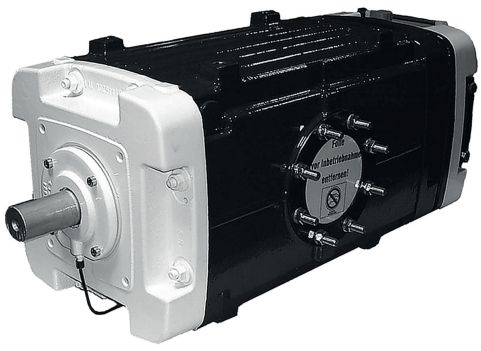
Installation Manual

(Original Instructions)

WITTIG

RFW 120-260



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Dear Customer,

Your new rotary vane compressor/vacuum pump is the product of intensive development based on decades of experience in the construction of rotary vane compressors. Our modern production methods, combined with adherence to the highest standards of quality and stringent testing, guarantee reliability, high operational availability and a long service life for your machine.

Of course this machine requires proper handling, especially under severe operating conditions. Startup, operation and maintenance must therefore be performed only by trained and authorised personnel.

This Installation Manual contains all of the necessary information and applies to all personnel responsible for the machine. Only careful adherence to the manual will guarantee proper functioning of the machine for a long period of operation. The complete manual must therefore be kept in the vicinity of the machine. We are sure that you understand that we can not accept liability for damages resulting from failure to observe these instructions.

Please ensure that repairs are carried out only by authorised service centres using original replacement parts, as otherwise our guarantee becomes invalid.

We wish you great satisfaction with your rotary vane compressor/vacuum pump from Gardner Denver. Should you have any further questions, we will be pleased to assist you at any time.

Yours sincerely,

Gardner Denver Drum Ltd.

Operating Principle, Machine versions

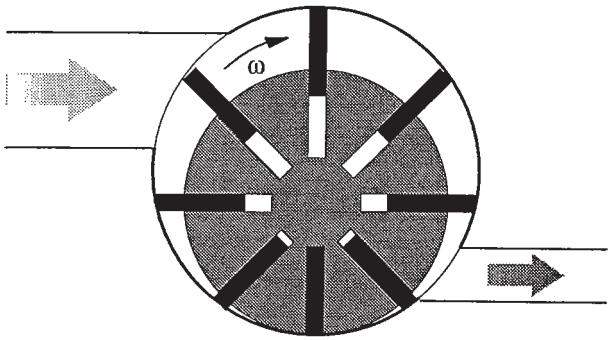
Operating Principle

Rotary vane compressor/vacuum pumps are multi-cell compressors that work on the displacement principle. They provide a constant, low-pulsation supply.

The single-phase machines have a cylindrical bored casing. The rotor, which is also cylindrical, is mounted eccentrically in the casing, forming a crescent-shaped working chamber. Moveable rotor vanes are fitted in the longitudinal grooves of the rotor; centrifugal force causes them to glide along the side of the casing when the rotor turns.

The vanes divide the crescent-shaped working chamber into cells of varying sizes. When the rotor turns, the cell volume on the suction side increases, and the resulting underpressure draws air into the cell, which is open to the suction nozzle. Upon further turning, the cell closes and the cell volume decreases. The enclosed air is thereby compressed and pushed out on the discharge side through the delivery nozzle.

In accordance with this operating principle, the machine works with polytropic compression. The achievable compression ratio p_{OUT}/p_{IN} is limited by the final compression temperature.



The operating principle of a rotary vane compressor or a compressor/vacuum pump

Machine versions

The various versions differ in their method of lubrication and of cooling:

Oil-lubricated machines are fed by means of an automatic lube oil pump in the oil well. The rotor shaft directly drives the lubricating pump.

Dry-running compressors for compressed air that is absolutely oil free operate with absolutely no oil in the compression chamber. The rolling bearings in these machines have permanent lubrication (permanent grease unit) or automatic lubricant input.

In air-cooled machines, two ventilators on the rotor shaft feed the coolant air axially via the casing ribbing.

Water-cooled machines have a water sleeve inside the casing. The coolant water circulates in a forced circulation system driven by a circulation pump.

Type code

	RFW		
Rotary vane compressor (Water Cooled)			
Size of Compressor / Vacuum Pump	**120** **150** **200** **260**		
Machine Designation - Pressure/Vacuum CW Rotation		**DVR**	
Machine Designation - Pressure/Vacuum ACW Rotation		**DVL**	
With Air Injection			**A**
Without Air Injection			

The RFW series includes, therefore, water-cooled and and fresh-oil lubricated machines for operation as compressor/vacuum pumps.

The first digit of an illustration reference number refers to the chapter in which the illustration can be found. Illustrations are numbered consecutively within each chapter. The last digit of an illustration reference number indicates the item number of the component in the particular illustration. Thus the reference (7.2/3) refers to the second illustration in chapter 7. item number 3.

1.1 Machine data
1.2 Dimensions
1.3 Lubrication
1.4 Water cooling
1.5 Drive

1.1 Machine data

The compressor/vacuum pumps in the series RFW are water-cooled, fresh-oil lubricated rotary vane compressors.

On the rating plate of each machine you will find, in addition to the machine number, the most important data.

Data for the type series

Rotary vane compressor/vacuum pumps	Type	RFW120 DV	RFW150 DV	RFW200 DV	RFW200 AI	RFW260 DV	RFW260 AI
Nominal operating vacuum (absolute)	mbar	400	400	400	400	400	400
Operating vacuum (absolute) for continuous operation [1]	mbar	200	200	200	50	200	50
Maximum operating vacuum (absolute) for short-term operation (maximum 15 min/hour)	mbar	100	100	100	N/A	100	N/A
Maximum operating pressure in compressor operation [2]	barg	2.0	2.0	2.0	2.0	2.0	2.0
Maximum operating pressure in compressor operation with V-belt drive [2]	barg	2.0	2.0	1.5	1.5	0.5	0.5
Suction pressure 400 mbar (absolute) Volume flow	m^3/h	680	820	1180	1120	1540	1460
Final overpressure	barg	0.0	0.0	0.0	0.0	0.0	0.0
Power requirement at drive shaft	kW	19.0	23.0	34.0	38.0	41.0	51.0
Suction pressure 1000 mbar (absolute) Volume flow	m^3/h	710	850	1210	1210	1570	1570
Final overpressure	barg	0.5	0.5	0.5	0.5	0.5	0.5
Power requirement at drive shaft	kW	27.5	30.0	45.0	45.0	58.0	58.0
Nominal speed	min^{-1}	1500	1500	1500	1500	1500	1500
Mass moment of inertia	kgm^2	0.52	0.52	0.73	0.73	0.95	0.95
Sound pressure level at 7 m at 400 mbar absolute / 0.5 bar gauge overpressure	db(A)	68/73.5	71/74	75/79	75/79	76/82	76/82
Weight including non-return valve	kg	220	220	280	283	360	365

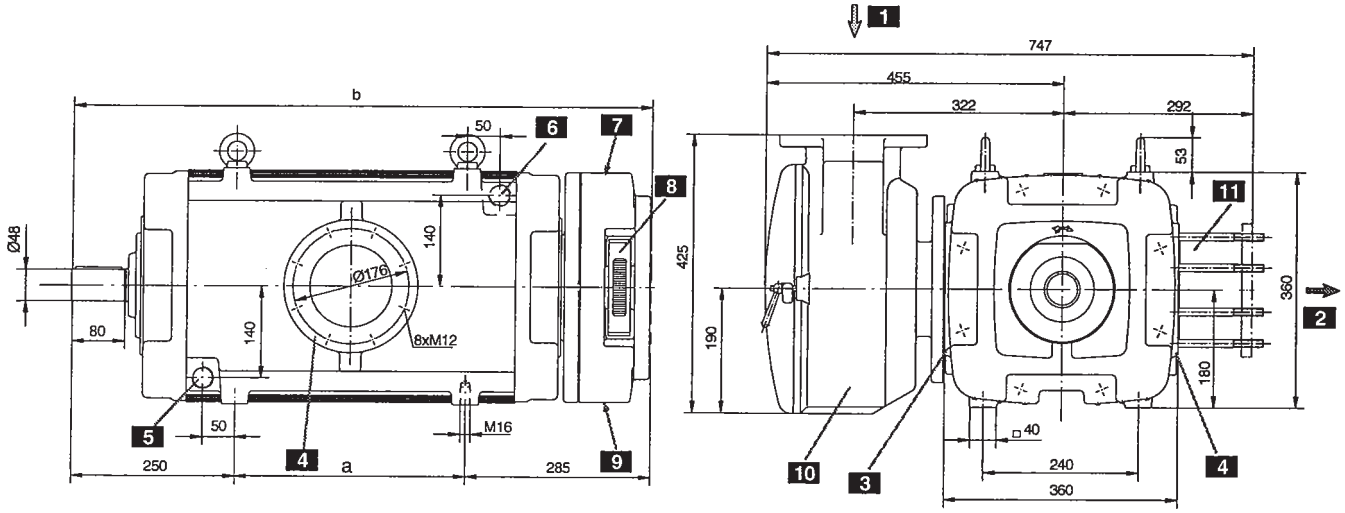
ATTENTION Protect with a ventilating valve!
Protect with a safety valve!

Data and illustrations accurate as of 01.04.1993. Subject to alterations.

1.2 Dimensions

Type	a	b
RFW 150	200	735
RFW 200	350	885
RFW 260	500	1035

Suction flange and pressure flange, connection for tanker flange according to DIN 28 461



1	Suction end	4	Discharge flange according to DIN 28461	7	Oil filler point	10	Vacuum intake filter/suction filter
2	Discharge end	5	Cooling water inlet R1"	8	Oil level indicator	11	Non-return valve
3	Suction flange according to DIN 28461	6	Cooling water outlet R1"	9	Oil drain cock		

Fig. 1.2 Dimensions RFW 150 - RFW 260

1.3 Lubrication

Lubrication is carried out by the built-in fixed drive lube oil pump.

Lubricating oil specification: Single-grade oils of the following classes:

API:	CC/SF	CD/SF
MIL-L:	2104 B	2104 C

See section 5.8, Lubrication oils, for the lubrication oil selection table

According to the German waste disposal law of 1 Nov. 86, the causation principle applies to the disposal of used oil. Owners of used oil are responsible for proper disposal!
Proof of the whereabouts of used oil is legally required.

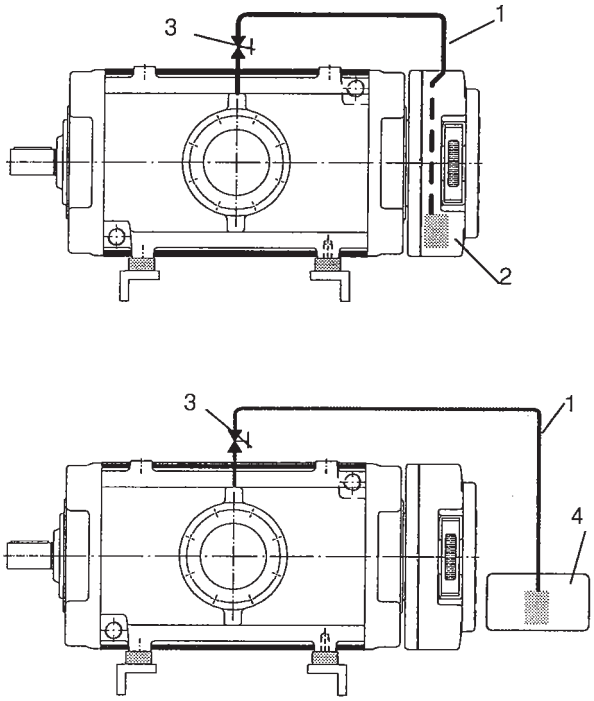
Information is available from the responsible intitutions.

Rotary vane compressor/vacuum pumps	Type	RFW 150 DV	RFW 200 DV	RFW 260 DV
Oil well capacity	l	7,5	7,5	7,5
Oil consumption	l/h	0,2	0,3	0,4
Add oil after operating hours	h	27	18	14
Oil level checks per day		once	once	once

Additional lubrication

For vehicles subject to extreme operating conditions ① additional lubrication may be necessary as illustrated in Fig. 1.3. If your machine is equipped with this type of auxiliary lubrication feature, it must be used as follows when the specified conditions exist:

- Open the regulating tap in the oil line of the auxiliary lubricating device
- Leave the regulating tap open until ca. 1/4 litre oil has been drawn into the machine.
  Note the noises produced by the machine!
  The additional oil intake volume of 1/4 l has been reached when the oil level in the oil sight glass has fallen ca. 1 cm.



1 Suction line
2 Oil well
3 Regulating tap
4 Additional oil vessel

Fig. 1.3 Additional lubrication

① Extreme operating conditions exist, for example in the following circumstances:

- Surrounding temperature 35°C
- Continuous operation (3 hours and more) of the machine at 200 mbar operating vacuum or 2 bar operating overpressure
- Suction or compression of aggressive substances (e.g., solvents, solvent vapours, acidic substances, etc.)

1.4 Water cooling

See Chapter 4.5 of the Installation Manual for information about recooling the cooling water. This process should be carried out in the vehicle by means of a forced-circulation cooling system with rotary pumps and coolers.

Rotary vane compressor/vacuum pumps	Type	RFW 150 DV	RFW 200 DV	RFW 260 DV
Heat to be dissipated	kW			
- at 0,5 bar overpressure		11,5	19,0	24,0
- at 2,0 bar overpressure		14,5	20,0	28,0
- at 400 mbar operating vacuum		11,0	17,0	19,0
Required pumping capacity of the water pump, at least	l/min			
- at 0,5 bar overpressure of the compressor/vacuum pump		15	25	35
- at 0,5 bar overpressure of the compressor/vacuum pump		20	29	40
- at 400 mbar operating vacuum of the compressor/vacuum pump		15	24	28
Pipework dimensions		R 1"	R 1"	R 1"
Recommended equalising tank	l	10	10	10

1. Technical data

These data apply for:

- Surrounding temperature 30°C
- Continuous operation
- Winter operation with antifreezing compound
- Summer operation without antifreezing compound

If the antifreezing compound remains in the cooling system during summer operation, it is necesary to increase the volume flow of the cooling water by ca. 15%. Otherwise the lower heat dissipation presents the danger of overheating.

ATTENTION Max. permissible cooling water temperature in the cooling water circuit is 60°C.

1.5 Drive

From the vehicle engine

- via auxiliary drive and propeller shaft
- via V-belt; the V-belt pulley is mounted onto the free end of the shaft
- via pneumatic clutch

By means of a hydraulic engine

From a diesel or electric engine

- via a flexible coupling

See installation instructions chapter 4.6 , Drive, for exact details.

2.1 Intended use
2.2 ATEX certification
2.3 Acceptance and monitoring
2.4 Operational safety
2.5 Environmental Protection
2.6 ATTENTION
2.7 Information
2.8 Points to note

2.1 Intended use

The compressor/vacuum pump is designed exclusively for compression or suction of filtered air. Additional Use or use for any other purpose is not considered intended use.

Intended use also requires adherence to the operating data and listed maintenance as set forth in the operating manual.

2.2 ATEX certification

The RFW in the ATEX Certified version is suitable for injesting combustible gases and gas mixtures in the group IIB,

Temperature Class T2 (Without Air Injection)
Temperature Class T3 (With Air Injection).

The vacuum pump must not be operated in an external atmosphere that is defined in the ATEX directive as Category 1, 2 or 3.

Marking of the vacuum pump:

- Without Air Injection:

II G C II BT2 (Maximum Vacuum 0.2 Bar a.)

- With Air Injection:

II G C II BT3 (Maximum Vacuum 0.05 Bar a.)

2.3 Acceptance and monitoring

The compressor/vacuum pump itself is not subject to any general acceptance and monitoring requirements.

Should special regulations be in effect at the site of operation, the operator is responsible for meeting these requirements.

In every case, the safety and accident prevention regulations of the local trade association must be observed.

2.4 Operational safety

This symbol indicates possible dangers to personal health and safety. Operational safety requires strict observance of instructions marked with this symbol. Safety instructions must be known to all persons who use the machine.

2.5 Environmental protection

This symbol indicates that environmental protection regulations must be observed.

2.6 ATTENTION

ATTENTION

"ATTENTION" indicates guidelines and regulations intended to prevent damage to the machine.

2.7 Information

This symbol indicates information of particular significance to the operator of the machine.

2.8 Points to note

The compressor/vacuum pump has been constructed using the latest technology and in accordance with the recognised safety regulations. Nevertheless its use could endanger the life and limb of the operator or of another party, or damage to the machine or to other property may occur.

- Use the compressor/vacuum pump only when it is in technically perfect condition, only in accordance with intended use and under observance of safety precautions. In particular, any faults that relate to the safety of the machine must be corrected immediately.
- Alterations, additions or modifications to the compressor/vacuum pump which could affect safety are not permitted without prior consultation with the manufacturer.
- All warning notices on the compressor/vacuum pump must be observed and maintained in a legible condition.
- Fire detection and fire extinguishing procedures must be observed.
- Any work undertaken on electrical appliances must be performed by a qualified electrician in accordance with electrical regulations.

Personnel who are to work with the compressor/vacuum pump must read the operating manual, in particular the chapter on safety instructions, be fore they begin such work. Reading the manual after such employment has begun is insufficient.

- Work on the machine must be carried out only when the machine is stopped.
- Before such work begins the drive must be secured against being switched on.
- While work on the machine is in progress the system must not be under pressure or suction.
- On the vehicle side: Close the shut-off slide. Bleed or vent the pressure line between the system and the shut-off slide.
- Release excess pressure by hand at the safety valve or vent the machine at the ventilating valve.
- Pay attention to the manometer!
- Remove the drive guard only when the machine is at a standstill.
- Remove the contact guard from the machine only after the machine and pressure line have cooled down.
- Before starting the machine, make sure all safety devices have been re-installed properly.

Environmental protection considerations require that all fluids emanating from the machine during maintenance, e.g., cooling water and lubricating oil, be collected and properly disposed of.

3. Transport, Storage, Delivery Contents

3.1 Transport
3.2 Storage
3.3 Delivery Contents

Symbols on the packing material:

This end up 

Fragile 

Protect from moisture 

3.1 Transport

Where no other agreement has been made, packaging conforms to the packing regulations (HPE) of the German Association of Palettes and Export Packing and of the VDE.

During transport it is essential to avoid violent movement and careless loading and unloading. The machine should be suspended only on the threaded bores that have been securely screwed in.

Any security devices that have been attached for transport must be removed.

3.2 Storage

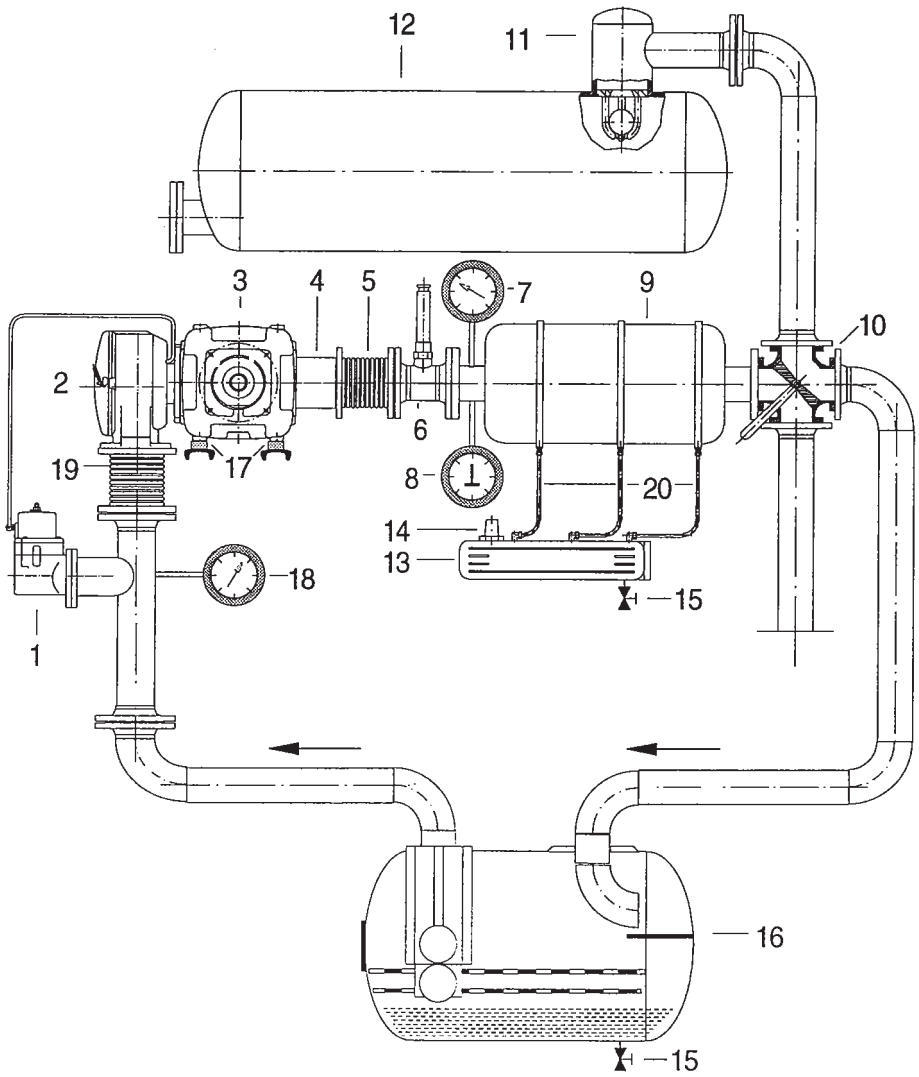
The machine should be stored in a dry, heated room until it is installed. Leave the covers on the delivery nozzles in place until final installation.

The protective coating on bare parts remains effective for approximately 1 year. It must be renewed if longer storage is necessary.

3.3 Delivery contents

The contents of the consignment are listed on the delivery notice. Please check immediately for completeness. Damages during transport as well as errors can only be accepted if they are reported immediately in writing.

4.1 Installation location and mounting
4.2 Protection from intake of dirt and residue
4.2.1 Arrangement of the suction line
4.2.2 Vacuum intake filter
4.2.3 Safety dome on the vehicle vessel
4.2.4 Safety vessel (fluid separator)
4.3 Noise suppression (low-noise installation)
4.3.1 Air noise suppression via exhaust silencer/oil separator
4.3.2 Body noise isolation
4.4 Safety and monitoring features
4.4.1 Vacuum meter
4.4.2 Vacuum intake filter
4.4.3 Ventilating valve
4.4.4 Non-return valve
4.4.5 Thermometer
4.4.6 Safety valve
4.4.7 Manometer
4.4.8 Contact prevention
4.4.9 Low-oil monitor
4.4.10 Rotation speed monitor
4.5 Water cooling
4.6 Drive
4.6.1 Drive via hydromotor
4.6.2 Drive via flexible coupling
4.6.3 Drive via drive shaft
4.6.4 Drive via V-belt



1 Ventilating valve
2 Vacuum intake filter
3 Rotary vane compressor/ vacuum pump
4 Non-return valve
5 Compensator
6 Safety valve
7 Manometer
8 Thermometer
9 Combined exhaust silencer/ oil separator
10 Four-way changeover valve
11 Safety dome with float valve
12 Vehicle tank
13 Collection tank
14 Ventilating silencer on collection tank
15 Drain cock
16 Safety vessel with float valve
17 Flexible mounting
18 Vacuum meter
19 Compensator
20 Oil drain lines with stop plugs, Ø 4 mm

Fig. 4.1 Elements of a system with compressor/vacuum pump

Note

- Fig. 4.1 shows an example of a completely installed compressor/vacuum pump of the RFW series.

  Other installation variations are also possible.

- Installation and startup may be carried out only by trained personnel. Damages resulting from improper handling cause liability to expire.

- The machine is delivered assembled. It should not exhibit any damages from transport.

- Please check whether the rotor shaft can be turned by hand; if it can not, please inform our service centre.

- The machine should be suspended only on the threaded bores that have been securely screwed in.

  The 2 cylinder pins and 2 cone pins (in the plastic bag) are to be kept by the final customer to be used in repairs.

4.1 Installation site and attachment

The installation location on the vehicle must

- be easily accessible
- be protected from dirt, flying debris and splashing water
- provide enough clearance for connection of cooling water inlet and suction and pressure lines
- be accessible for maintenance (oil filler screws, oil sight glass, inspection bore on top of the machine for wear check of rotor vanes).

The machine is mounted on the four feet (screw thread M16) at the top or bottom. The machine can be screwed directly to the chassis or on traverses.

Mounting traverses on the vehicle frame must be sufficiently strong; thin profiles or closed sheet-metal plates must not be used.

The mounting points (foundations for the machine feet) must be exactly aligned.

For dimensions and weights see chapter 1, Technical data.

ATTENTION The machine must be adequately earthed.

An earth bonding strap should be securely fastened between the machine body and a suitable point on the vehicle frame.

Ensure that the machine and all ancilliaries are earthed in accordance with BS5958 Pt1: 1991; 'Control Of Undisirable Static Electricity'.

If equipment is intended for use in a potentially dangerous zone, it must be suitable for that zone.

The machine must be adequately earthed. An earth bonding strap should be securely fastened between the machine body and a suitable point on the vehicle frame. Connection points should be selected to ensure maximum conductivity.

The safe operation of the machine in a potentially dangerous zone requires the use of safety equipment as described in the operating instructions and all associated documentation.

4.2 Protection from intake of dirt and residue

4.2.1 Suction line

The inside of the pipe must be corrosion-proof. Before installation the inside must be cleaned; welding debris, burn residue and rust must be removed carefully.

The suction line must incline towards the machine to prevent condensate from entering. A safety tank with drain cock must be fitted at the lowest point.

ATTENTION The suction line must be of sufficient size. Its diameter must be at least that given in the following table. Otherwise the machine will be overloaded!

Using a suction line of incorrect size invalidates any guarantee claims against Mannesmann Demag Wittig.

Rotary vane compressor / vacuum pump	Required minimum diameter of suction line
RFW 150	DN100
RFW 200	DN125
RFW 260	DN125

If the machine is used in a potentially dangerous zone, the above mentioned suction line equipment must be fitted.

4.2.2 Vacuum intake filter

The vacuum intake filter is installed directly before the machine. It protects the machine from contaminants and silences suction noise.

When installing the filter unit, note the direction of flow. The filter element must be removable for maintenance.

4.2.3 Safety dome

The safety dome on the vehicle tank must have, in additional to a float valve, a splash guard, which prevents splashing fluid from being pulled in.

4.2.4 Safety tank

The safety tank (located at the lowest point in the suction line) must be constructed in such a way that

- incoming air is not directed at the fluid surface
- sufficient settling room is available
- it is impossible for a filter element to dip into the fluid (even filters of non-absorbent material absorb fluid through capillary action)

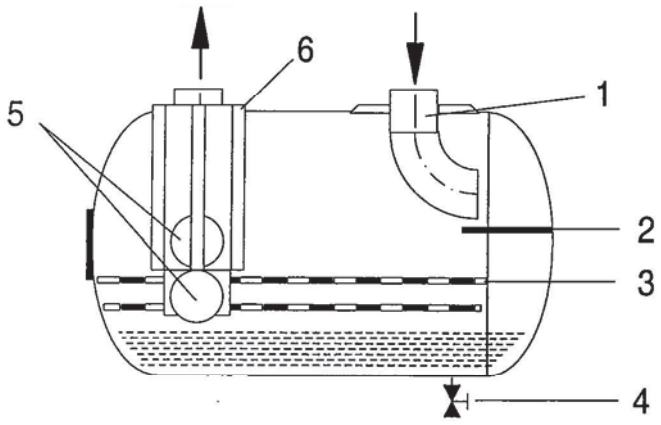
When a vacuum intake filter of the type SFA-F is used, no filter element is necessary in the security tank.

Below is an illustration of an optimised gravity separator. Its function must be checked as follows.

When the water volume to be separated is taken in

- the volume must remain in the tank and
- at atmospheric pressure, no more than 1 litre per hour must be drawn in.

We would be pleased to support you in designing and inspecting your safety tank.



1 Bent inlet pipe
2 Splash sheet
3 Double perforated sheet
4 Drain cock
5 Two ball floats
6 Four guide rods

Fig. 4.2 Safety tank

4.3 Noise suppression (low-noise installation)

The sound pressure level of the compressor/vacuum pumps of the RFW series lies significantly below the levels permissible for commercial vehicles. In order to maintain these low values with the installed machine, low-noise installation is necessary. The machine itself creates only an insignificant level of noise, so no sound insulation is necessary.

4.3.1 Air noise suppression via combined exhaust silencer/oil separator

The combined silencer/oil separator suppresses the exhaust noise of the compressor/vacuum pump and also removes 80 to 90% of the lubricating oil.

The silencer is installed between the compressor/vacuum pump and the four-way changeover valve, or in the exhaust line behind the four-way changeover valve.

The silencer/oil separator must be approved for the highest possible operating pressure (in compressor operation, depending on model, e.g., 2 bar overpressure).

The oil separator is connected to a ventilated collection tank (volume at least 10 l) via 2 or 3 oil drains. Ventilation diameter should be at least 1".
Orifices in the drains between the oil separator and the collection tank should have a diameter of 4 mm. The collection tank must have a condensate drain cock.

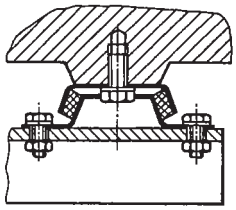
ATTENTION Be sure to observe the direction of flow when installing the silencer. The oil drain cock must be in a vertical position pointing downwards.

4.3.2 Body noise isolation

Rubber-metal cup elements for the flexible mounting of the machine on the traverses effect the isolation of body noise.

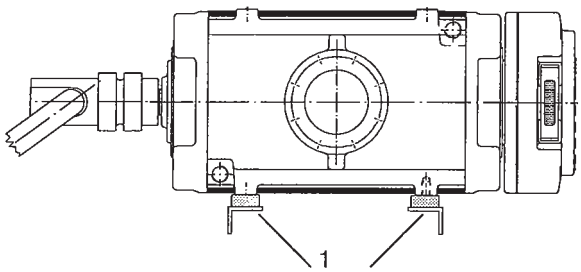
With V- belts, buffer stops to support the belt forces and a counterstop on the side of the compressor/vacuum pump opposite the belt drive are necessary.

Rubber-metal cup element



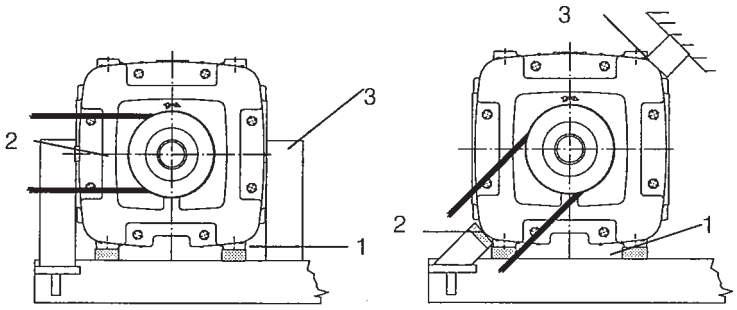
Low-noise installation with universal drive

1 Rubber-metal cup element

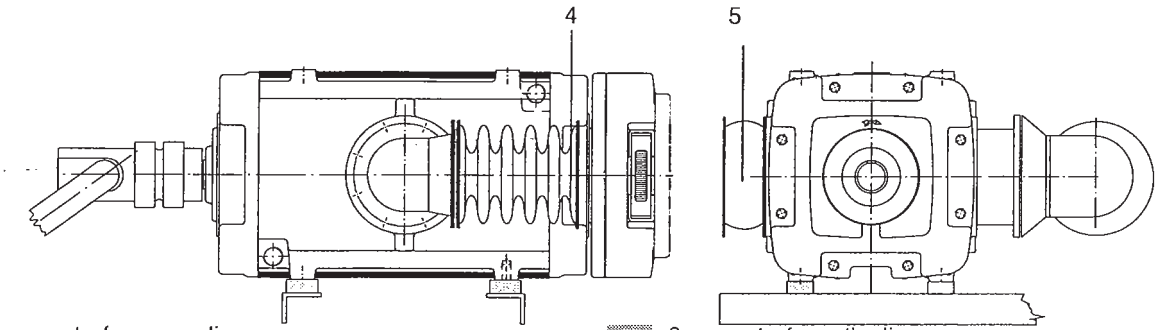


Low-noise installation with V-belt drive

1 Rubber-metal cup element
2 Buffer stop
3 Counterstop



Compensators in the suction line and in the pressure line effect the isolation of body noise and prevent thermal stresses.



4 Compensator for pressure line
Kompaflex axial compensator Type F, temperature- and compression-proof
DN 100 - PN 16 for RFW 150
DN 125 - PN 16 for RFW 200 and 260
Type W for high-grade steel pipelines
for welding into the line

5 Compensator for suction line
ERV-Pipe connector Type TAS with teflon coating and vacuum support ring
DN 100 for Typ RFW 150
DN 125 for Typ RFW 200 and 260

Cooling water lines

Flexible hoses as cooling water lines effect sufficient noise isolation.

4.4 Safety and monitoring features

The operational safety of the machine, i.e., operating without danger, requires the following safety and monitoring features:

Suction end

- **Ventilating valve**
- Vacuum meter
- Vacuum intake filter

Pressure end

- **Safety valve**
- Non-return valve
- Thermometer
- Manometer

Contact protection

- Protection from rotating parts and from the danger of burns

Machine protection

- Low-oil monitor
- Rotation speed monitor

Failure to observe these instructions cancels the right to guarantee claims.

4.4.1 Vacuum meter

For adherence to the permissible operating vacuum. Installed in the suction line directly in front of the suction nozzle.

4.4.2 Vacuum intake filter

The vacuum-tight filter protects the machine from mechanical contamination. Installed in the suction line.

When installing pay attention to the direction of flow and the clearance required for changing the filter element.

ATTENTION

Vacuum intake filter type SFA is not designed for overpressure.
Vacuum intake filters of the SFD series are pressure-shock-proof up to 10 bar.

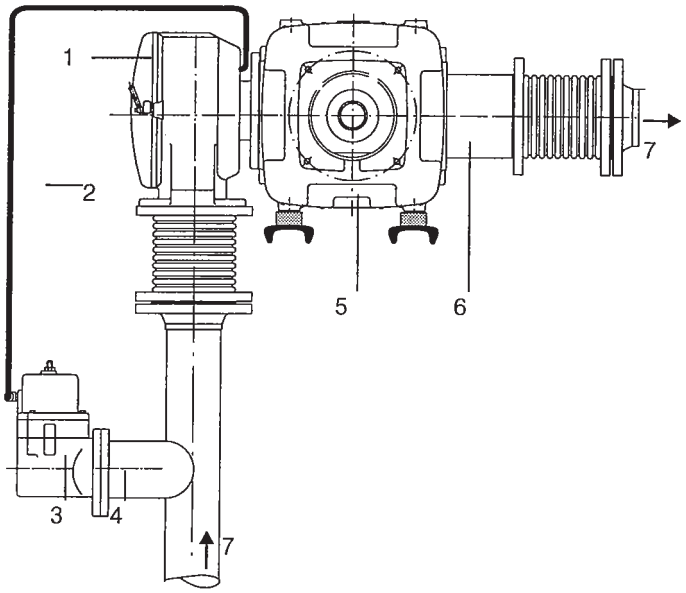
4.4.3 Ventilating valve

The ventilating valve is the regulator of the system and the safety device of the suction line. It is absolutely necessary.

Should the suction vacuum sink under the pre-set minimum level, the ventilating valve opens and the machine draws in atmospheric air. In this way the suction pressure is limited to the minimum value, e.g., 200 mbar.

If the ventilating valve is installed or arranged incorrectly or interfered with, an increase in vacuum and temperature creates the DANGER OF EXPLOSION!

The servo-controlled vacuum regulation and limit valve from Demag-Wittig achieves the highest level of functional safety and precise response. The setting is not dependent upon the flow rate. The compact design allows simple, space-saving installation.



1	Vacuum intake filter SFA or SFD	5	Compressor/vacuum pump
2	Servoline 10x1.5	6	Non-return valve
3	Ventilating valve BV-DN	7	To/from four-way changeover valve
4	Flange connection		

Fig. 4.3 Installation of the servo-controlled ventilating valve BV-DN

4.4.4 Non-return valve

The non-return valve prevents retroflow when the machine is stopped.

Installation between delivery nozzles of the machine and the delivery line.

Observe the direction of flow (arrow on the housing).

4.4.5 Thermometer

The thermometer for monitoring the compression temperature is to be positioned directly behind the delivery nozzle or the non-return valve. For this purpose a screw sleeve R 1/2" should be attached. The thermometer must be inserted into the pipe to a depth of one-half of the pipe diameter.

The indicating range of the thermometer must extend from 0 to 300°C.

If the machine is used in a potentially dangerous zone, the thermometer must be fitted as per section 4.4.5.

4.4.6 Safety valve

A non-blockable safety valve must be fitted after every compressor (German accident prevention regulation VBG 16). The valve should be designed and adjusted to prevent exceeding the highest permissible operating pressure by more than 10%. It must be able to expel the entire capacity of the compressor/vacuum pump. In addition, the valve must have a hand ventilating device.

⚠ **If the safety valve is installed or arranged incorrectly or interfered with, an increase in vacuum and temperature creates the DANGER OF EXPLOSION!**

During installation of the safety valve these points must be observed:

- Installation must be directly behind the compressor/vacuum pump, before every other blocking mechanism (especially the isolating valve).
- Component identification from TÜV (German technical inspection authorities) and the safety seal must be at hand.
- The setting must correspond to the maximum permissible operating pressure (see chapter 1.1, Machine data).
- The setting must be secure against unauthorised or erroneous alteration.
- The valve must not be blocked.
- The safety valve must not be used to adjust air volume in the compression operation.

⚠ Proper function must be confirmed each week by manual ventilation while the machine is operating.

4.4.7 Manometer

For continuous pressure monitoring. Range of measurement corresponds to operating pressure. Installation directly behind the delivery nozzle.

4.4.8 Contact prevention

The machine drive as well as the hot pressure line are to be fitted with a contact guard.

Unintentional contact with rotating or moving machine parts must be impossible.

The surface temperature must not exceed 80°C (according to German accident prevention regulations).

4.4.9 Low-oil monitor

A monitoring switch for indicating low oil level must be built into the oil well.

The low-oil monitor can be omitted if adherence to the minimum oil level according to 6.2 (optical control at the sight glass) is guaranteed by the operator.

4.4.10 Rotation speed monitor

We recommend use of a rotation speed monitor on the compression vacuum pump, with an indicator in the operating area. See chapter 4.6, Drive, for the permissible rotation speed ranges.

4.5 Water cooling

A forced-circulation cooling system with air-cooled cooler and rotary pump is necessary for recooling the cooling water.

The rotary pump should be installed so that it operates only when the compressor is running.

A thermometer must be installed in the water return.

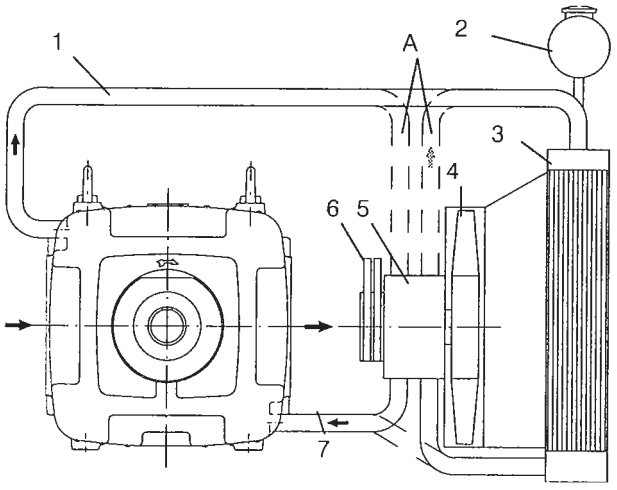
Rotary vane compressor/ vacuum pumps	Type	RFW 150 DV	RFW 200 DV	RFW 260 DV
Quantity of heat to be dissipated	kW			
- at 0,5 bar overpressure		11,5	19,0	24,0
- at 2,0 bar overpressure		14,5	20,0	28,0
- at 400 mbar operating vacuum		11,0	17,0	19,0
Required cooling water volume flow, at least	l/min			
- at 0,5 bar overpressure		15	25	35
- at 2,0 bar overpressure		20	29	40
- at 400 mbar operating vacuum		15	24	28
Pipework dimensions		R 1"	R 1"	R 1"
Recommended equalising tank	l	10	10	10

These data apply for:

- Surrounding temperature 30°C
- Continuous operation
- Winter operation with antifreezing compound
- Summer operation without antifreezing compound

If the antifreezing compound remains in the cooling system during summer operation, it is necessary to increase the volume flow of the cooling water by ca. 15%. Otherwise the lower heat dissipation presents the danger of overheating.

ATTENTION Max. permissible cooling water temperature in the cooling water circuit is 60°C.



1 Return line
2 Equalising tank
3 Cooler
4 Air fan
5 Water pump
6 Drive (V-belt)
A Alternative pipework

Fig. 4.4 Water cooling for a rotary vane compressor

4.6 Drive

ATTENTION The direction of rotation must agree with the directional arrow on the compressor/vacuum pump.

Permissible range of rotation speed

1000 to 1500 min^{-1}

ATTENTION Speed ratio or speed-reducing ratio of the drive absolutely must be taken into account. (Belt drive, vehicle auxiliary drive, etc.)

We recommend a rotation speed monitoring device on the compressor/vacuum pump with an indicator in the operator's area.

In any case, the rotation speed must be monitored after assembly of the compressor/vacuum pump, and operating instructions for the operator of the vehicle must be posted.

With drive via combustion engine, a rotation speed control device which prevents too high a rotation speed when load decreases must be installed on the motor.

ATTENTION Axial thrust from the drive must not be transferred to the rotor shaft.

Drive elements should be fitted on the rotor shaft with the existing M 12 thread.

Drive elements must not be hammered onto the rotor shaft.

⚠ A grip or coupling guard must be installed in every case.

4.6.1 Drive via hydromotor

Selection and assembly of the hydromotor are the responsiblity of the company completing the installation.

We can supply the correct mounting flange as well as a coupling.

The compressor side of the coupling has already been mounted by us. After fitting of the mounting flange the motor side of the coupling must not transfer axial thrust to the compressor/vacuum pump.

4.6.2 Drive via flexible coupling

In the case of direct coupling with the drive, e.g., with a diesel engine, a torsionally flexible coupling must be selected according to the specifications of the motor manufacturer in order to compensate for the cyclic irregularity of the drive.

ATTENTION Adjust the coupling to the manufacturer's exact specifications.

4.6.3 Drive via drive shaft

The drive shaft must

- be constructed as a splined shaft
- be balanced
- have the smallest possible angle and be as short as possible

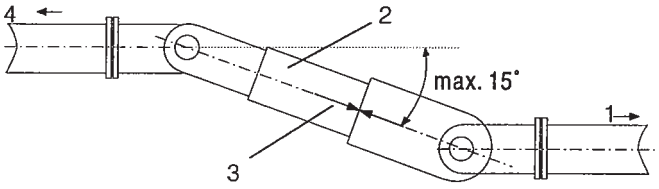
The central axes of the drive-shaft flanges must be parallel to each other.

The drive-shaft mounting flange must be fitted to the drive shaft of the compressor.

The splined shaft section of the drive shaft must be screwed on to the mounting flange on the compressor shaft.

The resulting diffraction angle must not exceed 15° at a rotation speed of 1500 min^{-1}.

ATTENTION Do not fit the drive shaft in the wrong way—observe the marking.



1 Drive
2 Splined shaft
3 Marking
4 Compressor/vacuum pump

Fig. 4.5 Drive shaft

4.6.4 Drive via V-belt

If the engine rotation speed must be geared up or down, V-belt drive is to be recommended. Observe the nominal rotation speeds given in 1.1, Machine data!

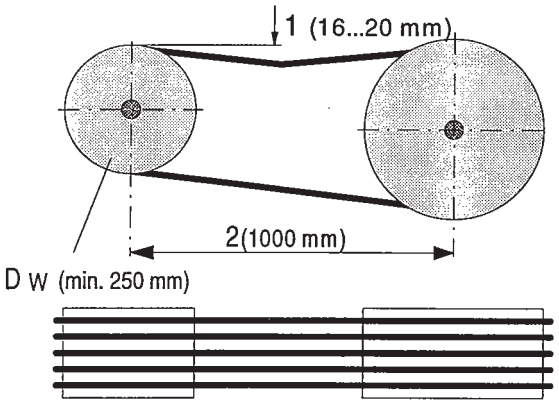
The V-belt disks listed in the following table can be fitted directly onto the free end of the shaft.

Rotation compressor/ vacuum pumps	Type	RFW 150 DV	RFW 200 DV	RFW 260 DV
Belt profile		SPB	SPB	SPB
Belt disk diameter Dw	mm	250	250	250
Max. operating pressure above atm. with V-belt drive	bar	2,0	1,5	0,5
Number of belts for compression operation		4	5	5
Max. operating vacuum with V-belt drive	mbar	200	200	200
Number of belts for suction operation		4	4	4

Assembly of the V-belt drive

- Carefully and precisely execute parallel alignment of the axes in all planes of the driving as well as of the driven shaft.
- The belt grooves in the belt disks must not be misaligned.
- V-belts of the correct length must be selected for consistent belt tension
- The V-belt tension is correct if the installed and tensioned V-belts can be pressed down with the thumb by 16 to 20 mm per 1000 centres.

ATTENTION V-belt drive via electric motor is not permissible due to breakdown torque.

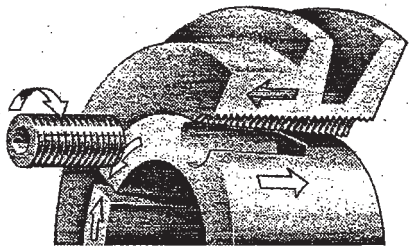


1 V-belt play (16 to 20 mm per 1000 mm centres).
2 Centres
D_W Diameter of the belt pulley min. 250mm.

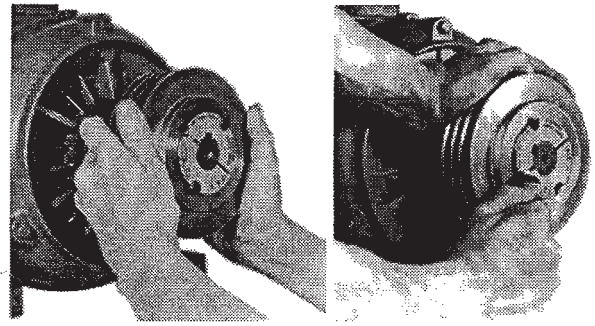
Fig. 4.6 Correct V-belt play

Mounting the V-belt pulleys with taper lock bushes

1. Clean and degrease bare surfaces. Place pulley and bush inside each other. Align the holes and insert screws loosely

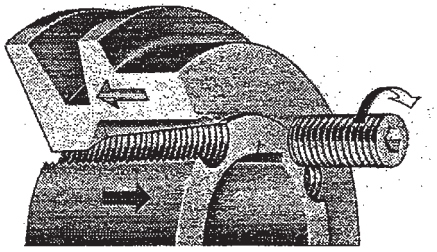


2. Push the pulley with the bush onto the shaft, align it and tighten the screws evenly and tightly.

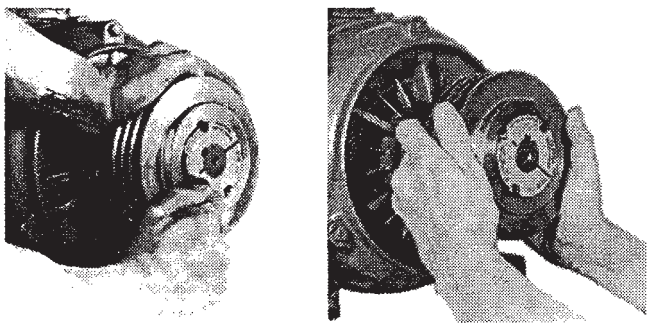


Dismantling

3. Remove screws. Use one screw as a forcing screw, screwing it firmly into the hole in the bush that is only half as deep as the others. This releases the taper-lock bush.



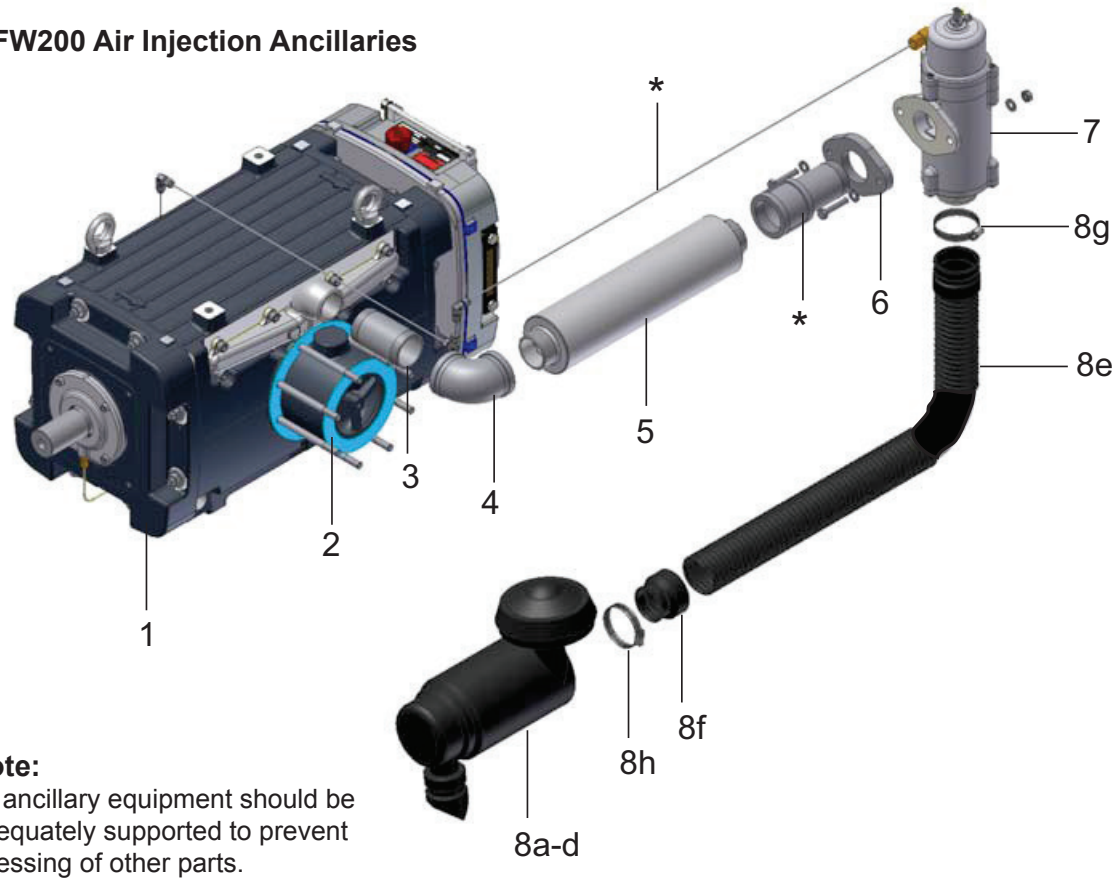
4. Remove the loosened pulley unit without striking it and without damaging the machine.



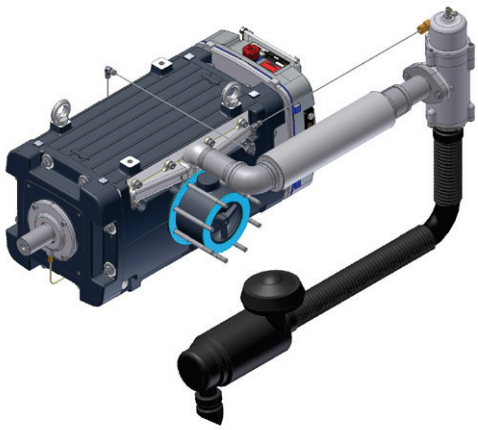
4.6.5 RFW Air Injection With Ancillaries & Customer Supplied Pipework

The RFW is also available with an air injection manifold which enables the vacuum pump to achieve extremely high vacuums whilst minimising surface temperatures and maximising the vacuum pump performance bringing the machine in line with ATEX certification. The ancillaries required for this arrangement are detailed below.

RFW200 Air Injection Ancillaries



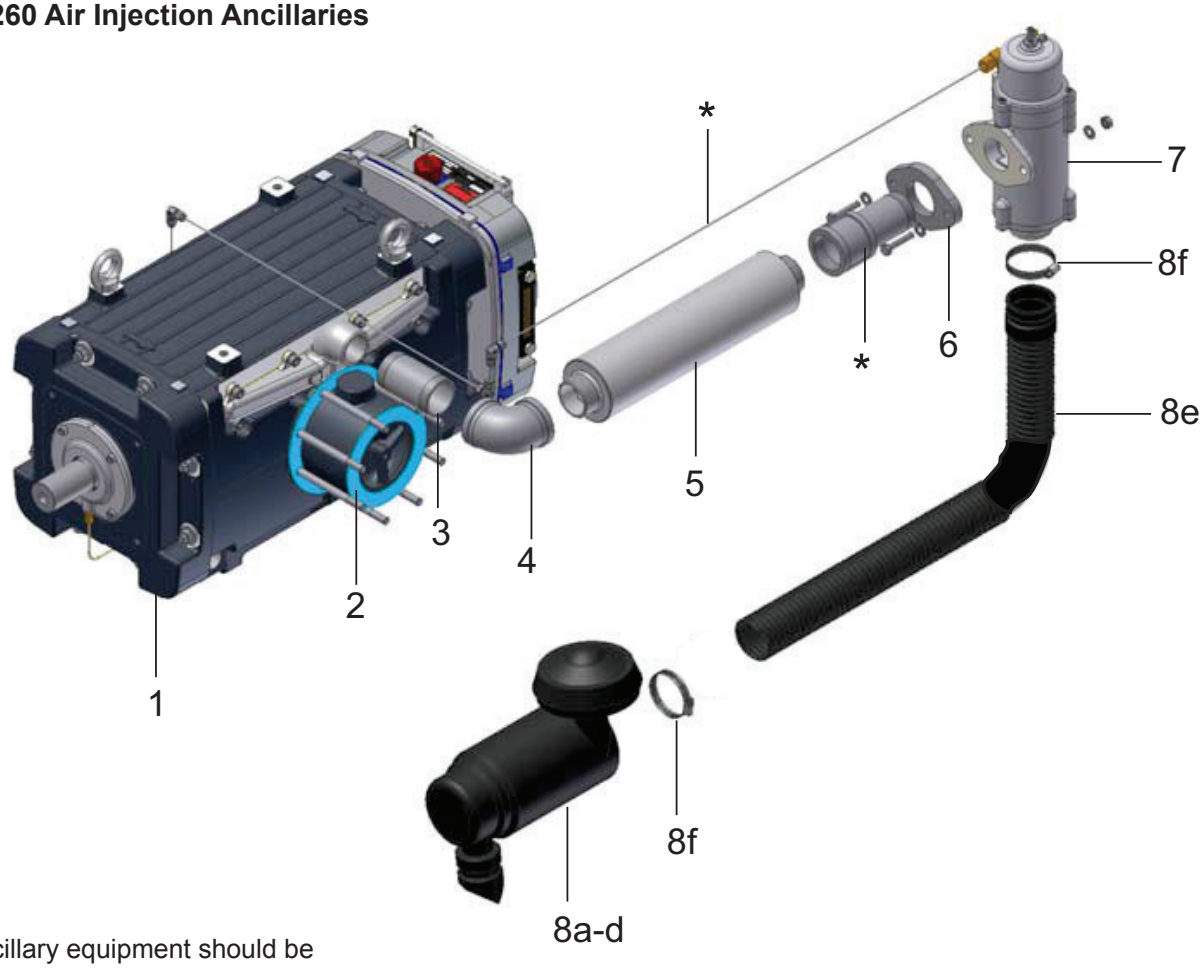
Note:
All ancillary equipment should be adequately supported to prevent stressing of other parts.



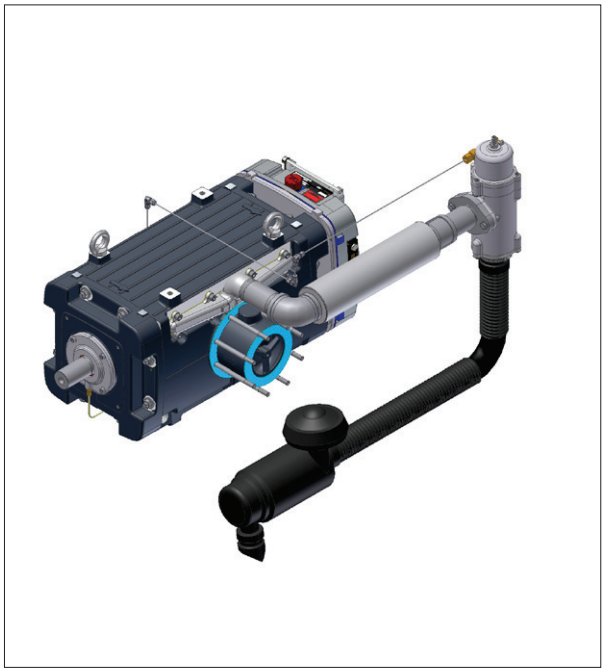
Ref	Qty	Description
1	1	RFW COMPRESSOR / VACUUM PUMP
2	1	VALVE, CHECK RV100
3	1	NIPPLE, HEX 1 1/2“ BSP, M/M, GALV
4	1	ELBOW, 2” x 1 1/2“ BSP, F/F, GALV
5	1	SILENCER 2” ABSORPTIVE
6	1	TW-FLANGE
7	1	VALVE, VACUUM SERVO, AIR INJECTION
8	1	INLET KIT *Consisting of:*
		INLET FILTER KIT (5”) *including:*
8a		1 off Raincap
8b		1 off Mounting Band
8c		1 off Indicator
8d		1 off Filter Assembly
		INLET HOSE KIT *Including:*
8e		1 off Duct & Moulded Cuff
8f		1 off Screw on Cuff
8g		1 off Hose Clip 60/80
8h		1 off Hose Clip 50/70
*		CUSTOMER SUPPLIED PIPEWORK & FITTINGS

4.6.5 RFW Air Injection With Ancillaries & Customer Supplied Pipework (Cont..)

RFW260 Air Injection Ancillaries



Note:
All ancillary equipment should be adequately supported to prevent stressing of other parts.



Ref	Qty	Description
1	1	RFW COMPRESSOR / VACUUM PUMP
2	1	VALVE, CHECK RV100
3	1	NIPPLE, HEX 1 1/2“ BSP, M/M, GALV
4	1	ELBOW, 2” x 1 1/2“ BSP, F/F, GALV
5	1	SILENCER 2” ABSORPTIVE
6	1	TW-FLANGE
7	1	VALVE, VACUUM SERVO, AIR INJECTION
8	1	INLET KIT *Consisting of:*
		INLET FILTER KIT *including:*
8a		1 off Raincap
8b		1 off Mounting Band
8c		1 off Indicator
8d		1 off Filter Assembly
		INLET HOSE KIT *Including:*
8e		1 off Hose
8f		2 off Hose Clips 70/90
*		CUSTOMER SUPPLIED PIPEWORK & FITTINGS

5.1	Testing the System
5.2	Cooling water
5.3	Lubricating oil
5.4	Shut-off slides and valves
5.5	Direction of rotation
5.6	Drive
5.7	Checking rotation speed, vacuum and pressure
5.7.1	Rotation speed
5.7.2	Vacuum at the vacuum meter
5.7.3	Pressure at the manometer
5.8	Lubrication oils for rotary vane compressor/ vacuum pumps

5.1 Testing the system

The initial startup as well as startup after a longer standstill (longer than 4 weeks) greatly influences the optimal functioning of the compressor/vacuum pump.

We strongly recommend that you allow sufficient time for startup. Hastiness may result in omission of important steps that could cause damage to the compressor/vacuum pump.

ATTENTION Damages resulting from incorrect startup procedures are not covered by the guarantee!

Before initial operation

- Inspect the compressor/vacuum pump (transport damage, faulty assembly)
- Confirm that drive guard and contact guards on the discharge side are in place.
- Check the operating data on the rating plate of the compressor/vacuum pump
- Instruct the operating personnel
- Transmit information concerning operation and maintenance of the compressor/vacuum pump
- Confirm that the rotor shaft can be turned by hand.

5.2 Cooling water

Fill cooling water only to the highest mark on the equalising tank or cooler. Determine the quantity according to the cooler volume and line volume. Use only clean tap water. Observe the instructions in chapter 1.4, Water cooling!

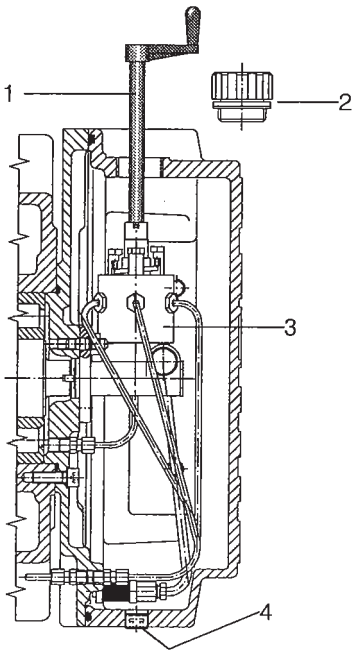
ATTENTION If frost danger exists, add antifreezing compound as instructed by the manufacturer (generally 33%).

5.3 Lubricating oil

- See 5.8 Lubricating oil table for types of oil

ATTENTION Single-grade oils are required for the RFW series. Use of multi-grade oils may result in damage to the machine. In addition, such use cancels the warranty obligations on the part of Gardner Denver.

- Check the oil level in the sight glass. If necessary, fill the oil well to ca. 3 cm below the thread of the filler cap.
- Manual pre-lubrication of the machine is necessary
  - before initial startup
  - before restart after a stoppage lasting 4 weeks or more
  - after machine underwent excess vacuum
  - when the danger exists that the lubricant film in the compression chamber of the compressor/vacuum pump has been removed by components of the suction air
- For pre-lubrication, proceed as follows:
  - Insert hand crank (in mounting) through the open oil fill opening and place it onto the oil pump shaft. Press down on the crank until the driving pin snaps in. Pre-lubricate with 40 complete revolutions of the hand crank.
  - Return the hand crank to the mounting and screw on the screw plug.



1	Hand crank	3	Oil pump
2	Screw plug	4	Oil drain cock

Fig. 5.1 Pre-lubricating with the hand crank

5.4 Shut-off Valves

Check the mounting direction of the non-return valve (see directional arrow).

Open all manually operated shut-off slides and valves.

Always turn the four-way changeover valve until it clicks into position; an intermediate position is not allows. Hot exhaust air may be taken into the machine again in intermediate position. Thus the machine may be overheated.

5.5 Direction of rotation

Upon initial startup, briefly turn the drive on and check the direction of rotation. Observe the rotation direction arrow on the machine housing!

5.6 Drive

Turn on the drive and check whether pressure/suction is created.

5.7 Checking rotation speed, vacuuum and pressure

5.7.1 Rotation speed

Permissible range of rotation speed

1000 to 1500 min^{-1}

5.7.2 Vacuum at the vacuum meter

Permissible minimum suction pressures

Continuous operating vacuum	200 mbar
Max. operating vacuum, for short intervals (up to 15 min/h)	100 mbar

Check manually whether ventilating valve responds.

5.7.3 Pressure at the manometer

Permissible maximum pressure is indicated on the rating plate (see also Chapter 1.1, Machine data).

Check manually whether safety valve blows off.

5.8 Lubrication oils for rotary vane compressor/vacuum pumps

Permissible are single-grade oils of the following specifications:

API:	CC/SE, CD/SF	For overpressure up to 2,0 bar
Mil-L:	2104 C, 2104 D	and vacuum up to 100 mbar

Summer oils	
ARAL	Kowal M 40
BP	Vanellus C3- 40, Energol IC-D 40, Energol HD-S 40
DEA	Regis SAE 40, Cronos Super SAE 40
ELF	Performance 2 B SAE 40
ESSO	Essolube HDX Plus+ 40, Essolube XD-3 + 40
MOBIL	Delvac 1340
SHELL	Rotella X 40, Rimula X Monograde 40
WINTERSHALL	Rekord 40

Winter oils	
ARAL	Kowal M 30
BP	Vanellus C3- 30, Energol IC-D 30, Energol HD-S 30
DEA	Regis SAE 30, Cronos Super SAE 30
ELF	Performance XC SAE 30
ESSO	Essolube HDX Plus+ 30, Essolube XD-3 + 30
MOBIL	Delvac 1330
SHELL	Rotella X 30, Rimula X Monograde 30
WINTERSHALL	Rekord 30

When ambient or intake temperatures reach or exceed 40°C, the next higher viscosity group should be used.

When ambient or intake temperatures decline to 5°C or less, the next lower viscosity group should be used.

ATTENTION

Single-grade oils are required for the RFW series. Use of multi-grade oils may result in damage to the machine. In addition, such use cancels the guarantee obligations on the part of Gardner Denver.

Information concerning operation, maintenance and spare parts has been summarised in a seperate operating manual.

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