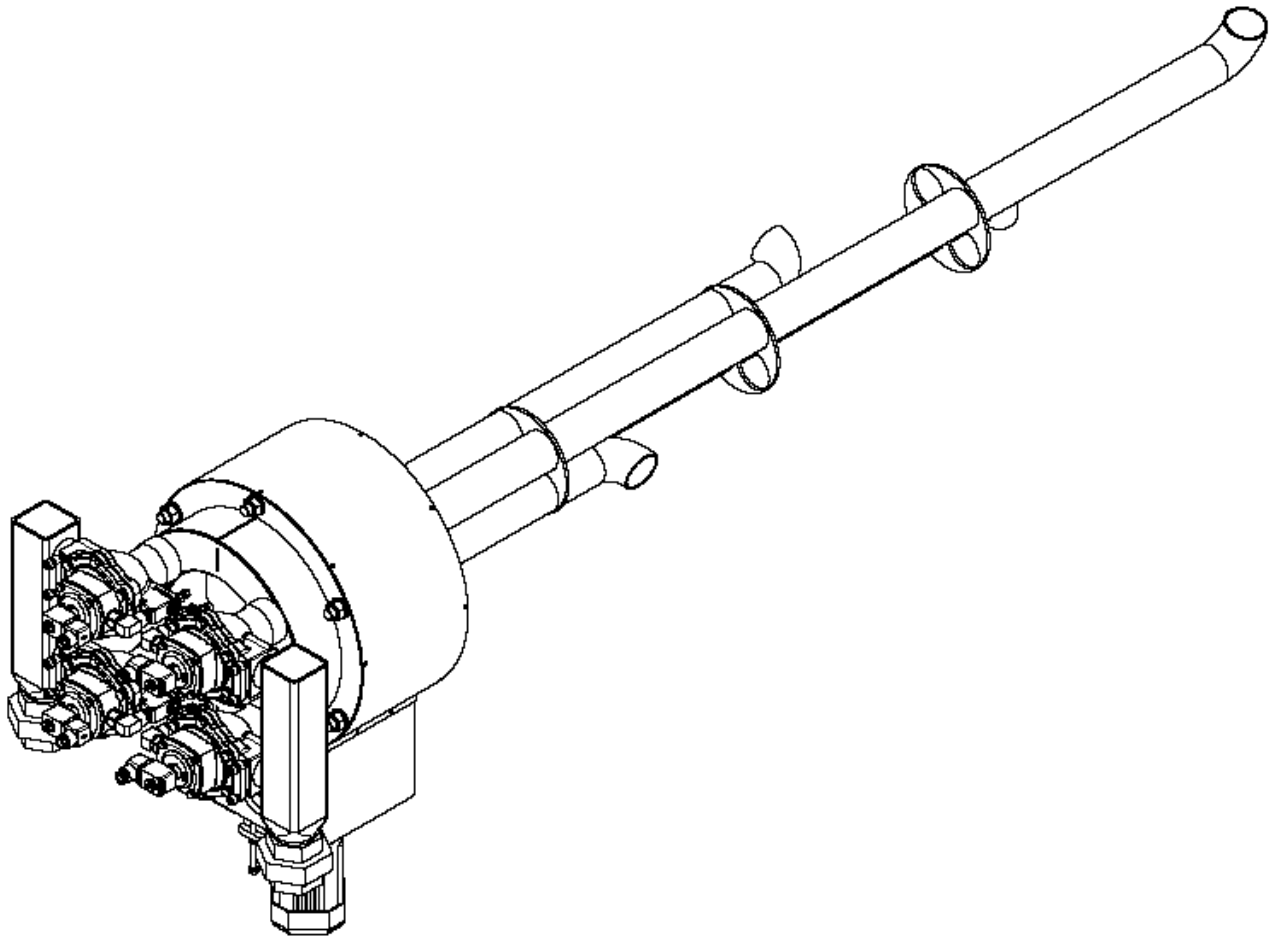
AEROVIT

DATA AND OPERATING INSTRUCTIONS FOR RUNNING AND MAINTENANCE OF SOOT REMOVAL SYSTEM

AEROVIT Type R International Patent



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1. Function

The shock wave installation is normally programmed to automatically activate the valves in sequence, the interval between signals depending on the type of fuel, the amount of fouling and boiler output. Increased smoke temperature indicates a need for shorter intervals between signals. Constant low smoke temperature indicates that the interval between signals may be prolonged. This is to minimize the air consumption. Use the guide to the PLC for changing the cleaning cycle.

2. Operation of the unit

The PLC-operation is turned on and off by the switch on the front side of the panel. Always remember to turn off the electrical supply to the unit at boiler inspection and shutdowns. The operation can be governed automatically by the boiler operation by connecting e.g. an exhauster to the short circuit inlet on the PLC panel.

IMPORTANT:
Always pressurize the unit before start of boiler / engine.
Always pressurize the unit during boiler / engine running.
Always turn off the electrical supply before removal of the valves/lance.
Always depressurize the unit before removal of the valves/lance.
Always depressurize the unit before boiler inspection.

3. Compressed air supply

The air receiver is fed from a compressor through a ½" pipe line. The pressure of the unit is adjusted by the air regulator. The filter, which is obligatory, under the regulator has to be inspected periodically in order to empty and clean the bowl and the filter. A non-return valve is mounted on the pipe line together with a 3-way valve to depressurize the installation.

The size of the compressor and the air consumption are dependent on the cleaning cycle, not on the number of valves. The number of signals per hour alone determines the air consumption, because the air consumption per signal is constant. The air receiver should operate on 0.8 - 0.9 MPa (8.0 - 9.0 bar).

Normally the pressure of the air receiver drops from 0.8 to 0.5 MPa when a valve is activated. With a standard air receiver of 150 litres the air consumption per signal will amount to: 3x150 = 450 litres "open air". With a cycle of 12 signals per hour the air consumption will amount to: 3x150x12 = 5400 litres "open air".

The service life of the air receiver is 3.6 million activations.

Always keep the unit pressurized to provide cooling of the valves and the diaphragms.

4. Boiler inspection

The unit is installed on the boiler and/or on the inspection doors.
Proceed inspection of the boiler through doors with AEROVIT as below:

1) Turn off the electrical supply to the installation.
2) Depressurize the installation through the 3-way valve.
3) Make sure that the AEROVIT Type R unit is totally deactivated.

After inspection follow the steps below:

3) Repressurize the installation through the 3-way valve.
4) Turn on the electrical supply to the installation.

5. Diaphragm valves series A40

The valves are 2-way normally closed diaphragm valves operated by a solenoid. They are designed for extremely fast opening/closing and high flow rates.
The body and cover are of anodized die-cast aluminium alloy and all bolts are in stainless steel. The solenoid valve is integrally mounted on the diaphragm valve and has an encapsulated coil (Class H insulation) with a waterproof (IP-65) plug-on connector.

5.1 Rotor and lance

The rotor and the 4 piped lance are made of electro galvanised steel elements. The rotor´s shells are made of stainless-steel.
The rotor is made by several elements assembled together, with an engine, IP55, which is directly creating the rotation of the lance through an internal chain.
The lance is composed by 4 pipes of different length and different orientation, in order to cover a cleaning area of 360 degrees. The pipes lengths can be different from application to application in relation to the area to be cleaned. Since the 4 piped lance is the only element of the unit to work inside the boiler, it is most exposed to wear and tearing. Hence there is the possibility to replace it with a new one by easy dismantling it from the base of the rotor.

5.2 Operation

The diaphragm divides the valve into an upper and a lower chamber. The air inlet leads into the lower chamber and is connected to the outlet when the diaphragm lifts. The diaphragm has a bleed hole through which the high pressure inlet air passes into and fills up the upper chamber, creating the same pressure on both sides of the diaphragm. The pressure in the upper chamber acts on the full surface of the diaphragm, whereas the pressure in the lower chamber acts on a reduced area of the diaphragm. This keeps the diaphragm pressed down on the outlet port, closing it.

The upper chamber is connected to the atmosphere via the outlet in the pilot base. The plunger in "normal" conditions keeps the outlet closed, maintaining the pressure in the upper chamber and hence the diaphragm valve closed.

When the solenoid is energised the plunger lifts within the core tube and the compressed air in the upper chamber exhausts quickly into the patented sound silencer.

Because the exhaust air passage has a higher flow rate than the bleed hole in the diaphragm, the pressure in the upper chamber falls suddenly. The pressure in the lower chamber then lifts the diaphragm, causing the compressed air to flow from inlet through outlet. As this happens within 1/40 second, a shock wave leaves the outlet with supersonic speed.

When the solenoid is de-energised, the plunger closes the air passage and the air is trapped above the diaphragm, closing the valve outlet.

The shock waves run into the rotor and then through the 4 piped lance into the inner side of the boiler.
For every activation, two of the 4 valves of the unit are contemporarily shooting, therefore after every second activation the cycle restarts. Thanks to a particular internal mechanism of the rotor, after each activation, 2 opposite pipes of the lance are shooting in two opposite directions. The rotor turns 360 degrees shooting 12 times during a complete rotation.

5.3 Disassembly & Reassembly procedures

5.3.1 Valves series A40

Depressurize valve, turn off electrical supply and proceed as below:

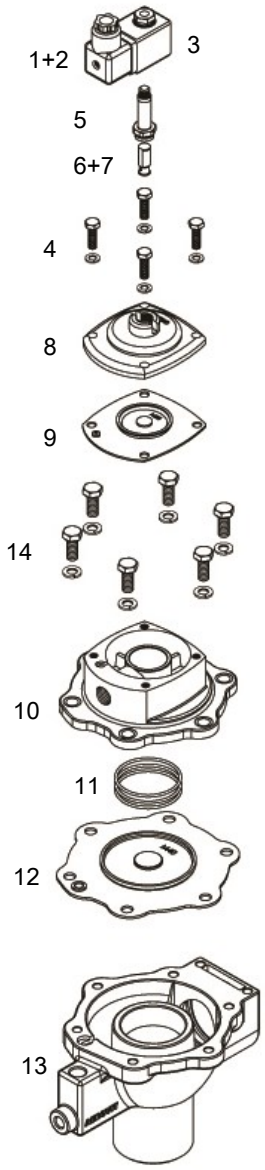
1. Loosen connector screw and remove Plug Connector (1+2) from Coil (3).
2. Remove the bolt and slip Coil off Solenoid base (5).
3. Loosen core sleeve and remove Solenoid base from Pilot valve bonnet (8). The Core and the Spring (6+7) come loose.
4. Loosen Screws (4) holding Pilot valve bonnet to Main valve bonnet (10) and remove Pilot valve bonnet (8).
5. Loosen Bonnet screws and remove Bonnet and Diaphragms (9+12) from Valve body (13).
6. All parts are now accessible for cleaning or replacements. Clean the air passage in Pilot Base. Replace worn or damaged parts.
7. Reassemble in reverse order paying careful attention to the exposed view.
8. Clean the bleed hole and replace Diaphragms with the steel plate up facing the Bonnets.
   The bleed hole in diaphragm must match the cavity in valve body and bonnet.
9. Tighten the Bonnet screws in Pilot valve bonnet to 16 Nm and in the Mainvalve bonnet to 20 Nm. Tighten the Pilot Base Screws criss-cross 1 Nm. Tighten the connector screw to 0.6 Nm.
10. After reassembly, operate the valve a few times to be sure of proper opening and closening.

5.3.2 Rotor and lance

Depressurize valve, turn off electrical supply and proceed as below:

1. Remove the unit by unscrewing the unit's interface from the boiler's wall/ inspection door.
2. Remove the rotor shell covering the central rotor side.
3. Remove the lance by unscrewing the 4 bolts placed in the inner part of the rotor.
4. Replace the lance with a new one.
5. Screw the lance up.
6. Place the unit back to the original position in a way that the rotor interface can be screwed to the boiler's wall/inspection door.
7. Adjust the central bolt and the main bolts of the rotor in a way that the 4 piped-lance is perfectly perpendicular to the rotor's interface, for a regular functioning.
8. Close the rotor shell.

5.4 Exploded view and spare parts, series A40 1½”



Spare Parts

1717		Spare part kit
	(9)	Diaphragm Pilot
	(11)	Spring
	(12)	Diaphragm Main
1722	(3)	Coil 24V AC
1724	(3)	Coil 24V DC
1725	(3)	Coil 230V
1726	(6+7)	Core assembly + spring
1728	(1+2)	Connector + gasket
1727	(5)	Solenoid base
1729	(4)	Bonnet screws small
1729-1	(14)	Bonnet screws large
1720	(8)	Pilot valve bonnet
1721	(10)	Main valve bonnet
1760	(13)	Valve body

Voltage:
DC 24V
AC 24V - 110V - 230 V / 50Hz

Power consumption:
23 VA

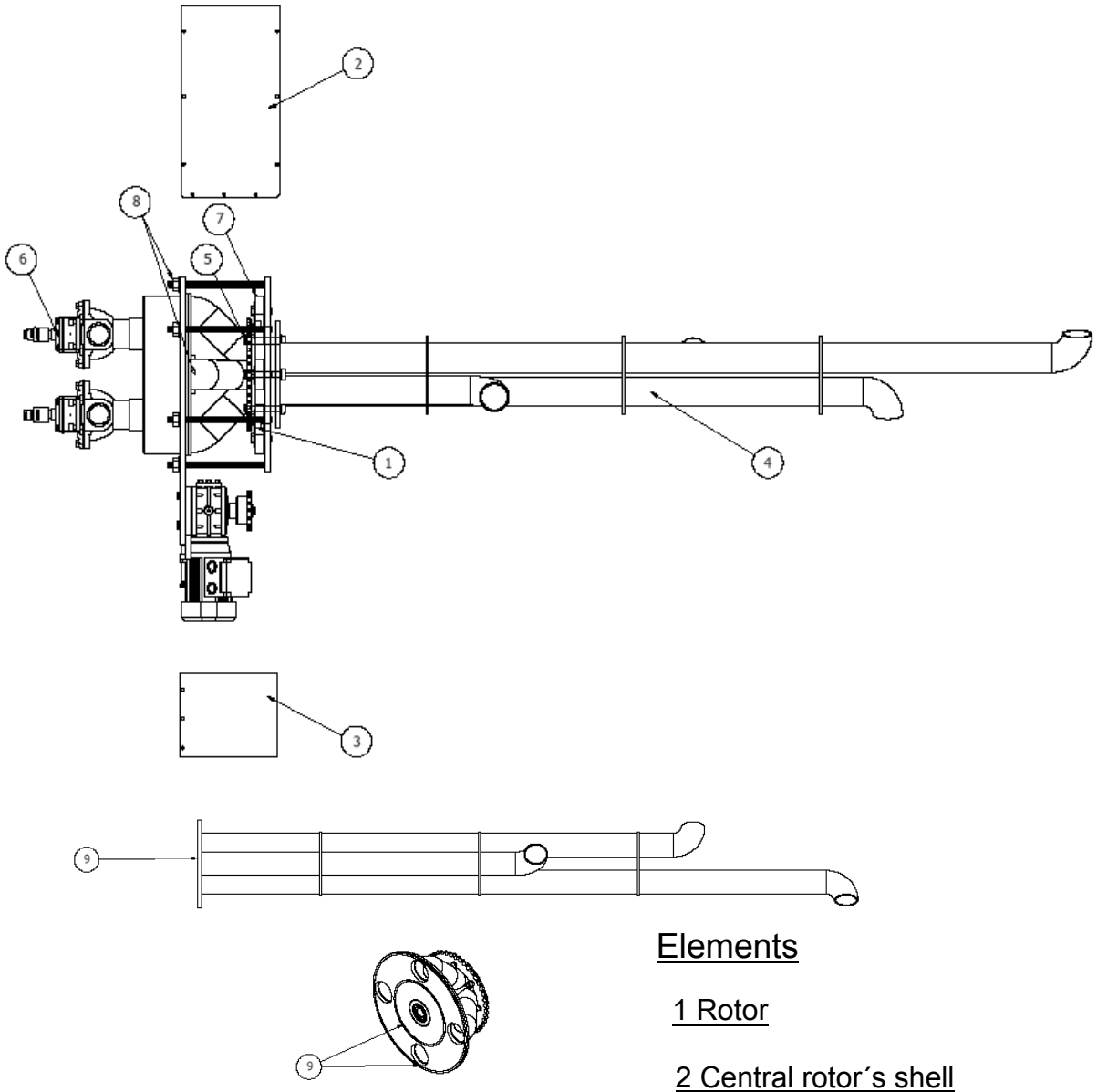
Temperature rating:
Coil: -40°C +80°C
Pilot: -40°C +80°C

Material diaphragm:
Nitril rubber with nylon reinforcement

Temperature rating:
STD: -20°C + 80°C
Viton: -20°C + 200°C

Operating pressure:
0,5 bar – 10 bar

5.5 Exploded view Rotor and Lance



Elements

1 Rotor

2 Central rotor´s shell

3 Lateral rotor´s shell

4 Lance

5 Lance´s bolts

6 AEROVIT valves

7 Bearings

8 Central and Main rotor´s bolts

9 Gaskets

6. Maintenance

Warning: Turn off electrical supply and depressurise the unit before making any repairs. It is not necessary to remove the valve form the unit during maintenance.

6.1 Cleaning of AEROVIT valves

A periodic cleaning of the valves is desirable. The time between cleanings will depend on the compressed air and the duty conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive leakage or noise will indicate that cleaning is required.

6.2 Preventative maintenance

- Keep the compressed air clean, dry and free from oil.
- Check the valves at least once a month to ensure proper opening and closing.
- Periodically inspect the valves' internals for damage, wear or clogging of the bleed hole on the diaphragm and on the pilot base. Thoroughly clean and replace worn or damaged parts.
- Periodically inspect the AEROVIT Type R unit for wear and tearing and for a correct fuunctioning of the motor, especially the 4 piped-lance in the inner part of the boliler, gaskets and bearings in the Rotor unit.
- Periodically check the central bolt and the main bolts of the rotor for making sure the 4 piped-lance maintains a perfectly perpendicular position towards the rotor's interface, for a regular functioning.

7. Improper operation

If the installation does not function:

- Check for and ensure supply to solenoid coil.
- Check for "burn out" of coil and replace if faulty.
- Check and ensure voltage to coil is at least 90% of rated.
- Check and ensure pressure of compressed air, 8 - 9 bar (0.8 -0.9 MPa).
- Check tightness of cover screws.
- If fault not corrected with above, disassemble valve, clean and replace worn or damaged parts.
- Check the central bolt and the main bolts of the rotor for making sure that the 4 piped-lance has a perfectly perpendicular position towards the rotor's interface, for a regular functioning.

8. Recommended spare parts

- Coil, 24 V or 230 V
- Diaphragms + springs
- Pilot group
- 4 piped-lance

9. Setting parameter for rotating cleaner

It is possible to have up to five valve groups, and max 6 rotors.

Settings for activation

Setting the number of valve groups and number of valves

You must enter the actual number of valve groups and the actual number of rotors, which your system has. This is done in data register 0 and 1
In DR2 the time is set as default on 60 sec. This is the time that needs to run from rotor has started running before error signal is given due to sensor is not registering rotor movement.
In DR3 it is possible to read out which rotor sensor that is failing.

DR0 = Number of rotors
DR1 = Number of valve groups
DR2 = Time in sec. before error signnal
DR3 = Which rotor sensor is failing

Settings for shot sequence.

A shot sequence consists of two steps.

Step 1.
In this step, the machine will activate the first two shots in each valve group. That is, V1 and V3. After the first activation, there will be a pause before shooting the next group.

Step 2
In this step, the machine will activate the next two shots in each valve group. That is, V 2 and V4.

Timer shot sequence

Timer 0 = Shot time
Timer 1 = Pause between group changes
Timer 2 = Pause between shots sequences

Settings for rotor

Each rotor has its own small sequence. Sequence is shown in the picture.

A rotor is running a number of times at a preset time. When this many times achieved will find its rotor position sensor. It is now in the last position. The next rotation will be until the rotor does not see the sensor anymore. This means that the sensor must be active as long as the rotor is in its last shot position.

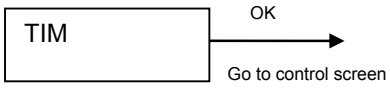
Times and counter the rotor 1 - 6

Rotor #1
Counter 20 = number of movements at the time.
Timer 20 = Time each motion to be carried
Rotor #2
Counter 21 = number of movements at the time.
Timer 22 = Time each motion to be carried
Rotor #3
Counter 22 = number of movements at the time.
Timer 22 = Time each motion to be carried
Rotor #4
Counter 23 = number of movements at the time.
Timer 23 = Time each motion to be carried
Rotor #5
Counter 24 = number of changes in time.
Timer 24 = Time every movement to be carried
Rotor #6
Counter 25 = number of movements at the time.
Timer 25 = Time each motion to be carried

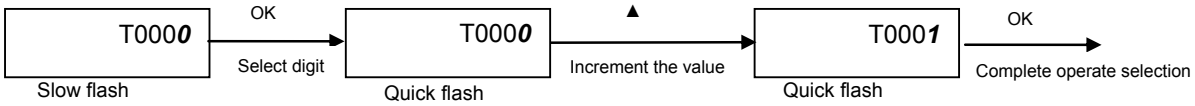
10 Example: Changing the Timer T1 from 300 to 600 seconds

(esc = back)

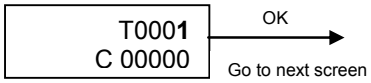
1. Select the Timer menu.



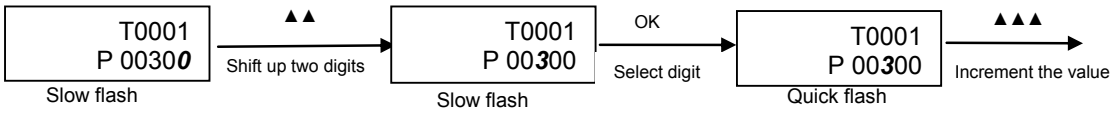
2. Select the operand number.

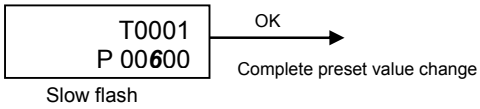


3. The current value of the selected timer number is displayed.



4. The present value of the selected timer is displayed.
   Change the preset value to 600 as described below:





5. The changed preset value is displayed without flashing. Write the new preset value to the
   CPU module RAM.