

W2V20

High Vacuum Rotary Vane Pump

User Instruction



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1.1 Safety precautions

Read and follow below instructions before you install and operate the pump.

* Notices for safe use :

Do not pump corrosive or explosive gases.

As the pump's driving principle, you cannot pump the gases which are explosive when compressed.

The standard W2V-series pumps are not designed to prevent corrosion.

In case of pumping strong corrosive gases, please contact our technical sales dept.

Do not use pump as compressor

Vacuum pump does not have any special design for withstanding inner pressure.

The accumulated pressure by compressed gases in exhaust line can break pump case, therefore can cause both personal injury and property damage.

Do not operate the pumps where explosive processes are involved.

If you need to use explosion-proof motor, please contact our technical sales dept.

The pump must be installed and managed by qualified expert.

Important safety information is highlighted as **WARNING** and **CAUTION** instructions.



WARNING

Indicates procedures that must be strictly observed to prevent personal injury.



CAUTION

Indicates procedures that must be strictly observed to prevent damage to pump or system.

Additional safety information



Danger of electric shock



Danger of hot surface



Danger of explosion



Danger of cut/crush

1.2 Description of W2V20

PRODUCT CODE RULE

W **2** V **20**

2 - 2 Stage Pump

20 - 200 ℓ/min (pumping speed)

- | | | |
|---------------------|-----------------------|-------------------------|
| ❶ Inlet end fitting | ❷ Gas ballast control | ❸ Exhaust end fitting |
| ❹ Oil filling-plug | ❺ Oil drain-plug | ❻ Oil level sight glass |
| ❼ Oil case | ❽ Electric motor | ❾ Terminal box |



W2V20

| | | |
|---------------------------------|--|---|
| Pumping Speed | 200 ℓ/min (12m ³ /h, 7.1CFM) | |
| Ultimate Pressure | Gas Ballast Closed | ≤ 1X10 ⁻³ torr (1.3 X 10 ⁻¹ Pa) |
| | Gas Ballast Open | 5X10 ⁻² torr (6.7 Pa) |
| Power Input Options | Standard | 220VAC 1Φ 50/60Hz |
| | Options | 220/380VAC 3Φ 50/60Hz |
| | Customer's Request (Voltage, Frequency, Phase) | |
| Full Load Power | 0.4kW (0.5 HP) | |
| Motor Speed | 1,700 rpm | |
| Inlet and Outlet Options | Standard | NW25 |
| | Option I | Hose Nipple (Φ12, Φ16 or Φ26 OD) |
| | Option II | PT Nipple (1/4", 3/8", 1/2", 3/4", 1") |
| | Option III | User Requested Type |
| Oil Capacity | 600 cc (0.6ℓ) | |
| Weight | 23.3 Kg(1Φ) / 20 Kg(3Φ) | |
| Ambient Temp | 7~40°C / 45~104°F | |
| Overall Dimension (mm) | 150(W) X 423(L) X 250(H) | |



WARNING

Do not carry out any unauthorized conversions or modifications on the pump

2.1 Unpack and Inspect

Remove all packing materials and protective covers.

Leave the inlet and outlet lids on before connection of the pump.

(The pump is supplied filled with oil.)

- ① Check the pump and accessories if they are the same type you have ordered.
- ② Check the oil level contained through the sight glass.
- ③ Check the pump if it has any sign of loose bolts, spilt oil, and broken/loose parts.
- ④ Do not use the pump if it is damaged; notify WSA with your order and serial number.

2.2 Location



CAUTION

**The pump should be set up on a flat, horizontal surface.
Terminal box should not to exposed to excessive moisture.**

The pump can be used free-standing on its baseplate.

To firmly install the pump in place, use bolts and fasten it to the ground or to a secure object through holes in the baseplate. It is recommended to use anti-vibration pads between base plate and fixing surface.

Locate the pump where you can check the oil level sight-glass and access the controls including oil filling-plug, oil drain-plug, and gas-ballast.

When installing the pump in a closed housing, make sure there is sufficient air circulation.

We use vacuum oil, 'MR-200' as our default vacuum oil and it is recommended to use the pump over 7 °C (45°F)

WSA standard pump is not suited for installation in explosion hazard areas.
If you need to apply the pump to such area, please contact us first.

2.3 Mechanical connection

Before connecting the WAS pump, remove the shipping seals from the inlet and exhaust connection flanges. (WSA pumps are sealed with white PE seals for domestic and ocean transport and metal blank clamped for air shipment to maintain oil inside)

WSA pumps are shipped with oil contained inside, so take extra care not to spill it

Retain shipping seals in case you need to store the pump in the future.

Ensure that sealing surfaces are clean and scratch-free prior to assembly.

2.3.1 Inlet port Connection

* **Connection Tip** : To achieve specified pumping speed, make the length of pipeline between vacuum chamber and the pump as short as possible. Also the internal diameter of the pipeline is at least the same as inlet port; the narrow inlet line can reduce pumping speed.

You can protect the pump with applying proper accessories such as separators, filters and cooling traps etc. between vacuum chamber and pump. However, the conductance value of the accessory could cause a reduction in pumping speed.

Connection

Connect the intake and exhaust lines with a clamp and centering each.

- Default : Connect to the NW25 flange supplied on the pump; use the clamp and centering.
- Option 1 : The hose nipple can be provided upon request. Applicable to vacuum hose.
(Φ 12 OD, Φ 16 OD, Φ 26 OD available depend on hose size.)
- Option 2 : Screw nipple can be used. Applicable to screw valves etc.
(1/4", 3/8", 1/2", 3/4", 1" ; available depending on connecting devices.)

Inlet filters can be installed for very dusty applications or pumping condensable vapor.

Valves can be used for isolating the pump from the vacuum system; to maintain vacuum when the pump is switched off. We recommend to install the Angle Valve. (refer section 7.2)

2.3.2 Outlet port Connection



WARNING

If the exhaust gases from the vacuum pump are harmful to human body, these must be safely lead away and subjected to post-treatment as required

* **Connection Tip** : Designing the exhaust line lower than the pump can prevent condensate from flowing back into the pump.

Oil vapors can be discharged from the exhaust port in low vacuum section (760 Torr~10 Torr) since the large amount of air is sucked into the vacuum pump. In order to reduce the emission of oil vapors, we recommend the installation of an additional exhaust filter (WSA oil mist trap : refer section 7.2) especially when the oil mist can not be lead out by separate hood or duct system. Contact WSA for the detailed inquiry.

Connection

Exhaust connecting options are the same as Inlet Connection

* **Connection Tip** : Ensure that the internal diameter of the exhaust line is at least the same as outlet port; the narrow exhaust line can accumulate the inner pressure in the pump and it can damage the pump seals therefore cause oil leaks. The maximum pressure in the oil case must not exceed 1.5 bar (absolute).



CAUTION

If the temperature of the pump-body exceeds 70°C (158 °F), you must fit suitable guards to prevent contact with hot surfaces.

Depending on the type of application or the kind of pumped media, the corresponding regulations and information sheets must be observed.

2.4 Electrical connection



WARNING

ELB(Earth leakage breaker) must be installed to prevent electrical accident. Electrical connections for 3 phase must be done by a qualified electrician.

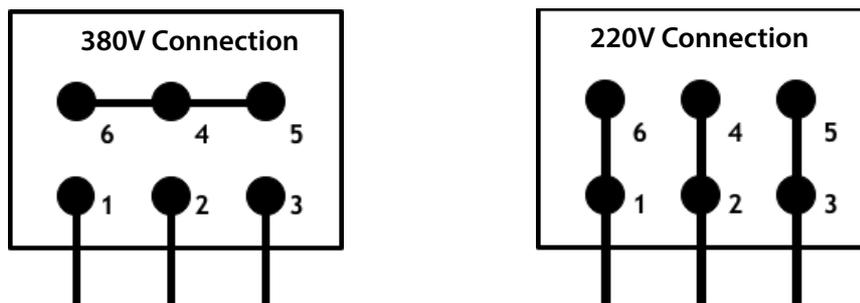
If you don't have knowledge of 3 phase power connection, please inquire of WSA.

WSA can not be responsible for any trouble caused by electrical connection.

* For 1 phase pump, no specific connection process is needed.
Simply connect the plug to the power.

Connection (3 phase)

- ① Open the cover of terminal box. You can see 6 electric cords need to be connected.
- ② For 3 phase motor, 3 external power cords and 1 extra electric cord to earth should be supplied.
- ③ With referring to the diagram on the back of terminal cover, connect the motor to the power.



(Fig) Examples of 3 phase power connection

380V at 3 phase : high voltage connection / 220V at 3 phase : low voltage connection.

- ④ After wiring the motor, check its direction of rotation by operating the pump for short time(2~3 sec) before connecting the pump to your vacuum system. If the rotation is the opposite to the direction of the arrow on the motor cap, change the codes from outside ; 1 2 3 (ex. 1 2 3 -> 1 3 2) and check the direction again.

3.1 Gas-ballast control

The gas ballast introduces a small amount of air(or inert gas) during the compression stage in order to adjust the saturation pressure of the vapor and it can prevent condensation of vapors in the pump; the condensates cause contamination of the oil.

In general use, it is recommended to use the pump with gas-ballast closed.

| GB control closed | GB control open |
|----------------------------|--|
| to achieve ultimate vacuum | to pump high concentrations of condensable vapor |
| to pump dry gases | to decontaminate the oil |

Operating pump with GB control open will lower ultimate vacuum level and raise the temperature of the pump body. Also it will increase the speed of oil loss from the pump.

3.2 Start-up procedure



WARNING

**Never operate the pump with a sealed exhaust line.
There is the danger of injury.**

Ensure all vacuum connections are completely sealed before switch on the pump.

Operating pump with being exposed to normal pressure in long period of time can cause serious mechanical troubles.

Do not operate the pump with inlet port open. It would overload the pump and cause oil loss.

Never expose any part of the body to the vacuum. It might cause personal injury.

*** In case of Emergency stop or Power failure**

There is no need of a particular procedure to prevent from losing vacuum in case of an emergency stop or power failure.

The oil regulator built inside of the pump prevents Back-Flow of oil when the pump stops.

However, it is more recommended to vent the inlet side of the pump if it stops accidentally.

Procedure

- ① Check that the pump oil-level is between the H and L marks through the oil-level sight-glass; if it is not, refer to sec 4.3 (Never operate the pump with the oil level below L mark.)
- ② Turn the gas-ballast control to the required position if you pump condensable vapor.
- ③ Switch on the electrical supply to the pump.
- ④ For 3 phase pump, check the direction of rotation of the motor.

When starting-up a pump after prolonged storage period, the actual vacuum level might not be able to reach to the ultimate pressure, specified on the pump. It is generally because of the contamination of the oil inside. Replace with new vacuum oil.

3.3 Decontamination of Oil

As the oil is gradually contaminated during operation by dissolved gases and vapors, the degas process is necessary to prevent corrosion of the pump. Allow the pump to continue operating with inlet port closed and gas ballast control open until the oil is free of condensed vapors.

It is recommended to leave the pump being operating in this mode for about 30 min after finishing the process. To attain the ultimate pressure, close the gas ballast after this process.

3.4 Switching Off & Shutdown

You can simply switch off to stop the pump, under normal circumstances.

* When motor is switched off while the gas ballast is open, the system pressure can be risen slowly. (Close the gas ballast to maintain vacuum level.)

If the pump is to be shutdown for an extended period after pumping aggressive or corrosive media or if the pump has to be stored, proceed as follows;

- ① Drain the oil through oil drain-plug.
- ② Add clean oil until the oil-level is at the H mark and let the pump operate for some time.
- ③ Drain the oil again and add clean oil until the oil level is at the H mark.
- ④ Seal the connection ports.



WARNING

When pumping harmful substance, take adequate safety precautions.

4.1 Safety Guide



WARNING

Obey the safety instruction given below.
If you do not, you can cause personal injury and property damage

Allow the pump to cool to a safe temperature before you start maintenance work.



WARNING

Disconnect the electrical connection before disassembling the pump.
Make absolutely sure that the pump cannot be accidentally started.
(pull the main plug)

A suitably trained and supervised technician must maintain the pump.

Obey your local and national safety requirements.

If the pump has pumped harmful substances, ascertain the nature of hazard and take adequate safety measures.



CAUTION

When disposing of used oil,
you must observe the applicable environmental regulation.

When the pump has been pumping corrosive media, we recommend to perform any possibly planned maintenance work immediately in order to prevent corrosion of the pump.

After maintenance is completed and reconnect the power of 3 phase pump,
recheck the pump rotation direction.

Do not reuse o-ring and seals if they are damaged.

4.2 Maintenance Frequency

The plan shown in the below Table details the routine maintenance operations necessary to maintain the pump in normal use.

More frequent maintenance may be required if the pump is used to process corrosive or abrasive gases and vapors; in these circumstances, we recommend that you replace the pump seals every year. If necessary, adjust the maintenance plan according to your experience.

When you maintain the pump, use WAS spares and service kits;
there contain all of the components necessary to complete maintenance operations successfully.
The Item Numbers of the spares and kits are given in Section 7.1.

* WAS provides 2 kinds of Service kits(Repair kits)

'Minor Repair Kit for W2V20' is for the general use for overhaul and consists of various metal and rubber parts. It contains mainly disposable parts which need to be periodically replaced.

'Major Repair Kit for W2V20' contains major parts(ex.vanes) which should be replaced for repair process in addition to all Minor parts.(refer sec 7.1)

Overhaul is a process of dismantlement the pump, cleaning all parts and reassembling. It is highly important to improve the performance and elongate lifetime of the pump. WSA recommends users to do overhaul at least every other year.

Maintenance Frequency

| Operation | Frequency |
|---|------------------------|
| Check the oil-level | Daily |
| Replace the oil | 2,500 operation hours |
| Inspect and clean the inlet-filter | Every oil change |
| Clean or replace the gas-ballast o-ring | Every oil change |
| Clean the motor fan-cover | Yearly |
| Clean and overhaul the pump | 15,000 operation hours |
| Fit new blades | 30,000 operation hours |
| Test the motor condition | 15,000 operation hours |

Oil change Frequency

| Application | Frequency (hrs) |
|--|-----------------|
| High Vacuum in Lab environment, or system seldom exposed to the air | 2,500 |
| High Vacuum in manufacturing environment, often exposed to the air | 1,200 |
| Vacuum furnace, large gas-exhaust diffusion system, system with booster pump | 600 |
| Vacuum drier, vacuum molding, vacuum packing | 200 |
| Vacuum distillation, low vacuum tank | 120 |

4.3 Maintenance of oil

4.3.1 Checking the oil-level

During operation of the pump, the oil level must always remain between marks H and L on the oil-level glass. The amount of oil must be checked and topped up as required.

Note : The pump must be switched off before topping up the oil. It is recommended to power off other components connected to pump for safety reason.

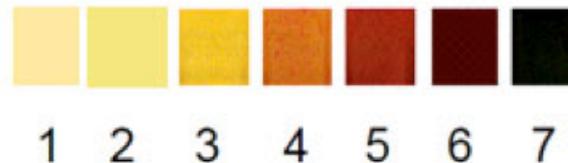
If gases or liquids dissolved in the oil result in a deterioration of the ultimate pressure, the oil can be degassed by allowing the pump to run for approx. 30 min. with the intake port closed and the gas ballast valve open.

4.3.2 Oil change

For proper operation of the pump, it is essential that the pump has an adequate supply of the correct and clean oil at all times.

Clean vacuum oil is basically odorless and transparent. (MR-200 has pale yellow color.)

As operating pumps, the color of vacuum oil turns from yellow through orange into red brown. This discoloration is caused by gases and foreign materials pumped in and this mixture would impair the vacuum level and damage the interior of pump.



Change vacuum oil when discoloration is dark yellow to red brown. (4 in above picture.)

When the color reach 6~7 with deterioration, the interior of pump would be damaged and overhaul process is necessary before operating the pump again.

If the vacuum oil becomes cloudy as milk color, it is caused by moisture flowed in.

In this case, stop the pump and wait until the fluid is divided into two layers; vacuum oil and water. Then drain the water layer completely through oil drain plug.

Design the process so as moisture not to be pumped in and install a cold trap if necessary.

Before and after a prolonged storage, additional change of oil is required.

If the speed of deterioration of oil is too fast, apply dust filter or oil filter to the pump. (refer to sec 7.4 : WMT-250/400)

Contact WSA for further information.



Caution

Only change the oil after the pump has been switched off and while the pump is still warm..

Procedure

- ① Remove the oil-drain plug and let the used oil drain into a suitable container.
- ② When the flow of oil slows down, screw the oil-drain plug back in, briefly switch on the pump (max. 10 sec) and then switch it off again. Remove the oil-drain plug once more and drain out the remaining oil.
- ③ Screw the oil-drain plug back in (check the gasket and reinstall a new one if necessary.)
- ④ Remove the oil-fill plug and fill in with fresh oil.
- ⑤ Screw the oil-fill plug back in.

* Recommended Vacuum oil : **NEOVAC MR 200**



Caution

We can only guarantee that the pump operates as specified by the technical data if the vacuum oil recommended by us is used.

The ultimate pressure is determined by the saturation vapor pressure, viscosity and solubility of gases of the vacuum oil used.

Use suitable vacuum oil for the pump.

* MSDS report of MR-200 is available to download on WSA web site.

(<http://www.wsavac.com/eng/sub/products/accessories.asp#>)

| NEOVAC MR-200 (Moresco corp.) | |
|-------------------------------|---|
| Color (ASTM) | bright yellow (L0.5) |
| Pour point | -17.5°C |
| Boiling point | 195°C / 0.1 Torr |
| Flash point | 256°C min. (COC) |
| Viscosity | 71.0 (40°C, mm ² / sec(cSt)) |
| Vapor pressure | 1 X 10 ⁻⁵ (50°C) |

4.4 Cleaning the Dirt Trap

WSA pump has dirt trap in the inlet port; a wire mesh structure which is designed to sieve coarse particles. To keep the pumping speed as specified, the dirt trap should be cleaned up regularly.

Take out the dirt trap from the inlet port and rinse it in a suitable container with solvent

Dry it completely with compressed air.

Check the status of dirt trap and replace it if damaged.



Caution

The cleaning intervals depend on the application. If the pump is exposed to large amounts of abrasive materials, a dust filter should be fitted into the intake line.

4.5 Storage and Disposal



Caution

Observe the storage temperature: -30~70°C (-22~158°F)
Storage below -30°C (-22°F) will permanently damage the pump seals.

4.5.1 Storage

The pump should be stored in a dry place preferably at room temperature 20°C (68°F).

All other components and connections to vacuum system must be properly removed and purged the pump with dry nitrogen if possible.

The used oil should be changed to prevent corrosion during the idle period. (refer 3.4)

The inlets and outlets of the pump must be sealed. (Use the seals provided upon delivery.)

The gas ballast switch must be tightly closed and it is recommended to put the pump in a PE bag with silica gel(desiccant) for prolonged storage.

When a pump is put into operation after over one year of storage, standard maintenance should be run on the pump and the oil should also be exchanged.

4.5.2 Disposal

Dispose of the pump, the oil and any components removed from the pump safely in accordance with all local and national safety and environmental requirements.

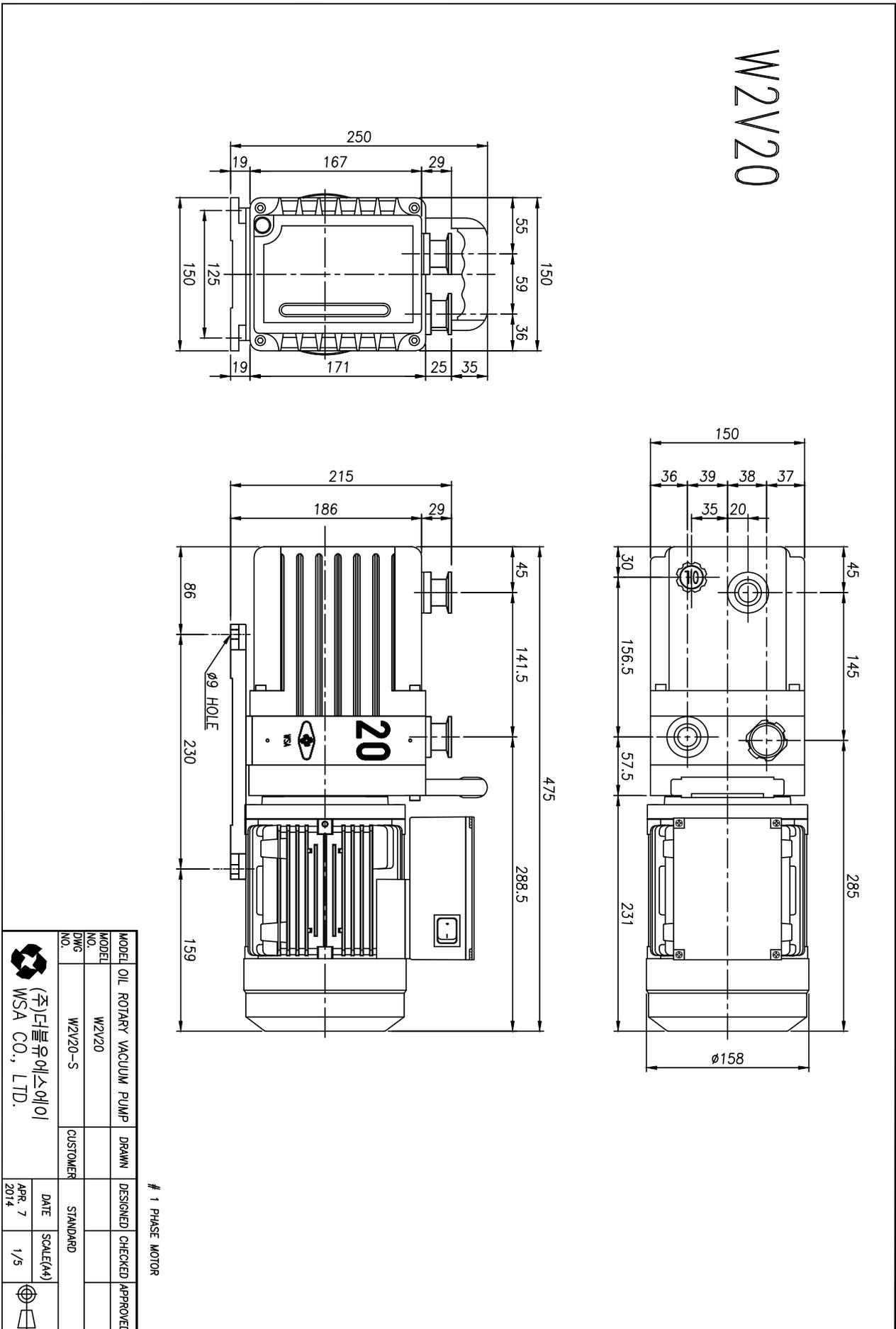
Take particular care with the following:

- Components which have come into contact with the vacuum oil.
- Components which have been contaminated with dangerous process substances.

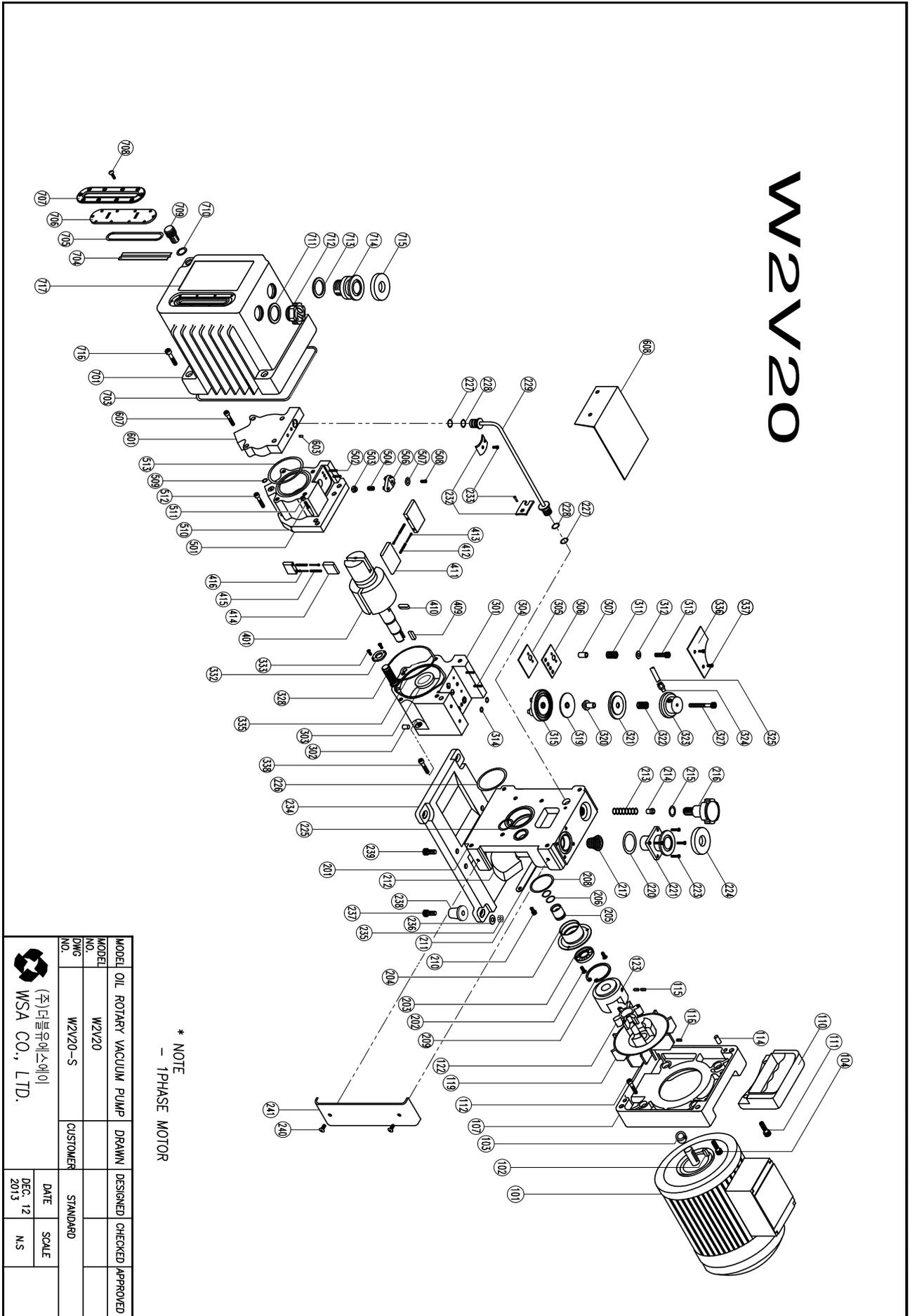
*** Do not incinerate fluoroelastomer seals and o-rings. (eg.viton)**

| Symtom | Possible cause | Corrective actions |
|---|--|--|
| The motor is noisy and does not rotate | voltage of power and connection. | Correct voltage or its connections. |
| | Any foreign material in the pump. | Remove the substance and/or change oil. |
| | Motor (Open internal circuit) | Replace open windings. |
| The pump is noisy and over-heated. | Any foreign material blocks the exhaust valve. | Remove the foreign material. |
| | Leakage in the system | Fine the part and fix the leakage. |
| | If leakage valve is opne | Close the valve. |
| | All valves in the vacuum line | Close if found open. |
| Vacuum level drops continuously. | Low oil level | Top vacuum oil up. |
| | Leakage on the connected device | Close the intake and recheck. |
| | Condensed moisture in oil | Change oil. |
| | Oil regulator failure | Replace the oil regulator. |
| | Gas ballast open | Close the gas ballast. |
| Motor rotates but pump doesn't run. | Worn out coupling | Replace coupling parts. |
| | Worn out key between motor and pump | Replace the key and set screws |
| | Any foreign material blocks the pump | Overhaul the pump |
| The pump fails to start | Status of connected voltage | Align the voltage with motor specification. |
| | Wiring is malfunctioning | Check and repair wiring. |
| | Too viscous oil. | Use recommended oil and change if contaminated. |
| | Oil temperature is below 7°C | Warm up the pump and oil. |
| | Any foreign material blocked | Overhaul the pump. |
| | Motor is malfunctioning | Overhaul or replace the motor. |
| Failure to reach ultimate vacuum | Leakage in the system | Do leak test. |
| | Measurement range of the gauge | Use suitable gauge for the vacuum level. |
| | Incorrect way of measuring vacuum | learn how to use the gauge correctly. |
| | Type of oil or contamination level | Use recommended oil and change it if contaminated. |
| | Valve failure | Repair or replace the valve |
| | Insufficient pump capacity | Replace the pump with sufficient capacity. |
| Pumping speed is too slow | Contamination of dirt trap | Clean or replace the dirt trap. |
| | Design of piping system. | Make the connected pipes bigger than pump and have minimum length. |

6.1 Dimensions of W2V20



6.2 Development figure of W2V20



Part List (BOM LIST : W2V20)

| Part No. | Code No. | Description | Specification | Qty |
|----------|--------------|-----------------------------|------------------------------|-----|
| 101 | JWME01010310 | MOTOR (1PHASE) | 1P 220V 400W 50/60Hz ±5% | 1 |
| 102 | WPMI01020300 | KEY (FOR MOTOR) | 5X5X15R | 1 |
| 103 | WPMC01030300 | RING (FOR COUPLING SPACE) | Ø20/14X8.5 (BRASS) | 1 |
| 104 | WPMIM6X35HN | BOLT | M6X35 | 4 |
| 107 | WPMA01070300 | MOTOR PLATE | DIECAST | 1 |
| 110 | WPMA01100700 | HANDLE | DIECAST | 1 |
| 111 | WPMIM6X15HN | BOLT | M6X15 | 2 |
| 112 | WPMIM6X20HN | BOLT | M6X20 | 4 |
| 114 | WPMC01140700 | MOTOR PLATE GUIDE PIN | Ø6 X 13L(BRASS) | 2 |
| 115 | WPMIM5X8HS00 | BOLT | M5X8 (SET SCREW) | 2 |
| 116 | WPMIM5X8HS00 | BOLT | M5X8 (SET SCREW) | 1 |
| 119 | WPMA00119030 | COUPLING FAN | DIECAST(Ø14) | 1 |
| 122 | WPRE01222100 | COUPLING JOINT | RUBBER | 1 |
| 123 | WPMA01230700 | COUPLING | DIECAST(Ø15) | 1 |
| 201 | WPMA02010300 | MAIN PLATE | DIECAST | 1 |
| 202 | WPMIM4X10HF0 | BOLT | M4 X 10(FLAT HEAD,Ni-PLATED) | 3 |
| 203 | WPRV02030700 | OIL SEAL (FOR HOUSING) | Ø22/32 X 7 | 1 |
| 204 | WPMA02040700 | OIL SEAL HOUSING(SLEEVE) | Ø40/32 X 25.5 | 1 |
| 205 | WPMI02050700 | BUSHING | Ø22/18x20,SUJ2 | 1 |
| 206 | WPRSS1800000 | O-RING | S-18(SILICON) | 2 |
| 208 | WPRSG3500000 | O-RING | G-35(SILICON) | 1 |
| 209 | WPMI02090700 | SNAP RING (FOR HOUSING) | R-32 | 1 |
| 210 | WPMIM4X80HN | BOLT | M4X8 | 2 |
| 211 | WPMI02110300 | SUCTION FELT STRAP | 1t x 92 x 13 x R34 | 1 |
| 212 | WPME02120700 | OIL SUCTION FELT | FELT | 1 |
| 213 | WPMI02132100 | G/B SPRING (FOR KNOB) | W0.9 X Ø4.5/6.3 X 33L | 1 |
| 214 | WPMC02142100 | G/B BRASS PIN(FOR KNOB) | Ø4.5 X 6.2 X 11.5(BRASS) | 1 |
| 215 | WPRSP10A0000 | O-RING | P-10A(SILICON) | 1 |
| 216 | WPRE02162100 | GAS BALLAST KNOB | Ø40 | 1 |
| 217 | WPM502170700 | STRAINER ASSEMBLY | Ø0.2 X 32# X Ø17 | 1 |
| 220 | WPRSP3000000 | O-RING | P-30(SILICON) | 1 |
| 221 | WPMZ02210700 | INTAKE FLANGE | NW-25 | 1 |
| 223 | WPMIM4X12HN | BOLT | M4 X 12 | 4 |
| 224 | WPRE0224N250 | NW25 FLANGE CAP | NW-25(CAP) | 1 |
| 225 | WPRSP2000000 | O-RING | P-20(SILICON) | 1 |
| 226 | WPRSG4500000 | O-RING | G-45(SILICON) | 1 |
| 227 | WPRSAN109000 | O-RING | AN-109(SILICON) | 2 |
| 228 | WPRSP10A0000 | O-RING | P-10A(SILICON) | 2 |
| 229 | WPMC02290200 | G/B TUBE ASSEMBLY(STANDARD) | BRASS | 1 |
| 232 | WPMI02322100 | GAS BALLAST CLAMP | 16 X 26 X 2.0T | 2 |
| 233 | WPMIM4X12HN | BOLT | M4X12 | 2 |
| 234 | WPMA02340300 | BASE PLATE | DIECAST | 1 |
| 235 | WPMIM6000000 | NUT | M6 | 4 |
| 236 | WPMIW6X18N0 | WASHER | Ø6 X 18(FLAT) | 4 |
| 237 | WPMIM6X20HN | BOLT | M6 X 20 | 4 |
| 238 | WPRE02380700 | BASE RUBBER | Ø24 X 12 | 4 |
| 239 | WPMIM6X15HN | BOLT | M6 X 15 | 4 |
| 240 | WPMIM4X8HB0 | BOLT | M4 X 8(ROUND HEAD,Ni-PLATED) | 4 |

| Part No. | Code No. | Description | Specification | Qty |
|----------|--------------|-------------------------------|-------------------------------|-----|
| 241 | WPRE024102YW | SIDE COVER (WSA) | ABS(YELLOW) | 2 |
| 301 | WPMI03010200 | 1ST STAGE STATOR | FC-25 | 1 |
| 302 | WPMC03022100 | TAPER PIN | Ø5.9 X Ø6.5 X 7 | 2 |
| 303 | WPRV03030700 | OIL SEAL(for block) | Ø25/35 X 7 | 1 |
| 304 | WPMI03041300 | VALVE GUIDE PIN(SPRING PIN) | Ø3 X 20 | 2 |
| 305 | WPRV03050200 | 1ST STAGE VALVE | 43 X 35 X 2t(VITON) | 1 |
| 306 | WPMI03060200 | 1ST VALVE BACK PLATE | 42 X 35 X 1.2t | 1 |
| 307 | WPMS03071300 | 1ST VALVE SPACER | Ø8/6.3 X 13(SUS) | 1 |
| 311 | WPMI03111300 | 1ST VALVE SPRING | W1 X Ø9/11 X 15.5L | 1 |
| 312 | WPMSW5N0000 | WASHER | Ø5(SUS FLAT) | 1 |
| 313 | WPMIM5X22HN | BOLT | M5 X 22 | 1 |
| 314 | WPRSP6000000 | DISTRIBUTER SLEEVE O-Ring | P-6(SILICON) | 2 |
| 315 | WPME03152100 | DISTRIBUTER SLEEVE ASSEMBLY | | 1 |
| 319 | WPRV03192100 | DISTRIBUTER VALVE | Ø45 X 9 X 1.5(VITON) | 1 |
| 320 | WPMI03202101 | DISTRIBRTER SPACER | Ø15 X 16(S45C,NEW TYPE) | 1 |
| 321 | WPMC03212100 | DISTRIBUTER WEIGHT | Ø44 X 4.7t | 1 |
| 322 | WPMI03222100 | DISTRIBUTER SPRING | W0.6 X Ø8.3/9.5 X 17L | 1 |
| 323 | WPMA03232100 | DISTRIBUTER CAP | Ø50 X 20 | 1 |
| 324 | WPMA03242100 | TUBE FITTING | Ø8 x 1/8"PC | 1 |
| 325 | WPRE03250200 | HOSE | 95MM | 1 |
| 327 | WPMIM5X50HN | BOLT | M5 X 50 | 1 |
| 328 | WPMI03280300 | OIL FILTER ASSEMBLY | | 1 |
| 332 | WPMI03320300 | OIL FILTER FIXTURE | t2.0(PRESS) | 1 |
| 333 | WPMIM4X8HN0 | BOLT | M4 X 8 | 2 |
| 335 | WPRSS8000000 | O-RING | S-80(SILICON) | 1 |
| 336 | WPMI03360200 | 1ST VALVE OIL BAFFLE | 52 X 64 X 1.2t | 1 |
| 337 | WPMIM4X8HN0 | BOLT | M4 X 8 | 2 |
| 338 | WPMIM6X25HN | BOLT | M6 X 25 | 3 |
| 401 | WPMI04010200 | ROTOR ASSEMBLY(NEW TYPE) | FCD-64 | 1 |
| 409 | WPMI04090700 | KEY | 5 X 5 X 11 X 17.5L | 1 |
| 410 | WPME04100700 | OIL PUMP BLADE | 8 X 6 X 21 | 1 |
| 411 | WPME04110200 | 1ST STAGE BLADE | 42 X 32 X 6t(ROUND 45x70x6.5) | 2 |
| 412 | WPMS04122100 | 1ST STAGE BLADE SPRING | W0.4 X Ø2.7/1.9 X 30L(SUS) | 2 |
| 413 | WPMI04132100 | 1ST STAGE BLADE SPRING GUIDE | Ø1.8/3 X 26(Ø2/3 x 26) | 2 |
| 414 | WPME04140200 | 2ND STAGE BLADE | 30 X 22 X 6t(ROUND 33x50x6.5) | 2 |
| 415 | WPMS04152100 | 2ND STAGE BLADE SPRING | W0.4 X Ø2.7/1.9 X 30L(SUS) | 2 |
| 416 | WPMI04162100 | 2ND STAGE BLADE SPRING | Ø1.8/3 X 26(Ø2/3 x 26) | 2 |
| 501 | WPMI05010200 | 2ND STAGE STATOR | FC-25(Ø49x50t) | 1 |
| 502 | WPMI05022100 | VALVE GUIDE PIN (spring pin) | Ø3 X 20 | 2 |
| 503 | WPRV05032100 | 2ND STAGE VALVE | Ø14.5 X 7(VITON) | 1 |
| 504 | WPMI05042100 | 2ND VALVE SPRING | W0.6 X Ø7.3/8.5 X 17L | 1 |
| 506 | WPMI05060300 | SPRING SUPPORT(for 2nd valve) | DIECAST(SMALL) | 1 |
| 507 | WPMIW5G00000 | WASHER | Ø5(GEAR, SPRING) | 1 |
| 508 | WPMIM5X20HN | BOLT | M5 X 20 | 1 |
| 509 | WPRSP6000000 | O-RING | P-6(SILICON) | 1 |
| 510 | WPMI05102100 | TAPER PIN(ONE SCREW) | Ø7 X 25L(M6) | 2 |
| 511 | WPMIM6000000 | NUT | M6 | 2 |
| 512 | WPMIM6X25HN | BOLT | M6 X 25 | 5 |

| Part No. | Code No. | Description | Specification | Qty |
|----------|--------------|------------------------------|-----------------------------|-----|
| 513 | WPRSG5500000 | O-RING | G-55(SILICON) | 1 |
| 601 | WPMI06010300 | END PLATE | FC-25 | 1 |
| 603 | WPMC06030300 | TAPER PIN | Ø3.5 X Ø2.9 X 6.0 | 1 |
| 607 | WPMIM6X30HN | BOLT | M6 X 30 | 4 |
| 608 | WPMI06080200 | 2ND DISCHARGE BAFFLE | 100 X 170 X 1.2t | 1 |
| 701 | WPMA07010200 | OIL BOX | DIECAST(171x166) | 1 |
| 703 | WPRS07030300 | O-RING(for oil box) | 167 X 126 X 2t(SILICON) | 1 |
| 704 | WPMS07041500 | OIL LEVEL PLATE SUS | 10 X 95 X 0.2t | 1 |
| 705 | WPRS07052100 | O-RING(for oil window) | 112.5x2(S-75,SILICON) | 1 |
| 706 | WPRE07062100 | OIL LEVEL WINDOW | 34 X 122 X 3, PC | 1 |
| 707 | WPMZ07072100 | OIL LEVEL BACK PLATE | DIECAST | 1 |
| 708 | WPMIM35X11C | BOLT | M3.5 X 11(CROSS, Ni-PLATED) | 10 |
| 709 | WPMC07091300 | OIL DRAIN PLUG | M10(BRASS) | 1 |
| 710 | WPRSAN109000 | O-RING(for drain plug) | AN-109(SILICON) | 1 |
| 711 | WPRSAN118000 | O-RING(for oil filling plug) | AN-118(SILICON) | 1 |
| 712 | WPRE07122100 | OIL FILLING PLUG | M24 | 1 |
| 713 | WPRN07130700 | O-RING(for exhaust flange) | Ø30/20.5 X 2.5t(NBR) | 1 |
| 714 | WPMZ07140700 | EXHAUST ASSEMBLY(OUTLET) | NW-25 | 1 |
| 715 | WPRE0224N250 | NW25 FLANGE CAP | NW-25(CAP) | 1 |
| 716 | WPMIM6X35HN | BOLT | M6 X 35 | 4 |
| 717 | WPMA0717020 | NAME PLATE (WSA) | 0.2t, AL STICKER | 1 |

7.1 Service Kits (Major / Minor) : W2V20

| No | C/N | Description | Qty | Standard | Remarks |
|----------------------------|-----|------------------------------|-----|----------------------------|-----------------|
| 1 | 203 | OIL SEAL(for housing) | 1 | Ø22/32 X 7 | Minor and Major |
| 2 | 205 | SEAL RING (BUSHING) | 1 | Ø22/18x20,SCM415 | Minor and Major |
| 3 | 206 | O-RING(for bushing) | 2 | S-18(SILICON) | Minor and Major |
| 4 | 208 | O-RING(for sleeve housing) | 1 | G-35(SILICON) | Minor and Major |
| 5 | 212 | OIL SUCTION FELT | 1 | FELT | Minor and Major |
| 6 | 215 | GAS BALLAST KNOB O-Ring | 1 | P-10A(SILICON) | Minor and Major |
| 7 | 220 | O-RING(for suction flange) | 1 | P-30(SILICON) | Minor and Major |
| 8 | 225 | O-RING(for body) | 1 | P-20(SILICON) | Minor and Major |
| 9 | 226 | O-RING(for body) | 1 | G-45(SILICON) | Minor and Major |
| 10 | 227 | O-RING(for gas ballast) | 2 | AN-109(SILICON) | Minor and Major |
| 11 | 228 | GAS BALLAST KNOB O-Ring | 2 | P-10A(SILICON) | Minor and Major |
| 12 | 303 | OIL SEAL(for block) | 1 | Ø25/35 X 7 | Minor and Major |
| 13 | 305 | 1ST STAGE VALVE | 1 | 43 X 35 X 2t(VITON) | Minor and Major |
| 14 | 314 | DISTRIBUTER SLEEVE O-Ring | 2 | P-6(SILICON) | Minor and Major |
| 15 | 319 | DISTRIBUTER VALVE(VITON) | 1 | Ø45 X 9 X 1.5(VITON) | Minor and Major |
| 16 | 325 | HOSE(for distribute casing) | 1 | Ø8/5 X 95mm | Minor and Major |
| 17 | 335 | O-RING(for 1st block) | 1 | S-80(SILICON) | Minor and Major |
| 18 | 503 | 2ND STAGE VALVE | 1 | Ø14.5 X 7(VITON) | Minor and Major |
| 19 | 509 | O-RING(for block oil hole) | 1 | P-6(SILICON) | Minor and Major |
| 20 | 513 | O-RING(for 2nd block) | 1 | G-55(SILICON) | Minor and Major |
| 21 | 703 | O-RING(for oil box) | 1 | 167 X 126 X 2t(SILICON) | Minor and Major |
| 22 | 705 | O-RING(for oil window) | 1 | 112.5x2(S-75,SILICON) | Minor and Major |
| 23 | 706 | OIL LEVEL WINDOW | 1 | 34 X 122 X 3, PC | Minor and Major |
| 24 | 710 | O-RING(for drain plug) | 1 | AN-109(SILICON) | Minor and Major |
| 25 | 711 | O-RING(for oil filling plug) | 1 | AN-118(SILICON) | Minor and Major |
| 26 | 713 | O-RING(for exhaust flange) | 1 | Ø30/20.5 X 2.5t(NBR) | Minor and Major |
| Minor Kit (No.1~26) | | | | | |
| 27 | 311 | 1ST VALVE SPRING | 1 | W1 X Ø9/11 X 15.5L | Major only |
| 28 | 322 | DISTRIBUTER SPRING | 1 | W0.6 X Ø8.3/9.5 X 17L | Major only |
| 29 | 410 | OIL PUMP BLADE | 1 | 8 X 6 X 21 | Major only |
| 30 | 411 | 1ST STAGE BLADE | 2 | 42 X 32 X 6t | Major only |
| 31 | 412 | 1ST STAGE BLADE SPRING | 2 | W0.4 X Ø2.7/1.9 X 30L(SUS) | Major only |
| 32 | 413 | 1ST STAGE BLADE SPRING GUIDE | 2 | Ø1.8/3 X 26 | Major only |
| 33 | 414 | 2ND STAGE BLADE | 2 | 30 X 22 X 6t | Major only |
| 34 | 415 | 1ST STAGE BLADE SPRING | 2 | W0.4 X Ø2.7/1.9 X 30L(SUS) | Major only |
| 35 | 416 | 1ST STAGE BLADE SPRING GUIDE | 2 | Ø1.8/3 X 26 | Major only |
| 36 | 504 | 2ND VALVE SPRING | 1 | W0.6 X Ø7.3/8.5 X 17L | Major only |
| Major Kit (No.1~36) | | | | | |

7.2 Accessories List

| Product | Item | Specificaton | Remark |
|--------------------------------------|--------------------|---|---------------------------|
| Oil Mist Trap | WOF-150(PC) | NW25 | Outlet Filter |
| | WOF-150(Metal) | | |
| | WOF-250(Metal) | | |
| | WOF-250(PA) | NW40 | |
| | WOF-350(Metal) | | |
| | WOF-450(Metal) | | |
| WSA Material Filter (Dust Filter) | WMT-250 | NW25 | Inlet Filter |
| | WMT-400 | NW40 | |
| Clamp | Clamp | NW16 / NW25 / NW40 / NW50 | In/Outlet pipe connection |
| Centering | Centering - NBR | NW16 / NW25 / NW40 / NW50 | Clamp fitting sealing |
| | Centering - Viton | | |
| Hose Nipple | Hose Nipple | NW25 - Φ 12 / Φ 16 / Φ 26 , NW40 - Φ 36 | for vaccum hose fitting |
| PT Nipple | PT Nipple | 1/4", 3/8", 1/2", 3/4", 1" for NW25 | Screw Nipple |
| Reducer | Reducer | VG50-NW25 / VG150-NW25 NW25-NW16/NW40-NW25/NW50-NW40 | Adjust In/outlet size |
| Angle Valve | Air single bellows | NW25 / NW40 | |
| | Air single o-ring | | |
| | Air double bellows | | |
| | Air double o-ring | | |
| | Manual bellows | | |
| | Manual o-ring | | |
| Auto Vent Velve | Auto Vent Velve | NW25 / NW40 | |
| Sol Valve | Sol Valve | NW25 / NW40 | |
| Z-Line Valve | Manual o-ring | NW25 / NW40 | |
| | Manual bellows | | |
| Vacuum Hose | Vacuum Hose | Φ 8 / Φ 13 / Φ 20 / Φ 32 | Soft rubber hose |
| Bellows | Bellows | NW16 / NW25 / NW40 / NW50 | Metal pipe to suspend |
| Blank | Blank | NW16 / NW25 / NW40 / NW50 | Metal lid to end fitting |
| Cross | Cross | NW16 / NW25 / NW40 / NW50 | Cross Fitting |
| Elbow | Elbow | NW16 / NW25 / NW40 / NW50 | Elbow Fitting |
| Tee | Tee | NW16 / NW25 / NW40 / NW50 | T-shpae Fitting |
| Welding Flange | Welding Flange | NW16/NW25/NW40/NW50-15mm/30mm | For welding |

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