.

/ The injected liquid ends up with gas at the discharge of the pump. Part of this liquid can be recirculated to the pump if a recovering tank forming separator is used. This makes it possible to minimize the amount of injected liquid. It is nevertheless mandatory to ensure the cooling of the pump; this is why we provide for installations with recovering tank a make-up supply of about 1,5 litre/minute per kW absorbed.

/ The setting accuracy of recirculation and injection flow rates is of prime importance for the smooth operation of vacuum pumps. A too high water flow rate will indeed have the effect of increasing the power absorbed by the pump. If, on the other hand, the cooling liquid flow is not sufficient, the vacuum ring will drop as a result. Besides, any abnormal heating of the liquid ring will cause the sucked-up volume of gas to drop.
As a common practice, it is advisable to adjust the liquid supply flow rate in such a way that temperature rise does not exceed 7 °C when the liquid passes through the pump.

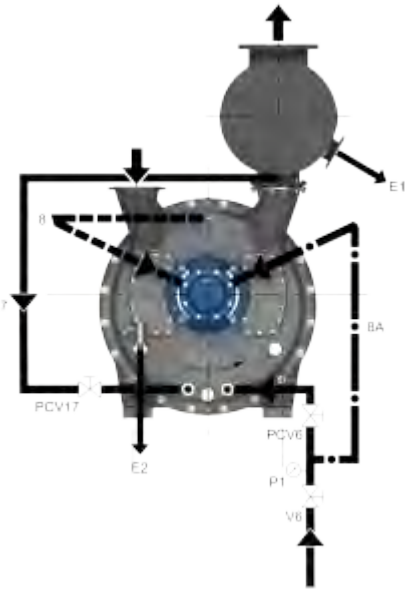
/ In Most applications, the liquid used is water. The diagram on page 5 shows the drop of the inlet flow of gas in function of the temperature of the water forming the liquid ring.

## Liquid ring feeding principle :



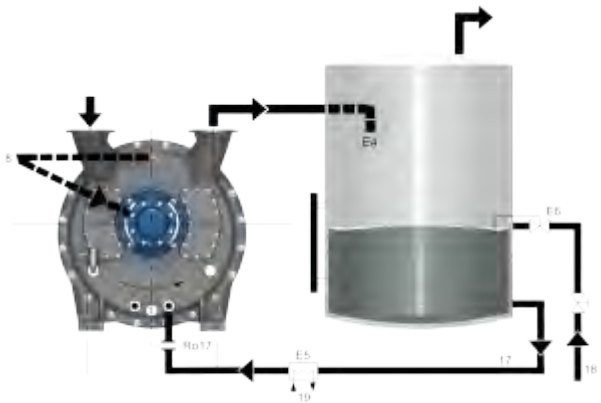

### / Pump without recirculation circuit

| | |
|---|---|
| 6 | Cooling liquid supply to liquid ring. |
| 8 | Injection to packing, internal circulation. |
| 8A | Injection to packing by cold water supply. |
| E1 | Separator overflow. |
| E2 | Level overflow in the pump. |
| V6 | Valve on supply circuit |
| PCV.6 | Setting of water flow rate to liquid ring. |
| PI | Pressure-gauge on cooling liquid supply circuit to liquid ring |




### / Pump with partial recirculation circuit

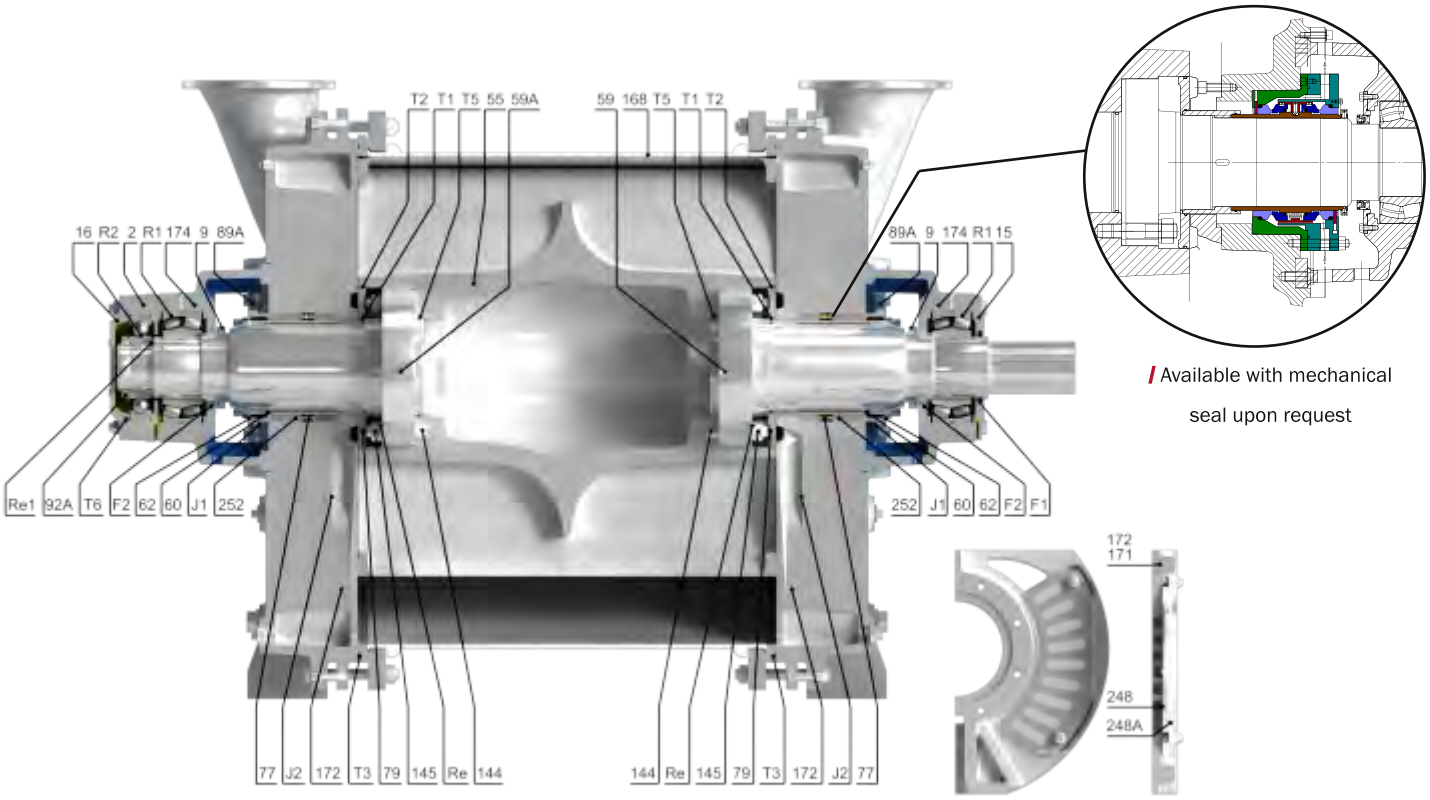
| | |
|---|---|
| 6 | Cooling liquid supply to liquid ring. |
| 8 | Injection to packing, internal circulation. |
| 8A | Injection to packing by cold water supply. |
| 7 | Recirculation |
| E1 | Separator overflow. |
| E2 | Level overflow in the pump. |
| V6 | Valve on supply circuit |
| PCV.6 | Setting of water flow rate to liquid ring. |
| PCV.17 | Setting valve of water flow rate on liquid ring recirculation circuit |
| PI | Pressure-gauge on cooling liquid supply circuit to liquid ring |




### / Pump with integral recirculation circuit

| | |
|---|---|
| 8 | Injection to packing, internal circulation. |
| 17 | Recirculation. |
| 18 | Cooling water make-up line. |
| 19 | Cooling water circuit for heat exchanger |
| E4 | Separator |
| E5 | Heat exchanger |
| E6 | Level regulator |
| Ro17 | Recirculation circuit setting office |

## SECTIONAL DRAWING :




/ Available with mechanical seal upon request

## / List of parts :

| | | | | | |
|---|---|---|---|---|---|
| 2 | Bearing housing | 92A | Bearing lock out | R2 | Axial bearing |
| 9 | Deflector disk | 144 | Stud-bolt | Re | Washer under 145 |
| 15 | Bearing cover inboard side | 145 | Nut on item 144 | Rel | Setting ring |
| 15B | Inner cover | 168 | Cylender casing | F1 | Felt-ring in item 15 |
| 16 | Blind cover | 171 | Guide plate inboard side | F2 | Felt-ring in item 15B |
| 55 | Impeller | 172 | Guide plate outbord side | T1 | O-ring between 60 and 79 |
| 59 | Shaft inboard side | 174 | Header | T2 | O-ring between 55 and 79 |
| 59A | Shaft outboard side | 248 | Flexible membrane on discharge port | T3 | O-ring between 171 - 168 and 172 |
| 60 | Shaft sleeve | | | T4 | O-ring between 15B and 174 |
| 62 | Two piece gland | 248A | Membrane cover | T5 | O-ring between 59-55-59A |
| 77 | Lantern ring | 252 | Packing ring | T6 | O-ring in item 2 |
| 79 | Protecting ring | R1 | Radial bearing | J1 | Gasket between 89A & 174 |
| 89A | Inspection port on item | | | J2 | Gasket between 171 - 174 and 172 |

## / Materials of construction

### / Cast iron - Steel

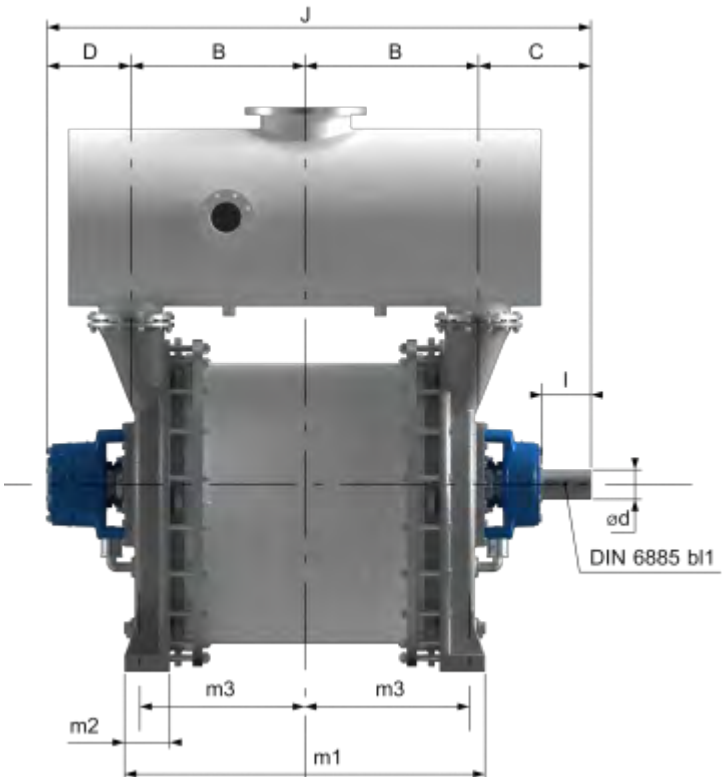
FT25 : cylinder / guide plates / headers
GGG40 : impeller
CK35 steel : shaft

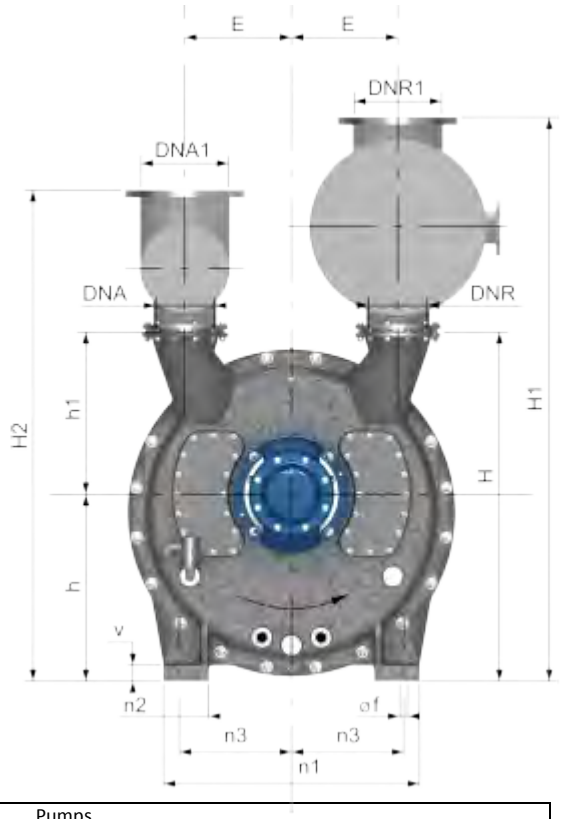
### / Stainless steel / Duplex materials

Stainless steel : cylinder / guide plates / impeller
CK35 : shaft (entirely protected)

**/ Separator tank and suction manifold in fiberglass is optional**
**/ Other materials are available upon request**

## DIMENSIONAL DRAWING :



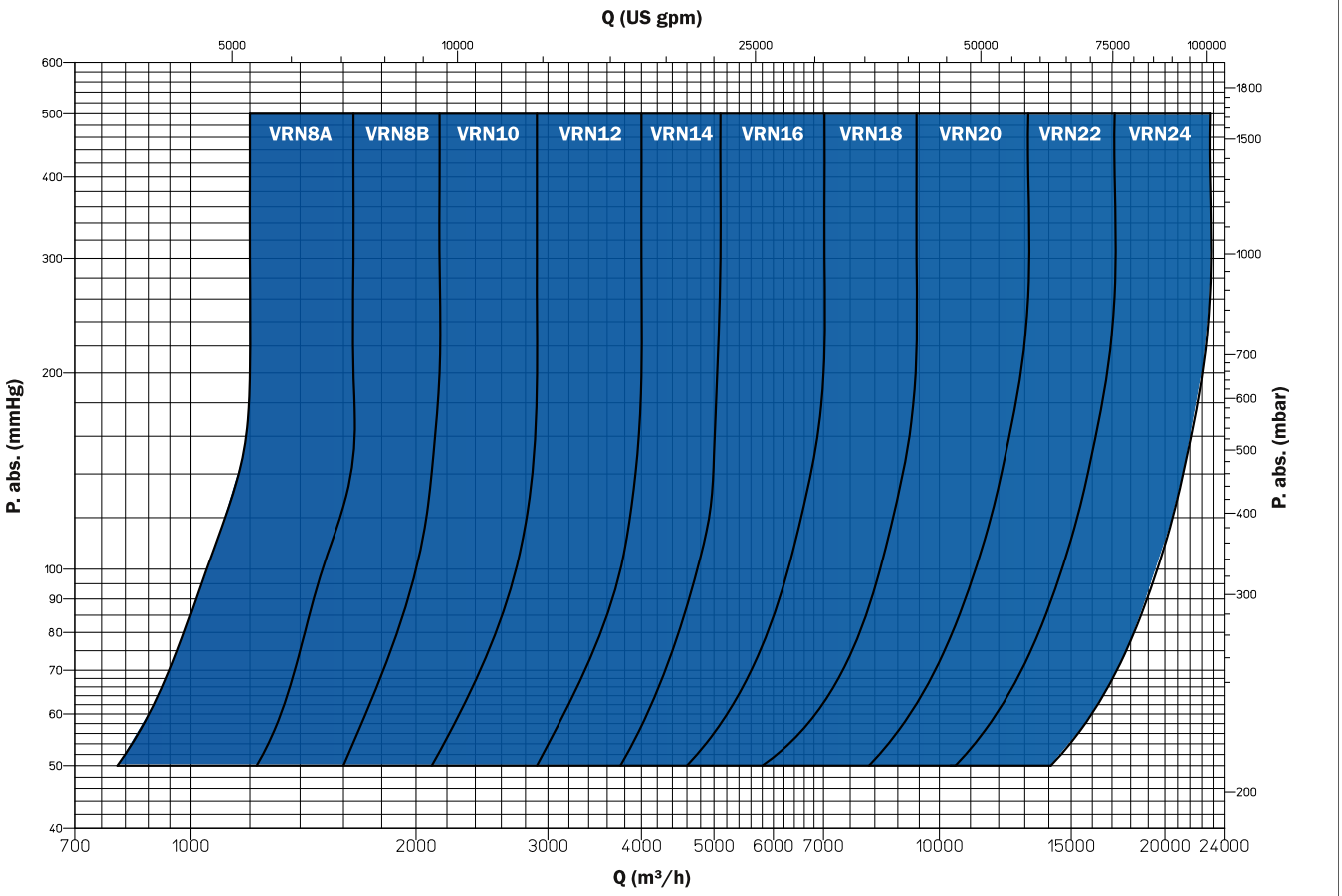

| Type | CONNECTIONS | | | | Pumps | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DNA | DNR | DNA 1 | DNR 1 | B | C | D | E | J | h | h1 | H | H1 | H2 | m1 | m2 | m3 |
| VRN 8A | 100 | 100 | 125 | 150 | 325 | 315 | 270 | 200 | 1235 | 375 | 325 | 700 | 1152 | 952 | 730 | 80 | 335 |
| VRN 8B | 100 | 100 | 125 | 150 | 250 | 315 | 270 | 200 | 1085 | 375 | 325 | 700 | 1152 | 952 | 580 | 80 | 260 |
| VRN 10 | 125 | 125 | 150 | 200 | 395 | 342 | 277 | 243 | 1409 | 435 | 395 | 830 | 1375 | 1120 | 890 | 100 | 405 |
| VRN 12 | 125 | 125 | 200 | 250 | 445 | 354 | 300 | 270 | 1544 | 500 | 410 | 910 | 1540 | 1250 | 1025 | 125 | 462,5 |
| VRN 14 | 150 | 150 | 200 | 300 | 504 | 406 | 314 | 315 | 1728 | 560 | 475 | 1035 | 1687 | 1387 | 1151 | 140 | 520,5 |
| VRN 16 | 200 | 200 | 250 | 300 | 580 | 410 | 325 | 360 | 1895 | 625 | 560 | 1185 | 1965 | 1600 | 1290 | 150 | 590 |
| VRN 18 | 200 | 200 | 250 | 350 | 670 | 440 | 340 | 410 | 2120 | 705 | 650 | 1355 | 2244 | 1830 | 1475 | 175 | 675 |
| VRN 20 | 250 | 250 | 300 | 400 | 764 | 478 | 360 | 472,5 | 2366 | 800 | 750 | 1550 | 2565 | 2090 | 1678 | 200 | 769 |
| VRN 22 | 300 | 300 | 350 | 450 | 883,5 | 573,5 | 426,5 | 540 | 2767 | 960 | 825 | 1775 | 2867 | 2497 | 1833 | 230 | 863,5 |
| VRN 24 | 350 | 350 | 400 | 500 | 1016 | 674 | 509 | 621 | 3215 | 1100 | 950 | 2050 | - | - | - | - | - |

| TYPE | PUMP | | | | | SHAFT END | |
|---|---|---|---|---|---|---|---|
| | n1 | n2 | n3 | øf | v | ød | v |
| VRN 8A | 530 | 100 | 220 | 25 | 40 | 70 | 105 |
| VRN 8B | 530 | 100 | 220 | 25 | 40 | 70 | 105 |
| VRN 10 | 620 | 110 | 260 | 25 | 40 | 80 | 130 |
| VRN 12 | 700 | 130 | 290 | 30 | 45 | 85 | 130 |
| VRN 14 | 800 | 150 | 330 | 40 | 50 | 100 | 170 |
| VRN 16 | 875 | 160 | 365 | 40 | 50 | 110 | 165 |
| VRN 18 | 990 | 175 | 415 | 40 | 60 | 120 | 165 |
| VRN 20 | 1120 | 200 | 470 | 40 | 60 | 130 | 200 |
| VRN 22 | 1300 | 230 | 570 | 40 | 80 | 150 | 250 |
| VRN 24 | - | - | - | - | - | 160 | 300 |

**/ Transmission with belt drive**

**/ Transmission with gear box**

## Coverage charts :




**/ Higher capacities upon request**

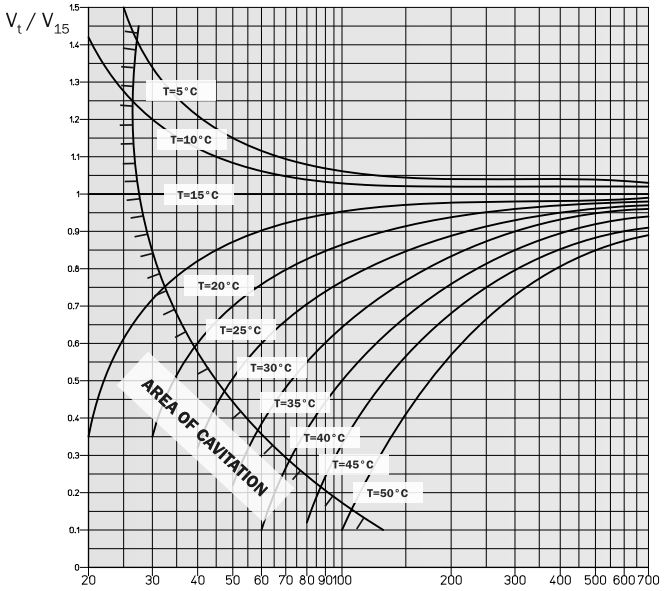
/ The present chart is only applicable for the pumping of dry air at 20 °C, a discharge pressure of 760 mmHg and a cooling water temperature of 15 °C.

/ The influence of the hygrometric degree of the air and of the cooling water temperature is shown on the figures on opposite page.

/ In the case of sealing or injection liquid other than water and of a discharge pressure different from atmospheric pressure or when high solubility gases ($CO_2$) are pumped please consult our technical service.

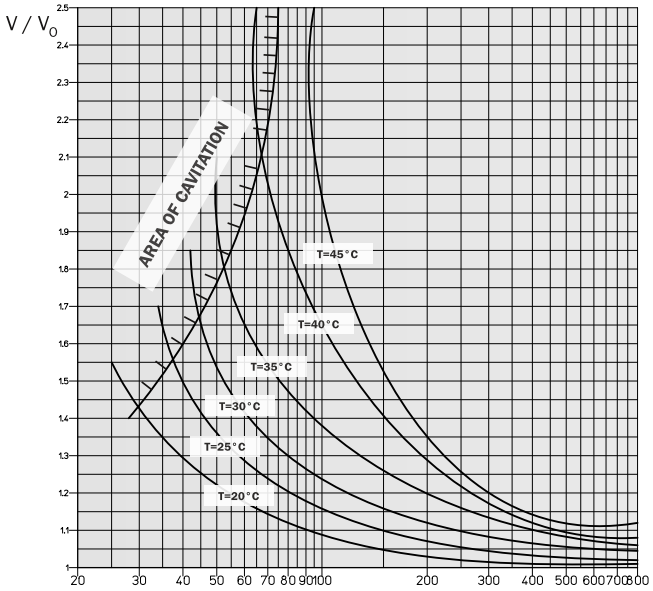
## Influence of water ring temperature and of the hygrometric degree of the inlet air capacity :

/ Drop in suction volume in relation to water ring temperature.




$V_{15}$ = Inlet capacity for a water ring temperature of 15°C
$V_t$ = Inlet capacity for a water ring temperature of T°C

/ Suction Volume correction for humidity-saturated air.




V = Inlet capacity for humidity saturated air at temperature T°C
$V_o$ = Inlet capacity for dry air at 20°C
Water ring temperature = 15°C

## Compression ratio regulation :

/ If a liquid ring pump is to operate at its maximum efficiency point, the size of the discharge ports must be adapted to the compression ratio to be achieved.

/ In the VRN vacuum pump, the port plates are provided with flexible membranes facing the discharge ports.

/ The position of these membranes depends on the distribution of pressure prevailing in the liquid ring. In this way, the total discharge port surface is always automatically adjusted according to the compression rate produced.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