

ON-LINE MANUAL Operation

6. Installation and operation of the vibrator

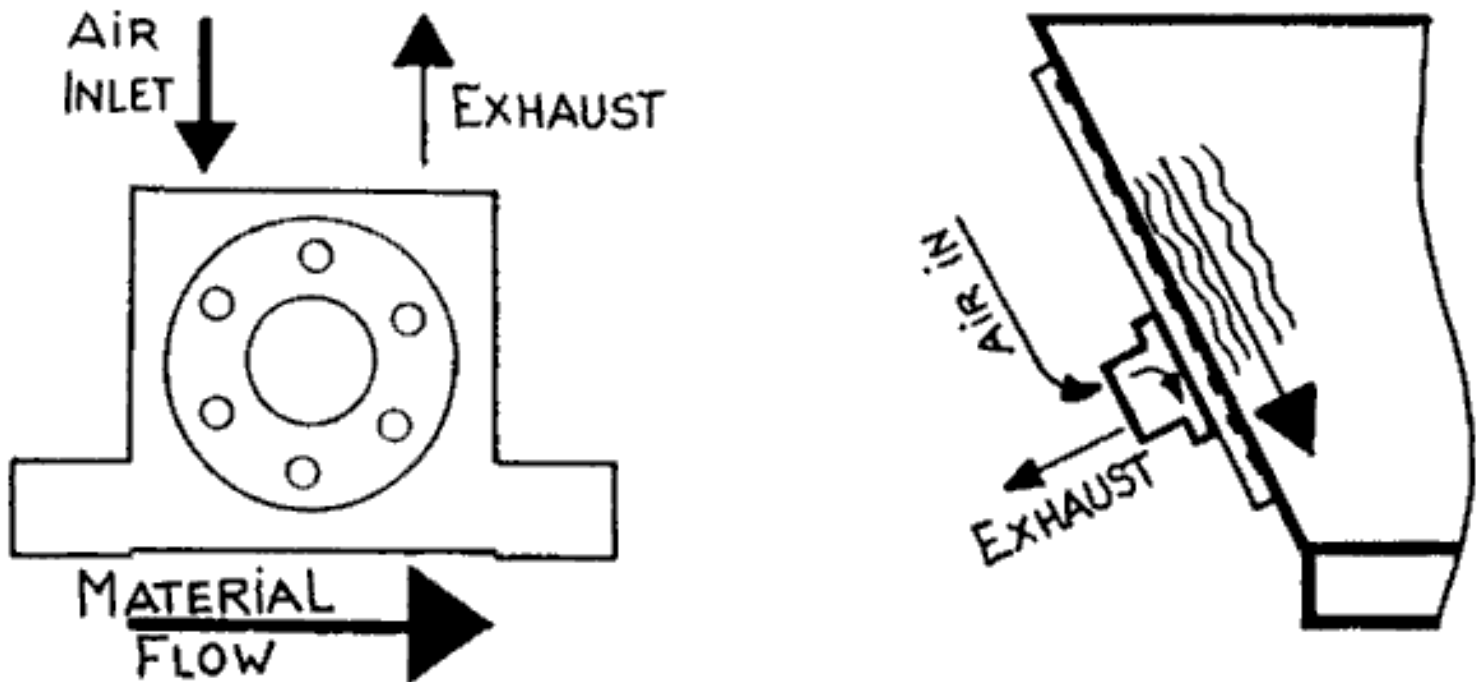
6.1 Mounting

Before mounting the vibrator make sure the location has been carefully selected to insure the best working results (refer to Chapter 3).

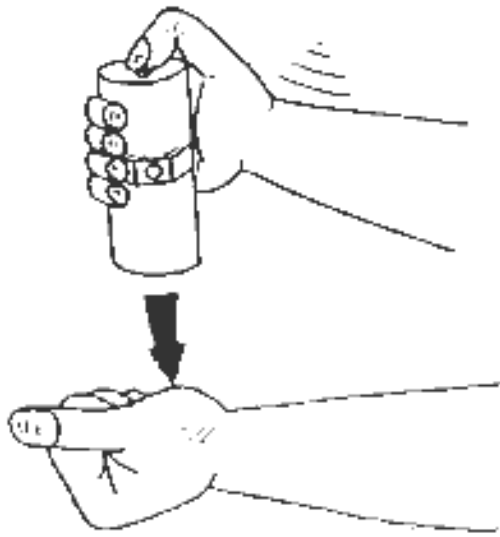
The mounting area must be clean and even. Please note that an uneven mounting area may cause the vibrator to malfunction due to torsion in the vibrator's body.

The vibrator should be placed, whenever possible, so that the rotation of the ball, roller or turbine supports the direction of material flow.

It is easy to verify the correct placement with the help of the air inlet as shown in figure 6.1.



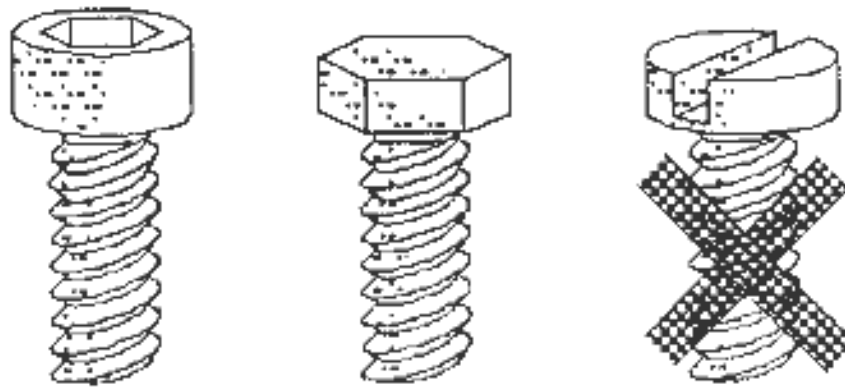
Support of flow and correct placement on a bin



Check free movement of the piston

Before mounting the Piston Vibrator FP-series, check to make sure that the piston is moving freely. Hit the vibrator against the ball of the thumb. You will hear a metallic "clack" of the piston when knocking the end cap. If the piston is not moving freely, add some drops of petroleum (kerosene) into the air inlet. It will loosen the clog of the piston which is probably caused by the congealed oil we use in manufacturing.

6.1.1. Screws and nuts



Allen Screws / Hexagon Screw / Slotted Screw

The following screw sizes have to be used:

Model	8/10	13/16	20/25	30/36	40/48	60/70
K-series	M6	M8	M8	M10	----	----
GT-series	M6	M8	M8	M10	M16	M16
Model	50	65	80	100	120	
R-series	M6	M8	M8	M10	M16	

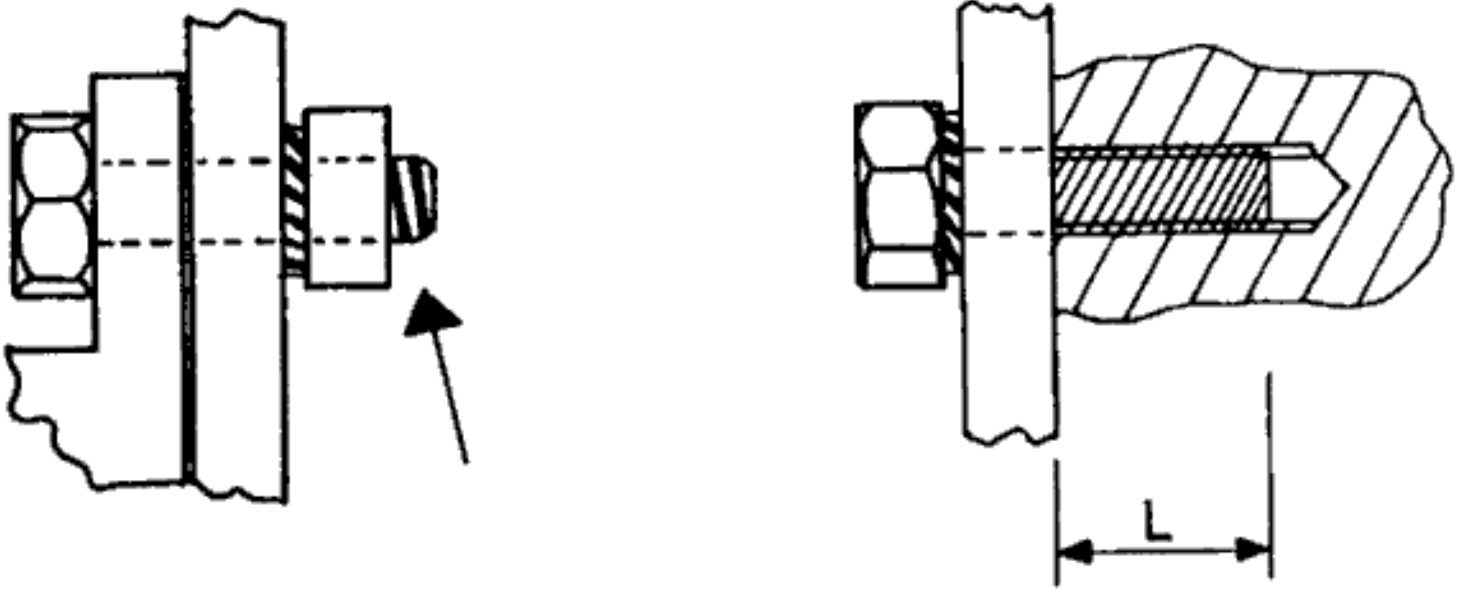
T-series	M6	M8	M10	M12	----	
Model	2	3	4	5	6	7
DAR-series	M6	M8	M10	M12	M16	M16
Model	12	18	25	35		
FP-series	M8	M10	M12	M12		

Allen Screws or Hexagon Screws with a minimum quality of 8.8 are recommended. Similarly, the nuts should conform to 8.8 quality.

Slotted Screws or other types of screws with less tensile strength should be avoided.

The screws should be long enough so that at least one full thread is out of the nut.

If a threaded hole in the object is used for mounting, the screw should be torn in at least 1.5 times the screw diameter.



Lengths of the screw in the thread

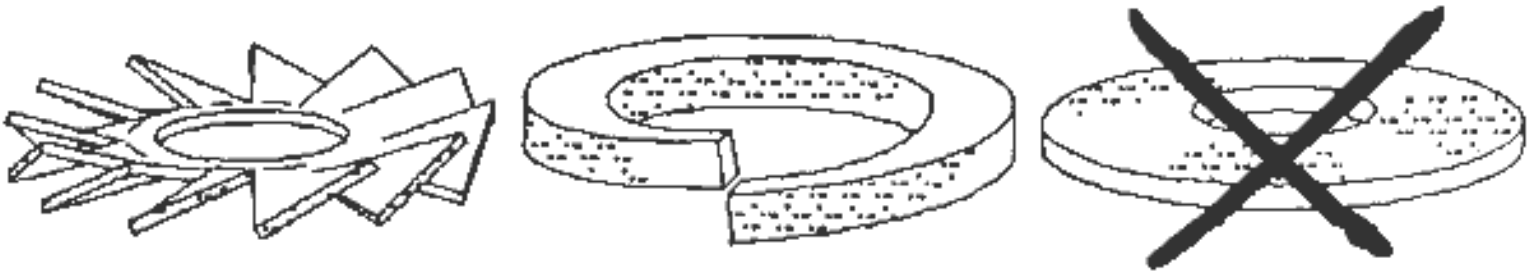
For FP-series the length of the screw in the vibrator thread should be as follows:

FP-Type	12	18	25	35
Minimum (mm)	10	10	12	12
Maximum (mm)	13	13	15	15

CAUTION: Always use a Tooth Lock Washer or a Spring Lock Washer.

The use of an adhesive sealant (LOCTITE 270 for instance) is suggested. Please follow the manufacturer's instructions.

Never use an ordinary Flat Washer or a Curved Washer because these washers do not stop movement, and loosening of the screw during vibration may occur.



Tooth Lock Washer / Spring Lock Washer / Curved Washer

The washer should be placed between mounting plate and nut, and between mounting plate and screw for FP-vibrators.

The tightening torque must not exceed the following values :

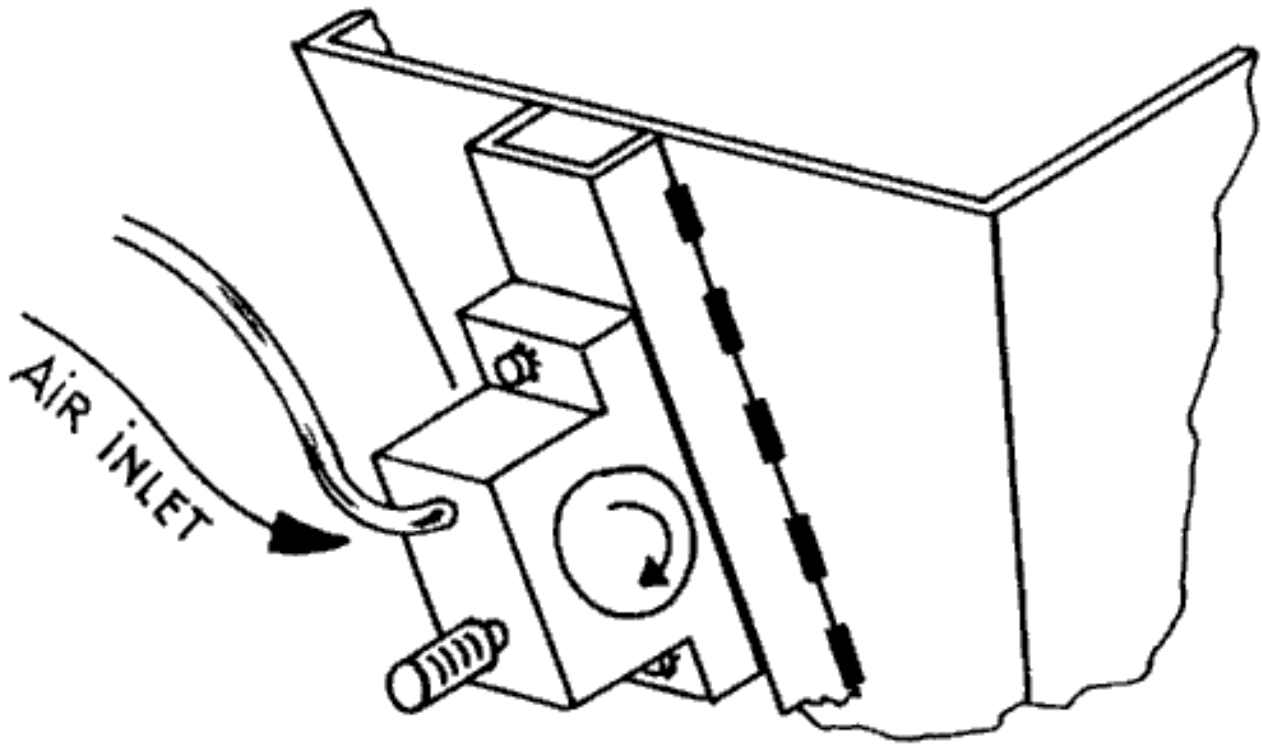
Thread	Minimum	Maximum
M6	6 N	10 N
M8	15 N	21 N
M10	30 N	42 N
M12	50 N	72 N
M16	150 N	174 N

Fig. 6.7. : Minimum / maximum torque

NOTE: FP-series : The socket with the mounting thread is the end cap with the smaller diameter. The thread in the other end cap (air exhaust port) is not metric!

The vibrator is to be placed, whenever possible, so that the rotation of the ball, roller or turbine supports the direction of material flow.

It is easy to verify the correct placement with the help of the air inlet as shown in figure 6.8.



Support of flow and correct placement on a bin

CAUTION: Make sure the vibrator is securely fixed! We strongly recommend that you retighten the screws after a few minutes of operation. A loose vibrator may fall down and harm people or machinery.

6.1.2. Air connection

The air pressure tube should be wide enough to allow a good air flow. The main air line should be dimensioned according to paragraph 2.4.. The connection from the main line to the vibrator is made with a short flexible tube. Make sure the inner span of this flexible connecting tube conforms to figure 6.9.

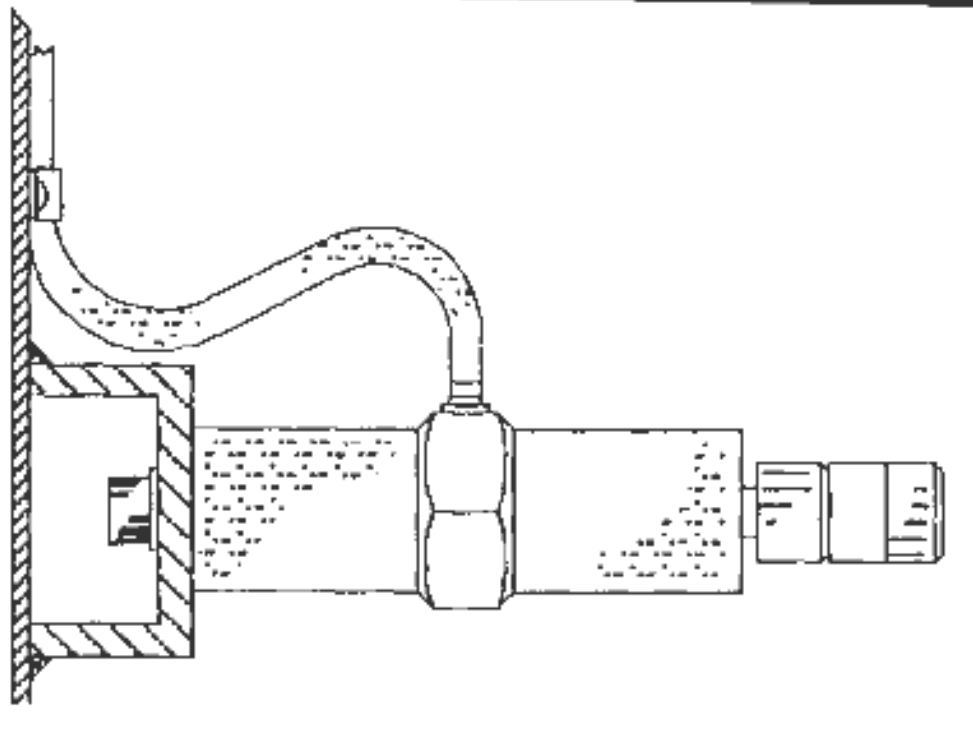
Profile Type	50	65	80	100	120	180
Inner Span (mm)	8	8	12	16	16	20

Fig. 6.9. : Minimum requirements of inner span of connecting tube

Make sure the air pressure tube at the air inlet port is flexible and freely movable so that vibration does not harm the tube at the transition piece. The tube is to be securely fixed at the object side, so that the tube may not come in resonance. You can let the tube hang from a structure point directly to the inlet port, but make sure that it does not create a safety hazard.

Make sure that the tube can never be buckled.

NOTE: The pipe thread is BSP type (British Standard Pipe) but will accept US NPT (National Pipe Thread) that is conical and has one extra turn per inch. Tighten very closely using Teflon-tape



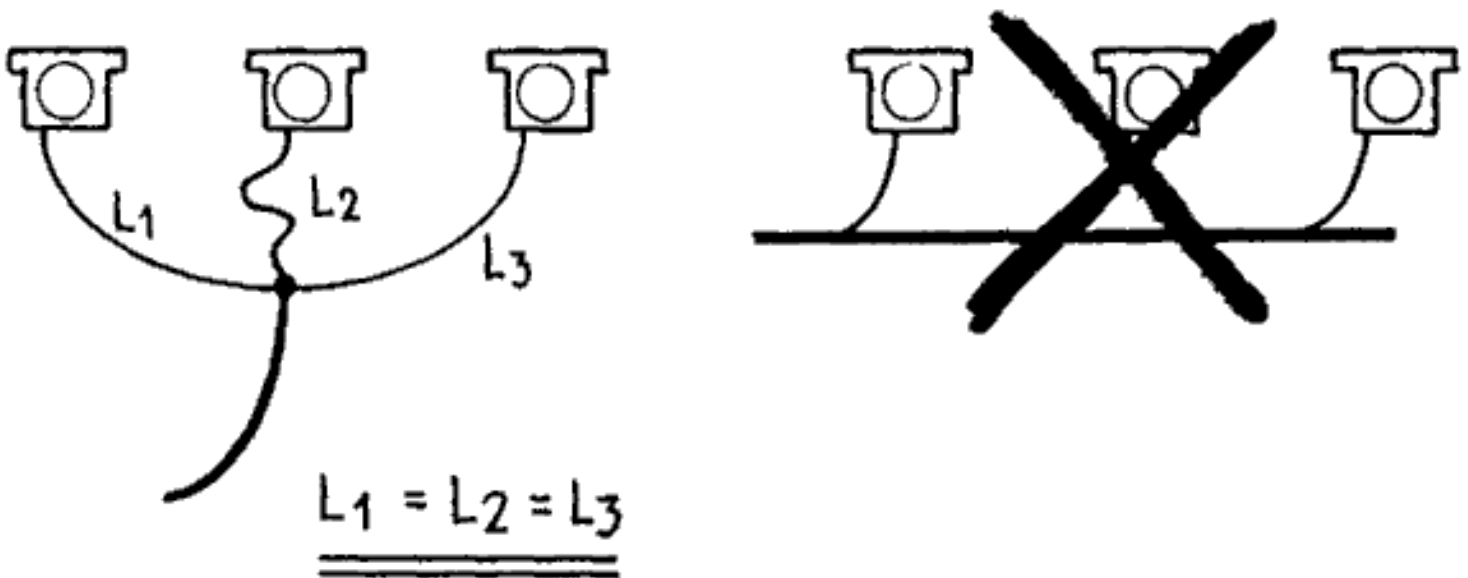
Fixation of the air pressure tube

The filter, regulator and lubricator unit should be placed as close as possible to the vibrator (less than 2 m).

If an electromagnetic valve is connected into the air line for intermittent operation of the vibrator, the distance between vibrator and valve should be less than 50 cm. This will guarantee a proper and immediate start and stop.

Only one lubricator unit needs to be used for a maximum of three vibrators. The lines from the junction to every vibrator should be of the same length to ensure that all vibrators are supplied with same pressure and flow through.

Again, when using electromagnetic valves, place each one within 50 cm of every vibrator so it is guaranteed that all vibrators will start and stop at the same time.



Connection of three vibrators to one lubricator unit

If a lubricator is used, the oil must be ISO VG5 as explained in paragraph 2.2.

Please note that suppliers of servicing units (filter-regulator-lubricator) sell their own oil for lubrication. Please verify it conforms to ISO VG5!

We recommend that you add a few drops of kerosene into the vibrator's air inlet before mounting the air tube. Kerosene will dispel the corrosion protective additive inside new vibrators during the first few seconds of operation.

6.1.3. Silencer

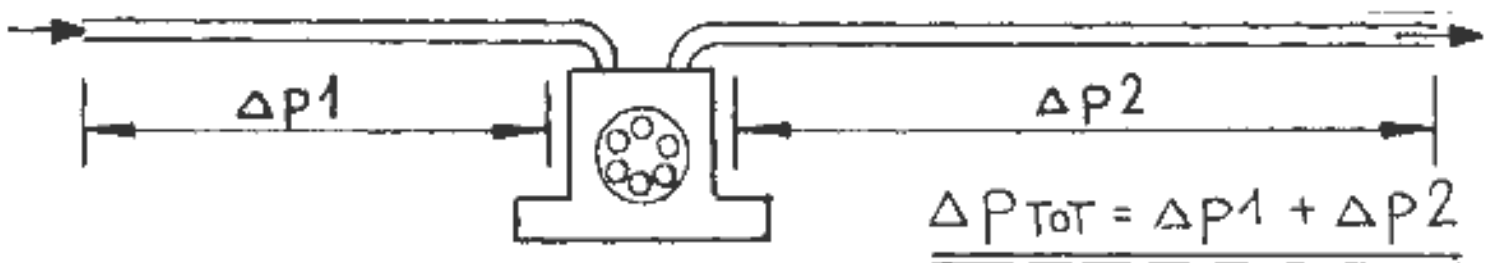
All vibrators except the R-series may be equipped with silencers or an exhaust hose. The use of the following silencers is recommended.

Vibrator Types/Models	Silencer	Size	Order-No.
GT-8 /-10, R-50, FP-12 / -18	Filter Type	1/8"	44025
K-8 to 25, GT-13 to 25, T-50 to 65, R-65 / -80	Filter Type	1/4"	44026
K-30 / -36, GT-30 to 48, T-80 to 100, R-100 / -120	Filter Type	3/8"	44027
DAR-2	Sintered	1/8"	39371
DAR-3 / -4	Sintered	1/4"	39372
DAR-5 / -6 / -7	Sintered	3/8"	39373
FP-25 / 35	Free Flow	1/4"	44029

Fig. 6.12. : Silencer cross reference

Silencers may clog due to dirt in air; hence, the use of air line filters is strongly recommended, but clogged silencers (filter types and sintered types) may be washed out with petroleum (kerosene). FF-types (Free-Flow 1/4") can be unscrewed, and both parts can be blown through with air pressure.

Instead of using silencers the exhaust air may be blown through a hose. Make sure that the hose inner span is about double the size of the air pressure tube, otherwise the full pressure (difference from air inlet port to the end of the exhaust hose) is not transformed into mechanical energy. As mentioned in Chapter 2.4. pressure loss in pipes (whether supplying nor exhausting) must not exceed 0.5 bar in total.



Pressure Loss

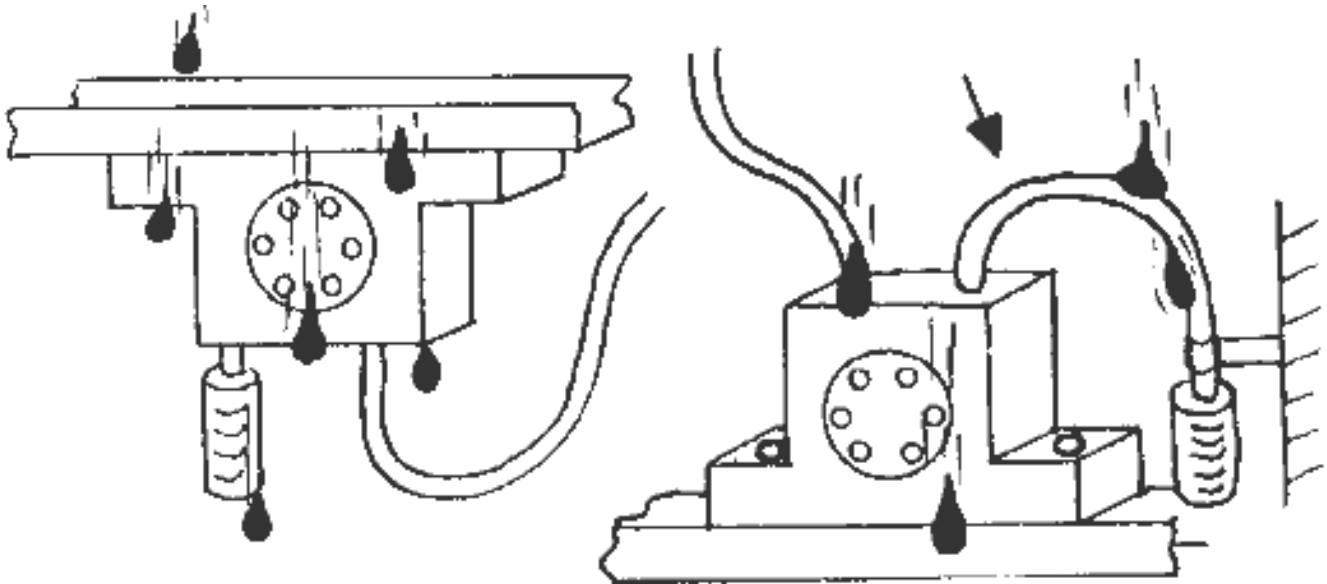
The exhaust pipe should not exceed 2 m.

6.1.4. Outdoor application

All FINDEVA vibrators may be used outdoors when operated under the following conditions :

The vibrator is to be installed so that no fluid may reach it. If the vibrator is exposed to fluids (rain drops or other moisture), one of the following steps must be taken:

- The vibrator should be mounted so that the exhaust port with silencer is turned against the ground or the exhaust port should be connected to a hose that is mounted so its end is against the ground, not allowing liquid or dirt to enter.



Mounting outdoors or exposed to liquids, dirt, etc.

- If the vibrator is exposed to fluids but above the measures can not be followed, use a silencer and have a continuous flow of about 0.5 to 1 bar (15 to 30 PSI) so that no fluids may enter.

CAUTION: Never operate vibrators without a silencer or exhaust hose if dirt, liquids or other particles (concrete powder, caustic solution, etc.) can enter the exhaust port.

6.2. Operation

After having successfully installed the vibrator, it can be set into operation.

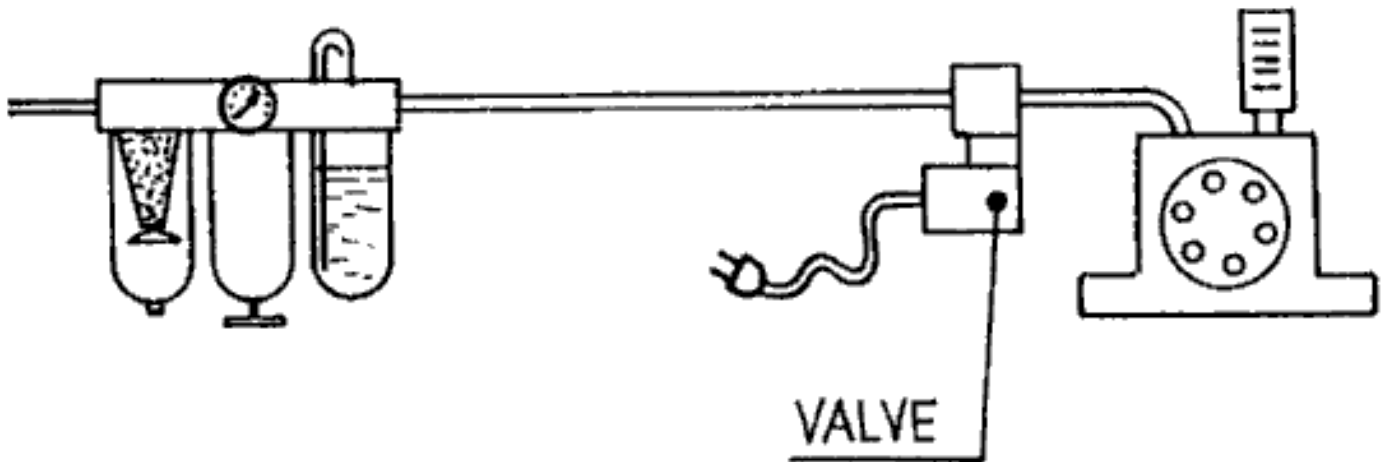
WARNINGS:

- Wear ear protection around pneumatic vibrators!
- Operation without a silencer should be avoided to keep the noise level (and possibility of ear damage) reduced as much as possible!
- Make sure the lubricator (if any) is filled.
- Make sure that the maximum air pressure to the vibrator is 7 bar!
- Check again that mounting screws are tightly fastened.
- Make sure the air pressure tube is connected to the inlet port.
- Vibrators mounted on bins and hoppers should not be operated if bin or hopper is empty since this may cause structural damage.

When starting the first time, the vibrator might reach its nominal frequency and force after only a few minutes. This is because the moving parts are covered with grease and the temperature is low so that the grease is stiff. All vibrators are run during the final inspection in the plant for some minutes but because of stocking the grease may have a chance to clog again.

We recommend that you operate vibrators intermittently for several reasons:

- the lifetime of the vibrator is extended
- costly air pressure energy is conserved
- operate only when material flow is required and shutters and gates are open to prevent material from packing in the bin, hopper or chute.
- an Operating Factor of 10 to 30 seconds ON and 1 to 5 minutes OFF has been found to be most efficient for most applications.



Intermittent operation

For intermittent operation, we recommend the use of electromechanical valves driven by timers or the machinery control system. The valve has to be set in line between the lubricator and the vibrator. The closer the valve is set to the vibrator the stronger start- and stop-intervals are. When the valve is set farther from the vibrator, the air pressure volume remaining in the air pressure tube has to be emptied and refilled.

Very often there is no need to run the vibrator at full power. Air power energy can be saved using a pressure regulator. Adjusting to the resonant frequency of the system extends the life time as well.

The frequency of all vibrators can be controlled with the help of pressure regulators in the supply pressure line. The FF-silencer connected to the piston vibrator's exhaust also allows adjustment of the vibration amplitude.

WARNING: For the following inspection wear ear protection !

When operating a vibrator for the first time, disconnect the exhaust hose and run the vibrator and measure its frequency and force. Do the same again with the exhaust hose mounted. Any difference in the values obtained show pressure and energy loss in the exhaust hose. If this occurs, increase diameter of the hose or cut the length of the hose.

The same procedure can be done with a silencer to verify the air flow is sufficient or to detect clogging.

If the vibrator cannot be set into operation or the desired operation power cannot be obtained please refer to Chapter 7.2.1. Fault Detection.

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ON-LINE MANUAL

Maintenance

7. Maintenance and repair

7.1. Maintenance

Under normal circumstances, the pneumatic vibrator units themselves do not require any kind of maintenance if they are operated in a proper way.

We suggest checking the vibrating system at regular intervals to insure that it is functioning properly. The frequency of the system can be measured with the help of a Vibrometer. A change in frequency is always the first indication for a loss in vibrating power.

NOTE: The frequency of a vibrator may vary depending on the size of the air compressor and the air reservoir. Make sure frequency and power measurements are obtained only when the reservoir is filled.

Required regular maintenance for the air pressure supply includes checking the following at regular intervals :

- The air filter for accumulation of dirt (clogging). This may lead to a loss in vibration energy. If clogged, wash out or replace.
- The silencer for accumulation of dirt (clogging). This may lead to a loss in vibration energy. If clogged, wash or replace. The FF-silencer (FOR piston vibrators) can be unscrewed into two pieces and blown out with compressed air.
- The lubricator for sufficient oil in the container.

NOTE: Very often vibrators are damaged because the lubricator runs out of oil. Therefore, make one person responsible either to keep the lubricators filled or to check the lubricators at regular intervals.

NOTE: For Piston Vibrators only !

The air lubricator may be filled with distilled water for the operation of piston vibrators. The materials (teflonized aluminum and leaded bronze) may be operated oilfree with only distilled water with excellent results. Operation with distilled water requires a 5 to 10 times higher flow rate than operation with oil because water is blown away very quickly, while oil adheres longer to the moving parts and the walls.

7.2. Troubleshooting

7.2.1. Vibrator does not start

- Piston Vibrator only: Remove it from the mount and hold it vertically in your hand. Turn it on. If it runs, check starter spring inside.

- Gumming of oil may keep the parts stuck together (mainly for FP- and DAR-Vibrators). Add ten drops of Kerosene (Petroleum) into the air pressure inlet to dissolve the gumming oil.
- If you suspect air pressure supply blockage:
 - Unscrew silencer or exhaust hose and run the vibrator. If it operates properly, then check the silencer or hose for clogging. If clogged, wash out (kerosene) or replace
 - Check air pressure to localize the blockage
 - at the compressor's site
 - at the maintenance unit (filter-regulator-lubricator)
 - at the end of the flexible tube

7.2.2. Vibrator does not always start

- Occurs in Piston Vibrators because they require a few seconds OFF- time before supplying again. Starter problems usually occur if the OFF-time cycle is extremely short.
 - The piston may need a few seconds to be pushed by the spring into the start position. This time depends on the manner of installation, with a longer supply pipe between valve and vibrator extending the OFF-time needed. Also, a clogged silencer will hinder the exhaust. To test this possibility, remove the silencer and run the vibrator. If it runs, then wash silencer out or replace it.
 - If the OFF-time required is short (less than 4 seconds), it is advantageous to use a 3-way valve so that the supply pipe to the vibrator is bled when switching OFF.
 - Using a hand-driven valve may sometimes cause starting problems if the air pressure is not moved through quickly enough. Electrically or pneumatically driven valves are recommended.
 - Insufficiently large tube or valve diameters may cause similar problems.

7.2.3. Vibrator runs too slow / Vibration power too low

New Installations

- Vibrators need up to 15 minutes to reach full power since excessive grease and anticorrosives have to be moved through.
- Adjust air pressure regulator to increase vibrator's speed
- Check that the air supply is connected to the inlet port and not to the exhaust port (arrow marks)
- Check that the flexible tube is not bent.
- Check to make sure that the inner span of the air pressure supply pipe (Paragraph 2.4. and 6.1.2.) is wide enough and not too long. Also check the inner span of the valves used.
- Check that there are not too many air consumers being operated at the same time with one air line. The consumers should be selectively controlled.

Existing Installations

- Remove silencer or exhaust hose. If the vibrator operates properly without them, then the silencer or exhaust hose is probably clogged with dirt. Wash out with petroleum (kerosene) or replace.
- Check the air line filter for accumulation of dirt. Air supply pipe irons may get rusty and these particles may clog the filter.
- Check the air supply for leaks. Make sure that the compressor is working continuously. Check to see if the flexible tube is bent.
- Eventually the lubrication oil will gum up. Add a few drops of petroleum (kerosene) into the air inlet port

to clean.

- Check vibrator for accumulation of dirt and clean with petroleum (kerosene).

7.2.4. Excessive noise during operation

High acoustic frequency:

- The vibrator is probably running too quickly or mounted too rigidly. Reduce the air pressure and adjust the vibrator to its optimal working frequency.
- The ball of ball vibrators may be worn out and cause an increase in frequency and a decrease in vibrating force.

Crackling sound

- Verify that the vibrator mounting screws are securely fixed
- If the bin or hopper is empty, cut down air supply.
- In turbine vibrators, ball bearings may be damaged

7.3. Repair

All FINDEVA vibrators except the K-series can be easily dismantled, maintained and repaired if necessary.

The following tools are necessary :

- Pin Wrench Pin 4, 5, 6, 7 or 8 mm (refer to list figure 7.1.)
- Vise with aluminum jaws
- Hammer
- For T-Turbines: Allen key (2.5 mm : T-50/-65 ; 3 mm : T-80/-100)

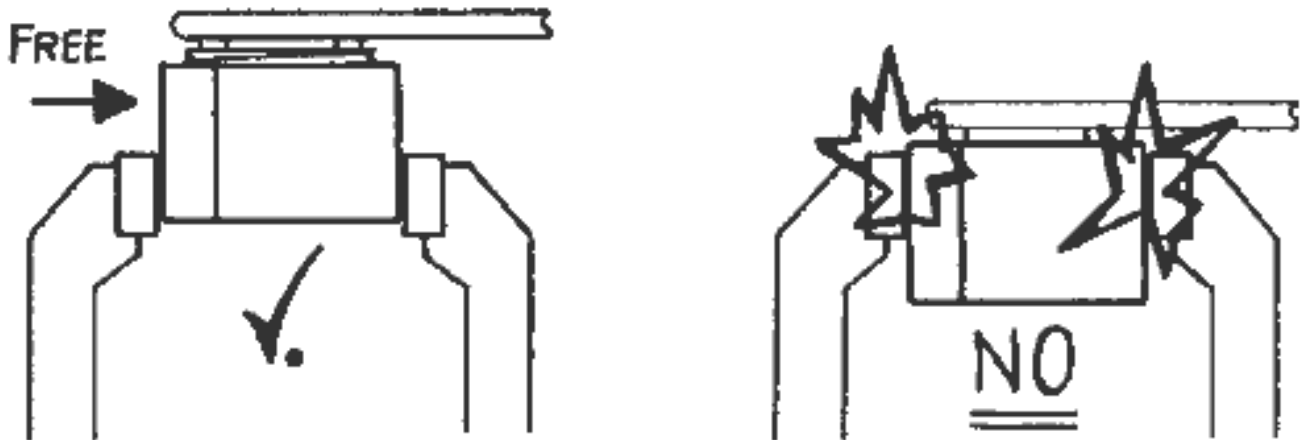
Wrench Pin diameter in mm	Models / Types			
	R	DAR	GT	FP
4	50	2	8/10	12/18
5	65	3	13/16	---
6	80	4	20/25	25/35
7	100	5	30/36	---

8	120	6/7	40/48	---
Turbine Vibrators : Pin dia. = 7 mm				

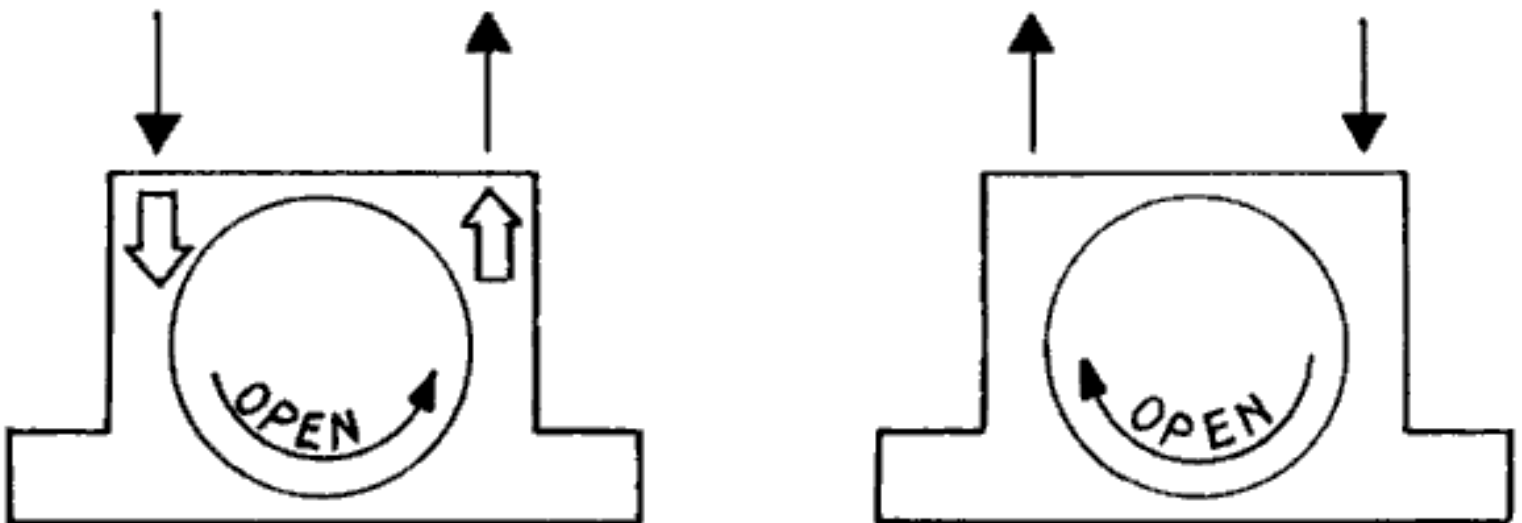
Fig. 7.1. : Pin wrench diameter cross reference

Place the vibrator as shown in figure 7.2. in the vise. Make sure that the part with the end cap to be loosened is not be pressed by the vise. Open the end cap in the same direction the rotor, ball or roller moves (figure 7.3.). Piston Vibrator end caps or sockets should be opened counter clockwise.

NOTE: If both end caps or the end cap and socket of a piston vibrator are to be opened, first loosen both sides before opening. This prevents the housing from breaking.



Do not press the end cap



Turning direction to open the end cap

NOTE: When changing parts, use only original parts. Other parts may not be of the same quality and may lead to malfunction.

7.3.1 Ball vibrators K-series

Ball vibrators should not be repaired since only the end caps and the ball can be replaced. If the ball is worn out, the races will be also, but the races can not be changed.

It is still possible to gain a few hundred hours of operation with a new ball.

The only way to open the end cap is to destroy it by drilling a hole into it. Check the races for cracks before closing again. A new end cap can be pressed in by hand.

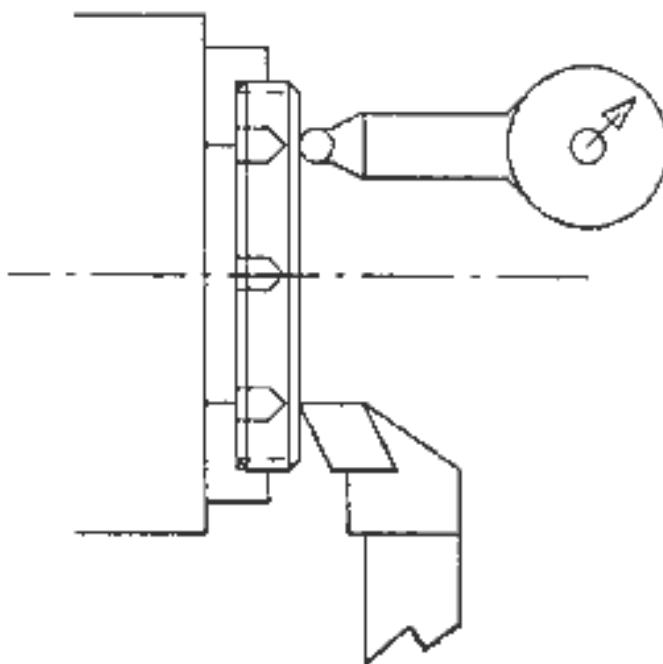
7.3.2. Roller vibrator R-series

When opening the vibrator check both of the black end caps for grooves due to abrasion of the roller. If grooves are visible it is an indication to use more lubrication and that the end caps should be changed. Please note that the end caps have right- and left-hand thread, and are sold in matched pairs only.

Also, check the roller race for rust, cracks, etc. Rust or other dirt particles may cause the roller to jump, causing the race to be worn out quickly.

It is possible to run the vibrator without the silencer plates on the end caps but the noise level will be greatly increased, and the silencer plates protect the vibrator from dirt entering through the exhaust holes.

7.3.3. Roller vibrator DAR-series



Overturn of the end plate

Like the R-series, the brass end caps may be worn out due to lack of lubrication or dirt contamination. If so place the end plate in a lathe as shown above. Check that the surface of the endplate is running true using D.T.I., and overturn the plate until it is even again.

This should be done before the groove is more than 30 µm (0.03 mm).

The total thickness of the endplate should not be less than shown below.

DAR-type DAR	-2	-3	-4	-5	-6	-7
Minimum thickness in mm	7	8	9	10	11	11

Minimum thickness of the brass end plate

Also, check the roller race for rust, cracks, etc. Rust or other dirt particles may cause the roller to jump, causing the race to be worn out quickly.

7.3.4. Turbine vibrator T-series

NOTE: Before opening the threaded end cap, make sure the Allen Key Screw on top of the housing is loosened to avoid destroying the thread.

The Allen key screw is a 2.5 mm (T-50 and T-65) or 3 mm type (T-80 and T-100). Open the threaded end cap counterclockwise. The other end cap is the same used with ball vibrator K-series and should not be moved away under normal circumstances.

The rotor and the ball bearings on its axles can be taken out of the housing. The ball bearings can be removed from the rotor's axles using a ball bearing extractor.

When reassembling the vibrator, the direction of the rotor blades is important, but the rotor cannot be mounted the wrong way because one end of the rotor axle contains a hole that fits into the fixed end cap.

When using a new threaded end cap make sure that the end cap is tightend before screwing in the Allen key screw. Now use a 4.2 mm drill (T-50 and T-65) or a 5.0 mm drill for T-80 and T-100 to spot-drill the end cap's thread through the allen screw hole, so that the headless Allen screw is securely blocking the end cap. Then, tighten the Allen key screw securely and place the sticker on the side of the end cap.

If new ball bearings are in use please note that the vibrator will need a few minutes to work up to its nominal frequency as the grease used in manufacturing is displaced.

When putting the vibrator back into operation, check the lubricator to make sure that it is operating properly and that the reservoir is filled.

7.3.5. Turbine vibrator GT-series

Under normal circumstances, the GT-Vibrator can only be opened on one side. The rotor and the ball bearings

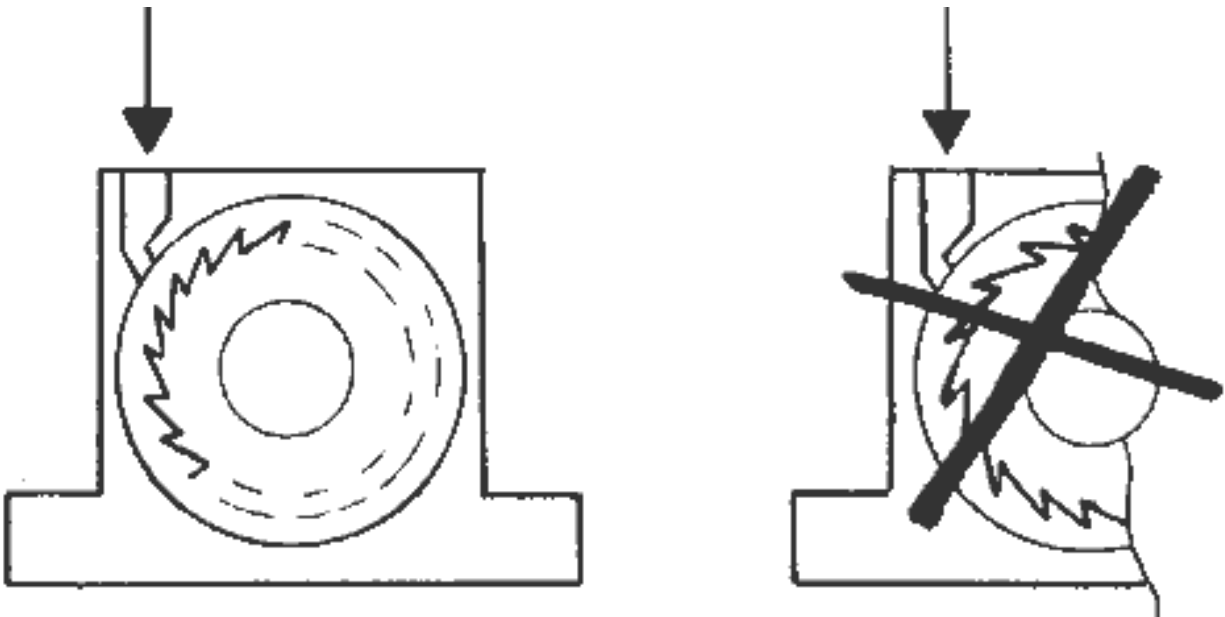
can be taken out, and the ball bearings can be removed from the axles very easily.

Please note that the ball bearings are not standard, since they must be shielded and they contain only one tenth of the standard amount of grease. This is sufficient to guarantee optimal greasing, while a standard amount of grease slows the frequency down considerably.

As a temporary solution to keep the production machines running, a pair of standard ball bearings may be used, but they must not be used longer than a few days while waiting for new original spare bearings to arrive.

NOTE: We do not recommend the use of other than the original spare ball bearings and will not take any responsibility for any damage resulting from the use of standard ball bearings.

When reassembling the vibrator, make sure that the rotor is mounted correctly. As shown in Fig. 7.6. the pockets of the rotor must be mounted so that the air pressure may fill them. Otherwise the rotor will turn, but with only about 50% of frequency and vibrating force.



Correct mounting of the rotor

Under normal circumstances a GT-vibrator will last longer than any other type of vibrator because changing the ball bearings makes the vibrator as good as a brand new one.

7.3.6 Piston vibrator FP-series

We recommend opening the socket end (the end with the metric mounting thread and the smaller diameter).

Check the spring for correct length and the piston for abrasion tolerance according to figure 7.7.

FP-Type	Nominal Diameter / Abrasion Tolerance	Spring Length Tolerance
----------------	---------------------------------------	-------------------------

FP-12-S FP-12-M FP-12-L	11.985 mm / -20 μ m	L=13 mm +/- 3 mm L=17 mm +/- 3 mm L=20 mm +/- 3 mm
FP-18-S FP-18-M FP-18-L	17.985 mm / -15 μ m	L=19 mm +/- 3 mm L=22 mm +/- 3 mm L=25 mm +/- 3 mm
FP-25-S FP-25-M FP-25-L	24.985 mm / -10 μ m	L=26 mm +/- 3 mm L=32 mm +/- 3 mm L=42 mm +/- 3 mm
FP-35-S FP-35-M FP-35-L	34.985 mm / -5 μ m	L=30 mm +/- 3 mm L=34 mm +/- 3 mm L=38 mm +/- 3 mm

Fig. 7.7. : Piston abrasion tolerance and spring length tolerance

The vibrator will work if it is out of tolerance, but the leakage area between piston and boring increases with the square of the diameter. The higher the leakage the less vibrating power the vibrator is able to generate. This is especially important with both the larger models FP-25 and FP-35 because of their already large diameter. Hence, we strongly recommend lubricating the piston vibrator to avoid abrasion as much as possible.

When reassembling the vibrator, it is important to place the spring as shown in figure 7.8., with the smaller end of the spring against the piston, otherwise the spring will block and damage the vibrator.

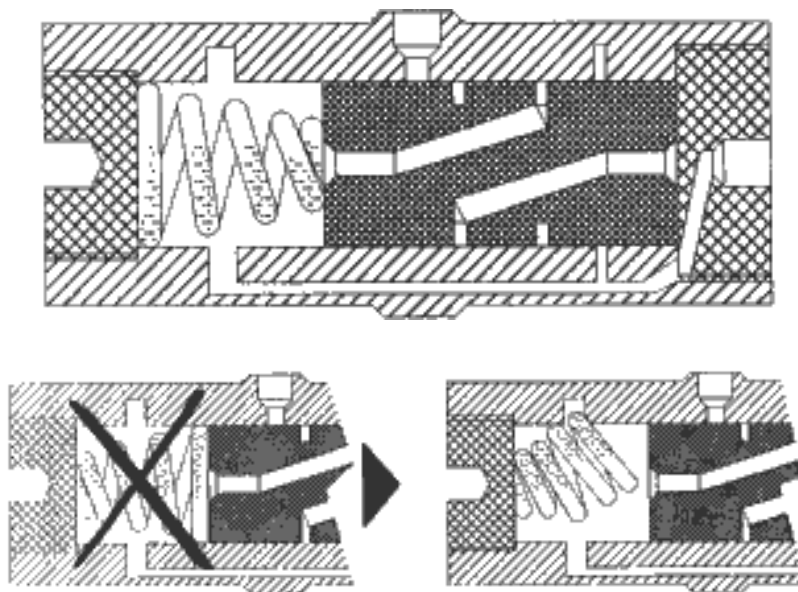


Fig. 7.8 - Correct / Incorrect installation of the spring

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ON-LINE MANUAL

Spare Parts

8. Spare parts list

8.1. Ball Vibrator K-series

Type	Plastic-Cap	Steel Ball	Silencer
K-8	91008.10	91008.20	44026.00
K-10	91008.10	91010.20	44026.00
K-13	91013.10	91013.20	44026.00
K-16	91013.10	91016.20	44026.00
K-20	91020.10	91020.20	44026.00
K-25	91020.10	91025.20	44026.00
K-30	91030.10	91030.20	44027.00
K-36	91030.10	91036.20	44027.00

8.2. Roller Vibrators R-series

Type	Threaded Cap Right	Threaded Cap Left	Roller	Screw Plug
R-50	93050.11	93050.12	93050.20	93050.30
R-65	93065.11	93065.12	93065.20	93065.30
R-80	93080.11	93080.12	93080.20	93065.30
R-100	93100.11	93100.12	93100.20	93100.30
R-120	93120.11	93120.12	93120.20	93100.30
R-80-S	96080.10	96080.10	96080.20	93065.30

8.3 Roller Vibrators DAR-series

Type	Threaded Cap Right	Threaded Cap Left	Roller
DAR-2	97002.11	97002.12	97002.20
DAR-3	97003.11	97003.12	97003.20

DAR-4	97004.11	97004.12	97004.20
DAR-5	97005.11	97005.12	97005.20
DAR-6	97006.11	97006.12	97006.20
DAR-7	97006.11	97006.12	97007.20
Silencers :	DAR-2 Sintered Type 1/8"		39371.00
	DAR-3 to 4 Sintered Type 1/4"		39372.00
	DAR-5 to 7 Sintered Type 3/8"		39373.00

8.4. Turbine Vibrators GT-series

Type	Threaded Cap Right	Threaded Cap Left	Ball Bearing	Rotor
GT-4	98004.31	98004.32	98004.10	98004.20
GT-6	98004.31	98004.32	98004.10	98006.20
GT-8	98008.31	98008.32	98008.10	98008.20
GT-10	98008.31	98008.32	98008.10	98010.20
GT-10-S	98008.31	98008.32	98008.10	98010.21
GT-13	98013.31	98013.32	98013.10	98013.20
GT-16	98013.31	98013.32	98013.10	98016.20
GT-16-S	98013.31	98013.32	98013.10	98016.21
GT-20	98020.31	98020.32	98020.10	98020.20
GT-25	98020.31	98020.32	98020.10	98025.20
GT-25-S	98020.31	98020.32	98020.10	98025.21
GT-30	98030.31	98030.32	98030.10	98030.20
GT-36	98030.31	98030.32	98030.10	98036.20
GT-36-S	98030.31	98030.32	98030.10	98036.21
GT-40	98040.31	98040.32	98040.10	98040.20
GT-48	98040.31	98040.32	98040.10	98048.20
GT-48-S	98040.31	98040.32	98040.10	98048.21
Silencers :	GT-4 to GT-10-S	Filter Type 1/8"	44025.00	
	GT-13 to GT-25-S	Filter Type 1/4"	44026.00	
	GT-30 to GT-48-S	Filter Type 3/8"	44027.00	

8.5. Turbine Vibrator T-series

Type	Threaded Cap Plastic	End Cap Plastic	Ball Bearing	Rotor
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T-50-LP	98050.30	91008.10	98050.10	98050.40
T-50-HP	98050.30	91008.10	98050.10	98050.50
T-65-LP	98065.30	91013.10	98065.10	98065.40
T-65-HP	98065.30	91013.10	98065.10	98065.50
T-80-LP	98080.30	91020.10	98080.10	98080.40
T-80-HP	98080.30	91020.10	98080.10	98080.50
T-100-HP	98100.30	91030.10	98100.10	98100.50
Silencers :	T-50 and T-65 series T-80 and T-100 series	Filter Type Filter Type	44046.00 44027.00	

8.6. Piston Vibrator FP-series

Type	Piston	Spring	Socket	End Cap
FP-12-S	99012.10	99012.20	99012.30	99012.40
FP-12-M	99012.11	99012.21	99012.30	99012.40
FP-12-L	99012.12	99012.22	99012.30	99012.40
FP-18-S	99018.10	99018.20	99018.30	99018.40
FP-18-M	99018.11	99018.21	99018.30	99018.40
FP-18-L	99018.12	99018.22	99018.30	99018.40
FP-25-S	99025.10	99025.20	99025.30	99025.40
FP-25-M	99025.11	99025.21	99025.30	99025.40
FP-25-L	99025.12	99025.22	99025.30	99025.40
FP-35-S	99035.10	99035.20	99035.30	99035.40
FP-35-M	99035.11	99035.21	99035.30	99035.40
FP-35-L	99035.12	99035.22	99035.30	99035.40
Silencers :	FP-12 and FP-18 series FP-25 and FP-35 series	Filter Type Free Flow	44025.00 44029.00	

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