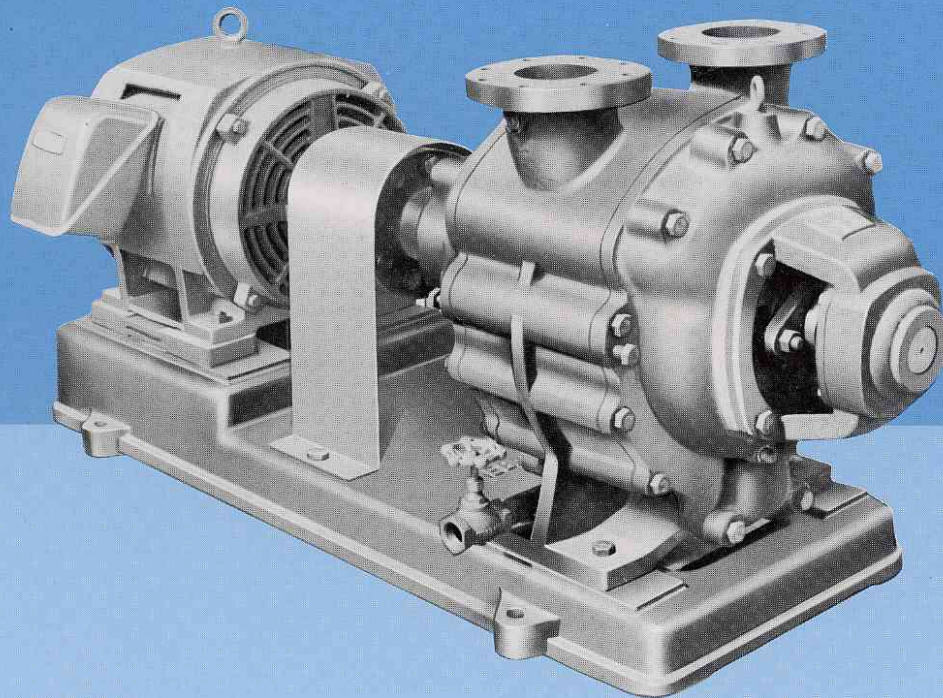


EBARA

CS 4013EF

EBARA Water Ring Vacuum Pumps

NVE Series



INTRODUCTION

Ebara Corporation, well known for many years' experience and superior technology in the manufacture of water-ring vacuum pumps, has developed a new series of such pumps.

Called the NVE series, they incorporate many new features including extremely quiet operation, markedly improved high-vacuum performance and high efficiency over the entire service range. Coupled with these advantages, fully standardized production and strict quality control insure your satisfaction in availability, quality and price.

Operation

The NVE Series Water-Ring Vacuum Pumps operate in the following manner.

Step (1)

Water (or any liquid) is filled to half capacity in the cylindrical inner casing installed eccentrically on the bottom of the pump body.

The rotor having a number of forward-bent vanes is rotated. This produces a centrifugal force to form a cylindrical water screen along the inner wall of the casing, with a crescent shaped void inside the water screen.

Into this void is sucked air through the open inlet.

Step (2)

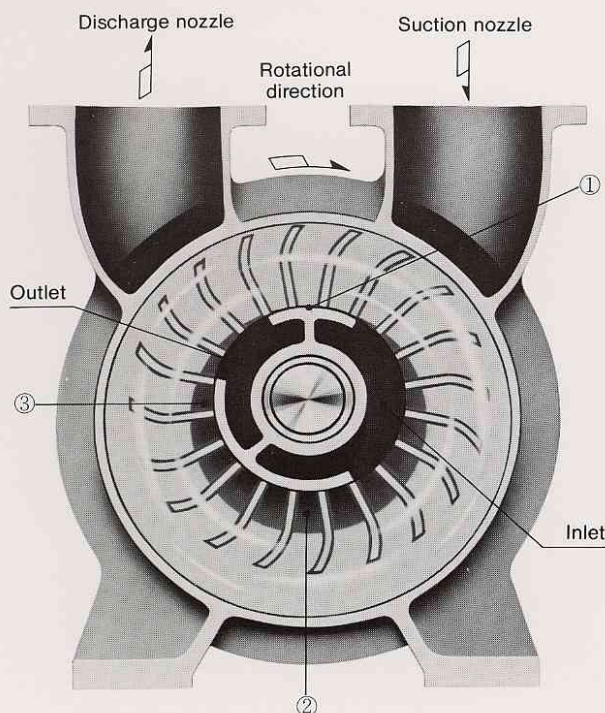
Further rotation of the rotor gradually drives the water screen away to let air almost completely fill in between the vanes.

Step (3)

The water screen gradually moves inward, compressing the air and forcing it out through the outlet shown.

These steps are repeated to effect a continuous sequence of suction and discharge. This sequence is similar to that of a reciprocating pump in that, with the void between adjacent vanes of the rotor serving as a cylinder, the water screen acts as if it were the piston going up and down as the rotor rotates, providing the action of a reciprocating pump.

As the sealing liquid accompanies the outgoing air (or gas) through the discharge port, the casing needs to be refilled with an equal quantity of liquid.



Features:

Extremely quiet

The check valve provided on the outlet side of the port cylinder eliminates excessive compression or contraflow compression that causes noise.

When the air or gas is overcompressed, the check valve (ball type) is released to smooth down the compressive action, thereby preventing sudden change in pressure and production of noise.

Marked improvement in high-vacuum performance with excellent efficiency over entire range

The cylindrical interior of the casing minimizes friction loss and allows compression to a high ratio (-700 mmHg in normal maximum degree of vacuum) with a high-speed rotation. This was all made possible by applying a one-turn-one-action concept to the NVE series.

Highly durable

With air passage to and from the rotor located inside the rotor (port cylinder type), thrust load imparted to the rotor is approximately half of that experienced in the side plate type that has the air

passage flanking the rotor. This considerably reduces stress applied to the main shaft and bearing, insuring high durability and long life.

Simple in construction and easy to handle

Simplified construction without mechanical contacts insures ease of handling and freedom from trouble.

Extensive application

Use of air or gas that contains water vapor or mist presents no problem, making the NVE series pumps highly usefull in various areas.

Circulation of the sealing liquid in the casing during the operation prevents gas leaks and heat of compression, insuring a long service life in each use.

Small space requirement

As the NVE series pumps operate at high speed, they are compact and require little space for installation.

Use

As vacuum pump

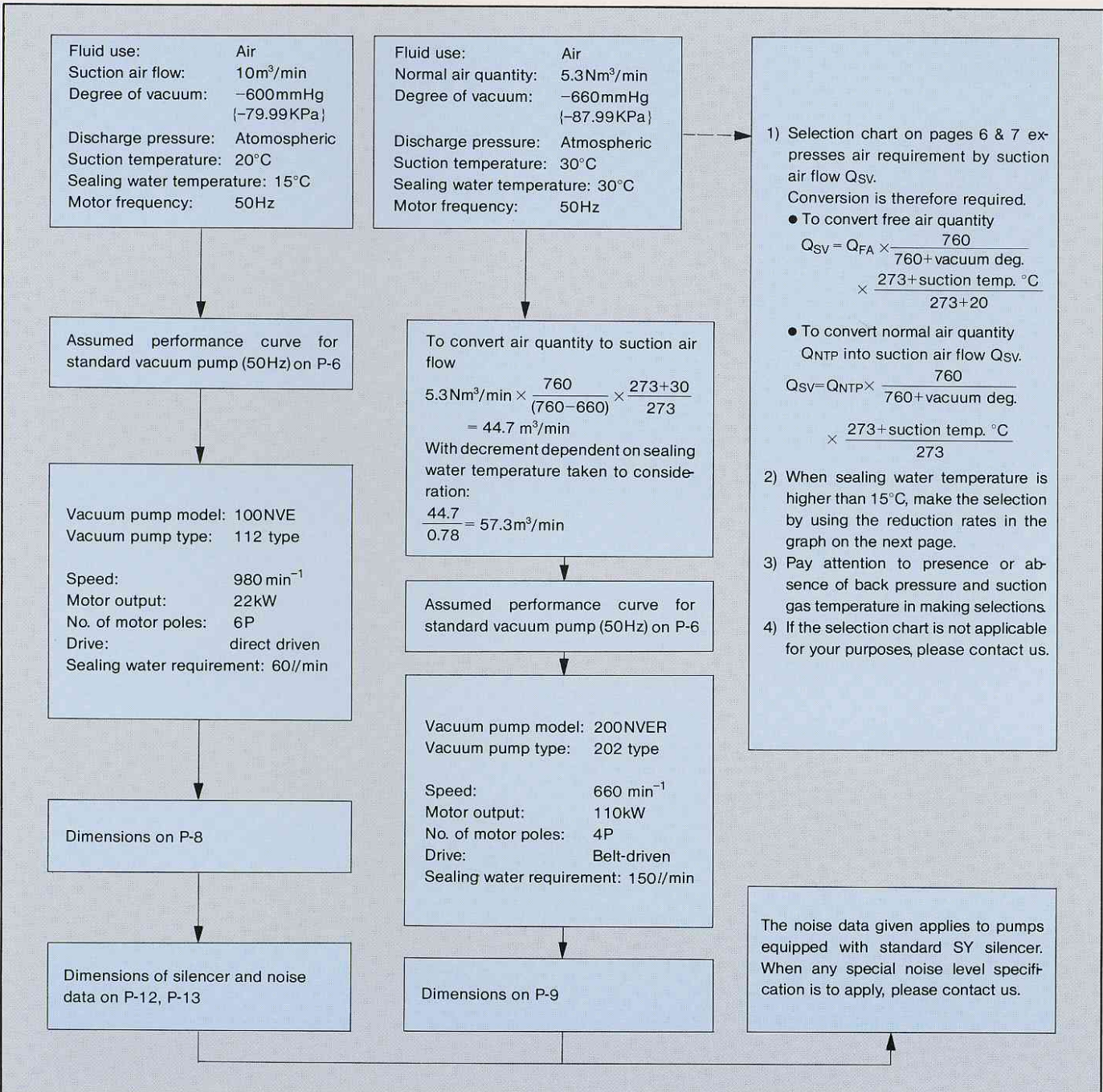
- For dewatering in the paper making process
- For extraction of air from condenser in power generation plants
- For extraction of air from condenser water chambers
- For dewatering of vacuum dehydrating filters
- For extraction of air and vapor from vacuum evaporators
- For supplying vacuum in carburetor test
- For dewatering and drying in various chemical plants
- For supplying vacuum in vacuum casting processes
- For priming of large-capacity volute pumps
- For supply vacuum in pneumatic transfer of various grains
- For vacuum transfer of iron sheets and paper sheets
- For supplying vacuum in vacuum deodorizing processes

As Compressor

- For pressure feeding of various gases in chemical plants
- For aeration in sewage treatment
- For supplying compressed air to sewage ejector
- For supplying compressed air to operate instruments
- For applying pressure to stock inlet at paper plants
- For oxygenation at fish farms
- For pressure feeding of carbon dioxide gas in sugar plants

Standard Specifications

Air flow range	2.7 to 90 m ³ /min in suction air flow (up to 240 m ³ /min as semi-standard type)
Vacuum range	Service degree of vacuum 0 to -700mmHg {0~-93.32KPa}
	Max. degree of vacuum -740mmHg {-98.66KPa} (with sealing water at 15°C)
Applicable fluid	Air and various gases (containing mist acceptable to a certain level)
Suction temperature	-15 to 50°C
	(Lower or higher temperatures are permissible, depending on choice of service pressure and sealing liquid)
Applicable sealing liquid	Fresh water or industrial water of normal temperature (with pressure at 1.0 kgf/cm ² {0.098MPa} or higher)
Applicable flange standard	10 kgf/cm ² FF under Japanese Industrial Standards (JIS)
Nozzle position	Suction — Upward on top of pump body
	Discharge — Upward on top of pump body
Sealing of shaft	Gland packing
Drive system	Motor-coupled or belt-driven
Rotational direction	Clockwise as viewed from shaft end
Base	Common base or independent
Location	Indoor or outdoor



Impact of Sealing Water on Performance

The sealing water used in this series of water-ring vacuum pumps is fresh water or industrial water. When any special pump specification that does not permit use of fresh water for the purpose is desired, contact us because there will be some change in standard performance.

1) Dependence of performance on quantity of sealing water

As the performance curves in the selection chart indicate, where approximate values for sealing water requirements are given, the higher the degree of vacuum, the more the sealing water is required. For details, see our performance test data available upon request.

If sealing water is excessive, the air flow decreases and the shaft torque increased.

If insufficient, the water screen in the casing cannot be maintained, and the suction air flow decreases, accompanied by an instability phenomenon, such as pulsation.

2) Dependence of performance on sealing water pressure

Sealing water must be maintained at approximately 1kgf/cm² {0.098MPa} throughout the operation. It may be used in circulation, where the operation is in a high vacuum region above -500mmHg

{-66.66KPa} and performance is degraded to a certain extent.

3) Dependence of performance on sealing water temperature

The void in the pump casing is usually occupied by sealing water vapor so that the suction air flow into the void varies depending on the temperature and service pressure of the sealing water.

The standard performance indicated in this catalog is based on data obtained with sealing water at 15°C. When installation is planned for use with sealing water at other than 15°C, determine the design air flow with a relative decrement taken into consideration:

$$Q_{sv} = \frac{P_s - P_v}{P_s - P_v 15^\circ C} Q_{sv 15^\circ C}$$

Q_{sv} : Planned suction air flow for pump

$Q_{sv 15^\circ C}$: Standard suction air flow (with sealing water at 15°C)

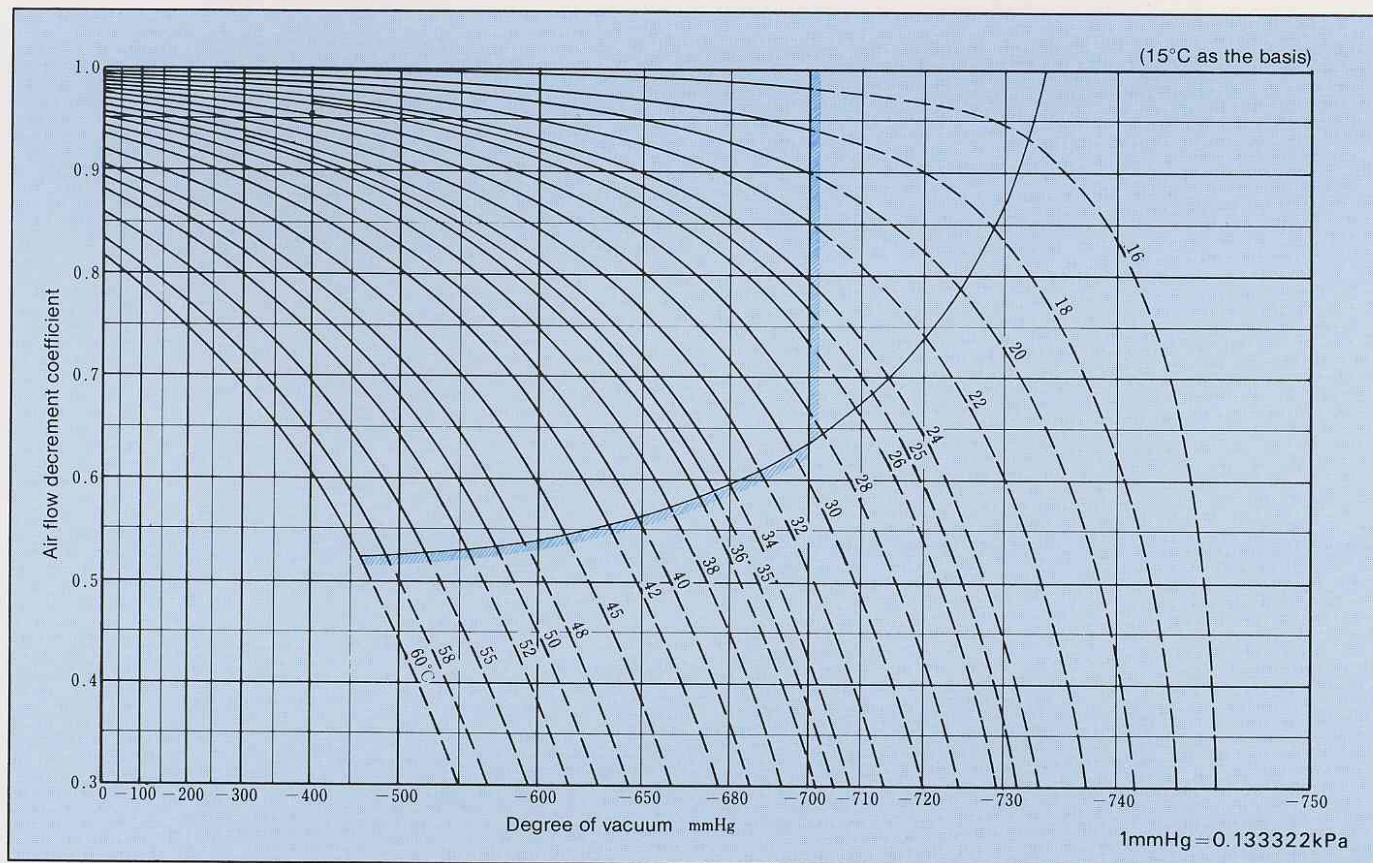
P_s : Degree of vacuum (absolute pressure)

P_v : Vapor pressure

$P_v 15^\circ C$: Vapor pressure with sealing water at 15°C

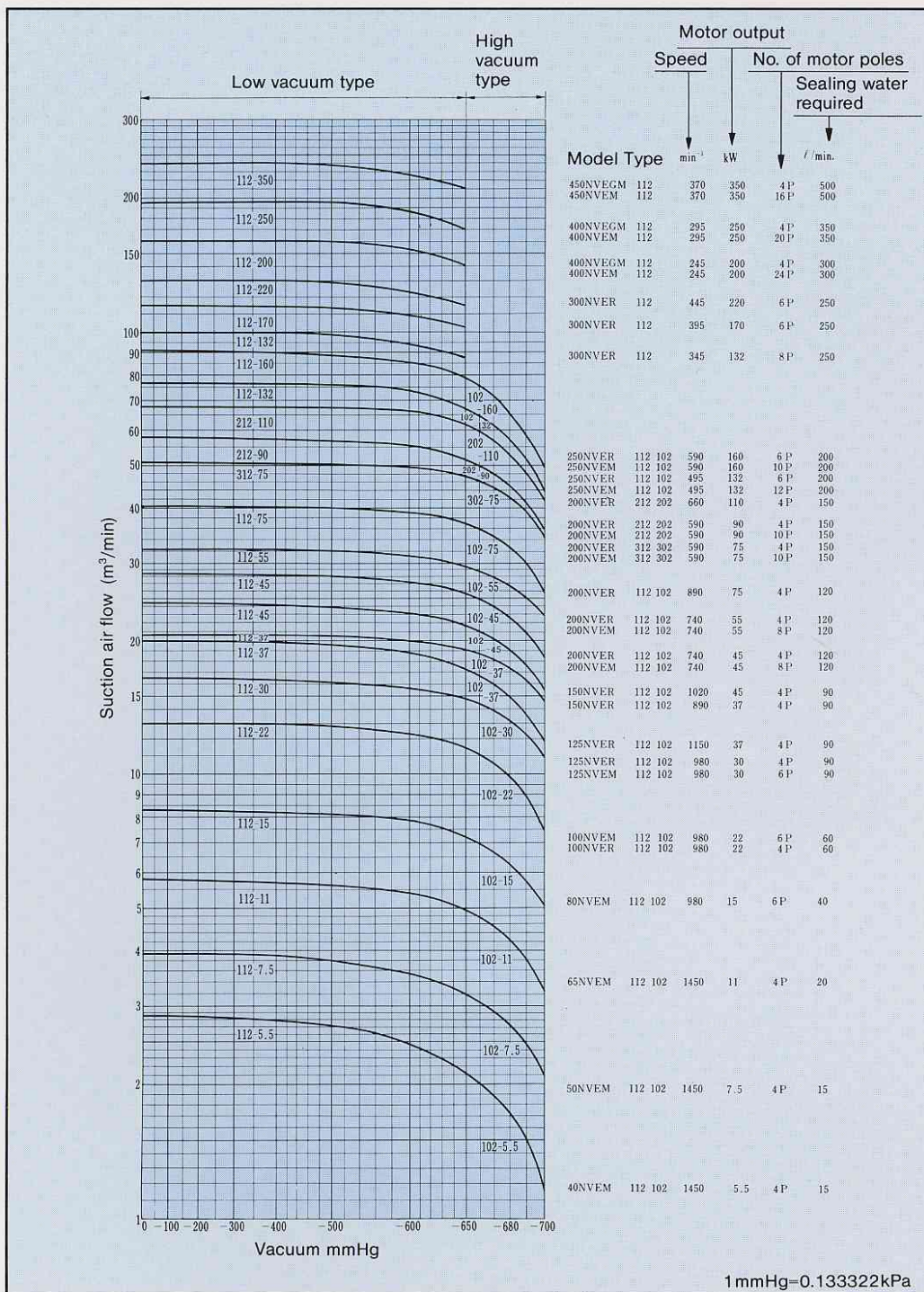
The graph below shows decrements in air flow relative to sealing water temperatures other than 15°C for standard performance.

Dependence of Performance on Sealing Water Temperature



SELECTION CHART 50Hz

Standard Performance Curves for NVE Series Water-Ring Vacuum Pumps

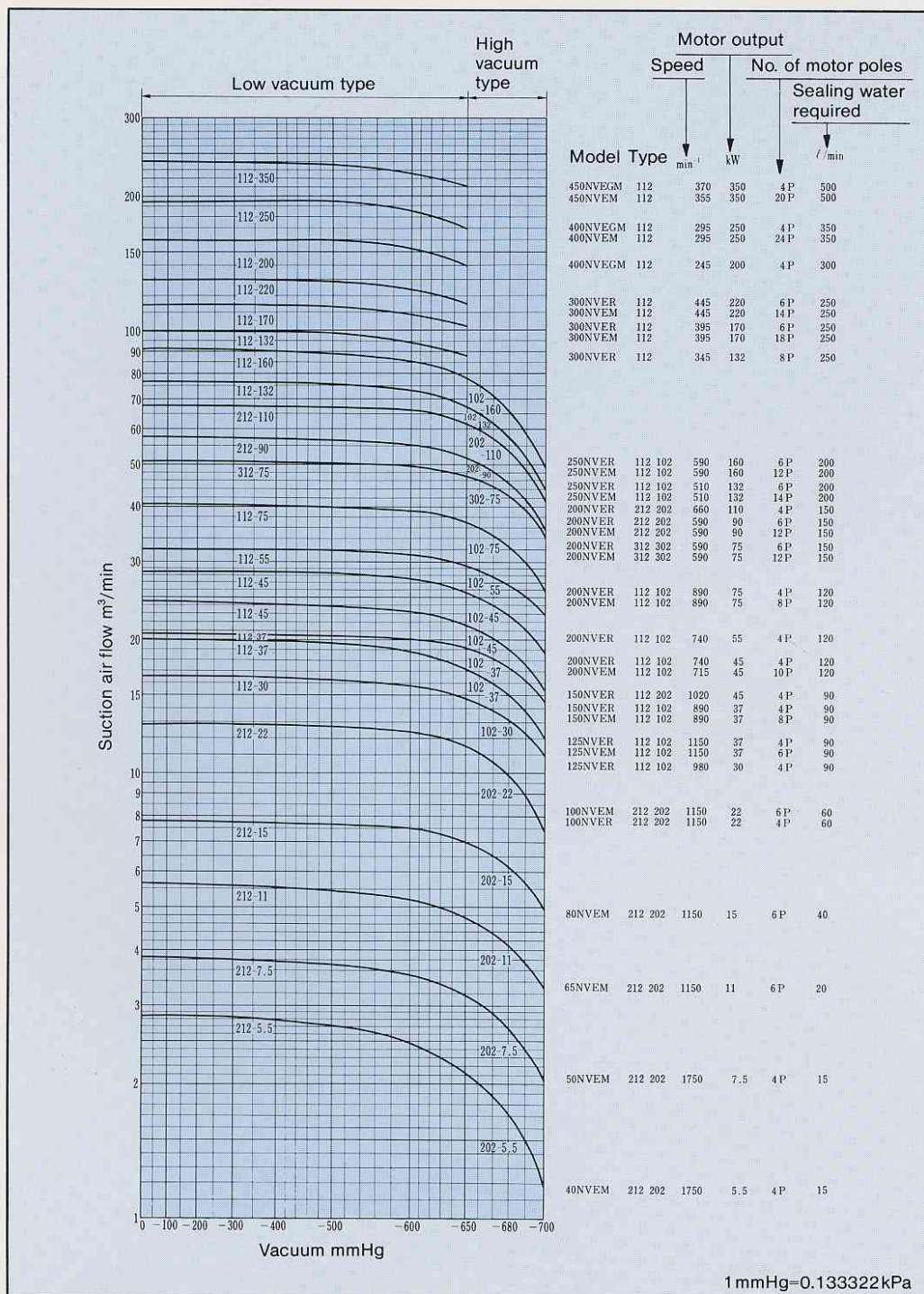


1. This chart indicates suction air flow Q_{sv} available with atmospheric pressure at 760mmHg {101.3KPa}, air at normal temperature (approximately 20°C) and sealing water at 15°C.
2. When planned service calls for a sealing water temperature other than 15°C, determine the relative decrement in air flow from the graph on Page 4 and select a proper type accordingly.

3. Air flow in a vacuum of -680mmHg {-9a66KPa} or more may vary by several percent.
4. In case the pump is to be subjected to a back pressure higher than a discharge pressure of 300mmAq {2.94KPa} (higher than atmospheric), or the suction air or gas exceeds 50°C, contact us for consultation service.

SELECTION CHART 60Hz

Standard Performance Curves for NVE Series Water-Ring Vacuum Pumps



5. The symbol M or R at the end of the model denomination denotes the drive method.

M: Motor-coupled

R: Belt-driven

6. Special sealing water, special gas or non-standard structural materials cause a drop in per-

formance to a certain extent. For example, a stainless steel rotor degrades performance by approximately 10%. In such a case, contact us for consultation service.

Construction

① Casing:

Constructed with sufficient rigidity, and air passages designed for minimum resistance.
The wall is thick enough to minimize noise penetration.
Suction and discharge nozzles open upward on the pump body for ease of piping.

② Rotor:

Made of special cast iron with internal air inlet and outlet.
Specially designed for excellent performance and high efficiency. Well balanced for minimum vibration.

③ Stuffing box:

Gland packing is used. Self-flushing to prevent ingress of external air.
Mechanical seal may be used, instead of gland packing.

④ Sealing compound:

Interface with the casing is sealed with liquid packing (Three-bond No. 1211).

⑤ Main shaft:

Thick enough to stand load and power transmission.
High precision machined. The rotor and shaft coupling are installed.

⑥ Port cylinder:

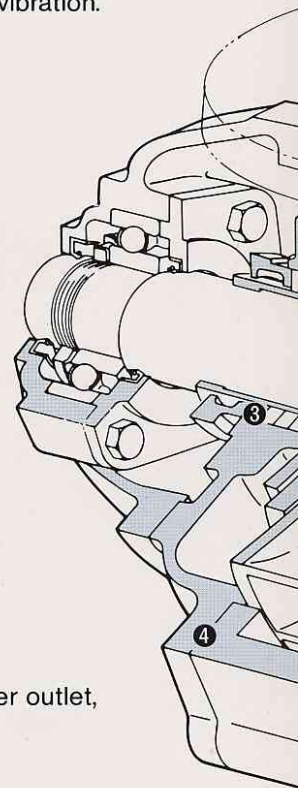
Port cylinders are provided to increase the durability of the pump.
A very small clearance between the rotor and port cylinders ensures high efficiency.
Outlet side is provided with a number of air flow passages.
Check valves are located in front of the outlet.

⑦ Check valve:

When gas in the rotor is compressed to a higher pressure than atmospheric at the port cylinder outlet, these valves are released to prevent excessive compression.
This smooths down compression, substantially lowering the noise and improving efficiency.

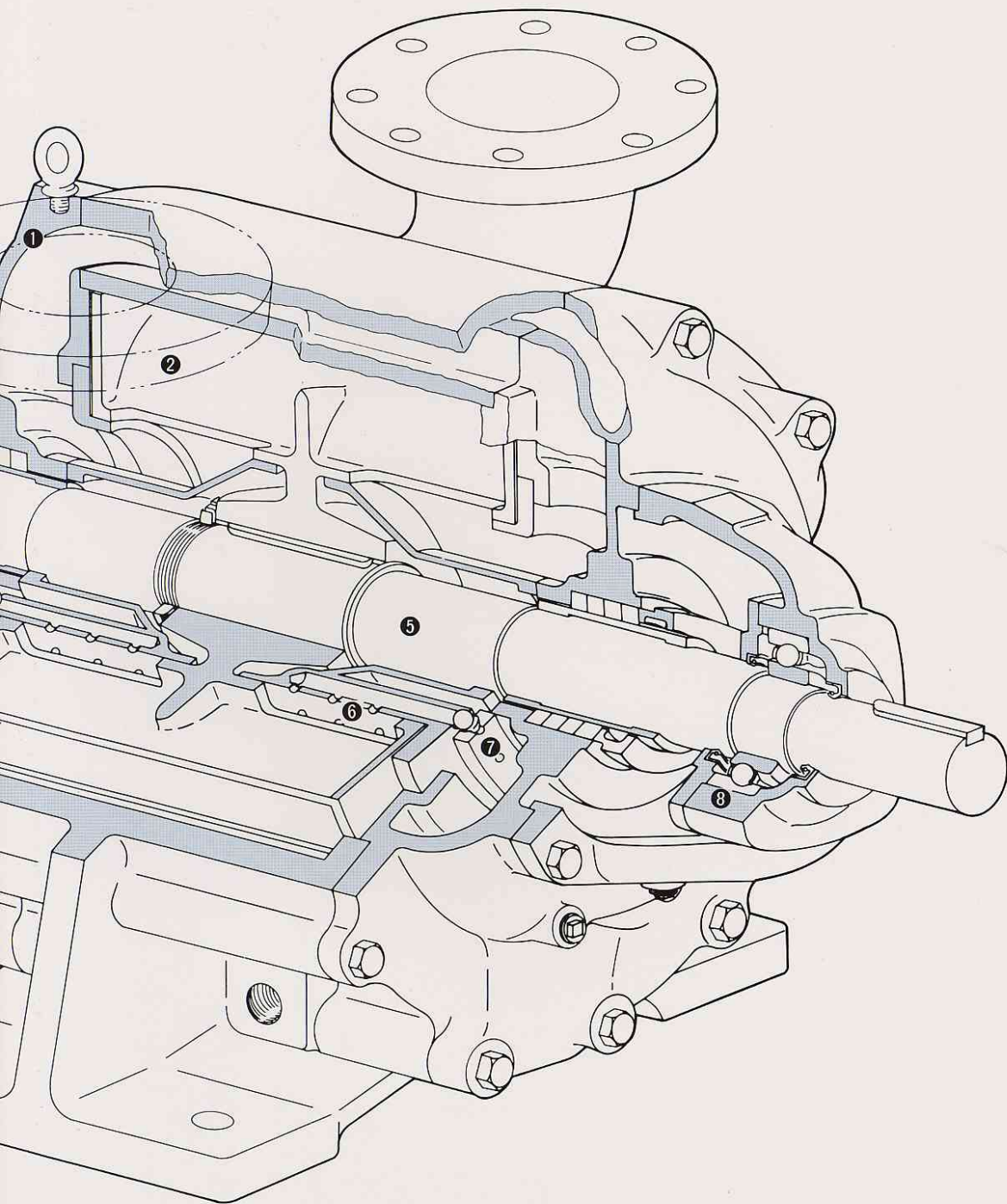
⑧ Bearings:

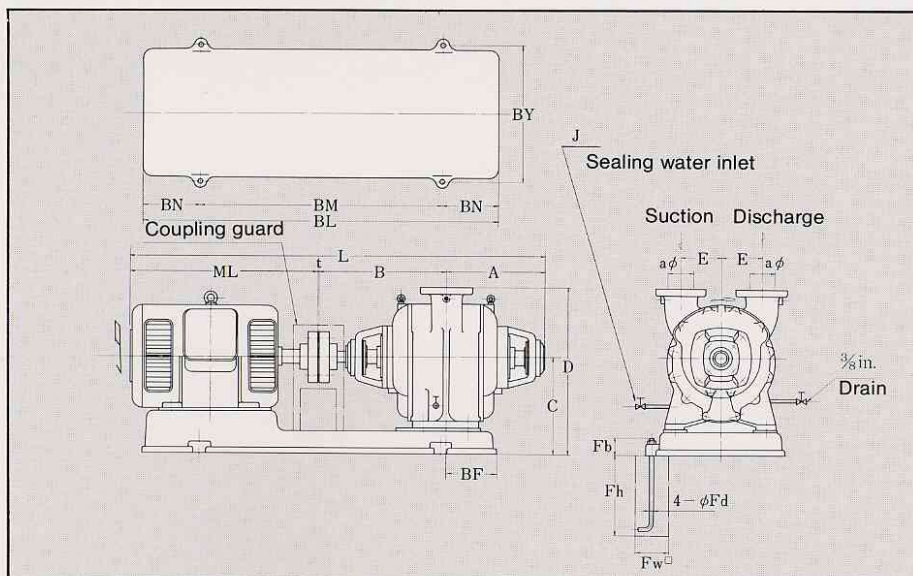
Ball bearings or self-aligning roller bearings are used.
Large-capacity bearings are selected providing sufficient load resistance.



Standard Materials for Principal Parts :

Part Name	Material
Pump casing	FC20
Rotor	FCD45
Main shaft	S45C
Shaft sleeve	SUS420J1
Port cylinder	FC20
Check valve (ball type).	—
Gland packing	Asbestos graphite
Sealing compound	Three-bond No. 1211
Coupling or V-belt pulley	FC20





DIMENSIONS NVEM Water-Ring Vacuum Pumps

unit (mm)

Unit (mm)

Hz	Model	Type	Motor					Pump							
			Frame	rpm	kW	ML	L	aφ	A	B	C	D	E	J	t
50	40NVEM	112/102	132 S	1450	5.5	392	989	40	269	325	305	530	110	½ in.	3
	50NVEM	112/102	132M	1450	7.5	431	1075	50	291	350	305	530	110	½ in.	3
	65NVEM	112/102	160M	1450	11	541	1260	65	326	390	305	530	130	¾ in.	3
	80NVEM	112/102	180M.L	970	15	598	1443	80	376	465	420	725	150	¾ in.	4
	100NVEM	112/102	200M.L	970	22	666	1619	100	429	520	420	725	160	1 in.	4
	125NVEM	112/102	200M.L	970	30	666	1718	125	468	580	420	725	200	1 in.	4
60	40NVEM	212/202	132 S	1750	5.5	392	1027	40	287	345	277	472	110	½ in.	3
	50NVEM	212/202	132M	1750	7.5	431	1117	50	313	370	277	472	110	½ in.	3
	65NVEM	212/202	160 L	1150	11	583	1358	65	347	425	380	655	130	¾ in.	3
	80NVEM	212/202	180M.L	1150	15	598	1464	80	393	470	380	655	150	¾ in.	3
	100NVEM	212/202	200M.L	1150	22	666	1657	100	447	540	380	655	160	1 in.	4
	125NVEM	112/102	200M	1150	37	668	1720	125	468	580	420	725	200	1 in.	4
	150NVEM	112/102	225 S	1150	37	719	1912	150	539	650	505	860	230	1 in.	4

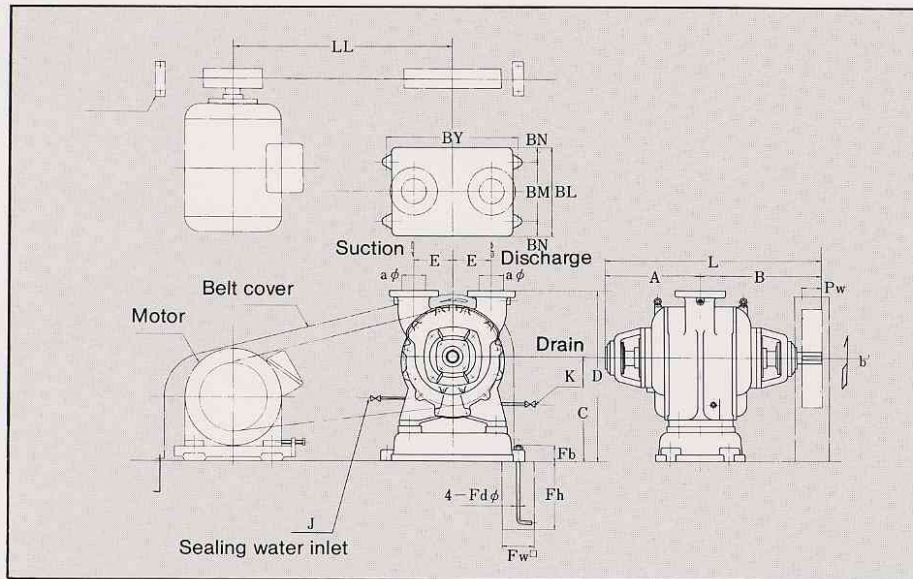
Hz	Model	Type	Base					Anchor bolt				Approx. weight.
			BL	BM	BN	BF	BY	Fd	Fb	Fh	Fw	(kg)
50	40NVEM	112/102	1050	690	180	200	410	M12	55	250	110	222
	50NVEM	112/102	1050	690	180	175	410	M12	55	250	110	236
	65NVEM	112/102	1050	690	180	135	410	M12	55	250	110	291
	80NVEM	112/102	1500	1020	240	345	590	M16	70	315	130	655
	100NVEM	112/102	1500	1020	240	290	590	M16	70	315	130	728
	125NVEM	112/102	1500	1020	240	230	590	M16	70	315	130	808
60	40NVEM	212/202	1050	690	180	180	410	M12	55	250	110	207
	50NVEM	212/202	1050	690	180	155	410	M12	55	250	110	231
	65NVEM	212/202	1400	960	220	310	530	M16	70	315	130	505
	80NVEM	212/202	1400	960	220	265	530	M16	70	315	130	595
	100NVEM	212/202	1400	960	220	195	530	M16	70	315	130	668
	125NVEM	112/102	1650	1020	240	230	590	M16	70	315	150	860
	150NVEM	112/102	1650	1050	300	270	640	M20	85	400		1190

Notes: 1. Dimensions are subjected to minor change. Contact us for actual information prior to detail designing.

2. Suction and discharge nozzle flanges are 10 kgf/cm² FF under JIS B 2212.

3. Motors are based on JEM (Class E) dimensions.

4. Approximate weight includes base and motor.



DIMENSIONS NVEM Water-Ring Vacuum Pumps

unit (mm)

Model	Type	Pump								
		a ϕ	A	B	L	C	D	E	J	K
125NVER	112/102	125	468	580	1048	420	725	200	1 in.	$\frac{3}{8}$ in.
150NVER	112/102	150	539	650	1189	495	850	230	1 in.	$\frac{1}{2}$ in.
200NVER	112/102	200	596	730	1326	600	1005	250	1 $\frac{1}{4}$ in.	$\frac{1}{2}$ in.
200NVER	312/302	200	730	870	1600	730	1200	270	1 $\frac{1}{2}$ in.	$\frac{1}{2}$ in.
200NVER	212/202	200	740	880	1620	730	1200	270	1 $\frac{1}{2}$ in.	$\frac{1}{2}$ in.
250NVER	112/102	250	817	1010	1827	830	1380	300	2 in.	$\frac{1}{2}$ in.

Model	Type	Base					Anchor bolt				Approx. weight (kg)
		BL	BM	BN	BY	LL	Fd	Fb	Fh	Fw	
125NVER	112/102	500	350	75	600	900	M16	70	315	130	530
150NVER	112/102	550	350	100	680	950	M20	85	400	150	820
200NVER	112/102	650	400	125	800	1050	M22	100	500	170	1200
200NVER	312/302	760	460	150	840	1200	M22	100	500	170	2050
200NVER	212/202	760	460	150	840	1200	M22	100	500	170	2080
250NVER	112/102	900	600	150	1050	1400	M24	115	630	190	3100

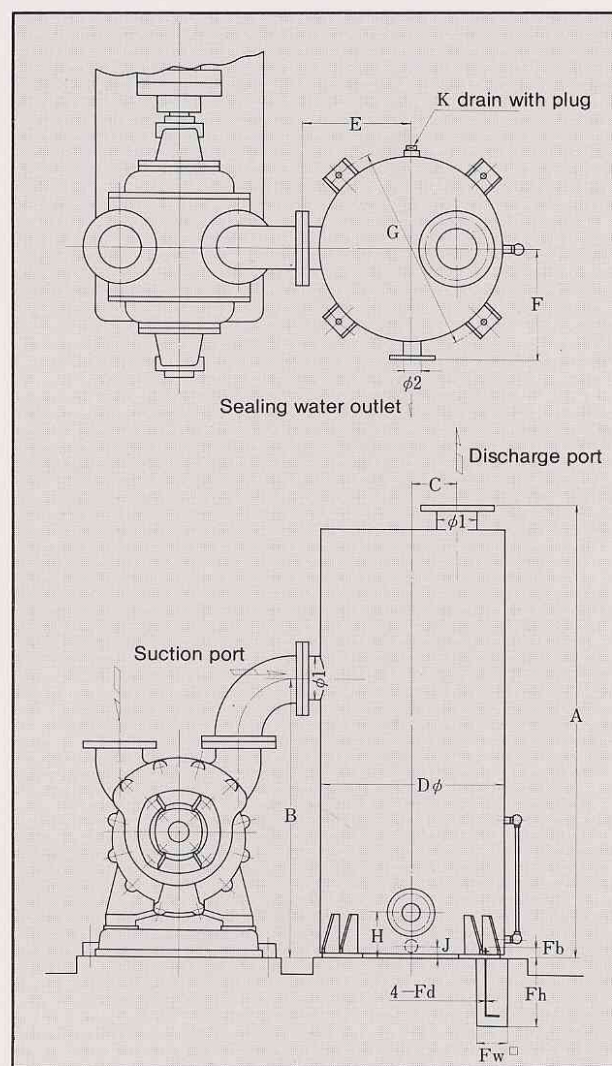
- Notes:**
1. Dimensions are subject to minor change. Contact us for actual information prior to detail designing.
 2. Suction and discharge nozzle flanges are 10 kgf/cm² FF under JIS B 2212.
 3. Approximate weight includes base and pulley (on pump side).

SILENCER SY SERIES (Also Serving As Separator)

The silencer is provided at the discharge port of the vacuum pump, and separates the sealing liquid and gas that come out together from the discharge port. An adequately designed silencer, it is extremely capable of suppressing exhaust noise.

Being of a vertical type, it requires only a small installation space.

Install the silencer as illustrated. (Take care not to position the silencer inlet at a much higher level than the pump discharge port)



○ Dimensions for SY Series Silencer-Separator

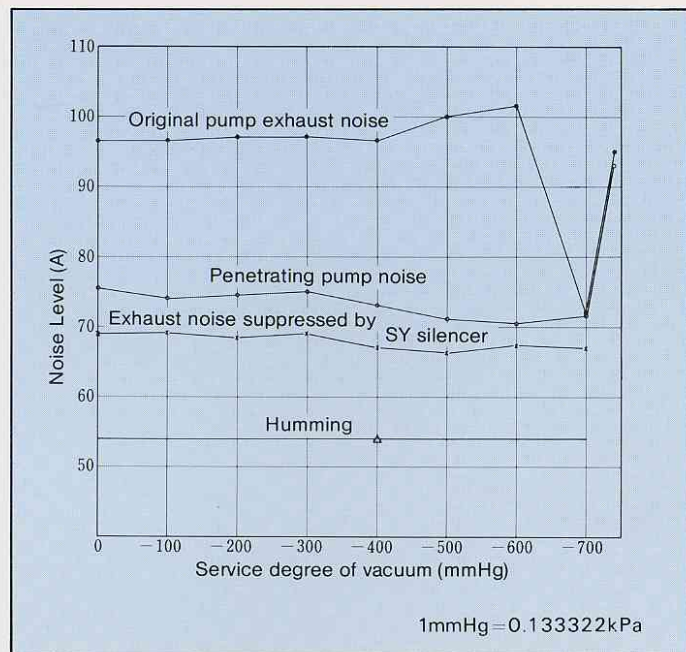
unit (mm)

Model	$\phi 1$	$\phi 2$	A	B	C	D	E	F
SY-40	40	25	779	465	85	370	235	235
SY-50	50	25	779	465	85	370	235	235
SY-65	65	40	1024	620	100	430	265	265
SY-80	80	40	1024	620	100	430	265	265
SY-100	100	50	1237	750	125	530	320	320
SY-125	125	50	1516	930	150	620	370	370
SY-150	150	65	1677	1030	175	700	420	420
SY-200	200	80	2131	1320	225	870	525	525
SY-250	250	80	2681	1680	265	1020	610	610

Model	G	H	J	K	Fd	Fb	Fh	Fw	Weight (kg)
SY-40	450	125	40	1 in.	M10	24	125	100	65
SY-50	450	125	40	1 in.	M10	24	125	100	70
SY-65	510	140	45	1 1/4 in.	M10	24	125	100	110
SY-80	510	140	45	1 1/4 in.	M10	24	125	100	110
SY-100	610	150	50	1 1/2 in.	M12	34	160	110	180
SY-125	700	150	50	1 1/2 in.	M12	34	160	110	250
SY-150	800	165	50	1 1/2 in.	M16	37	200	130	330
SY-200	1020	175	60	2 in.	M16	41	200	130	520
SY-250	1170	175	65	2 in.	M16	41	200	130	950

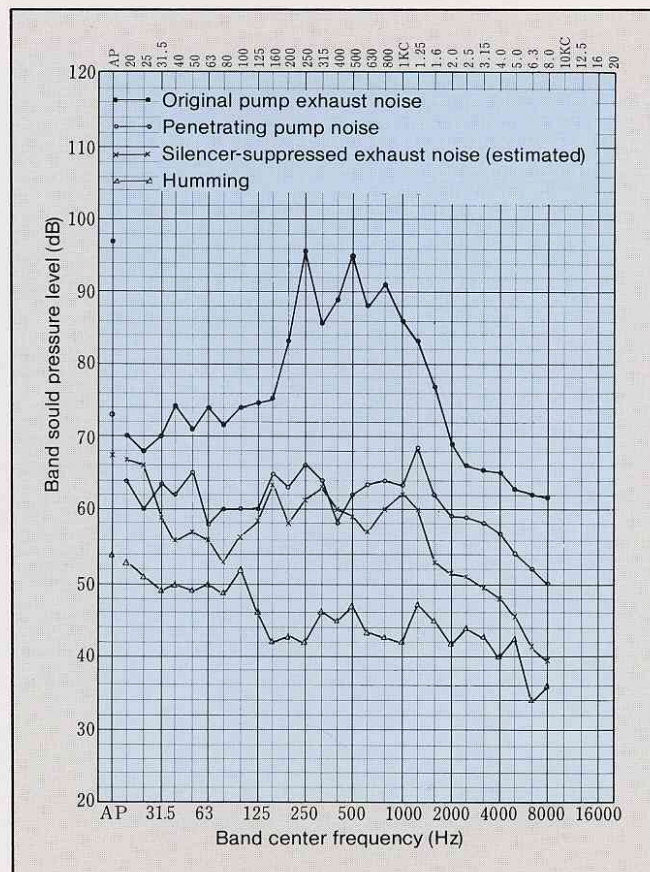
Noise Data

○ Noise Level (125 NVER)



○ Frequency Analysis

(125 NVER, service degree of vacuum at -400mmHg) -53.33KPa)



○ Noise Level

unit (dB)

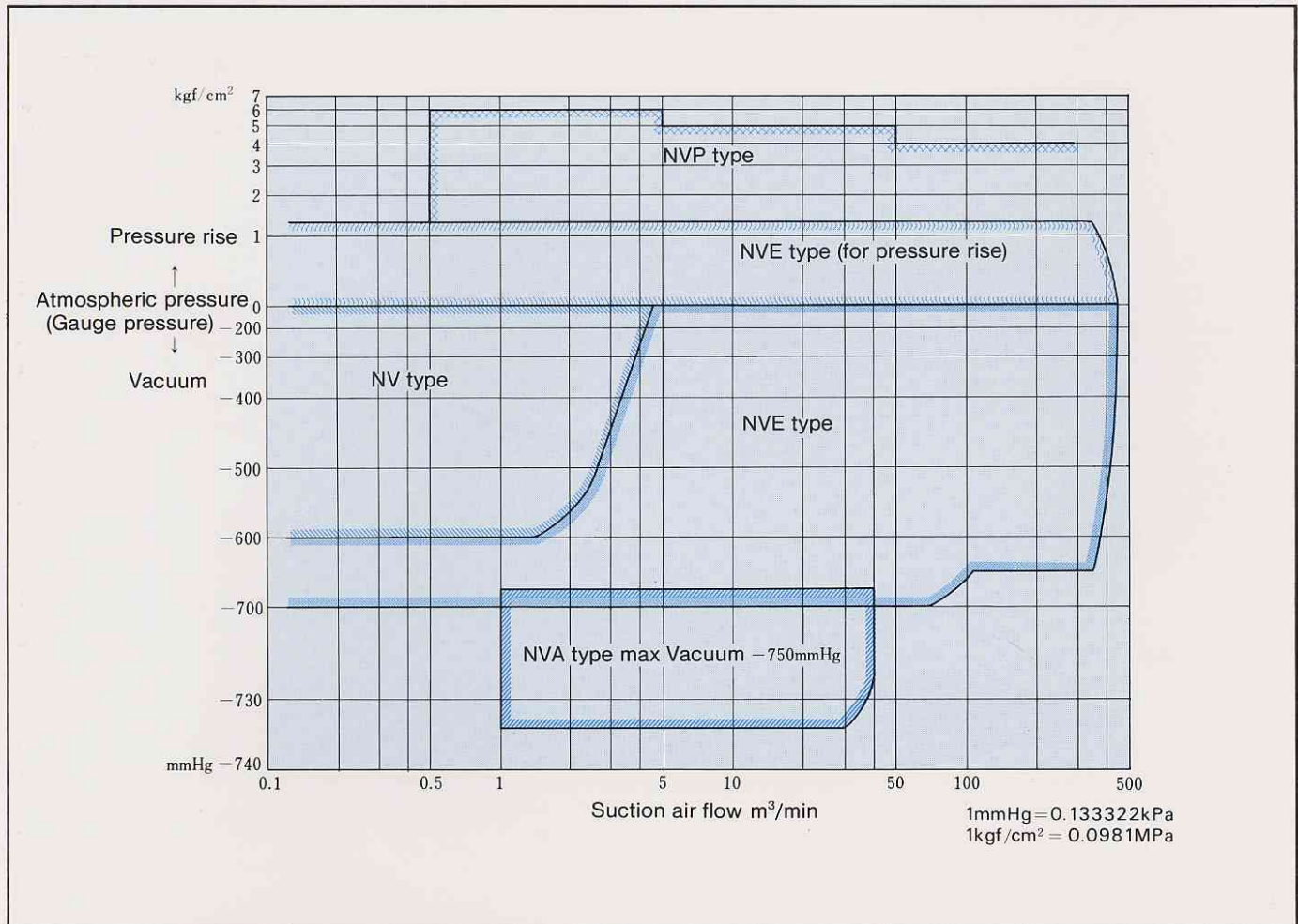
Model	Type	0mmHg {0KPa}		-400mmHg {-53.33KPa}		-600mmHg {-79.99KPa}	
		Penetrating noise	Exhaust noise	Penetrating noise	Exhaust noise	Penetrating noise	Exhaust noise
40NVE	112/102	69	66 (93)	65	64 (91)	66	62 (93)
40NVE	212/202	69	66 (93)	65	64 (91)	66	62 (93)
50NVE	112/102	69	66 (93)	65	64 (91)	66	62 (93)
50NVE	212/202	69	66 (93)	65	64 (91)	66	62 (93)
65NVE	112/102	70	67 (94)	65	65 (93)	66	66 (94)
65NVE	212/202	70	67 (94)	65	65 (93)	66	66 (94)
80NVE	112/102	69	68 (95)	68	66 (95)	71	62 (94)
80NVE	212/202	71	66 (93)	71	66 (94)	71	58 (94)
100NVE	112/102	72	68 (95)	72	66 (95)	71	63 (94)
100NVE	212/202	72	68 (95)	72	66 (95)	71	63 (94)
125NVE	112/102	75	69 (96)	73	67 (96)	70	67(101)
150NVE	112/102	79	77(107)	76	74(104)	73	71(105)
200NVE	112/102	80	77(108)	79	76(106)	76	71(105)
200NVE	312/302	82	79(109)	81	79(109)	80	72(106)
200NVE	212/202	82	79(109)	81	79(109)	80	72(106)
250NVE	112/102	83	80(110)	82	79(109)	82	74(108)

- Notes:**
- The noise levels given are shop-tested values, not guarantee values.
 - The noise levels given are as measured 1 meter away from the motor side.
 - The exhaust noise levels given are as measured with SY silencer installed. Parenthesized values are noise levels without the silencer.
 - Due to cavitation, noise level at carry-over degree of vacuum is higher than shown.

Application

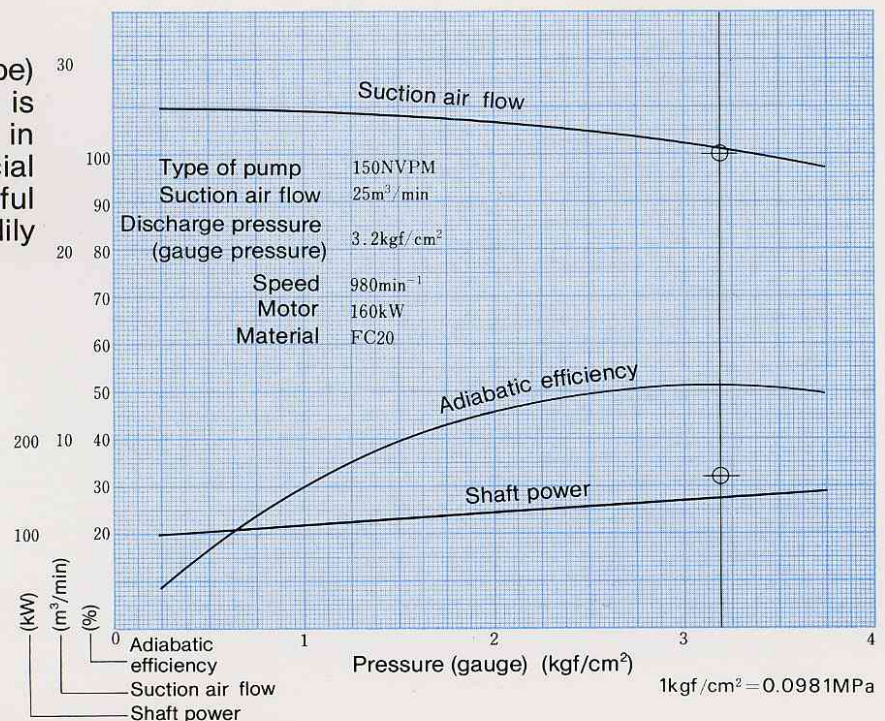
Types and applications of the water sealed vacuum pump and compressor are illustrated below.

Devices other than NV and NVE types are designed by special specifications. Details are available from us.



Compressor

The water sealed pump (NVP type) has many special features and is often used as a compressor, even in chemical industries handling special gases such as explosive gas, harmful gas, etc. This compressor is readily available from us on request.



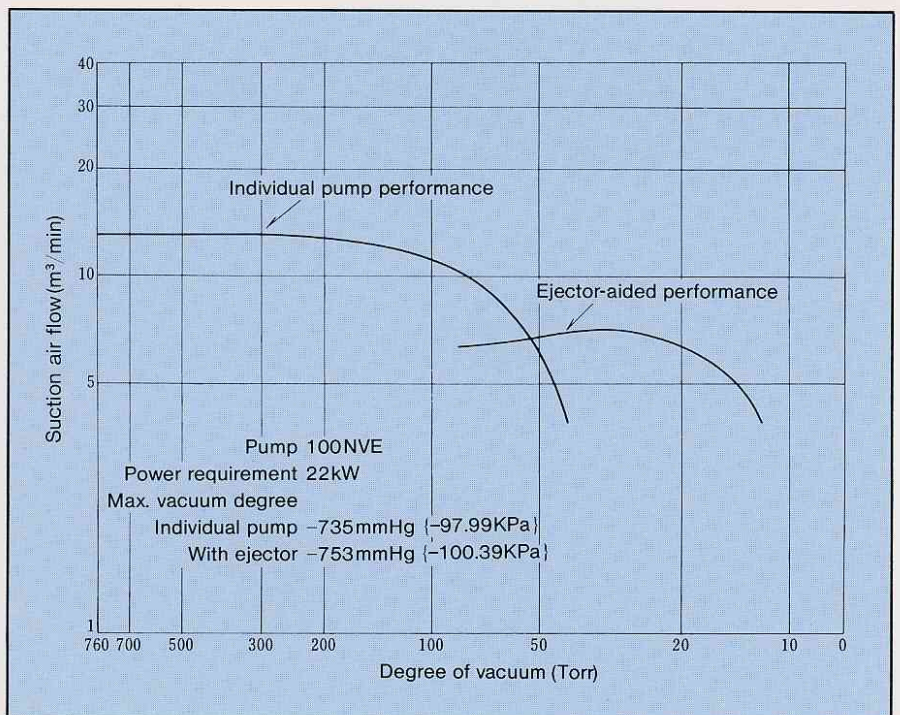
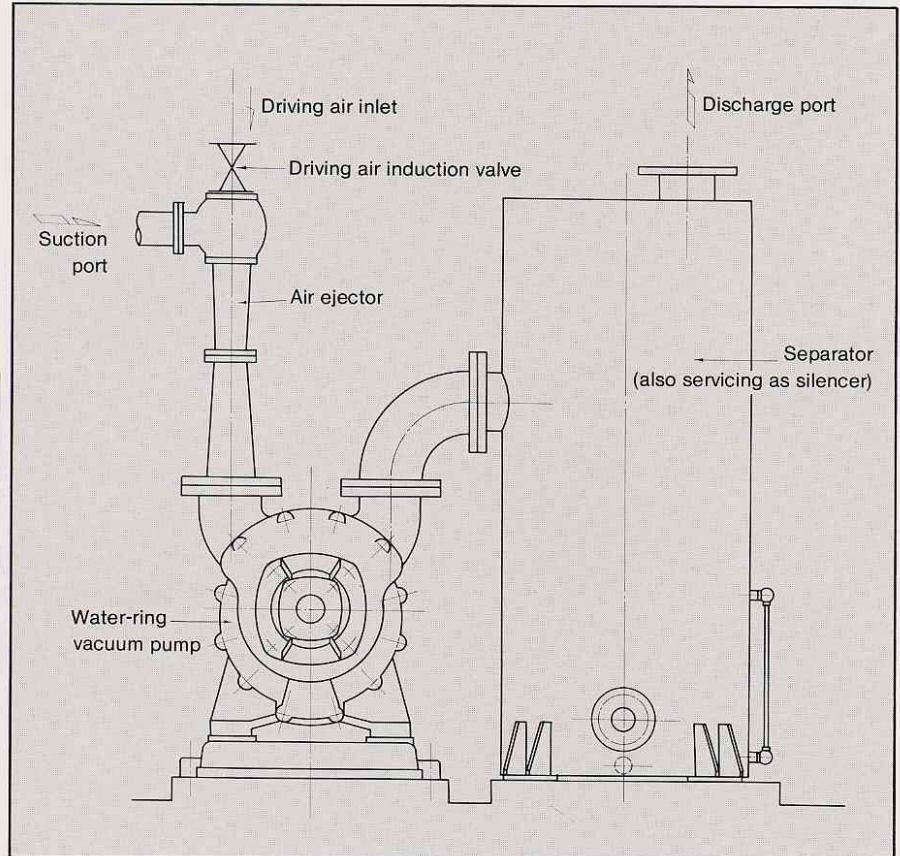
Air Ejector-Equipped Water-Ring Vacuum Pump NVA

Since a water ring vacuum pump uses water as a sealing liquid, the influence of sealing water vapor pressure, dependent on water temperature, is so great on high vacuum service (over -700mmHg) that the pump experiences a sharp drop in performance.

The NVA series is designed to offer high vacuum performance in higher vacuum regions (-735mmHg) with a higher efficiency. This series is the same as the NVE series water ring vacuum pump, except that an air ejector is connected to the suction port.

As the ejector is operative with atmospheric air or pump exhaust gas, it helps provide a high vacuum without an additional source of power. This makes the NVA series ideal for high vacuum service, or use as condenser exhausting pumps that operate at high temperature and require high vacuum.

For high vacuum service, the series may be used with mechanical booster. For more details on this, please contact us.





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